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MEASUREMENT REPORT
FCC PART 15.407 / 802.11a/ax WiFi 6E (OFDM)

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

Date of Testing:
5/23/2024 – 8/14/2024
Test Report Issue Date:
8/14/2024
Test Site/Location:
Element lab., Columbia, MD, USA
Test Report Serial No.:
1M2405140039-14-R1.A3L

FCC ID:	**A3LSMX828U**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SM-X828U
EUT Type:	Portable Tablet
Frequency Range:	5935 – 7115MHz
Modulation Type:	OFDM
FCC Classification:	15E 6GHz Low Power Dual Client (6CD)
FCC Rule Part(s):	Part 15 Subpart E (15.407)
Test Procedure(s):	ANSI C63.10-2013, KDB 987594 D02 v02r01

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.

Note: This revised Test Report (S/N: 1M2405140039-14-R1.A3L) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

RJ Ortanez
Executive Vice President

ACCREDITED
CERT #2041.01

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MEASUREMENT REPORT

Channel Bandwidth [MHz]	UNII Band	Tx Frequency [MHz]	Ant1		Ant2		MIMO	
			Max. Power [mW]	Max. Power [dBm]	Max. Power [mW]	Max. Power [dBm]	Max. Power [mW]	Max. Power [dBm]
20	5	5935 - 6415	2.61	4.17	1.89	2.76	8.39	9.24
	6	6435 - 6515	2.08	3.18	2.25	3.52	8.54	9.31
	7	6535 - 6875	2.08	3.18	1.72	2.36	8.60	9.34
	8	6895 - 7115	1.33	1.24	1.47	1.66	5.60	7.49
40	5	5965 - 6405	2.31	3.63	1.69	2.27	8.51	9.30
	6	6445 - 6525	1.84	2.64	2.05	3.11	7.54	8.77
	7	6565 - 6845	1.86	2.69	1.60	2.04	7.58	8.80
	8	6885 - 7085	1.24	0.93	1.40	1.47	4.95	6.95
80	5	5985 - 6385	2.31	3.64	1.67	2.22	8.55	9.32
	6	6465	1.74	2.40	2.05	3.11	8.58	9.33
	7	6545 - 6865	1.83	2.62	2.07	3.16	8.10	9.08
	8	6945 - 7025	1.24	0.93	1.44	1.59	5.66	7.53
160	5	6025 - 6345	2.62	4.19	1.61	2.06	7.80	8.92
	6	6505	2.00	3.00	2.11	3.25	8.44	9.26
	7	6665 - 6825	2.06	3.14	1.67	2.23	7.29	8.63
	8	6985	1.35	1.30	1.38	1.40	5.06	7.05

EUT Overview – EIRP

1.0 INTRODUCTION

1.1 Scope

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

1.2 Element Test Location

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

1.3 Test Facility / Accreditations

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

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

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

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

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

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Electronics Co., Ltd. Portable Tablet FCC ID: A3LSMX828U**. The test data contained in this report pertains only to the emissions due to the EUT's UNII transmitter while operating in the 6GHz band.

Test Device Serial No.: 17720, 17670, 25483, 17936, 18108, 17696

2.2 Device Capabilities

This device contains the following capabilities:

850/1700/1900 WCDMA/HSPA, Multi-band LTE, Multi-band 5G NR (FR1 and FR2), 802.11b/g/n/ac/ax WLAN, 802.11a/n/ac/ax UNII (5GHz and 6GHz), Bluetooth (1x, EDR, LE), NFC, Wireless Power Transfer

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

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

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

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

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

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

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

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

Notes:

1. 6GHz 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 [%]		
6GHz	a	97.40	97.75	97.41
	ax (HE20)	96.93	97.11	94.09
	ax (HE40)	93.85	94.67	89.94
	ax (HE80)	94.03	94.37	90.00
	ax (HE160)	94.20	93.72	87.89

Table 2-5. Measured Duty Cycles

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

WiFi Configurations		SISO		CDD		SDM	
		ANT1	ANT2	ANT1	ANT2	ANT1	ANT2
6GHz	11a	✓	✓	✓	✓	×	×
	11ax	✓	✓	✓	✓	✓	✓

Table 2-6. Antenna / Technology Configurations

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

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

802.11a	MCS Index				Spatial Stream	OFDM (802.11ax)											
20MHz						20MHz			40MHz			80MHz			160MHz		
	HT	VHT	HE	EHT		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	8.6	8.1	7.3	17.2	16.3	14.6	36	34	30.6	72.1	68.1	61.3
9	1	1	1	1	1	17.2	16.3	14.6	34.4	32.5	29.3	72.1	68.1	61.3	144.1	136.1	122.5
12	2	2	2	2	1	25.8	24.4	21.9	51.6	48.8	43.9	108.1	102.1	91.9	216.2	204.2	183.8
18	3	3	3	3	1	34.4	32.5	29.3	68.8	65	58.5	144.1	136.1	122.5	288.2	272.2	245
24	4	4	4	4	1	51.6	48.8	43.9	103.2	97.5	87.8	216.2	204.2	183.8	432.4	408.3	367.5
36	5	5	5	5	1	68.8	65	58.5	137.6	130	117	288.2	272.2	245	576.5	544.4	490
48	7	6	6	6	1	77.4	73.1	65.8	154.9	146.3	131.6	324.3	306.3	275.6	648.5	612.5	551.3
54		7	7	7	1	86	81.3	73.1	172.1	162.5	146.3	360.3	340.3	306.3	720.6	680.6	612.5
		8	8	8	1	103.2	97.5	87.8	206.5	195	175.5	432.4	408.3	367.5	864.7	816.7	735
		9	9	9	1	114.7	108.3	97.5	229.4	216.7	195	480.4	453.7	408.3	960.8	907.4	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
			11	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
				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
				13	1	172.1	162.5	146.3	344.1	325	292.5	720.6	680.6	612.5	1441.2	1361.1	1225
6	8	0	0	0	2	17.2	16.3	14.6	34.4	32.5	29.3	72.1	68.1	61.3	144.1	136.1	122.5
9	9	1	1	1	2	34.4	32.5	29.3	68.8	65	58.5	144.1	136.1	122.5	288.2	272.2	245
12	10	2	2	2	2	51.6	48.8	43.9	103.2	97.5	87.8	216.2	204.2	183.8	432.4	408.3	367.5
18	11	3	3	3	2	68.8	65	58.5	137.6	130	117	288.2	272.2	245	576.5	544.4	490
24	12	4	4	4	2	103.2	97.5	87.8	206.5	195	175.5	432.4	408.3	367.5	864.7	816.7	735
36	13	5	5	5	2	137.6	130	117	275.3	260	234	576.5	544.4	490	1152.9	1088.9	980
48	14	6	6	6	2	154.9	146.3	131.6	309.7	292.5	263.3	648.5	612.5	551.3	1297.1	1225	1102.5
54	15	7	7	7	2	172.1	162.5	146.3	344.1	325	292.5	720.6	680.6	612.5	1441.2	1361.1	1225
		8	8	8	2	206.5	195	175.5	412.9	390	351	864.7	816.7	735	1729.4	1633.3	1470
		9	9	9	2	229.4	216.7	195	458.8	433.3	390	960.8	907.4	816.7	1921.6	1814.8	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
			11	11	2	286.8	270.8	243.8	573.5	541.7	487.5	1201	1134.3	1020.8	2402	2268.5	2041.7
				12	2	309.7	292.5	263.3	619.4	585	526.5	1297.1	1225	1102.5	2594.1	2450	2205
				13	2	344.1	325	292.5	688.2	650	585	1441.2	1361.1	1225	2882.4	2722.2	2450

Table 2-7. Supported Data Rates

4. The device supports either Standard Power (SP) or Low Power Indoor (LPI) operation in the following UNII bands:

UNII Band	Standard Power (SP)	Low Power Indoor (LPI)
UNII 5	✓	✓
UNII 6	×	✓
UNII 7	✓	✓
UNII 8	×	✓

Table 2-8. Power Operation

✓= Support; × = NOT Support

2.3 Antenna Description

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

	Ant1 Peak Gain [dBi]	Ant2 Peak Gain [dBi]	Directional Gain [dBi]
5925 – 6425 MHz	-5.8	-8.3	-3.95
6425 – 6525 MHz	-5.9	-7.2	-3.52
6525 – 6875 MHz	-7.4	-7.4	-4.39
6875 – 7125 MHz	-8.5	-7.9	-5.18

Table 2-9. Antenna Peak Gain

2.4 Test Configuration

The EUT was tested per the guidance of ANSI C63.10-2013 and KDB 987594 D02 v02r01. ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing. See Sections 3.2 for AC line conducted emissions test setups, 3.3 for radiated emissions test setups, and 7.2, 7.3, 7.4, 7.5 and 7.6 for antenna port conducted emissions test setups.

This device operates in the 5.925-7.125 GHz band when under control of a low power indoor access point. Additionally, the device may operate in the 5.925-6.875 GHz bands when under control of a standard power access point. The worst-case emissions data is shown in this report.

2.5 Software and Firmware

The test was conducted with firmware version X828USQU0AXF7 installed on the EUT.

2.6 EMI Suppression Device(s) / Modifications

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

3.0 DESCRIPTION OF TESTS

3.1 Evaluation Procedure

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

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

3.2 AC Line Conducted Emissions

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

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

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

Line conducted emissions test results are shown in Section 7.8. The EMI Receiver mode of the Agilent MXE was used to perform AC line conducted emissions testing.

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 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 precautions were 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 were 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).

4.0 ANTENNA REQUIREMENTS

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

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

Conclusion:

The EUT complies with the requirement of §15.203.

5.0 MEASUREMENT UNCERTAINTY

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

Contribution	Expanded Uncertainty (±dB)
Contention Based Protocol Conducted Measurements	0.86
Conducted Bench Top Measurements	1.13
Line Conducted Disturbance	3.09
Radiated Disturbance (<1GHz)	4.98
Radiated Disturbance (>1GHz)	5.07
Radiated Disturbance (>18GHz)	5.09

6.0 TEST EQUIPMENT CALIBRATION DATA

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

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	WL25-1	Conducted Cable Set (25GHz)	4/2/2024	Annual	4/2/2025	WL25-1
-	WL25-2	Conducted Cable Set (25GHz)	4/2/2024	Annual	4/2/2025	WL25-2
-	WL40-1	Conducted Cable Set (40GHz)	4/2/2024	Annual	4/2/2025	WL40-1
	AP1-002	EMC Cable and Switch System	4/2/2024	Annual	4/2/2025	AP1-002
-	ETS-001	EMC Cable and Switch System	4/2/2024	Annual	4/2/2025	ETS-001
-	ETS-002	EMC Cable and Switch System	4/2/2024	Annual	4/2/2025	ETS-002
	MD 1M 18-40	EMC Cable and Switch System	4/2/2024	Annual	4/2/2025	MD 1M 18-40
Anritsu	MA24406A	Microwave Peak Power Sensor	9/7/2023	Annual	9/7/2024	11240
Emco	3116	Horn Antenna (18 - 40GHz)	8/8/2022	Biennial	8/8/2024	9203-2178
Rohde & Schwarz	TC-TA18	Vivaldi Antenna	2/23/2023	Biennial	2/23/2025	26040036
Rohde & Schwarz	FSW26	Signal and spectrum analyzer	3/8/2024	Annual	3/8/2025	103187
Pasternack	NMLC-2	Line Conducted Emissions Cable (NM)	4/2/2024	Annual	4/2/2025	NMLC-2
ETS-Lindgren	3816/2NM	Line Impedance Stabilization Network	8/11/2022	Biennial	8/11/2024	114451
Keysight Technologies	N9030A	PXA Signal Analyzer (44GHz)	4/9/2024	Annual	4/9/2025	MY52350166
Keysight Technologies	N9020A	MXA Signal Analyzer	4/11/2024	Annual	4/11/2025	MY54500644
Keysight Technologies	N9030A	PXA Signal Analyzer	2/29/2024	Annual	3/1/2025	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	4/5/2024	Annual	4/5/2025	101716
Rohde & Schwarz	FSW26	Signal and spectrum analyze (26.5GHz)	3/8/2024	Annual	3/8/2025	103187
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	2/15/2024	Annual	2/15/2025	103200
Sunol	JB6	JB6 Antenna	3/2/2023	Biennial	3/2/2025	A082816
Sunol	JB5	Bi-Log Antenna (30M-5GHz)	8/30/2022	Biennial	8/30/2024	A051107

Table 6-1. Annual Test Equipment Calibration Schedule

Note:

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

7.0 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.
FCC ID: A3LSMX828U
FCC Classification: 15E 6GHz Low Power Dual Client (6CD)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
2.1046, 15.407(a)(12)	Maximum Conducted Output Power	N/A	CONDUCTED	PASS	Section 7.3
15.407(a)(8)	Maximum Radiated Output Power (LPI)	< 24dBm over the frequency band of operation		PASS	Section 7.3
15.407(a)(7)	Maximum Radiated Output Power (SP)	< 30dBm over the frequency band of operation		PASS	Section 7.3
2.1049, 15.407(a)(11)	Occupied Bandwidth/ 26dB Bandwidth	99% of the occupied bandwidth of any channel must be contained within each of its respective U-NII sub bands. The maximum transmitter channel bandwidth for U-NII devices in the 5.925-7.125 GHz band is 320 megahertz.		PASS	Section 7.2
15.407(a)(8)	Maximum Power Spectral Density (LPI)	< -1dBm/MHz e.i.r.p.		PASS	Section 7.4
15.407(a)(7)	Maximum Power Spectral Density (SP)	< 17dBm/MHz e.i.r.p.		PASS	Section 7.4
15.407(a)(7)	Power Reduction Verification for standard client device	EUT must limit its power to no more than 6 dB below its associated standard power access point's authorized transmit power		PASS	See Report.
15.407(b)(7)	In-Band Emissions	EUT must meet the limits detailed in 15.407(b)(7)		PASS	Section 7.5
15.407(d)(6)	Contention Based Protocol	EUT must detect AWGN signal with 90% (or better) certainty		PASS	Section 7.6
15.407(b)(6)	Undesirable Emissions	< -27dBm/MHz e.i.r.p. outside of the 5.925 – 7.125GHz band	RADIATED	PASS	Section 7.7
15.205, 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209		PASS	Section 7.7
15.407(b)(9)	AC Conducted Emissions (150kHz – 30MHz)	< FCC 15.207 limits	LINE CONDUCTED	PASS	Section 7.8

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) Per 15.407(a)(7), a device operating under the control of a standard power access point in 5.925 - 6.875 GHz bands must not have the maximum power spectral density exceed 17 dBm/MHz e.i.r.p., must limit the maximum e.i.r.p. over the frequency band of operation does not exceed 30 dBm, and must limit its power to no more than 6 dB below its associated standard power access point's authorized transmit power. Compliance to this clause is addressed in Dual Client PRV Supplemental Test Report.
5) For conducted spurious emissions, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is Element "EST," Version 2.3.0.
6) For radiated band edge, automated test software was used to measure emissions and capture the corresponding plots necessary to show compliance. The measurement software utilized is Element "Chamber Automation," Version 1.6.1.

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.

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 ≥ 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

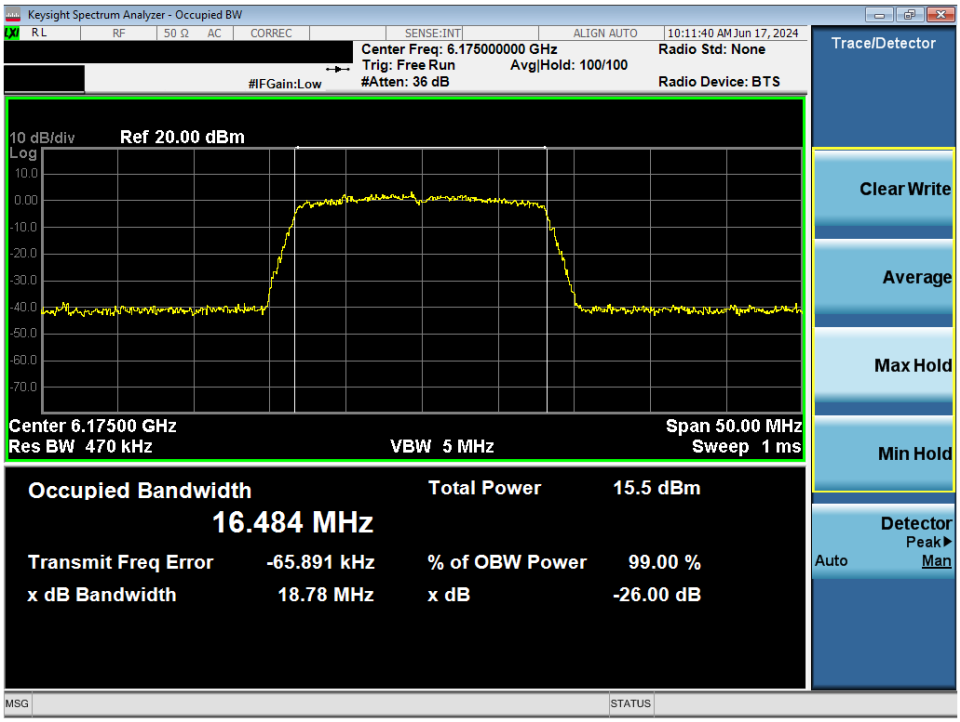
Test Notes

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

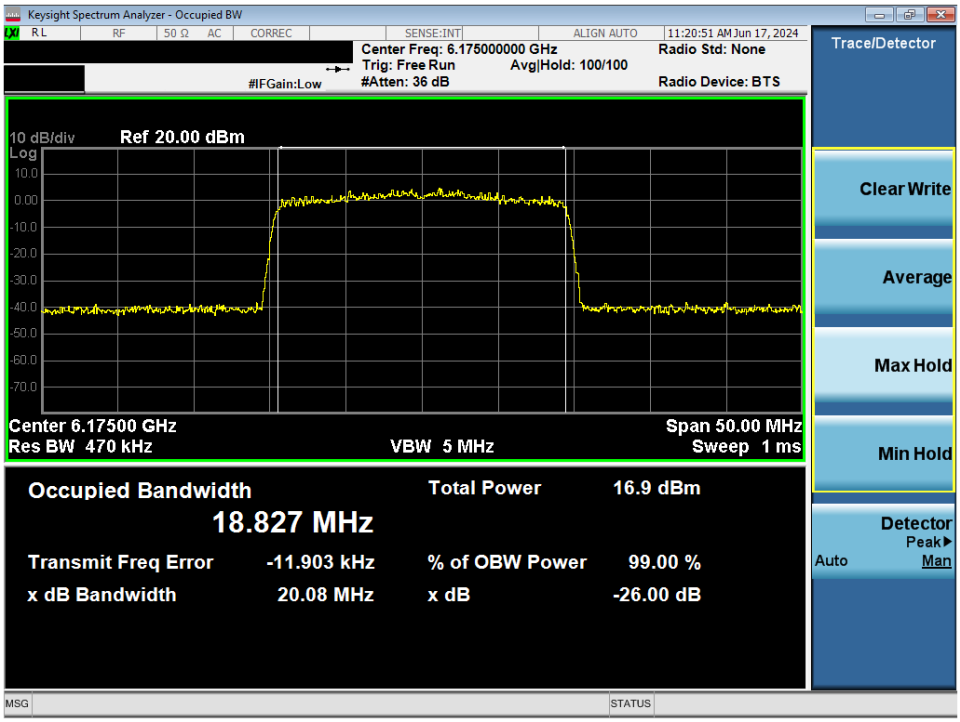
	Frequency [MHz]	Channel	802.11 MODE	Antenna-1 26dB Bandwidth [MHz]	Antenna-2 26dB Bandwidth [MHz]
Band 5	5935	2	a	18.88	18.42
	6175	45	a	18.78	18.43
	6415	93	a	18.72	18.37
	5935	2	ax (20MHz)	20.06	20.17
	6175	45	ax (20MHz)	20.08	20.13
	6415	93	ax (20MHz)	20.18	20.16
	5695	3	ax (40MHz)	39.86	40.11
	6165	43	ax (40MHz)	39.95	39.97
	6405	91	ax (40MHz)	40.11	40.08
	5985	7	ax (80MHz)	81.70	81.47
	6145	39	ax (80MHz)	81.49	81.69
	6385	87	ax (80MHz)	81.70	81.67
	6025	15	ax (160MHz)	163.76	164.13
	6185	47	ax (160MHz)	163.94	164.04
	6345	79	ax (160MHz)	164.05	163.56
Band 6	6435	97	a	18.75	18.53
	6475	105	a	18.72	18.45
	6515	113	a	18.82	18.47
	6345	97	ax (20MHz)	20.17	20.11
	6475	105	ax (20MHz)	20.14	20.15
	6515	113	ax (20MHz)	20.06	20.08
	6445	99	ax (40MHz)	39.95	39.99
	6485	107	ax (40MHz)	39.98	39.97
	6525	115	ax (40MHz)	39.98	40.21
	6465	103	ax (80MHz)	81.65	81.70
	6505	111	ax (160MHz)	164.29	164.05
Band 7	6535	117	a	18.71	18.42
	6695	149	a	18.70	18.50
	6875	185	a	18.80	18.49
	6535	117	ax (20MHz)	20.18	20.04
	6695	149	ax (20MHz)	20.11	20.10
	6875	185	ax (20MHz)	20.15	20.23
	6565	123	ax (40MHz)	40.19	40.01
	6725	155	ax (40MHz)	39.85	40.07
	6885	179	ax (40MHz)	40.04	39.96
	6545	119	ax (80MHz)	81.77	81.76
	6705	151	ax (80MHz)	81.49	81.57
	6865	183	ax (80MHz)	81.75	81.72
	6665	143	ax (160MHz)	164.25	164.47
	6825	175	ax (160MHz)	164.16	164.00
Band 8	6895	189	a	18.77	18.47
	6995	209	a	18.82	18.42
	7115	233	a	18.85	18.42
	6895	189	ax (20MHz)	20.02	20.19
	6995	209	ax (20MHz)	20.12	20.10
	7115	233	ax (20MHz)	20.07	20.14
	6925	187	ax (40MHz)	39.99	40.26
	7005	211	ax (40MHz)	39.91	39.94
	7085	227	ax (40MHz)	40.29	39.82
	6945	199	ax (80MHz)	81.52	81.66
	7025	215	ax (80MHz)	81.65	81.62
	6985	207	ax (160MHz)	164.37	164.13

Table 7-2. Bandwidth Test Results

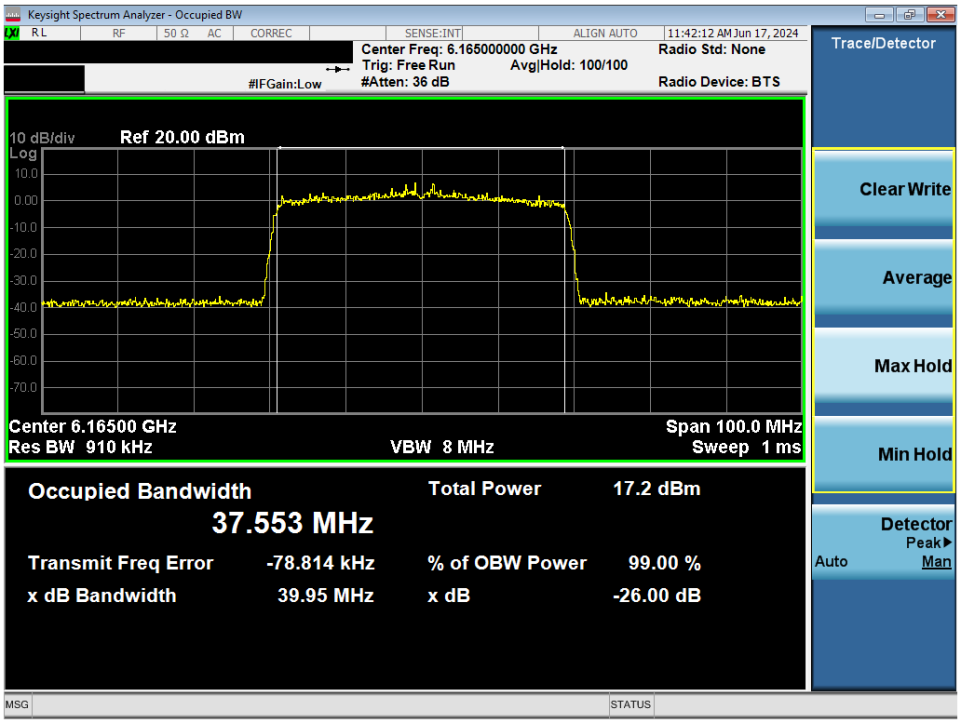
MIMO Antenna-1 26 dB Bandwidth Measurements - (UNII Band 5)



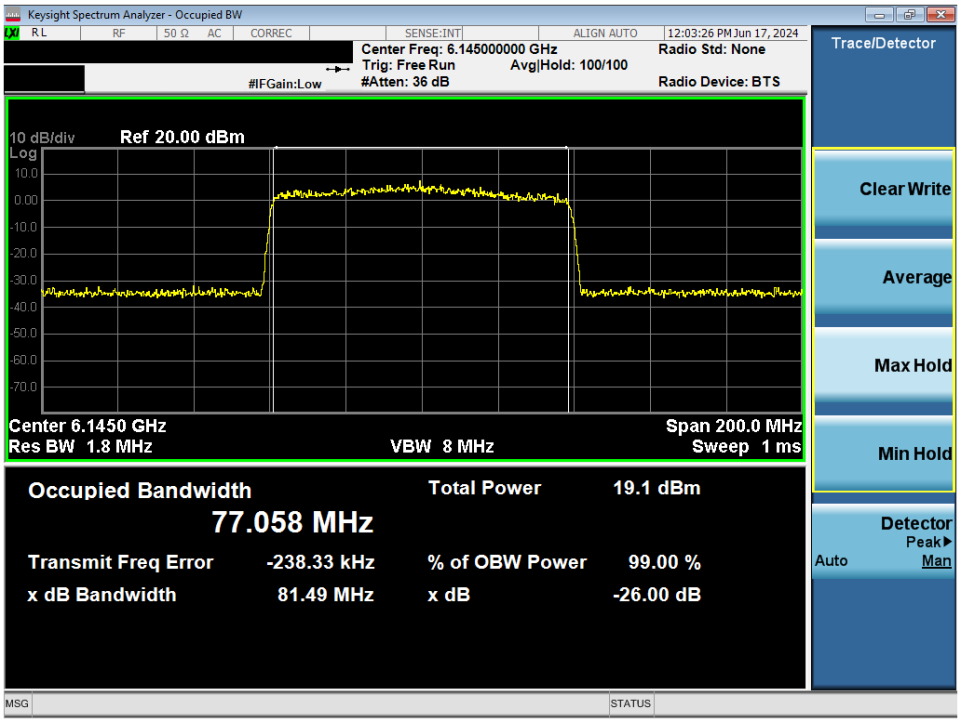
Plot 7-1. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 5) – Ch. 45)



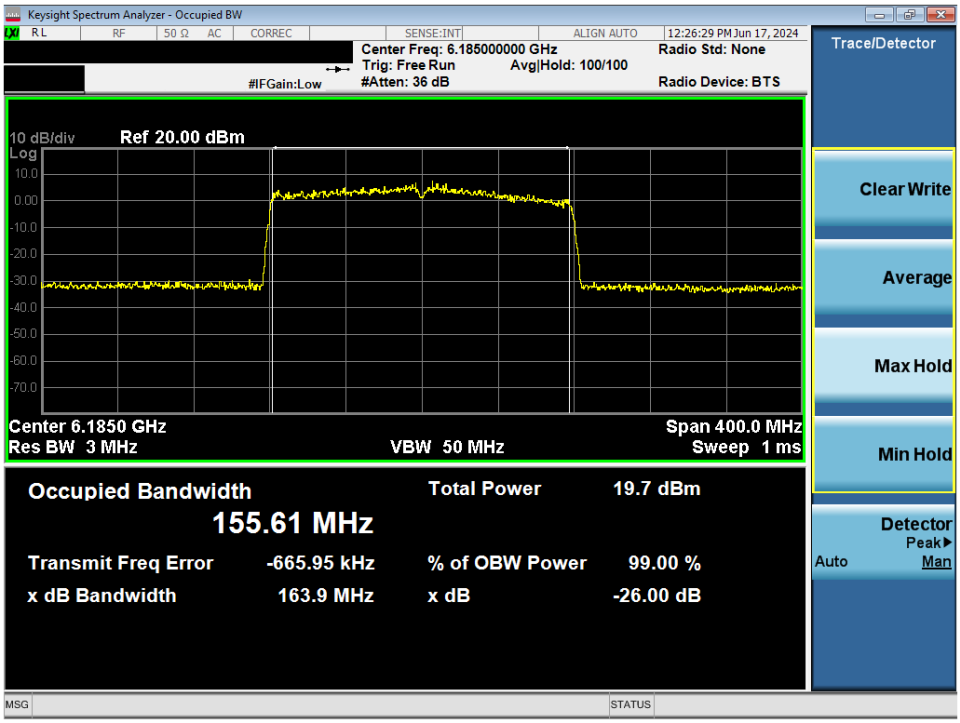
Plot 7-2. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 5) – Ch. 45)



Plot 7-3. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 5) – Ch. 43)

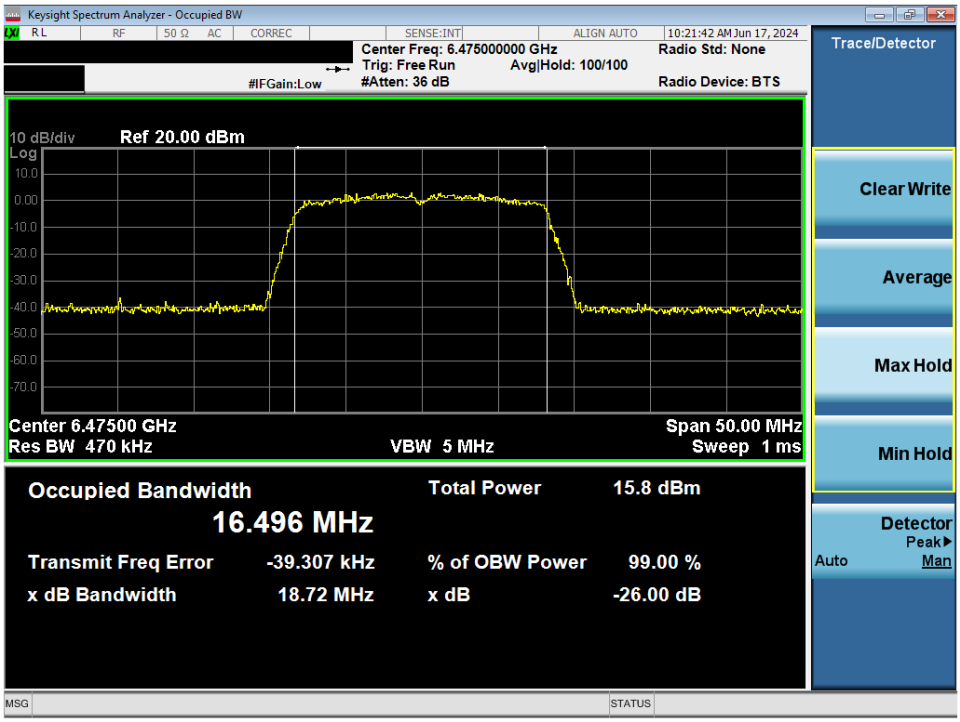


Plot 7-4. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 5) – Ch. 39)

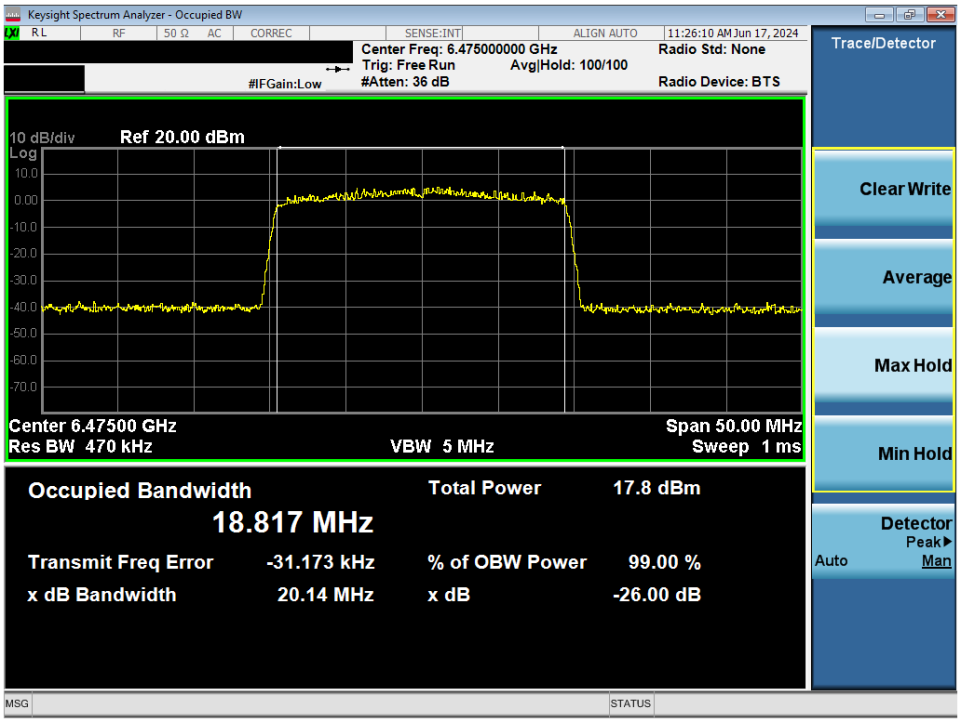


Plot 7-5. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax (UNII Band 5) – Ch. 47)

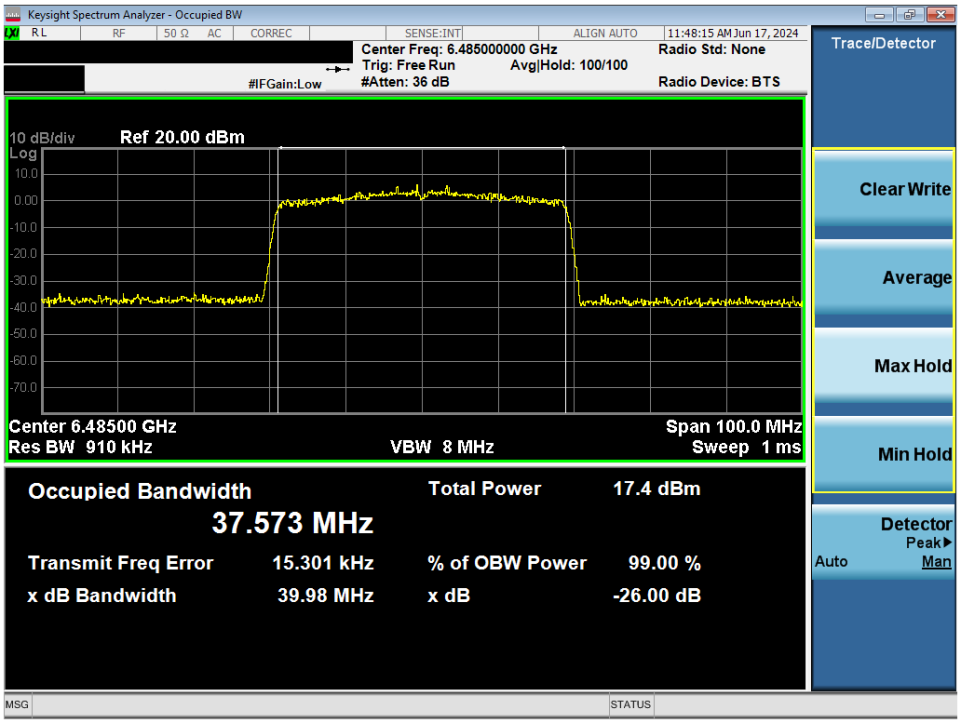
MIMO Antenna-1 26 dB Bandwidth Measurements - (UNII Band 6)



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

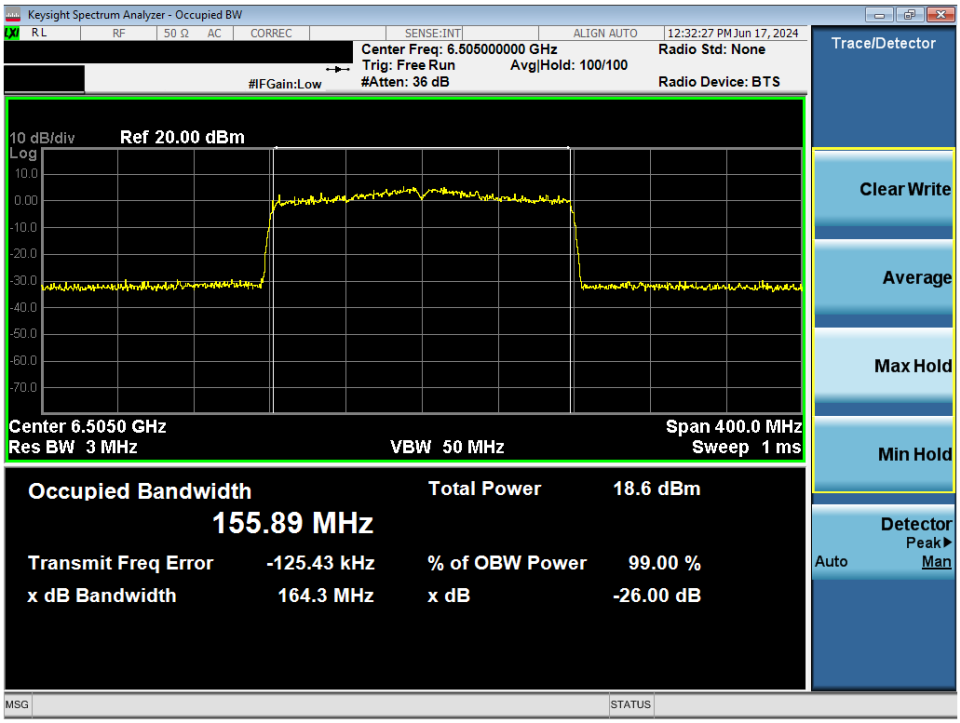


Plot 7-7. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 6) – Ch. 105)



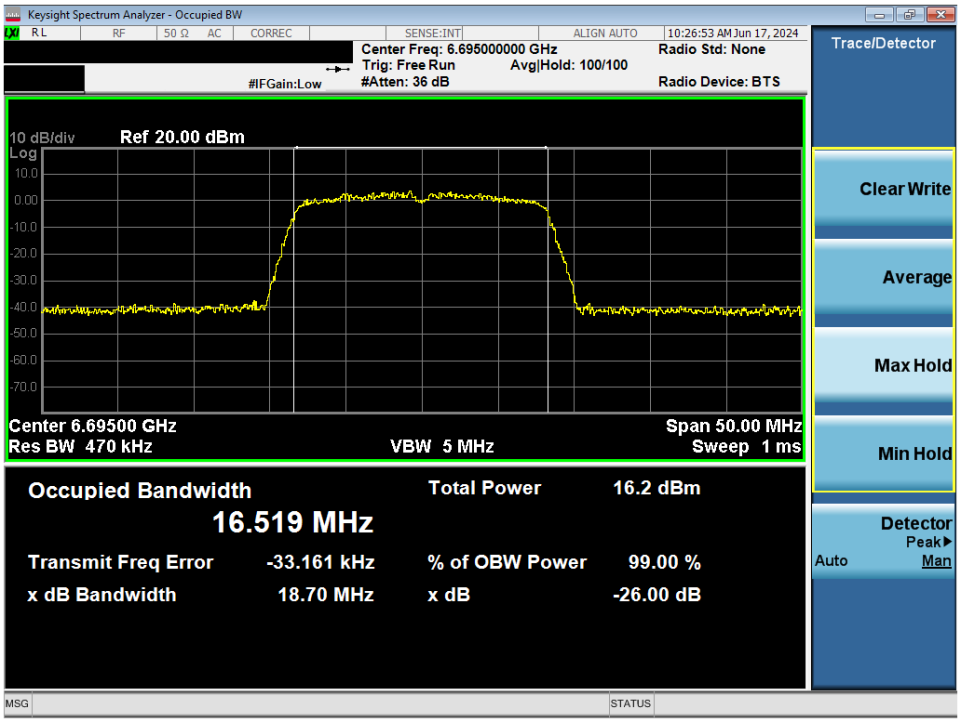
Plot 7-8. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 6) – Ch. 107)

Plot 7-9. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 6) – Ch. 103)

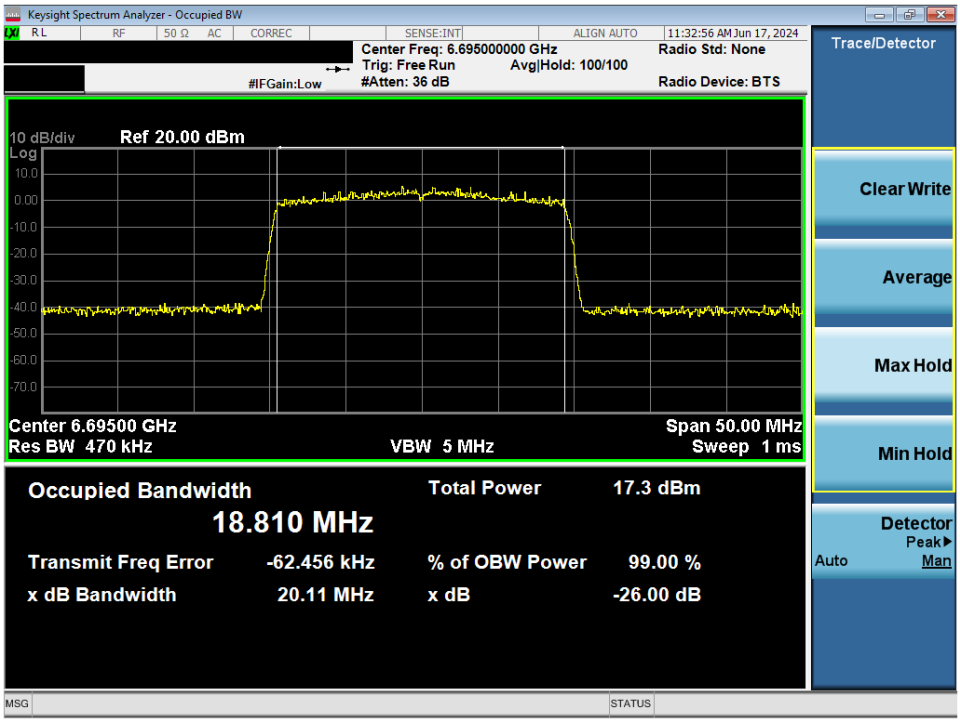


Plot 7-10. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax (UNII Band 6) – Ch. 111)

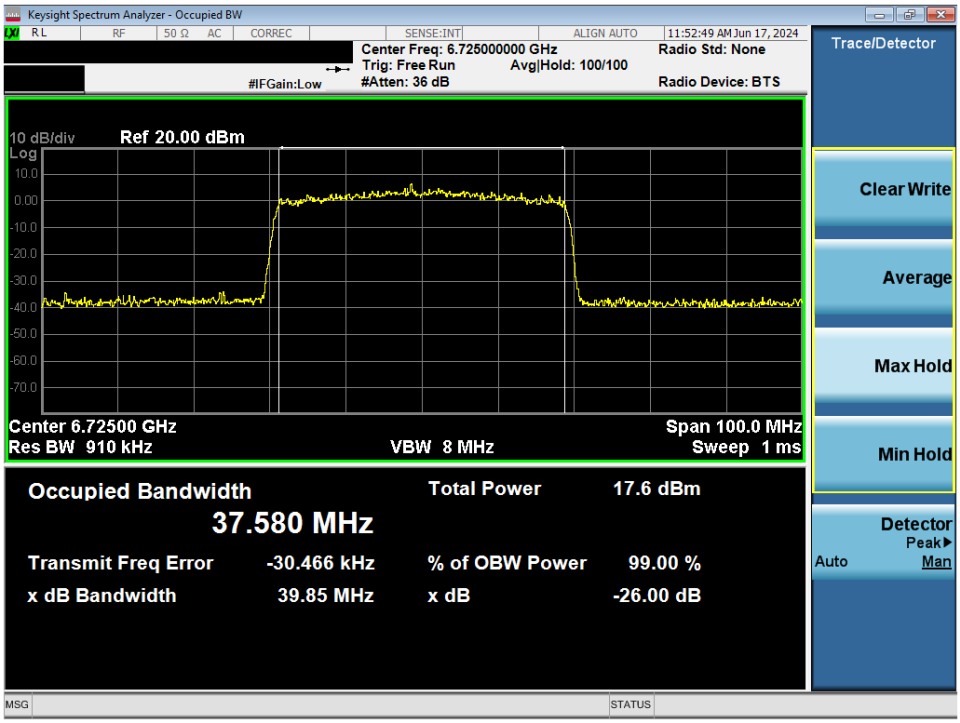
MIMO Antenna-1 26 dB Bandwidth Measurements - (UNII Band 7)



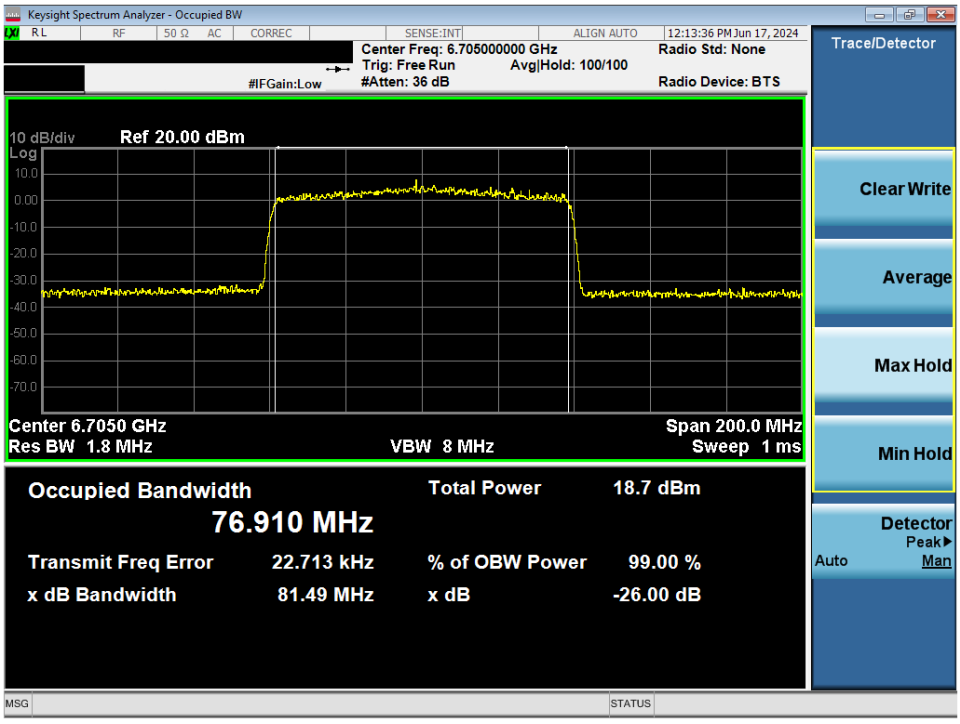
Plot 7-11. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 7) – Ch. 149)



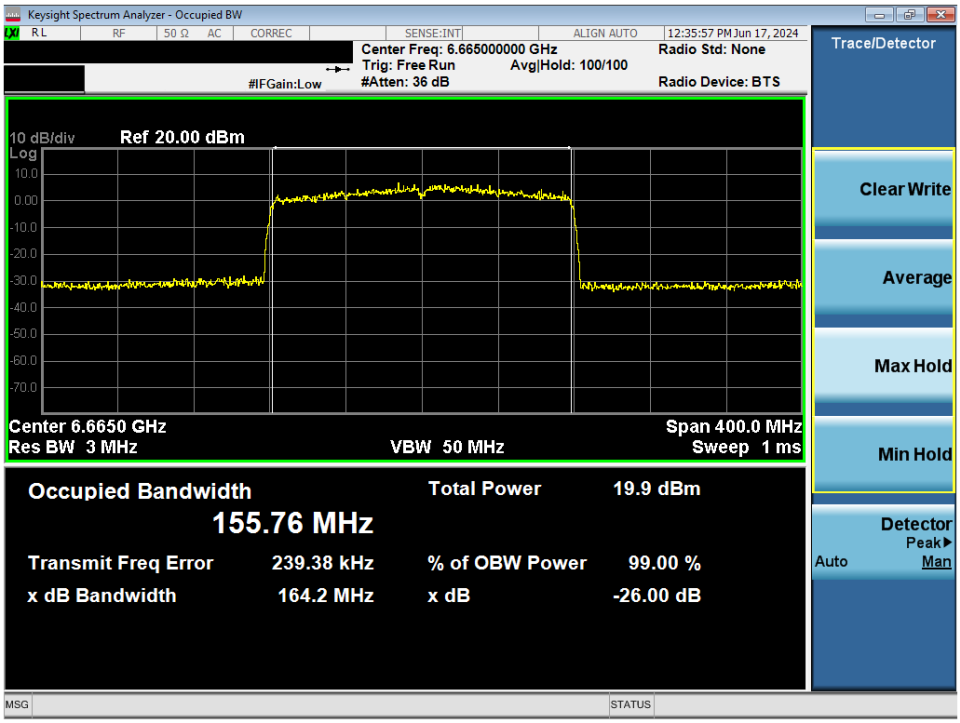
Plot 7-12. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 7) – Ch. 149)



Plot 7-13. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 7) – Ch. 155)

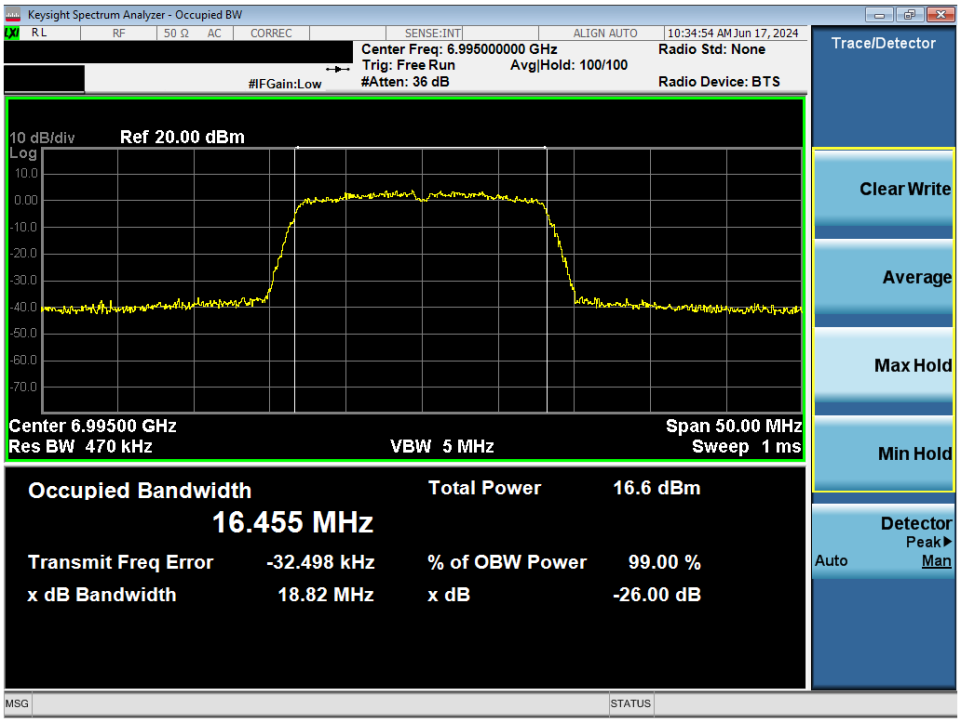


Plot 7-14. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 7) – Ch. 151)

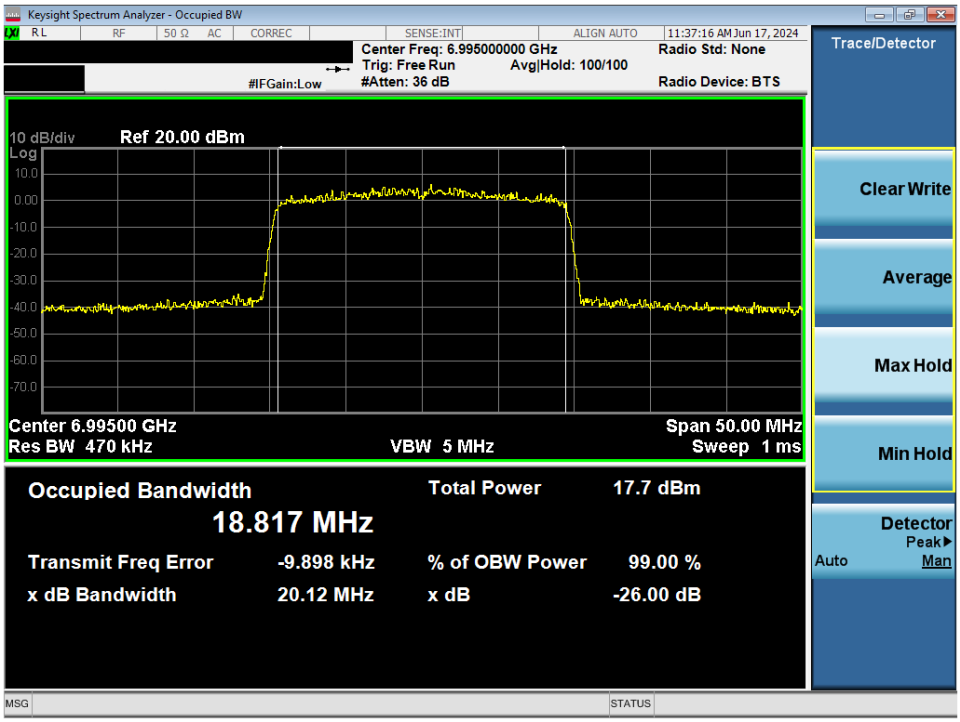


Plot 7-15. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax (UNII Band 7) – Ch. 143)

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

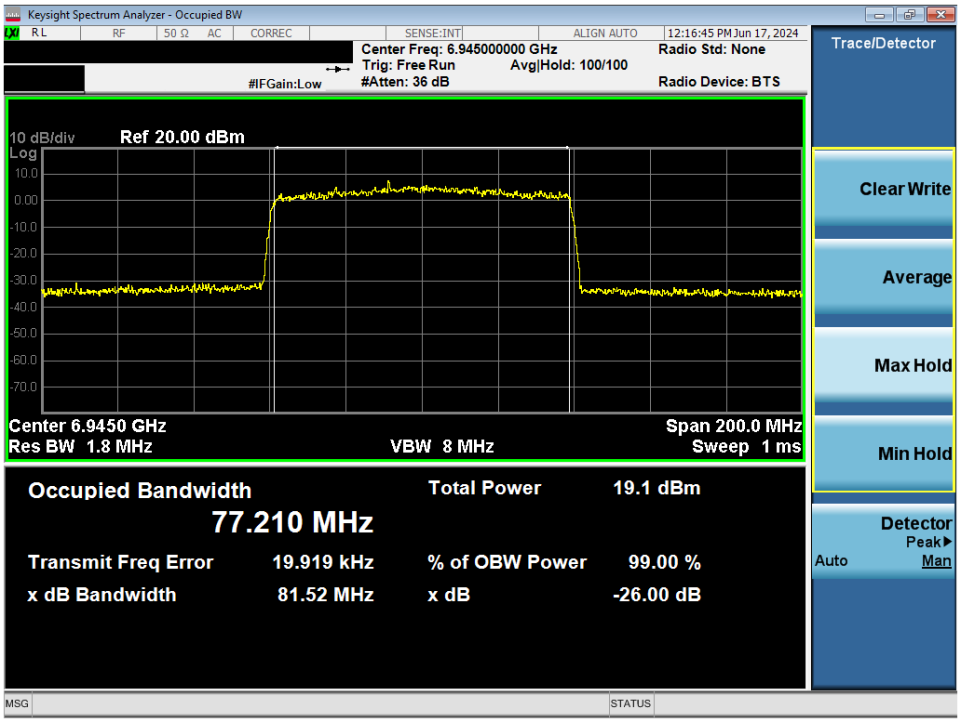


Plot 7-16. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11a (UNII Band 8) – Ch. 209)

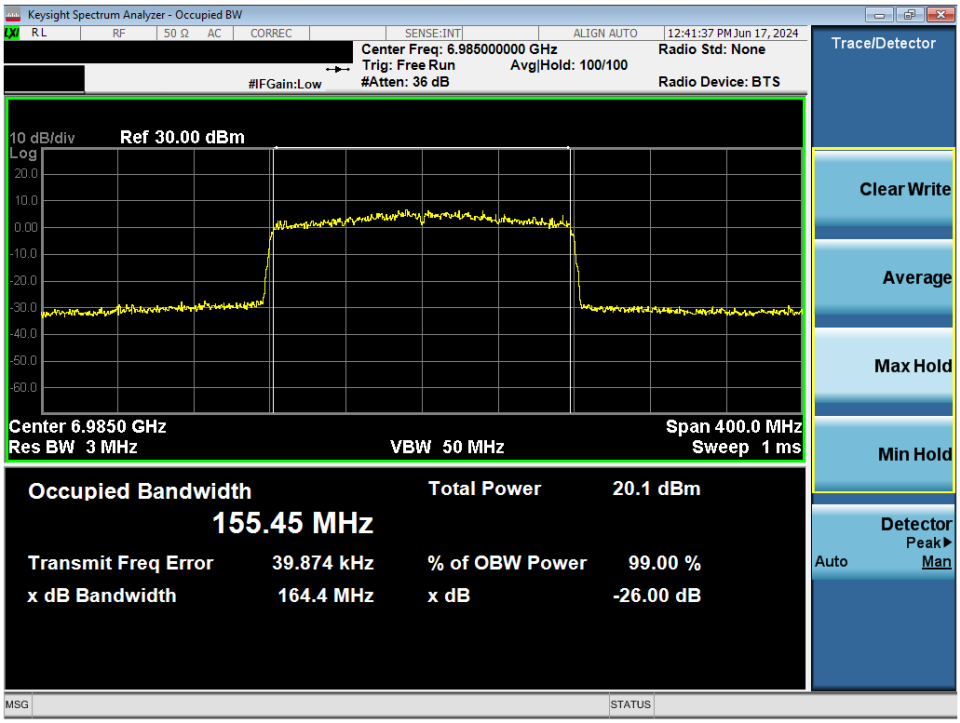


Plot 7-17. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax (UNII Band 8) – Ch. 209)

Plot 7-18. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax (UNII Band 8) – Ch. 211)

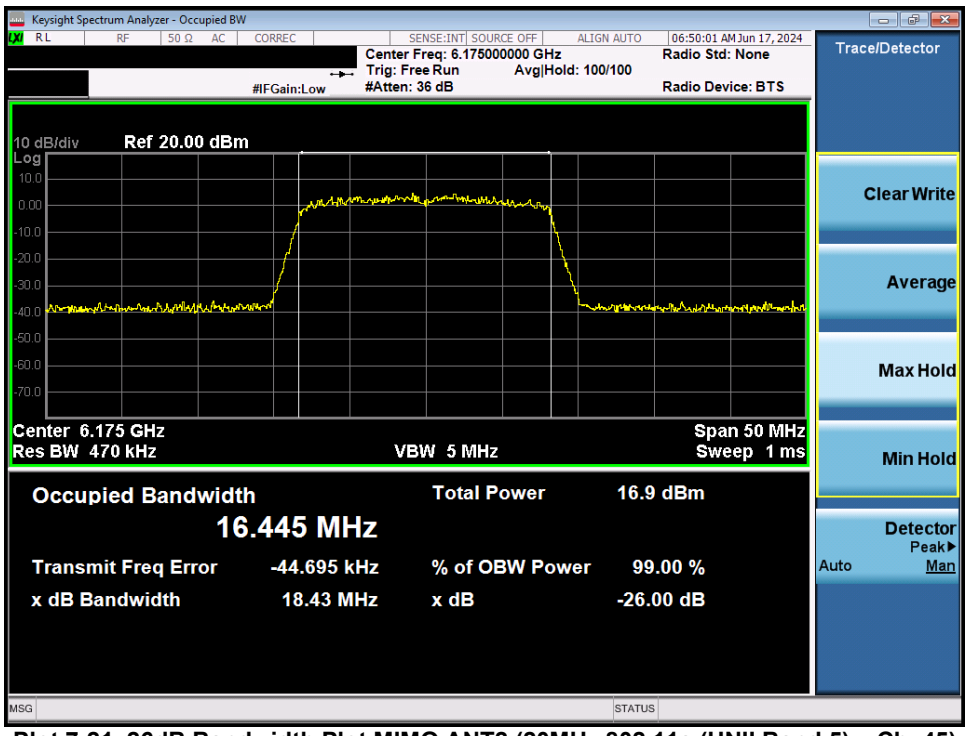


Plot 7-19. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax (UNII Band 8) – Ch. 199)

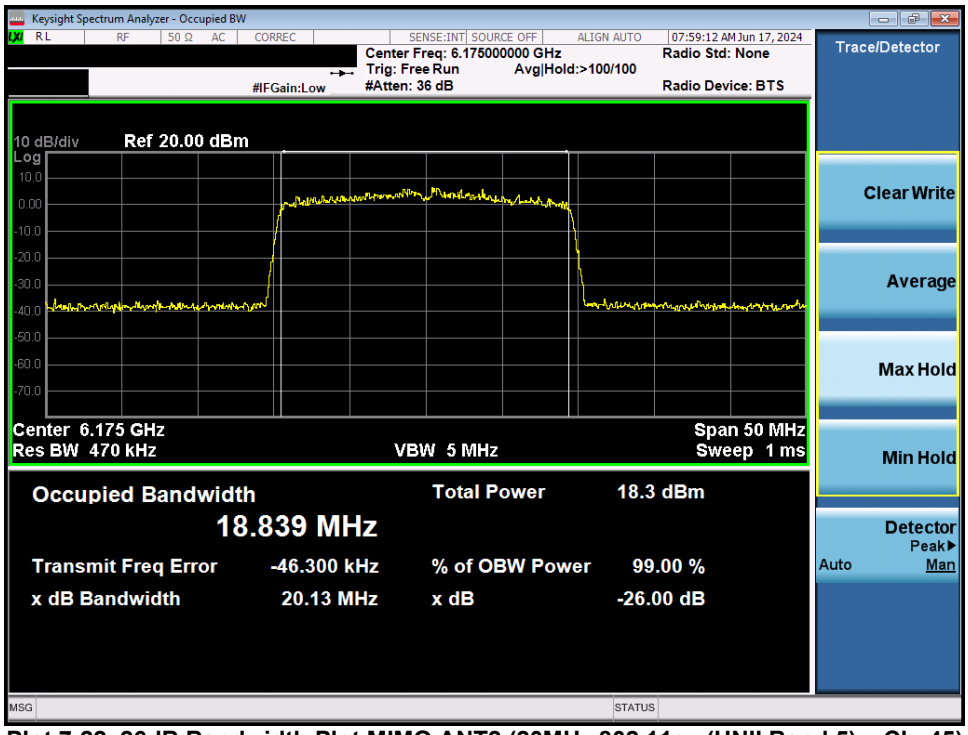


Plot 7-20. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax (UNII Band 8) – Ch. 207)

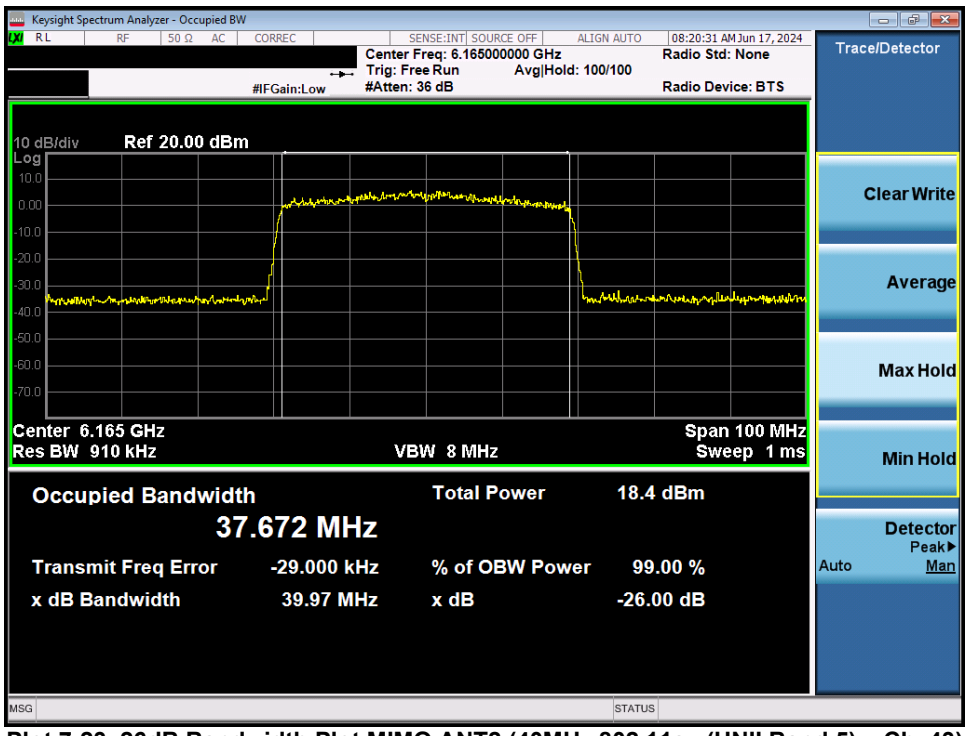
MIMO Antenna-2 26 dB Bandwidth Measurements - (UNII Band 5)



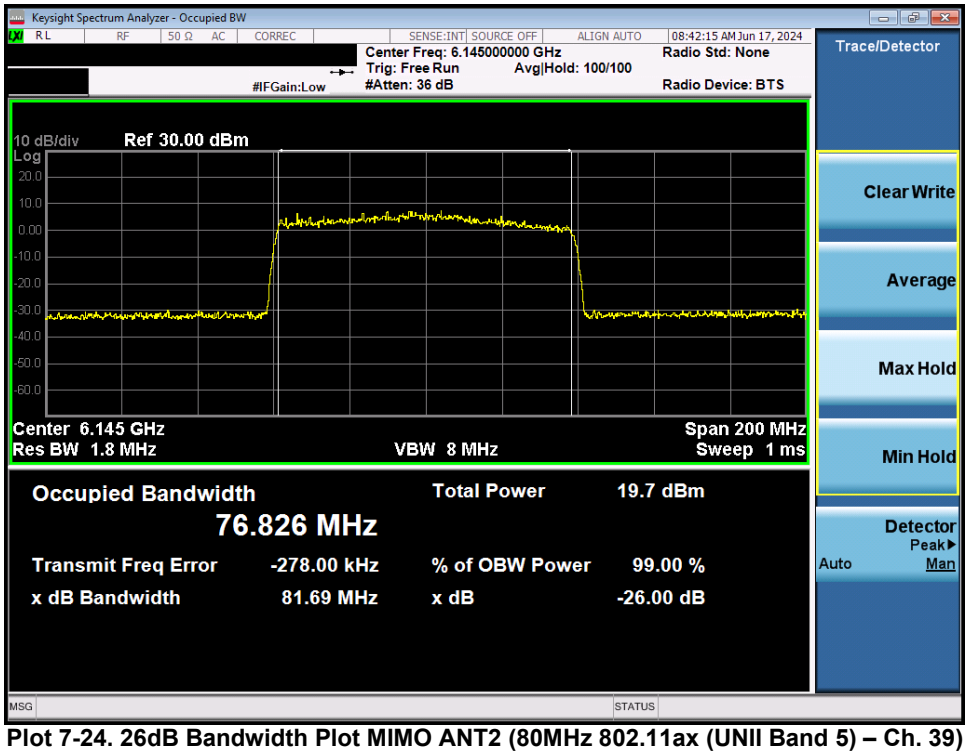
Plot 7-21. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 5) – Ch. 45)



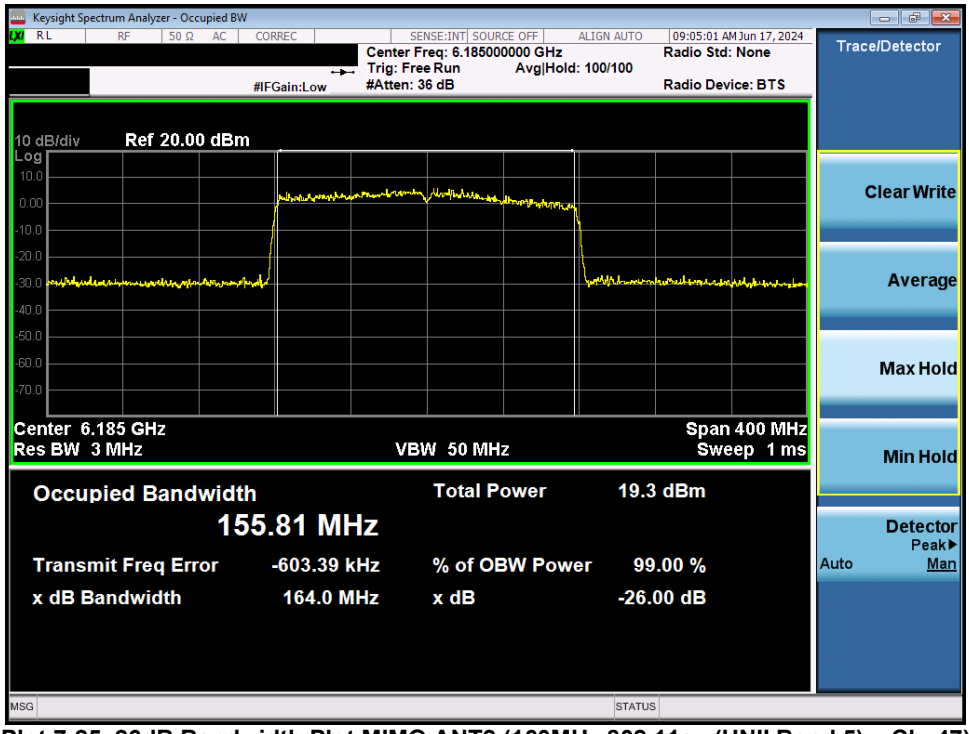
Plot 7-22. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 5) – Ch. 45)



Plot 7-23. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 5) – Ch. 43)

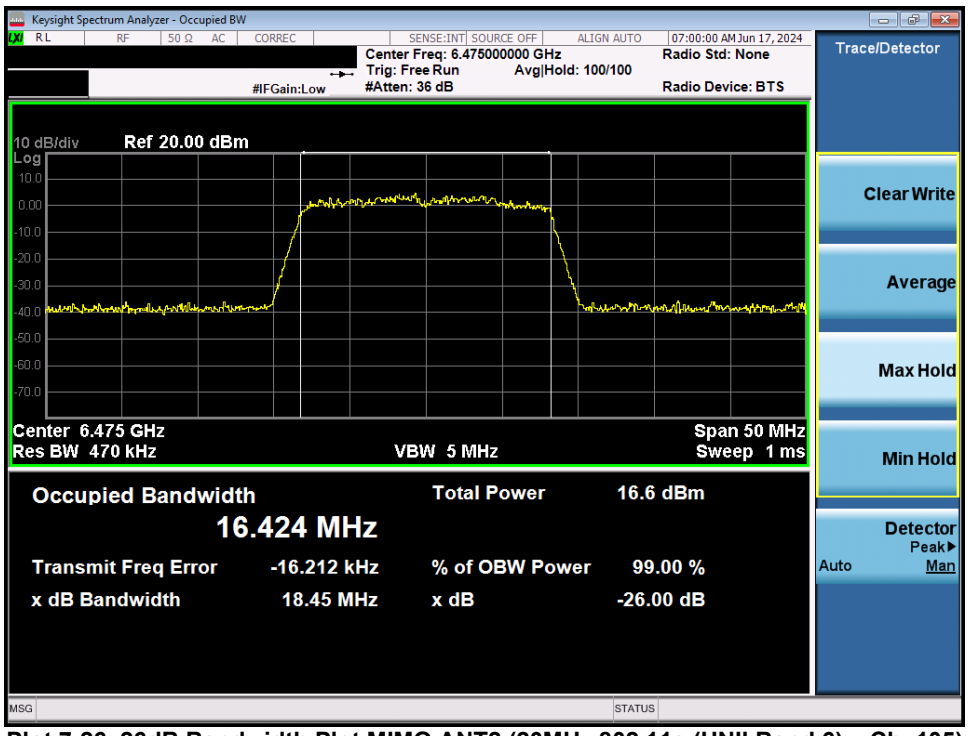


Plot 7-24. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 5) – Ch. 39)

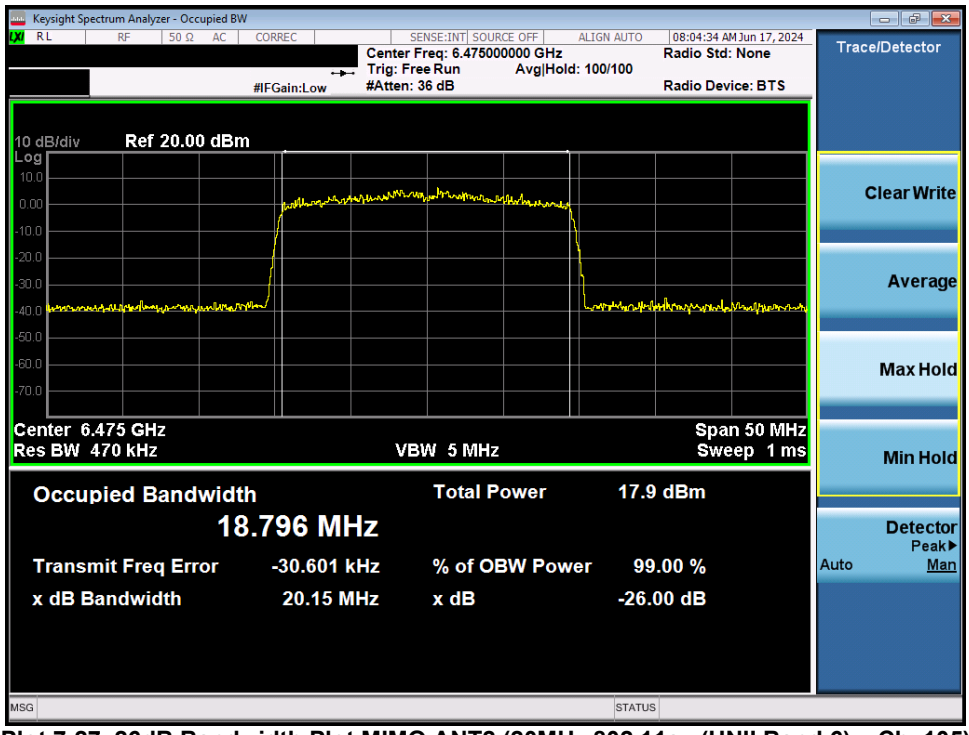


Plot 7-25. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax (UNII Band 5) – Ch. 47)

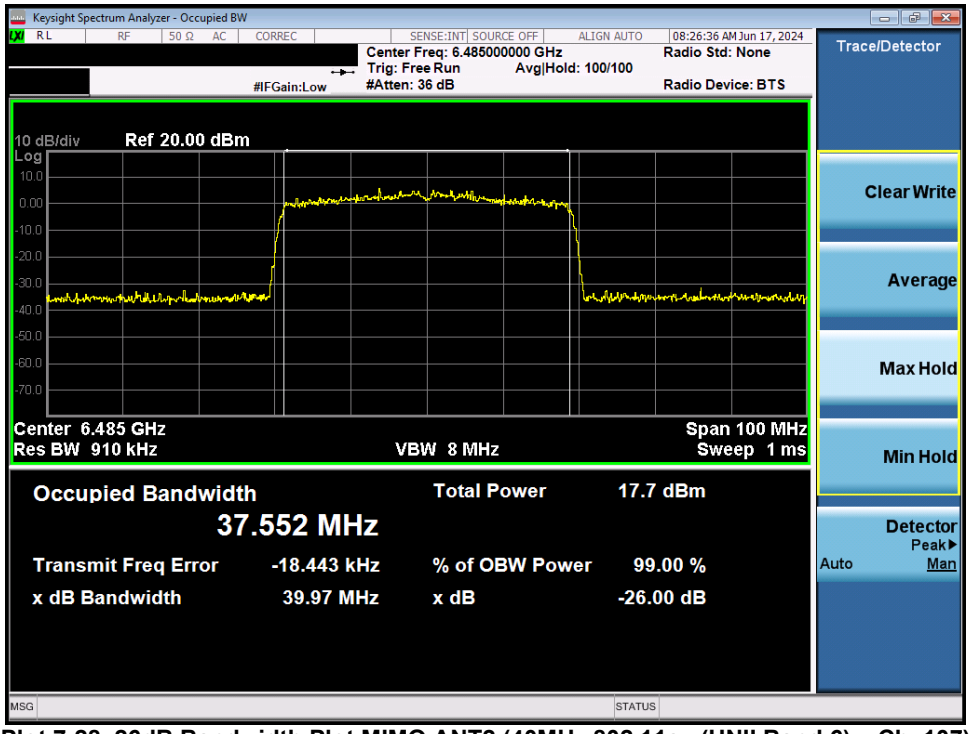
MIMO Antenna-2 26 dB Bandwidth Measurements - (UNII Band 6)



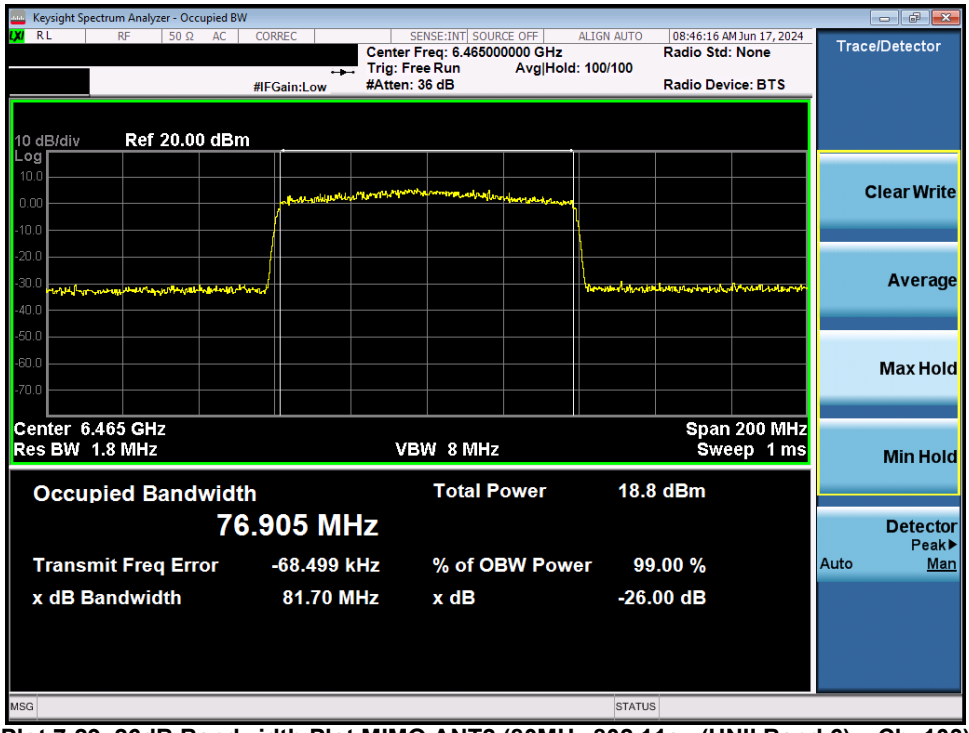
Plot 7-26. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 6) – Ch. 105)



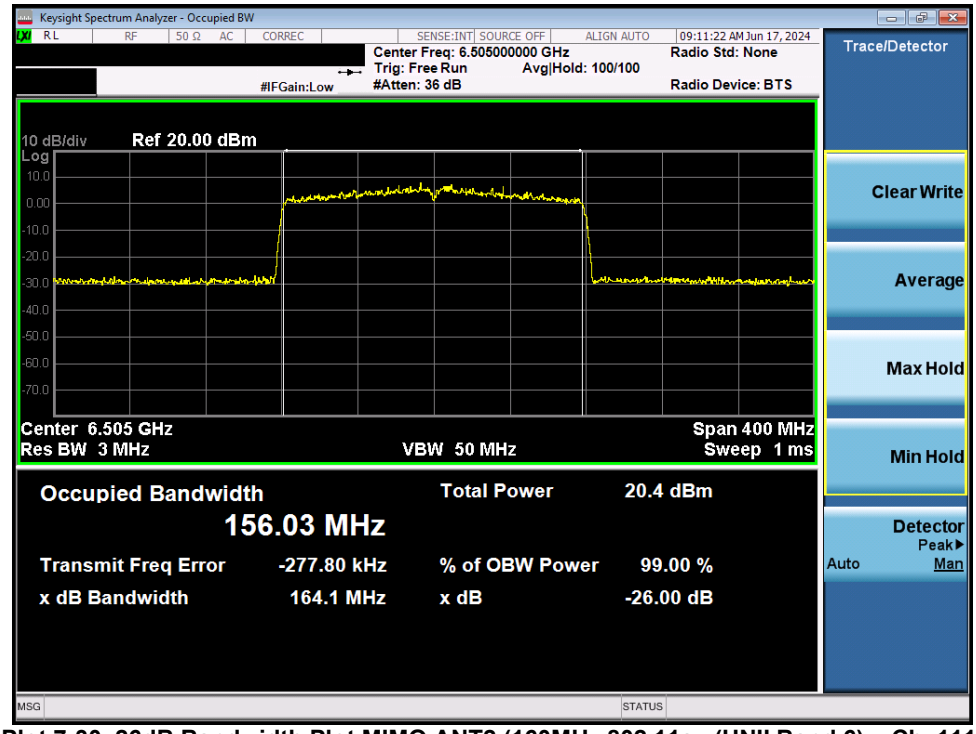
Plot 7-27. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 6) – Ch. 105)



Plot 7-28. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 6) – Ch. 107)

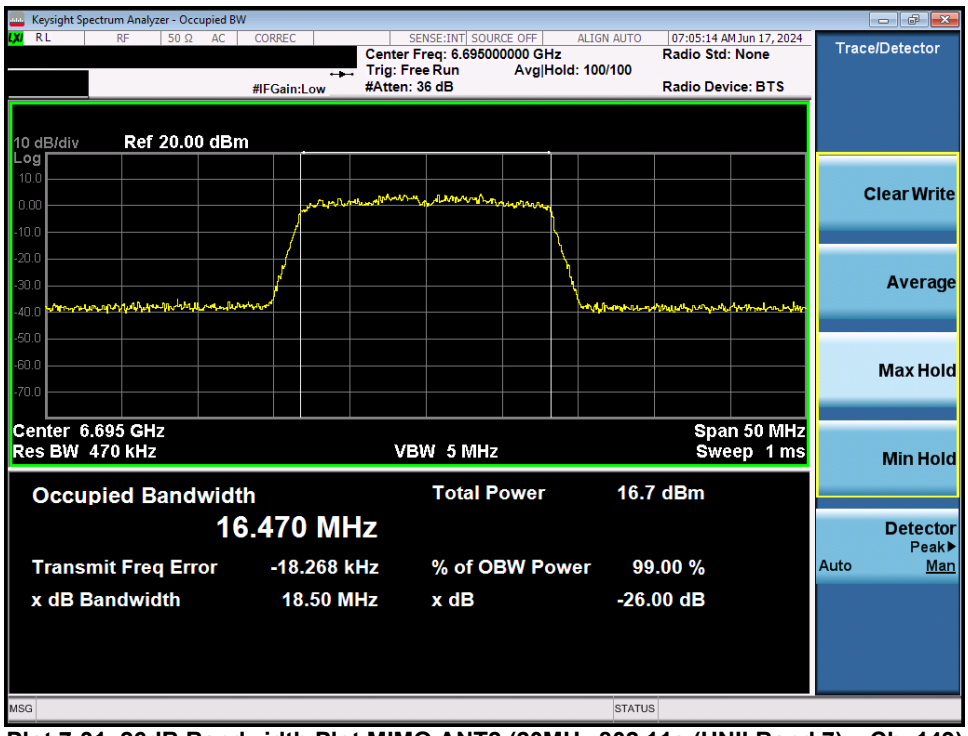


Plot 7-29. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 6) – Ch. 103)

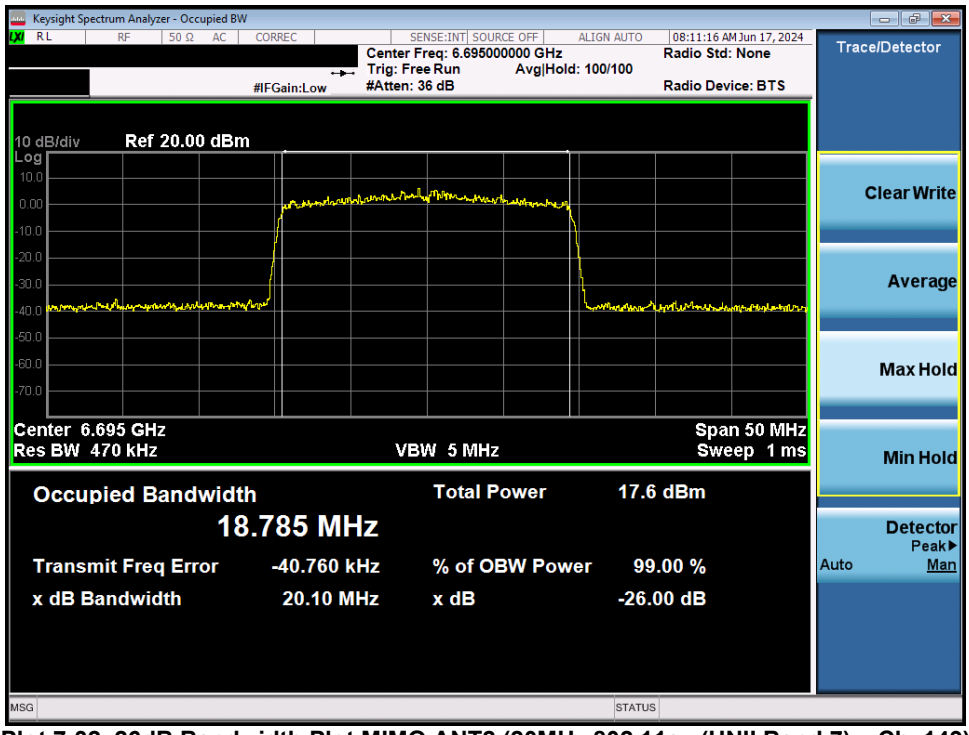


Plot 7-30. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax (UNII Band 6) – Ch. 111)

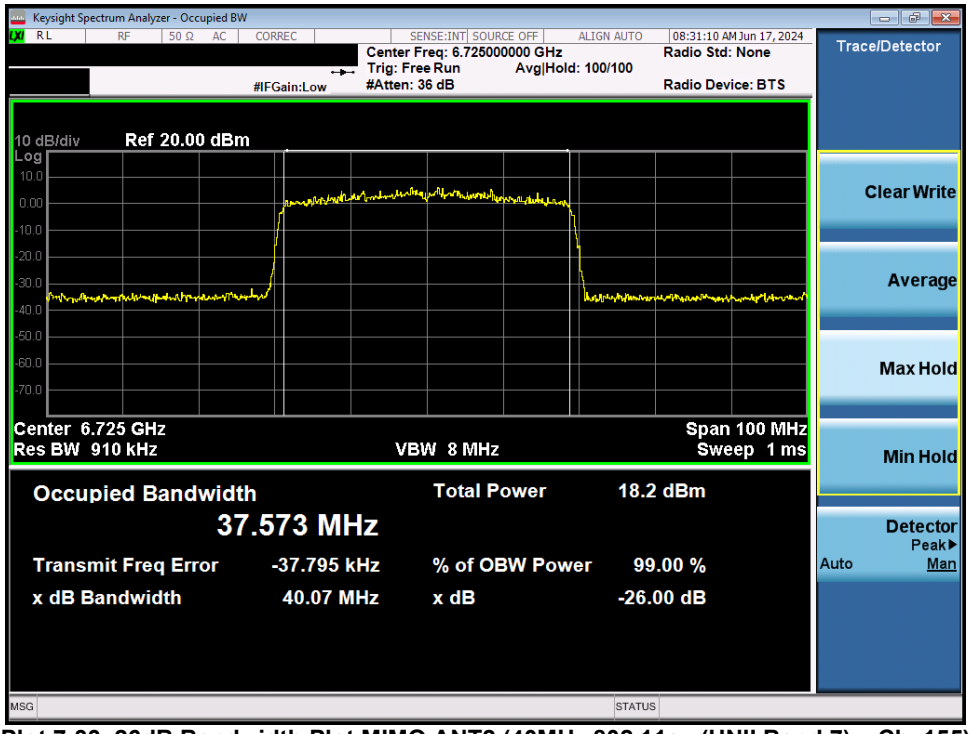
MIMO Antenna-2 26 dB Bandwidth Measurements - (UNII Band 7)



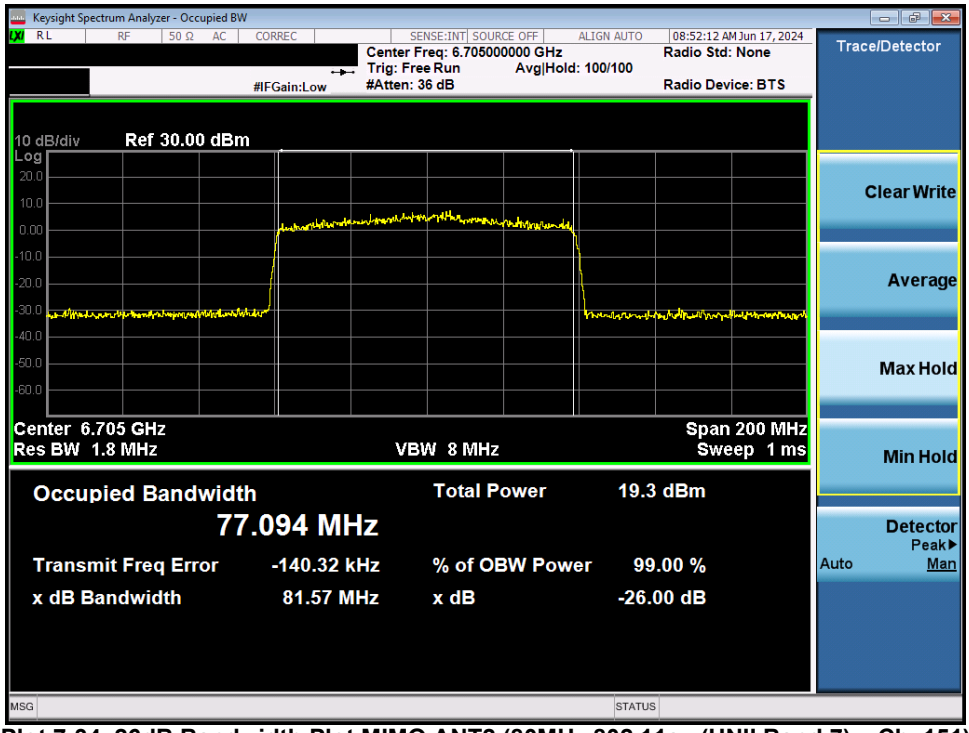
Plot 7-31. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 7) – Ch. 149)



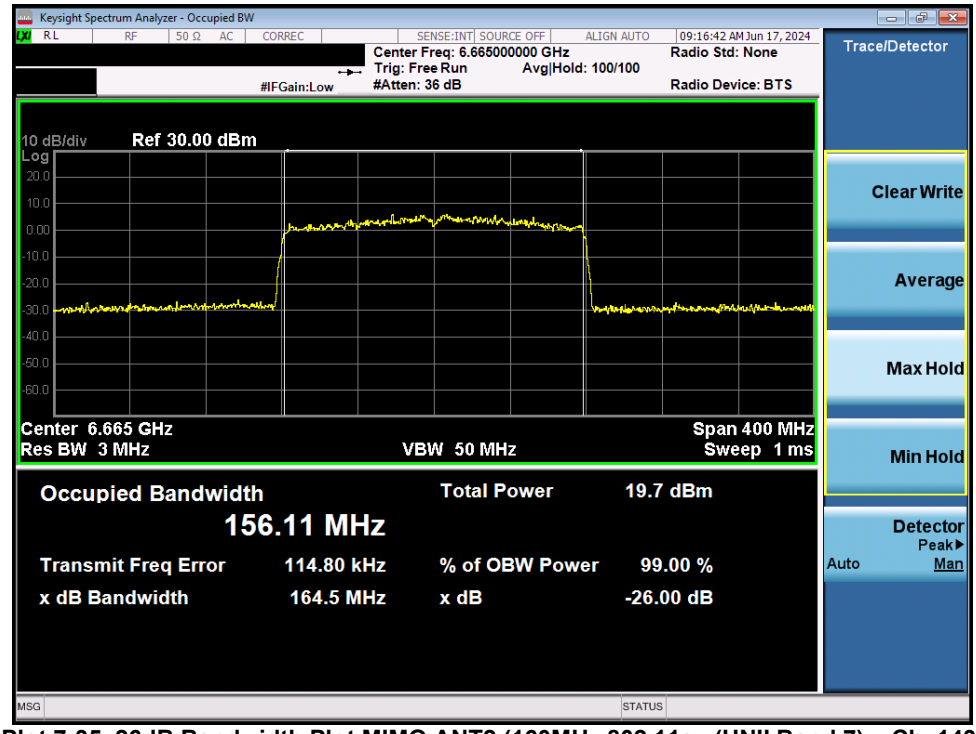
Plot 7-32. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 7) – Ch. 149)



Plot 7-33. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 7) – Ch. 155)

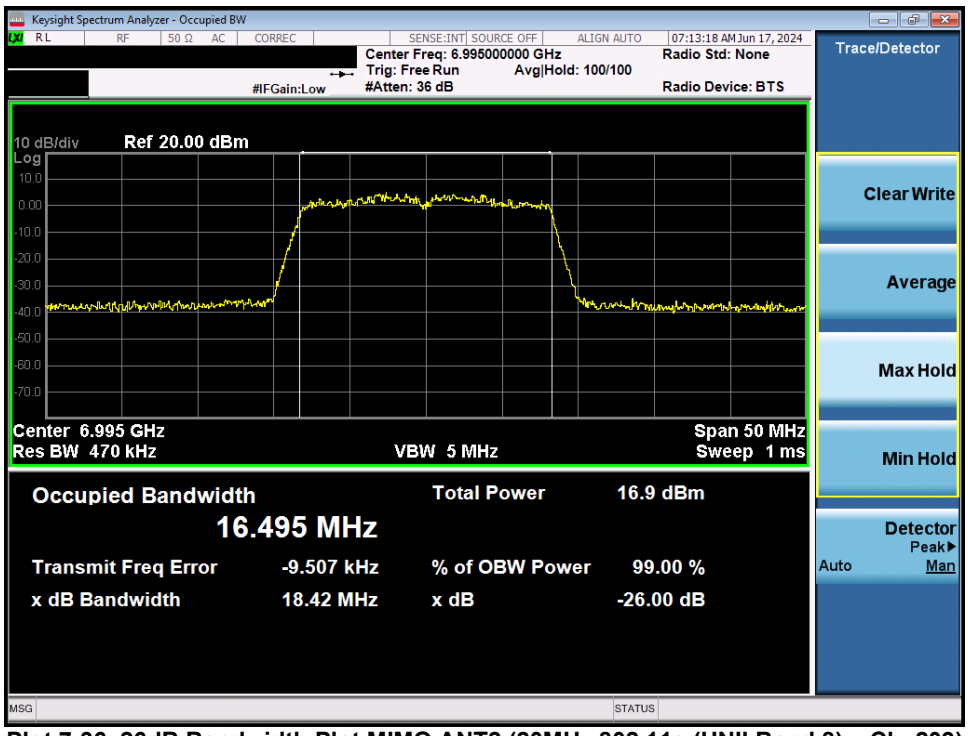


Plot 7-34. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 7) – Ch. 151)

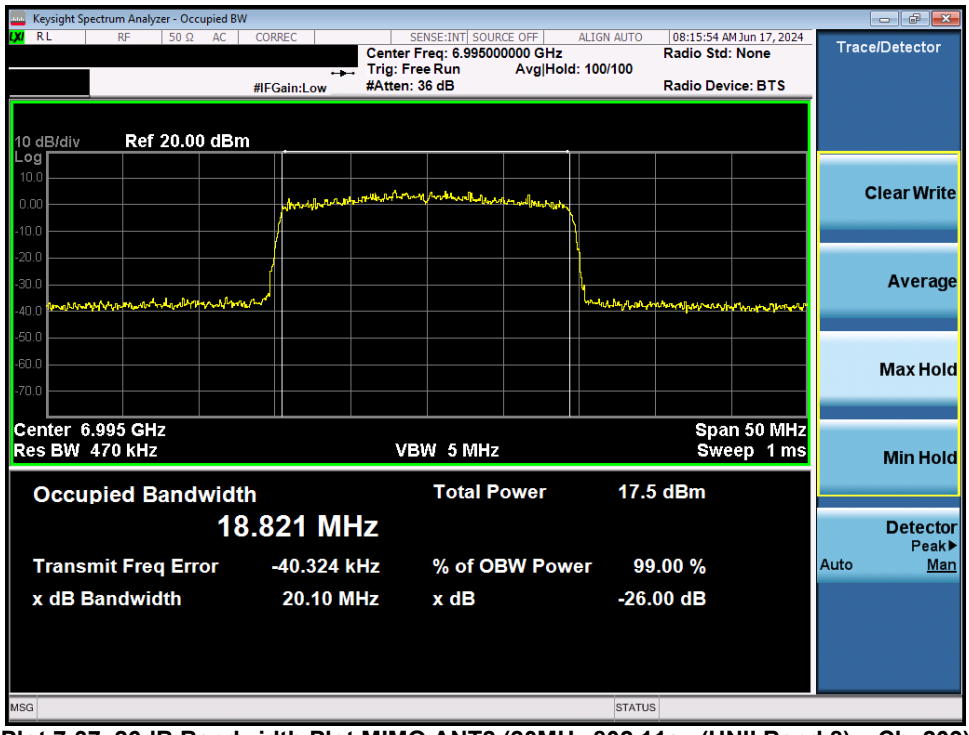


Plot 7-35. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax (UNII Band 7) – Ch. 143)

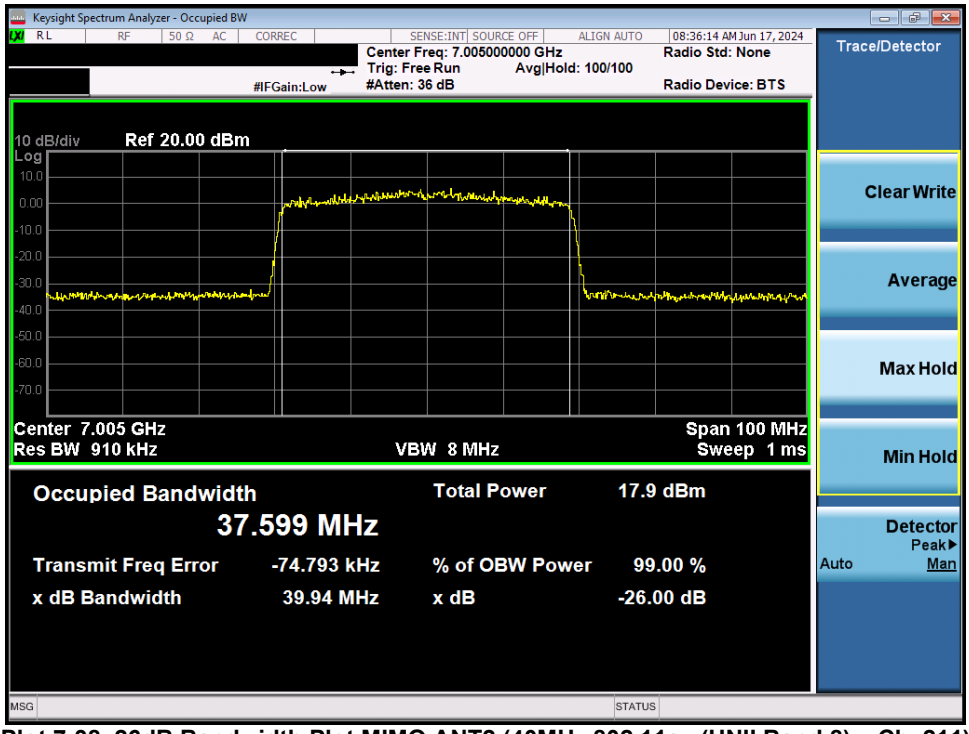
MIMO Antenna-2 26 dB Bandwidth Measurements - (UNII Band 8)



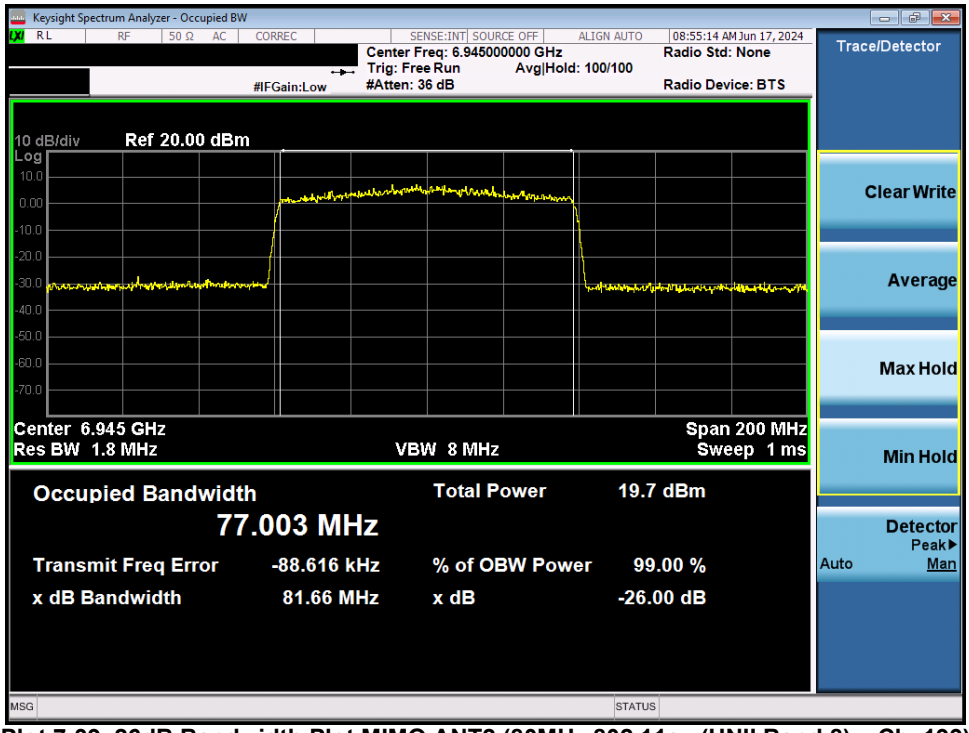
Plot 7-36. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11a (UNII Band 8) – Ch. 209)



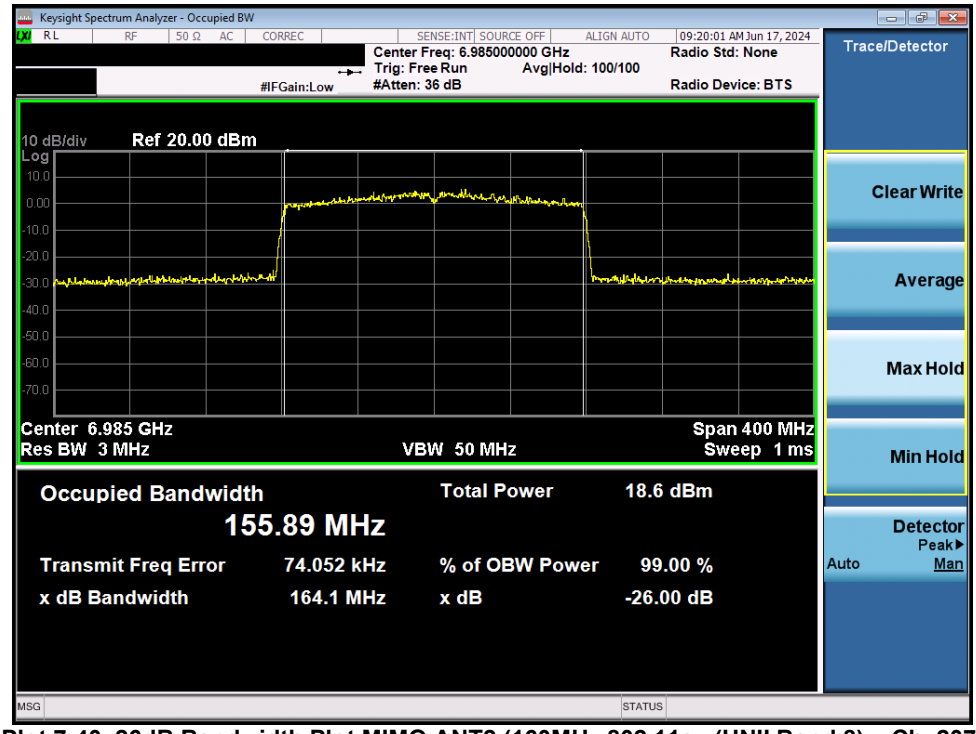
Plot 7-37. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax (UNII Band 8) – Ch. 209)



Plot 7-38. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax (UNII Band 8) – Ch. 211)



Plot 7-39. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax (UNII Band 8) – Ch. 199)



Plot 7-40. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax (UNII Band 8) – Ch. 207)

7.3 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.

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

Test Procedure Used

ANSI C63.10-2013 – Section 12.3.3.2 Method PM-G
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 7-2. Test Instrument & Measurement Setup

Test Notes

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

SISO ANT1 Maximum Conducted Output Power Measurements

6GHz WIFI (20MHz 802.11a SISO ANT1)				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 Power [dBm]				
UNII-5	5935	2	9.89	-5.80	4.09	24.00	-19.91
	5955	1	9.92	-5.80	4.12	24.00	-19.88
	6175	45	9.97	-5.80	4.17	24.00	-19.83
	6415	93	9.59	-5.80	3.79	24.00	-20.21
UNII-6	6435	97	9.86	-5.90	3.96	24.00	-20.04
	6475	105	9.88	-5.90	3.98	24.00	-20.02
	6515	113	9.98	-5.90	4.08	24.00	-19.92
UNII-7	6535	117	9.55	-7.40	2.15	24.00	-21.85
	6675	145	9.63	-7.40	2.23	24.00	-21.77
	6695	149	9.67	-7.40	2.27	24.00	-21.73
	6875	185	9.98	-7.40	2.58	24.00	-21.42
UNII-8	6895	189	9.48	-8.50	0.98	24.00	-23.02
	6995	209	9.74	-8.50	1.24	24.00	-22.76
	7115	233	9.56	-8.50	1.06	24.00	-22.94

Table 7-3. SISO ANT1 20MHz BW 802.11a (UNII) Maximum Conducted Output Power – LPI/SP

6GHz WIFI (20MHz 802.11ax SISO ANT1)				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 Power [dBm]				
UNII-5	5935	2	9.77	-5.80	3.97	24.00	-20.03
	5955	1	9.60	-5.80	3.80	24.00	-20.20
	6175	45	9.78	-5.80	3.98	24.00	-20.02
	6415	93	9.37	-5.80	3.57	24.00	-20.43
UNII-6	6435	97	9.58	-5.90	3.68	24.00	-20.32
	6475	105	9.56	-5.90	3.66	24.00	-20.34
	6515	113	9.61	-5.90	3.71	24.00	-20.29
UNII-7	6535	117	9.56	-7.40	2.16	24.00	-21.84
	6675	145	9.82	-7.40	2.42	24.00	-21.58
	6695	149	9.64	-7.40	2.24	24.00	-21.76
	6875	185	9.67	-7.40	2.27	24.00	-21.73
UNII-8	6895	189	9.59	-8.50	1.09	24.00	-22.91
	6995	209	9.99	-8.50	1.49	24.00	-22.51
	7115	233	9.83	-8.50	1.33	24.00	-22.68

Table 7-4. SISO ANT1 20MHz BW 802.11ax (UNII) Maximum Conducted Output Power – LPI/SP

6GHz WIFI (40MHz 802.11ax SISO ANT1)				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 Power [dBm]				
UNII-5	5965	3	9.43	-5.80	3.63	24.00	-20.37
	6165	43	9.20	-5.80	3.40	24.00	-20.60
	6285	67	9.29	-5.80	3.49	24.00	-20.51
	6405	91	9.26	-5.80	3.46	24.00	-20.54
UNII-6	6445	99	9.44	-5.90	3.54	24.00	-20.46
	6485	107	8.93	-5.90	3.03	24.00	-20.97
	6525	115	9.07	-5.90	3.17	24.00	-20.83
UNII-7	6565	123	9.49	-7.40	2.09	24.00	-21.91
	6685	147	9.34	-7.40	1.94	24.00	-22.06
	6725	155	9.06	-7.40	1.66	24.00	-22.34
	6845	179	9.31	-7.40	1.91	24.00	-22.09
UNII-8	6885	187	9.33	-8.50	0.83	24.00	-23.17
	7005	211	9.29	-8.50	0.79	24.00	-23.21
	7085	227	9.43	-8.50	0.93	24.00	-23.07

Table 7-5. SISO ANT1 40MHz BW 802.11ax (UNII) Maximum Conducted Output Power – LPI/SP

6GHz WIFI (80MHz 802.11ax SISO ANT1)				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 Power [dBm]				
UNII-5	5985	7	9.33	-5.80	3.53	24.00	-20.47
	6145	39	9.06	-5.80	3.26	24.00	-20.74
	6305	71	9.44	-5.80	3.64	24.00	-20.36
	6385	87	9.40	-5.80	3.60	24.00	-20.40
UNII-6	6465	103	9.20	-5.90	3.30	24.00	-20.70
UNII-7	6545	119	9.37	-5.90	3.47	24.00	-20.53
	6705	151	9.42	-7.40	2.02	24.00	-21.98
	6785	167	9.37	-7.40	1.97	24.00	-22.03
	6865	183	9.39	-7.40	1.99	24.00	-22.01
UNII-8	6945	199	9.43	-8.50	0.93	24.00	-23.07
	7025	215	9.23	-8.50	0.73	24.00	-23.27

Table 7-6. SISO ANT1 80MHz BW 802.11ax (UNII) Maximum Conducted Output Power – LPI/SP

6GHz WIFI (160MHz 802.11ax SISO ANT1)				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 Power [dBm]				
UNII-5	6025	15	9.60	-5.80	3.80	24.00	-20.20
	6185	47	9.99	-5.80	4.19	24.00	-19.81
	6345	79	9.76	-5.80	3.96	24.00	-20.04
UNII-6	6505	111	9.80	-5.90	3.90	24.00	-20.10
UNII-7	6665	143	9.94	-7.40	2.54	24.00	-21.46
	6825	175	9.82	-7.40	2.42	24.00	-21.58
UNII-8	6985	207	9.80	-8.50	1.30	24.00	-22.70

Table 7-7. SISO ANT1 160MHz BW 802.11ax (UNII) Maximum Conducted Output Power – LPI/SP

SISO ANT2 Maximum Conducted Output Power Measurements

6GHz WIFI (20MHz 802.11a SISO ANT2)				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 Power [dBm]				
UNII-5	5935	2	9.96	-8.30	1.66	24.00	-22.34
	5955	1	9.91	-8.30	1.61	24.00	-22.39
	6175	45	9.79	-8.30	1.49	24.00	-22.51
	6415	93	9.70	-8.30	1.40	24.00	-22.60
UNII-6	6435	97	9.75	-7.20	2.55	24.00	-21.46
	6475	105	9.63	-7.20	2.43	24.00	-21.57
	6515	113	9.82	-7.20	2.62	24.00	-21.38
UNII-7	6535	117	9.86	-7.40	2.46	24.00	-21.76
	6675	145	9.76	-7.40	2.36	24.00	-21.64
	6695	149	9.70	-7.40	2.30	24.00	-21.71
	6875	185	9.64	-7.40	2.24	24.00	-21.76
UNII-8	6895	189	9.96	-7.90	2.06	24.00	-21.94
	6995	209	9.79	-7.90	1.89	24.00	-22.11
	7115	233	9.56	-7.90	1.66	24.00	-22.34

Table 7-8. SISO ANT2 20MHz BW 802.11a (UNII) Maximum Conducted Output Power – LPI/SP

6GHz WIFI (20MHz 802.11ax SISO ANT2)				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 Power [dBm]				
UNII-5	5935	2	9.96	-8.30	1.66	24.00	-22.34
	5955	1	9.56	-8.30	1.26	24.00	-22.74
	6175	45	9.89	-8.30	1.59	24.00	-22.41
	6415	93	9.65	-8.30	1.35	24.00	-22.65
UNII-6	6435	97	9.76	-7.20	2.56	24.00	-21.44
	6475	105	9.66	-7.20	2.46	24.00	-21.54
	6515	113	9.85	-7.20	2.65	24.00	-21.35
UNII-7	6535	117	9.86	-7.40	2.46	24.00	-21.54
	6675	145	9.61	-7.40	2.21	24.00	-21.79
	6695	149	9.86	-7.40	2.46	24.00	-21.55
	6875	185	9.99	-7.40	2.59	24.00	-21.41
UNII-8	6895	189	9.49	-7.90	1.59	24.00	-22.41
	6995	209	9.81	-7.90	1.91	24.00	-22.09
	7115	233	9.87	-7.90	1.97	24.00	-22.03

Table 7-9. SISO ANT2 20MHz BW 802.11ax (UNII) Maximum Conducted Output Power – LPI/SP

6GHz WIFI (40MHz 802.11ax SISO ANT2)				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 Power [dBm]				
UNII-5	5965	3	9.20	-8.30	0.90	24.00	-23.10
	6165	43	9.47	-8.30	1.17	24.00	-22.83
	6285	67	9.13	-8.30	0.83	24.00	-23.17
	6405	91	9.36	-8.30	1.06	24.00	-22.94
UNII-6	6445	99	9.41	-7.20	2.21	24.00	-21.79
	6485	107	9.00	-7.20	1.80	24.00	-22.20
	6525	115	9.10	-7.20	1.90	24.00	-22.10
UNII-7	6565	123	9.44	-7.40	2.04	24.00	-21.96
	6685	147	9.03	-7.40	1.63	24.00	-22.37
	6725	155	9.32	-7.40	1.92	24.00	-22.08
	6845	179	9.14	-7.40	1.74	24.00	-22.26
UNII-8	6885	187	9.06	-7.90	1.16	24.00	-22.84
	7005	211	9.37	-7.90	1.47	24.00	-22.53
	7085	227	9.08	-7.90	1.18	24.00	-22.82

Table 7-10. SISO ANT2 40MHz BW 802.11ax (UNII) Maximum Conducted Output Power – LPI/SP

6GHz WIFI (80MHz 802.11ax SISO ANT WIFI 2)				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 Power [dBm]				
UNII-5	5985	7	9.31	-8.30	1.01	24.00	-22.99
	6145	39	9.37	-8.30	1.07	24.00	-22.93
	6305	71	9.23	-8.30	0.93	24.00	-23.07
	6385	87	9.42	-8.30	1.12	24.00	-22.88
UNII-6	6465	103	9.41	-7.20	2.21	24.00	-21.79
UNII-7	6545	119	9.46	-7.20	2.26	24.00	-21.74
	6705	151	9.38	-7.40	1.98	24.00	-22.02
	6785	167	9.14	-7.40	1.74	24.00	-22.26
	6865	183	9.17	-7.40	1.77	24.00	-22.23
UNII-8	6945	199	9.23	-7.90	1.33	24.00	-22.67
	7025	215	9.49	-7.90	1.59	24.00	-22.41

Table 7-11. SISO ANT2 80MHz BW 802.11ax (UNII) Maximum Conducted Output Power – LPI/SP

6GHz WIFI (160MHz 802.11ax SISO ANT2)				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 Power [dBm]				
UNII-5	6025	15	9.26	-8.30	0.96	24.00	-23.04
	6185	47	9.09	-8.30	0.79	24.00	-23.21
	6345	79	9.17	-8.30	0.87	24.00	-23.13
UNII-6	6505	111	9.55	-7.20	2.35	24.00	-21.65
UNII-7	6665	143	9.63	-7.40	2.23	24.00	-21.77
	6825	175	9.29	-7.40	1.89	24.00	-22.11
UNII-8	6985	207	9.30	-7.90	1.40	24.00	-22.60

Table 7-12. SISO ANT2 160MHz BW 802.11ax (UNII) Maximum Conducted Output Power – LPI/SP

MIMO Maximum Conducted Output Power Measurements

6GHz WIFI (20MHz 802.11a MIMO)						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-5	5935	2	9.65	9.72	12.70	-3.95	8.75	24.00	-15.25
	5955	1	9.58	9.62	12.61	-3.95	8.66	24.00	-15.34
	6175	45	8.54	9.47	12.04	-3.95	8.09	24.00	-15.91
	6415	93	9.47	9.86	12.68	-3.95	8.73	24.00	-15.27
UNII-6	6435	97	9.41	9.68	12.56	-3.52	9.04	24.00	-14.96
	6475	105	9.78	9.63	12.72	-3.52	9.20	24.00	-14.80
	6515	113	9.67	9.92	12.81	-3.52	9.29	24.00	-14.71
UNII-7	6535	117	9.34	9.85	12.61	-4.39	8.22	24.00	-15.78
	6675	145	9.75	9.79	12.78	-4.39	8.39	24.00	-15.61
	6695	149	9.60	9.69	12.66	-4.39	8.27	24.00	-15.73
	6875	185	9.69	9.75	12.73	-4.39	8.34	24.00	-15.66
UNII-8	6895	189	9.58	9.74	12.67	-5.18	7.49	24.00	-16.51
	6995	209	9.16	9.54	12.36	-5.18	7.18	24.00	-16.82
	7115	233	9.04	9.48	12.28	-5.18	7.10	24.00	-16.90

Table 7-13. MIMO 20MHz BW 802.11a (UNII) Maximum Conducted Output Power – LPI/SP

6GHz WIFI (20MHz 802.11ax MIMO)						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-5	5935	2	9.48	9.60	12.55	-3.95	8.60	24.00	-15.40
	5955	1	9.47	9.66	12.58	-3.95	8.63	24.00	-15.37
	6175	45	9.05	9.94	12.53	-3.95	8.58	24.00	-15.42
	6415	93	9.24	9.60	12.43	-3.95	8.48	24.00	-15.52
UNII-6	6435	97	9.28	9.25	12.28	-3.52	8.76	24.00	-15.24
	6475	105	9.89	9.78	12.85	-3.52	9.33	24.00	-14.67
	6515	113	9.15	9.78	12.49	-3.52	8.97	24.00	-15.03
UNII-7	6535	117	9.14	9.60	12.39	-4.39	8.00	24.00	-16.00
	6675	145	9.80	9.93	12.88	-4.39	8.49	24.00	-15.51
	6695	149	9.79	9.74	12.78	-4.39	8.39	24.00	-15.61
	6875	185	9.67	9.62	12.66	-4.39	8.27	24.00	-15.73
UNII-8	6895	189	9.26	9.60	12.44	-5.18	7.26	24.00	-16.74
	6995	209	9.07	9.46	12.28	-5.18	7.10	24.00	-16.90
	7115	233	9.51	9.78	12.66	-5.18	7.48	24.00	-16.52

Table 7-14. MIMO 20MHz BW 802.11ax (UNII) Maximum Conducted Output Power – LPI/SP

6GHz WIFI (40MHz 802.11ax MIMO)						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-5	5965	3	9.34	9.83	12.60	-3.95	8.65	24.00	-15.35
	6165	43	9.14	9.99	12.60	-3.95	8.65	24.00	-15.35
	6285	67	9.01	9.29	12.16	-3.95	8.21	24.00	-15.79
	6405	91	9.60	9.90	12.76	-3.95	8.81	24.00	-15.19
UNII-6	6445	99	9.18	9.25	12.23	-3.52	8.71	24.00	-15.29
	6485	107	9.44	9.15	12.31	-3.52	8.79	24.00	-15.21
	6525	115	9.18	9.35	12.28	-3.52	8.76	24.00	-15.24
UNII-7	6565	123	9.10	9.58	12.36	-4.39	7.97	24.00	-16.03
	6685	147	9.95	9.79	12.88	-4.39	8.49	24.00	-15.51
	6725	155	9.76	9.60	12.69	-4.39	8.30	24.00	-15.70
	6845	179	9.59	9.91	12.76	-4.39	8.37	24.00	-15.63
UNII-8	6885	187	9.01	9.22	12.13	-5.18	6.95	24.00	-17.05
	7005	211	9.01	9.18	12.11	-5.18	6.93	24.00	-17.07
	7085	227	9.02	9.01	12.03	-5.18	6.85	24.00	-17.15

Table 7-15. MIMO 40MHz BW 802.11ax (UNII) Maximum Conducted Output Power – LPI/SP

6GHz WIFI (80MHz 802.11ax MIMO)						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-5	5985	7	9.78	9.76	12.78	-3.95	8.83	24.00	-15.17
	6145	39	8.67	9.78	12.27	-3.95	8.32	24.00	-15.68
	6305	71	9.20	9.83	12.54	-3.95	8.59	24.00	-15.41
	6385	87	9.37	9.57	12.48	-3.95	8.53	24.00	-15.47
UNII-6	6465	103	9.88	9.84	12.87	-3.52	9.35	24.00	-14.65
UNII-7	6545	119	9.34	9.86	12.62	-3.52	9.10	24.00	-14.90
	6705	151	9.63	9.72	12.69	-4.39	8.30	24.00	-15.70
	6785	167	9.87	9.63	12.76	-4.39	8.37	24.00	-15.63
	6865	183	9.56	9.79	12.69	-4.39	8.30	24.00	-15.70
UNII-8	6945	199	9.48	9.90	12.71	-5.18	7.53	24.00	-16.47
	7025	215	9.43	9.87	12.67	-5.18	7.49	24.00	-16.51

Table 7-16. MIMO 80MHz BW 802.11ax (UNII) Maximum Conducted Output Power – LPI/SP

6GHz WIFI (160MHz 802.11ax MIMO)						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-5	6025	15	9.54	9.12	12.35	-3.95	8.40	24.00	-15.60
	6185	47	9.58	9.01	12.31	-3.95	8.36	24.00	-15.64
	6345	79	9.04	9.68	12.38	-3.95	8.43	24.00	-15.57
UNII-6	6505	111	9.62	9.96	12.80	-3.52	9.28	24.00	-14.72
UNII-7	6665	143	9.84	9.35	12.61	-4.39	8.22	24.00	-15.78
	6825	175	9.91	9.47	12.71	-4.39	8.32	24.00	-15.68
UNII-8	6985	207	9.52	8.90	12.23	-5.18	7.05	24.00	-16.95

Table 7-17. MIMO 160MHz BW 802.11ax (UNII) Maximum Conducted Output Power – LPI/SP

Sample MIMO Calculation:

Assuming at 5935MHz in 802.11a (20MHz BW) mode, the average conducted output power was measured to be 9.65 dBm for Antenna-1 and 9.72 dBm for Antenna-2.

Antenna 1 + Antenna 2 = MIMO

(9.65 dBm + 9.72 dBm) = (9.23 mW + 9.38 mW) = 18.61 mW = 12.70 dBm

Sample Directional Gain Calculation:

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

$$\text{Directional gain} = 10 \log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}] \text{ dBi}$$

Sample e.i.r.p. Calculation:

Assuming at 5935MHz in 802.11a (20MHz BW) mode, the average MIMO conducted power was calculated to be 12.70 dBm with directional gain of -3.95 dBi.

e.i.r.p. (dBm) = Conducted Power (dBm) + Ant gain (dBi)

12.70 dBm + -3.95 dBi = 8.75 dBm

7.4 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 for 802.11a/ax.

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

Test Procedure Used

ANSI C63.10-2013 – Section 12.3.2.2
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 ≥ 2 x (span/RBW)
6. Sweep time = auto
7. Detector = power averaging (RMS)
8. Trigger was set to free run for all modes.
9. Trace was averaged over 100 sweeps.
10. The peak search function of the spectrum analyzer was used to find the peak of the spectrum.

Test Setup

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

Figure 7-3. Test Instrument & Measurement Setup

Test Notes

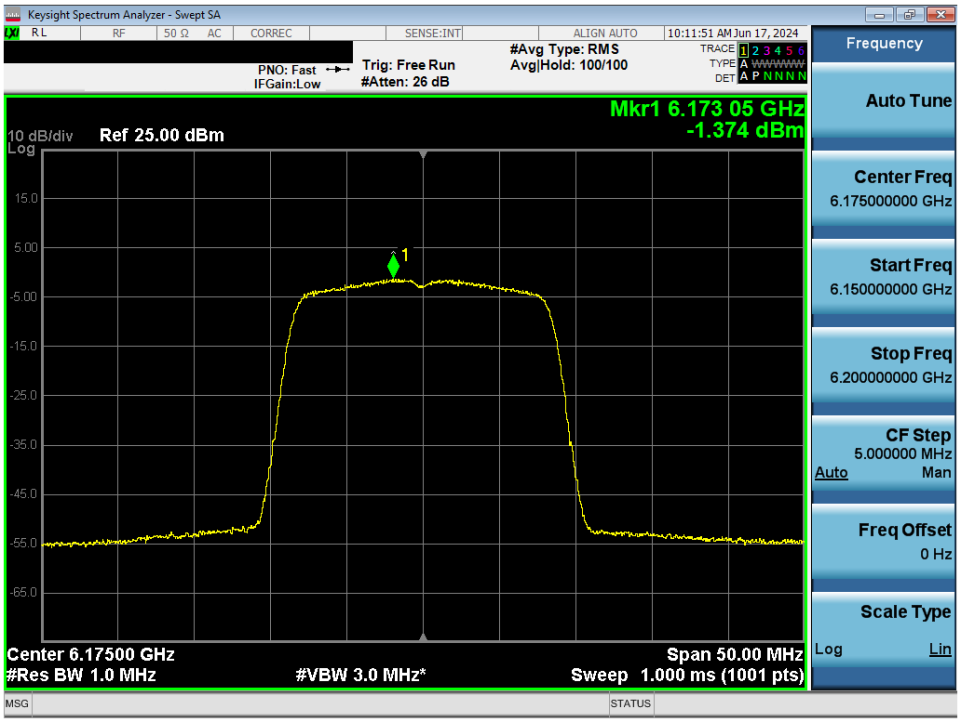
All cases were investigated; a subset of the taken plots were included to represent relevant settings and measurements.

MIMO Power Spectral Density Measurements

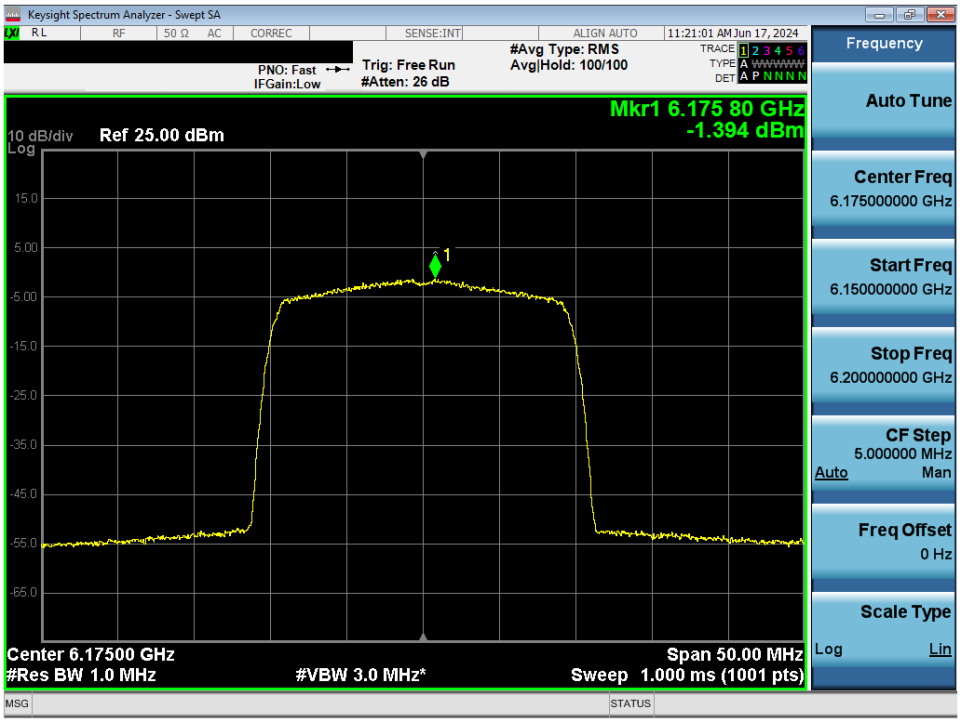
	Frequency [MHz]	Channel	802.11 MODE	Antenna-1 Power Density [dBm]	Antenna-2 Power Density [dBm]	Antenna-1 Gain [dBi]	Antenna-2 Gain [dBi]	Summed MIMO Power Density [dBm/MHz]	Directional Gain [dBi]	DCCF	e.i.r.p Density [dBm/MHz]	Max EIRP Density [dBm/MHz]	Margin [dB]
Band 5	5935	2	a	-1.07	-0.71	-5.80	-8.30	2.12	-3.95	0.11	-1.72	-1	-0.72
	6175	45	a	-1.37	-0.06	-5.80	-8.30	2.35	-3.95	0.11	-1.49	-1	-0.49
	6415	93	a	-1.35	0.02	-5.80	-8.30	2.40	-3.95	0.11	-1.44	-1	-0.44
	5935	2	ax (20MHz)	-1.35	-0.80	-5.80	-8.30	1.94	-3.95	0.26	-1.75	-1	-0.75
	6175	45	ax (20MHz)	-1.39	-0.26	-5.80	-8.30	2.22	-3.95	0.26	-1.47	-1	-0.47
	6415	93	ax (20MHz)	-1.21	-0.55	-5.80	-8.30	2.14	-3.95	0.26	-1.55	-1	-0.55
	5965	3	ax (40MHz)	-4.30	-3.25	-5.80	-8.30	-0.73	-3.95	0.46	-4.22	-1	-3.22
	6165	43	ax (40MHz)	-4.59	-3.52	-5.80	-8.30	-1.01	-3.95	0.46	-4.50	-1	-3.50
	6405	91	ax (40MHz)	-3.93	-3.22	-5.80	-8.30	-0.55	-3.95	0.46	-4.04	-1	-3.04
	5985	7	ax (80MHz)	-6.52	-6.14	-5.80	-8.30	-3.31	-3.95	0.46	-6.80	-1	-5.80
	6145	39	ax (80MHz)	-6.70	-6.02	-5.80	-8.30	-3.33	-3.95	0.46	-6.82	-1	-5.82
	6385	87	ax (80MHz)	-6.54	-6.04	-5.80	-8.30	-3.27	-3.95	0.46	-6.76	-1	-5.76
	6025	15	ax (160MHz)	-8.78	-8.80	-5.80	-8.30	-5.78	-3.95	0.56	-9.17	-1	-8.17
	6185	47	ax (160MHz)	-8.67	-8.77	-5.80	-8.30	-5.71	-3.95	0.56	-9.10	-1	-8.10
	6345	79	ax (160MHz)	-9.41	-7.45	-5.80	-8.30	-5.31	-3.95	0.56	-8.70	-1	-7.70
Band 6	6435	97	a	-1.25	-0.52	-5.90	-7.20	2.14	-3.52	0.11	-1.26	-1	-0.26
	6475	105	a	-0.94	-0.52	-5.90	-7.20	2.28	-3.52	0.11	-1.12	-1	-0.12
	6515	113	a	-1.12	-0.42	-5.90	-7.20	2.25	-3.52	0.11	-1.15	-1	-0.15
	6345	97	ax (20MHz)	-1.49	-0.80	-5.90	-7.20	1.88	-3.52	0.26	-1.37	-1	-0.37
	6475	105	ax (20MHz)	-0.93	-0.80	-5.90	-7.20	2.15	-3.52	0.26	-1.11	-1	-0.11
	6515	113	ax (20MHz)	-1.06	-0.58	-5.90	-7.20	2.20	-3.52	0.26	-1.06	-1	-0.06
	6445	99	ax (40MHz)	-4.53	-4.20	-5.90	-7.20	-1.35	-3.52	0.46	-4.41	-1	-3.41
	6485	107	ax (40MHz)	-4.26	-3.93	-5.90	-7.20	-1.08	-3.52	0.46	-4.14	-1	-3.14
	6525	115	ax (40MHz)	-4.27	-3.74	-5.90	-7.20	-0.99	-3.52	0.46	-4.04	-1	-3.04
	6465	103	ax (80MHz)	-6.94	-6.12	-5.90	-7.20	-3.50	-3.52	0.46	-6.55	-1	-5.55
	6505	111	ax (160MHz)	-8.65	-8.05	-5.90	-7.20	-5.33	-3.52	0.56	-8.28	-1	-7.28
Band 7	6535	117	a	-1.41	-0.25	-7.40	-7.40	2.22	-4.39	0.11	-2.06	-1	-1.06
	6695	149	a	-0.81	-0.43	-7.40	-7.40	2.40	-4.39	0.11	-1.88	-1	-0.88
	6875	185	a	-1.07	-0.62	-7.40	-7.40	2.17	-4.39	0.11	-2.11	-1	-1.11
	6535	117	ax (20MHz)	-1.28	-0.64	-7.40	-7.40	2.06	-4.39	0.26	-2.07	-1	-1.07
	6695	149	ax (20MHz)	-1.01	-0.78	-7.40	-7.40	2.12	-4.39	0.26	-2.01	-1	-1.01
	6875	185	ax (20MHz)	-0.90	-0.84	-7.40	-7.40	2.14	-4.39	0.26	-1.99	-1	-0.99
	6565	123	ax (40MHz)	-4.24	-3.37	-7.40	-7.40	-0.77	-4.39	0.46	-4.70	-1	-3.70
	6725	155	ax (40MHz)	-4.03	-3.62	-7.40	-7.40	-0.81	-4.39	0.46	-4.74	-1	-3.74
	6885	179	ax (40MHz)	-3.73	-3.50	-7.40	-7.40	-0.60	-4.39	0.46	-4.53	-1	-3.53
	6545	119	ax (80MHz)	-6.94	-5.79	-7.40	-7.40	-3.32	-4.39	0.46	-7.25	-1	-6.25
	6705	151	ax (80MHz)	-6.29	-5.90	-7.40	-7.40	-3.08	-4.39	0.46	-7.01	-1	-6.01
	6865	183	ax (80MHz)	-6.14	-5.84	-7.40	-7.40	-2.98	-4.39	0.46	-6.91	-1	-5.91
	6665	143	ax (160MHz)	-8.38	-8.75	-7.40	-7.40	-5.55	-4.39	0.56	-9.38	-1	-8.38
	6825	175	ax (160MHz)	-7.83	-8.14	-7.40	-7.40	-4.97	-4.39	0.56	-8.80	-1	-7.80
Band 8	6895	189	a	-0.78	-0.41	-8.50	-7.90	2.42	-5.18	0.11	-2.65	-1	-1.65
	6995	209	a	-0.85	-0.56	-8.50	-7.90	2.31	-5.18	0.11	-2.77	-1	-1.77
	7115	233	a	-0.69	-0.54	-8.50	-7.90	2.40	-5.18	0.11	-2.68	-1	-1.68
	6895	189	ax (20MHz)	-0.78	-0.61	-8.50	-7.90	2.32	-5.18	0.26	-2.61	-1	-1.61
	6995	209	ax (20MHz)	-0.87	-0.91	-8.50	-7.90	2.12	-5.18	0.26	-2.80	-1	-1.80
	7115	233	ax (20MHz)	-0.43	-0.56	-8.50	-7.90	2.52	-5.18	0.26	-2.41	-1	-1.41
	6925	187	ax (40MHz)	-3.98	-3.89	-8.50	-7.90	-0.92	-5.18	0.46	-5.65	-1	-4.65
	7005	211	ax (40MHz)	-3.43	-3.83	-8.50	-7.90	-0.61	-5.18	0.46	-5.34	-1	-4.34
	7085	227	ax (40MHz)	-3.86	-3.27	-8.50	-7.90	-0.54	-5.18	0.46	-5.27	-1	-4.27
	6945	199	ax (80MHz)	-6.13	-5.60	-8.50	-7.90	-2.84	-5.18	0.46	-7.57	-1	-6.57
	7025	215	ax (80MHz)	-5.66	-5.57	-8.50	-7.90	-2.60	-5.18	0.46	-7.33	-1	-6.33
	6985	207	ax (160MHz)	-7.82	-9.62	-8.50	-7.90	-5.62	-5.18	0.56	-10.24	-1	-9.24

Table 7-18. MIMO e.i.r.p. Conducted Power Spectral Density Measurements – LPI/SP

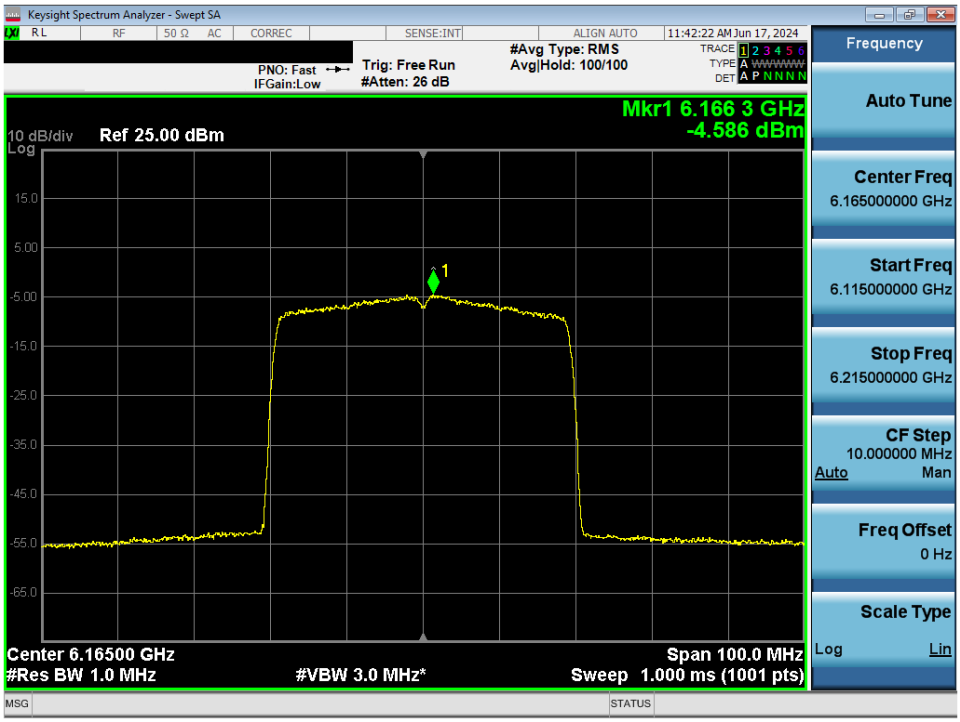
MIMO Antenna-1 Power Spectral Density Measurements - (UNII Band 5)



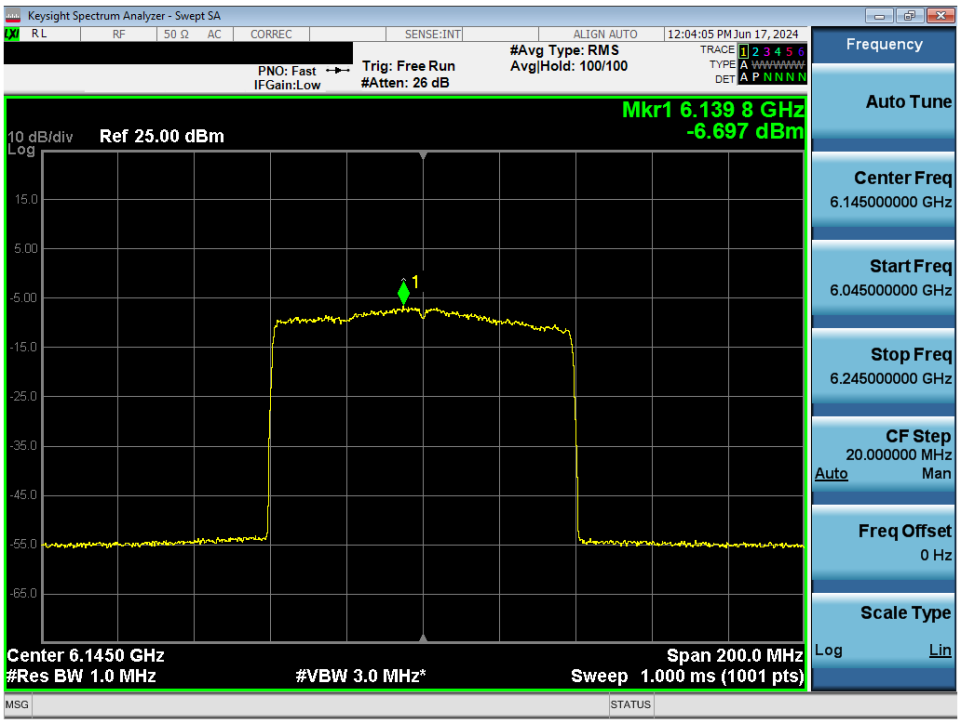
Plot 7-41. Power Spectral Density MIMO ANT1 (20MHz 802.11a (UNII Band 5) – Ch. 45) - LPI/SP



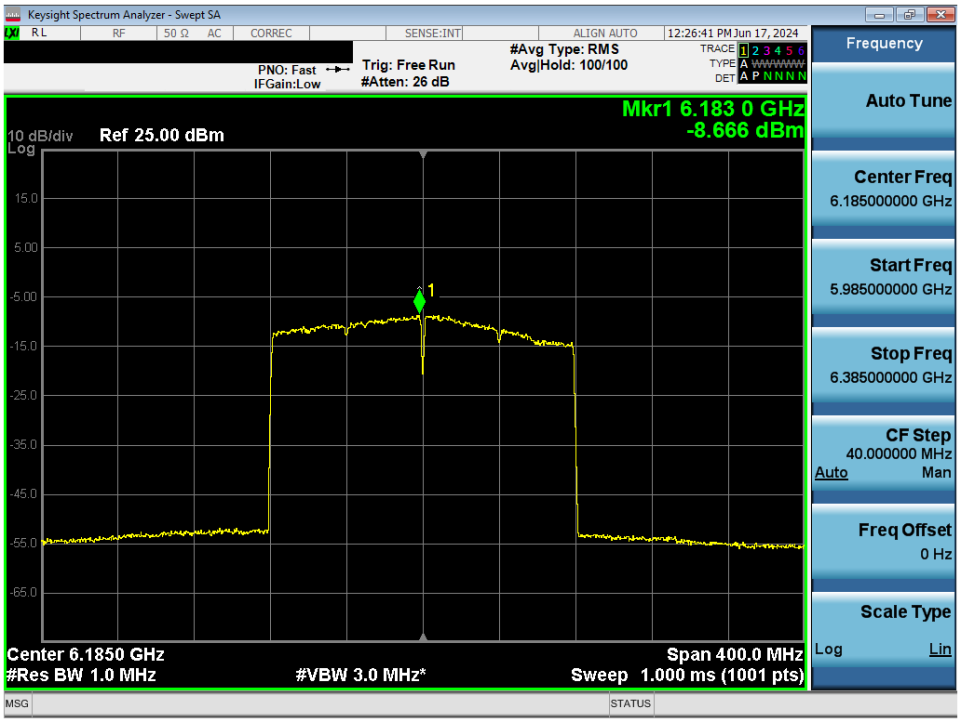
Plot 7-42. Power Spectral Density MIMO ANT1 (20MHz 802.11ax (UNII Band 5) – Ch. 45) - LPI/SP



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

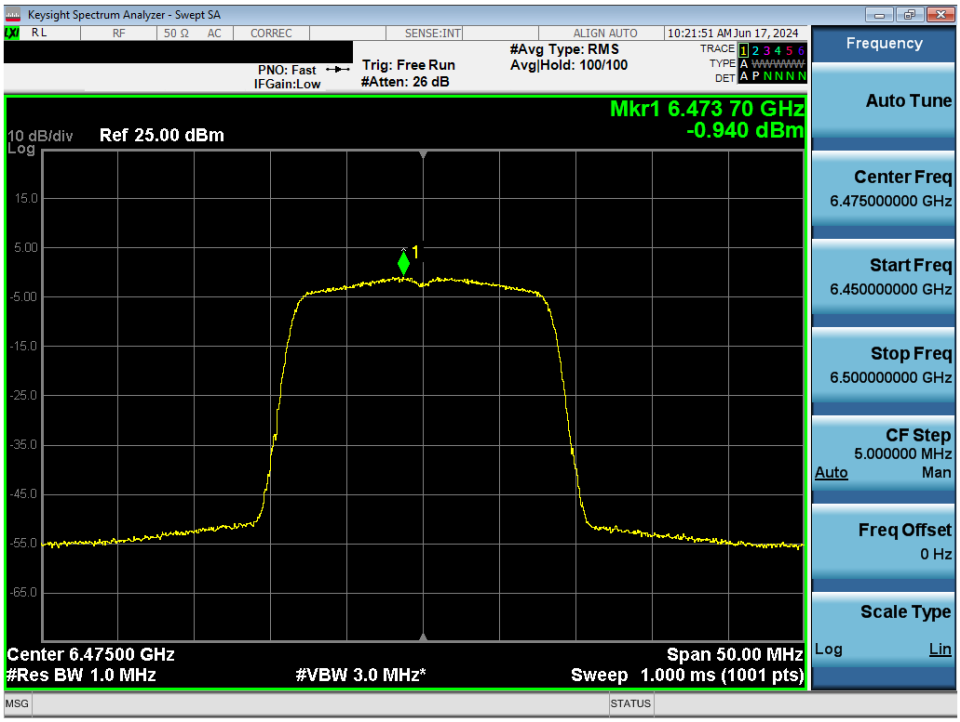


Plot 7-44. Power Spectral Density MIMO ANT1 (80MHz 802.11ax (UNII Band 5) – Ch. 39) - LPI/SP

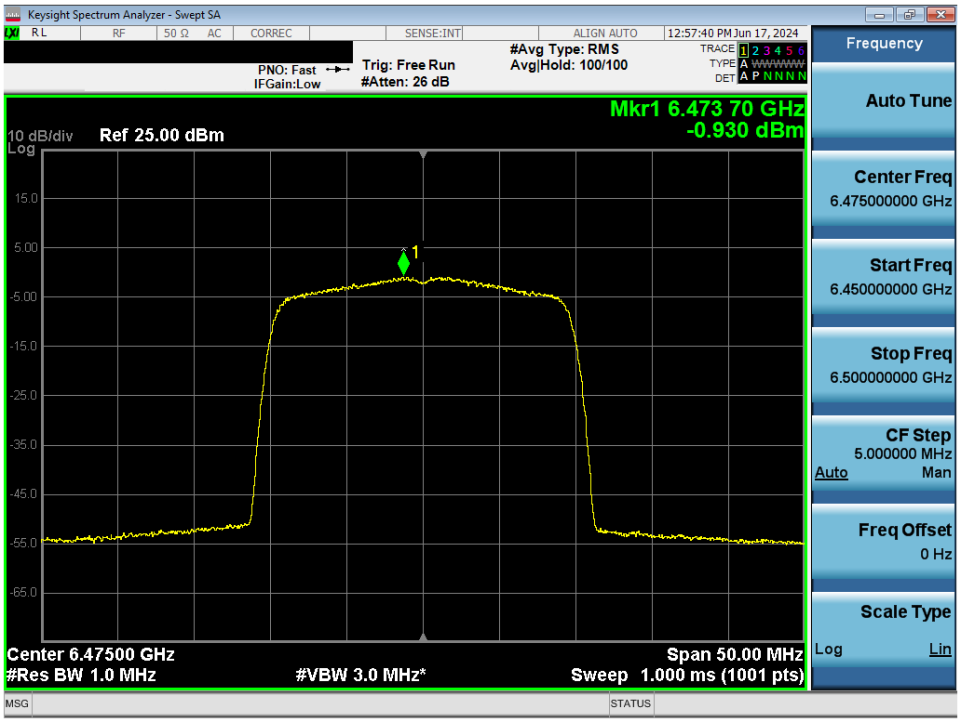


Plot 7-45. Power Spectral Density MIMO ANT1 (160MHz 802.11ax (UNII Band 5) – Ch. 47) - LPI/SP

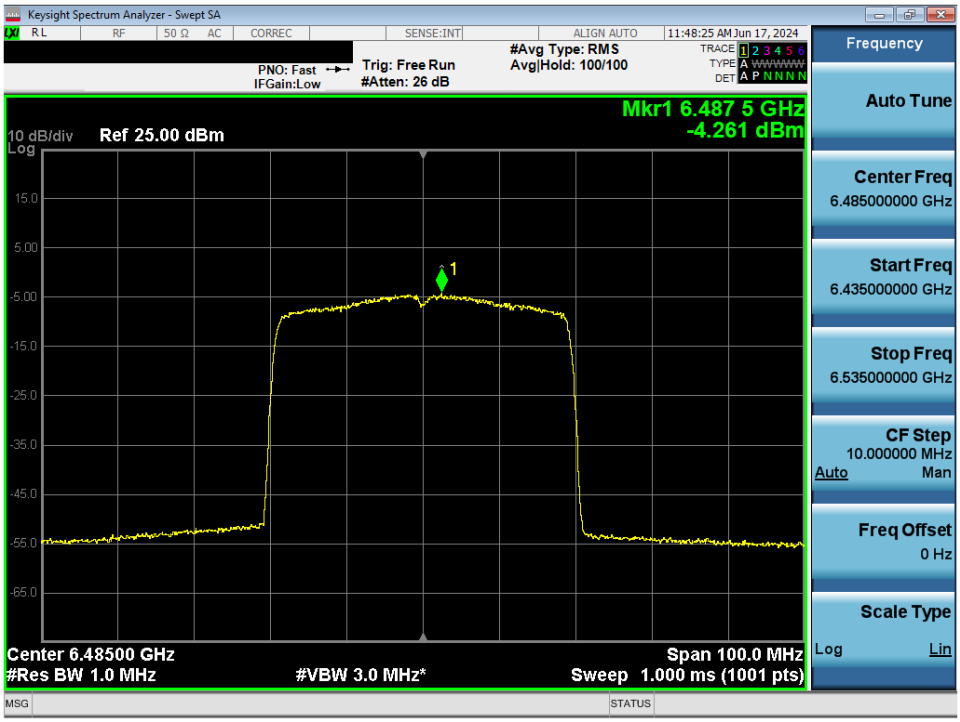
MIMO Antenna-1 Power Spectral Density Measurements - (UNII Band 6)



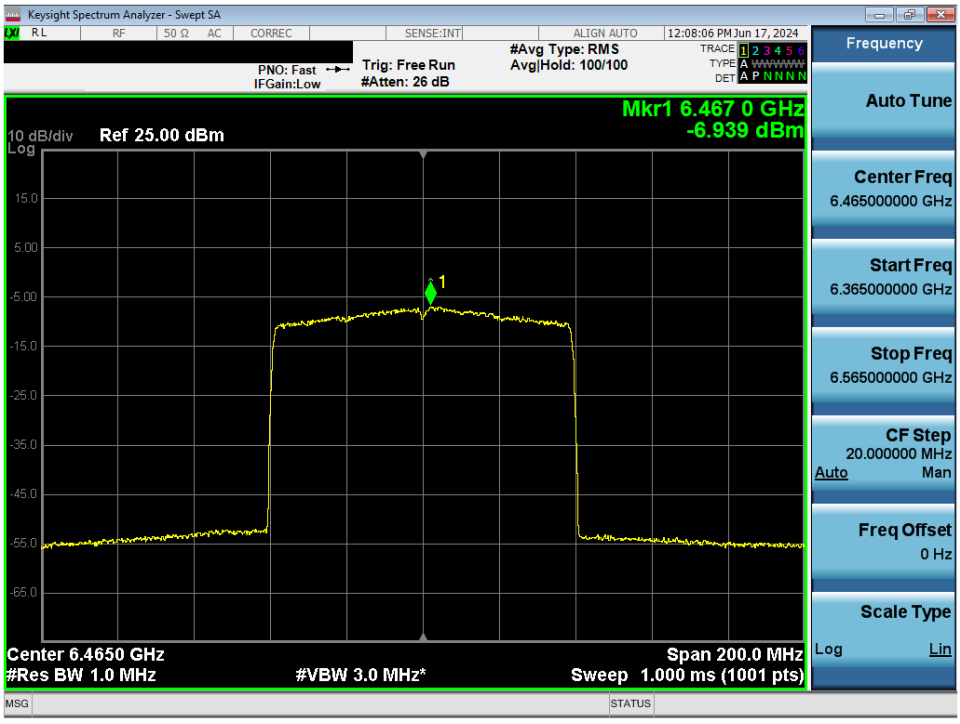
Plot 7-46. Power Spectral Density MIMO ANT1 (20MHz 802.11a (UNII Band 6) – Ch. 105) - LPI



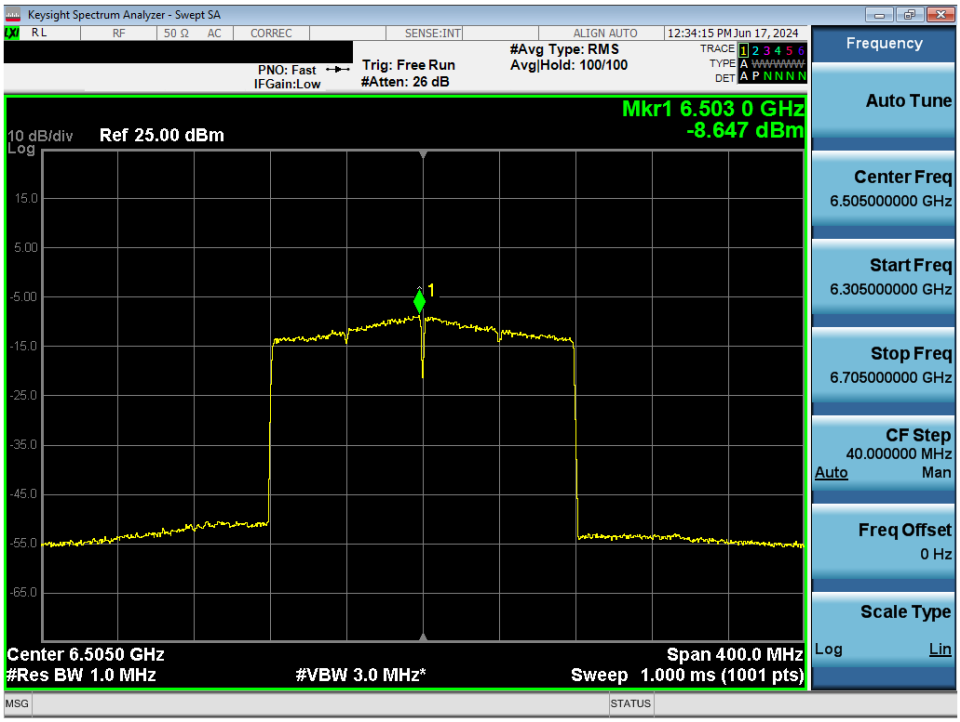
Plot 7-47. Power Spectral Density MIMO ANT1 (20MHz 802.11ax (UNII Band 6) – Ch. 105) - LPI



Plot 7-48. Power Spectral Density MIMO ANT1 (40MHz 802.11ax (UNII Band 6) – Ch. 107) - LPI

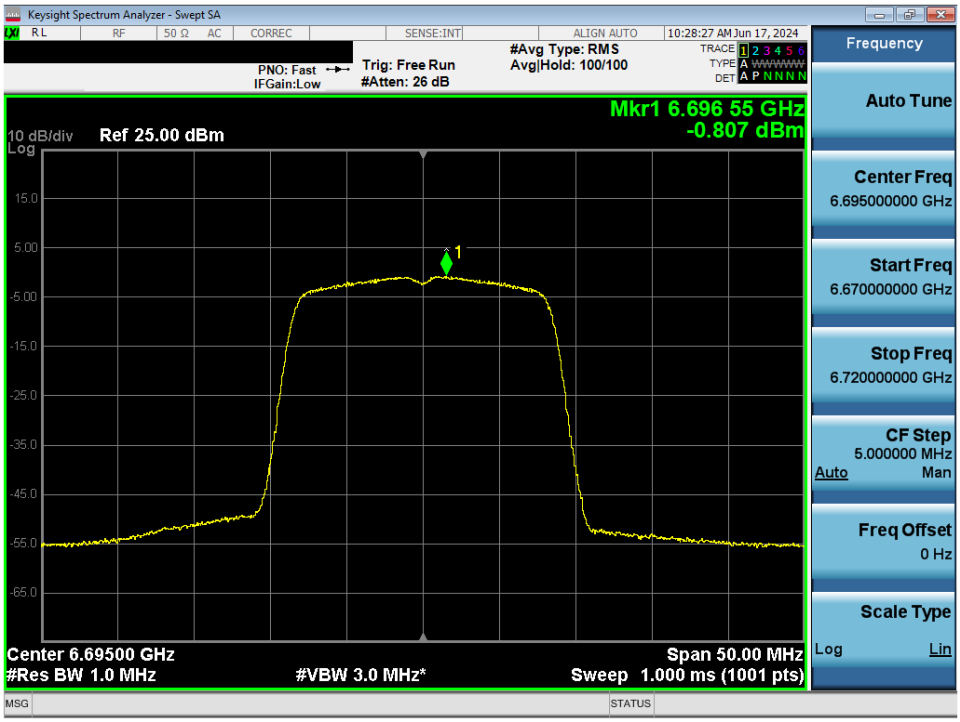


Plot 7-49. Power Spectral Density MIMO ANT1 (80MHz 802.11ax (UNII Band 6) – Ch. 103) - LPI

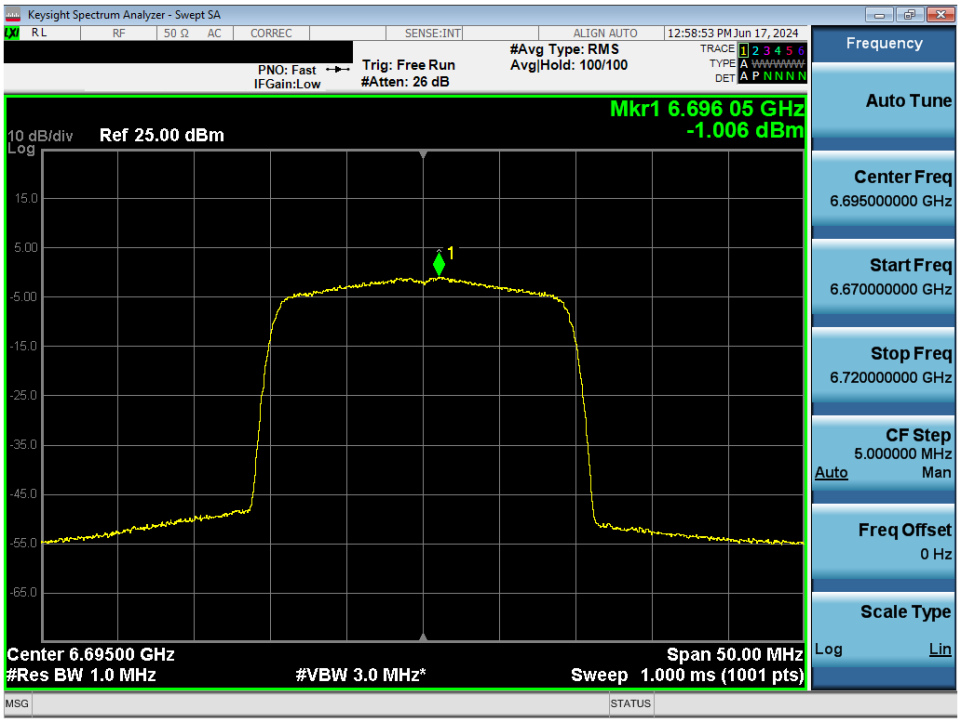


Plot 7-50. Power Spectral Density MIMO ANT1 (160MHz 802.11ax (UNII Band 6) – Ch. 111) - LPI

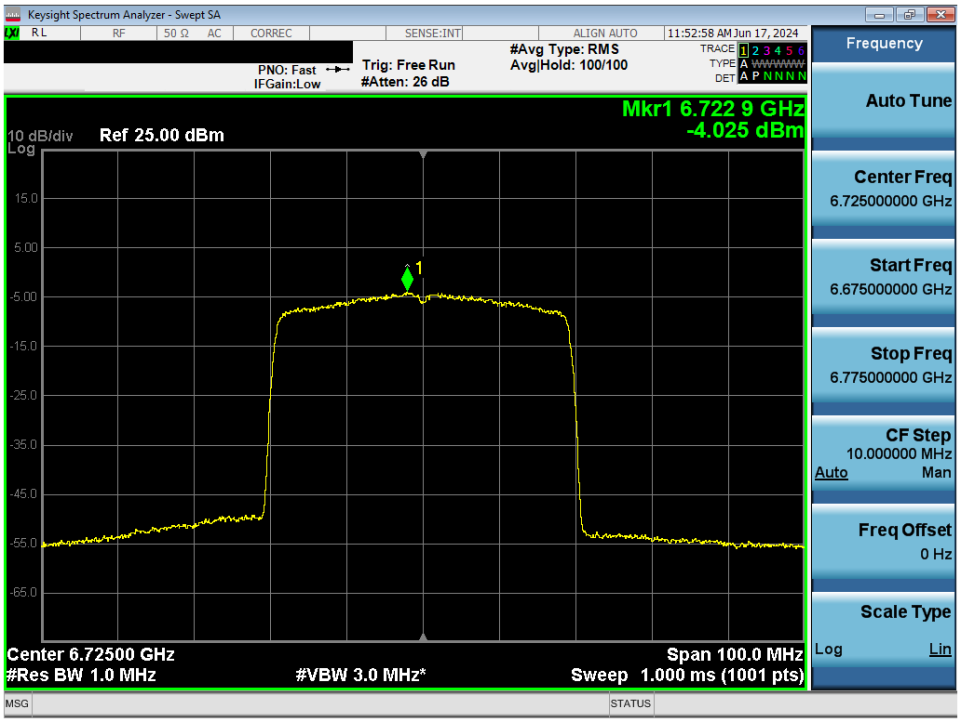
MIMO Antenna-1 Power Spectral Density Measurements - (UNII Band 7)



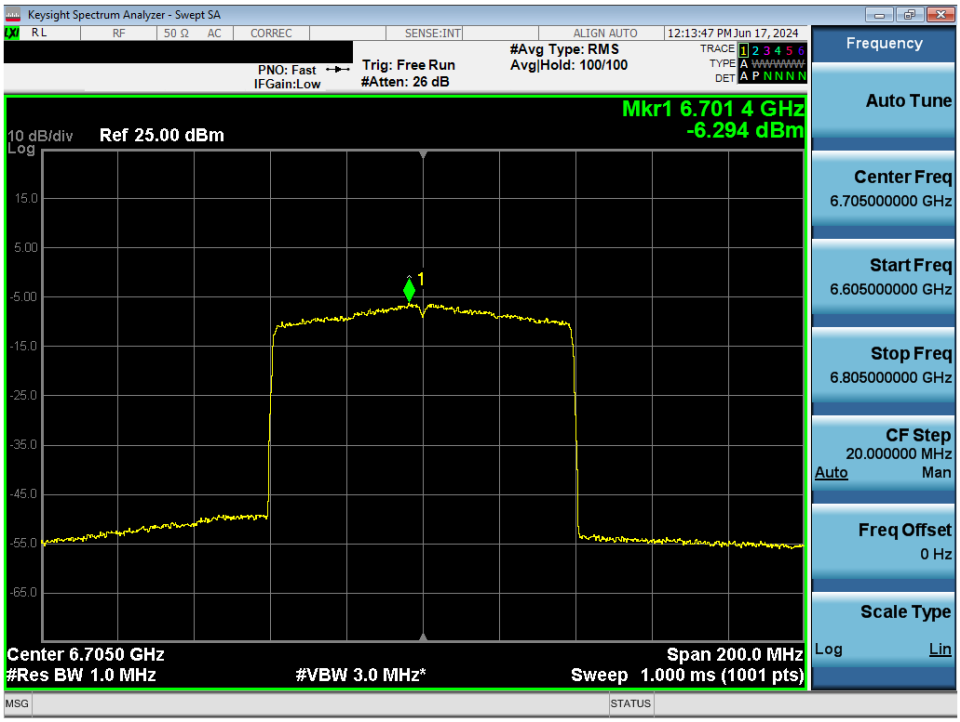
Plot 7-51. Power Spectral Density MIMO ANT1 (20MHz 802.11a (UNII Band 7) – Ch. 149) - LPI/SP



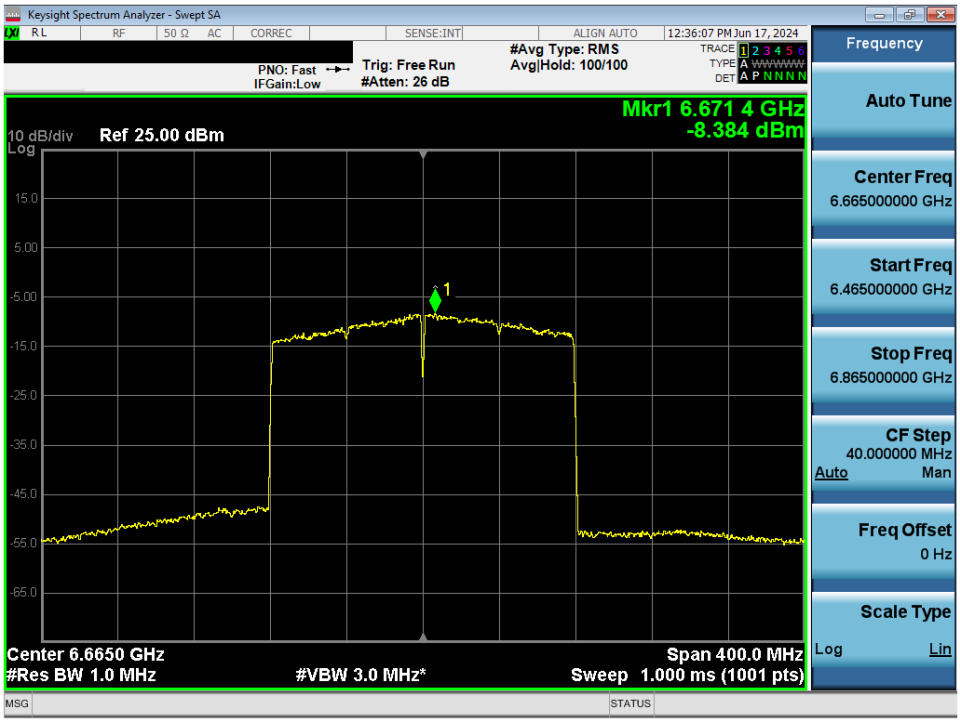
Plot 7-52. Power Spectral Density MIMO ANT1 (20MHz 802.11ax (UNII Band 7) – Ch. 149) - LPI/SP



Plot 7-53. Power Spectral Density MIMO ANT1 (40MHz 802.11ax (UNII Band 7) – Ch. 155) - LPI/SP

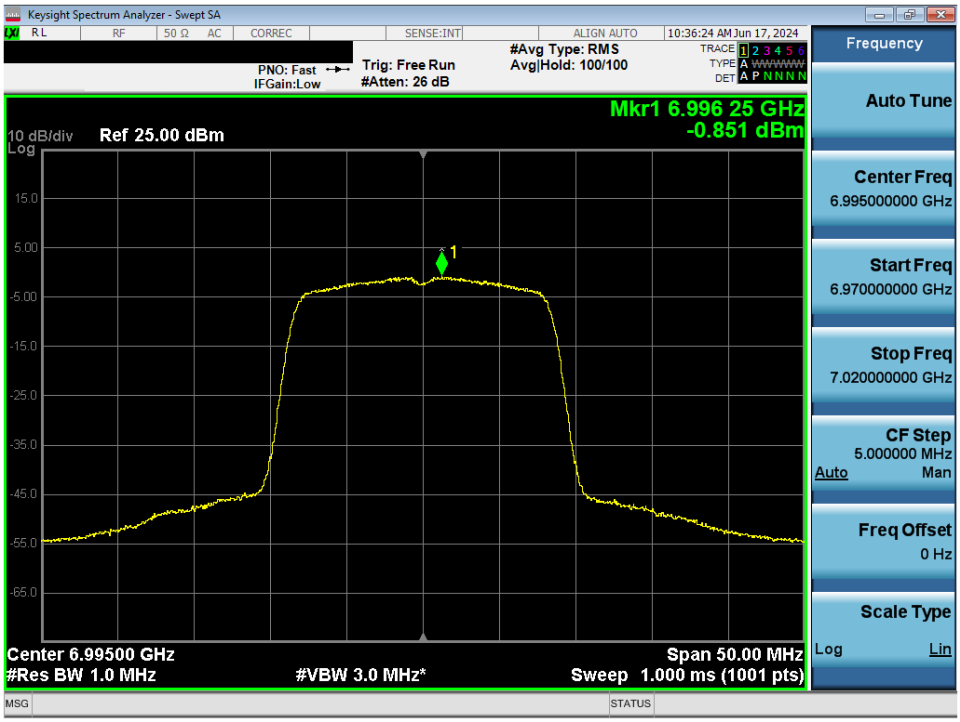


Plot 7-54. Power Spectral Density MIMO ANT1 (80MHz 802.11ax (UNII Band 7) – Ch. 151) - LPI/SP



Plot 7-55. Power Spectral Density MIMO ANT1 (160MHz 802.11ax (UNII Band 7) – Ch. 143) - LPI/SP

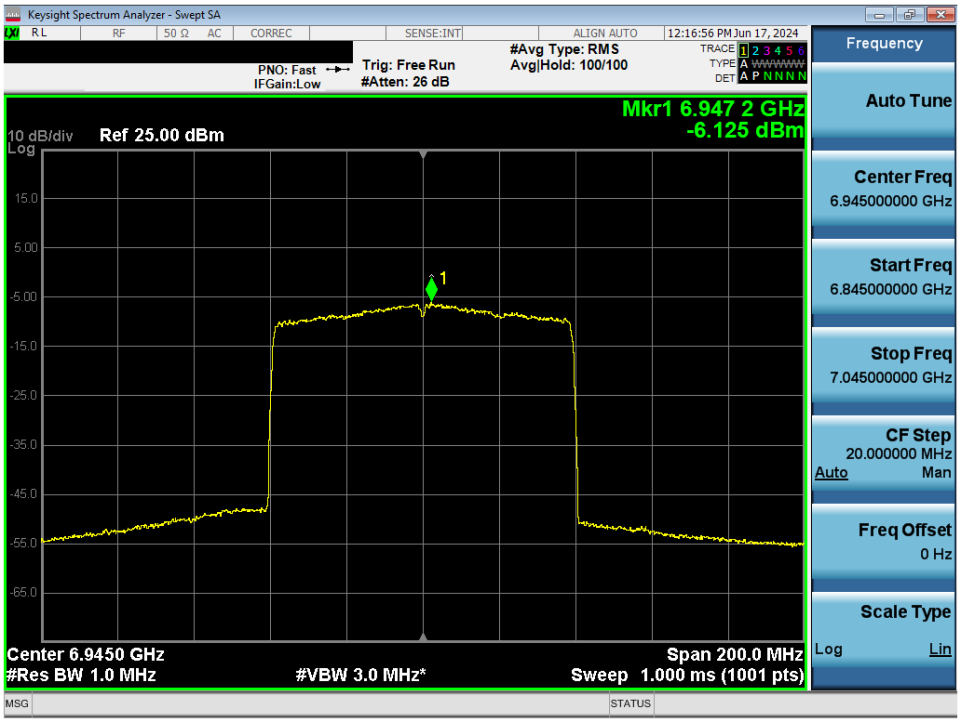
MIMO Antenna-1 Power Spectral Density Measurements - (UNII Band 8)



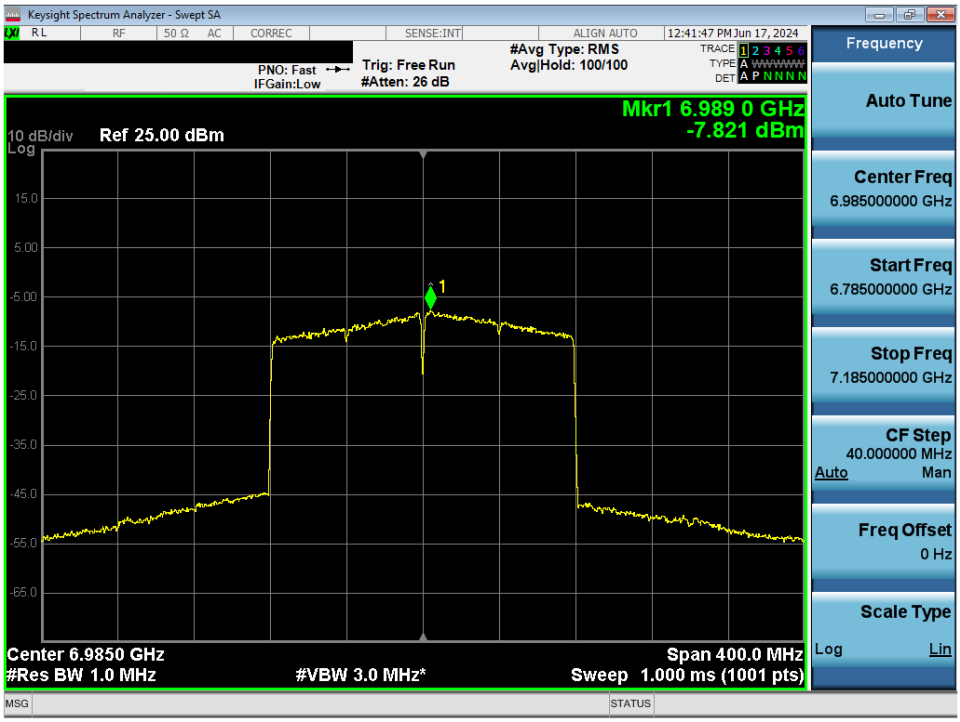
Plot 7-56. Power Spectral Density MIMO ANT1 (20MHz 802.11a (UNII Band 8) – Ch. 209) - LPI

Plot 7-57. Power Spectral Density MIMO ANT1 (20MHz 802.11ax (UNII Band 8) – Ch. 209) - LPI

Plot 7-58. Power Spectral Density MIMO ANT1 (40MHz 802.11ax (UNII Band 8) – Ch. 211) - LPI

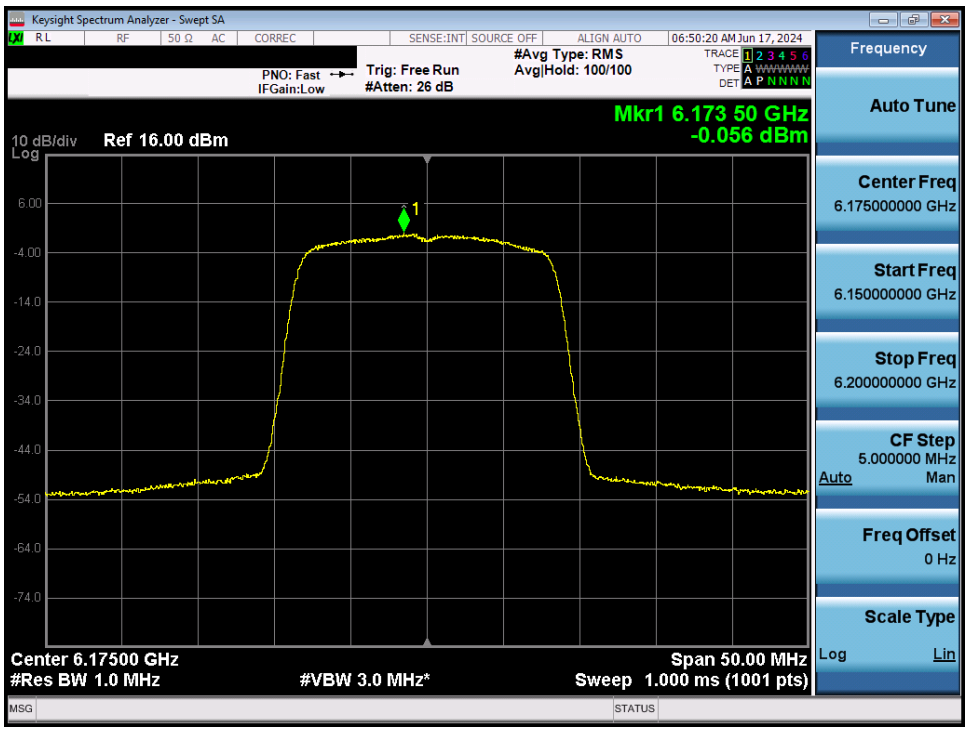


Plot 7-59. Power Spectral Density MIMO ANT1 (80MHz 802.11ax (UNII Band 8) – Ch. 199) - LPI

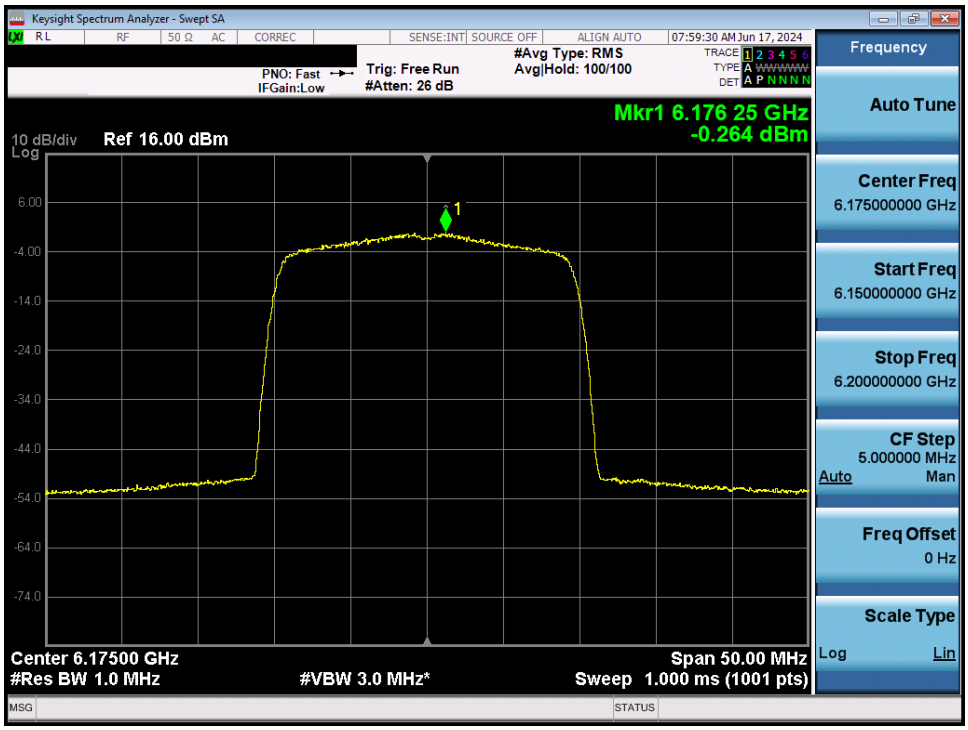


Plot 7-60. Power Spectral Density MIMO ANT1 (160MHz 802.11ax (UNII Band 8) – Ch. 207) - LPI

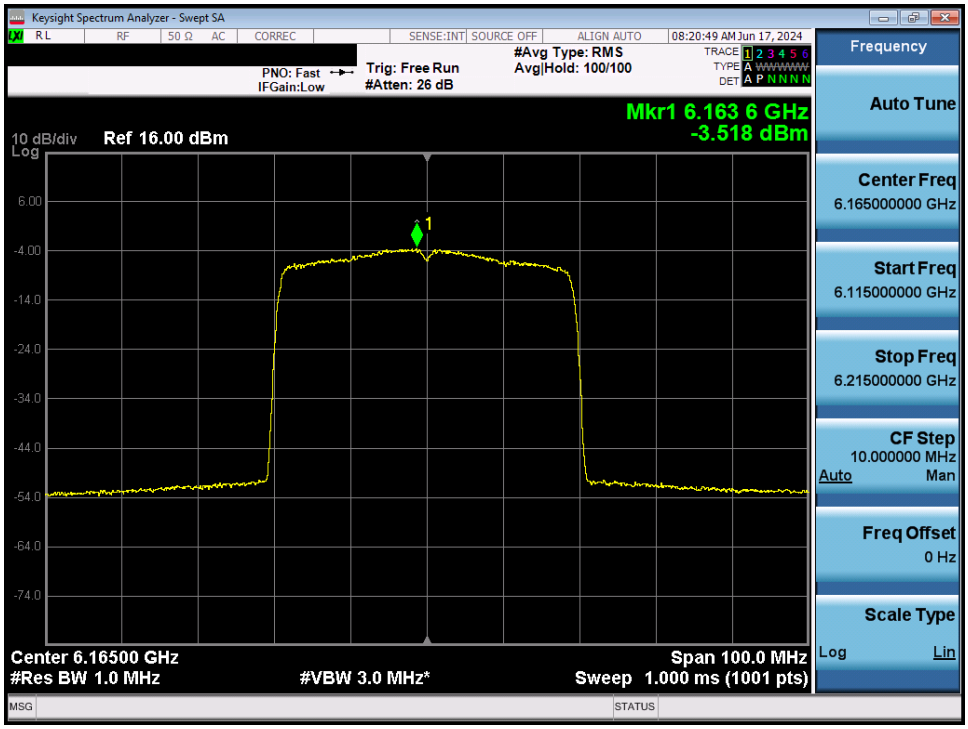
MIMO Antenna-2 Power Spectral Density Measurements - (UNII Band 5)



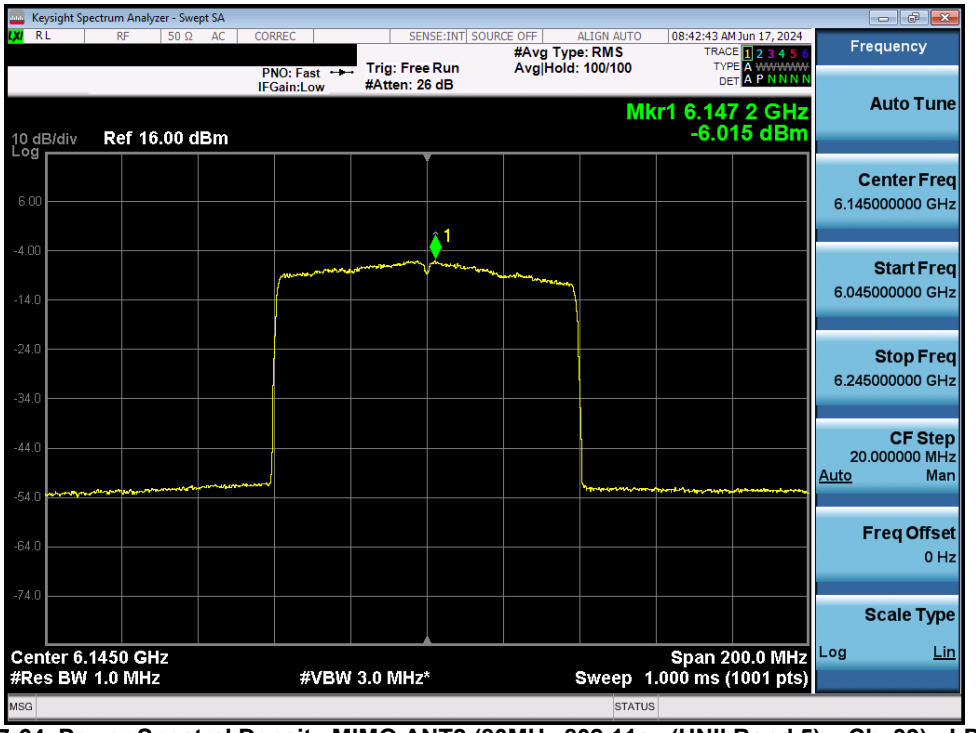
Plot 7-61. Power Spectral Density MIMO ANT2 (20MHz 802.11a (UNII Band 5) – Ch. 45) - LPI/SP



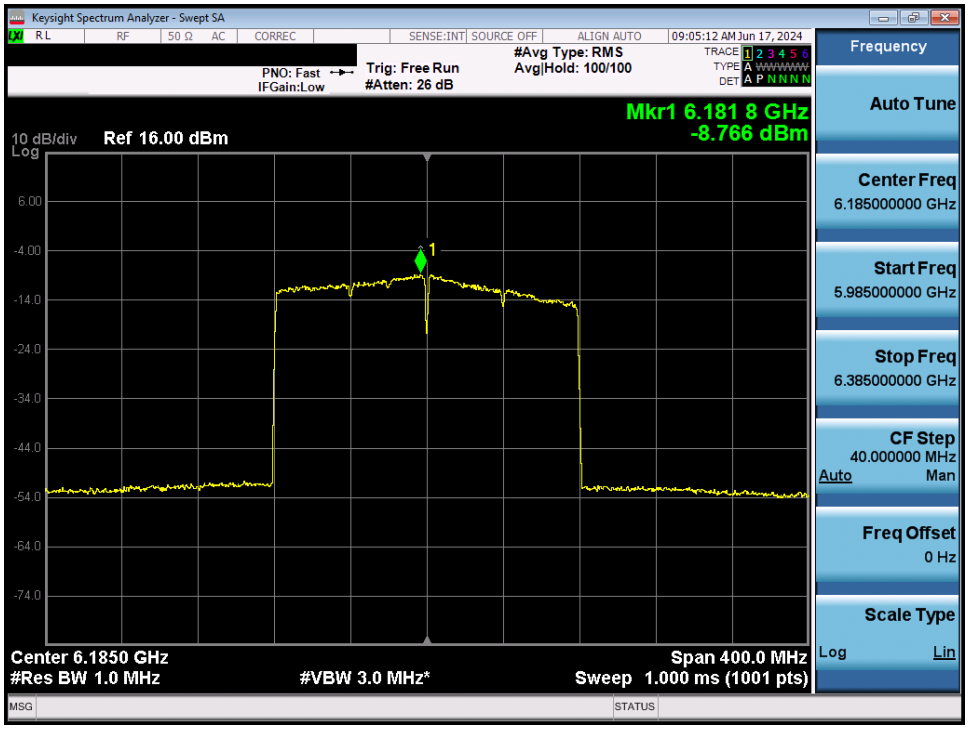
Plot 7-62. Power Spectral Density MIMO ANT2 (20MHz 802.11ax (UNII Band 5) – Ch. 45) - LPI/SP



Plot 7-63. Power Spectral Density MIMO ANT2 (40MHz 802.11ax (UNII Band 5) – Ch. 43) - LPI/SP

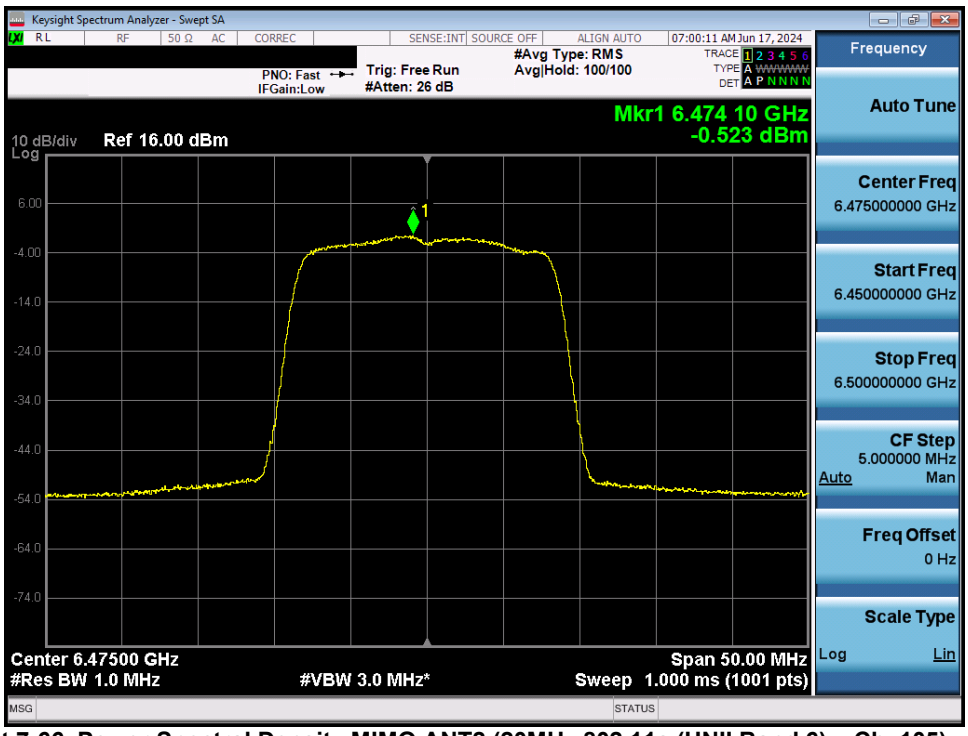


Plot 7-64. Power Spectral Density MIMO ANT2 (80MHz 802.11ax (UNII Band 5) – Ch. 39) - LPI/SP

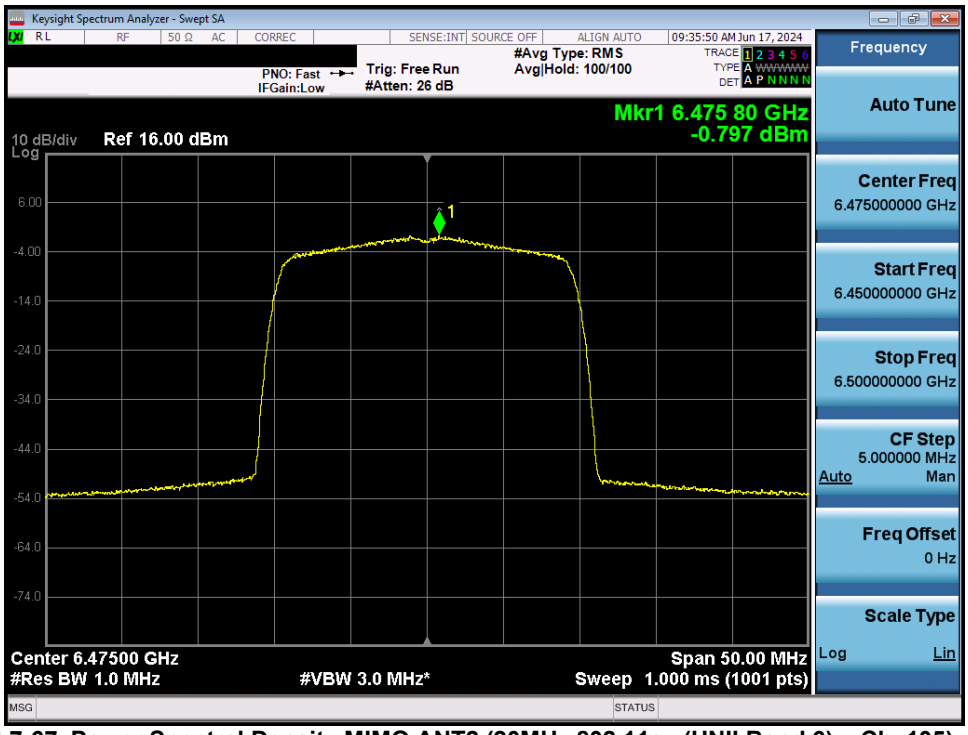


Plot 7-65. Power Spectral Density MIMO ANT2 (160MHz 802.11ax (UNII Band 5) – Ch. 47) - LPI/SP

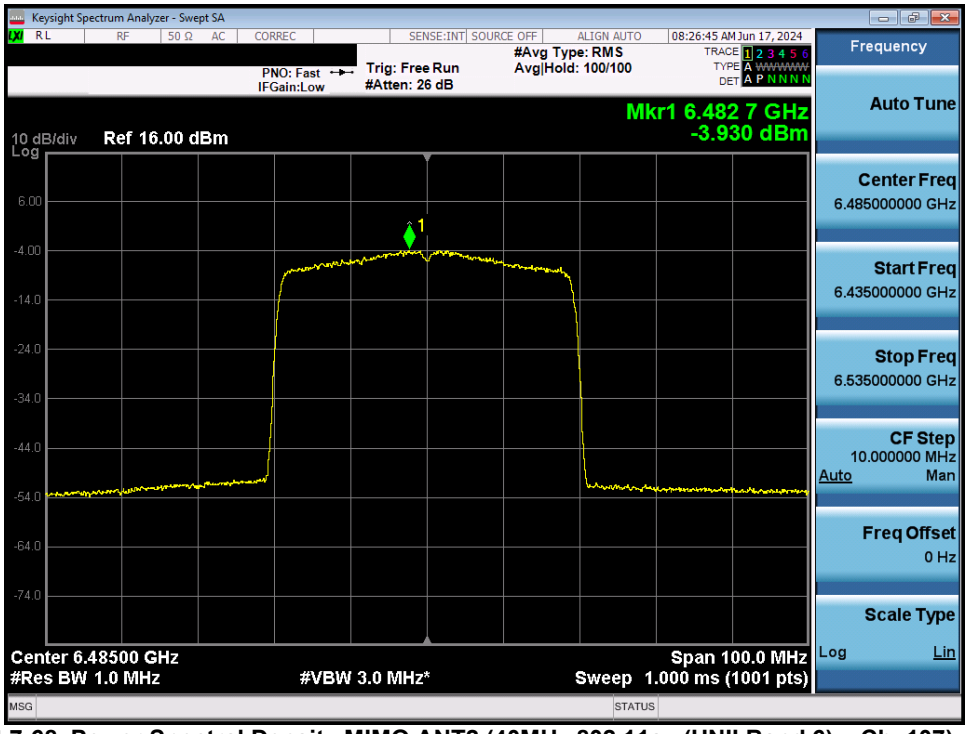
MIMO Antenna-2 Power Spectral Density Measurements - (UNII Band 6)



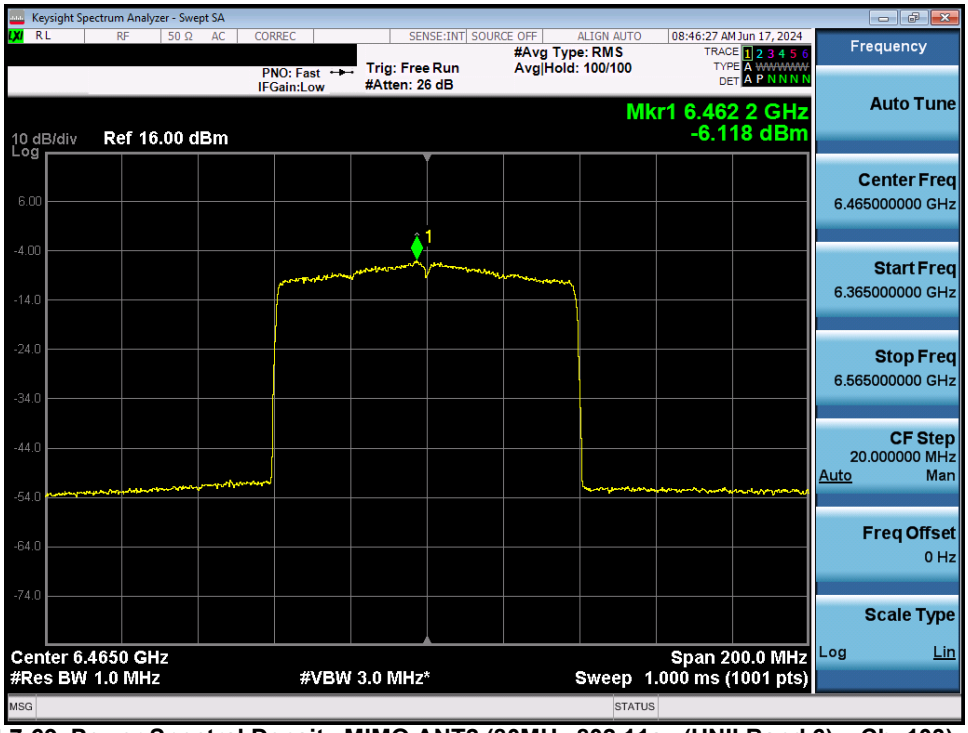
Plot 7-66. Power Spectral Density MIMO ANT2 (20MHz 802.11a (UNII Band 6) – Ch. 105) - LPI



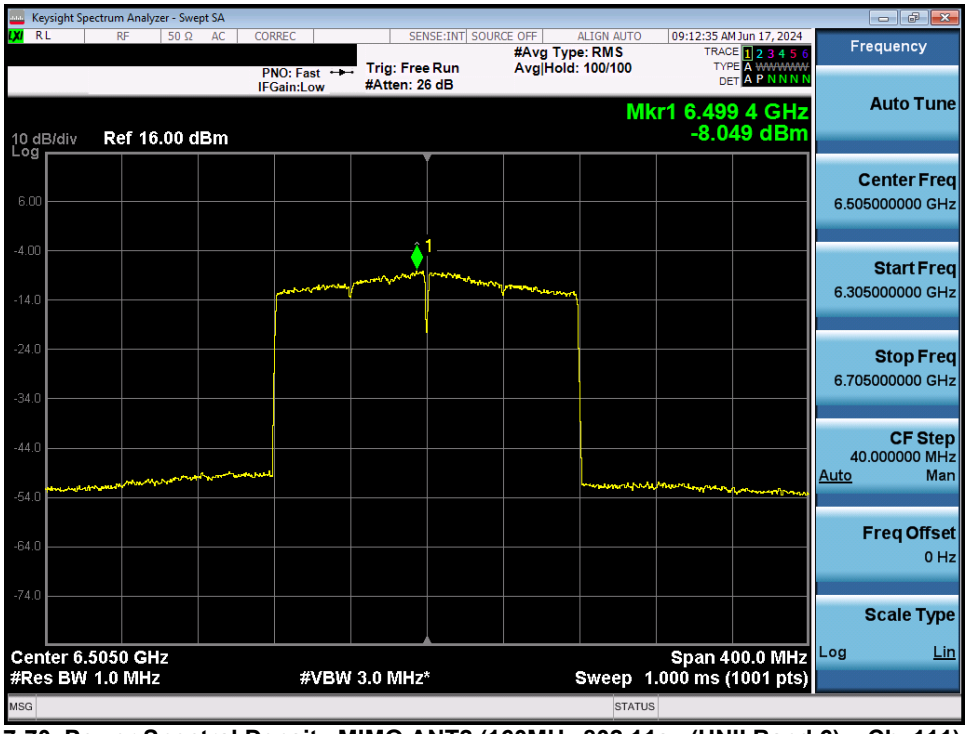
Plot 7-67. Power Spectral Density MIMO ANT2 (20MHz 802.11ax (UNII Band 6) – Ch. 105) - LPI



Plot 7-68. Power Spectral Density MIMO ANT2 (40MHz 802.11ax (UNII Band 6) – Ch. 107) - LPI

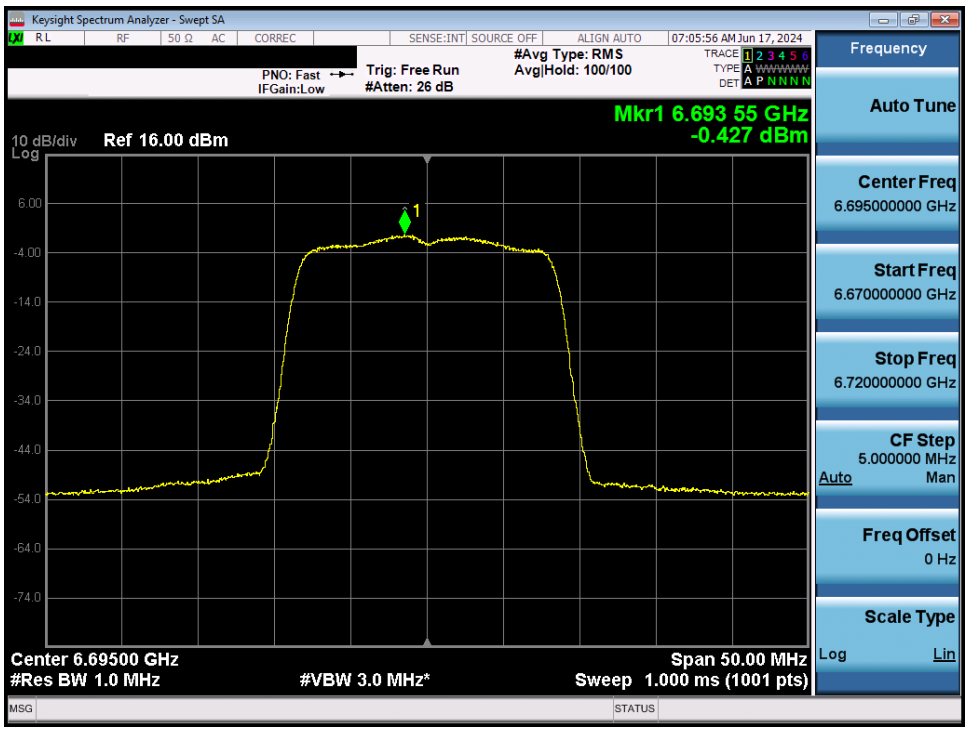


Plot 7-69. Power Spectral Density MIMO ANT2 (80MHz 802.11ax (UNII Band 6) – Ch. 103) - LPI

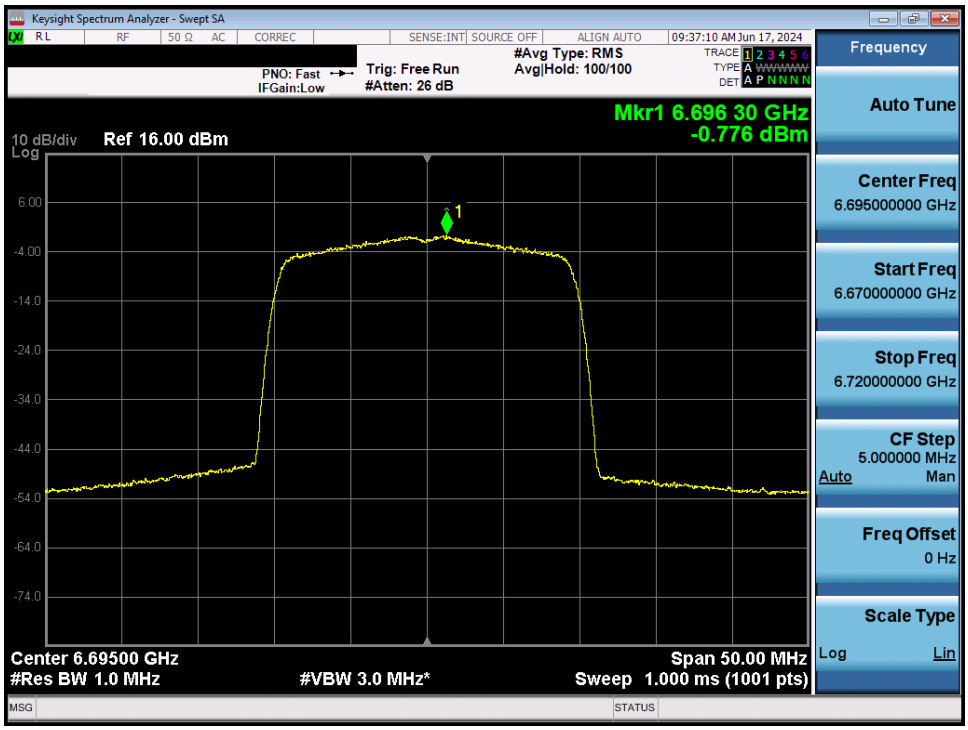


Plot 7-70. Power Spectral Density MIMO ANT2 (160MHz 802.11ax (UNII Band 6) – Ch. 111) - LPI

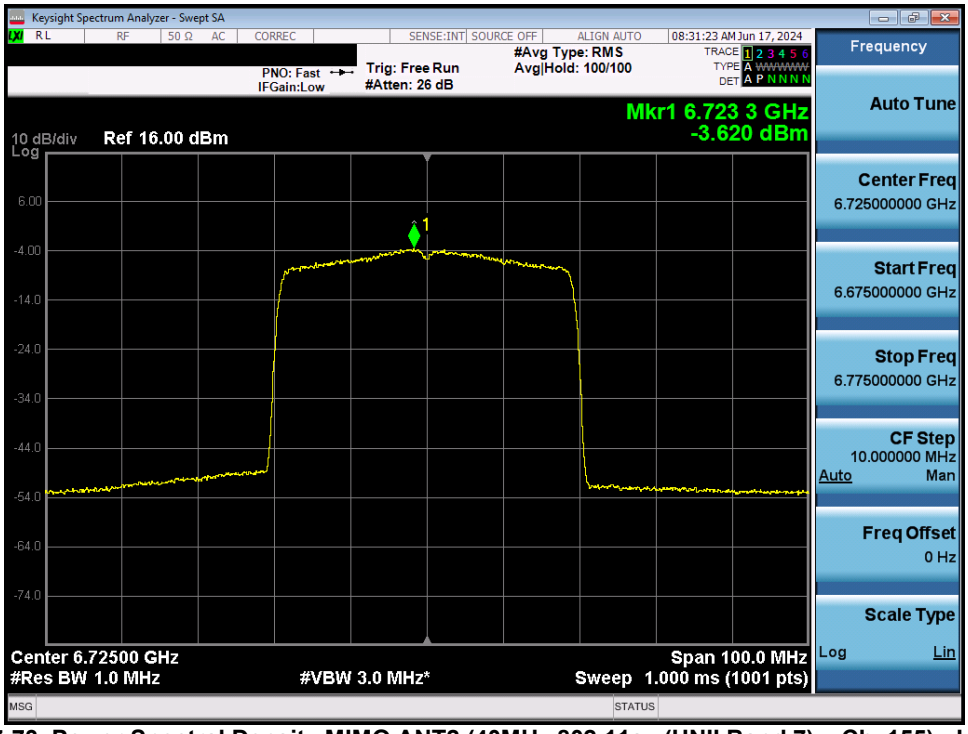
MIMO Antenna-2 Power Spectral Density Measurements - (UNII Band 7)



Plot 7-71. Power Spectral Density MIMO ANT2 (20MHz 802.11a (UNII Band 7) – Ch. 149) - LPI/SP

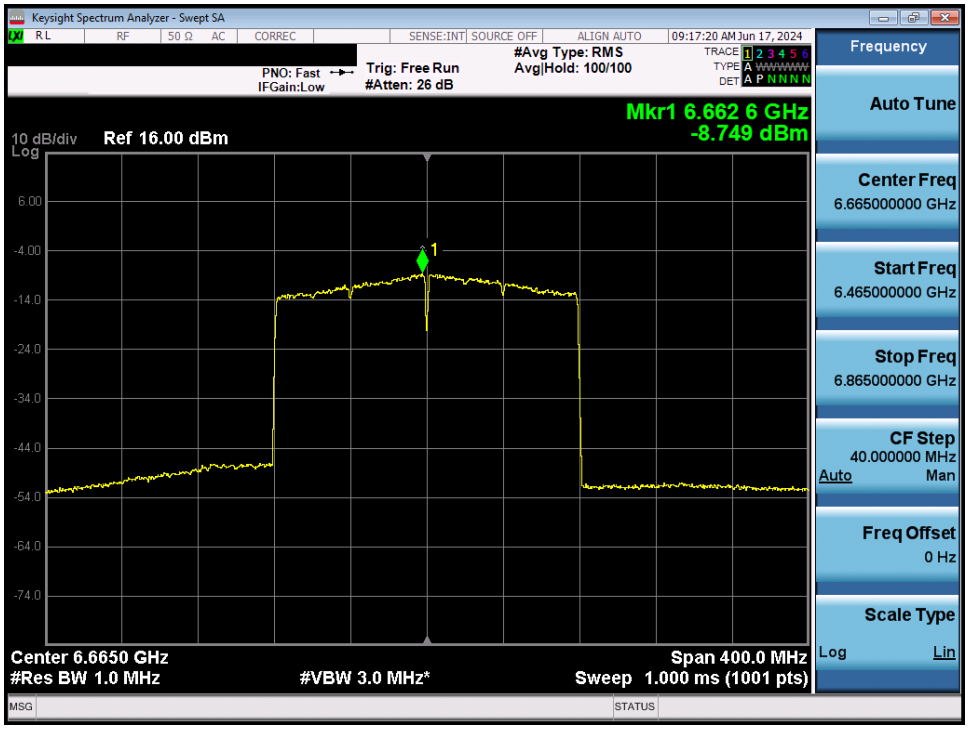


Plot 7-72. Power Spectral Density MIMO ANT2 (20MHz 802.11ax (UNII Band 7) – Ch. 149) - LPI/SP



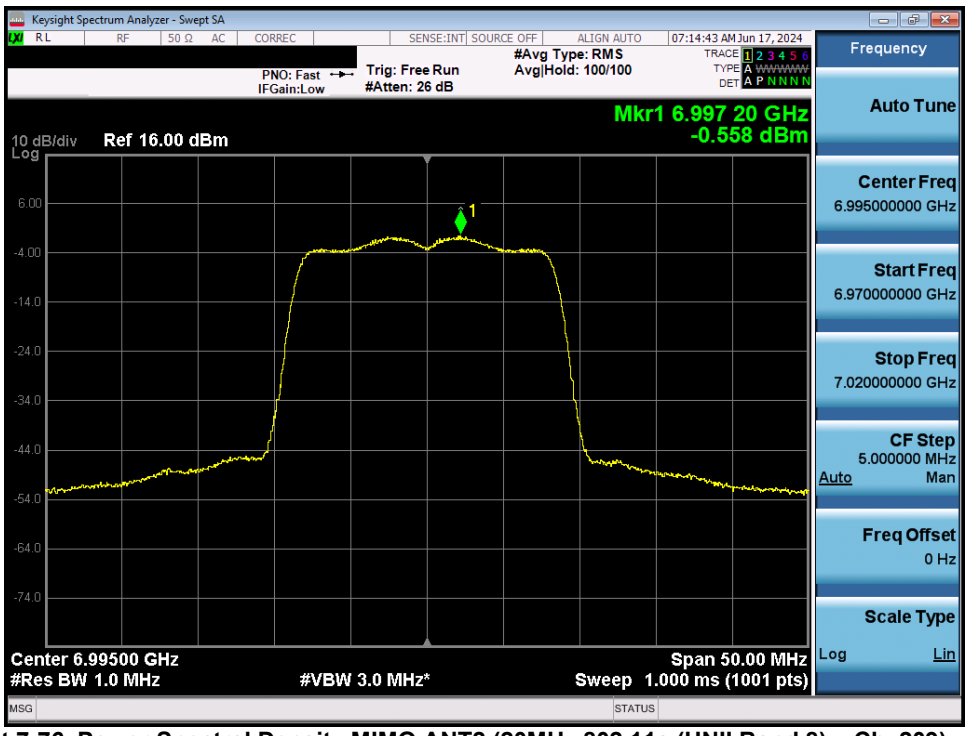
Plot 7-73. Power Spectral Density MIMO ANT2 (40MHz 802.11ax (UNII Band 7) – Ch. 155) - LPI/SP

Plot 7-74. Power Spectral Density MIMO ANT2 (80MHz 802.11ax (UNII Band 7) – Ch. 151) - LPI/SP

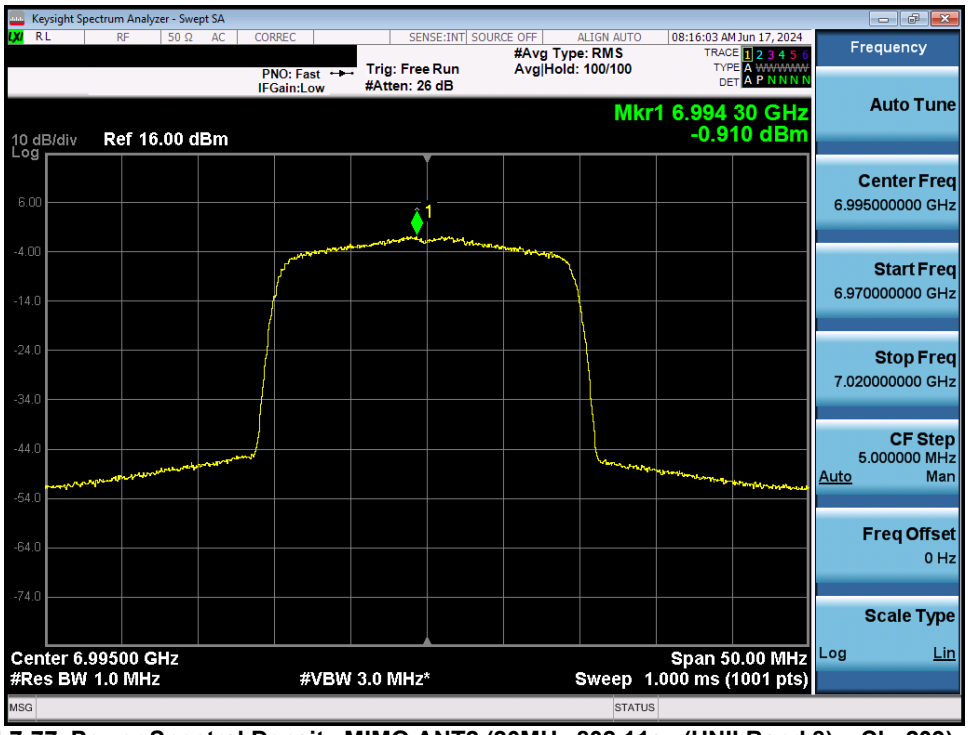


Plot 7-75. Power Spectral Density MIMO ANT2 (160MHz 802.11ax (UNII Band 7) – Ch. 143) - LPI/SP

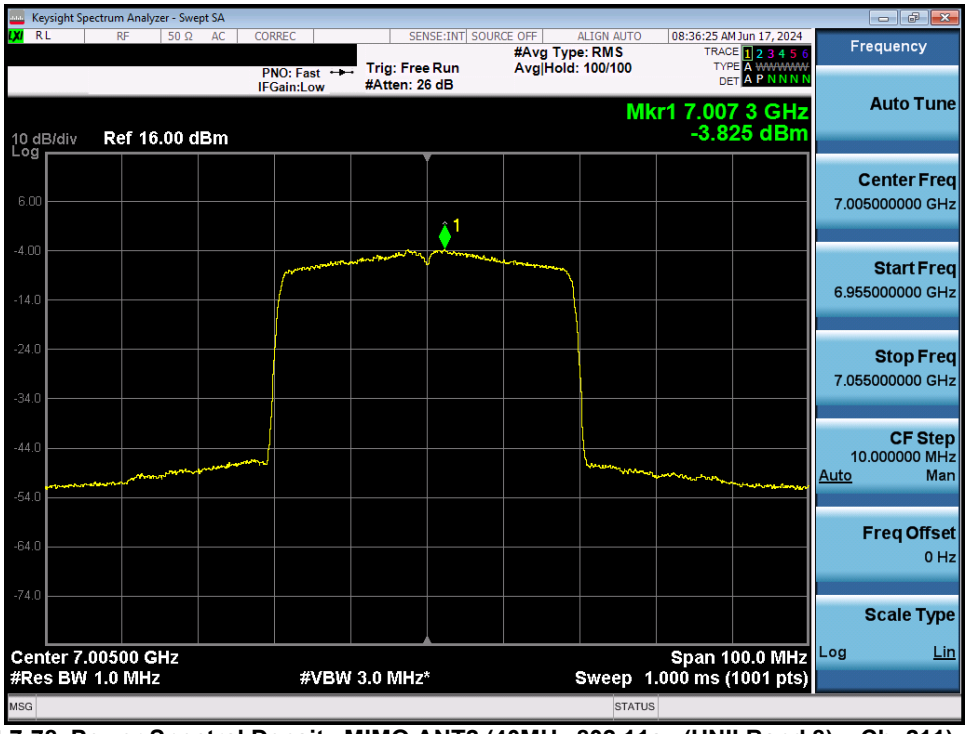
MIMO Antenna-2 Power Spectral Density Measurements - (UNII Band 8)



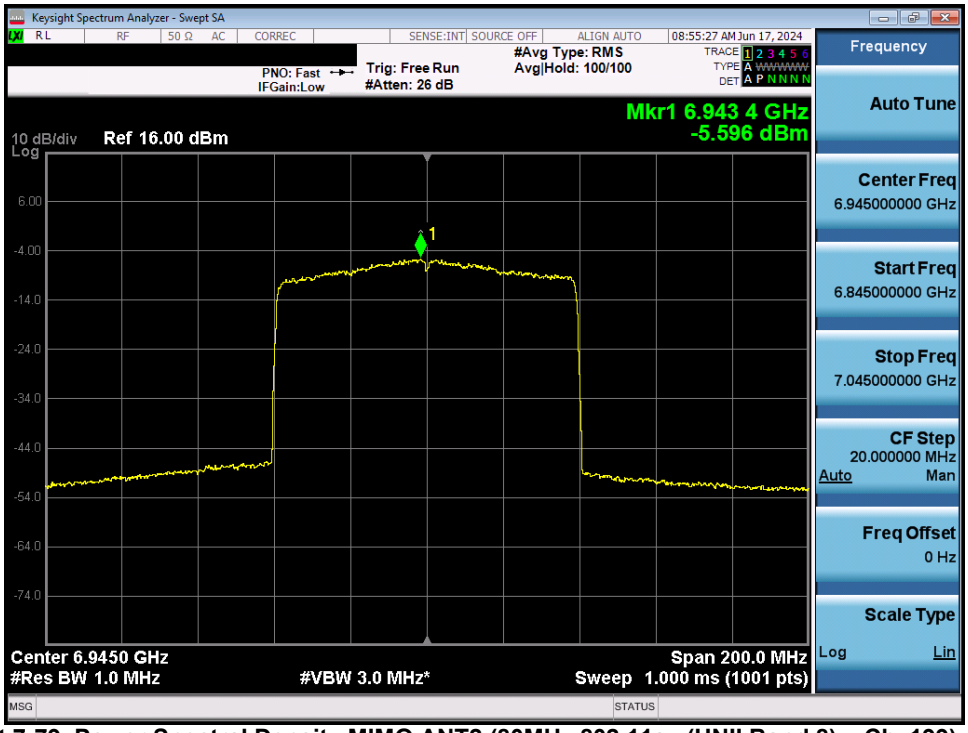
Plot 7-76. Power Spectral Density MIMO ANT2 (20MHz 802.11a (UNII Band 8) – Ch. 209) - LPI



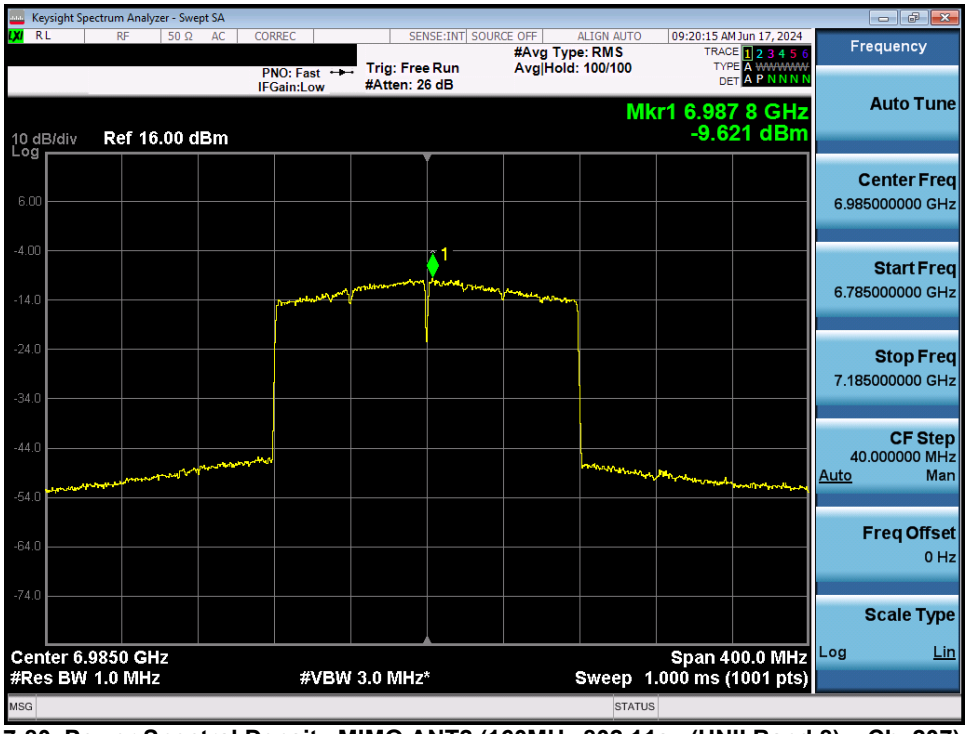
Plot 7-77. Power Spectral Density MIMO ANT2 (20MHz 802.11ax (UNII Band 8) – Ch. 209) - LPI



Plot 7-78. Power Spectral Density MIMO ANT2 (40MHz 802.11ax (UNII Band 8) – Ch. 211) - LPI



Plot 7-79. Power Spectral Density MIMO ANT2 (80MHz 802.11ax (UNII Band 8) – Ch. 199) - LP



Plot 7-80. Power Spectral Density MIMO ANT2 (160MHz 802.11ax (UNII Band 8) – Ch. 207) - LPI

Note:

Per ANSI C63.10-2013 Section 14.3.2.2 and KDB 662911 v02r01 Section E)2), the power spectral density at Antenna 1 and Antenna 2 were first measured separately as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

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

$$\text{Directional gain} = 10 \log[(10^{G1/20} + 10^{G2/20} + \ldots + 10^{GN/20})^2 / N_{ANT}] \text{ dBi}$$

Sample MIMO Calculation:

At 5935MHz in 802.11a (20MHz BW) mode, the average conducted power spectral density was measured to be -1.07 dBm for Antenna-1 and -0.71 dBm for Antenna-2.

Antenna 1 + Antenna 2 = MIMO

(-1.07 dBm + -0.71 dBm) = (0.781 mW + 0.849 mW) = 1.630 mW = 2.12 dBm

Sample e.i.r.p Power Spectral Density Calculation:

At 5935 MHz in 802.11a (20MHz BW) mode, the average MIMO power density was calculated to be 2.12 dBm with directional gain of -3.95 dBi.

e.i.r.p. Power Spectral Density(dBm) = Power Spectral Density (dBm) + Ant gain (dBi) + DCCF

2.12 dBm + -3.95 dBi + 0.11dB = -1.72 dBm

7.5 In-Band Emissions

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.

For transmitters operating within the 5.925-7.125 GHz bands: Power spectral density must ax SUppressed by 20 dB at 1 MHz outside of channel edge, by 28 dB at one channel bandwidth from the channel center, and by 40 dB at one- and one-half times the channel bandwidth away from channel center. At frequencies between one megahertz outside an unlicensed device's channel edge and one channel bandwidth from the center of the channel, the limits must be linearly interpolated between 20 dB and 28 dB suppression, and at frequencies between one and one- and one-half times an unlicensed device's channel bandwidth, the limits must be linearly interpolated between 28 dB and 40 dB suppression. Emissions removed from the channel center by more than one- and one-half times the channel bandwidth must ax SUppressed by at least 40 dB.

Test Procedure Used

KDB 987594 D02 v02r01

Test Settings

1. Connect output of the antenna port to a spectrum analyzer or EMI receiver, with appropriate attenuation, as to not damage the instrumentation.
2. Set the reference level of the measuring equipment in accordance with procedure 4.1.5.2 of ANSI C63.10- 2013.
3. Measure the 26 dB EBW using the test procedure 12.4.1 of ANSI C63.10-2013. (This will be used to determine the channel edge.)
4. Measure the power spectral density (which will be used for emissions mask reference) using the following procedure:
    a) Set the span to encompass the entire 26 dB EBW of the signal.
    b) Set RBW = same RBW used for 26 dB EBW measurement.
    c) Set VBW ≥ 3 X RBW
    d) Number of points in sweep ≥ [2 X span / RBW].
    e) Sweep time = auto.
    f) Detector = RMS (i.e., power averaging)
    g) Trace average at least 100 traces in power averaging (rms) mode.
    h) Use the peak search function on the instrument to find the peak of the spectrum.
5. For the purposes of developing the emission mask, the channel bandwidth is defined as the 26 dB EBW.
6. Using the measuring equipment limit line function, develop the emissions mask based on the following requirements. The emissions power spectral density must be reduced below the peak power spectral density (in dB) as follows:
    i) Suppressed by 20 dB at 1 MHz outside of the channel edge. (The channel edge is defined as the 26-dB point on either side of the carrier center frequency.)
    j) Suppressed by 28 dB at one channel bandwidth from the channel center.
    k) Suppressed by 40 dB at one- and one-half times the channel bandwidth from the channel center.
7. Adjust the span to encompass the entire mask as necessary.
8. Clear trace.
9. Trace average at least 100 traces in power averaging (rms) mode.
10. Adjust the reference level as necessary so that the crest of the channel touches the top of the emission mask.

Test Setup

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

Figure 7-4. Test Instrument & Measurement Setup

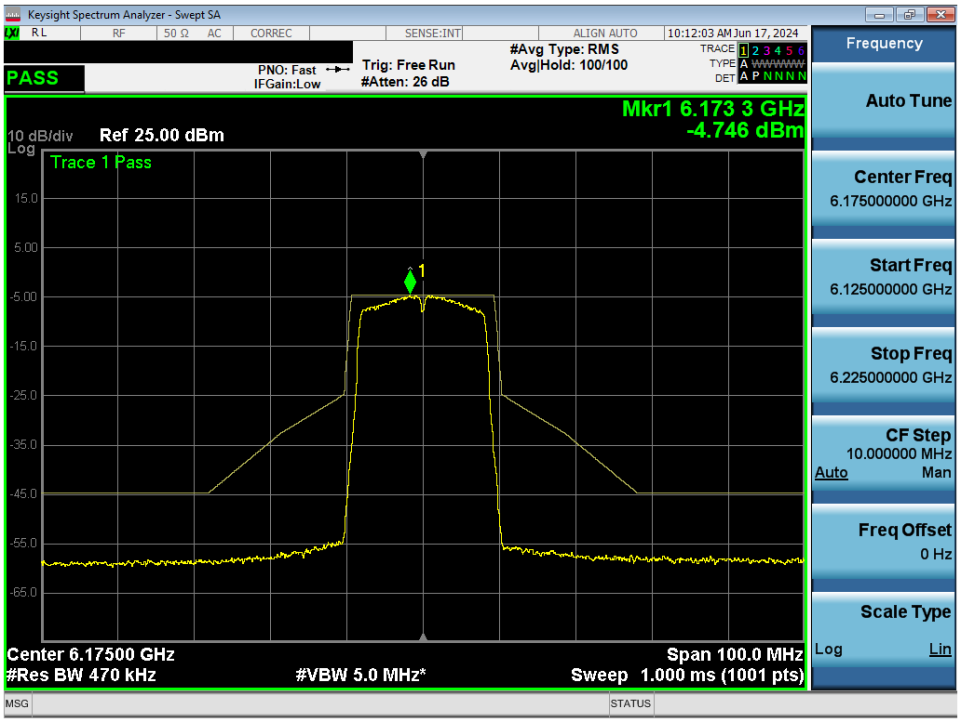
Test Notes

None.

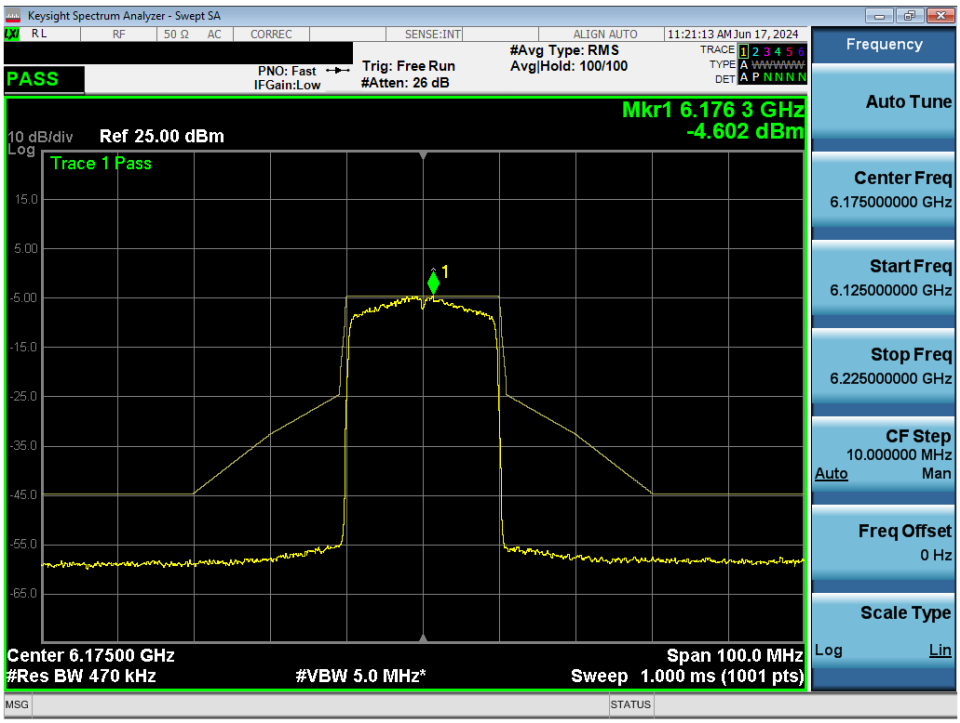
	Frequency [MHz]	Channel	802.11 MODE	Antenna-1 In-Band Emission	Antenna-2 In-Band Emission
Band 5	5935	2	a	PASS	PASS
	6175	45	a	PASS	PASS
	6415	93	a	PASS	PASS
	5935	2	ax (20MHz)	PASS	PASS
	6175	45	ax (20MHz)	PASS	PASS
	6415	93	ax (20MHz)	PASS	PASS
	5965	3	ax (40MHz)	PASS	PASS
	6165	43	ax (40MHz)	PASS	PASS
	6405	91	ax (40MHz)	PASS	PASS
	5985	7	ax (80MHz)	PASS	PASS
	6145	39	ax (80MHz)	PASS	PASS
	6385	87	ax (80MHz)	PASS	PASS
	6025	15	ax (160MHz)	PASS	PASS
	6185	47	ax (160MHz)	PASS	PASS
	6345	79	ax (160MHz)	PASS	PASS
Band 6	6435	97	a	PASS	PASS
	6475	105	a	PASS	PASS
	6515	113	a	PASS	PASS
	6345	97	ax (20MHz)	PASS	PASS
	6475	105	ax (20MHz)	PASS	PASS
	6515	113	ax (20MHz)	PASS	PASS
	6445	99	ax (40MHz)	PASS	PASS
	6485	107	ax (40MHz)	PASS	PASS
	6525	115	ax (40MHz)	PASS	PASS
	6465	103	ax (80MHz)	PASS	PASS
	6505	111	ax (160MHz)	PASS	PASS
Band 7	6535	117	a	PASS	PASS
	6695	149	a	PASS	PASS
	6875	185	a	PASS	PASS
	6535	117	ax (20MHz)	PASS	PASS
	6695	149	ax (20MHz)	PASS	PASS
	6875	185	ax (20MHz)	PASS	PASS
	6565	123	ax (40MHz)	PASS	PASS
	6725	155	ax (40MHz)	PASS	PASS
	6885	179	ax (40MHz)	PASS	PASS
	6545	119	ax (80MHz)	PASS	PASS
	6705	151	ax (80MHz)	PASS	PASS
	6865	183	ax (80MHz)	PASS	PASS
	6665	143	ax (160MHz)	PASS	PASS
	6825	175	ax (160MHz)	PASS	PASS
Band 8	6895	189	a	PASS	PASS
	6995	209	a	PASS	PASS
	7115	233	a	PASS	PASS
	6895	189	ax (20MHz)	PASS	PASS
	6995	209	ax (20MHz)	PASS	PASS
	7115	233	ax (20MHz)	PASS	PASS
	6925	187	ax (40MHz)	PASS	PASS
	7005	211	ax (40MHz)	PASS	PASS
	7085	227	ax (40MHz)	PASS	PASS
	6945	199	ax (80MHz)	PASS	PASS
	7025	215	ax (80MHz)	PASS	PASS
	6985	207	ax (160MHz)	PASS	PASS

Table 7-19. In- Band Emissions Test Result – LPI/SP

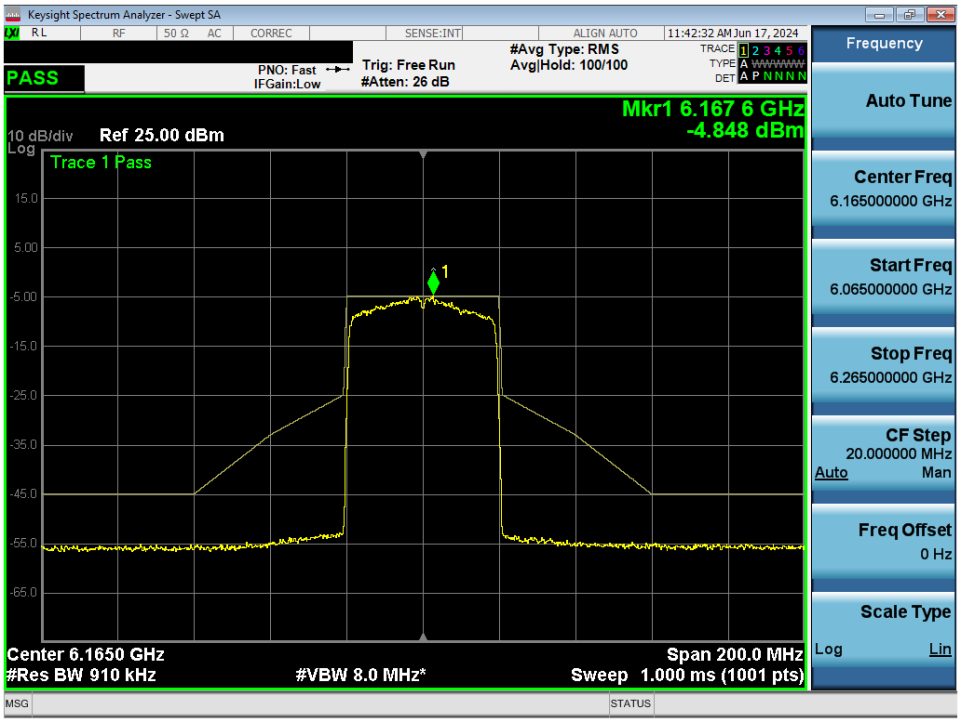
MIMO Antenna-1 In-Band Emission Measurements - (UNII Band 5)



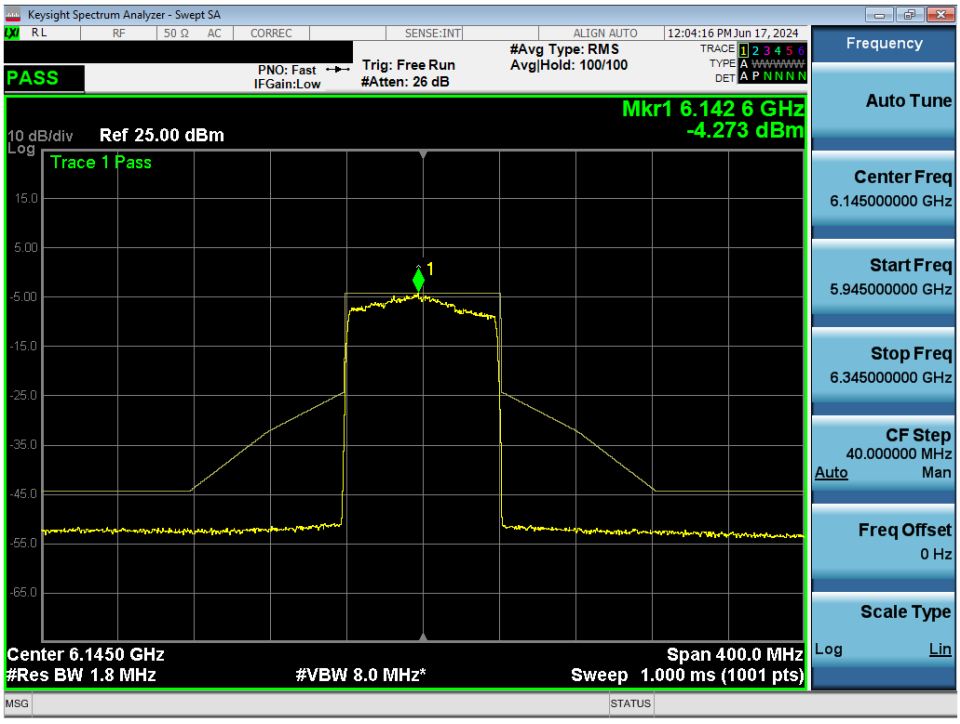
Plot 7-81. In-Band Emission MIMO ANT1 (20MHz 802.11a (UNII Band 5) – Ch. 45)



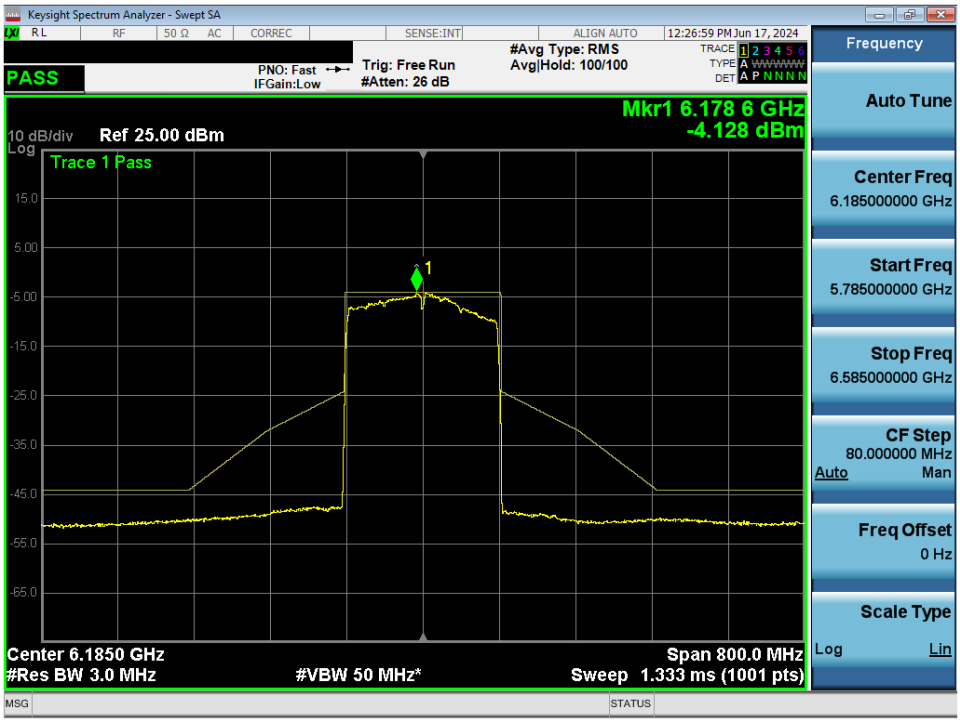
Plot 7-82. In-Band Emission MIMO ANT1 (20MHz 802.11ax (UNII Band 5) – Ch. 45)



Plot 7-83. In-Band Emission MIMO ANT1 (40MHz 802.11ax (UNII Band 5) – Ch. 43)

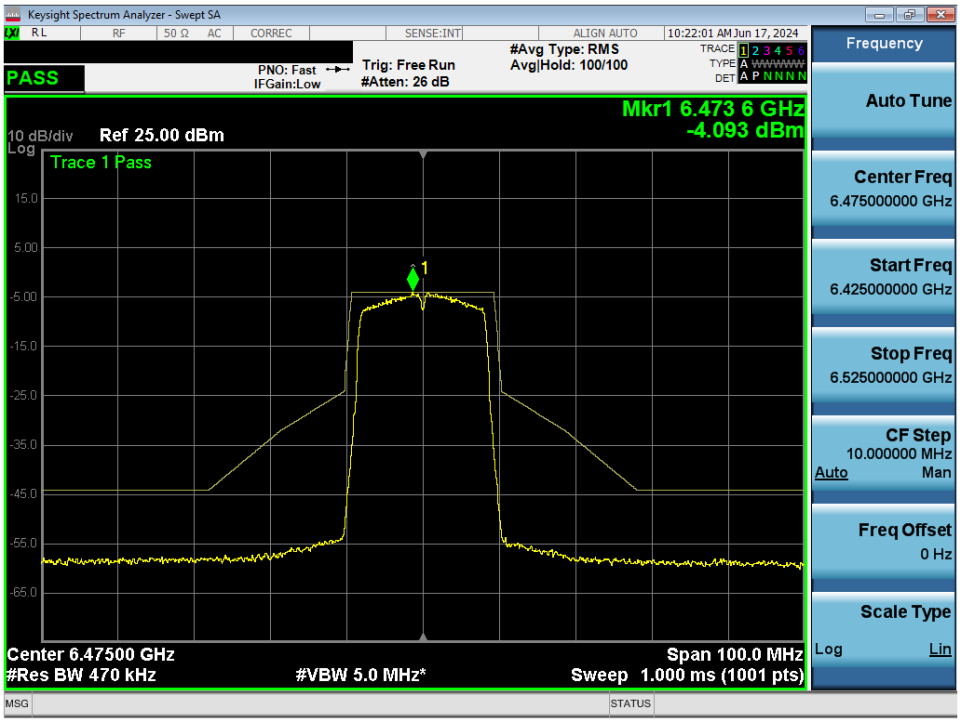


Plot 7-84. In-Band Emission MIMO ANT1 (80MHz 802.11ax (UNII Band 5) – Ch. 39)

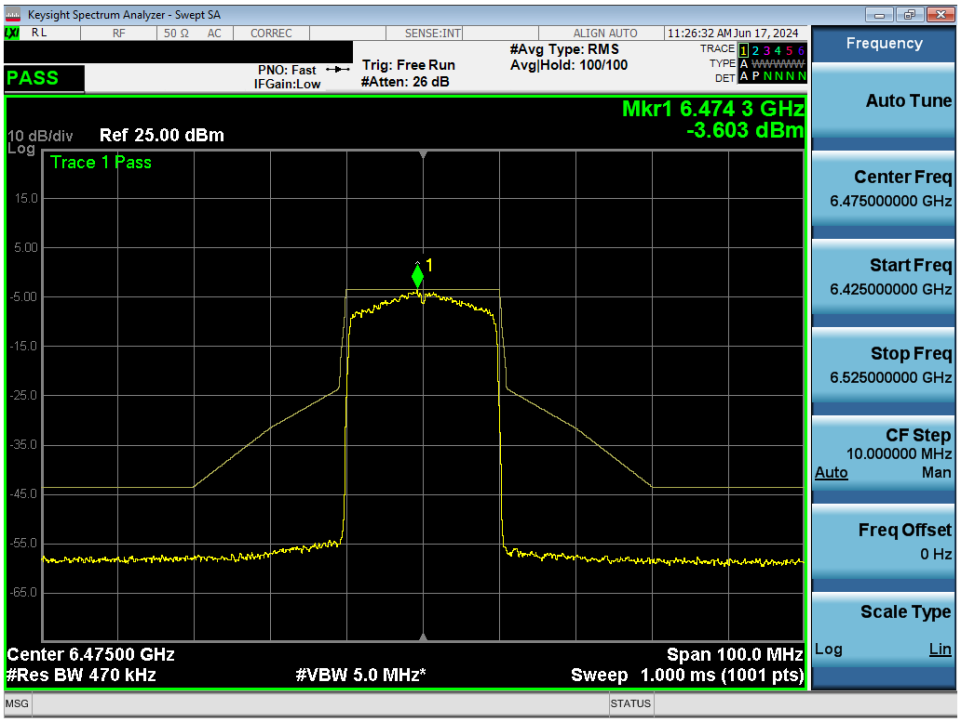


Plot 7-85. In-Band Emission MIMO ANT1 (160MHz 802.11ax (UNII Band 5) – Ch. 47)

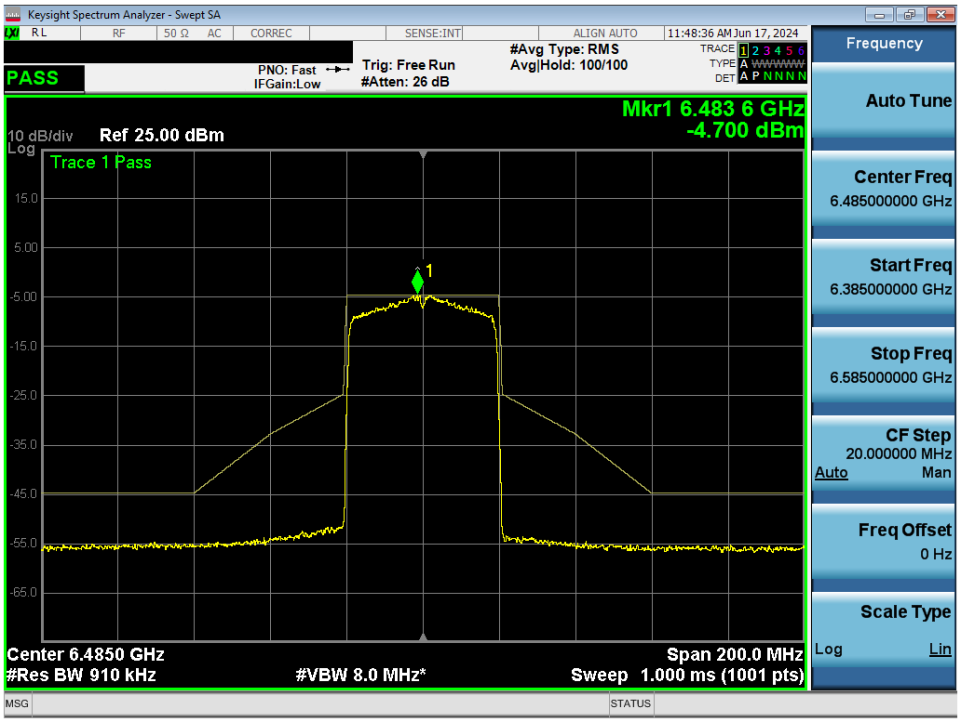
MIMO Antenna-1 In-Band Emission Measurements - (UNII Band 6)



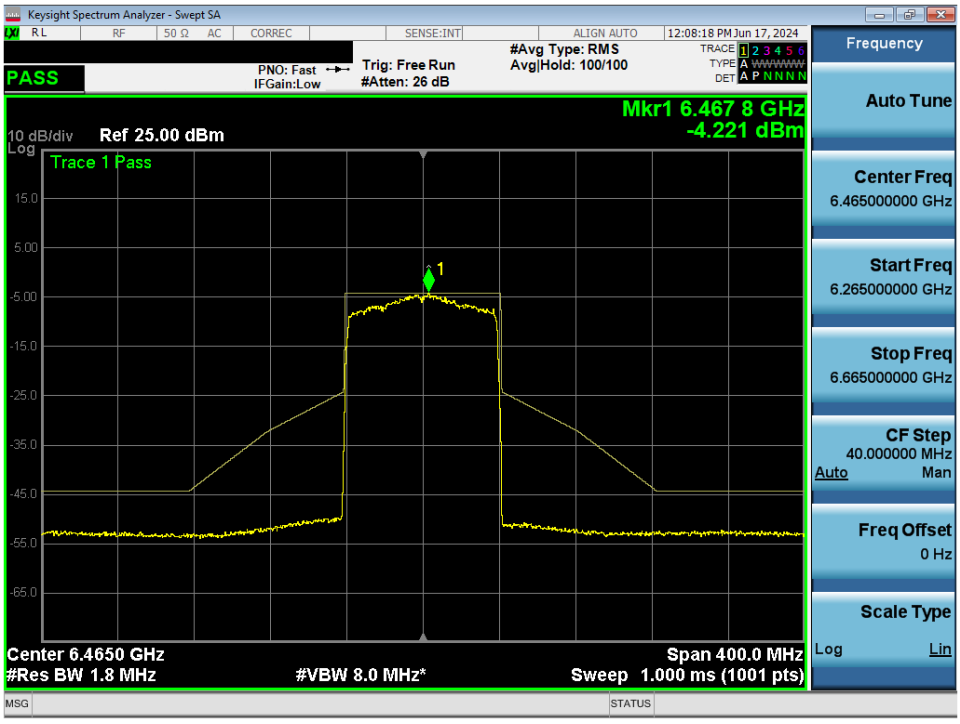
Plot 7-86. In-Band Emission MIMO ANT1 (20MHz 802.11a (UNII Band 6) – Ch. 105)



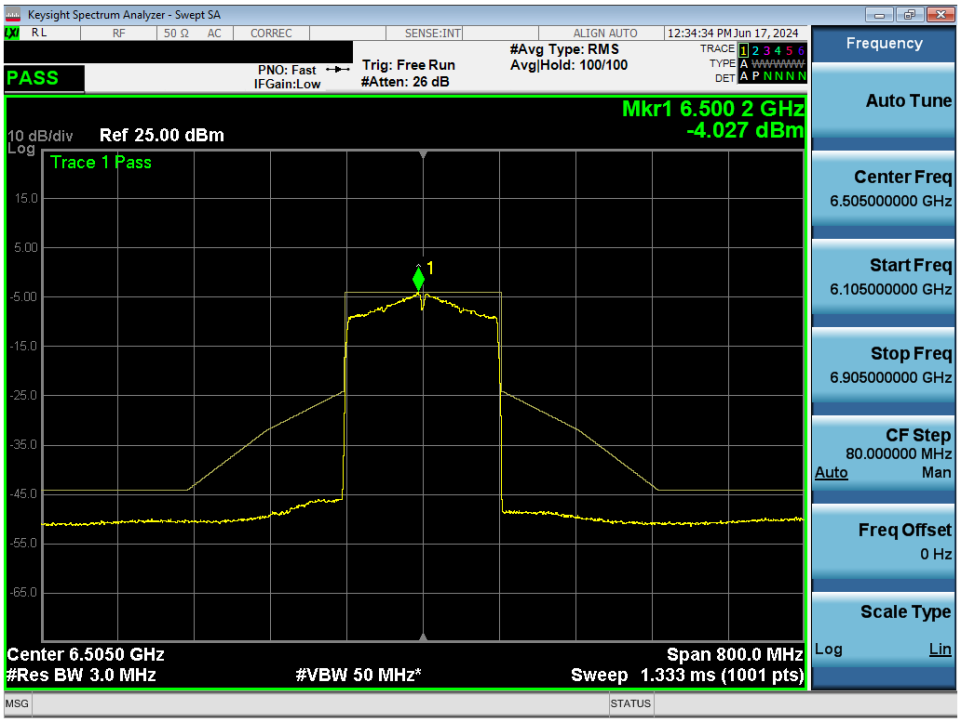
Plot 7-87. In-Band Emission MIMO ANT1 (20MHz 802.11ax (UNII Band 6) – Ch. 105)



Plot 7-88. In-Band Emission MIMO ANT1 (40MHz 802.11ax (UNII Band 6) – Ch. 107)

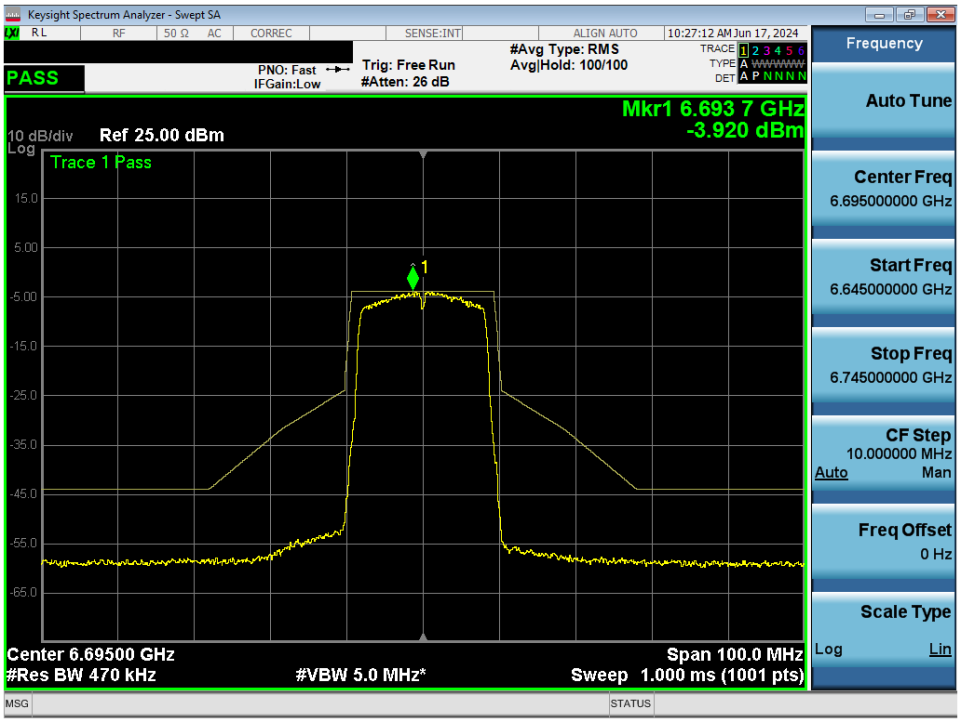


Plot 7-89. In-Band Emission MIMO ANT1 (80MHz 802.11ax (UNII Band 6) – Ch. 103)

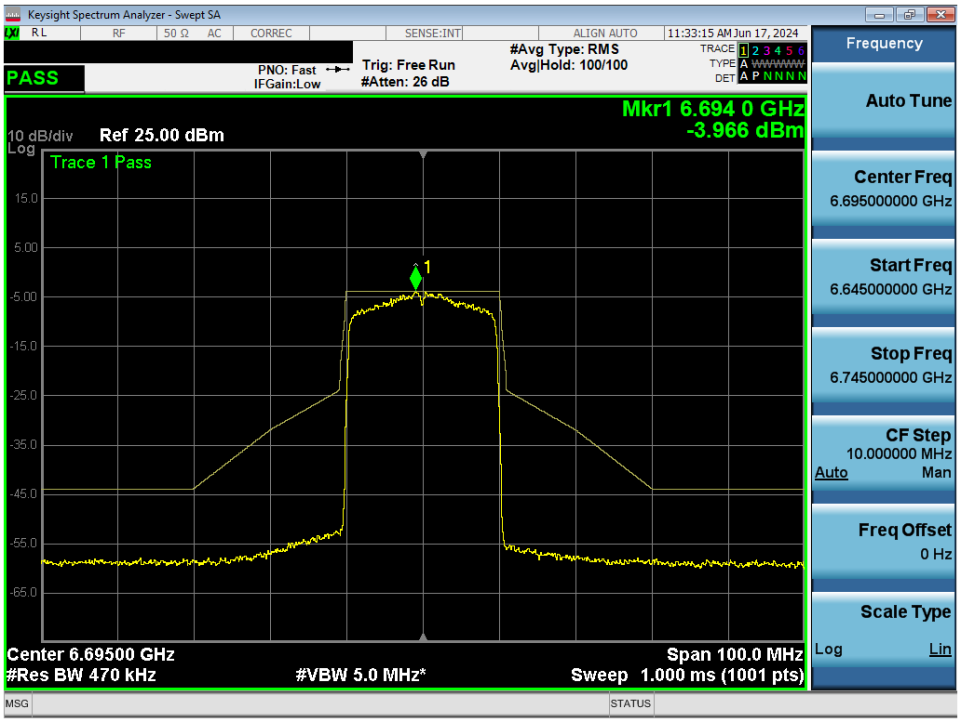


Plot 7-90. In-Band Emission MIMO ANT1 (160MHz 802.11ax (UNII Band 6) – Ch. 111)

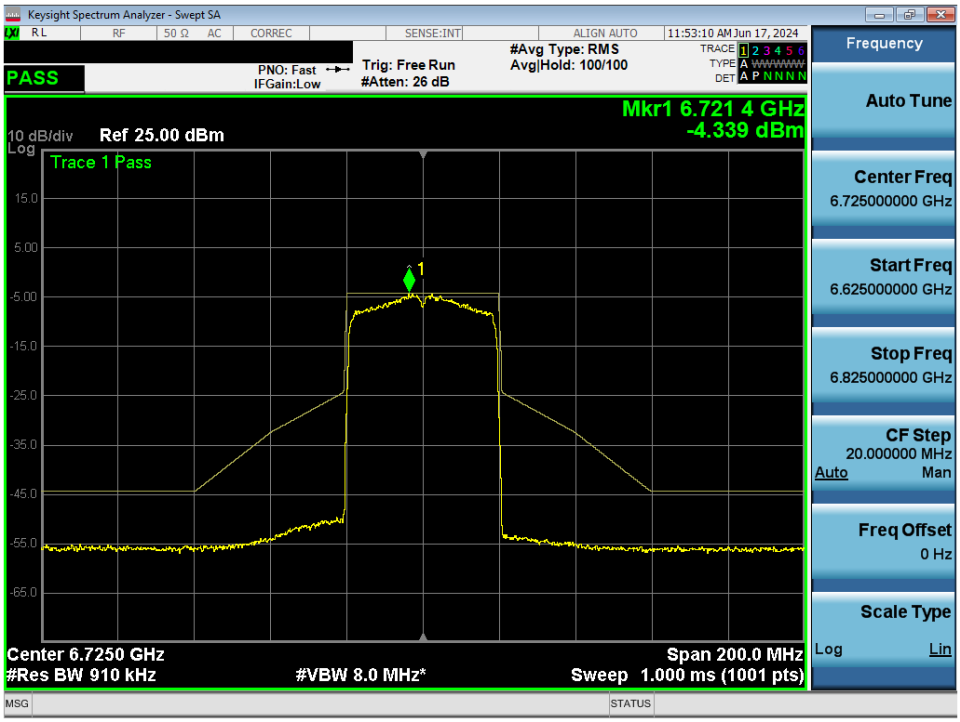
MIMO Antenna-1 In-Band Emission Measurements - (UNII Band 7)



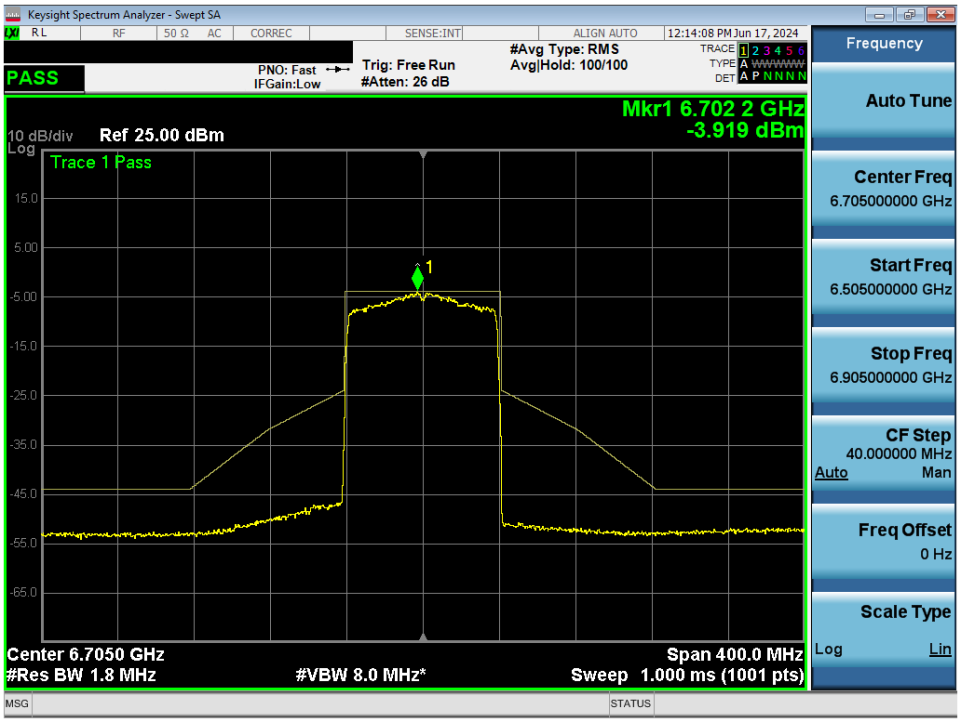
Plot 7-91. In-Band Emission MIMO ANT1 (20MHz 802.11a (UNII Band 7) – Ch. 149)



Plot 7-92. In-Band Emission MIMO ANT1 (20MHz 802.11ax (UNII Band 7) – Ch. 149)



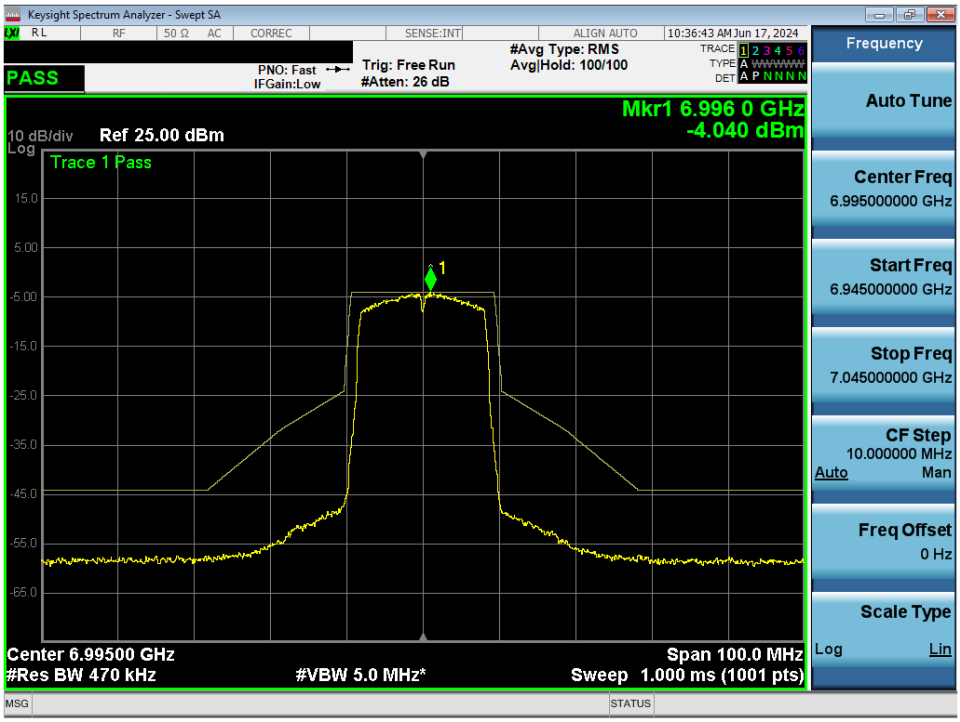
Plot 7-93. In-Band Emission MIMO ANT1 (40MHz 802.11ax (UNII Band 7) – Ch. 155)



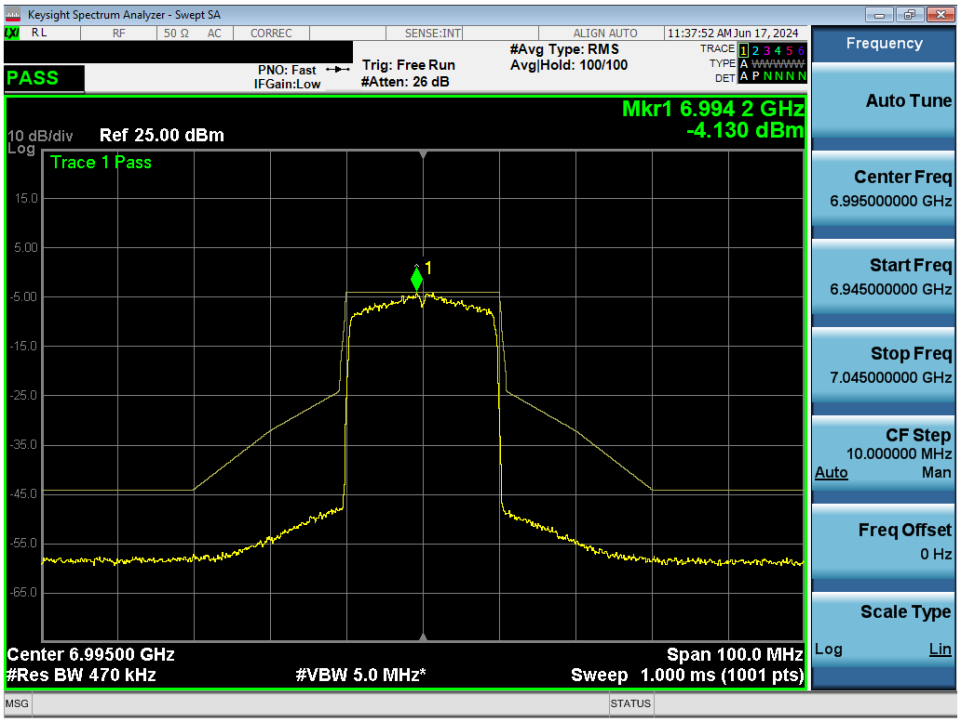
Plot 7-94. In-Band Emission MIMO ANT1 (80MHz 802.11ax (UNII Band 7) – Ch. 151)

Plot 7-95. In-Band Emission MIMO ANT1 (160MHz 802.11ax (UNII Band 7) – Ch. 143)

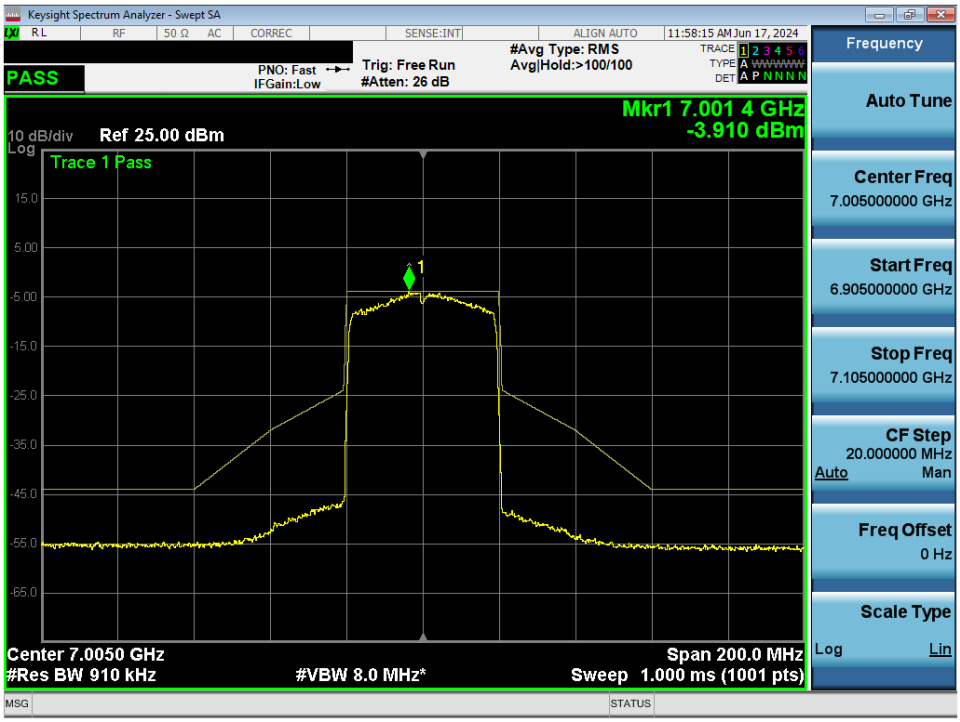
MIMO Antenna-1 In-Band Emission Measurements - (UNII Band 8)



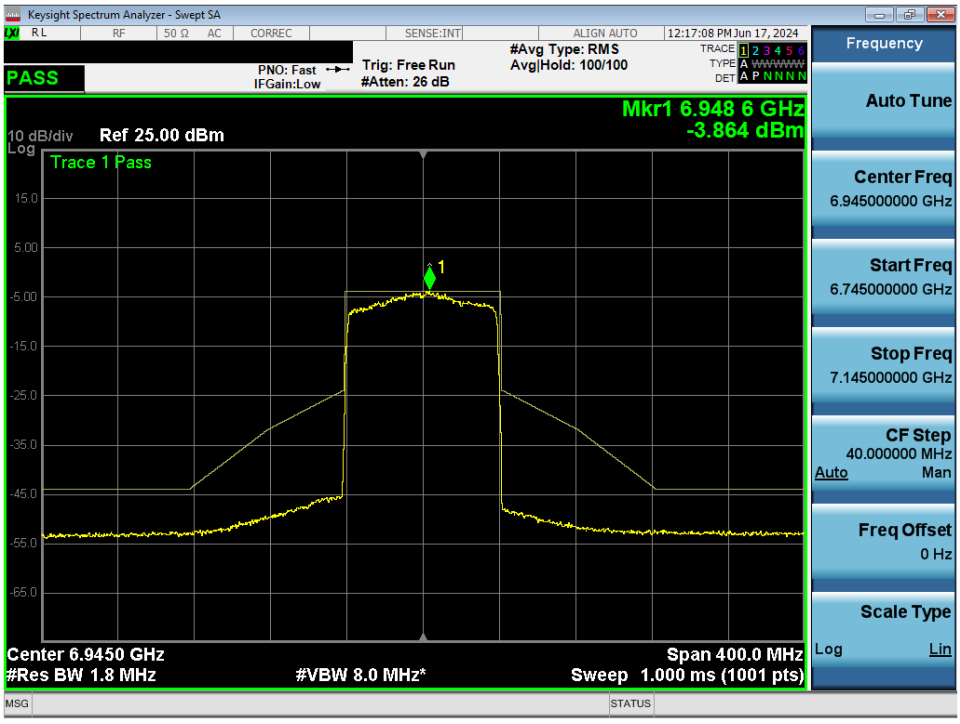
Plot 7-96. In-Band Emission MIMO ANT1 (20MHz 802.11a (UNII Band 8) – Ch. 209)



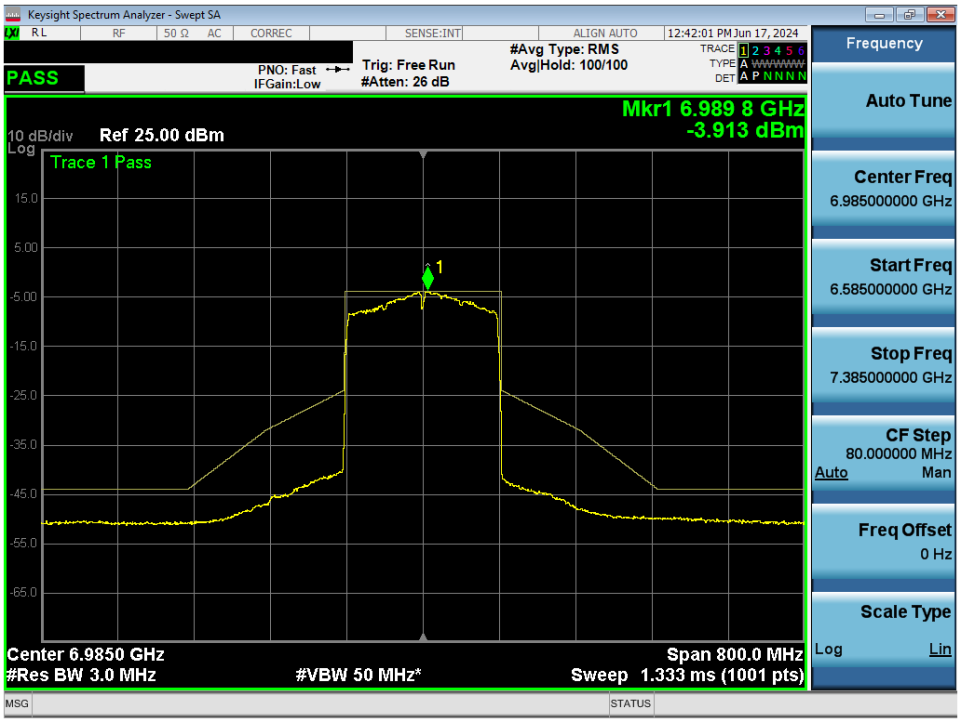
Plot 7-97. In-Band Emission MIMO ANT1 (20MHz 802.11ax (UNII Band 8) – Ch. 209)



Plot 7-98. In-Band Emission MIMO ANT1 (40MHz 802.11ax (UNII Band 8) – Ch. 211)



Plot 7-99. In-Band Emission MIMO ANT1 (80MHz 802.11ax (UNII Band 8) – Ch. 199)



Plot 7-100. In-Band Emission MIMO ANT1 (160MHz 802.11ax (UNII Band 8) – Ch. 207)