ELEMENT WASHINGTON DC LLC
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MEASUREMENT REPORT

FCC Part 15.407 802.11ax/be WiFi 6GHz VLP (OFDMA)

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

Date of Testing:
09/03/2024 – 12/06/2024
Test Report Issue Date:
12/06/2024
Test Site/Location:
Element lab., Columbia, MD, USA
Element Lab., Morgan Hill, CA, USA
Test Report Serial No.:
1M2408260070-16.A3L

FCC ID:	**A3LSMS938JPN**
APPLICANT:	**Samsung Electronics Co., Ltd.**

Application Type:	Certification
Model:	SC-52F
Additional Model:	SCG32
EUT Type:	Portable Handset
Frequency Range:	5925 - 6425MHz and 6525 - 6875MHz
Modulation Type:	OFDMA
FCC Classification:	15E 6GHz Very Low Power Device (6VL)
FCC Rule Part(s):	Part 15 Subpart E (15.407)
Test Procedure(s):	ANSI C63.10-2013, KDB 987594 D02 v03, 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

ACCREDITED
CERT #2041.01

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Channel Bandwidth [MHz]	UNII Band	Tx Frequency [MHz]	Antenna-1		Antenna-2		MIMO	
			Max. Power [mW]	Max. Power [dBm]	Max. Power [mW]	Max. Power [dBm]	Max. Power [mW]	Max. Power [dBm]
20	5	5935 - 6415	1.00	0.01	1.10	0.42	3.92	5.93
	7	6535 - 6875	0.88	-0.56	0.82	-0.87	3.28	5.16
40	5	5965 - 6405	1.97	2.95	2.18	3.39	7.64	8.83
	7	6565 - 6845	1.77	2.47	1.78	2.51	6.98	8.44
80	5	5985 - 6385	3.71	5.69	4.36	6.39	15.00	11.76
	7	6545 - 6865	3.49	5.43	3.13	4.95	12.68	11.03
160	5	6025 - 6345	3.92	5.93	4.47	6.50	17.10	12.33
	7	6665 - 6825	3.52	5.47	3.19	5.04	13.46	11.29
320	5	6105 - 6265	3.74	5.73	4.01	6.03	16.60	12.20
	7	6585 - 6745	3.41	5.33	3.18	5.02	12.33	10.91

EUT Overview - EIRP

1 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).

Measurements were performed at Element located in Morgan Hill, CA 95037, U.S.A. (“CA”)

- Element is an ISO 17025-2017 accredited test facility under the American Association for Laboratory Accreditation (A2LA) with Certificate number 2041.02 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 facility is a registered (22831) test laboratory with the site description on file with ISED

2 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Samsung Electronics Co., Ltd. Portable Handset FCC: A3LSMS938JPN**. 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 in very low power (VLP) mode.

Test Device Serial No.: *2054M, 2284M, 1150M, 1292M, 1182M, 1250M, 2066M, 1295M, 1259M, 1258M*

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

Band 5		Band 7	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
2	5935	117	6535
:	:	:	:
45	6175	149	6695
:	:	:	:
93	6415	185	6875

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

Band 5		Band 7	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
3	5965	123	6565
:	:	:	:
43	6165	155	6725
:	:	:	:
91	6405	179	6845

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

Band 5		Band 7	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
7	5985	119	6545
:	:	:	:
39	6145	151	6705
:	:	:	:
87	6385	183	6865

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

Band 5		Band 7	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
15	6025	143	6665
:	:	:	:
47	6185	175	6825
:	:		
79	6345		

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

Band 5		Band 7	
Ch.	**Frequency (MHz)**	**Ch.**	**Frequency (MHz)**
31	6105	127	6585
63	6265	159	6745

Table 2-5. 802.11be (320MHz BW) Frequency / Channel Operations

Notes:

1. 6GHz NII operation is possible in 20MHz, 40MHz, 80MHz, 160MHz, and 320MHz 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:

Target Maximum Average Conducted Powers / Maximum Achievable Duty Cycles															
Band	Bandwidth	Tone Type	Tone Size	ANT1				ANT2				MIMO (1+2)			
				Duty Cycle [%]	Pulse Width	Period	Radiated DCCF [dB]	Duty Cycle [%]	Pulse Width	Period	Radiated DCCF [dB]	Duty Cycle [%]	Pulse Width	Period	Radiated DCCF [dB]
6GHz	20MHz	RU	26T	98.05	5.030	5.130	N/A	99.54	4.578	4.599	N/A	99.15	2.344	2.364	N/A
			52T	99.54	4.565	4.586	N/A	99.54	4.563	4.584	N/A	99.19	2.341	2.360	N/A
			106T	99.08	2.484	2.507	N/A	99.20	2.488	2.508	N/A	98.56	1.300	1.319	N/A
			242T	98.07	1.118	1.140	N/A	98.33	1.121	1.140	N/A	97.07	0.617	0.635	0.13
		MRU	52+26T	99.40	3.499	3.520	N/A	99.43	3.500	3.520	N/A	98.96	1.808	1.827	N/A
			106+26T	98.97	2.027	2.048	N/A	99.02	2.027	2.047	N/A	98.35	1.070	1.088	N/A
	40MHz	RU	26T	99.43	4.572	4.598	N/A	99.56	4.575	4.595	N/A	99.24	2.345	2.363	N/A
			52T	99.52	4.562	4.584	N/A	99.52	4.563	4.585	N/A	99.24	2.341	2.359	N/A
			106T	99.12	2.473	2.495	N/A	99.20	2.488	2.508	N/A	98.63	1.300	1.318	N/A
			242T	98.25	1.120	1.140	N/A	98.33	1.120	1.139	N/A	97.21	0.617	0.635	0.12
			484T	99.15	2.105	2.123	N/A	98.12	1.095	1.116	N/A	97.15	0.606	0.624	0.13
		MRU	52+26T	99.29	3.495	3.520	N/A	99.46	3.500	3.519	N/A	99.01	1.808	1.826	N/A
			106+26T	99.12	2.027	2.045	N/A	99.07	2.027	2.046	N/A	98.44	1.070	1.087	N/A
	80MHz	RU	26T	99.50	4.572	4.595	N/A	99.54	4.574	4.595	N/A	99.24	2.345	2.363	N/A
			52T	99.45	4.560	4.585	N/A	99.59	4.566	4.585	N/A	99.24	2.342	2.360	N/A
			106T	98.96	2.481	2.507	N/A	99.20	2.479	2.499	N/A	98.63	1.299	1.317	N/A
			242T	98.07	1.119	1.141	N/A	98.33	1.120	1.139	N/A	97.19	0.616	0.634	0.12
			484T	99.06	2.102	2.122	N/A	99.06	2.102	2.122	N/A	95.26	0.357	0.375	0.21
			996T	99.06	2.003	2.022	N/A	98.11	1.037	1.057	N/A	95.26	0.357	0.375	0.21
		MRU	52+26T	99.40	3.498	3.519	N/A	99.43	3.499	3.519	N/A	99.01	1.808	1.826	N/A
			106+26T	98.97	2.024	2.045	N/A	99.02	2.027	2.047	N/A	98.44	1.070	1.087	N/A
			484+242T	98.54	1.420	1.441	N/A	98.54	1.420	1.441	N/A	96.35	0.462	0.480	0.16
	160MHz	RU	26T	99.41	4.561	4.588	N/A	99.46	4.572	4.597	N/A	99.24	2.345	2.363	N/A
			52T	99.50	4.563	4.586	N/A	99.48	4.565	4.589	N/A	99.24	2.341	2.359	N/A
			106T	99.04	2.485	2.509	N/A	99.12	2.487	2.509	N/A	98.63	1.300	1.318	N/A
			242T	98.24	1.119	1.139	N/A	98.24	1.119	1.139	N/A	97.20	0.617	0.635	0.12
			484T	99.10	2.102	2.121	N/A	99.06	2.103	2.123	N/A	95.23	0.358	0.375	0.21
			996T	98.11	1.037	1.057	N/A	98.11	1.038	1.058	N/A	95.18	0.358	0.376	0.21
			2x996T	98.10	1.033	1.053	N/A	98.20	1.034	1.053	N/A	95.13	0.353	0.372	0.22
		MRU	52+26T	99.56	4.550	4.570	N/A	99.46	3.500	3.519	N/A	99.01	1.808	1.826	N/A
			106+26T	99.54	4.551	4.572	N/A	99.07	2.027	2.046	N/A	98.35	1.070	1.088	N/A
			484+242T	97.50	809.600	830.400	0.11	98.54	1.421	1.442	N/A	96.23	0.462	0.481	0.17
			996+484T	98.61	1.422	1.442	N/A	98.49	1.373	1.394	N/A	96.16	0.448	0.466	0.17
			966+484+242T	99.58	5.448	5.471	N/A	99.65	5.452	5.471	N/A	99.65	5.446	5.465	N/A
	320MHz	RU	26T	99.56	4.571	4.591	N/A	99.24	4.574	4.609	N/A	99.24	2.345	2.363	N/A
			52T	99.48	4.562	4.586	N/A	99.43	4.560	4.586	N/A	99.24	2.341	2.359	N/A
			106T	99.04	2.485	2.509	N/A	99.28	2.489	2.507	N/A	98.63	1.300	1.318	N/A
			242T	98.07	1.116	1.138	N/A	100.36	1.118	1.114	N/A	97.18	0.617	0.634	0.12
			484T	99.01	2.101	2.122	N/A	99.06	2.102	2.122	N/A	95.26	0.358	0.376	0.21
			996T	98.02	1.037	1.058	N/A	98.20	1.038	1.057	N/A	95.23	0.358	0.376	0.21
			2x996T	98.00	1.030	1.051	N/A	97.00	595.200	613.600	0.13	95.02	0.353	0.372	0.22
			4x996T	98.18	1.027	1.046	N/A	98.28	1.028	1.046	N/A	96.90	0.569	0.588	0.14
		MRU	52+26T	99.29	3.499	3.524	N/A	99.29	3.496	3.521	N/A	98.96	1.808	1.827	N/A
			106+26T	99.46	3.500	3.519	N/A	99.07	2.026	2.045	N/A	98.34	1.069	1.087	N/A
			484+242T	99.85	812.000	813.200	N/A	98.68	1.423	1.442	N/A	96.25	0.462	0.480	0.17
			996+484T	97.71	784.000	802.400	0.10	99.22	2.670	2.691	N/A	96.05	0.447	0.466	0.18
			966+484+242T	99.54	5.449	5.474	N/A	99.63	5.455	5.475	N/A	99.67	5.451	5.469	N/A
			2x996+484T	97.95	846.300	864.000	0.09	98.60	1.618	1.641	N/A	96.30	0.479	0.497	0.16
			3x996T	97.48	712.000	730.400	0.11	98.46	1.345	1.366	N/A	95.67	0.411	0.429	0.19
			3x996+484T	98.40	1.170	1.189	N/A	99.13	2.272	2.292	N/A	97.18	0.641	0.660	0.12

Table 2-6. 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
6 GHz	11ax	✓	✓	✓	✓	✓	✓
	11be	✓	✓	✓	✓	✓	✓

Table 2-7. Frequency / Channel Operations

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

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

MCS Index		Spatial Stream	OFDMA (802.11ax/be)																					OFDMA (802.11be)		
			26T			52T			106T			242T			484T			996T			2x996T			4x996T		
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	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI	0.8µs GI	1.6µs GI	3.2µs GI
0	0	1	0.9	0.8	0.8	1.8	1.7	1.5	3.8	3.5	3.2	8.6	8.1	7.3	17.2	16.3	14.6	36	34	30.6	72.1	68.1	61.3	144.1	136.1	122.5
1	1	1	1.8	1.7	1.5	3.5	3.3	3	7.5	7.1	6.4	17.2	16.3	14.6	34.4	32.5	29.3	72.1	68.1	61.3	144.1	136.1	122.5	288.2	272.2	245
2	2	1	2.6	2.5	2.3	5.3	5	4.5	11.3	10.6	9.6	25.8	24.4	21.9	51.6	48.8	43.9	108.1	102.1	91.9	216.2	204.2	183.8	432.4	408.3	367.5
3	3	1	3.5	3.3	3	7.1	6.7	6	15	14.2	12.8	34.4	32.5	29.3	68.8	65	58.5	144.1	136.1	122.5	288.2	272.2	245	576.5	544.4	490
4	4	1	5.3	5	4.5	10.6	10	9	22.5	21.3	19.1	51.6	48.8	43.9	103.2	97.5	87.8	216.2	204.2	183.8	432.4	408.3	367.5	864.7	816.7	735
5	5	1	7.1	6.7	6	14.1	13.3	12	30	28.3	25.5	68.8	65	58.5	137.6	130	117	288.2	272.2	245	576.5	544.4	490	1152.9	1088.9	980
6	6	1	7.9	7.5	6.8	15.9	15	13.5	33.8	31.9	28.7	77.4	73.1	65.8	154.9	146.3	131.6	324.3	306.3	275.6	648.5	612.5	551.3	1297.1	1225	1102.5
7	7	1	8.8	8.3	7.5	17.6	16.7	15	37.5	35.4	31.9	86	81.3	73.1	172.1	162.5	146.3	360.3	340.3	306.3	720.6	680.6	612.5	1441.2	1361.1	1225
8	8	1	10.6	10	9	21.2	20	18	45	42.5	38.3	103.2	97.5	87.8	206.5	195	175.5	432.4	408.3	367.5	864.7	816.7	735	1729.4	1633.3	1470
9	9	1	11.8	11.1	10	23.5	22.2	20	50	47.2	42.5	114.7	108.3	97.5	229.4	216.7	195	480.4	453.7	408.3	960.8	907.4	816.7	1921.6	1814.8	1633.3
10	10	1	13.2	12.5	11.3	26.5	25	22.5	56.3	53.1	47.8	129	121.9	109.7	258.1	243.8	219.4	540.4	510.4	459.4	1080.9	1020.8	918.8	2161.8	2041.7	1837.5
11	11	1	14.7	13.9	12.5	29.4	27.8	25	62.5	59	53.1	143.4	135.4	121.9	286.8	270.8	243.8	600.5	567.1	510.4	1201	1134.3	1020.8	2402	2268.5	2041.7
	12	1	15.9	15	13.5	31.8	30	27	67.5	63.8	57.4	154.9	146.3	131.6	309.7	292.5	263.3	648.5	612.5	551.3	1297.1	1225	1102.5	2594.1	2450	2205
	13	1	17.6	16.7	15	35.3	33.3	30	75	70.8	63.8	172.1	162.5	146.3	344.1	325	292.5	720.6	680.6	612.5	1441.2	1361.1	1225	2882.4	2722.2	2450
0	0	2	1.8	1.7	1.5	3.5	3.3	3	7.5	7.1	6.4	17.2	16.3	14.6	34.4	32.5	29.3	72.1	68.1	61.3	144.1	136.1	122.5	288.2	272.2	245
1	1	2	3.5	3.3	3	7.1	6.7	6	15	14.2	12.8	34.4	32.5	29.3	68.8	65	58.5	144.1	136.1	122.5	288.2	272.2	245	576.5	544.4	490
2	2	2	5.3	5	4.5	10.6	10	9	22.5	21.3	19.1	51.6	48.8	43.9	103.2	97.5	87.8	216.2	204.2	183.8	432.4	408.3	367.5	864.7	816.7	735
3	3	2	7.1	6.7	6	14.1	13.3	12	30	28.3	25.5	68.8	65	58.5	137.6	130	117	288.2	272.2	245	576.5	544.4	490	1152.9	1088.9	980
4	4	2	10.6	10	9	21.2	20	18	45	42.5	38.3	103.2	97.5	87.8	206.5	195	175.5	432.4	408.3	367.5	864.7	816.7	735	1729.4	1633.3	1470
5	5	2	14.1	13.3	12	28.2	26.7	24	60	56.7	51	137.6	130	117	275.3	260	234	576.5	544.4	490	1152.9	1088.9	980	2305.9	2177.8	1960
6	6	2	15.9	15	13.5	31.8	30	27	67.5	63.8	57.4	154.9	146.3	131.6	309.7	292.5	263.3	648.5	612.5	551.3	1297.1	1225	1102.5	2594.1	2450	2205
7	7	2	17.6	16.7	15	35.3	33.3	30	75	70.8	63.8	172.1	162.5	146.3	344.1	325	292.5	720.6	680.6	612.5	1441.2	1361.1	1225	2882.4	2722.2	2450
8	8	2	21.2	20	18	42.4	40	36	90	85	76.5	206.5	195	175.5	412.9	390	351	864.7	816.7	735	1729.4	1633.3	1470	3458.8	3266.7	2940
9	9	2	23.5	22.2	20	47.1	44.4	40	100	94.4	85	229.4	216.7	195	458.8	433.3	390	960.8	907.4	816.7	1921.6	1814.8	1633.3	3843.1	3629.6	3266.7
10	10	2	26.5	25	22.5	52.9	50	45	112.5	106.3	95.6	258.1	243.8	219.4	516.2	487.5	438.8	1080.9	1020.8	918.8	2161.8	2041.7	1837.5	4323.5	4083.3	3675
11	11	2	29.4	27.8	25	58.8	55.6	50	125	118.1	106.3	286.8	270.8	243.8	573.5	541.7	487.5	1201	1134.3	1020.8	2402	2268.5	2041.7	4803.9	4537	4083.3
	12	2	31.8	30	27	63.5	60	54	135	127.5	114.8	309.7	292.5	263.3	619.4	585	526.5	1297.1	1225	1102.5	2594.1	2450	2205	5188.2	4900	4410
	13	2	35.3	33.3	30	70.6	66.7	60	150	141.7	127.5	344.1	325	292.5	688.2	650	585	1441.2	1361.1	1225	2882.4	2722.2	2450	5764.7	5444.4	4900

Table 2-8. Supported Data Rates

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

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

Table 2-9. Power Operation

✓= Support; × = NOT Support

2.3 Antenna Description

The following antenna gains were used for the testing.

Frequency	Ant1 Peak Gain [dBi]	Ant2 Peak Gain [dBi]	Directional Gain [dBi]
5925 MHz	-6.12	-5.30	-2.69
6025 MHz	-6.49	-5.01	-2.71
6125 MHz	-6.22	-5.37	-2.77
6225 MHz	-6.31	-6.15	-3.22
6325 MHz	-5.91	-5.38	-2.63
6425 MHz	-5.88	-5.84	-2.85
6525 MHz	-6.52	-6.25	-3.37
6625MHz	-6.69	-6.56	-3.61
6725MHz	-6.97	-6.80	-3.87
6825MHz	-6.85	-6.82	-3.82
6925MHz	-6.97	-6.41	-2.09
7025MHz	-6.50	-6.03	-3.44
7125MHz	-6.49	-6.84	-3.65

Table 2-10 Antenna Peak Gain per Frequency

	Ant1 Peak Gain [dBi]	Ant2 Peak Gain [dBi]	Directional Gain [dBi]
5925 – 6425 MHz	-5.91	-5.38	-2.63
6425 – 6525 MHz	-5.88	-5.84	-2.85
6525 – 6875 MHz	-6.52	-6.25	-3.37
6875 – 7125 MHz	-6.50	-6.03	-3.25

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, 3.3 for radiated emissions test setups, and 7.3, 7.3, 7.4, 7.5 and 7.6 for antenna port conducted emissions test setups.

This device supports operation in very low power mode limited to the 5925 - 6425MHz and 6525 - 6875MHz bands.

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) Model: NQ-WC-06 while operating under normal conditions in a simulated call or data transmission configuration. The worst case radiated emissions data is shown in this report.

2.5 Software and Firmware

The test was conducted with firmware version S938USQUOAXJ3 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 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 to v03 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.

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

4 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 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

Table 5-1. Measurement Uncertainty Budget – MD

Contribution	Expanded Uncertainty (±dB)
Conducted Bench Top Measurements	1.65
Line Conducted Disturbance	2.71
Radiated Disturbance (<30MHz)	4.06
Radiated Disturbance (30MHz - 1GHz)	4.30
Radiated Disturbance (1 - 18GHz)	4.78
Radiated Disturbance (>18GHz)	4.79

Table 5-2. Measurement Uncertainty Budget – CA

6 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	MA24408A	Microwave Peak Power Sensor	5/21/2024	Annual	5/21/2025	11675
Anritsu	MA24408A	Microwave Peak Power Sensor	4/10/2024	Annual	4/10/2025	12798
ETS-Lindgren	3116C	Horn Antenna (18-40GHz)	2/27/2023	Biennial	2/27/2025	218893
Rohde & Schwarz	TC-TA18	Vivaldi Antenna	2/23/2023	Biennial	2/23/2025	26040036
Rohde & Schwarz	FSW26	Signal and Spectrum Analyzer (26.5GHz)	3/8/2024	Annual	3/8/2025	103187
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 (44GHz)	4/5/2024	Annual	4/5/2025	101716
Pasternak	NMLC-2	EMI Test Receiver (2Hz to 44GHz)	4/2/2024	Annual	4/2/2025	NMLC-2
Rohde & Schwarz	ENV216	Two-Line V-Network	1/31/2023	Biennial	1/31/2025	101379
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	9/19/2024	Annual	9/19/2025	MY57141001
Sunol	JB6	JB6 Antenna	3/2/2023	Biennial	3/2/2025	A082816
Sunol	JB5	Bi-Log Antenna (20M-5GHz)	9/11/2024	Biennial	9/11/2026	A051107
Rohde & Schwarz	SMW200A	Vector Signal Generator	4/4/2024	Annual	4/4/2025	109456

Table 6-1. Annual Test Equipment Calibration Schedule – MD

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
ETS-Lindgren	3117	Double Ridged Guide Antenna (1-18 GHz)	4/9/2024	Annual	4/9/2025	00218555
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	5/29/2024	Annual	11/29/2024	102132
Rohde & Schwarz	TS-PR18	Pre-Amplifier (1GHz - 18GHz)	8/14/2024	Annual	8/15/2025	101648
Rohde & Schwarz	FSV40	Signal Analyzer (10Hz-40GHz)	5/29/2024	Annual	5/29/2025	101619
Rohde & Schwarz	ESW44	EMI Test Receiver	5/1/2024	Annual	5/1/2025	101867
Rohde & Schwarz	FSW67	Signal and Spectrum Analyzer (2Hz-67GHz)	7/5/2024	Annual	7/5/2025	101366
Rohde & Schwarz	TS-PR8	Pre-Amplifier (30MHz - 8GHz)	7/3/2024	Annual	7/3/2025	102356
Schwarzbeck	VULB 9162	Bilog Antenna (30MHz - 6GHz)	4/29/2024	Annual	4/29/2025	00304

Table 6-2. Annual Test Equipment Calibration Schedule – CA

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 TEST RESULTS

7.1 Summary

Company Name: Samsung Electronics Co., Ltd.

FCC ID: A3LSMS938JPN

FCC Classification: 15E 6GHz Very Low Power Device (6VL)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference	Test Lab Location	Data Referencing?
2.1046, 15.407(a)(12)	Maximum Conducted Output Power	N/A	CONDUCTED	PASS	Section 7.4	MD	Yes
15.407(a)(9)	Maximum Radiated Output Power	< 14dBm e.i.r.p.		PASS	Section 7.4	MD	Yes
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 7.3	MD	Yes
15.407(a)(9)	Maximum Power Spectral Density	< -5dBm/MHz e.i.r.p.		PASS	Section 7.5	MD	Yes
15.407(b)(7)	In-Band Emissions	EUT must meet the limits detailed in 15.407(b)(7)		PASS	Section 7.6	MD	Yes
15.407(d)(6)	Contention Based Protocol	EUT must detect AWGN signal with 90% (or better) certainty	RADIATED	PASS	Section 7.7	MD	Yes
15.407(d)(10)	Transmit Power Control	Must operate at least 6 dB below the maximum EIRP power spectral density (PSD) value of −5 dBm/MHz		PASS	Please see WiFi 6GHz (6VL) OFDM report	MD	No (full testing)
15.407(b)(6)	Undesirable Emissions	< -27dBm/MHz e.i.r.p. outside of the 5.925 – 7.125GHz band		PASS	Section 7.8	CA	Yes
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 7.8	CA	Yes
15.407(b)(9)	AC Conducted Emissions (150kHz – 30MHz)	< FCC 15.207 limits	LINE CONDUCTED	PASS	Please see WiFi 6GHz (6VL) OFDM report	MD	Yes

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 1.3.1.
6) 802.11ax OFDMA testing was performed for all signal tone configurations as specified by the 802.11ax standard. Worst case results are determined and reported per the guidance provided at the October 2018 TCB Workshop.
7) Only one RU index could be selected at a time, so no contiguous or non-contiguous RUs were considered for testing.
8) Data was leveraged from model SM-S938U for the certification of SC-52F. See Table 7-2 for spot-check results.

7.2 Data Reference Spot Check Results

Overview

The spot-check data presented in this section was measured on the variant model following the guidance of the FCC's Data Referencing guidance in KDB 484596. Each spot-check test on the EUT was performed using the same procedure and setting that were used to perform the test on the corresponding reference device. For the worst-case RSE data, the measurement is determined by an actual emission and not by noise floor.

All test cases were performed to verify the variant EUT is still in compliance with the spot-checked results to the reference device and was performed using the guidance of ANSI C63.10-2013.

Results

FCC Rules	Test Item	Units	Limit	Reference Model: SM-S938U	Variant Model: SC-52F	Deviation (dB)	Max Deviation (dB)	Pass/Fail
2.1046, 15.407(a)(8)	Conducted Output Power	dBm	-	11.32	11.31	-0.01	1	PASS
15.407(d)(6)	Contention Based Protocol	dBm	-62	-65.54	-65.77	-0.23	3	PASS
15.209	Radiated Spurious Emissions	dBµV/m	53.98	48.10	48.38	0.28	3	PASS
15.209	Radiated Band Edge Emissions	dBµV/m	68.2	65.98	66.13	0.15	3	PASS

Table 7-2. Summary of Spot-checks

Conducted Output Power – Spot-check (SC-52F)

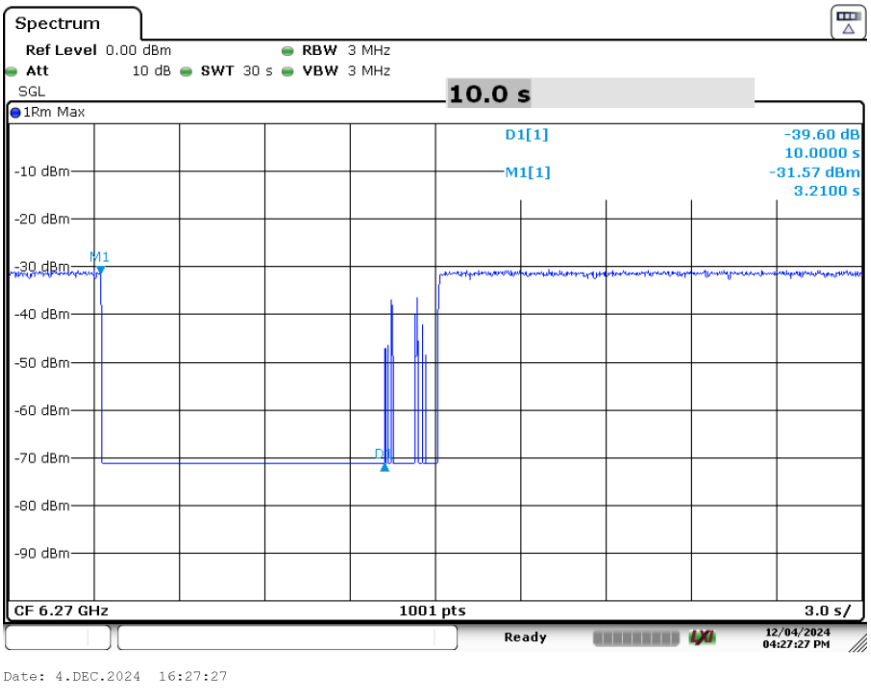
40MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm)			Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index						
					65						
					ANT1	ANT2	MIMO				
	5	6165	43	484T	8.17	8.42	11.31	-2.63	8.68	14.0	-5.32
	7	6725	155	484T	8.54	8.27	11.42	-3.37	8.04	14.0	-5.96

Table 7-3. Conducted Output Power Measurements – Spot-check (SC-52F)

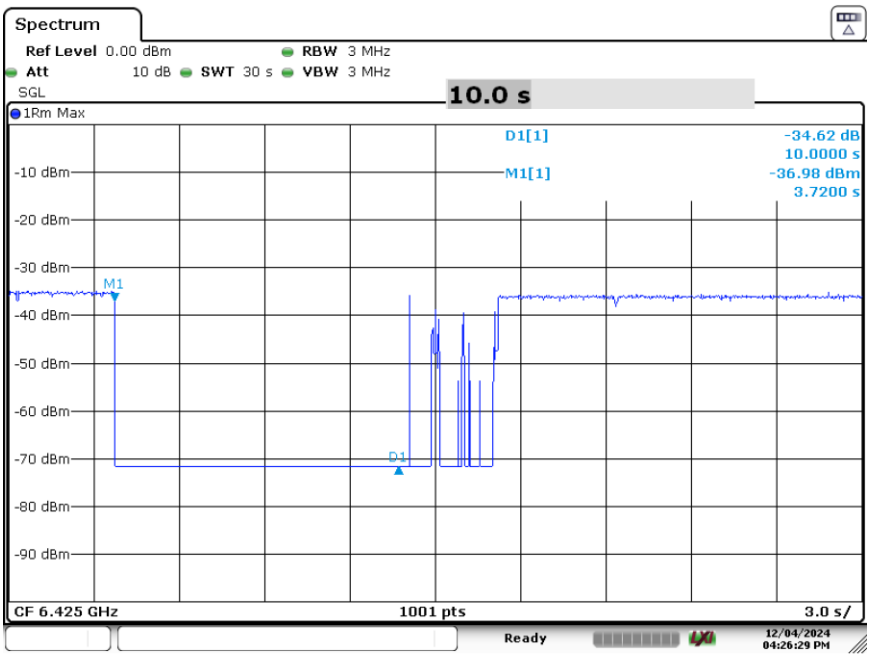
Contention Based Protocol Detection Spot-check SC-52F

Band	Channel	Channel Freq [MHz]	Channel BW [MHz]	Incumbent Freq [MHz]	Injected (AWGN) [dBm]	Antenna Gain [dBi]	Path Loss (dB)	Adjusted Power Level [dBm]	Detection Limit [dBm]	Margin [dB]
UNII Band 5	95	6425	320	6270	-73.29	-6.49	1.03	-65.77	-62.0	-3.77
				6425	-75.30	-6.49	1.03	-67.78	-62.0	-5.78
				6580	-74.32	-6.49	1.03	-66.80	-62.0	-4.80

Table 7-4. Contention Based Protocol – Incumbent Detection – Spot-check (SC-52F)

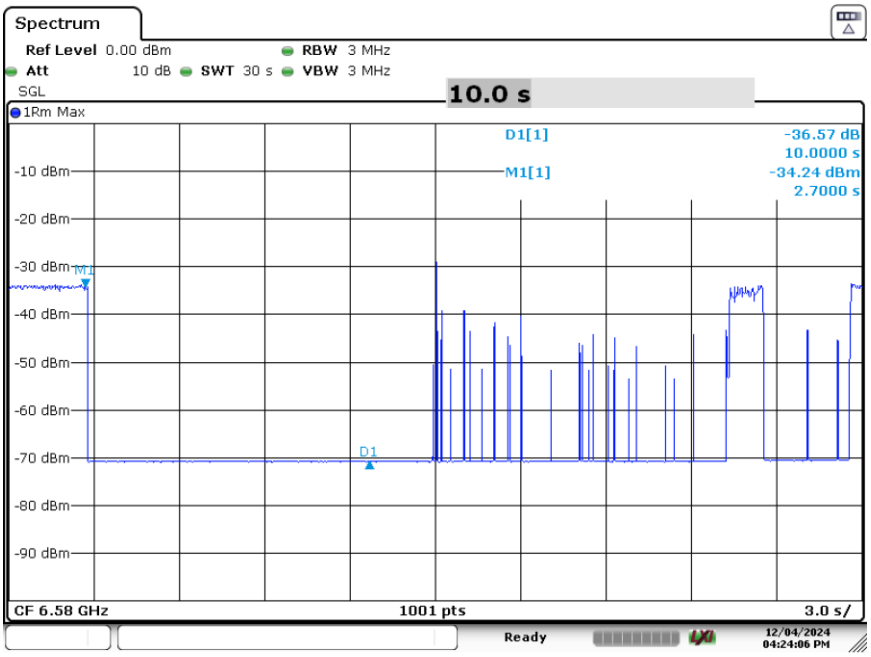


Plot 7-1. Contention Based Protocol Timing Plot (320MHz (UNII Band 5) – Ch.95 Low)



Date: 4.DEC.2024 16:26:29

Plot 7-2. Contention Based Protocol Timing Plot (320MHz (UNII Band 5) – Ch. 95 Mid)

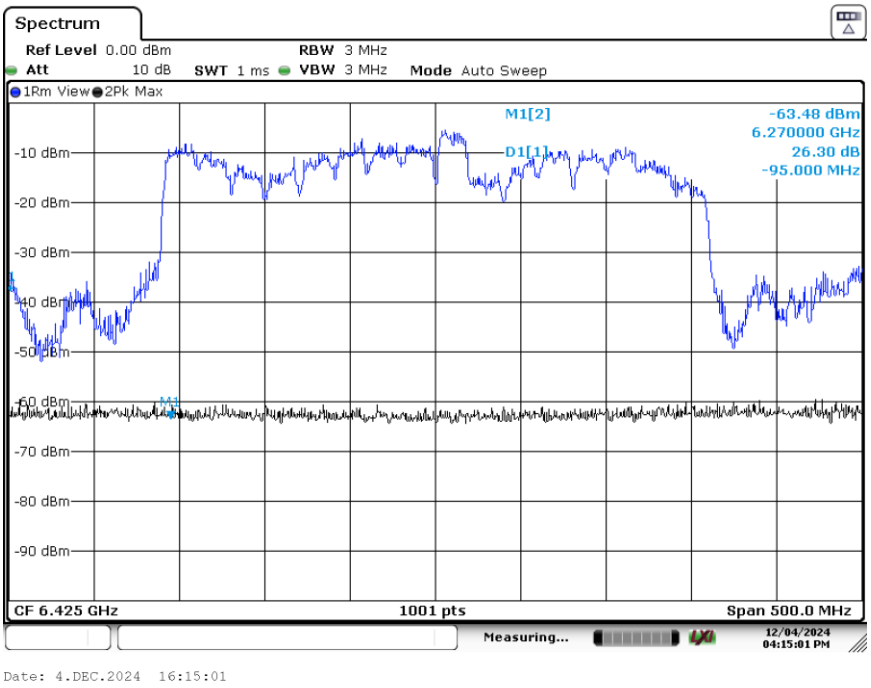


Date: 4.DEC.2024 16:24:06

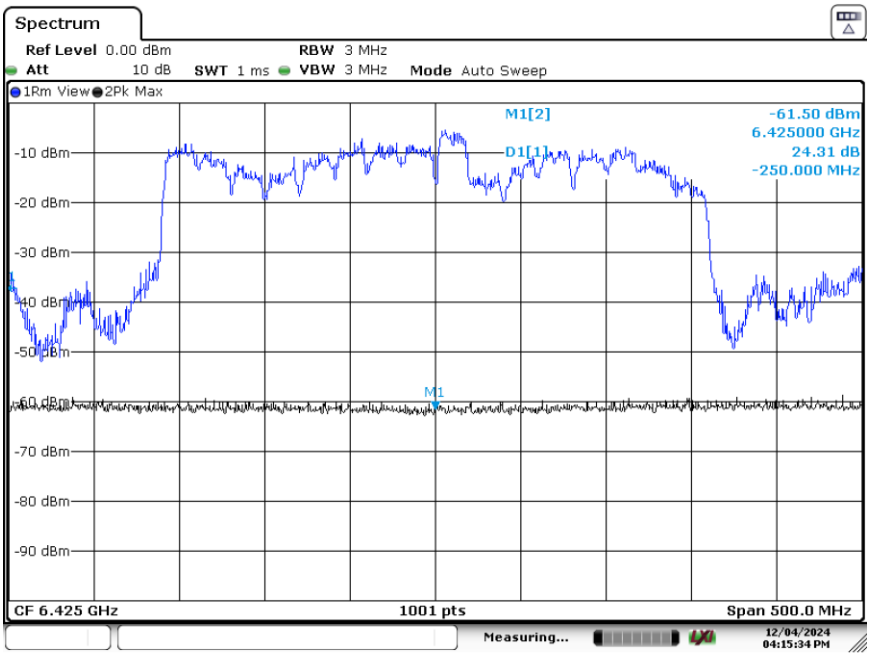
Plot 7-3. Contention Based Protocol Timing Plot (320MHz (UNII Band 5) – Ch. 95 High)

Contention Based Protocol Incumbent Avoidance Spot-Check

- When a 10 MHz AWGN signal centered at 6270 MHz (lower edge of channel) is injected, the channel completely stops transmitting.
- When a 10 MHz AWGN signal centered at 6425 MHz (middle of channel) is injected, the channel completely stops transmitting.
- When a 10 MHz AWGN signal centered at 6580 MHz (upper edge of channel) is injected, the channel completely stops transmitting.

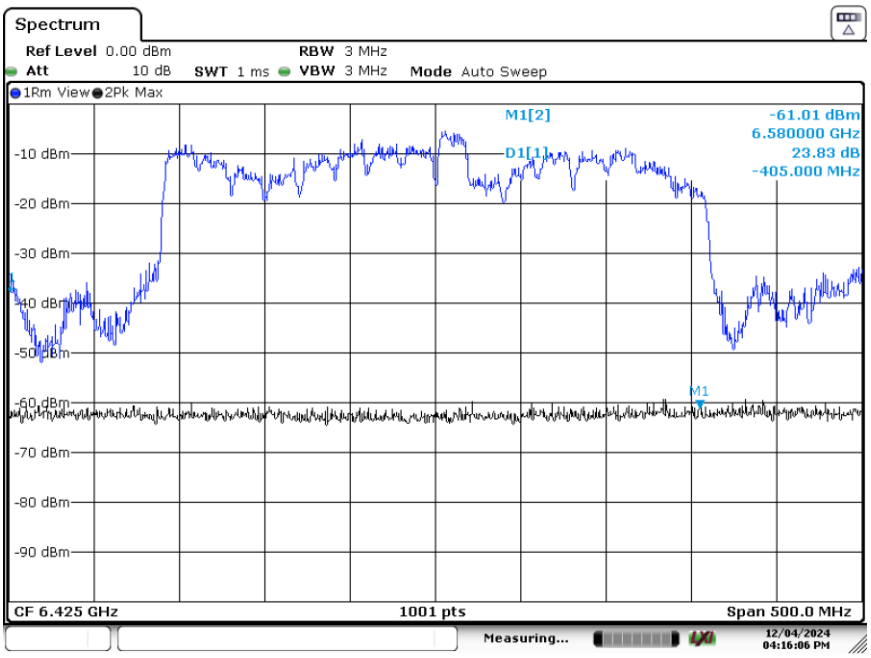


Plot 7-4. CBP 320MHz Channel - Injection Lower Edge – [6270 MHz]



Date: 4.DEC.2024 16:15:34

Plot 7-5. CBP 320MHz Channel - Injection Center – 6425 MHz]



Date: 4.DEC.2024 16:16:06

Plot 7-6. CBP 320MHz Channel - Injection Upper Edge – [6580 MHz]

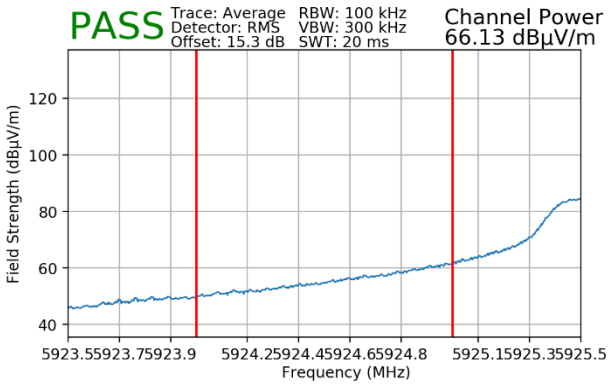
Radiated Spurious Emission – Spot-check (SC-52F)

Mode	Antenna	UNII Band	Channel	Test Channel Freq. [MHz]	RU Index	Restricted	Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Distance Correction Factor [dB]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
802.11be RU26T	MIMO	5	2	5935	4	*	17805.00	Average	H	204	355	-82.77	24.15	0.00	48.38	53.98	-5.60

Table 7-5. Radiated Measurements MIMO (Spot-check)

Radiated Band Edge – Spot-check (SC-52F) – (20MHz 242 Tone)

Worst Case Mode:	802.11be
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5935MHz
Channel:	2
RU Index:	61



Plot 7-7. Radiated Lower Band Edge Plot MIMO (Average – UNII Band 5)

7.3 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 $\geq$ 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

1. All cases were investigated; a subset of the taken plots were included to represent relevant settings and measurements.
2. In this section, the bandwidth data tables include mainly the 26dB bandwidth measurements. In case of 320MHz operation, an occupied bandwidth measurement was included in the table to demonstrate compliance. Thus, all measurements in the tables are 26dB bandwidth measurements except for the 320MHz bandwidth cases which are occupied bandwidth measurements.

	Frequency [MHz]	Channel	802.11 MODE	Antenna-1 26dB Bandwidth [MHz]	Antenna-2 26dB Bandwidth [MHz]
Band 5	5935	2	be (20MHz)	20.38	20.12
	6175	45	be (20MHz)	20.58	19.97
	6415	93	be (20MHz)	20.41	20.08
	5965	3	be (40MHz)	23.16	24.63
	6165	43	be (40MHz)	23.75	24.08
	6405	91	be (40MHz)	25.36	23.85
	5985	7	be (80MHz)	32.29	33.36
	6145	39	be (80MHz)	32.27	32.04
	6385	87	be (80MHz)	32.11	30.82
	6025	15	be (160MHz)	34.33	35.81
	6185	47	be (160MHz)	37.42	39.88
	6345	79	be (160MHz)	37.04	38.75
	6105	31	be (320MHz)	46.54	47.73
	6265	63	be (320MHz)	46.57	47.27
Band 7	6695	117	be (20MHz)	20.34	20.19
	6695	149	be (20MHz)	20.16	20.23
	6875	185	be (20MHz)	19.96	20.32
	6565	123	be (40MHz)	23.13	24.12
	6685	155	be (40MHz)	23.91	23.83
	6845	179	be (40MHz)	22.90	24.17
	6545	119	be (80MHz)	33.02	33.54
	6705	151	be (80MHz)	32.66	32.36
	6865	183	be (80MHz)	33.02	33.18
	6665	143	be (160MHz)	38.41	37.60
	6825	175	be (160MHz)	39.93	40.29

Table 7-6. 26dB Bandwidth Results – 26 Tones – VLP

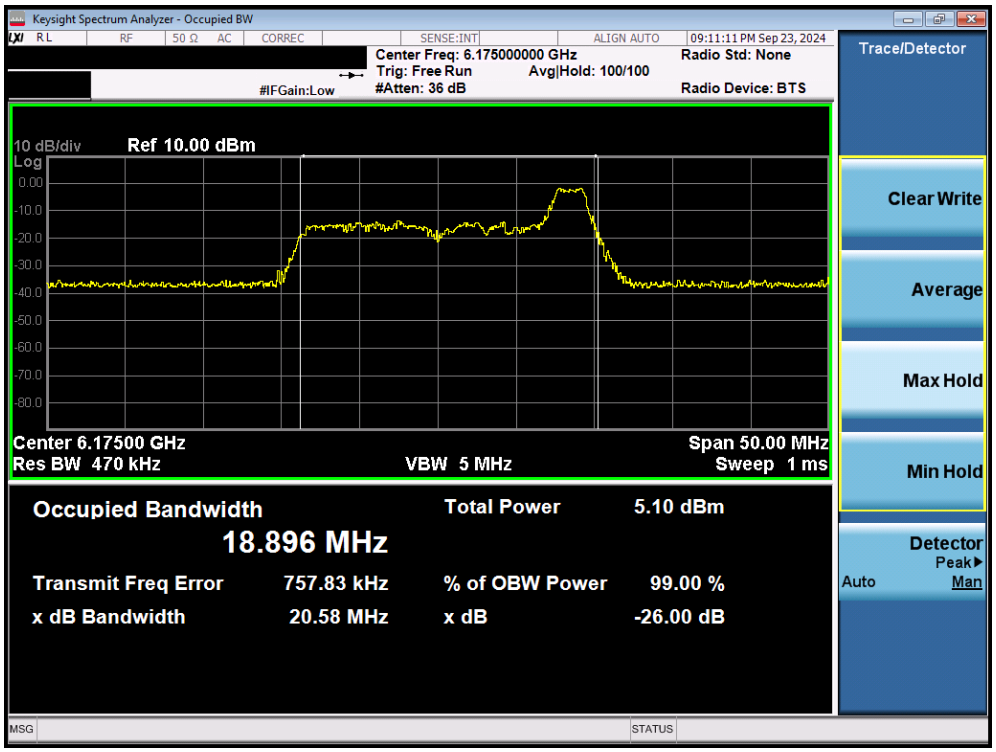
	Frequency [MHz]	Channel	802.11 MODE	MRU Configuration	Antenna-1 26dB Bandwidth [MHz]	Antenna-2 26dB Bandwidth [MHz]	Antenna-1 Occupied Bandwidth [MHz]	Antenna-2 Occupied Bandwidth [MHz]
Band 5	6145	45	be (80MHz)	52+26T	18.85	18.52	-	-
	6175	45	be (20MHz)	106+26T	20.38	20.23	-	-
	6145	39	be (80MHz)	484+242T	89.63	89.93	-	-
	6185	47	be (160MHz)	996+484T	173.83	179.97	-	-
	6105	31	be (320MHz)	2x996+484T	-	-	237.69	237.38
	6105	31	be (320MHz)	3x996T	-	-	316.21	317.12
	6105	31	be (320MHz)	3x996+484T	-	-	316.04	315.84
Band 7	6695	149	be (20MHz)	52+26T	18.67	18.97	-	-
	6695	149	be (20MHz)	106+26T	20.46	20.33	-	-
	6705	151	be (80MHz)	484+242T	88.73	89.62	-	-
	6665	143	be (160MHz)	996+484T	176.72	177.15	-	-

Table 7-7. 26dB Bandwidth Results – MRU – VLP

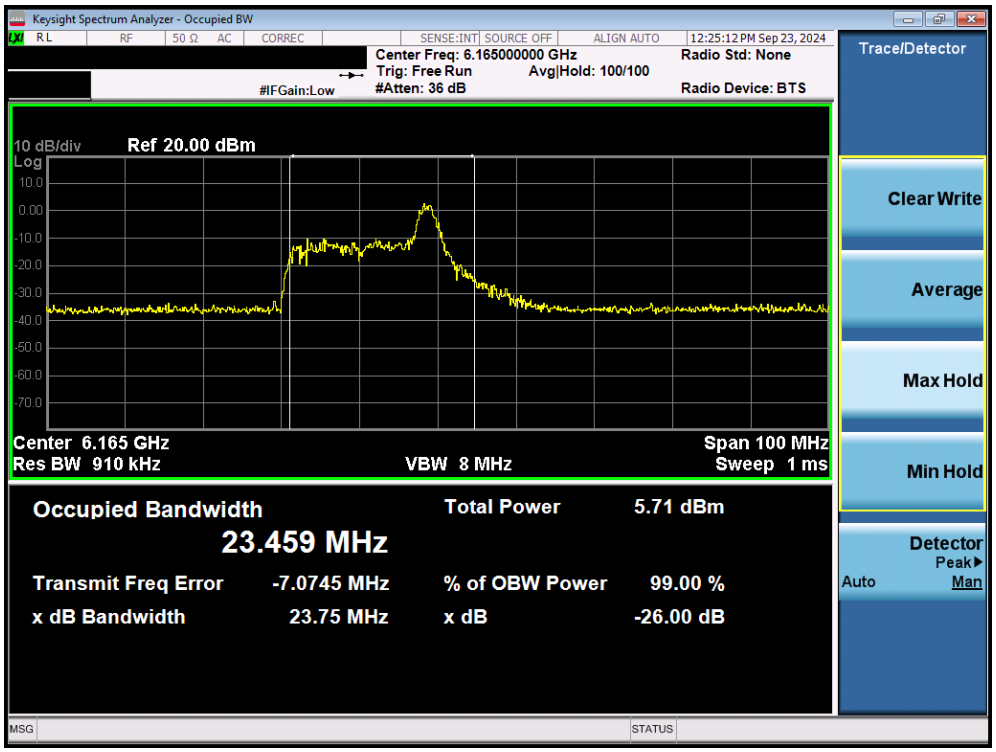
	Frequency [MHz]	Channel	802.11 MODE	Antenna-1 26dB Bandwidth [MHz]	Antenna-2 26dB Bandwidth [MHz]	Antenna-1 Occupied Bandwidth [MHz]	Antenna-2 Occupied Bandwidth [MHz]
Band 5	5935	2	be (20MHz)	21.77	21.61	-	-
	6175	45	be (20MHz)	21.69	20.96	-	-
	6415	93	be (20MHz)	21.87	21.27	-	-
	5965	3	be (40MHz)	42.05	42.31	-	-
	6165	43	be (40MHz)	42.23	42.66	-	-
	6405	91	be (40MHz)	42.76	42.87	-	-
	5985	7	be (80MHz)	89.98	93.14	-	-
	6145	39	be (80MHz)	90.27	95.69	-	-
	6385	87	be (80MHz)	90.84	94.30	-	-
	6025	15	be (160MHz)	176.35	179.46	-	-
	6185	47	be (160MHz)	182.91	181.83	-	-
	6345	79	be (160MHz)	178.75	177.09	-	-
	6105	31	be (320MHz)	-	-	315.78	315.21
	6265	63	be (320MHz)	-	-	314.59	314.88
Band 7	6695	117	be (20MHz)	21.62	21.29	-	-
	6695	149	be (20MHz)	21.49	21.84	-	-
	6875	185	be (20MHz)	21.24	21.47	-	-
	6565	123	be (40MHz)	42.30	42.88	-	-
	6685	155	be (40MHz)	43.11	42.45	-	-
	6845	179	be (40MHz)	42.57	43.18	-	-
	6545	119	be (80MHz)	91.08	94.09	-	-
	6705	151	be (80MHz)	90.09	90.93	-	-
	6865	183	be (80MHz)	89.49	93.82	-	-
	6665	143	be (160MHz)	180.65	180.32	-	-

Table 7-8. 26dB Bandwidth Results – Full Tones – VLP

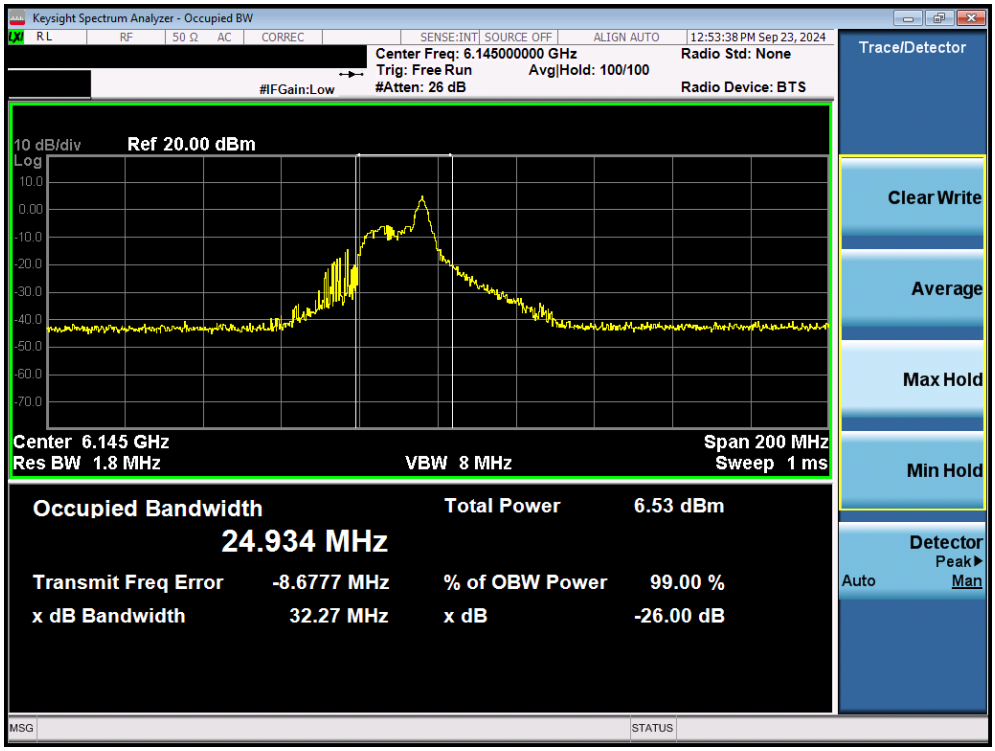
7.3.1 MIMO Antenna-1 Bandwidth Measurements - (Partial Tones)



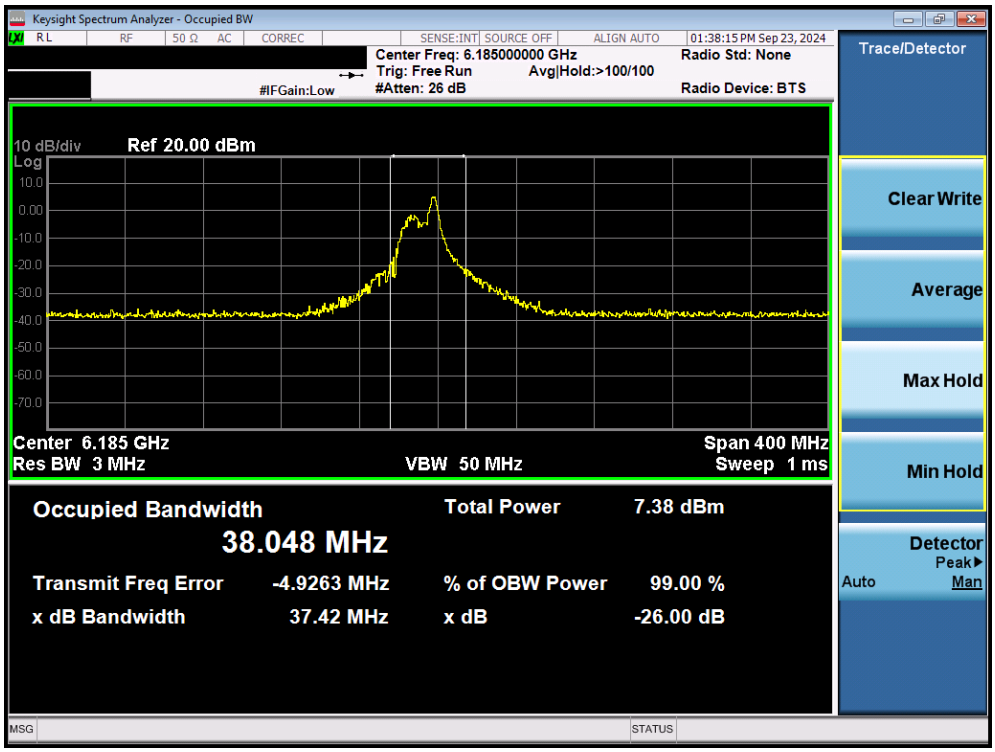
Plot 7-8. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 45) - VLP



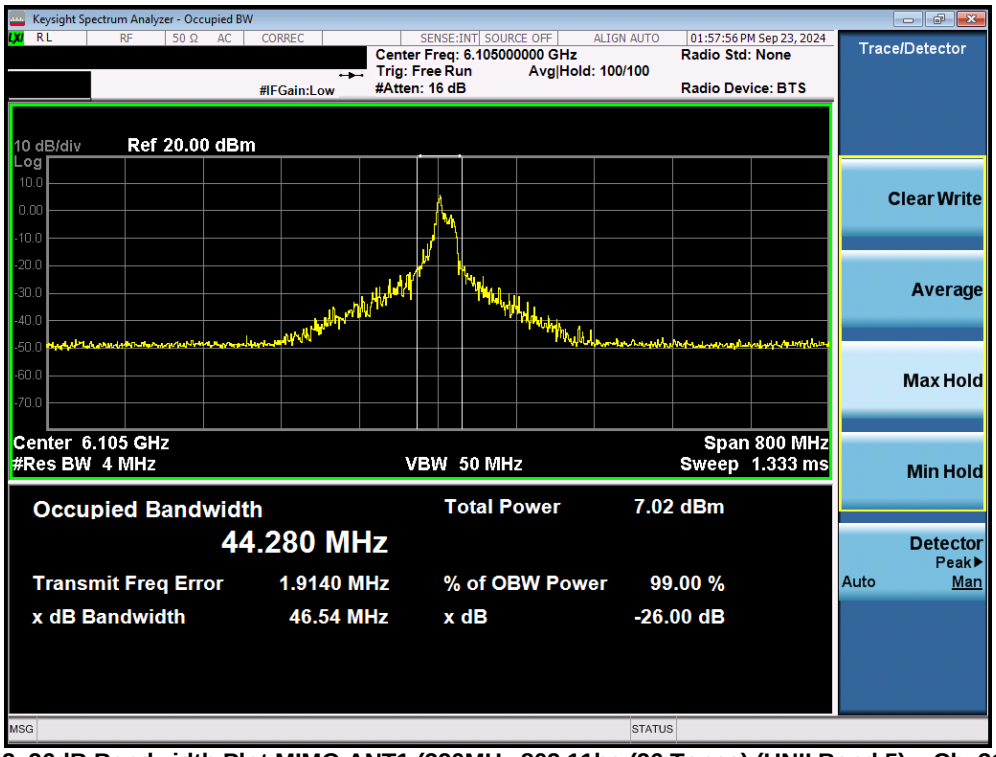
Plot 7-9. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 43) - VLP



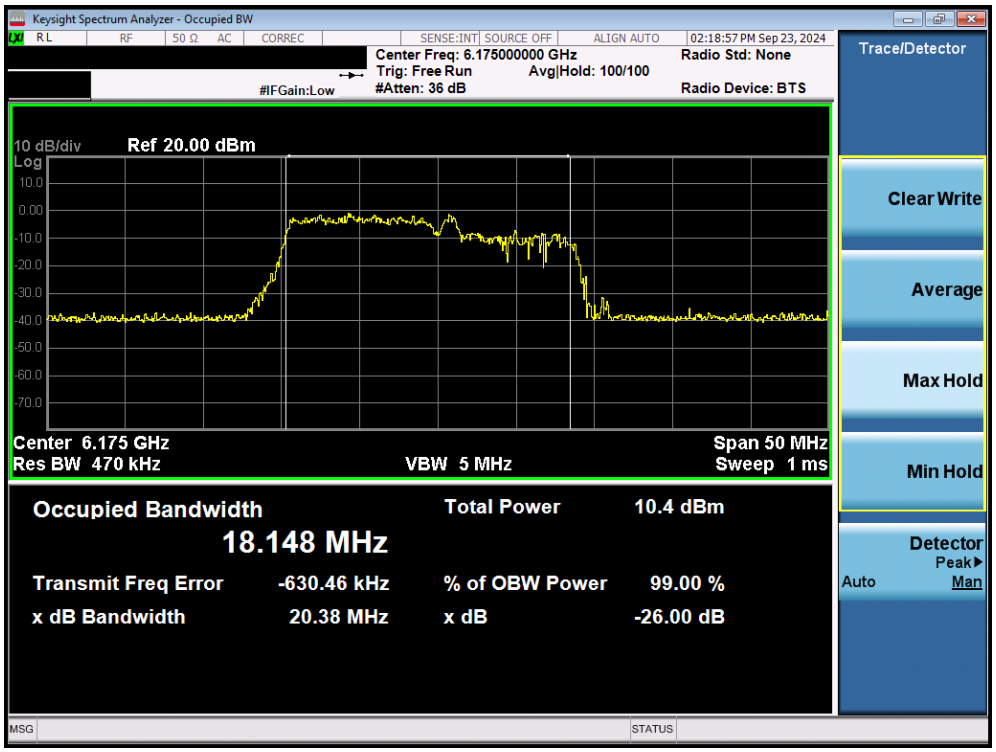
Plot 7-10. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 39) - VLP



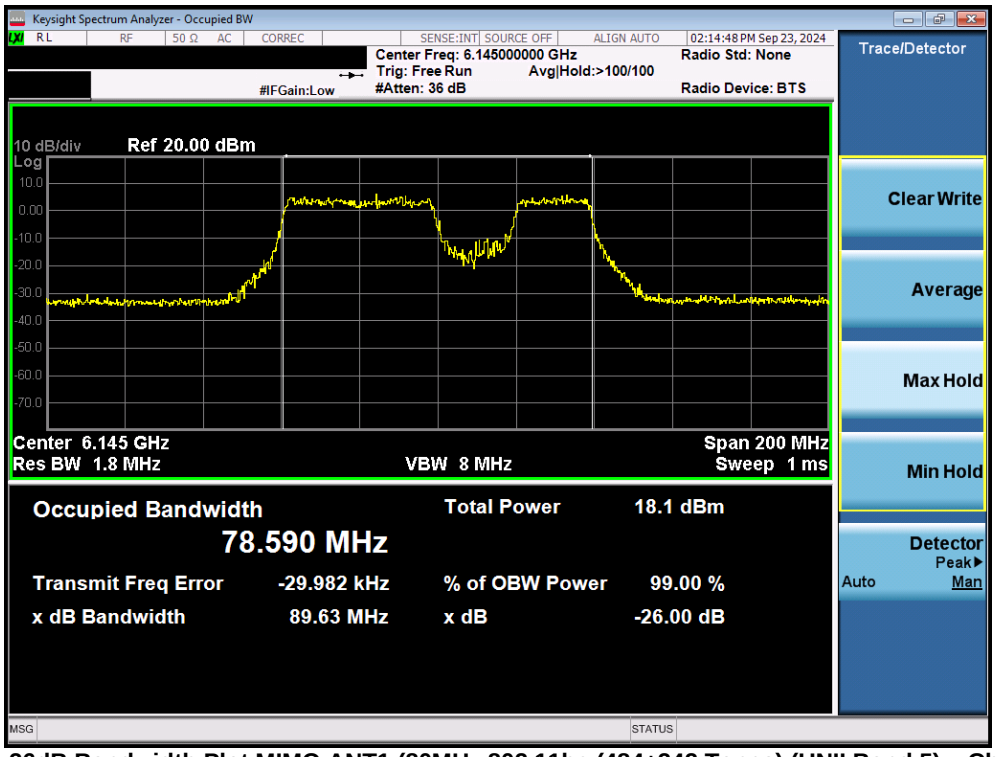
Plot 7-11. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 47) - VLP



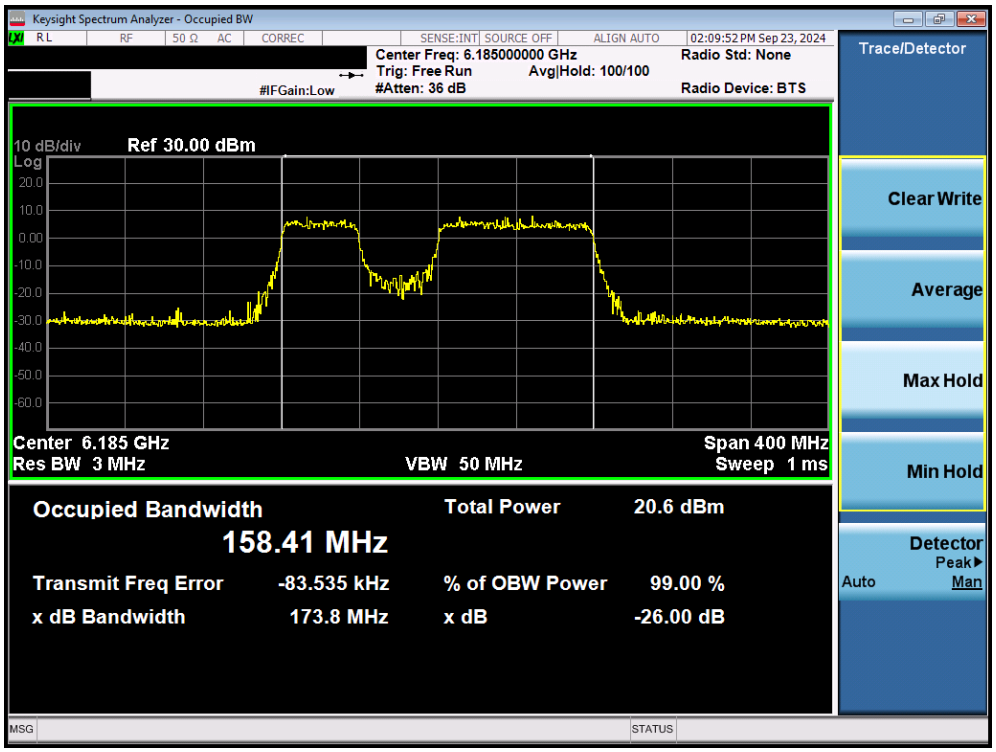
Plot 7-12. 26dB Bandwidth Plot MIMO ANT1 (320MHz 802.11be (26 Tones) (UNII Band 5) – Ch. 31) - VLP



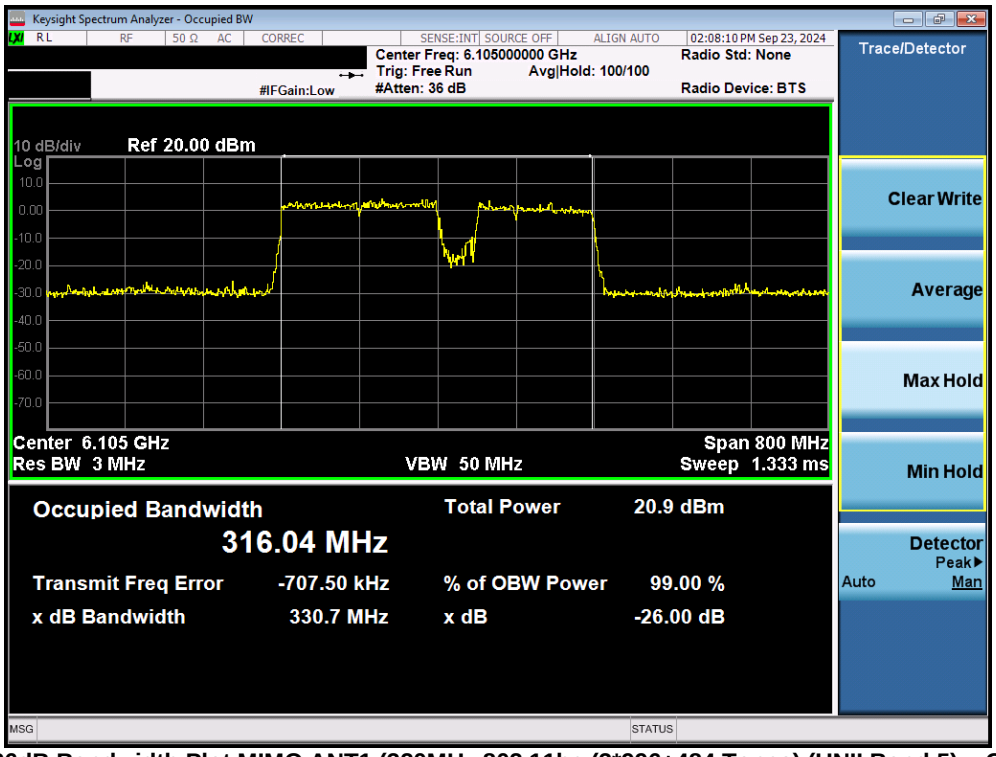
Plot 7-13. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11be (106+26 Tones) (UNII Band 5) – Ch. 45) - VLP



Plot 7-14. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11be (484+242 Tones) (UNII Band 5) – Ch. 39) VLP

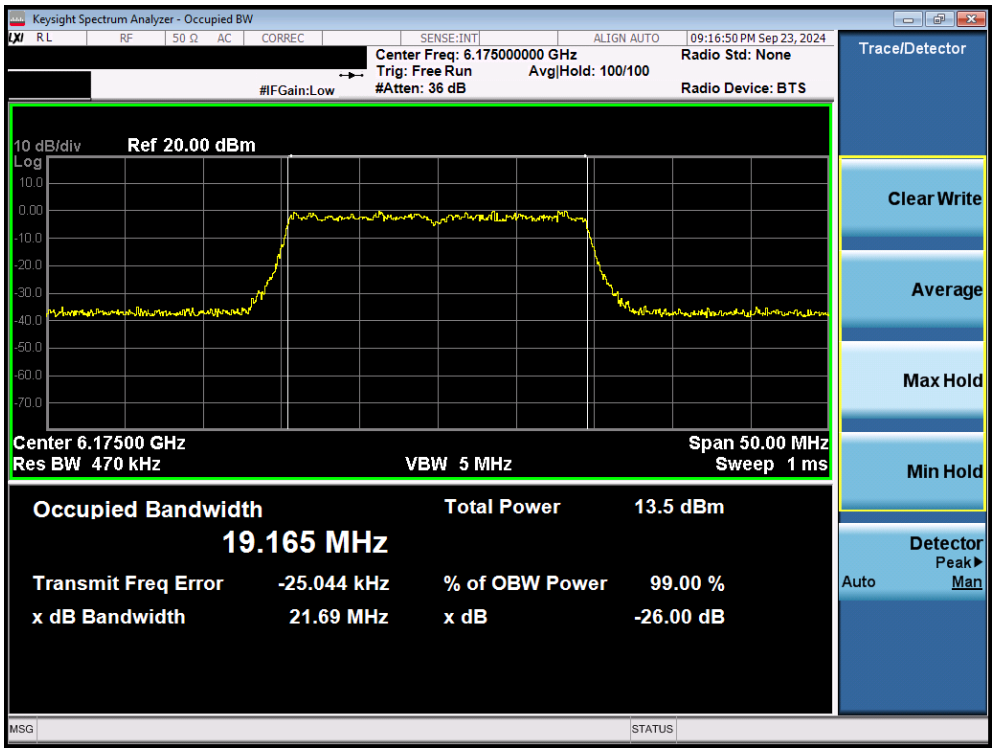


Plot 7-15. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11be (996+484 Tones) (UNII Band 5) – Ch. 47) VLP

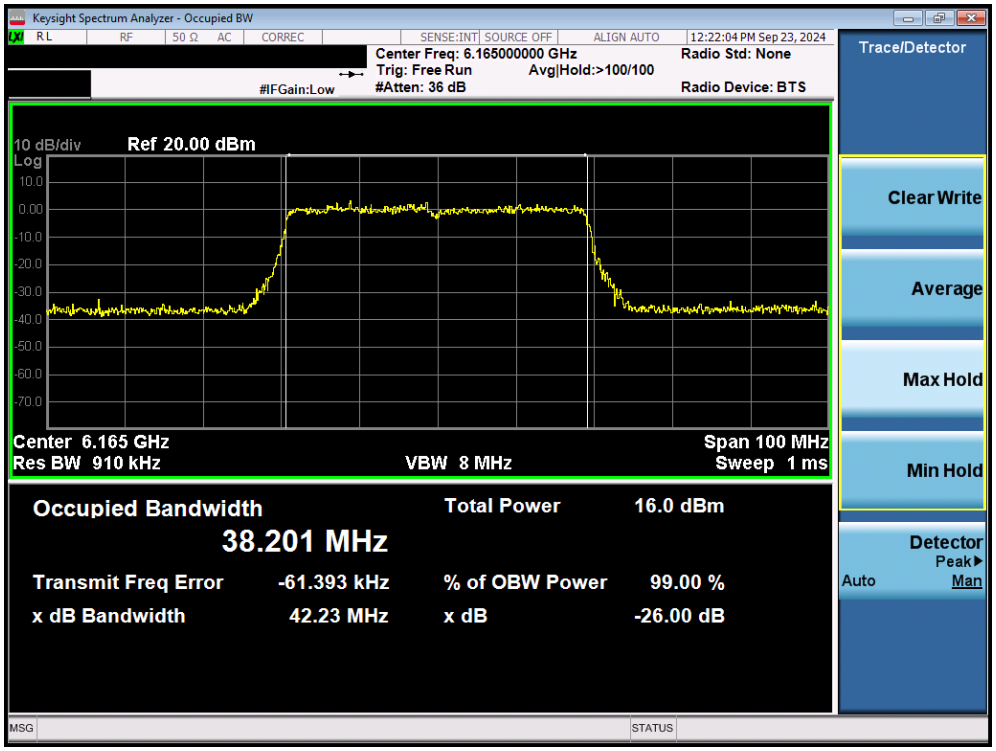


Plot 7-16. 26dB Bandwidth Plot MIMO ANT1 (320MHz 802.11be (3*996+484 Tones) (UNII Band 5) – Ch. 31) VLP

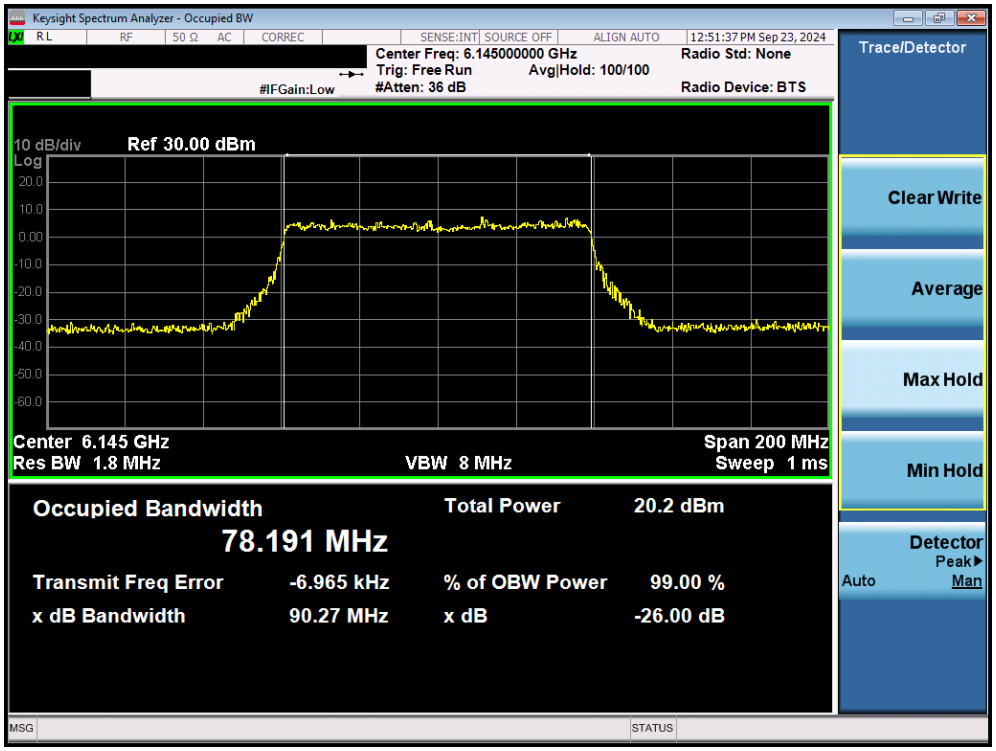
7.3.2 MIMO Antenna-1 Bandwidth Measurements - (Full Tones)



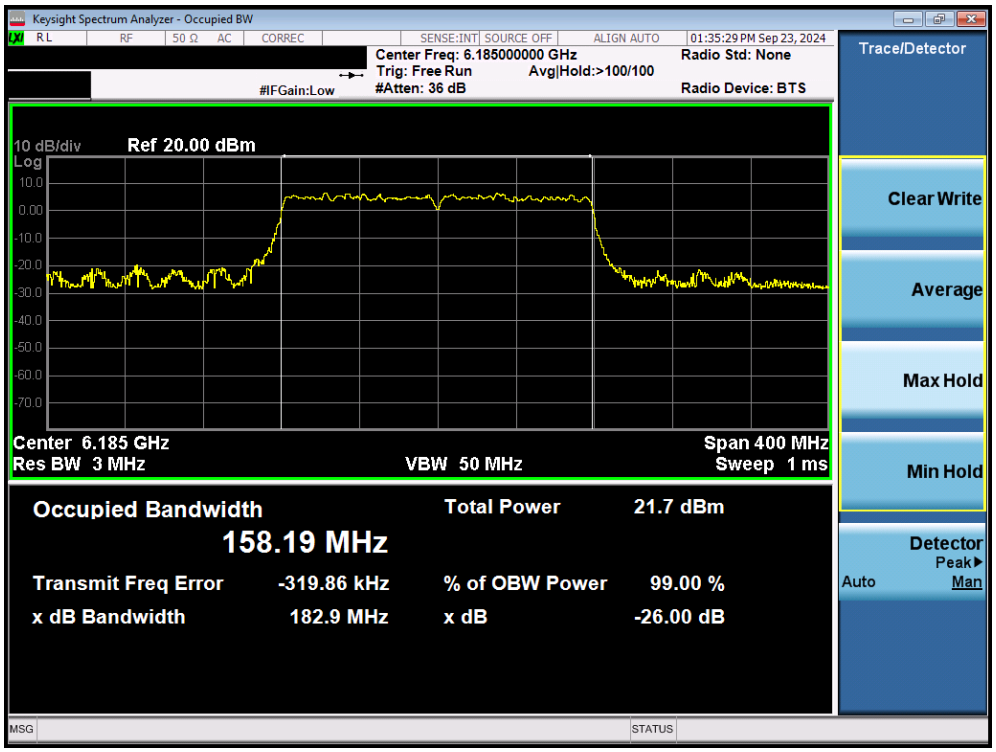
Plot 7-17. 26dB Bandwidth Plot MIMO ANT1 (20MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 45) - VLP



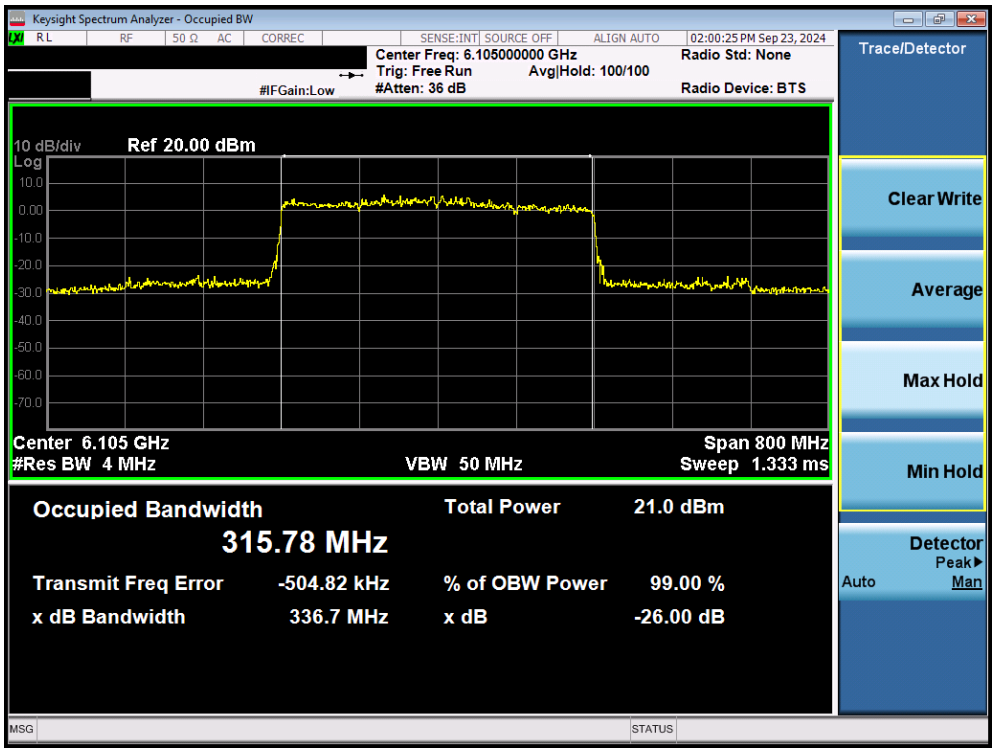
Plot 7-18. 26dB Bandwidth Plot MIMO ANT1 (40MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 43) - VLP



Plot 7-19. 26dB Bandwidth Plot MIMO ANT1 (80MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 39) - VLP

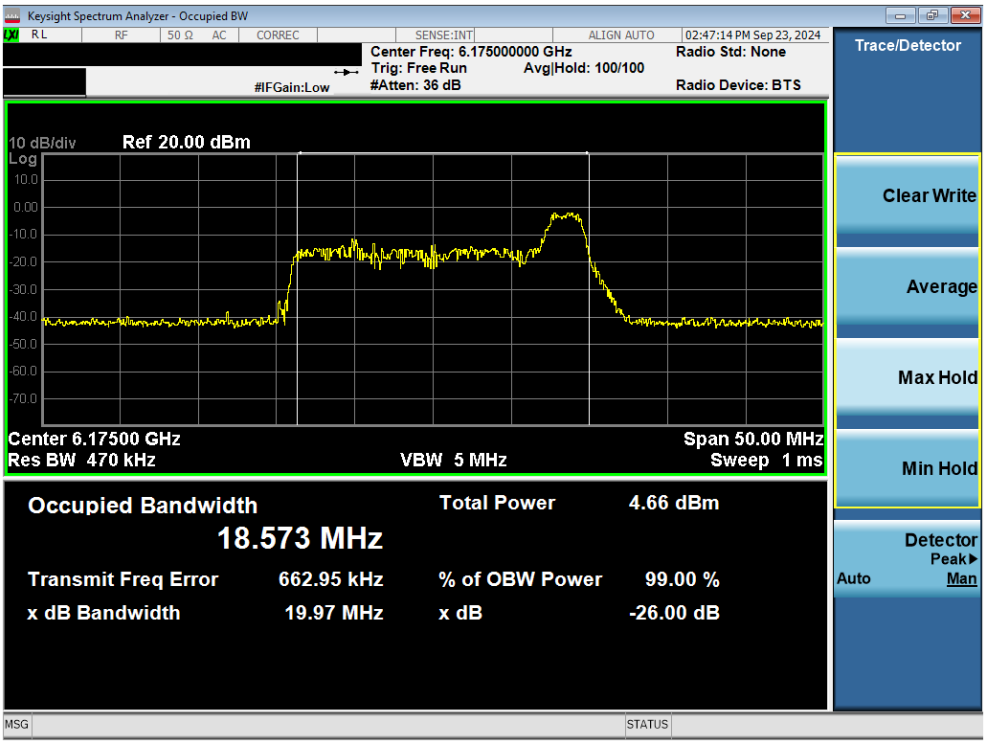


Plot 7-20. 26dB Bandwidth Plot MIMO ANT1 (160MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 47) - VLP

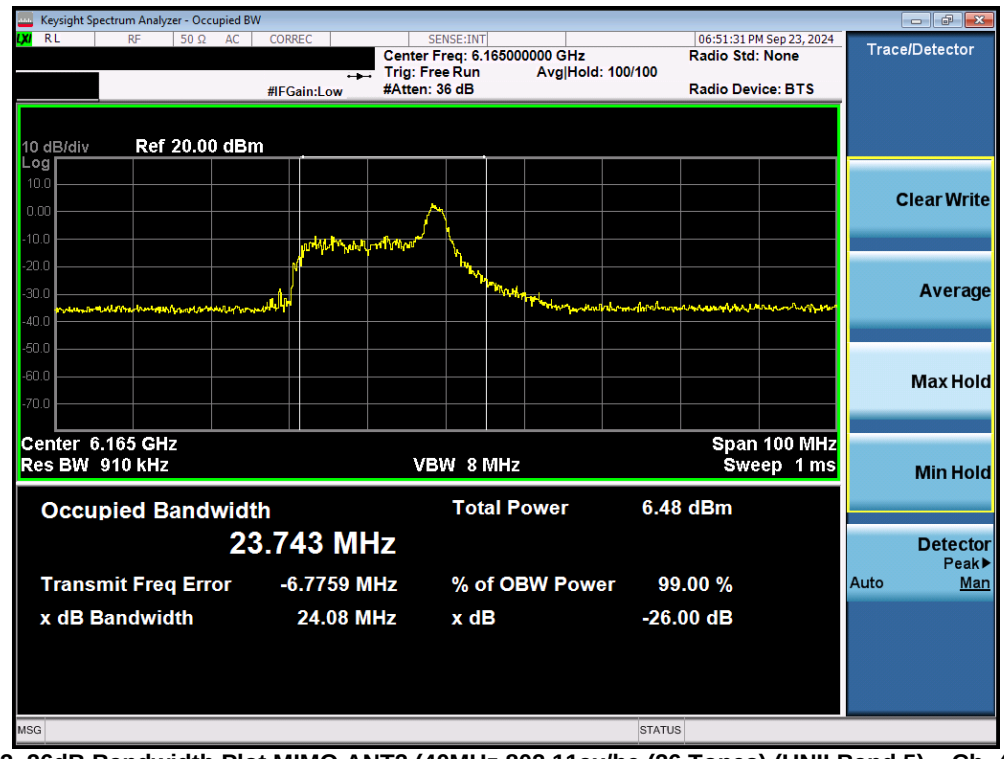


Plot 7-21. 26dB Bandwidth Plot MIMO ANT1 (320MHz 802.11be (Full Tones) (UNII Band 5) – Ch. 31) - VLP

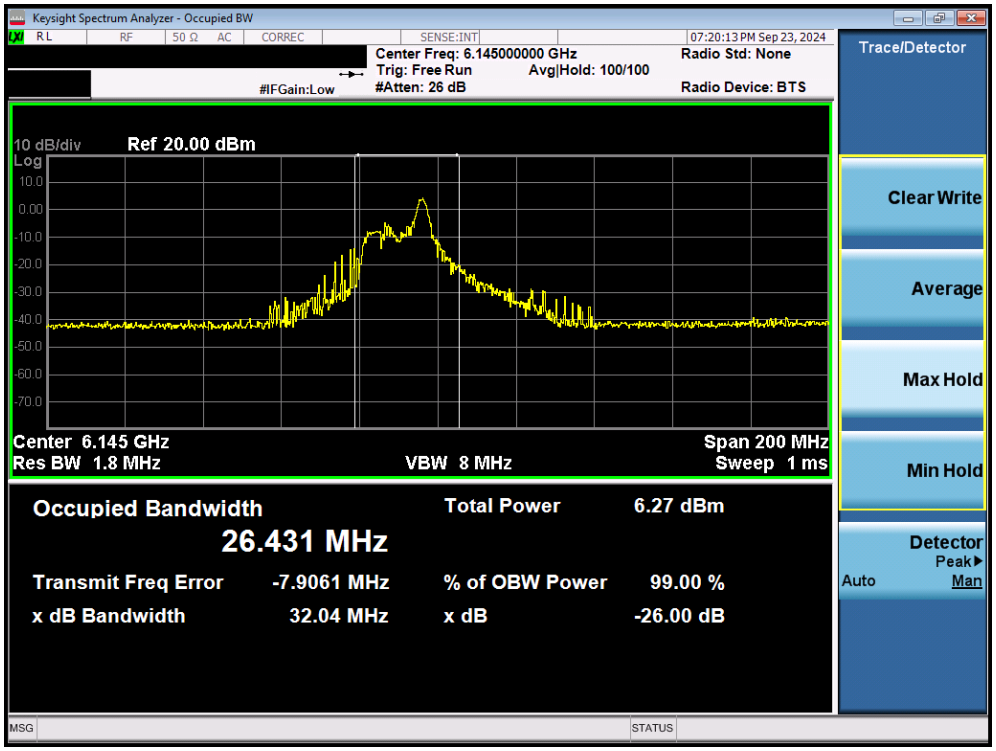
7.3.3 MIMO Antenna-2 Bandwidth Measurements – (Partial Tones)



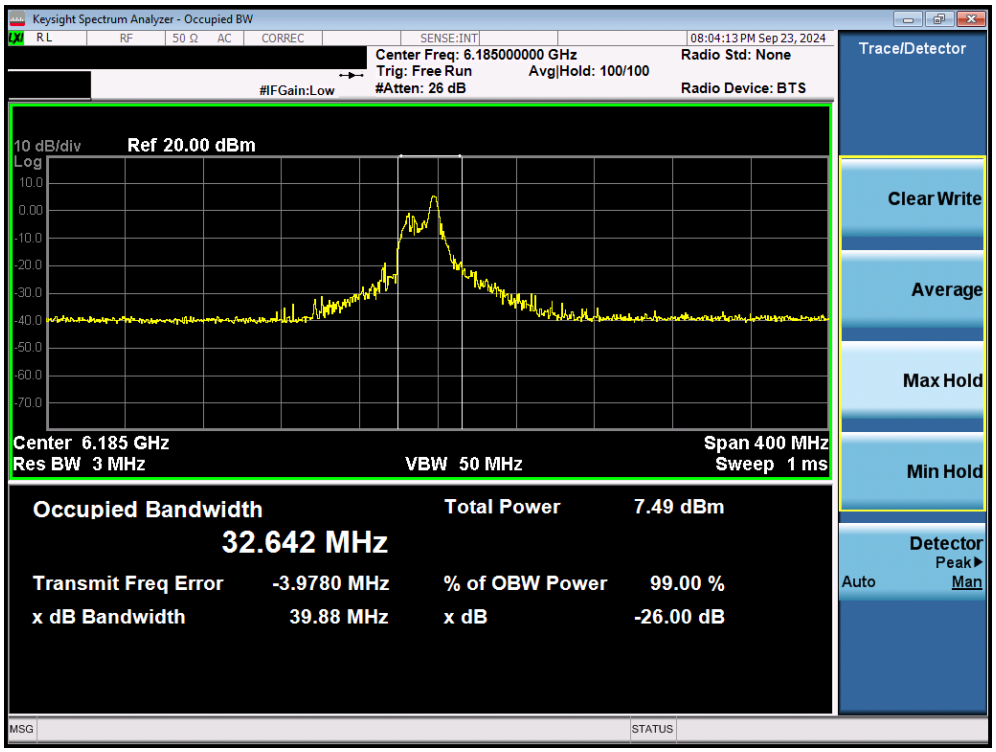
Plot 7-22. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 45) - VLP



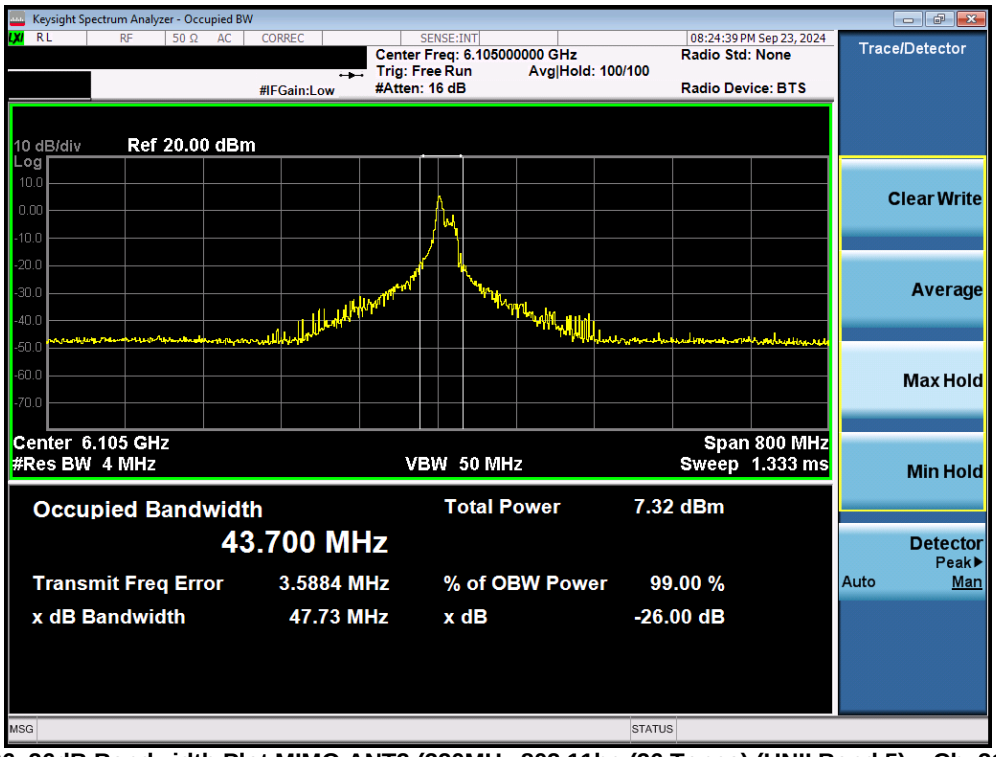
Plot 7-23. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 43) - VLP



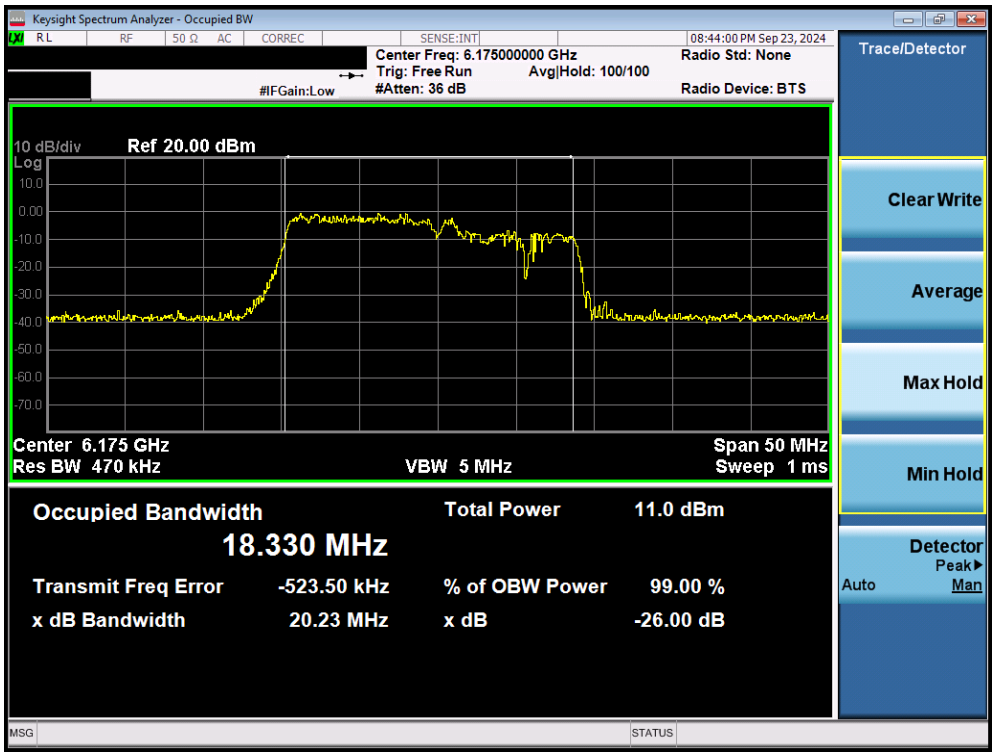
Plot 7-24. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 39) - VLP



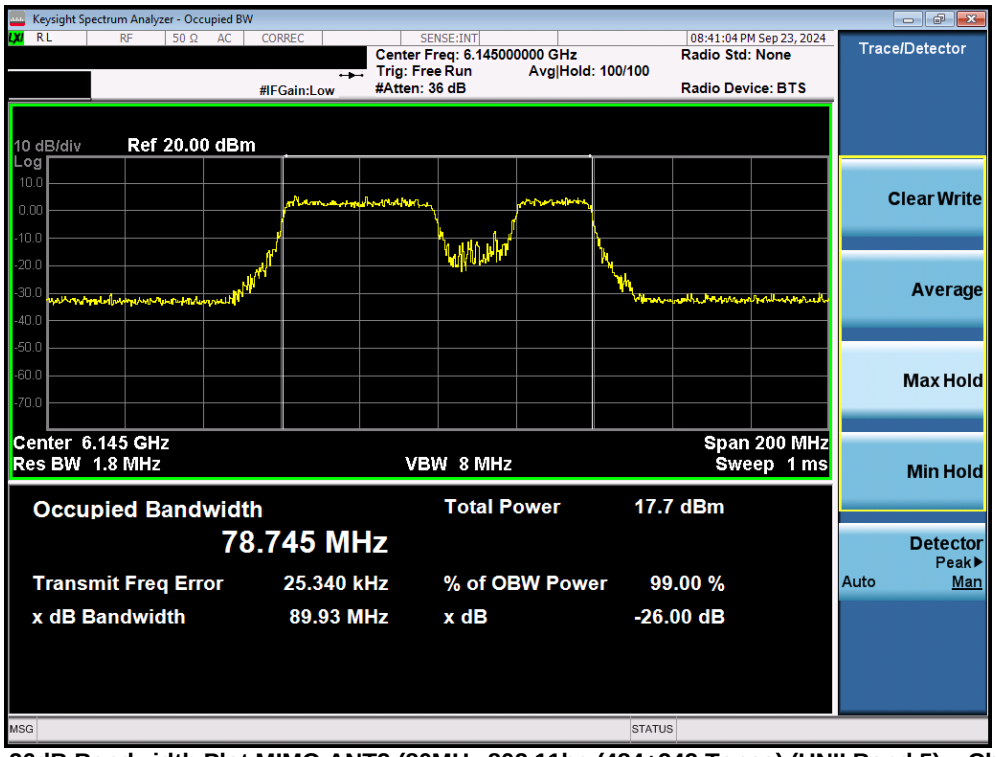
Plot 7-25. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 47) - VLP



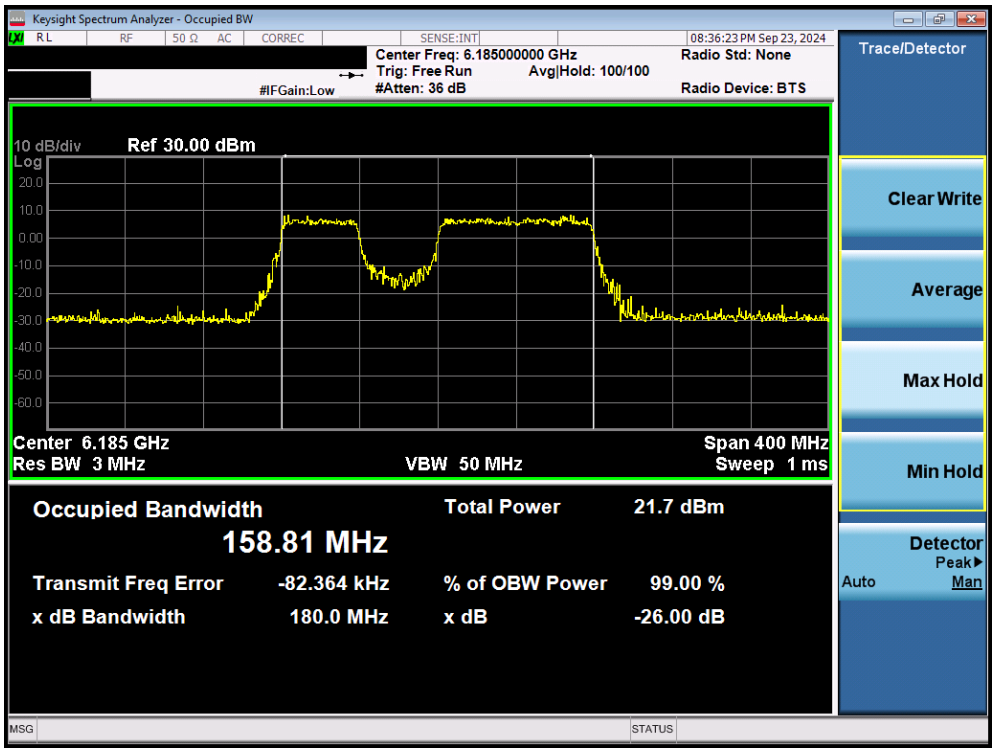
Plot 7-26. 26dB Bandwidth Plot MIMO ANT2 (320MHz 802.11be (26 Tones) (UNII Band 5) – Ch. 31) - VLP



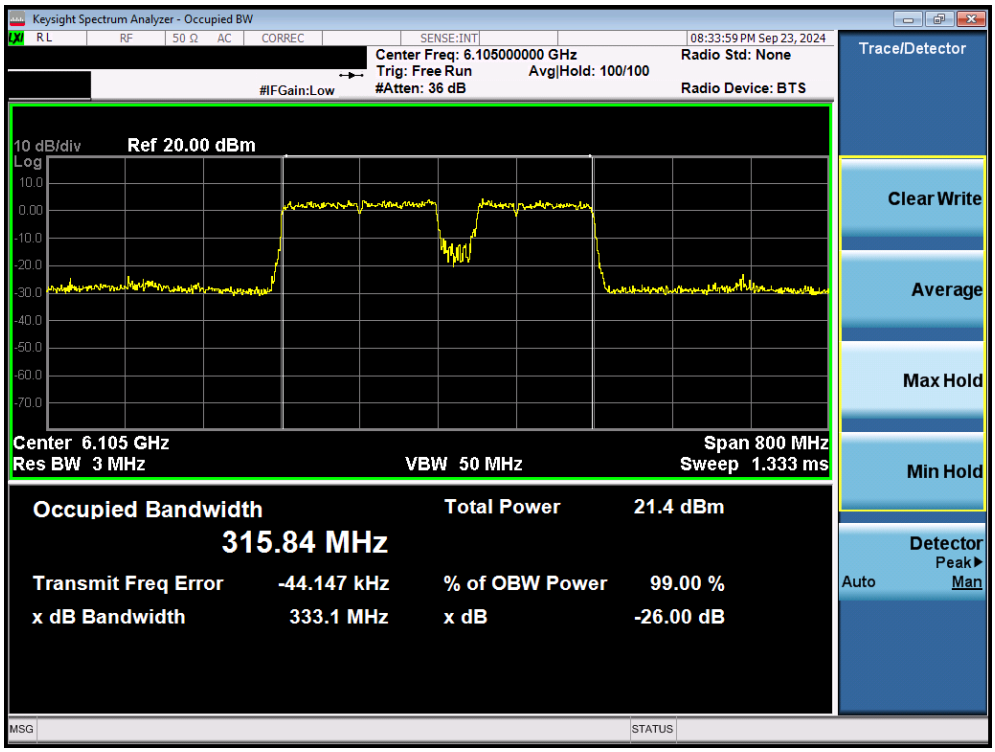
Plot 7-27. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11be (106+26 Tones) (UNII Band 5) – Ch. 45) - VLP



Plot 7-28. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11be (484+242 Tones) (UNII Band 5) – Ch. 39) VLP

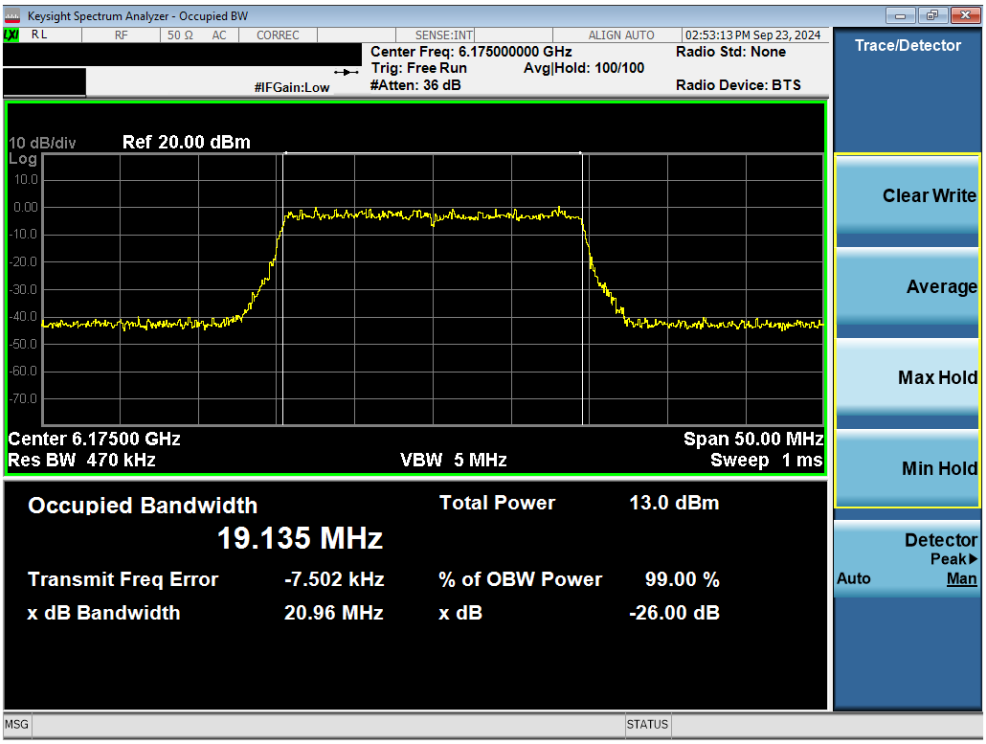


Plot 7-29. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11be (996+484 Tones) (UNII Band 5) – Ch. 47) VLP

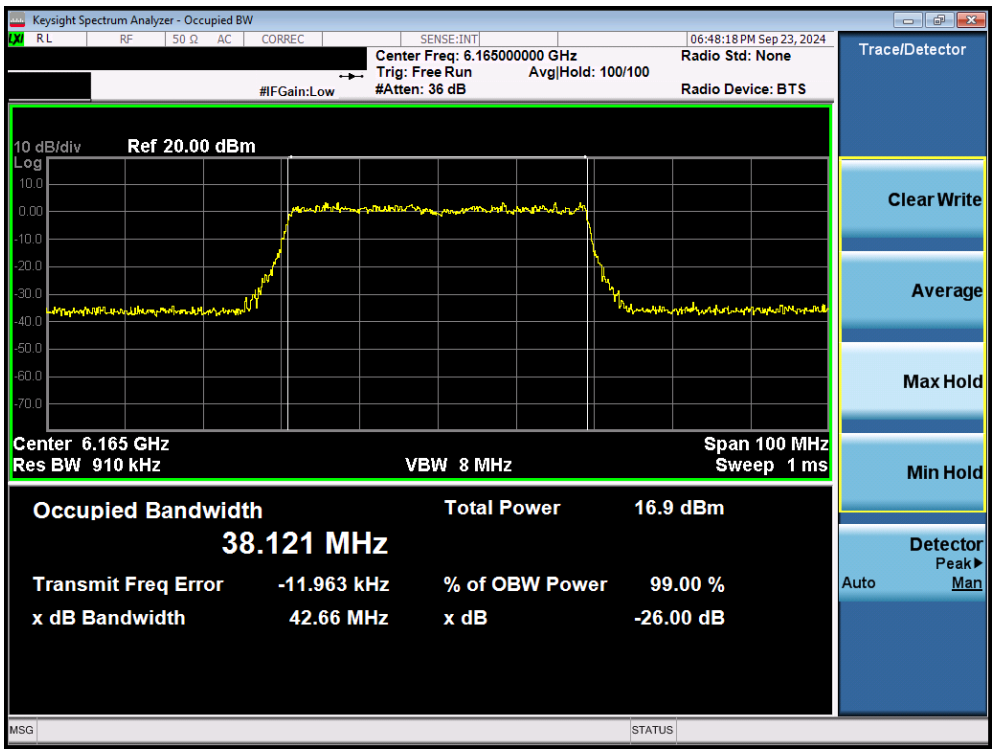


Plot 7-30. 26dB Bandwidth Plot MIMO ANT2 (320MHz 802.11be (3*996+484 Tones) (UNII Band 5) – Ch. 31) VLP

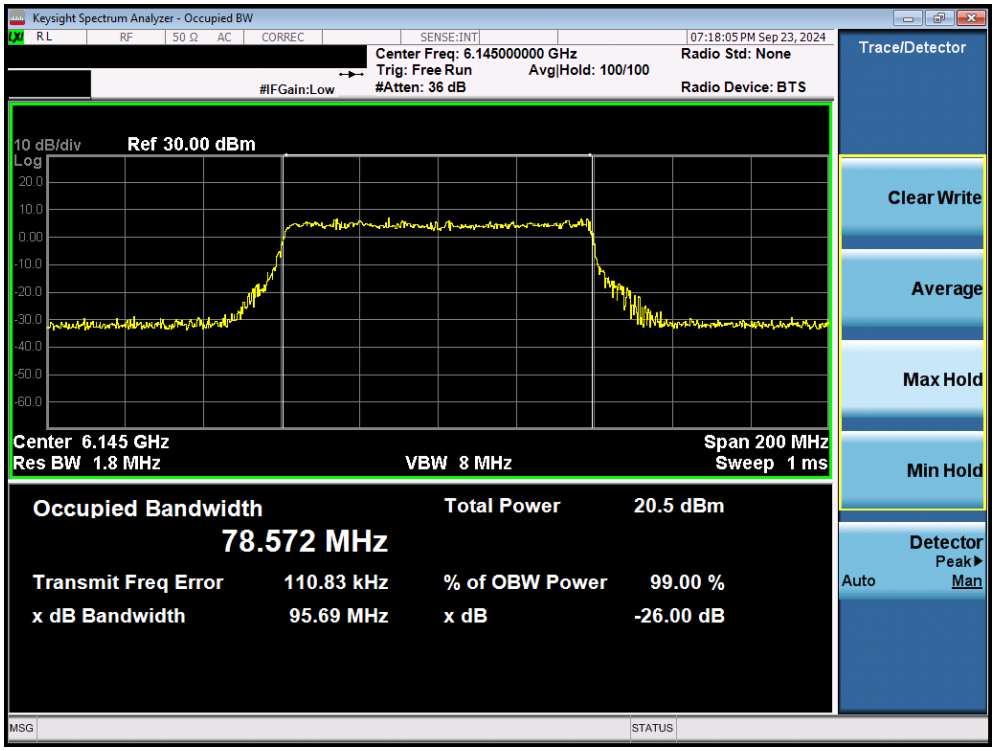
7.3.4 MIMO Antenna-2 Bandwidth Measurements – (Full Tones)



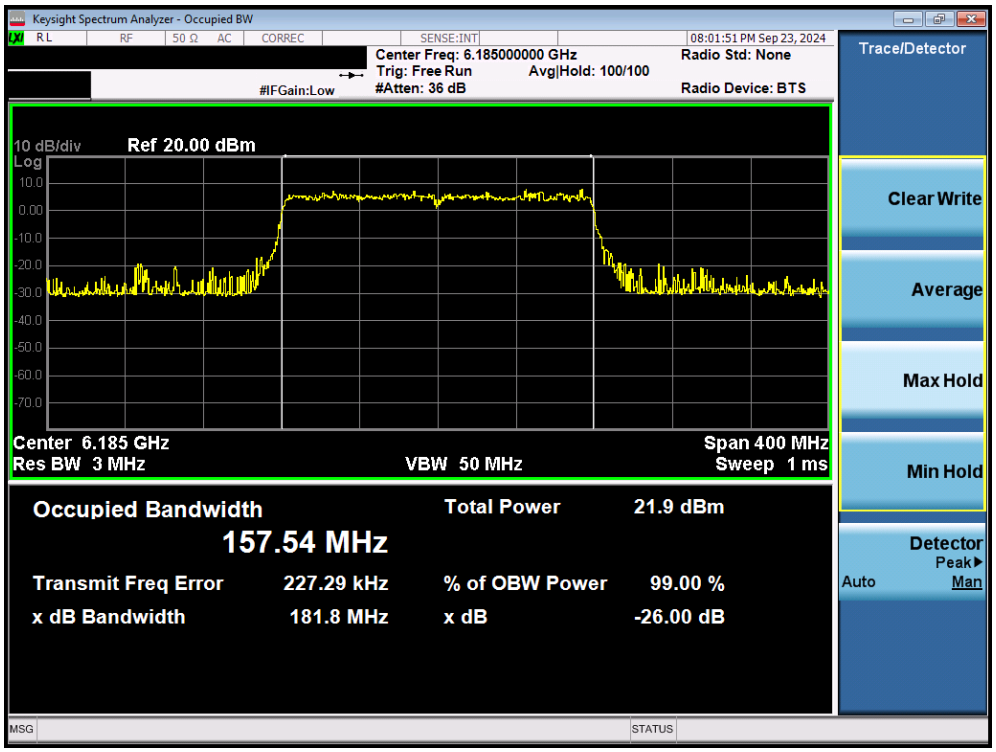
Plot 7-31. 26dB Bandwidth Plot MIMO ANT2 (20MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 45) - VLP



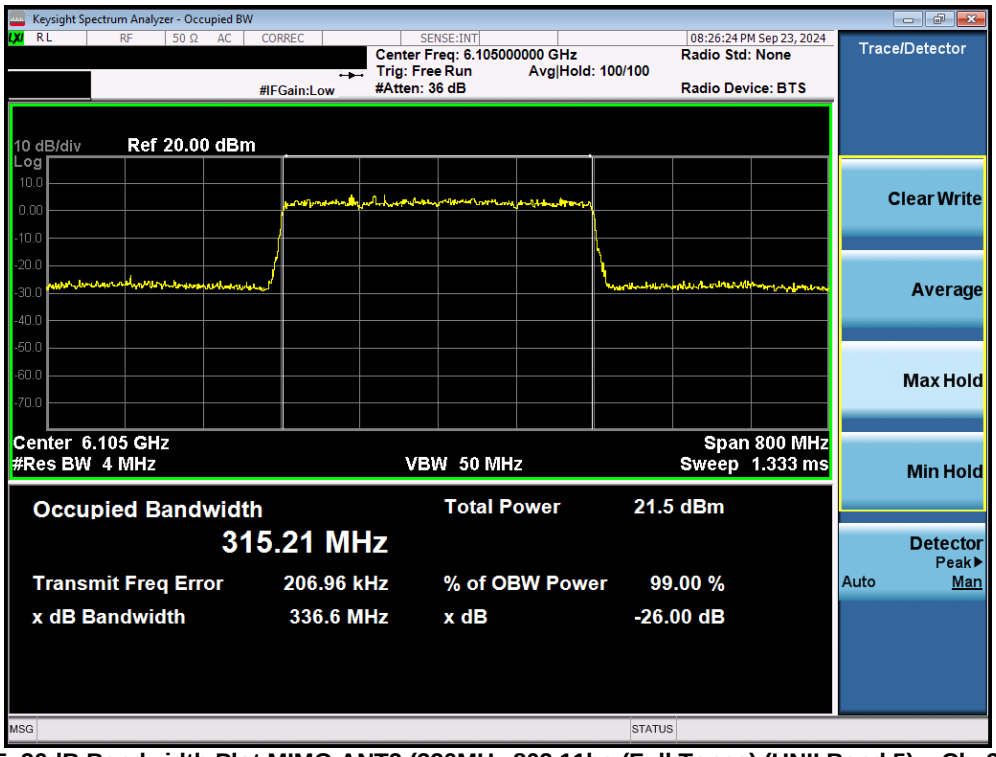
Plot 7-32. 26dB Bandwidth Plot MIMO ANT2 (40MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 43) - VLP



Plot 7-33. 26dB Bandwidth Plot MIMO ANT2 (80MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 39) - VLP



Plot 7-34. 26dB Bandwidth Plot MIMO ANT2 (160MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 47) - VLP



Plot 7-35. 26dB Bandwidth Plot MIMO ANT2 (320MHz 802.11be (Full Tones) (UNII Band 5) – Ch. 31) - VLP

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.

For very low power devices operating in the 5.925-6.425 GHz and 6.525-6.875 GHz bands, the maximum power spectral density must not exceed −5 dBm e.i.r.p in any 1-megahertz band and the maximum e.i.r.p must not exceed 14 dBm.

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

None.

SISO Maximum Conducted Output Power Measurements (26 Tones)

20MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm)			Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index						
					0	4	8				
	5	5935	2	26T	-4.04	-4.63	-5.08	-5.91	-9.95	14.0	-23.95
		6175	45	26T	-4.47	-4.79	-4.04	-5.91	-9.95	14.0	-23.95
		6415	93	26T	-4.51	-4.58	-4.24	-5.91	-10.15	14.0	-24.15
	7	6535	117	26T	-4.22	-4.11	-4.04	-6.52	-10.56	14.0	-24.56
		6695	149	26T	-4.36	-4.02	-4.22	-6.52	-10.54	14.0	-24.54

Table 7-9. SISO ANT1 20MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power - VLP

20MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm)			Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index						
					0	4	8				
	5	5935	2	26T	-4.07	-4.47	-4.24	-5.38	-9.45	14.0	-23.45
		6175	45	26T	-4.07	-4.44	-4.11	-5.38	-9.45	14.0	-23.45
		6415	93	26T	-4.06	-4.29	-4.06	-5.38	-9.44	14.0	-23.44
	7	6535	117	26T	-4.35	-4.68	-4.29	-6.25	-10.54	14.0	-24.54
		6695	149	26T	-4.60	-4.50	-4.52	-6.25	-10.75	14.0	-24.75

Table 7-10. SISO ANT2 20MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power - VLP

SISO Maximum Conducted Output Power Measurements (52 Tones)

20MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm)			Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index						
					37	38	40				
	5	5935	2	52T	-1.73	-1.33	-1.73	-5.91	-7.24	14.0	-21.24
		6175	45	52T	-1.98	-1.75	-1.45	-5.91	-7.36	14.0	-21.36
		6415	93	52T	-1.97	-1.73	-1.78	-5.91	-7.64	14.0	-21.64
	7	6535	117	52T	-1.53	-1.12	-1.04	-6.52	-7.56	14.0	-21.56
		6695	149	52T	-1.24	-1.25	-1.04	-6.52	-7.56	14.0	-21.56

Table 7-11. SISO ANT1 20MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power - VLP

20MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm)			Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index						
					37	38	40				
	5	5935	2	52T	-1.17	-1.06	-1.29	-5.38	-6.44	14.0	-20.44
		6175	45	52T	-1.48	-1.22	-1.06	-5.38	-6.44	14.0	-20.44
		6415	93	52T	-1.48	-1.14	-1.45	-5.38	-6.52	14.0	-20.52
	7	6535	117	52T	-1.60	-1.68	-1.45	-6.25	-7.70	14.0	-21.70
		6695	149	52T	-1.68	-1.36	-1.57	-6.25	-7.61	14.0	-21.61

Table 7-12. SISO ANT2 20MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power - VLP

SISO Maximum Conducted Output Power Measurements (106 Tones)

20MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm)		Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index					
					53	54				
		5935	2	106T	1.67	1.31	-5.91	-4.24	14.0	-18.24
		6175	45	106T	1.27	1.22	-5.91	-4.64	14.0	-18.64
		6415	93	106T	1.19	1.32	-5.91	-4.59	14.0	-18.59
	7	6535	117	106T	1.95	1.99	-6.52	-4.53	14.0	-18.53
		6695	149	106T	1.99	1.97	-6.52	-4.53	14.0	-18.53

Table 7-13. SISO ANT1 20MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power - VLP

20MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm)		Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index					
					53	54				
		5935	2	106T	1.83	1.67	-5.38	-3.55	14.0	-17.55
		6175	45	106T	1.47	1.33	-5.38	-3.91	14.0	-17.91
		6415	93	106T	1.50	1.40	-5.38	-3.88	14.0	-17.88
	7	6535	117	106T	1.01	1.06	-6.25	-5.19	14.0	-19.19
		6695	149	106T	1.25	1.31	-6.25	-4.94	14.0	-18.94

Table 7-14. SISO ANT2 20MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power - VLP

SISO Maximum Conducted Output Power Measurements (242 Tones)

20MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm) RU Index 61	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	5935	2	242T	5.50	-5.91	-0.41	14.0	-14.41
		6175	45	242T	5.92	-5.91	0.01	14.0	-13.99
		6415	93	242T	5.65	-5.91	-0.26	14.0	-14.26
	7	6535	117	242T	5.96	-6.52	-0.56	14.0	-14.56
		6695	149	242T	5.88	-6.52	-0.64	14.0	-14.64

Table 7-15. SISO ANT1 20MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power - VLP

20MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm) RU Index 61	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	5935	2	242T	5.70	-5.38	0.32	14.0	-13.68
		6175	45	242T	5.75	-5.38	0.37	14.0	-13.63
		6415	93	242T	5.80	-5.38	0.42	14.0	-13.58
	7	6535	117	242T	5.38	-6.25	-0.87	14.0	-14.87
		6695	149	242T	5.05	-6.25	-1.20	14.0	-15.20

Table 7-16. SISO ANT2 20MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power - VLP

SISO Maximum Conducted Output Power Measurements (484 Tones)

40MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm) RU Index 65	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	5965	3	484T	8.43	-5.91	2.52	14.0	-11.48
		6165	43	484T	8.86	-5.91	2.95	14.0	-11.05
		6405	91	484T	8.47	-5.91	2.56	14.0	-11.44
	7	6565	123	484T	8.99	-6.52	2.47	14.0	-11.53
		6725	155	484T	8.96	-6.52	2.44	14.0	-11.56
		6845	179	484T	8.87	-6.52	2.35	14.0	-11.65

Table 7-17. SISO ANT1 40MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power - VLP

40MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm) RU Index 65	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	5965	3	484T	8.49	-5.38	3.11	14.0	-10.89
		6165	43	484T	8.54	-5.38	3.16	14.0	-10.84
		6405	91	484T	8.77	-5.38	3.39	14.0	-10.61
	7	6565	123	484T	8.44	-6.25	2.19	14.0	-11.81
		6725	155	484T	8.36	-6.25	2.11	14.0	-11.89
		6845	179	484T	8.76	-6.25	2.51	14.0	-11.49

Table 7-18. SISO ANT2 40MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power - VLP

SISO Maximum Conducted Output Power Measurements (996 Tones)

80MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm)	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index				
					67				
	5	5985	7	996T	11.60	-5.91	5.69	14.0	-8.31
		6145	39	996T	11.01	-5.91	5.10	14.0	-8.90
		6385	87	996T	11.31	-5.91	5.40	14.0	-8.60
	7	6705	151	996T	11.95	-6.52	5.43	14.0	-8.57

Table 7-19. SISO ANT1 80MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power - VLP

80MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm)	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index				
					67.00				
	5	5985	7	996T	11.33	-5.38	5.95	14.0	-8.05
		6145	39	996T	11.48	-5.38	6.10	14.0	-7.90
		6385	87	996T	11.77	-5.38	6.39	14.0	-7.61
	7	6705	151	996T	11.20	-6.25	4.95	14.0	-9.05

Table 7-20. SISO ANT2 80MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power - VLP

SISO Maximum Conducted Output Power Measurements (2x996 Tones)

160MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm) RU Index 68	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	6025	15	2x996T	11.84	-5.91	5.93	14.0	-8.07
		6185	47	2x996T	11.01	-5.91	5.10	14.0	-8.90
		6345	79	2x996T	11.34	-5.91	5.43	14.0	-8.57
	7	6665	143	2x996T	11.99	-6.52	5.47	14.0	-8.53

Table 7-21. SISO ANT1 160MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power – VLP

160MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm) RU Index 68.00	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	6025	15	2x996T	11.57	-5.38	6.19	14.0	-7.81
		6185	47	2x996T	11.61	-5.38	6.23	14.0	-7.77
		6345	79	2x996T	11.88	-5.38	6.50	14.0	-7.50
	7	6665	143	2x996T	11.29	-6.25	5.04	14.0	-8.96

Table 7-22. SISO ANT2 160MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power – VLP

SISO Maximum Conducted Output Power Measurements (4x996 Tones)

320MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm)	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index				
					69				
	5	6105	31	4x996T	11.6	-5.91	5.73	14.0	-8.27
	7	6745	159	4x996T	11.9	-6.52	5.33	14.0	-8.67

Table 7-23. SISO ANT1 320MHz BW 802.11be (UNII) Maximum Conducted Output Power – VLP

320MHz BW	Band	Freq [MHz]	Channel	Tones	Avg Conducted Power (dBm)	Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index				
					69.00				
	5	6105	31	4x996T	11.41	-5.38	6.03	14.0	-7.97
	7	6745	159	4x996T	11.27	-6.25	5.02	14.0	-8.98

Table 7-24. SISO ANT2 320MHz BW 802.11be (UNII) Maximum Conducted Output Power – VLP

MIMO Maximum Conducted Output Power Measurements (26 Tones)

20MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm)									Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index												
					0			4			8						
					ANT1	ANT2	MIMO	ANT1	ANT2	MIMO	ANT1	ANT2	MIMO				
	5	5935	2	26T	-4.50	-4.02	-1.24	-5.47	-4.42	-1.90	-5.50	-4.19	-1.79	-2.63	-3.87	14.0	-17.87
		6175	45	26T	-4.89	-4.02	-1.42	-5.21	-4.39	-1.77	-4.78	-4.06	-1.39	-2.63	-4.03	14.0	-18.03
		6415	93	26T	-4.93	-4.01	-1.44	-5.21	-4.24	-1.69	-4.87	-4.01	-1.41	-2.63	-4.04	14.0	-18.04
	7	6535	117	26T	-4.10	-4.30	-1.19	-4.77	-4.63	-1.69	-4.24	-4.24	-1.23	-3.37	-4.56	14.0	-18.56
		6695	149	26T	-4.38	-4.55	-1.45	-4.44	-4.45	-1.43	-4.24	-4.47	-1.34	-3.37	-4.72	14.0	-18.72

Table 7-25. MIMO 20MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power – VLP

MIMO Maximum Conducted Output Power Measurements (52 Tones)

20MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm)									Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index												
					37			38			40						
					ANT1	ANT2	MIMO	ANT1	ANT2	MIMO	ANT1	ANT2	MIMO				
	5	5935	2	52T	-2.57	-1.12	1.23	-2.17	-1.01	1.46	-2.57	-1.24	1.16	-2.63	-1.17	14.0	-15.17
		6175	45	52T	-2.50	-1.43	1.08	-2.17	-1.17	1.37	-1.87	-1.01	1.59	-2.63	-1.04	14.0	-15.04
		6415	93	52T	-2.43	-1.43	1.11	-2.15	-1.09	1.42	-2.41	-1.40	1.13	-2.63	-1.21	14.0	-15.21
	7	6535	117	52T	-1.37	-1.55	1.55	-1.54	-1.63	1.43	-1.35	-1.40	1.64	-3.37	-1.74	14.0	-15.74
		6695	149	52T	-1.41	-1.63	1.49	-1.07	-1.31	1.82	-1.34	-1.52	1.58	-3.37	-1.55	14.0	-15.55

Table 7-26. MIMO 20MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power – VLP

MIMO Maximum Conducted Output Power Measurements (106 Tones)

20MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm) RU Index 53 ANT1	53 ANT2	53 MIMO	54 ANT1	54 ANT2	54 MIMO	Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
		5935	2	106T	0.83	1.88	4.40	0.89	1.72	4.34	-2.63	1.77	14.0	-12.23
		6175	45	106T	0.43	1.52	4.02	0.59	1.38	4.01	-2.63	1.39	14.0	-12.61
		6415	93	106T	0.77	1.55	4.19	0.90	1.45	4.19	-2.63	1.56	14.0	-12.44
	7	6535	117	106T	1.32	1.06	4.20	1.38	1.11	4.26	-3.37	0.88	14.0	-13.12
		6695	149	106T	1.56	1.30	4.44	1.55	1.36	4.47	-3.37	1.09	14.0	-12.91

Table 7-27. MIMO 20MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power – VLP

MIMO Maximum Conducted Output Power Measurements (242 Tones)

20MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm) RU Index 61			Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					ANT1	ANT2	MIMO				
	5	5935	2	242T	4.66	5.75	8.25	-2.63	5.62	14.0	-8.38
		6175	45	242T	5.08	5.80	8.47	-2.63	5.83	14.0	-8.17
		6415	93	242T	5.23	5.85	8.56	-2.63	5.93	14.0	-8.07
	7	6535	117	242T	5.62	5.43	8.54	-3.37	5.16	14.0	-8.84
		6695	149	242T	5.67	5.10	8.40	-3.37	5.03	14.0	-8.97

Table 7-28. MIMO 20MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power – VLP

MIMO Maximum Conducted Output Power Measurements (484 Tones)

40MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm) RU Index 65			Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					ANT1	ANT2	MIMO				
	5	5965	3	484T	8.01	8.54	11.29	-2.63	8.66	14.0	-5.34
		6165	43	484T	8.02	8.59	11.32	-2.63	8.69	14.0	-5.31
		6405	91	484T	8.05	8.82	11.46	-2.63	8.83	14.0	-5.17
	7	6565	123	484T	8.61	8.49	11.56	-3.37	8.19	14.0	-5.81
		6725	155	484T	8.69	8.41	11.56	-3.37	8.19	14.0	-5.81
		6845	179	484T	8.80	8.81	11.82	-3.37	8.44	14.0	-5.56

Table 7-29. MIMO 40MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power – VLP

MIMO Maximum Conducted Output Power Measurements (996 Tones)

80MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm) RU Index 67			Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					ANT1	ANT2	MIMO				
	5	5985	7	996T	10.97	11.38	14.19	-2.63	11.56	14.0	-2.44
		6145	39	996T	10.43	11.53	14.03	-2.63	11.39	14.0	-2.61
		6385	87	996T	10.89	11.82	14.39	-2.63	11.76	14.0	-2.24
	7	6705	151	996T	11.53	11.25	14.40	-3.37	11.03	14.0	-2.97

Table 7-30. MIMO 80MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power – VLP

MIMO Maximum Conducted Output Power Measurements (2x996 Tones)

160MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm)			Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					RU Index						
					68						
					ANT1	ANT2	MIMO				
	5	6025	15	2x996T	11.21	11.62	14.43	-2.63	11.80	14.0	-2.20
		6185	47	2x996T	10.56	11.66	14.16	-2.63	11.52	14.0	-2.48
		6345	79	2x996T	10.71	11.93	14.37	-2.63	11.74	14.0	-2.26
	7	6665	143	2x996T	11.94	11.34	14.66	-3.37	11.29	14.0	-2.71

Table 7-31. MIMO 160MHz BW 802.11ax/be (UNII) Maximum Conducted Output Power – VLP

MIMO Maximum Conducted Output Power Measurements (4x996 Tones)

320MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm) RU Index 69			Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
					ANT1	ANT2	MIMO				
	5	6105	31	4x996T	11.01	11.46	14.25	-2.63	11.62	14.0	-2.38
	7	6745	159	4x996T	11.22	11.32	14.28	-3.37	10.91	14.0	-3.09

Table 7-32. MIMO 320MHz BW 802.11be (UNII) Maximum Conducted Output Power – VLP

MIMO Maximum Conducted Output Power Measurements (MRU)

20MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm) MRU Index 70 ANT1	70 ANT2	70 MIMO	71 ANT1	71 ANT2	71 MIMO	72 ANT1	72 ANT2	72 MIMO	Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	6175	45	52+26T	-3.21	-1.12	0.97	-3.30	-1.20	0.89	-3.17	-1.10	1.00	-2.63	-1.63	14.0	-15.63
	7	6695	149	52+26T	-1.33	-1.68	1.51	-1.44	-1.76	1.41	-1.28	-1.60	1.57	-3.37	-1.80	14.0	-15.80

Table 7-33. MIMO 20MHz BW 802.11be (UNII) Maximum Conducted Output Power (52+26 Tones) – VLP

20MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm) MRU Index 82 ANT1	82 ANT2	82 MIMO	83 ANT1	83 ANT2	83 MIMO	Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	6175	45	106+26T	-0.30	1.82	3.90	-0.26	1.85	3.93	-2.63	1.30	14.0	-12.70
	7	6695	149	106+26T	1.71	1.36	4.55	1.73	1.39	4.57	-3.37	1.20	14.0	-12.80

Table 7-34. MIMO 20MHz BW 802.11be (UNII) Maximum Conducted Output Power (106+26 Tones) – VLP

80MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm) MRU Index 90 ANT1	90 ANT2	90 MIMO	91 ANT1	91 ANT2	91 MIMO	93 ANT1	93 ANT2	93 MIMO	Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	6145	39	242+484T	8.81	8.63	11.73	8.81	8.66	11.75	8.90	8.68	11.80	-2.63	9.17	14.0	-4.83
	7	6705	151	242+484T	8.67	7.22	11.02	8.71	7.22	11.04	8.68	7.33	11.07	-3.37	7.69	14.0	-6.31

Table 7-35. MIMO 80MHz BW 802.11be (UNII) Maximum Conducted Output Power (484+242 Tones) – VLP

160MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm) MRU Index 94 ANT1	94 ANT2	94 MIMO	95 ANT1	95 ANT2	95 MIMO	1094 ANT1	1094 ANT2	1094 MIMO	Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	6185	47	996+484T	11.87	11.99	14.94	11.92	11.99	14.97	11.36	11.65	14.52	-2.63	12.33	14.0	-1.67
	7	6825	175	996+484T	11.99	10.45	14.30	11.99	10.35	14.26	11.99	10.42	14.29	-3.37	10.92	14.0	-3.08

Table 7-36. MIMO 160MHz BW 802.11be (UNII) Maximum Conducted Output Power (996+484 Tones) – VLP

320MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm) MRU Index 100 ANT1	100 ANT2	100 MIMO	101 ANT1	101 ANT2	101 MIMO	11102 ANT1	11102 ANT2	11102 MIMO	Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	6105	31	2x996+484T	11.86	11.35	14.62	11.88	11.33	14.62	11.81	11.31	14.58	-2.63	11.99	14.0	-2.01
	7	6745	159	2x996+484T	11.99	10.42	14.29	11.98	10.42	14.28	11.96	10.37	14.25	-3.37	10.91	14.0	-3.09

Table 7-37. MIMO 320MHz BW 802.11be (UNII) Maximum Conducted Output Power (2*996+484 Tones) – VLP

320MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm) MRU Index 104 ANT1	104 ANT2	104 MIMO	10104 ANT1	10104 ANT2	10104 MIMO	11104 ANT1	11104 ANT2	11104 MIMO	Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	6105	31	3x996T	11.99	11.60	14.81	11.99	11.54	14.78	11.99	11.64	14.83	-2.63	12.20	14.0	-1.80
	7	6745	159	3x996T	11.81	10.21	14.09	11.91	10.25	14.17	11.87	10.28	14.16	-3.37	10.80	14.0	-3.20

Table 7-38. MIMO 320MHz BW 802.11be (UNII) Maximum Conducted Output Power (3*996 Tones) – VLP

320MHz BW	Band	Freq [MHz]	Channel	Tones	Average Conducted Power (dBm) MRU Index 105 ANT1	105 ANT2	105 MIMO	106 ANT1	106 ANT2	106 MIMO	11105 ANT1	11105 ANT2	11105 MIMO	Dir. Ant. Gain [dBi]	Max e.i.r.p [dBm]	e.i.r.p Limit [dBm]	e.i.r.p Margin [dB]
	5	6105	31	3x996+484T	11.72	11.21	14.48	11.73	11.19	14.48	11.76	11.23	14.51	-2.63	11.88	14.0	-2.12
	7	6745	159	3x996+484T	11.93	10.31	14.21	11.93	10.32	14.21	11.99	10.35	14.26	-3.37	10.88	14.0	-3.12

Table 7-39. MIMO 320MHz BW 802.11be (UNII) Maximum Conducted Output Power (3*996+484 Tones) – VLP

Sample MIMO Calculation:

At 5935MHz in 802.11ax (20MHz BW – 26 Tones) mode, the average conducted output power was measured to be -4.50 dBm for Antenna-1 and -4.02 dBm for Antenna-2.

Antenna 1 + Antenna 2 = MIMO

(-4.50 dBm + -4.02 dBm) = (0.355 mW + 0.396 mW) = 0.751 mW = -1.24 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:

At 5935MHz in 802.11ax (20MHz BW – 26 Tones) mode, the average MIMO conducted power was calculated to be -1.24 dBm with directional gain of -2.63 dBi.

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

-1.24 dBm + -2.63 dBi = -3.87 dBm

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.

For very low power devices operating in the 5.925-6.425 GHz and 6.525-6.875 GHz bands, the maximum power spectral density must not exceed −5 dBm e.i.r.p in any 1-megahertz band and the maximum e.i.r.p must not exceed 14 dBm.

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

None.

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]	Directional Gain [dBi]	EIRP [dBm]	Max EIRP [dBm]	Margin [dB]
Band 5	5935	2	be (20MHz)	-6.98	-6.49	-5.91	-5.38	-3.72	-2.63	-6.35	-5	-1.35
	6175	45	be (20MHz)	-6.77	-7.05	-5.91	-5.38	-3.90	-2.63	-6.53	-5	-1.53
	6415	93	be (20MHz)	-7.55	-6.14	-5.91	-5.38	-3.78	-2.63	-6.41	-5	-1.41
	5965	3	be (40MHz)	-6.80	-7.12	-5.91	-5.38	-3.95	-2.63	-6.58	-5	-1.58
	6165	43	be (40MHz)	-7.18	-5.48	-5.91	-5.38	-3.24	-2.63	-5.87	-5	-0.87
	6405	91	be (40MHz)	-7.03	-6.59	-5.91	-5.38	-3.79	-2.63	-6.42	-5	-1.42
	5985	7	be (80MHz)	-6.63	-6.72	-5.91	-5.38	-3.66	-2.63	-6.29	-5	-1.29
	6145	39	be (80MHz)	-6.14	-6.46	-5.91	-5.38	-3.28	-2.63	-5.91	-5	-0.91
	6385	87	be (80MHz)	-6.04	-6.22	-5.91	-5.38	-3.12	-2.63	-5.75	-5	-0.75
	6025	15	be (160MHz)	-7.14	-6.83	-5.91	-5.38	-3.97	-2.63	-6.60	-5	-1.60
	6185	47	be (160MHz)	-7.40	-5.87	-5.91	-5.38	-3.55	-2.63	-6.18	-5	-1.18
	6345	79	be (160MHz)	-7.03	-5.20	-5.91	-5.38	-3.01	-2.63	-5.64	-5	-0.64
	6105	31	be (320MHz)	-6.26	-6.22	-5.91	-5.38	-3.23	-2.63	-5.86	-5	-0.86
	6265	63	be (320MHz)	-7.49	-4.74	-5.91	-5.38	-2.89	-2.63	-5.52	-5	-0.52
Band 7	6695	117	be (20MHz)	-8.07	-5.95	-6.52	-6.25	-3.87	-3.37	-7.24	-5	-2.24
	6695	149	be (20MHz)	-7.12	-7.02	-6.52	-6.25	-4.06	-3.37	-7.43	-5	-2.43
	6875	185	be (20MHz)	-6.97	-7.03	-6.52	-6.25	-3.99	-3.37	-7.36	-5	-2.36
	6565	123	be (40MHz)	-7.12	-7.16	-6.52	-6.25	-4.13	-3.37	-7.50	-5	-2.50
	6725	155	be (40MHz)	-6.94	-6.66	-6.52	-6.25	-3.79	-3.37	-7.16	-5	-2.16
	6845	179	be (40MHz)	-6.44	-6.49	-6.52	-6.25	-3.45	-3.37	-6.82	-5	-1.82
	6545	119	be (80MHz)	-5.92	-6.38	-6.52	-6.25	-3.14	-3.37	-6.51	-5	-1.51
	6705	151	be (80MHz)	-7.09	-6.43	-6.52	-6.25	-3.73	-3.37	-7.11	-5	-2.11
	6865	183	be (80MHz)	-6.20	-7.31	-6.52	-6.25	-3.71	-3.37	-7.08	-5	-2.08
	6665	143	be (160MHz)	-6.81	-6.41	-6.52	-6.25	-3.59	-3.37	-6.97	-5	-1.97
	6825	175	be (160MHz)	-6.14	-6.29	-6.52	-6.25	-3.20	-3.37	-6.58	-5	-1.58

Table 7-40. MIMO e.i.r.p. Conducted Power Spectral Density Measurements (26 Tones) – VLP

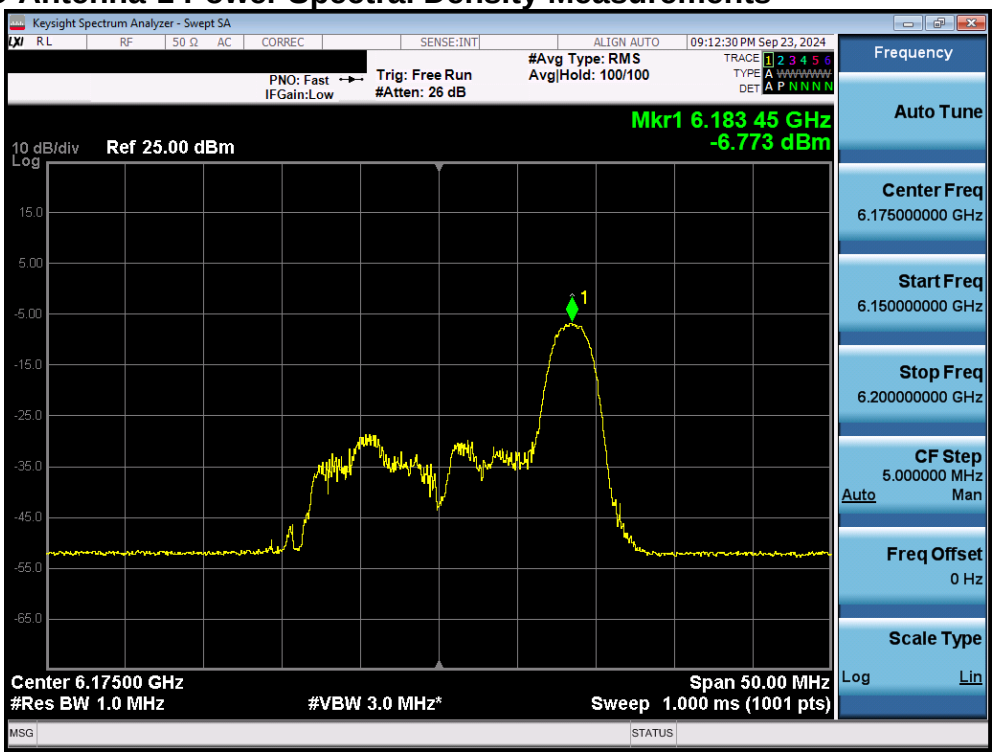
	Frequency [MHz]	Channel	802.11 MODE	MRU Cases	Antenna-1 Power Density [dBm]	Antenna-2 Power Density [dBm]	Antenna-1 Gain [dBi]	Antenna-2 Gain [dBi]	Summed MIMO Power Density [dBm]	Directional Gain [dBi]	DCCF [dB]	EIRP [dBm]	Max EIRP [dBm]	Margin [dB]
Band 5	6175	45	be (20MHz)	52+26T	-8.16	-7.28	-5.91	-5.38	-4.69	-2.63	0.00	-7.32	-5	-2.32
	6175	45	be (20MHz)	106+26T	-7.64	-6.70	-5.91	-5.38	-4.13	-2.63	0.00	-6.76	-5	-1.76
	6145	39	be (80MHz)	484+242T	-7.18	-7.23	-5.91	-5.38	-4.19	-2.63	0.16	-6.66	-5	-1.66
	6185	47	be (160MHz)	996+484T	-7.50	-6.77	-5.91	-5.38	-4.11	-2.63	0.17	-6.57	-5	-1.57
	6105	31	be (320MHz)	3x996+484T	-10.61	-10.43	-5.91	-5.38	-7.51	-2.63	0.12	-10.02	-5	-5.02
	6105	31	be (320MHz)	3x996T	-10.23	-9.37	-5.91	-5.38	-6.76	-2.63	0.19	-9.21	-5	-4.21
	6105	31	be (320MHz)	2x996+484T	-9.08	-8.30	-5.91	-5.38	-5.66	-2.63	0.16	-8.13	-5	-3.13
Band 7	6695	149	be (20MHz)	52+26T	-8.03	-8.44	-6.52	-6.25	-5.22	-3.37	0.00	-8.59	-5	-3.59
	6695	149	be (20MHz)	106+26T	-7.84	-7.17	-6.52	-6.25	-4.48	-3.37	0.00	-7.85	-5	-2.85
	6705	151	be (80MHz)	484+242T	-7.31	-7.75	-6.52	-6.25	-4.52	-3.37	0.16	-7.73	-5	-2.73
	6665	143	be (160MHz)	996+484T	-8.29	-7.68	-6.52	-6.25	-4.96	-3.37	0.17	-8.17	-5	-3.17

Table 7-41. MIMO e.i.r.p. Conducted Power Spectral Density Measurements (MRU Cases) – VLP

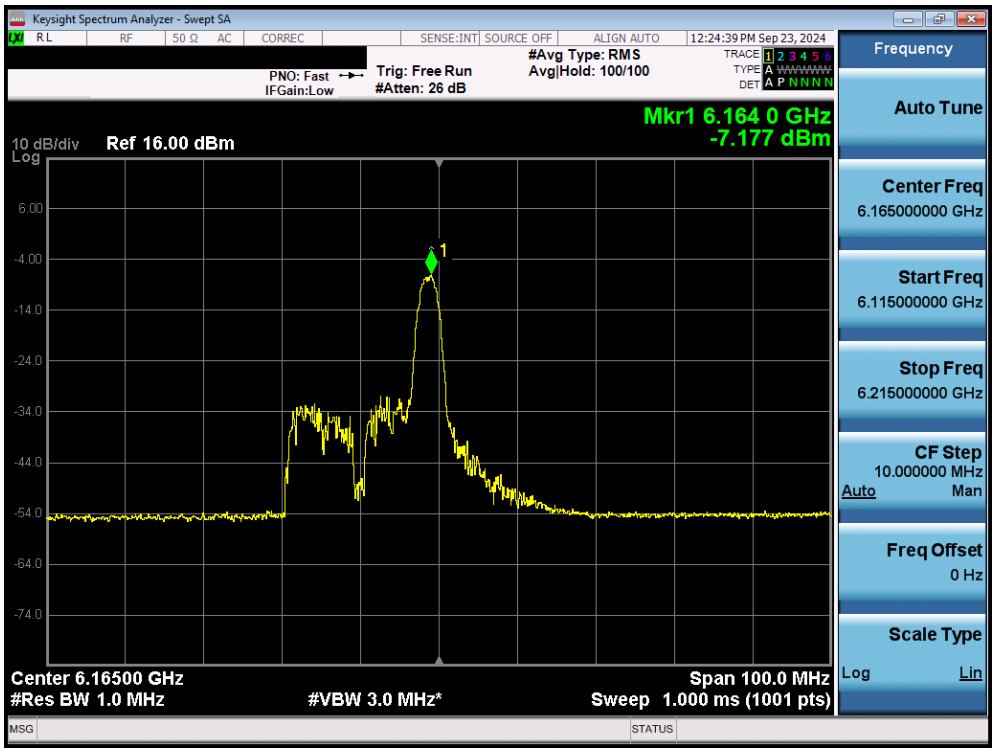
	Frequency [MHz]	Channel	802.11 MODE	Antenna-1 Power Density [dBm]	Antenna-2 Power Density [dBm]	Antenna-1 Gain [dBi]	Antenna-2 Gain [dBi]	Summed MIMO Power Density [dBm]	Directional Gain [dBi]	DCCF [dB]	EIRP [dBm]	Max EIRP [dBm]	Margin [dB]
Band 5	5935	2	be (20MHz)	-5.39	-5.77	-5.91	-5.38	-2.57	-2.63	0.13	-5.07	-5	-0.07
	6175	45	be (20MHz)	-5.59	-5.80	-5.91	-5.38	-2.68	-2.63	0.13	-5.18	-5	-0.18
	6415	93	be (20MHz)	-6.82	-5.88	-5.91	-5.38	-3.31	-2.63	0.13	-5.81	-5	-0.81
	5965	3	be (40MHz)	-6.84	-6.19	-5.91	-5.38	-3.49	-2.63	0.13	-5.99	-5	-0.99
	6165	43	be (40MHz)	-6.59	-5.73	-5.91	-5.38	-3.13	-2.63	0.13	-5.63	-5	-0.63
	6405	91	be (40MHz)	-6.34	-5.93	-5.91	-5.38	-3.12	-2.63	0.13	-5.62	-5	-0.62
	5985	7	be (80MHz)	-6.20	-5.63	-5.91	-5.38	-2.90	-2.63	0.21	-5.32	-5	-0.32
	6145	39	be (80MHz)	-5.97	-5.76	-5.91	-5.38	-2.85	-2.63	0.21	-5.28	-5	-0.28
	6385	87	be (80MHz)	-6.19	-5.73	-5.91	-5.38	-2.95	-2.63	0.21	-5.37	-5	-0.37
	6025	15	be (160MHz)	-8.37	-7.98	-5.91	-5.38	-5.16	-2.63	0.22	-7.57	-5	-2.57
	6185	47	be (160MHz)	-8.83	-7.78	-5.91	-5.38	-5.26	-2.63	0.22	-7.67	-5	-2.67
	6345	79	be (160MHz)	-9.37	-8.38	-5.91	-5.38	-5.83	-2.63	0.22	-8.24	-5	-3.24
	6105	31	be (320MHz)	-10.53	-11.03	-5.91	-5.38	-7.76	-2.63	0.14	-10.26	-5	-5.26
	6265	63	be (320MHz)	-11.89	-10.55	-5.91	-5.38	-8.16	-2.63	0.14	-10.65	-5	-5.65
Band 7	6695	117	be (20MHz)	-5.68	-5.69	-6.52	-6.25	-2.67	-3.37	0.13	-5.92	-5	-0.92
	6695	149	be (20MHz)	-6.15	-5.30	-6.52	-6.25	-2.69	-3.37	0.13	-5.93	-5	-0.93
	6875	185	be (20MHz)	-5.85	-5.82	-6.52	-6.25	-2.82	-3.37	0.13	-6.07	-5	-1.07
	6565	123	be (40MHz)	-6.97	-5.40	-6.52	-6.25	-3.10	-3.37	0.13	-6.35	-5	-1.35
	6725	155	be (40MHz)	-6.43	-5.68	-6.52	-6.25	-3.03	-3.37	0.13	-6.27	-5	-1.27
	6845	179	be (40MHz)	-6.17	-5.80	-6.52	-6.25	-2.97	-3.37	0.13	-6.22	-5	-1.22
	6545	119	be (80MHz)	-6.21	-5.16	-6.52	-6.25	-2.65	-3.37	0.21	-5.81	-5	-0.81
	6705	151	be (80MHz)	-6.26	-6.10	-6.52	-6.25	-3.17	-3.37	0.21	-6.33	-5	-1.33
	6865	183	be (80MHz)	-6.15	-6.66	-6.52	-6.25	-3.39	-3.37	0.21	-6.55	-5	-1.55
	6665	143	be (160MHz)	-9.86	-8.85	-6.52	-6.25	-6.31	-3.37	0.22	-9.47	-5	-4.47

Table 7-42. MIMO e.i.r.p. Conducted Power Spectral Density Measurements (Full Tones) – VLP

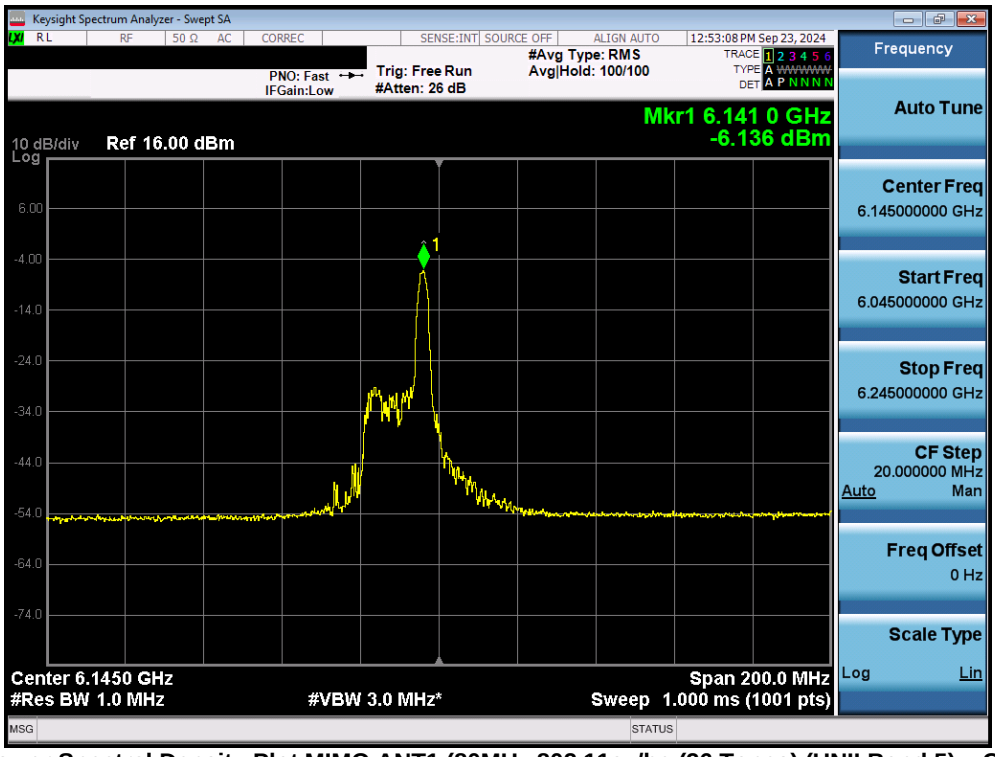
7.5.1 MIMO Antenna-1 Power Spectral Density Measurements



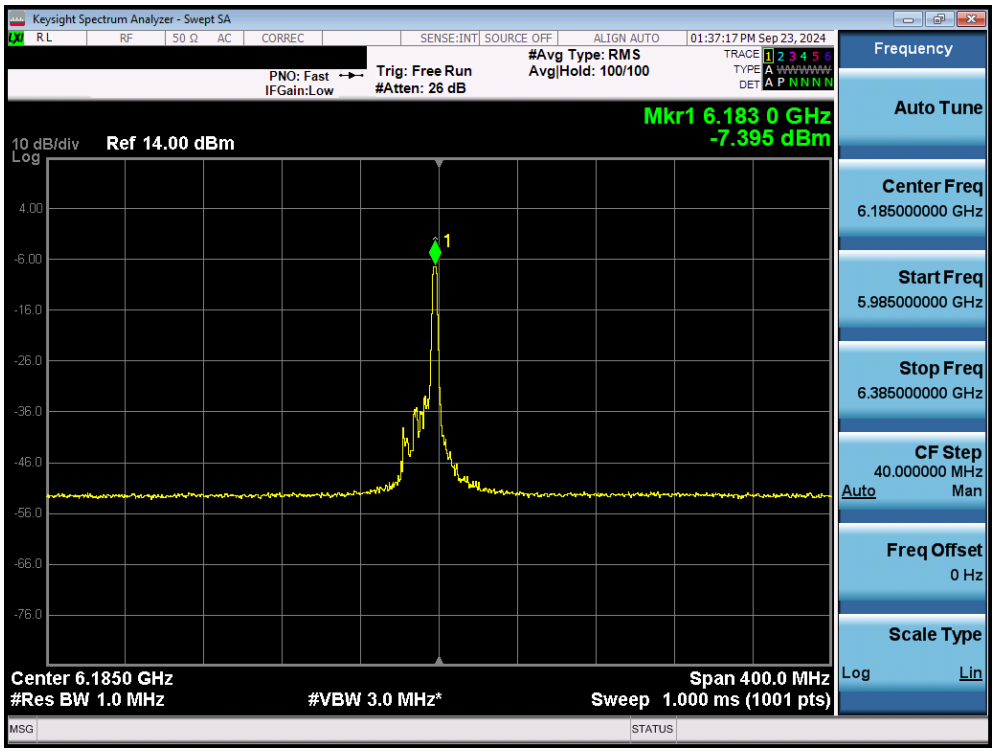
Plot 7-36. Power Spectral Density Plot MIMO ANT1 (20MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 45) - VLP



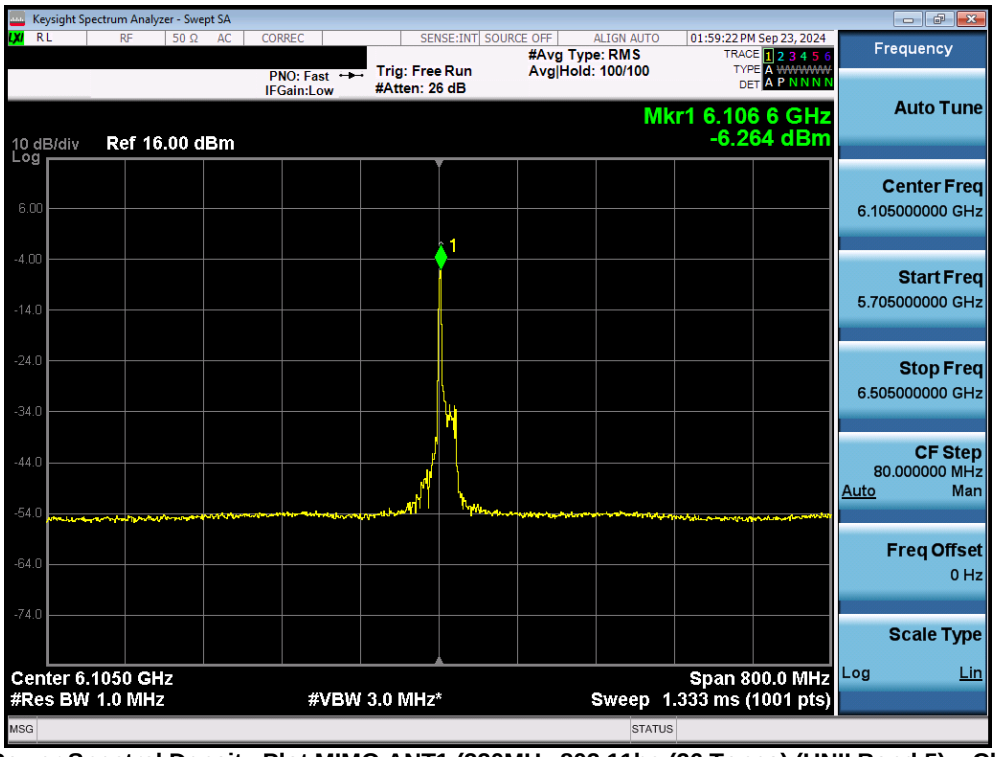
Plot 7-37. Power Spectral Density Plot MIMO ANT1 (40MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 43) - VLP



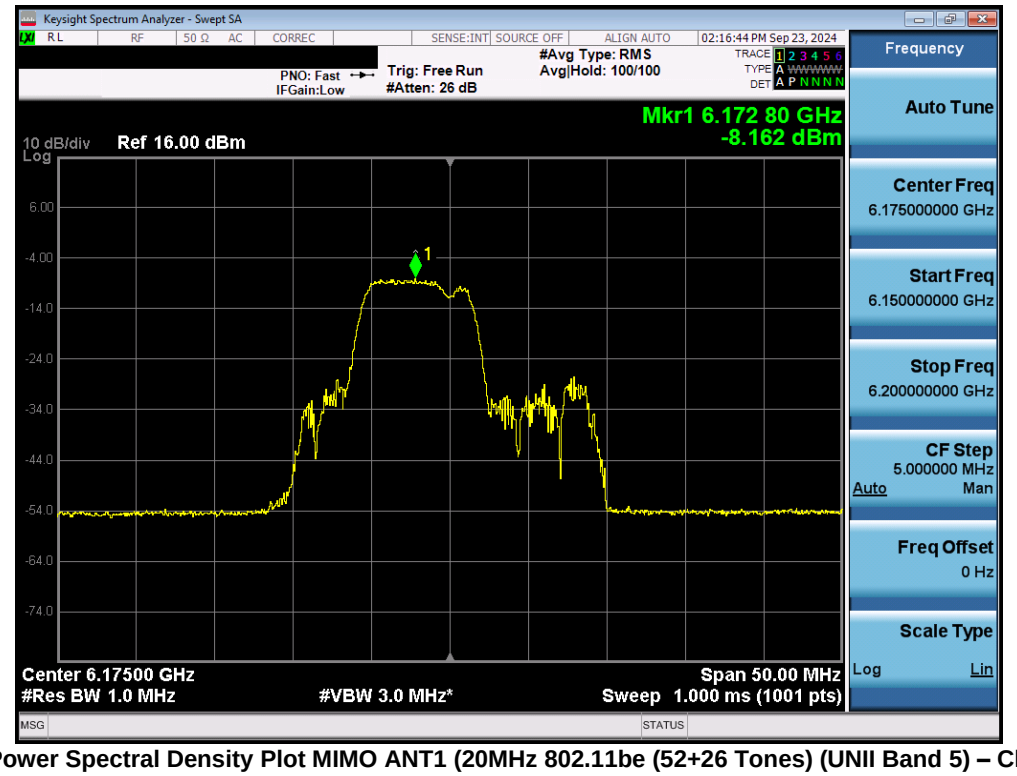
Plot 7-38. Power Spectral Density Plot MIMO ANT1 (80MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 39) - VLP



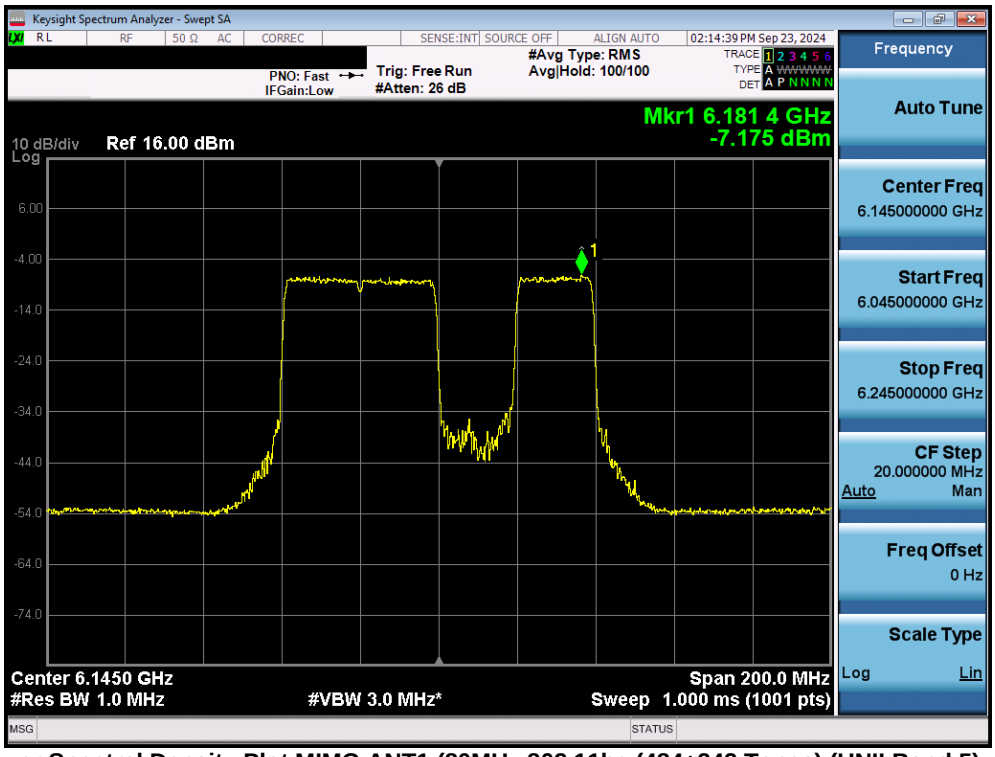
Plot 7-39. Power Spectral Density Plot MIMO ANT1 (160MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 47) - VLP



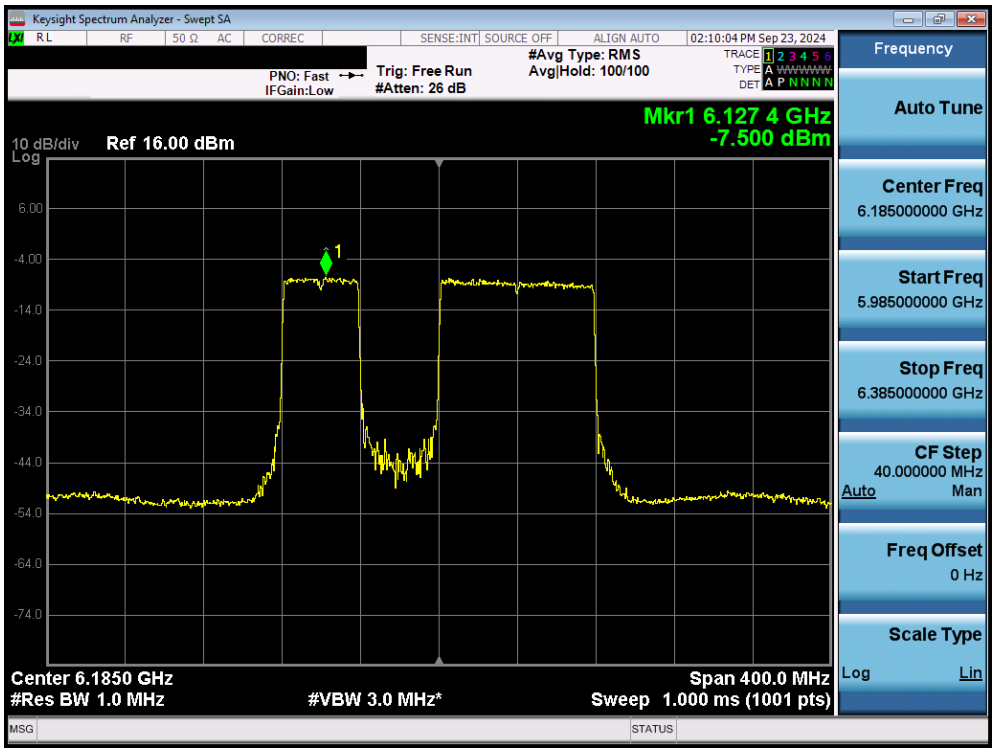
Plot 7-40. Power Spectral Density Plot MIMO ANT1 (320MHz 802.11be (26 Tones) (UNII Band 5) – Ch. 31) - VLP



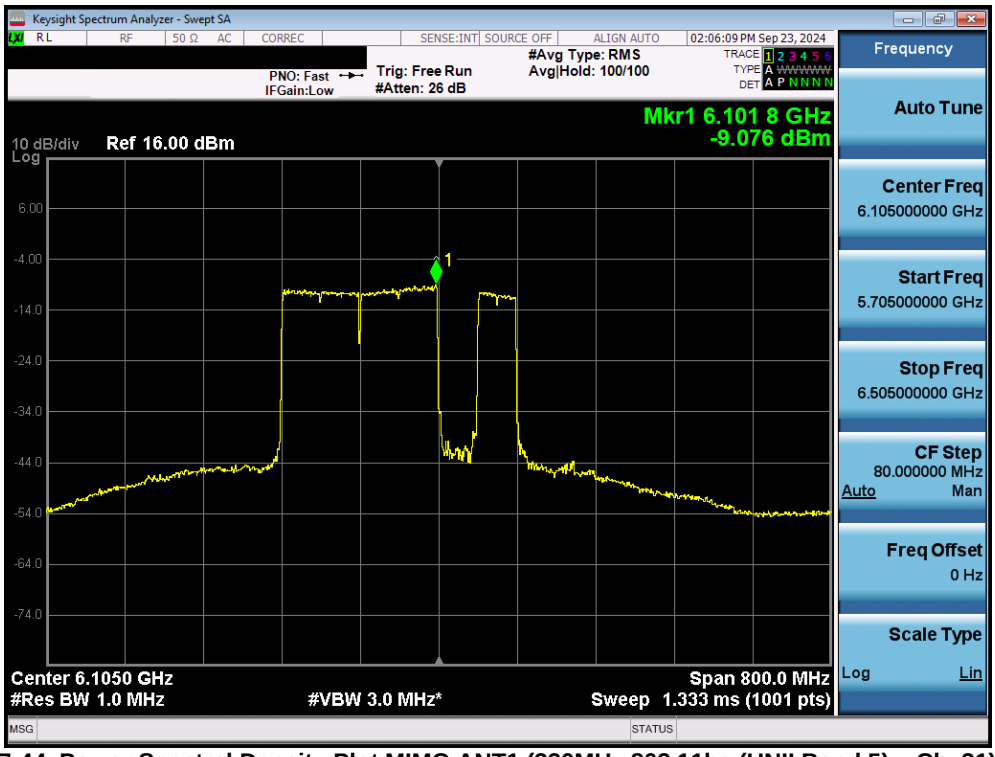
Plot 7-41. Power Spectral Density Plot MIMO ANT1 (20MHz 802.11be (52+26 Tones) (UNII Band 5) – Ch. 45) - VLP



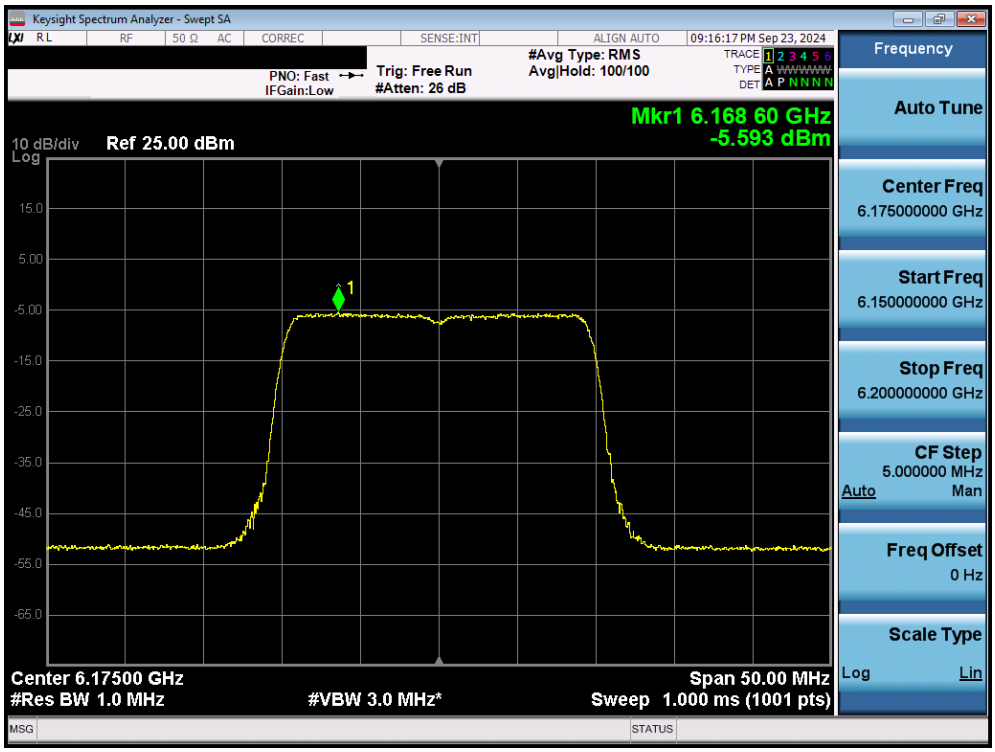
Plot 7-42. Power Spectral Density Plot MIMO ANT1 (80MHz 802.11be (484+242 Tones) (UNII Band 5) – Ch. 39) VLP



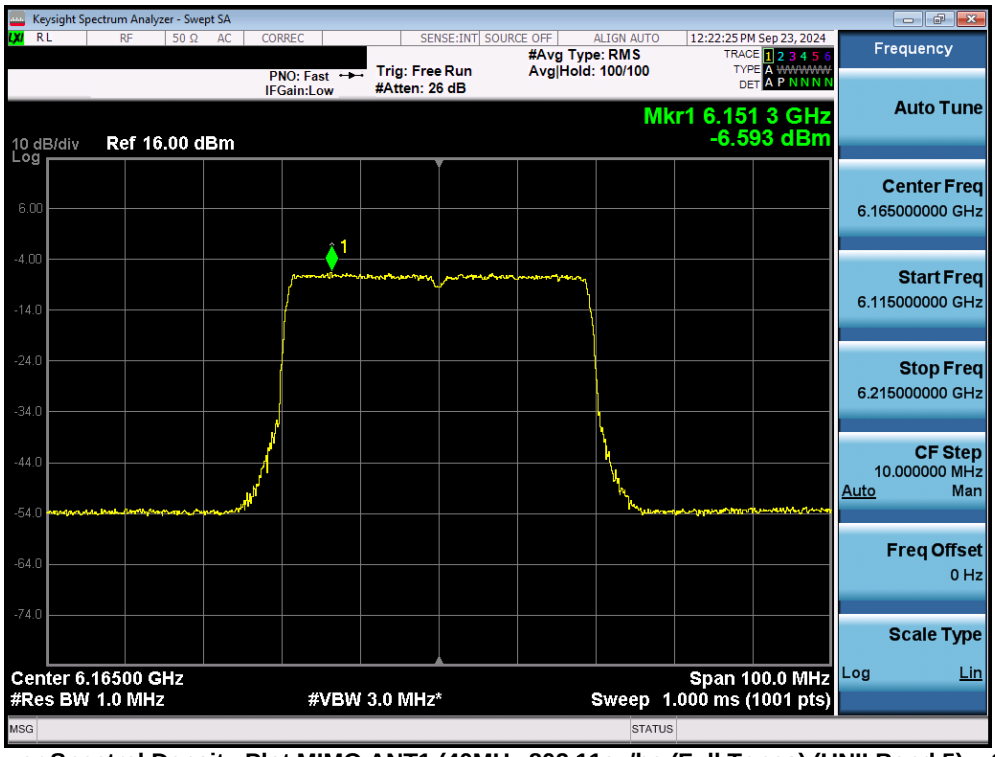
Plot 7-43. Power Spectral Density Plot MIMO ANT1 (160MHz 802.11be (996+484 Tones) (UNII Band 5) – Ch. 47) VLP



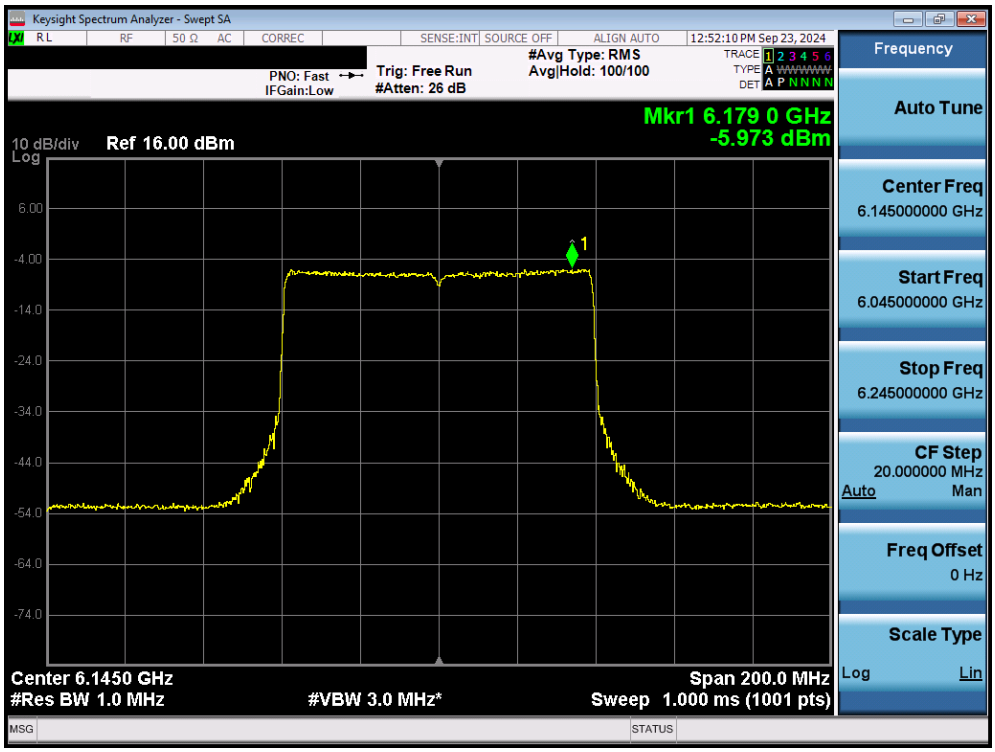
Plot 7-44. Power Spectral Density Plot MIMO ANT1 (320MHz 802.11be (UNII Band 5) – Ch. 31) VLP



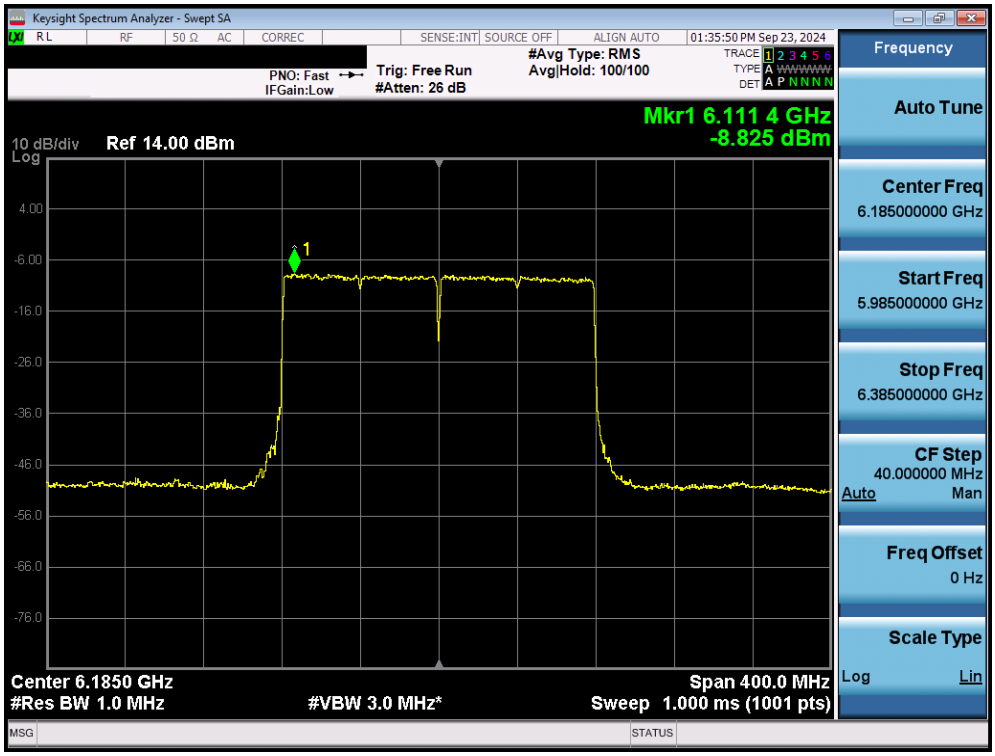
Plot 7-45. Power Spectral Density Plot MIMO ANT1 (20MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 45) - VLP



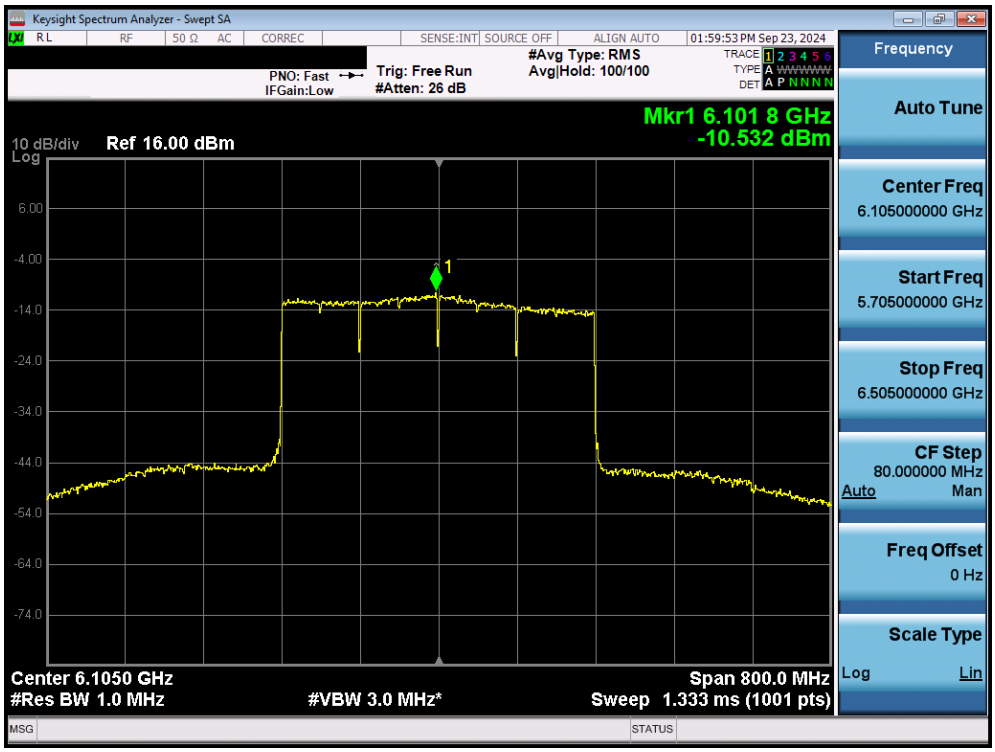
Plot 7-46. Power Spectral Density Plot MIMO ANT1 (40MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 43) - VLP



Plot 7-47. Power Spectral Density Plot MIMO ANT1 (80MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 39) - VLP

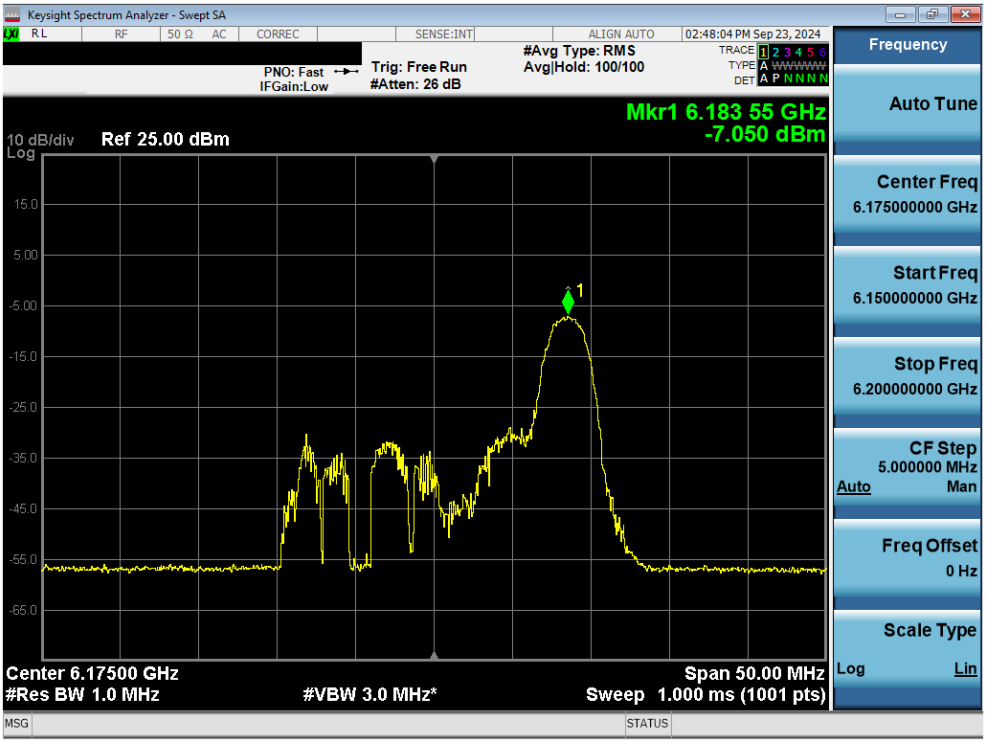


Plot 7-48. Power Spectral Density Plot MIMO ANT1 (160MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 47) - VLP

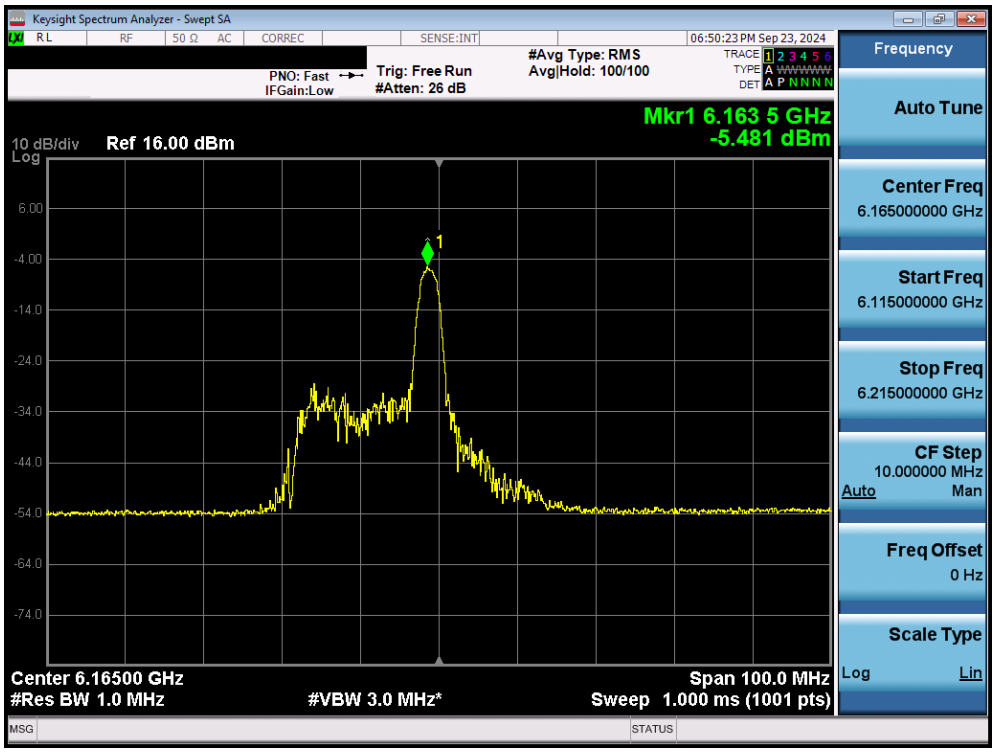


Plot 7-49. Power Spectral Density Plot MIMO ANT1 (320MHz 802.11be (Full Tones) (UNII Band 5) – Ch. 31) - VLP

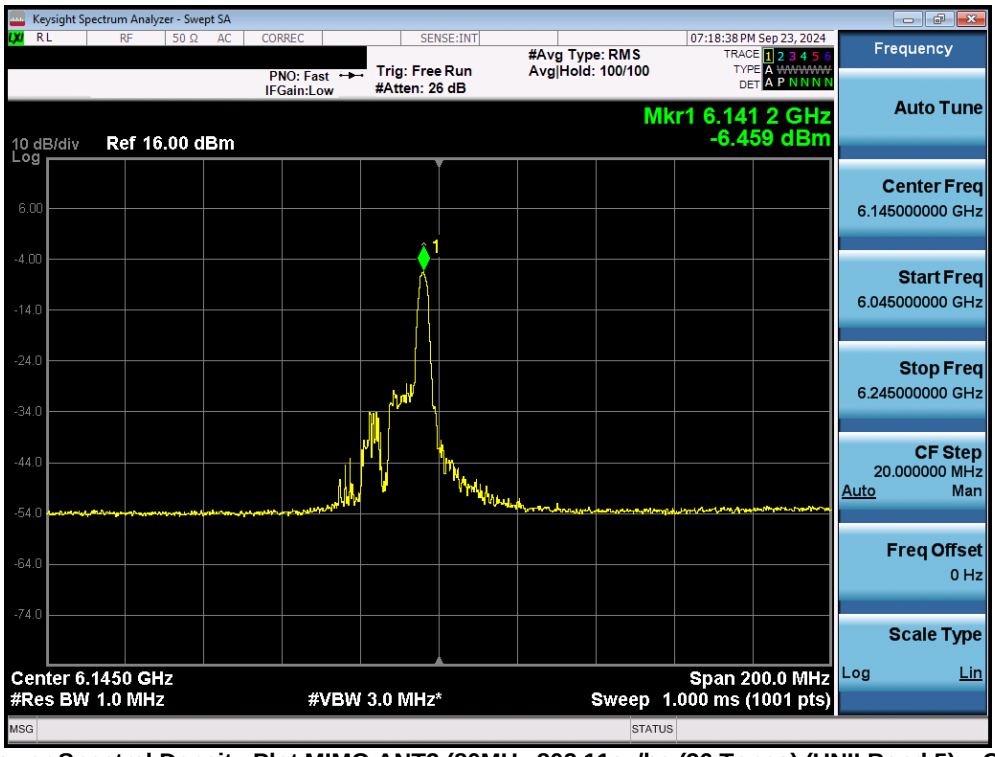
7.5.2 MIMO Antenna-2 Power Spectral Density Measurements



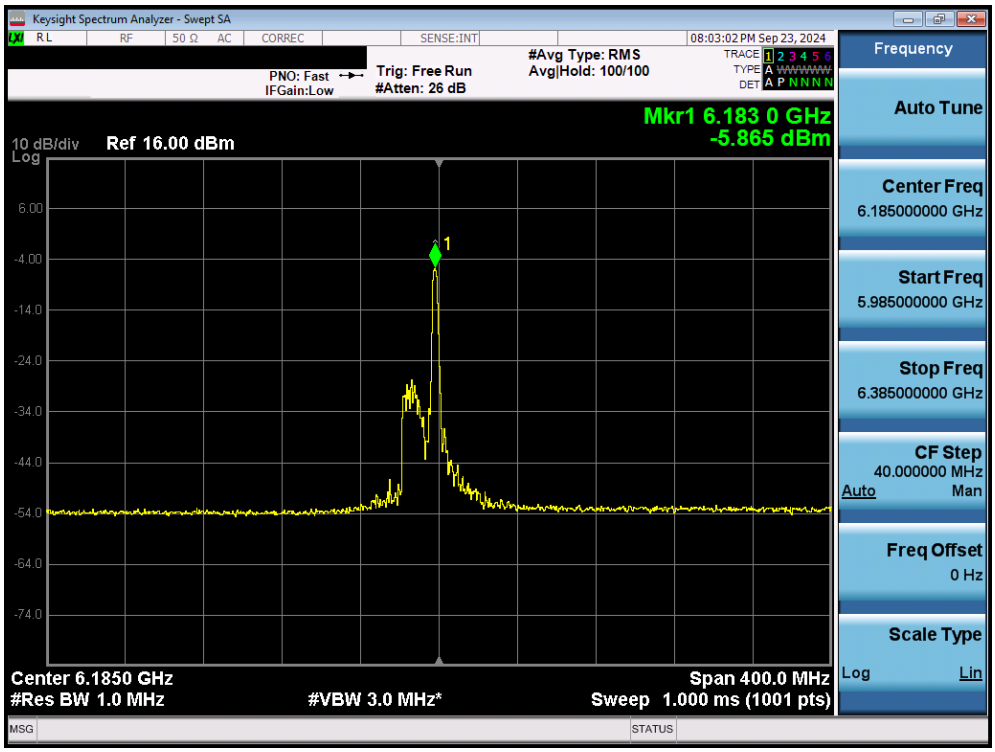
Plot 7-50. Power Spectral Density Plot MIMO ANT2 (20MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 45) - VLP



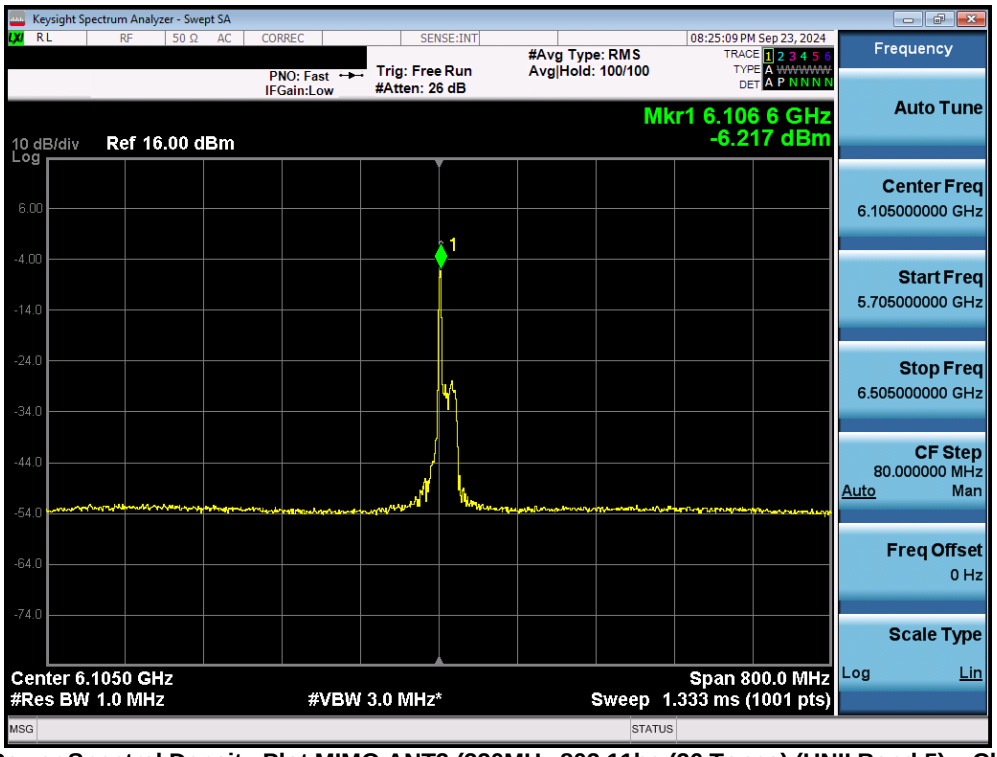
Plot 7-51. Power Spectral Density Plot MIMO ANT2 (40MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 43) - VLP



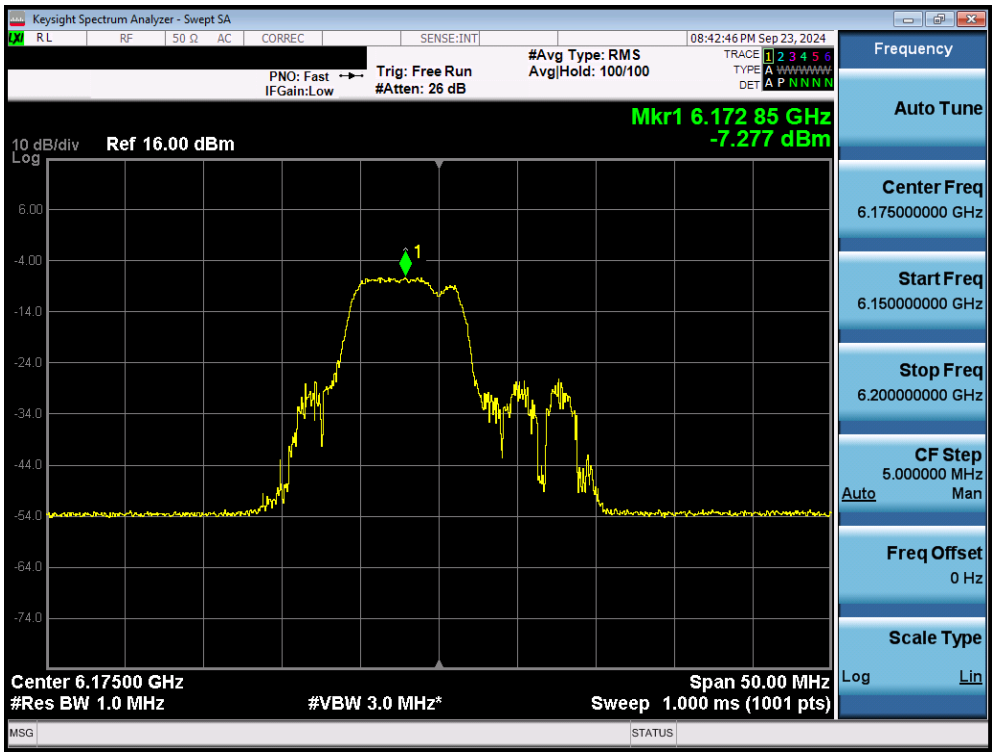
Plot 7-52. Power Spectral Density Plot MIMO ANT2 (80MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 39) - VLP



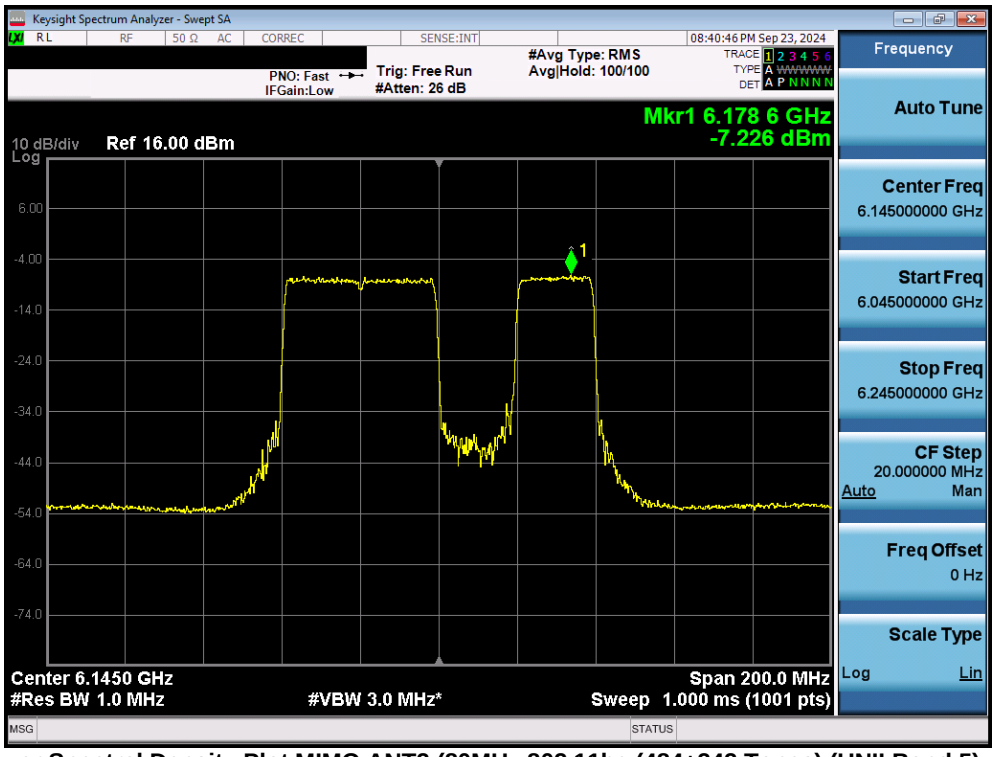
Plot 7-53. Power Spectral Density Plot MIMO ANT2 (160MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 47) - VLP



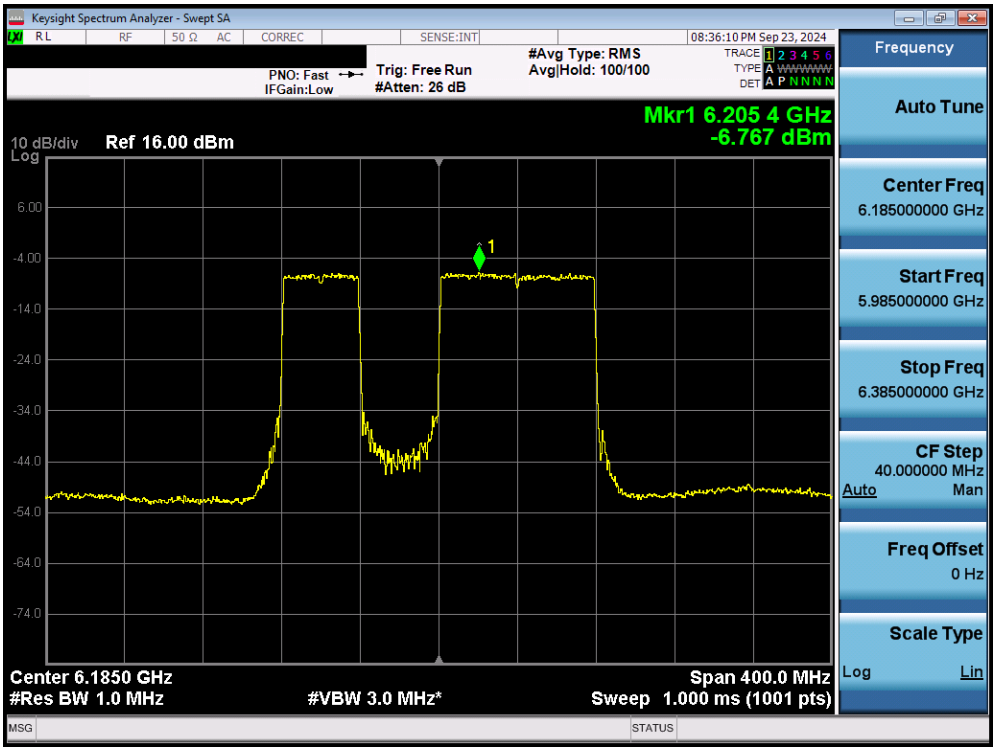
Plot 7-54. Power Spectral Density Plot MIMO ANT2 (320MHz 802.11be (26 Tones) (UNII Band 5) – Ch. 31) - VLP



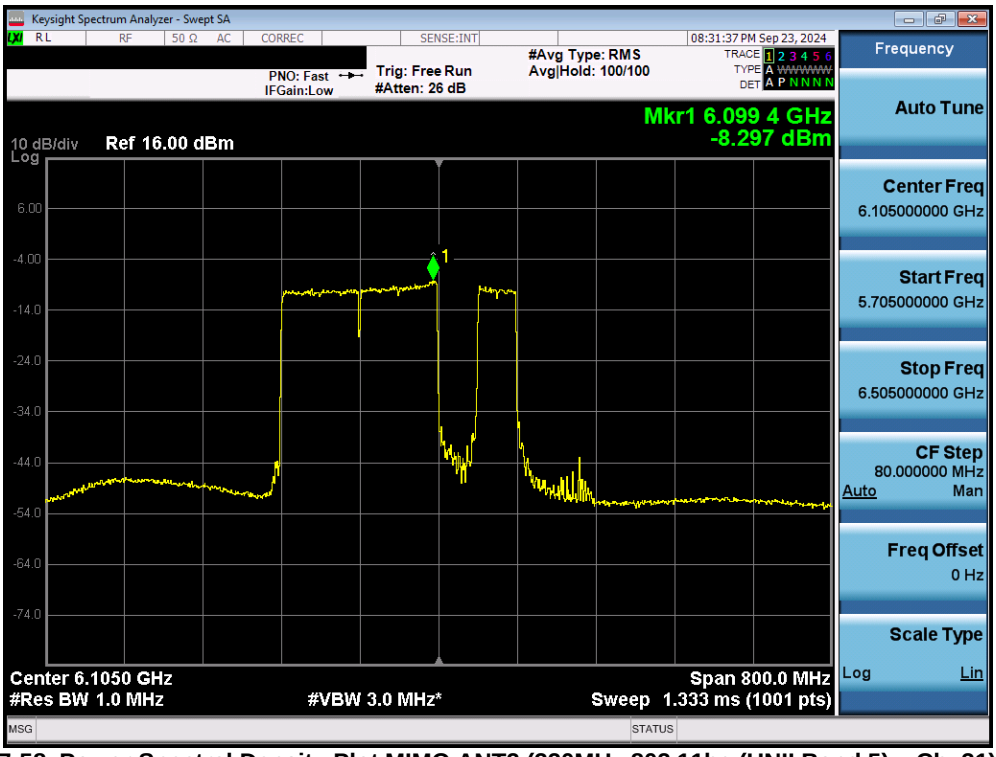
Plot 7-55. Power Spectral Density Plot MIMO ANT2 (20MHz 802.11be (52+26 Tones) (UNII Band 5) – Ch. 45) - VLP



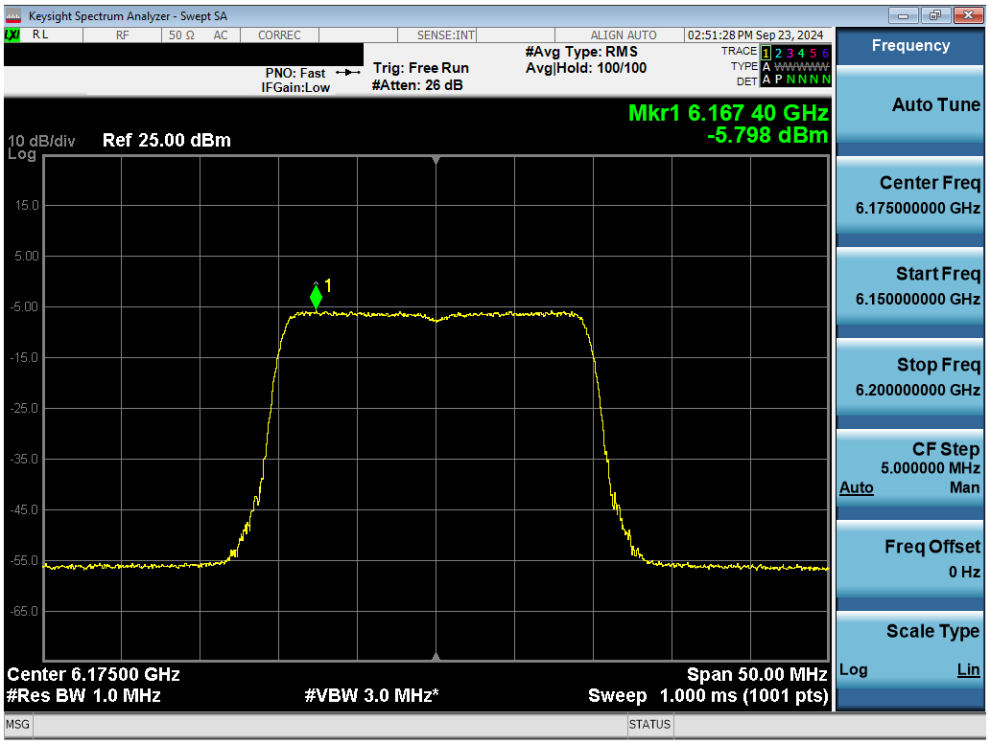
Plot 7-56. Power Spectral Density Plot MIMO ANT2 (80MHz 802.11be (484+242 Tones) (UNII Band 5) – Ch. 39) VLP



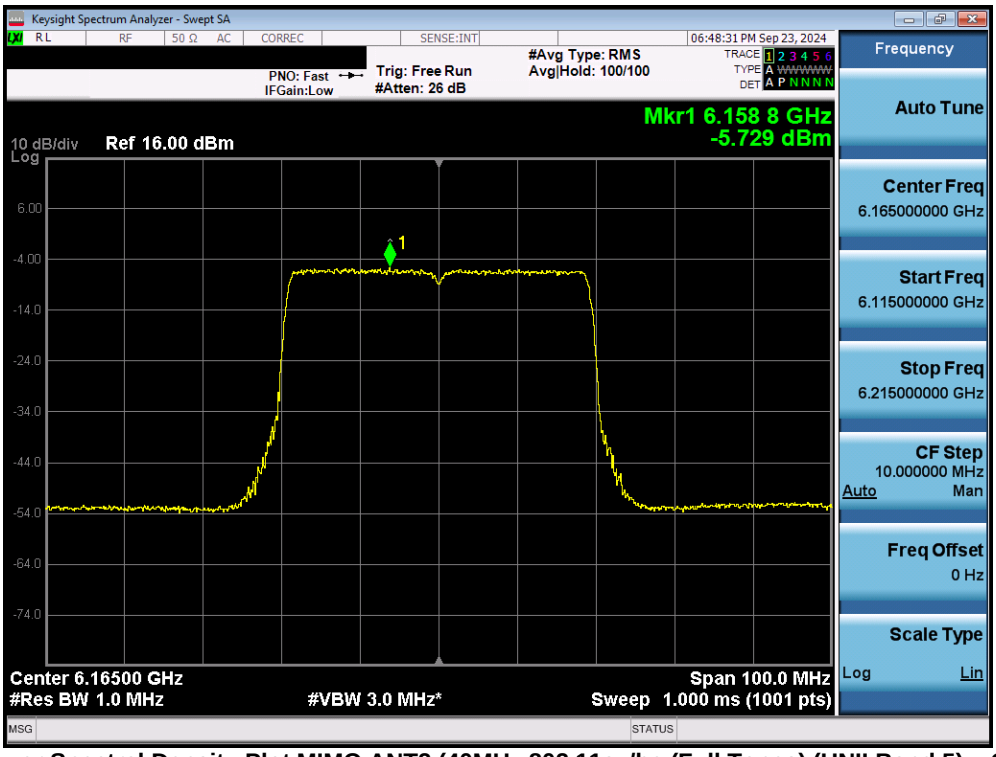
Plot 7-57. Power Spectral Density Plot MIMO ANT2 (160MHz 802.11be (996+484 Tones) (UNII Band 5) – Ch. 47) VLP



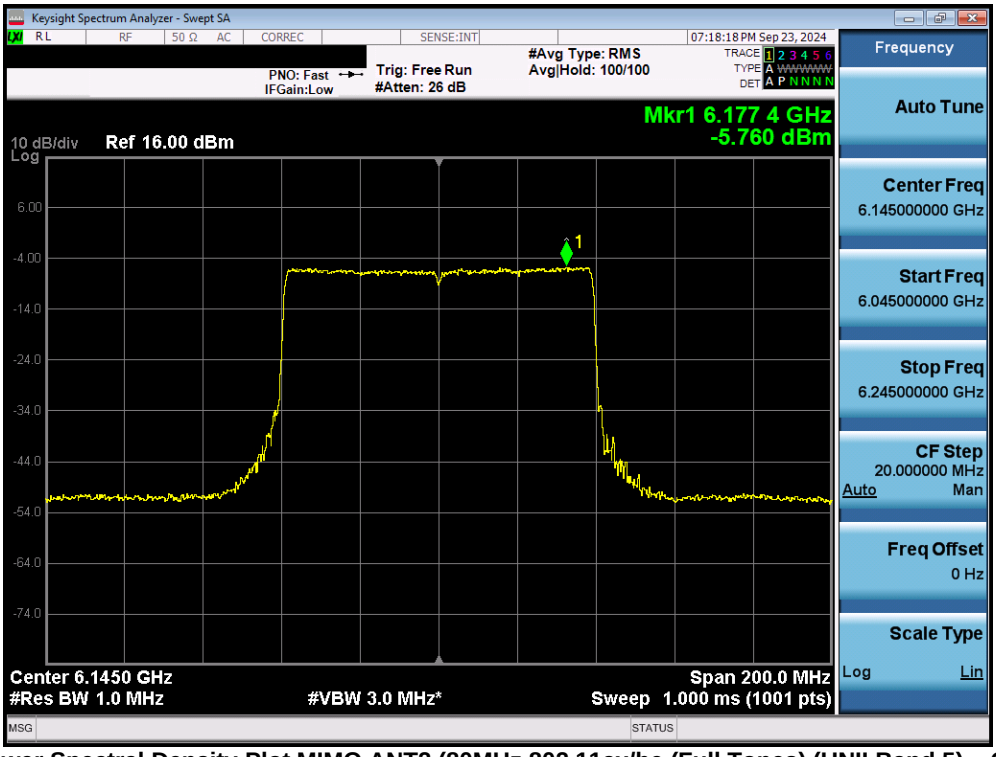
Plot 7-58. Power Spectral Density Plot MIMO ANT2 (320MHz 802.11be (UNII Band 5) – Ch. 31) VLP



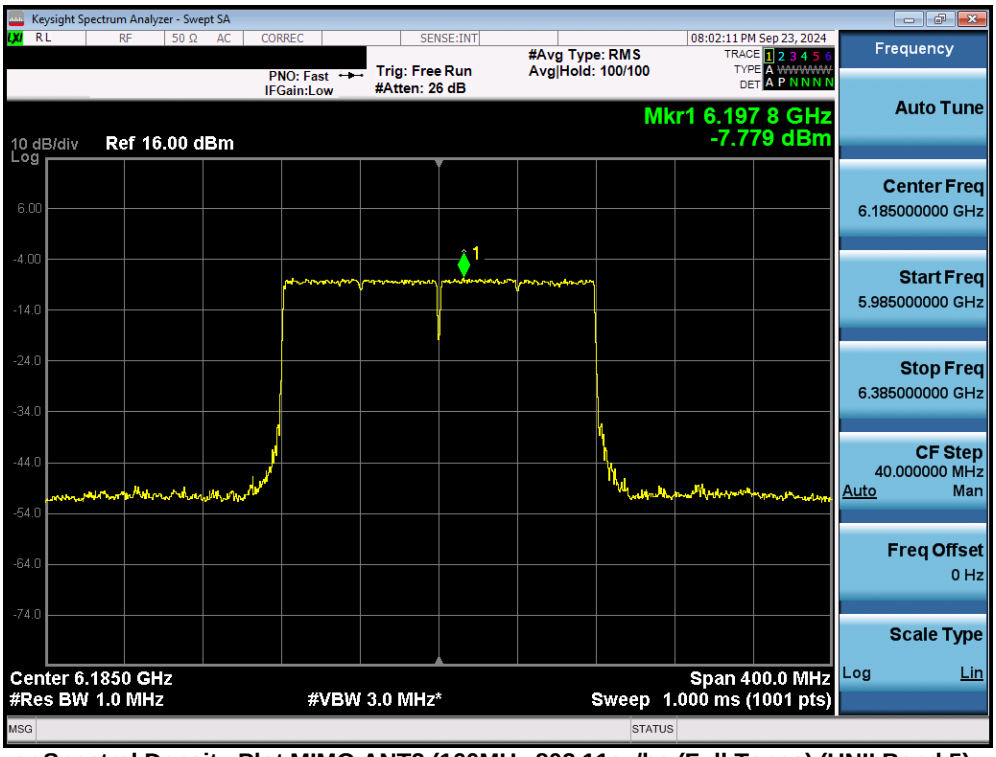
Plot 7-59. Power Spectral Density Plot MIMO ANT2 (20MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 45) - VLP



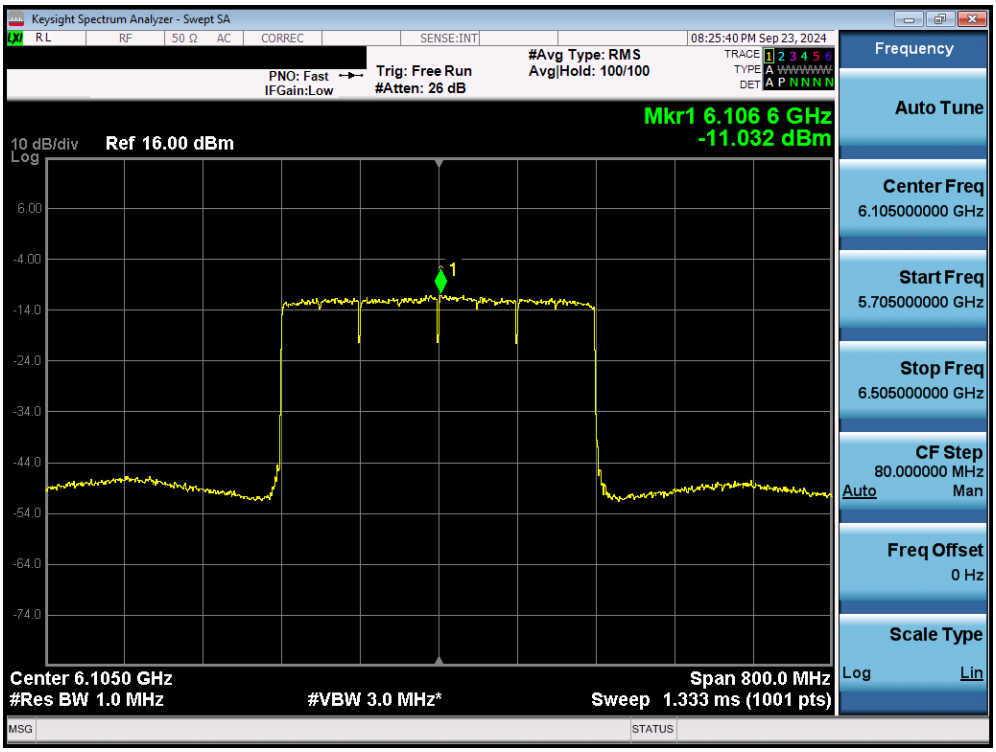
Plot 7-60. Power Spectral Density Plot MIMO ANT2 (40MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 43) - VLP



Plot 7-61. Power Spectral Density Plot MIMO ANT2 (80MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 39) - VLP



Plot 7-62. Power Spectral Density Plot MIMO ANT2 (160MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 47) - VLP



Plot 7-63. Power Spectral Density Plot MIMO ANT2 (320MHz 802.11be (Full Tones) (UNII Band 5) – Ch. 31) - VLP

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 802.11ax (20MHz BW) mode, the average conducted power spectral density was measured to be -6.98 dBm for Antenna-1 and -6.49 dBm for Antenna-2.

Antenna 1 + Antenna 2 = MIMO

(-6.98 dBm + -6.49 dBm) = (0.200 mW + 0.224 mW) = 0.424 mW = -3.73 dBm

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

At 5935 MHz in 802.11ax (20MHz BW) mode, the average MIMO power density was calculated to be -3.73 dBm with directional gain of -2.63 dBi.

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

-3.73 dBm + -2.63 dBi = -6.36 dBm

7.6 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 be 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 be suppressed by at least 40 dB.

Test Procedure Used

KDB 987594 D02 v03

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:
    a) 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.)
    b) Suppressed by 28 dB at one channel bandwidth from the channel center.
    c) 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	be (20MHz)	PASS	PASS
	6175	45	be (20MHz)	PASS	PASS
	6415	93	be (20MHz)	PASS	PASS
	5965	3	be (40MHz)	PASS	PASS
	6165	43	be (40MHz)	PASS	PASS
	6405	91	be (40MHz)	PASS	PASS
	5985	7	be (80MHz)	PASS	PASS
	6145	39	be (80MHz)	PASS	PASS
	6385	87	be (80MHz)	PASS	PASS
	6025	15	be (160MHz)	PASS	PASS
	6185	47	be (160MHz)	PASS	PASS
	6345	79	be (160MHz)	PASS	PASS
	6105	31	be (320MHz)	PASS	PASS
	6265	63	be (320MHz)	PASS	PASS
Band 7	6695	117	be (20MHz)	PASS	PASS
	6695	149	be (20MHz)	PASS	PASS
	6875	185	be (20MHz)	PASS	PASS
	6565	123	be (40MHz)	PASS	PASS
	6725	155	be (40MHz)	PASS	PASS
	6845	179	be (40MHz)	PASS	PASS
	6545	119	be (80MHz)	PASS	PASS
	6705	151	be (80MHz)	PASS	PASS
	6865	183	be (80MHz)	PASS	PASS
	6665	143	be (160MHz)	PASS	PASS
	6825	175	be (160MHz)	PASS	PASS
Band 7/8	6745	159	be (320MHz)	PASS	PASS

Table 7-43. In Band Emission Results (26 Tones)

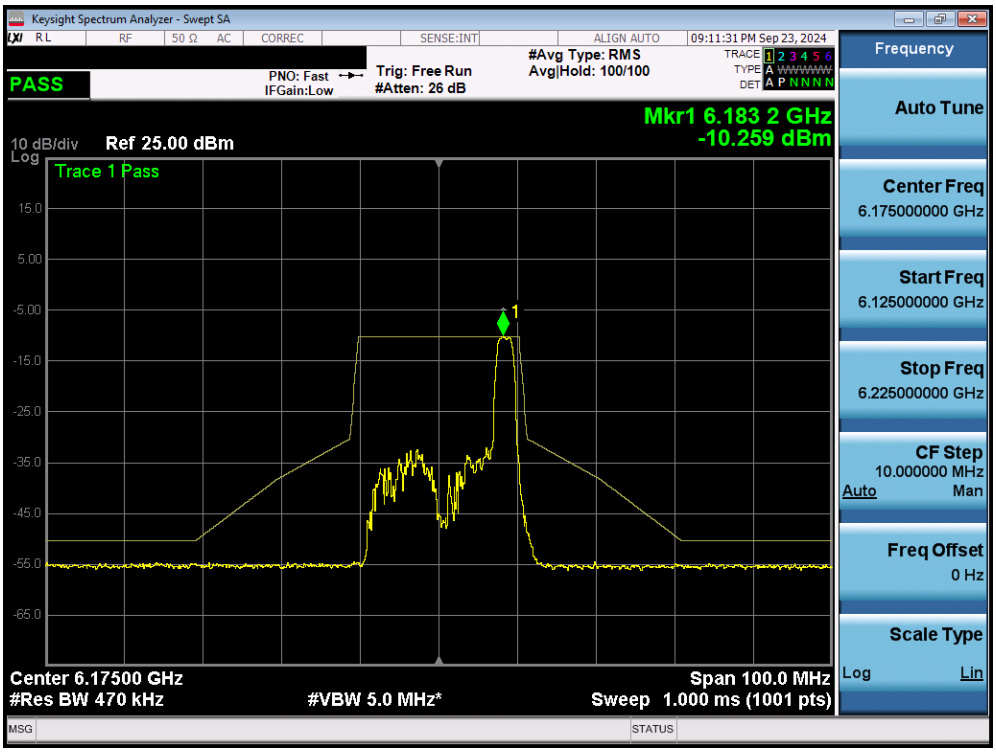
	Frequency [MHz]	Channel	802.11 MODE	Antenna-1 In-Band Emission	Antenna-2 In-Band Emission
Band 5	5935	2	be (20MHz)	PASS	PASS
	6175	45	be (20MHz)	PASS	PASS
	6415	93	be (20MHz)	PASS	PASS
	5965	3	be (40MHz)	PASS	PASS
	6165	43	be (40MHz)	PASS	PASS
	6405	91	be (40MHz)	PASS	PASS
	5985	7	be (80MHz)	PASS	PASS
	6145	39	be (80MHz)	PASS	PASS
	6385	87	be (80MHz)	PASS	PASS
	6025	15	be (160MHz)	PASS	PASS
	6185	47	be (160MHz)	PASS	PASS
	6345	79	be (160MHz)	PASS	PASS
	6105	31	be (320MHz)	PASS	PASS
	6265	63	be (320MHz)	PASS	PASS
Band 7	6695	117	be (20MHz)	PASS	PASS
	6695	149	be (20MHz)	PASS	PASS
	6875	185	be (20MHz)	PASS	PASS
	6565	123	be (40MHz)	PASS	PASS
	6725	155	be (40MHz)	PASS	PASS
	6845	179	be (40MHz)	PASS	PASS
	6545	119	be (80MHz)	PASS	PASS
	6705	151	be (80MHz)	PASS	PASS
	6865	183	be (80MHz)	PASS	PASS
	6665	143	be (160MHz)	PASS	PASS
	6825	175	be (160MHz)	PASS	PASS
Band 6/7	6585	127	be (320MHz)	PASS	PASS
Band 7/8	6745	159	be (320MHz)	PASS	PASS

Table 7-44. In Band Emission Results (Full Tones)

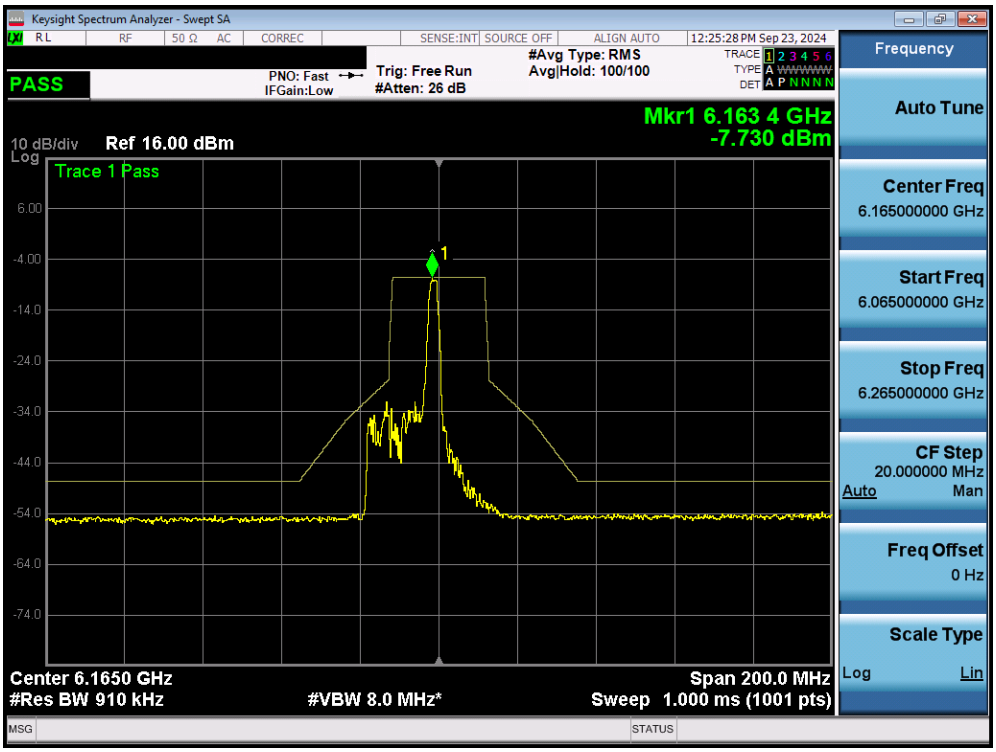
	Frequency [MHz]	Channel	802.11 MODE	MRU Cases	Antenna-1 In-Band Emission	Antenna-2 In-Band Emission
Band 5	6175	45	be (20MHz)	52+26T	PASS	PASS
	6175	45	be (20MHz)	106+26T	PASS	PASS
	6145	39	be (80MHz)	484+242T	PASS	PASS
	6185	47	be (160MHz)	996+484T	PASS	PASS
	6105	31	be (320MHz)	3x996+484T	PASS	PASS
	6105	31	be (320MHz)	3x996T	PASS	PASS
	6105	31	be (320MHz)	2x996+484T	PASS	PASS
Band 7	6695	149	be (20MHz)	52+26T	PASS	PASS
	6695	149	be (20MHz)	106+26T	PASS	PASS
	6705	151	be (80MHz)	484+242T	PASS	PASS
	6665	143	be (160MHz)	996+484T	PASS	PASS
Band 7/8	6745	159	be (320MHz)	3x996+484T	PASS	PASS
	6745	159	be (320MHz)	3x996T	PASS	PASS
	6745	159	be (320MHz)	2x996+484T	PASS	PASS

Table 7-45. In Band Emission Results (MRU)

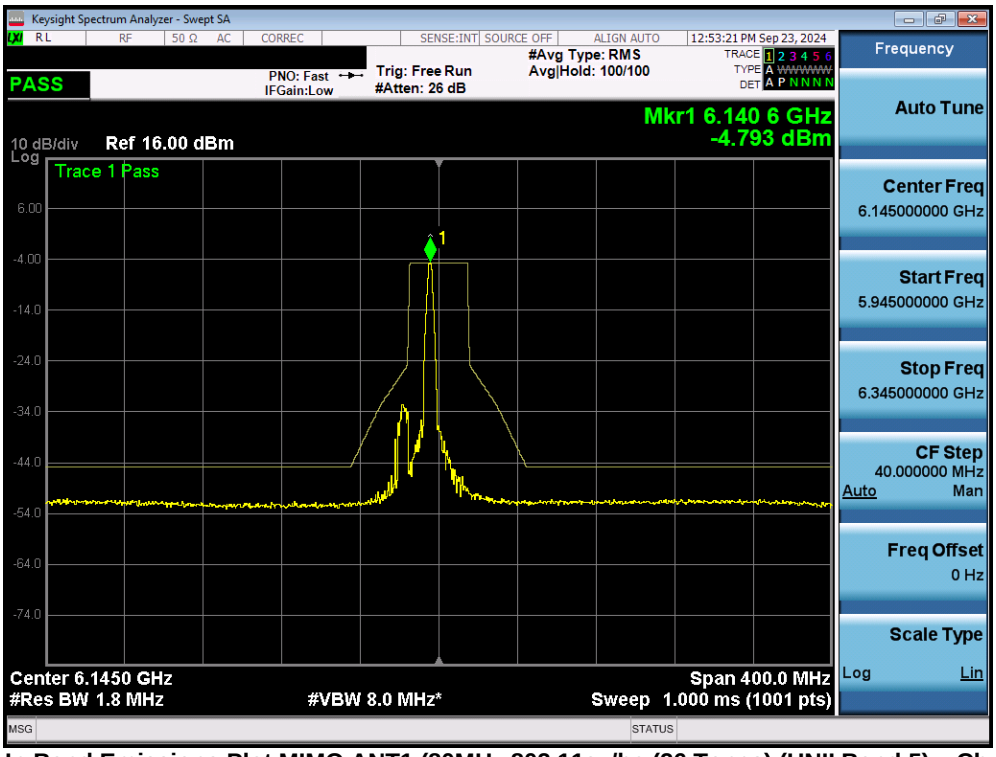
7.6.1 MIMO Antenna-1 In-Band Emission Measurements



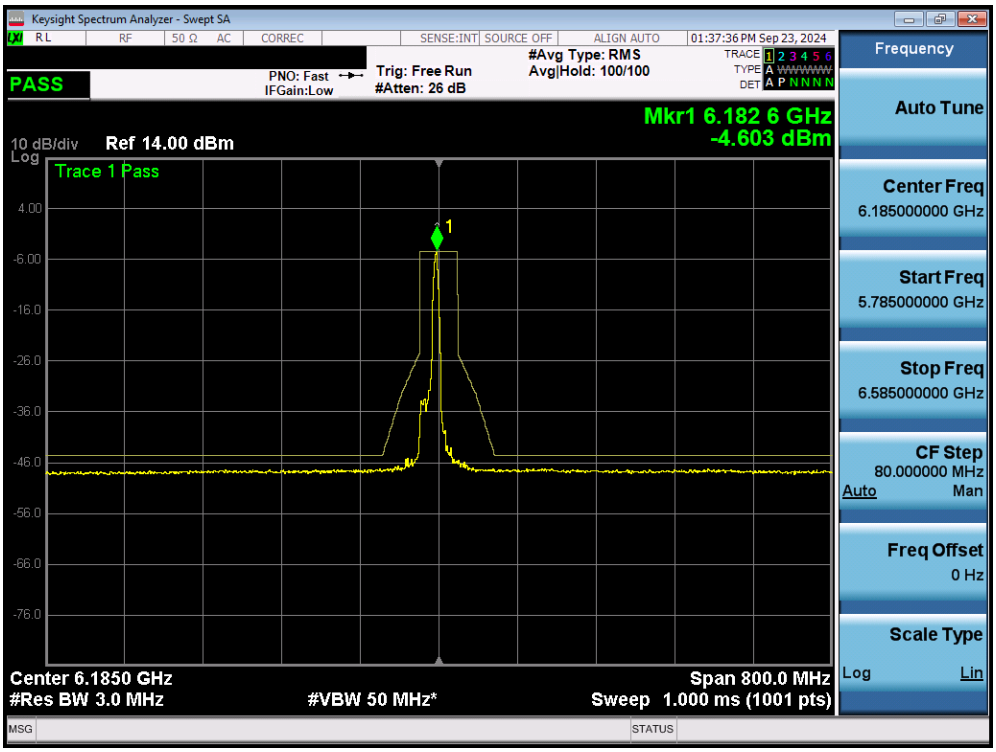
Plot 7-64. In Band Emissions Plot MIMO ANT1 (20MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 45) - VLP



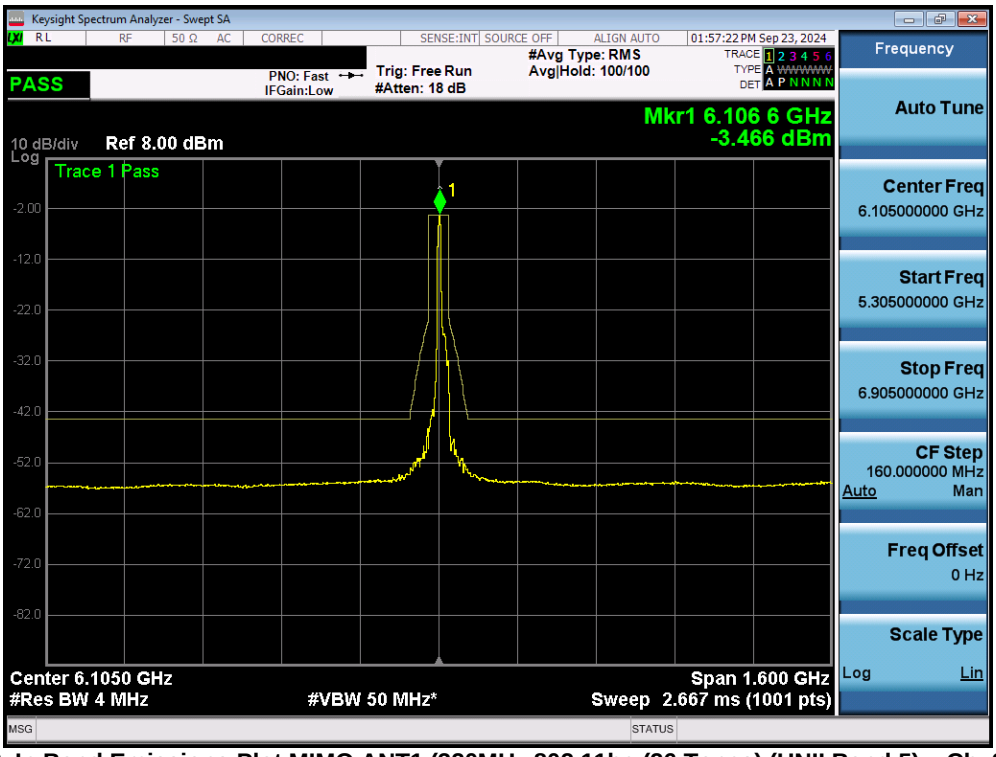
Plot 7-65. In Band Emissions Plot MIMO ANT1 (40MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 43) - VLP



Plot 7-66. In Band Emissions Plot MIMO ANT1 (80MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 39) - VLP

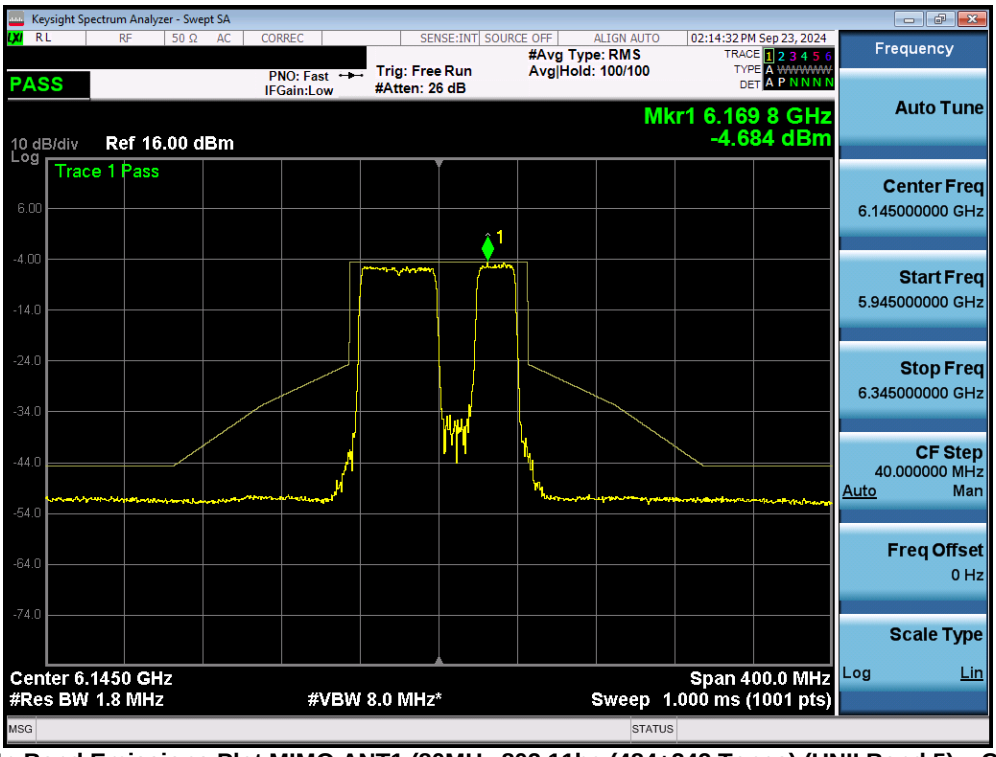


Plot 7-67. In Band Emissions Plot MIMO ANT1 (160MHz 802.11ax/be (26 Tones) (UNII Band 5) – Ch. 47) - VLP

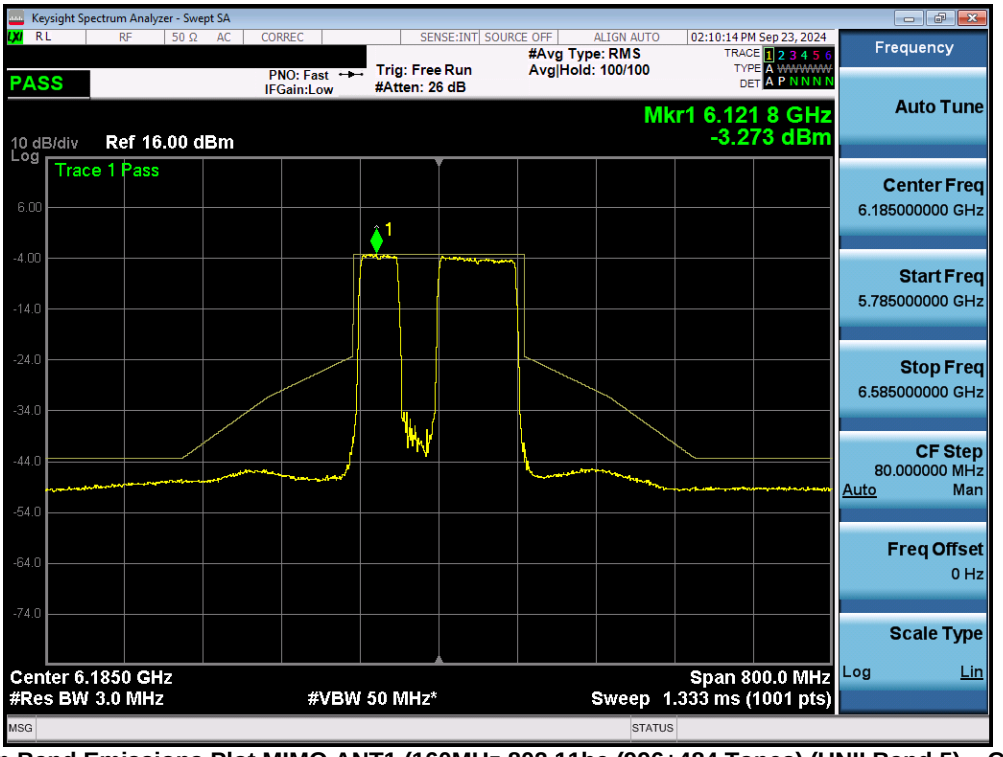


Plot 7-68. In Band Emissions Plot MIMO ANT1 (320MHz 802.11be (26 Tones) (UNII Band 5) – Ch. 31) - VLP

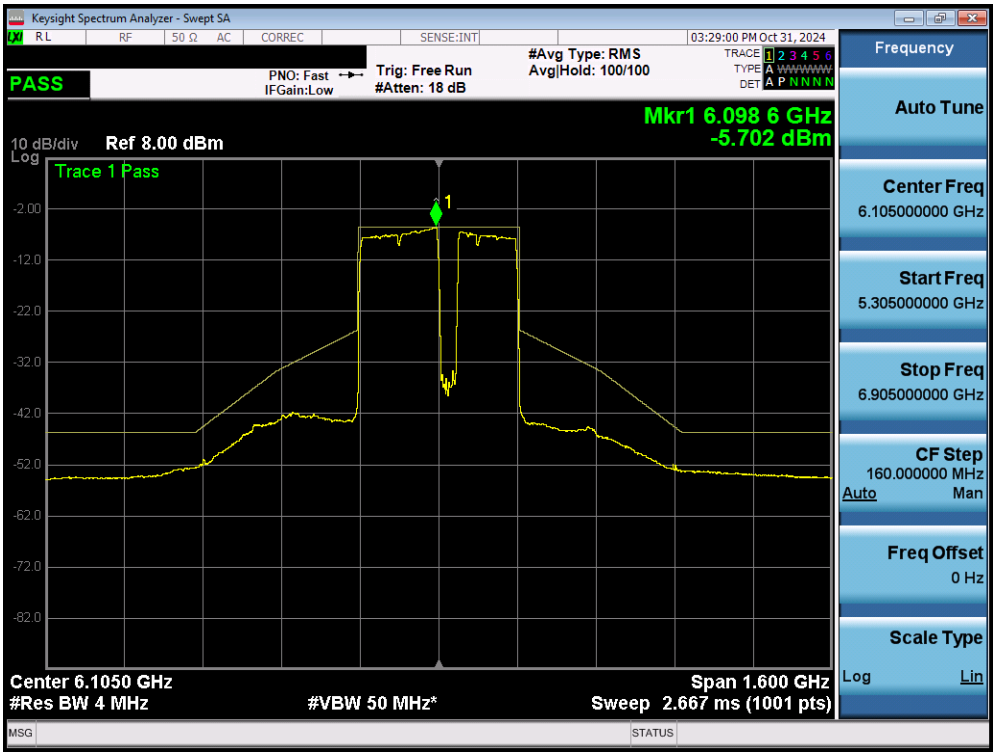
Plot 7-69. In Band Emissions Plot MIMO ANT1 (20MHz 802.11be (106+26 Tones) (UNII Band 5) – Ch. 45) - VLP



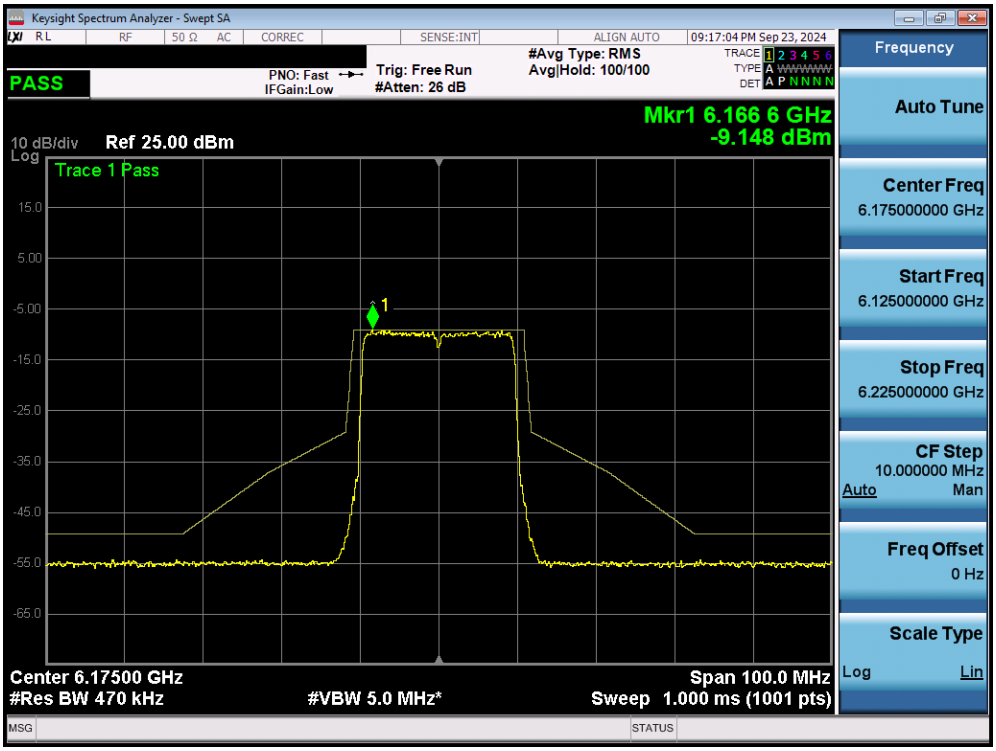
Plot 7-70. In Band Emissions Plot MIMO ANT1 (80MHz 802.11be (484+242 Tones) (UNII Band 5) – Ch. 39) VLP



Plot 7-71. In Band Emissions Plot MIMO ANT1 (160MHz 802.11be (996+484 Tones) (UNII Band 5) – Ch. 47) VLP



Plot 7-72. In Band Emissions Plot MIMO ANT1 (320MHz 802.11be (3*996+484 Tones) (UNII Band 5) – Ch. 31) VLP



Plot 7-73. In Band Emissions Plot MIMO ANT1 (20MHz 802.11ax/be (Full Tones) (UNII Band 5) – Ch. 45) - VLP