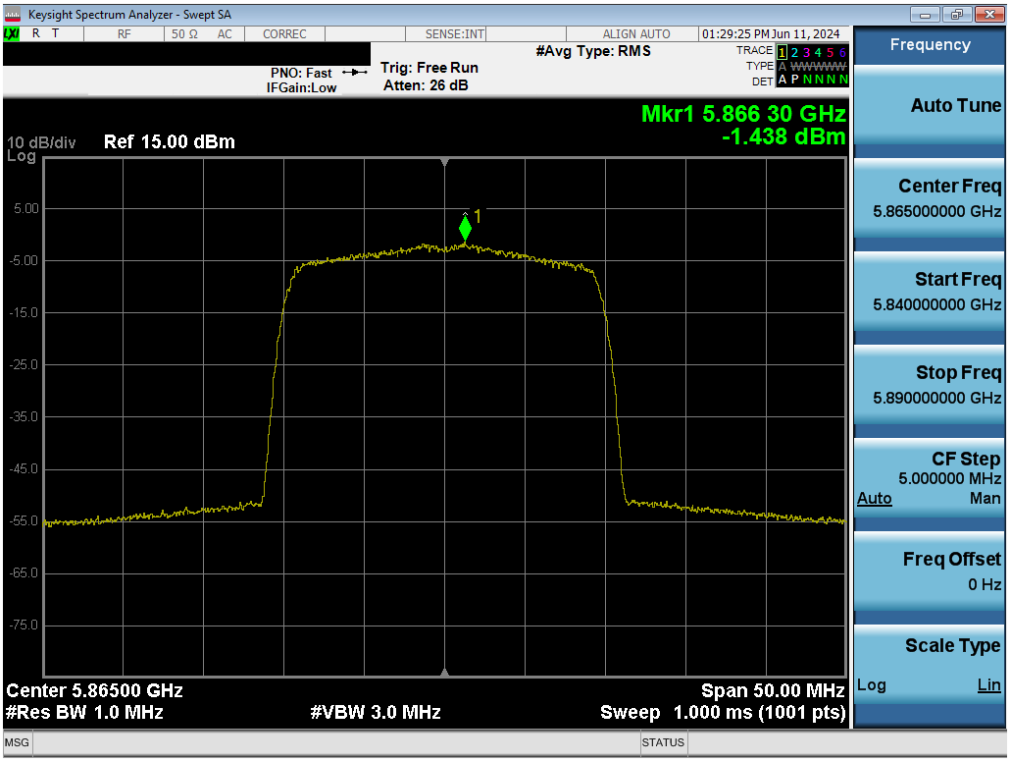
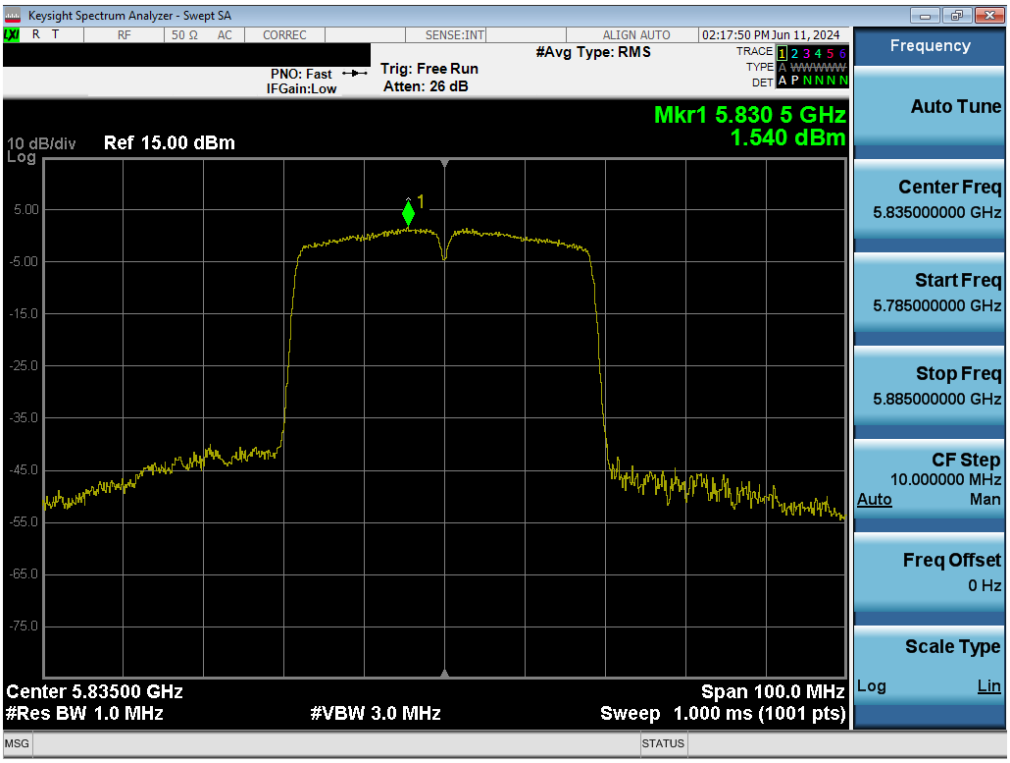
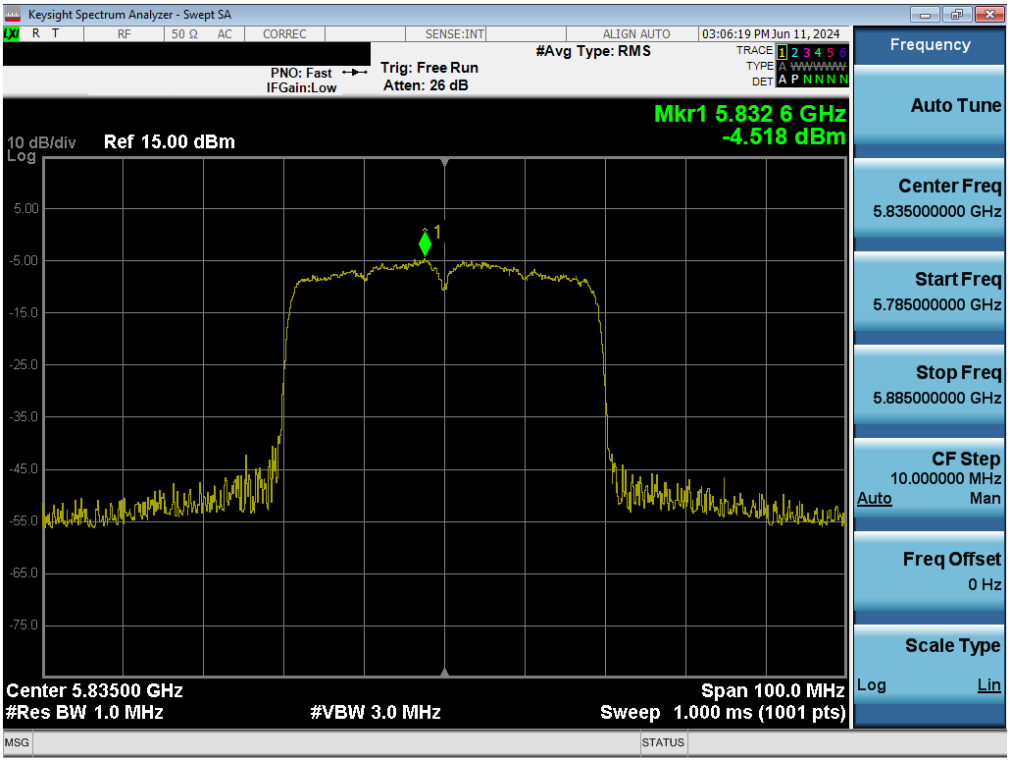


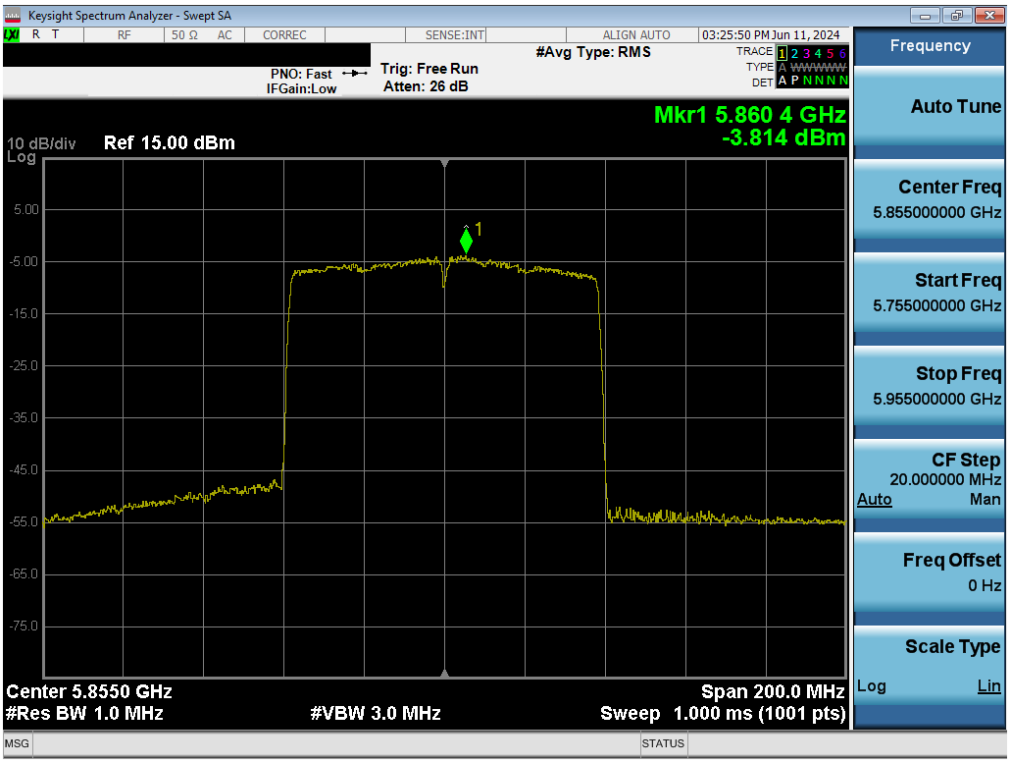
Plot 7-117. Power Spectral Density Plot MIMO ANT1 (20MHz BW 802.11ax (UNII Band 4) – Ch. 173)



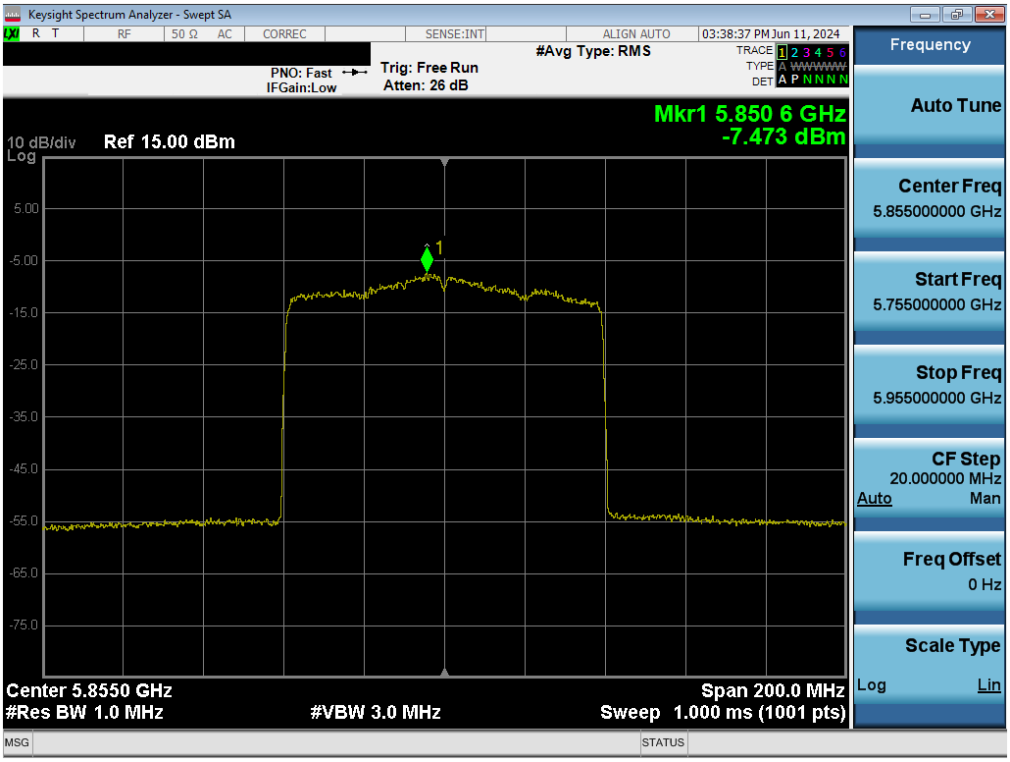
Plot 7-118. Power Spectral Density Plot MIMO ANT1 (40MHz BW 802.11n (UNII Band 3/4) – Ch. 167)



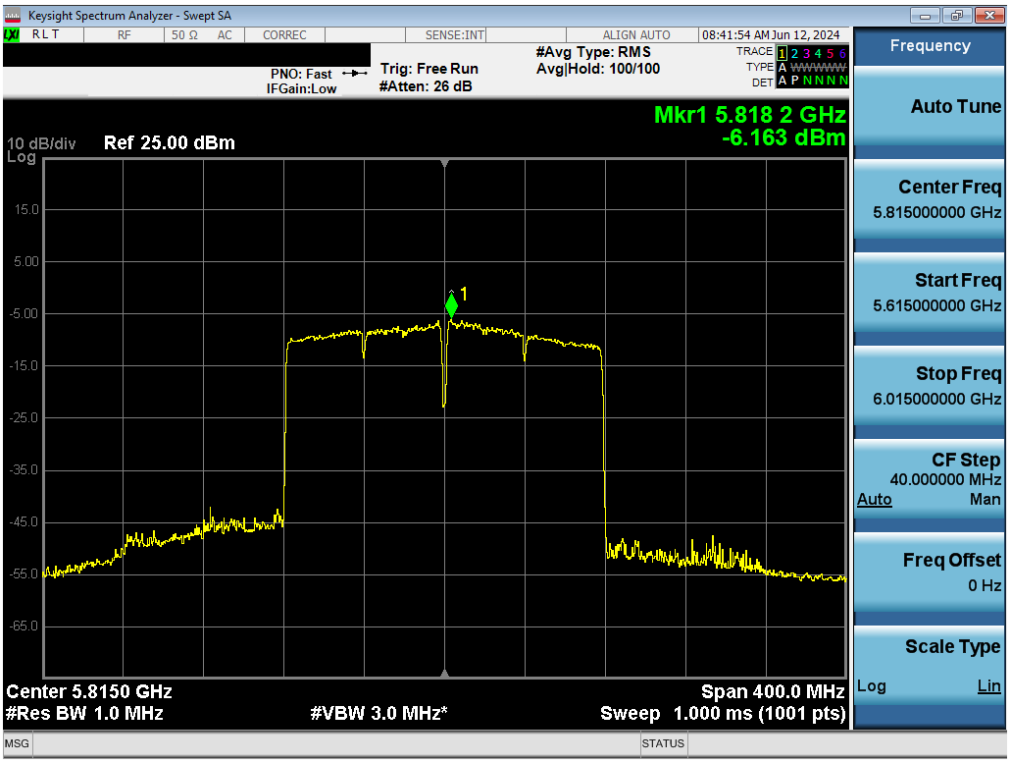
Plot 7-119. Power Spectral Density Plot MIMO ANT1 (40MHz BW 802.11ax (UNII Band 3/4) – Ch. 167)



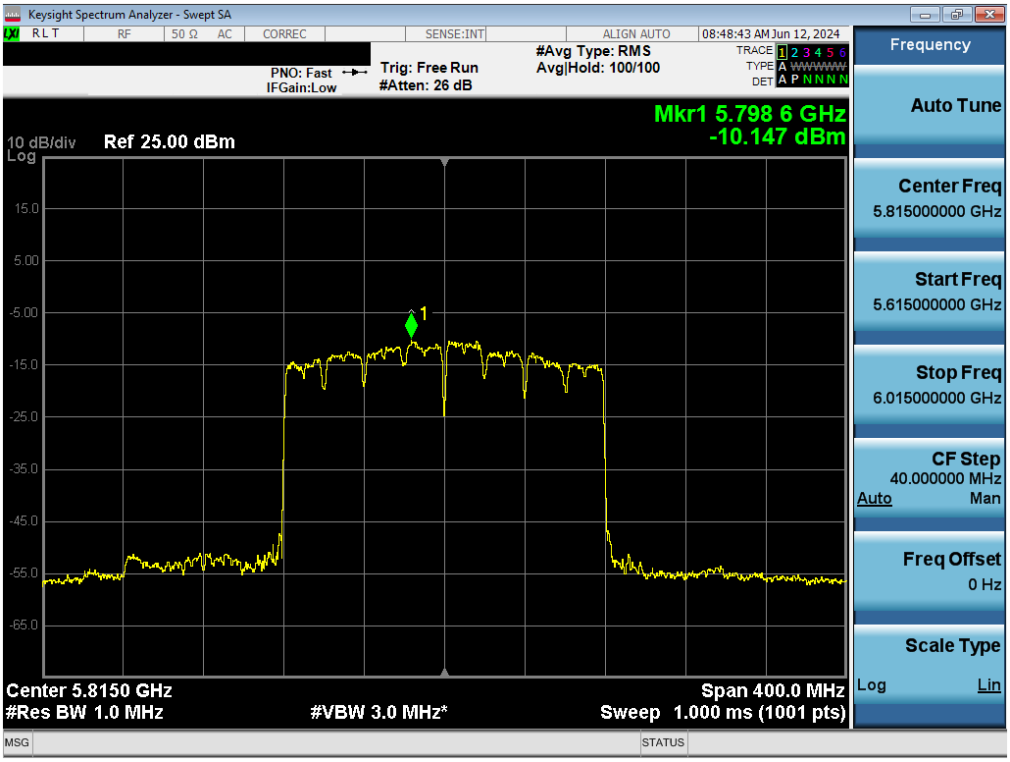
Plot 7-120. Power Spectral Density Plot MIMO ANT1 (80MHz BW 802.11ac (UNII Band 3/4) – Ch. 171)



Plot 7-121. Power Spectral Density Plot MIMO ANT1 (80MHz BW 802.11ax (UNII Band 3/4) – Ch. 171)

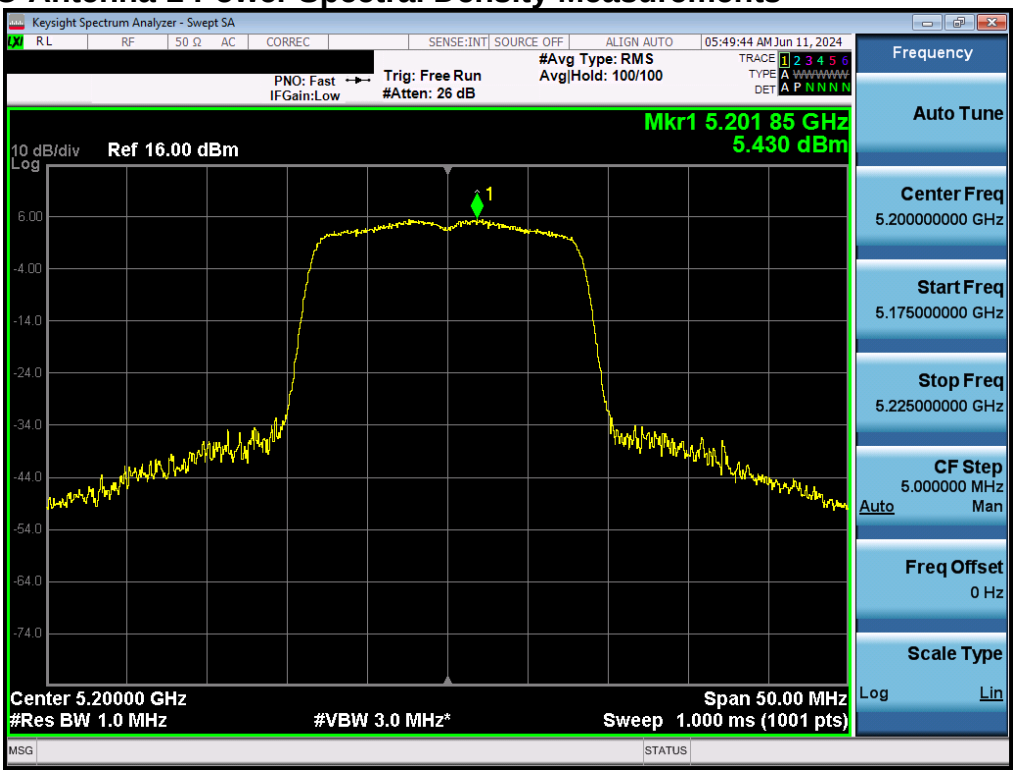


Plot 7-122. Power Spectral Density Plot MIMO ANT1 (160MHz BW 802.11ac (UNII Band 3/4) – Ch. 163)

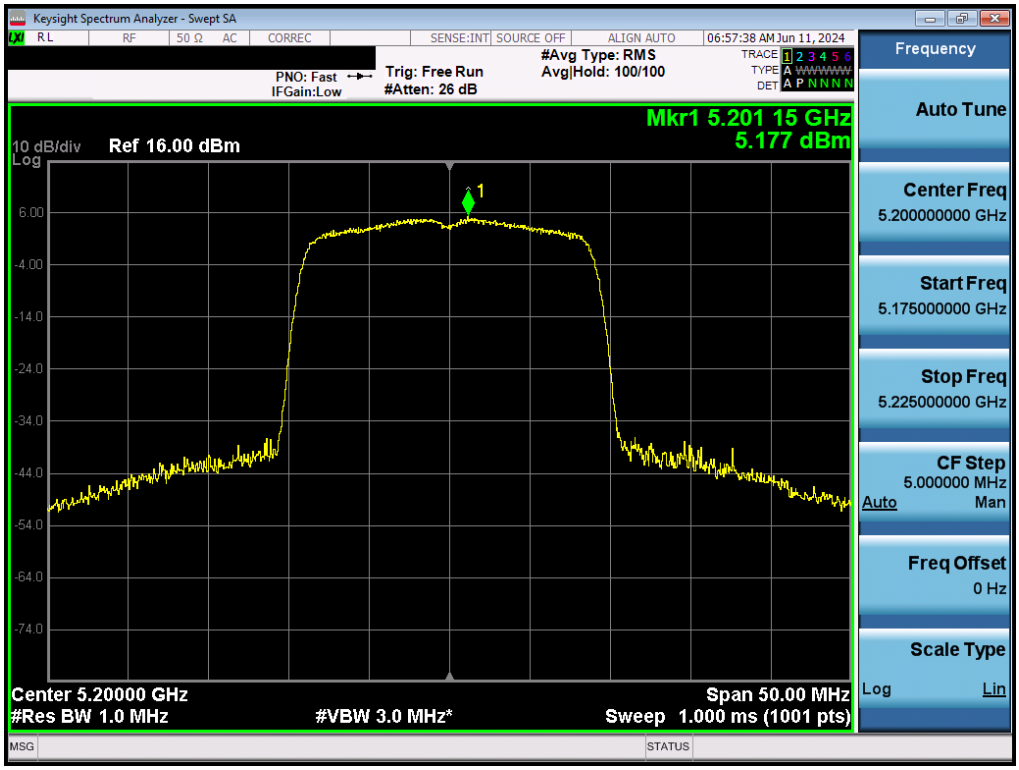


Plot 7-123. Power Spectral Density Plot MIMO ANT1 (160MHz BW 802.11ax (UNII Band 3/4) – Ch. 163)

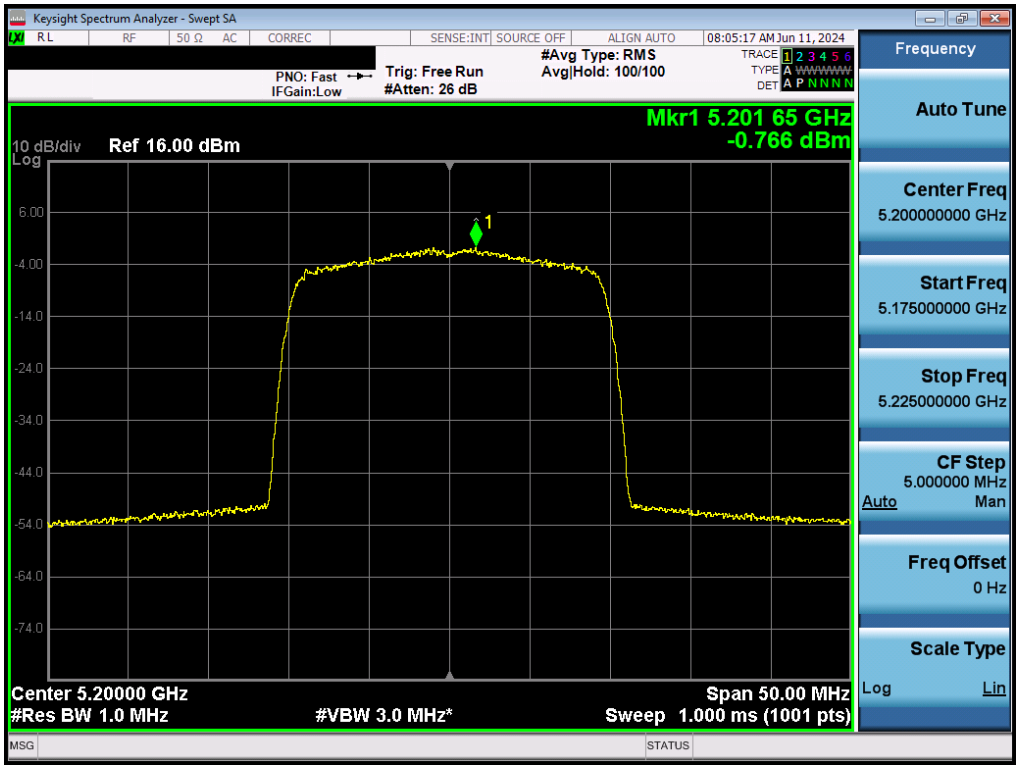
7.5.2 MIMO Antenna-2 Power Spectral Density Measurements



Plot 7-124. Power Spectral Density Plot MIMO ANT2 (802.11a (UNII Band 1) – Ch. 40)

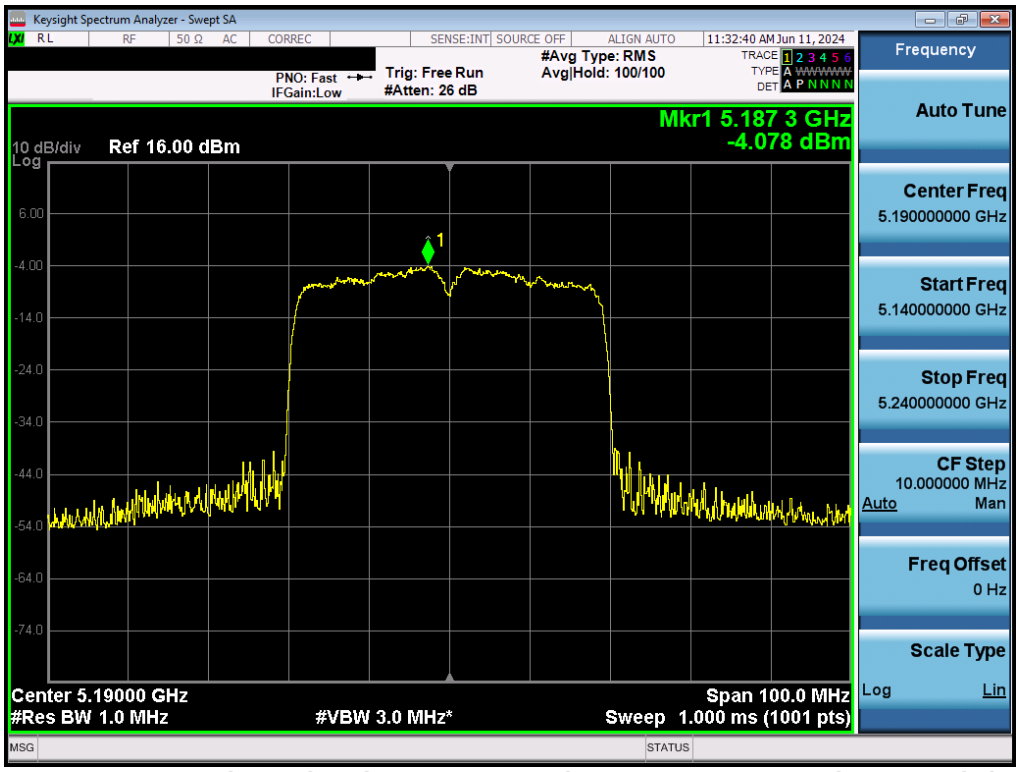


Plot 7-125. Power Spectral Density Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 1) – Ch. 40)

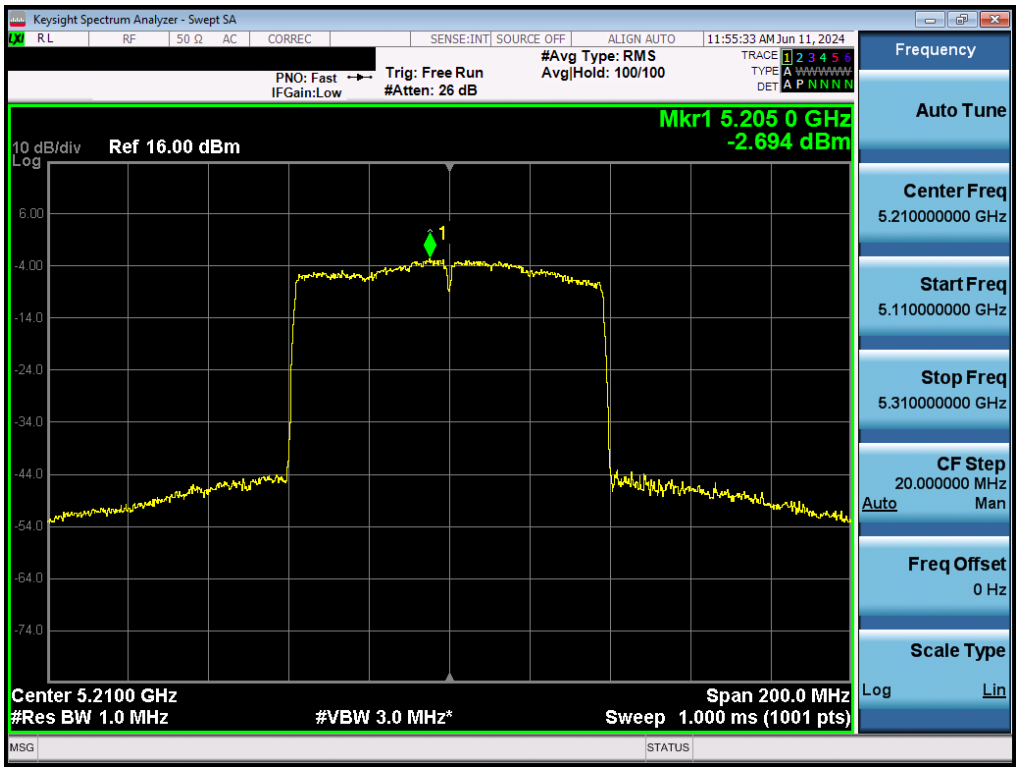


Plot 7-126. Power Spectral Density Plot MIMO ANT2 (20MHz BW 802.11ax (UNII Band 1) – Ch. 40)

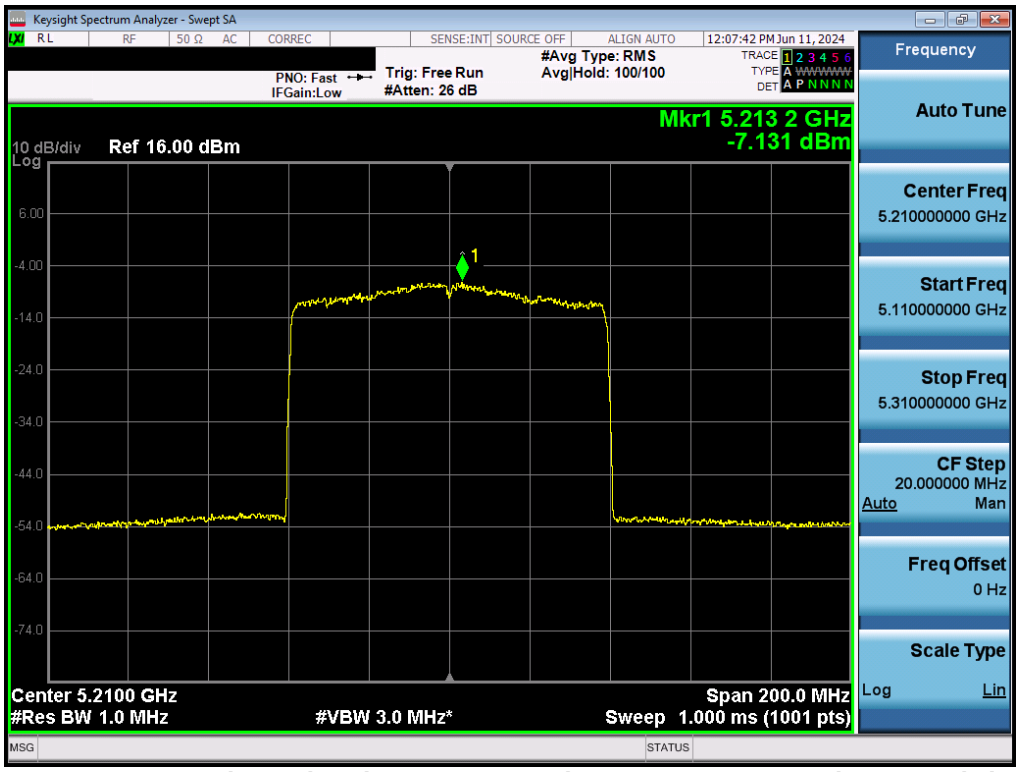
Plot 7-127. Power Spectral Density Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 1) – Ch. 38)



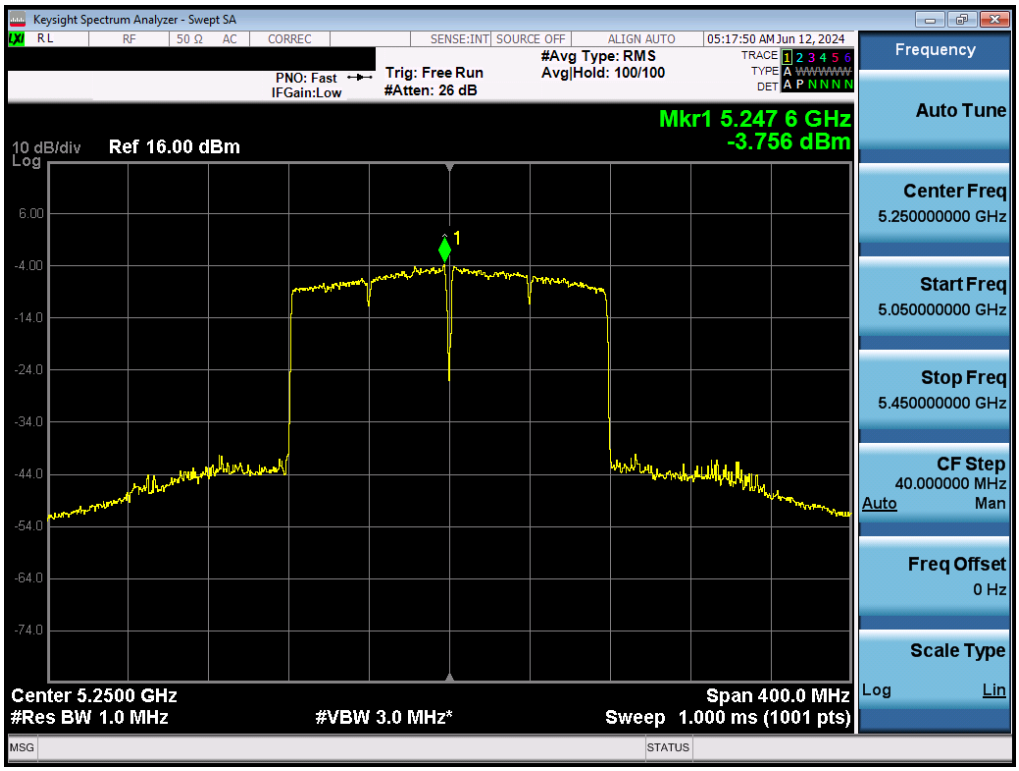
Plot 7-128. Power Spectral Density Plot MIMO ANT2 (40MHz BW 802.11ax (UNII Band 1) – Ch. 38)



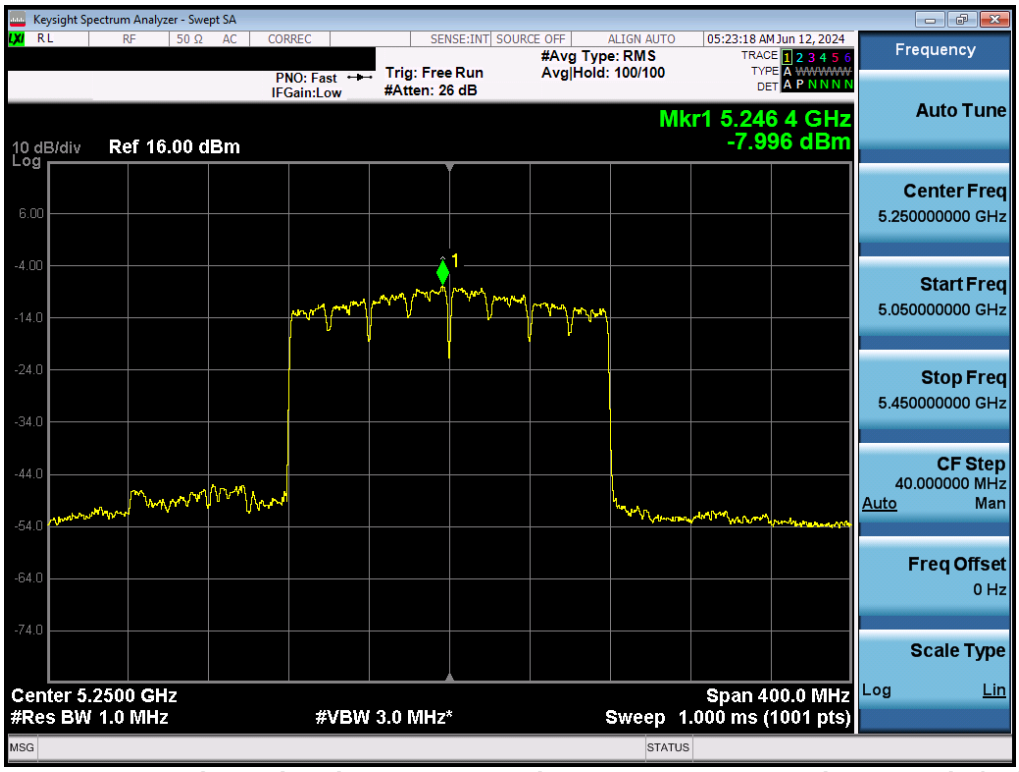
Plot 7-129. Power Spectral Density Plot MIMO ANT2 (80MHz BW 802.11ac (UNII Band 1) – Ch. 42)



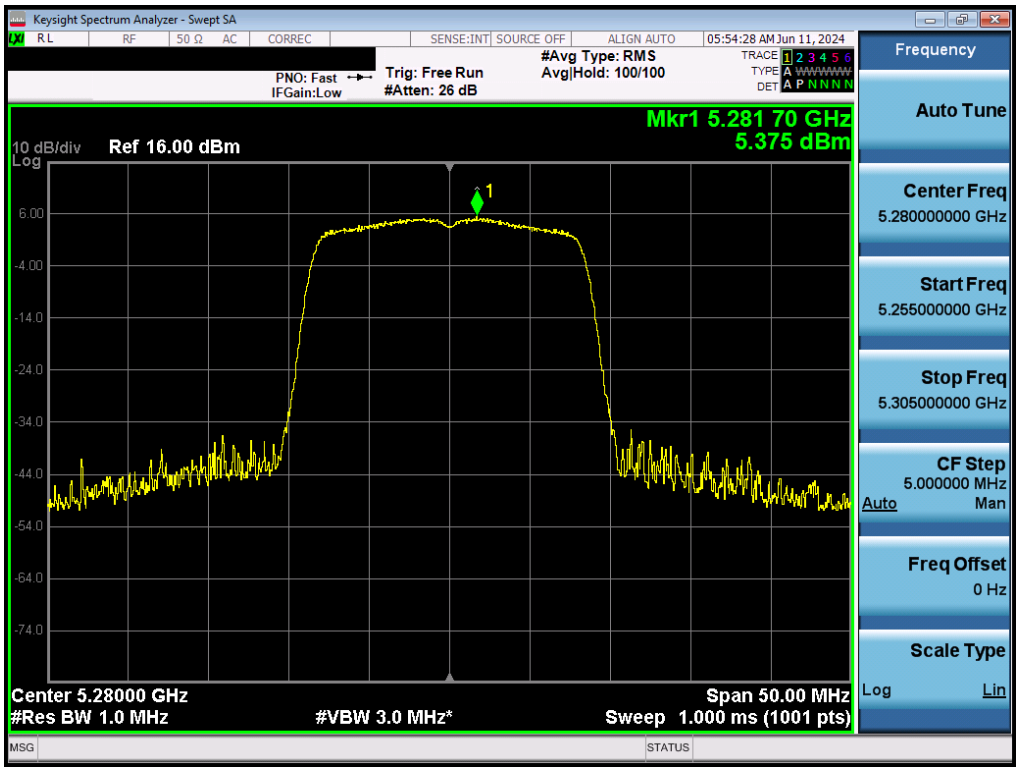
Plot 7-130. Power Spectral Density Plot MIMO ANT2 (80MHz BW 802.11ax (UNII Band 1) – Ch. 42)



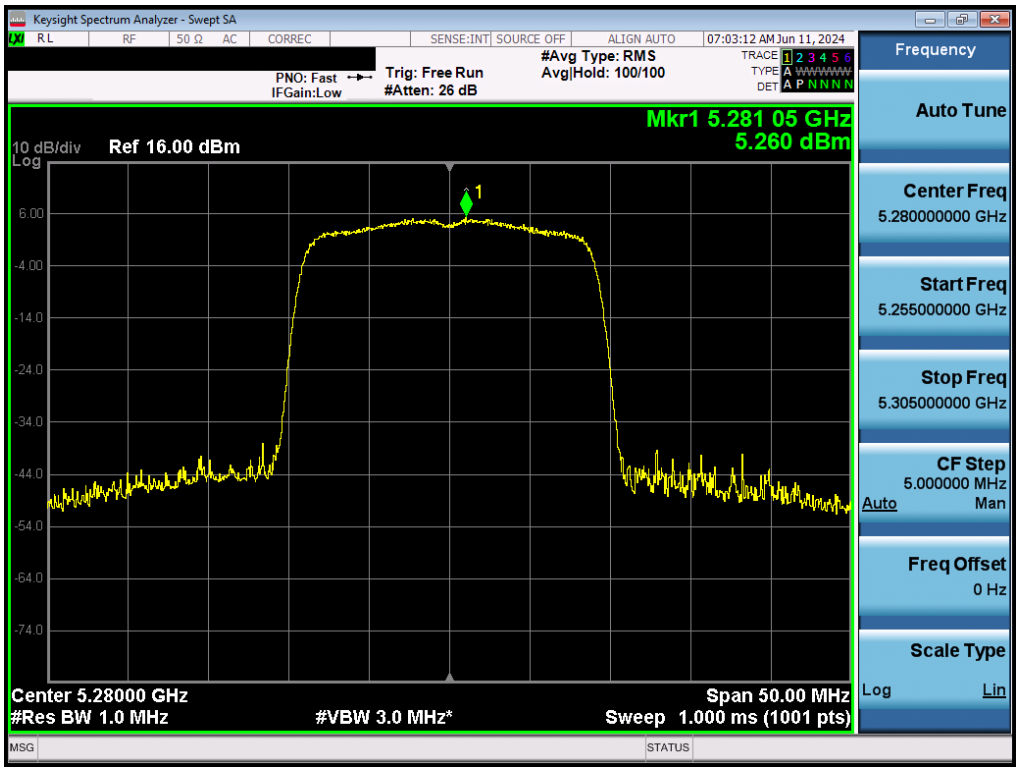
Plot 7-131. Power Spectral Density Plot MIMO ANT2 (160MHz BW 802.11ac (UNII Band 1/2A) – Ch. 50)



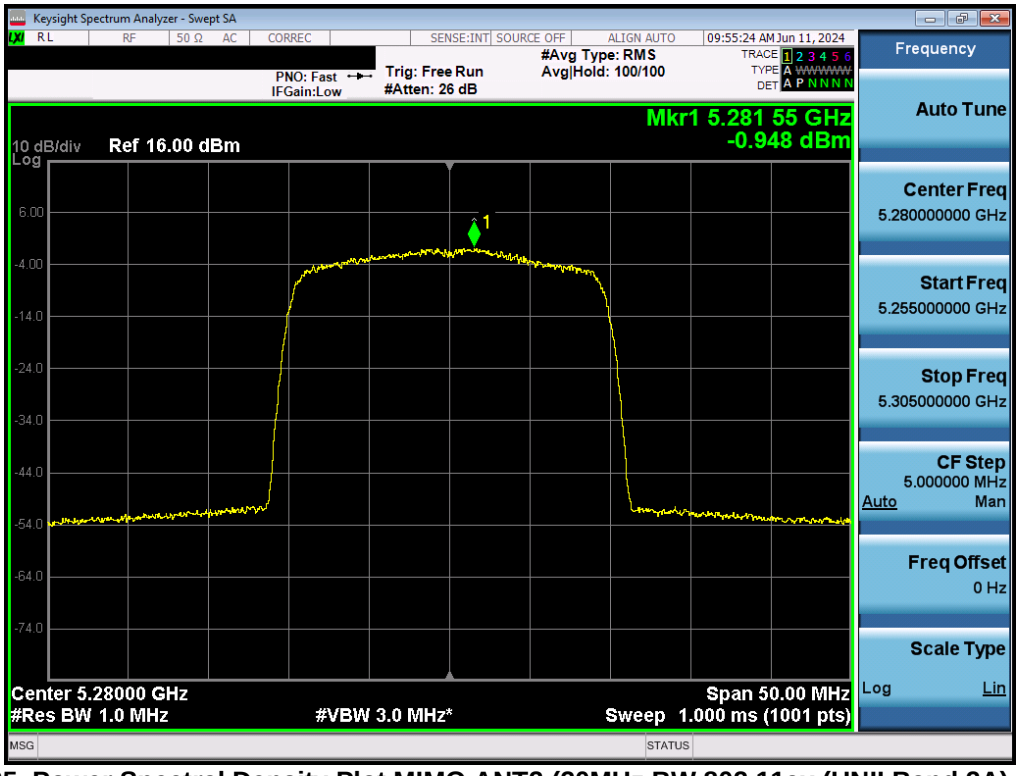
Plot 7-132. Power Spectral Density Plot MIMO ANT2 (160MHz BW 802.11ax (UNII Band 1/2A) – Ch. 50)



Plot 7-133. Power Spectral Density Plot MIMO ANT2 (802.11a (UNII Band 2A) – Ch. 56)

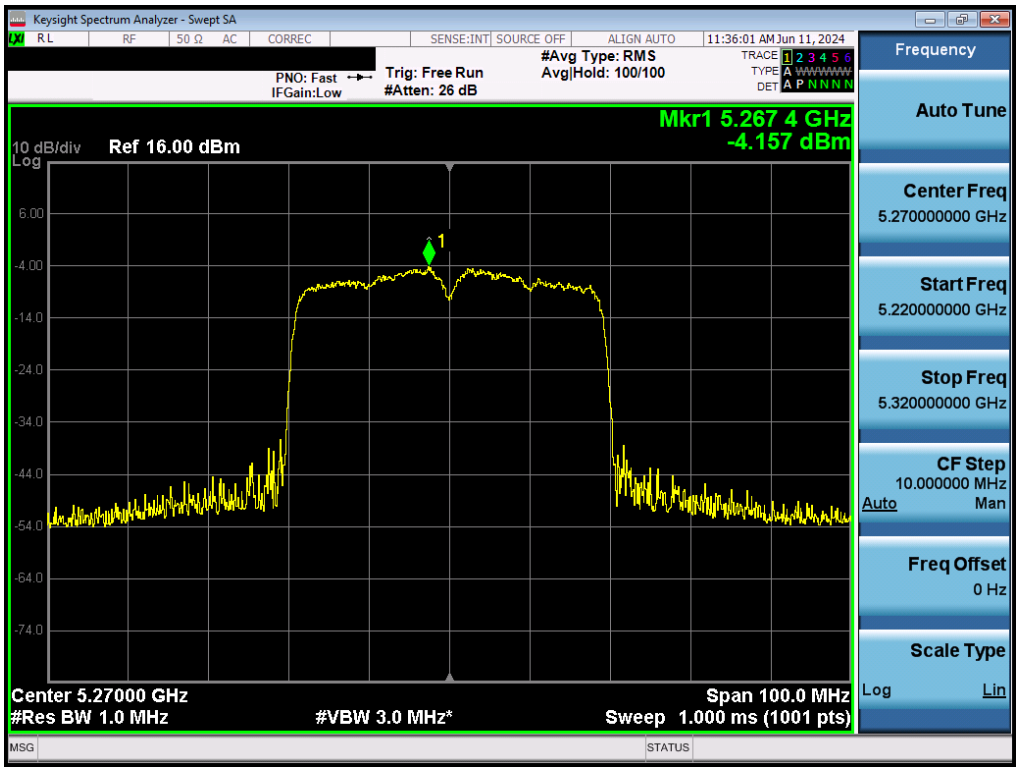


Plot 7-134. Power Spectral Density Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 2A) – Ch. 56)

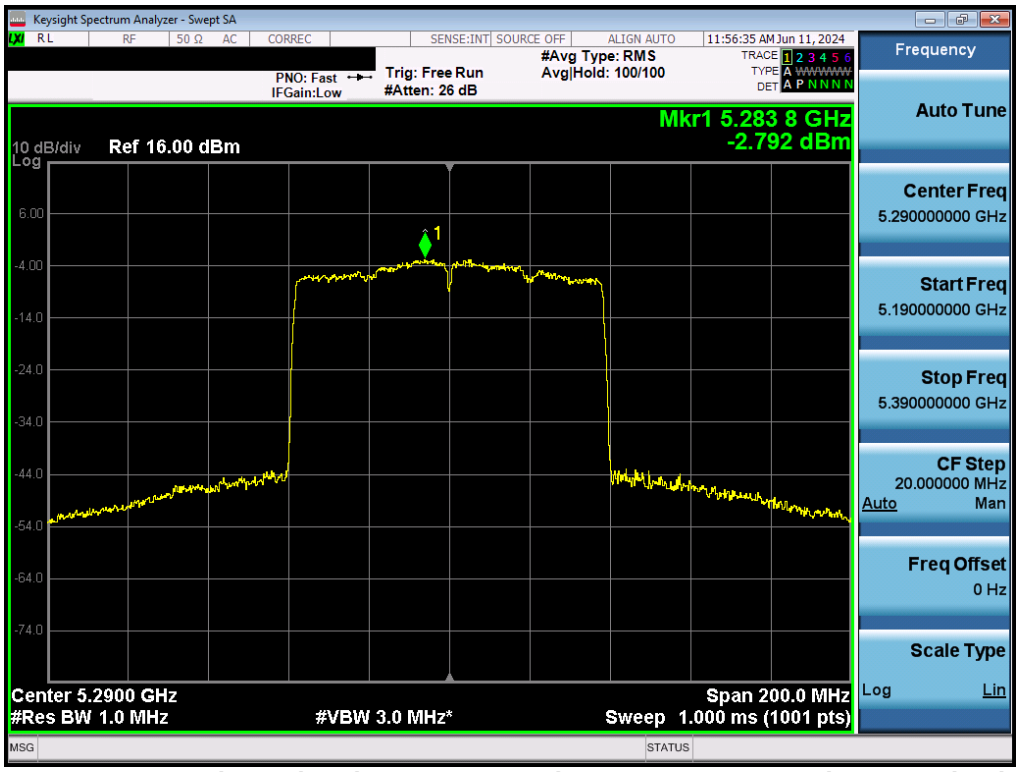


Plot 7-135. Power Spectral Density Plot MIMO ANT2 (20MHz BW 802.11ax (UNII Band 2A) – Ch. 56)

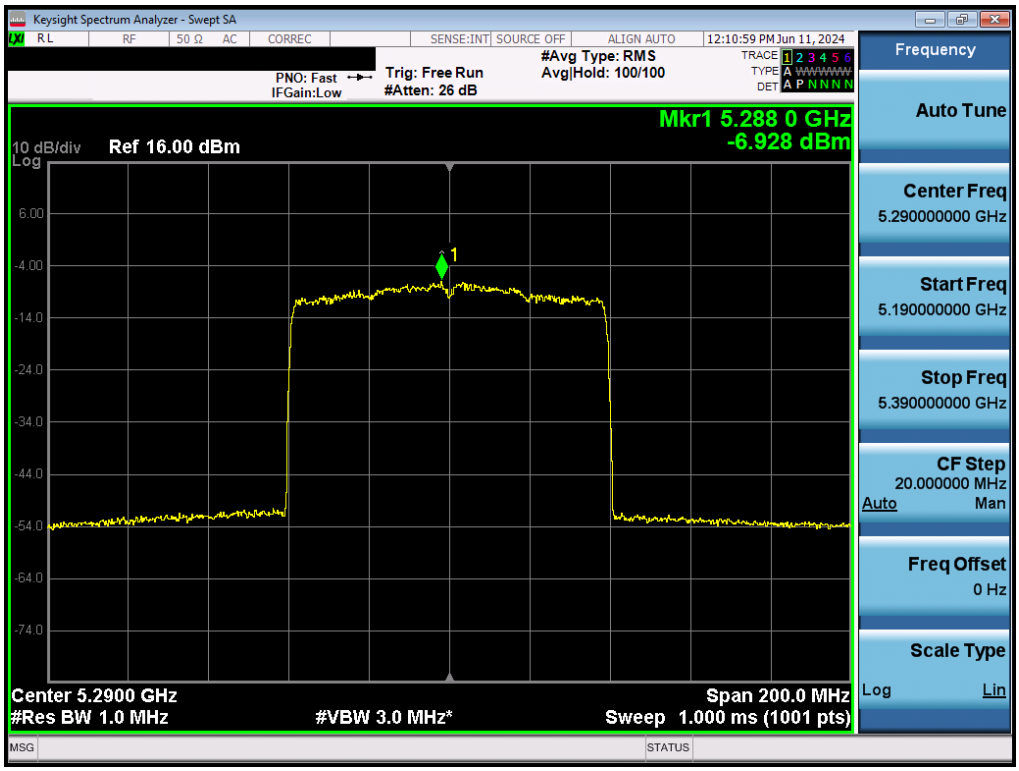
Plot 7-136. Power Spectral Density Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 2A) – Ch. 54)



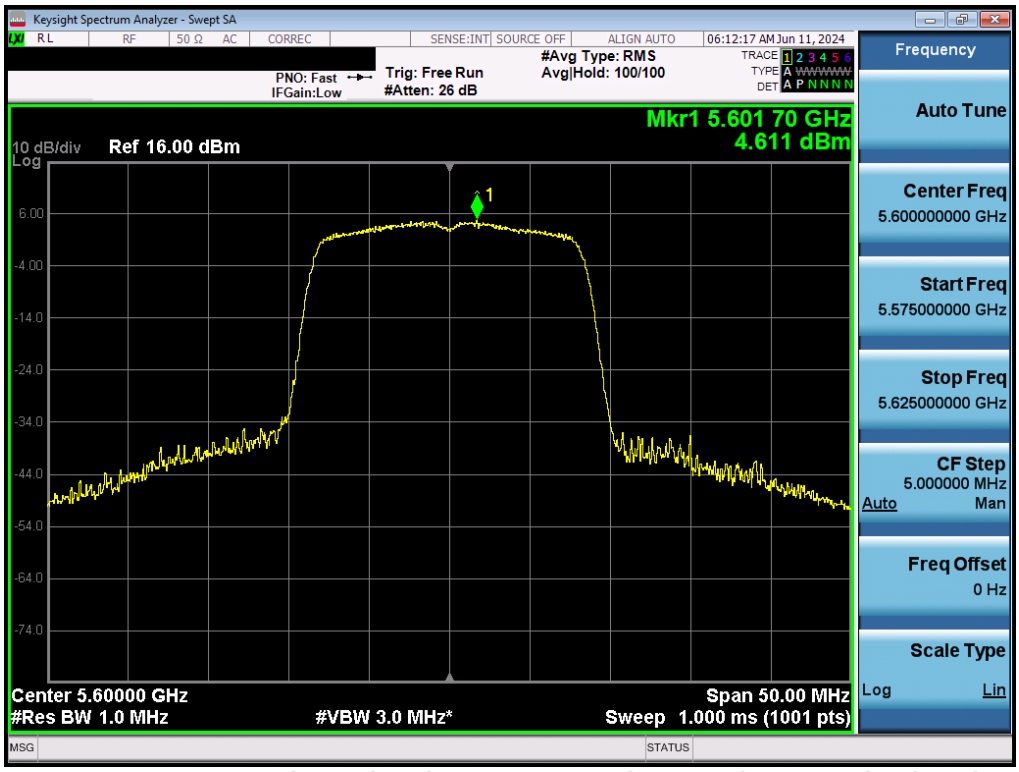
Plot 7-137. Power Spectral Density Plot MIMO ANT2 (40MHz BW 802.11ax (UNII Band 2A) – Ch. 54)



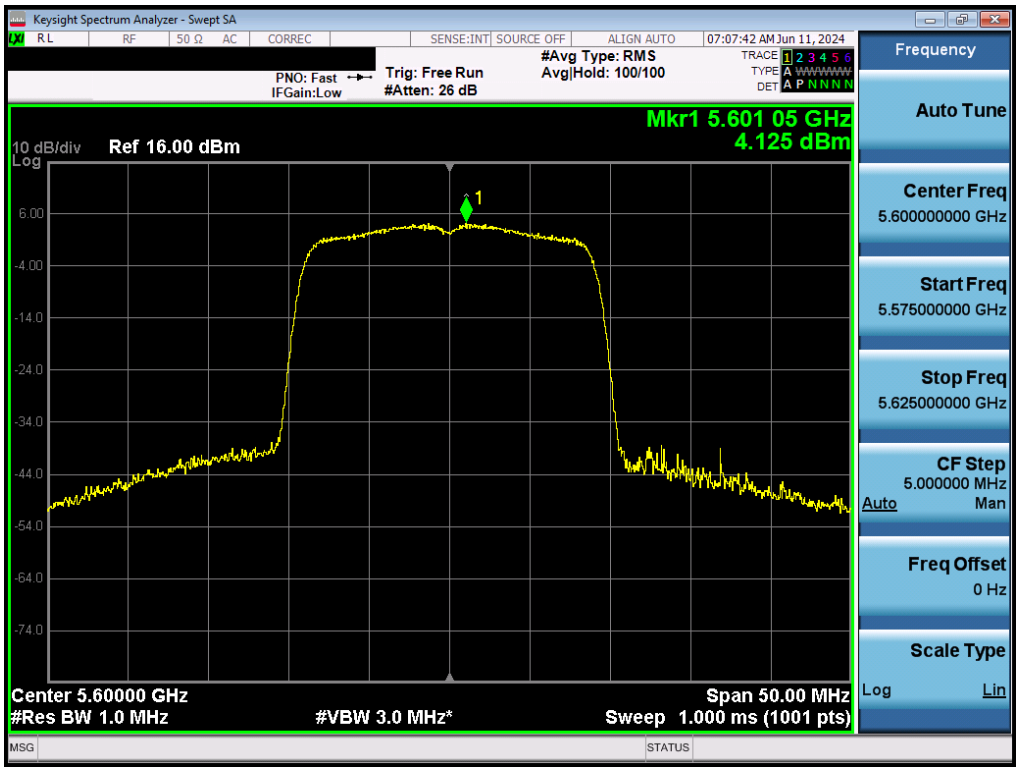
Plot 7-138. Power Spectral Density Plot MIMO ANT2 (80MHz BW 802.11ac (UNII Band 2A) – Ch. 58)



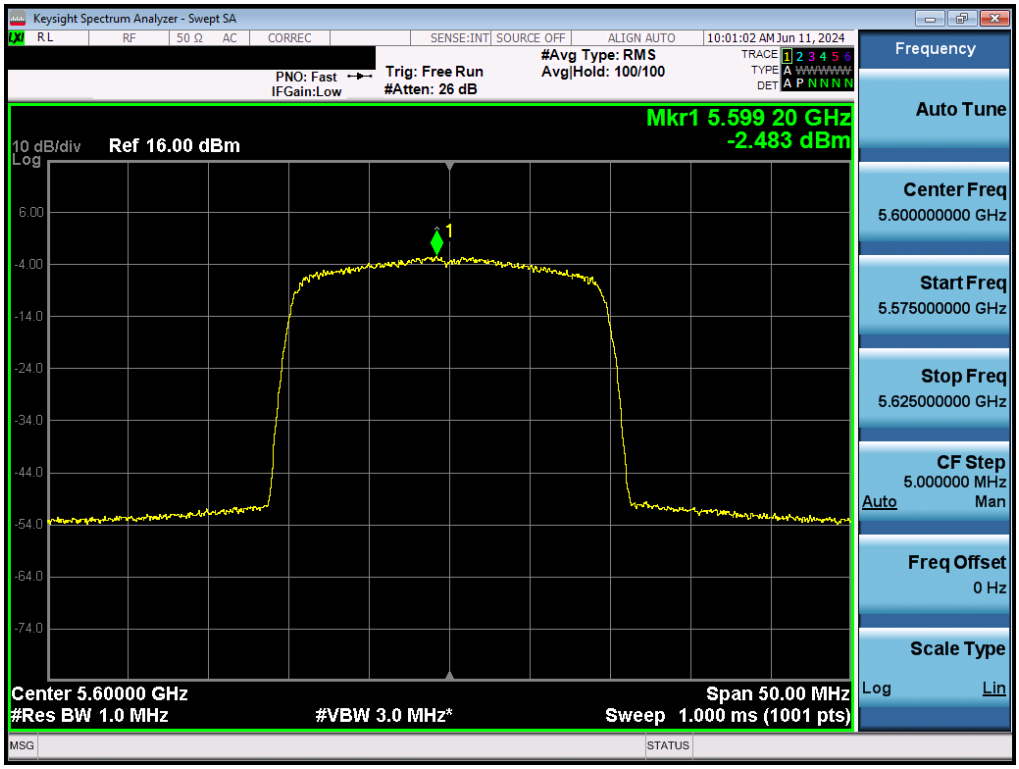
Plot 7-139. Power Spectral Density Plot MIMO ANT2 (80MHz BW 802.11ax (UNII Band 2A) – Ch. 58)



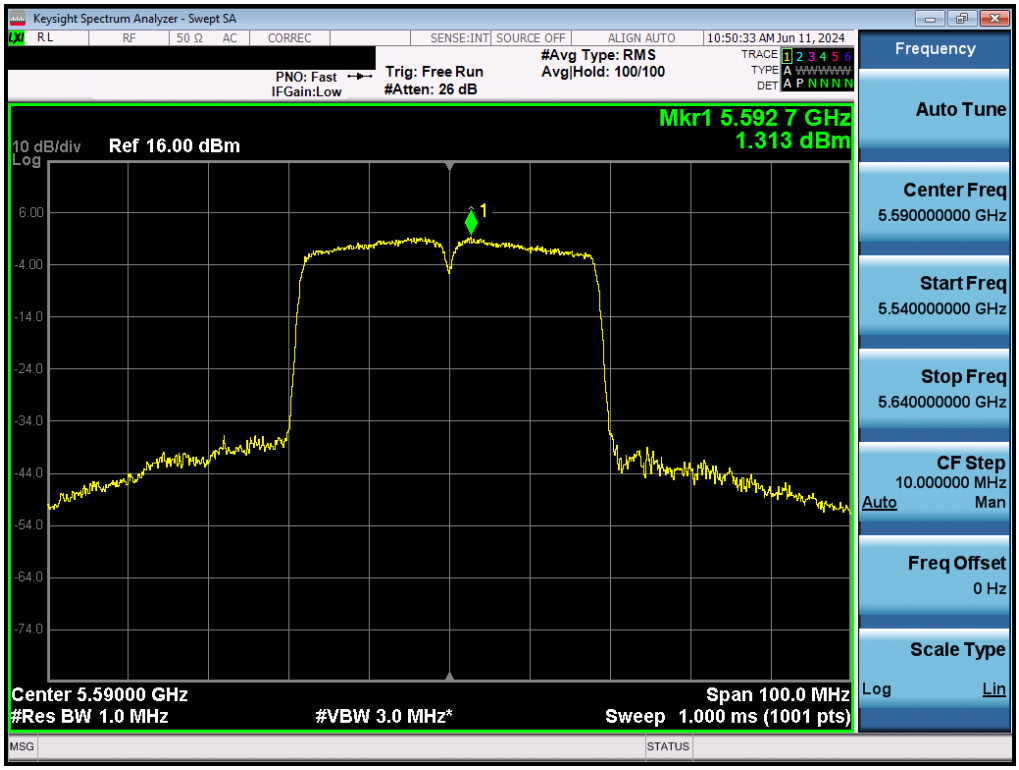
Plot 7-140. Power Spectral Density Plot MIMO ANT2 (802.11a (UNII Band 2C) – Ch. 120)



Plot 7-141. Power Spectral Density Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 2C) – Ch. 120)

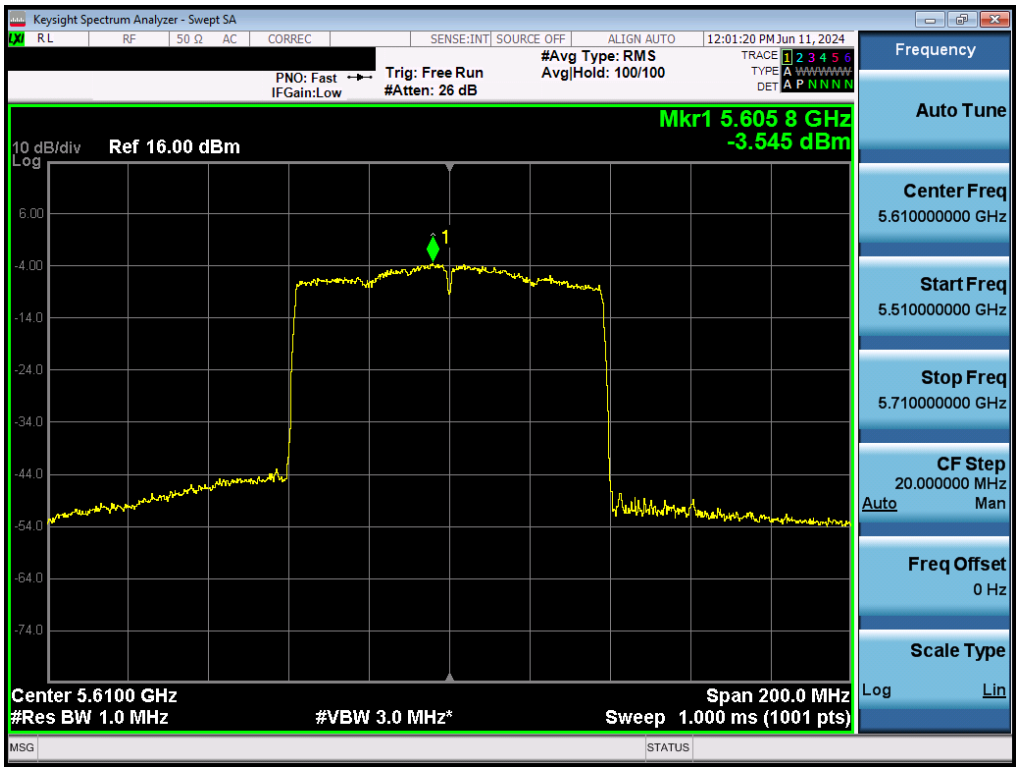


Plot 7-142. Power Spectral Density Plot MIMO ANT2 (20MHz BW 802.11ax (UNII Band 2C) – Ch. 120)

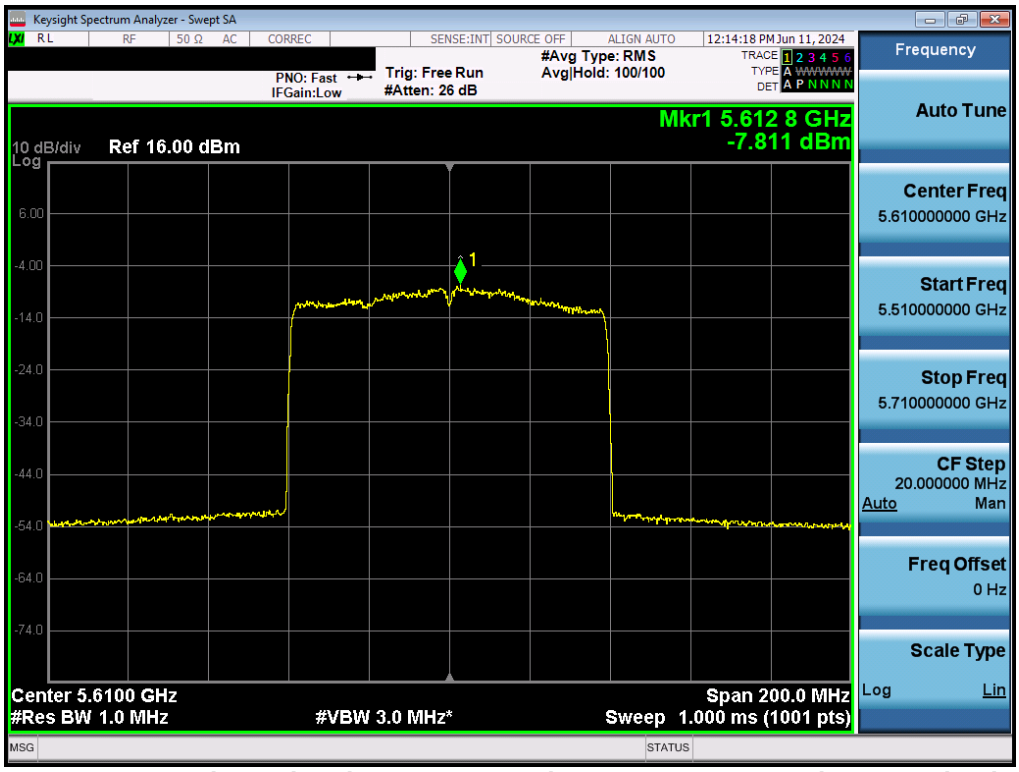


Plot 7-143. Power Spectral Density Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 2C) – Ch. 118)

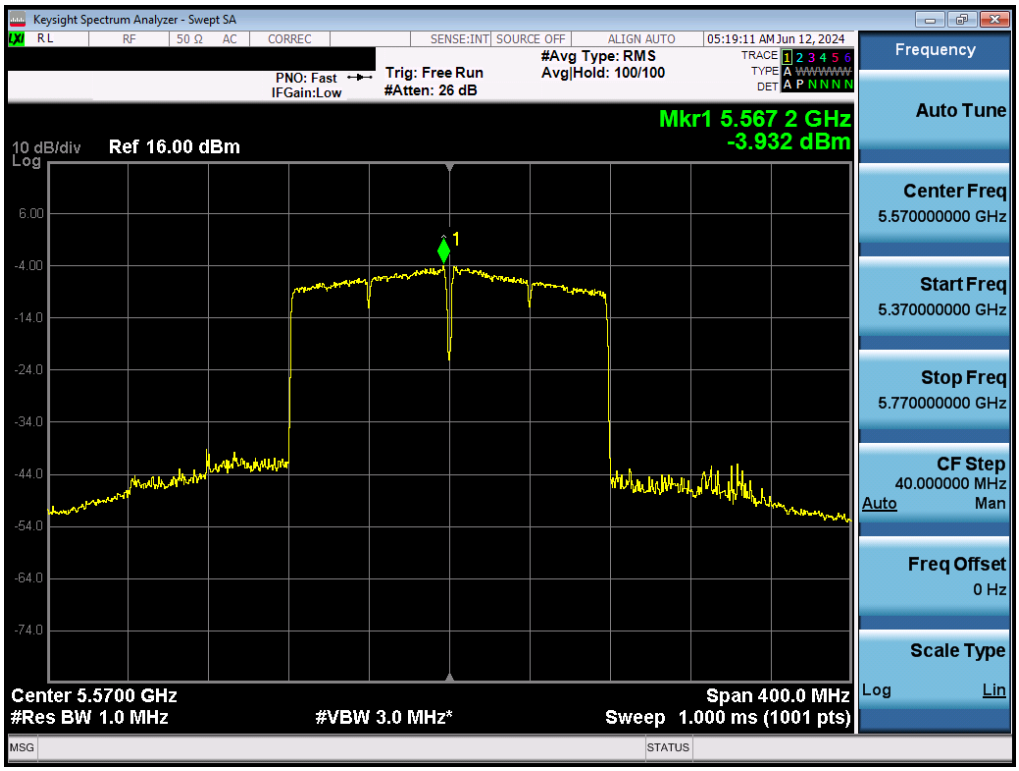
Plot 7-144. Power Spectral Density Plot MIMO ANT2 (40MHz BW 802.11ax (UNII Band 2C) – Ch. 118)



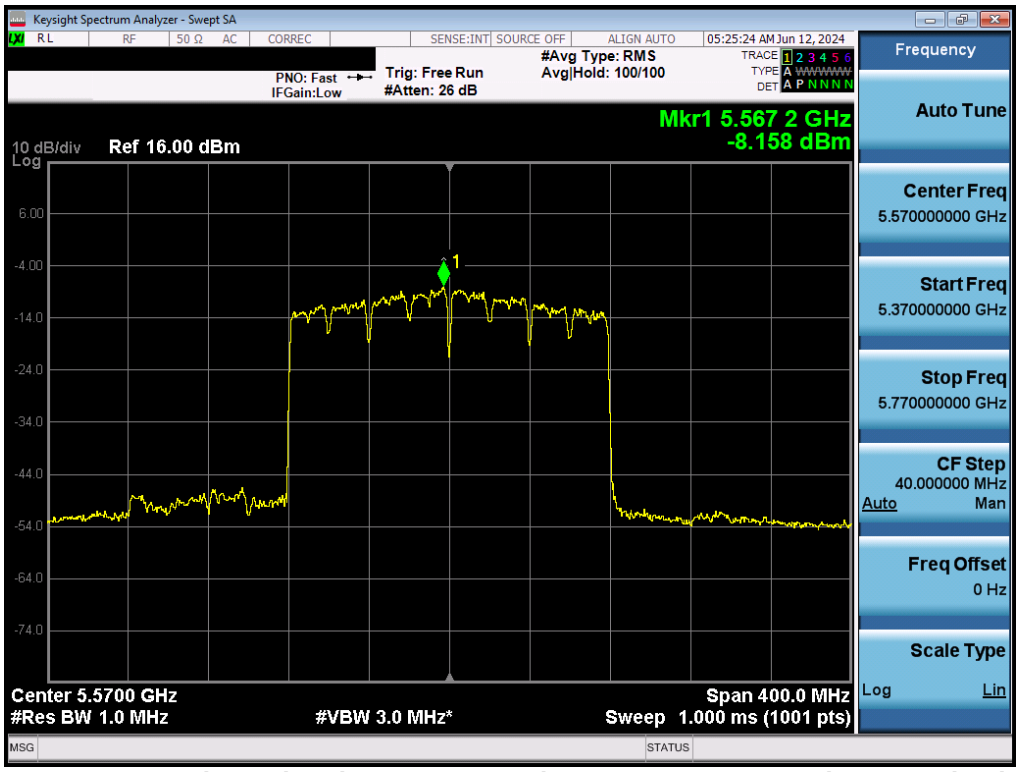
Plot 7-145. Power Spectral Density Plot MIMO ANT2 (80MHz BW 802.11ac (UNII Band 2C) – Ch. 122)



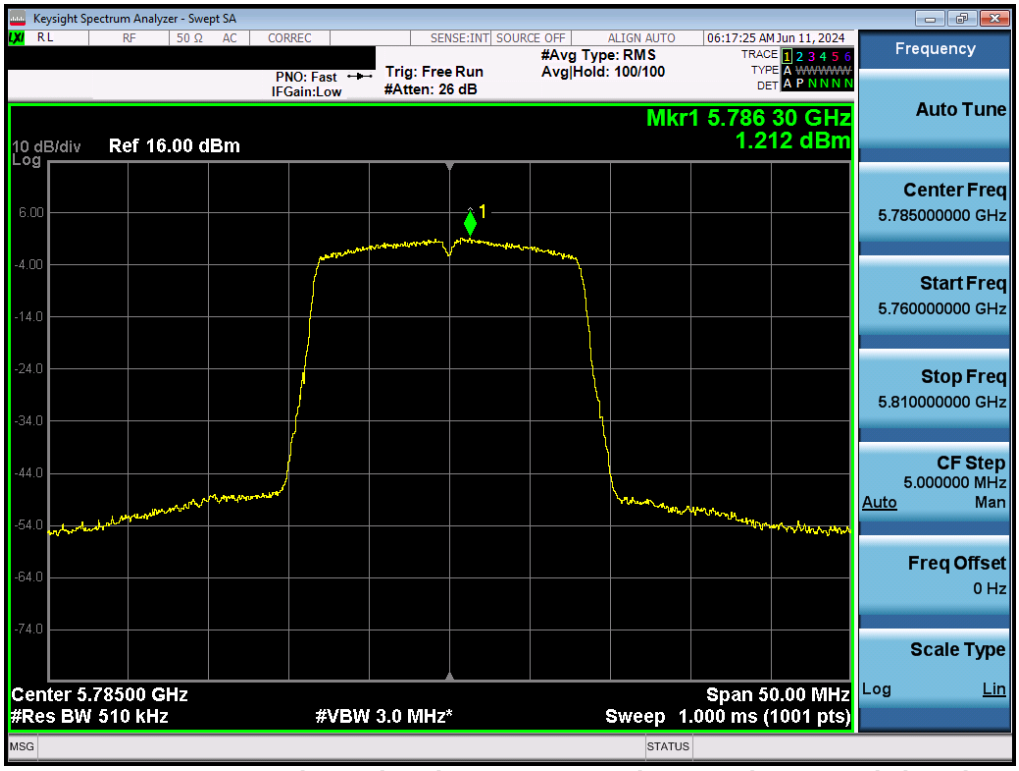
Plot 7-146. Power Spectral Density Plot MIMO ANT2 (80MHz BW 802.11ax (UNII Band 2C) – Ch. 122)



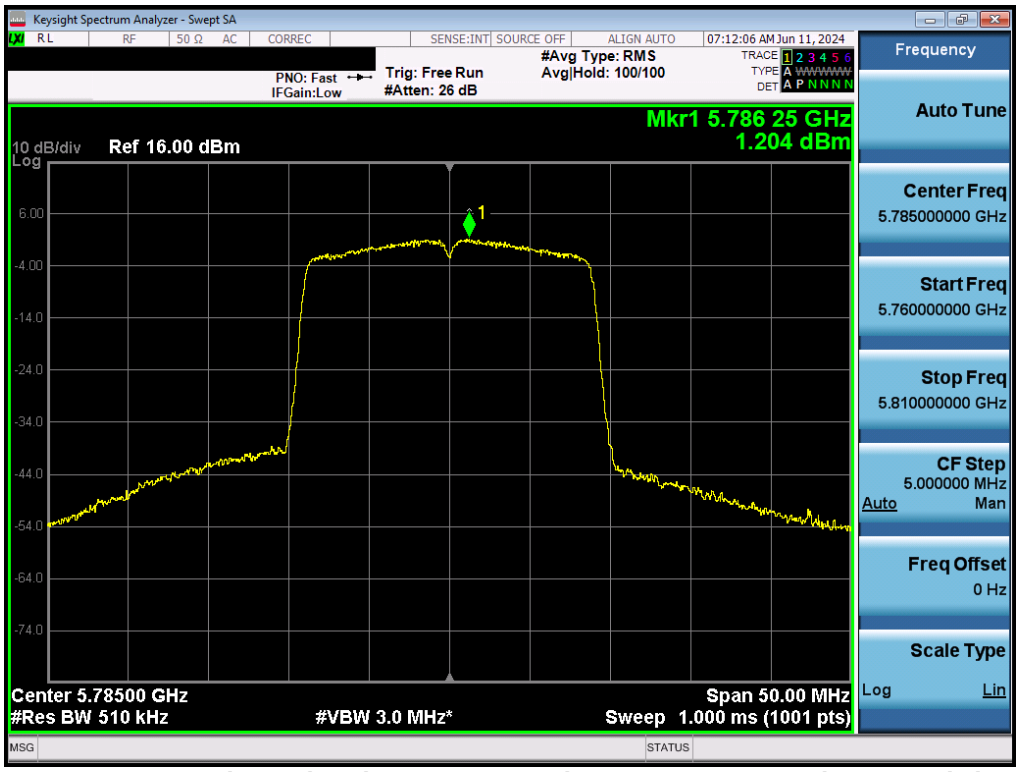
Plot 7-147. Power Spectral Density Plot MIMO ANT2 (160MHz BW 802.11ac (UNII Band 2C) – Ch. 114)



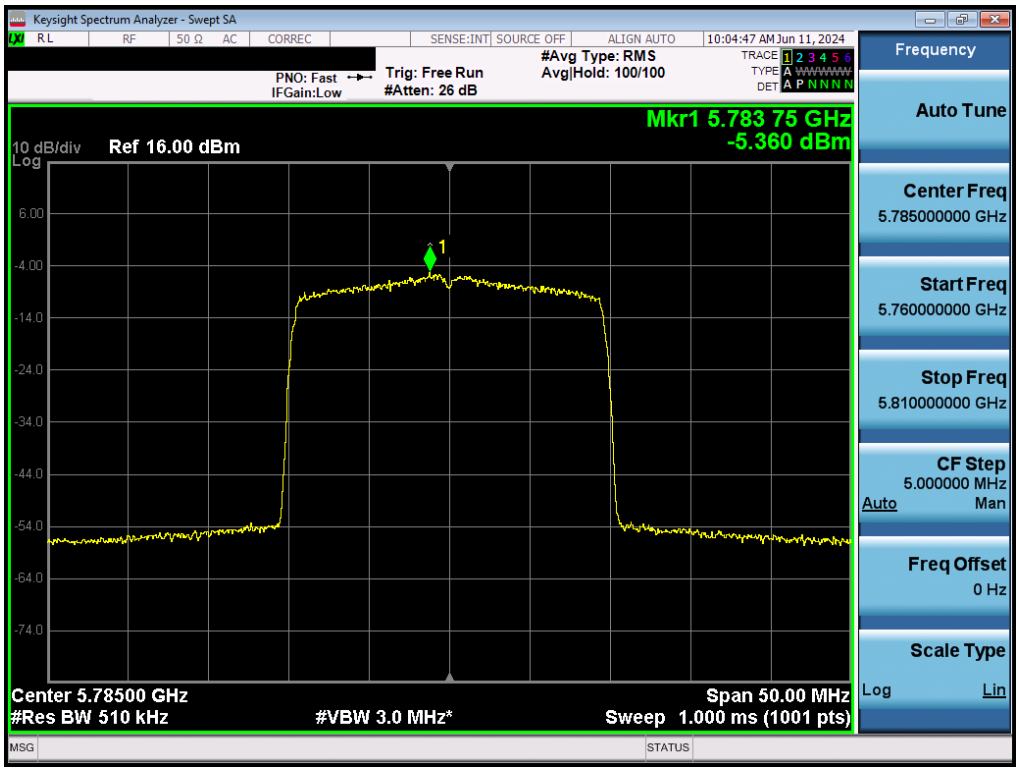
Plot 7-148. Power Spectral Density Plot MIMO ANT2 (160MHz BW 802.11ax (UNII Band 2C) – Ch. 114)



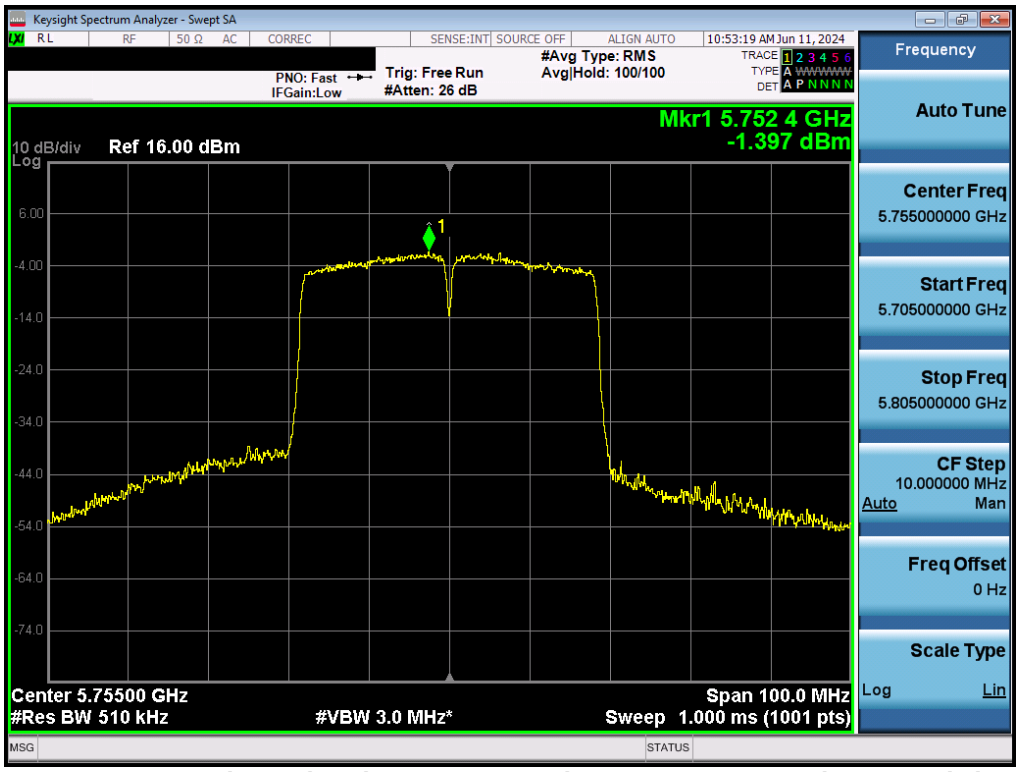
Plot 7-149. Power Spectral Density Plot MIMO ANT2 (802.11a (UNII Band 3) – Ch. 157)



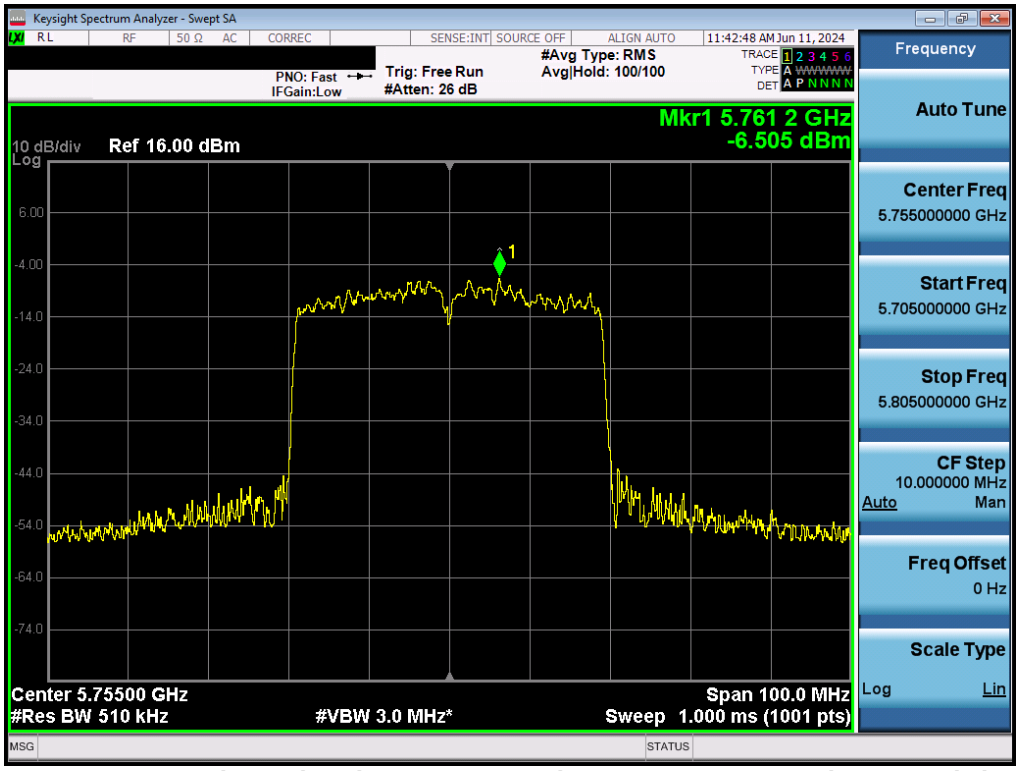
Plot 7-150. Power Spectral Density Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 3) – Ch. 157)



Plot 7-151. Power Spectral Density Plot MIMO ANT2 (20MHz BW 802.11ax (UNII Band 3) – Ch. 157)



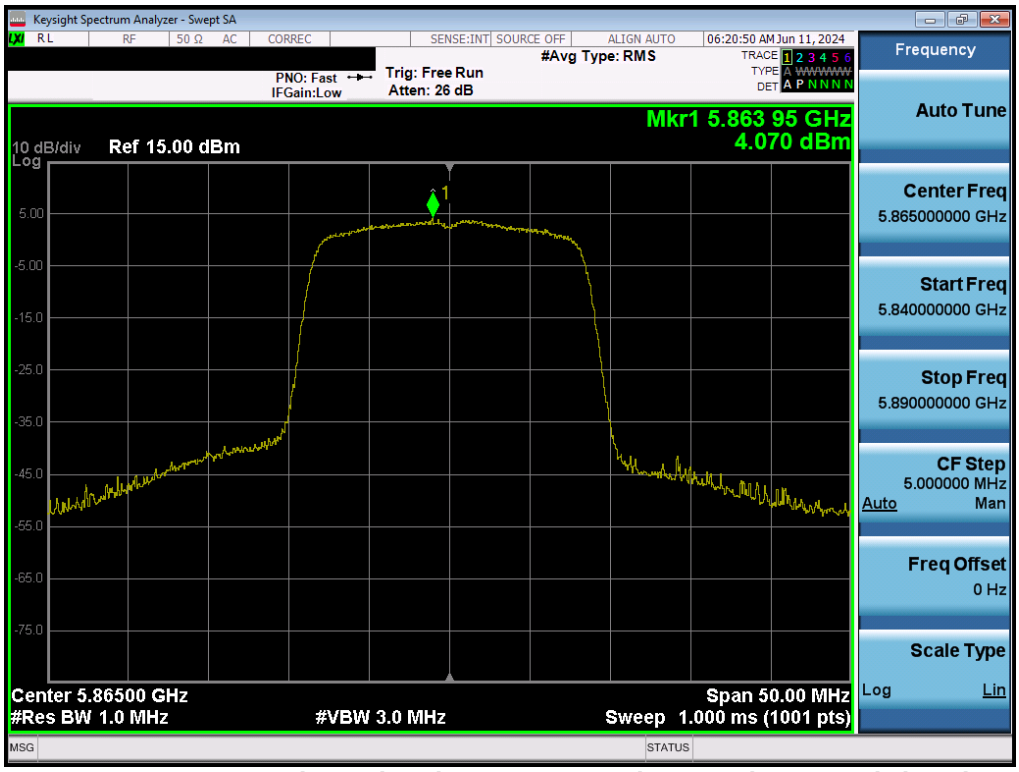
Plot 7-152. Power Spectral Density Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 3) – Ch. 151)



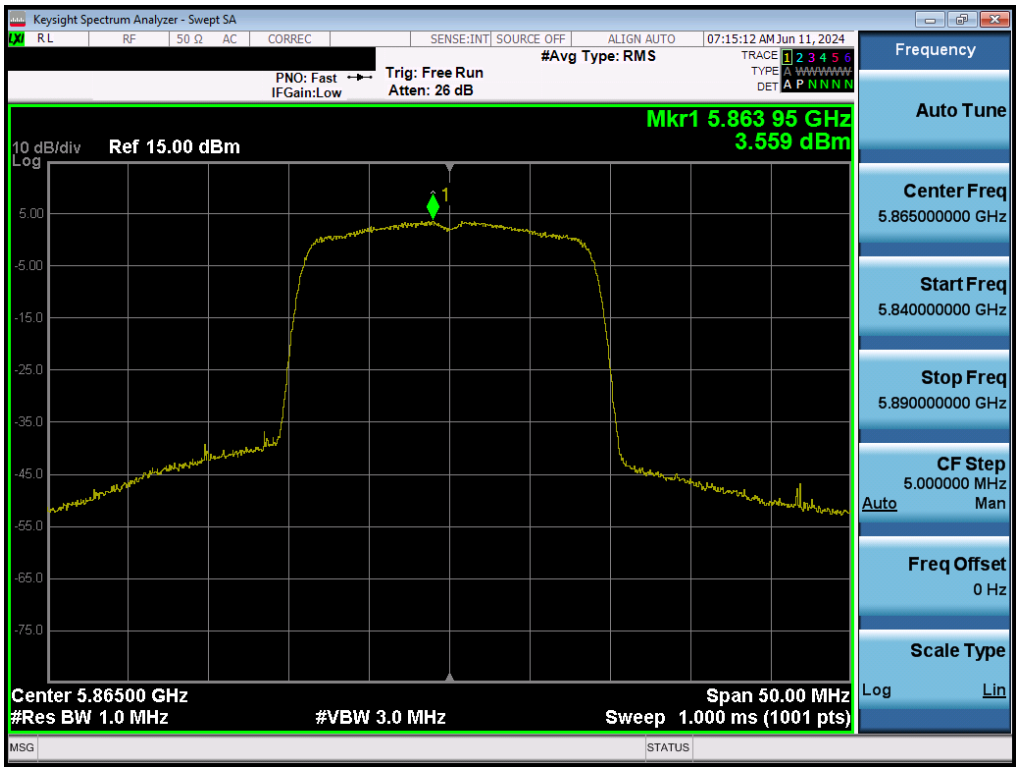
Plot 7-153. Power Spectral Density Plot MIMO ANT2 (40MHz BW 802.11ax (UNII Band 3) – Ch. 151)

Plot 7-154. Power Spectral Density Plot MIMO ANT2 (80MHz BW 802.11ac (UNII Band 3) – Ch. 155)

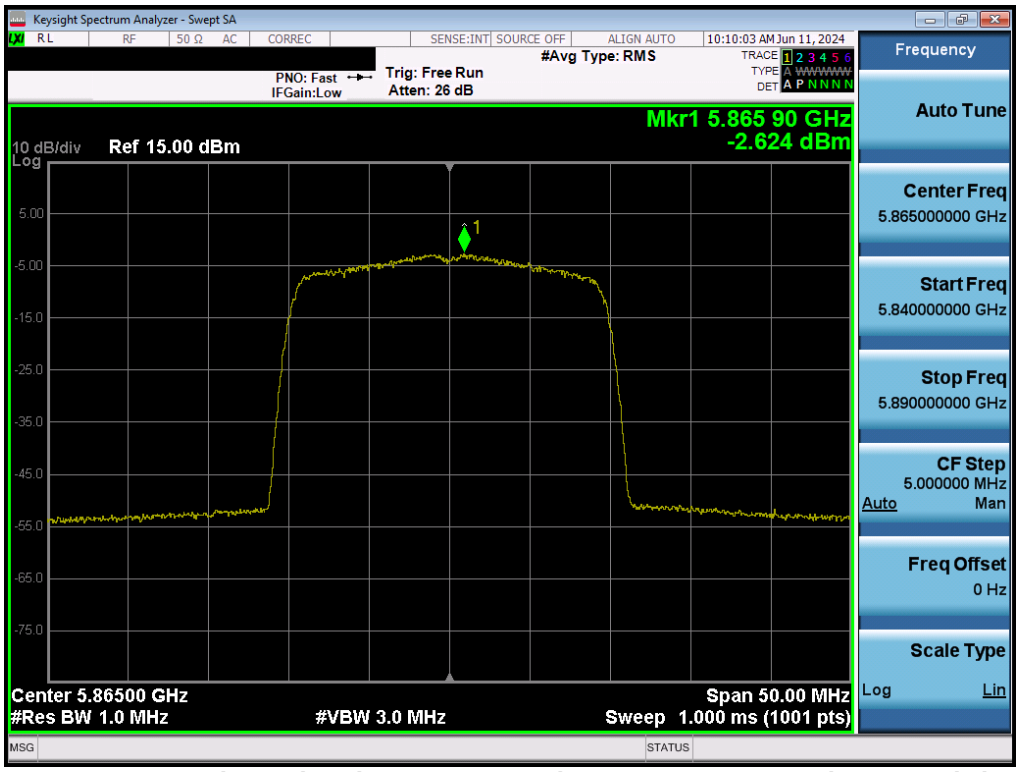
Plot 7-155. Power Spectral Density Plot MIMO ANT2 (80MHz BW 802.11ax (UNII Band 3) – Ch. 155)



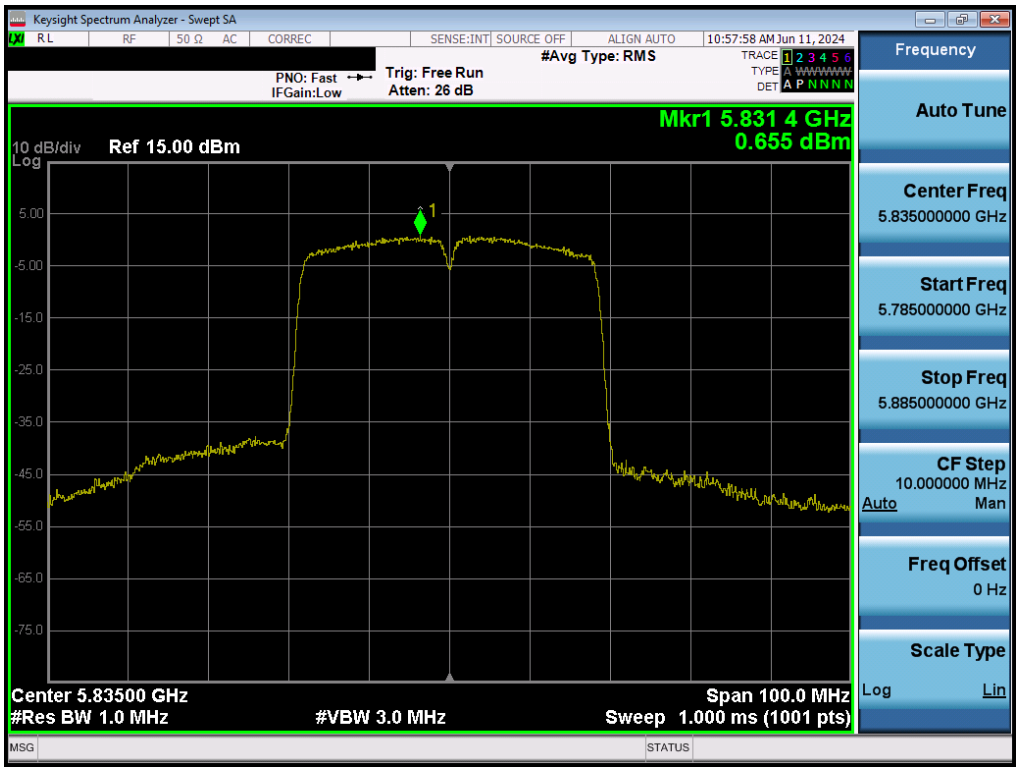
Plot 7-156. Power Spectral Density Plot MIMO ANT2 (802.11a (UNII Band 4) – Ch. 173)



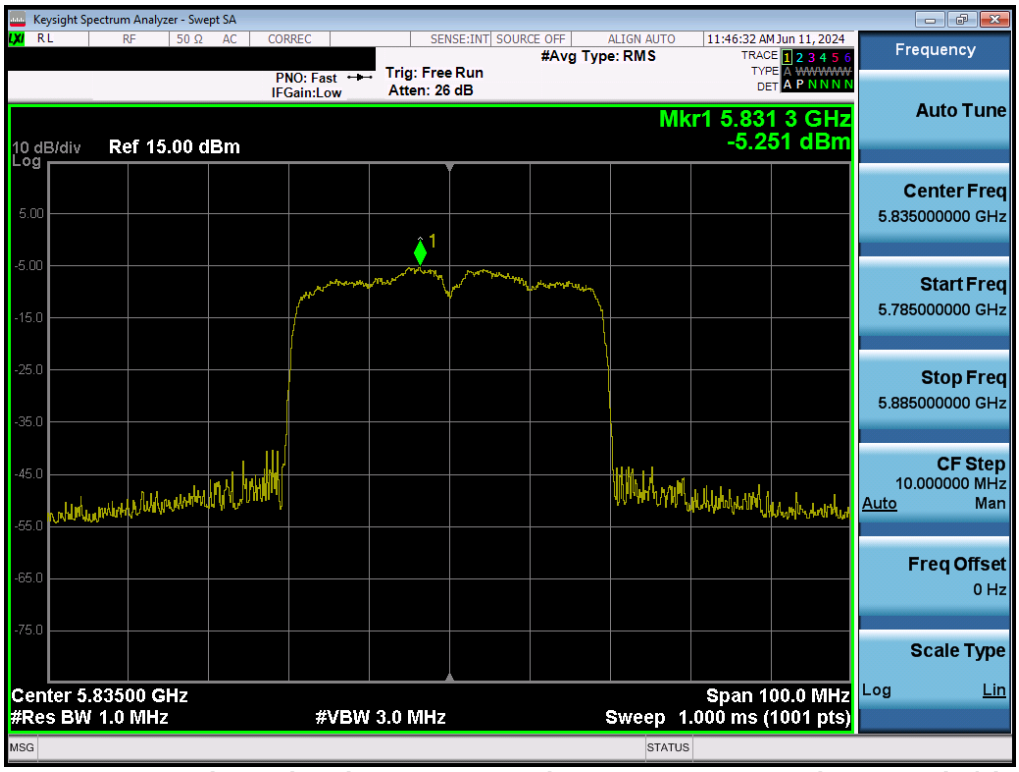
Plot 7-157. Power Spectral Density Plot MIMO ANT2 (20MHz BW 802.11n (UNII Band 4) – Ch. 173)



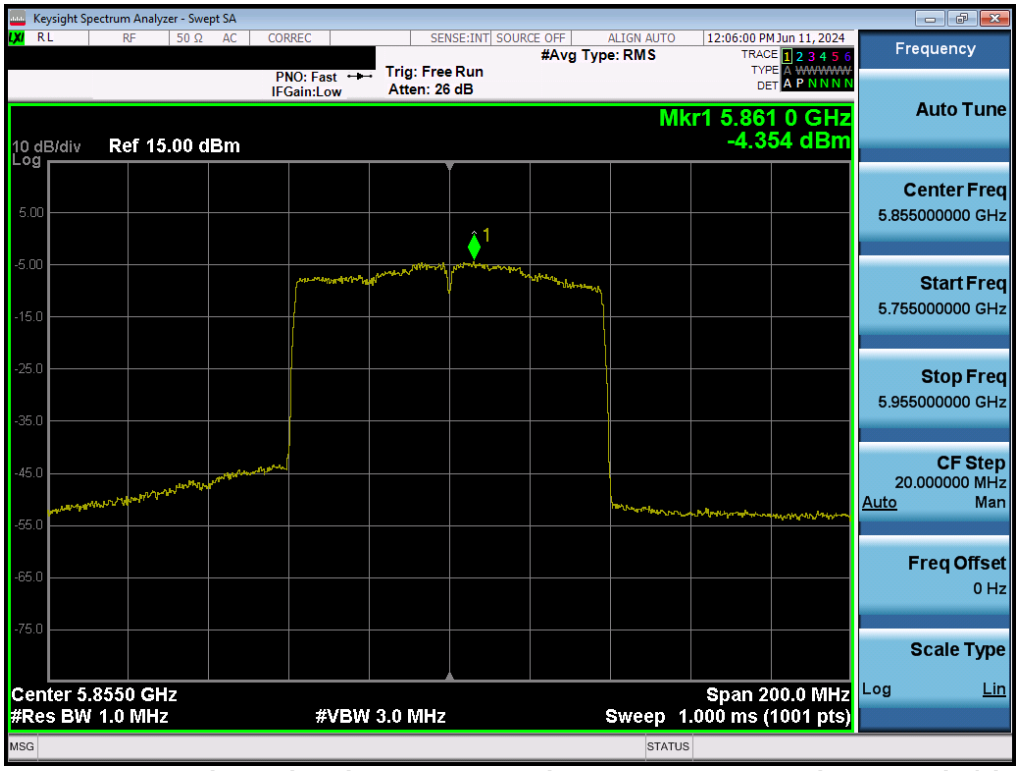
Plot 7-158. Power Spectral Density Plot MIMO ANT2 (20MHz BW 802.11ax (UNII Band 4) – Ch. 173)



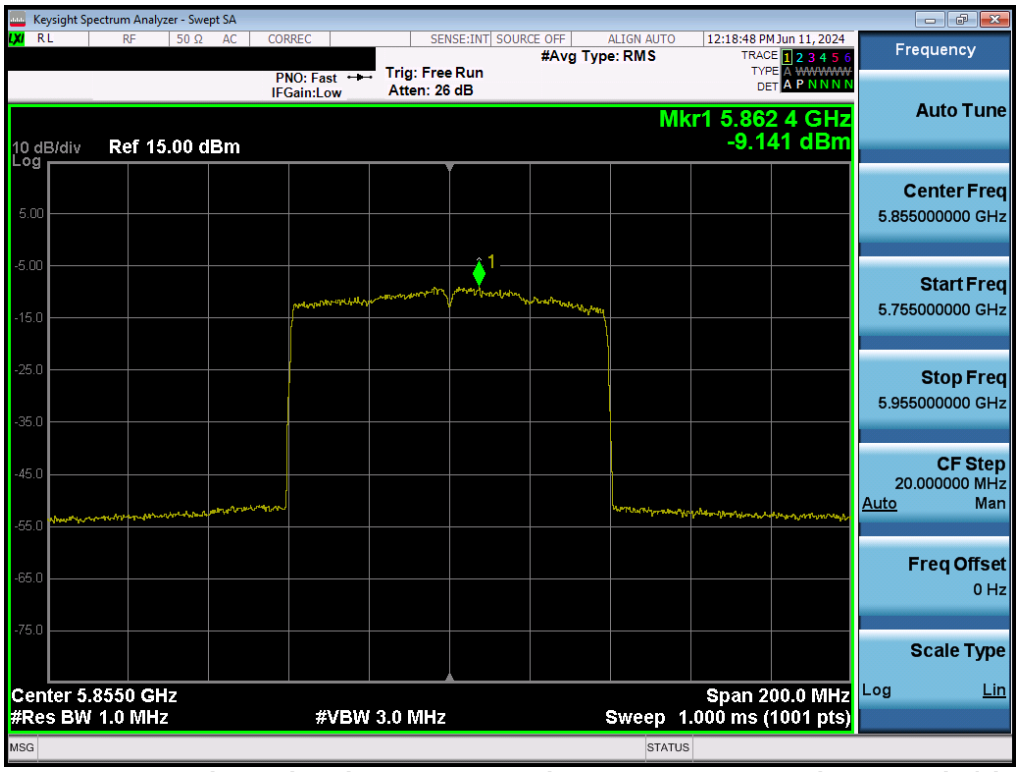
Plot 7-159. Power Spectral Density Plot MIMO ANT2 (40MHz BW 802.11n (UNII Band 3/4) – Ch. 167)



Plot 7-160. Power Spectral Density Plot MIMO ANT2 (40MHz BW 802.11ax (UNII Band 3/4) – Ch. 167)



Plot 7-161. Power Spectral Density Plot MIMO ANT2 (80MHz BW 802.11ac (UNII Band 3/4) – Ch. 171)



Plot 7-162. Power Spectral Density Plot MIMO ANT2 (80MHz BW 802.11ax (UNII Band 3/4) – Ch. 171)

Plot 7-163. Power Spectral Density Plot MIMO ANT2 (160MHz BW 802.11ac (UNII Band 3/4) – Ch. 163)

Plot 7-164. Power Spectral Density Plot MIMO ANT2 (160MHz BW 802.11ax (UNII Band 3/4) – Ch. 163)

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.

Sample MIMO Calculation:

At 5180MHz in 802.11n (20MHz BW) mode, the average conducted power spectral density was measured to be 5.64 dBm for Antenna 1 and 5.00 dBm for Antenna 2.

Antenna 1 + Antenna 2 = MIMO

(5.64 dBm + 5.00 dBm) = (3.66 mW + 3.16 mW) = 6.82 mW = 8.34 dBm

7.6 Radiated Emission Measurements

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna 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. All channels, modes, and modulations/data rates were investigated among all UNII bands. Only the radiated emissions of the configuration that produced the worst-case emissions are reported in this section.

For transmitters operating in the 5.15-5.25 GHz and 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an EIRP of −27 dBm/MHz.

For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an EIRP of −27 dBm/MHz.

For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of −27 dBm/MHz at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

For transmitters operating in the 5.850 – 5.895 GHz band: all emissions at or above 5.895GHz shall not exceed an e.i.r.p. of -5dBm/MHz and shall decrease linearly up to an e.i.r.p. of -27dBm/MHz at or above 5.925GHz, and all emissions below 5.725 GHz shall not exceed an e.i.r.p. of -27dBm/MHz at 5.65 GHz increasing linearly to 10dBm/MHz at 5.7GHz and from 5.7GHz increasing linearly to a level of 15.6dMb/MHz at 5.72GHz, and from 5.72GHz increasing linearly to a level of 27dBm/MHz at 5.725GHz.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR and Table 6 of RSS-Gen (8.10) must not exceed the limits shown in the table below per FCC §15.209 and RSS-Gen (8.9).

Frequency	Field Strength [μV/m]	Measured Distance [Meters]
0.009 – 0.490 MHz	2400\F (kHz)	300
0.490 – 1.705 MHz	24000\F (kHz)	30
1.705 – 30.00 MHz	30	30
30.00 – 88.00 MHz	100	3
88.00 – 216.0 MHz	150	3
216.0 – 960.0 MHz	200	3
Above 960.0 MHz	500	3

Table 7-19. Radiated Limits

Test Procedures Used

ANSI C63.10-2013 – Sections 12.7.7.2, 12.7.6, 12.7.5 (Radiated Spurious Emissions)
ANSI C63.10-2013 – Section 12.7.4.4 (Band Edge Measurements)

Test Settings – Above 1GHz

Average Field Strength Measurements (Method AD – Average Detection)

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest.
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = power average (RMS)
5. Number of measurement points = 1001 (Number of points must be ≥ 2 x span\\RBW)
6. Sweep time = auto
7. Trace (RMS) averaging was performed over at least 100 traces.

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest.
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize.

Test Settings – Below 1GHz

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest.
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize.

Test Setup

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

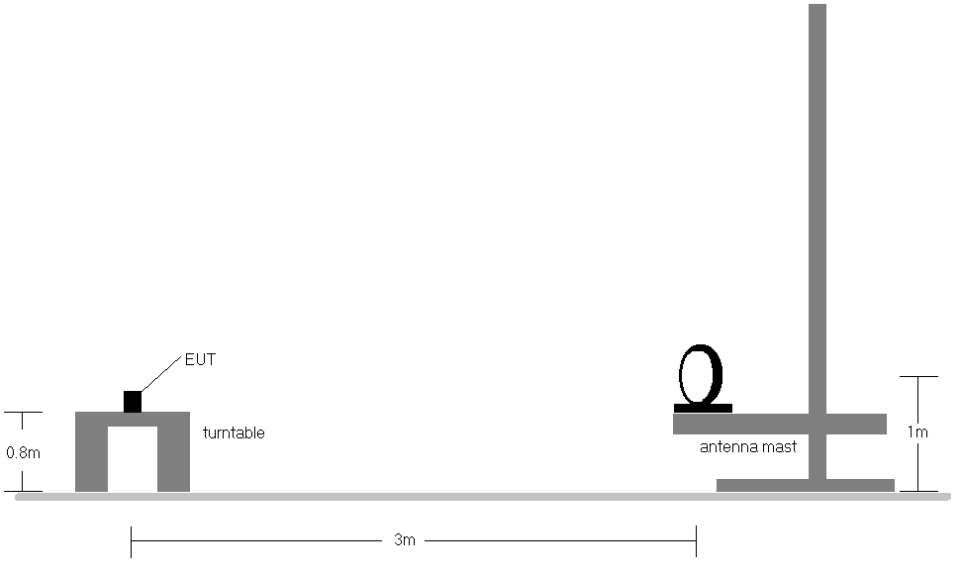


Figure 7-5. Radiated Test Setup < 30MHz

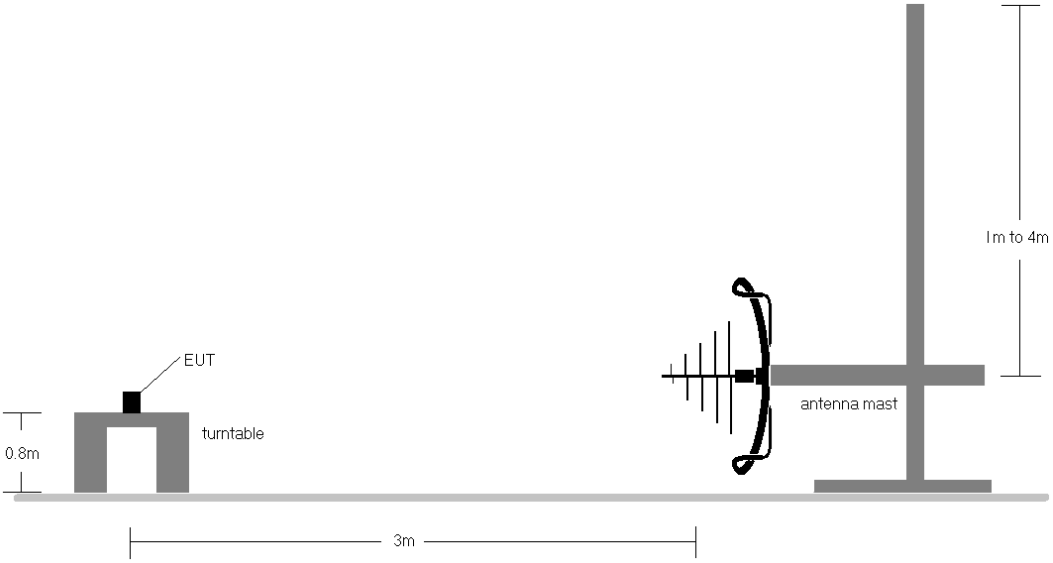


Figure 7-6. Radiated Test Setup < 1GHz

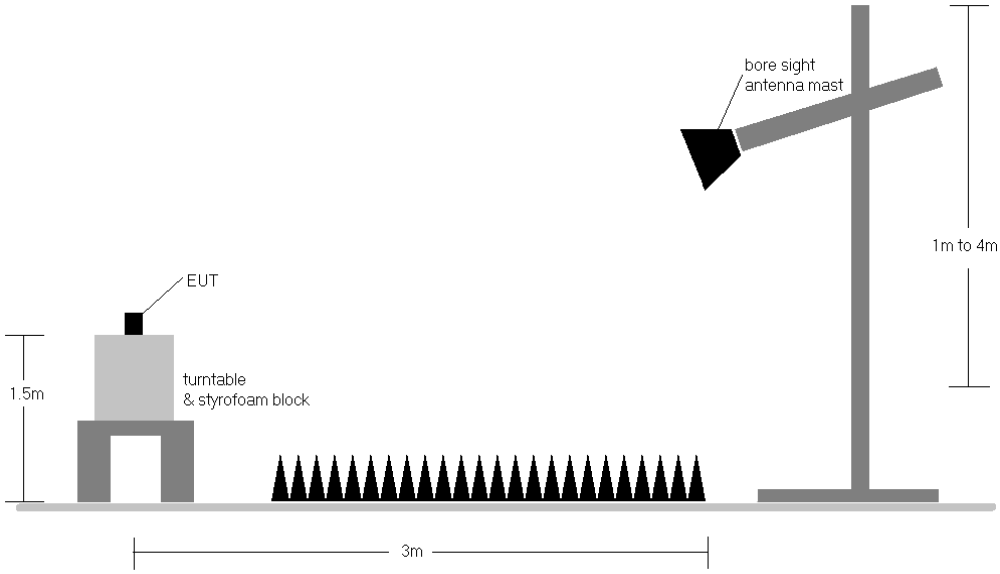


Figure 7-7. Radiated Test Setup > 1GHz

Test Notes

1. All spurious emissions lying in restricted bands specified in §15.205 are below the limits shown in §15.209. All spurious emissions that do not lie in a restricted band are subject to an average limit of -27dBm/MHz. At 3 meters, the field strength limit in dBμV/m can be determined by adding a “conversion” factor of 95.2dB to the EIRP limit of -27dBm/MHz to obtain the limit for out of band spurious emissions of 68.2dBμV/m.
2. All spurious emissions that do not lie in a restricted band are subject to a peak limit not to exceed 20dB of the average limit [68.2dBμV/m]. If a peak measurement passes the average limit, it was determined no further investigation is necessary.
3. The antenna is manipulated through typical positions, polarity, and length during the tests. The EUT is manipulated through three orthogonal planes.
4. This unit was tested with its standard battery.
5. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas. The worst-case emissions are reported, however emissions whose levels were not within 20dB of the respective limits were not reported.
6. Emissions below 18GHz were measured at a 3-meter test distance while emissions above 18GHz were measured at a 1-meter test distance with the application of a distance correction factor.
7. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. Any emissions found to be within 20dB of the limit are fully investigated and the results are shown in this section.
8. The "-" shown in the following RSE tables are used to denote a noise floor measurement.
9. In the case where a peak-detector measurement passed the given RMS limit it was determined sufficient to demonstrate compliance.
10. The results recorded using the broadband antenna are known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.

Sample Calculations

Determining Spurious Emissions Levels

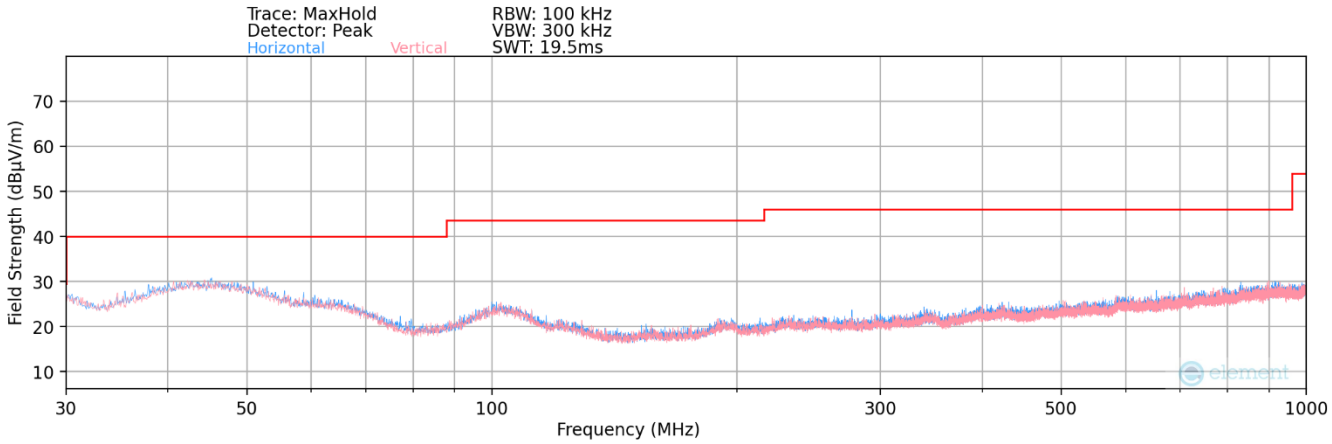
- Field Strength Level $_{[dB\mu V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB/m]}$
- AFCL $_{[dB/m]}$ = Antenna Factor $_{[dB/m]}$ + Cable Loss $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\mu V/m]}$ – Limit $_{[dB\mu V/m]}$

Radiated Band Edge Measurement Offset

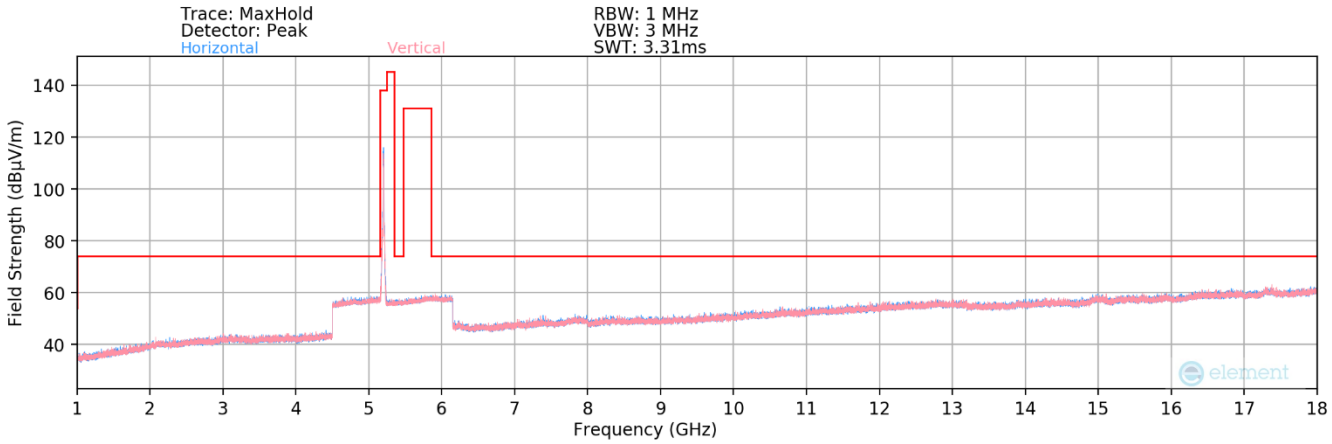
- The amplitude offset shown in the radiated restricted band edge plots was calculated using the formula:

  Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

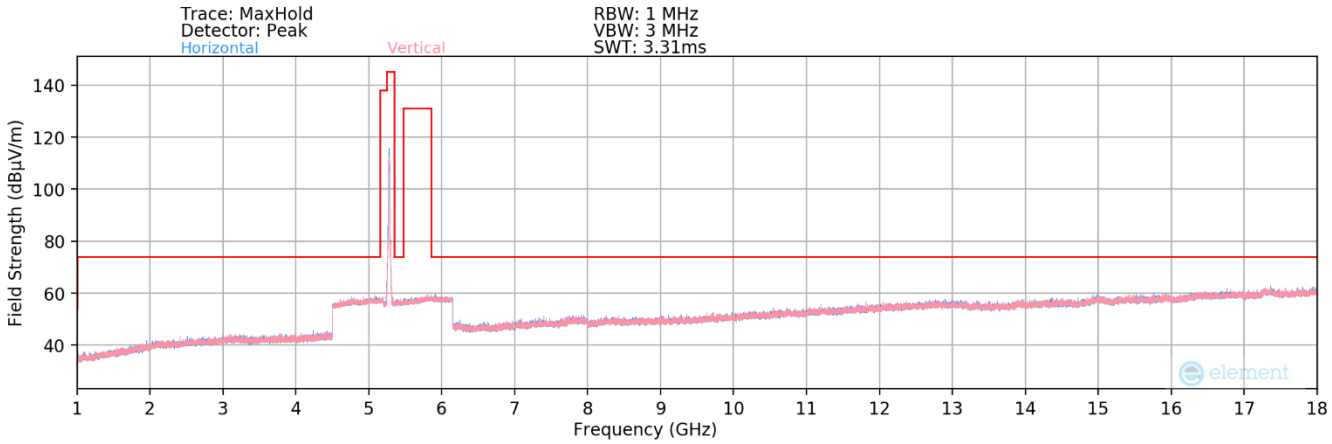
7.6.1 MIMO Radiated Spurious Emission Measurements



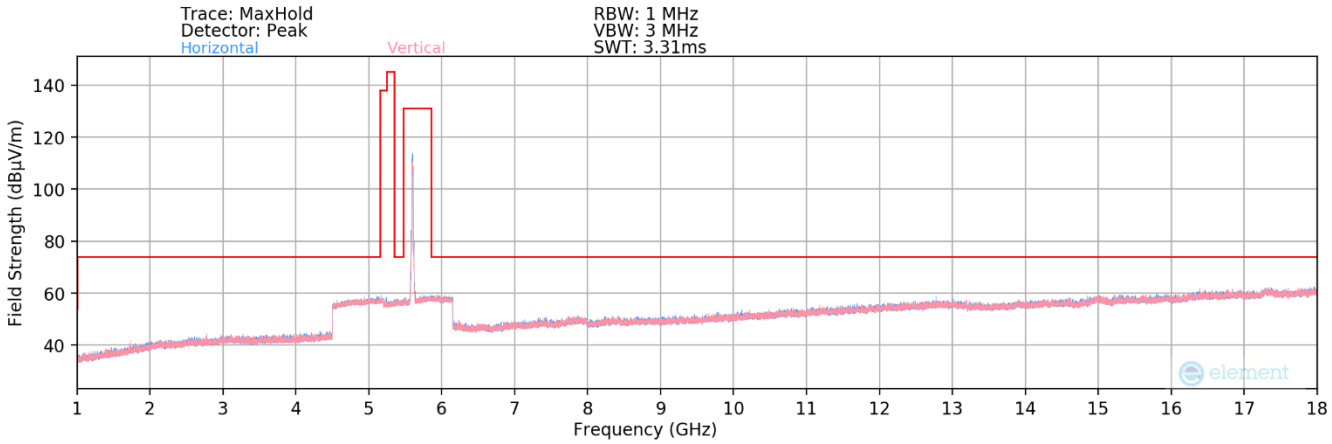
Plot 7-165. Radiated Spurious Plot below 1GHz MIMO (802.11a)



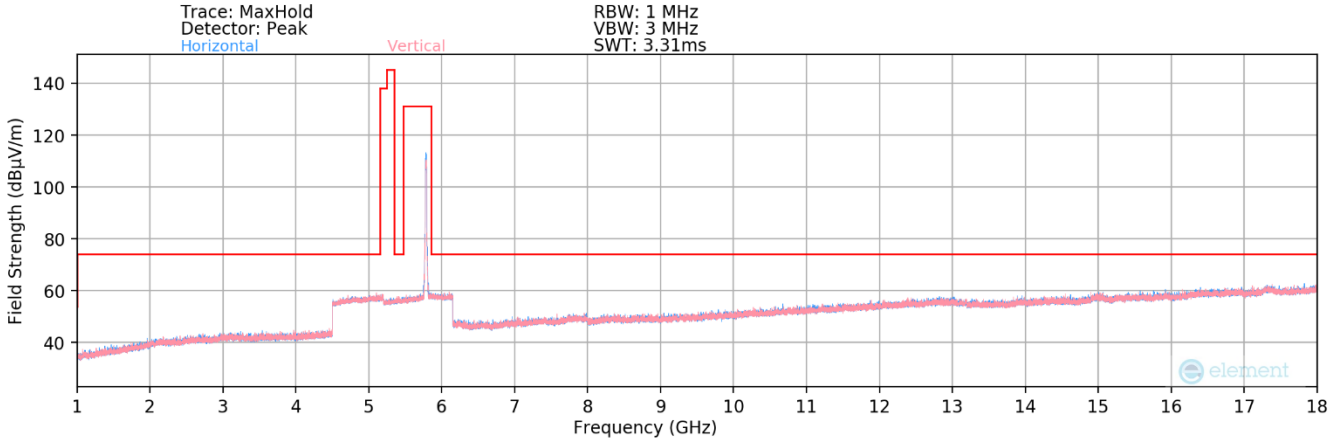
Plot 7-166. Radiated Spurious Plot above 1GHz MIMO (802.11a – UNII Band 1 Ch. 40)



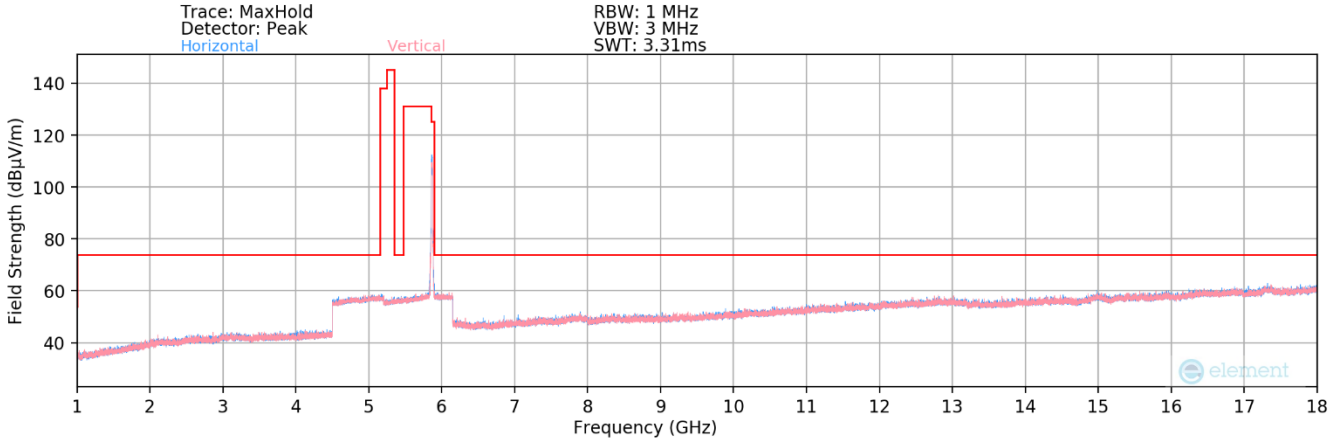
Plot 7-167. Radiated Spurious Plot above 1GHz MIMO (802.11a – UNII Band 2A Ch. 56)



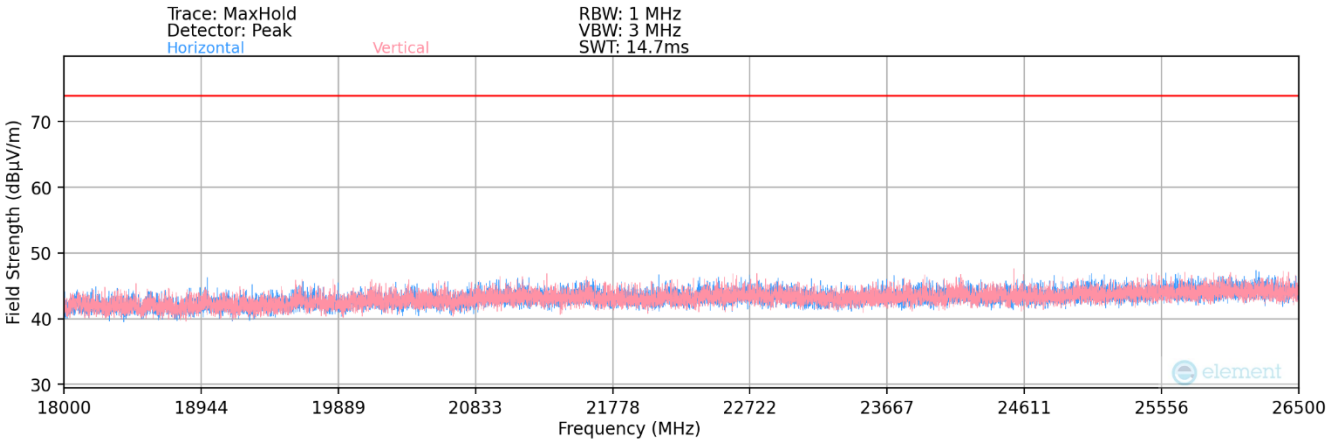
Plot 7-168. Radiated Spurious Plot above 1GHz MIMO (802.11a – UNII Band 2C Ch. 120)



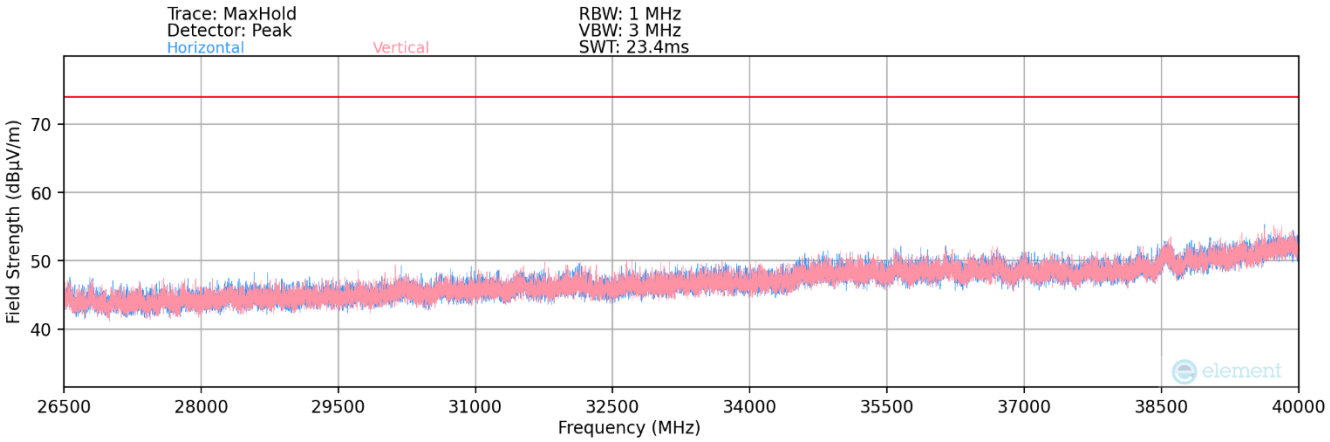
Plot 7-169. Radiated Spurious Plot above 1GHz MIMO (802.11a – UNII Band 3 Ch. 157)



Plot 7-170. Radiated Spurious Plot above 1GHz MIMO (802.11a – UNII Band 4 Ch. 173)



Plot 7-171. Radiated Spurious Plot 18GHz – 26.5GHz MIMO (802.11a)



Plot 7-172. Radiated Spurious Plot 26.5GHz – 40GHz MIMO (802.11a)

MIMO Radiated Spurious Emission Measurements – UNII Band 1

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6Mbps
Distance of Measurements: 1 & 3 Meters

Mode	Antenna	UNII Band	Channel	Test Channel Freq. [MHz]	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]
802.11a	MIMO	1	36	5180		10360.00	Peak	V	112	31	-67.94	16.03	0.00	55.09	68.20	-13.11
					*	15540.00	Average	V	-	-	-82.44	23.04	0.00	47.60	53.98	-6.38
					*	15540.00	Peak	V	-	-	-70.66	23.04	0.00	59.38	73.98	-14.60
					*	20720.00	Average	V	-	-	-65.21	3.16	-9.54	35.41	53.98	-18.57
					*	20720.00	Peak	V	-	-	-55.33	3.16	-9.54	45.29	73.98	-28.69
						25900.00	Peak	V	-	-	-54.44	4.24	-9.54	47.26	68.20	-20.94
			40	5200		10400.00	Peak	V	115	21	-67.83	16.25	0.00	55.42	68.20	-12.78
					*	15600.00	Average	V	-	-	-81.88	23.40	0.00	48.52	53.98	-5.46
					*	15600.00	Peak	V	-	-	-69.45	23.40	0.00	60.95	73.98	-13.03
					*	20800.00	Average	V	-	-	-63.88	3.15	-9.54	36.73	53.98	-17.25
					*	20800.00	Peak	V	-	-	-55.65	3.15	-9.54	44.96	73.98	-29.02
						26000.00	Peak	V	-	-	-54.68	4.16	-9.54	46.94	68.20	-21.26
			48	5240		10480.00	Peak	V	118	21	-67.24	16.26	0.00	56.02	68.20	-12.18
					*	15720.00	Average	V	-	-	-82.42	23.33	0.00	47.91	53.98	-6.07
					*	15720.00	Peak	V	-	-	-71.32	23.33	0.00	59.01	73.98	-14.97
						20960.00	Peak	V	-	-	-54.04	3.27	-9.54	46.70	68.20	-21.50
						26200.00	Peak	V	-	-	-55.15	3.96	-9.54	46.27	68.20	-21.93

Table 7-20. Radiated Measurements MIMO

MIMO Radiated Spurious Emission Measurements – UNII Band 2A

Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6Mbps
Distance of Measurements: 1 & 3 Meters

Mode	Antenna	UNII Band	Channel	Test Channel Freq. [MHz]	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]
802.11a	MIMO	2A	52	5260		10520.00	Peak	V	143	21	-67.83	16.33	0.00	55.50	68.20	-12.70
					*	15780.00	Average	V	-	-	-82.16	23.33	0.00	48.17	53.98	-5.81
					*	15780.00	Peak	V	-	-	-70.71	23.33	0.00	59.62	73.98	-14.36
					*	21040.00	Average	V	-	-	-63.54	3.35	-9.54	37.27	53.98	-16.71
					*	21040.00	Peak	V	-	-	-54.41	3.35	-9.54	46.40	73.98	-27.58
						26300.00	Peak	V	-	-	-54.73	3.91	-9.54	46.64	68.20	-21.56
			56	5280		10560.00	Peak	V	155	21	-68.74	16.58	0.00	54.84	68.20	-13.36
					*	15840.00	Average	V	-	-	-82.18	23.62	0.00	48.44	53.98	-5.54
					*	15840.00	Peak	V	-	-	-70.67	23.62	0.00	59.95	73.98	-14.03
					*	21120.00	Average	V	-	-	-63.86	3.46	-9.54	37.06	53.98	-16.92
					*	21120.00	Peak	V	-	-	-55.46	3.46	-9.54	45.46	73.98	-28.52
						26400.00	Peak	V	-	-	-55.26	3.71	-9.54	45.91	68.20	-22.29
			64	5320	*	10640.00	Average	V	155	17	-80.76	16.85	0.00	43.09	53.98	-10.88
					*	10640.00	Peak	V	155	17	-69.55	16.85	0.00	54.30	73.98	-19.68
					*	15960.00	Average	V	-	-	-82.15	24.02	0.00	48.87	53.98	-5.11
					*	15960.00	Peak	V	-	-	-70.39	24.02	0.00	60.63	73.98	-13.35
					*	21280.00	Average	V	-	-	-64.30	3.58	-9.54	36.74	53.98	-17.24
					*	21280.00	Peak	V	-	-	-55.26	3.58	-9.54	45.78	73.98	-28.20
						26600.00	Peak	V	-	-	-55.62	3.91	-9.54	45.76	68.20	-22.44

Table 7-21. Radiated Measurements MIMO

MIMO Radiated Spurious Emission Measurements – UNII Band 2C

Worst Case Mode: 802.11a

Worst Case Transfer Rate: 6Mbps

Distance of Measurements: 1 & 3 Meters

Mode	Antenna	UNII Band	Channel	Test Channel Freq. [MHz]	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]
802.11a	MIMO	2C	100	5500	*	11000.00	Average	V	-	-	-81.62	17.49	0.00	42.87	53.98	-11.11
					*	11000.00	Peak	V	-	-	-69.82	17.49	-9.54	45.13	73.98	-28.85
						16500.00	Peak	V	-	-	-71.41	25.00	-9.54	51.05	68.20	-17.15
						22000.00	Peak	V	-	-	-55.09	3.53	-9.54	45.89	68.20	-22.31
						27500.00	Peak	V	-	-	-55.19	3.97	-9.54	46.24	68.20	-21.96
			120	5600	*	11200.00	Average	V	127	153	-80.60	17.61	0.00	44.01	53.98	-9.97
					*	11200.00	Peak	V	127	153	-69.06	17.61	0.00	55.55	73.98	-18.43
						16800.00	Peak	V	-	-	-70.48	24.98	0.00	61.50	68.20	-6.70
					*	22400.00	Average	V	-	-	-63.75	3.58	-9.54	37.29	53.98	-16.69
					*	22400.00	Peak	V	-	-	-54.44	3.58	-9.54	46.59	73.98	-27.39
						28000.00	Peak	V	-	-	-55.74	4.52	-9.54	46.24	68.20	-21.96
			144	5720	*	11440.00	Average	V	-	-	-81.68	18.15	0.00	43.47	53.98	-10.51
					*	11440.00	Peak	V	-	-	-70.39	18.15	0.00	54.76	73.98	-19.22
						17160.00	Peak	V	-	-	-71.21	25.10	0.00	60.89	68.20	-7.31
					*	22880.00	Average	V	-	-	-63.90	3.76	-9.54	37.31	53.98	-16.67
					*	22880.00	Peak	V	-	-	-54.27	3.76	-9.54	46.94	73.98	-27.04
						28600.00	Peak	V	-	-	-54.20	4.96	-9.54	48.22	68.20	-19.98

Table 7-22. Radiated Measurements MIMO

MIMO Radiated Spurious Emission Measurements – UNII Band 3

Worst Case Mode: 802.11a

Worst Case Transfer Rate: 6Mbps

Distance of Measurements: 1 & 3 Meters

Mode	Antenna	UNII Band	Channel	Test Channel Freq. [MHz]	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]
802.11a	MIMO	3	149	5745	*	11490.00	Average	V	-	-	-81.82	18.28	0.00	43.46	53.98	-10.52
					*	11490.00	Peak	V	-	-	-70.52	18.28	0.00	54.76	73.98	-19.22
						17235.00	Peak	V	-	-	-70.71	25.51	0.00	61.80	68.20	-6.40
					*	22980.00	Average	V	-	-	-64.04	3.66	-9.54	37.08	53.98	-16.90
					*	22980.00	Peak	V	-	-	-56.05	3.66	-9.54	45.07	73.98	-28.91
						28725.00	Peak	V	-	-	-55.67	5.05	-9.54	46.85	68.20	-21.35
			157	5785	*	11570.00	Average	V	-	-	-81.45	18.16	0.00	43.71	53.98	-10.27
					*	11570.00	Peak	V	-	-	-69.98	18.16	0.00	55.18	73.98	-18.80
						17355.00	Peak	V	-	-	-71.01	26.74	0.00	62.73	68.20	-5.47
						23140.00	Peak	V	-	-	-55.11	3.65	-9.54	46.01	68.20	-22.19
						28925.00	Peak	V	-	-	-55.77	4.92	-9.54	46.61	68.20	-21.59
			165	5825	*	11650.00	Average	V	-	-	-81.61	18.25	0.00	43.64	53.98	-10.34
					*	11650.00	Peak	V	-	-	-69.94	18.25	0.00	55.31	73.98	-18.67
						17475.00	Peak	V	-	-	-71.24	26.50	0.00	62.26	68.20	-5.94
						23300.00	Peak	V	-	-	-55.56	3.55	-9.54	45.45	68.20	-22.75
						29125.00	Peak	V	-	-	-55.62	5.01	-9.54	46.85	68.20	-21.35

Table 7-23. Radiated Measurements MIMO

MIMO Radiated Spurious Emission Measurements – UNII Band 4

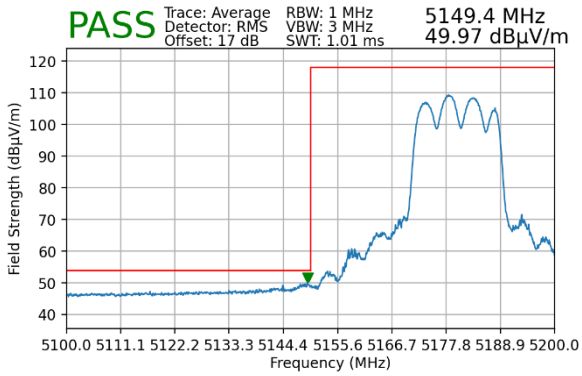
Worst Case Mode: 802.11a
Worst Case Transfer Rate: 6Mbps
Distance of Measurements: 1 & 3 Meters

Mode	Antenna	UNII Band	Channel	Test Channel Freq. [MHz]	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]
802.11a	MIMO	4	169	5845	*	11690.00	Average	V	-	-	-81.61	18.65	0.00	44.04	53.98	-9.94
					*	11690.00	Peak	V	-	-	-69.73	18.65	0.00	55.92	73.98	-18.06
						17535.00	Peak	V	-	-	-71.88	26.34	0.00	61.46	68.20	-6.74
						23380.00	Peak	V	-	-	-55.77	3.53	-9.54	45.22	68.20	-22.98
						29225.00	Peak	V	-	-	-55.70	5.04	-9.54	46.80	68.20	-21.40
						35070.00	Peak	V	-	-	-54.58	7.60	-9.54	50.48	68.20	-17.72
			173	5865	*	11730.00	Average	V	-	-	-81.49	18.20	0.00	43.71	53.98	-10.27
					*	11730.00	Peak	V	-	-	-70.22	18.20	0.00	54.98	73.98	-19.00
						17595.00	Peak	V	-	-	-71.55	26.29	0.00	61.74	68.20	-6.46
						23460.00	Peak	V	-	-	-55.56	3.57	-9.54	45.48	68.20	-22.72
						29325.00	Peak	V	-	-	-54.72	5.14	-9.54	47.88	68.20	-20.32
						35190.00	Peak	V	-	-	-55.12	7.80	-9.54	50.15	68.20	-18.05
			177	5885	*	11770.00	Average	V	-	-	-81.50	18.48	0.00	43.98	53.98	-10.00
					*	11770.00	Peak	V	-	-	-69.79	18.48	0.00	55.69	73.98	-18.29
						17655.00	Peak	V	-	-	-70.78	26.16	0.00	62.38	68.20	-5.82
						23540.00	Peak	V	-	-	-55.83	3.57	-9.54	45.21	68.20	-22.99
						29425.00	Peak	V	-	-	-55.07	5.13	-9.54	47.52	68.20	-20.68
						35310.00	Peak	V	-	-	-54.73	7.91	-9.54	50.64	68.20	-17.56

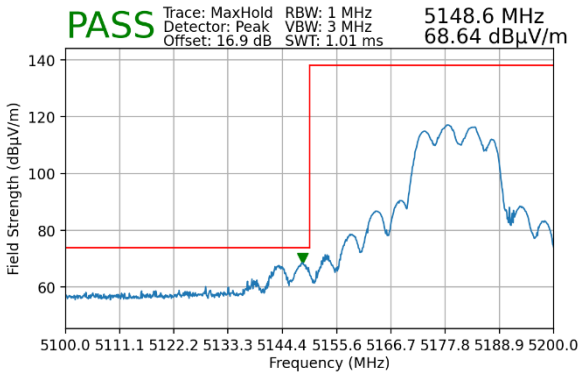
Table 7-24. Radiated Measurements MIMO

7.6.2 MIMO Radiated Band Edge Measurements (20MHz BW)

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6M
Distance of Measurements:	3 Meters
Operating Frequency:	5180MHz
Channel:	36

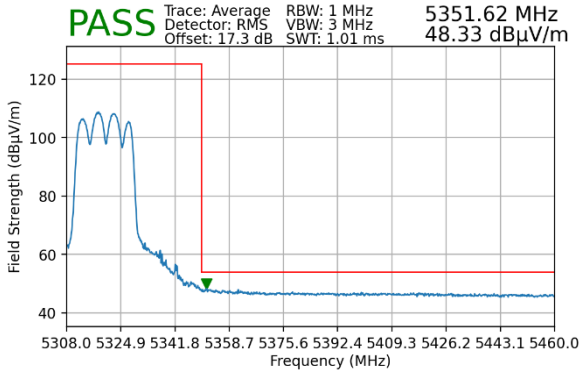


Plot 7-173. Radiated Lower Band Edge Plot MIMO (Average – UNII Band 1)

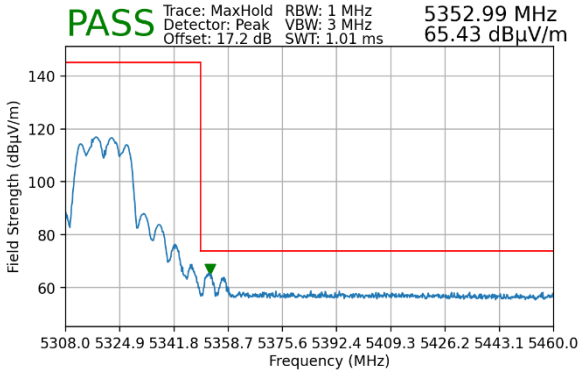


Plot 7-174. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 1)

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6M
Distance of Measurements:	3 Meters
Operating Frequency:	5320MHz
Channel:	64

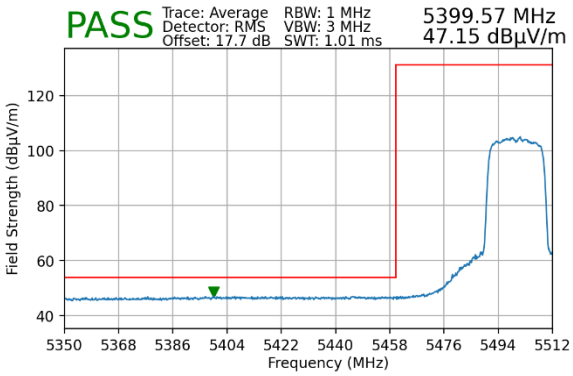


Plot 7-175. Radiated Upper Band Edge Plot MIMO (Average – UNII Band 2A)

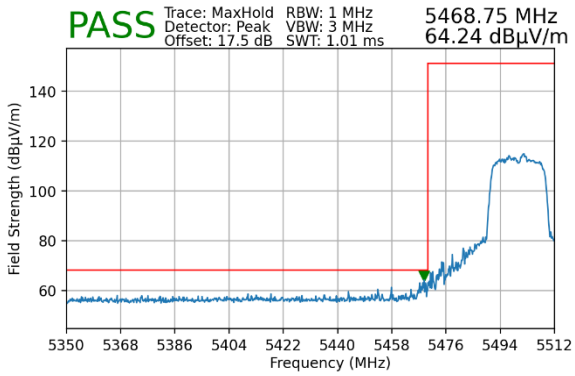


Plot 7-176. Radiated Upper Band Edge Plot MIMO (Peak – UNII Band 2A)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5500MHz
Channel:	100

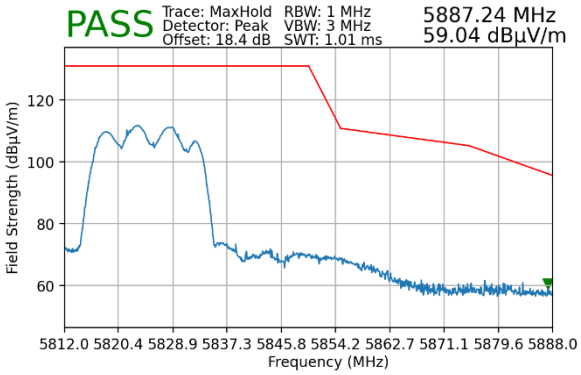


Plot 7-177. Radiated Lower Band Edge Plot MIMO (Average – UNII Band 2C)



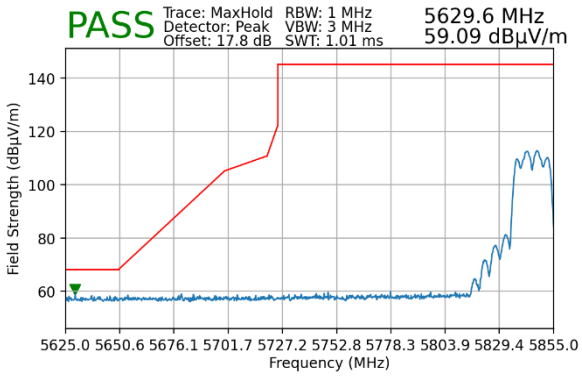
Plot 7-178. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 2C)

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6M
Distance of Measurements:	3 Meters
Operating Frequency:	5825MHz
Channel:	165



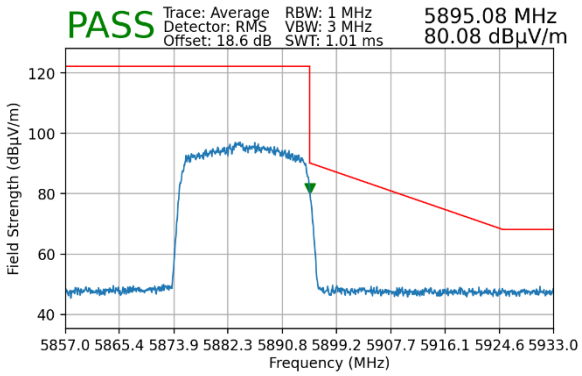
Plot 7-179. Radiated Upper Band Edge Plot MIMO (Peak – UNII Band 3)

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	6M
Distance of Measurements:	3 Meters
Operating Frequency:	5845MHz
Channel:	169

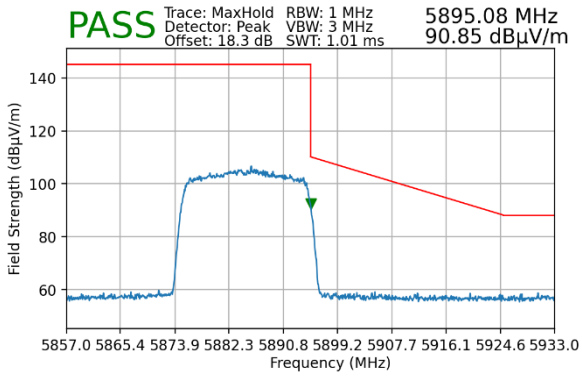


Plot 7-180. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 4)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5885MHz
Channel:	177



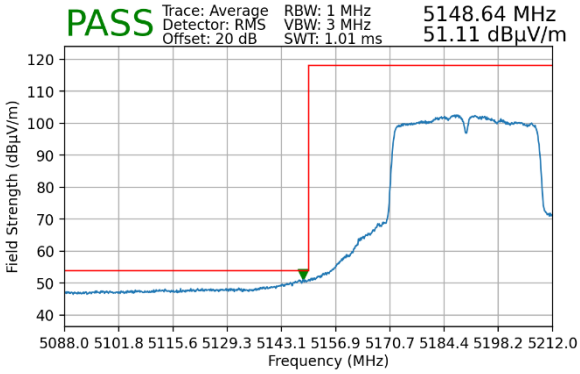
Plot 7-181. Radiated Upper Band Edge Plot MIMO (Average – UNII Band 4)



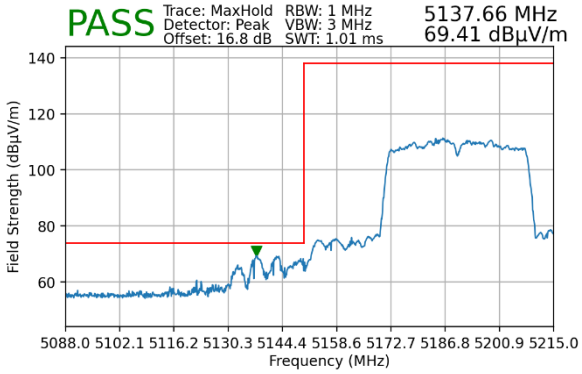
Plot 7-182. Radiated Upper Band Edge Plot MIMO (Peak – UNII Band 4)

7.6.3 MIMO Radiated Band Edge Measurements (40MHz BW)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5190MHz
Channel:	38

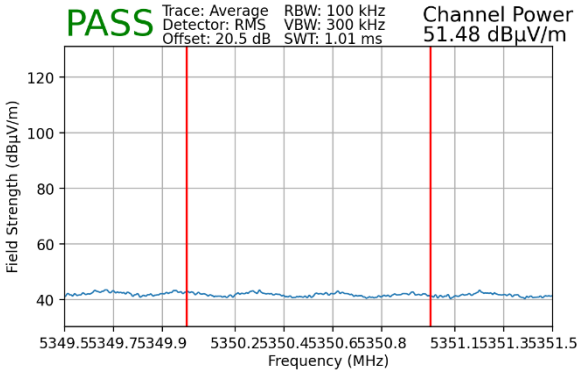


Plot 7-183. Radiated Lower Band Edge Plot MIMO (Average – UNII Band 1)

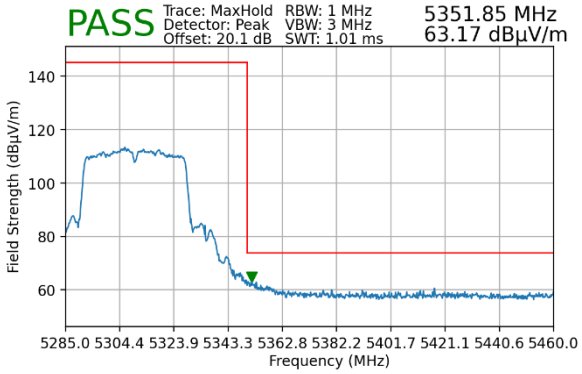


Plot 7-184. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 1)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5310MHz
Channel:	62

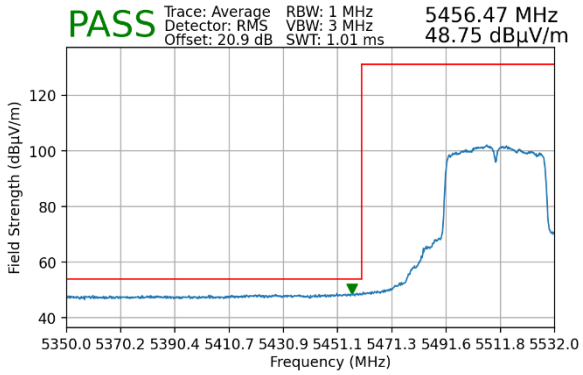


Plot 7-185. Radiated Upper Band Edge Plot MIMO (Average – UNII Band 2A)

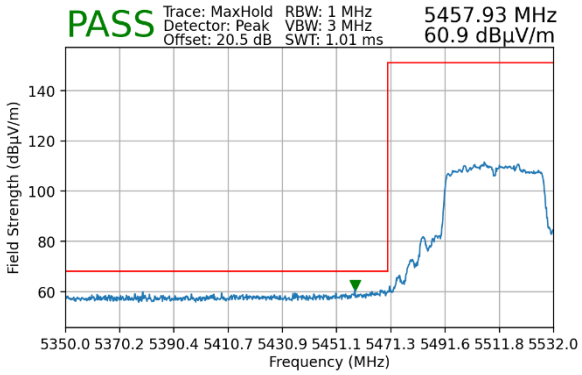


Plot 7-186. Radiated Upper Band Edge Plot MIMO (Peak – UNII Band 2A)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5510MHz
Channel:	102

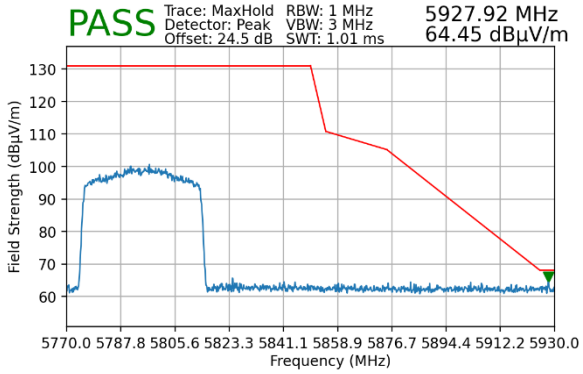


Plot 7-187. Radiated Lower Band Edge Plot MIMO (Average – UNII Band 2C)



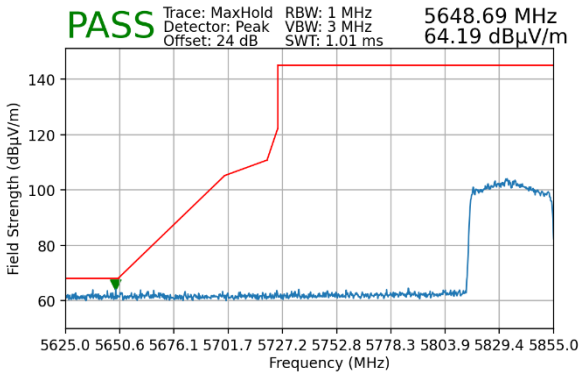
Plot 7-188. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 2C)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5795MHz
Channel:	159



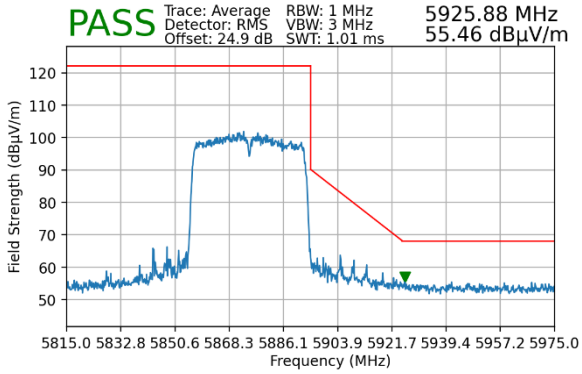
Plot 7-189. Radiated Upper Band Edge Plot MIMO (Peak – UNII Band 3)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5835MHz
Channel:	167

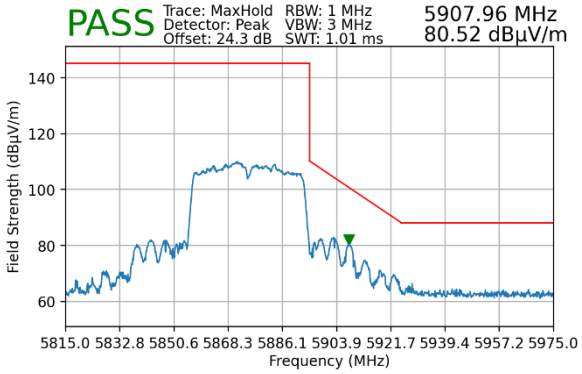


Plot 7-190. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 4)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5875MHz
Channel:	175



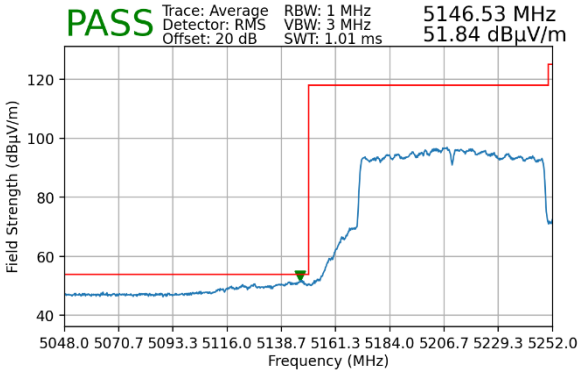
Plot 7-191. Radiated Upper Band Edge Plot MIMO (Average – UNII Band 4)



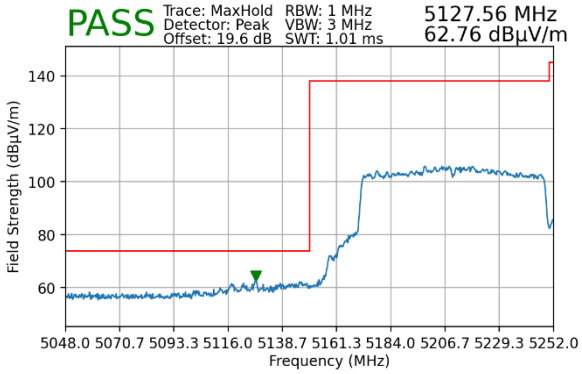
Plot 7-192. Radiated Upper Band Edge Plot MIMO (Peak – UNII Band 4)

7.6.4 MIMO Radiated Band Edge Measurements (80MHz BW)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5210MHz
Channel:	42

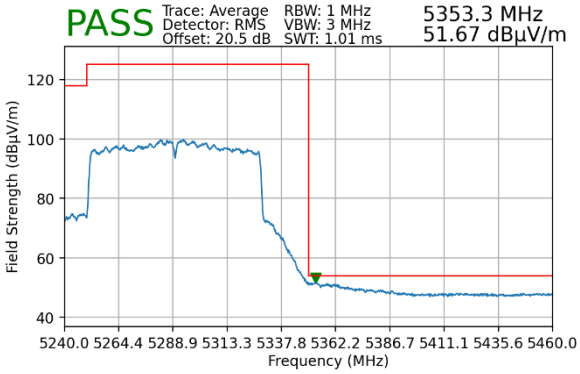


Plot 7-193. Radiated Lower Band Edge Plot MIMO (Average – UNII Band 1)

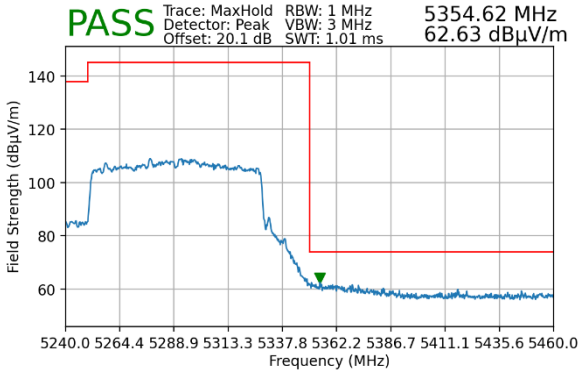


Plot 7-194. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 1)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5290MHz
Channel:	58

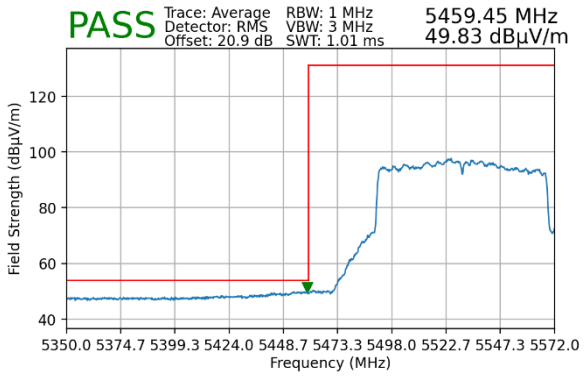


Plot 7-195. Radiated Upper Band Edge Plot MIMO (Average – UNII Band 2A)

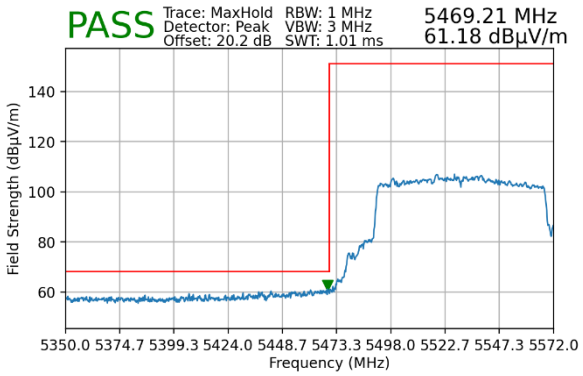


Plot 7-196. Radiated Upper Band Edge Plot MIMO (Peak – UNII Band 2A)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5530MHz
Channel:	106

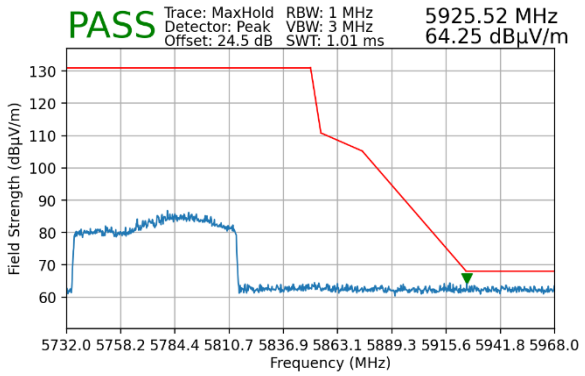


Plot 7-197. Radiated Lower Band Edge Plot MIMO (Average – UNII Band 2C)



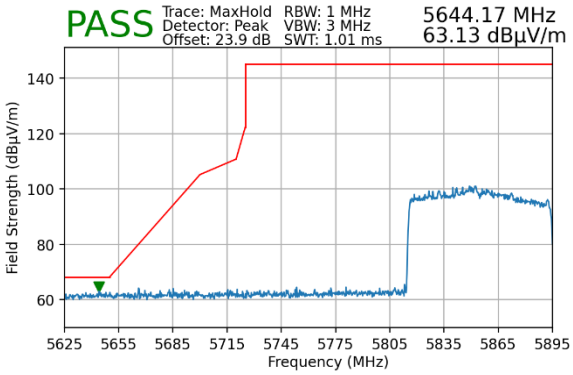
Plot 7-198. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 2C)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5775MHz
Channel:	155



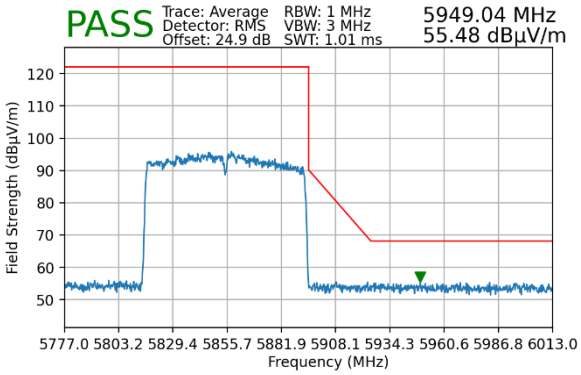
Plot 7-199. Radiated Upper Band Edge Plot MIMO (Peak – UNII Band 3)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5855MHz
Channel:	171

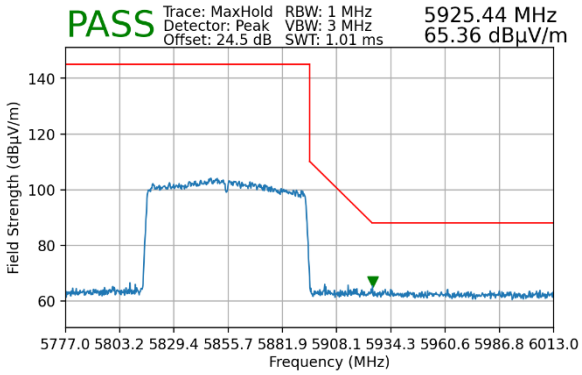


Plot 7-200. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 4)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5855MHz
Channel:	171



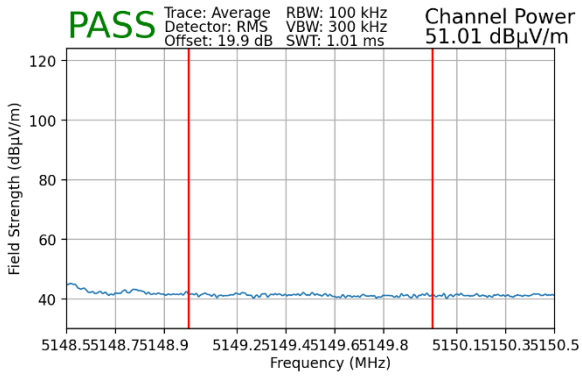
Plot 7-201. Radiated Upper Band Edge Plot MIMO (Average – UNII Band 4)



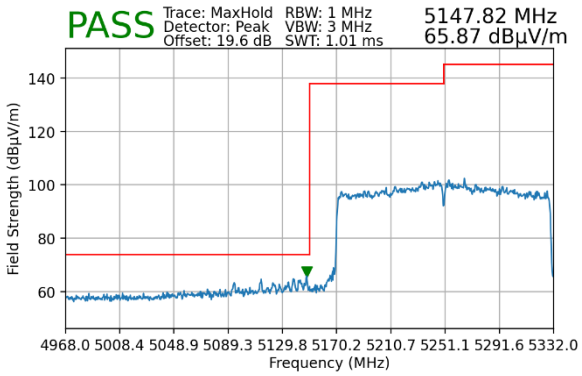
Plot 7-202. Radiated Upper Band Edge Plot MIMO (Peak – UNII Band 4)

7.6.5 MIMO Radiated Band Edge Measurements (160MHz BW)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5250MHz
Channel:	50

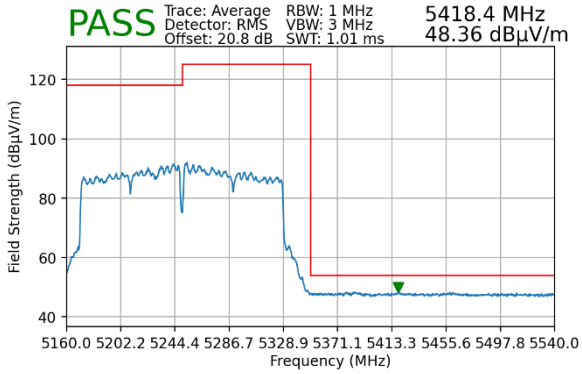


Plot 7-203. Radiated Lower Band Edge Plot MIMO (Average – UNII Band 1)

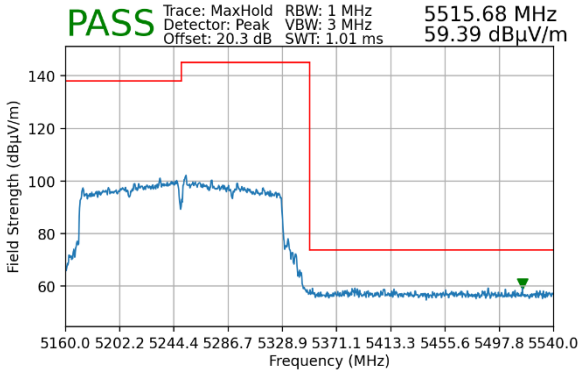


Plot 7-204. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 1)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5250MHz
Channel:	50

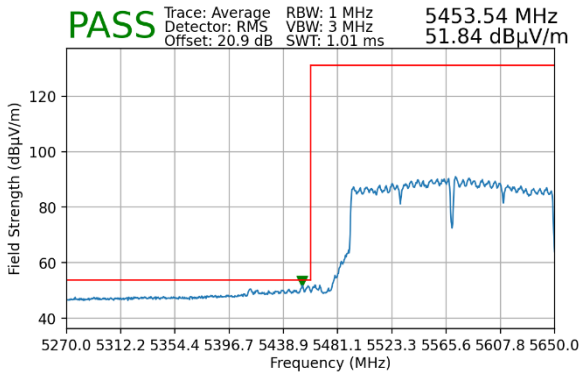


Plot 7-205. Radiated Upper Band Edge Plot MIMO (Average – UNII Band 2A)

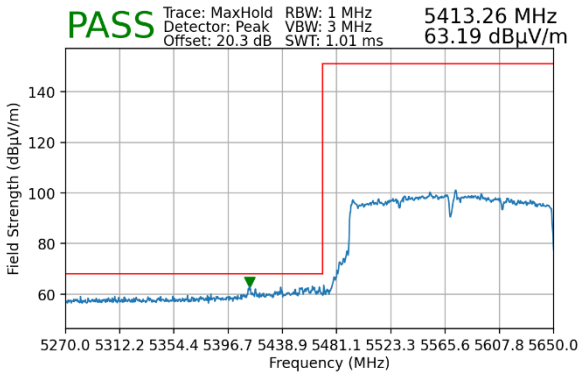


Plot 7-206. Radiated Upper Band Edge Plot MIMO (Peak – UNII Band 2A)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5570MHz
Channel:	114

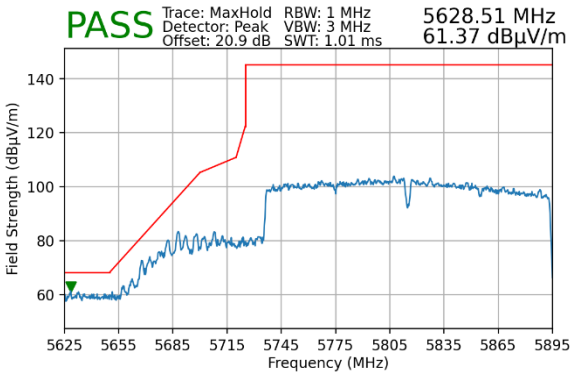


Plot 7-207. Radiated Lower Band Edge Plot MIMO (Average – UNII Band 2C)



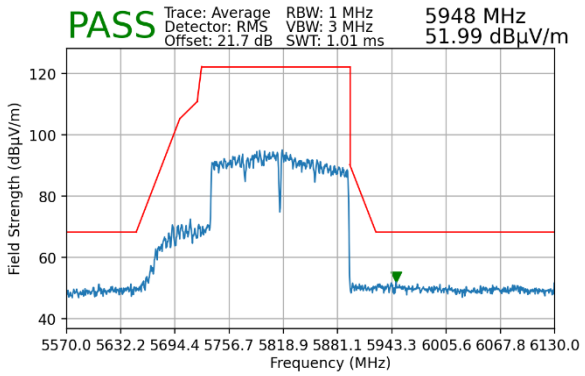
Plot 7-208. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 2C)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5815MHz
Channel:	163

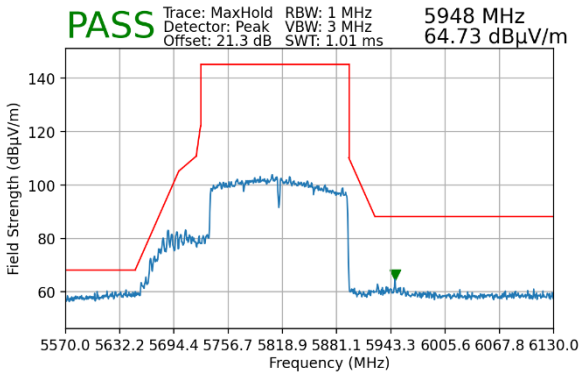


Plot 7-209. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 4)

Worst Case Mode:	802.11ac
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	5815MHz
Channel:	163



Plot 7-210. Radiated Lower Band Edge Plot MIMO (Average – UNII Band 4)



Plot 7-211. Radiated Lower Band Edge Plot MIMO (Peak – UNII Band 4)

7.7 Line-Conducted Test Data

Test Overview and Limit

All AC line conducted spurious emissions are measured with a receiver connected to a grounded LISN while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates and modes were investigated for conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst-case emissions are reported in this section.

All conducted emissions must not exceed the limits shown in the table below per FCC §15.207 and RSS-Gen (8.8).

Frequency of emission (MHz)	Conducted Limit (dBμV)	
	Quasi-peak	Average
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30	60	50

Table 7-25. Conducted Limits

*Decreases with the logarithm of the frequency.

Test Procedures Used

ANSI C63.10-2013, Section 6.2

Test Settings

Quasi-Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = quasi-peak
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the spurious emission of interest
2. RBW = 9kHz (for emissions from 150kHz – 30MHz)
3. Detector = RMS
4. Sweep time = auto couple
5. Trace mode = max hold
6. Trace was allowed to stabilize

Test Setup

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

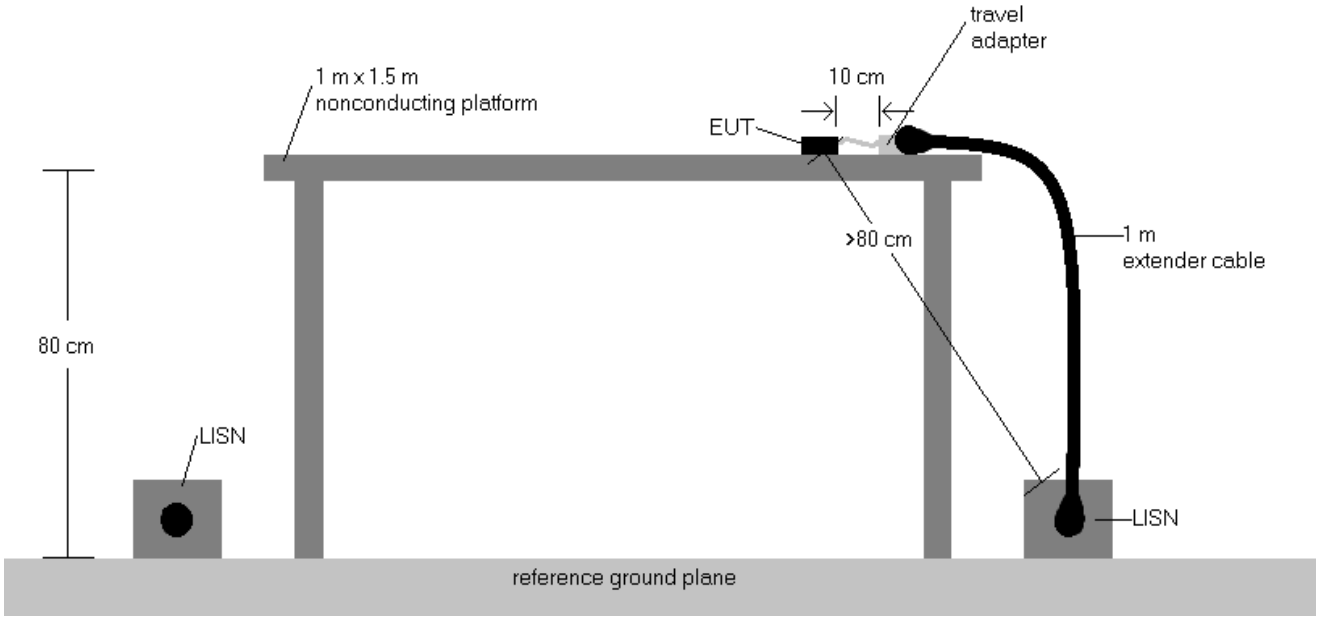
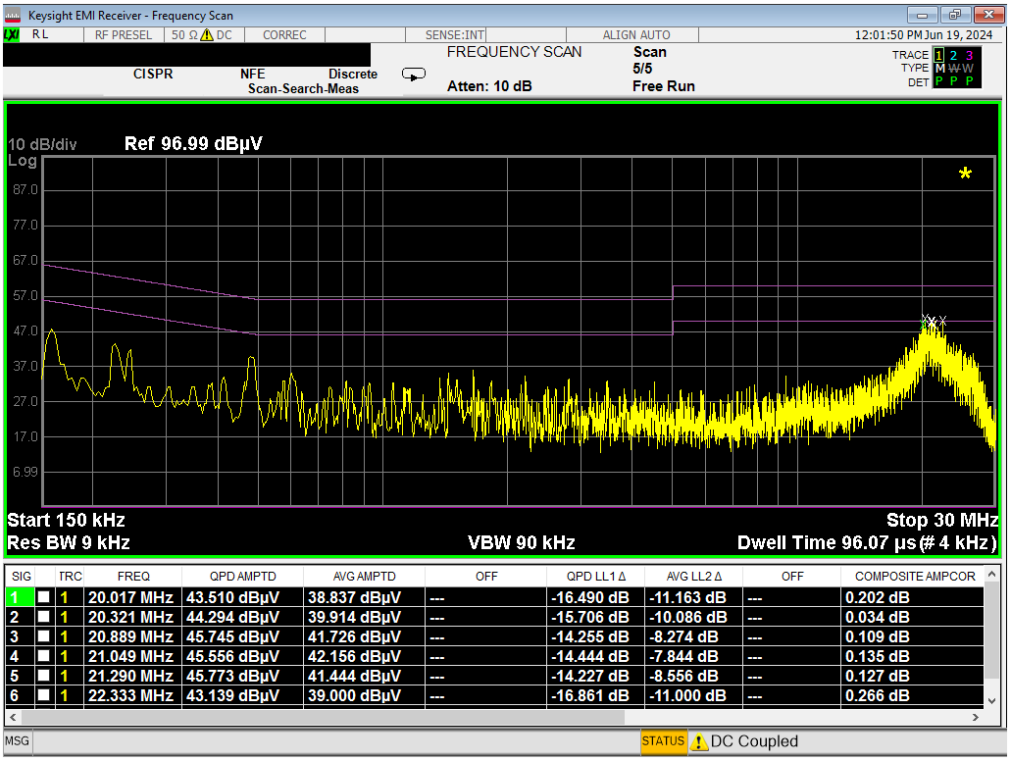


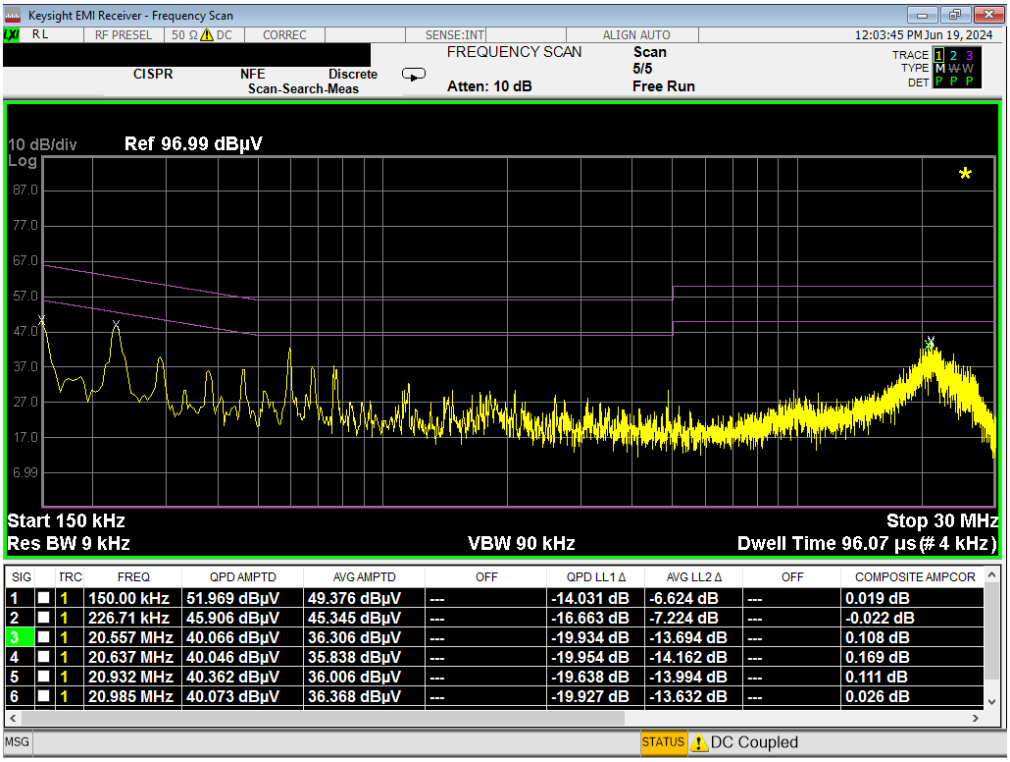
Figure 7-8. Test Instrument & Measurement Setup

Test Notes

1. All modes of operation were investigated, and the worst-case emissions are reported using mid channel. The emissions found were not affected by the choice of channel used during testing.
2. The limit for an intentional radiator from 150kHz to 30MHz is specified in §15.207 and RSS-Gen (8.8).
3. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
4. QP/AV Level (dBμV) = QP/AV Analyzer/Receiver Level (dBμV) + Corr. (dB)
5. Margin (dB) = QP/AV Limit (dBμV) - QP/AV Level (dBμV)
6. Traces shown in plot are made using a peak detector.
7. Deviations to the Specifications: None.



Plot 7-212. Line Conducted Plot with 802.11a UNII Band 1 (L1)



Plot 7-213. Line Conducted Plot with 802.11a UNII Band 1 (N)