Note:

Per ANSI C63.10-2013 Section 14.3.2.2 and KDB 662911 v02r01 Section E)2), the power spectral density at Antenna WF5t and Antenna WF5b 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 Directional Gain Calculation:

For correlated signals, assuming the antenna gain is 1.7 dBi for Antenna WF5t and 3.6 dBi for Antenna WF5b.

$$\text{Directional gain} = 10\log[(10^{G_1/20} + 10^{G_2/20} + \ldots + 10^{G_N/20})^2 / N_{ANT}]\ \text{dBi}$$
$$= 10\log[(10^{4.7/20} + 10^{0.6/20} / 2]\ \text{dBi}$$
$$= 4.77\ \text{dBi}$$

For uncorrelated signals, assuming the antenna gain is 4.7 dBi for Antenna WF5t and 0.6 dBi for Antenna WF5b.

$$\text{Directional gain} = 10\log[(10^{G_1/10} + 10^{G_2/10} + \ldots + 10^{G_N/10}) / N_{ANT}]\ \text{dBi}$$
$$= 10\log[(10^{4.7/10} + 10^{0.6/10} / 2]\ \text{dBi}$$
$$= 1.77\ \text{dBi}$$

Sample SDM Calculation:

At 5955MHz in 802.11ax (20MHz BW) mode, the average conducted power spectral density was measured to be -11.26 dBm for Antenna WF5t and -11.50 dBm for Antenna WF5b.

Antenna WF5t + Antenna WF5b = SDM

(-10.03 dBm + -10.01 dBm) = (0.099 mW + 0.100 mW) = 0.199 mW = -7.01 dBm

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

At 5955MHz in 802.11ax (20MHz BW) mode, the average SDM power density was calculated to be -7.01 dBm with directional gain of 1.77 dBi.

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

-7.01 dBm + 1.77 dBi = -5.23 dBm

7.5 In-Band Emissions – 802.11ax OFDMA
§15.407(b)(7), RSS-248 [4.7.2]

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 KDB 789033 D02 v02r01, and at the appropriate frequencies.

For transmitters operating solely in the 5.925-7.125 GHz bands: 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

ANSI C63.10-2013 – Section 12.3.2.2
KDB 987594 D02 v01r01

Test Settings

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

Test Setup

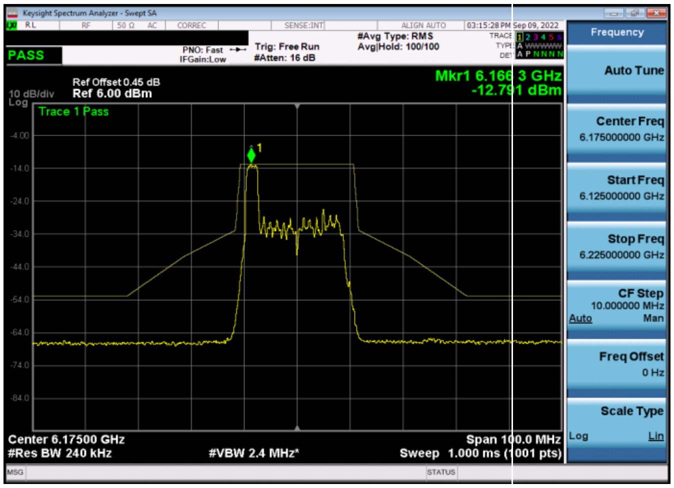
The EUT and measurement equipment were set up as shown in the diagram below.

Figure 7-4. Test Instrument & Measurement Setup

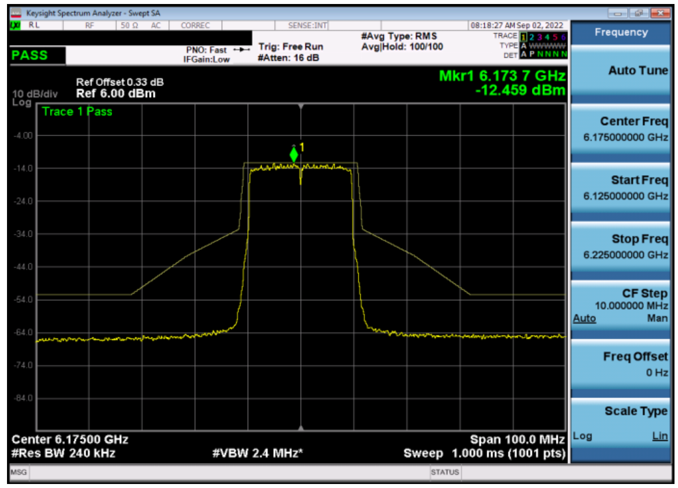
Test Notes

None

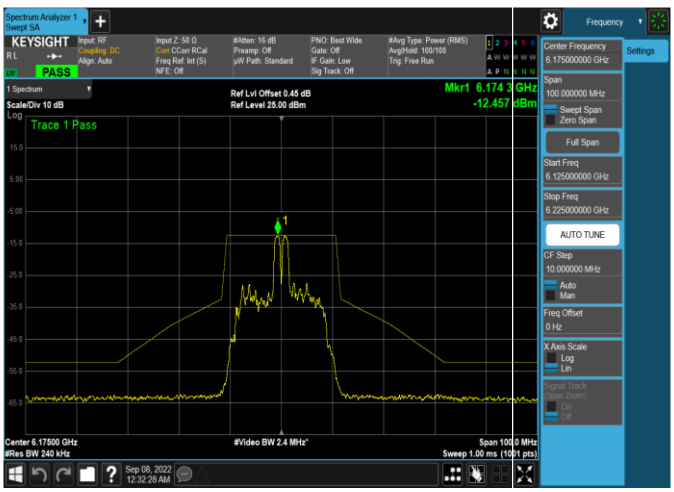
7.5.1 Antenna WF5t In-Band Emission Measurements



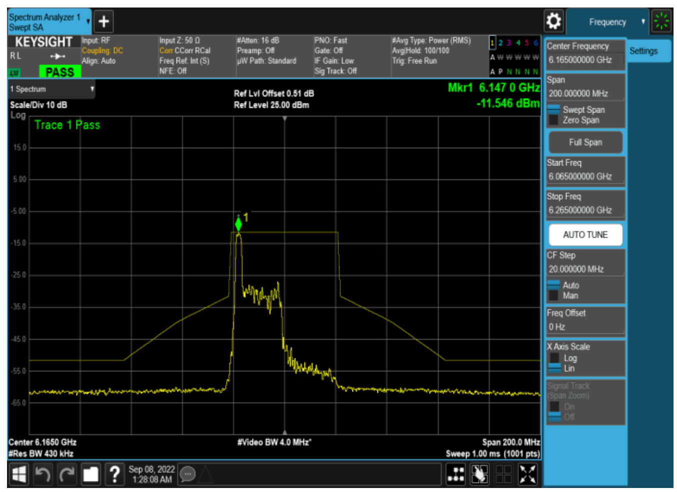
Plot 7-384. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU26 (UNII Band 5) – Ch. 45)



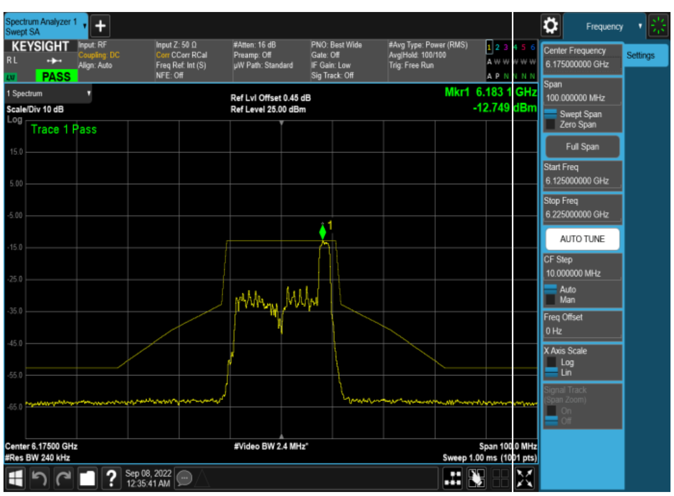
Plot 7-387. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU242 (UNII Band 5) – Ch. 45)



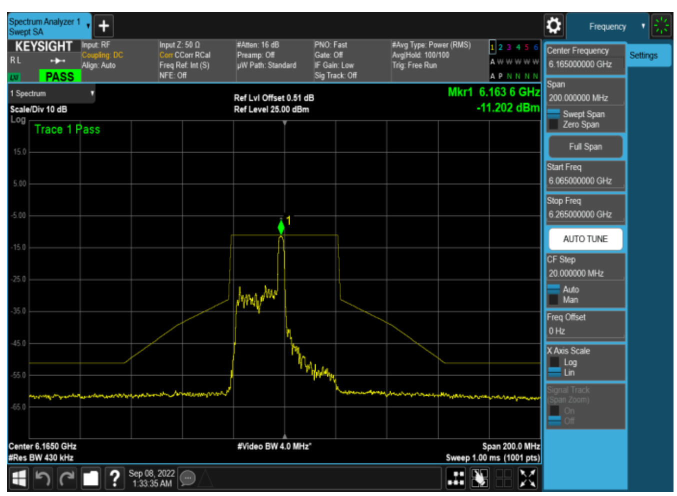
Plot 7-385. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU26 (UNII Band 5) – Ch. 45)



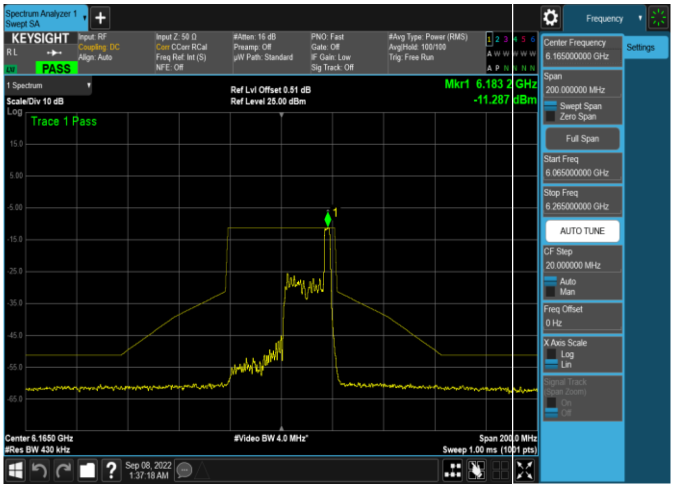
Plot 7-388. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU26 (UNII Band 5) – Ch. 43)



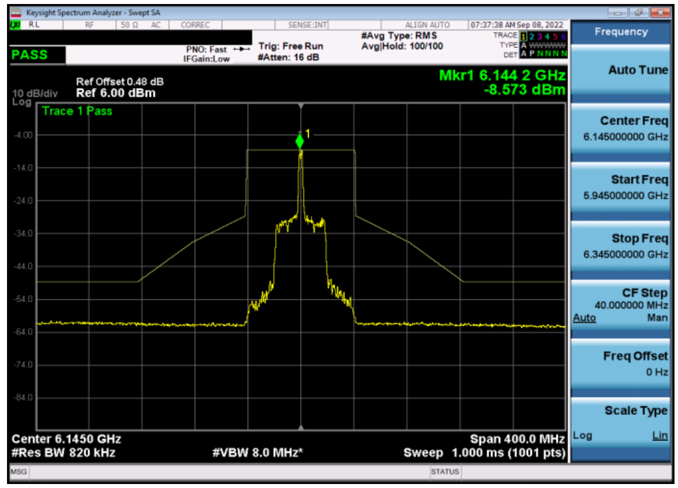
Plot 7-386. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU26 (UNII Band 5) – Ch. 45)



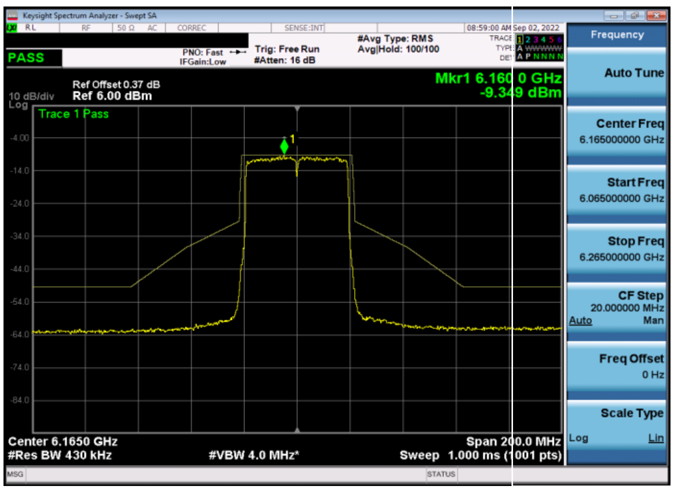
Plot 7-389. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU26 (UNII Band 5) – Ch. 43)



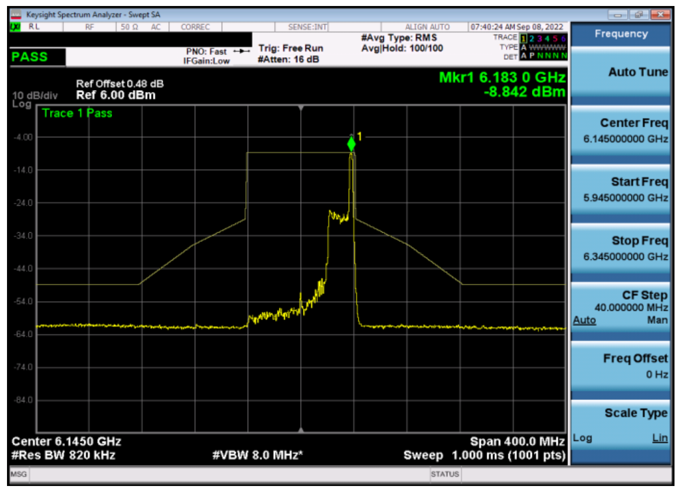
Plot 7-390. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU26 (UNII Band 5) – Ch. 43)



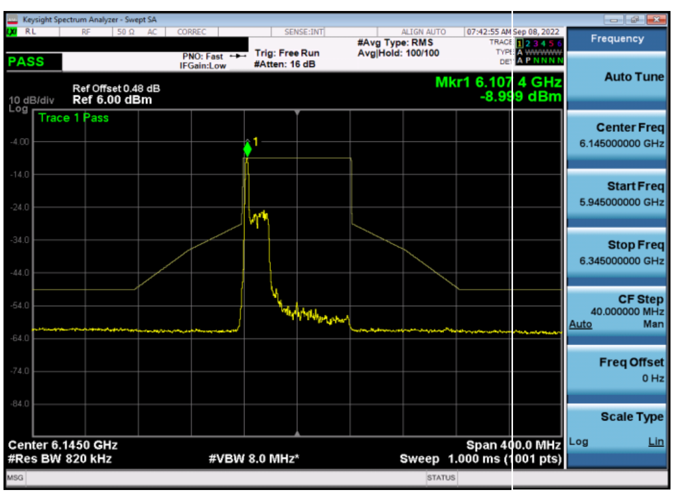
Plot 7-393. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU26 (UNII Band 5) – Ch. 39)



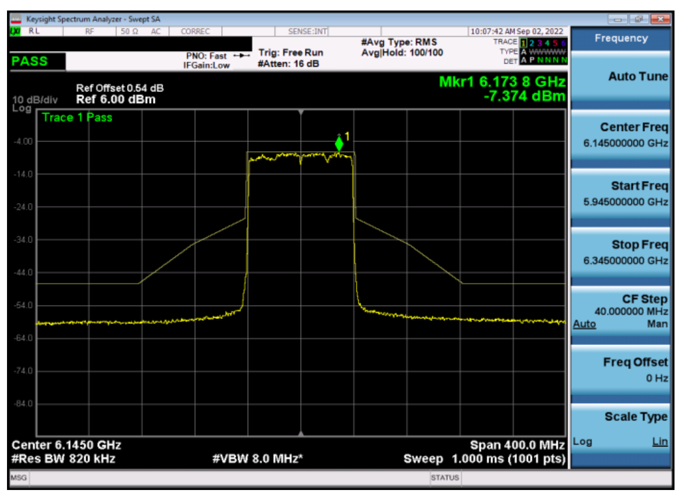
Plot 7-391. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU484 (UNII Band 5) – Ch. 43)



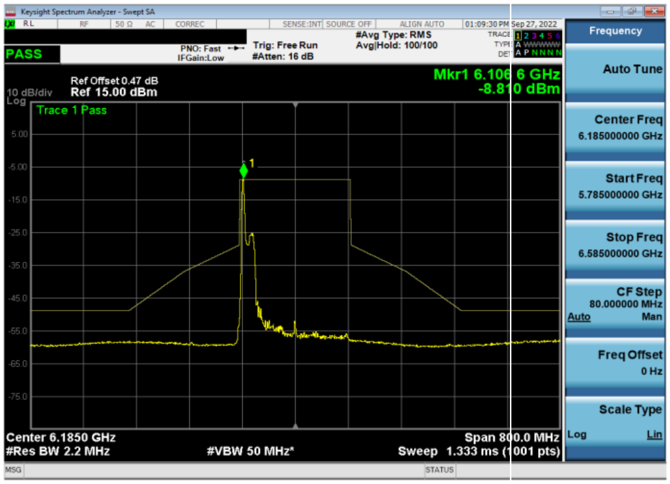
Plot 7-394. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU26 (UNII Band 5) – Ch. 39)



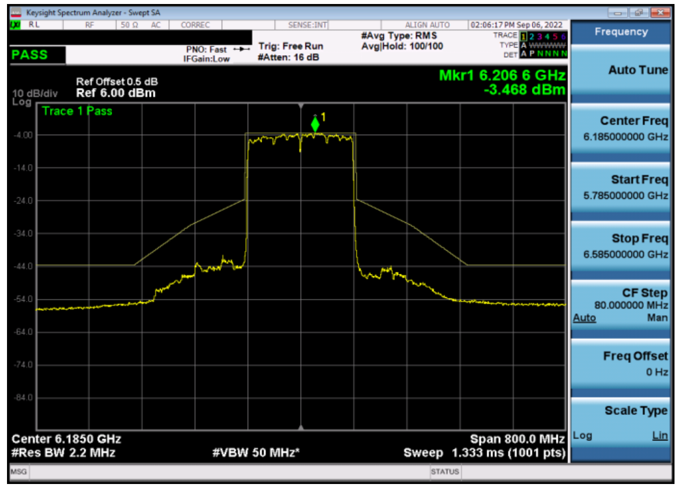
Plot 7-392. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU26 (UNII Band 5) – Ch. 39)



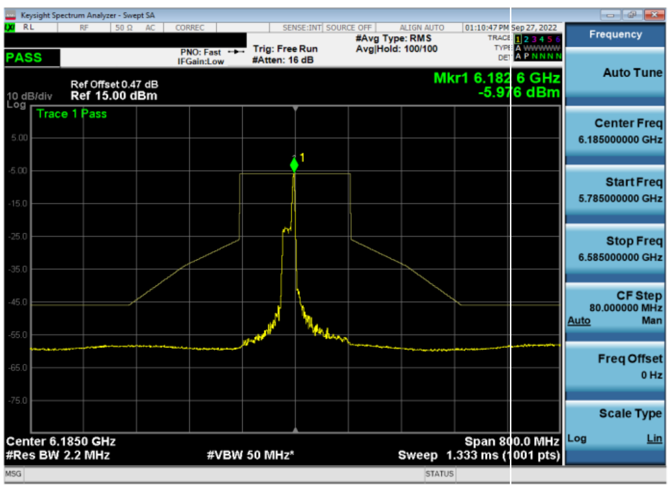
Plot 7-395. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU996 (UNII Band 5) – Ch. 39)



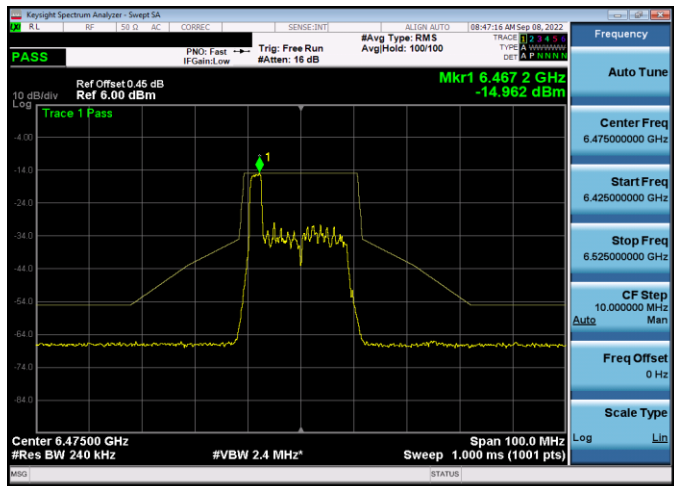
Plot 7-396. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU26 (UNII Band 5) – Ch. 47)



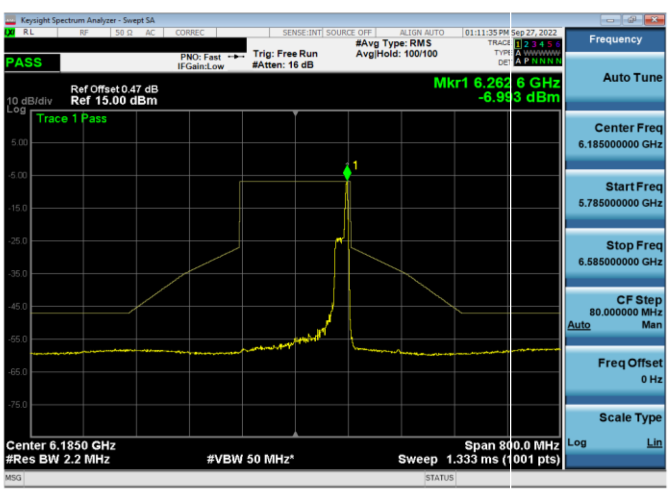
Plot 7-399. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU484 (UNII Band 5) – Ch. 47)



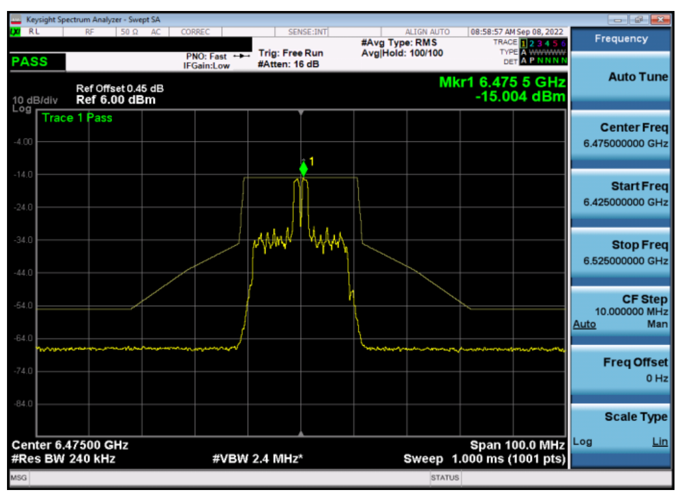
Plot 7-397. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU26 (UNII Band 5) – Ch. 47)



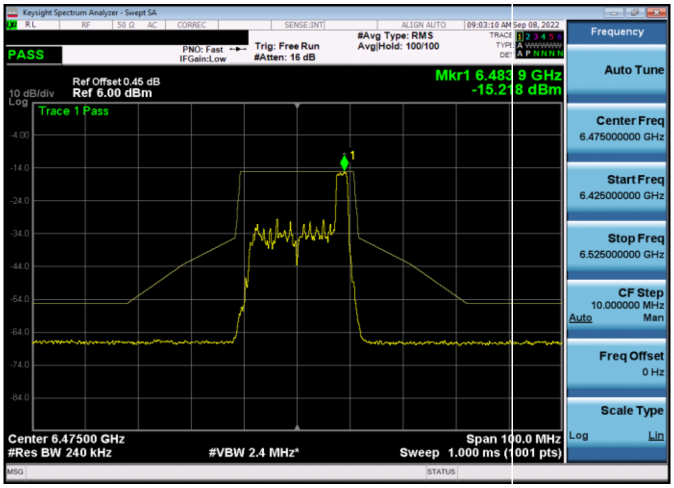
Plot 7-400. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU26 (UNII Band 6) – Ch. 105)



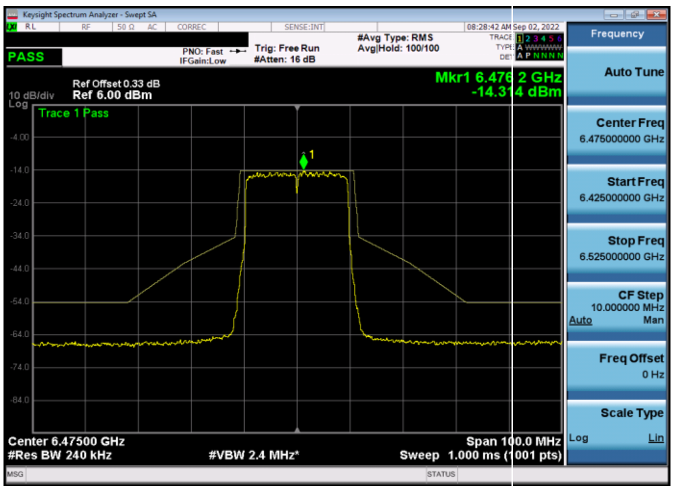
Plot 7-398. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU26 (UNII Band 5) – Ch. 47)



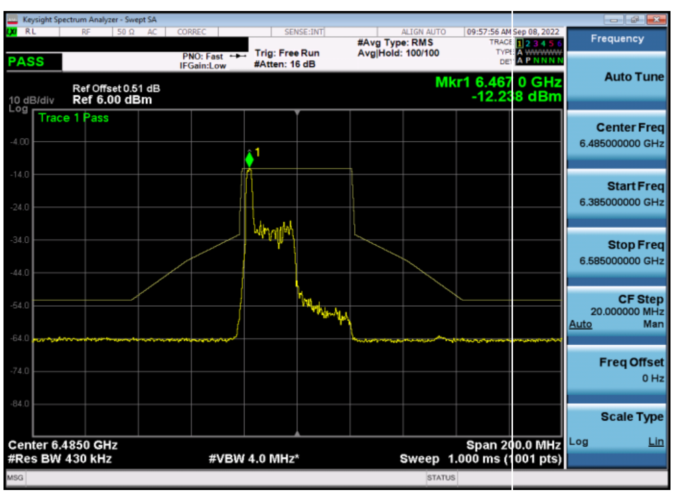
Plot 7-401. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU26 (UNII Band 6) – Ch. 105)



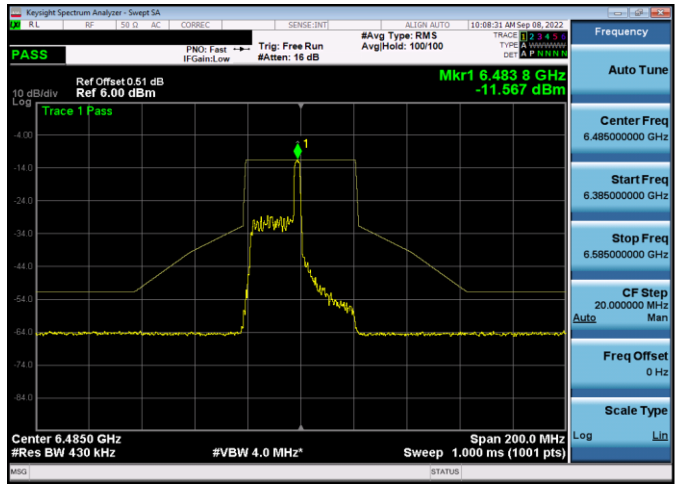
Plot 7-402. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU26 (UNII Band 6) – Ch. 105)



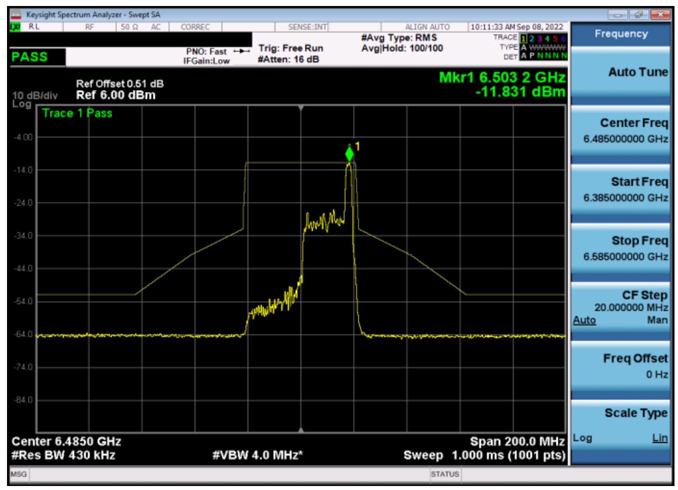
Plot 7-403. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU242 (UNII Band 6) – Ch. 105)



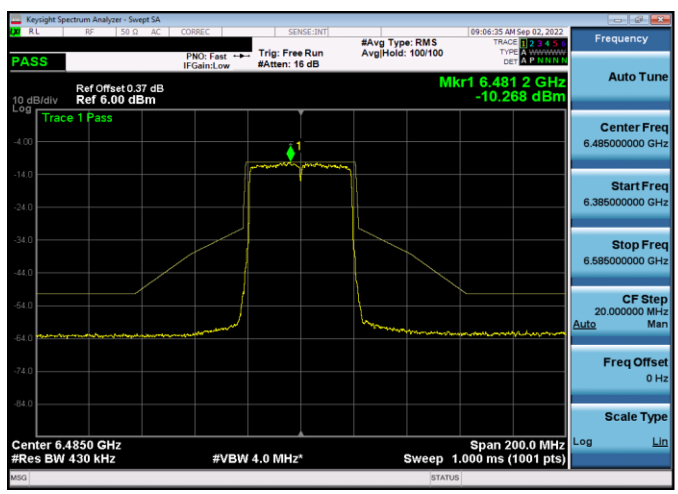
Plot 7-404. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU26 (UNII Band 6) – Ch. 107)



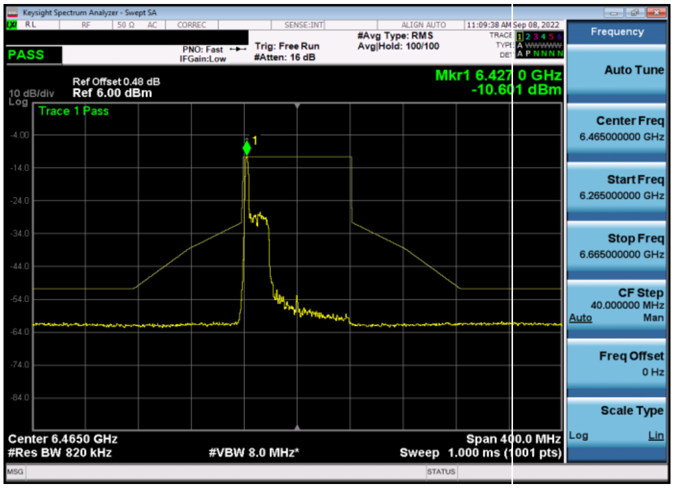
Plot 7-405. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU26 (UNII Band 6) – Ch. 107)



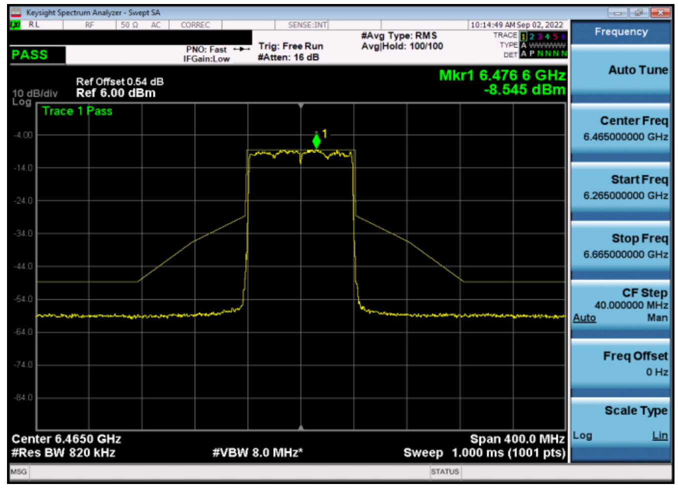
Plot 7-406. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU26 (UNII Band 6) – Ch. 107)



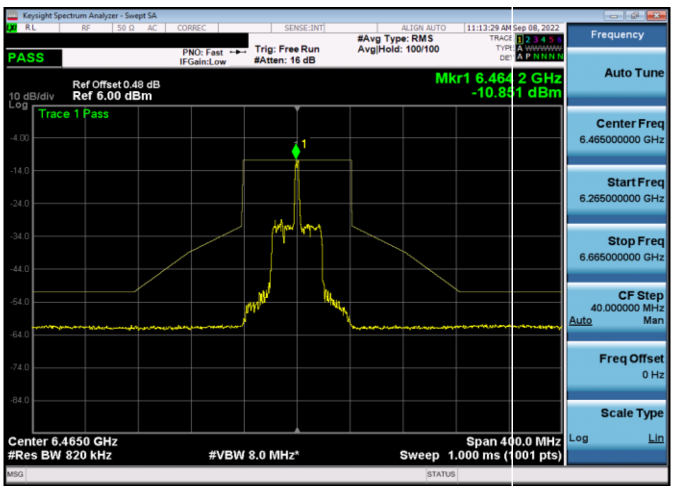
Plot 7-407. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU484 (UNII Band 6) – Ch. 107)



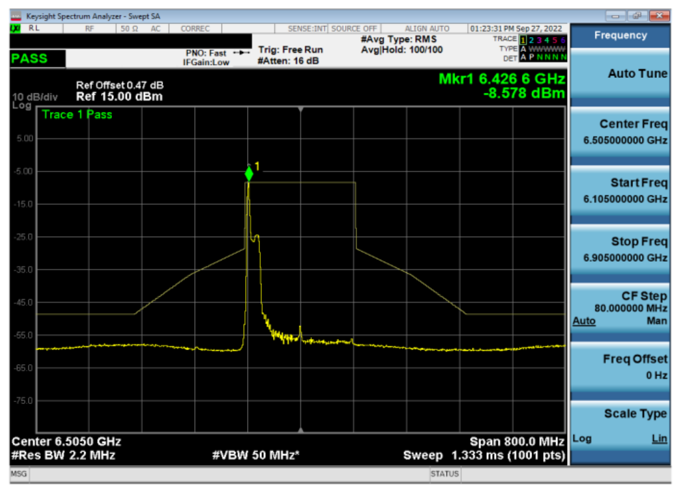
Plot 7-408. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU26 (UNII Band 6) – Ch. 103)



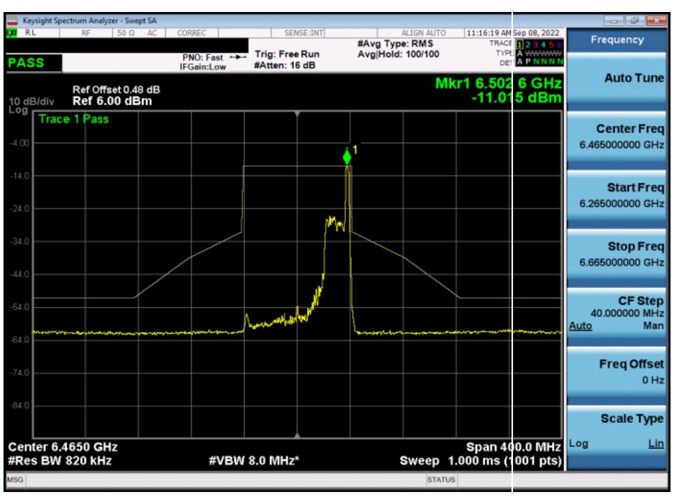
Plot 7-411. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU996 (UNII Band 6) – Ch. 103)



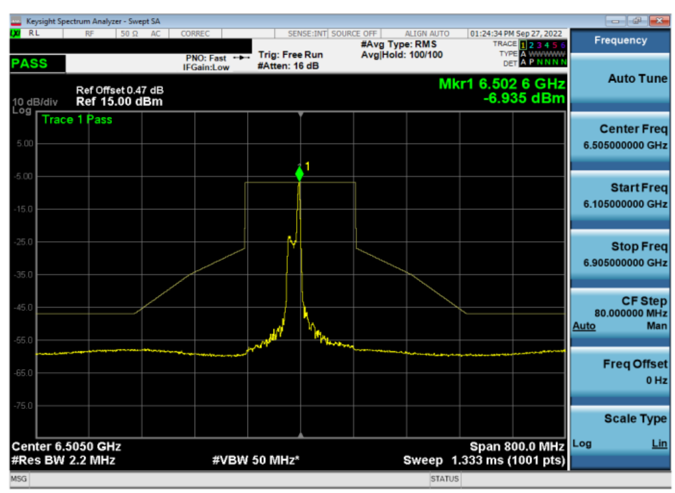
Plot 7-409. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU26 (UNII Band 6) – Ch. 103)



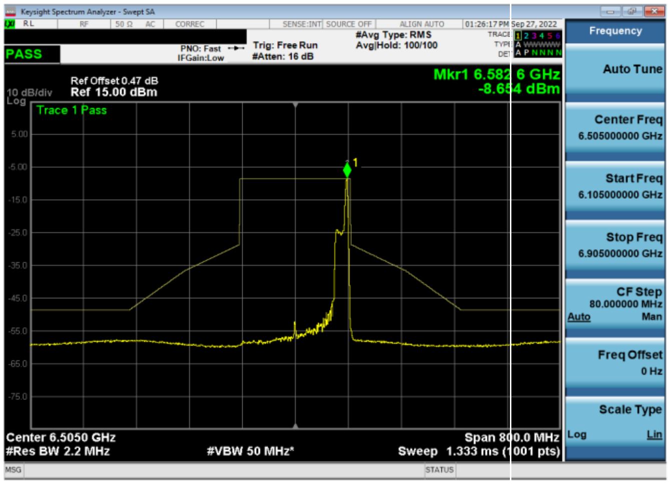
Plot 7-412. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU26 (UNII Band 6) – Ch. 111)



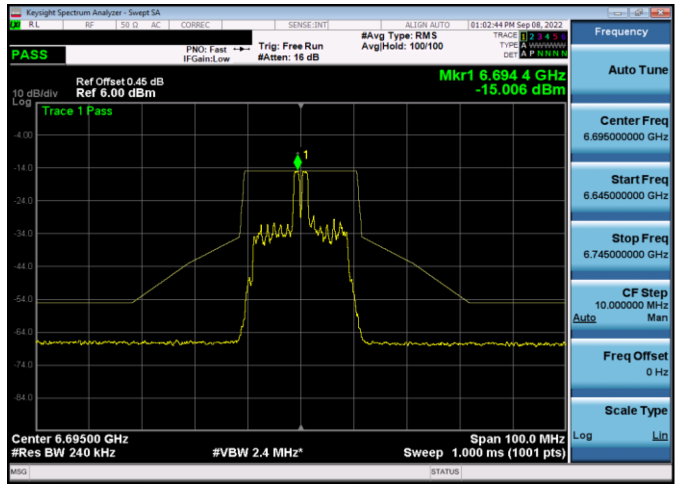
Plot 7-410. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU26 (UNII Band 6) – Ch. 103)



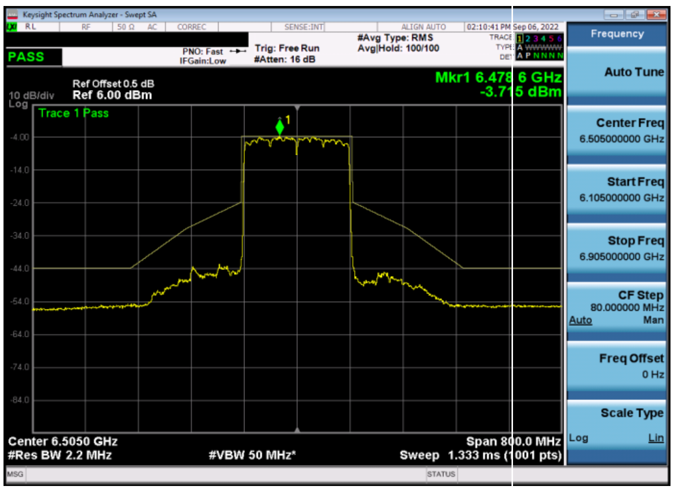
Plot 7-413. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU26 (UNII Band 6) – Ch. 111)



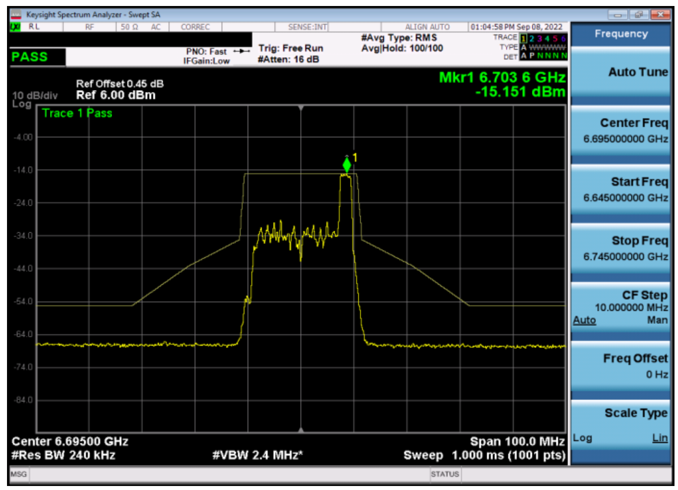
Plot 7-414. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU26 (UNII Band 6) – Ch. 111)



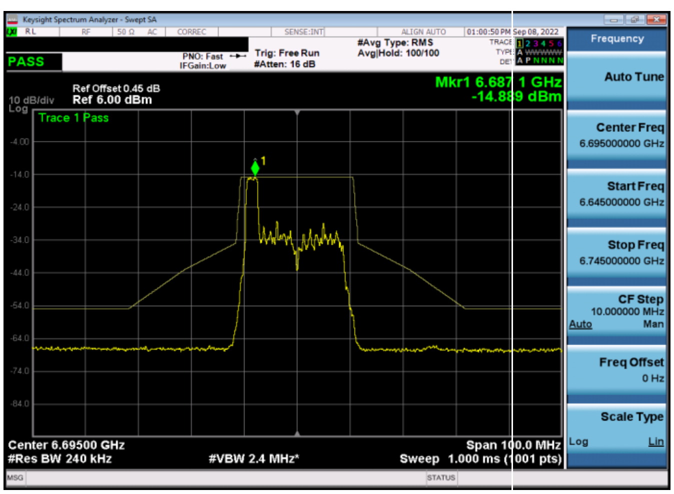
Plot 7-417. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU26 (UNII Band 7) – Ch. 149)



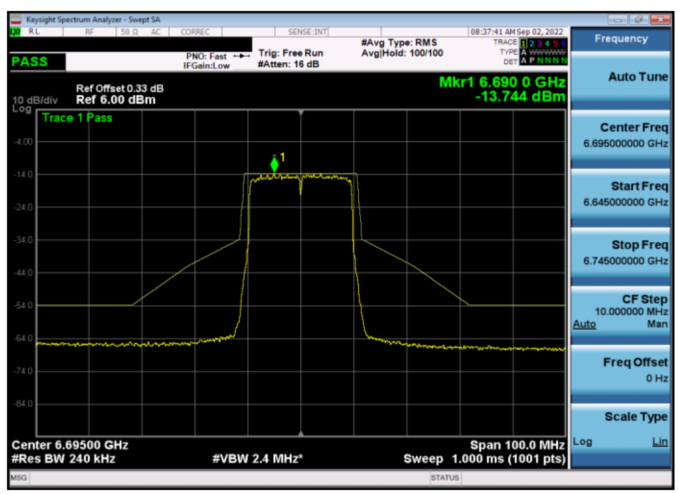
Plot 7-415. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU484 (UNII Band 6) – Ch. 111)



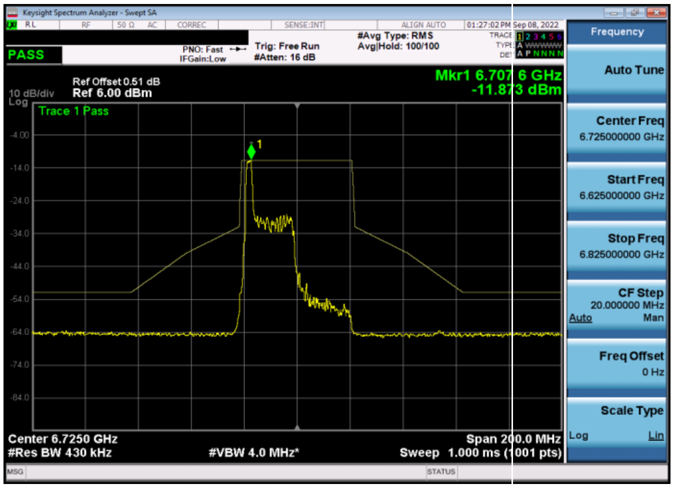
Plot 7-418. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU26 (UNII Band 7) – Ch. 149)



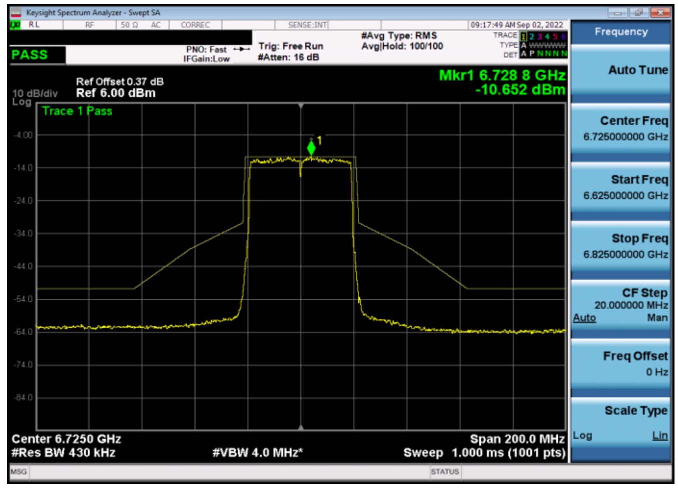
Plot 7-416. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU26 (UNII Band 7) – Ch. 149)



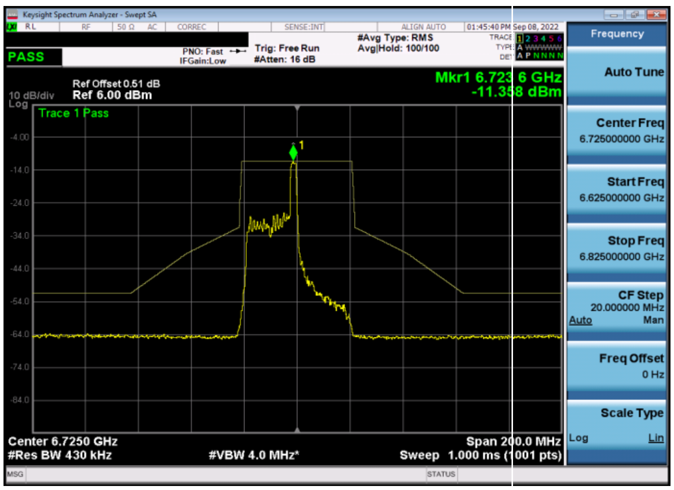
Plot 7-419. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU242 (UNII Band 7) – Ch. 149)



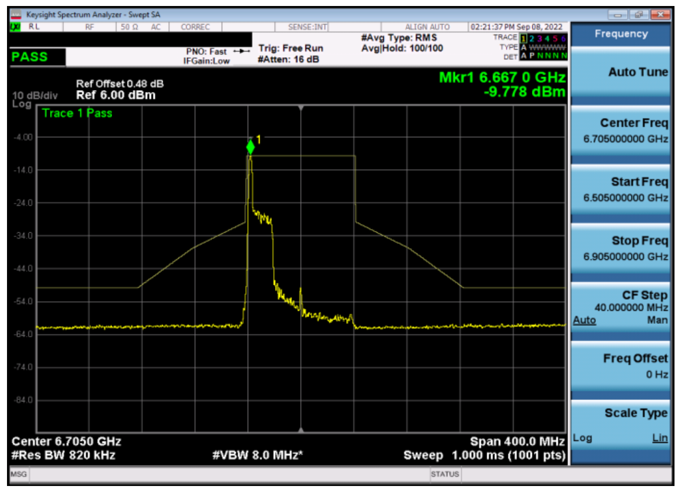
Plot 7-420. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU26 (UNII Band 7) – Ch. 155)



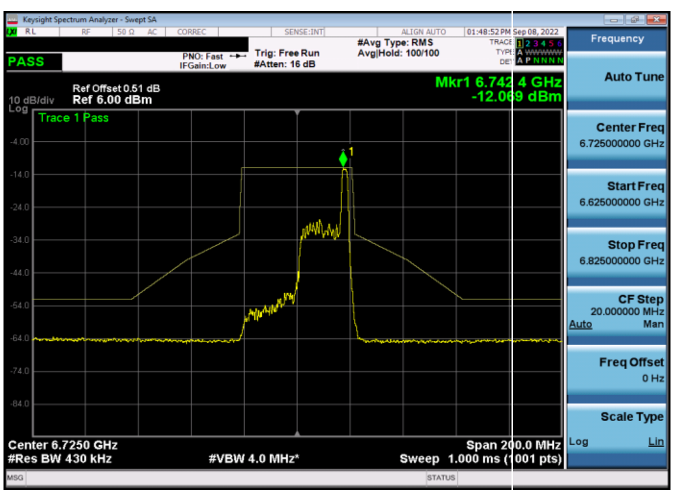
Plot 7-423. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU484 (UNII Band 7) – Ch. 155)



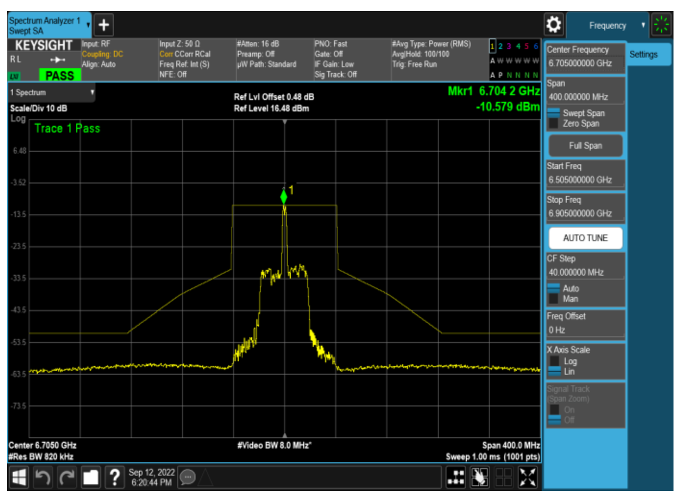
Plot 7-421. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU26 (UNII Band 7) – Ch. 155)



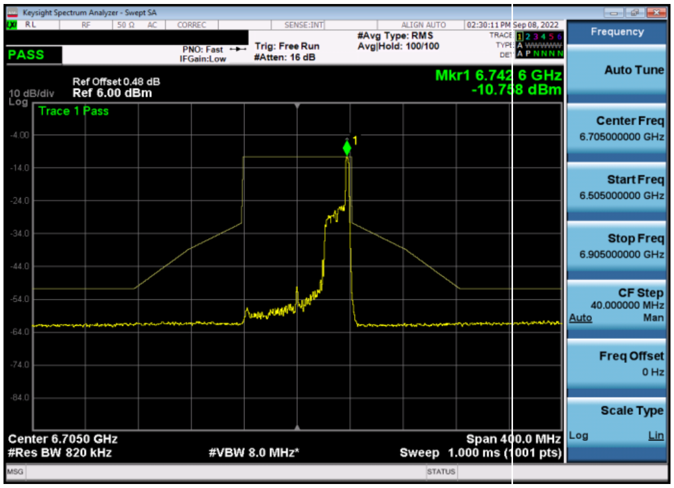
Plot 7-424. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU26 (UNII Band 7) – Ch. 151)



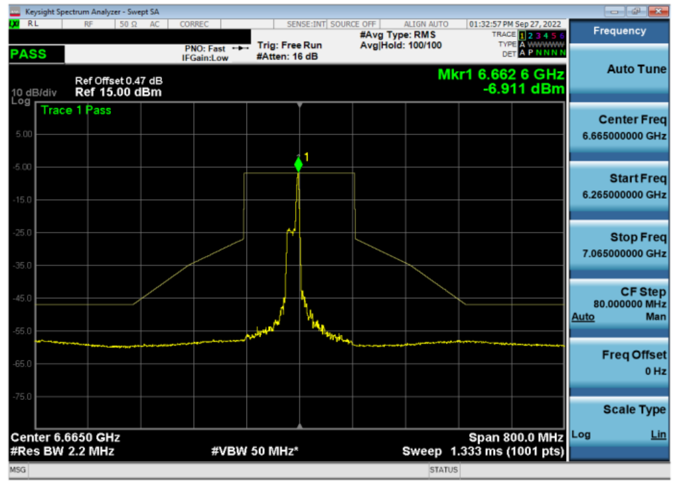
Plot 7-422. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU26 (UNII Band 7) – Ch. 155)



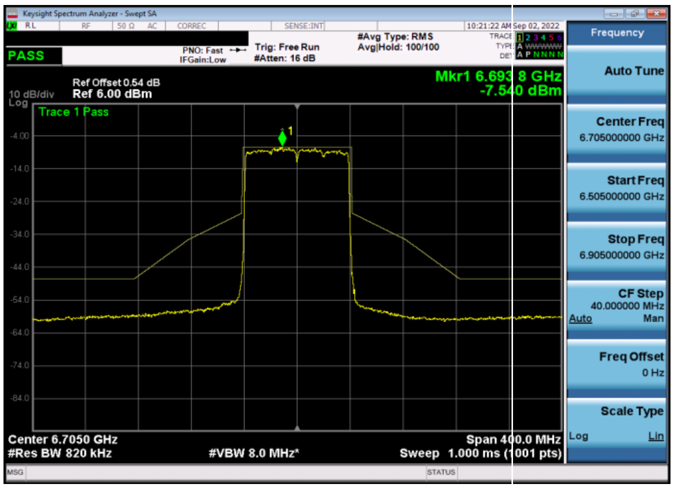
Plot 7-425. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU26 (UNII Band 7) – Ch. 151)



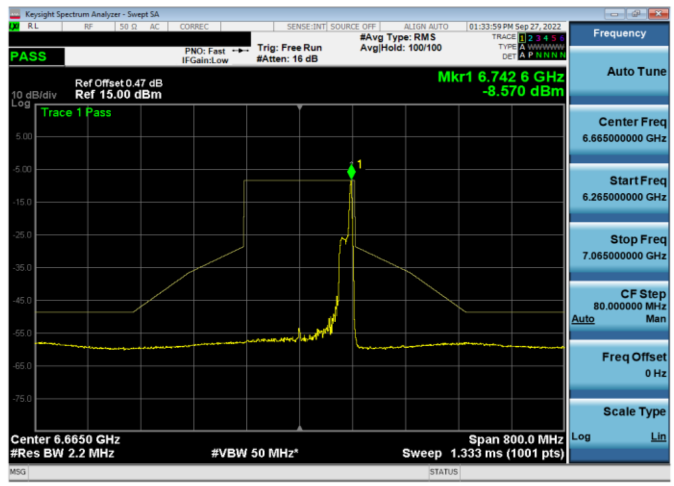
Plot 7-426. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU26 (UNII Band 7) – Ch. 151)



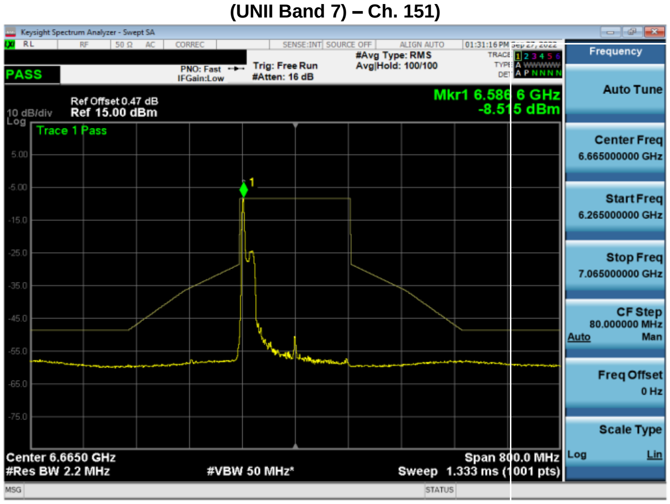
Plot 7-429. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU26 (UNII Band 7) – Ch. 143)



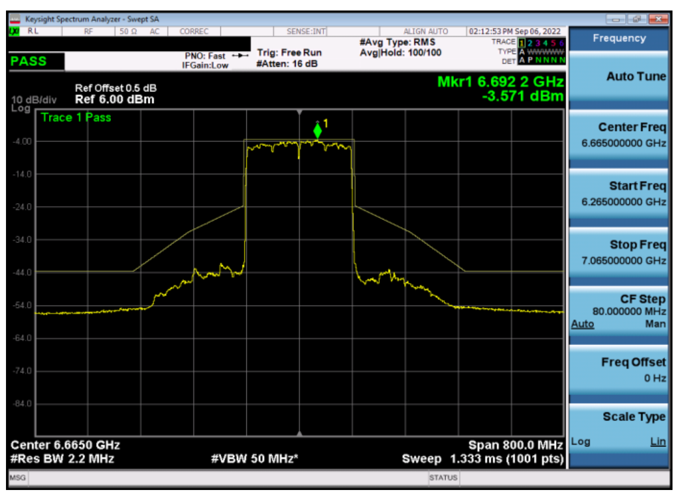
Plot 7-427. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU996 (UNII Band 7) – Ch. 151)



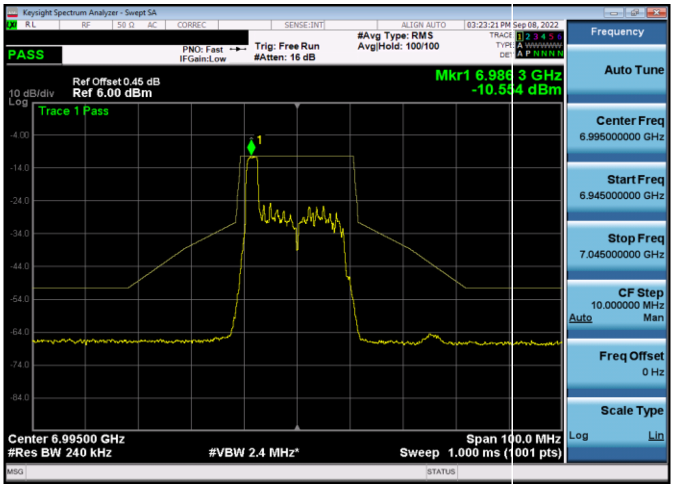
Plot 7-430. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU26 (UNII Band 7) – Ch. 143)



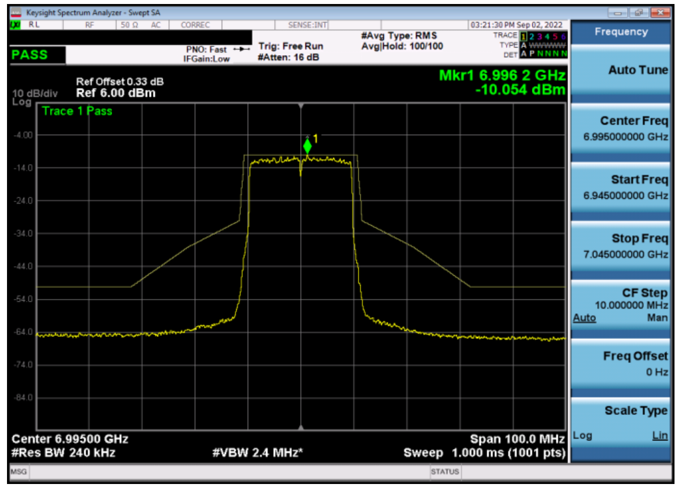
Plot 7-428. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU26 (UNII Band 7) – Ch. 143)



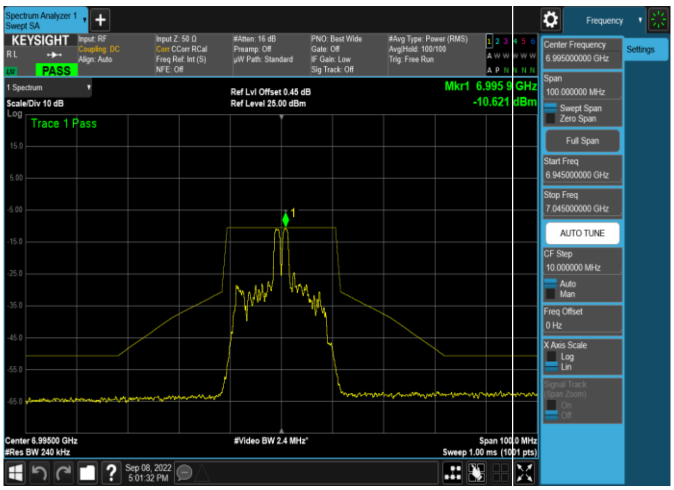
Plot 7-431. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU484 (UNII Band 7) – Ch. 143)



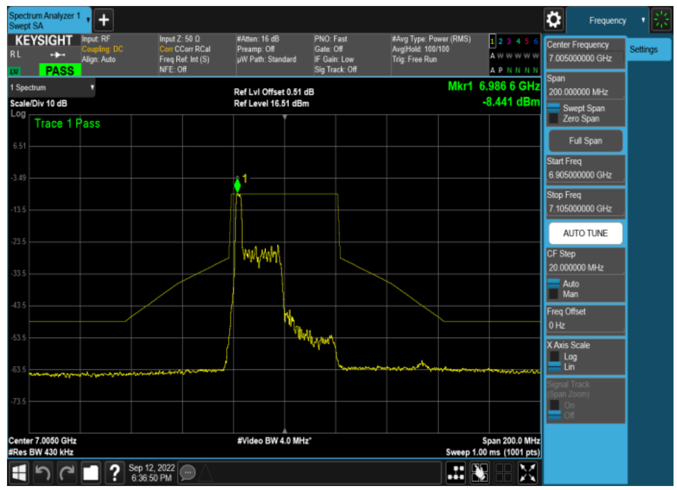
Plot 7-432. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU26 (UNII Band 8) – Ch. 209)



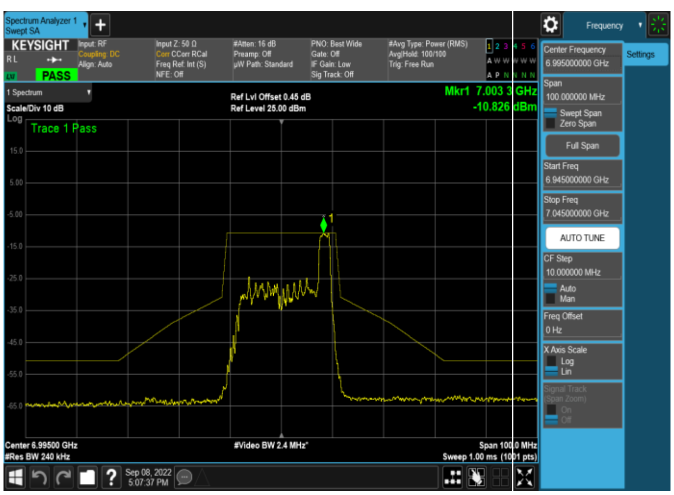
Plot 7-435. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU242 (UNII Band 8) – Ch. 209)



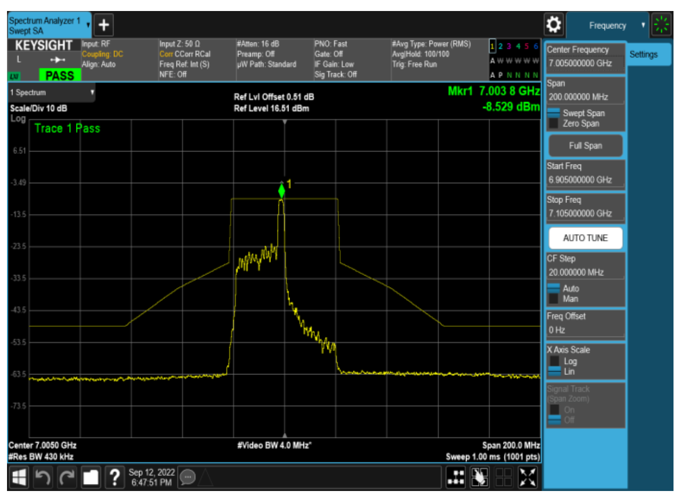
Plot 7-433. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU26 (UNII Band 8) – Ch. 209)



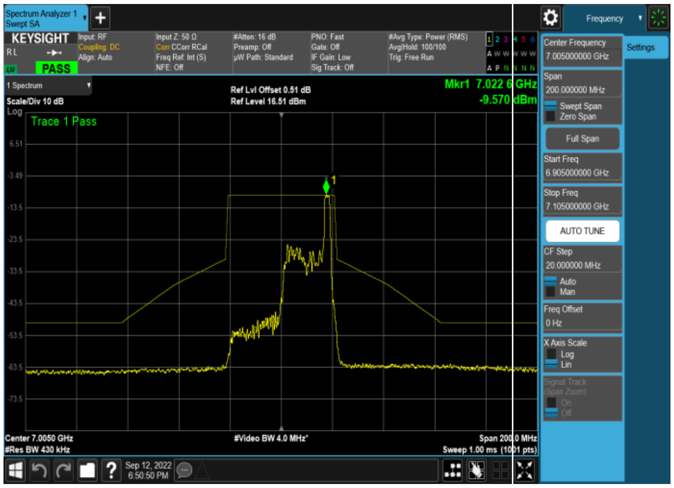
Plot 7-436. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU26 (UNII Band 8) – Ch. 211)



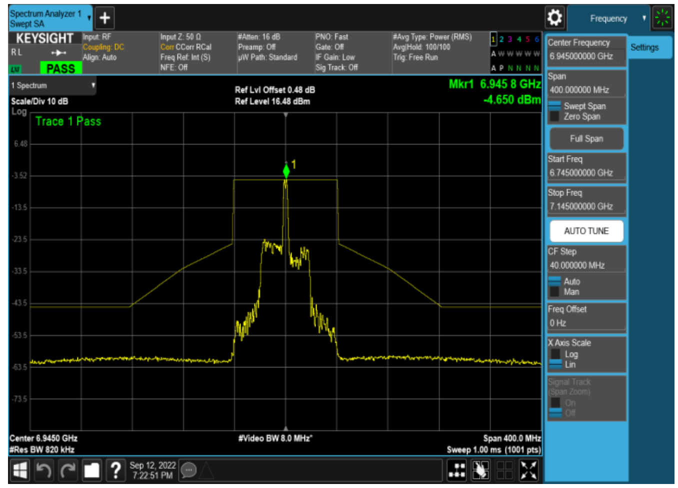
Plot 7-434. In-Band Emission Plot Antenna WF5t (20MHz 802.11ax RU26 (UNII Band 8) – Ch. 209)



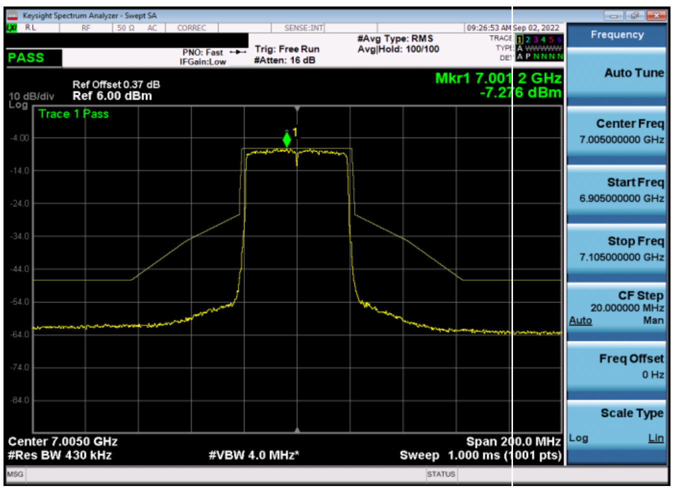
Plot 7-437. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU26 (UNII Band 8) – Ch. 211)



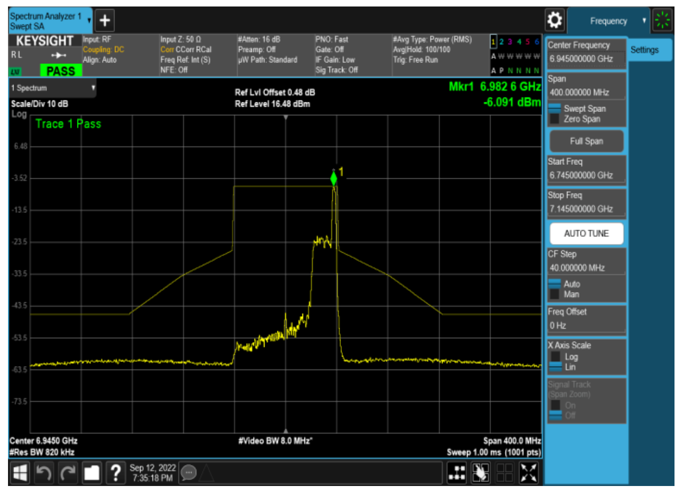
Plot 7-438. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU26 (UNII Band 8) – Ch. 211)



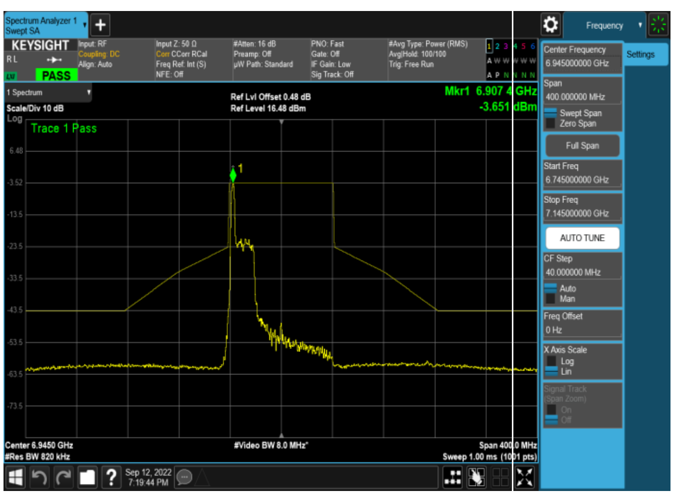
Plot 7-441. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU26 (UNII Band 8) – Ch. 199)



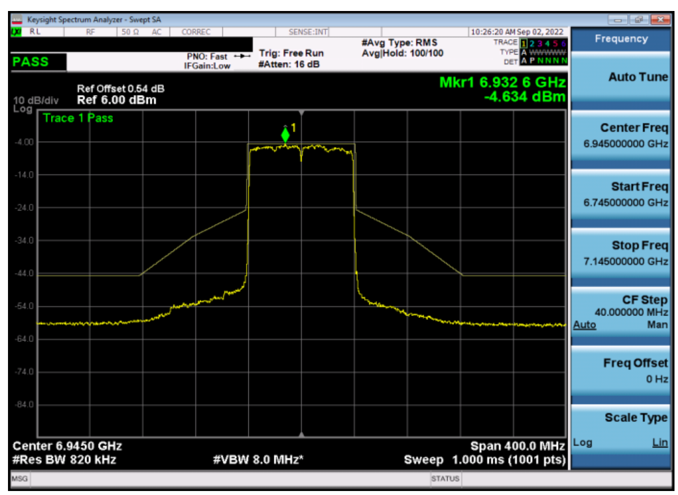
Plot 7-439. In-Band Emission Plot Antenna WF5t (40MHz 802.11ax RU484 (UNII Band 8) – Ch. 211)



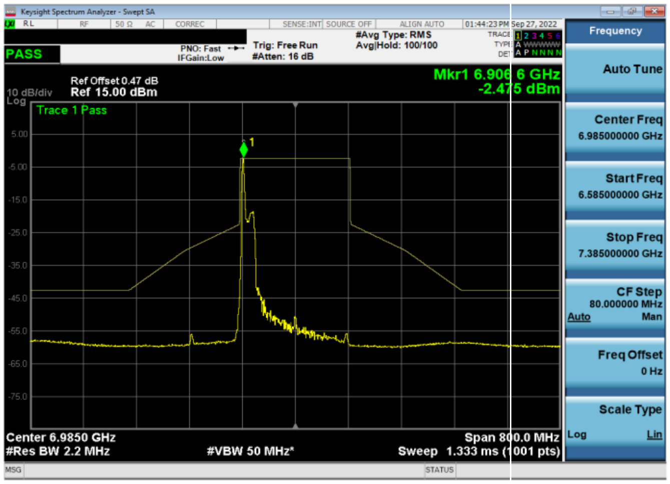
Plot 7-442. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU26 (UNII Band 8) – Ch. 199)



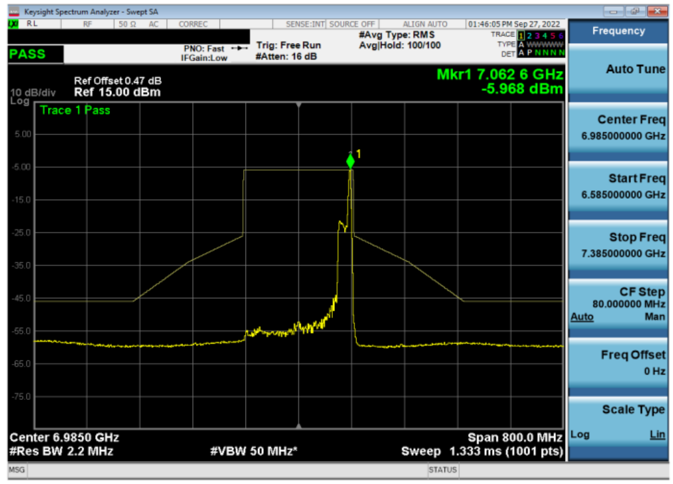
Plot 7-440. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU26 (UNII Band 8) – Ch. 199)



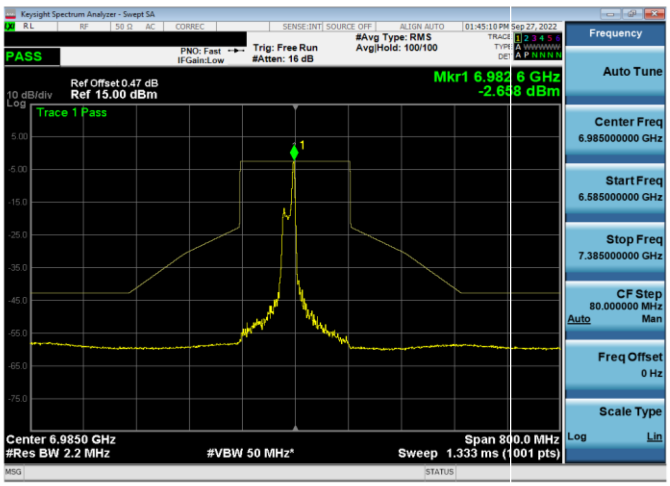
Plot 7-443. In-Band Emission Plot Antenna WF5t (80MHz 802.11ax RU996 (UNII Band 8) – Ch. 199)



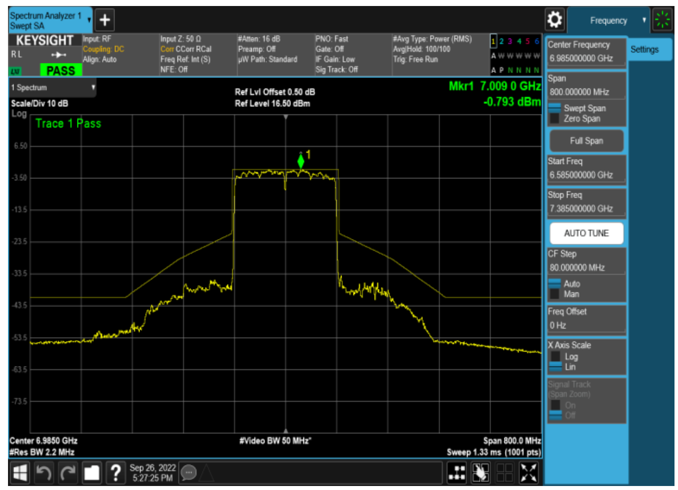
Plot 7-444. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU26 (UNII Band 8) – Ch. 207)



Plot 7-446. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU26 (UNII Band 8) – Ch. 207)



Plot 7-445. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU26 (UNII Band 8) – Ch. 207)



Plot 7-447. In-Band Emission Plot Antenna WF5t (160MHz 802.11ax RU484 (UNII Band 8) – Ch. 207)