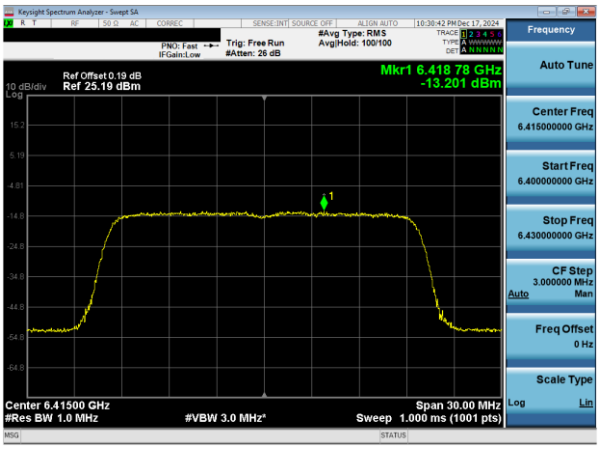
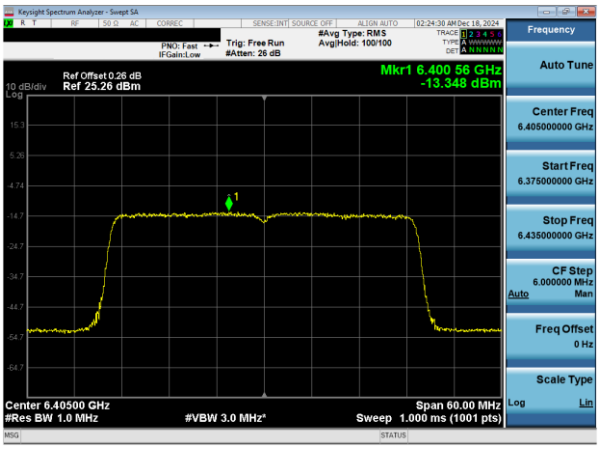
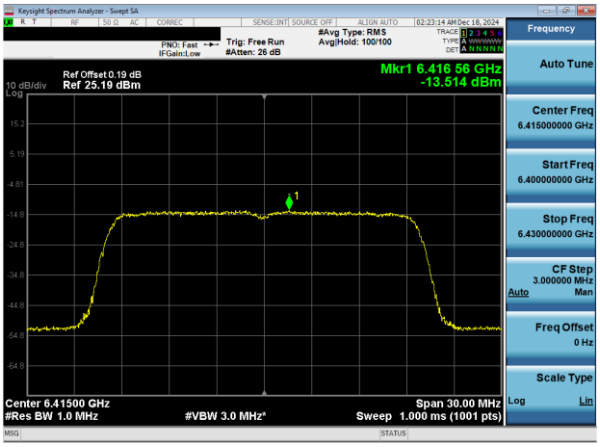


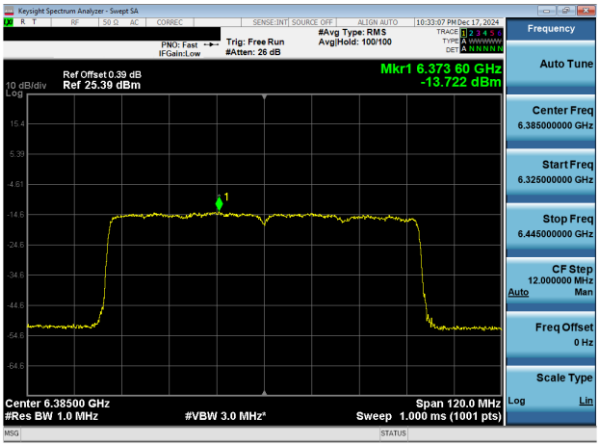
Plot 7-71. PSD Plot Antenna WF8 (20MHz 802.11ax RU242 (UNII Band 5) – Ch. 93)



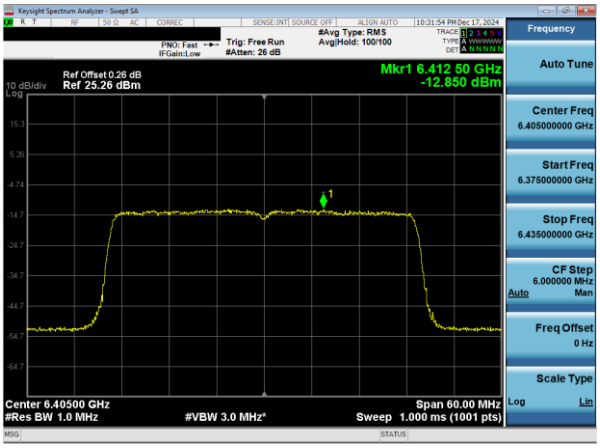
Plot 7-74. PSD Plot Antenna WF7a (40MHz 802.11ax RU484 (UNII Band 5) – Ch. 91)



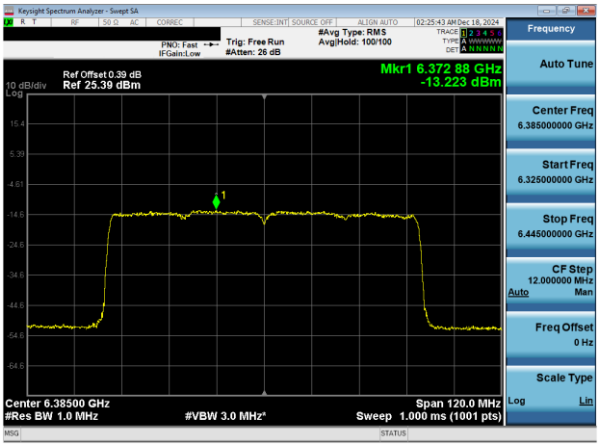
Plot 7-72. PSD Plot Antenna WF7a (20MHz 802.11ax RU242 (UNII Band 5) – Ch. 93)



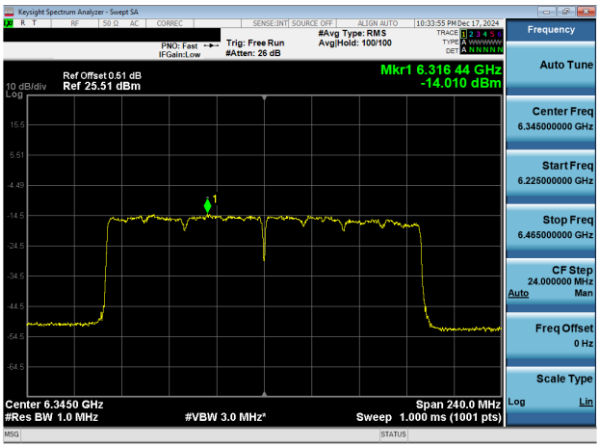
Plot 7-75. PSD Plot Antenna WF8 (80MHz 802.11ax RU996 (UNII Band 5) – Ch. 87)



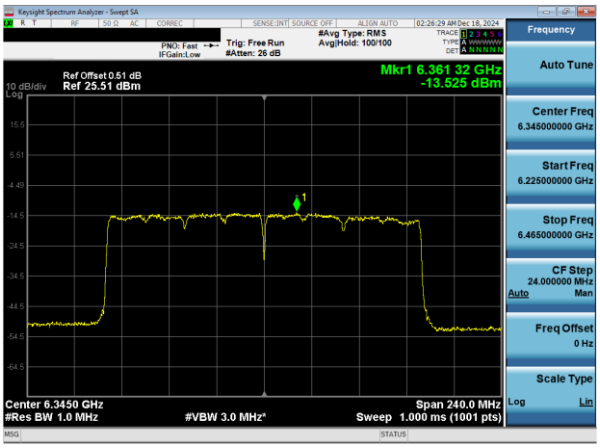
Plot 7-73. PSD Plot Antenna WF8 (40MHz 802.11ax RU484 (UNII Band 5) – Ch. 91)



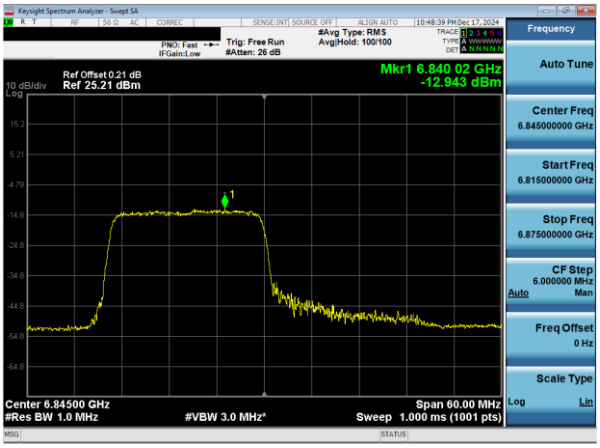
Plot 7-76. PSD Plot Antenna WF7a (80MHz 802.11ax RU996 (UNII Band 5) – Ch. 87)



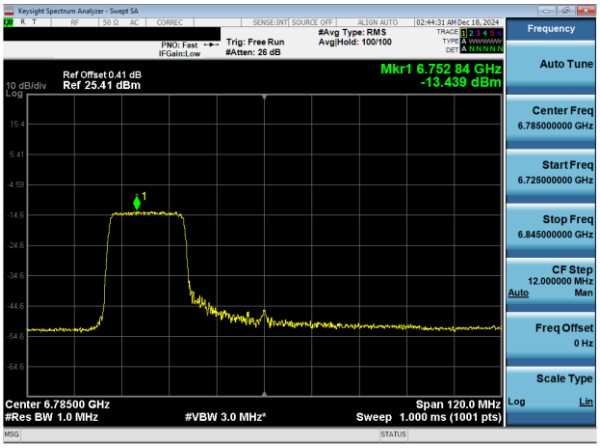
Plot 7-77. PSD Plot Antenna WF8 (160MHz 802.11ax RU996x2 (UNII Band 5) – Ch. 47)



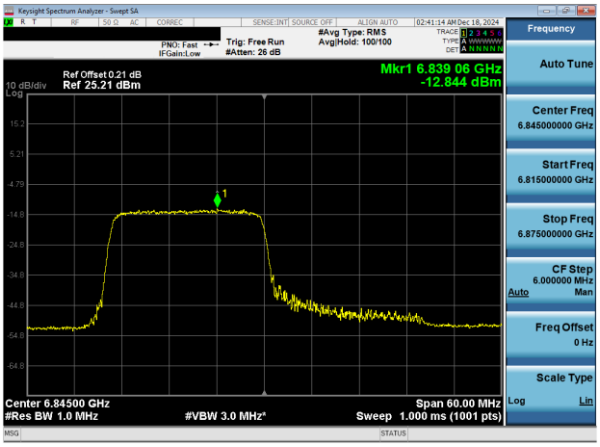
Plot 7-78. PSD Plot Antenna WF7a (160MHz 802.11ax RU996x2 (UNII Band 5) – Ch. 47)



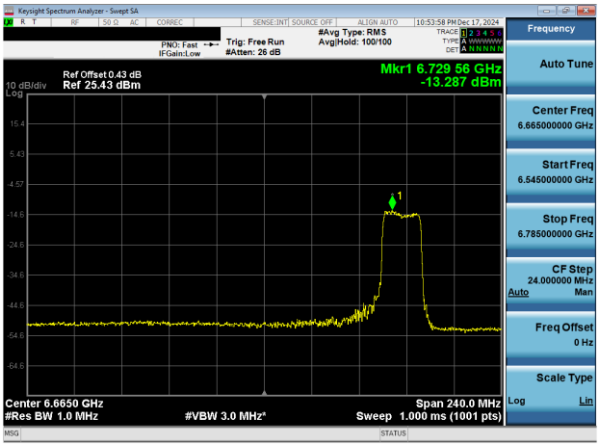
Plot 7-79. PSD Plot Antenna WF8 (40MHz 802.11ax RU242 (UNII Band 7) – Ch. 179)



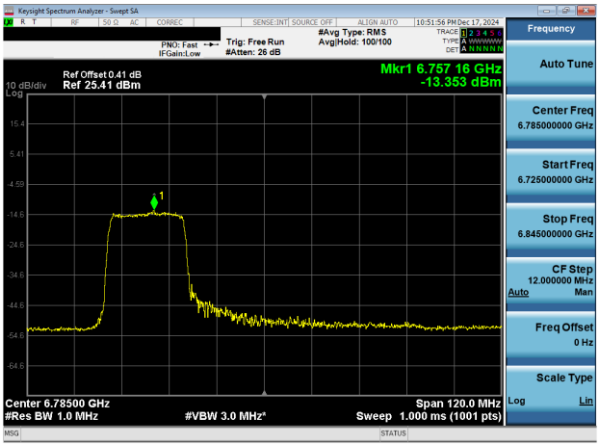
Plot 7-82. PSD Plot Antenna WF7a (80MHz 802.11ax RU242 (UNII Band 7) – Ch. 167)



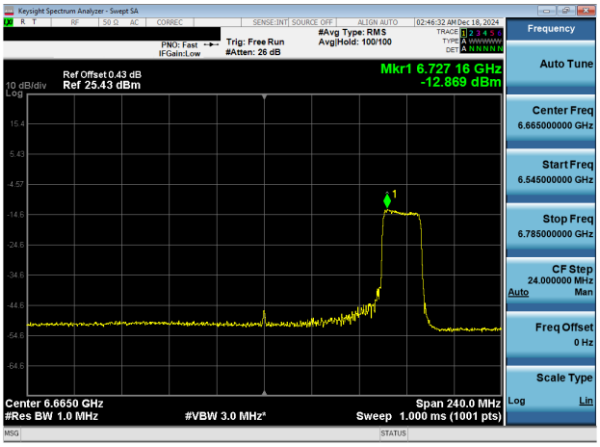
Plot 7-80. PSD Plot Antenna WF7a (40MHz 802.11ax RU242 (UNII Band 7) – Ch. 179)



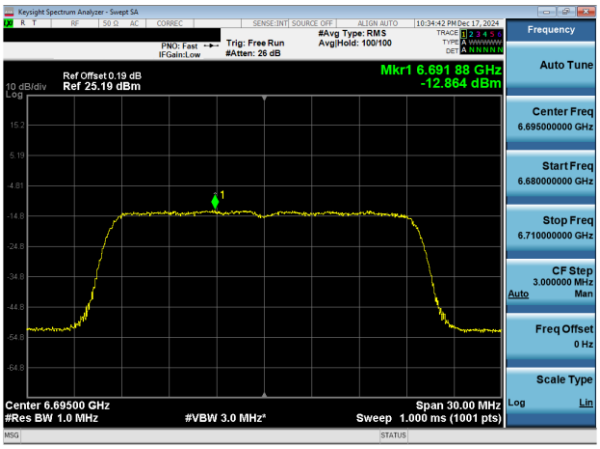
Plot 7-83. PSD Plot Antenna WF8 (160MHz 802.11ax RU242 (UNII Band 7) – Ch. 143)



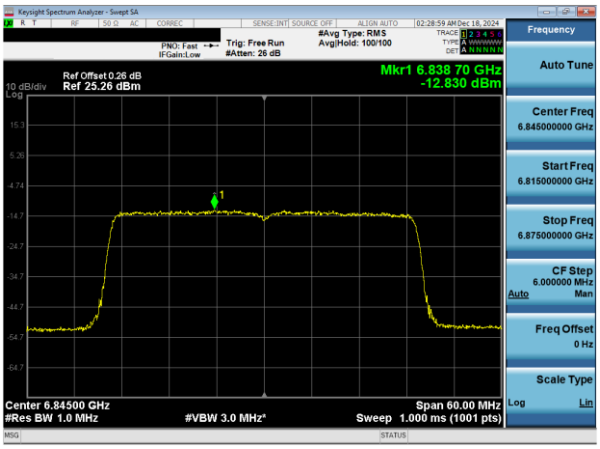
Plot 7-81. PSD Plot Antenna WF8 (80MHz 802.11ax RU242 (UNII Band 7) – Ch. 167)



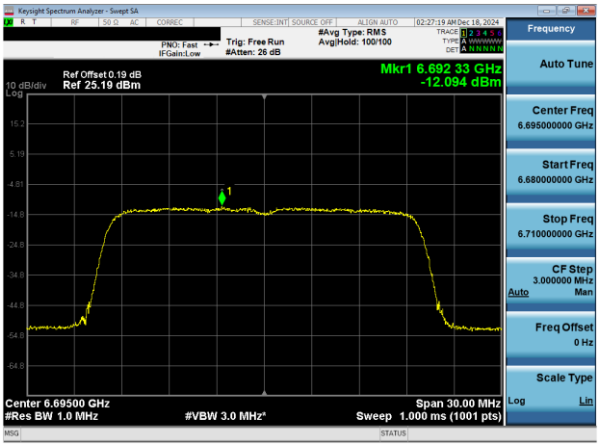
Plot 7-84. PSD Plot Antenna WF7a (160MHz 802.11ax RU242 (UNII Band 7) – Ch. 143)



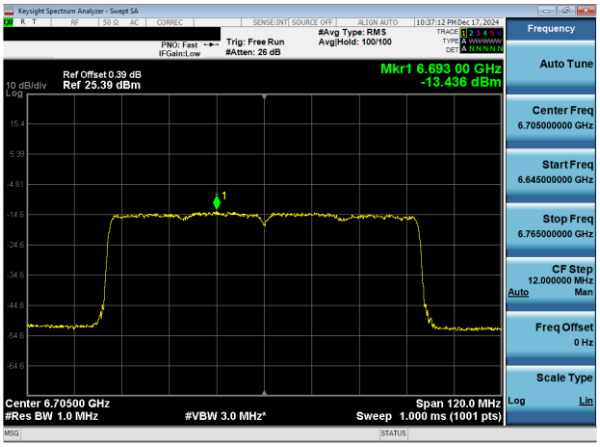
Plot 7-85. PSD Plot Antenna WF8 (20MHz 802.11ax RU242 (UNII Band 7) – Ch. 149)



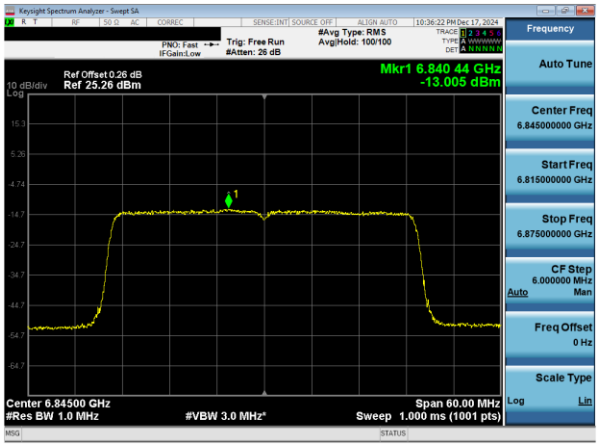
Plot 7-88. PSD Plot Antenna WF7a (40MHz 802.11ax RU484 (UNII Band 7) – Ch. 179)



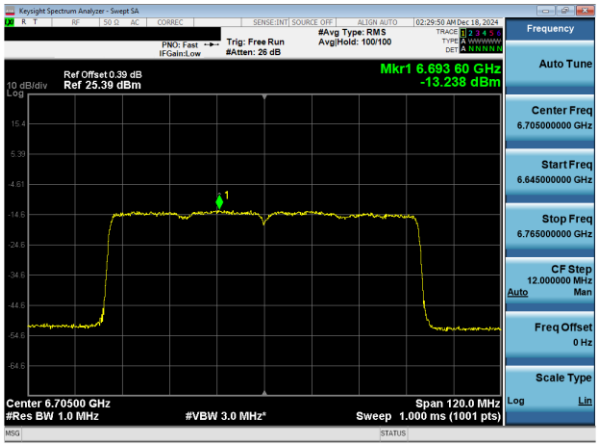
Plot 7-86. PSD Plot Antenna WF7a (20MHz 802.11ax RU242 (UNII Band 7) – Ch. 149)



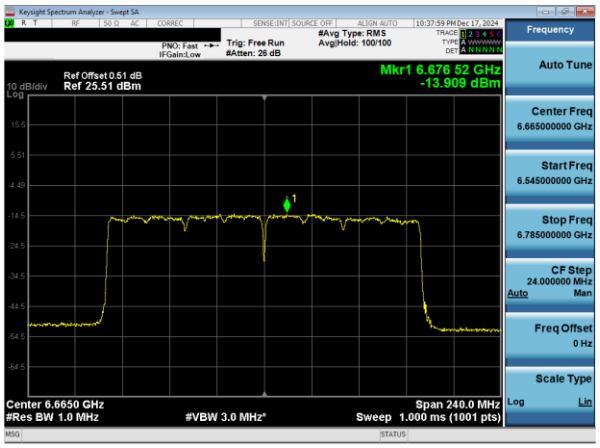
Plot 7-89. PSD Plot Antenna WF8 (80MHz 802.11ax RU996 (UNII Band 7) – Ch. 151)



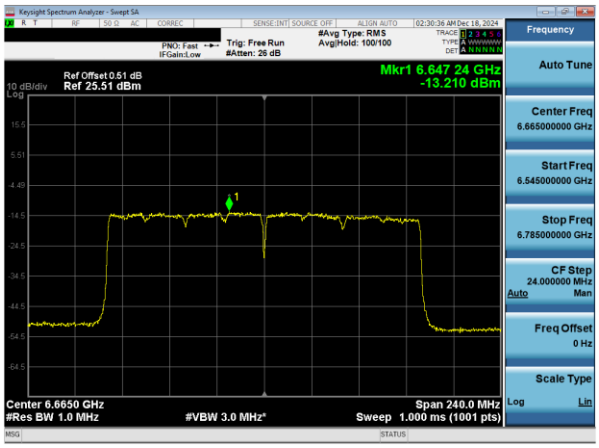
Plot 7-87. PSD Plot Antenna WF8 (40MHz 802.11ax RU484 (UNII Band 7) – Ch. 179)



Plot 7-90. PSD Plot Antenna WF7a (80MHz 802.11ax RU996 (UNII Band 7) – Ch. 151)



Plot 7-91. PSD Plot Antenna WF8 (160MHz 802.11ax RU996x2 (UNII Band 7) – Ch. 143)



Plot 7-92. PSD Plot Antenna WF7a (160MHz 802.11ax RU996x2 (UNII Band 7) – Ch. 143)

Note:

Per ANSI C63.10-2020 Section 14.5.2.2 and KDB 662911 v02r01 Section E)2), the power spectral density at Antenna WF8 and Antenna WF7a 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 1.80 dBi for Antenna WF8 and 0.50 dBi for Antenna WF7a.

$$\text{Directional gain} = 10 \log[(10^{G_1/20} + 10^{G_2/20} + \ldots + 10^{G_N/20})^2 / N_{ANT}] \text{ dBi}$$
$$= 10 \log[(10^{1.80/20} + 10^{0.50/20})^2 / 2] \text{ dBi}$$
$$= 4.18 \text{ dBi}$$

For uncorrelated signals, assuming the antenna gain is 1.80 dBi for Antenna WF8 and -0.20 dBi for Antenna WF7a.

$$\text{Directional gain} = 10 \log[(10^{G_1/10} + 10^{G_2/10} + \ldots + 10^{G_N/10}) / N_{ANT}] \text{ dBi}$$
$$= 10 \log[(10^{1.80/10} + 10^{0.50/10} / 2] \text{ dBi}$$
$$= 1.20 \text{ dBi}$$

Sample SDM Calculation:

At 6115MHz in 802.11ax (20MHz BW) mode, the average conducted power spectral density was measured to be -14.75 dBm for Antenna WF8 and -14.34 dBm for Antenna WF7a.

Antenna WF8 + Antenna WF7a = SDM

(-14.75 dBm + -14.34 dBm) = (0.033 mW + 0.037 mW) = 0.07 mW = -11.53 dBm

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

At 6115MHz in 802.11ax (20MHz BW) mode, the average SDM power density was calculated to be -11.53 dBm with directional gain of 3.92 dBi.

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

-11.53 dBm + 3.92 dBi = -7.61 dBm

7.5 In-Band Emissions

§15.407(b)(7); RSS-248[4.6.2]

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 C63.10-2020 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 C63.10-2020 – Section 12.4.2.2
KDB 987594 D02 v03 – Section J

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 4.1.6.2 of ANSI C63.10-2020.
3. Measure the 26 dB EBW using the test procedure 12.5.2 of ANSI C63.10-2020. (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

1. All RU's were investigated and only worst case partially loaded and fully loaded RU's were reported.
2. Low, mid, and high channels were tested and only worst case channel In-band plots have been reported.

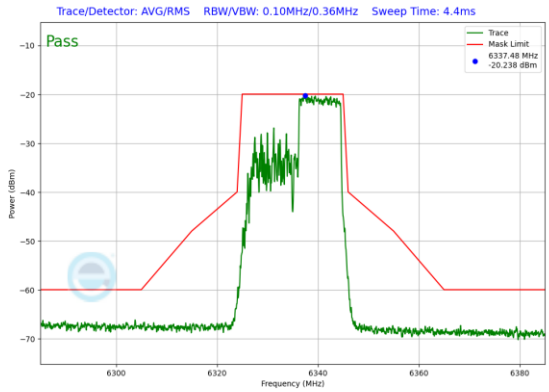
7.5.1 Antenna WF8 In-Band Emission Measurements – VLP

	Frequency [MHz]	Channel	802.11 MODE	RU Size	RU Index	Antenna WF8 In-Band Emission
Band 5	6275	65	ax (20MHz)	106	53	Pass
	6275	65	ax (20MHz)	106	54	Pass
	6335	77	ax (20MHz)	106	53	Pass
	6335	77	ax (20MHz)	106	54	Pass
	6415	93	ax (20MHz)	106	53	Pass
	6415	93	ax (20MHz)	106	54	Pass
	6125	35	ax (40MHz)	242	61	Pass
	6125	35	ax (40MHz)	242	62	Pass
	6245	59	ax (40MHz)	242	61	Pass
	6245	59	ax (40MHz)	242	62	Pass
	6405	91	ax (40MHz)	106	53	Pass
	6405	91	ax (40MHz)	106	54	Pass
	6405	91	ax (40MHz)	106	56	Pass
	6145	39	ax (80MHz)	242	61	Pass
	6145	39	ax (80MHz)	242	62	Pass
	6145	39	ax (80MHz)	242	64	Pass
	6225	55	ax (80MHz)	242	61	Pass
	6225	55	ax (80MHz)	242	62	Pass
	6225	55	ax (80MHz)	242	64	Pass
	6385	87	ax (80MHz)	106	53	Pass
	6385	87	ax (80MHz)	106	56	Pass
	6385	87	ax (80MHz)	106	60	Pass
	6185	47 (L)	ax (160MHz)	242	61	Pass
	6185		ax (160MHz)	242	64	Pass
	6185	47 (U)	ax (160MHz)	242	64	Pass
	6345	79 (L)	ax (160MHz)	106	53	Pass
	6345		ax (160MHz)	106	60	Pass
	6345	79 (U)	ax (160MHz)	106	60	Pass
Band 7	6535	117	ax (20MHz)	106	53	Pass
	6535	117	ax (20MHz)	106	54	Pass
	6695	149	ax (20MHz)	106	53	Pass
	6695	149	ax (20MHz)	106	54	Pass
	6855	181	ax (20MHz)	106	53	Pass
	6855	181	ax (20MHz)	106	54	Pass
	6565	123	ax (40MHz)	106	53	Pass
	6565	123	ax (40MHz)	106	54	Pass
	6565	123	ax (40MHz)	106	56	Pass
	6725	155	ax (40MHz)	106	53	Pass
	6725	155	ax (40MHz)	106	54	Pass
	6725	155	ax (40MHz)	106	56	Pass
	6845	179	ax (40MHz)	106	53	Pass
	6845	179	ax (40MHz)	106	54	Pass
	6845	179	ax (40MHz)	106	56	Pass
	6625	135	ax (80MHz)	106	53	Pass
	6625	135	ax (80MHz)	106	56	Pass
	6625	135	ax (80MHz)	106	60	Pass
	6705	151	ax (80MHz)	106	53	Pass
	6705	151	ax (80MHz)	106	56	Pass
	6705	151	ax (80MHz)	106	60	Pass
	6785	167	ax (80MHz)	106	53	Pass
	6785	167	ax (80MHz)	106	56	Pass
	6785	167	ax (80MHz)	106	60	Pass
	6665	143 (L)	ax (160MHz)	106	53	Pass
	6665		ax (160MHz)	106	60	Pass
	6665	143 (U)	ax (160MHz)	106	60	Pass

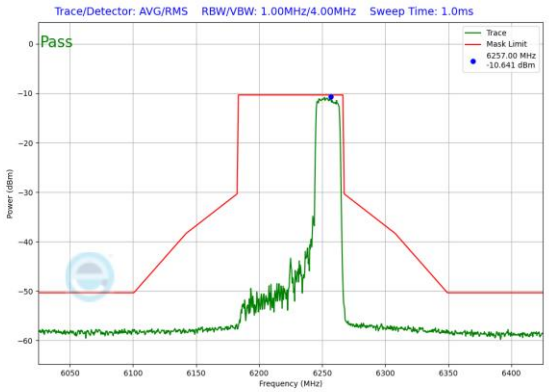
Table 7-43. Power Spectral Density Measurements SDM (RU106/242)

	Frequency [MHz]	Channel	802.11 MODE	RU Size	RU Index	Antenna WF8 In-Band Emission
Band 5	6115	33	ax (20MHz)	242	61	Pass
	6255	61	ax (20MHz)	242	61	Pass
	6415	93	ax (20MHz)	242	61	Pass
	6125	35	ax (40MHz)	484	65	Pass
	6245	59	ax (40MHz)	484	65	Pass
	6405	91	ax (40MHz)	484	65	Pass
	6145	39	ax (80MHz)	996	67	Pass
	6225	55	ax (80MHz)	996	67	Pass
	6385	87	ax (80MHz)	996	67	Pass
	6185	47	ax (160MHz)	996x2	68	Pass
	6345	79	ax (160MHz)	996x2	68	Pass
Band 7	6535	117	ax (20MHz)	242	61	Pass
	6695	149	ax (20MHz)	242	61	Pass
	6855	181	ax (20MHz)	242	61	Pass
	6565	123	ax (40MHz)	484	65	Pass
	6725	155	ax (40MHz)	484	65	Pass
	6845	179	ax (40MHz)	484	65	Pass
	6625	135	ax (80MHz)	996	67	Pass
	6705	151	ax (80MHz)	996	67	Pass
	6785	167	ax (80MHz)	996	67	Pass
	6665	143	ax (160MHz)	996x2	68	Pass

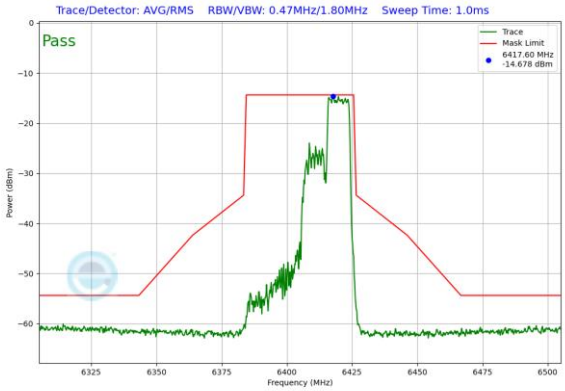
Table 7-44. Power Spectral Density Measurements SDM (Fully-loaded RU)



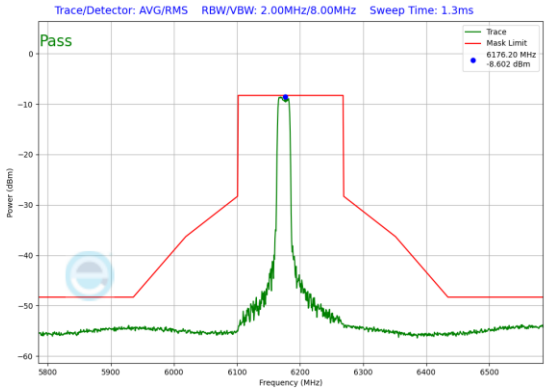
Plot 7-93. In-Band Emission Plot Antenna WF8 (20MHz 802.11ax RU106 (UNII Band 5) – Ch. 77)



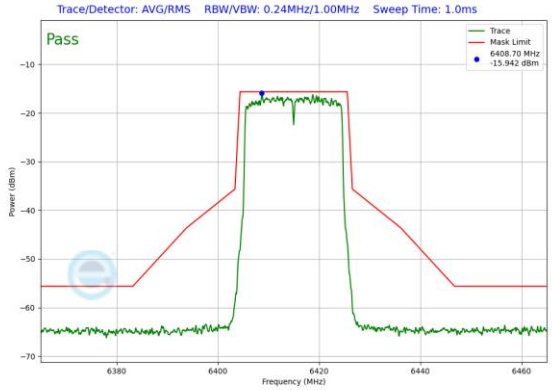
Plot 7-95. In-Band Emission Plot Antenna WF8 (80MHz 802.11ax RU242 (UNII Band 5) – Ch. 55)



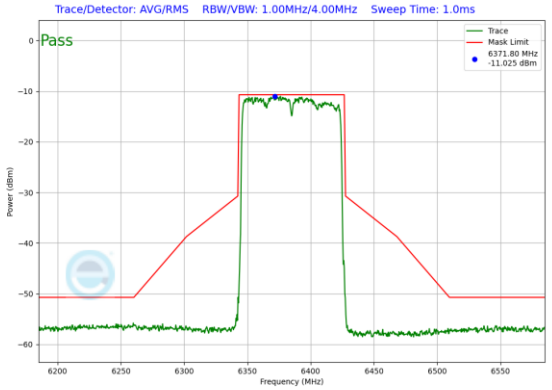
Plot 7-94. In-Band Emission Plot Antenna WF8 (40MHz 802.11ax RU106 (UNII Band 5) – Ch. 91)



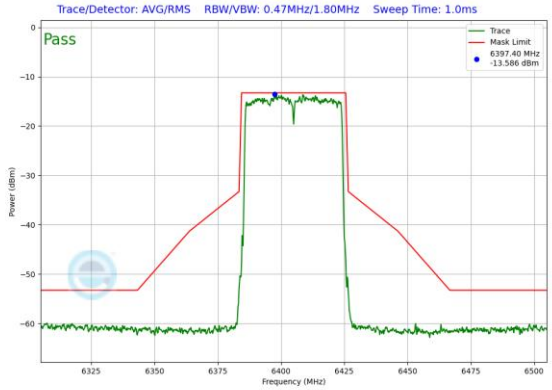
Plot 7-96. In-Band Emission Plot Antenna WF8 (160MHz 802.11ax RU106 (UNII Band 5) – Ch. 47)



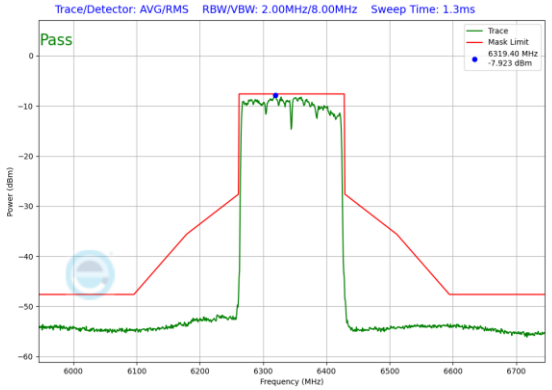
Plot 7-97. In-Band Emission Plot Antenna WF8 (20MHz 802.11ax RU242 (UNII Band 5) – Ch. 93)



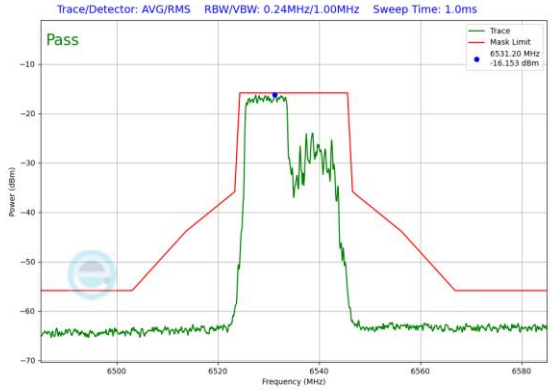
Plot 7-99. In-Band Emission Plot Antenna WF8 (80MHz 802.11ax RU996 (UNII Band 5) – Ch. 87)



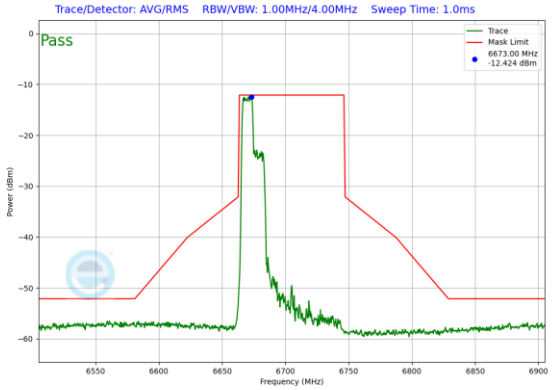
Plot 7-98. In-Band Emission Plot Antenna WF8 (40MHz 802.11ax RU484 (UNII Band 5) – Ch. 91)



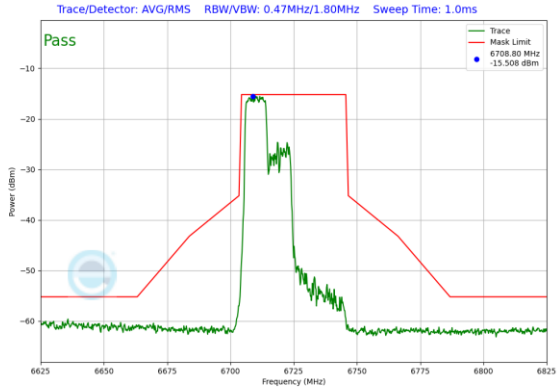
Plot 7-100. In-Band Emission Plot Antenna WF8 (160MHz 802.11ax RU996x2 (UNII Band 5) – Ch. 79)



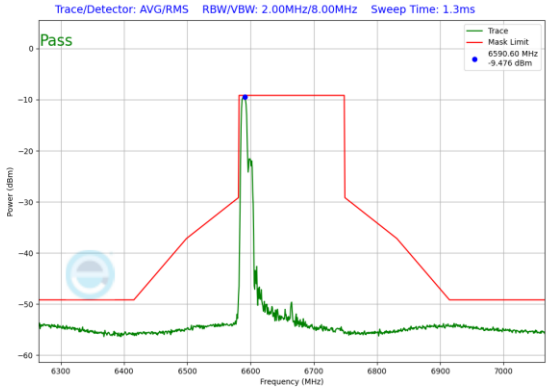
Plot 7-101. In-Band Emission Plot Antenna WF8 (20MHz 802.11ax RU106 (UNII Band 7) – Ch. 117)



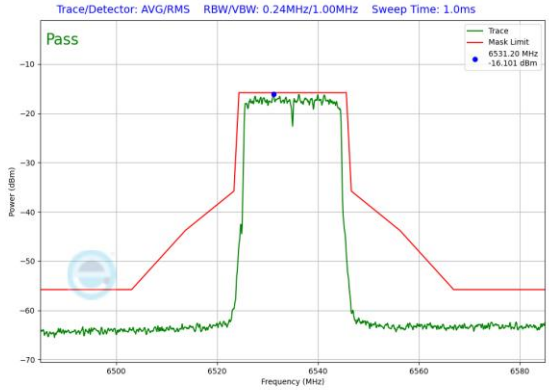
Plot 7-103. In-Band Emission Plot Antenna WF8 (80MHz 802.11ax RU106 (UNII Band 7) – Ch. 151)



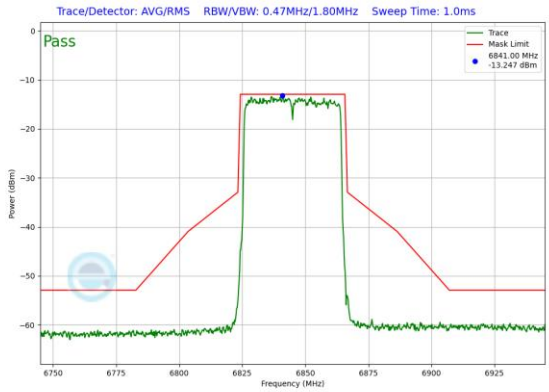
Plot 7-102. In-Band Emission Plot Antenna WF8 (40MHz 802.11ax RU106 (UNII Band 7) – Ch. 155)



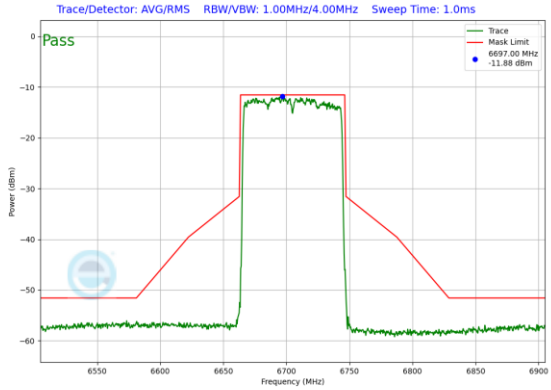
Plot 7-104. In-Band Emission Plot Antenna WF8 (160MHz 802.11ax RU106 (UNII Band 7) – Ch. 143)



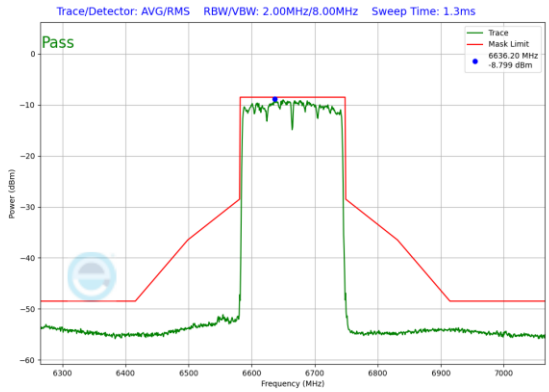
Plot 7-105. In-Band Emission Plot Antenna WF8 (20MHz 802.11ax RU242 (UNII Band 7) – Ch. 117)



Plot 7-106. In-Band Emission Plot Antenna WF8 (40MHz 802.11ax RU484 (UNII Band 7) – Ch. 179)



Plot 7-107. In-Band Emission Plot Antenna WF8 (80MHz 802.11ax RU996 (UNII Band 7) – Ch. 151)



Plot 7-108. In-Band Emission Plot Antenna WF8 (160MHz 802.11ax RU996x2 (UNII Band 7) – Ch. 143)

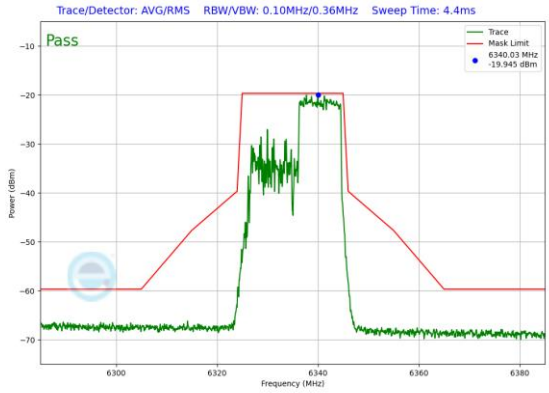
7.5.2 Antenna WF7a In-Band Emission Measurements – VLP

	Frequency [MHz]	Channel	802.11 MODE	RU Size	RU Index	Antenna WF7a In-Band Emission
Band 5	6275	65	ax (20MHz)	106	53	Pass
	6275	65	ax (20MHz)	106	54	Pass
	6335	77	ax (20MHz)	106	53	Pass
	6335	77	ax (20MHz)	106	54	Pass
	6415	93	ax (20MHz)	106	53	Pass
	6415	93	ax (20MHz)	106	54	Pass
	6125	35	ax (40MHz)	242	61	Pass
	6125	35	ax (40MHz)	242	62	Pass
	6245	59	ax (40MHz)	242	61	Pass
	6245	59	ax (40MHz)	242	62	Pass
	6405	91	ax (40MHz)	106	53	Pass
	6405	91	ax (40MHz)	106	54	Pass
	6405	91	ax (40MHz)	106	56	Pass
	6145	39	ax (80MHz)	242	61	Pass
	6145	39	ax (80MHz)	242	62	Pass
	6145	39	ax (80MHz)	242	64	Pass
	6225	55	ax (80MHz)	242	61	Pass
	6225	55	ax (80MHz)	242	62	Pass
	6225	55	ax (80MHz)	242	64	Pass
	6385	87	ax (80MHz)	106	53	Pass
	6385	87	ax (80MHz)	106	56	Pass
	6385	87	ax (80MHz)	106	60	Pass
	6185	47 (L)	ax (160MHz)	242	61	Pass
	6185		ax (160MHz)	242	64	Pass
	6185	47 (U)	ax (160MHz)	242	64	Pass
	6345	79 (L)	ax (160MHz)	106	53	Pass
	6345		ax (160MHz)	106	60	Pass
	6345	79 (U)	ax (160MHz)	106	60	Pass
Band 7	6535	117	ax (20MHz)	106	53	Pass
	6535	117	ax (20MHz)	106	54	Pass
	6695	149	ax (20MHz)	106	53	Pass
	6695	149	ax (20MHz)	106	54	Pass
	6855	181	ax (20MHz)	106	53	Pass
	6855	181	ax (20MHz)	106	54	Pass
	6565	123	ax (40MHz)	106	53	Pass
	6565	123	ax (40MHz)	106	54	Pass
	6565	123	ax (40MHz)	106	56	Pass
	6725	155	ax (40MHz)	106	53	Pass
	6725	155	ax (40MHz)	106	54	Pass
	6725	155	ax (40MHz)	106	56	Pass
	6845	179	ax (40MHz)	106	53	Pass
	6845	179	ax (40MHz)	106	54	Pass
	6845	179	ax (40MHz)	106	56	Pass
	6625	135	ax (80MHz)	106	53	Pass
	6625	135	ax (80MHz)	106	56	Pass
	6625	135	ax (80MHz)	106	60	Pass
	6705	151	ax (80MHz)	106	53	Pass
	6705	151	ax (80MHz)	106	56	Pass
	6705	151	ax (80MHz)	106	60	Pass
	6785	167	ax (80MHz)	106	53	Pass
	6785	167	ax (80MHz)	106	56	Pass
	6785	167	ax (80MHz)	106	60	Pass
	6665	143 (L)	ax (160MHz)	106	53	Pass
	6665		ax (160MHz)	106	60	Pass
	6665	143 (U)	ax (160MHz)	106	60	Pass

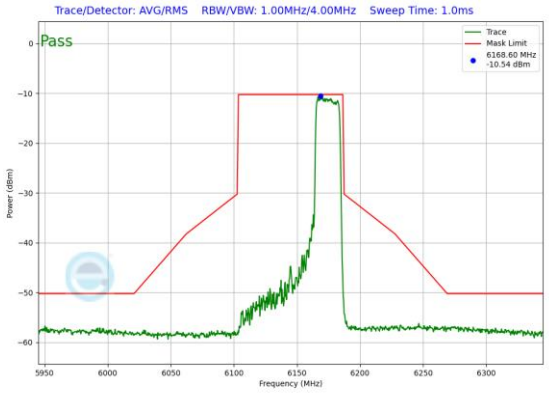
Table 7-45. Power Spectral Density Measurements SDM (RU106/242)

	Frequency [MHz]	Channel	802.11 MODE	RU Size	RU Index	Antenna WF7a In-Band Emission
Band 5	6115	33	ax (20MHz)	242	61	Pass
	6255	61	ax (20MHz)	242	61	Pass
	6415	93	ax (20MHz)	242	61	Pass
	6125	35	ax (40MHz)	484	65	Pass
	6245	59	ax (40MHz)	484	65	Pass
	6405	91	ax (40MHz)	484	65	Pass
	6145	39	ax (80MHz)	996	67	Pass
	6225	55	ax (80MHz)	996	67	Pass
	6385	87	ax (80MHz)	996	67	Pass
	6185	47	ax (160MHz)	996x2	68	Pass
	6345	79	ax (160MHz)	996x2	68	Pass
Band 7	6535	117	ax (20MHz)	242	61	Pass
	6695	149	ax (20MHz)	242	61	Pass
	6855	181	ax (20MHz)	242	61	Pass
	6565	123	ax (40MHz)	484	65	Pass
	6725	155	ax (40MHz)	484	65	Pass
	6845	179	ax (40MHz)	484	65	Pass
	6625	135	ax (80MHz)	996	67	Pass
	6705	151	ax (80MHz)	996	67	Pass
	6785	167	ax (80MHz)	996	67	Pass
	6665	143	ax (160MHz)	996x2	68	Pass

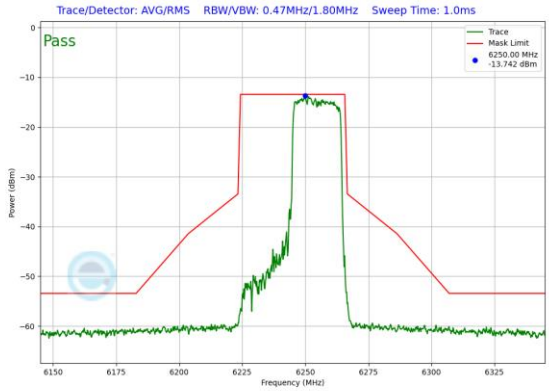
Table 7-46. Power Spectral Density Measurements SDM (Fully-loaded RU)



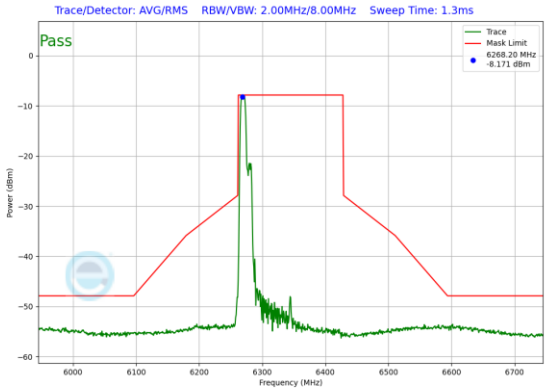
Plot 7-109. In-Band Emission Plot Antenna WF7a (20MHz 802.11ax RU106 (UNII Band 5) – Ch. 77)



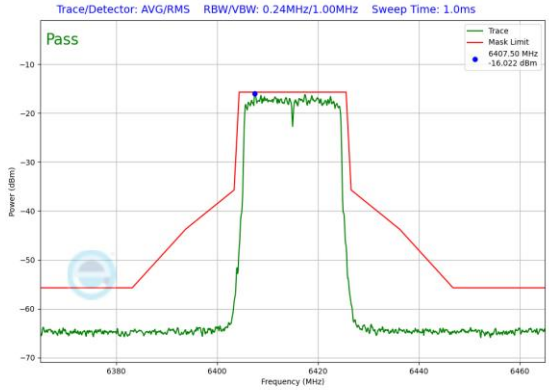
Plot 7-111. In-Band Emission Plot Antenna WF7a (80MHz 802.11ax RU242 (UNII Band 5) – Ch. 39)



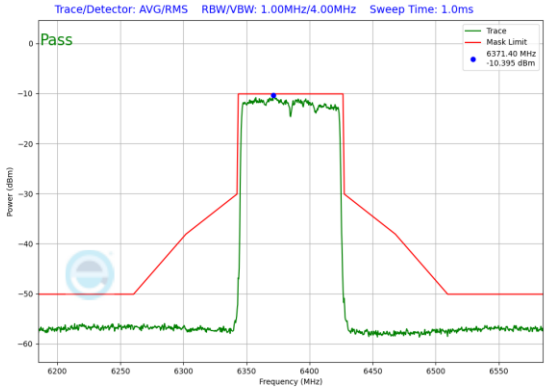
Plot 7-110. In-Band Emission Plot Antenna WF7a (40MHz 802.11ax RU242 (UNII Band 5) – Ch. 59)



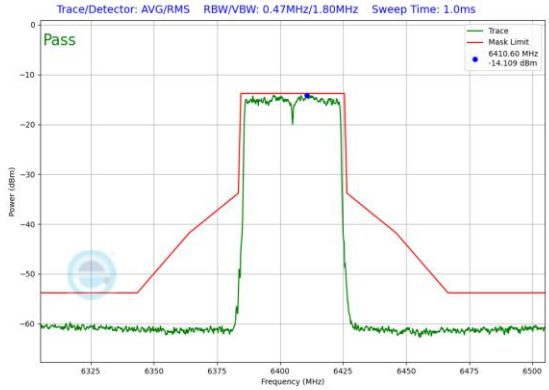
Plot 7-112. In-Band Emission Plot Antenna WF7a (160MHz 802.11ax RU106 (UNII Band 5) – Ch. 79)



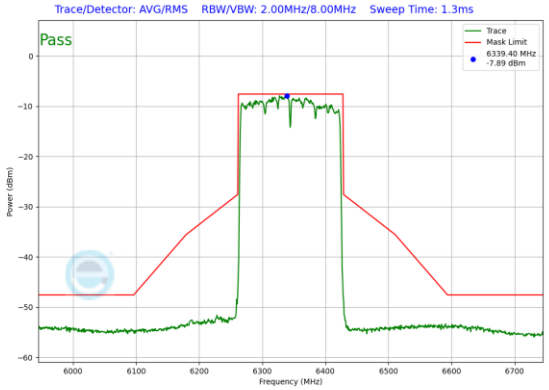
Plot 7-113. In-Band Emission Plot Antenna WF7a (20MHz 802.11ax RU242 (UNII Band 5) – Ch. 93)



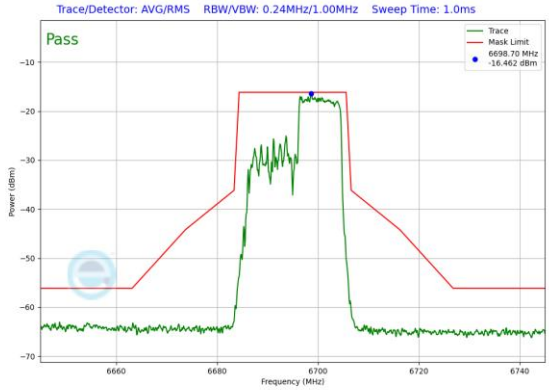
Plot 7-115. In-Band Emission Plot Antenna WF7a (80MHz 802.11ax RU996 (UNII Band 5) – Ch. 87)



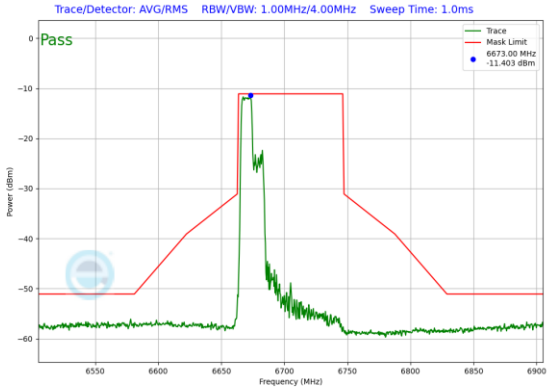
Plot 7-114. In-Band Emission Plot Antenna WF7a (40MHz 802.11ax RU484 (UNII Band 5) – Ch. 91)



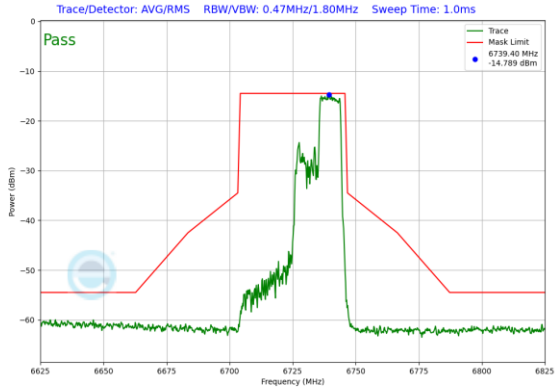
Plot 7-116. In-Band Emission Plot Antenna WF7a (160MHz 802.11ax RU996x2 (UNII Band 5) – Ch. 79)



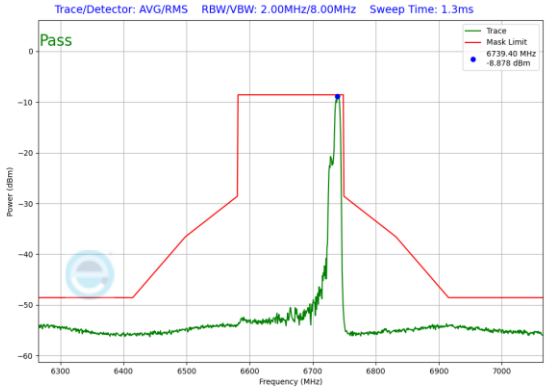
Plot 7-117. In-Band Emission Plot Antenna WF7a (20MHz 802.11ax RU106 (UNII Band 7) – Ch. 149)



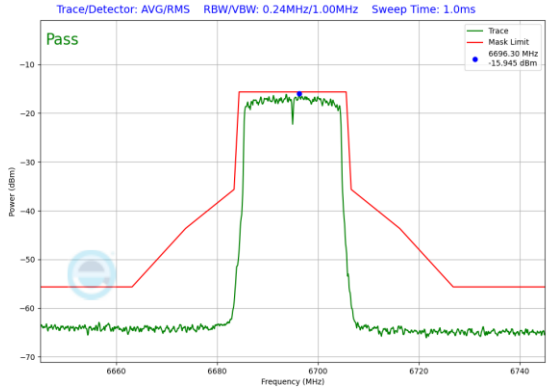
Plot 7-119. In-Band Emission Plot Antenna WF7a (80MHz 802.11ax RU106 (UNII Band 7) – Ch. 151)



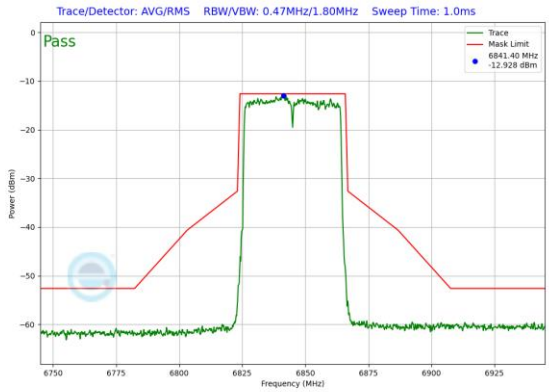
Plot 7-118. In-Band Emission Plot Antenna WF7a (40MHz 802.11ax RU106 (UNII Band 7) – Ch. 155)



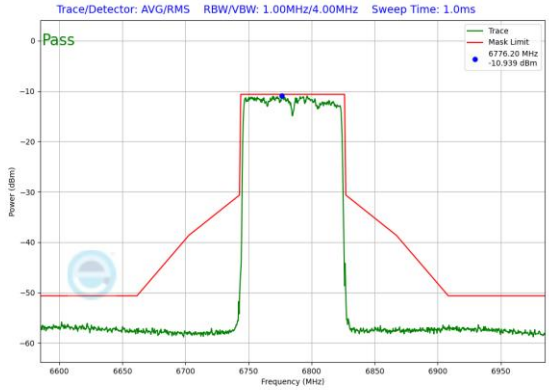
Plot 7-120. In-Band Emission Plot Antenna WF7a (160MHz 802.11ax RU106 (UNII Band 7) – Ch. 143)



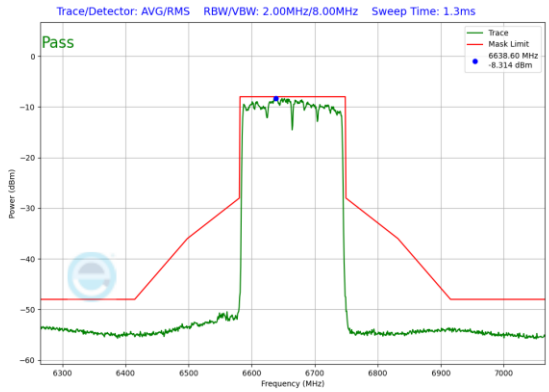
Plot 7-121. In-Band Emission Plot Antenna WF7a (20MHz 802.11ax RU242 (UNII Band 7) – Ch. 149)



Plot 7-122. In-Band Emission Plot Antenna WF7a (40MHz 802.11ax RU484 (UNII Band 7) – Ch. 179)



Plot 7-123. In-Band Emission Plot Antenna WF7a (80MHz 802.11ax RU996 (UNII Band 7) – Ch. 167)



Plot 7-124. In-Band Emission Plot Antenna WF7a (160MHz 802.11ax RU996x2 (UNII Band 7) – Ch. 143)

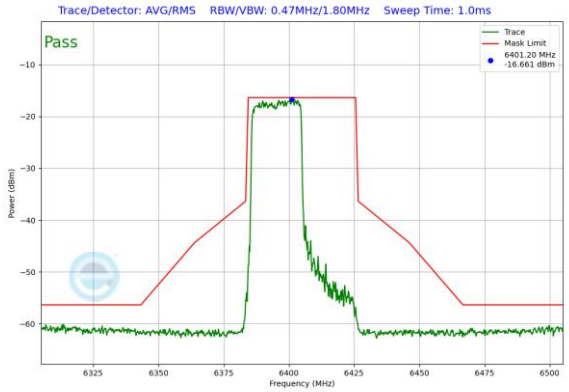
7.5.3 SDM In-Band Emission Measurements – VLP

	Frequency [MHz]	Channel	802.11 MODE	RU Size	RU Index	Mode	Antenna WF8 In-Band Emission	Antenna WF7a In-Band Emission
	6125	35	ax (40MHz)	242	61	SDM	Pass	Pass
	6125	35	ax (40MHz)	242	62	SDM	Pass	Pass
	6245	59	ax (40MHz)	242	61	SDM	Pass	Pass
	6245	59	ax (40MHz)	242	62	SDM	Pass	Pass
	6405	91	ax (40MHz)	242	61	SDM	Pass	Pass
	6405	91	ax (40MHz)	242	62	SDM	Pass	Pass
	6145	39	ax (80MHz)	242	61	SDM	Pass	Pass
	6145	39	ax (80MHz)	242	62	SDM	Pass	Pass
	6145	39	ax (80MHz)	242	64	SDM	Pass	Pass
	6225	55	ax (80MHz)	242	61	SDM	Pass	Pass
	6225	55	ax (80MHz)	242	62	SDM	Pass	Pass
	6225	55	ax (80MHz)	242	64	SDM	Pass	Pass
	6385	87	ax (80MHz)	242	61	SDM	Pass	Pass
	6385	87	ax (80MHz)	242	62	SDM	Pass	Pass
	6385	87	ax (80MHz)	242	64	SDM	Pass	Pass
	6185	47 (L)	ax (160MHz)	242	61	SDM	Pass	Pass
	6185		ax (160MHz)	242	64	SDM	Pass	Pass
	6185	47 (U)	ax (160MHz)	242	64	SDM	Pass	Pass
	6345	79 (L)	ax (160MHz)	242	61	SDM	Pass	Pass
	6345		ax (160MHz)	242	64	SDM	Pass	Pass
	6345	79 (U)	ax (160MHz)	242	64	SDM	Pass	Pass
Band 7	6565	123	ax (40MHz)	242	61	SDM	Pass	Pass
	6565	123	ax (40MHz)	242	62	SDM	Pass	Pass
	6725	155	ax (40MHz)	242	61	SDM	Pass	Pass
	6725	155	ax (40MHz)	242	62	SDM	Pass	Pass
	6845	179	ax (40MHz)	242	61	SDM	Pass	Pass
	6845	179	ax (40MHz)	242	62	SDM	Pass	Pass
	6625	135	ax (80MHz)	242	61	SDM	Pass	Pass
	6625	135	ax (80MHz)	242	62	SDM	Pass	Pass
	6625	135	ax (80MHz)	242	64	SDM	Pass	Pass
	6705	151	ax (80MHz)	242	61	SDM	Pass	Pass
	6705	151	ax (80MHz)	242	62	SDM	Pass	Pass
	6705	151	ax (80MHz)	242	64	SDM	Pass	Pass
	6785	167	ax (80MHz)	242	61	SDM	Pass	Pass
	6785	167	ax (80MHz)	242	62	SDM	Pass	Pass
	6785	167	ax (80MHz)	242	64	SDM	Pass	Pass
	6665	143 (L)	ax (160MHz)	242	61	SDM	Pass	Pass
	6665		ax (160MHz)	242	64	SDM	Pass	Pass
	6665	143 (U)	ax (160MHz)	242	64	SDM	Pass	Pass

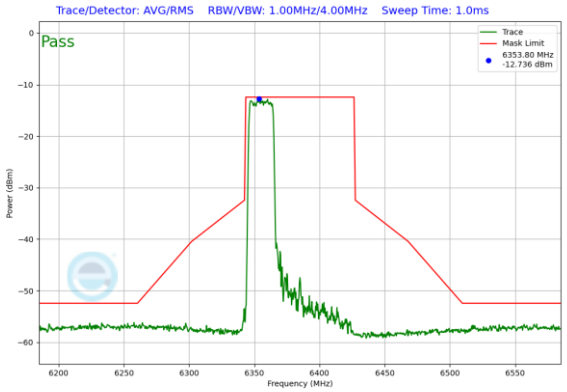
Table 7-47. Power Spectral Density Measurements SDM (RU106/242)

	Frequency [MHz]	Channel	802.11 MODE	RU Size	RU Index	Mode	Antenna WF8 In-Band Emission	Antenna WF7a In-Band Emission
Band 5	6115	33	ax (20MHz)	242	61	SDM	Pass	Pass
	6255	61	ax (20MHz)	242	61	SDM	Pass	Pass
	6415	93	ax (20MHz)	242	61	SDM	Pass	Pass
	6125	35	ax (40MHz)	484	65	SDM	Pass	Pass
	6245	59	ax (40MHz)	484	65	SDM	Pass	Pass
	6405	91	ax (40MHz)	484	65	SDM	Pass	Pass
	6145	39	ax (80MHz)	996	67	SDM	Pass	Pass
	6225	55	ax (80MHz)	996	67	SDM	Pass	Pass
	6385	87	ax (80MHz)	996	67	SDM	Pass	Pass
	6185	47	ax (160MHz)	996x2	68	SDM	Pass	Pass
	6345	79	ax (160MHz)	996x2	68	SDM	Pass	Pass
Band 7	6535	117	ax (20MHz)	242	61	SDM	Pass	Pass
	6695	149	ax (20MHz)	242	61	SDM	Pass	Pass
	6855	181	ax (20MHz)	242	61	SDM	Pass	Pass
	6565	123	ax (40MHz)	484	65	SDM	Pass	Pass
	6725	155	ax (40MHz)	484	65	SDM	Pass	Pass
	6845	179	ax (40MHz)	484	65	SDM	Pass	Pass
	6625	135	ax (80MHz)	996	67	SDM	Pass	Pass
	6705	151	ax (80MHz)	996	67	SDM	Pass	Pass
	6785	167	ax (80MHz)	996	67	SDM	Pass	Pass
	6665	143	ax (160MHz)	996x2	68	SDM	Pass	Pass

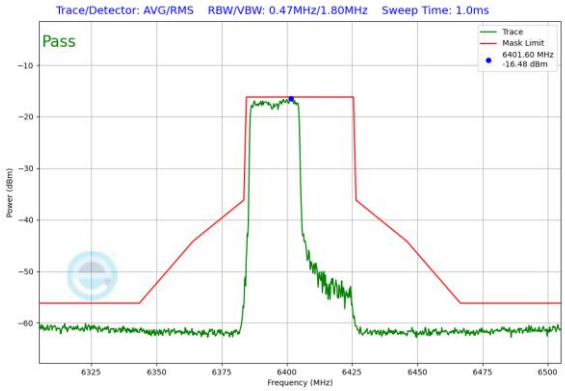
Table 7-48. Power Spectral Density Measurements SDM (Fully-loaded RU)



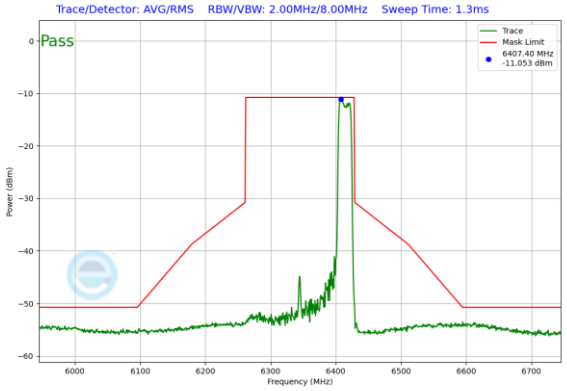
Plot 7-125. In-Band Emission Plot Antenna WF8 (40MHz 802.11ax RU242 (UNII Band 5) – Ch. 91)



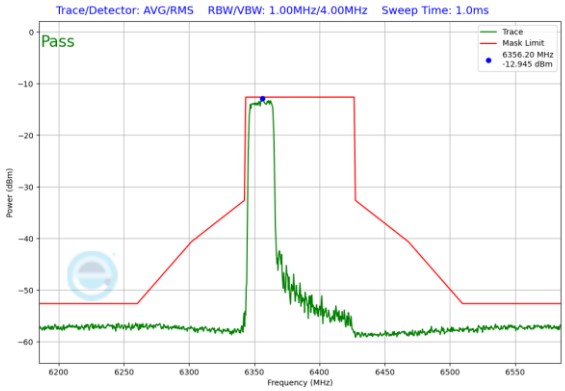
Plot 7-128. In-Band Emission Plot Antenna WF7a (80MHz 802.11ax RU242 (UNII Band 5) – Ch. 87)



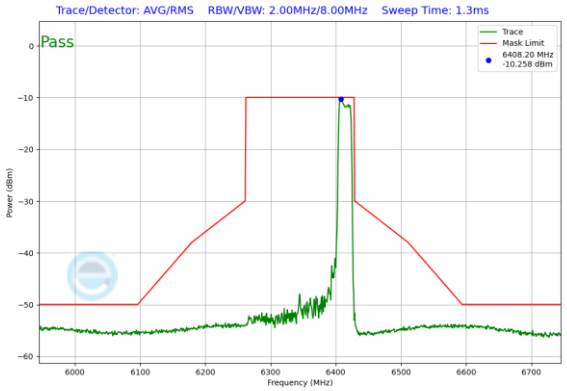
Plot 7-126. In-Band Emission Plot Antenna WF7a (40MHz 802.11ax RU242 (UNII Band 5) – Ch. 91)



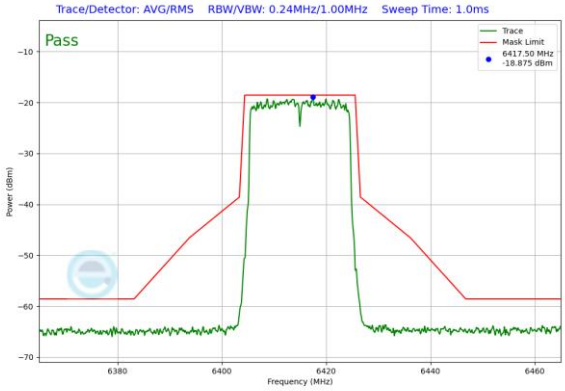
Plot 7-129. In-Band Emission Plot Antenna WF8 (160MHz 802.11ax RU242 (UNII Band 5) – Ch. 79)



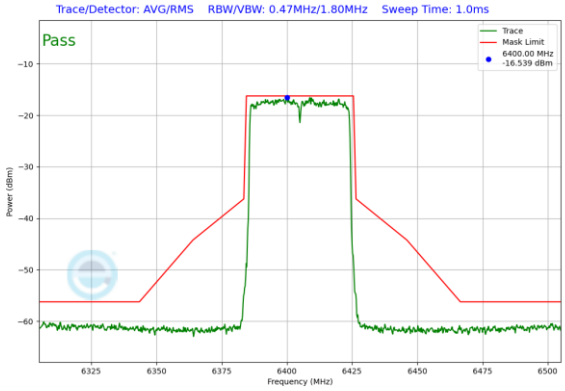
Plot 7-127. In-Band Emission Plot Antenna WF8 (80MHz 802.11ax RU242 (UNII Band 5) – Ch. 87)



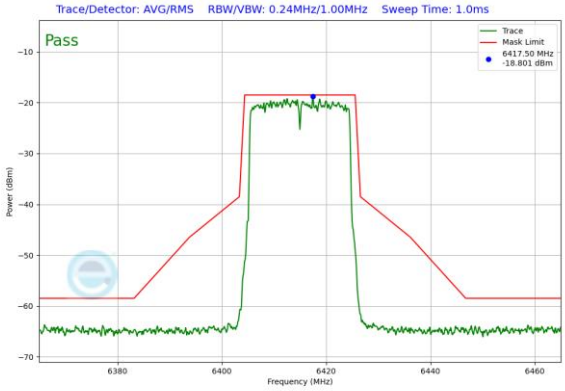
Plot 7-130. In-Band Emission Plot Antenna WF7a (160MHz 802.11ax RU242 (UNII Band 5) – Ch. 79)



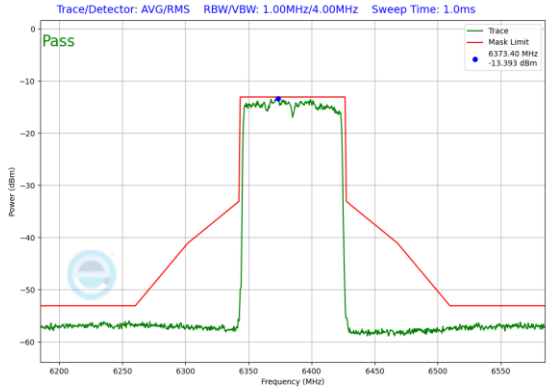
Plot 7-131. In-Band Emission Plot Antenna WF8 (20MHz 802.11ax RU242 (UNII Band 5) – Ch. 93)



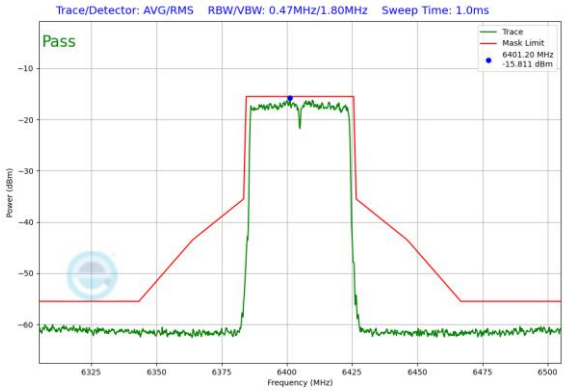
Plot 7-134. In-Band Emission Plot Antenna WF7a (40MHz 802.11ax RU484 (UNII Band 5) – Ch. 91)



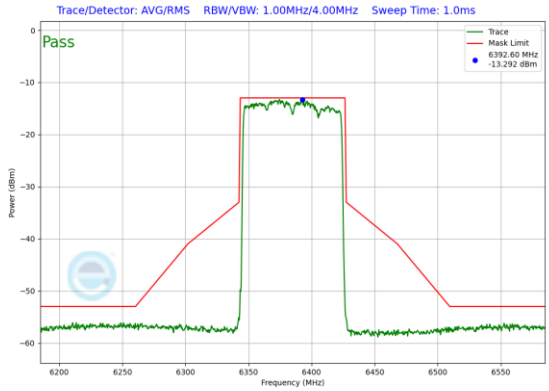
Plot 7-132. In-Band Emission Plot Antenna WF7a (20MHz 802.11ax RU242 (UNII Band 5) – Ch. 93)



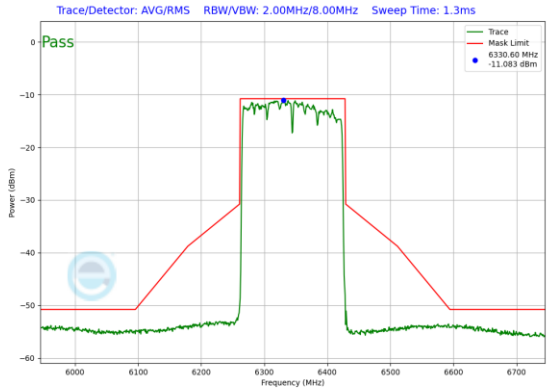
Plot 7-135. In-Band Emission Plot Antenna WF8 (80MHz 802.11ax RU996 (UNII Band 5) – Ch. 87)



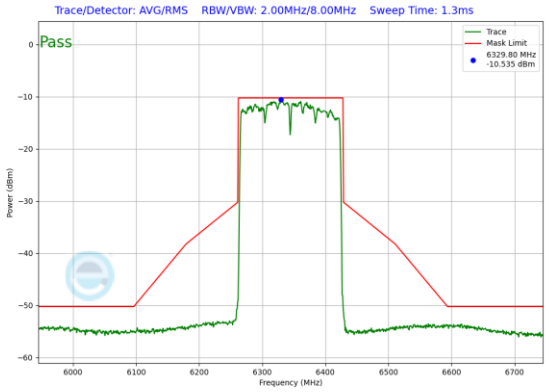
Plot 7-133. In-Band Emission Plot Antenna WF8 (40MHz 802.11ax RU484 (UNII Band 5) – Ch. 91)



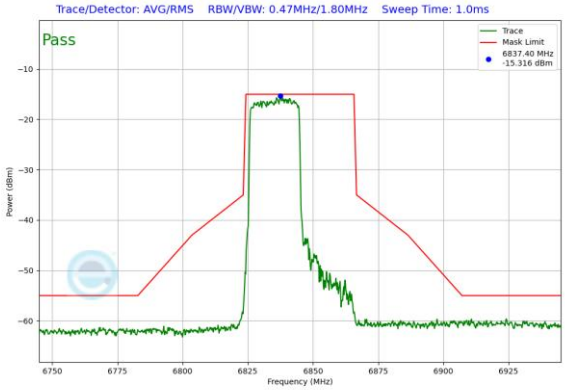
Plot 7-136. In-Band Emission Plot Antenna WF7a (80MHz 802.11ax RU996 (UNII Band 5) – Ch. 87)



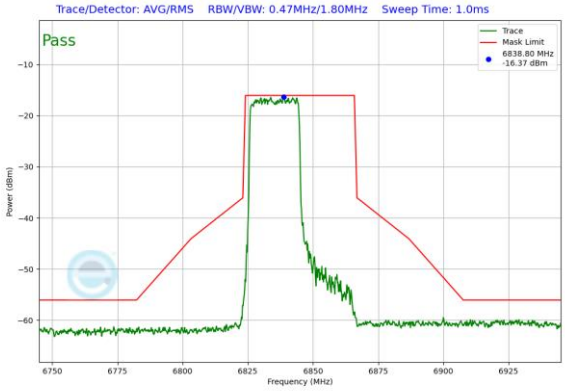
Plot 7-137. In-Band Emission Plot Antenna WF8 (160MHz 802.11ax RU996x2 (UNII Band 5) – Ch. 79)



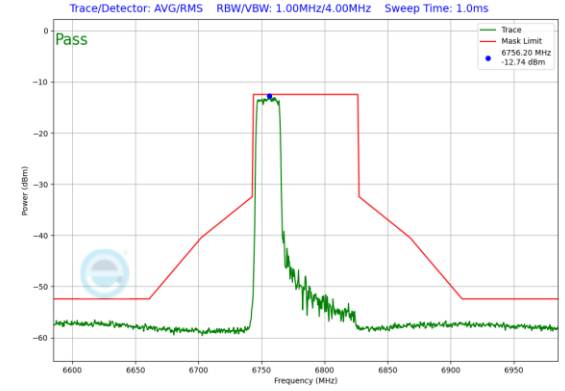
Plot 7-138. In-Band Emission Plot Antenna WF7a (160MHz 802.11ax RU996x2 (UNII Band 5) – Ch. 79)



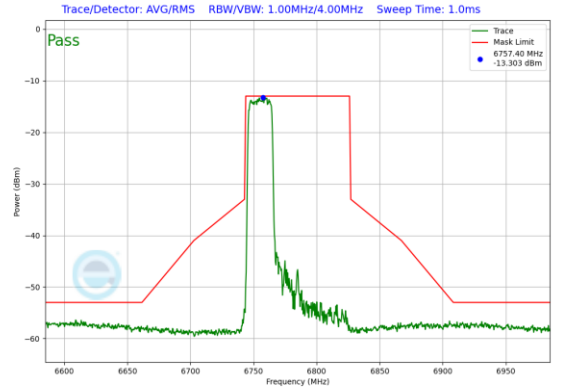
Plot 7-139. In-Band Emission Plot Antenna WF8 (40MHz 802.11ax RU242 (UNII Band 7) – Ch. 179)



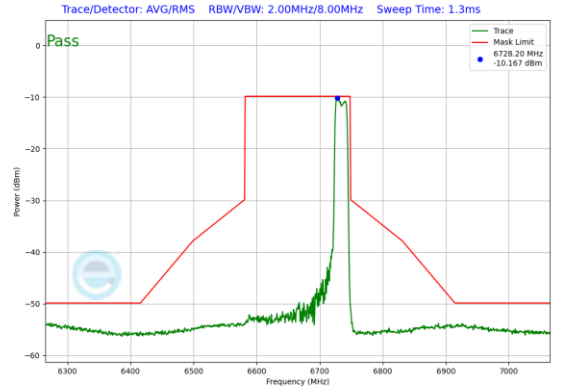
Plot 7-140. In-Band Emission Plot Antenna WF7a (40MHz 802.11ax RU242 (UNII Band 7) – Ch. 179)



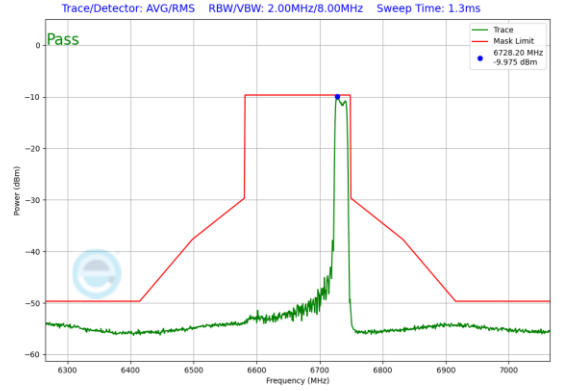
Plot 7-141. In-Band Emission Plot Antenna WF8 (80MHz 802.11ax RU242 (UNII Band 7) – Ch. 167)



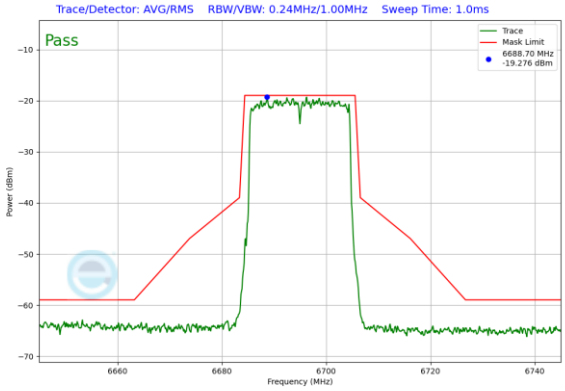
Plot 7-142. In-Band Emission Plot Antenna WF7a (80MHz 802.11ax RU242 (UNII Band 7) – Ch. 167)



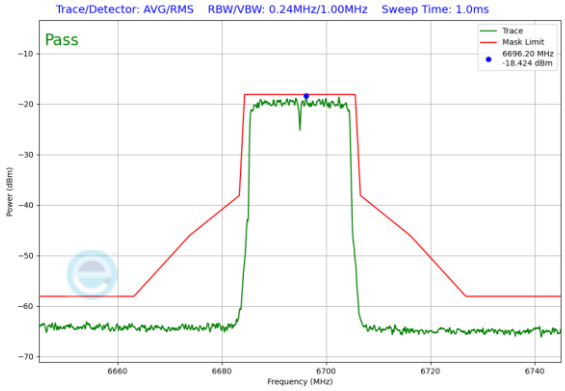
Plot 7-143. In-Band Emission Plot Antenna WF8 (160MHz 802.11ax RU242 (UNII Band 7) – Ch. 143)



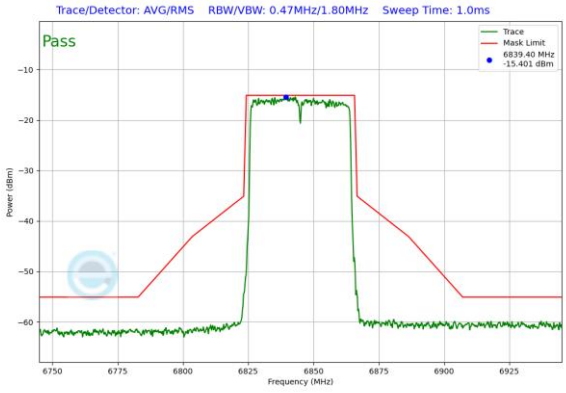
Plot 7-144. In-Band Emission Plot Antenna WF7a (160MHz 802.11ax RU242 (UNII Band 7) – Ch. 143)



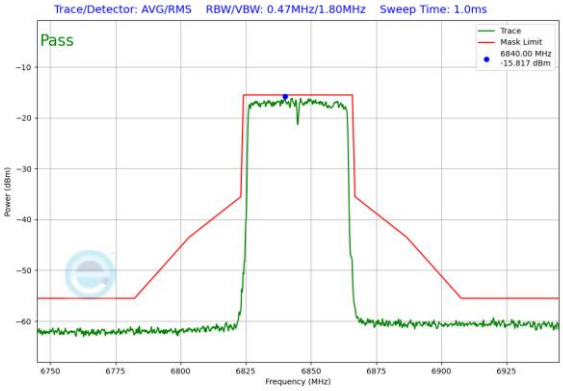
Plot 7-145. In-Band Emission Plot Antenna WF8 (20MHz 802.11ax RU242 (UNII Band 7) – Ch. 149



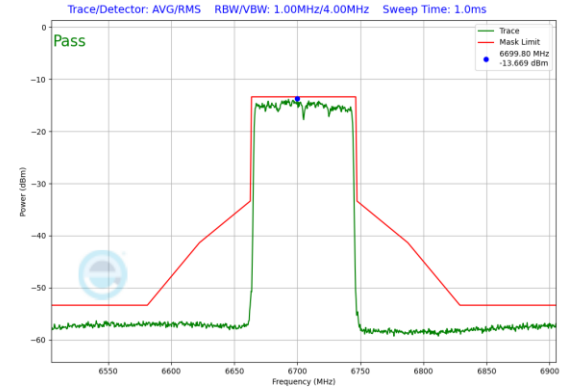
Plot 7-146. In-Band Emission Plot Antenna WF7a (20MHz 802.11ax RU242 (UNII Band 7) – Ch. 149)



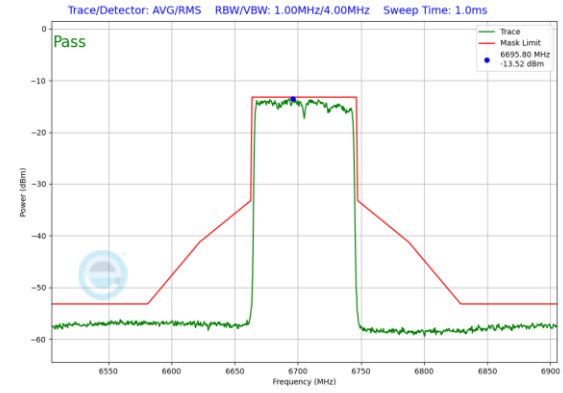
Plot 7-147. In-Band Emission Plot Antenna WF8 (40MHz 802.11ax RU484 (UNII Band 7) – Ch. 179)



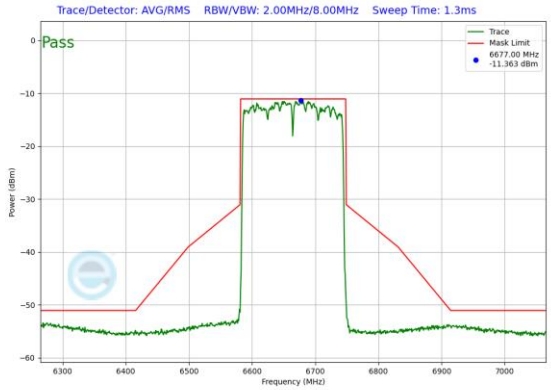
Plot 7-148. In-Band Emission Plot Antenna WF7a (40MHz 802.11ax RU484 (UNII Band 7) – Ch. 179)



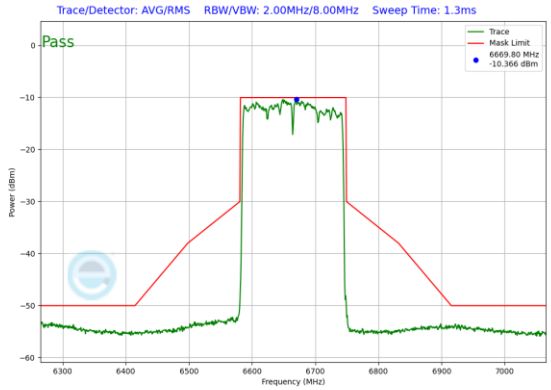
Plot 7-149. In-Band Emission Plot Antenna WF8 (80MHz 802.11ax RU996 (UNII Band 7) – Ch. 151)



Plot 7-150. In-Band Emission Plot Antenna WF7a (80MHz 802.11ax RU996 (UNII Band 7) – Ch. 151)



Plot 7-151. In-Band Emission Plot Antenna WF8 (160MHz 802.11ax RU996x2 (UNII Band 7) – Ch. 143)



Plot 7-152. In-Band Emission Plot Antenna WF7a (160MHz 802.11ax RU996x2 (UNII Band 7) – Ch. 143)

7.6 Contention Based Protocol

§15.407(d)(6); RSS-248[4.7]

Test Overview and Limit

Indoor access points, subordinate devices and client devices operating in the 5.925-7.125 GHz band (herein referred to as unlicensed devices) are required to use technologies that include a contention-based protocol to avoid co-channel interference with incumbent devices sharing the band. To ensure incumbent co-channel operations are detected in a technology-agnostic manner, unlicensed devices are required to detect co-channel radio frequency energy (energy detect) and avoid simultaneous transmission.

Unlicensed indoor low-power devices must detect co-channel radio frequency power that is at least -62 dBm or lower. Upon detection of energy in the band, unlicensed low power indoor devices must vacate the channel and stay off the channel as long as detected radio frequency power is equal to or greater than the threshold (-62 dBm). The -62 dBm (or lower) threshold is referenced to a 0 dBi antenna gain.

To ensure incumbent operations are reliably detected in the band, low power indoor devices must detect RF energy throughout their intended operating channel.

Test Procedure Used

KDB 987594 D02 v03 – Section I

Test Settings

1. Configure the EUT to transmit with a constant duty cycle.
2. Set the operating parameters of the EUT including power level, operating frequency, modulation and bandwidth
3. Set the signal analyzer center frequency to the nominal EUT channel center frequency. The span range of the signal analyzer shall be between two times and five times the OBW of the EUT.
4. Connect the output port of the EUT to the signal analyzer 2, as shown in Figure 2. Ensure that the attenuator 2 provides enough attenuation to not overload the signal analyzer 2 receiver.
5. Monitoring the signal analyzer 2, verify the EUT is operating and transmitting with the parameters set at step two.
6. Using an AWGN signal source, generate (but do not transmit, i.e., RF OFF) a 10 MHz-wide AWGN signal. Use Table 1 to determine the center frequency of the 10 MHz AWGN signal relative to the EUT's channel bandwidth and center frequency.
7. Set the AWGN signal power to an extremely low level (more than 20 dB below the -62 dBm threshold). Connect the AWGN signal source, via a 3-dB splitter, to the signal analyzer 1 and the EUT as shown in Figure 2.
8. Transmit the AWGN signal (RF ON) and verify its characteristics on the signal analyzer 1.
9. Monitor the signal analyzer 2 to verify if the AWGN signal has been detected and the EUT has ceased transmission. If the EUT continues to transmit, then incrementally increase the AWGN signal power level until the EUT stops transmitting.
10. Including all losses in the RF paths) Determine and record the AWGN signal power level (at the EUT's antenna port) at which the EUT ceased transmission. Repeat the procedure at least 10 times to verify the EUT can detect an AWGN signal with 90% (or better) level of certainty.
11. Refer to Table 1 to determine number of times the detection threshold testing needs to be repeated. If testing is required more than once, then go back to step 5, choose a different center frequency for the AWGN signal and repeat the process.

Test Setup

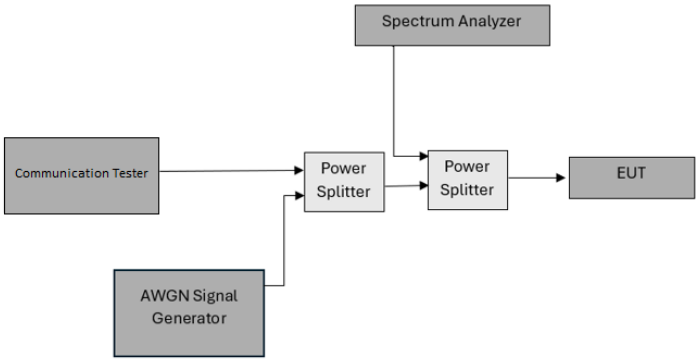


Figure 2. Contention-based protocol test setup, conducted method

Test Notes

1. The EUT does not support channel puncturing.
2. Per guidance from KDB 987594 D02 v03, contention-based protocol was tested using an AWGN signal with a bandwidth of 10MHz. The amplitude of the signal was increased until detected by the EUT, signaled by the ceasing of transmission, marker indicates the point at which the AWGN signal is introduced.
3. Per Guidance from KDB 987594 D04 v03, contention-based protocol was tested with receiver with the lowest antenna gain.
4. 15 trials were ran in order to assure that at least 90% of certainty was met.

Detection Level = Injected AWGN Power (dBm) – Antenna Gain (dBi) + Path Loss (dB)

Equation 7-1. Incumbent Detection Level Calculation

Band	Channel	Channel Frquency [MHz]	Channel BW [MHz]	Incumbent Frequency [MHz]	Injected (AWGN) [dBm]	Antenna Gain [dBi]	Adjusted Power Level [dBm]	Detection Limit [dBm]	Margin [dB]
UNII Band 5	53	6215	20	6215	-75.61	0.20	-75.81	-62.0	-13.81
	47	6185	160	6115	-71.05	0.20	-71.25	-62.0	-9.25
				6185	-70.27	0.20	-70.47	-62.0	-8.47
				6260	-66.11	0.20	-66.31	-62.0	-4.31
UNII Band 7	149	6695	20	6695	-75.68	0.20	-75.88	-62.0	-13.88
	143	6665	160	6590	-68.99	0.20	-69.19	-62.0	-7.19
				6665	-72.01	0.20	-72.21	-62.0	-10.21
				6740	-68.10	0.20	-68.30	-62.0	-6.30

Table 7-49. Contention Based Protocol – Incumbent Detection Results

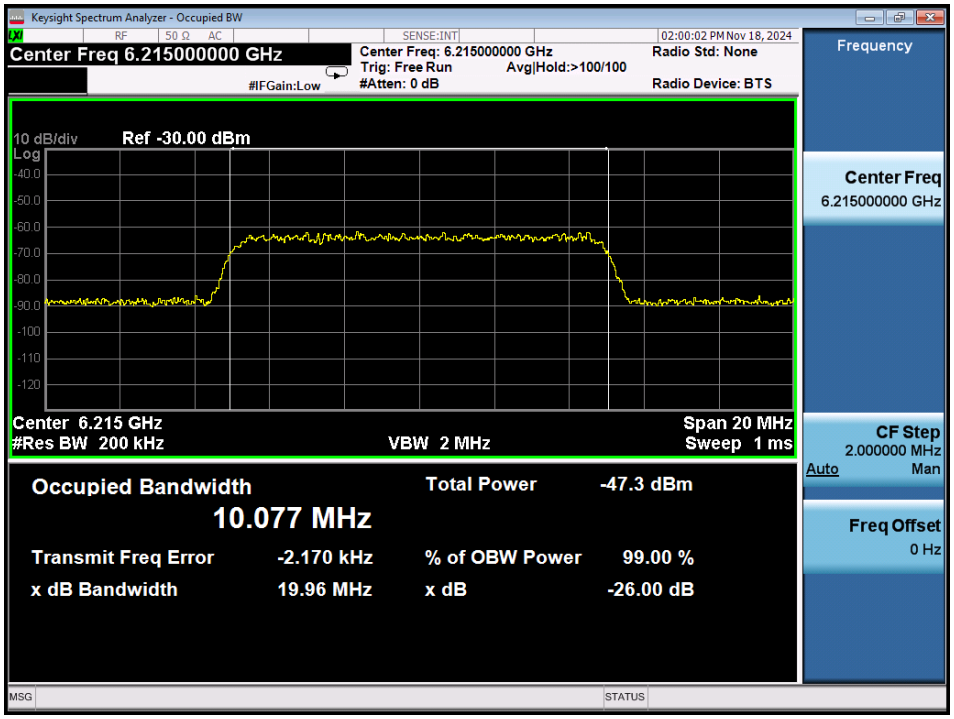
Band	Channel	Channel Frquency [MHz]	Channel BW [MHz]	Incumbent Frequency [MHz]	EUT Transmission Status Adjusted AWGN Power (dBm)		
					Normal	Minimal	Ceased
UNII Band 5	53	6215	20	6215	-86.99	-77.06	-75.81
	47	6185	160	6110	-82.43	-72.50	-71.25
				6185	-81.64	-71.72	-70.47
				6260	-77.49	-67.56	-66.31
UNII Band 7	149	6695	20	6695	-86.86	-77.10	-75.88
	143	6665	160	6750	-80.17	-70.41	-69.19
				6825	-83.19	-73.43	-72.21
				6900	-79.28	-69.52	-68.30

Table 7-50. Contention Based Protocol VLP – Detection Results – All Tx Cases

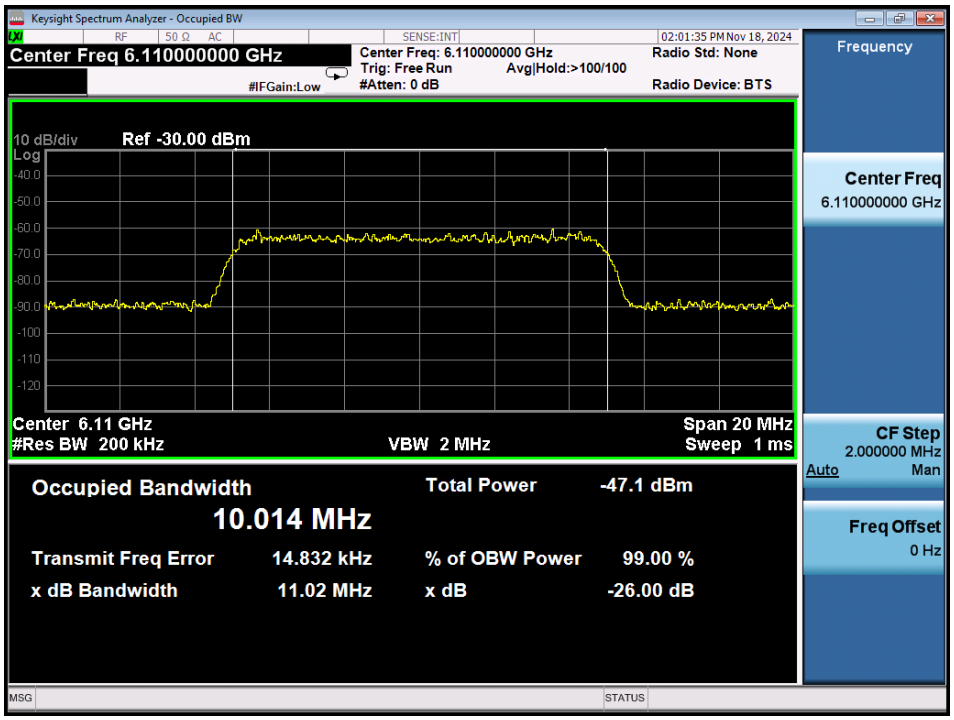
CBP Detection (1 = Detection, Blank = No Detection)																					
Band	Channel	Channel Frquency [MHz]	Channel BW [MHz]	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Detection Rate [%]	Limit [%]	Pass/Fail
UNII Band 5	53	6215	20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100.0	90	Pass
	47	6185	160	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100.0	90	Pass
				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100.0	90	Pass
				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100.0	90	Pass
UNII Band 7	149	6695	20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100.0	90	Pass
	175	6665	160	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100.0	90	Pass
				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100.0	90	Pass
				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100.0	90	Pass

Table 7-51. Contention Based Protocol – Incumbent Detection Trial Results

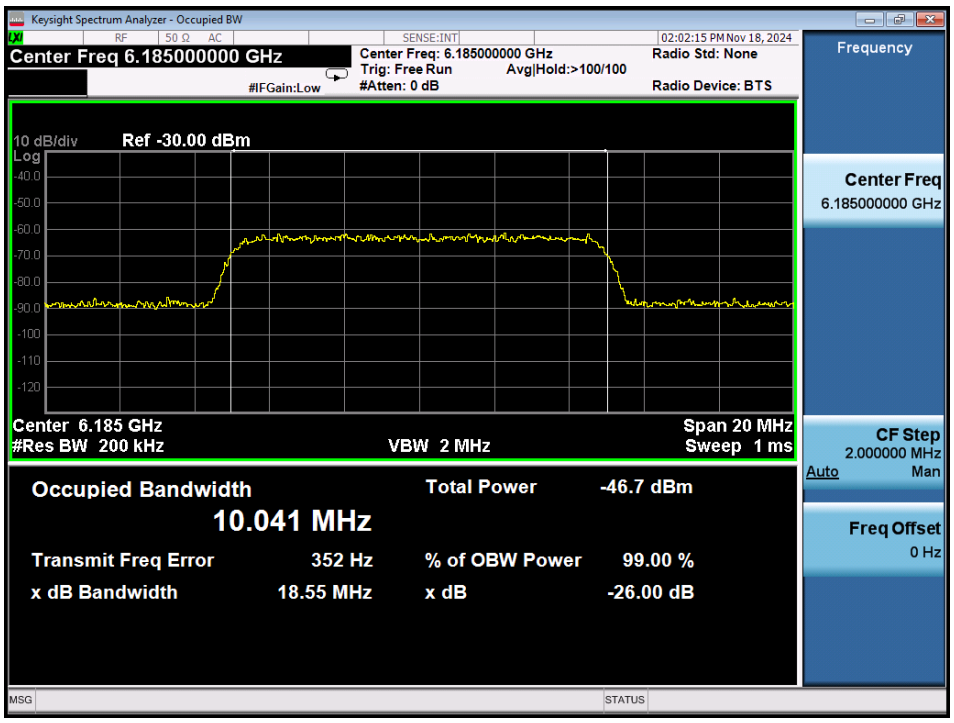
AWGN Plots



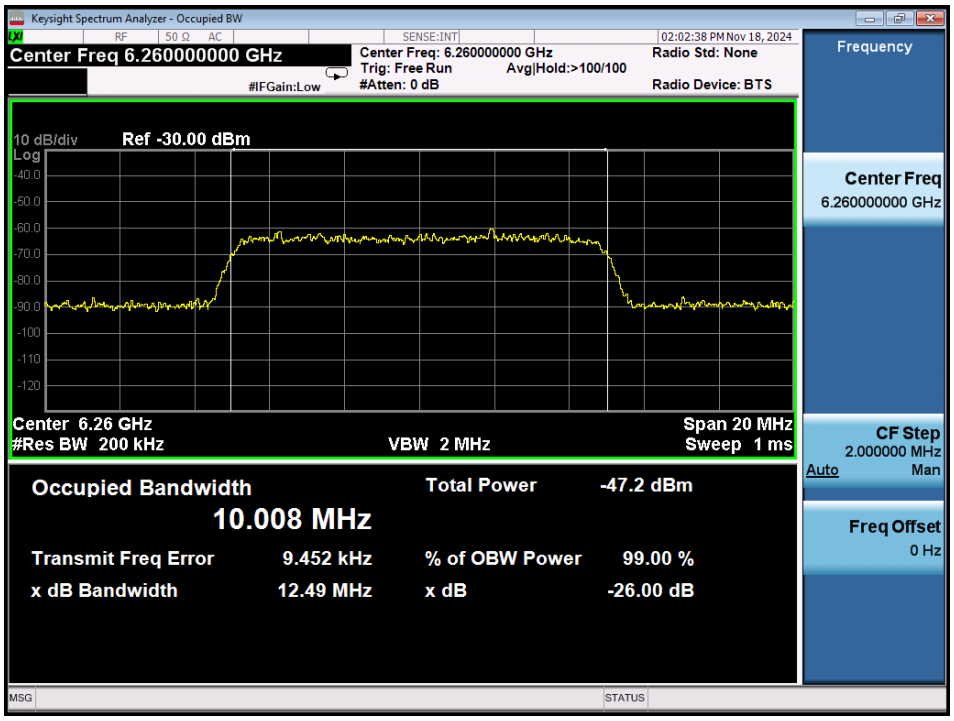
Plot 7-153. AWGN Signal – UNII 5 – 20MHz



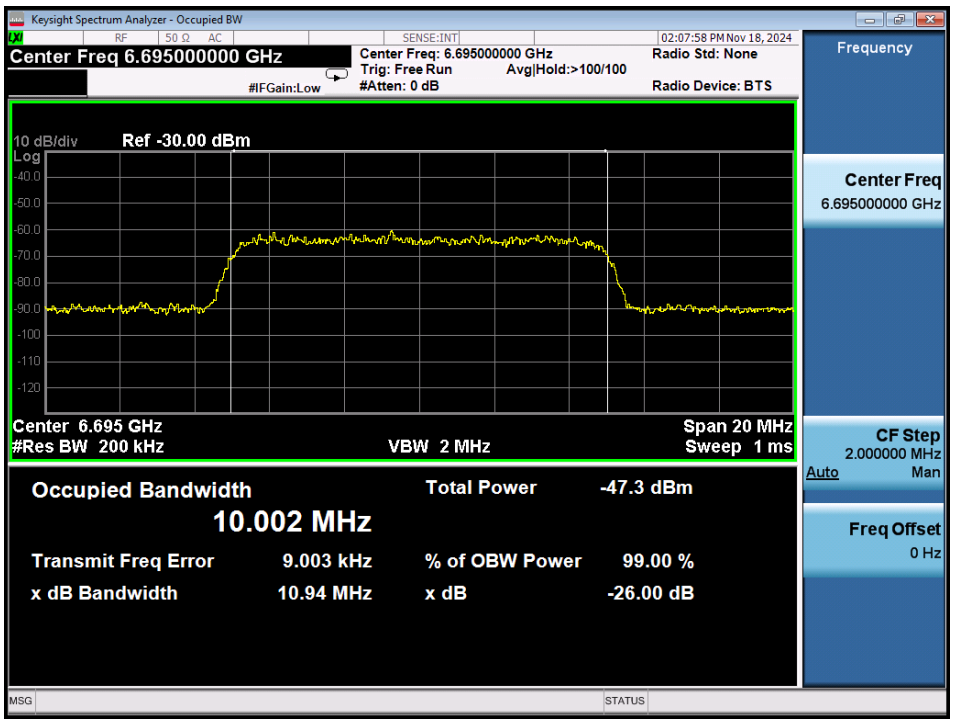
Plot 7-154. AWGN Signal – UNII 5 – 160MHz - Low



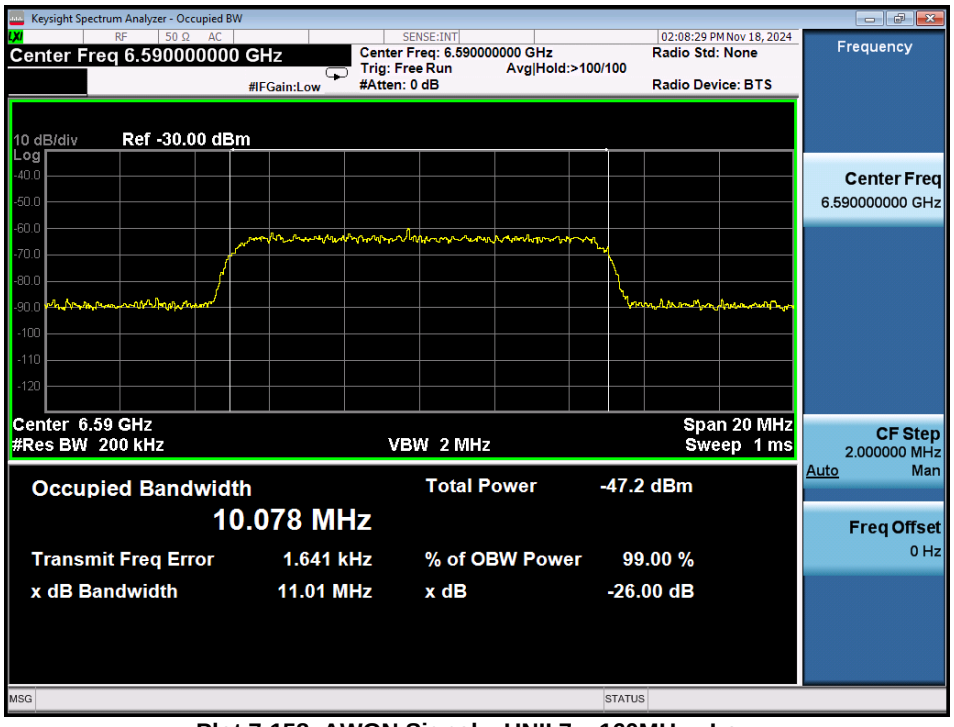
Plot 7-155. AWGN Signal – UNII 5 – 160MHz – Mid



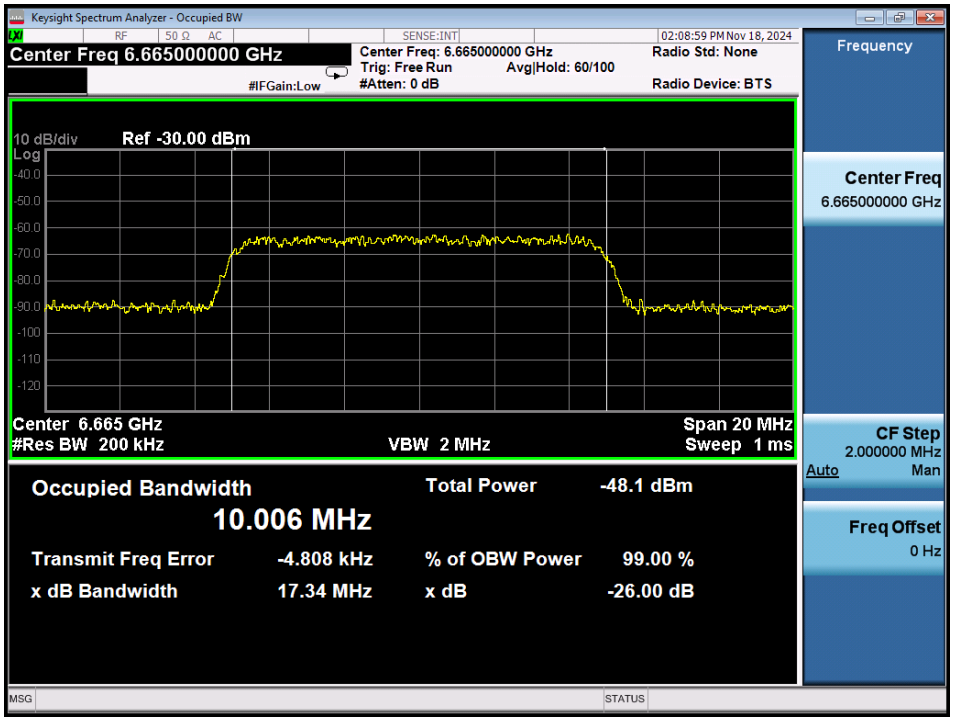
Plot 7-156. AWGN Signal – UNII 5 – 160MHz - High



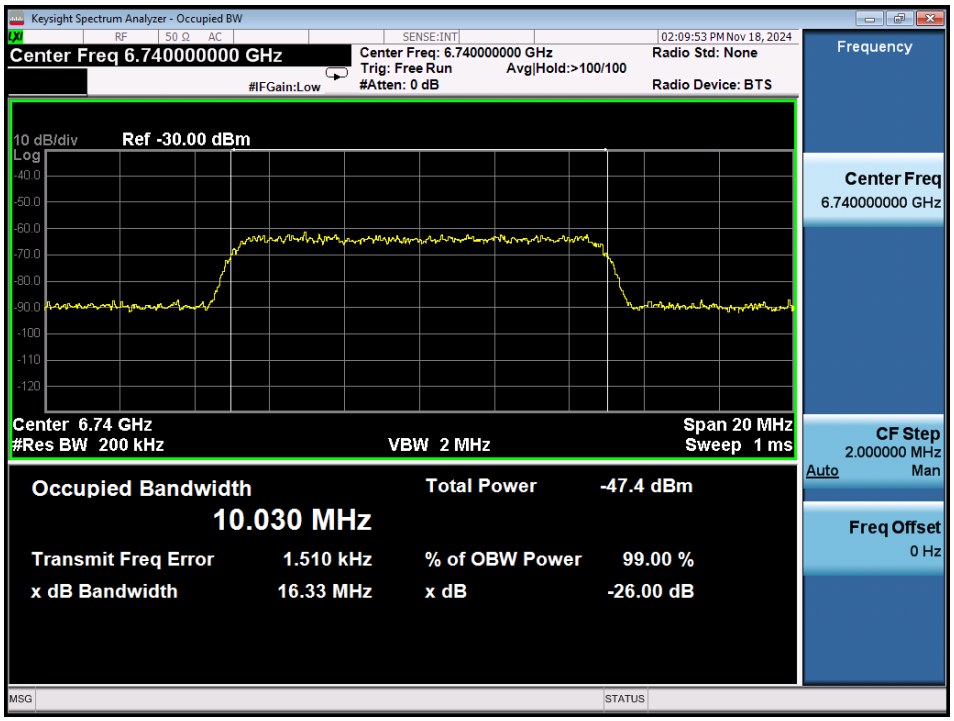
Plot 7-157. AWGN Signal – UNII 7 – 20MHz



Plot 7-158. AWGN Signal – UNII 7 – 160MHz - Low

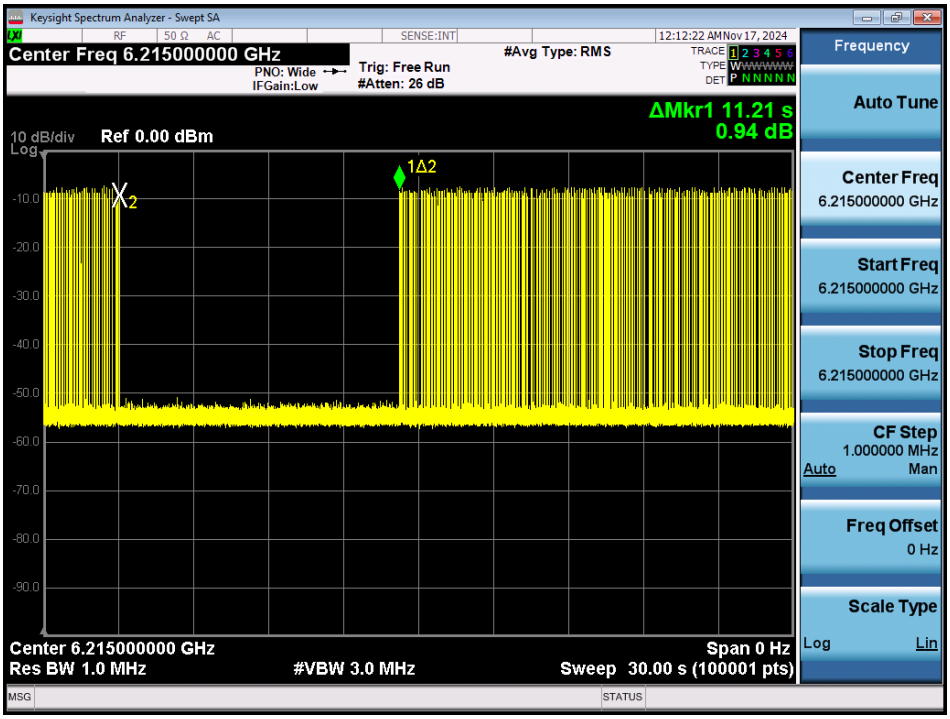


Plot 7-159. AWGN Signal – UNII 7 – 160MHz – Mid

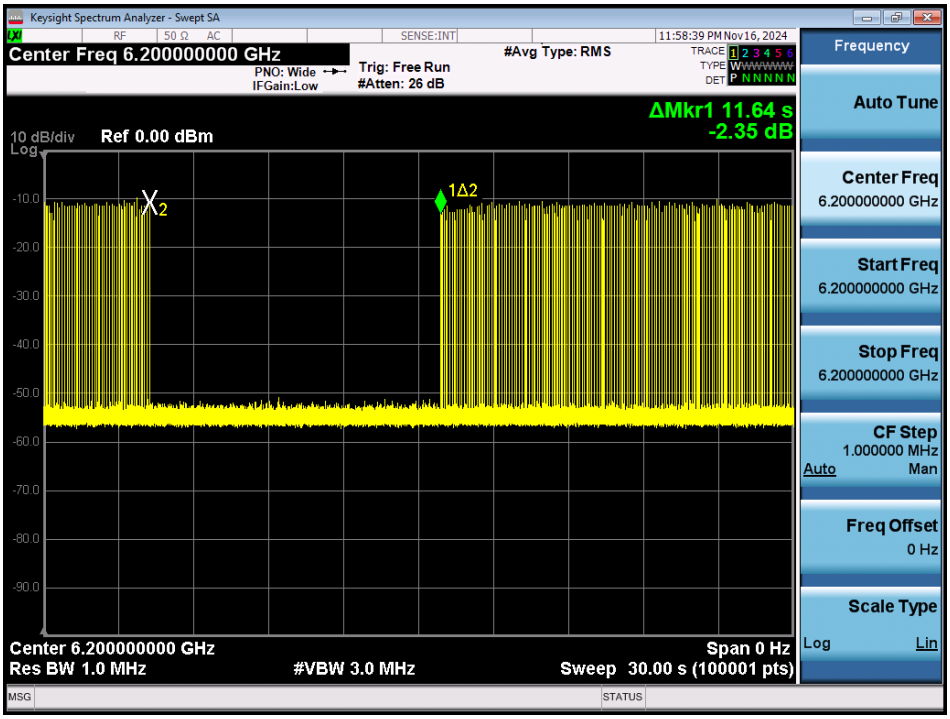


Plot 7-160. AWGN Signal – UNII 7 – 160MHz - High

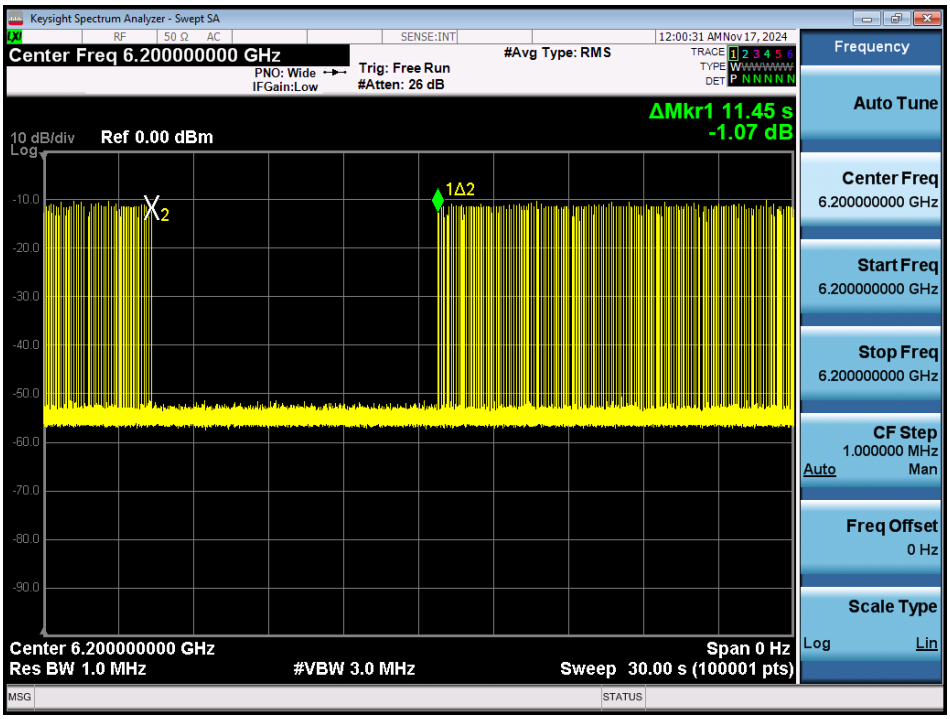
Contention-Based Protocol Timing Plots



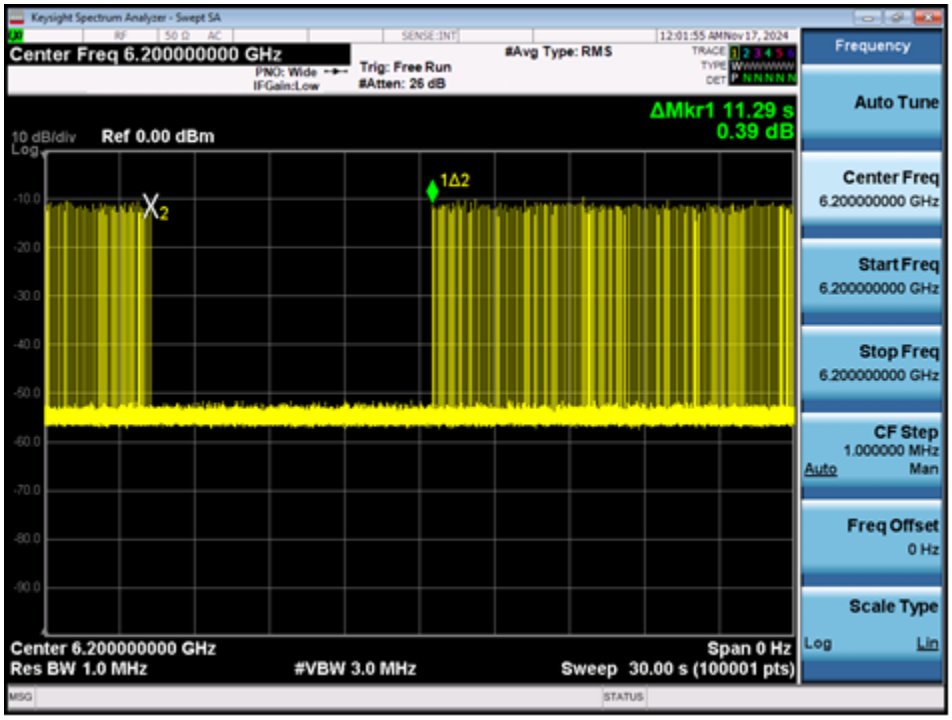
Plot 7-161. Contention Based Protocol Timing Plot – UNII 5 – 20MHz Channel 53



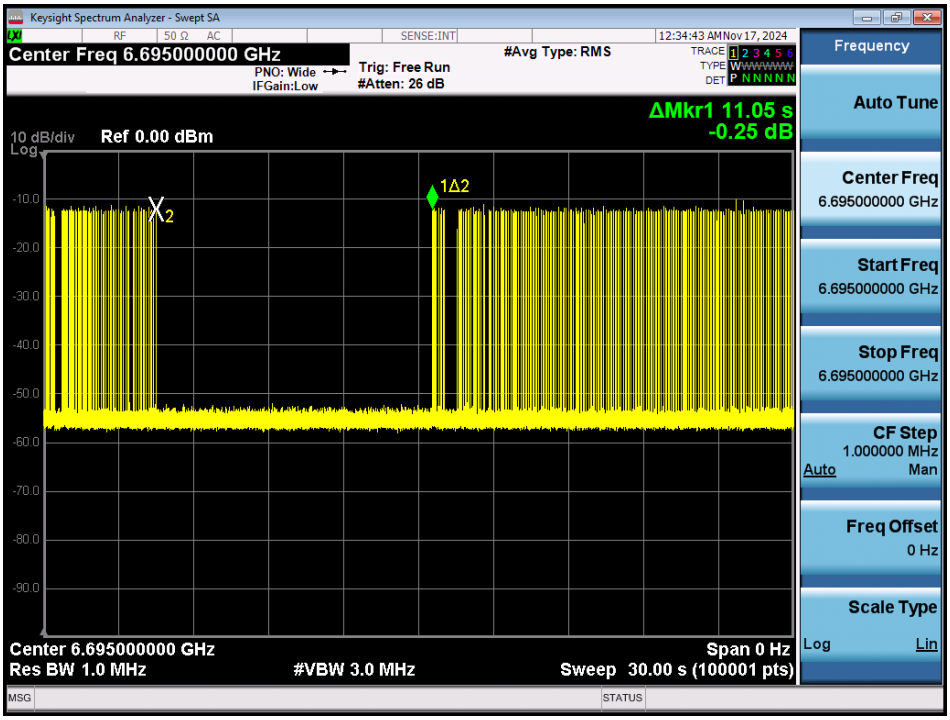
Plot 7-162. Contention Based Protocol Timing Plot – UNII 5 – 160MHz Channel 47 – Low



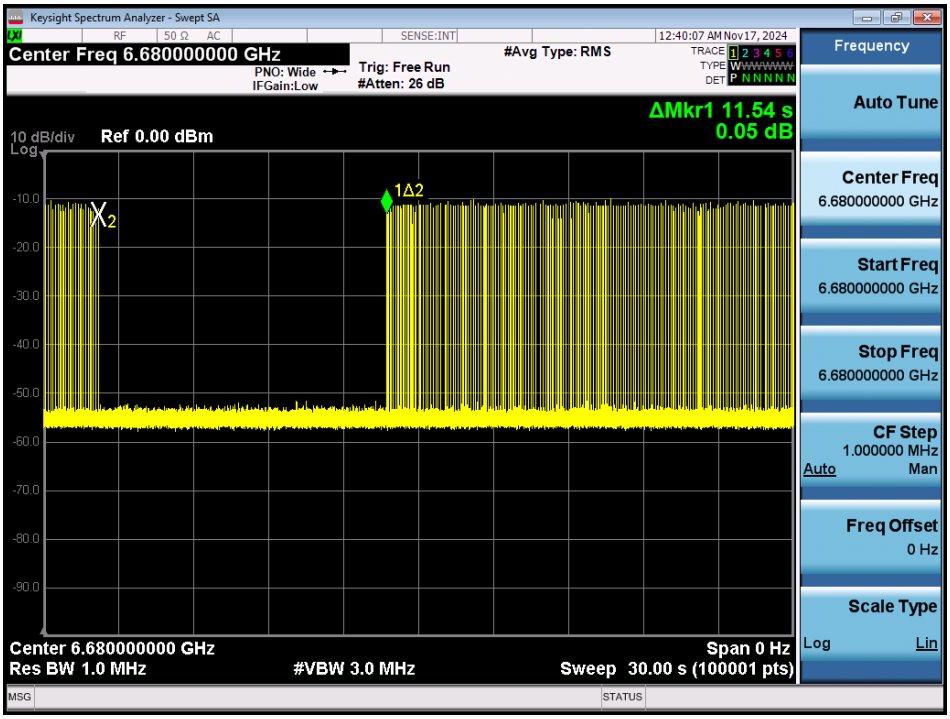
Plot 7-163. Contention Based Protocol Timing Plot –UNII 5 – 160MHz Channel 47 – Mid



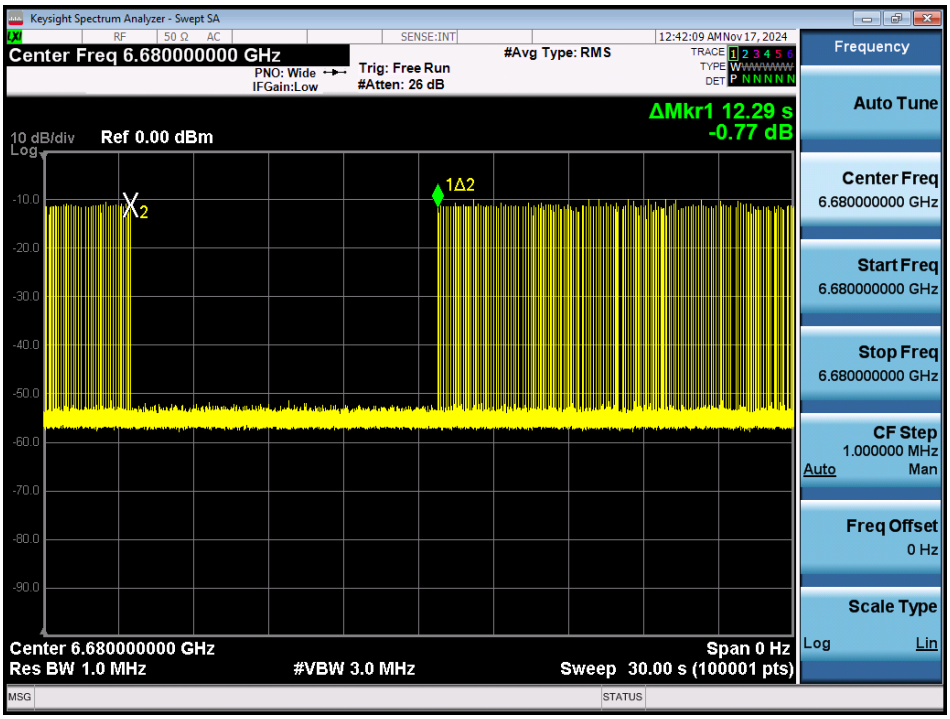
Plot 7-164. Contention Based Protocol Timing Plot – UNII 5 – 160MHz Channel 47 – High



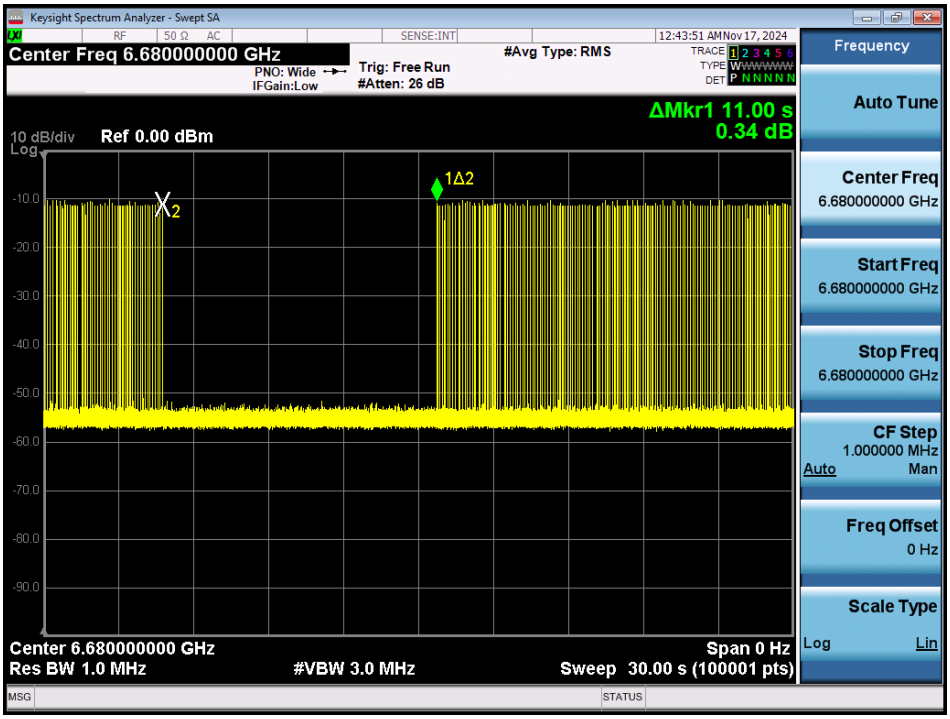
Plot 7-165. Contention Based Protocol Timing Plot – UNII 7 – 20MHz Channel 149



Plot 7-166. Contention Based Protocol Timing Plot – UNII 7 – 160MHz Channel 143 – Low

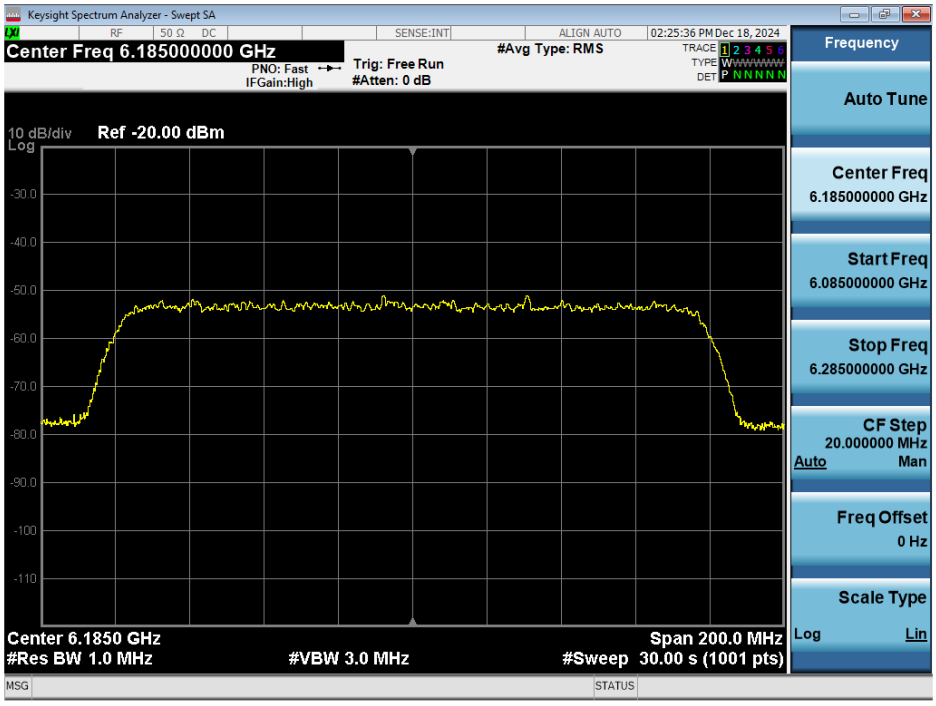


Plot 7-167. Contention Based Protocol Timing Plot – UNII 7 – 160MHz Channel 143 – Mid

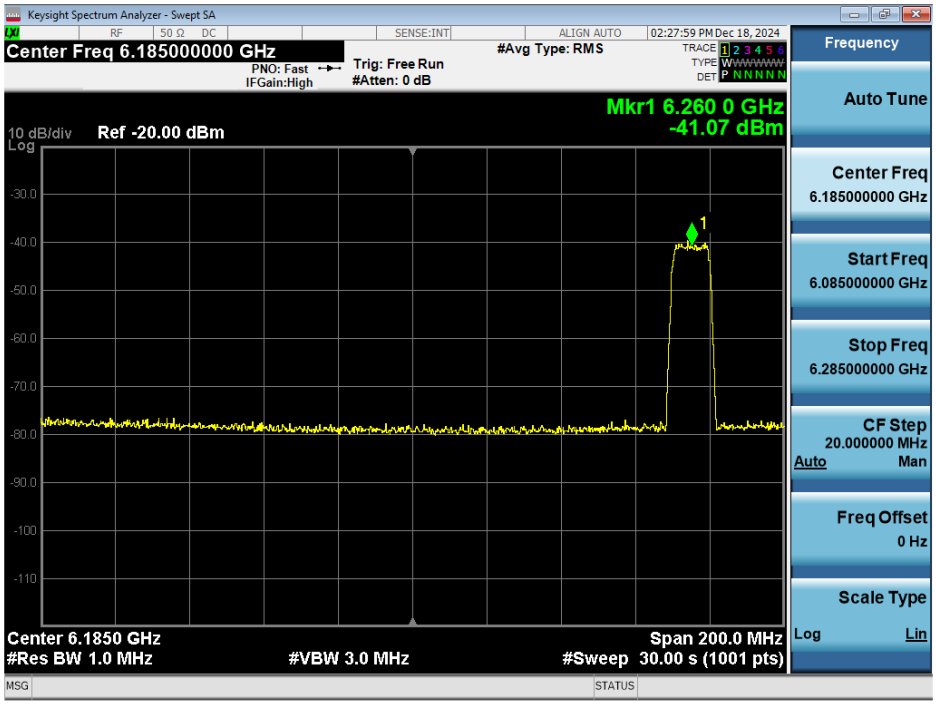


Plot 7-168. Contention Based Protocol Timing Plot – UNII 7 – 160MHz Channel 143 – High

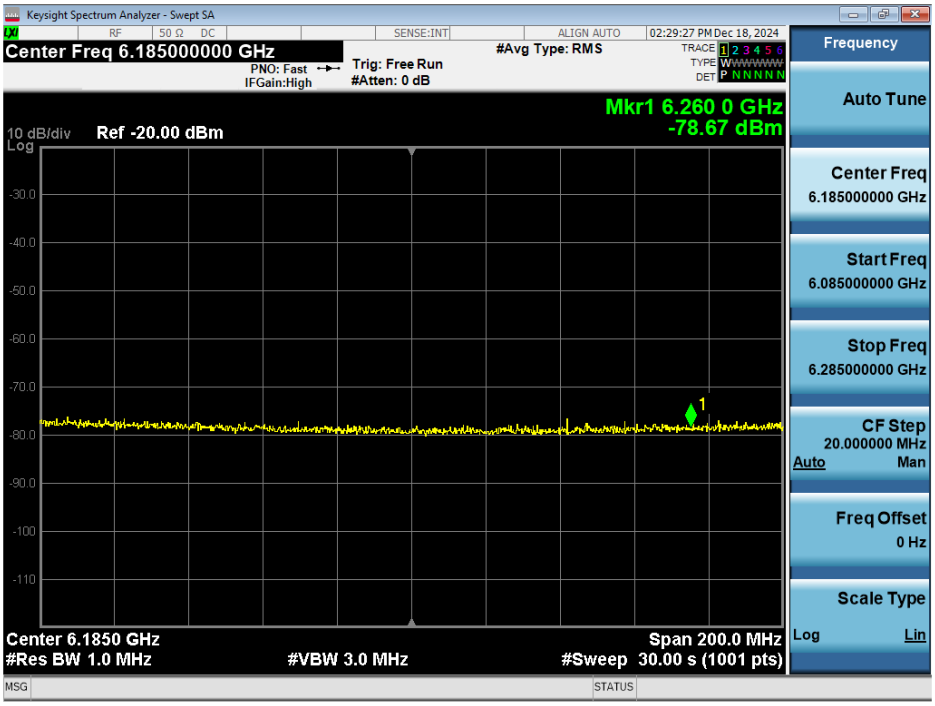
CBP Bandwidth Reduction Plots



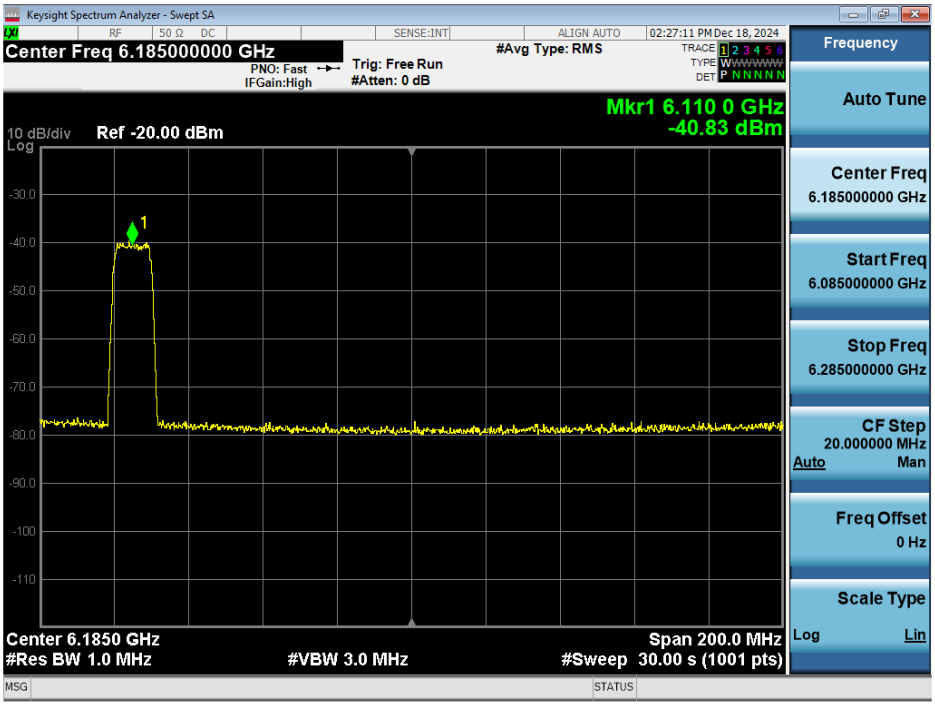
Plot 7-169. 160MHz Bandwidth, Before AWGN Signal Injected – Channel 47



Plot 7-170. 160MHz Bandwidth, AWGN Signal Injected at Low End – Channel 47



Plot 7-171. 160MHz Bandwidth, AWGN Signal Injected at Center – Channel 47



Plot 7-172. 160MHz Bandwidth, AWGN Signal Injected at High End – Channel 47

7.7 Radiated Spurious Emissions – Above 1GHz

§15.407(b) §15.205 §15.209; RSS-Gen [8.9]

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 C63.10-2020 and KDB 789033 D02 v02r01, and at the appropriate frequencies. All channels, modes (e.g. RU26, RU52, RU106, RU242, RU484, RU996 and RU996x2) 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 5.925-7.125 GHz band: All emissions outside of the 5.925-7.125 GHz band shall not exceed an EIRP of −27 dBm/MHz. Emissions found in a restricted band are subject to the limits of 15.209 and RSS-Gen (8.9) as shown in the table below.

Frequency	Field Strength [µV/m]	Measured Distance [Meters]
Above 960.0 MHz	500	3

Table 7-52. Radiated Limits

Test Procedures Used

ANSI C63.10-2020 – Sections 12.7.7, 12.7.6
KDB 789033 D02 v02r01 – Section G

Test Settings

Average 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 = power average (RMS)
5. Number of measurement points = 1001 (Number of points must be ≥ 2 x span/RBW)
6. Averaging type = power (RMS)
7. Sweep time = auto couple
8. Trace was averaged over 100 sweeps

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 Setup

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

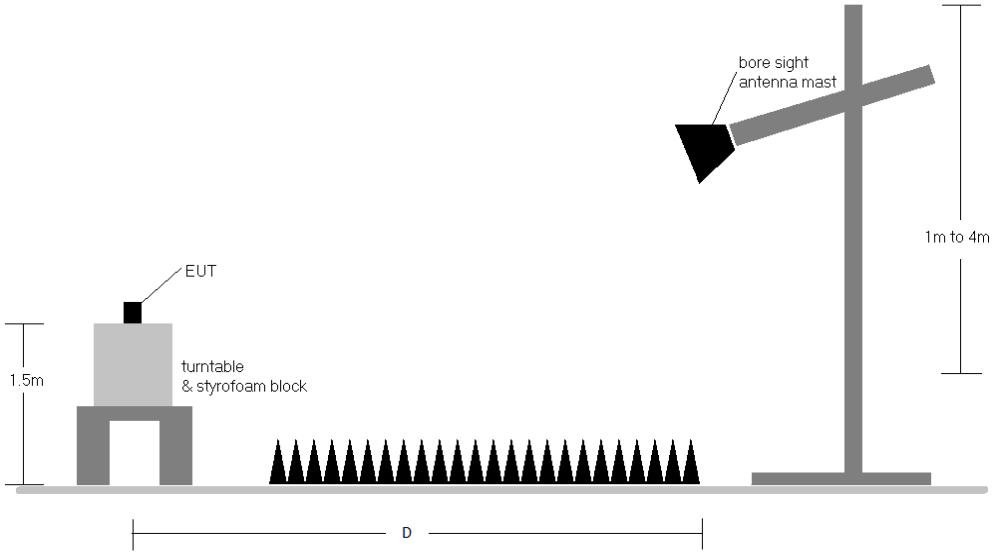


Figure 7-5. Test Instrument & Measurement Setup

Test Notes

1. All emissions that lie in the restricted bands (denoted by a * next to the frequency) specified in §15.205 and section 8.10 of RSS-Gen are below the limit shown in Table 7-52.
2. All spurious emissions lying in restricted bands specified in §15.205 and section 8.10 of RSS-Gen are below the limit shown in Table 7-52. All spurious emissions that do not lie in a restricted band are subject to a limit of -27dBm/MHz. At a distance of 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.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. 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.
5. D is the measurement test distance and emissions 1-18GHz were measured at a 3 meters test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
6. 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.
7. All data rates were investigated and only the worse case is reported
8. The unit was tested with all possible modes and only the highest emission is reported.
9. The "-" shown in the following RSE tables are used to denote a noise floor measurement.
10. All radiated measurements were tested at the highest supported power setting per band.

Sample Calculations

Determining Spurious Emissions Levels

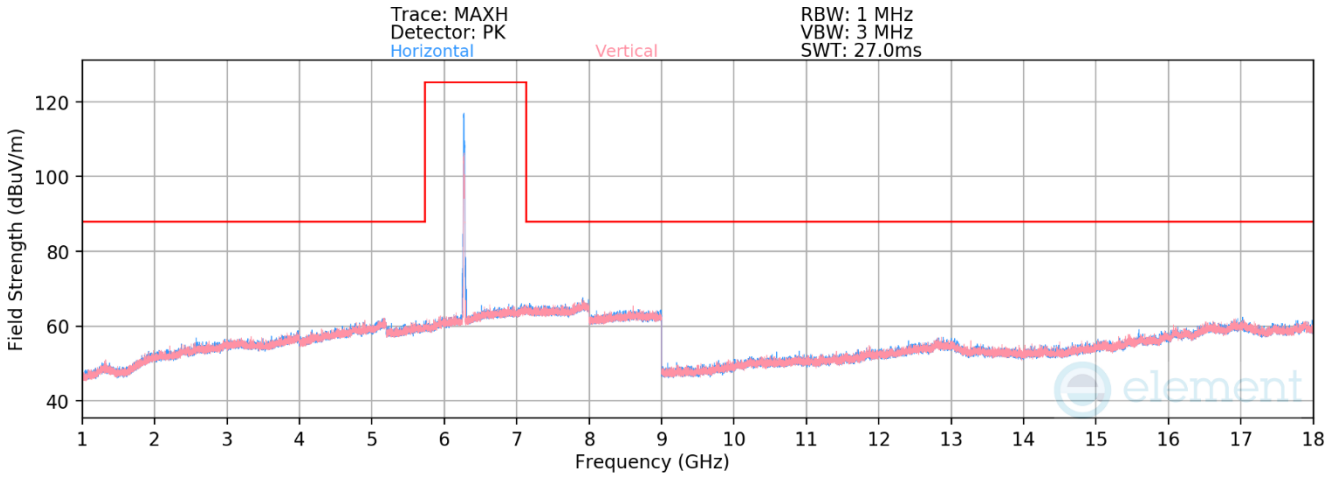
- Field Strength Level $_{[dB\mu V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB/m]}$
- AFCL $_{[dB/m]}$ = Antenna Factor $_{[dB/m]}$ + Cable Loss $_{[dB]}$ – Preamplifier Gain $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\mu V/m]}$ – Limit $_{[dB\mu V/m]}$

Radiated Band Edge Measurement Offset

- The amplitude offset shown in the radiated restricted band edge plots in Section 7.7.5 was calculated using the formula:
  Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

7.7.2 Antenna WF8 Radiated Spurious Emission

RU106

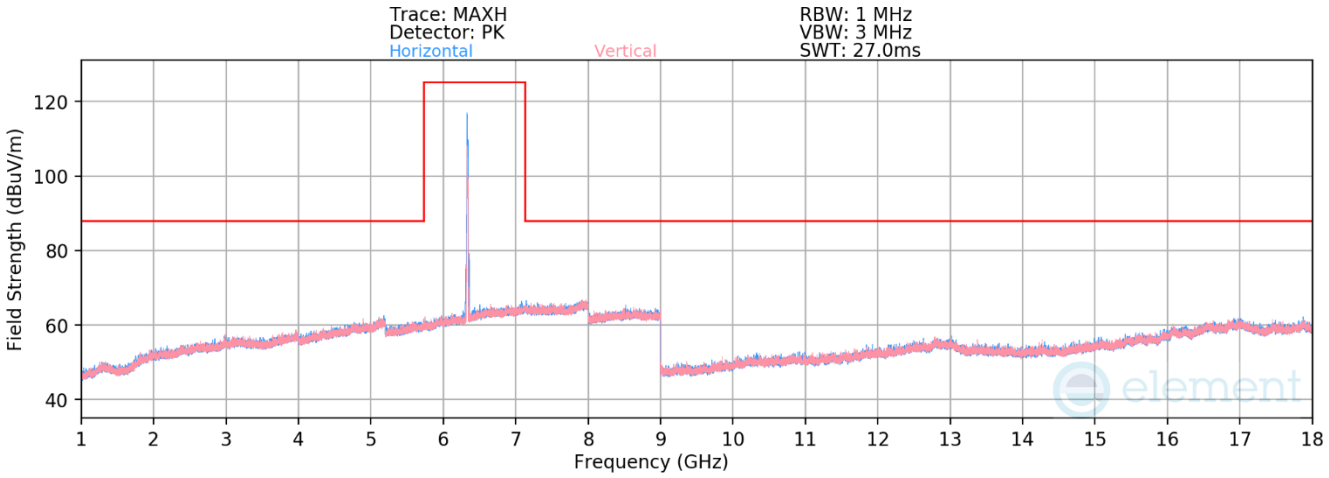


Plot 7-173. Radiated Spurious Emissions 1-18GHz Antenna WF8 (802.11ax – Ch. 65 – RU106)

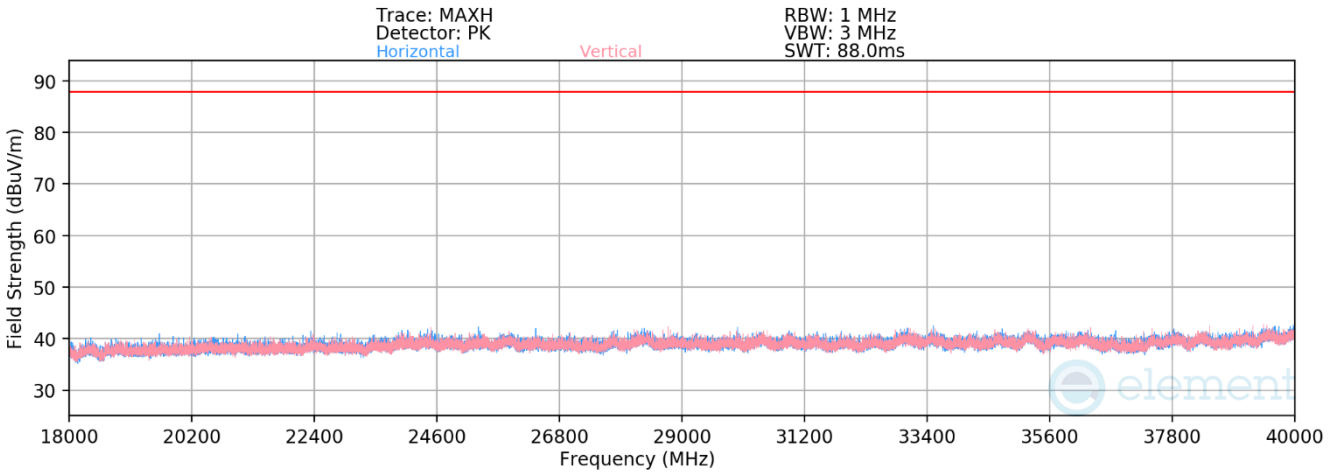
Mode:	802.11ax
Data Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	6275MHz
Channel:	65

	Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	12550.00	Average	H	-	-	-84.87	21.26	43.39	53.98	-10.59
*	12550.00	Peak	H	-	-	-73.20	20.98	54.78	73.98	-19.20

Table 7-53. Radiated Spurious Emission Measurements Antenna WF8 – RU106



Plot 7-174. Radiated Spurious Emissions 1-18GHz Antenna WF8 (802.11ax – Ch. 77 – RU106)

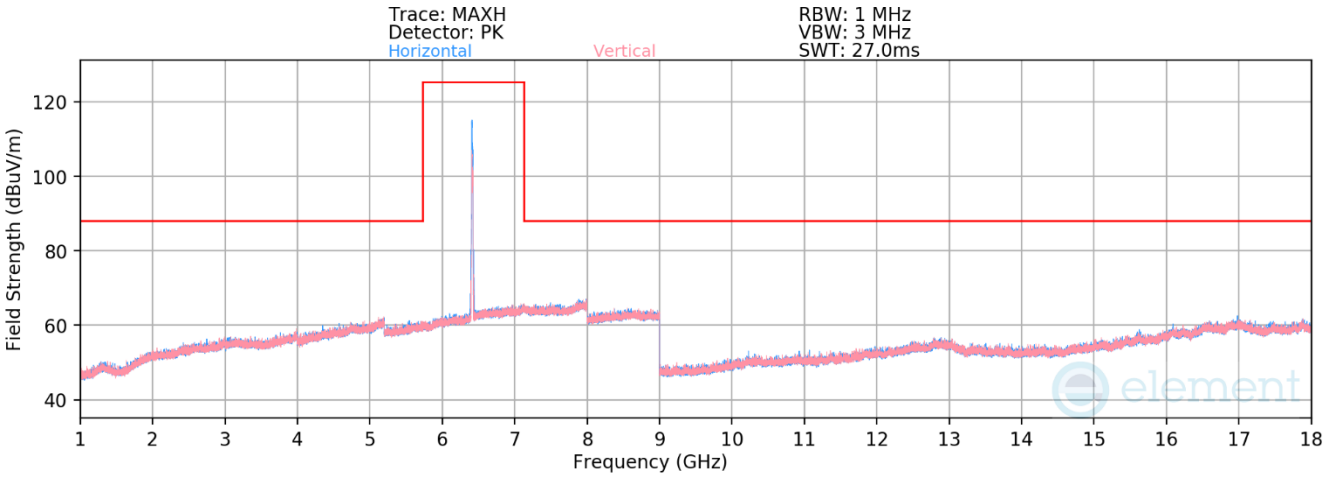


Plot 7-175. Radiated Spurious Emissions 18-40GHz Antenna WF8 (802.11ax – Ch. 77 – RU106)

Mode:	802.11ax
Data Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	6335MHz
Channel:	77

	Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
*	12670.00	Average	V	-	-	-85.11	21.36	43.25	53.98	-10.73
*	12670.00	Peak	V	-	-	-73.35	21.35	55.00	73.98	-18.98

Table 7-54. Radiated Spurious Emission Measurements Antenna WF8 – RU106

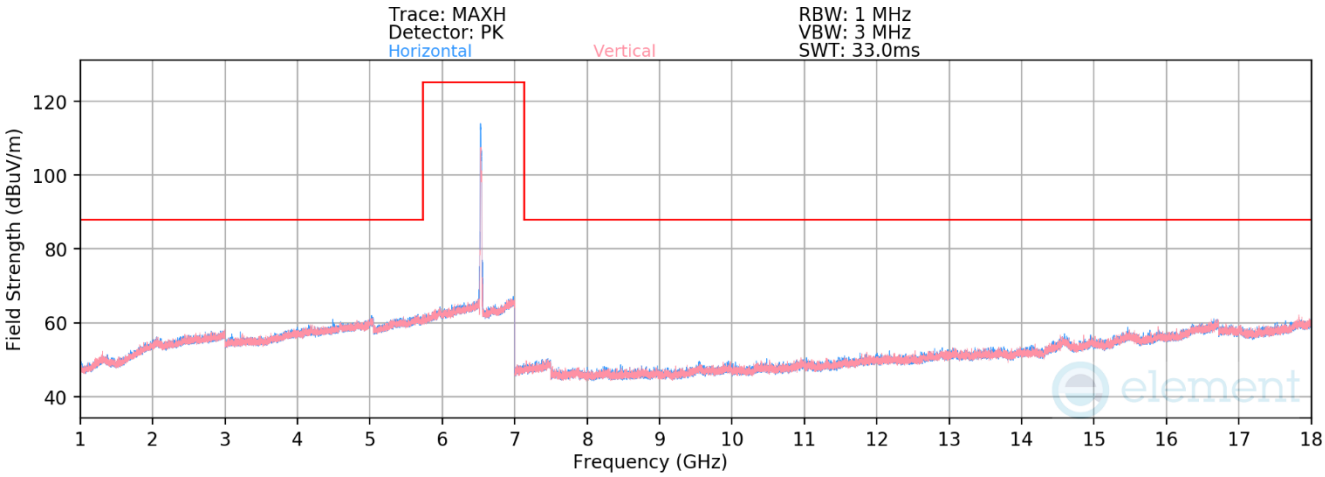


Plot 7-176. Radiated Spurious Emissions 1-18GHz Antenna WF8 (802.11ax – Ch. 93 – RU106)

Mode:	802.11ax
Data Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	6415MHz
Channel:	93

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
12830.00	Average	H	-	-	-85.21	22.26	44.05	68.23	-24.18
12830.00	Peak	H	-	-	-73.83	22.04	55.21	88.23	-33.02

Table 7-55. Radiated Spurious Emission Measurements Antenna WF8 – RU106



Plot 7-177. Radiated Spurious Emissions 1-18GHz Antenna WF8 (802.11ax – Ch. 117 – RU106)

Mode:	802.11ax
Data Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	6535MHz
Channel:	117

Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
13070.00	Average	V	-	-	-81.09	15.69	41.60	68.23	-26.63
13070.00	Peak	V	-	-	-70.04	15.81	52.78	88.23	-35.45

Table 7-56. Radiated Spurious Emission Measurements Antenna WF8 – RU106