7.4.4 Sum and Directional Gain Calculation

Per ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 Section 14.5.2.2 and KDB 662911 v02r01 Section E)2), the power spectral density at Antenna 0 and Antenna 1 were first measured separately during CDD/SDM transmission as shown in the section above. The measured values were then summed in linear power units then converted back to dBm.

Per ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 Subclause 14.6.3, the correlated directional gain is calculated using the following formula, where G_N is the gain of the nth antenna and N_{ANT}, the total number of antennas used.

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

Per ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024 Subclause 14.6.3, the uncorrelated directional gain is calculated using the following formula, where G_N is the gain of the nth antenna and N_{ANT}, the total number of antennas used.

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

Sample CDD/SDM Calculation:

At 6115MHz in 802.11ax (20MHz BW) mode, the average power spectral density was measured to be -12.69 dBm for Antenna 0 and -12.88 dBm for Antenna 1.

Antenna 0 + Antenna 1 = CDD/SDM

(-12.69 dBm + -12.88 dBm) = (0.0538 mW + 0.0538 mW) = .1054 mW = -9.77 dBm

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

At 6115MHz in 802.11ax (20MHz BW) mode, the average CDD/SDM power spectral density was calculated to be -9.77 dBm with directional gain of 2.01 dBi.

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

-9.77 dBm + 2.01 dBi = -7.77 dBm

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7.5 In-Band Emissions

Test Overview and Limit

The spectrum analyzer was connected to the antenna terminal while the EUT was operating at its maximum duty cycle, at its maximum power control level, as defined in ANSI C63.10:2020 + Cor. 1:2023 + C63.10a:2024 + Errata to C63.10a:2024 and KDB 789033 D02 v02r01, and at the appropriate frequencies.

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

Test Procedure Used

ANSI C63.10:2020 + Cor. 1:2023 + C63.10a:2024 + Errata to C63.10a:2024 – Section 12.4.2.2
KDB 987594 D02 v02r01 – 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 + Cor. 1:2023 + C63.10a:2024 + Errata to C63.10a:2024.
3. Measure the 26 dB EBW using the test procedure 12.5.2 of ANSI C63.10:2020 + Cor. 1:2023 + C63.10a:2024 + Errata to C63.10a:2024. (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.

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Test Setup

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

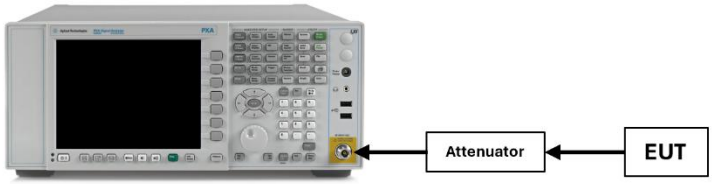

Figure 7-4. Test Instrument & Measurement Setup

Test Notes

1. All data rates and channels (low, mid, and high) were investigated. Only the worst-case plots are reported.

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7.5.1 Antenna 0 In-Band Emission Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate	Antenna 0 In-Band Emission
Band 5	6115	33	a	54Mbps	Pass
	6275	65	a	24Mbps	Pass
	6415	93	a	24Mbps	Pass
	6115	33	ax (20MHz)	MCS2	Pass
	6275	65	ax (20MHz)	MCS4	Pass
	6415	93	ax (20MHz)	MCS2	Pass
	6125	35	ax (40MHz)	MCS2	Pass
	6285	67	ax (40MHz)	MCS2	Pass
	6405	91	ax (40MHz)	MCS2	Pass
	6145	39	ax (80MHz)	MCS2	Pass
	6305	71	ax (80MHz)	MCS2	Pass
Band 6	6435	97	a	54Mbps	Pass
	6475	105	a	24Mbps	Pass
	6515	113	a	24Mbps	Pass
	6445	99	ax (40MHz)	MCS2	Pass
	6485	107	ax (40MHz)	MCS2	Pass
	6465	103	ax (80MHz)	MCS2	Pass
	6505	111	ax (160MHz)	MCS4	Pass
Band 7	6535	117	ax (20MHz)	MCS4	Pass
	6695	149	ax (20MHz)	MCS11	Pass
	6875	185	ax (20MHz)	MCS4	Pass
	6565	123	ax (40MHz)	MCS4	Pass
	6725	155	ax (40MHz)	MCS2	Pass
	6845	179	ax (40MHz)	MCS2	Pass
	6545	119	ax (80MHz)	MCS2	Pass
	6705	151	ax (80MHz)	MCS2	Pass
	6865	183	ax (80MHz)	MCS2	Pass
	6665	143	ax (160MHz)	MCS4	Pass
	6825	175	ax (160MHz)	MCS2	Pass
Band 8	6895	189	ax (20MHz)	MCS4	Pass
	6995	209	ax (20MHz)	MCS4	Pass
	7115	233	ax (20MHz)	MCS4	Pass
	6885	187	ax (40MHz)	MCS2	Pass
	7005	211	ax (40MHz)	MCS2	Pass
	7085	227	ax (40MHz)	MCS2	Pass
	6945	199	ax (80MHz)	MCS4	Pass
	7025	215	ax (80MHz)	MCS2	Pass
	6985	207	ax (160MHz)	MCS2	Pass

Table 7-21. In-Band Emission Measurements Antenna 0

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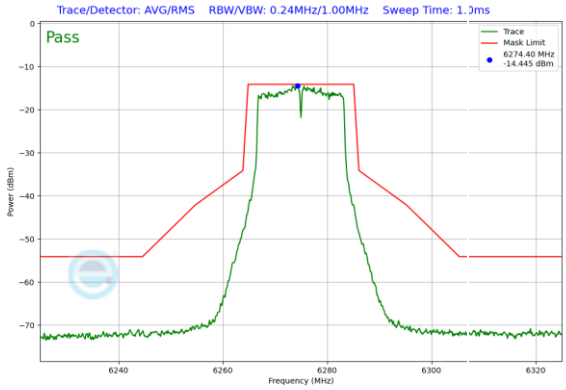
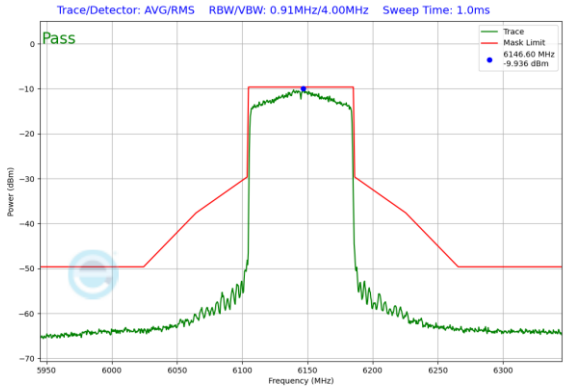
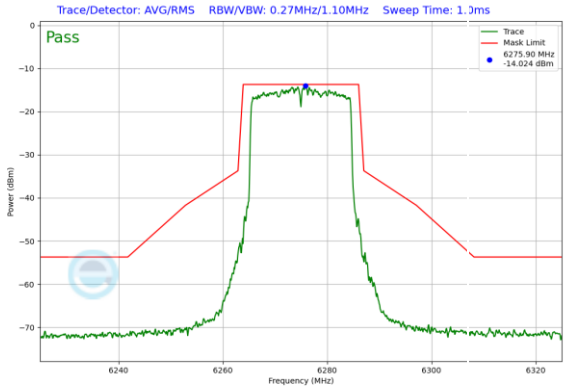


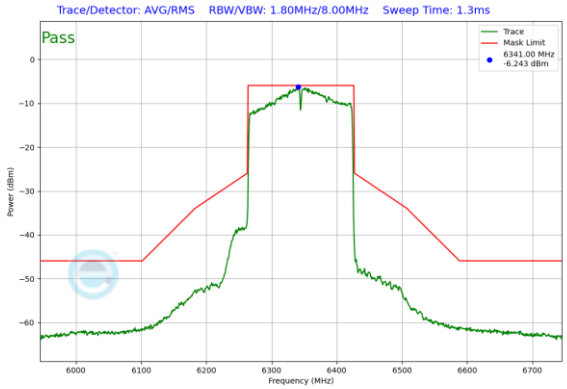
Plot 7-113. VLP In-Band Emission Plot Antenna 0 (20MHz 802.11a (UNII Band 5) – Ch. 65, 24Mbps)



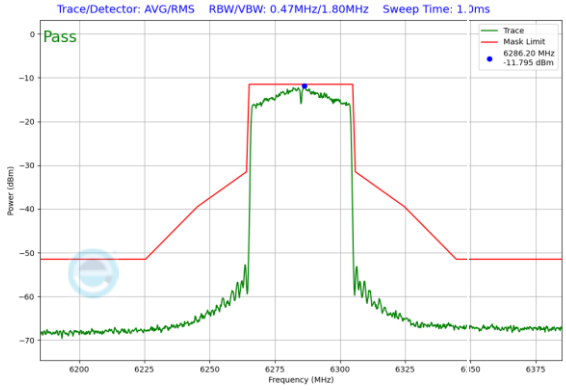
Plot 7-116. VLP In-Band Emission Plot Antenna 0 (80MHz 802.11ax (UNII Band 5) – Ch. 39, MCS2)



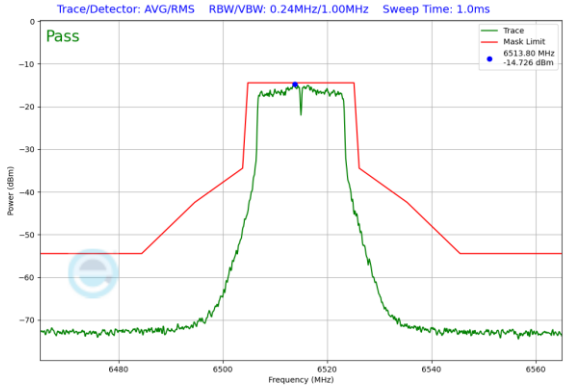
Plot 7-114. VLP In-Band Emission Plot Antenna 0 (20MHz 802.11ax (UNII Band 5) – Ch. 65, MCS4)



Plot 7-117. VLP In-Band Emission Plot Antenna 0 (160MHz 802.11ax (UNII Band 5) – Ch. 79, MCS4)



Plot 7-115. VLP In-Band Emission Plot Antenna 0 (40MHz 802.11ax (UNII Band 5) – Ch. 67, MCS2)



Plot 7-118. VLP In-Band Emission Plot Antenna 0 (20MHz 802.11a (UNII Band 6) – Ch. 113, 24Mbps)

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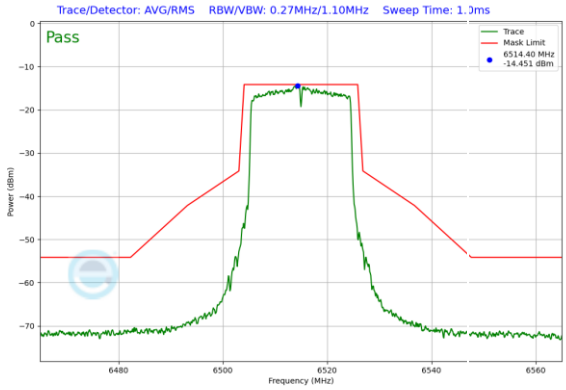
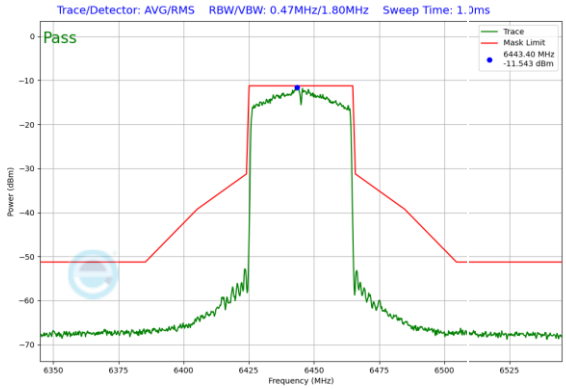
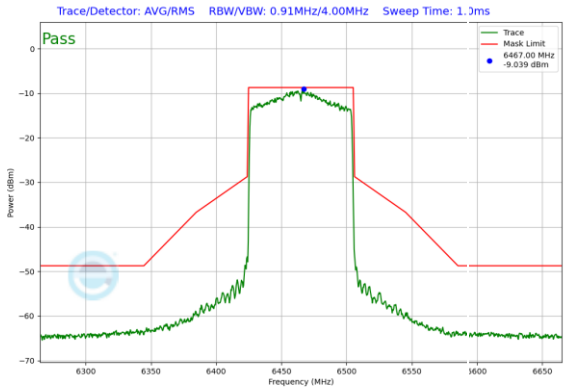


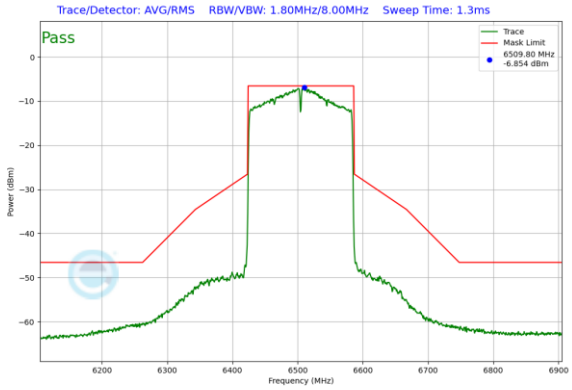
Plot 7-119. VLP In-Band Emission Plot Antenna 0 (20MHz 802.11ax (UNII Band 6) – Ch. 113, MCS4)



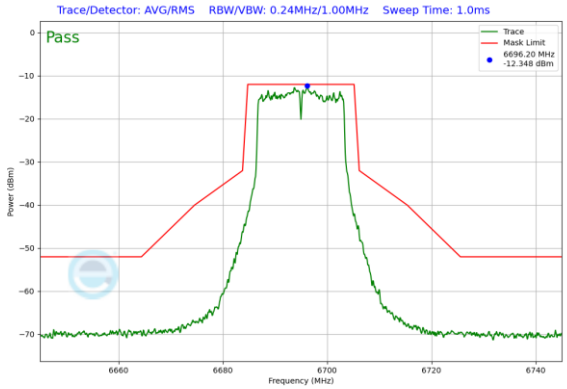
Plot 7-120. VLP In-Band Emission Plot Antenna 0 (40MHz 802.11ax (UNII Band 6) – Ch. 99, MCS2)



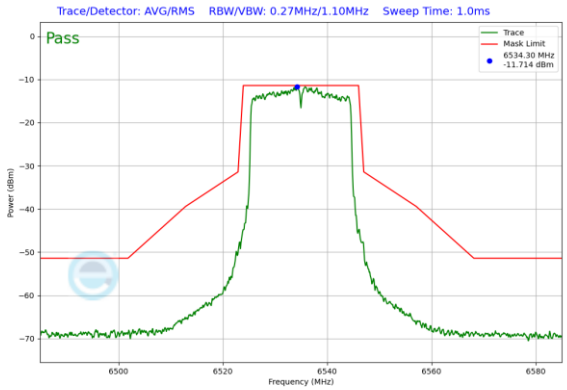
Plot 7-121. VLP In-Band Emission Plot Antenna 0 (80MHz 802.11ax (UNII Band 6) – Ch. 103, MCS2)



Plot 7-122. VLP In-Band Emission Plot Antenna 0 (160MHz 802.11ax (UNII Band 6) – Ch. 111, MCS4)



Plot 7-123. VLP In-Band Emission Plot Antenna 0 (20MHz 802.11a (UNII Band 7) – Ch. 149, 54Mbps)



Plot 7-124. VLP In-Band Emission Plot Antenna 0 (20MHz 802.11ax (UNII Band 7) – Ch. 117, MCS4)

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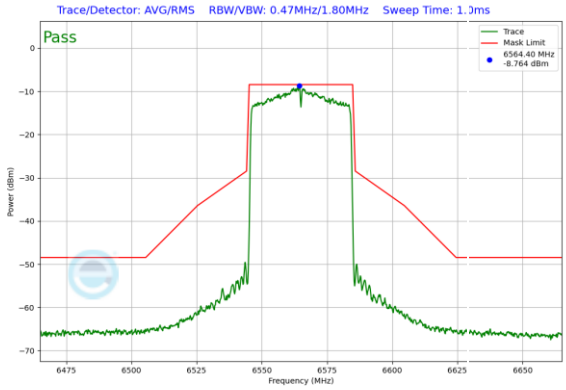
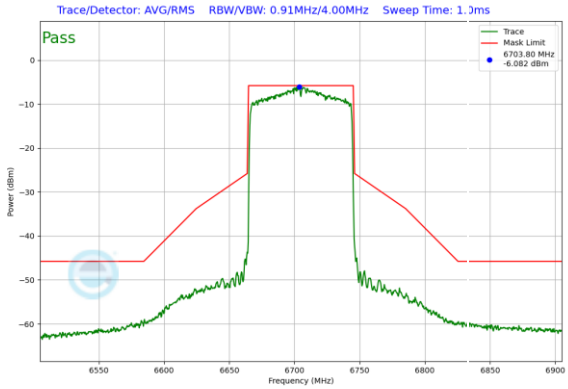
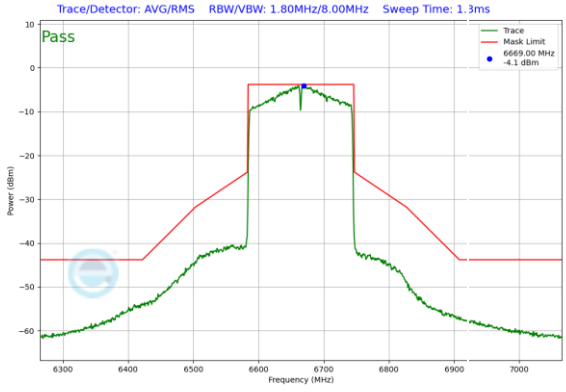


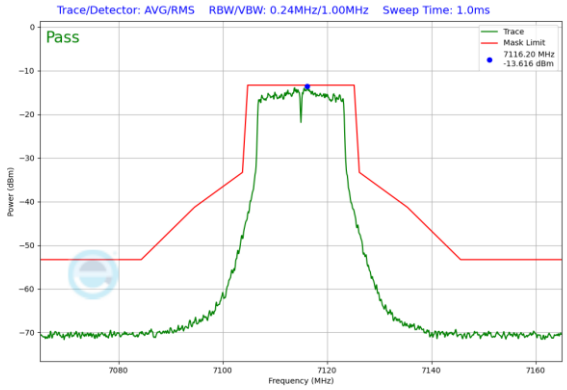
Plot 7-125. VLP In-Band Emission Plot Antenna 0 (40MHz 802.11ax (UNII Band 7) – Ch. 123, MCS4)



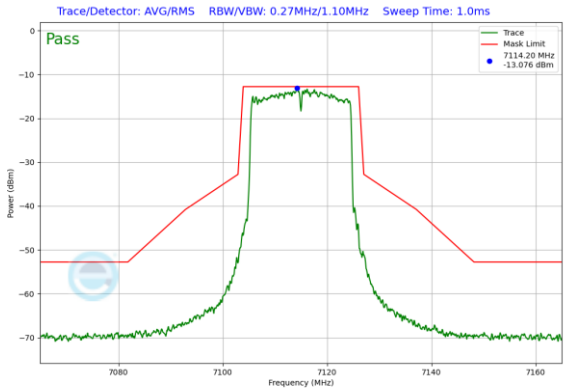
Plot 7-126. VLP In-Band Emission Plot Antenna 0 (80MHz 802.11ax (UNII Band 7) – Ch. 151, MCS2)



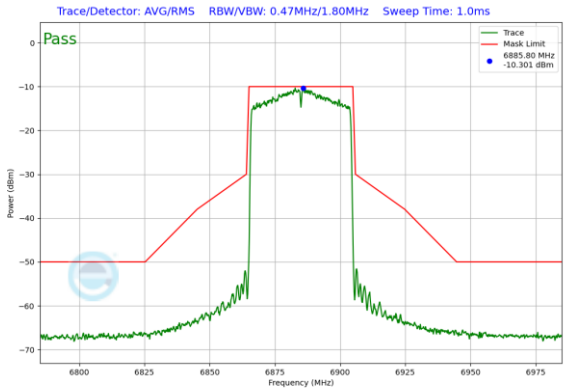
Plot 7-127. VLP In-Band Emission Plot Antenna 0 (160MHz 802.11ax (UNII Band 7) – Ch. 143, MCS4)



Plot 7-128. VLP In-Band Emission Plot Antenna 0 (20MHz 802.11a (UNII Band 8) – Ch. 233, 54Mbps)



Plot 7-129. VLP In-Band Emission Plot Antenna 0 (20MHz 802.11ax (UNII Band 8) – Ch. 233, MCS4)



Plot 7-130. VLP In-Band Emission Plot Antenna 0 (40MHz 802.11ax (UNII Band 8) – Ch. 187, MCS2)

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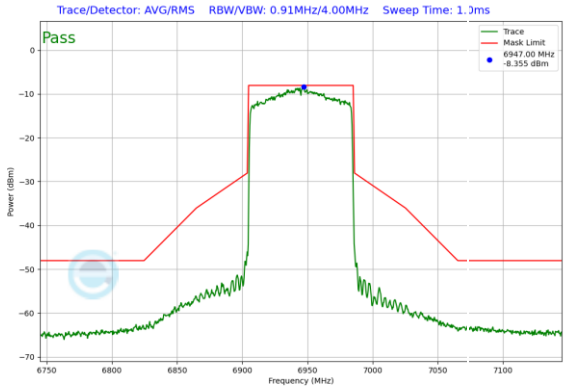
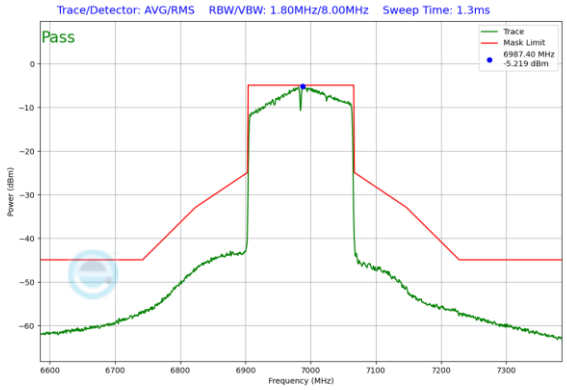


Plot 7-131. VLP In-Band Emission Plot Antenna 0 (80MHz 802.11ax (UNII Band 8) – Ch. 199, MCS4)



Plot 7-132. VLP In-Band Emission Plot Antenna 0 (160MHz 802.11ax (UNII Band 8) – Ch. 207, MCS2)

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7.5.2 Antenna 1 In-Band Emission Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Data Rate	Antenna 1 In-Band Emission
Band 5	6115	33	a	54Mbps	Pass
	6275	65	a	24Mbps	Pass
	6415	93	a	24Mbps	Pass
	6115	33	ax (20MHz)	MCS2	Pass
	6275	65	ax (20MHz)	MCS4	Pass
	6415	93	ax (20MHz)	MCS2	Pass
	6125	35	ax (40MHz)	MCS2	Pass
	6285	67	ax (40MHz)	MCS2	Pass
	6405	91	ax (40MHz)	MCS2	Pass
	6145	39	ax (80MHz)	MCS2	Pass
	6305	71	ax (80MHz)	MCS2	Pass
Band 6	6435	97	a	54Mbps	Pass
	6475	105	a	24Mbps	Pass
	6515	113	a	24Mbps	Pass
	6445	99	ax (40MHz)	MCS2	Pass
	6485	107	ax (40MHz)	MCS2	Pass
	6465	103	ax (80MHz)	MCS2	Pass
	6505	111	ax (160MHz)	MCS4	Pass
Band 7	6535	117	ax (20MHz)	MCS4	Pass
	6695	149	ax (20MHz)	MCS11	Pass
	6875	185	ax (20MHz)	MCS4	Pass
	6565	123	ax (40MHz)	MCS4	Pass
	6725	155	ax (40MHz)	MCS2	Pass
	6845	179	ax (40MHz)	MCS2	Pass
	6545	119	ax (80MHz)	MCS2	Pass
	6705	151	ax (80MHz)	MCS2	Pass
	6865	183	ax (80MHz)	MCS2	Pass
	6665	143	ax (160MHz)	MCS4	Pass
	6825	175	ax (160MHz)	MCS2	Pass
Band 8	6895	189	ax (20MHz)	MCS4	Pass
	6995	209	ax (20MHz)	MCS4	Pass
	7115	233	ax (20MHz)	MCS4	Pass
	6885	187	ax (40MHz)	MCS2	Pass
	7005	211	ax (40MHz)	MCS2	Pass
	7085	227	ax (40MHz)	MCS2	Pass
	6945	199	ax (80MHz)	MCS4	Pass
	7025	215	ax (80MHz)	MCS2	Pass
	6985	207	ax (160MHz)	MCS2	Pass

Table 7-22. In-Band Emission Measurements Antenna 1

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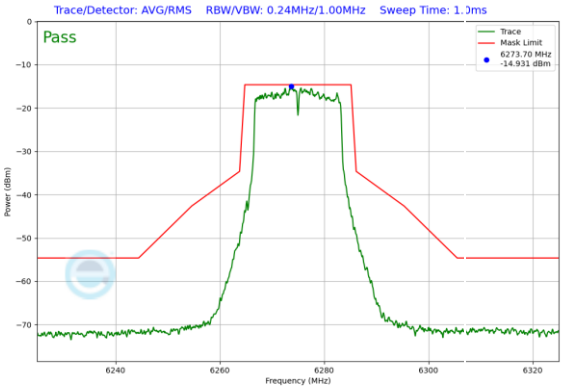
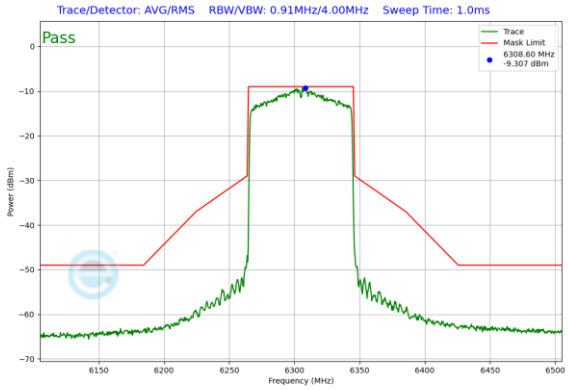
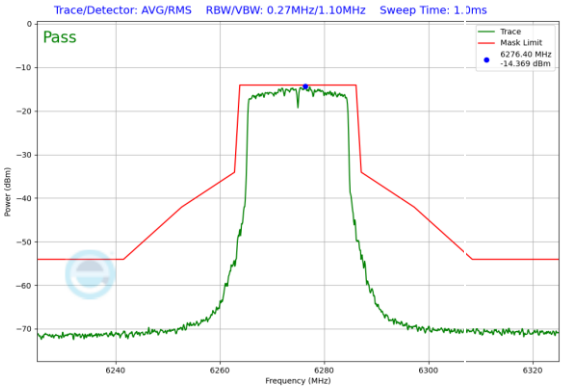


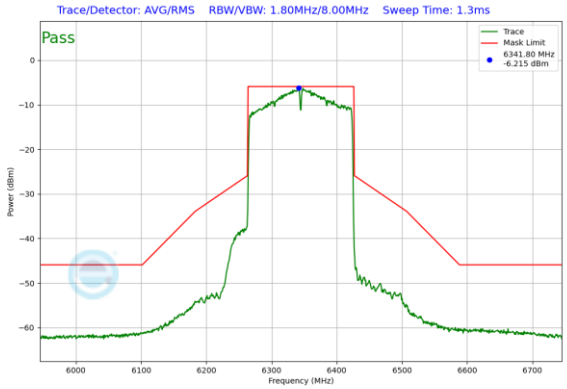
Plot 7-133. VLP In-Band Emission Plot Antenna 1 (20MHz 802.11a (UNII Band 5) – Ch. 65, 54Mbps)



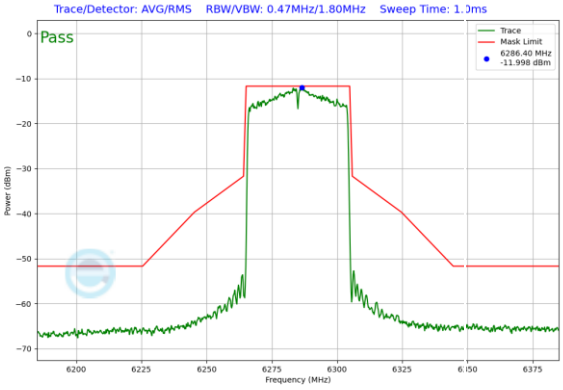
Plot 7-136. VLP In-Band Emission Plot Antenna 1 (80MHz 802.11ax (UNII Band 5) – Ch. 71, MCS4)



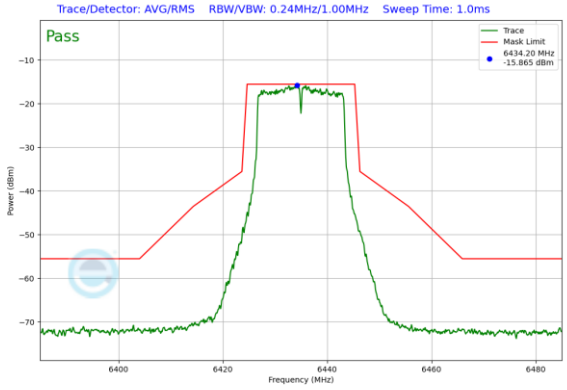
Plot 7-134. VLP In-Band Emission Plot Antenna 1 (20MHz 802.11ax (UNII Band 5) – Ch. 65, MCS4)



Plot 7-137. VLP In-Band Emission Plot Antenna 1 (160MHz 802.11ax (UNII Band 5) – Ch. 79, MCS4)



Plot 7-135. VLP In-Band Emission Plot Antenna 1 (40MHz 802.11ax (UNII Band 5) – Ch. 67, MCS4)



Plot 7-138. VLP In-Band Emission Plot Antenna 1 (20MHz 802.11a (UNII Band 6) – Ch. 97, 12Mbps)

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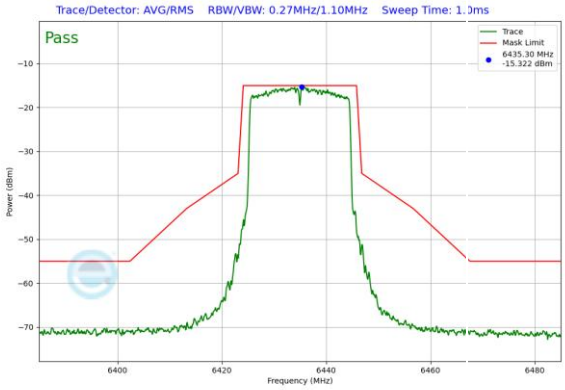
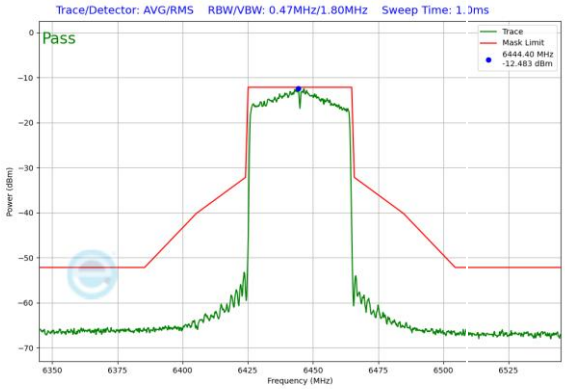
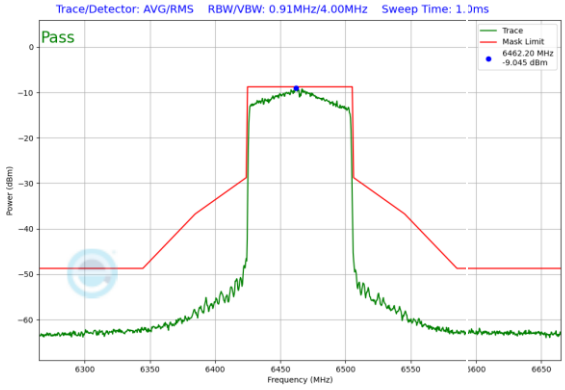


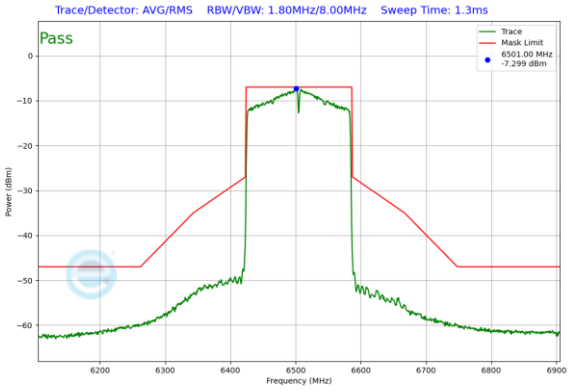
Plot 7-139. VLP In-Band Emission Plot Antenna 1 (20MHz 802.11ax (UNII Band 6) – Ch. 97, MCS4)



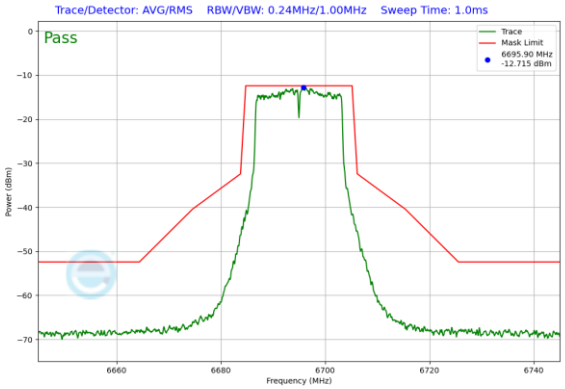
Plot 7-140. VLP In-Band Emission Plot Antenna 1 (40MHz 802.11ax (UNII Band 6) – Ch. 99, MCS4)



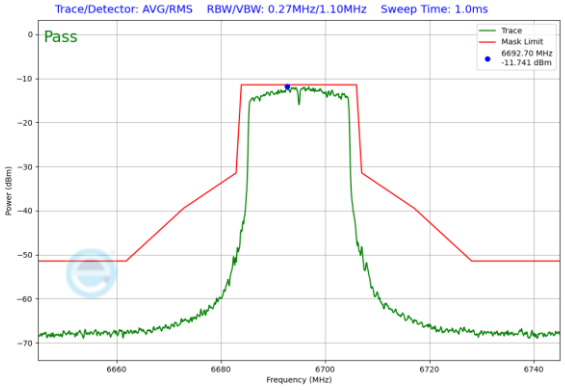
Plot 7-141. VLP In-Band Emission Plot Antenna 1 (80MHz 802.11ax (UNII Band 6) – Ch. 103, MCS2)



Plot 7-142. VLP In-Band Emission Plot Antenna 1 (160MHz 802.11ax (UNII Band 6) – Ch. 111, MCS2)



Plot 7-143. VLP In-Band Emission Plot Antenna 1 (20MHz 802.11a (UNII Band 7) – Ch. 149, 24Mbps)



Plot 7-144. VLP In-Band Emission Plot Antenna 1 (20MHz 802.11ax (UNII Band 7) – Ch. 149, MCS4)

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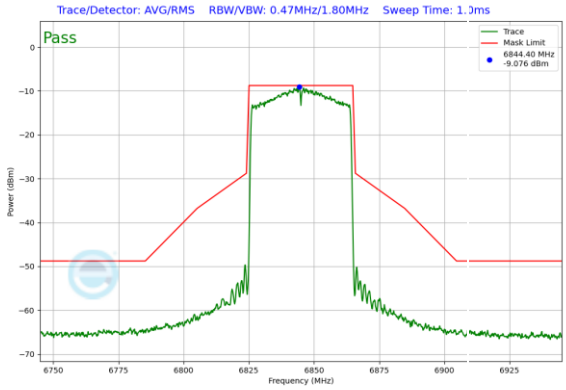
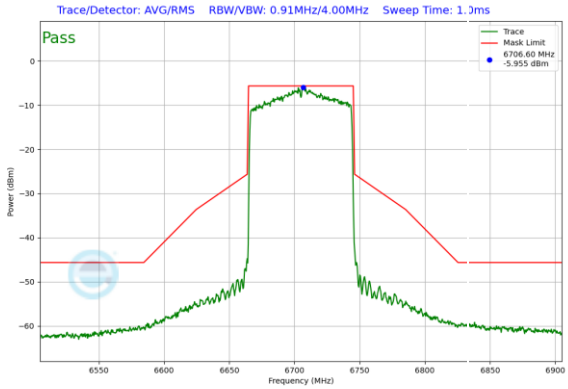
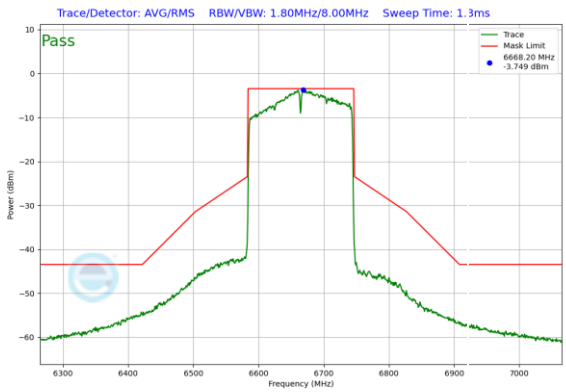


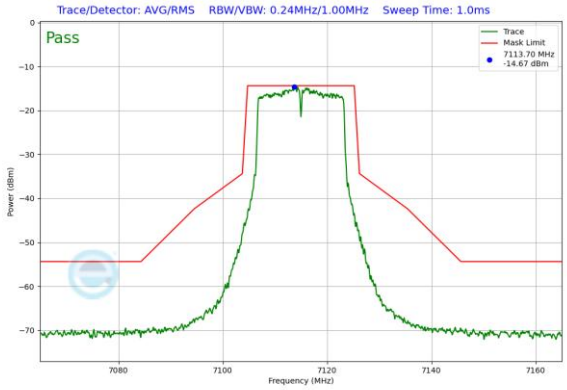
Plot 7-145. VLP In-Band Emission Plot Antenna 1 (40MHz 802.11ax (UNII Band 7) – Ch. 179, MCS2)



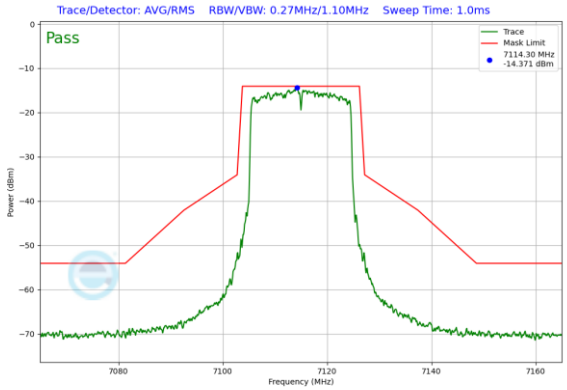
Plot 7-146. VLP In-Band Emission Plot Antenna 1 (80MHz 802.11ax (UNII Band 7) – Ch. 151, MCS4)



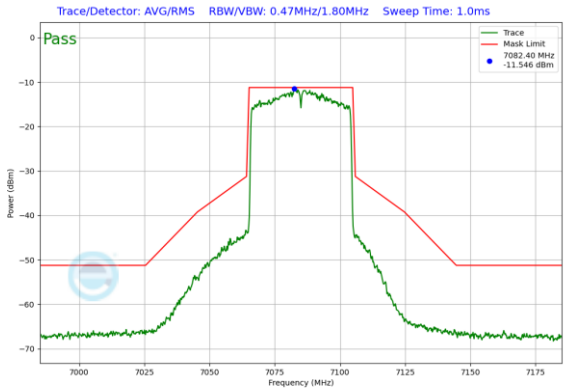
Plot 7-147. VLP In-Band Emission Plot Antenna 1 (160MHz 802.11ax (UNII Band 7) – Ch. 143, MCS4)



Plot 7-148. VLP In-Band Emission Plot Antenna 1 (20MHz 802.11a (UNII Band 8) – Ch. 233, 12Mbps)



Plot 7-149. VLP In-Band Emission Plot Antenna 1 (20MHz 802.11ax (UNII Band 8) – Ch. 233, MCS11)



Plot 7-150. VLP In-Band Emission Plot Antenna 1 (40MHz 802.11ax (UNII Band 8) – Ch. 227, MCS2)

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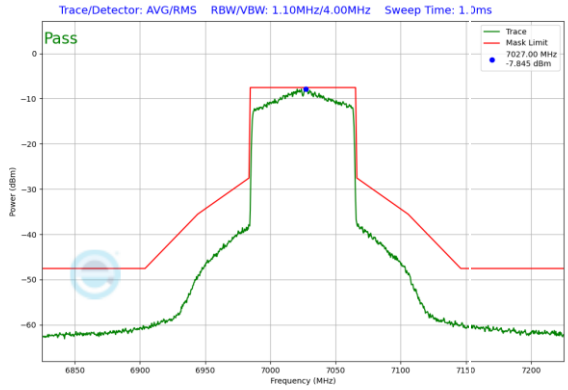
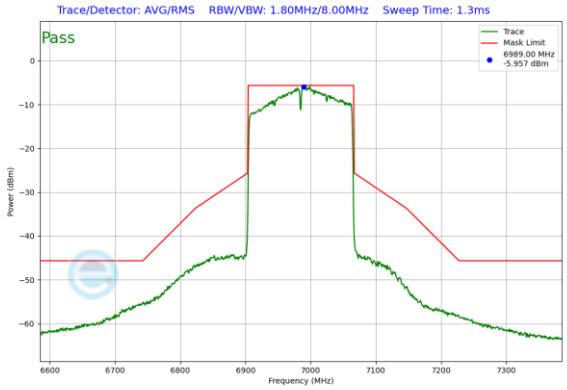


Plot 7-151. VLP In-Band Emission Plot Antenna 1 (80MHz 802.11ax (UNII Band 8) – Ch. 215, MCS4)



Plot 7-152. VLP In-Band Emission Plot Antenna 1 (160MHz 802.11ax (UNII Band 8) – Ch. 207, MCS4)

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7.5.3 SDM In-Band Emission Measurements

	Frequency [MHz]	Channel No.	802.11 Mode	Mode	Data Rate	Antenna 0 In-Band Emission	Antenna 1 In-Band Emission
Band 5	6115	33	ax (20MHz)	SDM	MCS2	Pass	Pass
	6275	65	ax (20MHz)	SDM	MCS4	Pass	Pass
	6415	93	ax (20MHz)	SDM	MCS2	Pass	Pass
	6125	35	ax (40MHz)	SDM	MCS2	Pass	Pass
	6285	67	ax (40MHz)	SDM	MCS2	Pass	Pass
	6405	91	ax (40MHz)	SDM	MCS2	Pass	Pass
	6145	39	ax (80MHz)	SDM	MCS2	Pass	Pass
	6305	71	ax (80MHz)	SDM	MCS2	Pass	Pass
Band 6	6445	99	ax (40MHz)	SDM	MCS2	Pass	Pass
	6485	107	ax (40MHz)	SDM	MCS2	Pass	Pass
	6465	103	ax (80MHz)	SDM	MCS2	Pass	Pass
	6505	111	ax (160MHz)	SDM	MCS4	Pass	Pass
Band 7	6535	117	ax (20MHz)	SDM	MCS4	Pass	Pass
	6695	149	ax (20MHz)	SDM	MCS11	Pass	Pass
	6875	185	ax (20MHz)	SDM	MCS4	Pass	Pass
	6565	123	ax (40MHz)	SDM	MCS4	Pass	Pass
	6725	155	ax (40MHz)	SDM	MCS2	Pass	Pass
	6845	179	ax (40MHz)	SDM	MCS2	Pass	Pass
	6545	119	ax (80MHz)	SDM	MCS2	Pass	Pass
	6705	151	ax (80MHz)	SDM	MCS2	Pass	Pass
	6865	183	ax (80MHz)	SDM	MCS2	Pass	Pass
	6665	143	ax (160MHz)	SDM	MCS4	Pass	Pass
	6825	175	ax (160MHz)	SDM	MCS2	Pass	Pass
Band 8	6895	189	ax (20MHz)	SDM	MCS4	Pass	Pass
	6995	209	ax (20MHz)	SDM	MCS4	Pass	Pass
	7115	233	ax (20MHz)	SDM	MCS4	Pass	Pass
	6885	187	ax (40MHz)	SDM	MCS2	Pass	Pass
	7005	211	ax (40MHz)	SDM	MCS2	Pass	Pass
	7085	227	ax (40MHz)	SDM	MCS2	Pass	Pass
	6945	199	ax (80MHz)	SDM	MCS4	Pass	Pass
	7025	215	ax (80MHz)	SDM	MCS2	Pass	Pass
	6985	207	ax (160MHz)	SDM	MCS2	Pass	Pass

Table 7-23. In-Band Emission Measurements SDM

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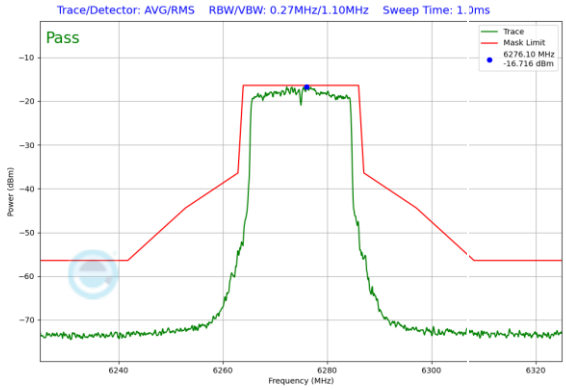
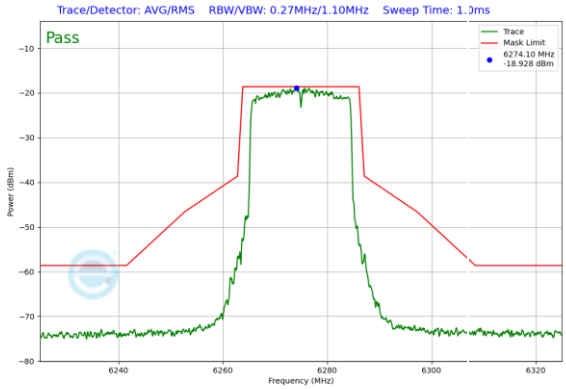
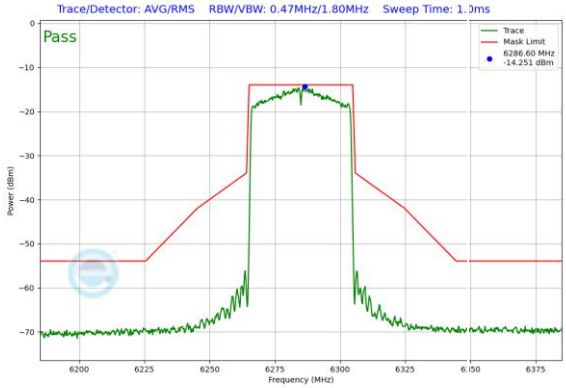


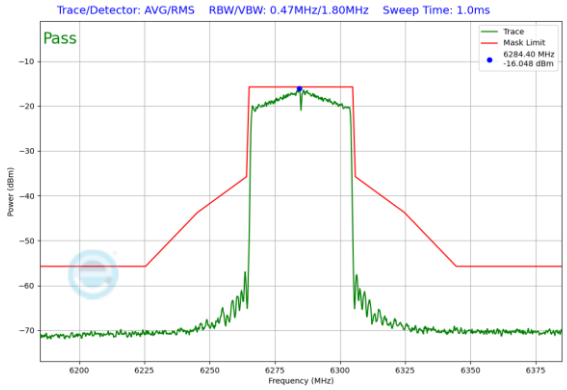
Plot 7-153. VLP In-Band Emission Plot SDM Antenna 0 (20MHz 802.11ax (UNII Band 5) – Ch. 65, MCS4)



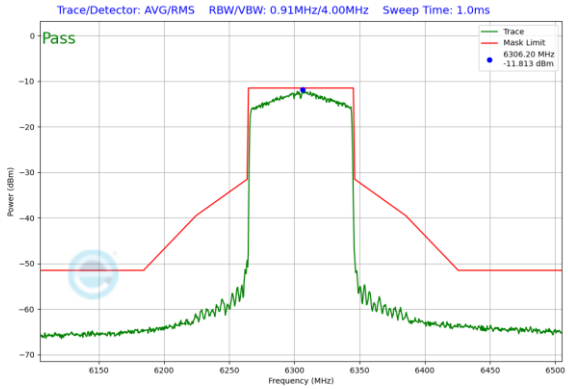
Plot 7-154. VLP In-Band Emission Plot SDM Antenna 1 (20MHz 802.11ax (UNII Band 5) – Ch. 65, MCS4)



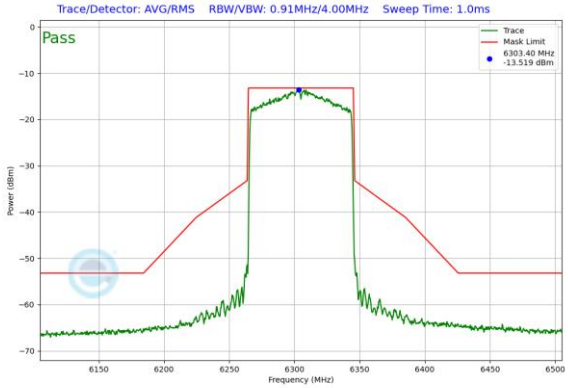
Plot 7-155. VLP In-Band Emission Plot SDM Antenna 0 (40MHz 802.11ax (UNII Band 5) – Ch. 67, MCS4)



Plot 7-156. VLP In-Band Emission Plot SDM Antenna 1 (40MHz 802.11ax (UNII Band 5) – Ch. 67, MCS4)



Plot 7-157. VLP In-Band Emission Plot SDM Antenna 0 (80MHz 802.11ax (UNII Band 5) – Ch. 71, MCS4)



Plot 7-158. VLP In-Band Emission Plot SDM Antenna 1 (80MHz 802.11ax (UNII Band 5) – Ch. 71, MCS4)

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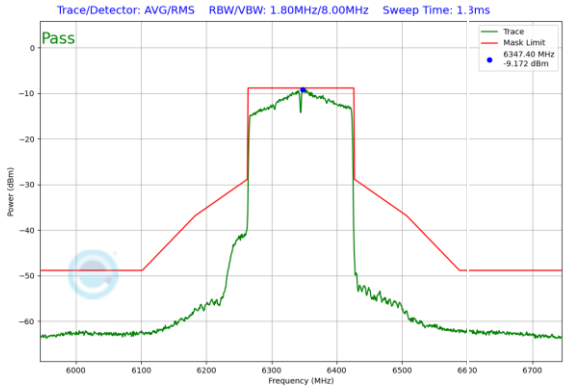
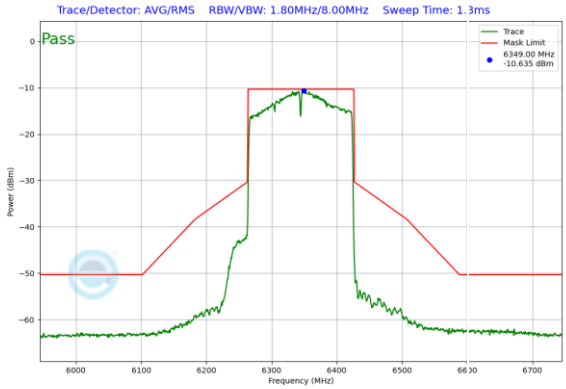
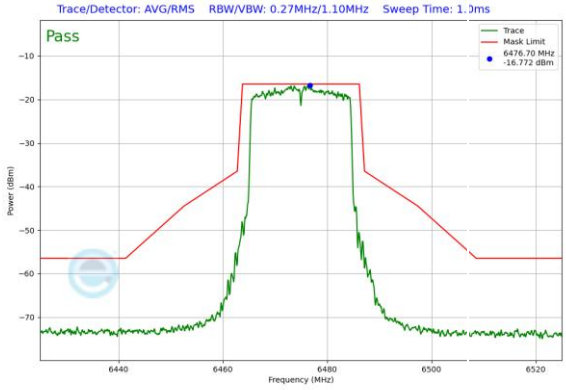


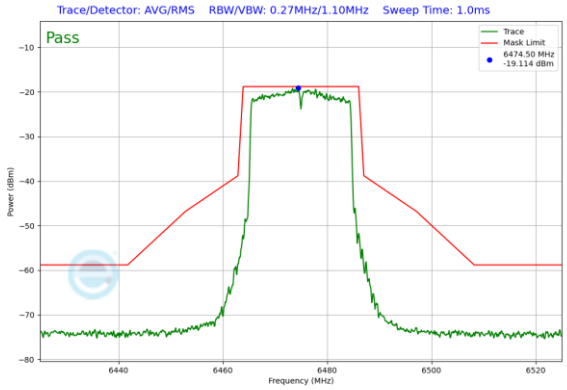
Plot 7-159. VLP In-Band Emission Plot SDM Antenna 0 (160MHz 802.11ax (UNII Band 5) – Ch. 79, MCS4)



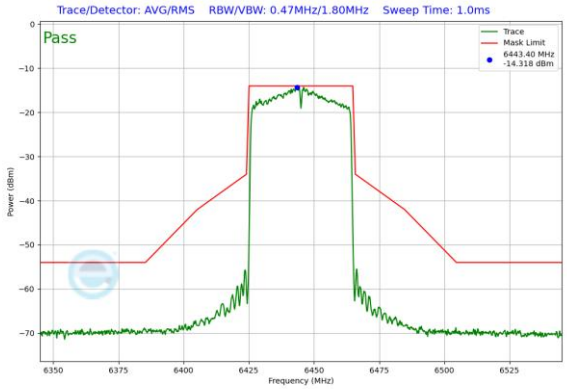
Plot 7-160. VLP In-Band Emission Plot SDM Antenna 1 (160MHz 802.11ax (UNII Band 5) – Ch. 79, MCS2)



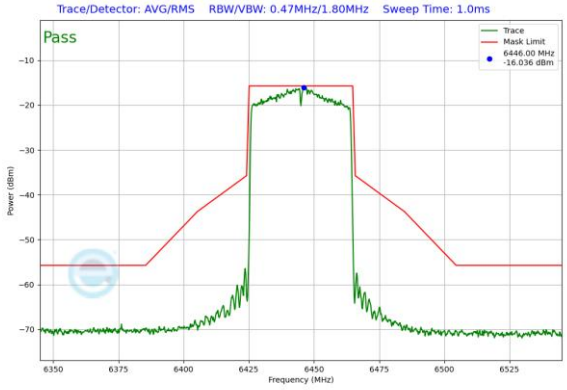
Plot 7-161. VLP In-Band Emission Plot SDM Antenna 0 (20MHz 802.11ax (UNII Band 6) – Ch. 105, MCS2)



Plot 7-162. VLP In-Band Emission Plot SDM Antenna 1 (20MHz 802.11ax (UNII Band 6) – Ch. 105, MCS2)



Plot 7-163. VLP In-Band Emission Plot SDM Antenna 0 (40MHz 802.11ax (UNII Band 6) – Ch. 99, MCS2)



Plot 7-164. VLP In-Band Emission Plot SDM Antenna 1 (40MHz 802.11ax (UNII Band 6) – Ch. 99, MCS2)

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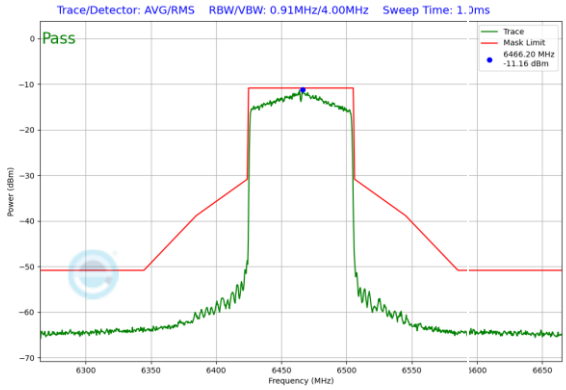
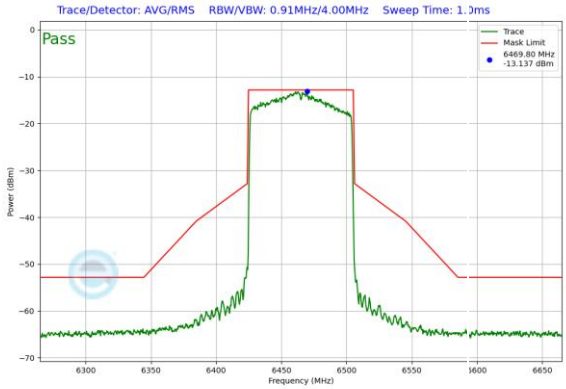
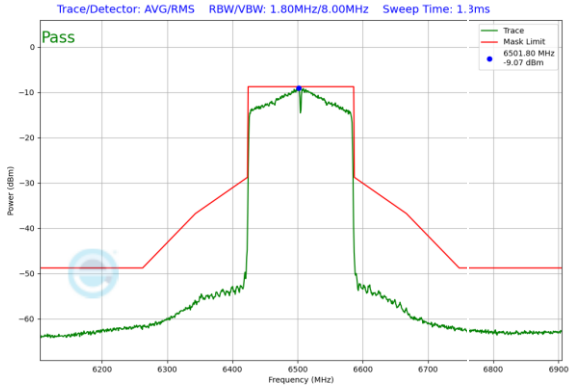


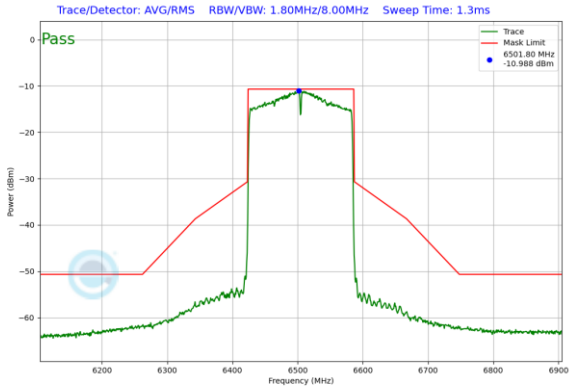
Plot 7-165. VLP In-Band Emission Plot SDM Antenna 0 (80MHz 802.11ax (UNII Band 6) – Ch. 103, MCS2)



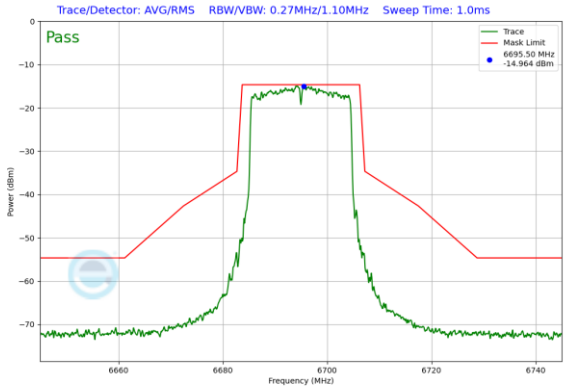
Plot 7-166. VLP In-Band Emission Plot SDM Antenna 1 (80MHz 802.11ax (UNII Band 6) – Ch. 103, MCS2)



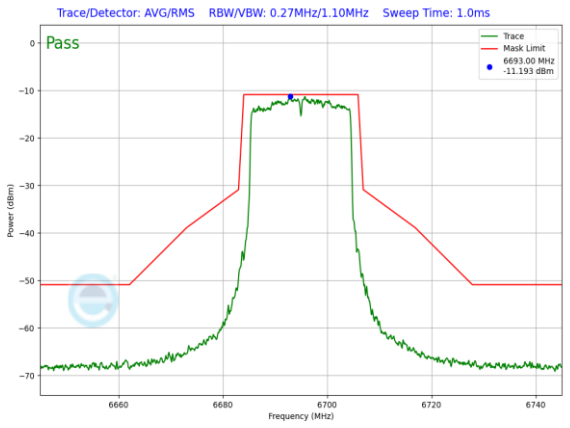
Plot 7-167. VLP In-Band Emission Plot SDM Antenna 0 (160MHz 802.11ax (UNII Band 6) – Ch. 111, MCS2)



Plot 7-168. VLP In-Band Emission Plot SDM Antenna 1 (160MHz 802.11ax (UNII Band 6) – Ch. 111, MCS2)



Plot 7-169. VLP In-Band Emission Plot SDM Antenna 0 (20MHz 802.11ax (UNII Band 7) – Ch. 149, MCS2)



Plot 7-170. VLP In-Band Emission Plot SDM Antenna 1 (20MHz 802.11ax (UNII Band 7) – Ch. 149, MCS2)

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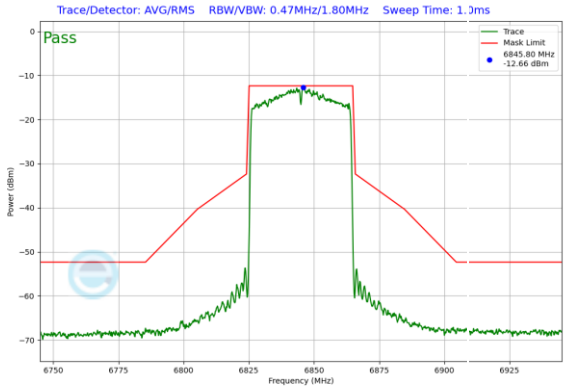
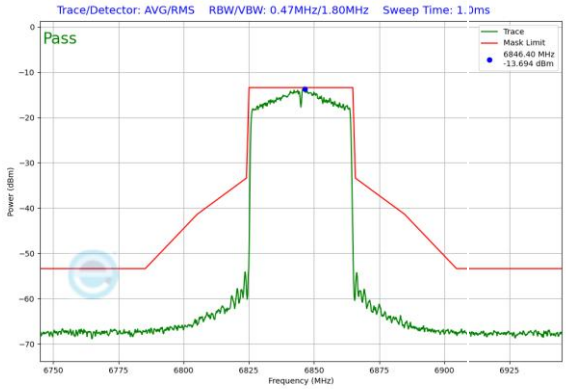
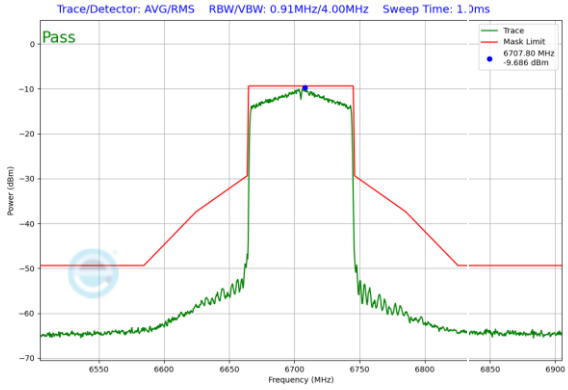


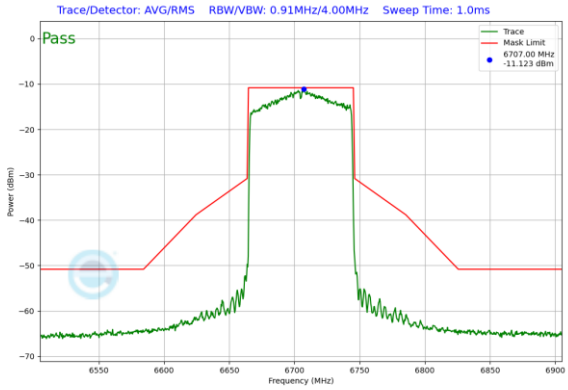
Plot 7-171. VLP In-Band Emission Plot SDM Antenna 0 (40MHz 802.11ax (UNII Band 7) – Ch. 179, MCS2)



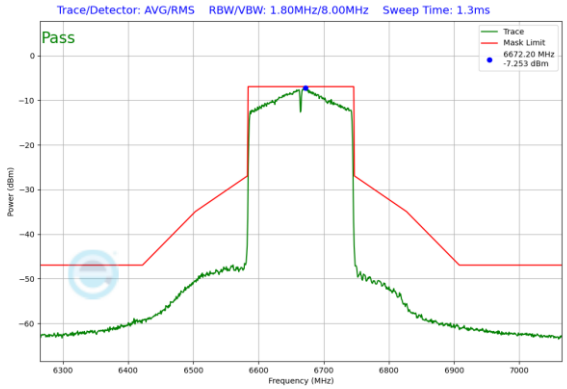
Plot 7-172. VLP In-Band Emission Plot SDM Antenna 1 (40MHz 802.11ax (UNII Band 7) – Ch. 179, MCS2)



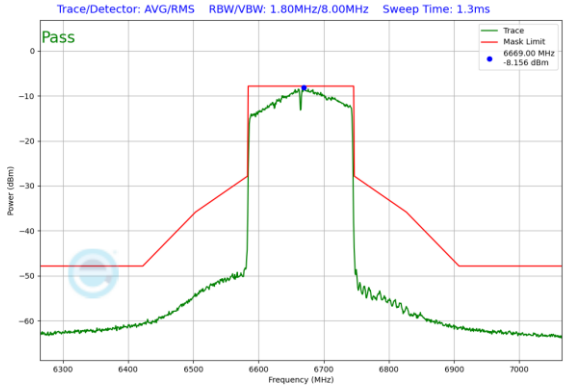
Plot 7-173. VLP In-Band Emission Plot SDM Antenna 0 (80MHz 802.11ax (UNII Band 7) – Ch. 151, MCS2)



Plot 7-174. VLP In-Band Emission Plot SDM Antenna 1 (80MHz 802.11ax (UNII Band 7) – Ch. 151, MCS2)



Plot 7-175. VLP In-Band Emission Plot SDM Antenna 0 (160MHz 802.11ax (UNII Band 7) – Ch. 143, MCS2)



Plot 7-176. VLP In-Band Emission Plot SDM Antenna 1 (160MHz 802.11ax (UNII Band 7) – Ch. 143, MCS2)

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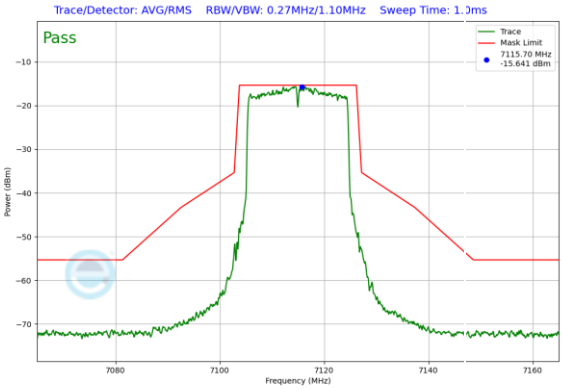
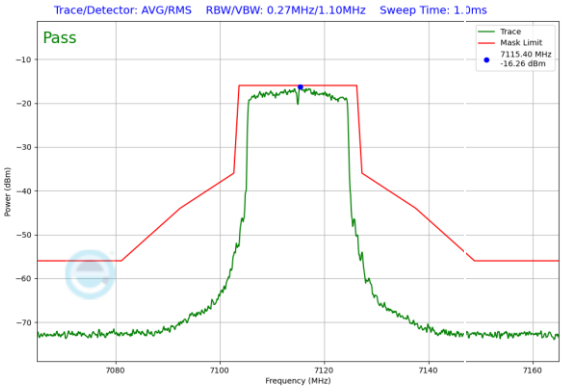
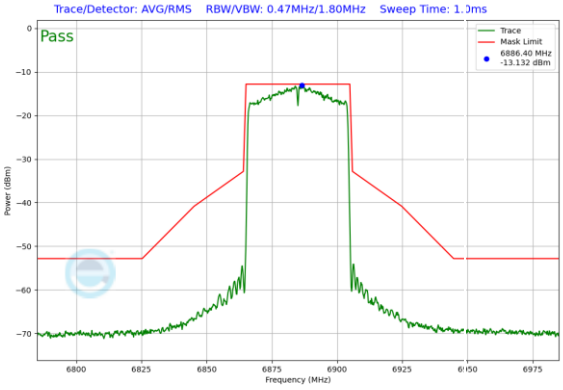


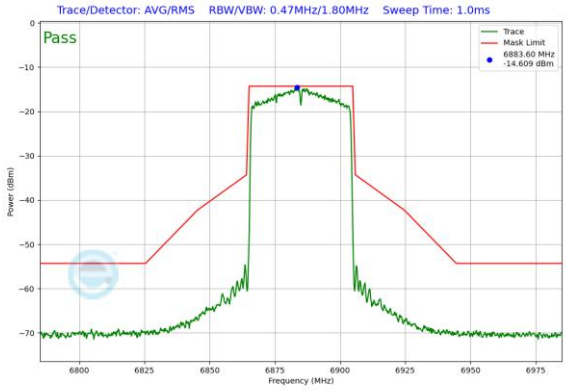
Plot 7-177. VLP In-Band Emission Plot SDM Antenna 0 (20MHz 802.11ax (UNII Band 8) – Ch. 233, MCS2)



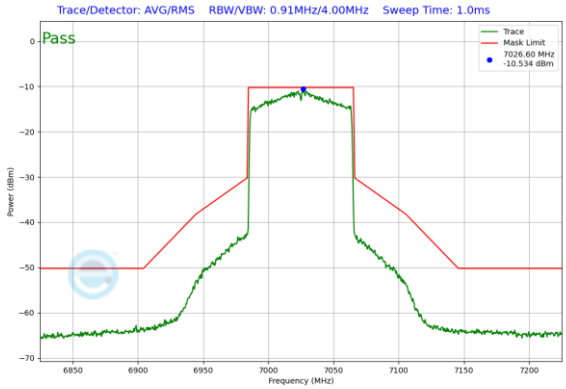
Plot 7-178. VLP In-Band Emission Plot SDM Antenna 1 (20MHz 802.11ax (UNII Band 8) – Ch. 233, MCS2)



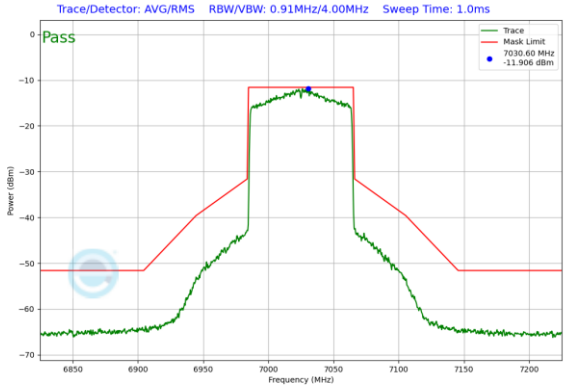
Plot 7-179. VLP In-Band Emission Plot SDM Antenna 0 (40MHz 802.11ax (UNII Band 8) – Ch. 187, MCS2)



Plot 7-180. VLP In-Band Emission Plot SDM Antenna 1 (40MHz 802.11ax (UNII Band 8) – Ch. 187, MCS2)



Plot 7-181. VLP In-Band Emission Plot SDM Antenna 0 (80MHz 802.11ax (UNII Band 8) – Ch. 215, MCS2)



Plot 7-182. VLP In-Band Emission Plot SDM Antenna 1 (80MHz 802.11ax (UNII Band 8) – Ch. 215, MCS2)

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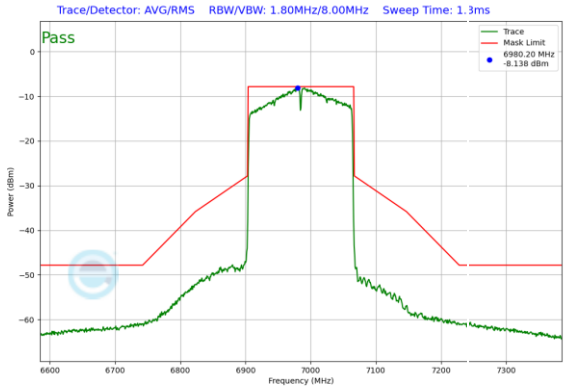
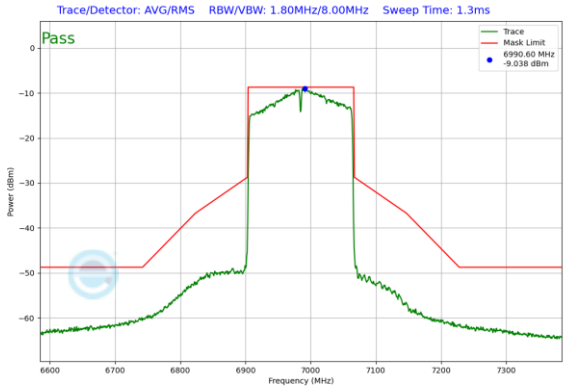


Plot 7-183. VLP In-Band Emission Plot SDM Antenna 0 (160MHz 802.11ax (UNII Band 8) – Ch. 207, MCS2)



Plot 7-184. VLP In-Band Emission Plot SDM Antenna 1 (160MHz 802.11ax (UNII Band 8) – Ch. 207, MCS2)

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7.6 Contention Based Protocol

Test Overview and Limit

Indoor access points, subordinate devices and all client devices (except for Fixed clients), and VLP devices operating in the 5.925-7.125 GHz band (herein referred to as unlicensed devices) must use 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, unlicensed devices must detect RF energy throughout their intended operating channel.

Test Procedure Used

KDB 987594 D02 v02r01 – 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.

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Test Setup

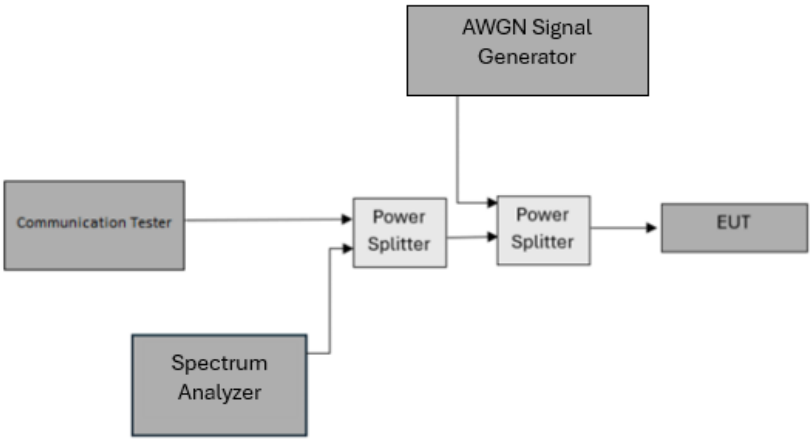

Figure 7-5. Contention-based protocol test setup, conducted method

Test Notes

1. 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.
2. Per KDB 987594 D02 v03, contention-based protocol was tested with receiver with the lowest antenna gain.
3. 15 trials were ran in order to assure that at least 90% of certainty was met.
4. The EUT does not support Channel Puncturing, but it does support Bandwidth Reduction.
5. The Channel Power (AWGN) plots do not account for the cable loss at the antenna connector. This loss is added separately in the Incumbent Detection Results table. Across UNII-5 to UNII-8, the antenna connectors loss ranges from 1.1 dB to 1.3 dB.

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

Equation 7-1. Incumbent Detection Level Calculation

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Band	Channel	Channel Frequency [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	-66.29	-2.77	-63.52	-62.0	-1.52
	47	6185	160	6112	-66.31	-2.77	-63.54	-62.0	-1.54
				6185	-66.12	-2.77	-63.35	-62.0	-1.35
				6258	-66.11	-2.77	-63.34	-62.0	-1.34
UNII Band 6	101	6455	20	6455	-66.04	-2.77	-63.27	-62.0	-1.27
	111	6505	160	6432	-65.93	-2.77	-63.16	-62.0	-1.16
				6505	-66.21	-2.77	-63.44	-62.0	-1.44
				6578	-66.29	-2.77	-63.52	-62.0	-1.52
UNII Band 7	149	6695	20	6695	-66.53	-2.77	-63.76	-62.0	-1.76
	143	6665	160	6592	-66.19	-2.77	-63.42	-62.0	-1.42
				6665	-66.43	-2.77	-63.66	-62.0	-1.66
				6738	-66.25	-2.77	-63.48	-62.0	-1.48
UNII Band 8	197	6935	20	6935	-66.07	-2.77	-63.30	-62.0	-1.30
	207	6985	160	6912	-66.20	-2.77	-63.43	-62.0	-1.43
				6985	-66.63	-2.77	-63.86	-62.0	-1.86
				7058	-66.29	-2.77	-63.52	-62.0	-1.52

Table 7-24. Contention Based Protocol – Incumbent Detection Results

Band	Channel	Channel Frequency [MHz]	Channel BW [MHz]	Incumbent Frequency [MHz]	EUT Transmission Status Adjusted AWGN Power (dBm)		
					Normal	Minimal	Ceased
UNII Band 5	53	6215	20	6215	-74.70	-64.77	-63.52
	47	6185	160	6112	-74.72	-64.79	-63.54
				6185	-74.53	-64.60	-63.35
				6258	-74.52	-64.59	-63.34
UNII Band 6	101	6455	20	6455	-74.45	-64.52	-63.27
	111	6505	160	6432	-74.34	-64.41	-63.16
				6505	-74.62	-64.69	-63.44
				6578	-74.70	-64.77	-63.52
UNII Band 7	149	6695	20	6695	-74.74	-64.98	-63.76
	143	6665	160	6592	-74.40	-64.64	-63.42
				6665	-74.64	-64.88	-63.66
				6738	-74.46	-64.70	-63.48
UNII Band 8	197	6935	20	6935	-74.28	-64.52	-63.30
	207	6985	160	6912	-74.41	-64.65	-63.43
				6985	-74.84	-65.08	-63.86
				7058	-74.50	-64.74	-63.52

Table 7-25. Contention Based Protocol – Detection Results – All Tx Cases

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CBP Detection (1 = Detection, Blank = No Detection)																					
	Channel	Channel Frequency [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 6	101	6455	20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100.0	90	Pass
	111	6505	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
	143	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
UNII Band 8	197	6935	20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	100.0	90	Pass
	207	6985	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 7-26. Contention Based Protocol – Incumbent Detection Trial Results

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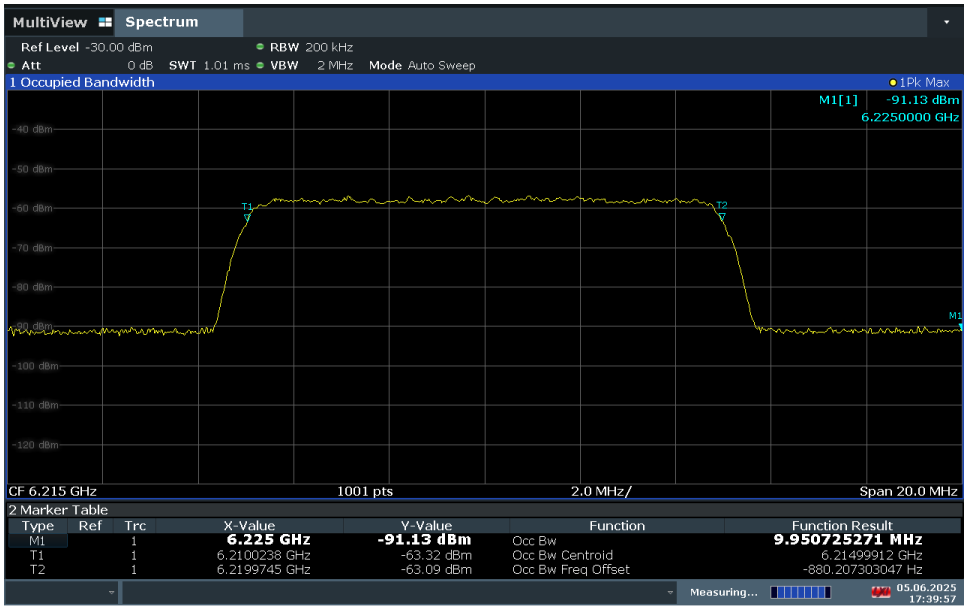
AWGN Plot



17:39:58 05.06.2025

Plot 7-185. AWGN Signal – UNII 5 – 20MHz

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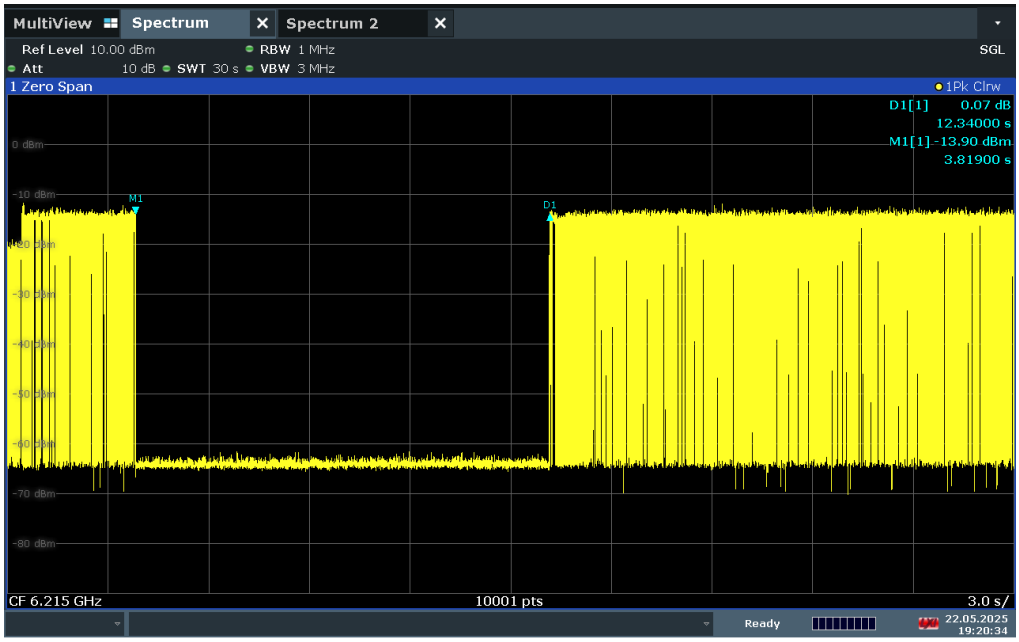
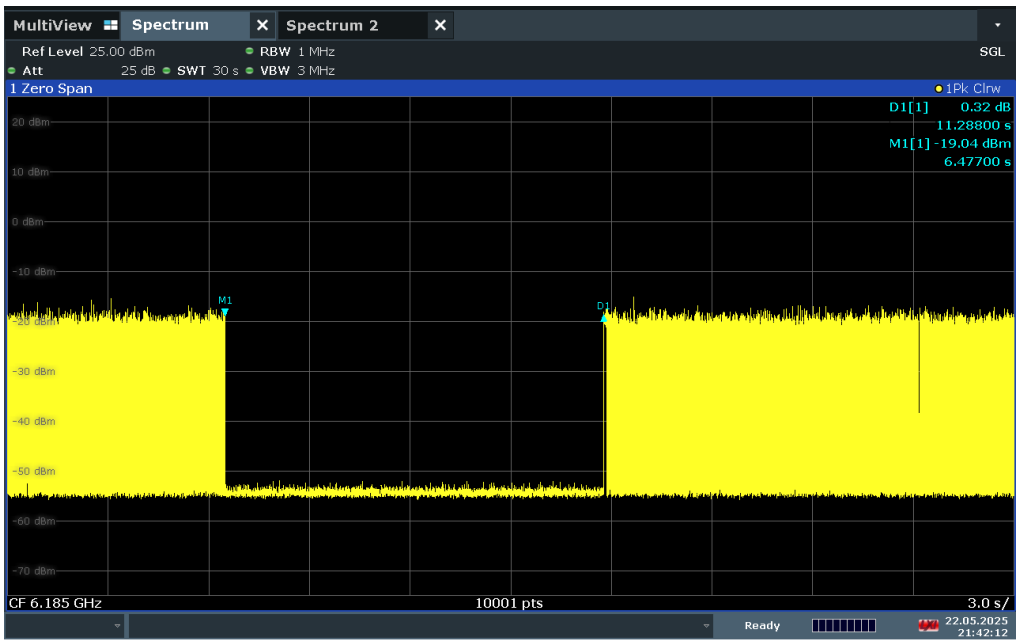
Contention-Based Protocol Timing Plots



19:20:34 22.05.2025

Plot 7-186. Contention Based Protocol Timing Plot – UNII 5 – 20MHz Channel 53



21:42:13 22.05.2025

Plot 7-187. Contention Based Protocol Timing Plot – UNII 5 – 160MHz Channel 47 – Low

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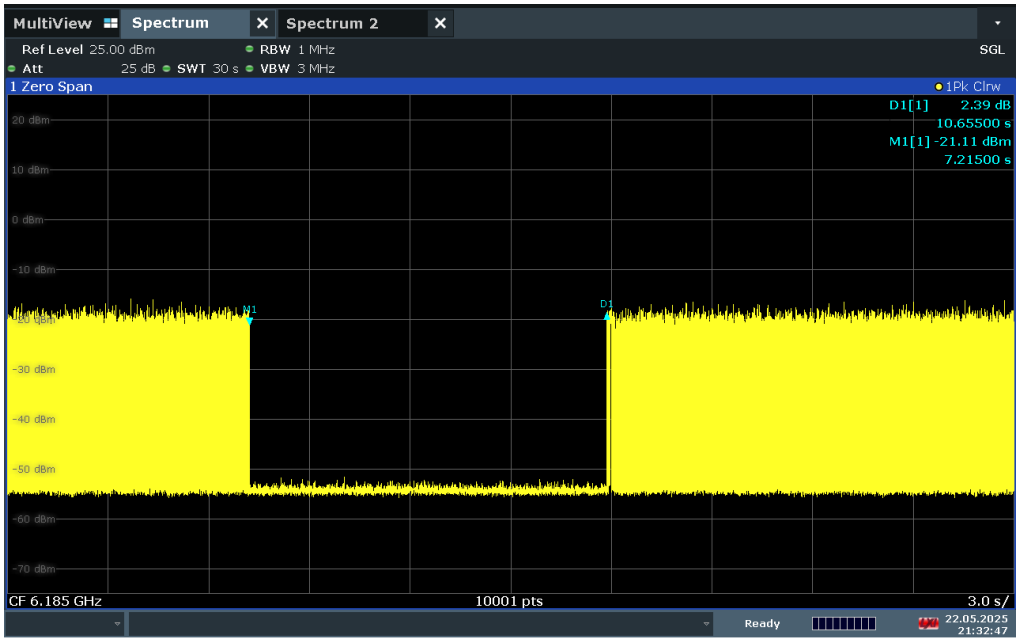
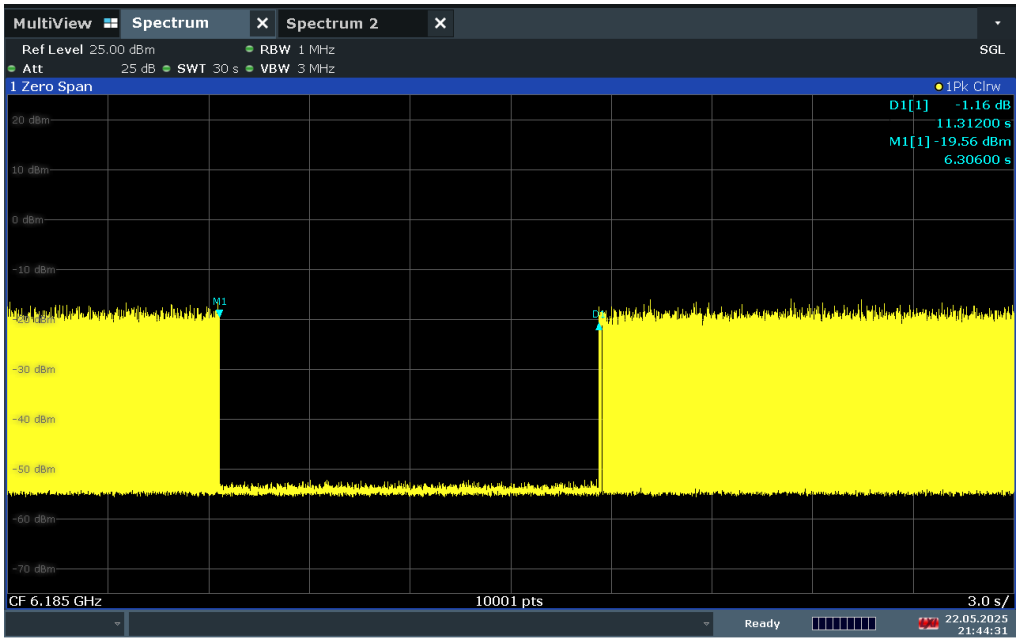


21:32:47 22.05.2025

Plot 7-188. Contention Based Protocol Timing Plot – UNII 5 – 160MHz Channel 47 – Mid



21:44:32 22.05.2025

Plot 7-189. Contention Based Protocol Timing Plot – UNII 5 – 160MHz Channel 47 – High

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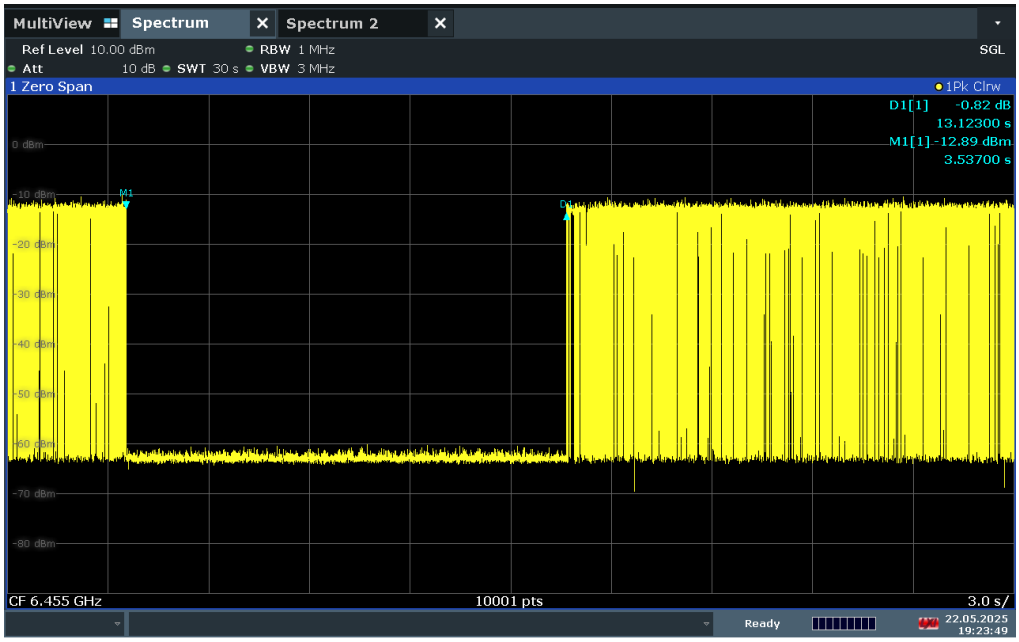
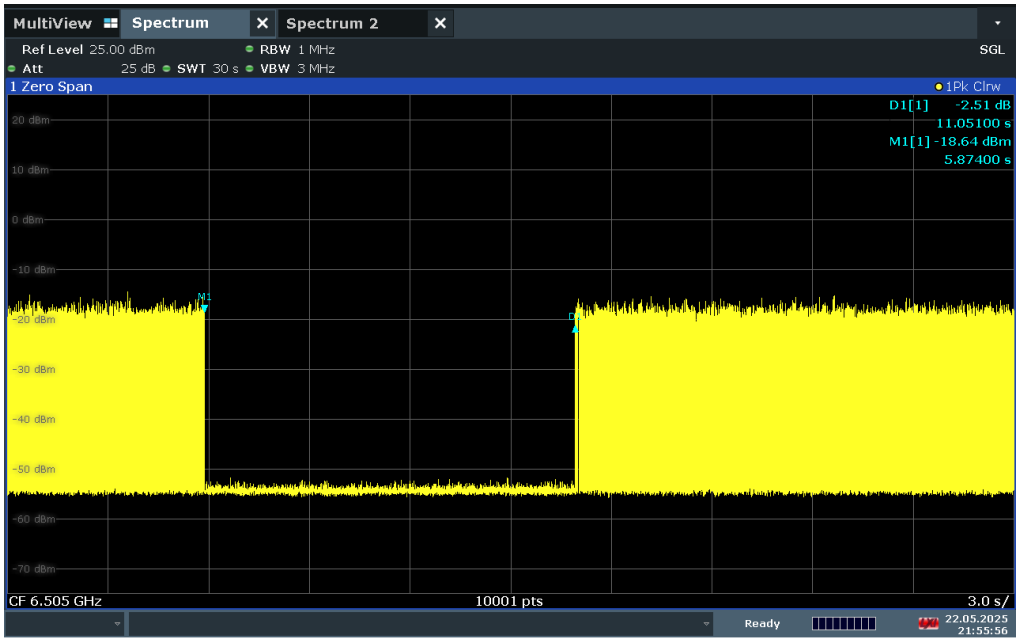


19:23:50 22.05.2025

Plot 7-190. Contention Based Protocol Timing Plot – UNII 6 – 20MHz Channel 101



21:55:56 22.05.2025

Plot 7-191. Contention Based Protocol Timing Plot – UNII 6 – 160MHz Channel 111 – Low

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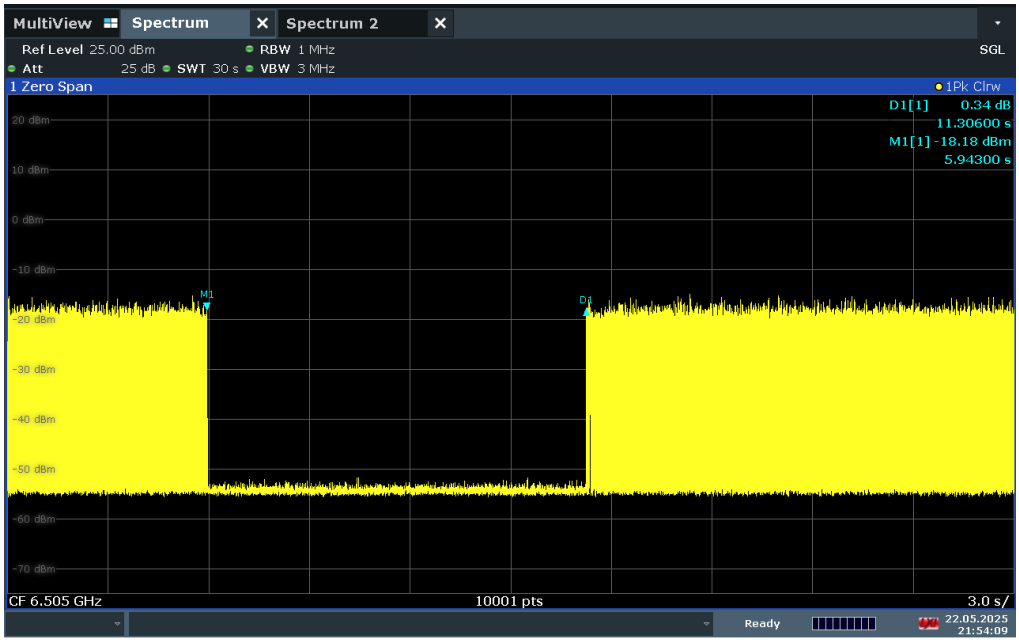
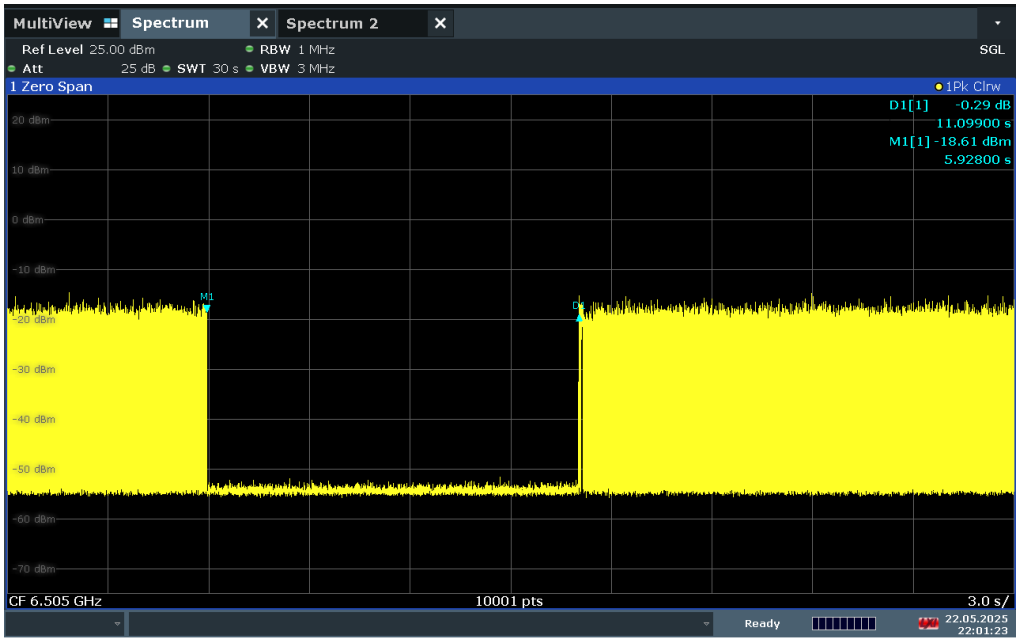


21:54:10 22.05.2025

Plot 7-192. Contention Based Protocol Timing Plot – UNII 6 – 160MHz Channel 111 – Mid



22:01:24 22.05.2025

Plot 7-193. Contention Based Protocol Timing Plot – UNII 6 – 160MHz Channel 111 – High

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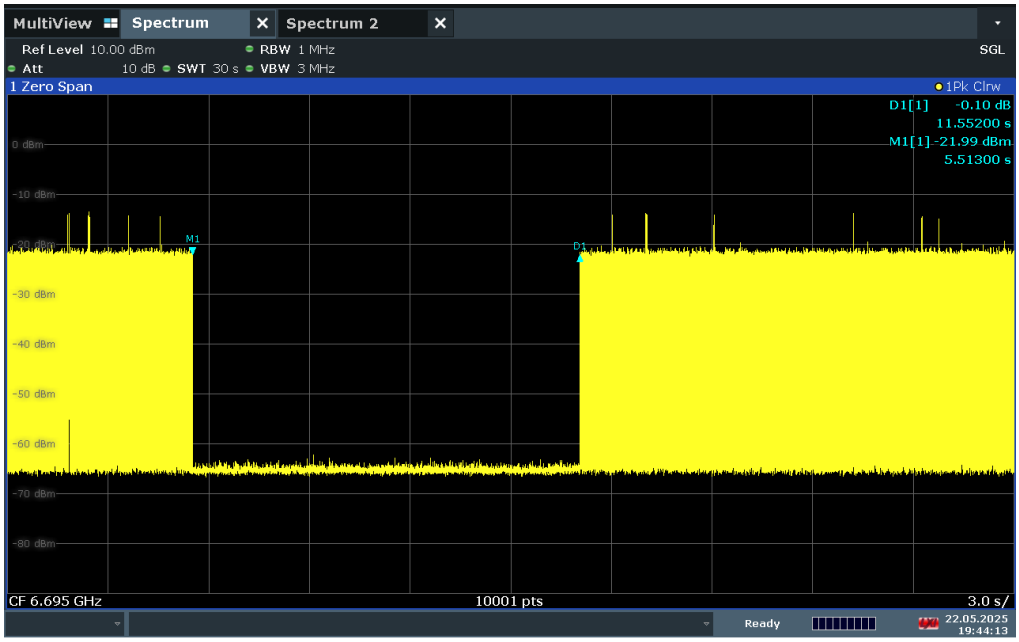
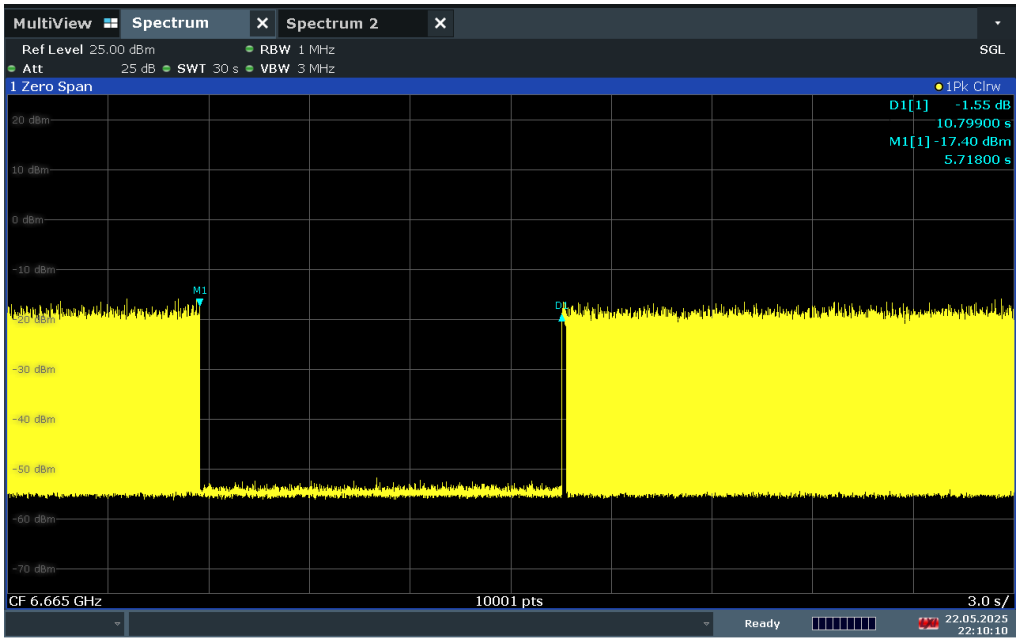


19:44:13 22.05.2025

Plot 7-194. Contention Based Protocol Timing Plot – UNII 7 – 20MHz Channel 149



22:10:10 22.05.2025

Plot 7-195. Contention Based Protocol Timing Plot – UNII 7 – 160MHz Channel 143 – Low

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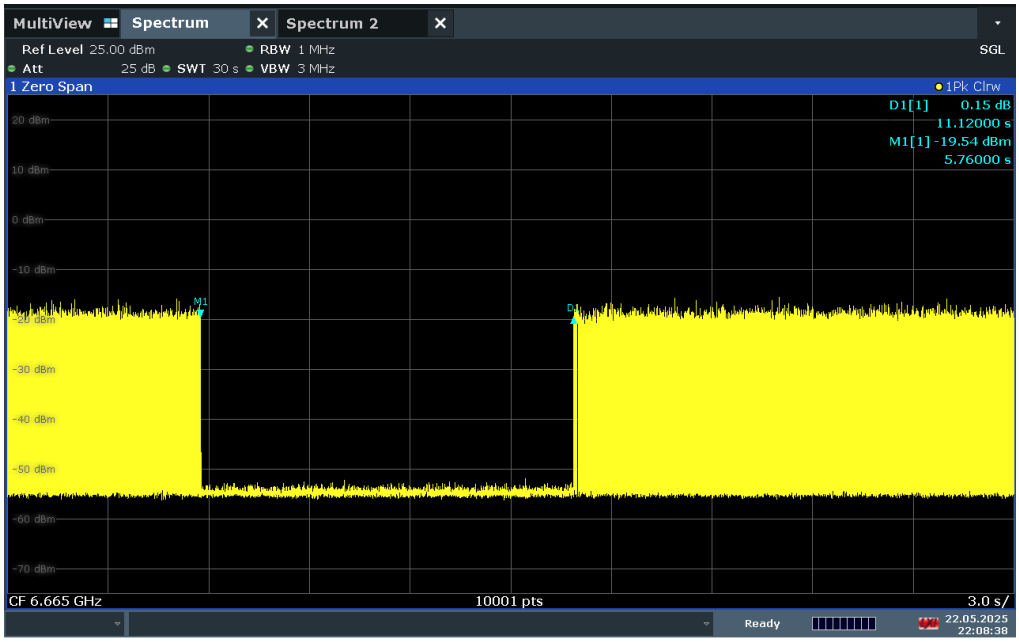
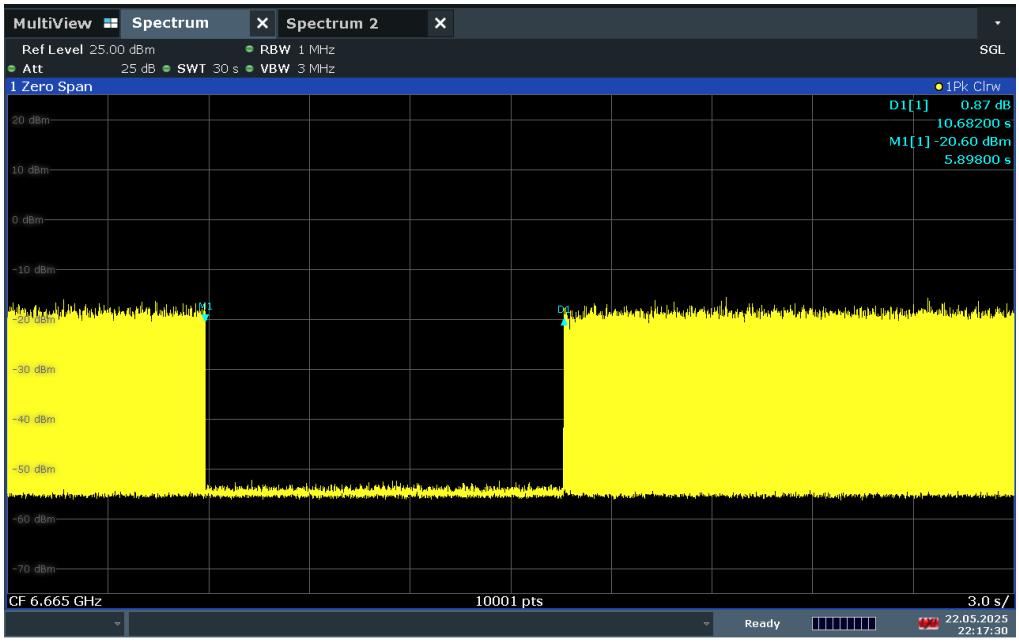


22:08:39 22.05.2025

Plot 7-196. Contention Based Protocol Timing Plot – UNII 7 – 160MHz Channel 143 – Mid



22:17:31 22.05.2025

Plot 7-197. Contention Based Protocol Timing Plot – UNII 7 – 160MHz Channel 143 – High

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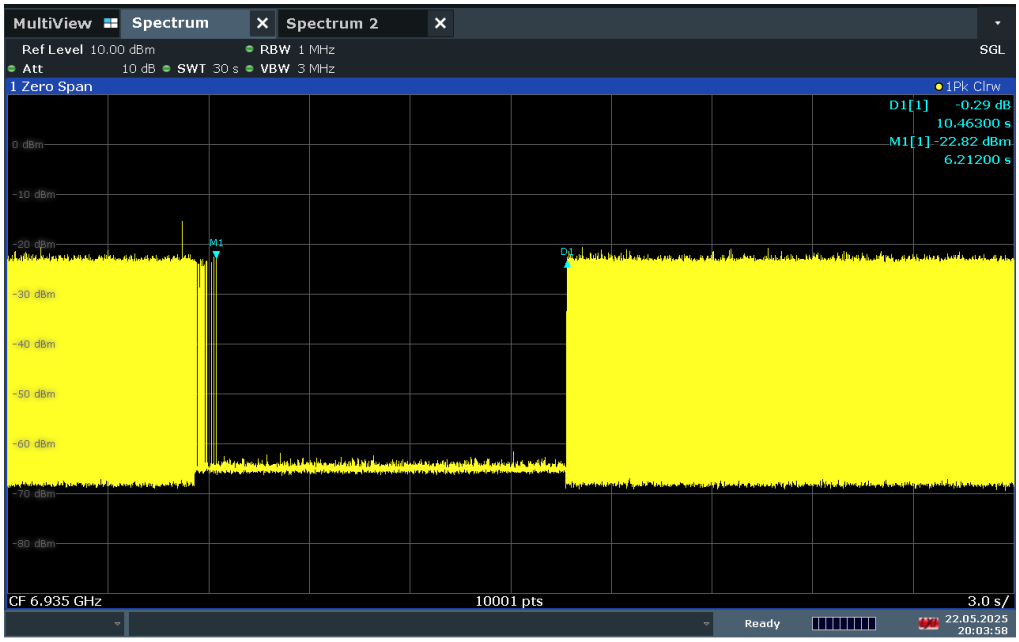
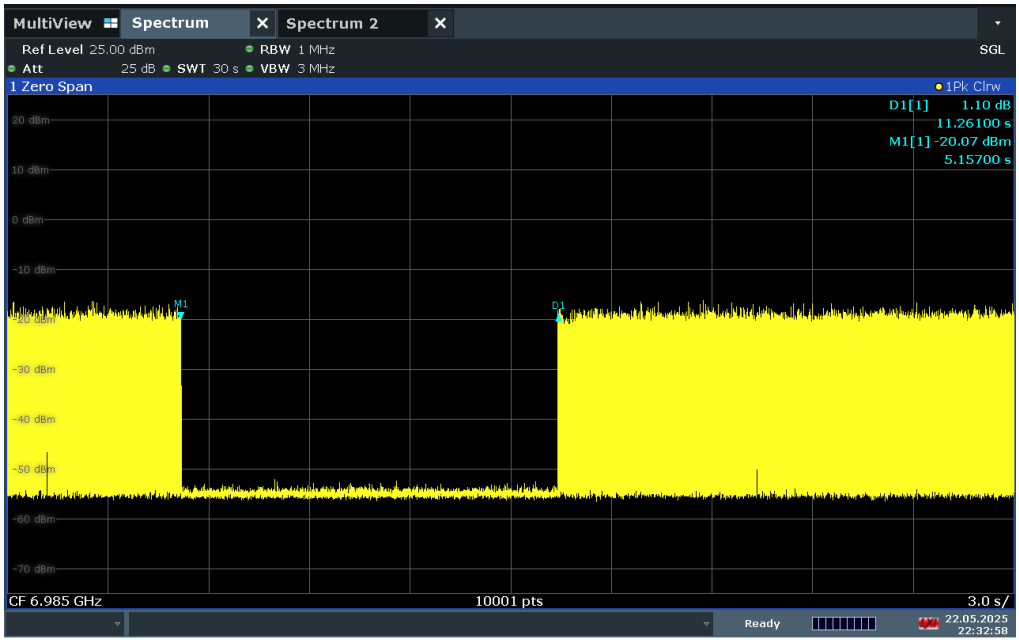


20:03:59 22.05.2025

Plot 7-198. Contention Based Protocol Timing Plot – UNII 8 – 20MHz Channel 197



22:32:59 22.05.2025

Plot 7-199. Contention Based Protocol Timing Plot – UNII 8 – 160MHz Channel 207 – Low

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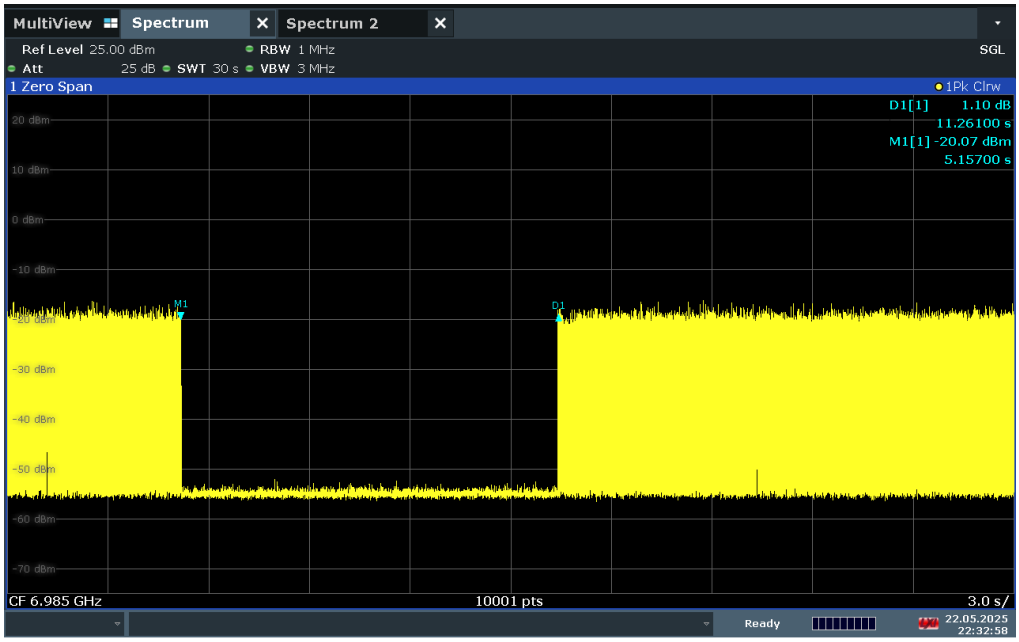
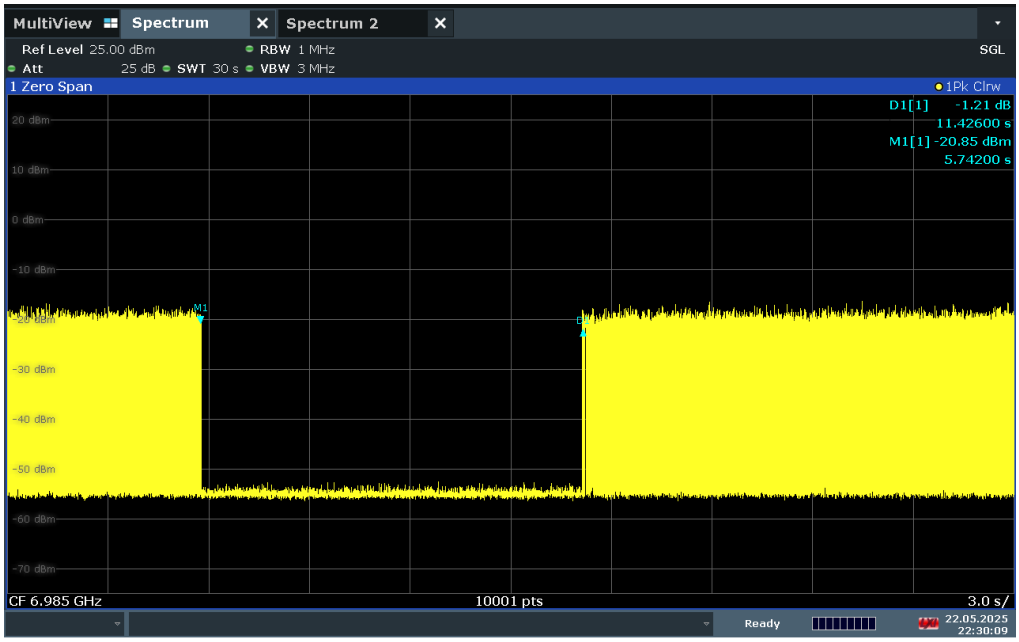


22:32:59 22.05.2025

Plot 7-200. Contention Based Protocol Timing Plot – UNII 8 – 160MHz Channel 207 – Mid



22:30:10 22.05.2025

Plot 7-201. Contention Based Protocol Timing Plot – UNII 8 – 160MHz Channel 207 – High

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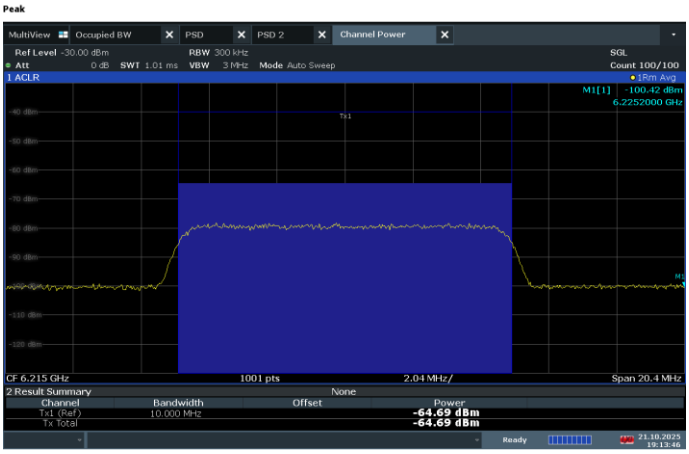
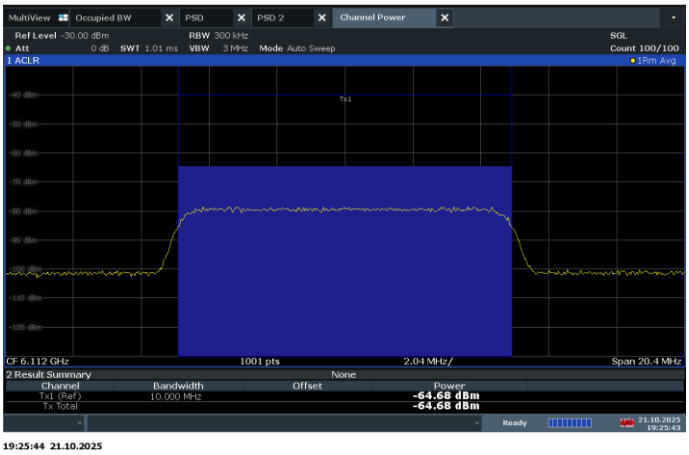
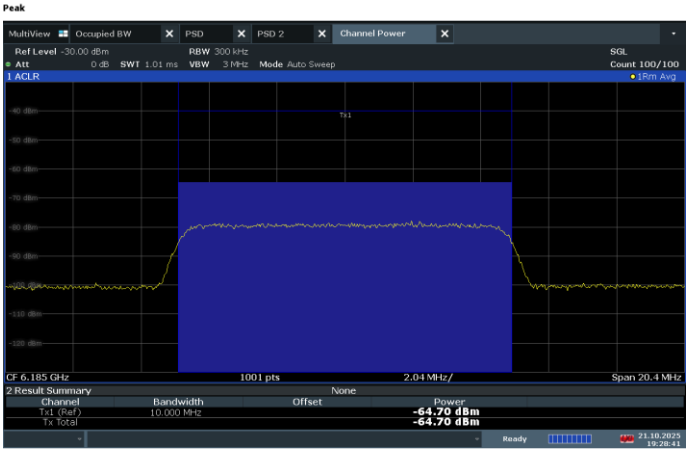


Plot 7-202. Channel Power – UNII 5 – 20MHz



Plot 7-203. Channel Power – UNII 5 – 160MHz – Low



Plot 7-204. Channel Power – UNII 5 – 160MHz – Mid

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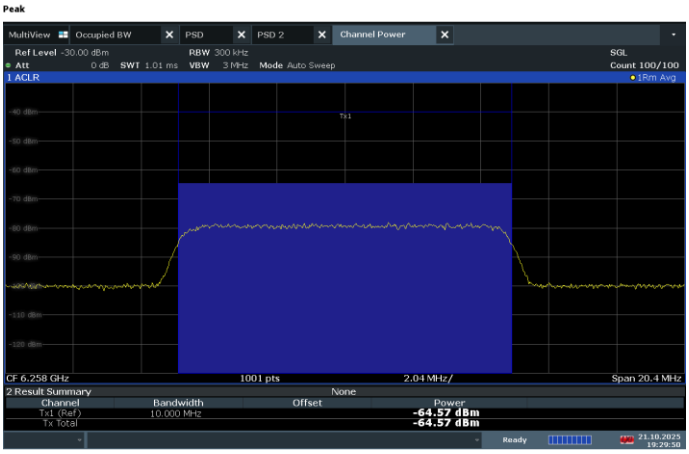
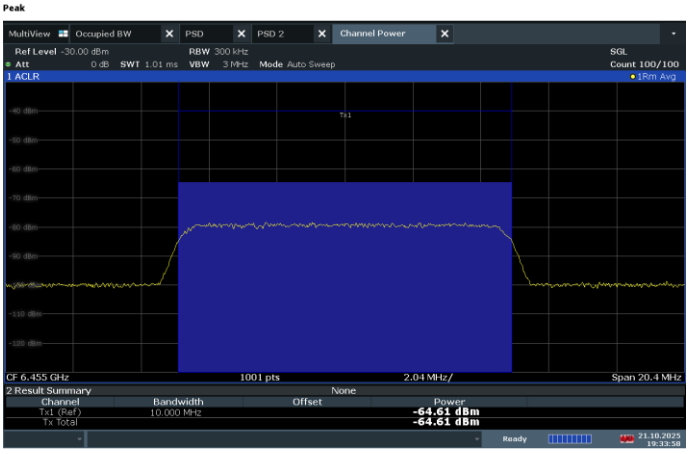
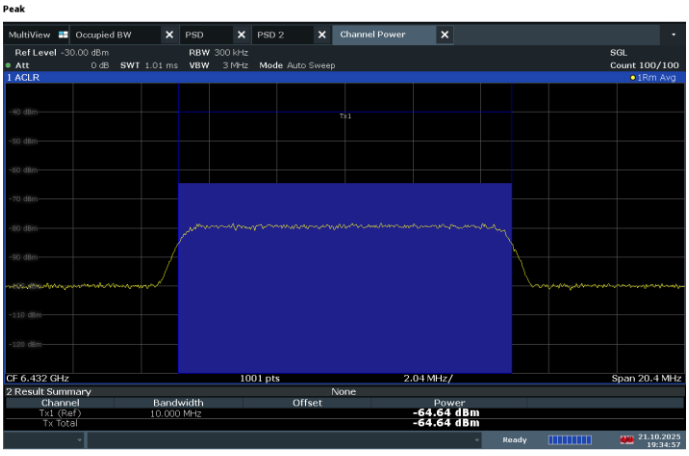


Plot 7-205. Channel Power – UNII 5 – 160MHz – High



Plot 7-206. Channel Power – UNII 6 – 20MHz



Plot 7-207. Channel Power – UNII 6 – 160MHz – Low

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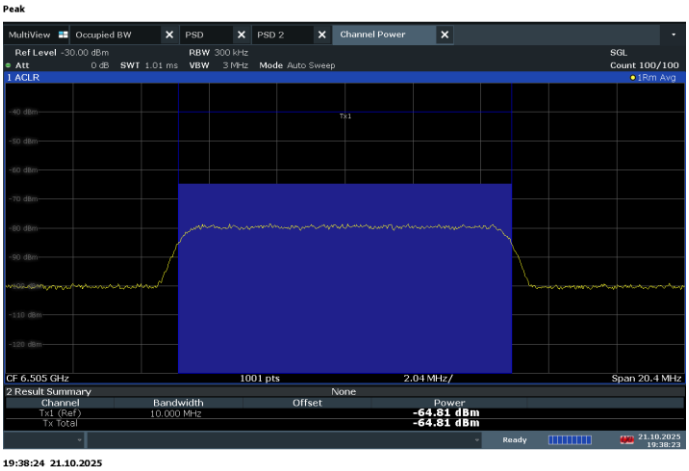
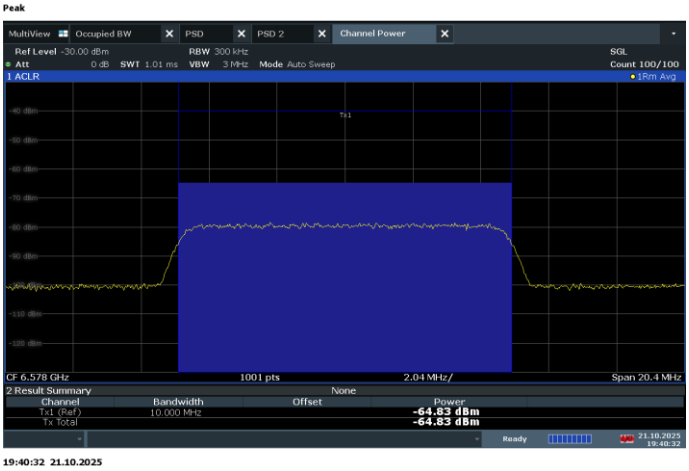
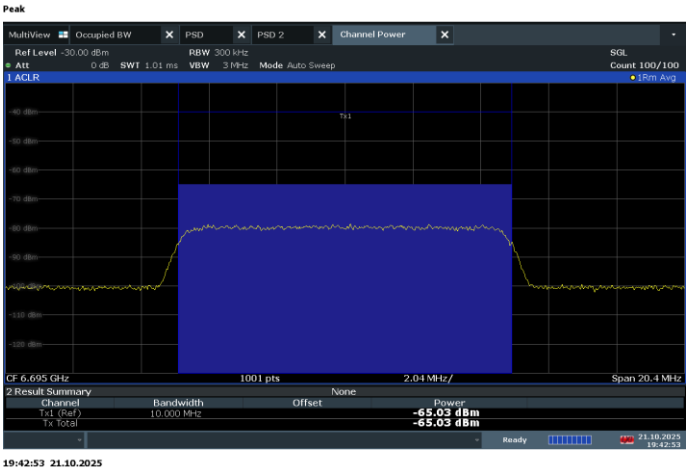


Plot 7-208. Channel Power – UNII 6 – 160MHz - Mid



Plot 7-209. Channel Power – UNII 6 – 160MHz – High



Plot 7-210. Channel Power – UNII 7 – 20MHz

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