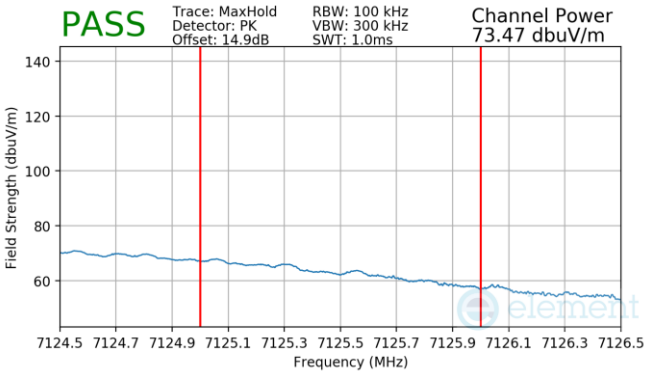
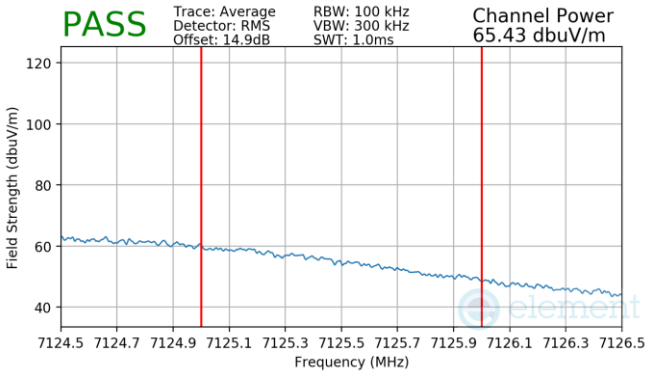
Worst Case Mode:	802.11a
Worst Case Transfer Rate:	54Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	7115MHz
Channel:	233

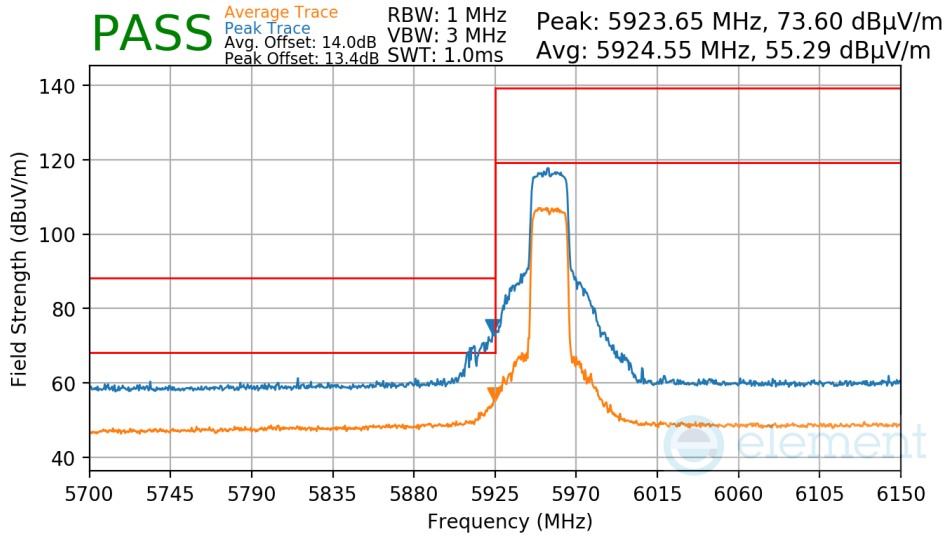


Plot 7-457. Antenna WF5T Radiated Upper Band Edge (Peak – UNII Band 8)



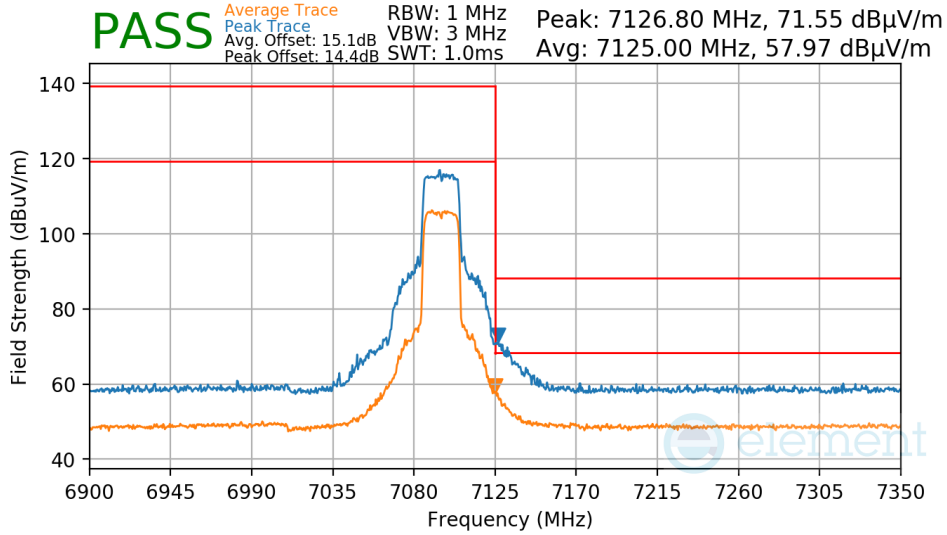
Plot 7-458. Antenna WF5T Radiated Upper Band Edge (Average – UNII Band 8)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	5955MHz
Channel:	1



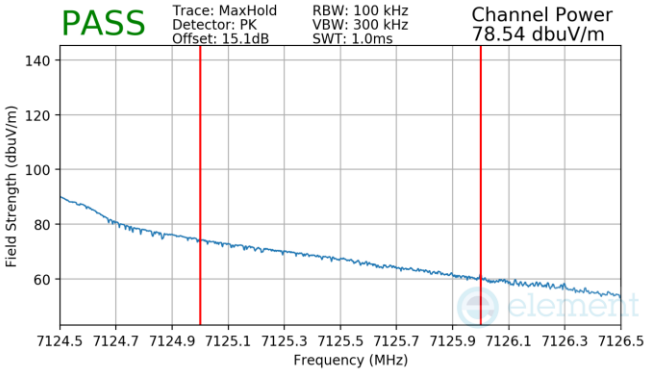
Plot 7-459. Antenna WF5T Radiated Lower Band Edge (Peak/Average – UNII Band 5)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	7095MHz
Channel:	229

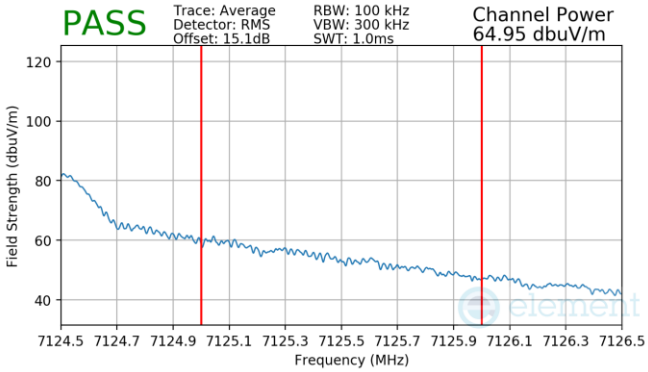


Plot 7-460. Antenna WF5T Radiated Upper Band Edge (Peak/Average – UNII Band 8)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	7115MHz
Channel:	233



Plot 7-461. Antenna WF5T Radiated Upper Band Edge (Peak – UNII Band 8)

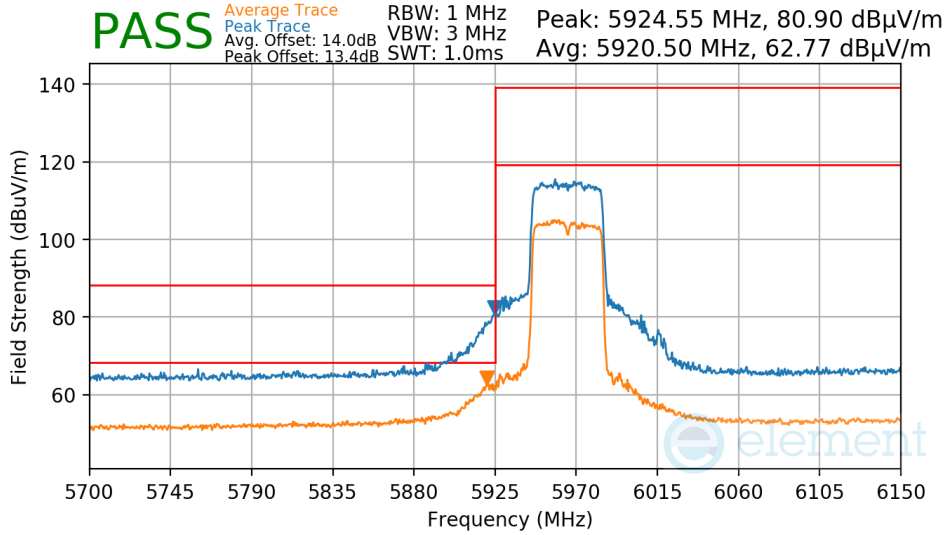


Plot 7-462. Antenna WF5T Radiated Upper Band Edge (Average – UNII Band 8)

7.8.5 Antenna WF5T Radiated Band Edge Measurements (40MHz BW)

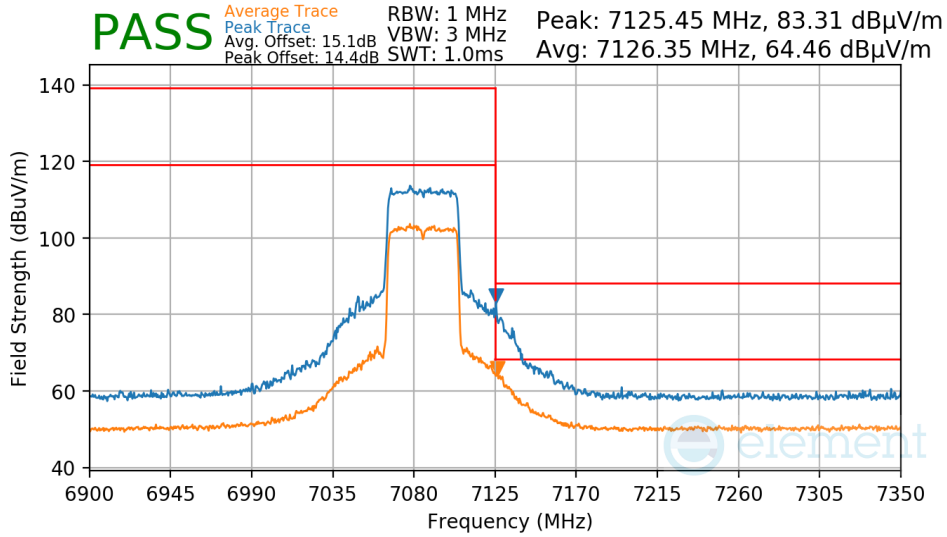
§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	5965MHz
Channel:	3



Plot 7-463. Antenna WF5T Radiated Lower Band Edge (Peak & Average – UNII Band 5)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	7085MHz
Channel:	227

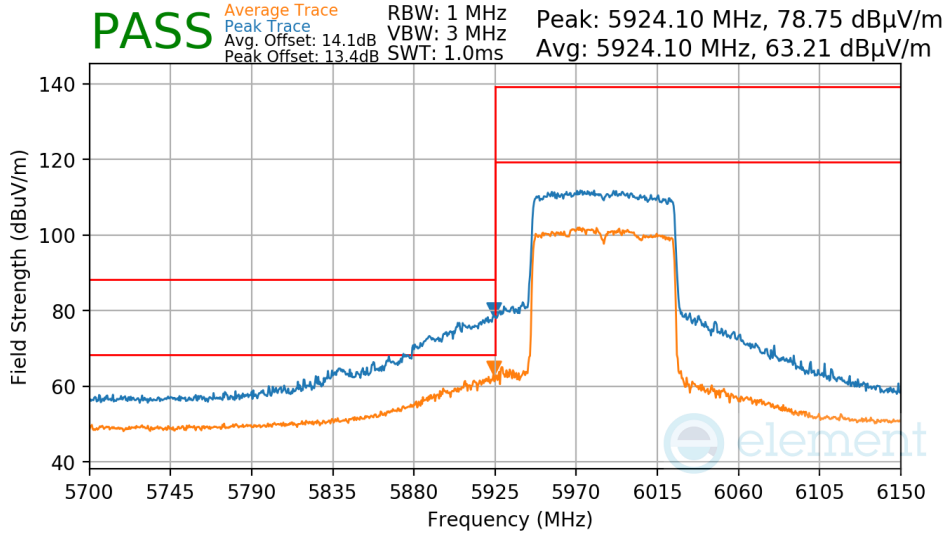


Plot 7-464. Antenna WF5T Radiated Upper Band Edge (Peak & Average – UNII Band 8)

7.8.6 Antenna WF5T Radiated Band Edge Measurements (80MHz BW)

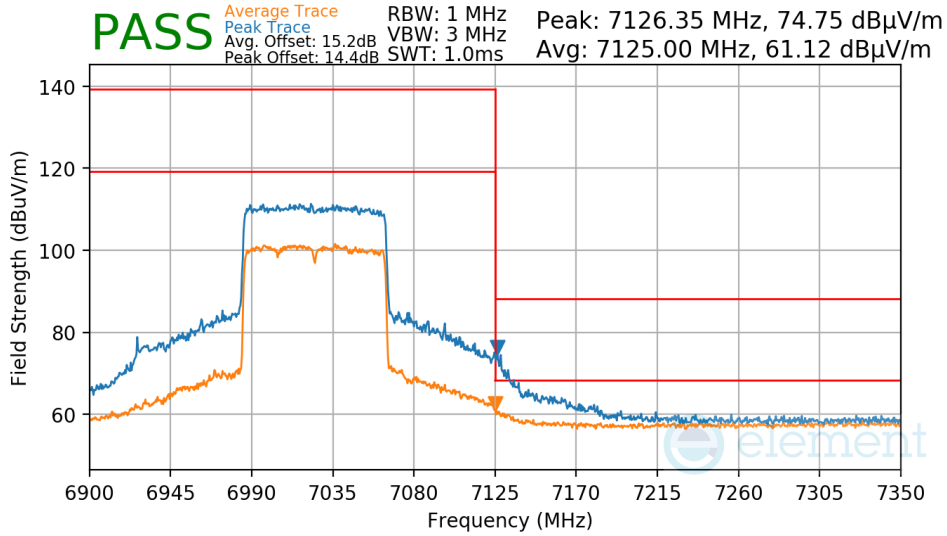
§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	5985MHz
Channel:	7



Plot 7-465. Antenna WF5T Radiated Lower Band Edge (Peak & Average – UNII Band 5)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	7025MHz
Channel:	215

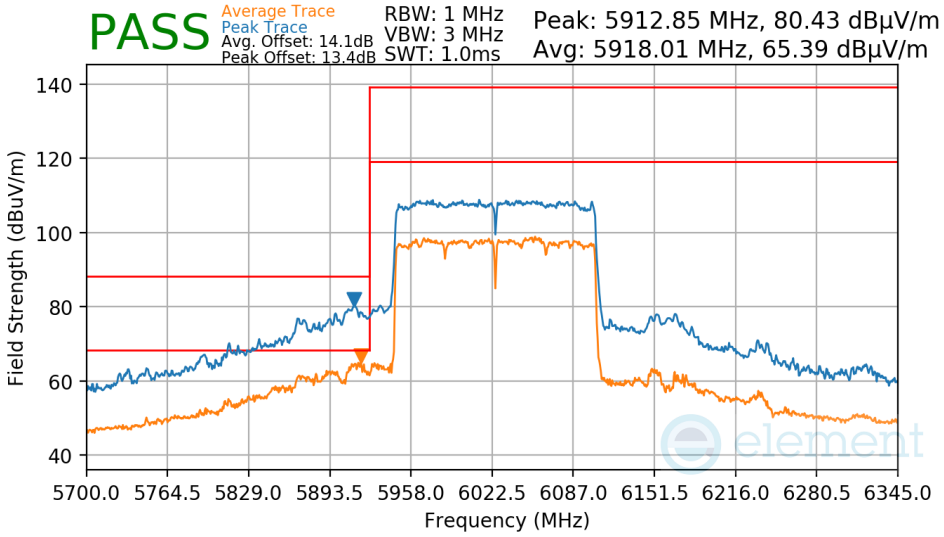


Plot 7-466. Antenna WF5T Radiated Upper Band Edge (Peak & Average – UNII Band 8)

7.8.7 Antenna WF5T Radiated Band Edge Measurements (160MHz BW)

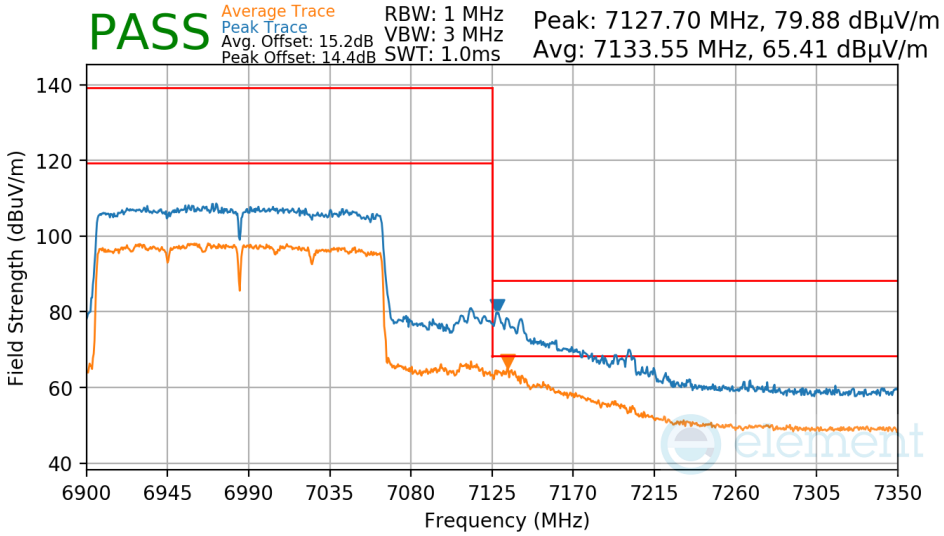
§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	6025MHz
Channel:	15



Plot 7-467. Antenna WF5T Radiated Lower Band Edge (Peak & Average – UNII Band 5)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	6985MHz
Channel:	207

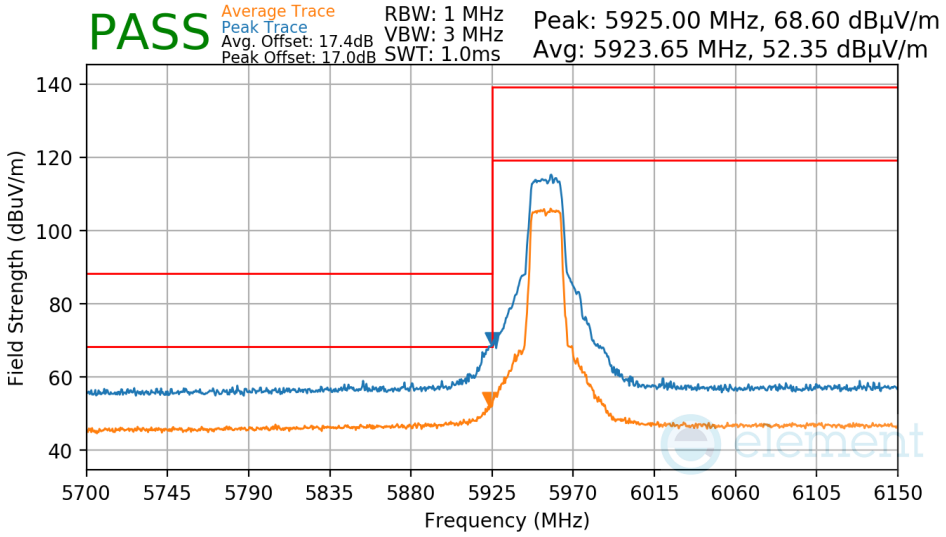


Plot 7-468. Antenna WF5T Radiated Upper Band Edge (Peak & Average – UNII Band 8)

7.8.8 Antenna WF2 Radiated Band Edge Measurements (20MHz BW)

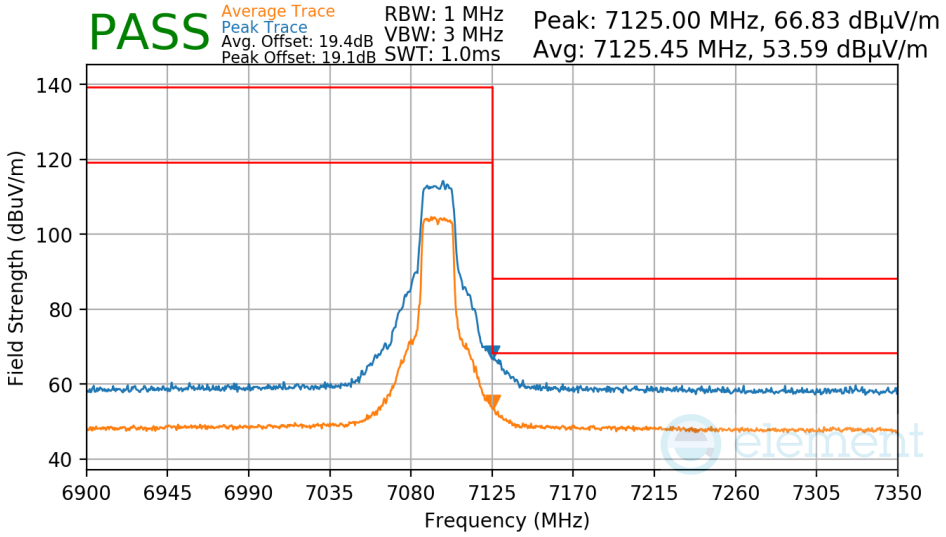
§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	54Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	5955MHz
Channel:	1



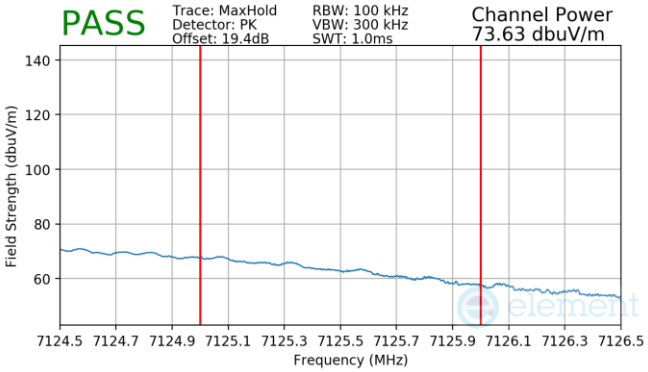
Plot 7-469. Antenna WF2 Radiated Lower Band Edge (Peak/Average – UNII Band 5)

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	54Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	7095MHz
Channel:	229

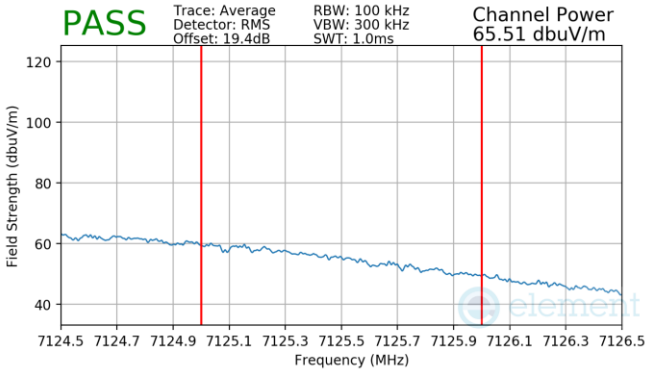


Plot 7-470. Antenna WF2 Radiated Upper Band Edge (Peak/Average – UNII Band 8)

Worst Case Mode:	802.11a
Worst Case Transfer Rate:	54Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	7115MHz
Channel:	233

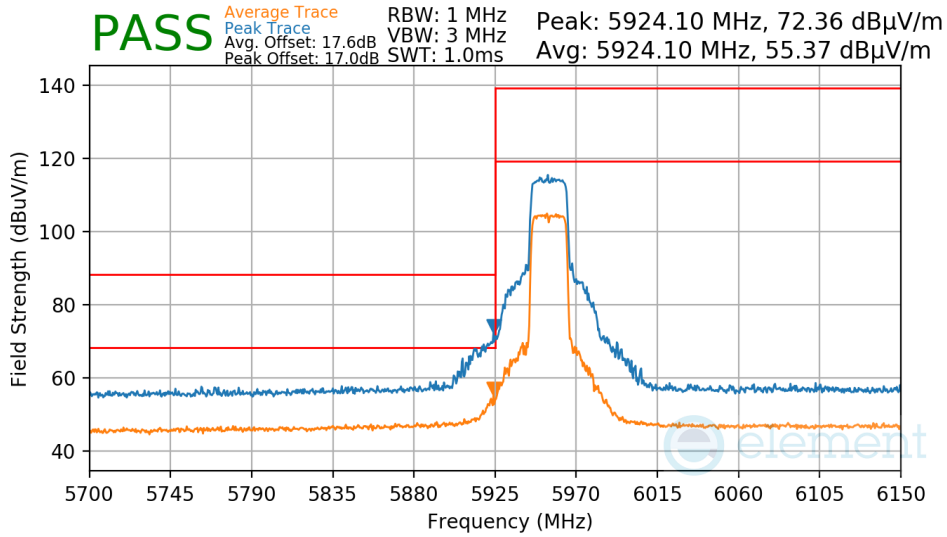


Plot 7-471. Antenna WF2 Radiated Upper Band Edge (Peak – UNII Band 8)



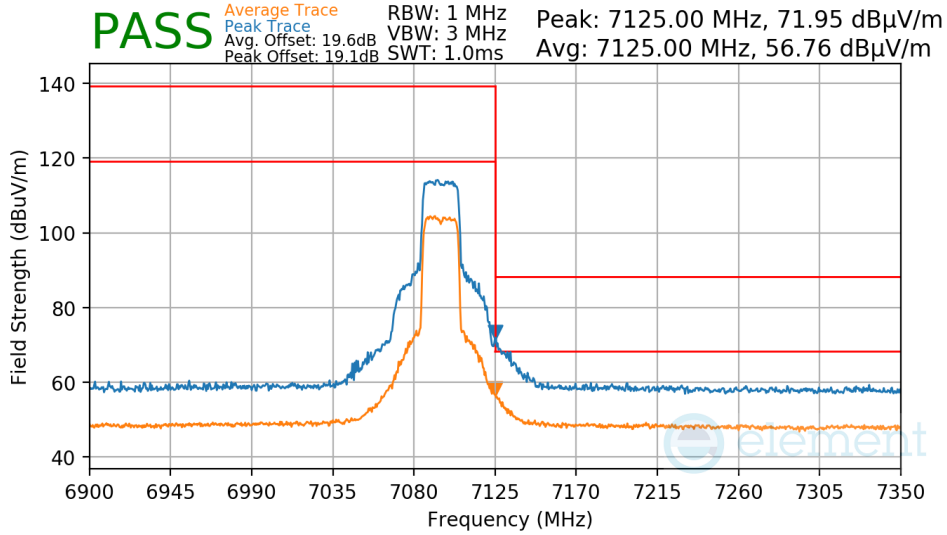
Plot 7-472. Antenna WF2 Radiated Upper Band Edge (Average – UNII Band 8)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	5955MHz
Channel:	1



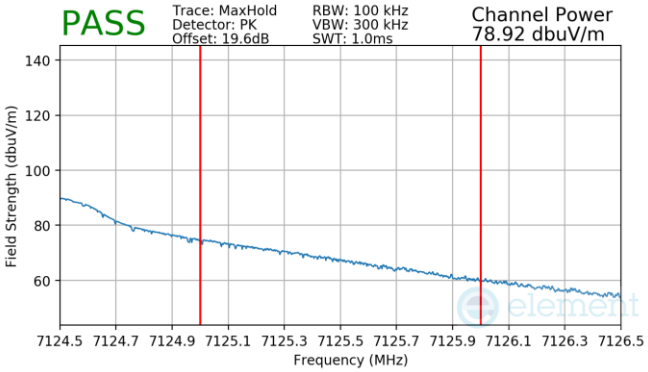
Plot 7-473. Antenna WF2 Radiated Lower Band Edge (Peak/Average – UNII Band 5)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	7095MHz
Channel:	229

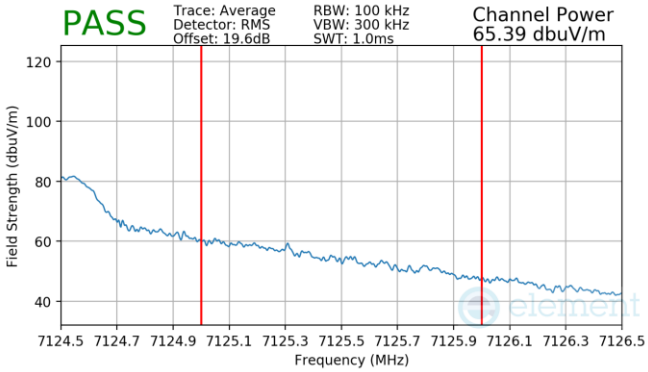


Plot 7-474. Antenna WF2 Radiated Upper Band Edge (Peak/Average – UNII Band 8)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	7115MHz
Channel:	233



Plot 7-475. Antenna WF2 Radiated Upper Band Edge (Peak – UNII Band 8)

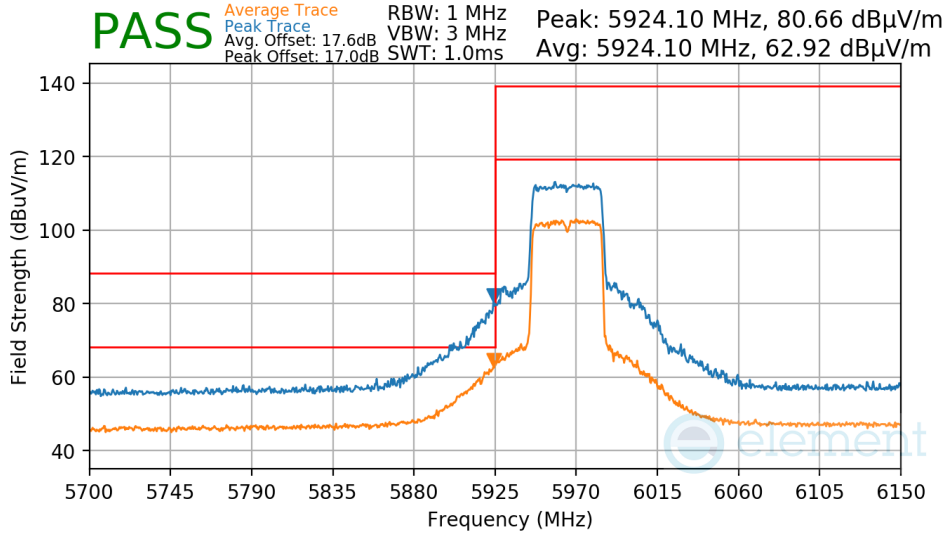


Plot 7-476. Antenna WF2 Radiated Upper Band Edge (Average – UNII Band 8)

7.8.9 Antenna WF2 Radiated Band Edge Measurements (40MHz BW)

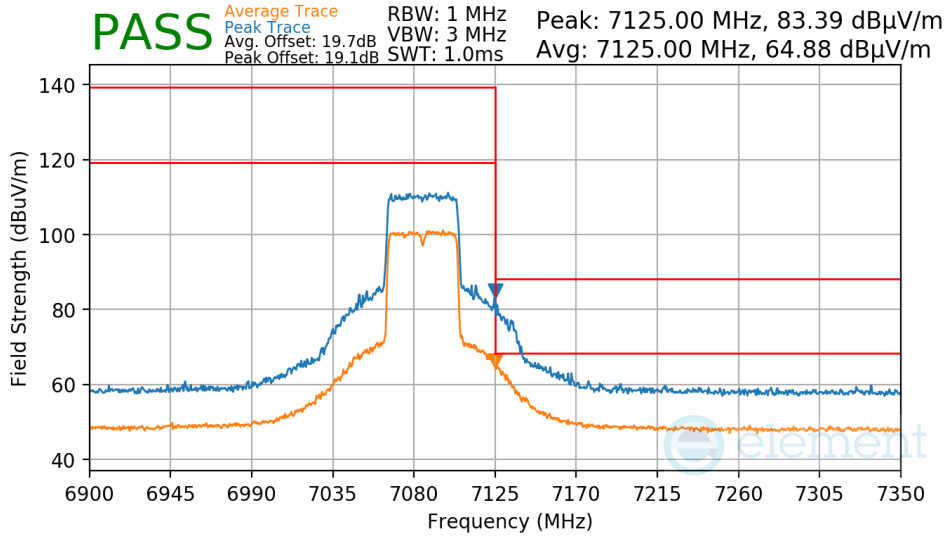
§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	5965MHz
Channel:	3



Plot 7-477. Antenna WF2 Radiated Lower Band Edge (Peak & Average – UNII Band 5)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	7085MHz
Channel:	227

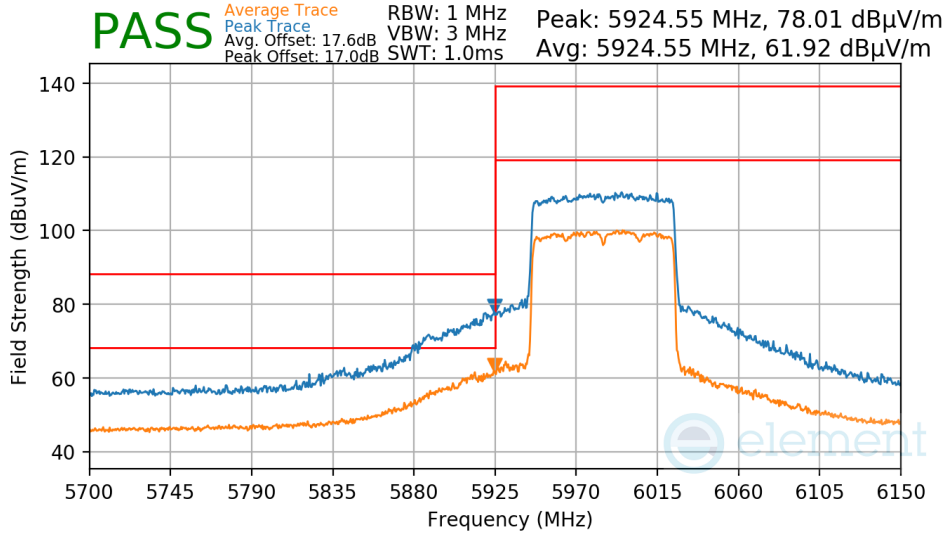


Plot 7-478. Antenna WF2 Radiated Upper Band Edge (Peak & Average – UNII Band 8)

7.8.10 Antenna WF2 Radiated Band Edge Measurements (80MHz BW)

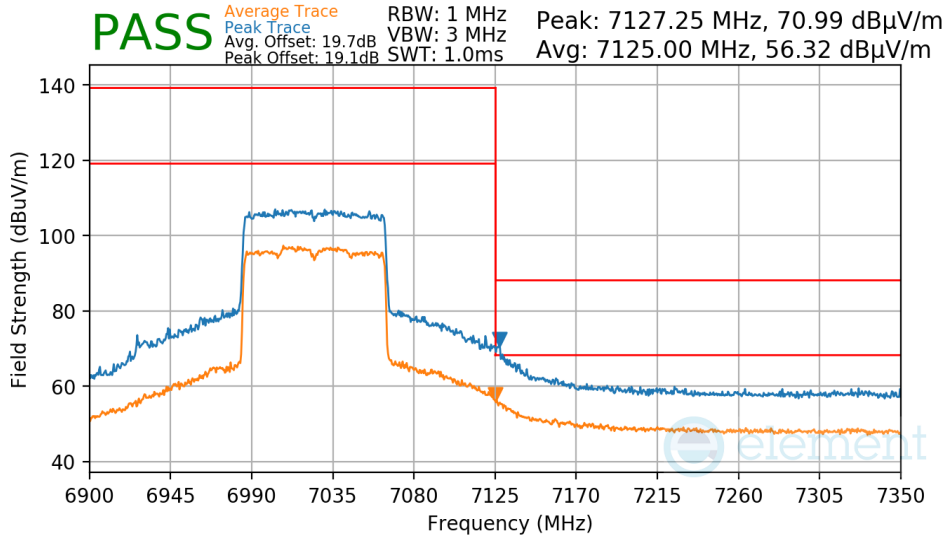
§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	5985MHz
Channel:	7



Plot 7-479. Antenna WF2 Radiated Lower Band Edge (Peak & Average – UNII Band 5)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	7025MHz
Channel:	215

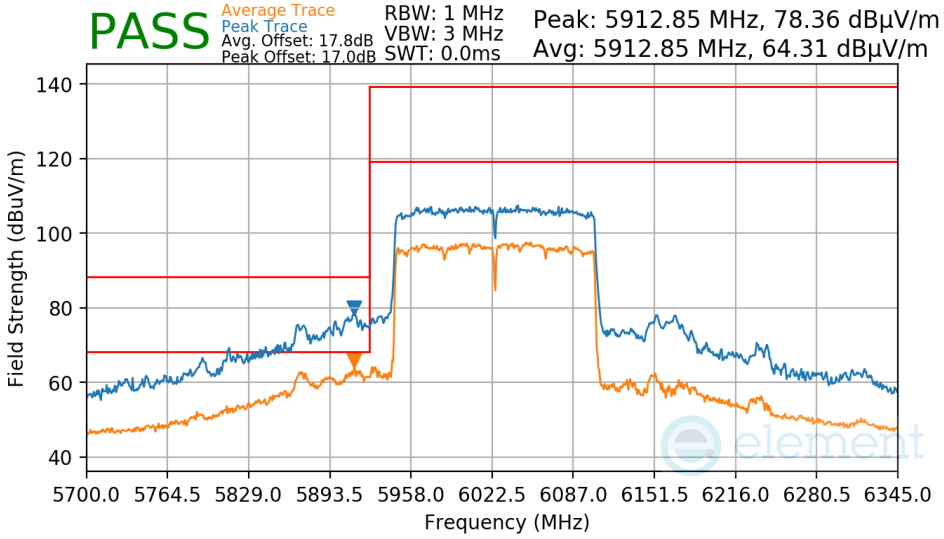


Plot 7-480. Antenna WF2 Radiated Upper Band Edge (Peak & Average – UNII Band 8)

7.8.11 Antenna WF2 Radiated Band Edge Measurements (160MHz BW)

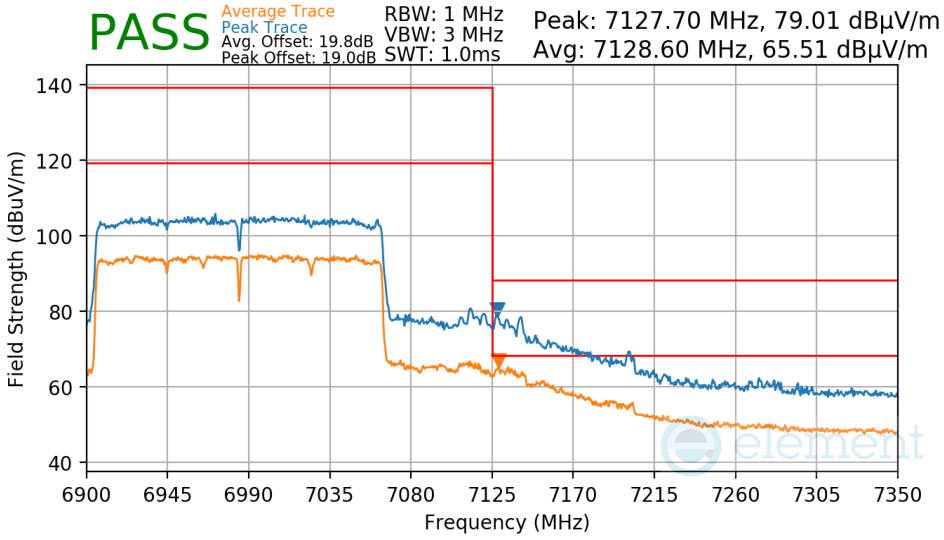
§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	6025MHz
Channel:	15



Plot 7-481. Antenna WF2 Radiated Lower Band Edge (Peak & Average – UNII Band 5)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	6985MHz
Channel:	207

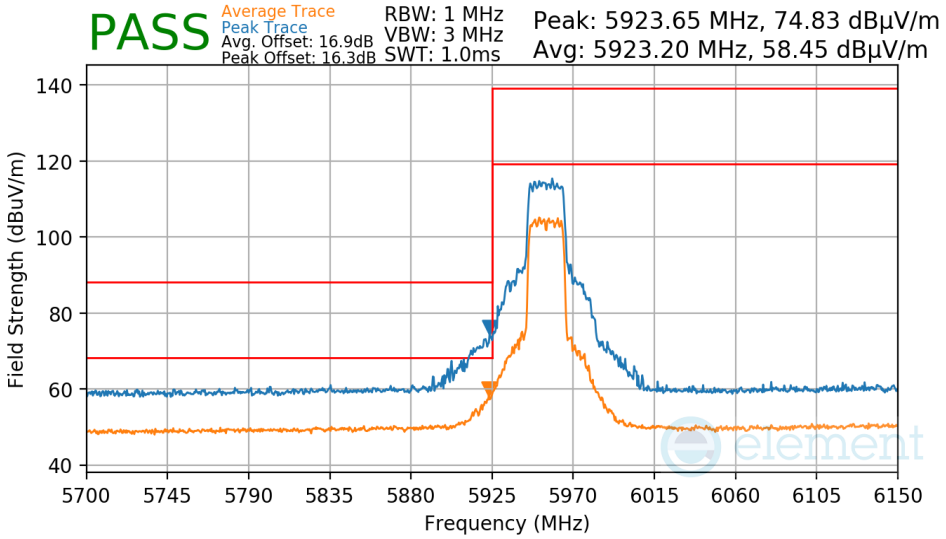


Plot 7-482. Antenna WF2 Radiated Upper Band Edge (Peak & Average – UNII Band 8)

7.8.12 SDM Radiated Band Edge Measurements (20MHz BW)

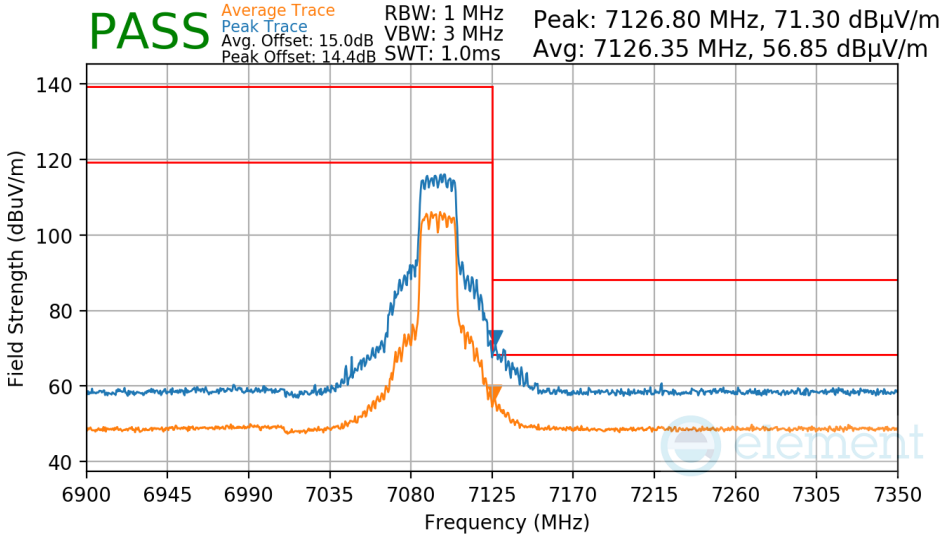
§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	5955MHz
Channel:	1



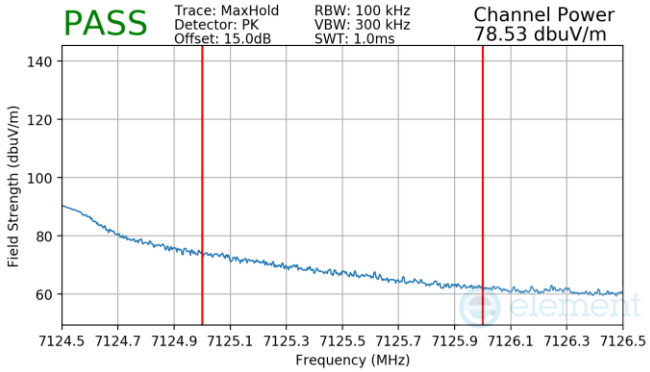
Plot 7-483. SDM Radiated Lower Band Edge (Peak/Average – UNII Band 5)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	7095MHz
Channel:	229

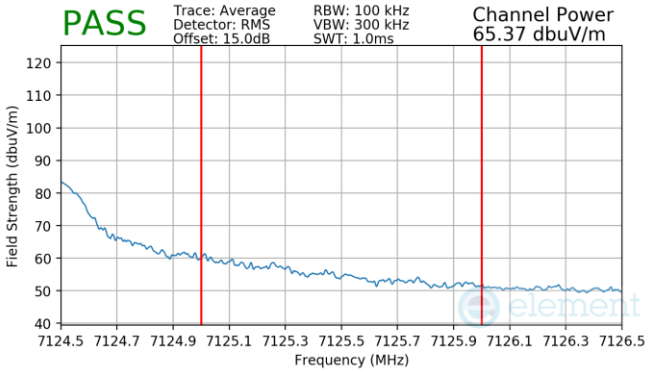


Plot 7-484. SDM Radiated Upper Band Edge (Peak/Average – UNII Band 8)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	7115MHz
Channel:	233



Plot 7-485. SDM Radiated Upper Band Edge (Peak – UNII Band 8)

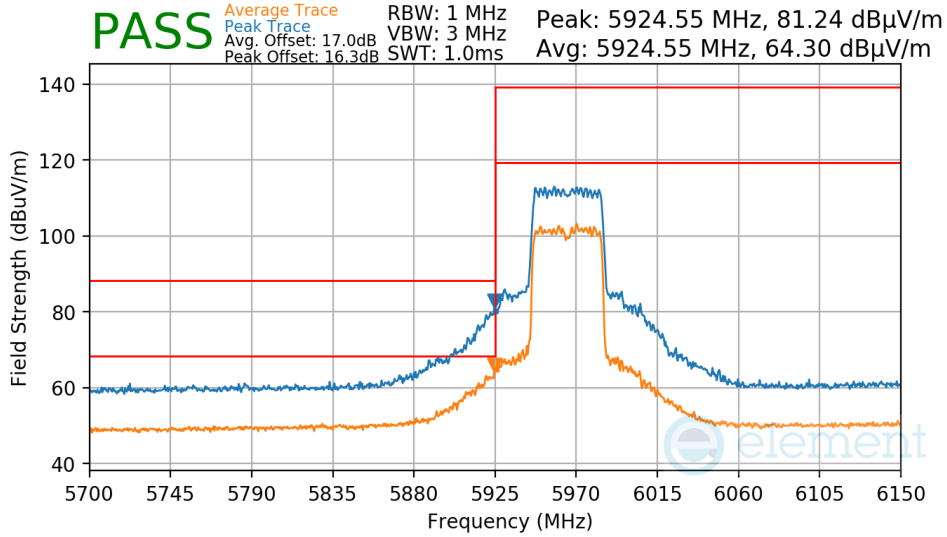


Plot 7-486. SDM Radiated Upper Band Edge (Average – UNII Band 8)

7.8.13 SDM Radiated Band Edge Measurements (40MHz BW)

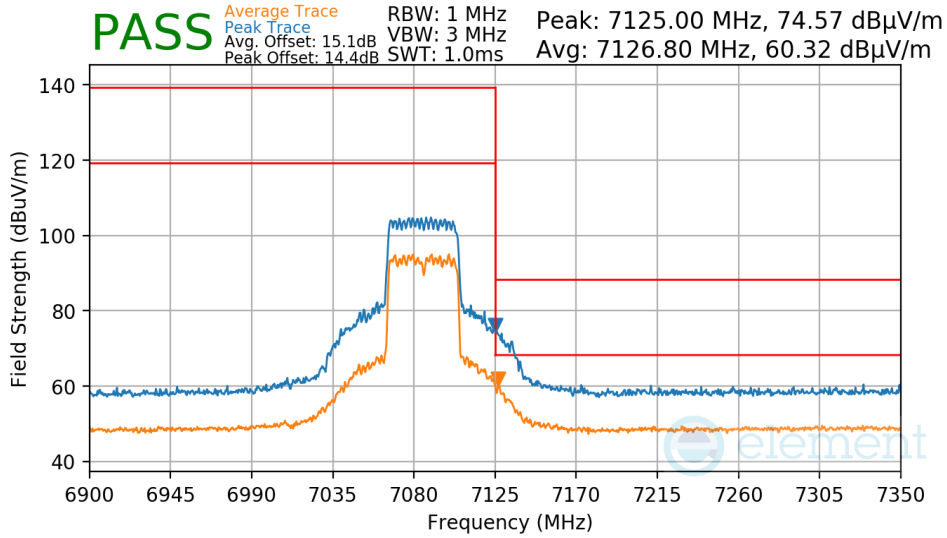
§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	5965MHz
Channel:	3



Plot 7-487. SDM Radiated Lower Band Edge (Peak & Average – UNII Band 5)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	7085MHz
Channel:	227

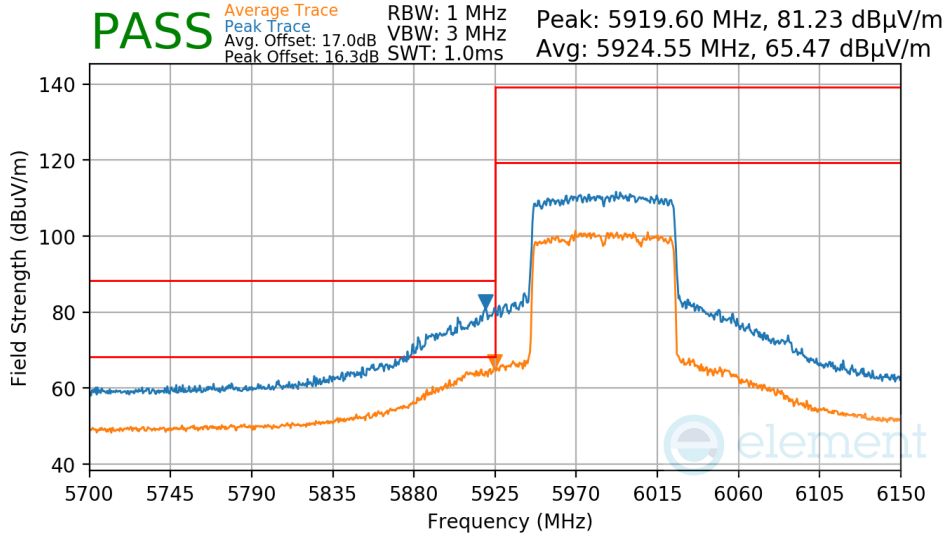


Plot 7-488. SDM Radiated Upper Band Edge (Peak & Average – UNII Band 8)

7.8.14 SDM Radiated Band Edge Measurements (80MHz BW)

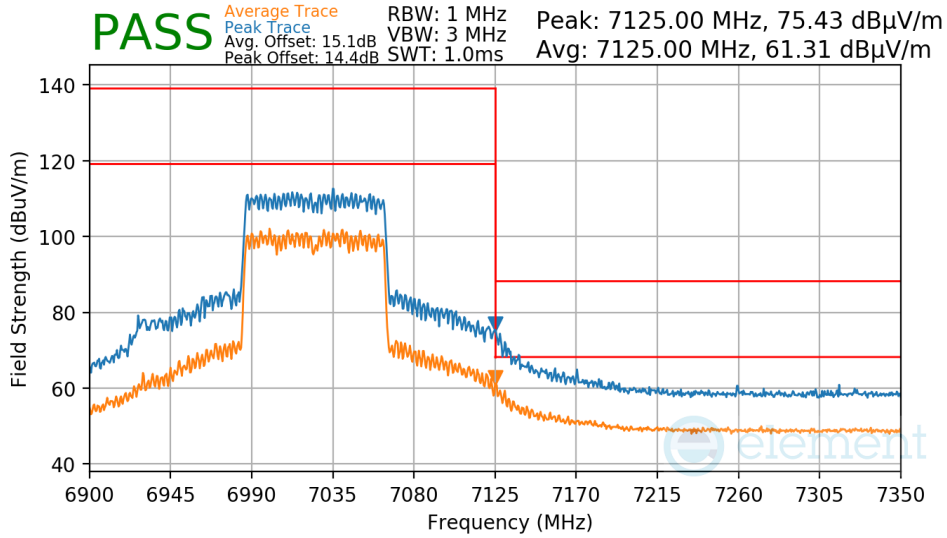
§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	5985MHz
Channel:	7



Plot 7-489. SDM Radiated Lower Band Edge (Peak & Average – UNII Band 5)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	7025MHz
Channel:	215

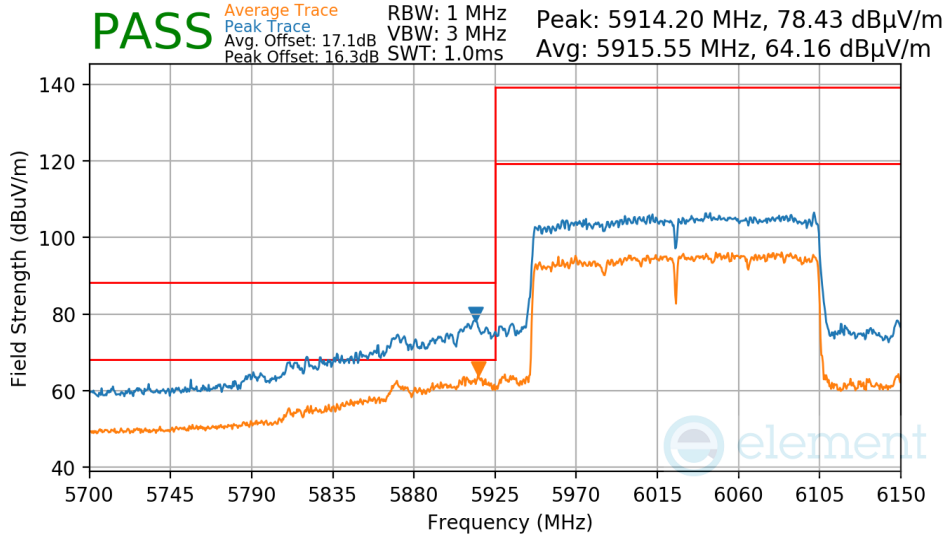


Plot 7-490. SDM Radiated Upper Band Edge (Peak & Average – UNII Band 8)

7.8.15 SDM Radiated Band Edge Measurements (160MHz BW)

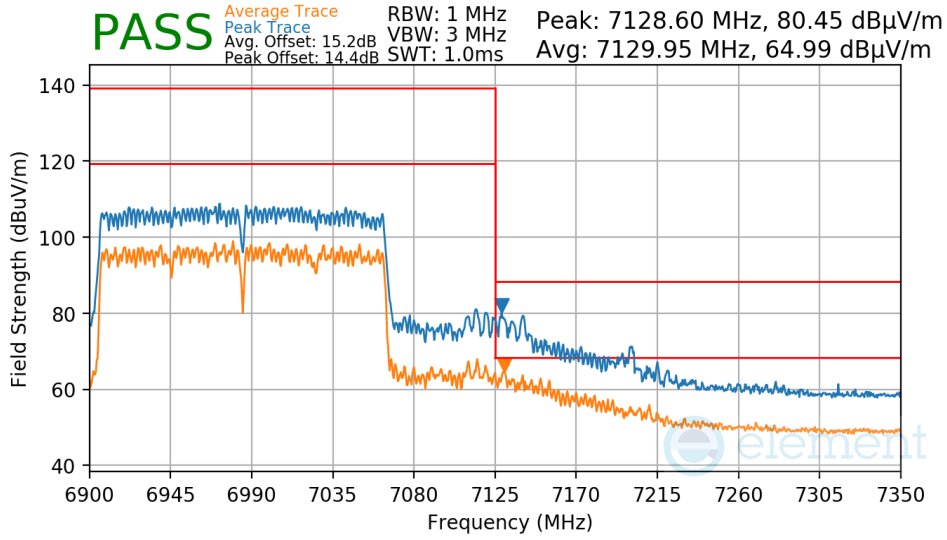
§15.407(b.1)(b.2) §15.205 §15.209

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	6025MHz
Channel:	15



Plot 7-491. SDM Radiated Lower Band Edge (Peak & Average – UNII Band 5)

Worst Case Mode:	802.11ax
Worst Case Transfer Rate:	MCS11
Distance of Measurements:	3 Meters
Operating Frequency:	6985MHz
Channel:	207



Plot 7-492. SDM Radiated Upper Band Edge (Peak & Average – UNII Band 8)

7.9 Radiated Spurious Emissions – Below 1GHz

§15.209

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 maximum power, and at the appropriate frequencies. All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 7-98 per Section 15.209.

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

Table 7-98. Radiated Limits

Test Procedures Used

ANSI C63.10-2020

Test Settings

Quasi-Peak Field Strength Measurements

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

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 120kHz (for emissions from 30MHz – 1GHz)
3. VBW = 300kHz
4. Detector = quasi-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 diagrams below.

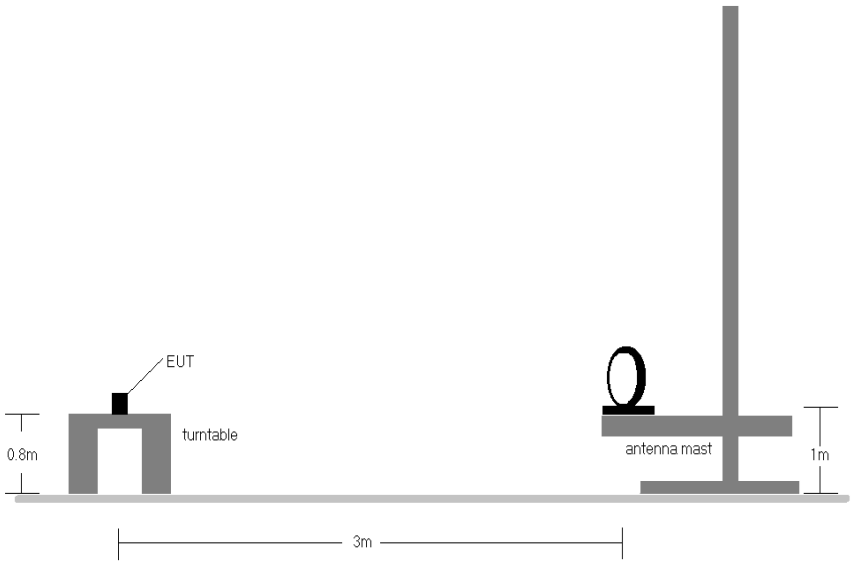


Figure 7-8. Radiated Test Setup < 30MHz

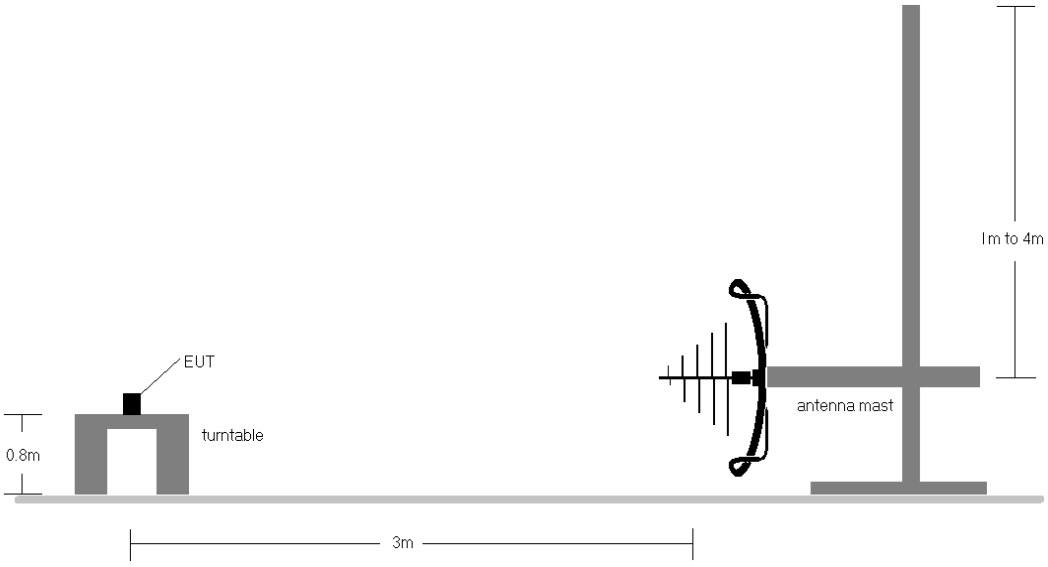


Figure 7-9. Radiated Test Setup < 1GHz

Test Notes

1. All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 7-98.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes. For below 30MHz the loop antenna was positioned in 3 orthogonal planes (X front, Y side, Z top) to determine the orientation resulting in the worst case emissions.
3. This unit was tested with its standard battery.
4. The spectrum is investigated using a peak detector and final measurements are recorded using CISPR quasi peak detector on emissions that were within 6dB of the limit.
5. Emissions were measured at a 3 meter test distance.
6. Emissions are investigated while operating on the center channel of the mode, band, and modulation that produced the worst case results during the transmitter spurious emissions testing.
7. No spurious emissions were detected within 20dB of the limit below 30MHz.
8. The results recorded using the broadband antenna is known to correlate with the results obtained by using a tuned dipole with an acceptable degree of accuracy. The VSWR for the measurement antenna was found to be less than 2:1.
9. Both configurations below were investigated, and the worst case has been reported.
    a. EUT powered by AC/DC adaptor via USB-C cable with wire charger
    b. EUT powered by host PC via USB-C cable with wire charger
10. All antenna configurations were investigated and only the worst case is reported.
11. The unit was tested with all possible modes and only the highest emission is reported.

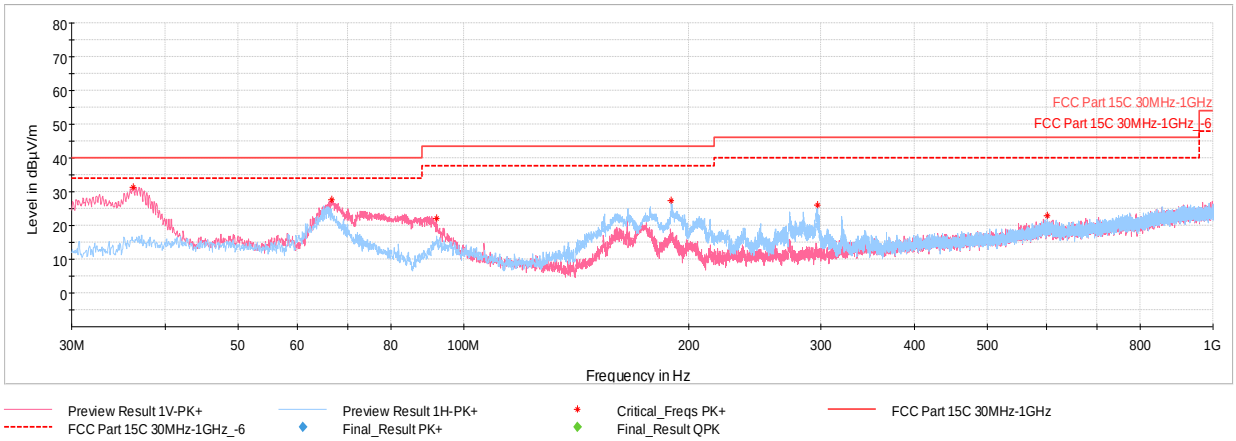
Sample Calculations

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 $_{[dB]}$ - Preamp Gain $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\mu V/m]}$ – Limit $_{[dB\mu V/m]}$

7.9.1 SDM Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209



Plot 7-493. Radiated Spurious Emissions below 1GHz SDM, 802.11ax, Ch.1 with host PC via USB-C cable with wire charger

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]
36.26	Max-Peak	V	100	343	-60.86	-14.82	31.32	40.00	-8.68
66.76	Max-Peak	V	100	199	-62.32	-17.13	27.55	40.00	-12.45
92.03	Max-Peak	V	100	112	-67.47	-17.38	22.15	43.52	-21.37
189.42	Max-Peak	H	100	154	-62.58	-17.04	27.38	43.52	-16.14
296.61	Max-Peak	H	100	88	-66.86	-13.97	26.17	46.02	-19.85
601.33	Max-Peak	H	100	230	-77.43	-6.61	22.96	46.02	-23.06

Table 7-99. Radiated Spurious Emissions Measurement below 1GHz SDM, 802.11ax, Ch.1 with host PC via USB-C cable with wire charger

7.10 AC Line-Conducted Emissions Measurement

§15.407

Test Overview and Limit

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

All conducted emissions must not exceed the limits shown in the table below, per Section 15.207.

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

Table 7-100. Conducted Limits

*Decreases with the logarithm of the frequency.

Test Procedures Used

ANSI C63.10-2020, Section 6.2

Test Settings

Quasi-Peak Measurements

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

Average Measurements

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

Test Setup

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

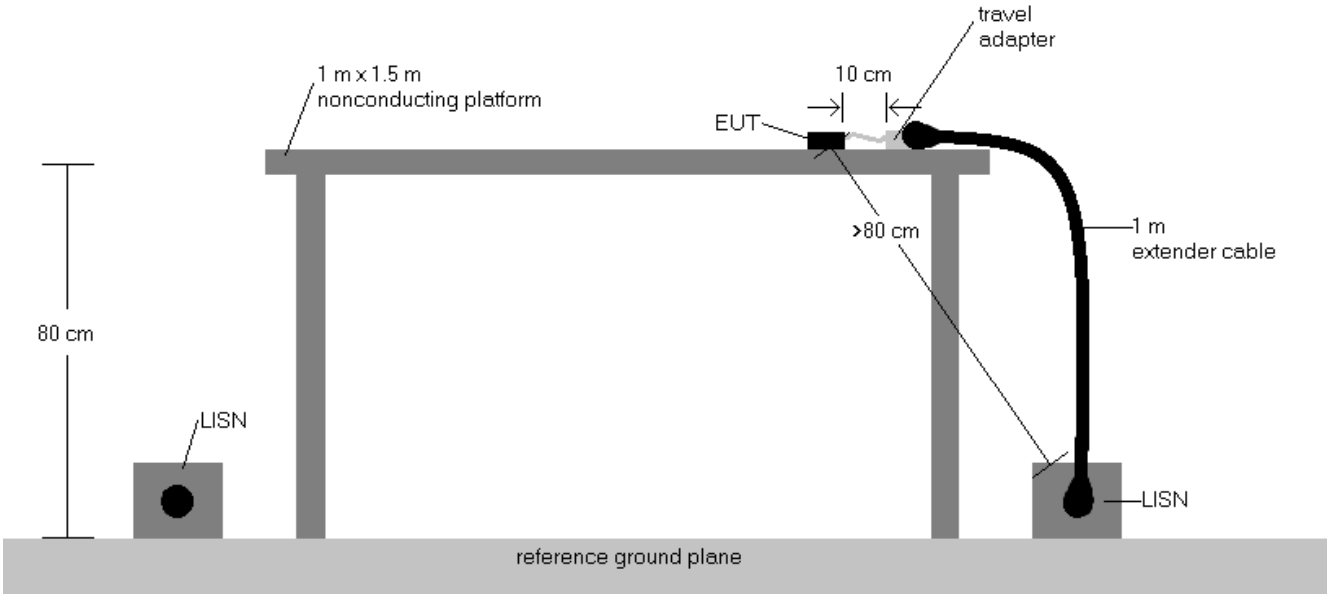
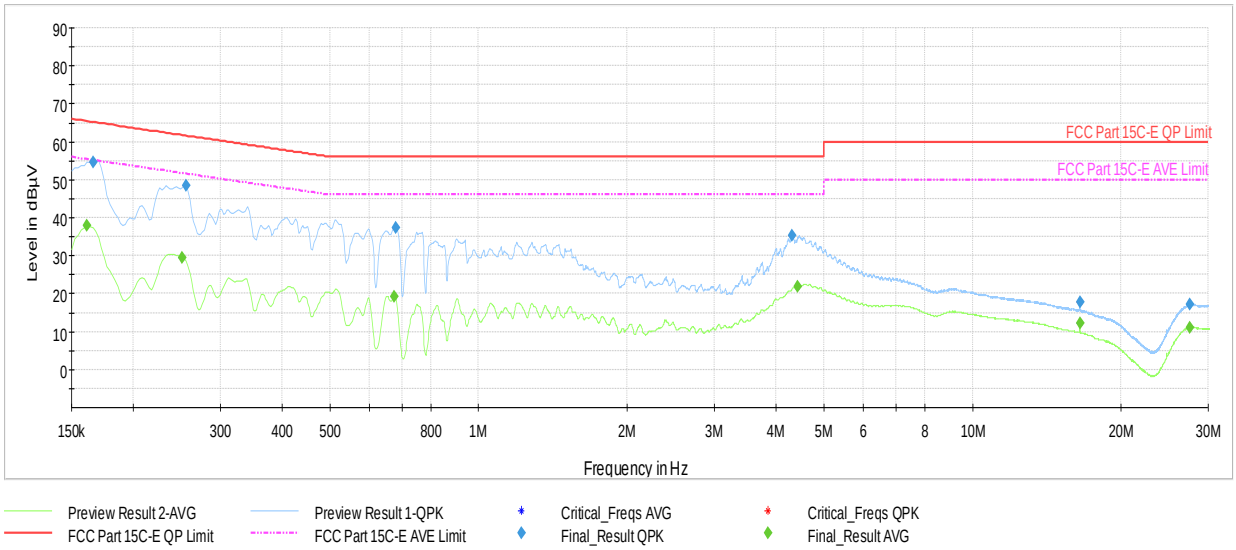


Figure 7-10. Test Instrument & Measurement Setup

Test Notes

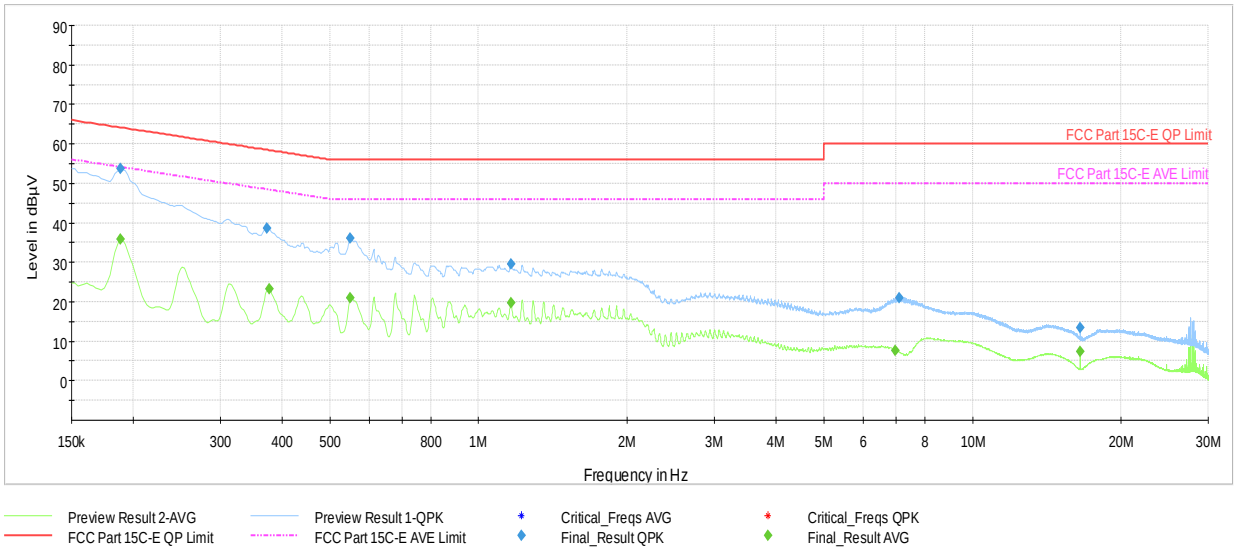
1. All modes of operation were investigated, and the worst-case emissions are reported. The emissions found were not affected by the choice of channel used during testing.
2. Both configurations below were investigated, and the worst case has been reported.
    a. EUT powered by AC/DC adaptor via USB-C cable with wire charger
    b. EUT powered by host PC via USB-C cable with wire charger
3. The limit for an intentional radiator from 150kHz to 30MHz are specified in 15.207.
4. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
5. QP/AV Level (dBµV) = QP/AV Analyzer/Receiver Level (dBµV) + Correction Factor (dB)
6. Margin (dB) = QP/AV Level (dBµV) - QP/AV Limit (dBµV)
7. Traces shown in plots are made using quasi-peak and average detectors.
8. Deviations to the Specifications: None.
9. The unit was tested with all possible modes and only the highest emission is reported.



Plot 7-494. AC Line Conducted Plot with 802.11ax SDM – Ch.1 (L1), with AC/DC Adapter via USB-C cable with wire charger

Frequency [MHz]	Process State	QuasiPeak [dBµV]	Average [dBµV]	Limit [dBµV]	Margin [dB]	Line	PE
0.161	FINAL	—	37.88	55.40	-17.52	L1	GND
0.166	FINAL	54.6	—	65.17	-10.59	L1	GND
0.251	FINAL	—	29.61	51.72	-22.11	L1	GND
0.256	FINAL	48.5	—	61.57	-13.11	L1	GND
0.674	FINAL	—	19.23	46.00	-26.77	L1	GND
0.679	FINAL	37.2	—	56.00	-18.77	L1	GND
4.315	FINAL	35.3	—	56.00	-20.68	L1	GND
4.425	FINAL	—	21.79	46.00	-24.21	L1	GND
16.485	FINAL	17.8	—	60.00	-42.21	L1	GND
16.485	FINAL	—	12.29	50.00	-37.71	L1	GND
27.580	FINAL	—	11.07	50.00	-38.93	L1	GND
27.580	FINAL	17.2	—	60.00	-42.78	L1	GND

Table 7-101. AC Line Conducted Data with 802.11ax SDM – Ch. 1 (L1) with AC/DC Adapter via USB-C cable with wire charger



Plot 7-495. AC Line Conducted Plot with 802.11ax SDM – Ch. 1 (N), with host PC via USB-C cable with wire charger

Frequency [MHz]	Process State	QuasiPeak [dBµV]	Average [dBµV]	Limit [dBµV]	Margin [dB]	Line	PE
0.188	FINAL	—	35.77	54.11	-18.35	N	ON
0.188	FINAL	53.7	—	64.11	-10.45	N	ON
0.373	FINAL	38.7	—	58.44	-19.78	N	ON
0.377	FINAL	—	23.18	48.34	-25.16	N	ON
0.551	FINAL	36.1	—	56.00	-19.92	N	ON
0.551	FINAL	—	20.89	46.00	-25.11	N	ON
1.163	FINAL	—	19.67	46.00	-26.33	N	ON
1.165	FINAL	29.5	—	56.00	-26.55	N	ON
6.963	FINAL	—	7.75	50.00	-42.25	N	ON
7.100	FINAL	21.0	—	60.00	-39.03	N	ON
16.496	FINAL	—	7.48	50.00	-42.52	N	ON
16.496	FINAL	13.3	—	60.00	-46.69	N	ON

Table 7-102. AC Line Conducted Data with 802.11ax SDM – Ch. 1 (N), with host PC via USB-C cable with wire charger

8.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Apple Tablet Device FCC ID: BCGA2993** is in compliance with Part 15 Subpart E (15.407) of the FCC Rules of the Innovation, Science and Economic Development Canada Rules.