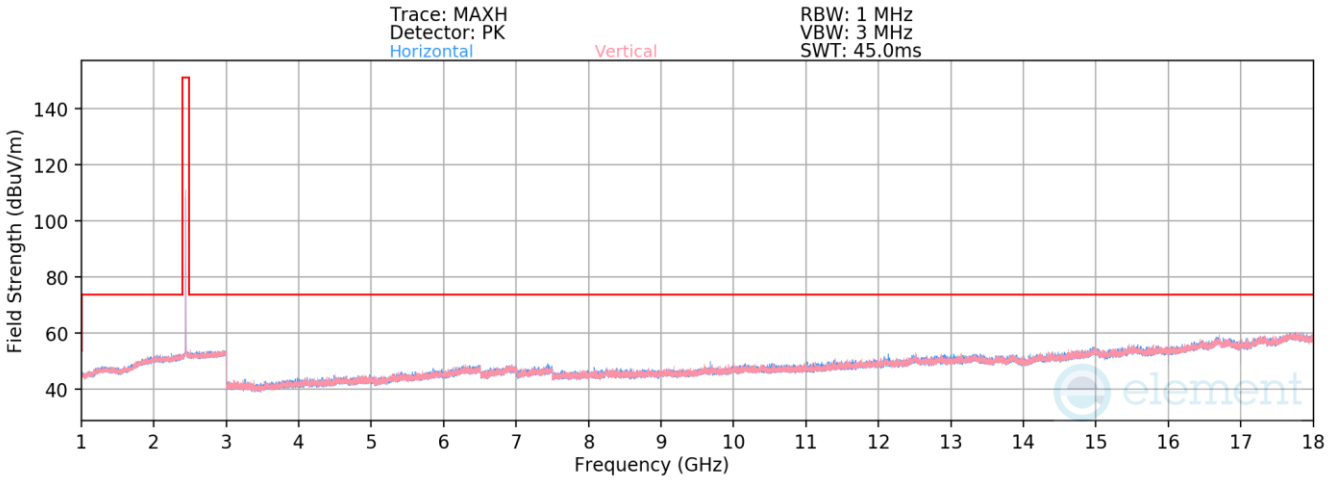
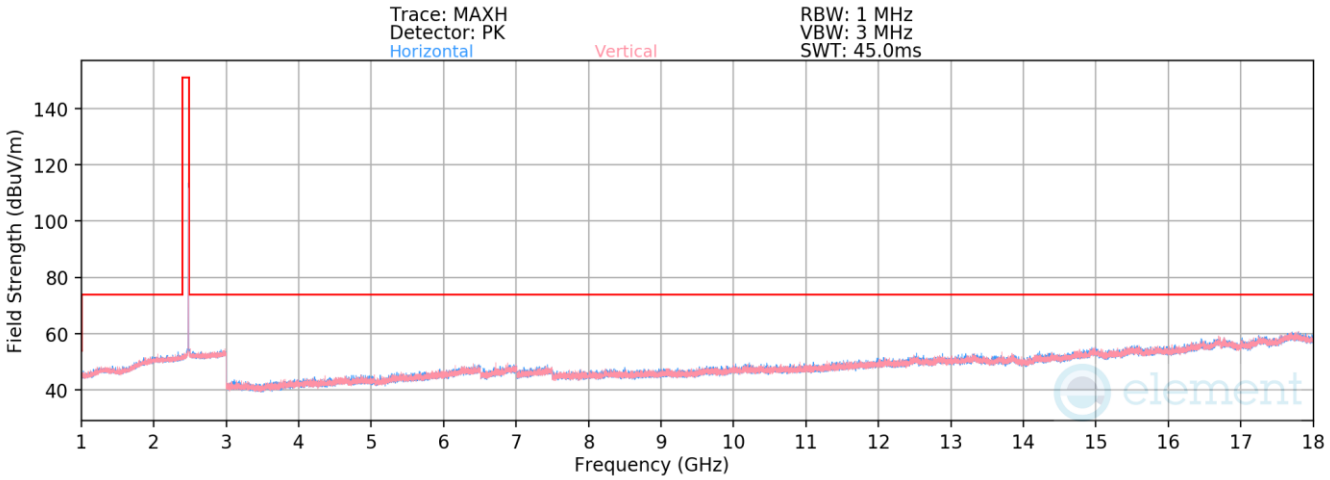


Plot 7-113. Radiated Spurious Emissions 1-18GHz TxBF (4Mbps, HDR4, ePA – Ch. 38)

Bluetooth Mode:	HDR4
Data Rate:	4Mbps
Power Scheme	ePA
Distance of Measurements:	3 Meters
Operating Frequency:	2441MHz
Channel:	38

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]
4882.00	Avg	-	-	-	-80.72	6.23	32.51	53.98	-21.47
4882.00	Peak	-	-	-	-68.70	6.23	44.53	73.98	-29.45
7323.00	Avg	-	-	-	-81.85	9.95	35.10	53.98	-18.88
7323.00	Peak	-	-	-	-69.81	9.95	47.14	73.98	-26.84
12205.00	Avg	-	-	-	-84.75	14.84	37.09	53.98	-16.89
12205.00	Peak	-	-	-	-73.76	14.84	48.08	73.98	-25.90

Table 7-28. Radiated Measurements TxBF

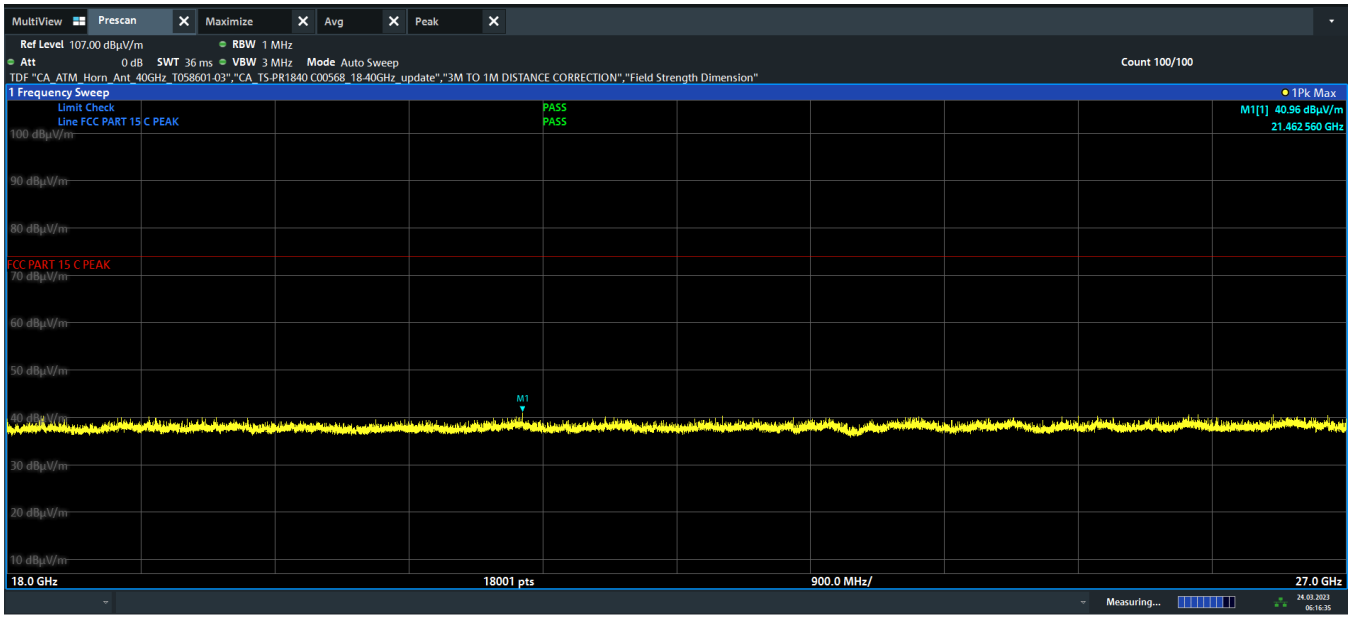


Plot 7-114. Radiated Spurious Emissions 1-18GHz TxBF (4Mbps, HDR4, ePA – Ch. 73)

Bluetooth Mode:	HDR4
Data Rate:	4Mbps
Power Scheme	ePA
Distance of Measurements:	3 Meters
Operating Frequency:	2476MHz
Channel:	73

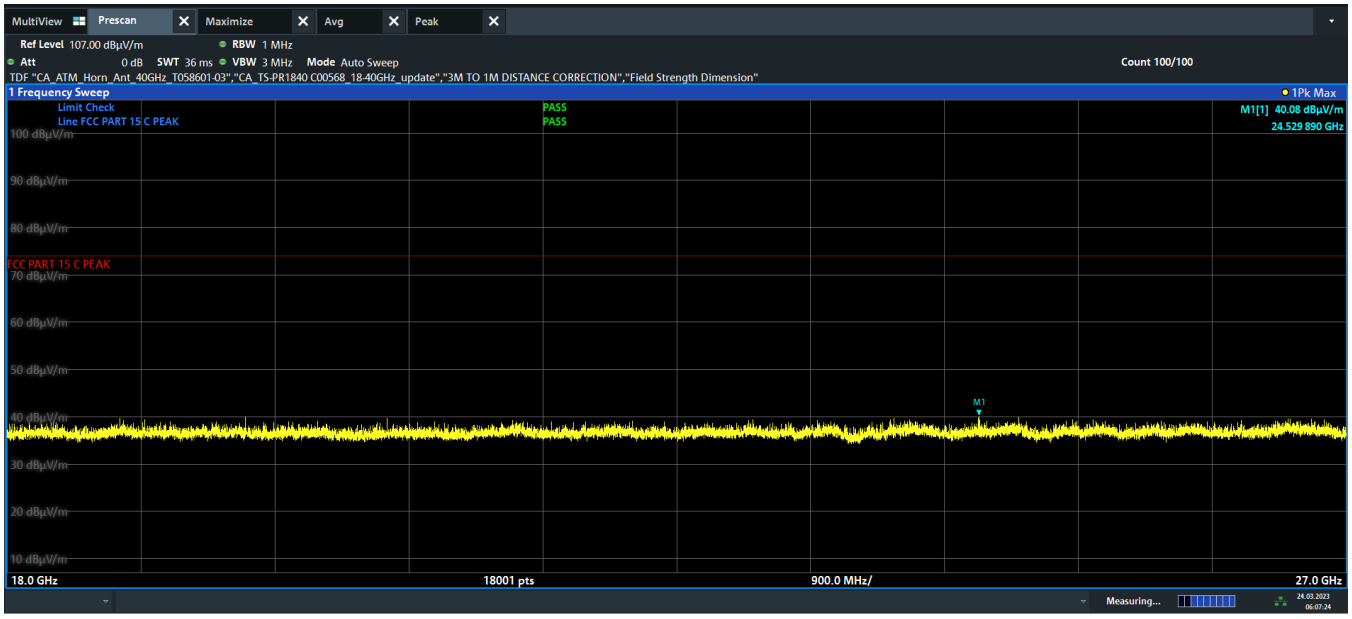
Frequency [MHz]	Detector	Ant. Pol. [H/V]	Antenna Height [cm]	Turntable Azimuth [degree]	Analyzer Level [dBm]	AFCL [dB/m]	Field Strength [dBµV/m]	Limit [dBµV/m]	Margin [dB]
4952.00	Avg	-	-	-	-80.98	6.44	32.46	53.98	-21.52
4952.00	Peak	-	-	-	-69.33	6.44	44.11	73.98	-29.87
7428.00	Avg	-	-	-	-81.80	9.97	35.17	53.98	-18.81
7428.00	Peak	-	-	-	-70.13	9.97	46.84	73.98	-27.14
12380.00	Avg	-	-	-	-84.82	15.03	37.21	53.98	-16.77
12380.00	Peak	-	-	-	-73.33	15.03	48.70	73.98	-25.28

Table 7-29. Radiated Measurements TxBF



06:16:35 24.03.2023

Plot 7-115. Radiated Spurious Emissions Plot Above 18GHz (4Mbps, HDR4, ePA – Ch. 38, Ant2 Pol. H)



06:07:24 24.03.2023

Plot 7-116. Radiated Spurious Emissions Plot Above 18GHz (4Mbps, HDR4, ePA – Ch. 38, Ant2 Pol. V)

7.7.1 Radiated Restricted Band Edge Measurements

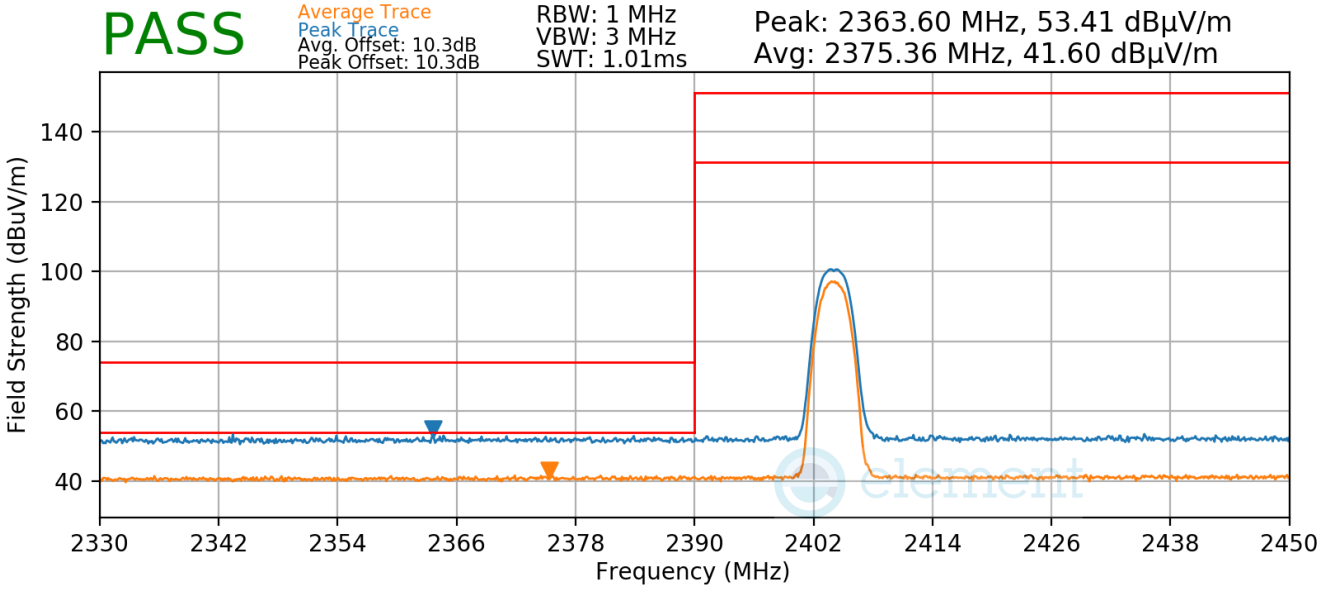
§15.205 §15.209; RSS-Gen [8.9]

Ant1

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR4
Data Rate:	4Mbps
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2404MHz
Channel:	1



Plot 7-117. Radiated Restricted Lower Band Edge Measurement Ant1

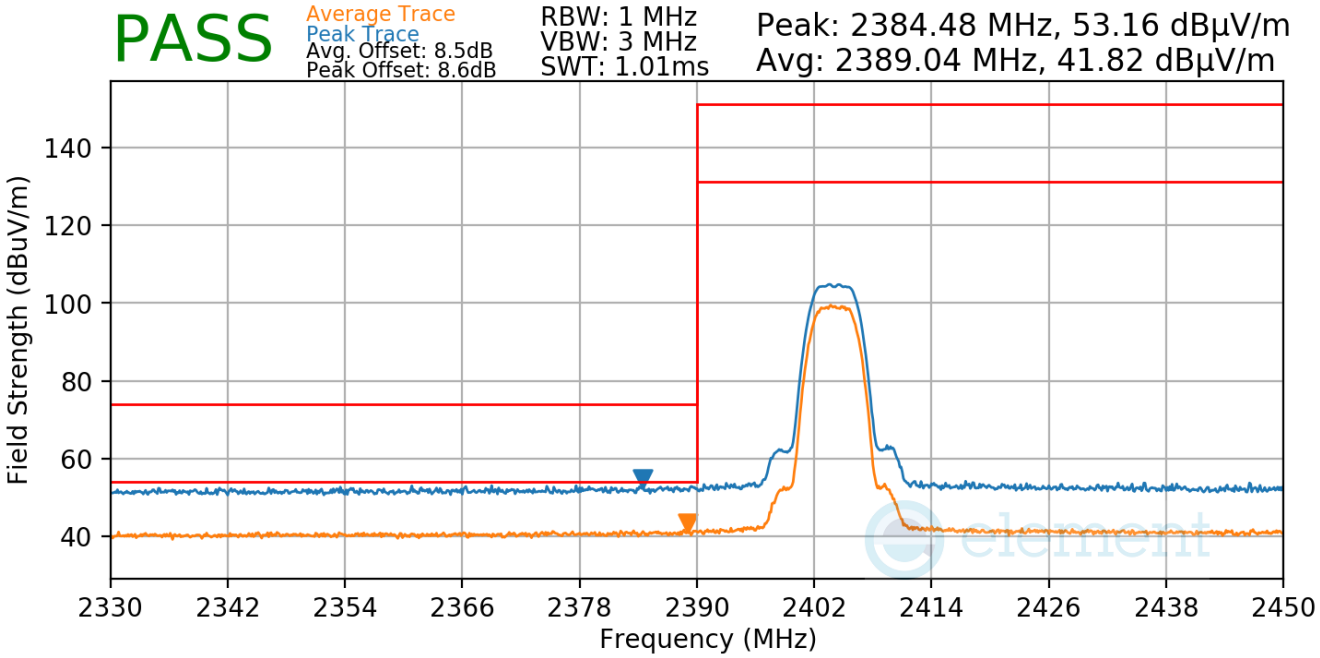
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR8
Data Rate:	8Mbps
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2404MHz
Channel:	1



Plot 7-118. Radiated Restricted Lower Band Edge Measurement Ant1

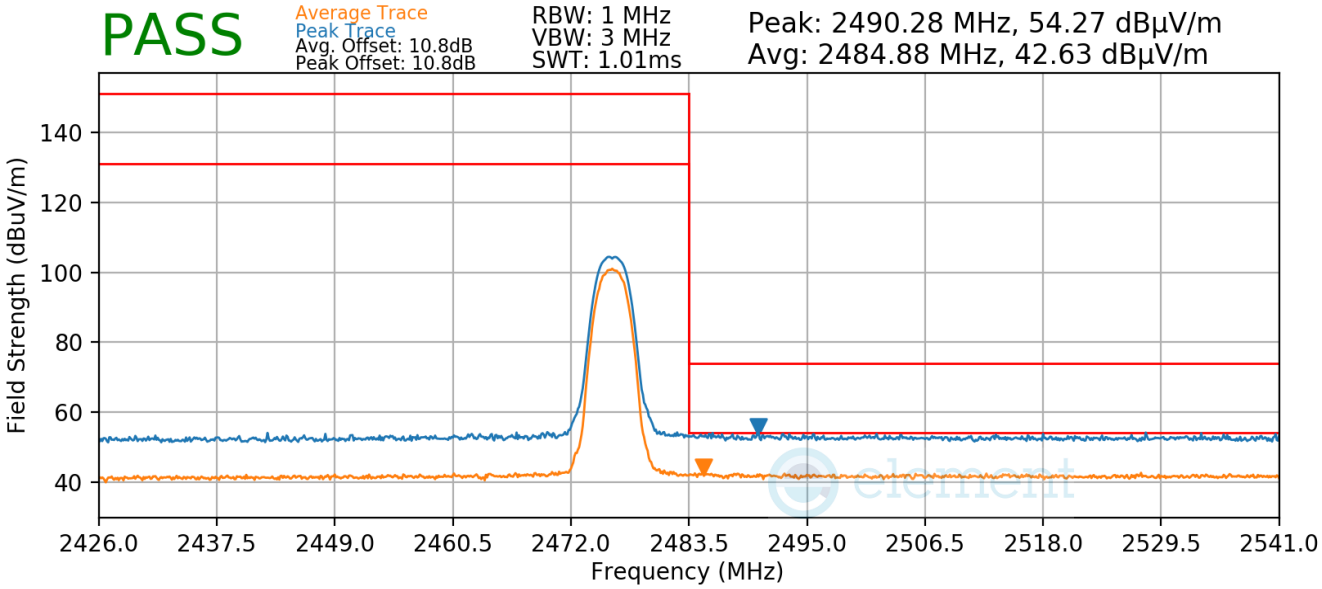
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR4
Data Rate:	4Mbps
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	73



Plot 7-119. Radiated Restricted Upper Band Edge Measurement Ant1

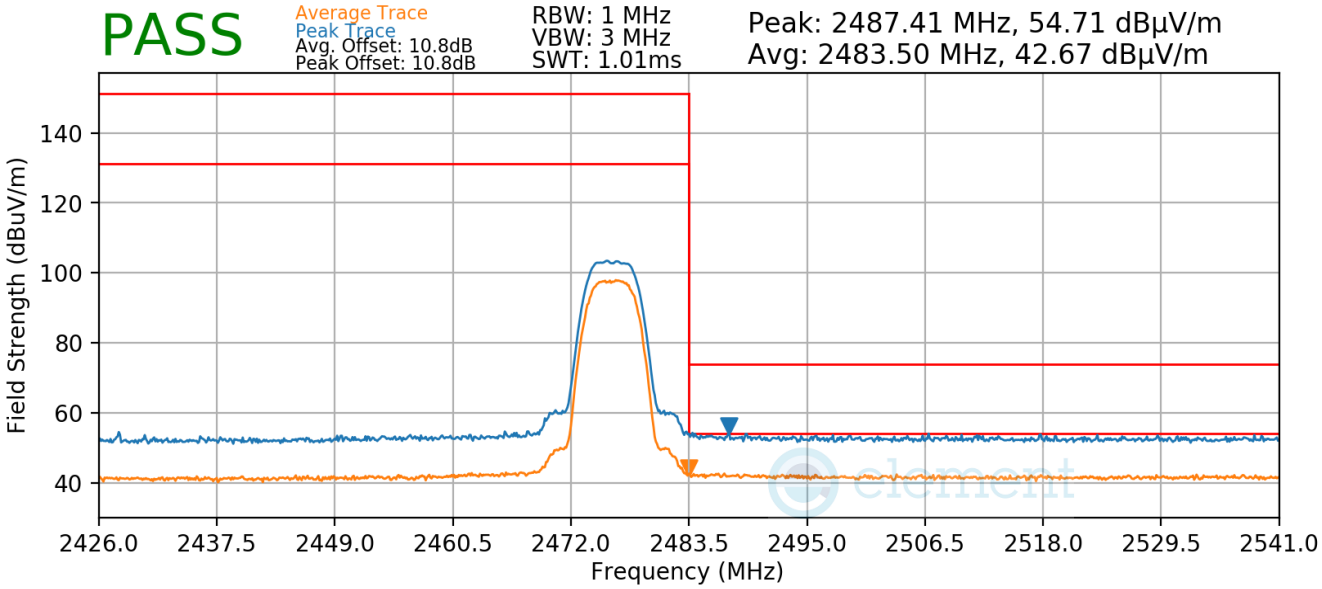
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR8
Data Rate:	8Mbps
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	73



Plot 7-120. Radiated Restricted Upper Band Edge Measurement Ant1

Radiated Restricted Band Edge Measurements

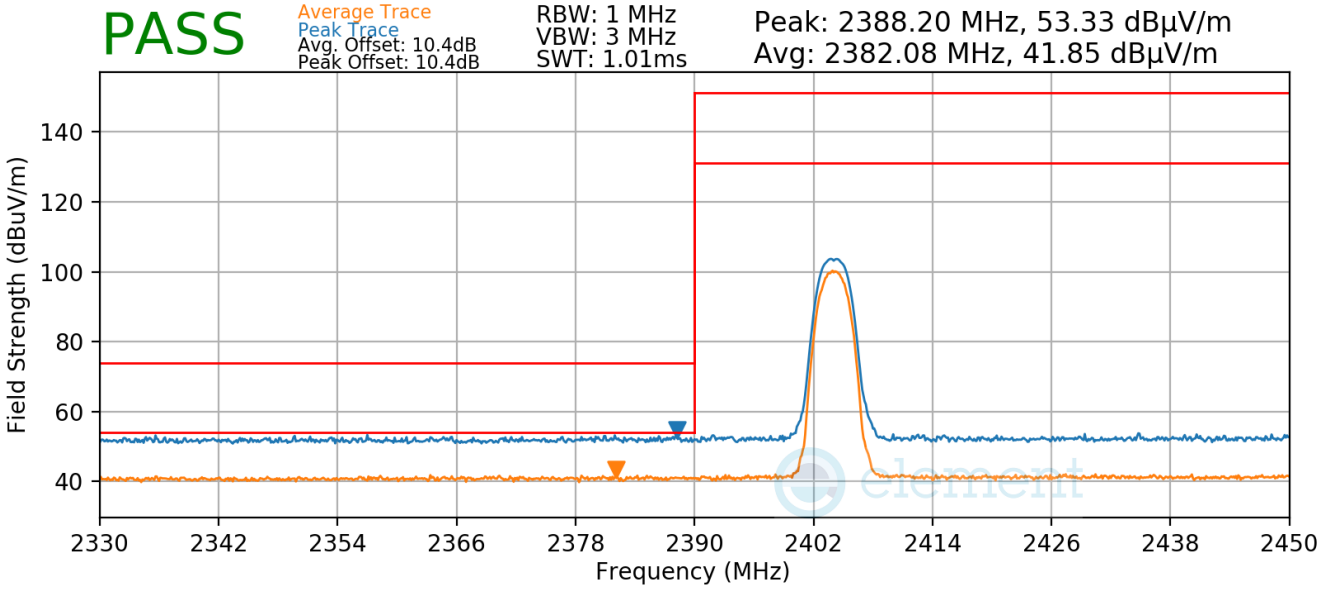
§15.205 §15.209; RSS-Gen [8.9]

Ant2

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR4
Data Rate:	4Mbps
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2404MHz
Channel:	1



Plot 7-121. Radiated Restricted Lower Band Edge Measurement Ant2

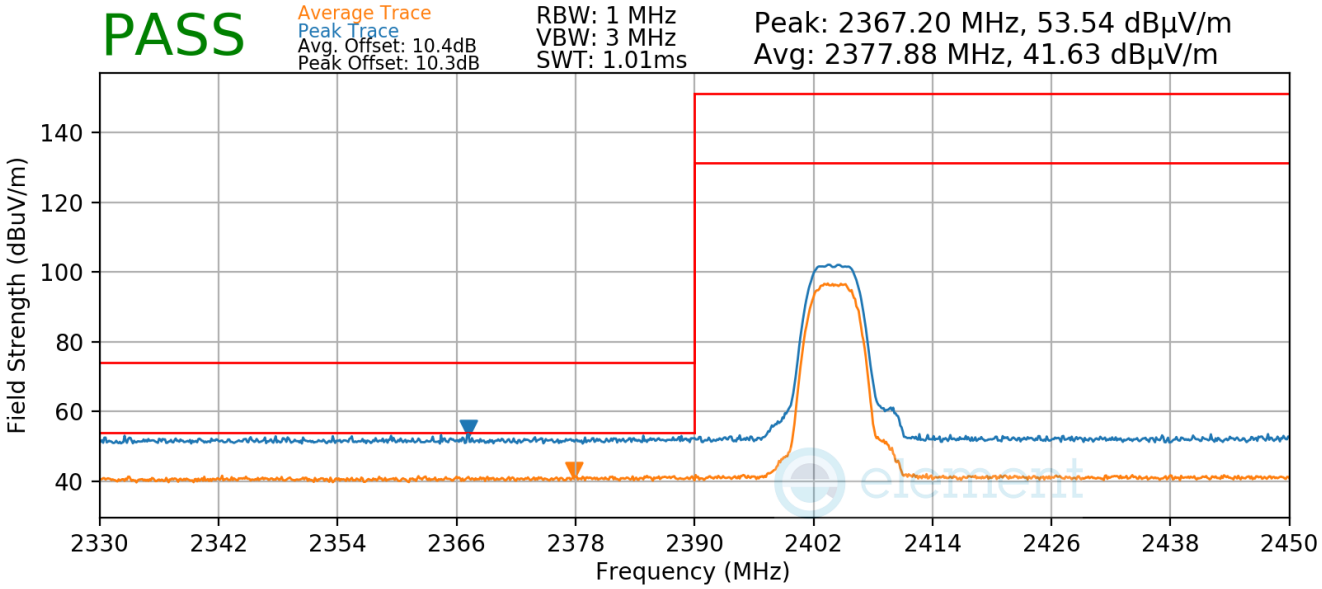
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR8
Data Rate:	8Mbps
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2404MHz
Channel:	1



Plot 7-122. Radiated Restricted Lower Band Edge Measurement Ant2

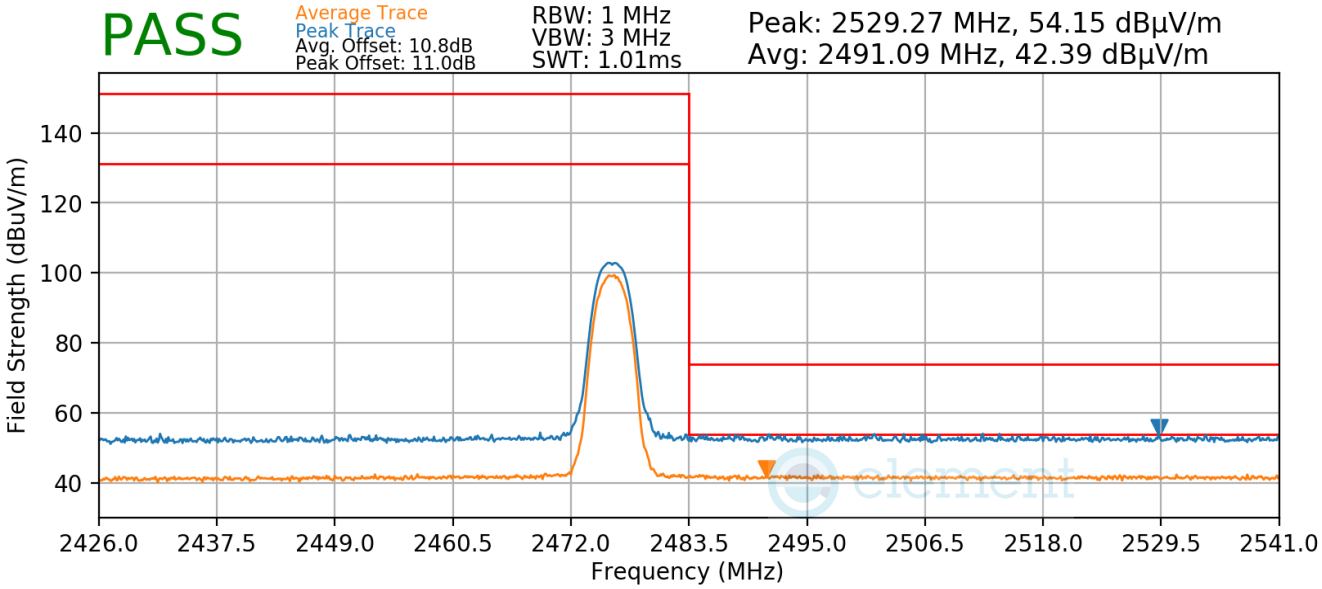
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR4
Data Rate:	4Mbps
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	73



Plot 7-123. Radiated Restricted Upper Band Edge Measurement Ant2

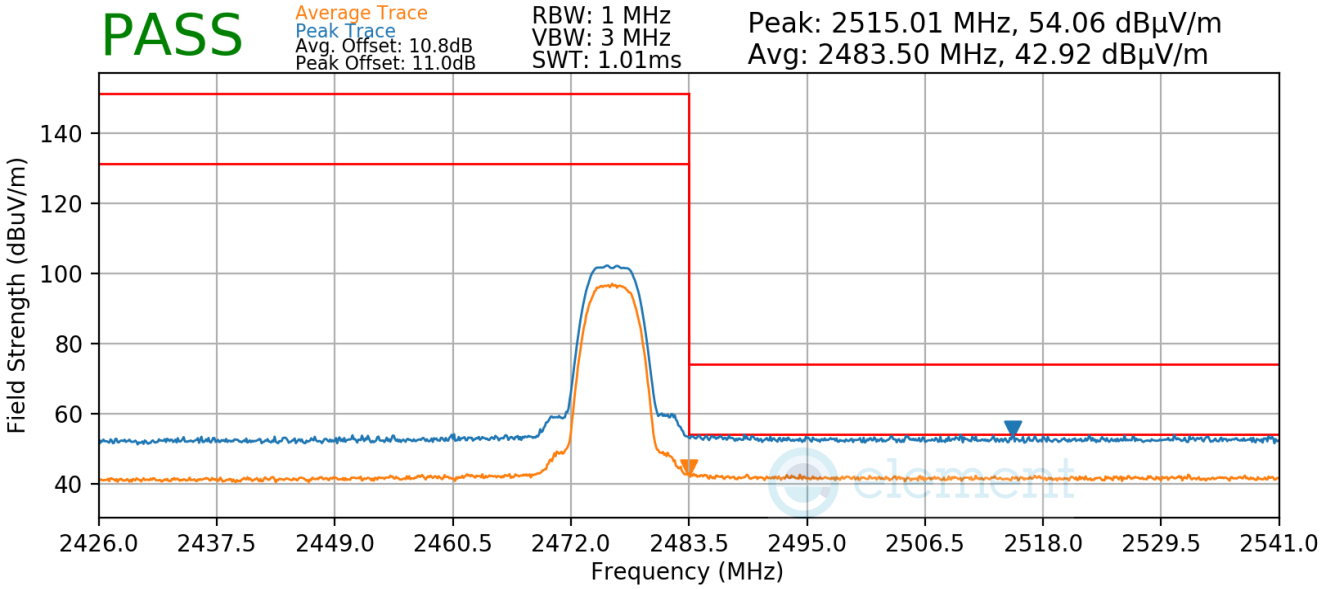
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR8
Data Rate:	8Mbps
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	73



Plot 7-124. Radiated Restricted Upper Band Edge Measurement Ant2

Radiated Restricted Band Edge Measurements

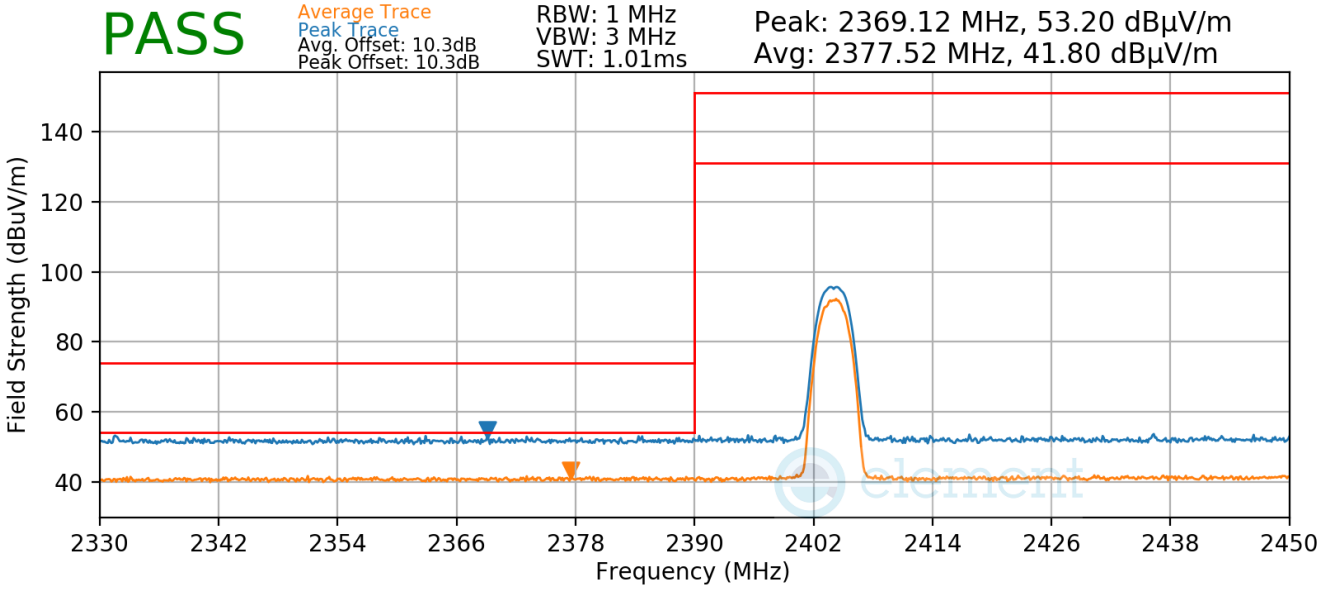
§15.205 §15.209; RSS-Gen [8.9]

NB UNII_L

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR4
Data Rate:	4Mbps
Power Scheme:	iPA
Measurement Distance:	3 Meters
Operating Frequency:	2404MHz
Channel:	1



Plot 7-125. Radiated Restricted Lower Band Edge Measurement NB UNII_L

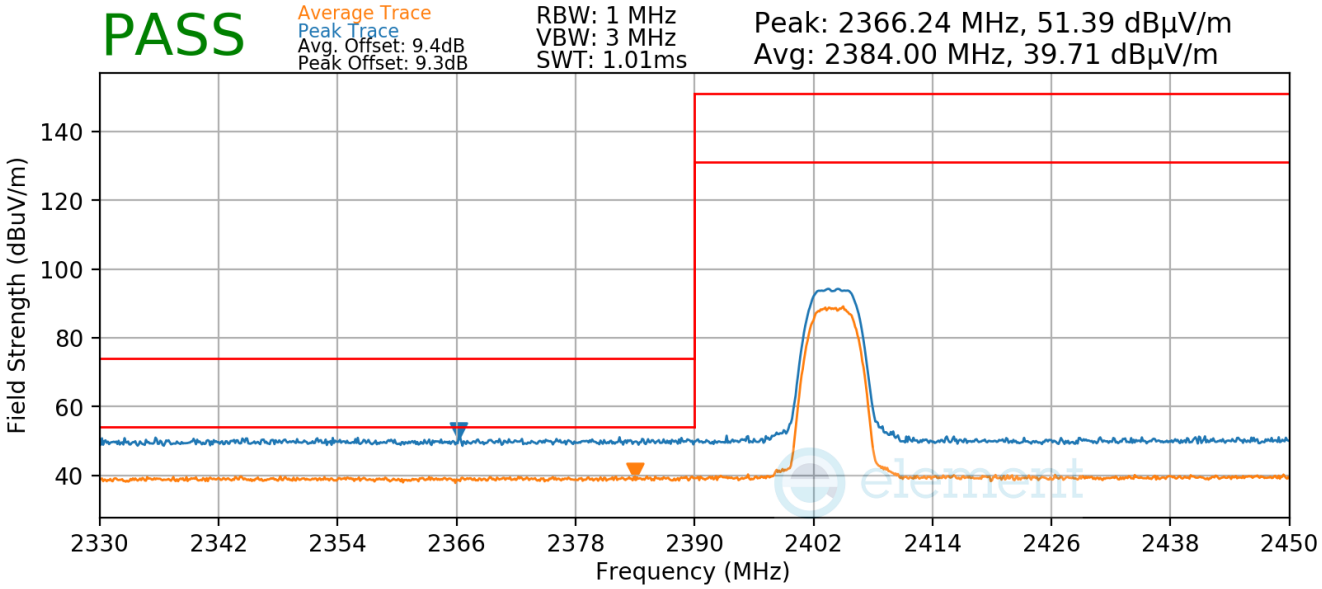
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR8
Data Rate:	8Mbps
Power Scheme:	iPA
Measurement Distance:	3 Meters
Operating Frequency:	2404MHz
Channel:	1



Plot 7-126. Radiated Restricted Lower Band Edge Measurement NB UNII_L

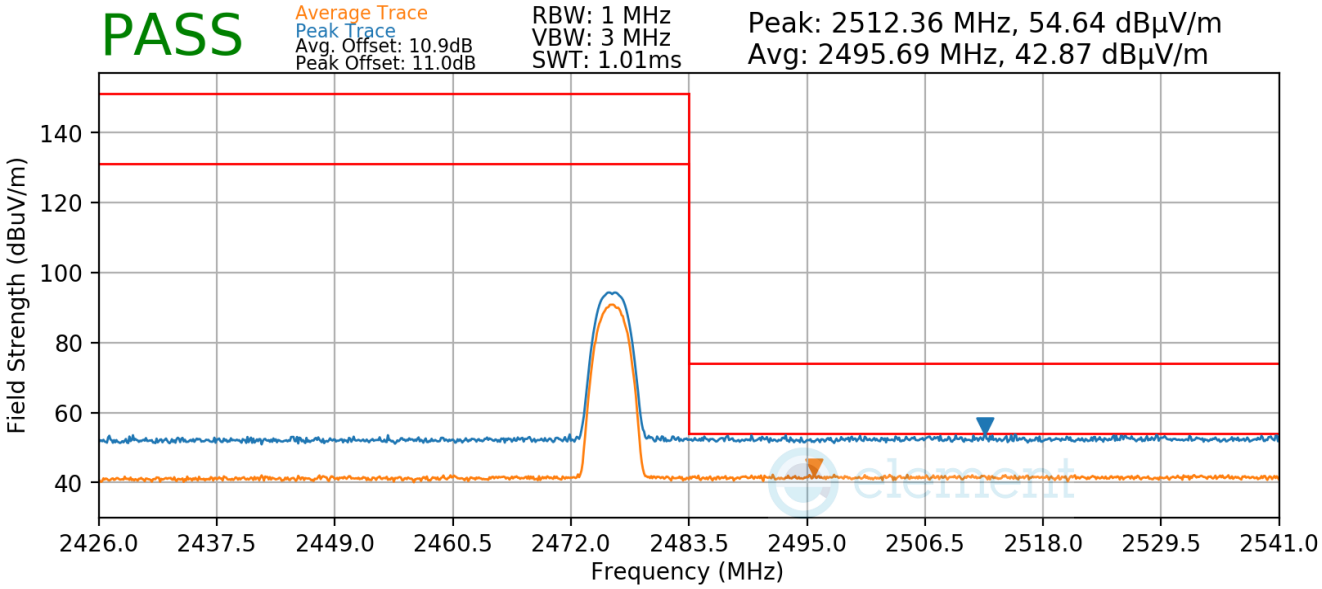
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR4
Data Rate:	4Mbps
Power Scheme:	iPA
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	73



Plot 7-127. Radiated Restricted Upper Band Edge Measurement NB UNII_L

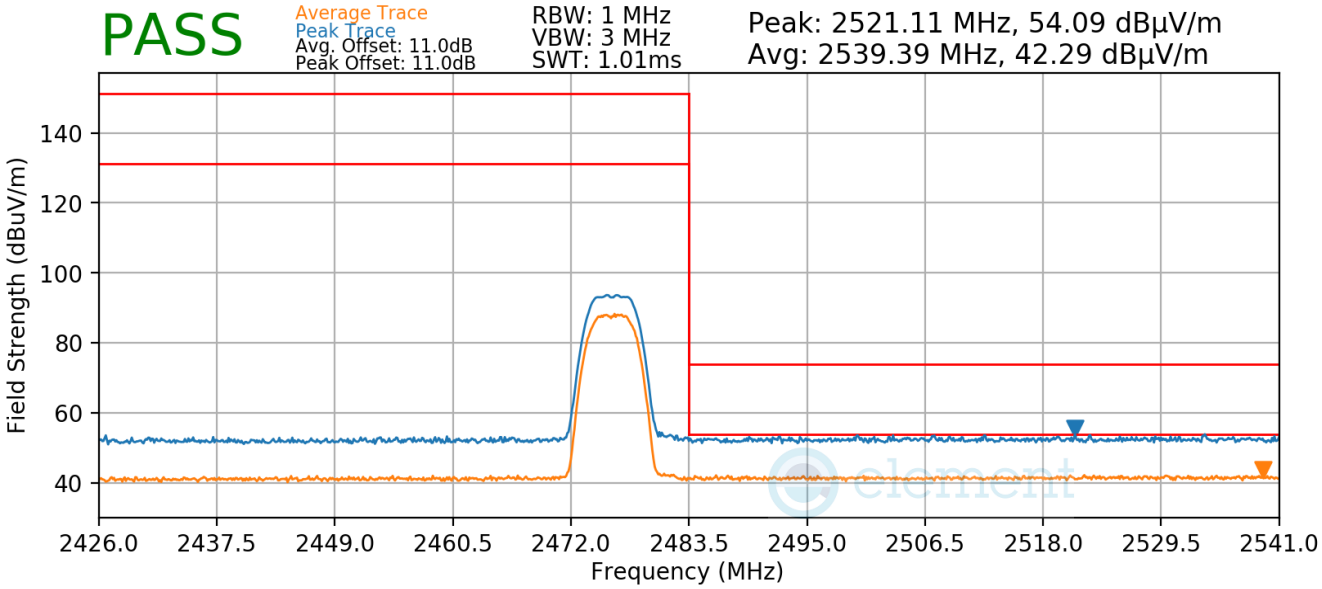
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR8
Data Rate:	8Mbps
Power Scheme:	iPA
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	73



Plot 7-128. Radiated Restricted Upper Band Edge Measurement NB UNII_L

Radiated Restricted Band Edge Measurements

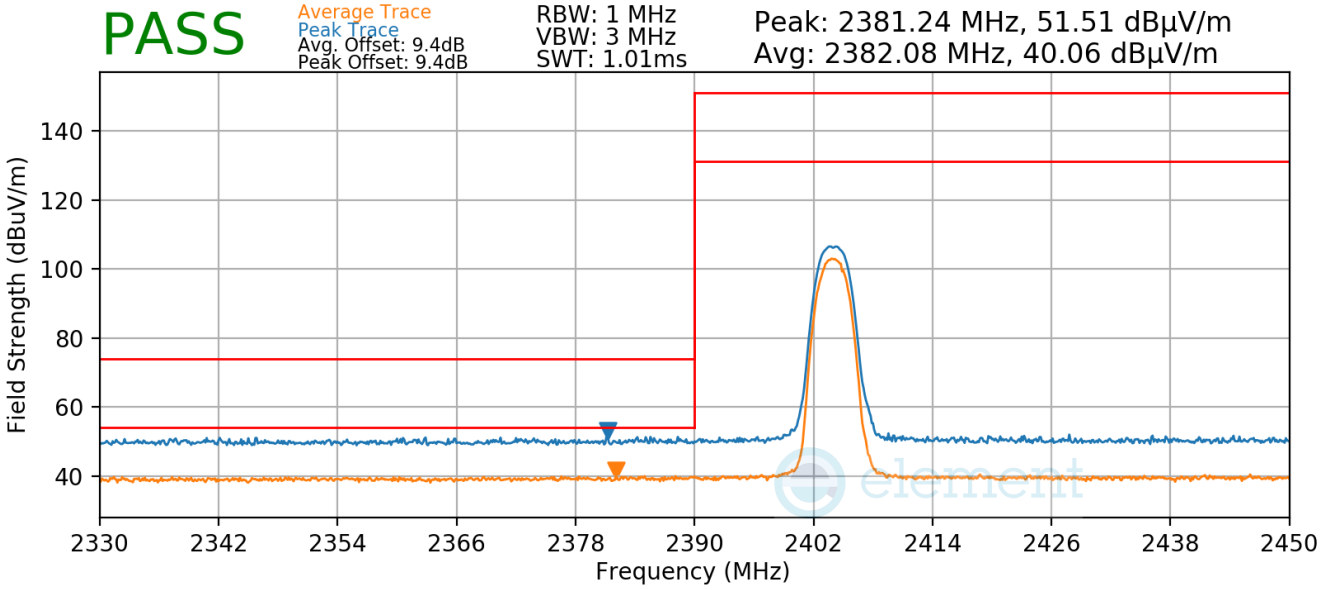
§15.205 §15.209; RSS-Gen [8.9]

TxBF

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR4
Data Rate:	4Mbps
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2404MHz
Channel:	1



Plot 7-129. Radiated Restricted Lower Band Edge Measurement TxBF

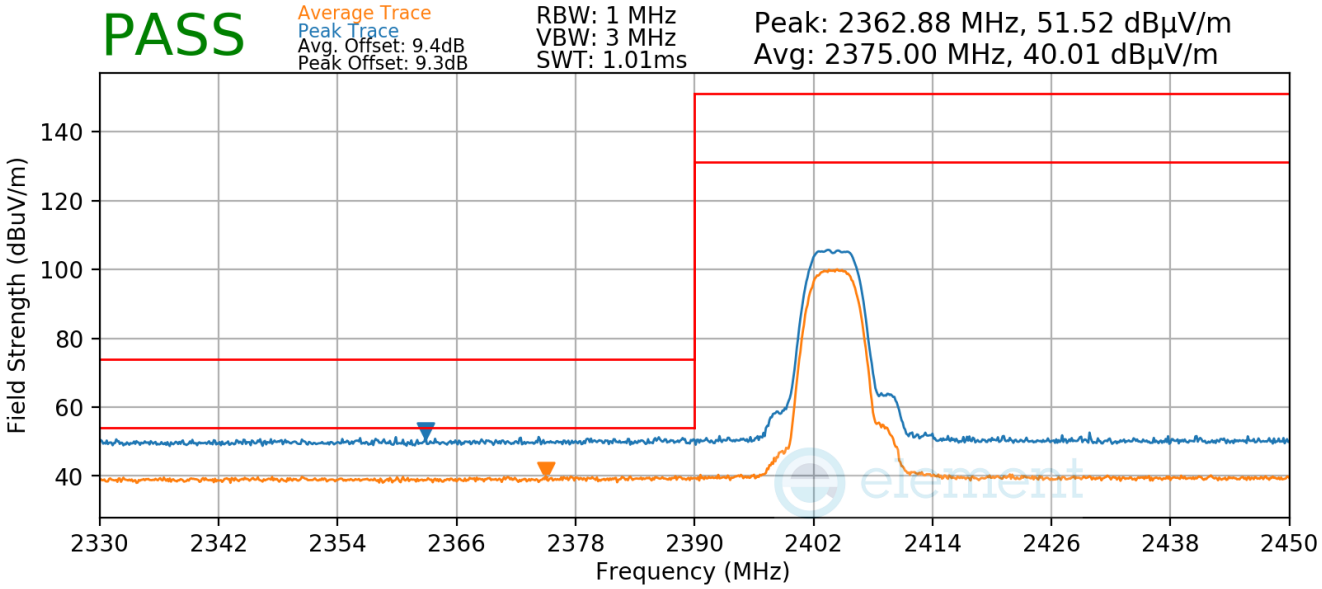
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR8
Data Rate:	8Mbps
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2404MHz
Channel:	1



Plot 7-130. Radiated Restricted Lower Band Edge Measurement TxBF

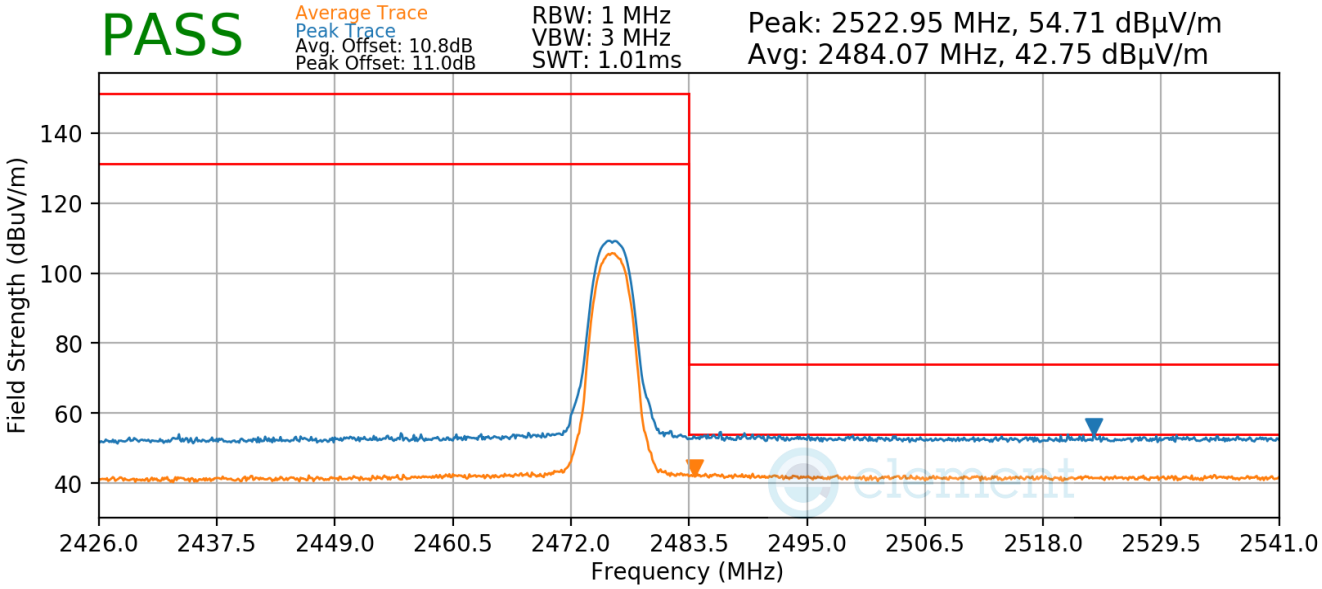
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR4
Data Rate:	4Mbps
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	73



Plot 7-131. Radiated Restricted Upper Band Edge Measurement TxBF

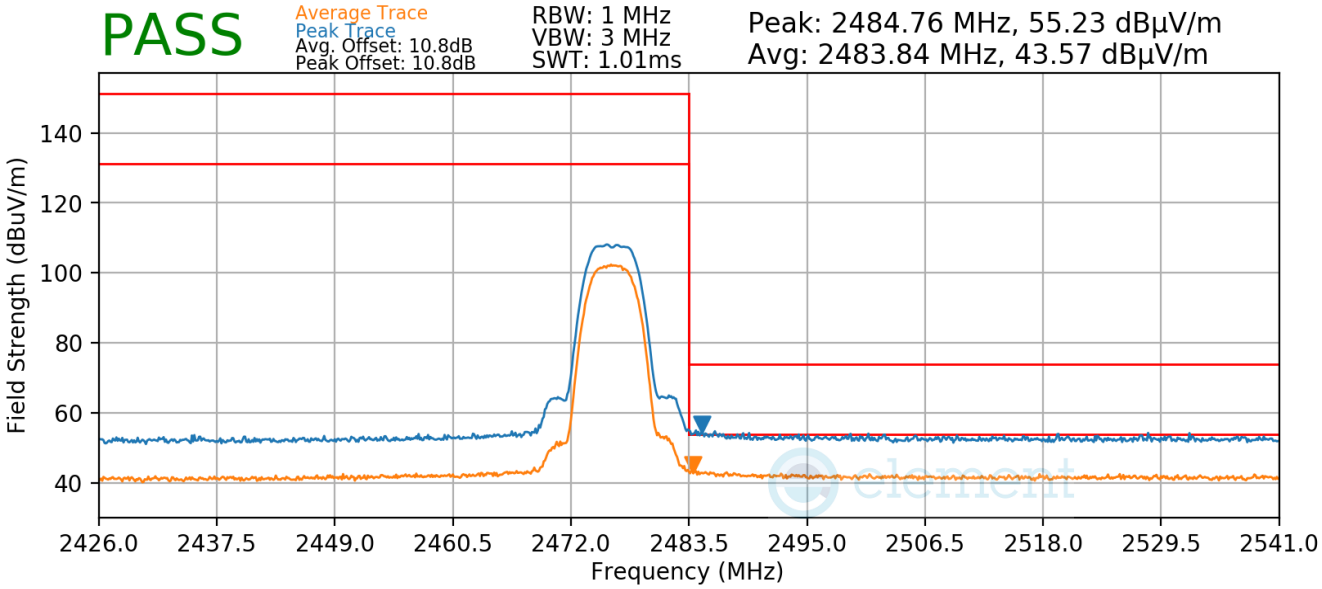
Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The amplitude offset shown in the following plots for average measurements was calculated using the formula:

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

Bluetooth Mode:	HDR8
Data Rate:	8Mbps
Power Scheme:	ePA
Measurement Distance:	3 Meters
Operating Frequency:	2476MHz
Channel:	73



Plot 7-132. Radiated Restricted Upper Band Edge Measurement TxBF

7.8 Radiated Spurious Emissions – Below 1GHz

§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 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 and Table 7 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-30 per Section 15.209 and RSS-Gen (8.9).

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

Table 7-30. Radiated Limits

Test Procedures Used

ANSI C63.10-2013

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 = 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.

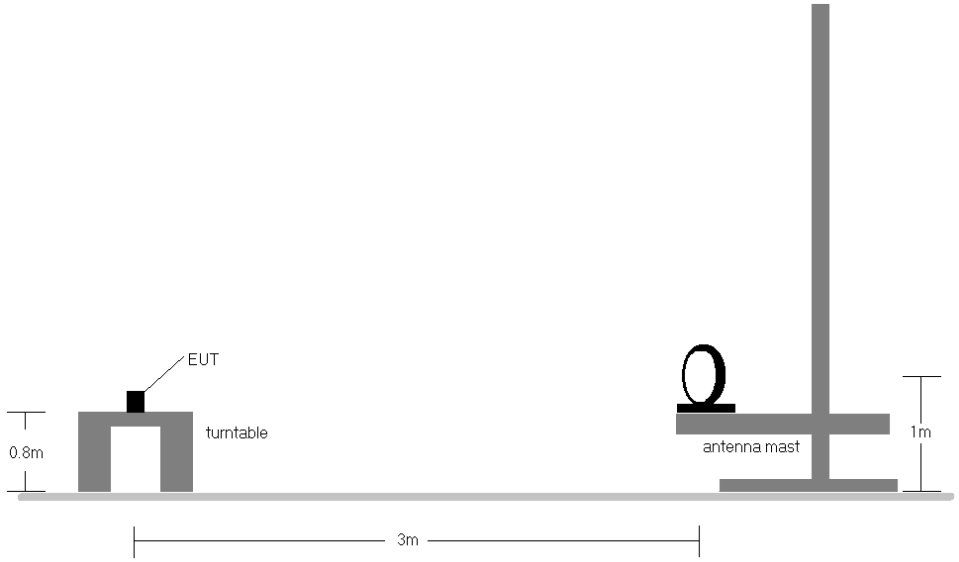


Figure 7-7. Radiated Test Setup < 30MHz

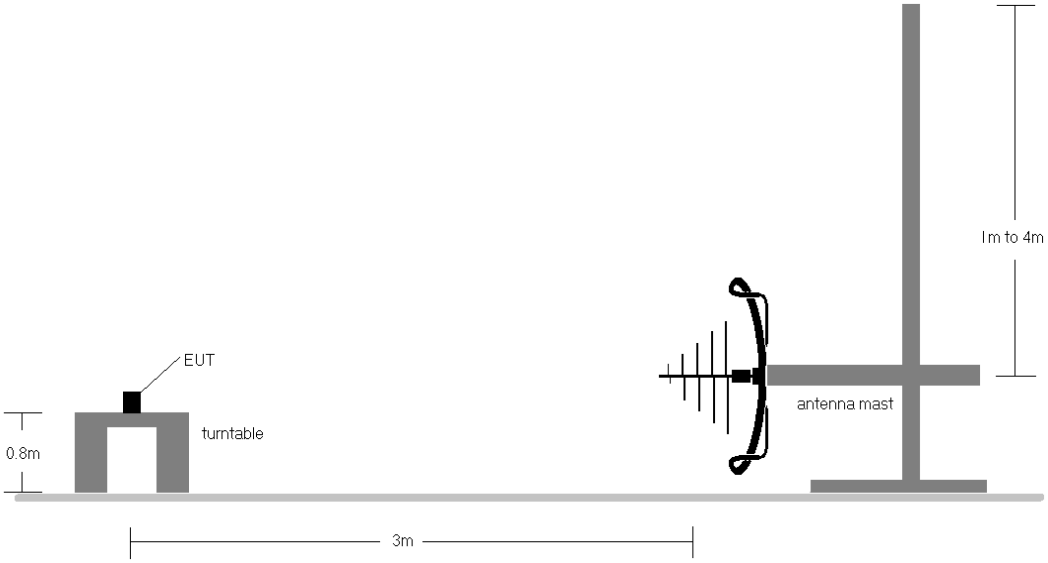


Figure 7-8. Radiated Test Setup < 1GHz

Test Notes

1. All emissions lying in restricted bands specified in §15.205 and RSS-Gen(8.10) are below the limit shown in Table 7-30.
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. All supported modulation, antenna (including TxBF mode) and power schemes have been tested on the unit and only worst case configuration is reported.
10. Both configurations below were investigated, and the worst case has been reported.
    a. EUT powered by AC/DC adaptor to USB-C Power Pack to Magnetic Charging Cable
    b. EUT powered by host PC via USB-C Power Pack to Magnetic Charging Cable

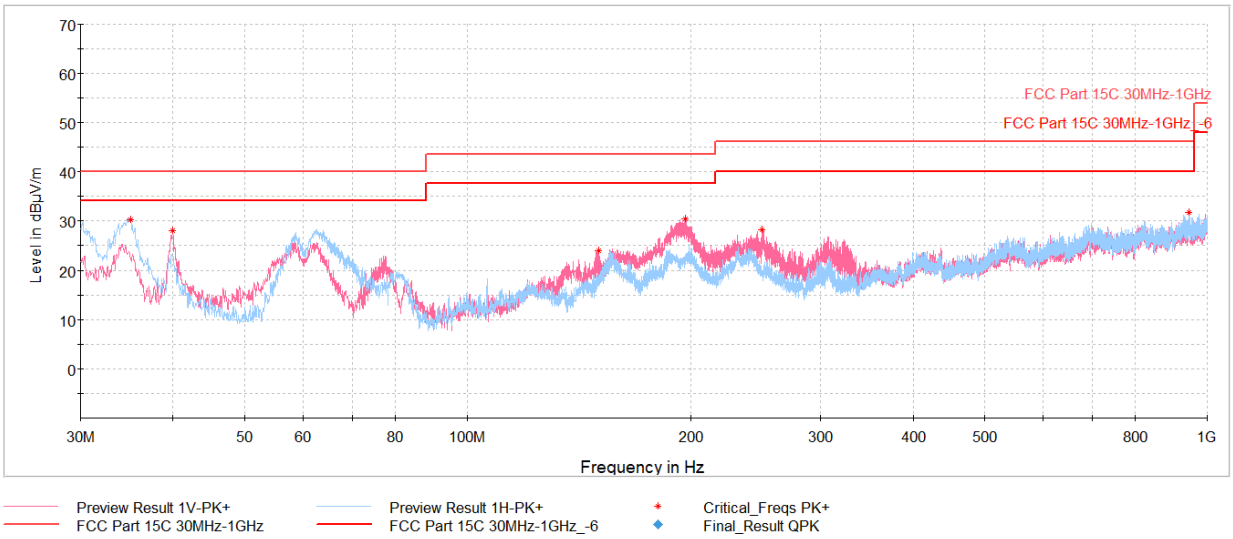
Sample Calculations

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 Spurious Emissions Measurements (Below 1GHz)
§15.209; RSS-Gen [8.9]

Ant2



Plot 7-133. Radiated Spurious Emissions Below 1GHz Ant2 (4Mbps, ePA – Ch.38 with AC/DC Adapter)

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]
35.09	Max Peak	H	200	177	-65.35	-11.39	30.26	40.00	-9.74
39.99	Max Peak	V	200	44	-64.85	-14.26	27.89	40.00	-12.11
150.43	Max Peak	V	300	146	-69.09	-13.82	24.09	43.52	-19.43
196.60	Max Peak	V	100	137	-63.40	-13.31	30.29	43.52	-13.23
249.75	Max Peak	V	100	195	-68.51	-10.26	28.23	46.02	-17.79
944.90	Max Peak	H	300	33	-80.06	4.72	31.66	46.02	-14.36

Table 7-31. Radiated Spurious Emissions Below 1GHz Ant2 (4Mbps, ePA – Ch.38 with AC/DC Adapter)

7.9 AC Line-Conducted Emissions Measurement

§15.207; RSS-Gen [8.8]

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 and RSS-Gen (8.8).

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

Table 7-32. Conducted Limits

*Decreases with the logarithm of the frequency.

Test Procedures Used

ANSI C63.10-2013 – Subclause 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.

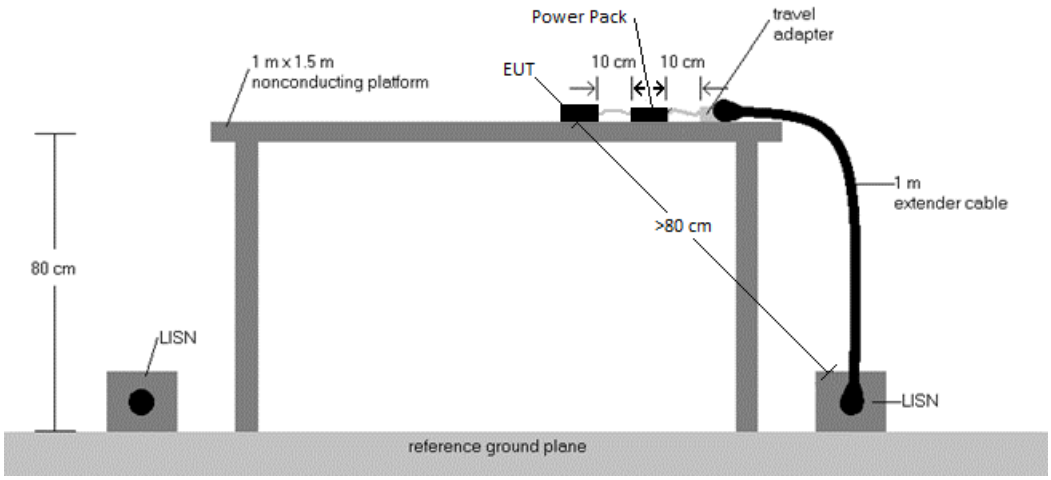
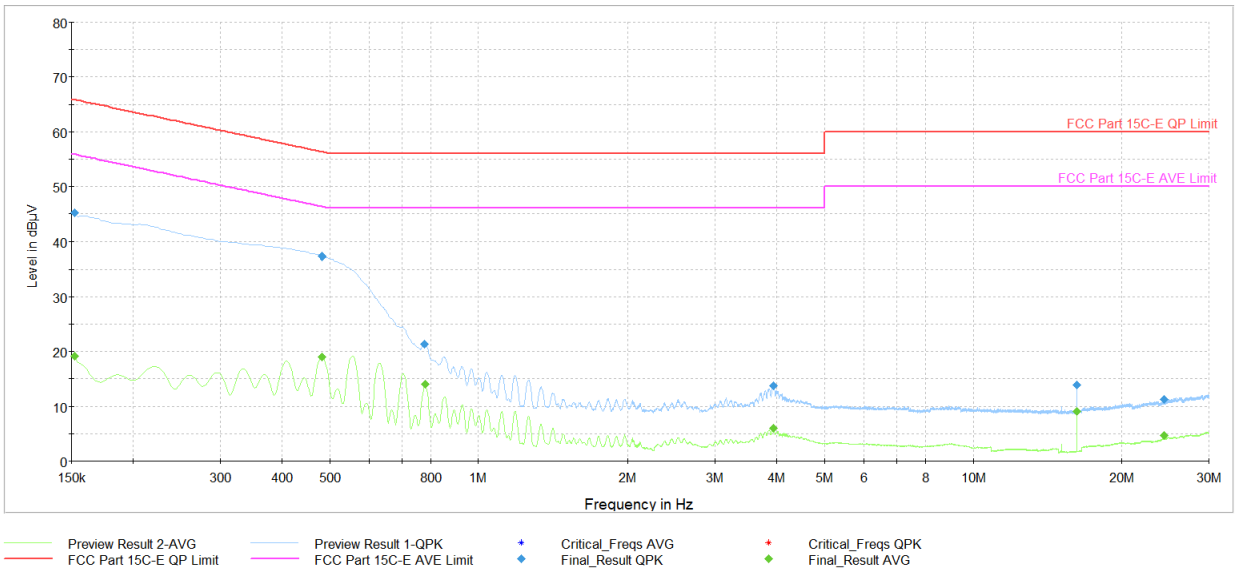


Figure 7-9. Test Instrument & Measurement Setup

Test Notes

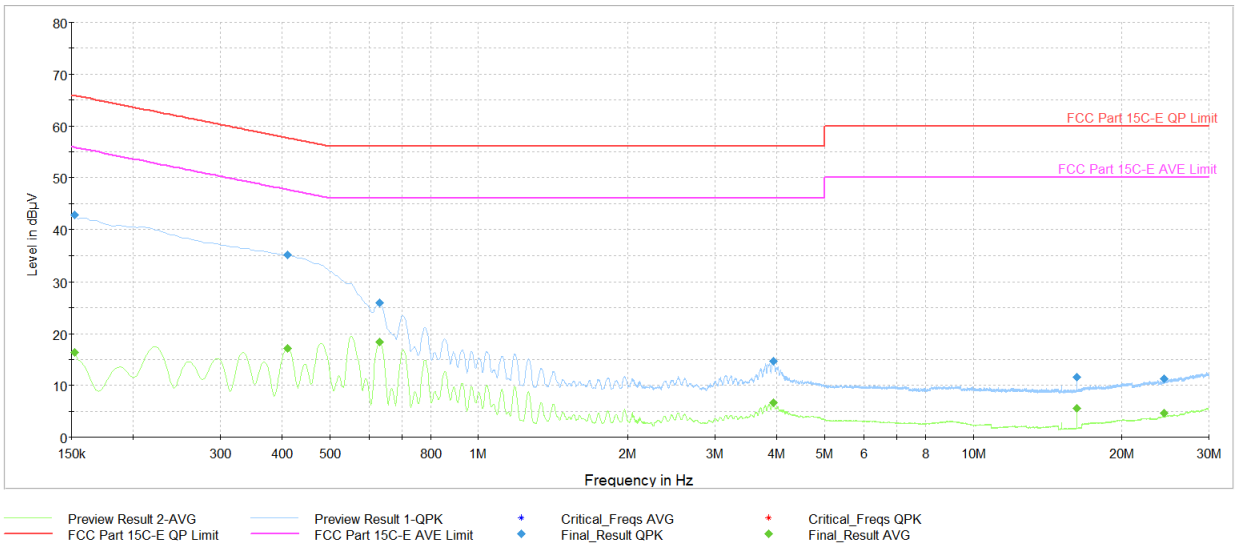
1. All modes of operation were investigated and the worst-case emissions are reported. The emissions found were not affected by the choice of channel used during testing.
2. Both configurations below were investigated, and the worst case has been reported.
   a. EUT powered by AC/DC adaptor to USB-C Power Pack to Magnetic Charging Cable
   b. EUT powered by host PC via USB-C Power Pack to Magnetic Charging Cable
3. The limit for an intentional radiator from 150kHz to 30MHz are specified in Part 15.207 and RSS-Gen(8.8).
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 plot are made using quasi peak and average detectors.
8. Deviations to the Specifications: None.



Plot 7-134. AC Line Conducted Plot with Bluetooth HDR Ant2 (L1, 4Mbps ePA - Ch.38 with AC/DC Adapter)

Frequency [MHz]	Process State	QuasiPeak [dBµV]	Average [dBµV]	Limit [dBµV]	Margin [dB]	Line	PE
0.152	FINAL	—	19.16	55.88	-36.71	L1	GND
0.152	FINAL	45.2	—	65.88	-20.66	L1	GND
0.483	FINAL	—	18.99	46.29	-27.30	L1	GND
0.483	FINAL	37.3	—	56.29	-19.02	L1	GND
0.778	FINAL	21.4	—	56.00	-34.59	L1	GND
0.780	FINAL	—	14.02	46.00	-31.98	L1	GND
3.944	FINAL	—	5.94	46.00	-40.06	L1	GND
3.948	FINAL	13.7	—	56.00	-42.26	L1	GND
16.213	FINAL	13.8	—	60.00	-46.16	L1	GND
16.213	FINAL	—	9.10	50.00	-40.90	L1	GND
24.320	FINAL	—	4.74	50.00	-45.26	L1	GND
24.320	FINAL	11.2	—	60.00	-48.77	L1	GND

Table 7-33. AC Line Conducted Data with Bluetooth HDR Ant2 (L1, 4Mbps ePA - Ch.38 with AC/DC Adapter)



Plot 7-135. AC Line Conducted Plot with Bluetooth HDR Ant2 (N, 4Mbps ePA - Ch.38 with AC/DC Adapter)

Frequency [MHz]	Process State	QuasiPeak [dBµV]	Average [dBµV]	Limit [dBµV]	Margin [dB]	Line	PE
0.152	FINAL	—	16.43	55.88	-39.44	N	GND
0.152	FINAL	42.7	—	65.88	-23.14	N	GND
0.411	FINAL	—	17.20	47.63	-30.43	N	GND
0.411	FINAL	35.1	—	57.63	-22.48	N	GND
0.632	FINAL	—	18.36	46.00	-27.64	N	GND
0.632	FINAL	25.9	—	56.00	-30.10	N	GND
3.944	FINAL	—	6.71	46.00	-39.29	N	GND
3.946	FINAL	14.7	—	56.00	-41.31	N	GND
16.217	FINAL	11.6	—	60.00	-48.38	N	GND
16.217	FINAL	—	5.54	50.00	-44.46	N	GND
24.326	FINAL	—	4.65	50.00	-45.35	N	GND
24.329	FINAL	11.2	—	60.00	-48.77	N	GND

Table 7-34. AC Line Conducted Data with Bluetooth HDR Ant2 (N, 4Mbps ePA - Ch.38 with AC/DC Adapter)

8.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Apple Head Mounted Device FCC ID: BCGA2117 and IC: 579C-A2117** is in compliance with Part 15 Subpart C (15.247) of the FCC Rules and RSS-247 of the Innovation, Science and Economic Development Canada Rules.