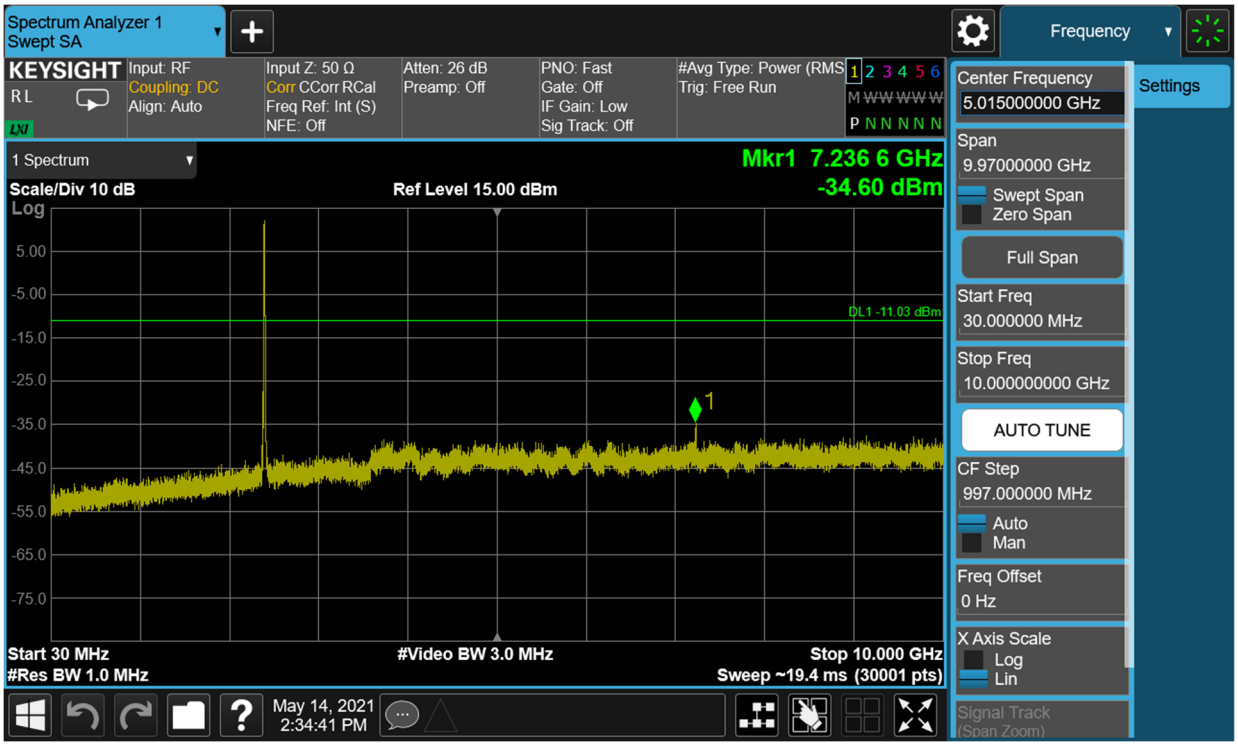
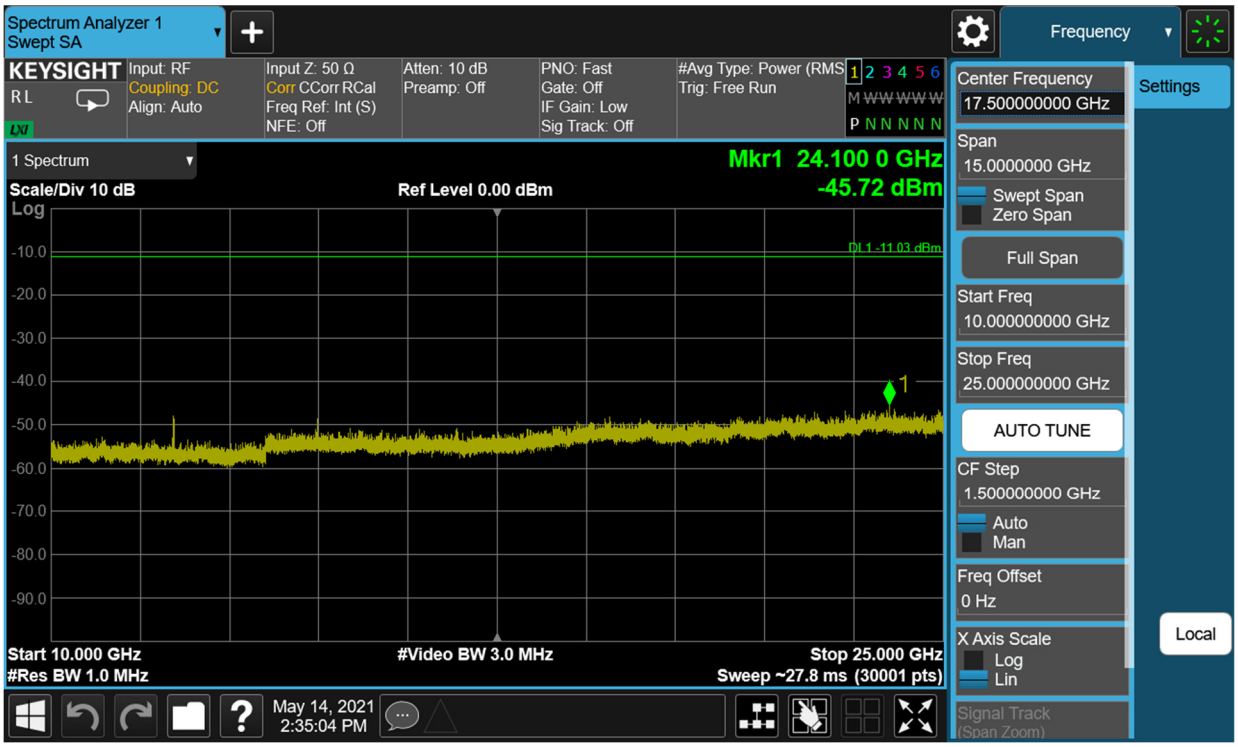
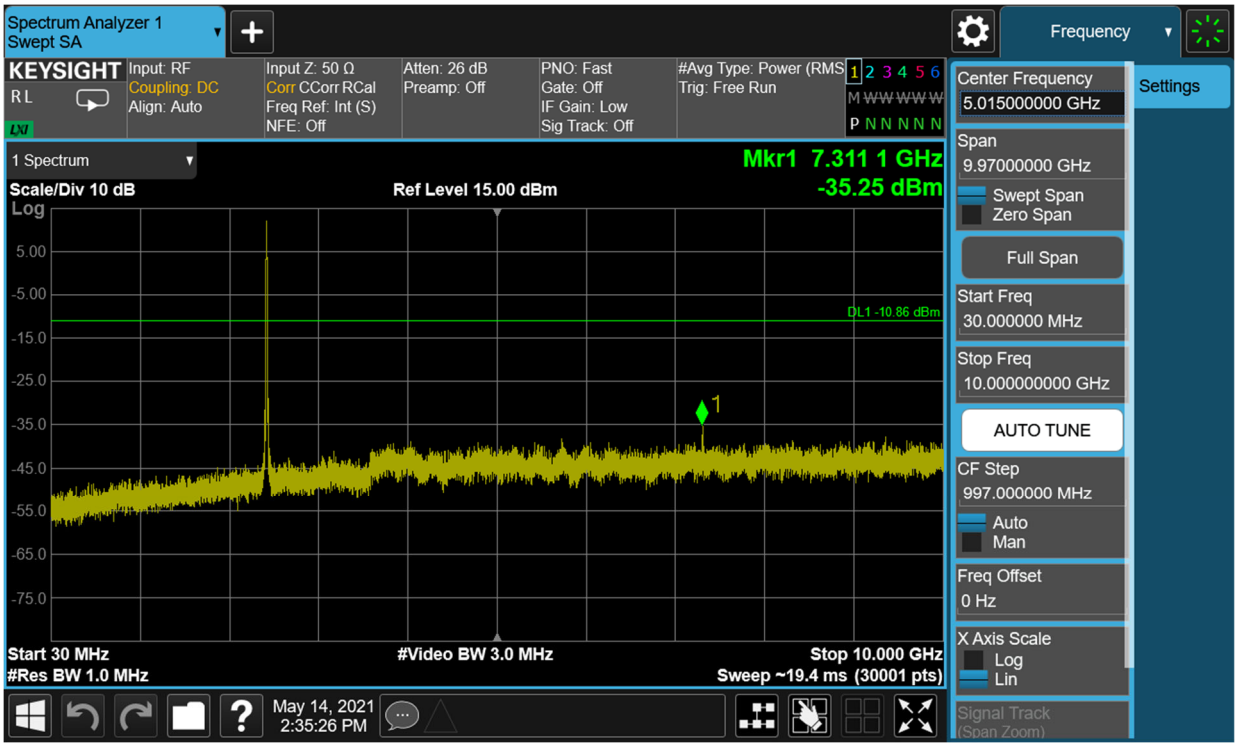
SISO Antenna-1 Conducted Spurious Emission



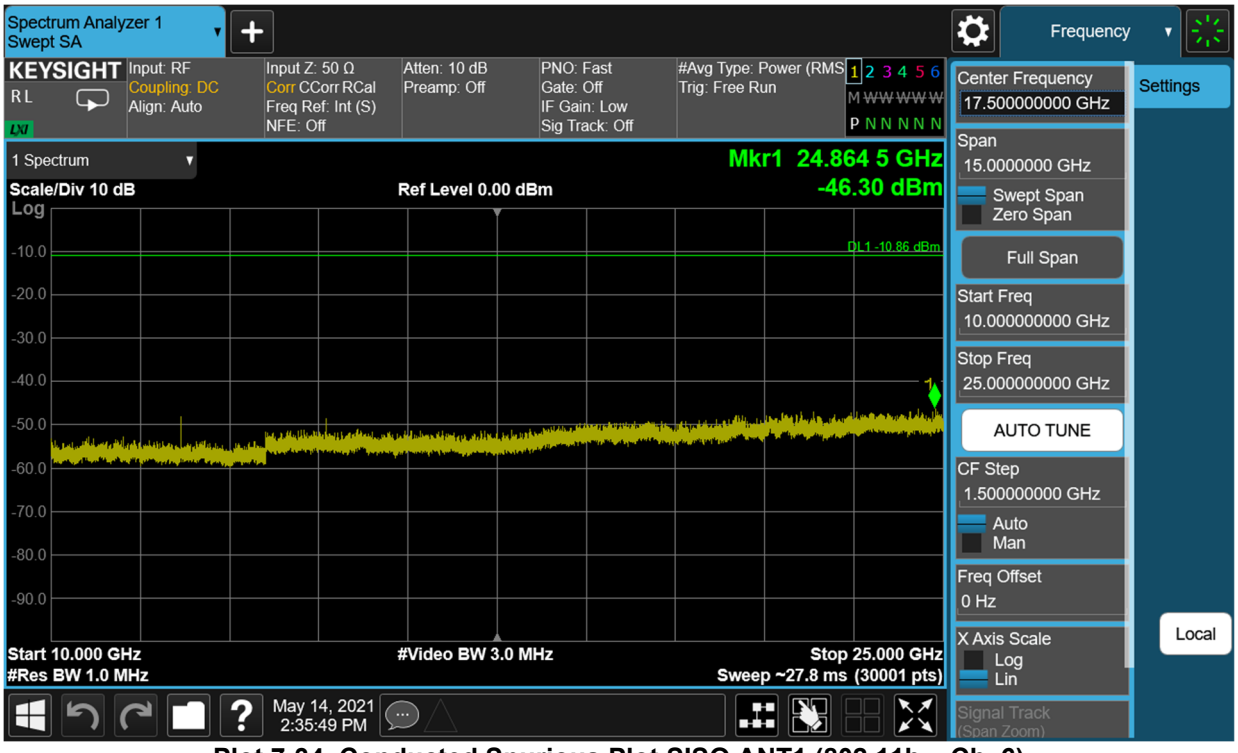
Plot 7-31. Conducted Spurious Plot SISO ANT1 (802.11b – Ch. 1)



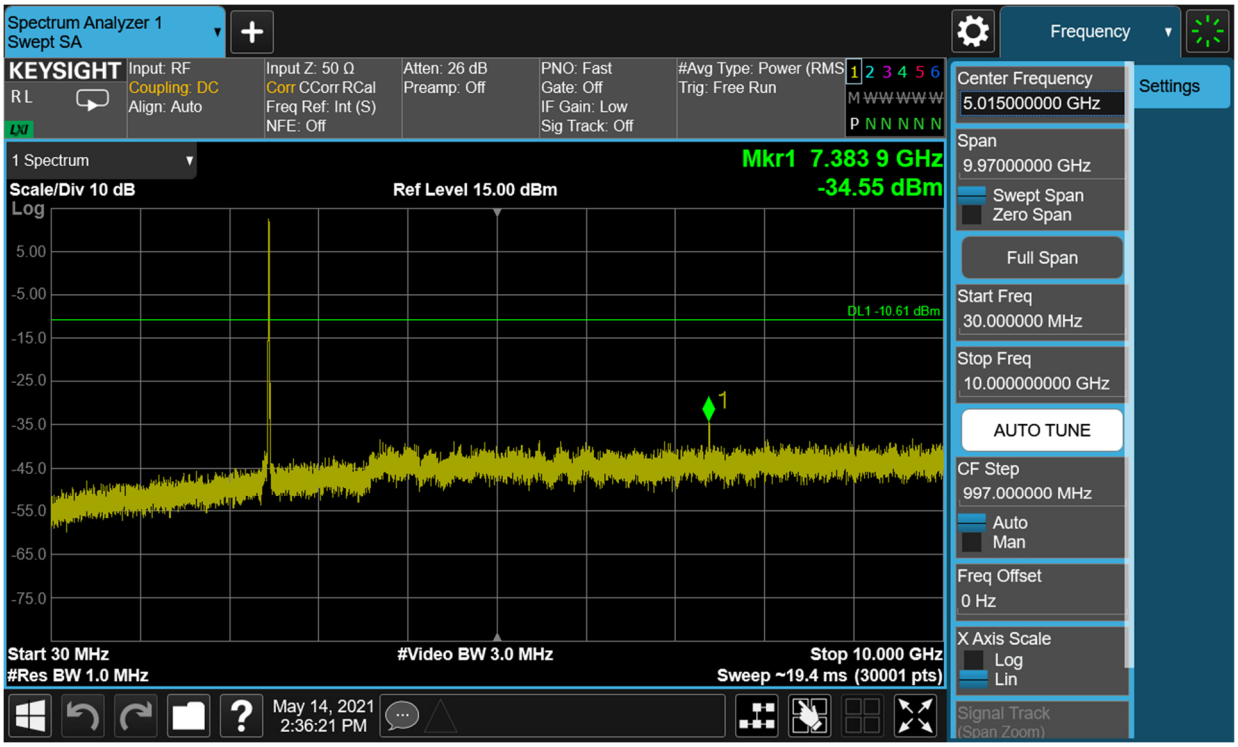
Plot 7-32. Conducted Spurious Plot SISO ANT1 (802.11b – Ch. 1)



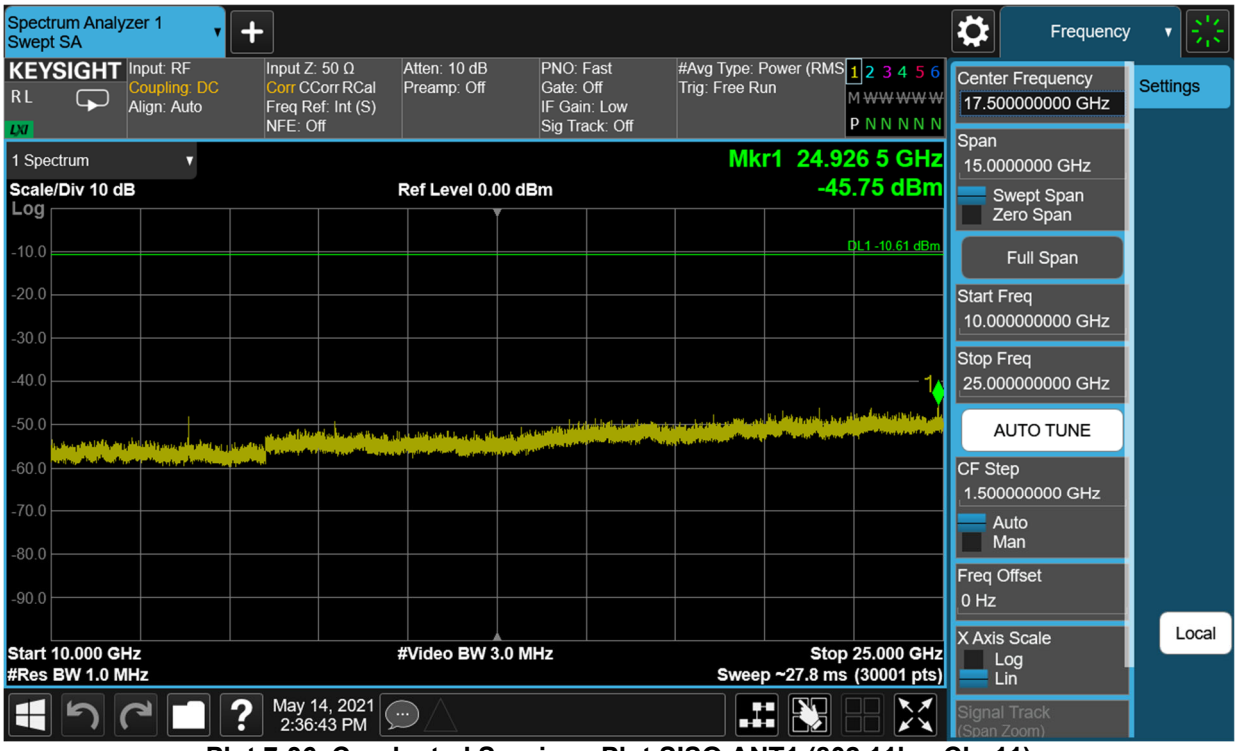
Plot 7-33. Conducted Spurious Plot SISO ANT1 (802.11b – Ch. 6)



Plot 7-34. Conducted Spurious Plot SISO ANT1 (802.11b – Ch. 6)



Plot 7-35. Conducted Spurious Plot SISO ANT1 (802.11b – Ch. 11)



Plot 7-36. Conducted Spurious Plot SISO ANT1 (802.11b – Ch. 11)

7.7 Radiated Spurious Emission Measurements – Above 1 GHz

§15.247(d) §15.205 & §15.209; RSS-Gen [8.9]

Test Overview and Limit

All out of band radiated spurious emissions are measured with a spectrum analyzer connected to a receive antenna while the EUT is operating at its maximum duty cycle, at 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 6 of RSS-Gen (8.10) must not exceed the limits shown in Table 7-7 per Section 15.209 and RSS-Gen (8.9).

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

Table 7-7. Radiated Limits

Test Procedures Used

ANSI C63.10-2013 – Section 6.6.4.3
KDB 558074 D01 v05 – Sections 8.6, 8.7

Test Settings

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = power average (RMS)
5. Number of measurement points = 1001 (Number of points must be ≥ 2 x span/RBW)
6. Sweep time = auto
7. Trace (RMS) averaging was performed over at least 100 traces

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = peak
5. Sweep time = auto couple
6. Trace mode = max hold
7. Trace was allowed to stabilize

Test Setup

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

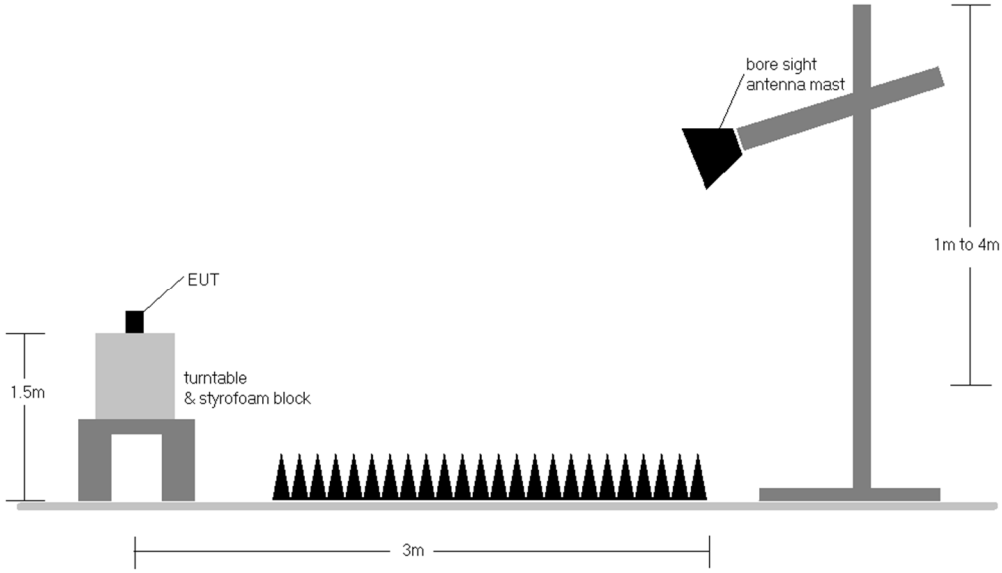


Figure 7-6. Test Instrument & Measurement Setup

Test Notes

1. The optional test procedures for antenna port conducted measurements of unwanted emissions per the guidance of KDB 558074 D01 v05 were not used to evaluate this device for compliance to radiated limits. All radiated spurious emissions levels were measured in a radiated test setup.
2. All emissions lying in restricted bands specified in Section 15.205 and Section 8.10 of RSS-Gen are below the limit shown in Table 7-7.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. N/A
5. The spectrum is measured from 9kHz to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHz. Above 1 GHz, average and peak measurements were taken using linearly polarized horn antennas. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
6. Emissions below 18GHz were measured at a 3 meter test distance while emissions above 18GHz were measured at a 1 meter test distance with the application of a distance correction factor.
7. Radiated spurious emissions were investigated while operating in MIMO mode, however, it was determined that single antenna operation produced the worst case emissions. Since the emissions produced from MIMO operation were found to be more than 20dB below the limit, the MIMO emissions are not reported.

8. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. Any emissions found to be within 20dB of the limit are fully investigated and the results are shown in this section.
9. The "-" shown in the following RSE tables are used to denote a noise floor measurement.

Sample Calculations

Determining Spurious Emissions Levels

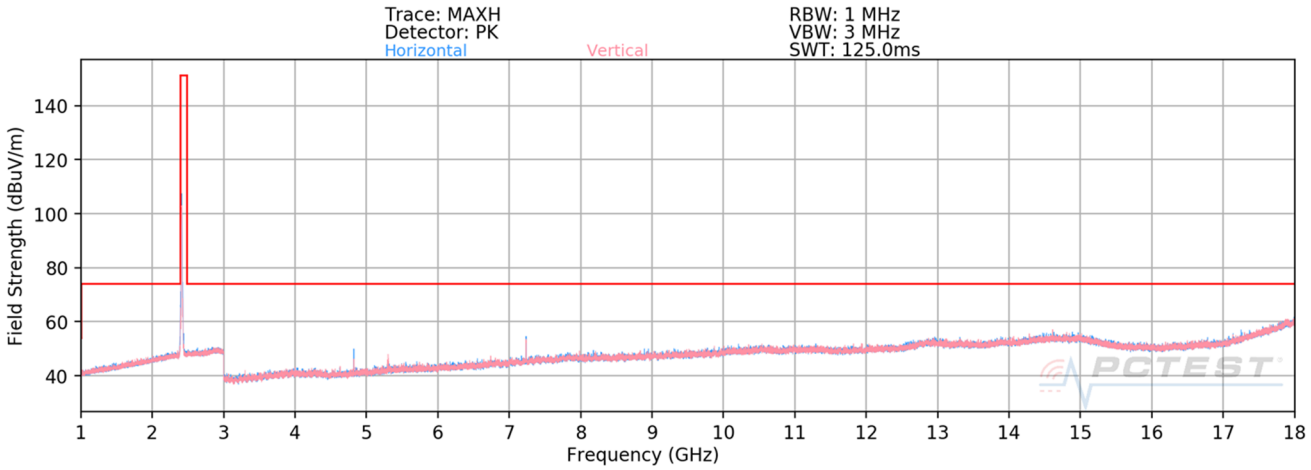
- Field Strength Level $_{[dB\mu V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB/m]}$
- AFCL $_{[dB/m]}$ = Antenna Factor $_{[dB/m]}$ + Cable Loss $_{[dB]}$
- Margin $_{[dB]}$ = Field Strength Level $_{[dB\mu V/m]}$ – Limit $_{[dB\mu V/m]}$

Radiated Band Edge Measurement Offset

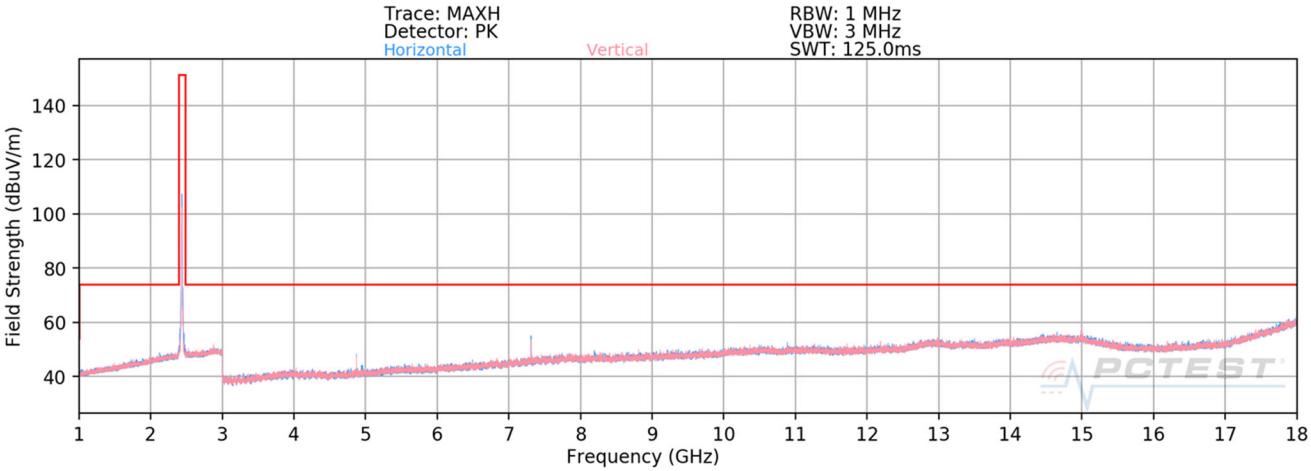
- The amplitude offset shown in the radiated restricted band edge plots in Section 7.7 was calculated using the formula:
  Offset (dB) = (Antenna Factor + Cable Loss + Attenuator) – Preamplifier Gain

7.7.1 SISO Antenna-1 Radiated Spurious Emission Measurements

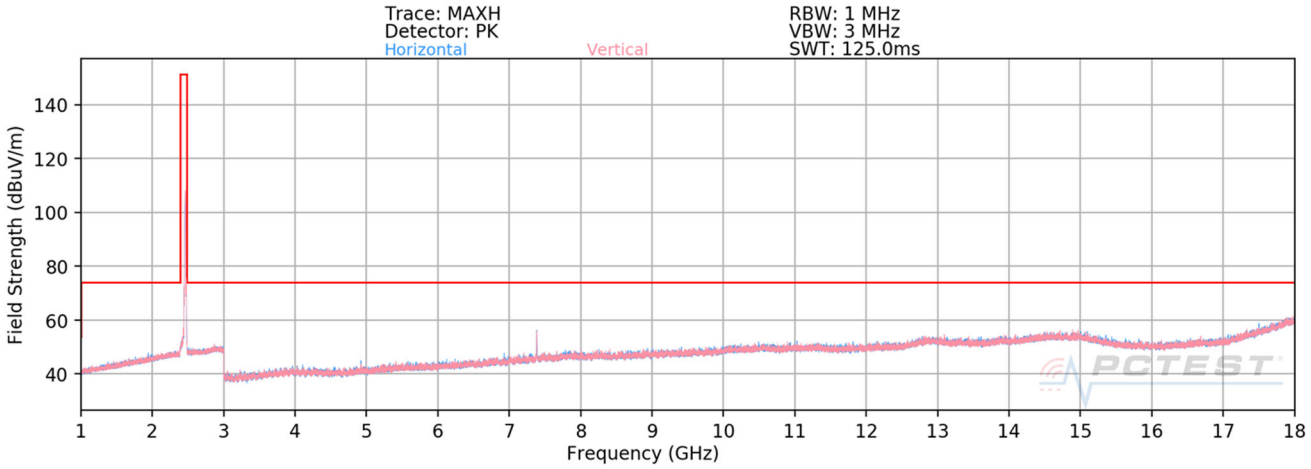
§15.247(d) §15.205 & §15.209; RSS-Gen [8.9]



Plot 7-37. Radiated Spurious Plot above 1GHz SISO ANT1 (802.11b – Ch. 1)



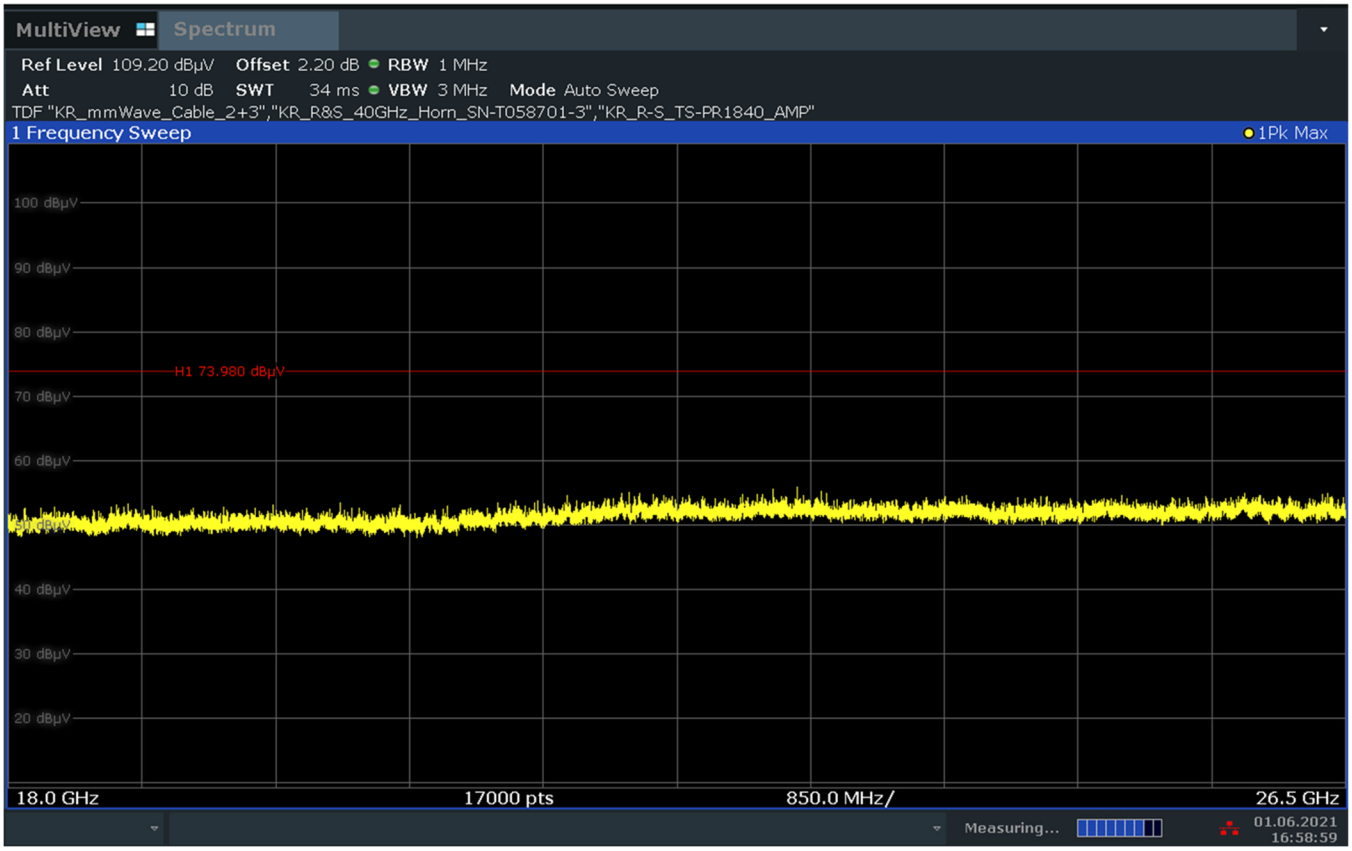
Plot 7-38. Radiated Spurious Plot above 1GHz SISO ANT1 (802.11b – Ch. 6)



Plot 7-39. Radiated Spurious Plot above 1GHz SISO ANT1 (802.11b – Ch. 11)

SISO Antenna-1 Radiated Spurious Emissions Measurements (Above 18GHz)

§15.209; RSS-Gen [8.9]



Plot 7-40. Radiated Spurious Plot above 18GHz SISO ANT1

SISO Antenna-1 Radiated Spurious Emission Measurements

§15.247(d) §15.205 & §15.209; RSS-Gen [8.9]

Worst Case Mode:	802.11b
Worst Case Transfer Rate:	1 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2412MHz
Channel:	01

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]
4824.00	Avg	H	105	27	-76.65	2.18	32.53	53.98	-21.45
4824.00	Peak	H	105	27	-66.73	2.18	42.45	73.98	-31.53
12060.00	Avg	H	-	-	-82.09	15.07	39.98	53.98	-14.00
12060.00	Peak	H	-	-	-72.10	15.07	49.97	73.98	-24.01

Table 7-8. Radiated Measurements SISO ANT1

Worst Case Mode:	802.11b
Worst Case Transfer Rate:	1 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2437MHz
Channel:	06

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]
4874.00	Avg	H	130	31	-73.55	2.73	36.18	53.98	-17.80
4874.00	Peak	H	130	31	-66.42	2.73	43.31	73.98	-30.67
7311.00	Avg	H	103	48	-66.62	8.46	48.84	53.98	-5.14
7311.00	Peak	H	103	48	-61.30	8.46	54.16	73.98	-19.82
12185.00	Avg	H	-	-	-82.00	15.55	40.55	53.98	-13.43
12185.00	Peak	H	-	-	-71.93	15.55	50.62	73.98	-23.36

Table 7-9. Radiated Measurements SISO ANT1

Worst Case Mode:	802.11b
Worst Case Transfer Rate:	1 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2462MHz
Channel:	11

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]
4924.00	Avg	H	100	44	-73.34	2.70	36.36	53.98	-17.62
4924.00	Peak	H	100	44	-65.56	2.70	44.14	73.98	-29.84
7386.00	Avg	H	100	49	-65.66	8.87	50.21	53.98	-3.77
7386.00	Peak	H	100	49	-60.44	8.87	55.43	73.98	-18.55
12310.00	Avg	H	-	-	-81.96	15.62	40.66	53.98	-13.32
12310.00	Peak	H	-	-	-72.06	15.62	50.56	73.98	-23.42

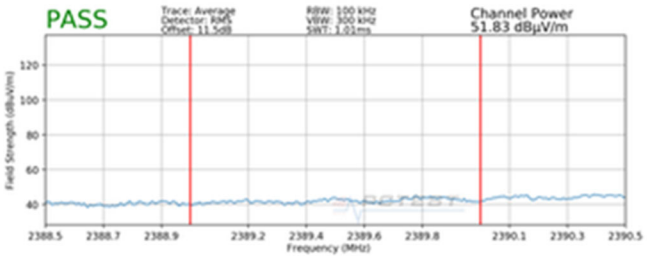
Table 7-10. Radiated Measurements SISO ANT1

7.7.2 SISO Antenna-1 Radiated Restricted Band Edge Measurements

§15.205 §15.209; RSS-Gen [8.9]

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting.

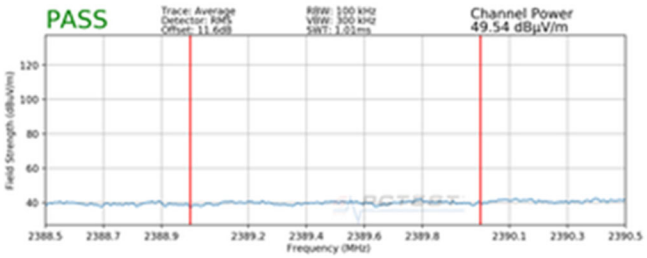
Worst Case Mode:	802.11g
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2412MHz
Channel:	1



Plot 7-41. Radiated Restricted Lower Band Edge Measurement SISO ANT1 (Average)

Plot 7-42. Radiated Restricted Lower Band Edge Measurement SISO ANT1 (Peak)

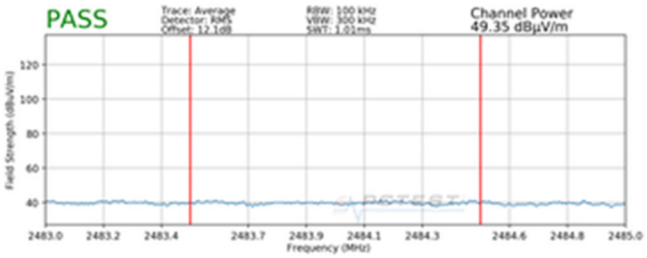
Worst Case Mode:	802.11n
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	2417MHz
Channel:	2



Plot 7-43. Radiated Restricted Lower Band Edge Measurement SISO ANT1 (Average)

Plot 7-44. Radiated Restricted Lower Band Edge Measurement SISO ANT1 (Peak)

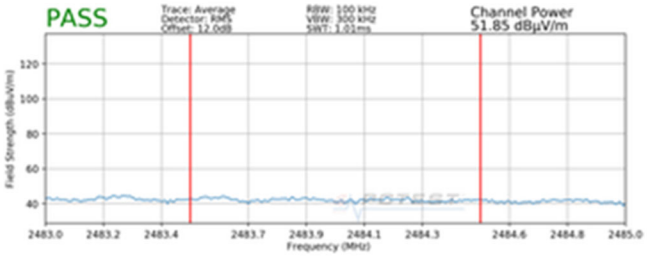
Worst Case Mode:	802.11n
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	2452MHz
Channel:	9



Plot 7-45. Radiated Restricted Upper Band Edge Measurement SISO ANT1 (Average)

Plot 7-46. Radiated Restricted Upper Band Edge Measurement SISO ANT1 (Peak)

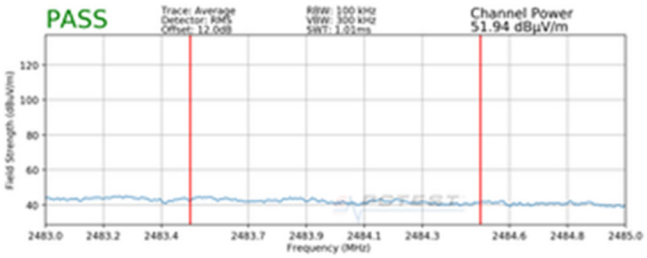
Worst Case Mode:	802.11g
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2457MHz
Channel:	10



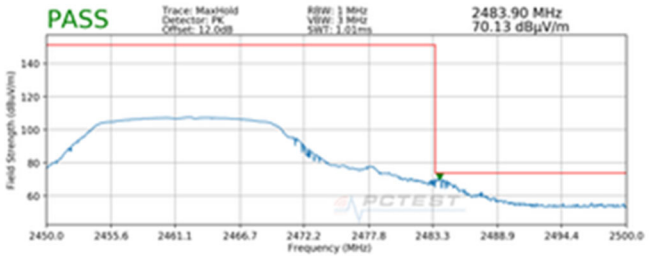
Plot 7-47. Radiated Restricted Upper Band Edge Measurement SISO ANT1 (Average)

Plot 7-48. Radiated Restricted Upper Band Edge Measurement SISO ANT1 (Peak)

Worst Case Mode:	802.11g
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2462MHz
Channel:	11

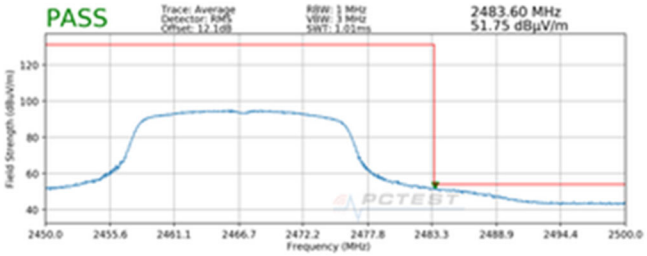


Plot 7-49. Radiated Restricted Upper Band Edge Measurement SISO ANT1 (Average)

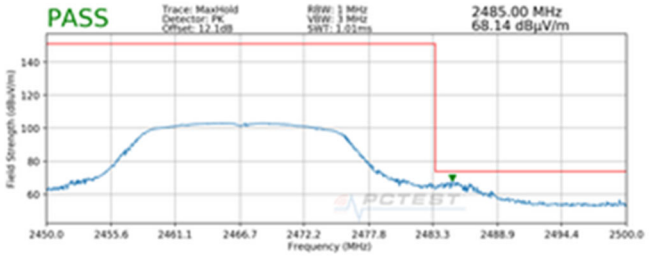


Plot 7-50. Radiated Restricted Upper Band Edge Measurement SISO ANT1 (Peak)

Worst Case Mode:	802.11n
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	2467MHz
Channel:	12

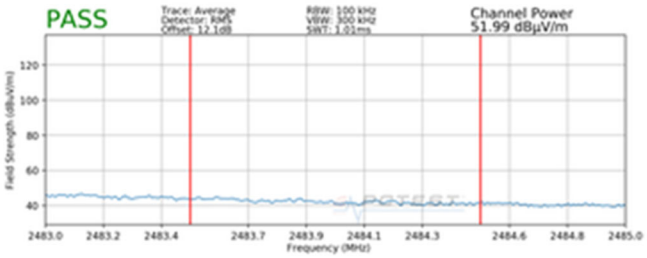


Plot 7-51. Radiated Restricted Upper Band Edge Measurement SISO ANT1 (Average)

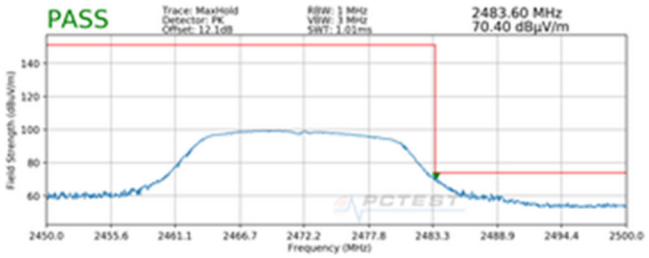


Plot 7-52. Radiated Restricted Upper Band Edge Measurement SISO ANT1 (Peak)

Worst Case Mode:	802.11n
Worst Case Transfer Rate:	MCS0
Distance of Measurements:	3 Meters
Operating Frequency:	2472MHz
Channel:	13



Plot 7-53. Radiated Restricted Upper Band Edge Measurement SISO ANT1 (Average)



Plot 7-54. Radiated Restricted Upper Band Edge Measurement SISO ANT1 (Peak)

7.8 Line-Conducted Test Data

§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 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 7-11. Conducted Limits

*Decreases with the logarithm of the frequency.

Test Procedures Used

ANSI C63.10-2013, Section 6.2

Test Settings

Quasi-Peak Field Strength 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 Field Strength 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.

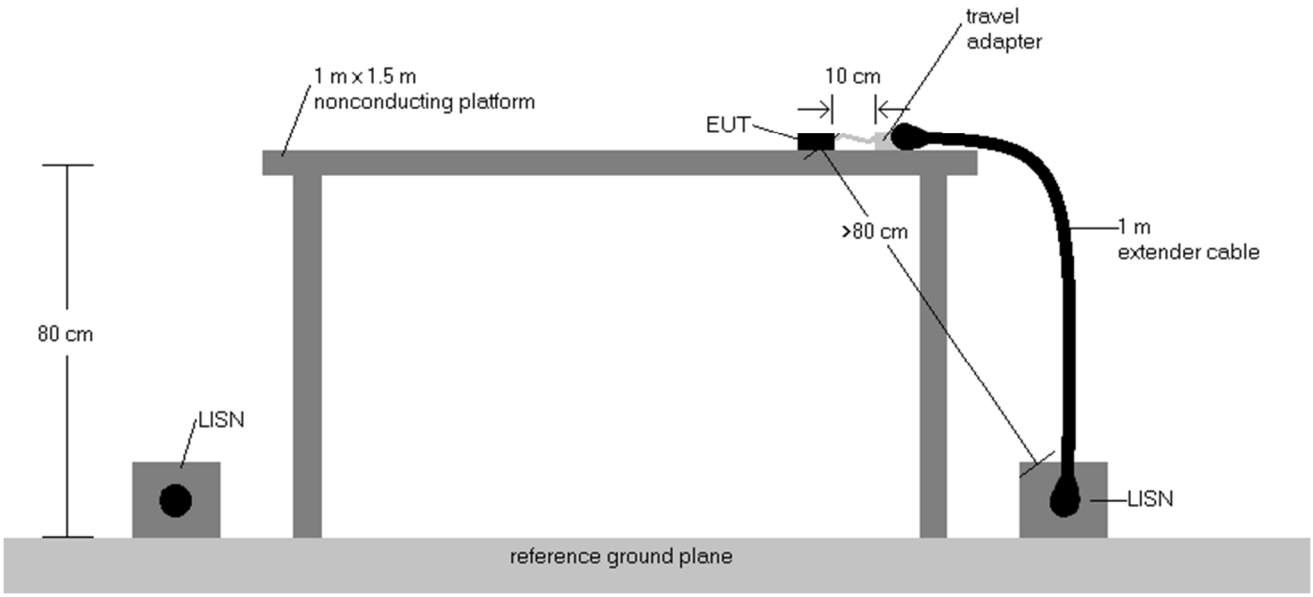
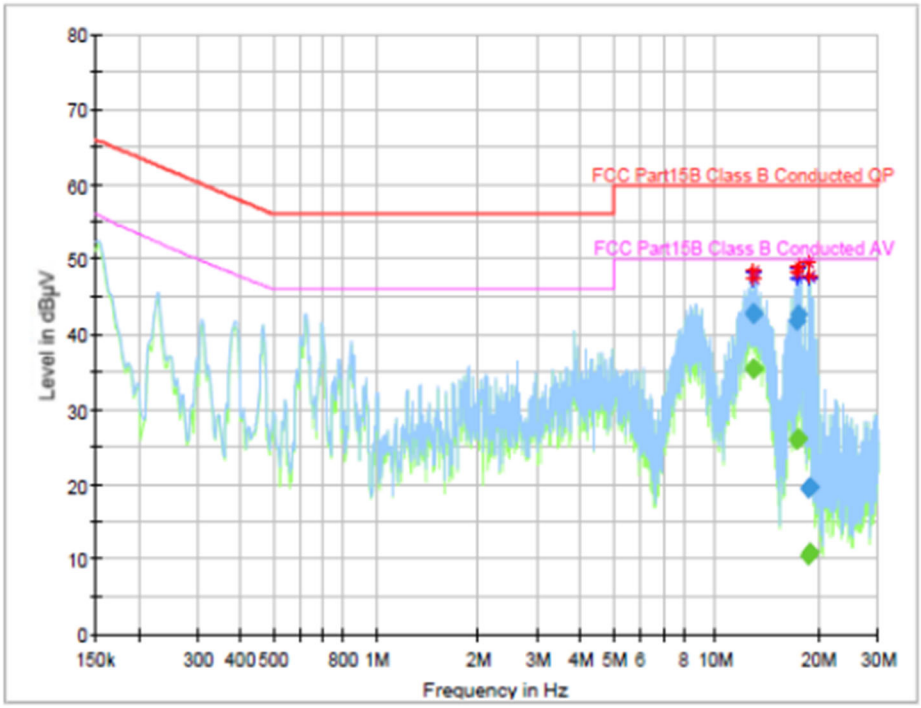


Figure 7-7. Test Instrument & Measurement Setup

Test Notes

1. All modes of operation were investigated and the worst-case emissions are reported using mid channel. The emissions found were not affected by the choice of channel used during testing.
2. The limit for an intentional radiator from 150kHz to 30MHz are specified in Part 15.207 and RSS-Gen(8.8).
3. Corr. (dB) = Cable loss (dB) + LISN insertion factor (dB)
4. QP/AV Level (dBμV) = QP/AV Analyzer/Receiver Level (dBμV) + Corr. (dB)
5. Margin (dB) = QP/AV Limit (dBμV) - QP/AV Level (dBμV)
6. Traces shown in plot are made using a peak detector.
7. Deviations to the Specifications: None.

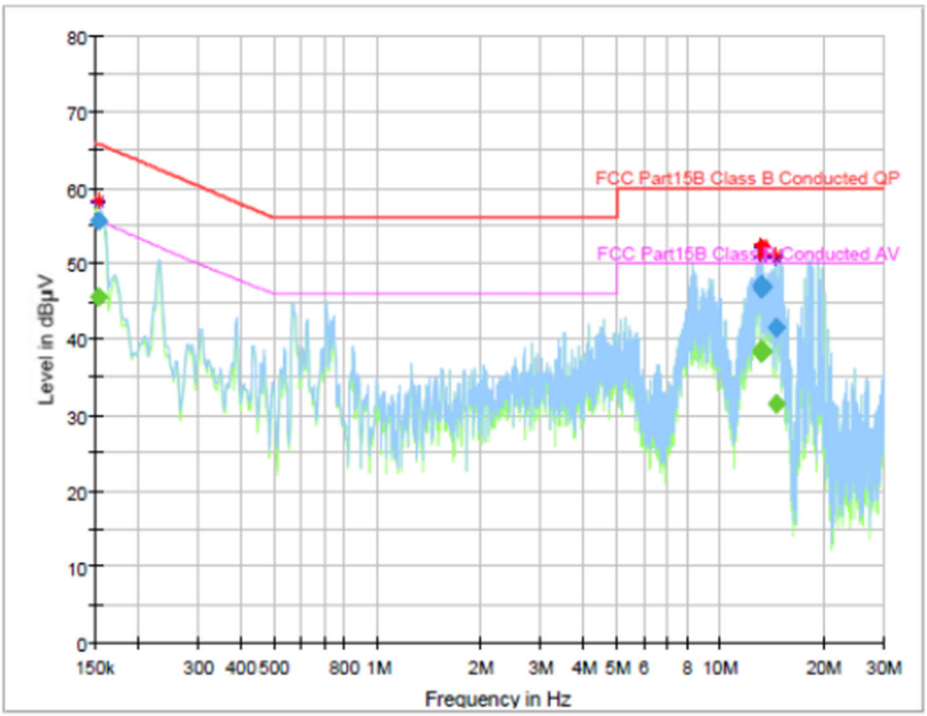


Plot 7-55. Line Conducted Plot with 802.11b (L1)

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
12.878040	---	35.26	50.00	14.74	1000.0	9.000	L1	10.0
12.878040	42.63	---	60.00	17.37	1000.0	9.000	L1	10.0
12.928785	---	35.45	50.00	14.55	1000.0	9.000	L1	10.0
12.928785	42.92	---	60.00	17.08	1000.0	9.000	L1	10.0
17.292855	---	25.85	50.00	24.15	1000.0	9.000	L1	10.0
17.292855	41.71	---	60.00	18.29	1000.0	9.000	L1	10.0
17.528670	---	26.04	50.00	23.96	1000.0	9.000	L1	10.0
17.528670	42.67	---	60.00	17.33	1000.0	9.000	L1	10.0
18.651030	---	10.59	50.00	39.41	1000.0	9.000	L1	10.0
18.651030	19.37	---	60.00	40.63	1000.0	9.000	L1	10.0
18.833115	---	11.04	50.00	38.96	1000.0	9.000	L1	10.0
18.833115	19.66	---	60.00	40.34	1000.0	9.000	L1	10.0

Table 7-12. Line Conducted Data with 802.11b (L1)



Plot 7-56. Line Conducted Plot with 802.11b (N)

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.152985	—	45.49	55.82	10.33	1000.0	9.000	N	9.7
0.152985	55.61	—	65.84	10.22	1000.0	9.000	N	9.7
13.125795	—	38.57	50.00	11.43	1000.0	9.000	N	10.0
13.125795	47.08	—	60.00	12.92	1000.0	9.000	N	10.0
13.194450	—	38.12	50.00	11.88	1000.0	9.000	N	10.0
13.194450	46.63	—	60.00	13.37	1000.0	9.000	N	10.0
13.242210	—	38.47	50.00	11.53	1000.0	9.000	N	10.0
13.242210	47.10	—	60.00	12.90	1000.0	9.000	N	10.0
13.284000	—	38.50	50.00	11.50	1000.0	9.000	N	10.0
13.284000	46.83	—	60.00	13.17	1000.0	9.000	N	10.0
14.597400	—	31.43	50.00	18.57	1000.0	9.000	N	10.0
14.597400	41.56	—	60.00	18.44	1000.0	9.000	N	10.0

Table 7-13. Line Conducted Data with 802.11b (N)

8.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMA127FN** is in compliance with Part 15 Subpart C (15.247) of the FCC Rules.