7.5 Conducted Emissions at the Band Edge

§15.247(d)

Test Overview and Limit

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. For the following out of band conducted spurious emissions plots at the band edge, the EUT was set at a data rate of 1Mbps for "b" mode, 6 Mbps for "g" mode, and 6.5/7.2Mbps for "n" mode as these settings produced the worst-case emissions.

The limit for out-of-band spurious emissions at the band edge is 30dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth per the PSD procedure (Section 7.4).

Test Procedure Used

KDB 558074 D01 v04 – Section 11.3

Test Settings

1. Start and stop frequency were set such that the band edge would be placed in the center of the plot
2. Span was set large enough so as to capture all out of band emissions near the band edge
3. RBW = 100kHz
4. VBW = 1MHz
5. Detector = Peak
6. Number of sweep points ≥ 2 x Span/RBW
7. Trace mode = max hold
8. Sweep time = auto couple
9. The trace was allowed to stabilize

Test Setup

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

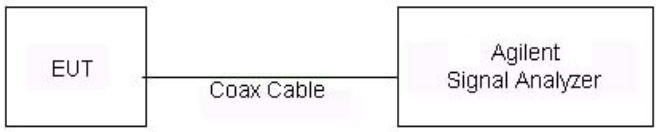

Figure 7-4. Test Instrument & Measurement Setup

Test Notes

None

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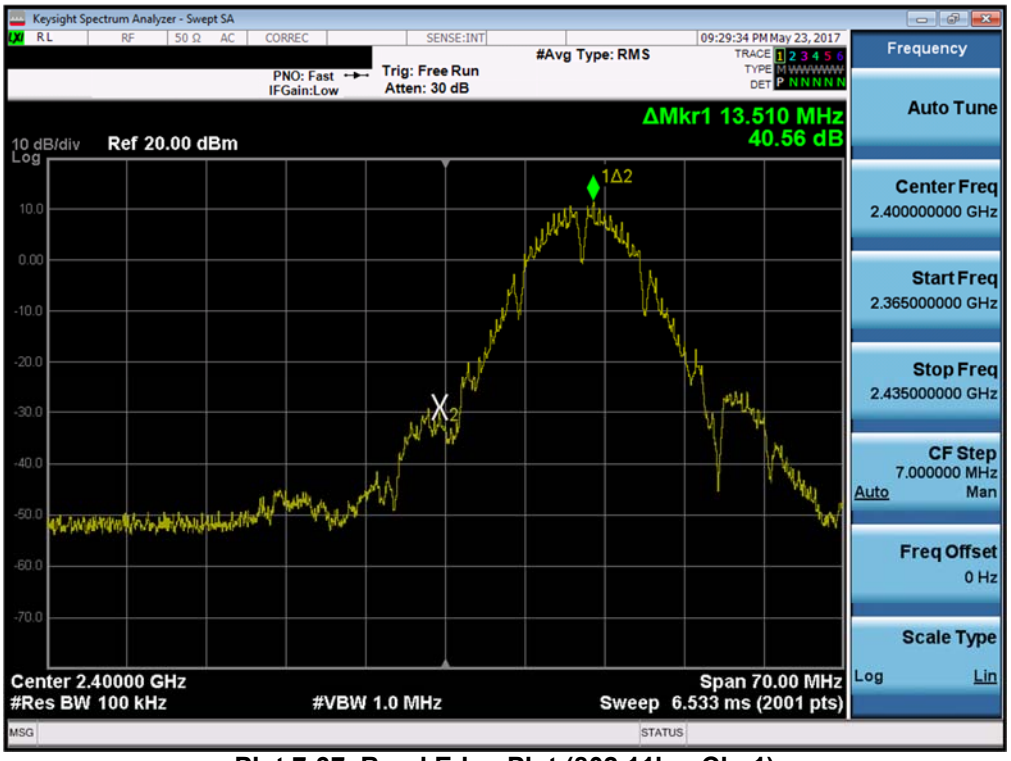
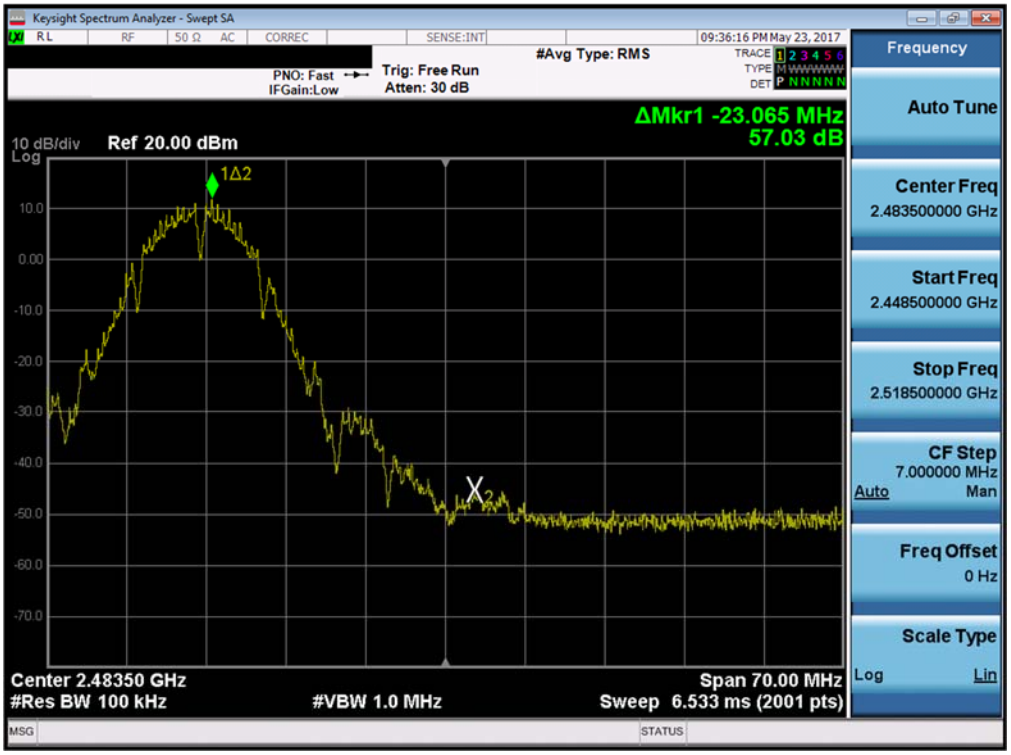
Antenna-1 Conducted Emissions at the Band Edge



Plot 7-37. Band Edge Plot (802.11b – Ch. 1)



Plot 7-38. Band Edge Plot (802.11b – Ch. 11)

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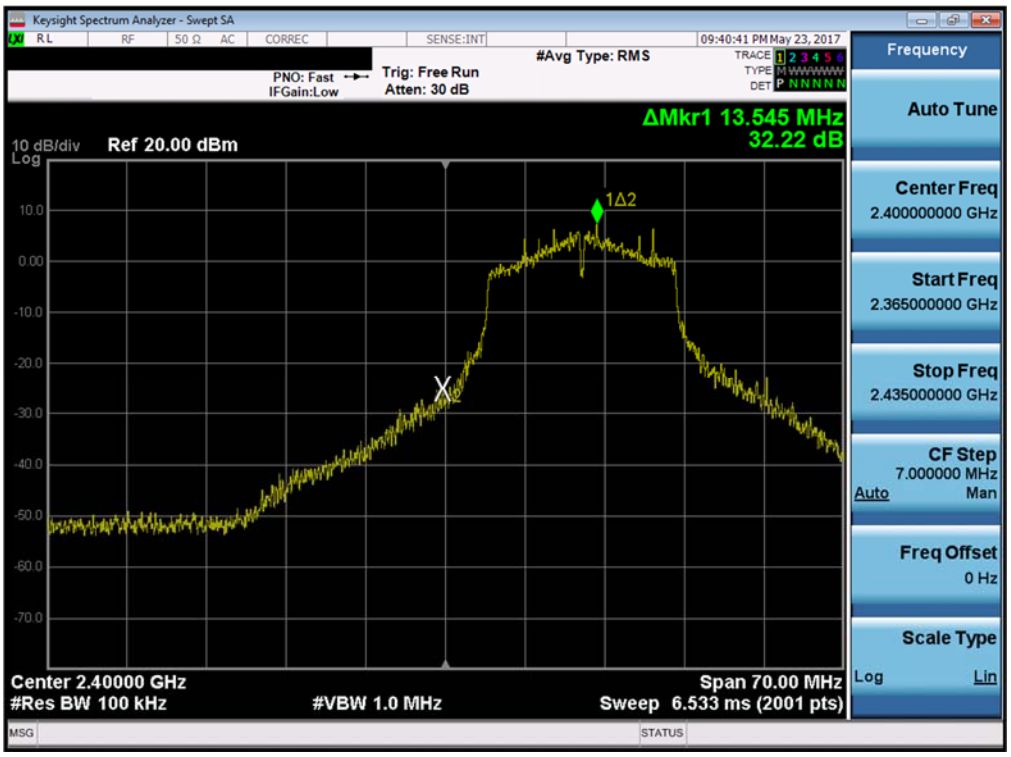
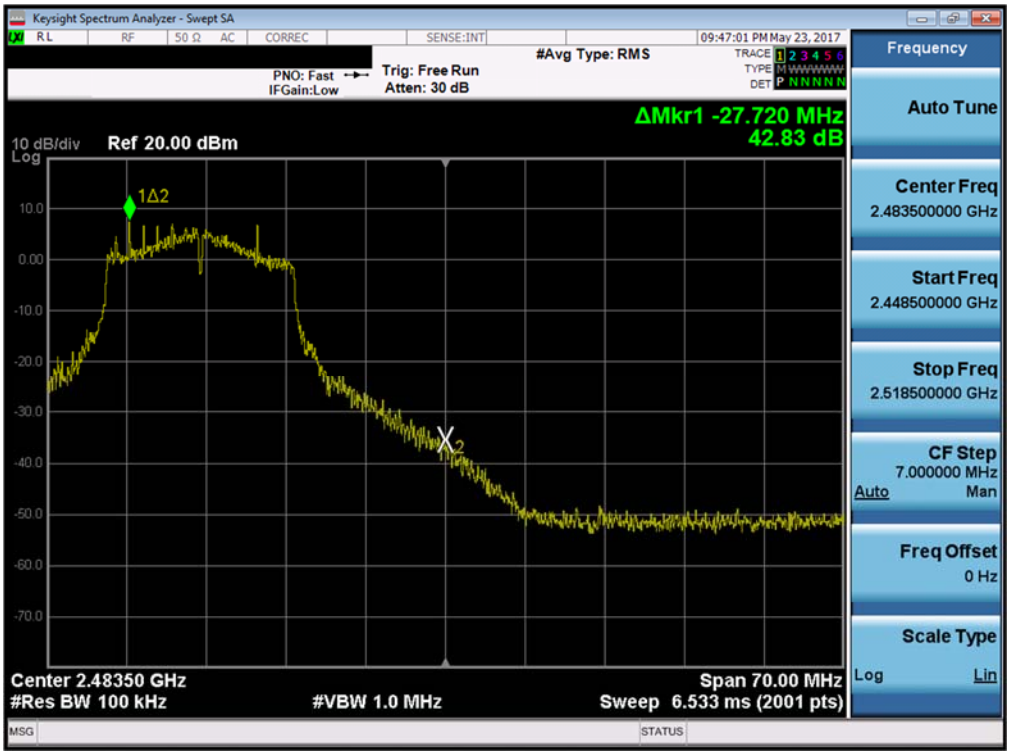


Plot 7-39. Band Edge Plot (802.11g– Ch. 1)



Plot 7-40. Band Edge Plot (802.11g – Ch. 11)

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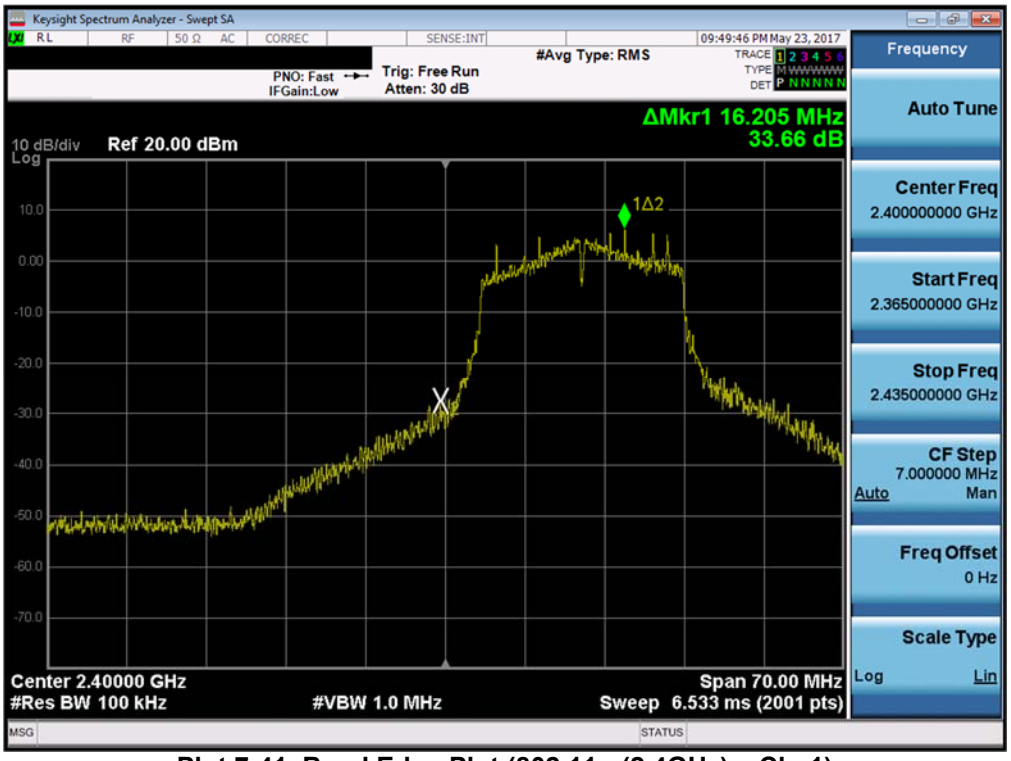
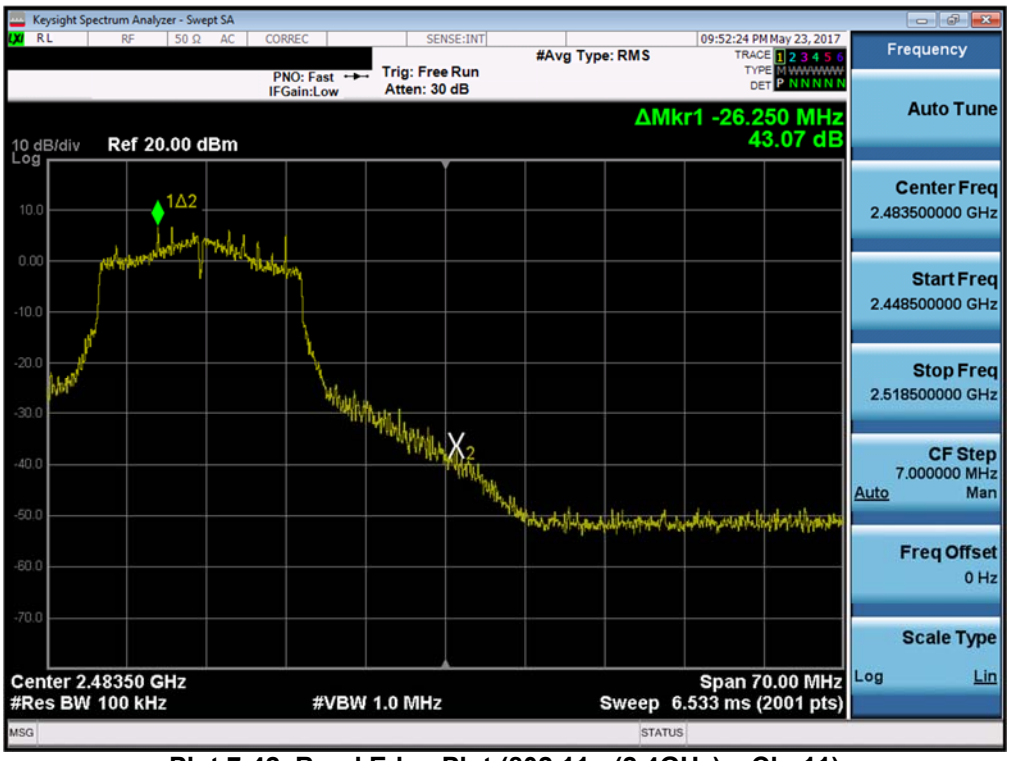


Plot 7-41. Band Edge Plot (802.11n (2.4GHz) – Ch. 1)



Plot 7-42. Band Edge Plot (802.11n (2.4GHz) – Ch. 11)

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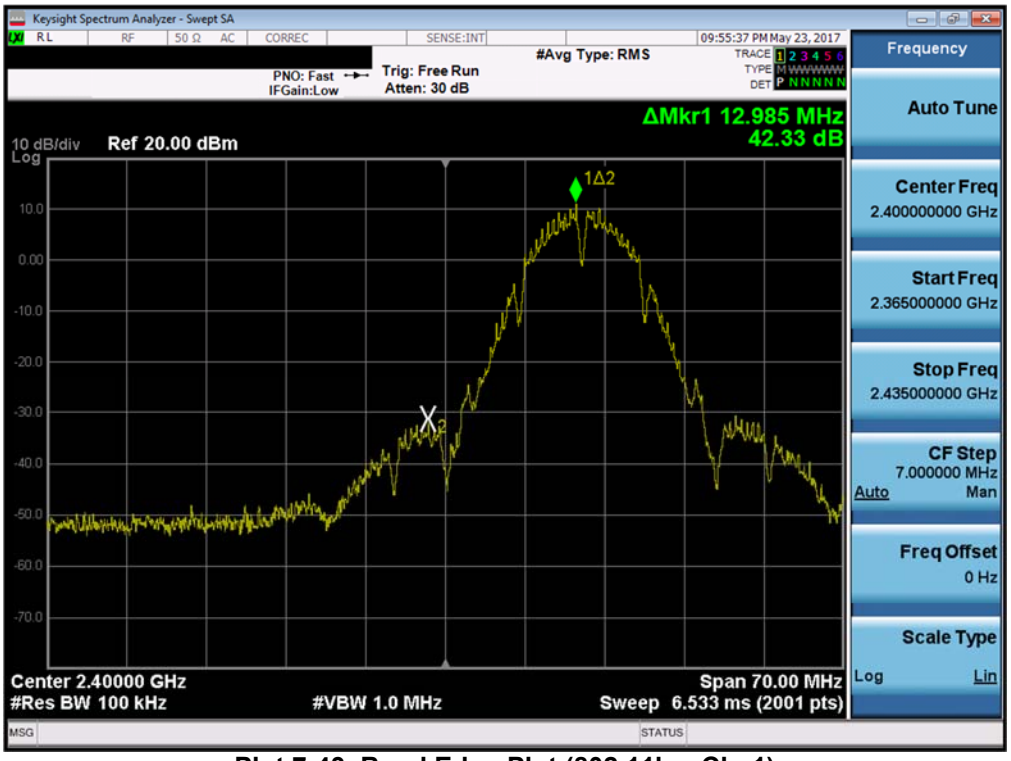
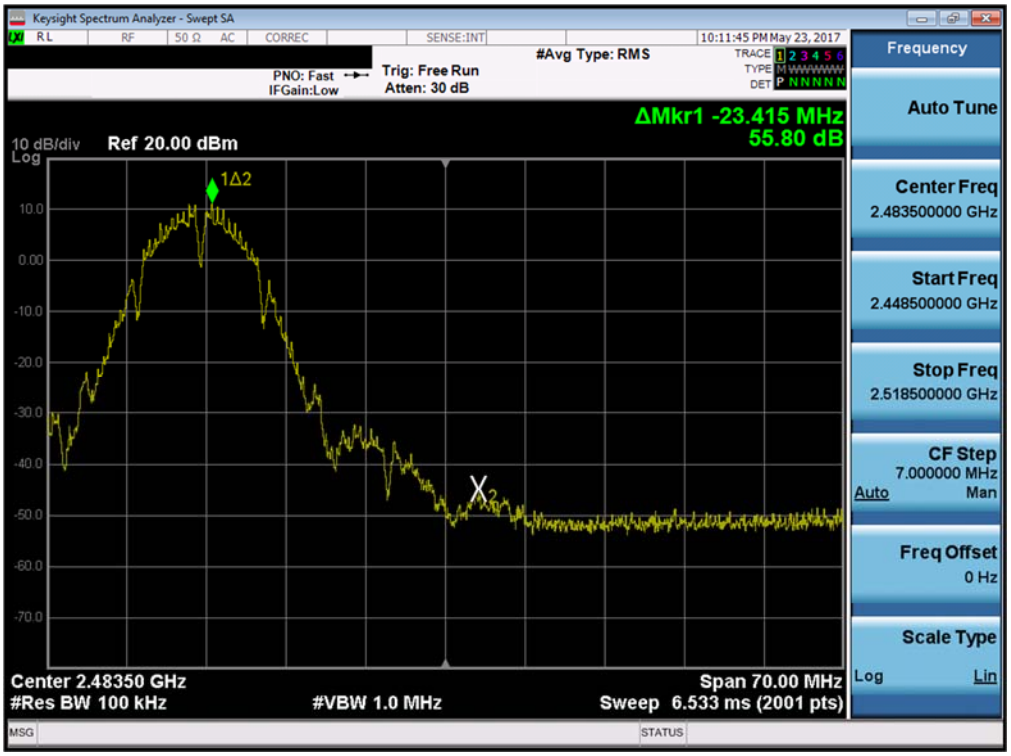
Antenna-2 Conducted Emissions at the Band Edge



Plot 7-43. Band Edge Plot (802.11b – Ch. 1)



Plot 7-44. Band Edge Plot (802.11b – Ch. 11)

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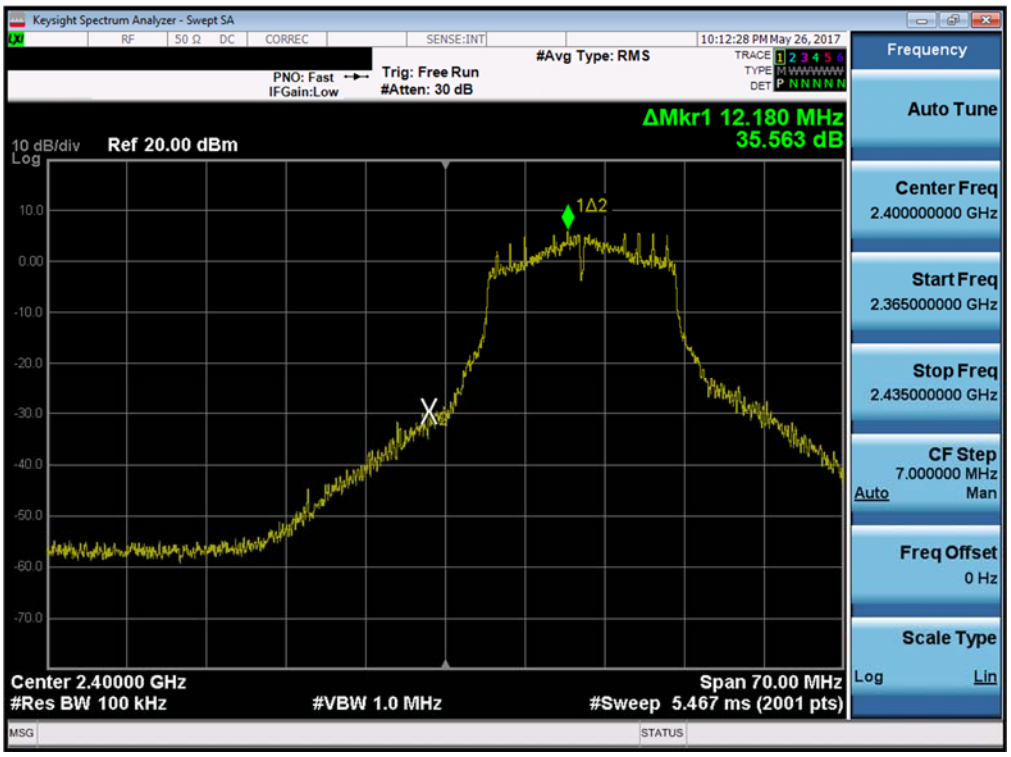
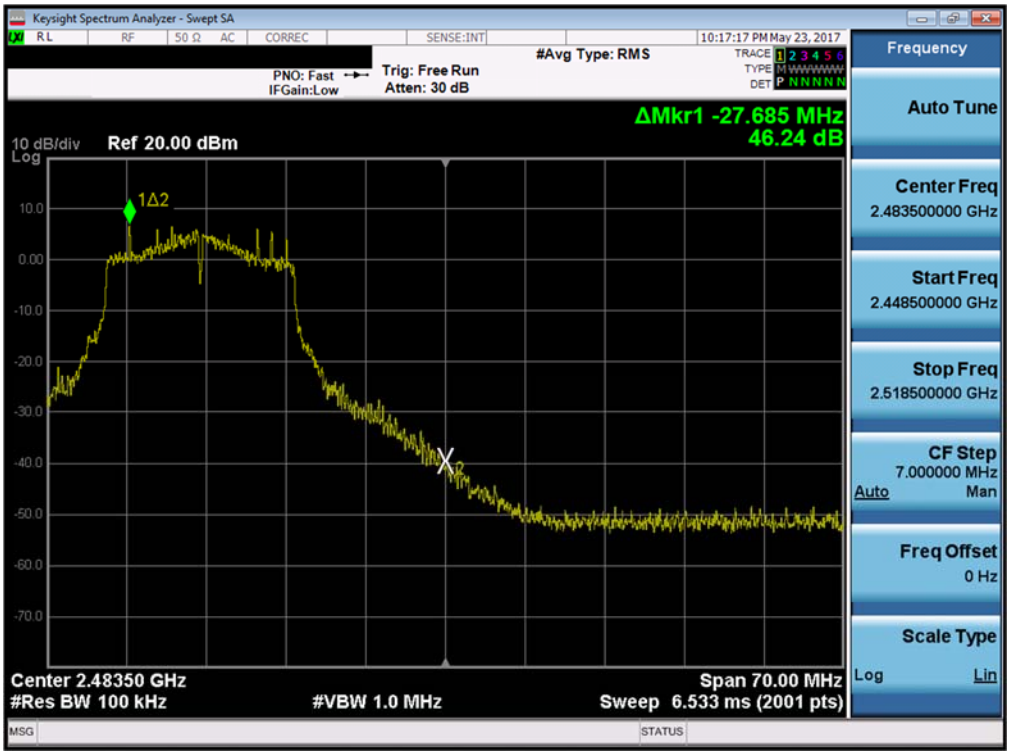


Plot 7-45. Band Edge Plot (802.11g– Ch. 1)



Plot 7-46. Band Edge Plot (802.11g – Ch. 11)

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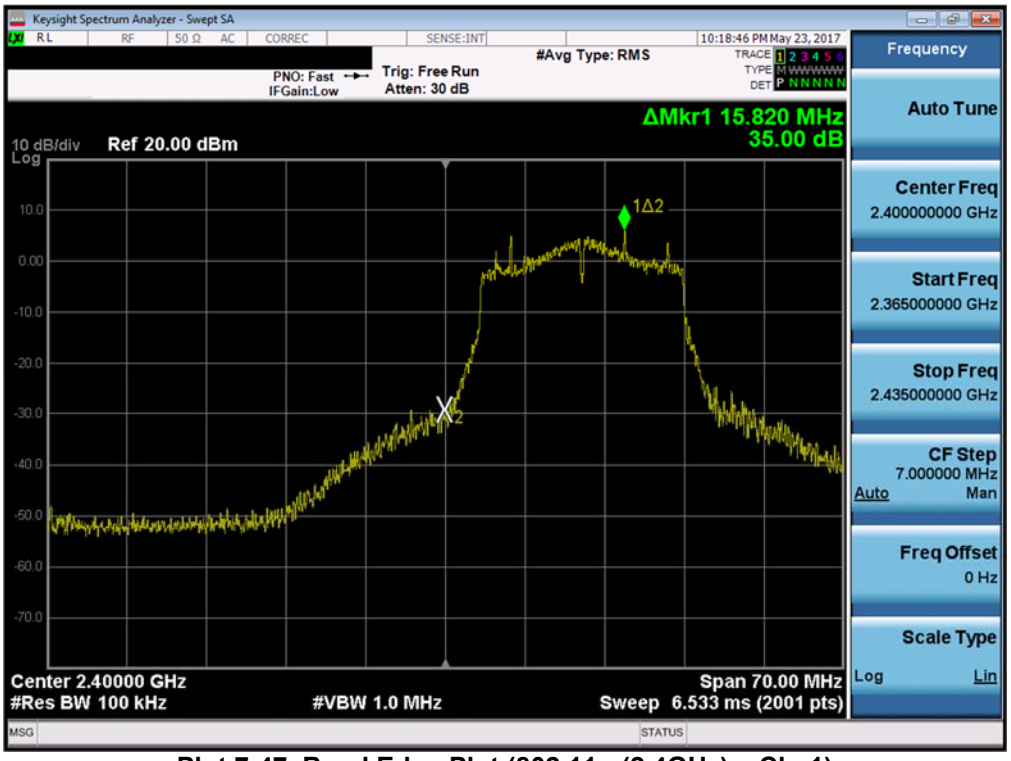
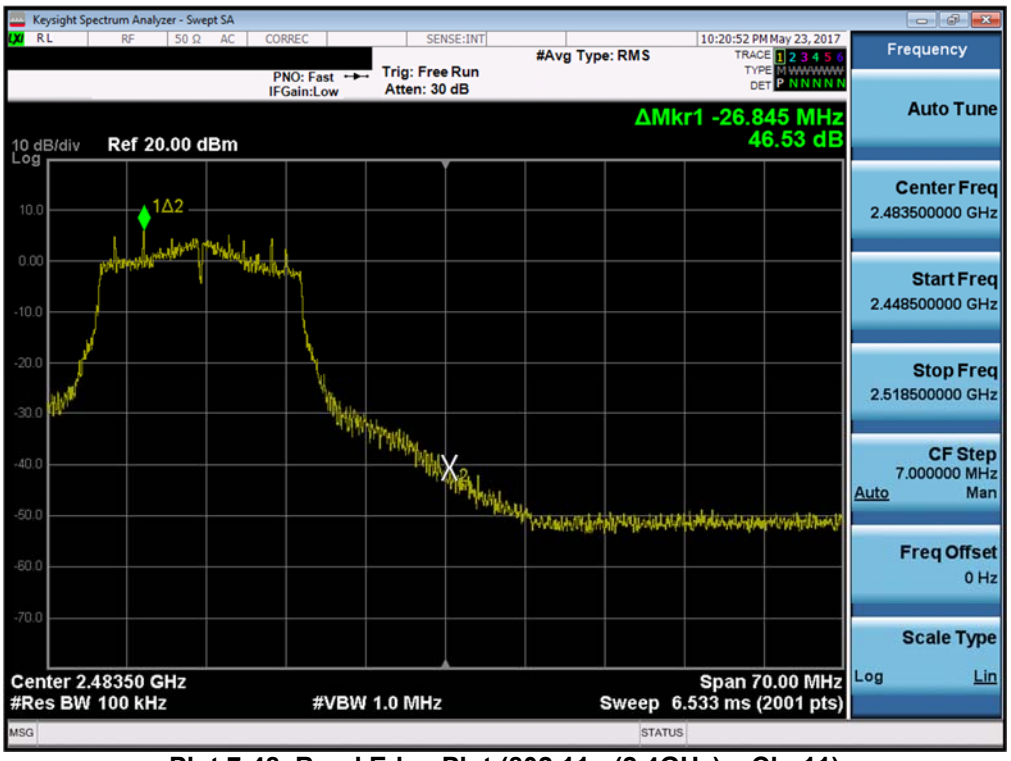


Plot 7-47. Band Edge Plot (802.11n (2.4GHz) – Ch. 1)



Plot 7-48. Band Edge Plot (802.11n (2.4GHz) – Ch. 11)

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7.6 Conducted Spurious Emissions

§15.247(d)

Test Overview and Limit

All out of band emissions are measured with a spectrum analyzer connected to the antenna terminal of the EUT while the EUT is operating at its maximum duty cycle, at maximum power, and at the appropriate frequencies. All data rates were investigated to determine the worst case configuration. For the following out of band conducted spurious emissions plots, the EUT was investigated in all available data rates for "b", "g", and "n" modes. The worst case spurious emissions for the 2.4GHz band were found while transmitting in "b" mode at 1 Mbps and are shown in the plots below.

The limit for out-of-band spurious emissions at the band edge is 30dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth per the procedure in Section 11.1 of KDB 558074 D01 v04.

Test Procedure Used

KDB 558074 D01 v04 – Section 11.3
KDB 662911 D01 v02r01 – Section E)3)b)

Test Settings

1. Start frequency was set to 30MHz and stop frequency was set to 25GHz (separated into two plots per channel)
2. RBW = 1MHz
3. VBW = 3MHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Setup

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

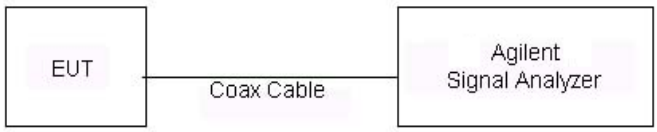

Figure 7-5. Test Instrument & Measurement Setup

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Test Notes

1. RBW was set to 1MHz rather than 100kHz in order to increase the measurement speed.

2. The display line shown in the following plots denotes the limit at 30dB below the fundamental emission level measured in a 100kHz bandwidth. However, since the traces in the following plots are measured with a 1MHz RBW, the display line may not necessarily appear to be 30dB below the level of the fundamental in a 1MHz bandwidth.

3. For plots showing conducted spurious emissions near the limit, the frequencies were investigated with a reduced RBW to ensure that no emissions were present.

4. The conducted spurious emissions were measured to relative limits. Therefore, in accordance with KDB 662911 D01 v02r01 Section E)3)b), it was unnecessary to show compliance through the summation of test results of the individual outputs.

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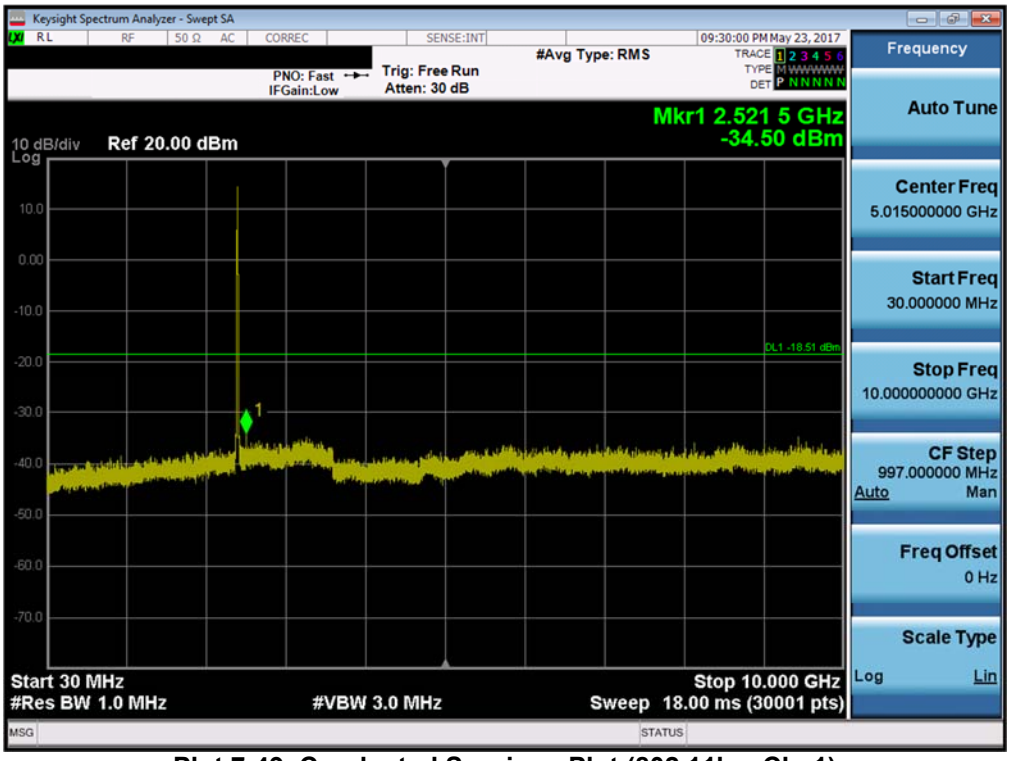
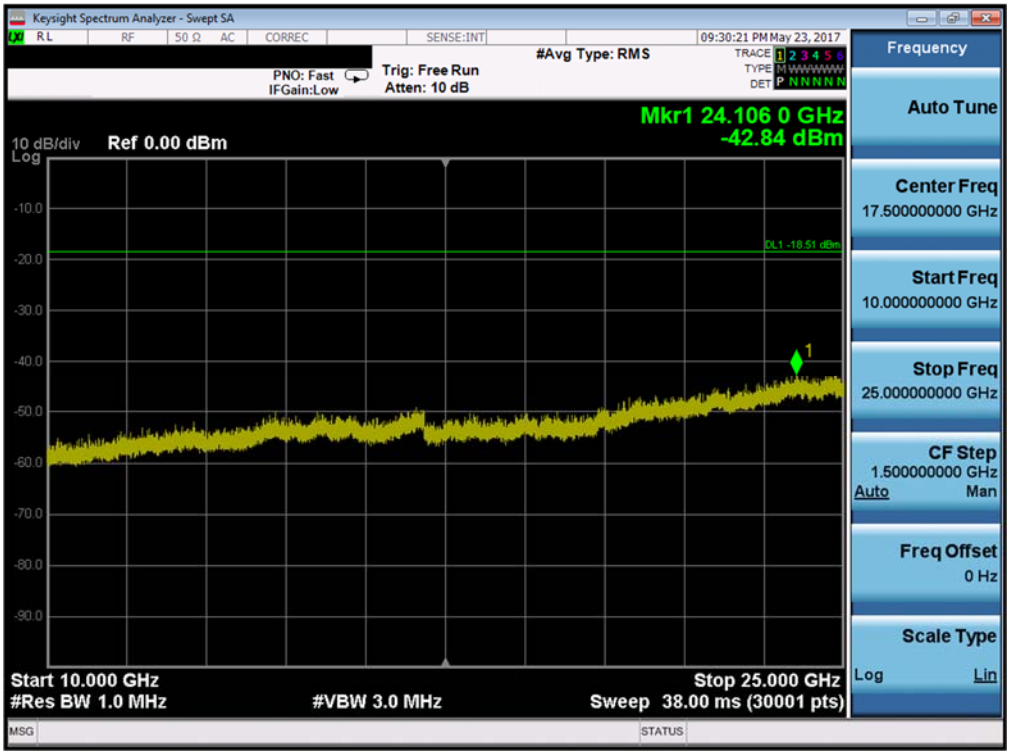
Antenna-1 Conducted Spurious Emission



Plot 7-49. Conducted Spurious Plot (802.11b – Ch. 1)



Plot 7-50. Conducted Spurious Plot (802.11b – Ch. 1)

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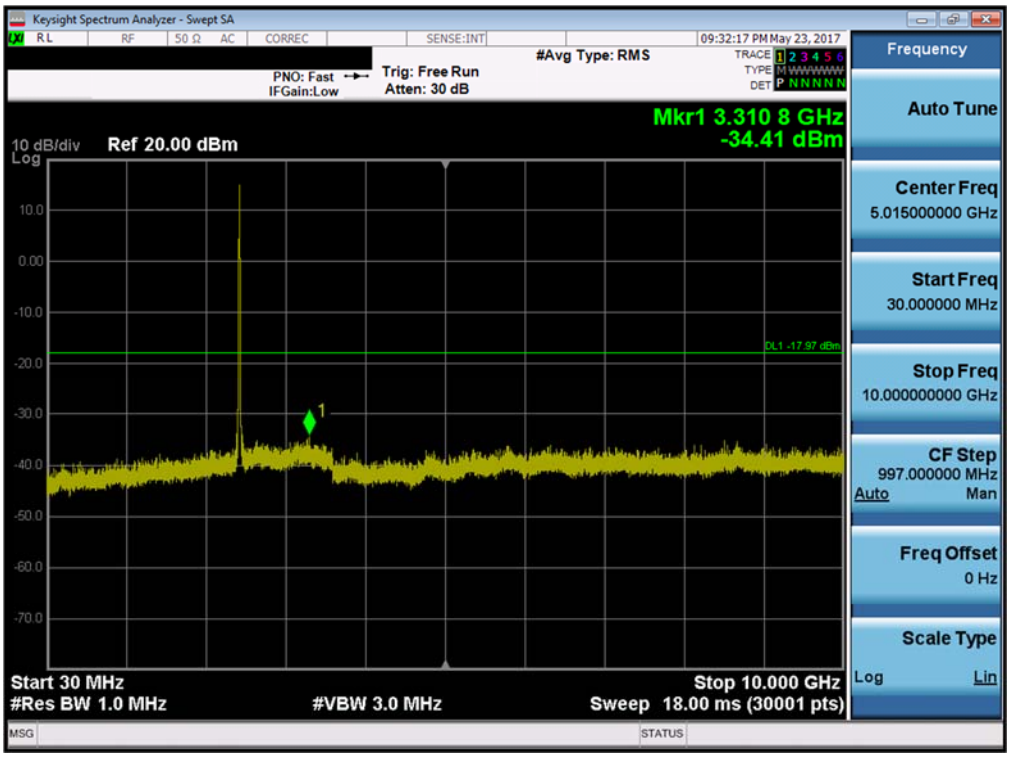
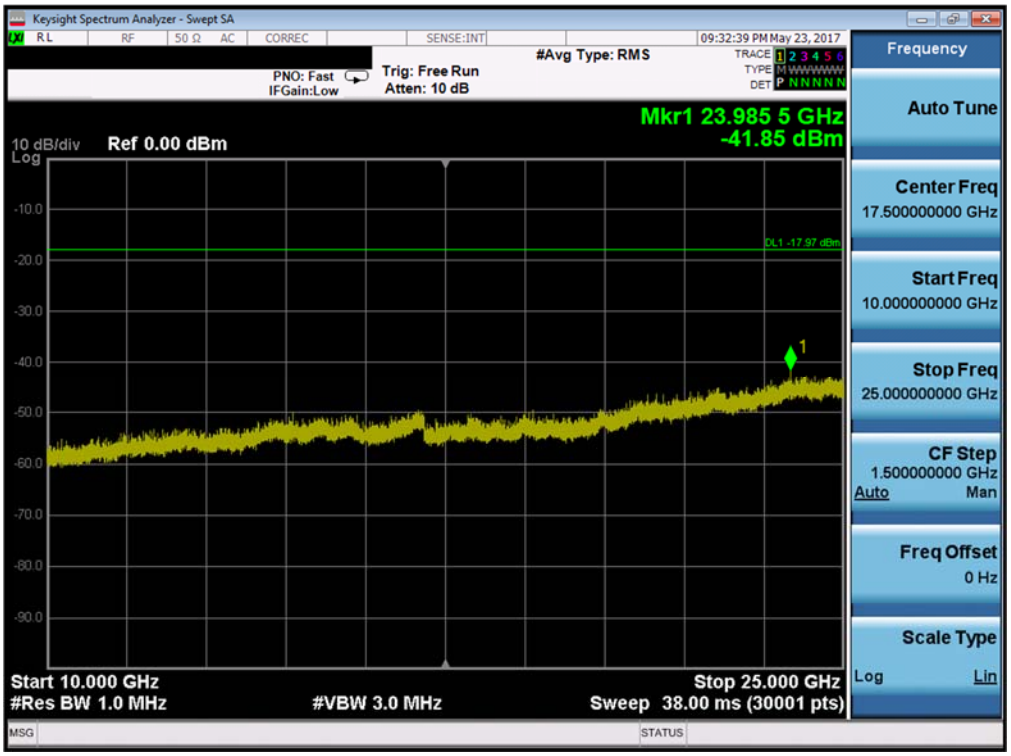


Plot 7-51. Conducted Spurious Plot (802.11b – Ch. 6)



Plot 7-52. Conducted Spurious Plot (802.11b – Ch. 6)

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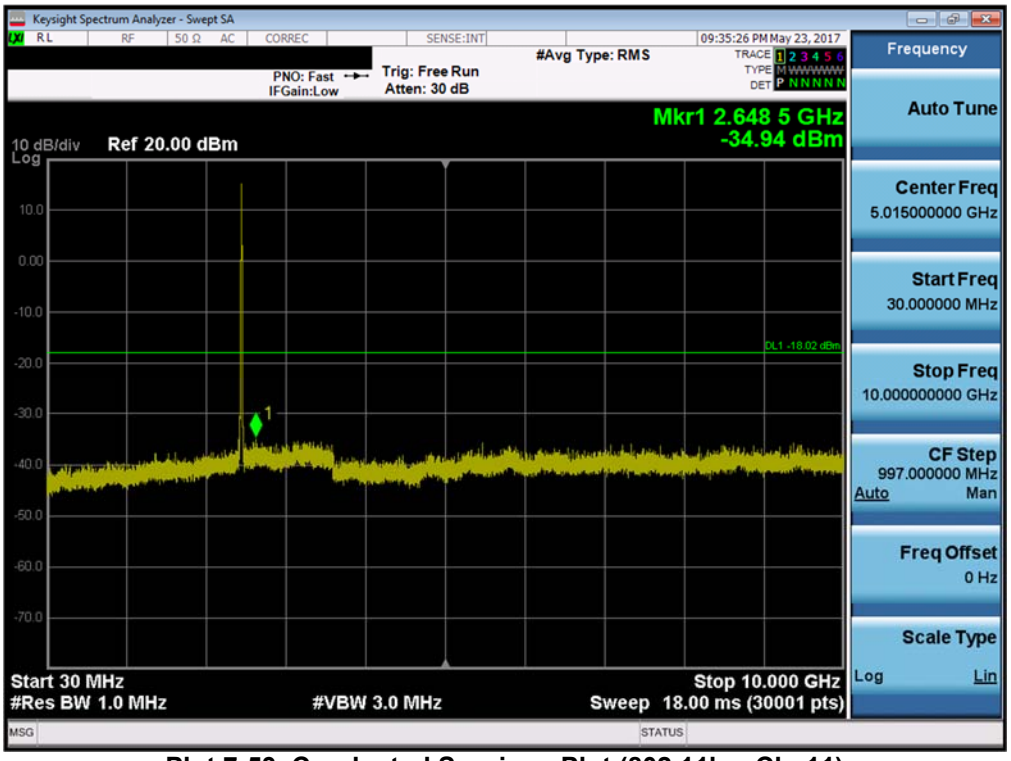
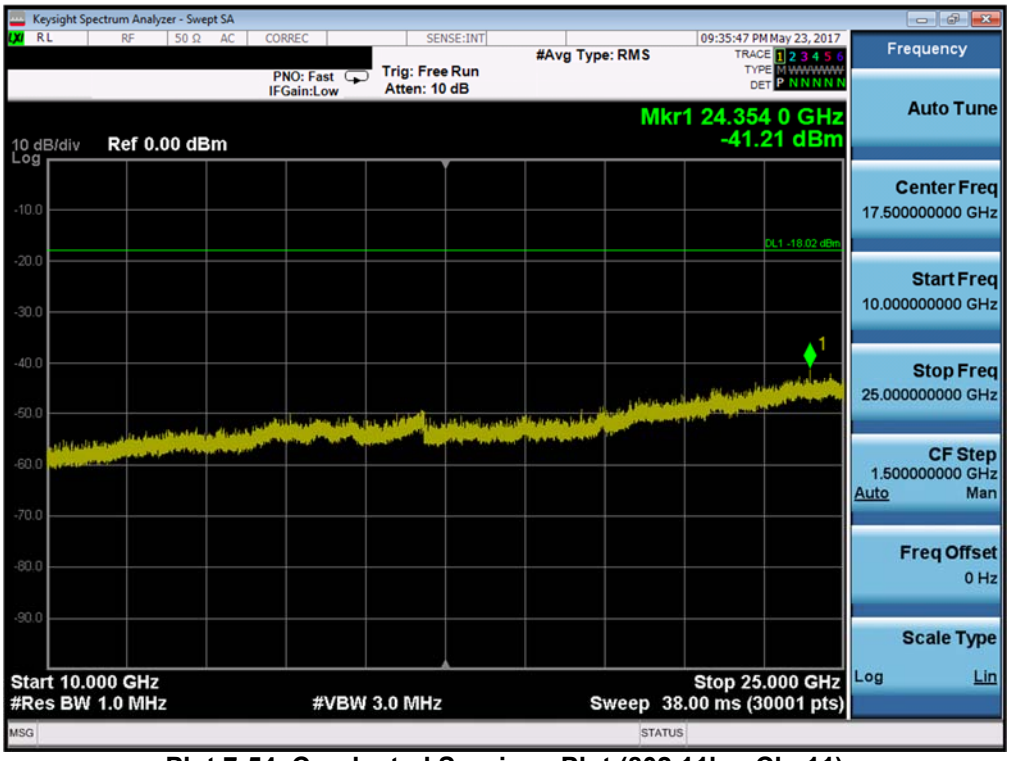


Plot 7-53. Conducted Spurious Plot (802.11b – Ch. 11)



Plot 7-54. Conducted Spurious Plot (802.11b – Ch. 11)

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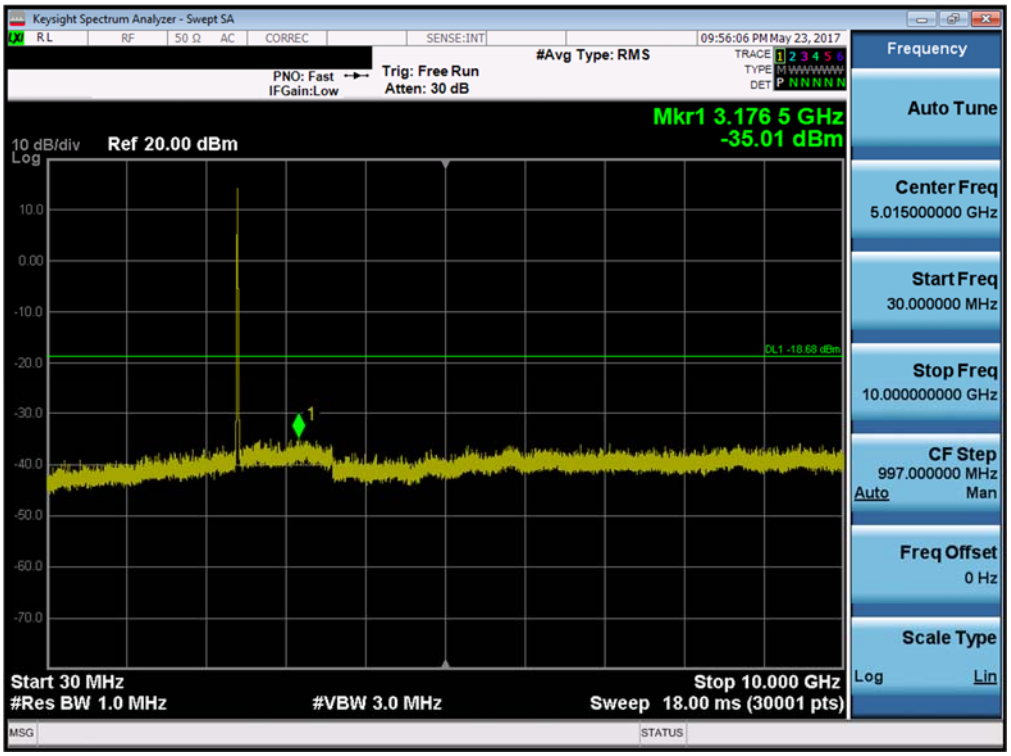
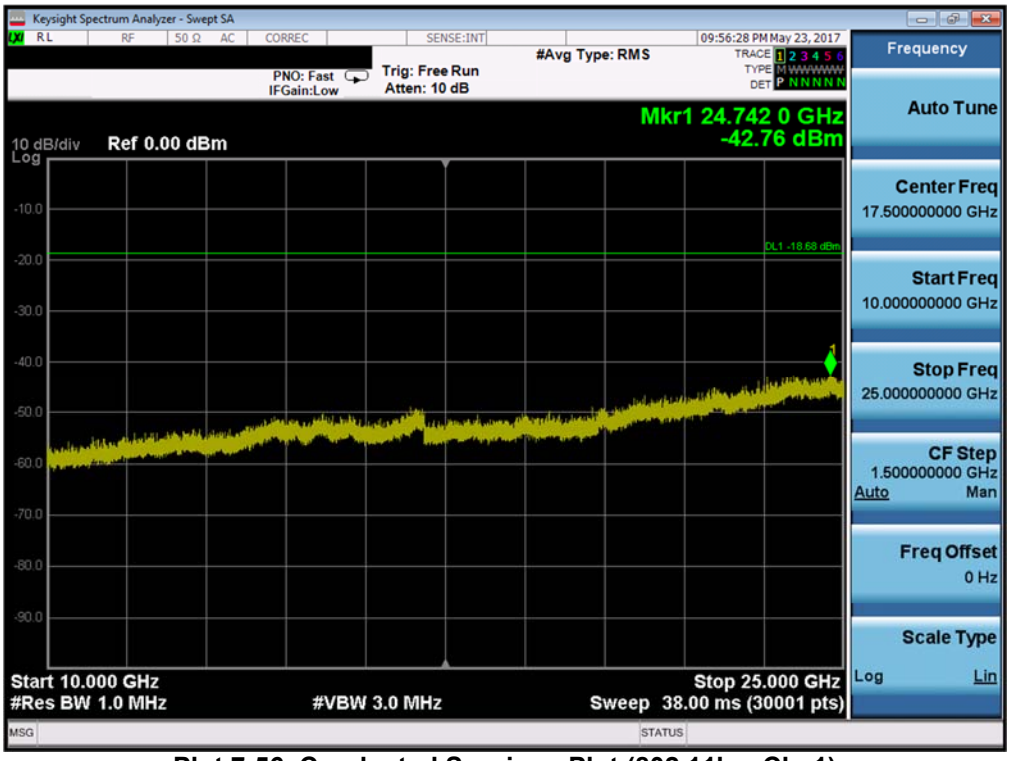
Antenna-2 Conducted Spurious Emissions



Plot 7-55. Conducted Spurious Plot (802.11b – Ch. 1)



Plot 7-56. Conducted Spurious Plot (802.11b – Ch. 1)

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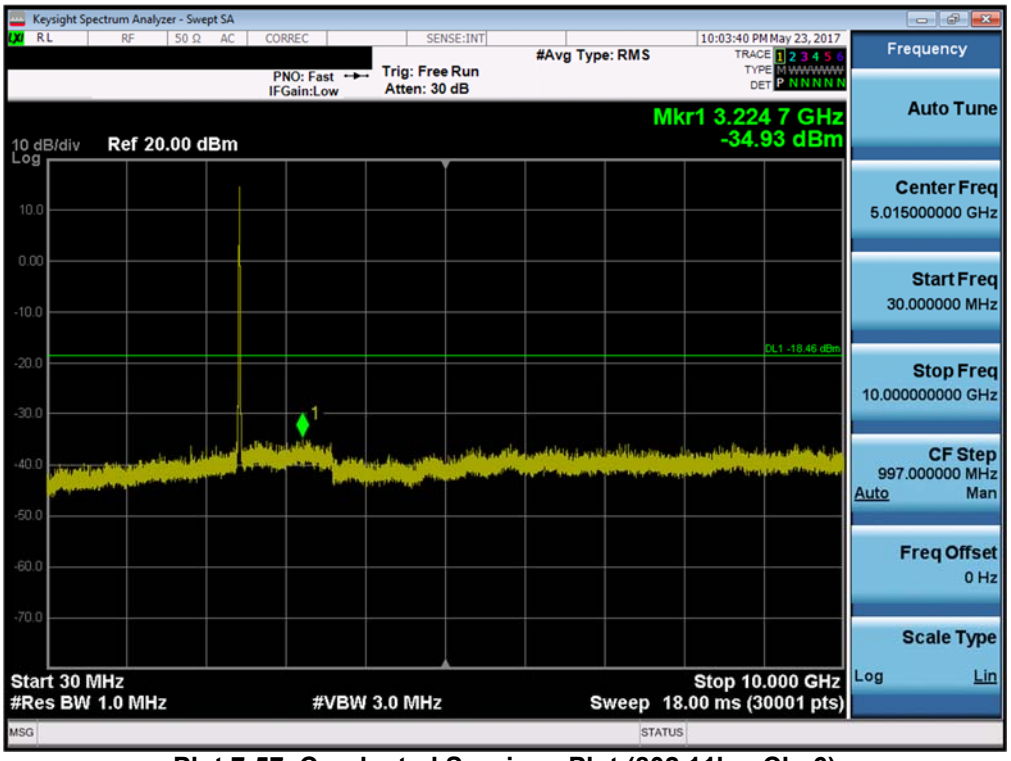
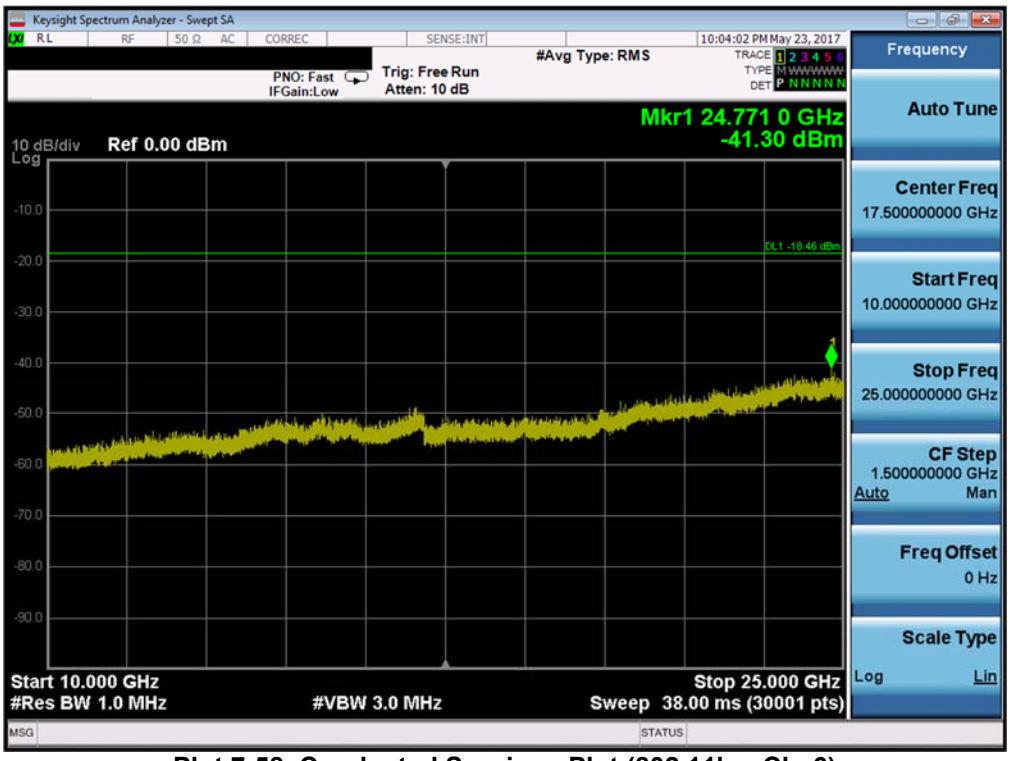


Plot 7-57. Conducted Spurious Plot (802.11b – Ch. 6)



Plot 7-58. Conducted Spurious Plot (802.11b – Ch. 6)

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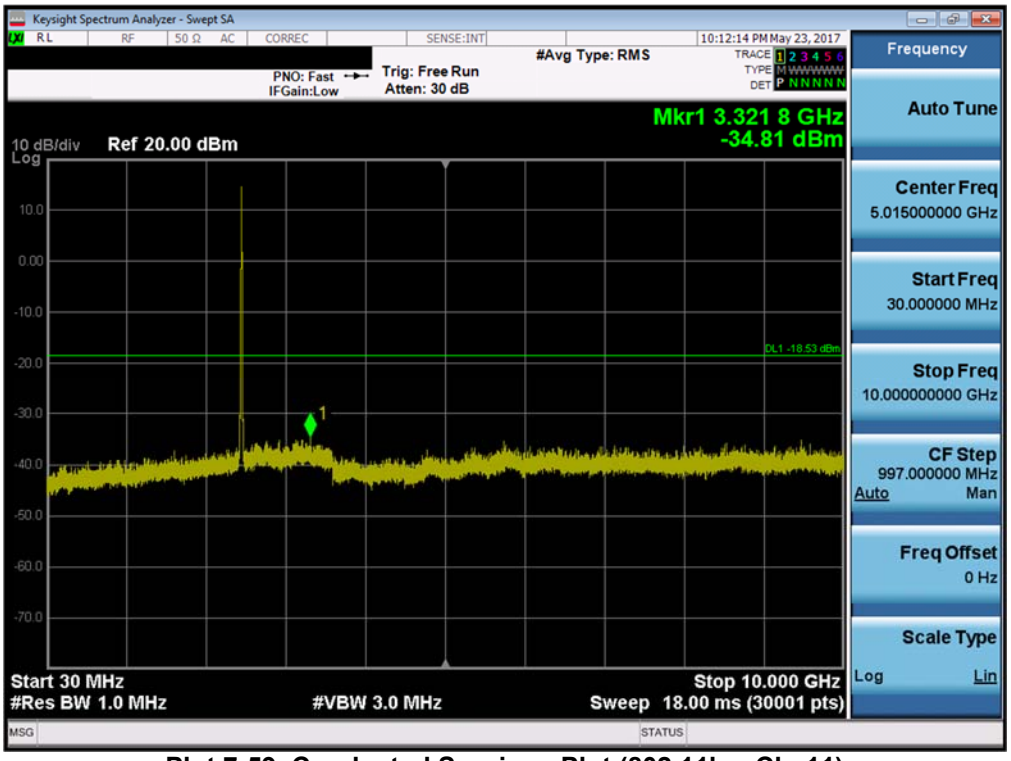
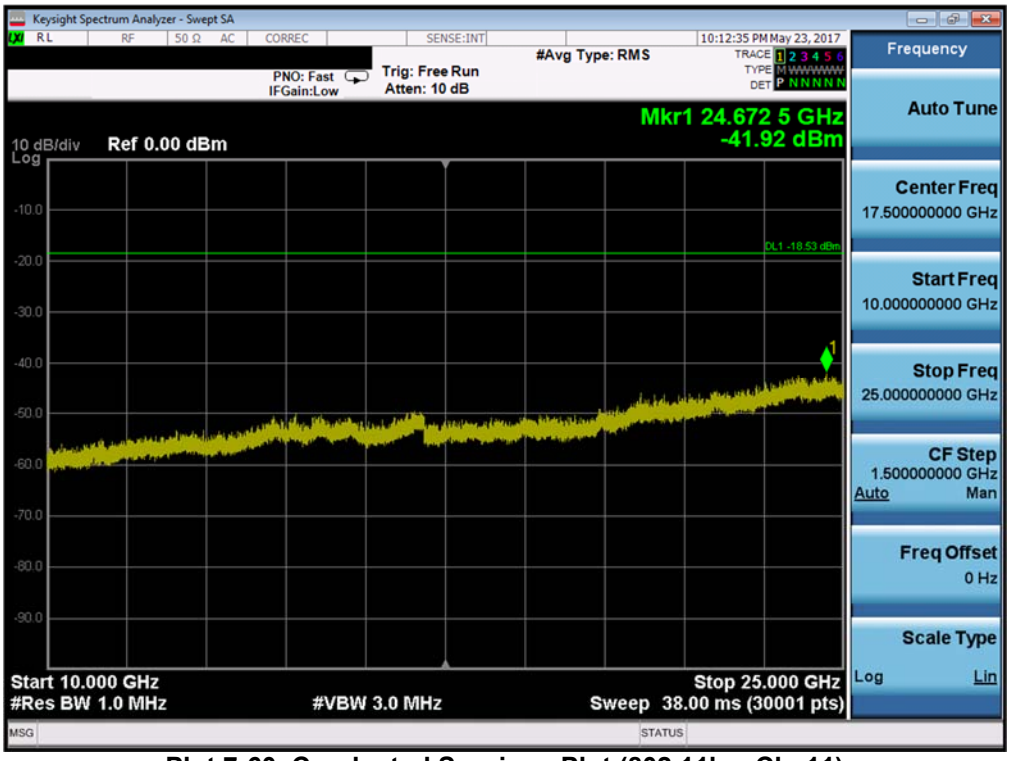


Plot 7-59. Conducted Spurious Plot (802.11b – Ch. 11)



Plot 7-60. Conducted Spurious Plot (802.11b – Ch. 11)

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7.7 Radiated Spurious Emission Measurements – Above 1 GHz

§15.247(d) §15.205 & §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 7-11 per Section 15.209.

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

Table 7-11. Radiated Limits

Test Procedures Used

KDB 558074 D01 v04 – Section 12.1, 12.2.7

Test Settings

Average Field Strength Measurements per Section 12.2.5.1 of KDB 558074 D01 v04

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 per Section 12.2.4 of KDB 558074 D01 v04

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

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Test Setup

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

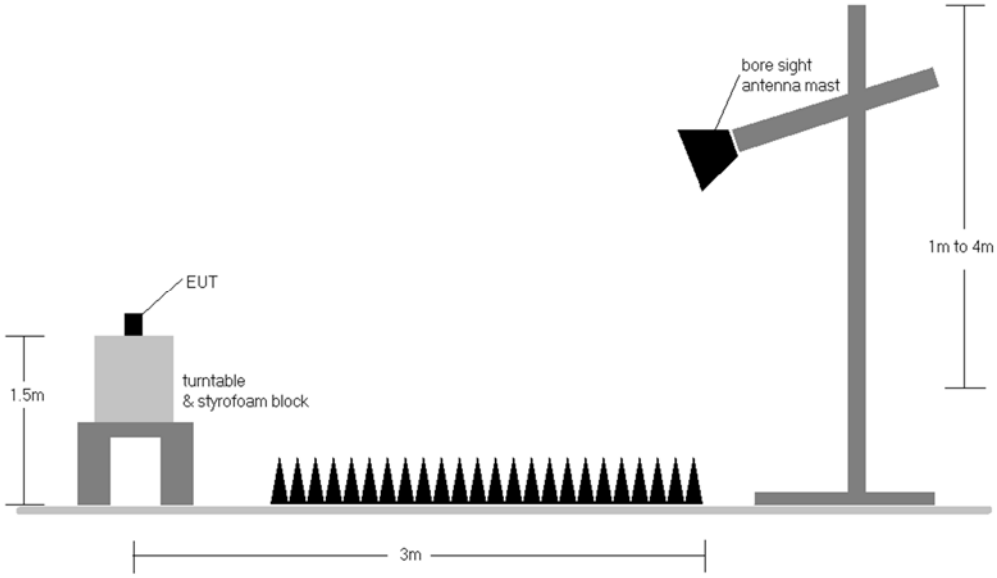

Figure 7-6. Test Instrument & Measurement Setup

Test Notes

1. The optional test procedures for antenna port conducted measurements of unwanted emissions per the guidance of KDB 558074 D01 v04 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 §15.205 are below the limit shown in Table 7-11.
3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
4. This unit was tested with its standard battery.
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.

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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. Rohde & Schwarz EMC32, Version 9.15.00 automated test software was used to perform the Radiated Spurious Emissions Pre-Scan testing.
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 [dBμV/m] = Analyzer Level [dBm] + 107 + AFCL [dB/m]
- AFCL [dB/m] = Antenna Factor [dB/m] + Cable Loss [dB]
- Margin [dB] = Field Strength Level [dBμV/m] – Limit [dBμV/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

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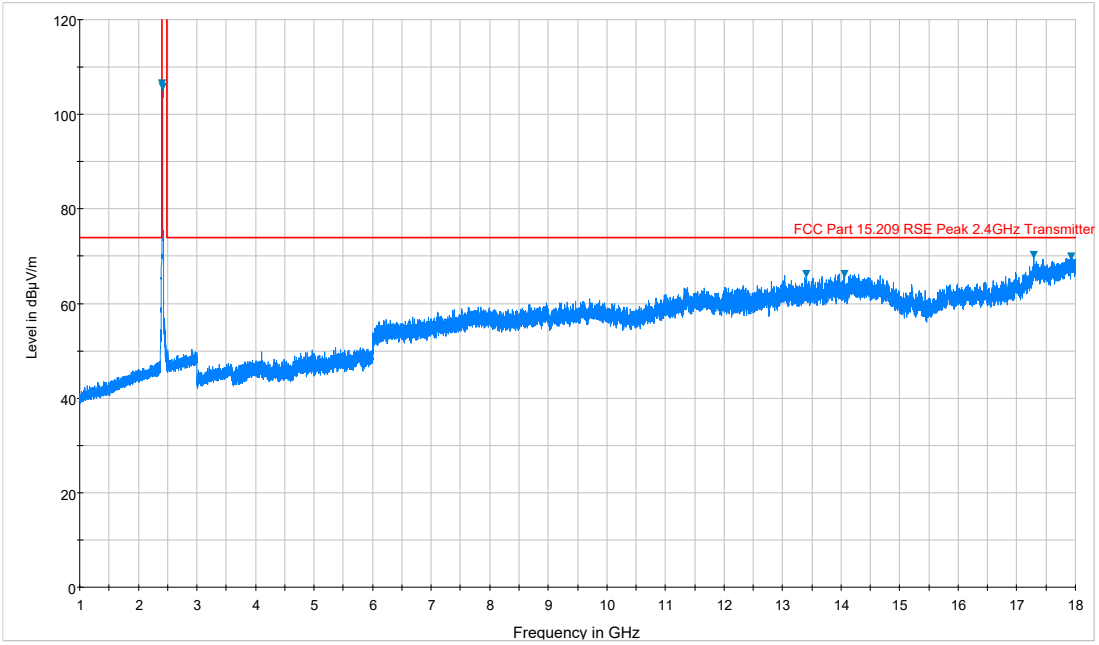
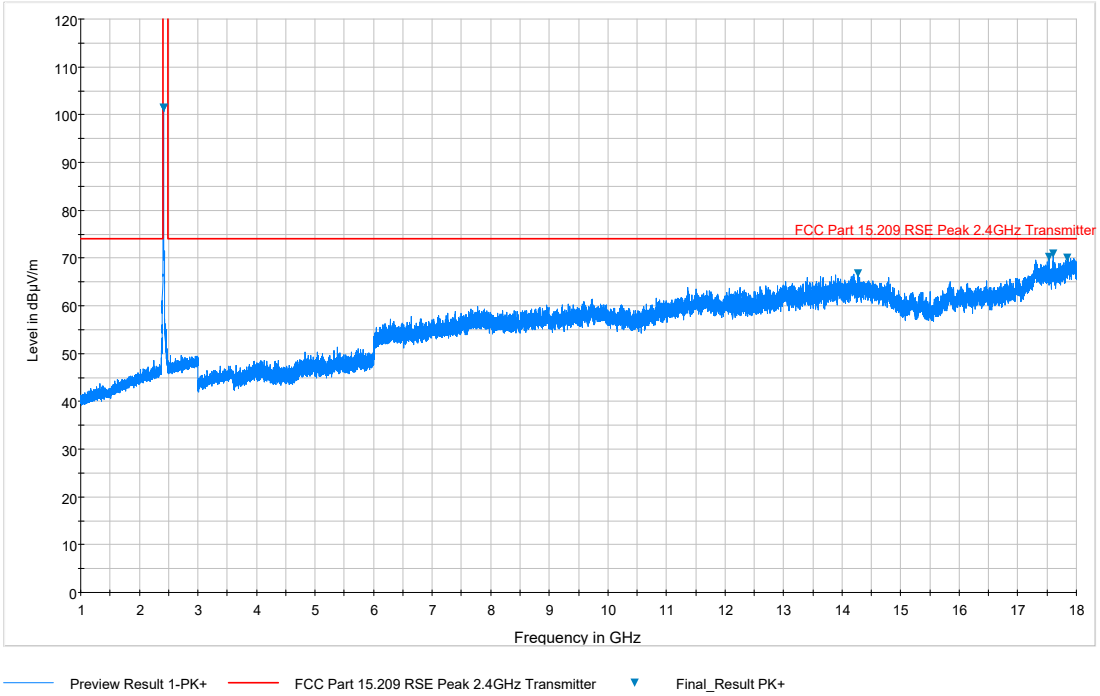
7.7.1 Antenna-1 Radiated Spurious Emission Measurements

§15.247(d) §15.205 & §15.209



Plot 7-61. Radiated Spurious Plot above 1GHz (802.11b – Ch. 1, Ant. Pol. H)



Plot 7-62. Radiated Spurious Plot above 1GHz (802.11b – Ch. 1, Ant. Pol. V)

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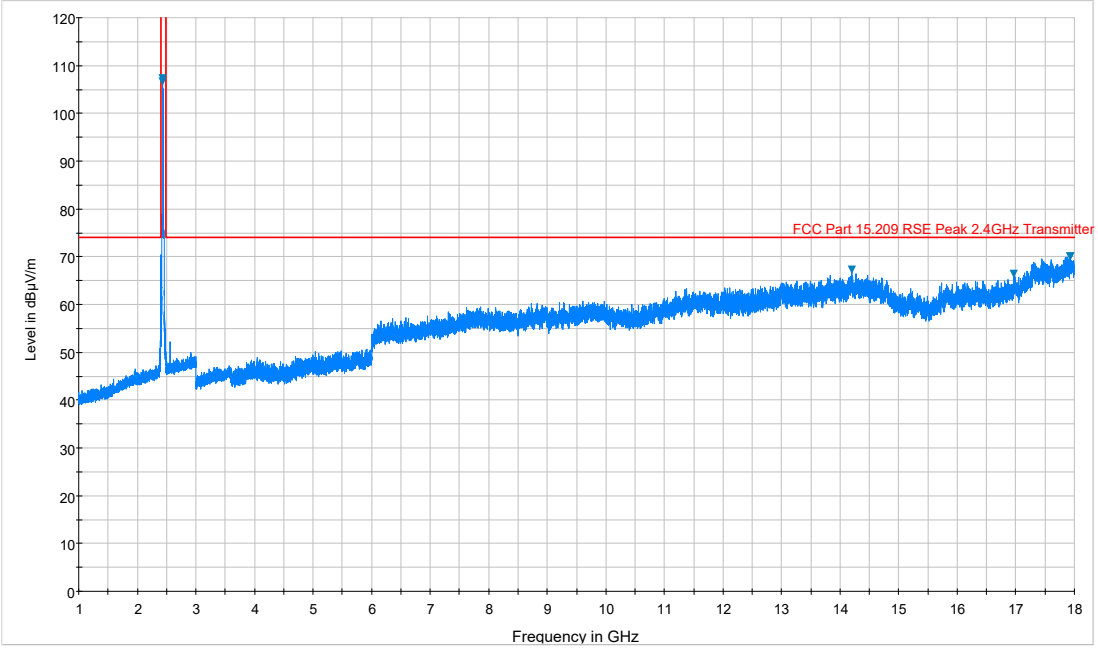
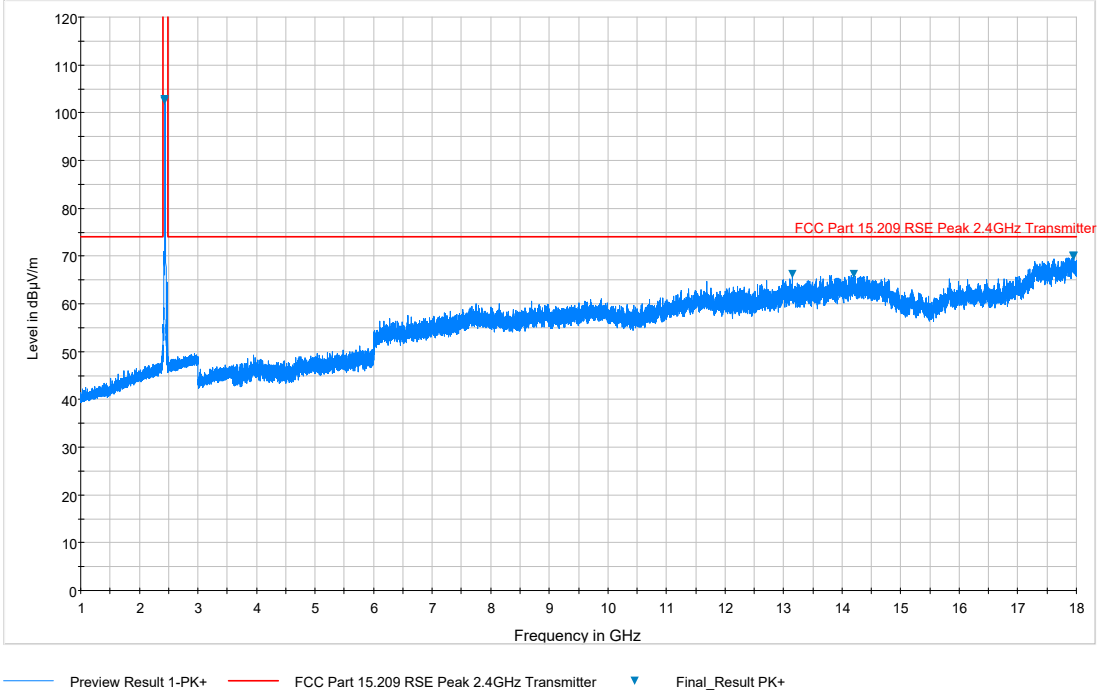


Plot 7-63. Radiated Spurious Plot above 1GHz (802.11b – Ch. 6, Ant. Pol. H)



Plot 7-64. Radiated Spurious Plot above 1GHz (802.11b – Ch. 6, Ant. Pol. V)

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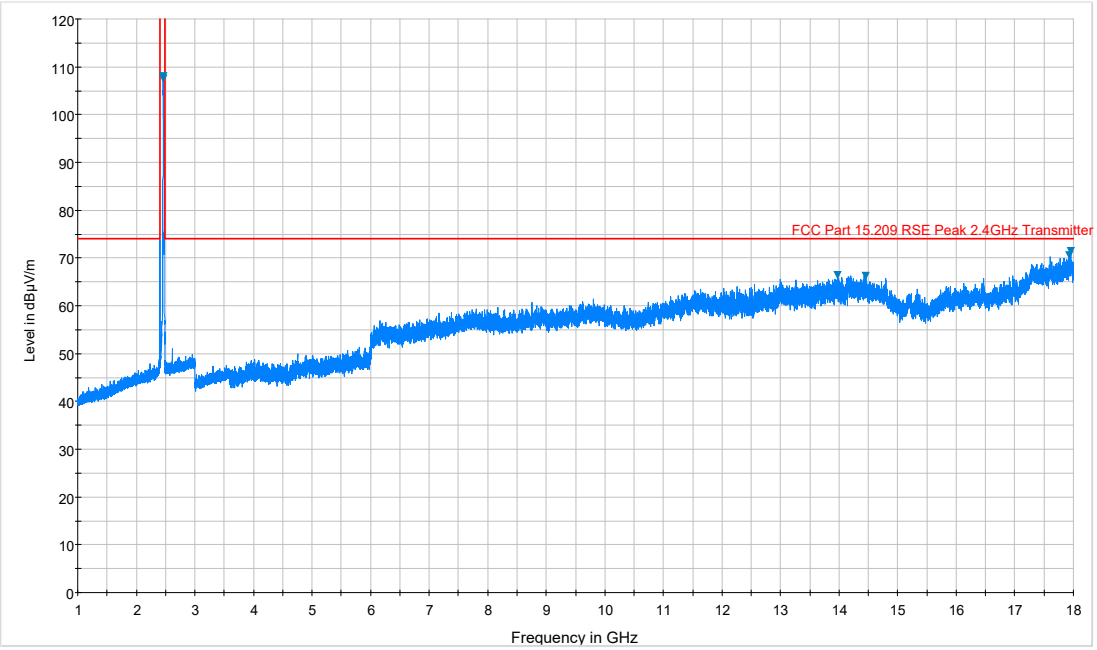
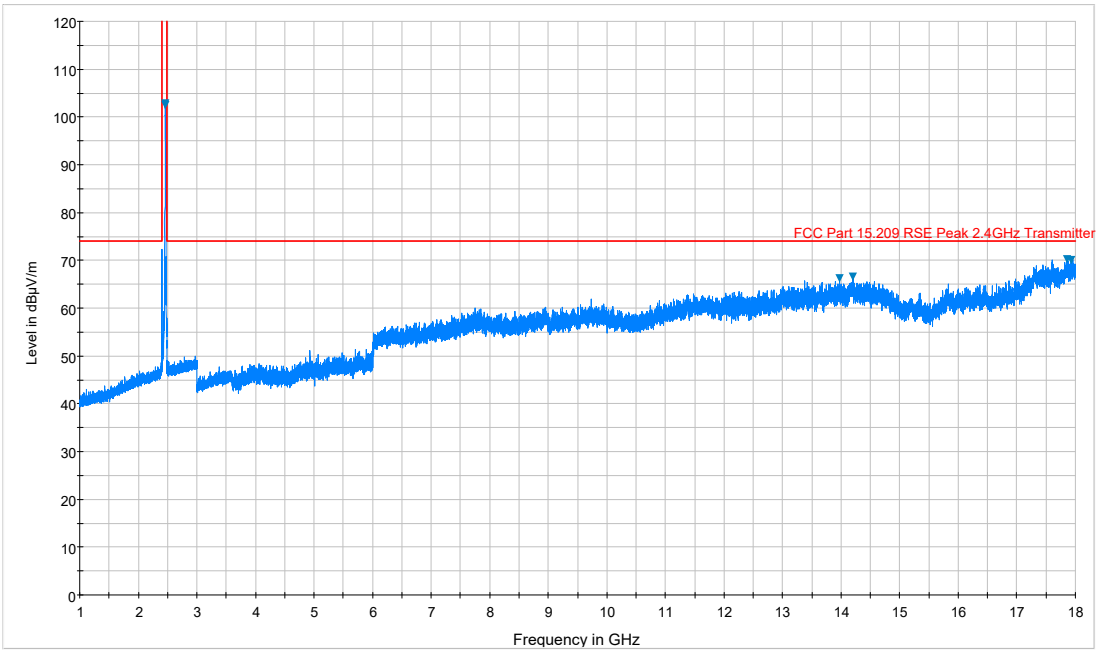


Preview Result 1-PK+ FCC Part 15.209 RSE Peak 2.4GHz Transmitter Final_Result PK+

Plot 7-65. Radiated Spurious Plot above 1GHz (802.11b – Ch. 11, Ant. Pol. H)



Preview Result 1-PK+ FCC Part 15.209 RSE Peak 2.4GHz Transmitter Final_Result PK+

Plot 7-66. Radiated Spurious Plot above 1GHz (802.11b – Ch. 11, Ant. Pol. V)

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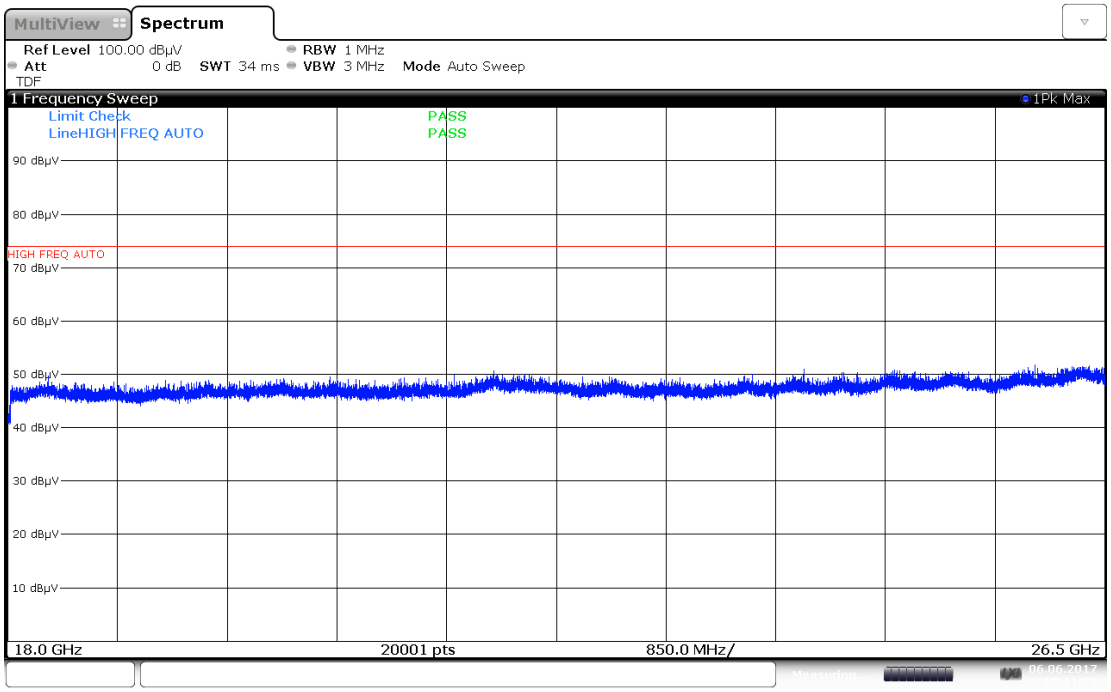
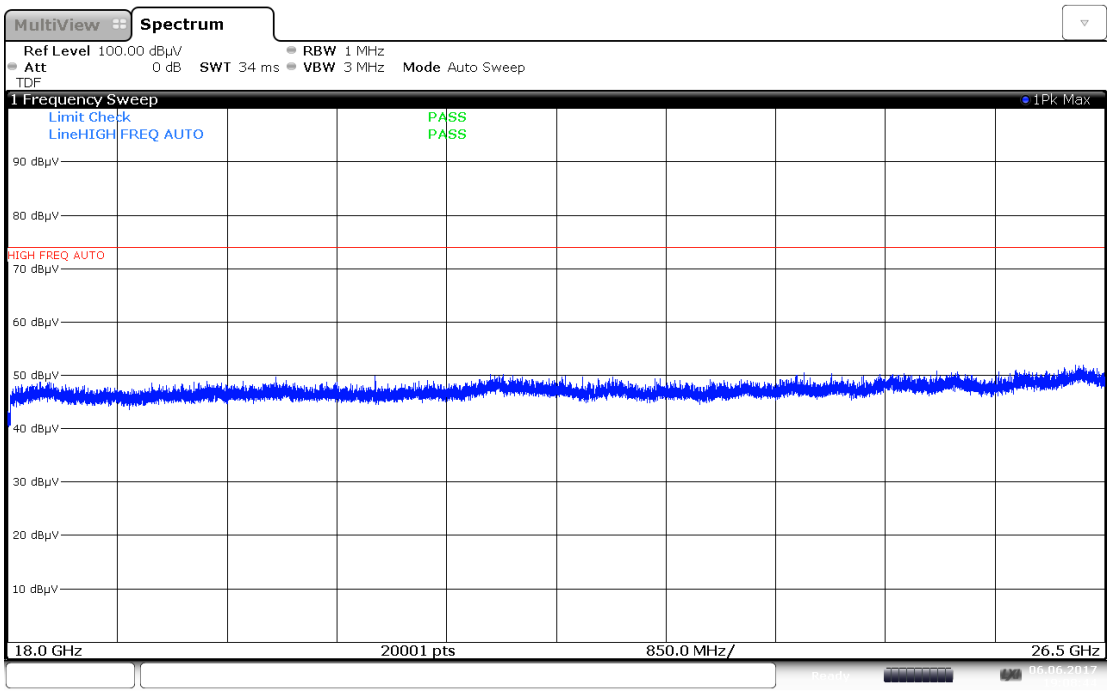
Antenna-1 Radiated Spurious Emissions Measurements (Above 18GHz)

§15.209



18:41:29 06.06.2017

Plot 7-67. Radiated Spurious Plot above 18GHz (Pol. H)



19:08:44 06.06.2017

Plot 7-68. Radiated Spurious Plot above 18GHz (Pol. V)

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Antenna-1 Radiated Spurious Emission Measurements

§15.247(d) §15.205 & §15.209

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	V	246	242	-64.12	0.05	42.93	53.98	-11.05
4824.00	Peak	V	246	242	-55.42	0.05	51.63	73.98	-22.35
12060.00	Avg	V	-	-	-71.05	14.63	50.58	53.98	-3.39
12060.00	Peak	V	-	-	-59.69	14.63	61.94	73.98	-12.03

Table 7-12. Radiated Measurements

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	V	205	119	-65.13	0.34	42.21	53.98	-11.77
4874.00	Peak	V	205	119	-56.04	0.34	51.30	73.98	-22.68
7311.00	Avg	V	329	210	-67.77	10.13	49.36	53.98	-4.62
7311.00	Peak	V	329	210	-57.39	10.13	59.74	73.98	-14.24
12185.00	Avg	V	-	-	-72.88	16.74	50.86	53.98	-3.11
12185.00	Peak	V	-	-	-58.27	16.74	65.47	73.98	-8.50

Table 7-13. Radiated Measurements

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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	V	156	203	-64.14	0.55	43.41	53.98	-10.57
4924.00	Peak	V	156	230	-56.56	0.55	50.99	73.98	-22.99
7386.00	Avg	V	240	272	-68.14	10.27	49.13	53.98	-4.85
7386.00	Peak	V	240	272	-57.79	10.27	59.48	73.98	-14.50
12310.00	Avg	V	-	-	-70.69	14.60	50.91	53.98	-3.07
12310.00	Peak	V	-	-	-58.09	14.60	63.51	73.98	-10.47

Table 7-14. Radiated Measurements

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	V	114	54	-65.63	0.34	41.71	53.98	-12.27
4874.00	Peak	V	114	54	-56.09	0.34	51.25	73.98	-22.73
7311.00	Avg	V	113	154	-67.52	10.13	49.61	53.98	-4.37
7311.00	Peak	V	113	154	-57.75	10.13	59.38	73.98	-14.60
12185.00	Avg	V	-	-	-72.84	16.74	50.90	53.98	-3.07
12185.00	Peak	V	-	-	-57.14	16.74	66.60	73.98	-7.37

Table 7-15. Radiated Measurements with WCP

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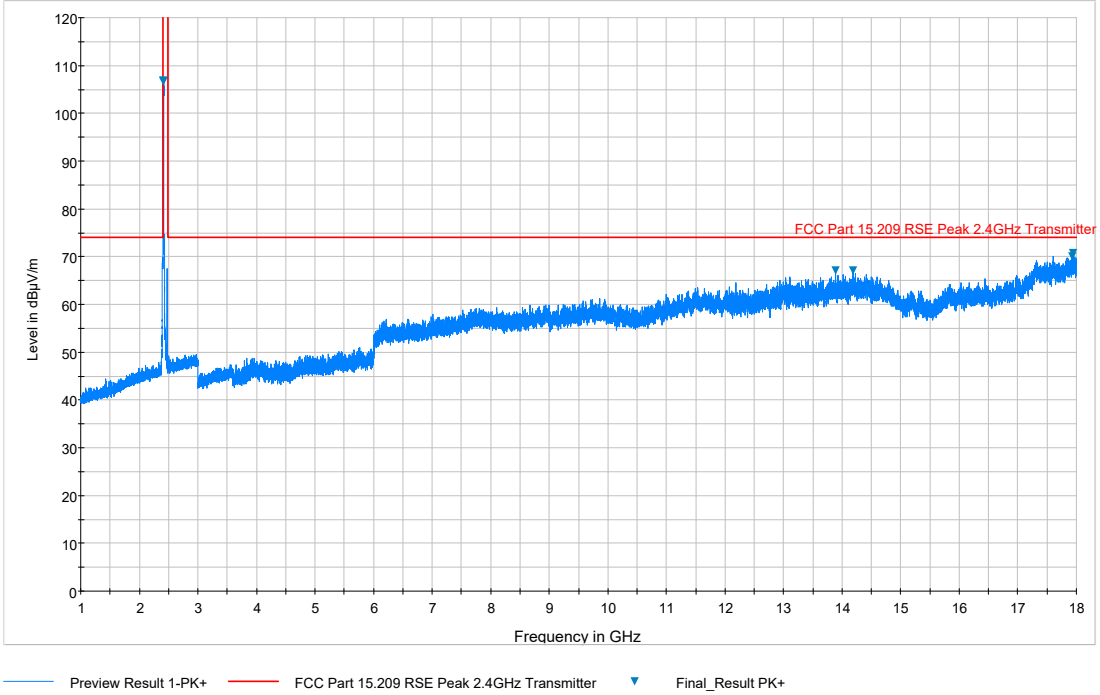
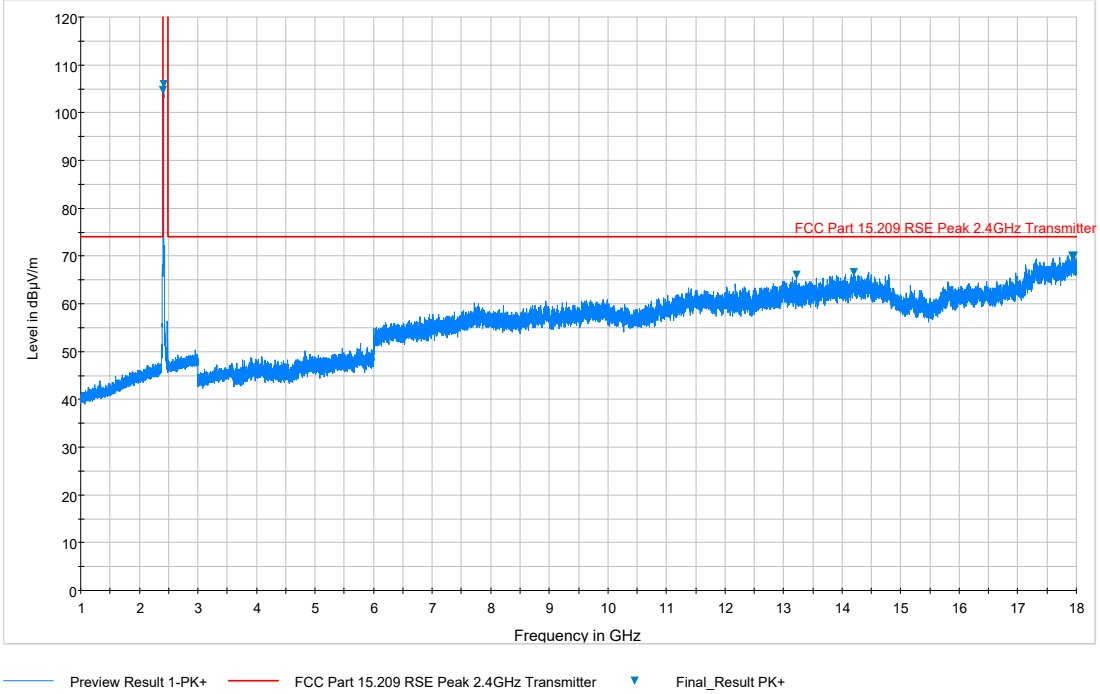
7.7.2 Antenna-2 Radiated Spurious Emission Measurements

§15.247(d) §15.205 & §15.209



Plot 7-69. Radiated Spurious Plot above 1GHz (802.11b – Ch. 1, Ant. Pol. H)



Plot 7-70. Radiated Spurious Plot above 1GHz (802.11b – Ch. 1, Ant. Pol. V)

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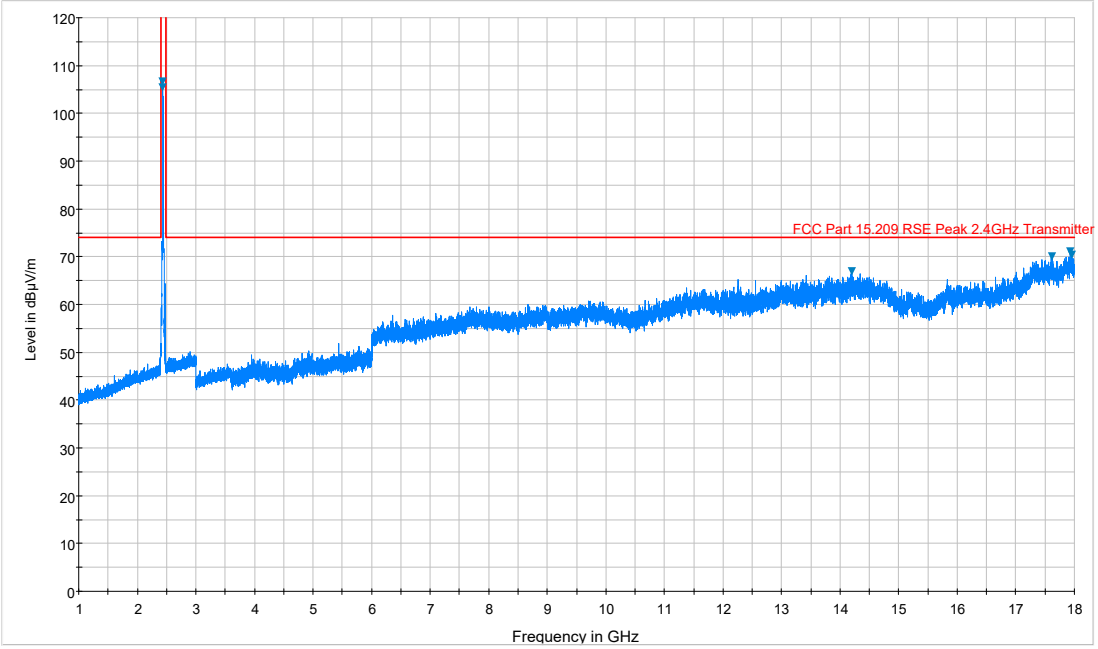
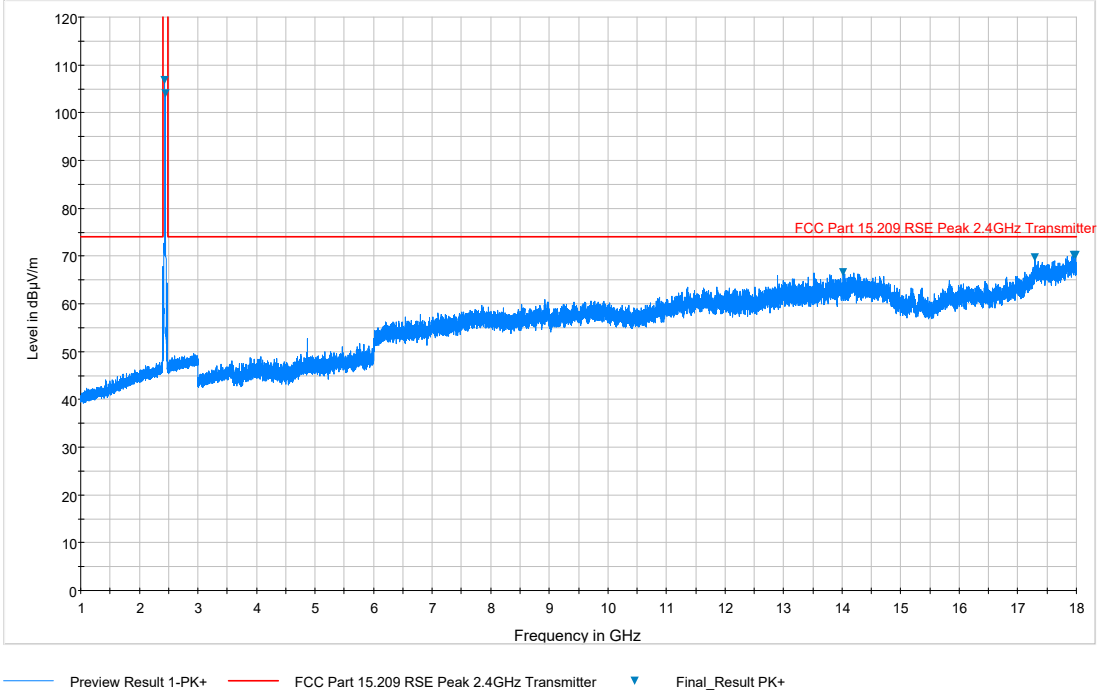


Plot 7-71. Radiated Spurious Plot above 1GHz (802.11b – Ch. 6, Ant. Pol. H)



Plot 7-72. Radiated Spurious Plot above 1GHz (802.11b – Ch. 6, Ant. Pol. V)

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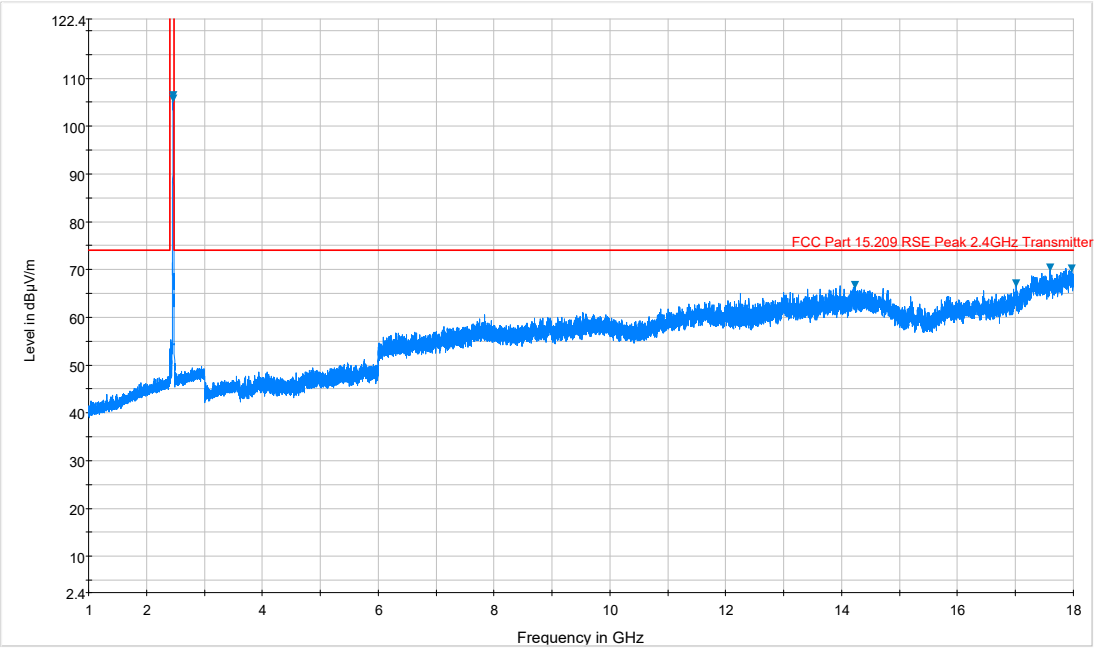
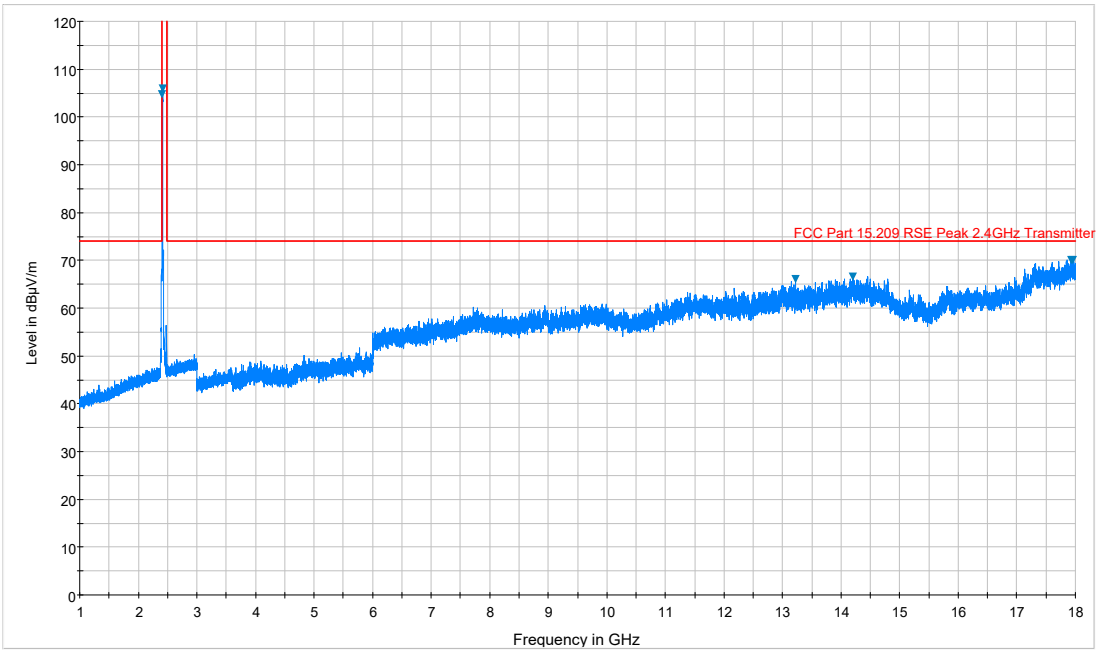


Preview Result 1-PK+ FCC Part 15.209 RSE Peak 2.4GHz Transmitter Final_Result PK+

Plot 7-73. Radiated Spurious Plot above 1GHz (802.11b – Ch. 11, Ant. Pol. H)



Preview Result 1-PK+ FCC Part 15.209 RSE Peak 2.4GHz Transmitter Final_Result PK+

Plot 7-74. Radiated Spurious Plot above 1GHz (802.11b – Ch. 11, Ant. Pol. V)

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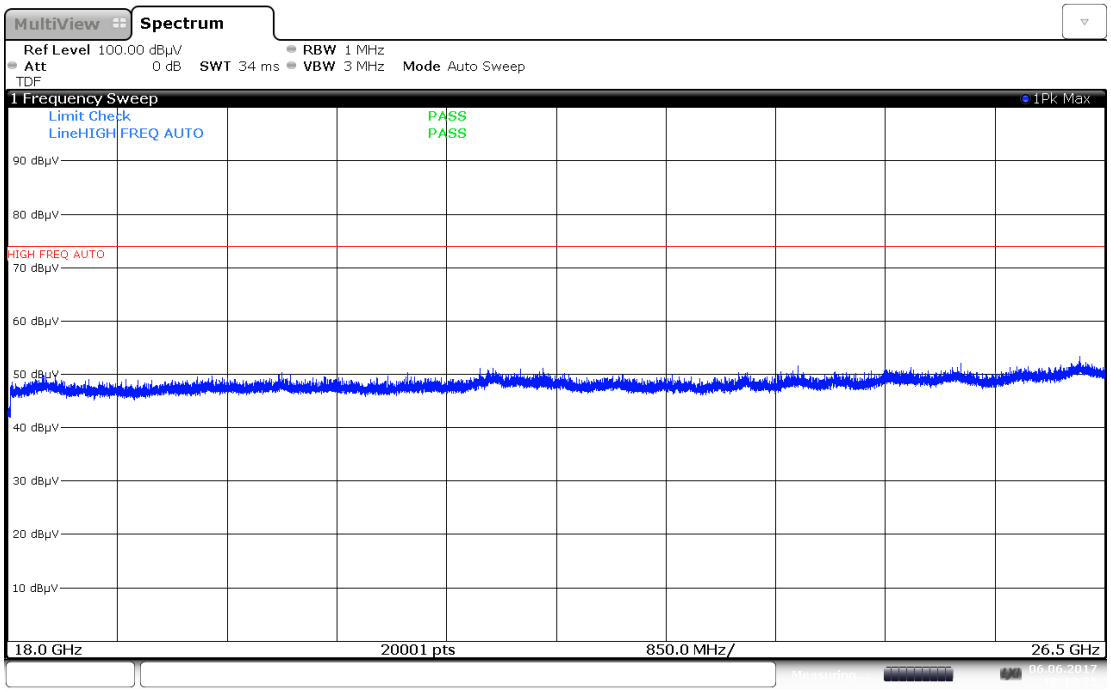
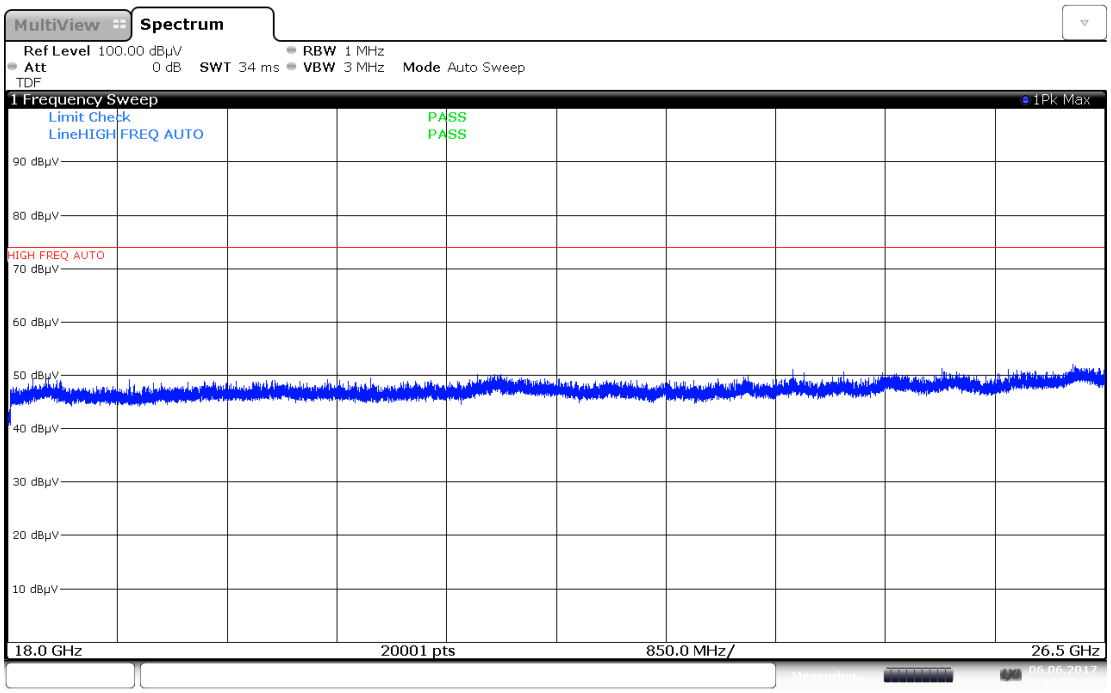
Antenna-2 Radiated Spurious Emissions Measurements (Above 18GHz)

§15.209



18:49:26 06.06.2017

Plot 7-75. Radiated Spurious Plot above 18GHz (Pol. H)



19:10:53 06.06.2017

Plot 7-76. Radiated Spurious Plot above 18GHz (Pol. V)

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Antenna-2 Radiated Spurious Emission Measurements

§15.247(d) §15.205 & §15.209

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	V	154	84	-56.52	0.05	50.53	53.98	-3.45
4824.00	Peak	V	154	84	-51.80	0.05	55.25	73.98	-18.73
12060.00	Avg	V	-	-	-70.74	14.63	50.89	53.98	-3.08
12060.00	Peak	V	-	-	-58.07	14.63	63.56	73.98	-10.41

Table 7-16. Radiated Measurements

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	V	152	95	-56.86	0.34	50.48	53.98	-3.50
4874.00	Peak	V	152	95	-51.87	0.34	55.47	73.98	-18.51
7311.00	Avg	V	-	-	-69.92	10.13	47.21	53.98	-6.77
7311.00	Peak	V	-	-	-58.23	10.13	58.90	73.98	-15.08
12185.00	Avg	V	-	-	-72.88	16.74	50.86	53.98	-3.11
12185.00	Peak	V	-	-	-58.40	16.74	65.34	73.98	-8.63

Table 7-17. Radiated Measurements

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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	V	130	80	-63.13	0.55	44.42	53.98	-9.56
4924.00	Peak	V	130	80	-55.41	0.55	52.14	73.98	-21.84
7386.00	Avg	V	-	-	-69.58	10.27	47.69	53.98	-6.29
7386.00	Peak	V	-	-	-58.04	10.27	59.23	73.98	-14.75
12310.00	Avg	V	-	-	-70.70	14.60	50.90	53.98	-3.08
12310.00	Peak	V	-	-	-57.20	14.60	64.40	73.98	-9.58

Table 7-18. Radiated Measurements

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	V	116	281	-59.06	0.05	47.99	53.98	-5.99
4824.00	Peak	V	116	281	-53.29	0.05	53.76	73.98	-20.22
12060.00	Avg	V	-	-	-70.71	14.63	50.92	53.98	-3.05
12060.00	Peak	V	-	-	-58.95	14.63	62.68	73.98	-11.29

Table 7-19. Radiated Measurements with WCP

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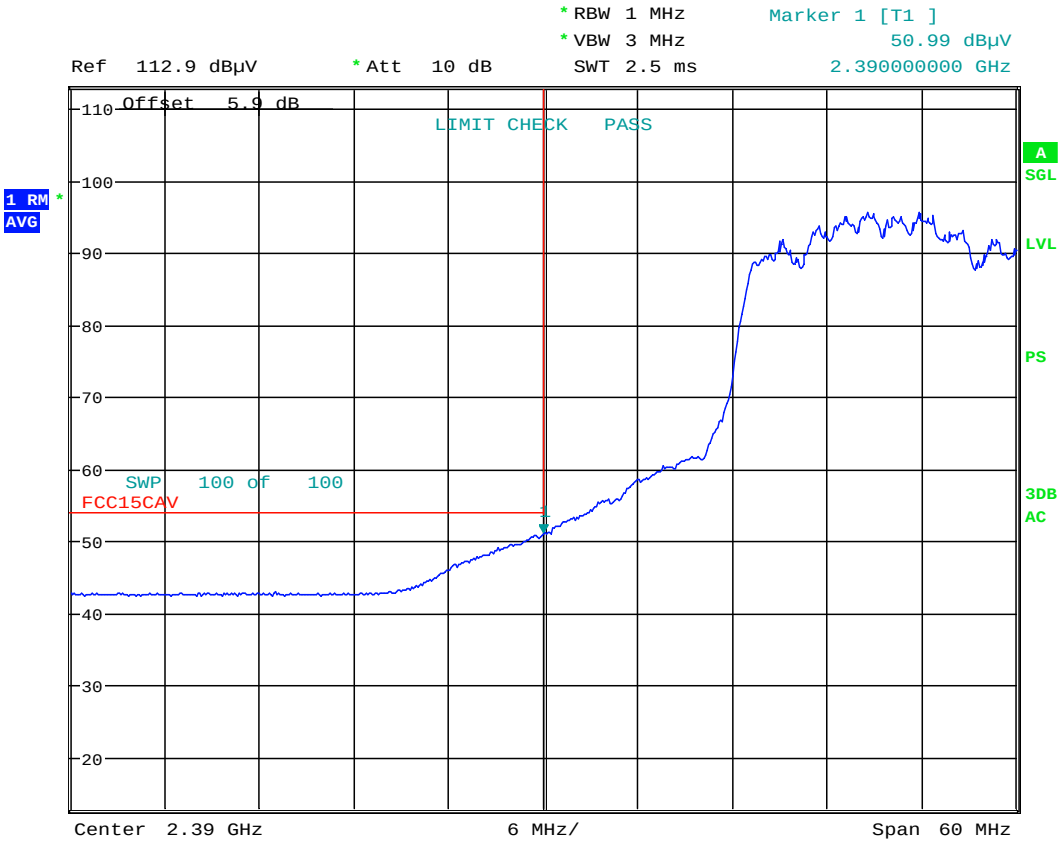
7.7.3 Antenna-1 Radiated Restricted Band Edge Measurements

§15.205 §15.209

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



Date: 8.JUN.2017 02:49:50

Plot 7-77. Radiated Restricted Lower Band Edge Measurement (Average)

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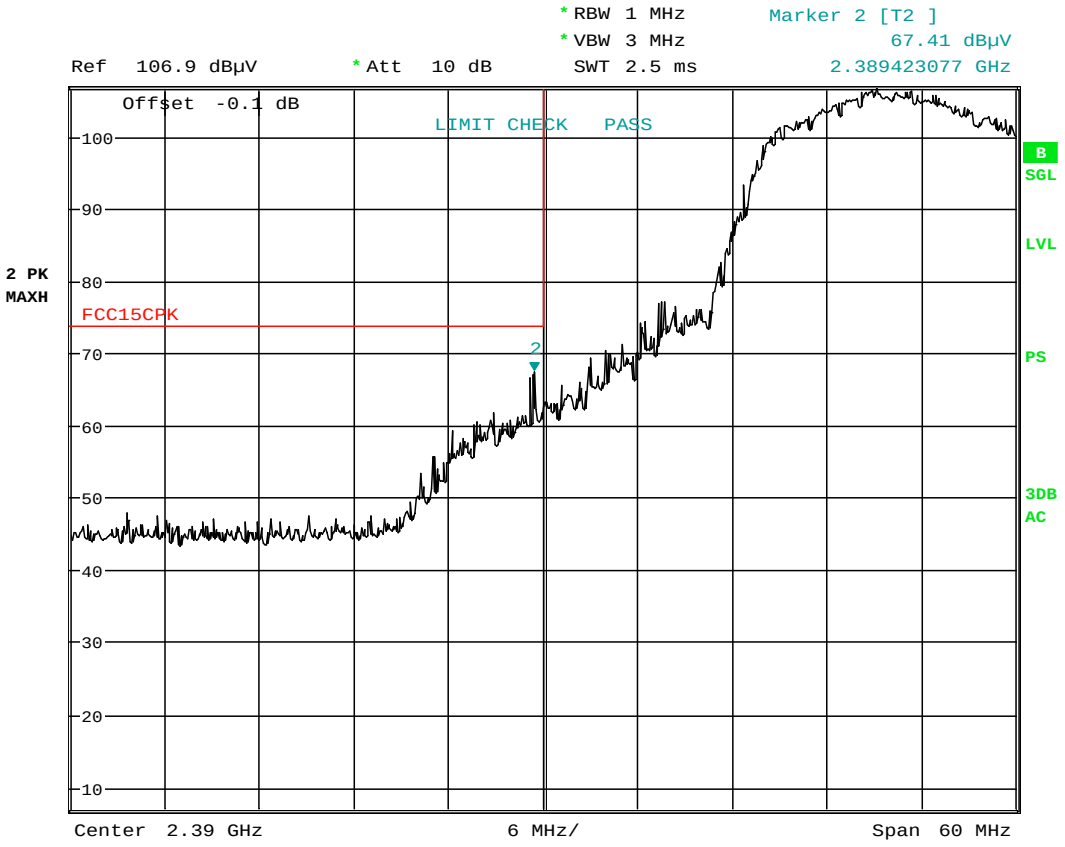
Antenna-1 Radiated Restricted Band Edge Measurements

§15.205 §15.209



Date: 7.JUN.2017 23:31:59

Plot 7-78. Radiated Restricted Lower Band Edge Measurement (Peak)

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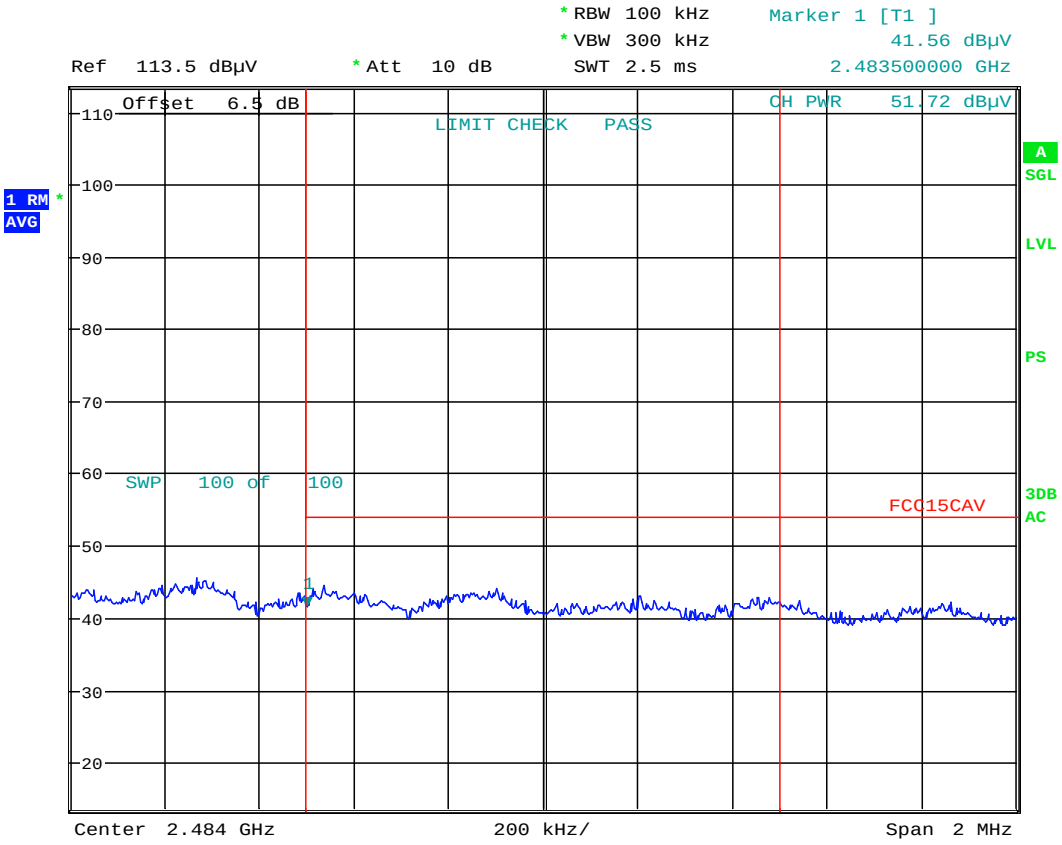
Antenna-1 Radiated Restricted Band Edge Measurements

§15.205 §15.209

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



Date: 8.JUN.2017 02:55:50

Plot 7-79. Radiated Restricted Upper Band Edge Measurement (Average)

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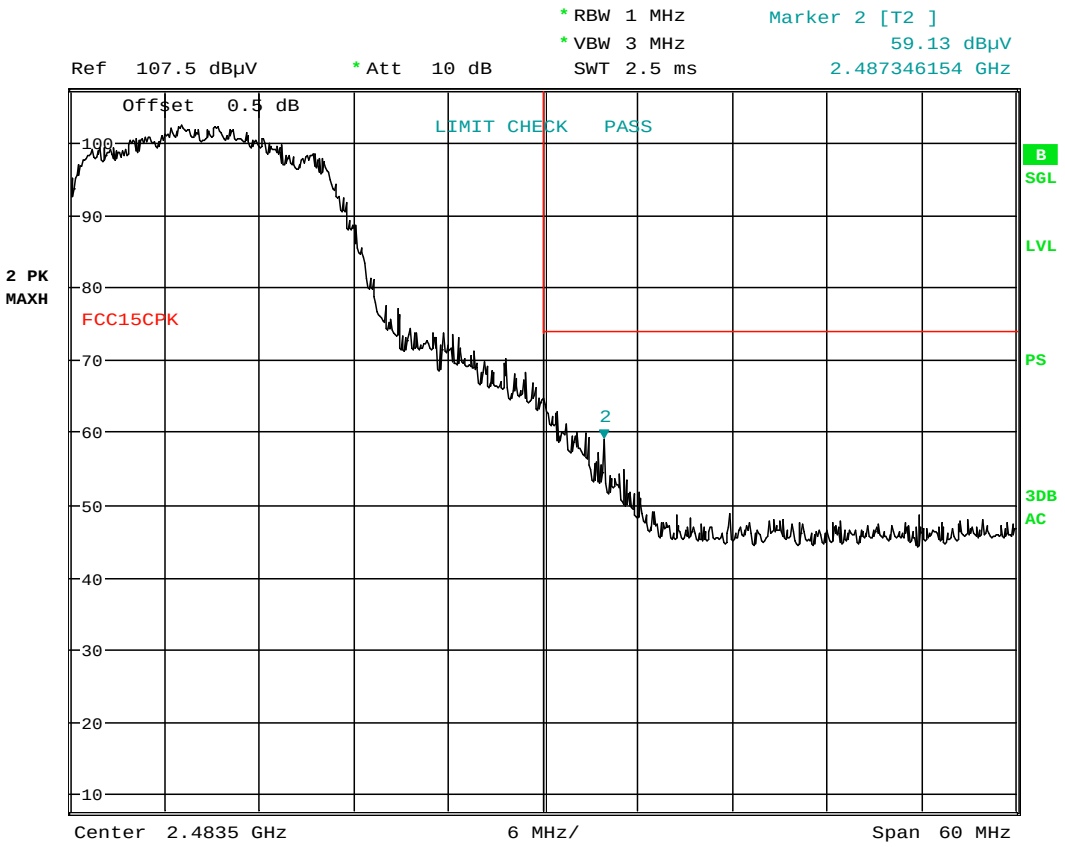
Antenna-1 Radiated Restricted Band Edge Measurements

§15.205 §15.209



Date: 7.JUN.2017 23:52:43

Plot 7-80. Radiated Restricted Upper Band Edge Measurement (Peak)

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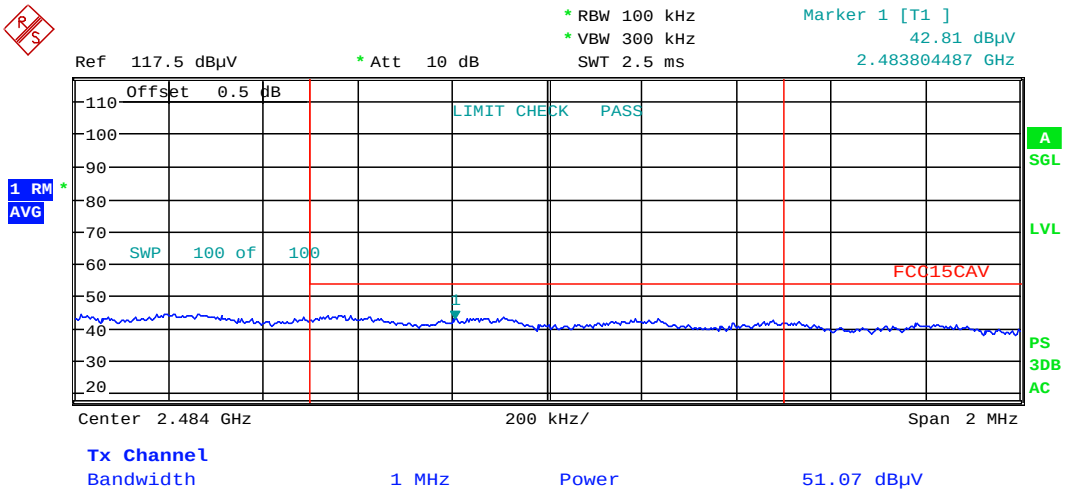
Antenna-1 WCP Radiated Restricted Band Edge Measurements

§15.205 §15.209

Worst Case Mode:	802.11g
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2412MHz
Channel:	01



Date: 13.JUN.2017 10:05:52

Plot 7-81. Radiated Restricted Band Edge Measurement with WCP (Average)

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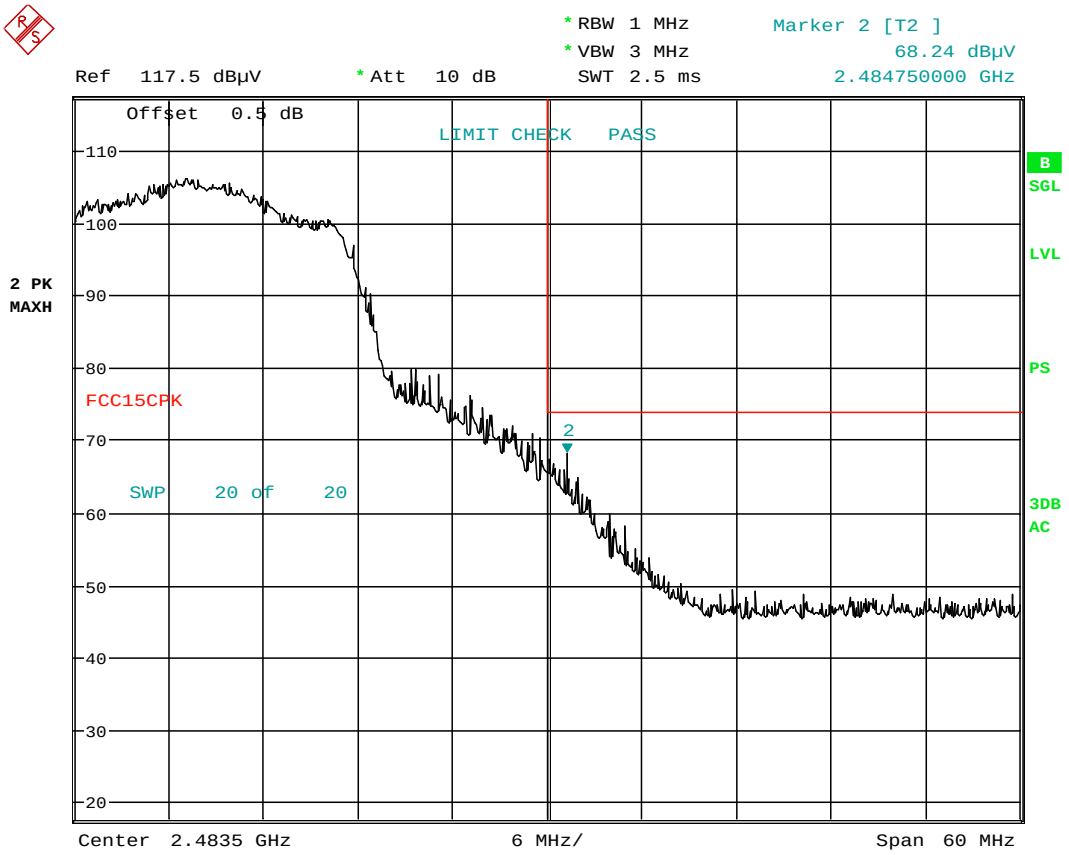
Antenna-1 WCP Radiated Restricted Band Edge Measurements

§15.205 §15.209



Date: 13.JUN.2017 10:06:40

Plot 7-82. Radiated Restricted Band Edge Measurement with WCP (Peak)

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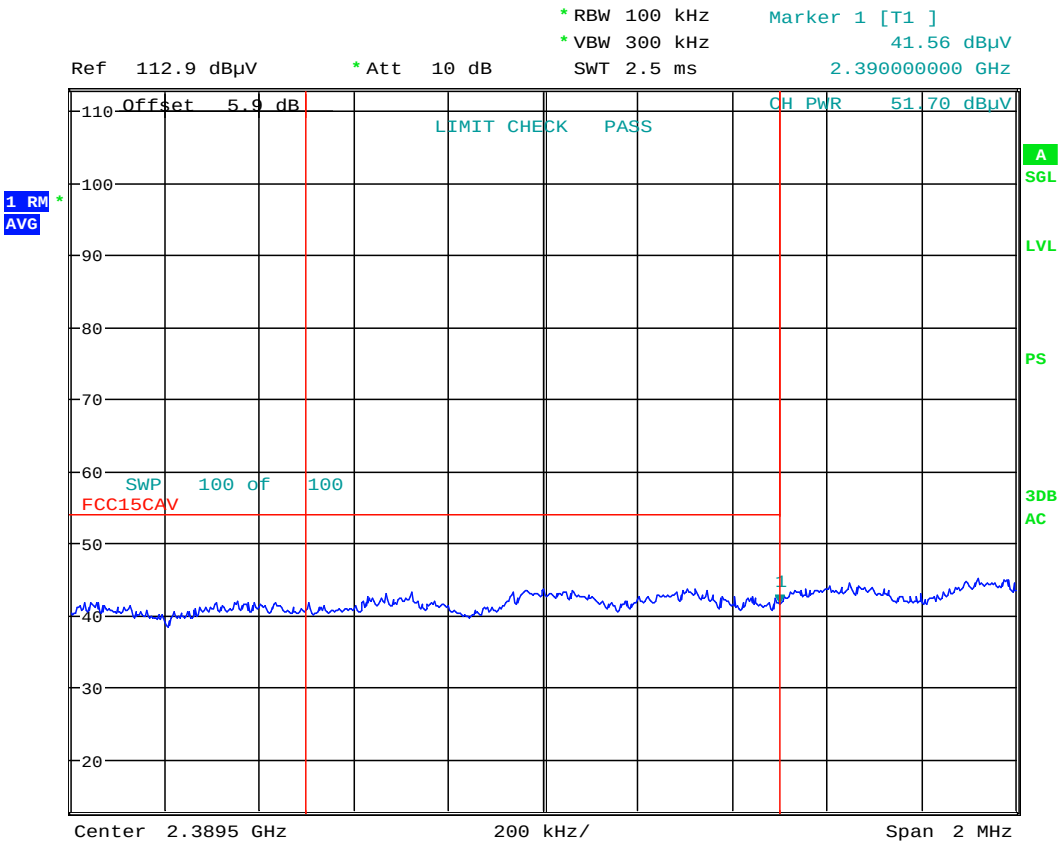
7.7.4 Antenna-2 Radiated Restricted Band Edge Measurements

§15.205 §15.209

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



Date: 8.JUN.2017 00:58:58

Plot 7-83. Radiated Restricted Lower Band Edge Measurement (Average)

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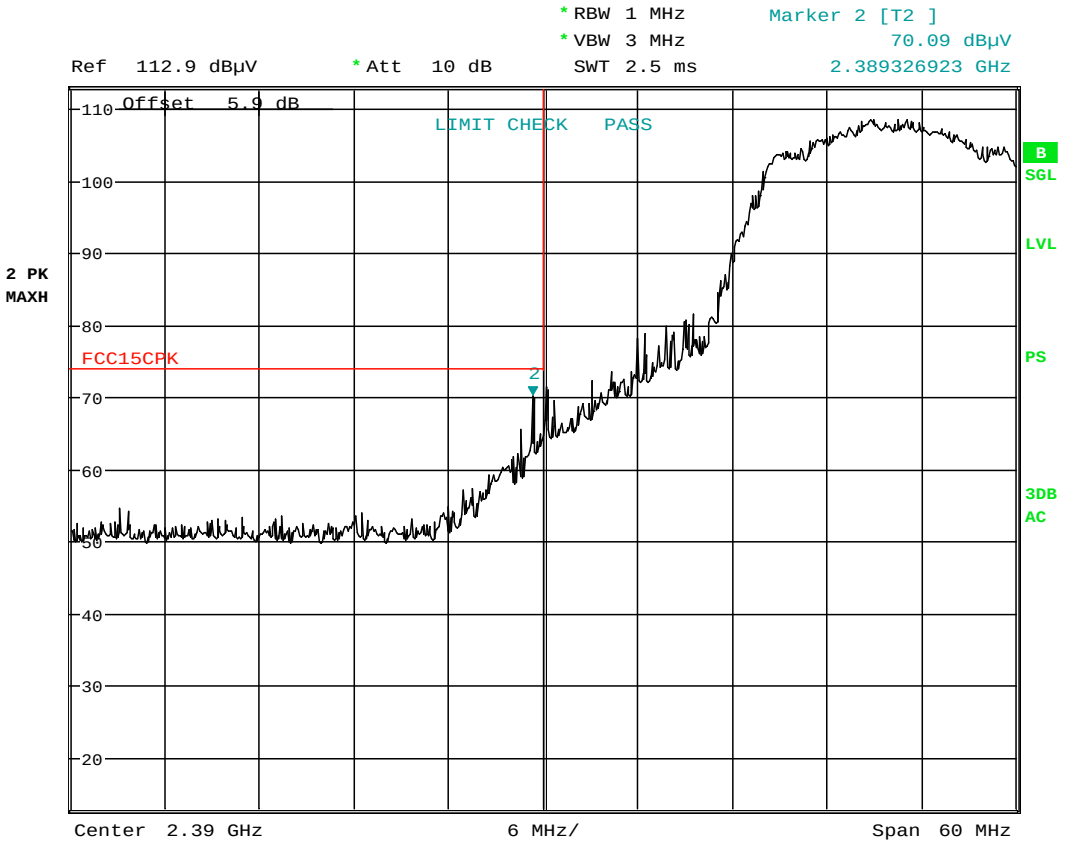
Antenna-2 Radiated Restricted Band Edge Measurements

§15.205 §15.209



Date: 8.JUN.2017 00:59:48

Plot 7-84. Radiated Restricted Lower Band Edge Measurement (Peak)

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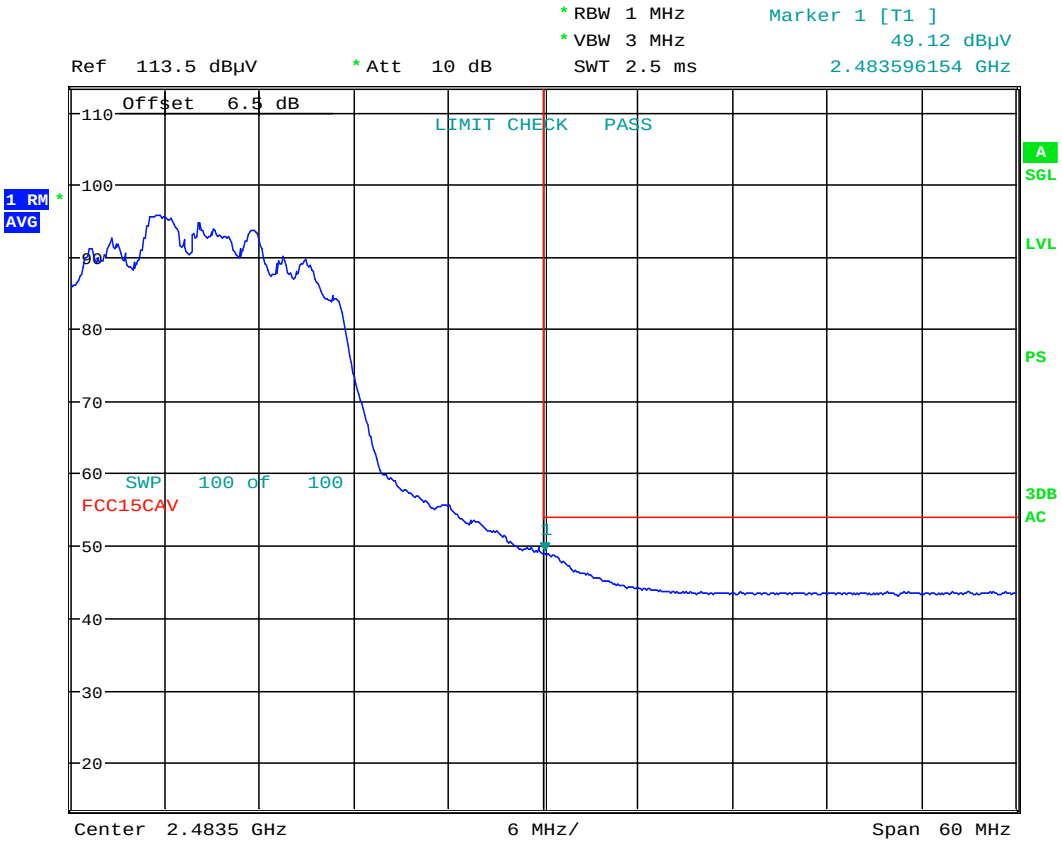
Antenna-2 Radiated Restricted Band Edge Measurements

§15.205 §15.209

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



Date: 8.JUN.2017 01:09:23

Plot 7-85. Radiated Restricted Upper Band Edge Measurement (Average)

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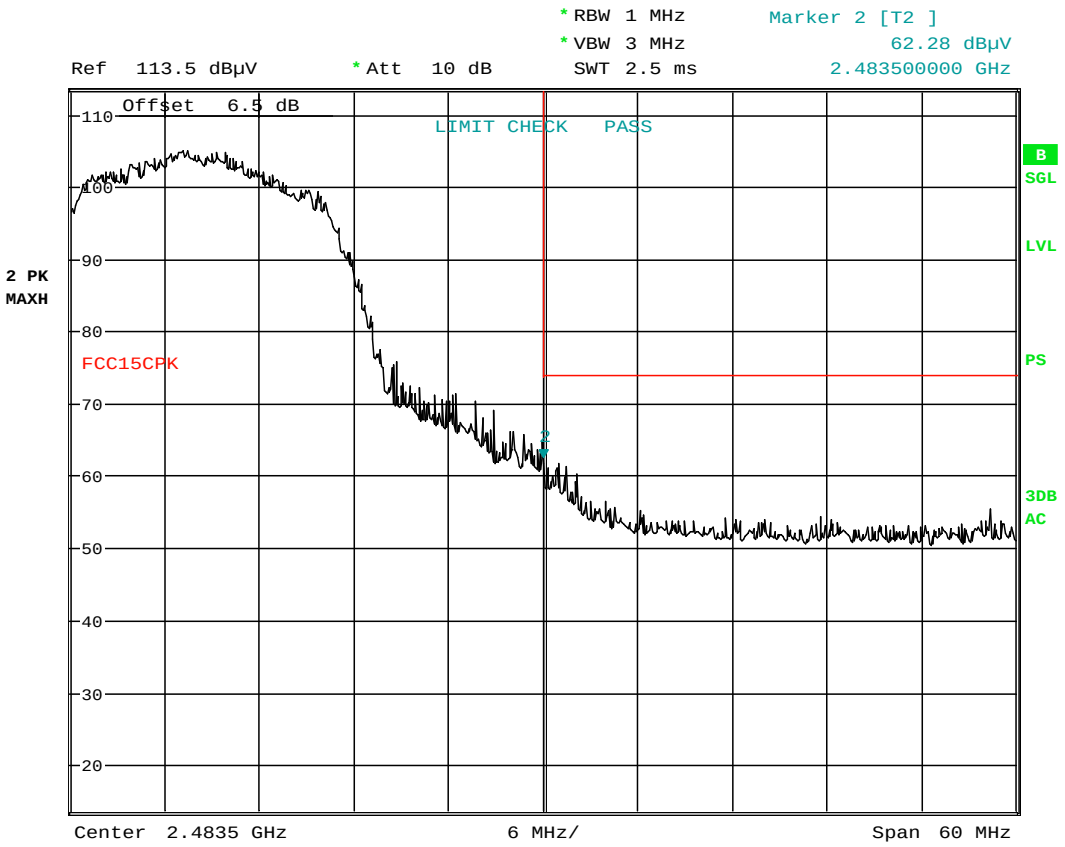
Antenna-2 Radiated Restricted Band Edge Measurements

§15.205 §15.209



Date: 8.JUN.2017 01:09:40

Plot 7-86. Radiated Restricted Upper Band Edge Measurement (Peak)

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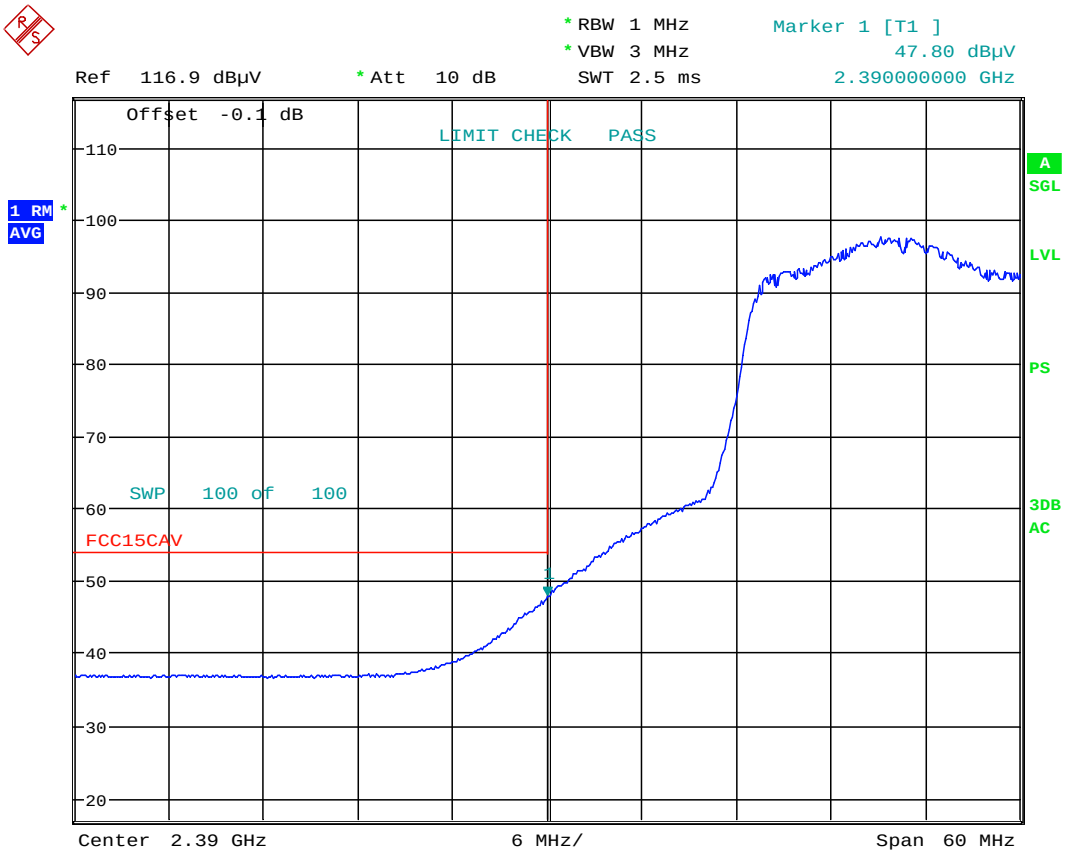
Antenna-2 WCP Radiated Restricted Band Edge Measurements

§15.205 §15.209

Worst Case Mode:	802.11g
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2412MHz
Channel:	01



Date: 13.JUN.2017 10:15:07

Plot 7-87. Radiated Restricted Band Edge Measurement with WCP (Average)

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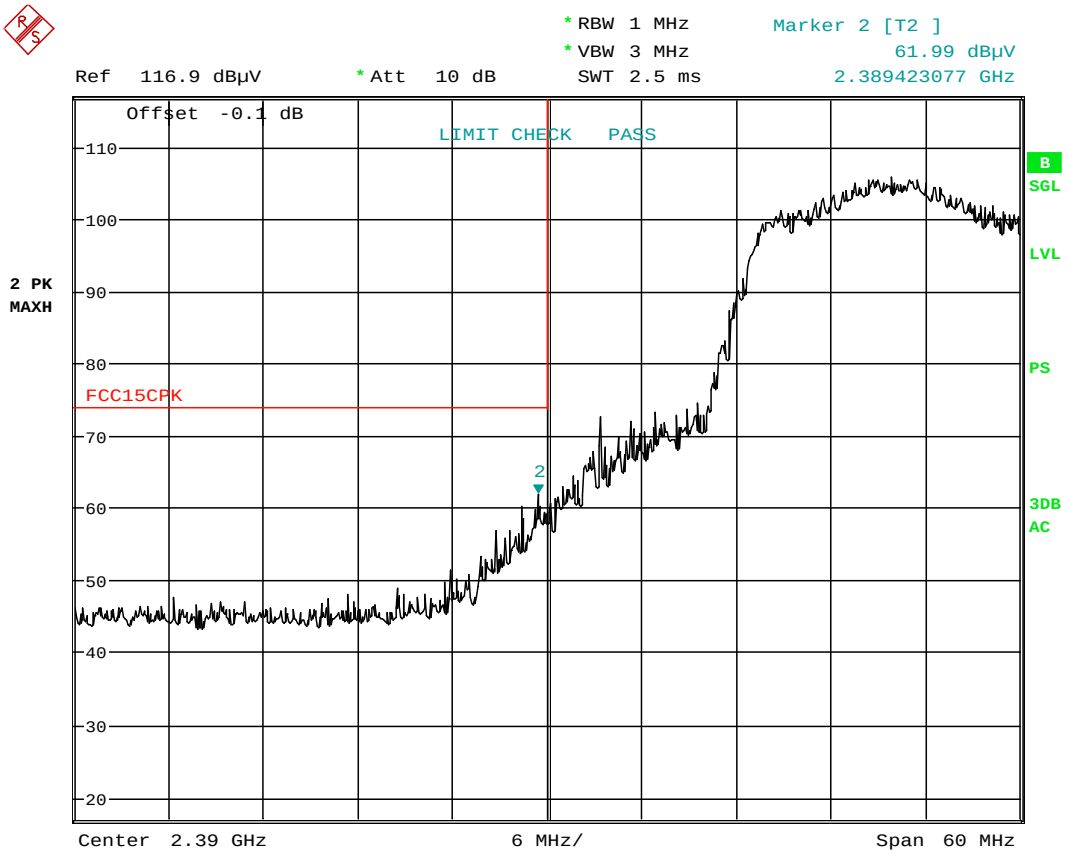
Antenna-2 WCP Radiated Restricted Band Edge Measurements

§15.205 §15.209



Date: 13.JUN.2017 10:15:24

Plot 7-88. Radiated Restricted Band Edge Measurement with WCP (Peak)

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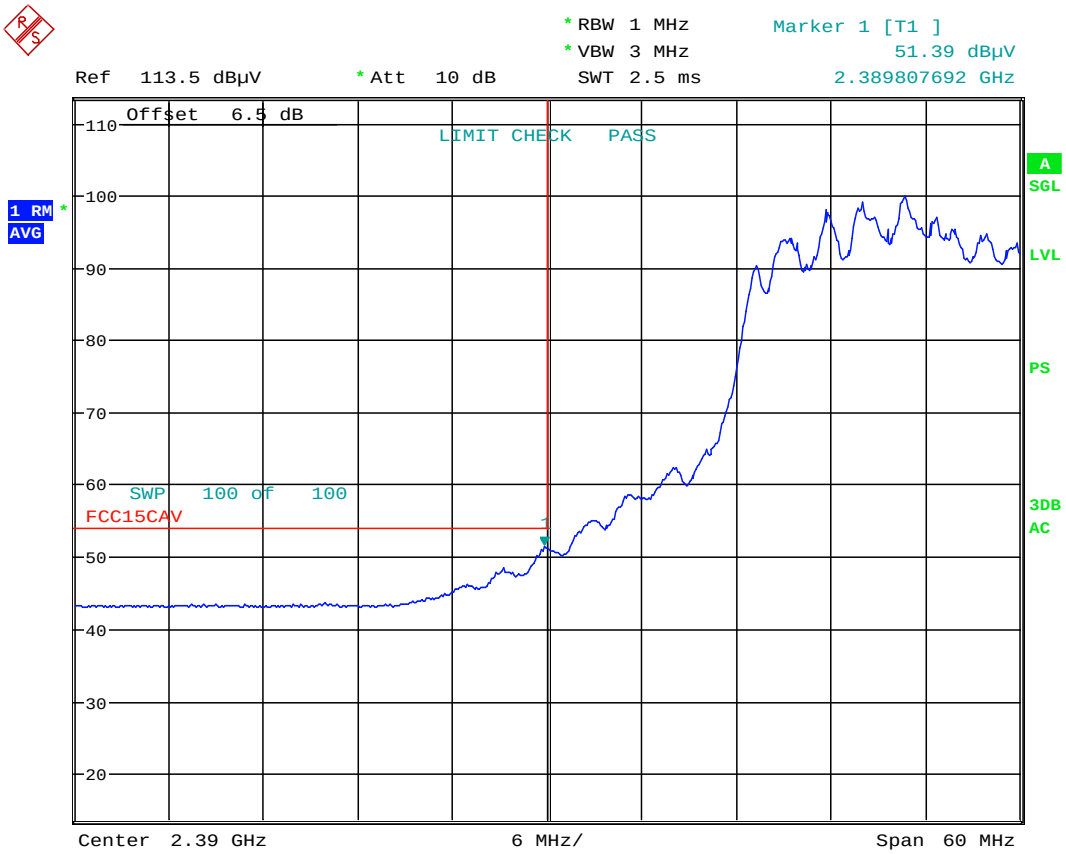
7.7.5 MIMO Radiated Restricted Band Edge Measurements

§15.205 §15.209

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:	802.11n
Worst Case Transfer Rate:	MCS8
Distance of Measurements:	3 Meters
Operating Frequency:	2412MHz
Channel:	1



Date: 14.JUN.2017 01:20:32

Plot 7-89. Radiated Restricted Lower Band Edge Measurement (Average)

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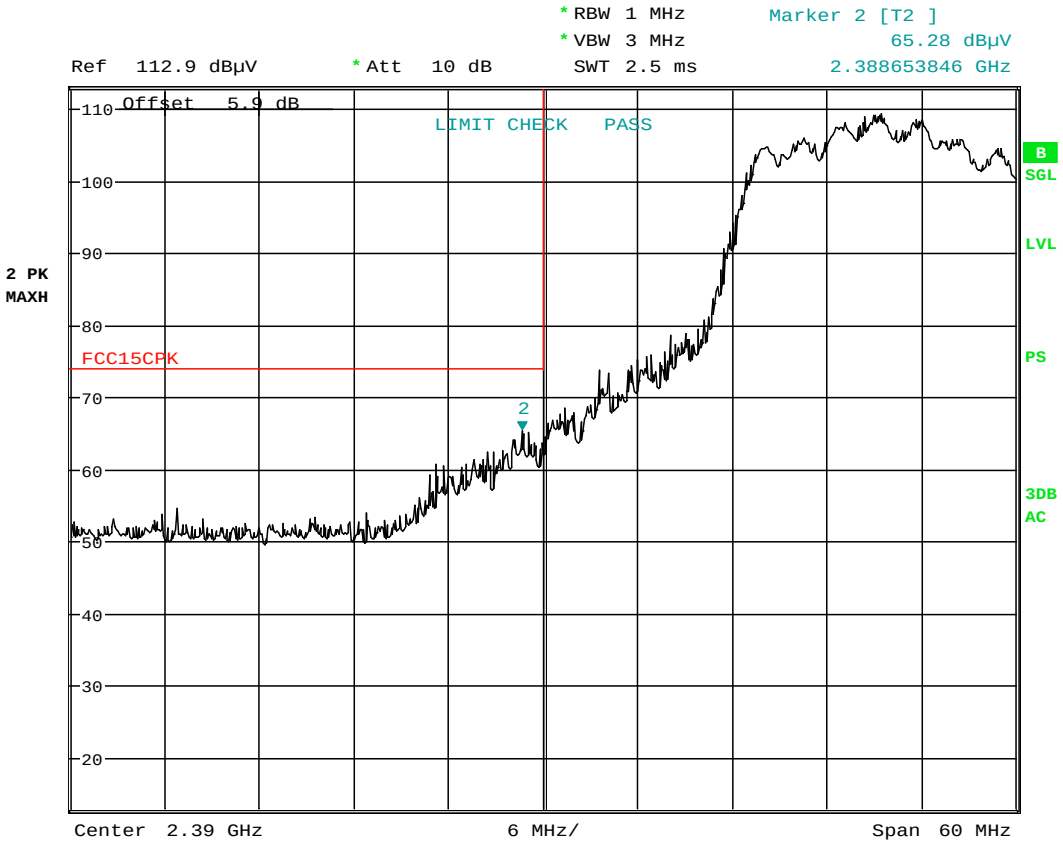
MIMO Radiated Restricted Band Edge Measurements

§15.205 §15.209



Date: 8.JUN.2017 01:20:16

Plot 7-90. Radiated Restricted Lower Band Edge Measurement (Peak)

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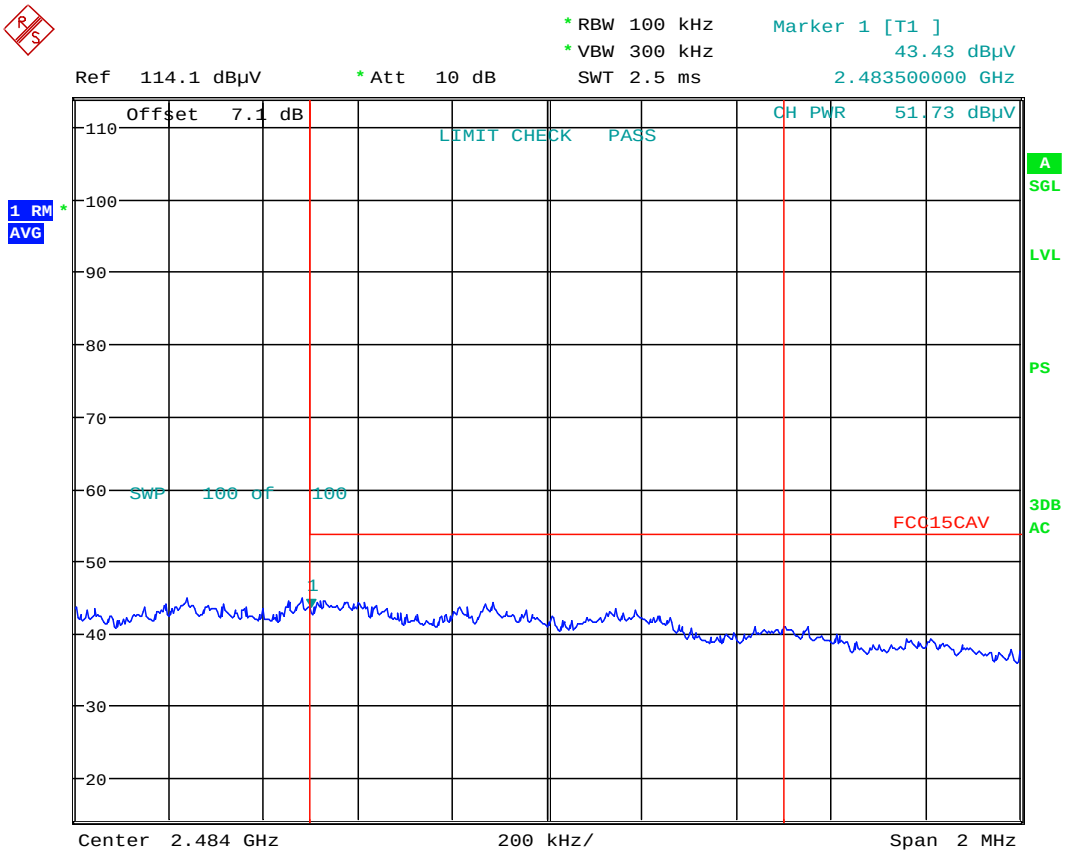
MIMO Radiated Restricted Band Edge Measurements

§15.205 §15.209

Worst Case Mode:	802.11n
Worst Case Transfer Rate:	MCS8
Distance of Measurements:	3 Meters
Operating Frequency:	2462MHz
Channel:	11



Date: 14.JUN.2017 01:28:53

Plot 7-91. Radiated Restricted Upper Band Edge Measurement (Average)

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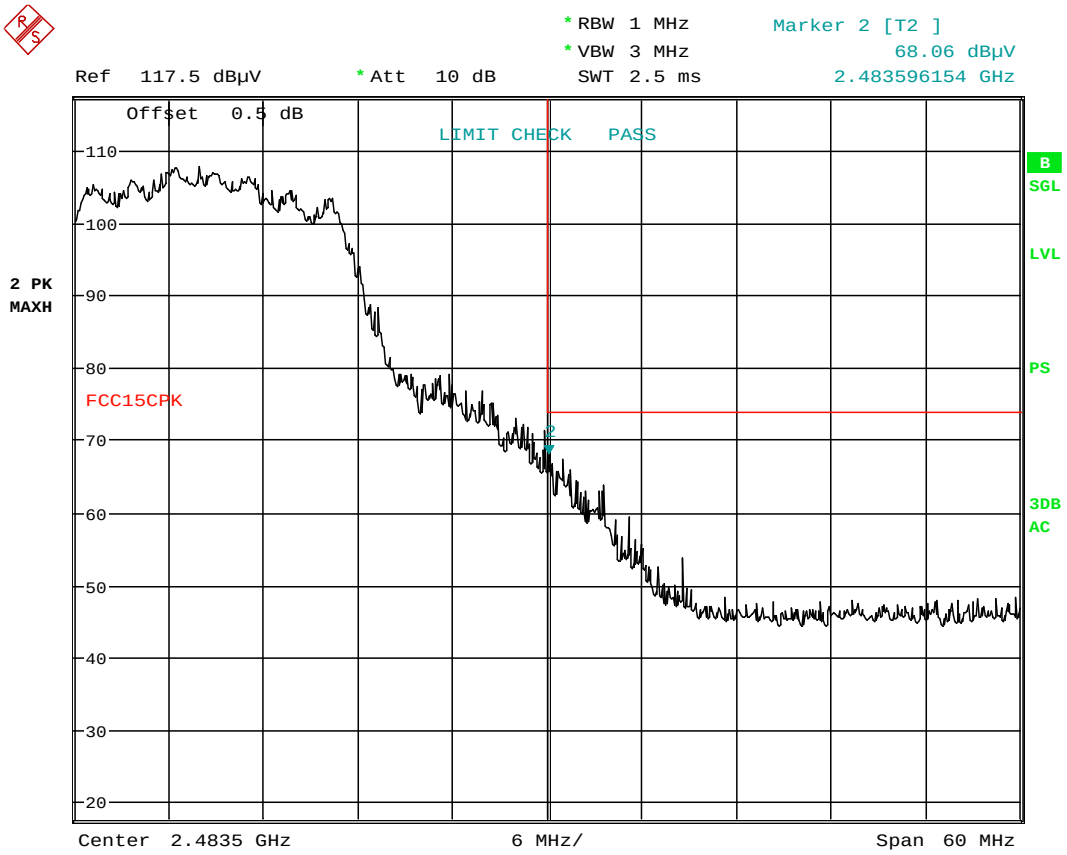
MIMO Radiated Restricted Band Edge Measurements

§15.205 §15.209



Date: 13.JUN.2017 02:14:02

Plot 7-92. Radiated Restricted Upper Band Edge Measurement (Peak)

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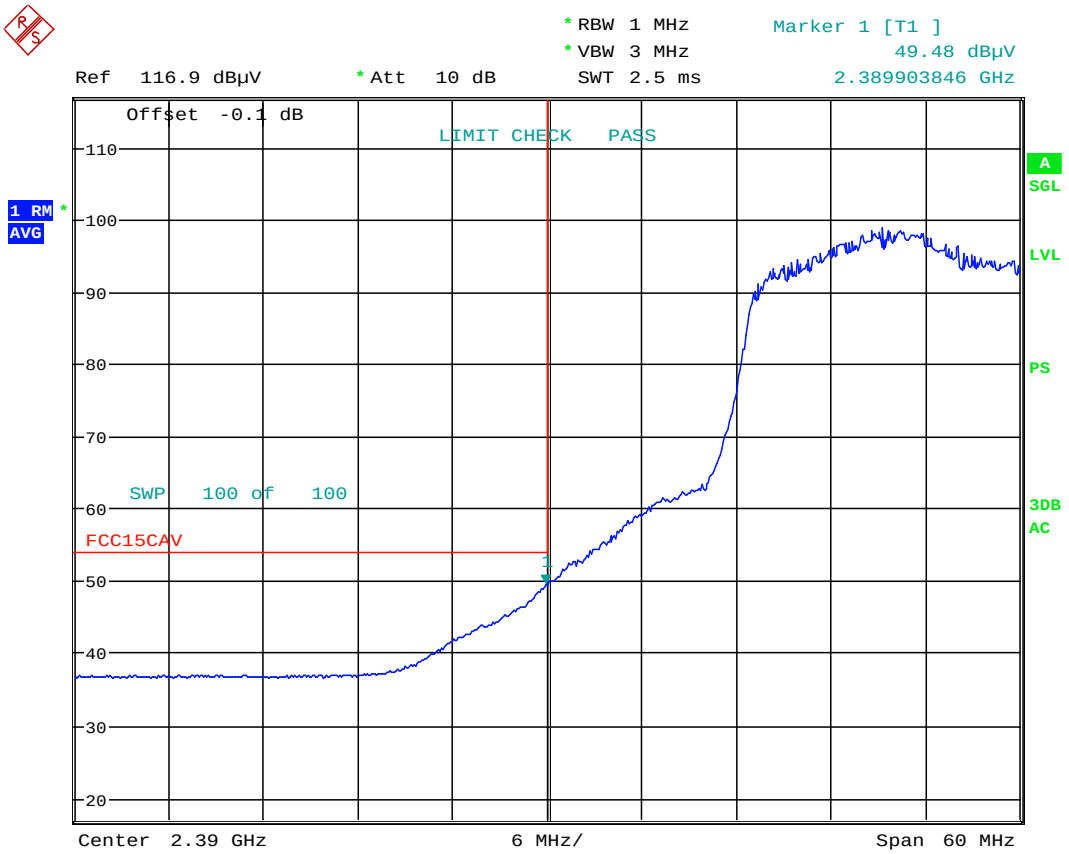
MIMO WCP Radiated Restricted Band Edge Measurements

§15.205 §15.209

Worst Case Mode:	802.11g
Worst Case Transfer Rate:	6 Mbps
Distance of Measurements:	3 Meters
Operating Frequency:	2412MHz
Channel:	01



Date: 13.JUN.2017 10:25:22

Plot 7-93. Radiated Restricted Band Edge Measurement with WCP (Average)

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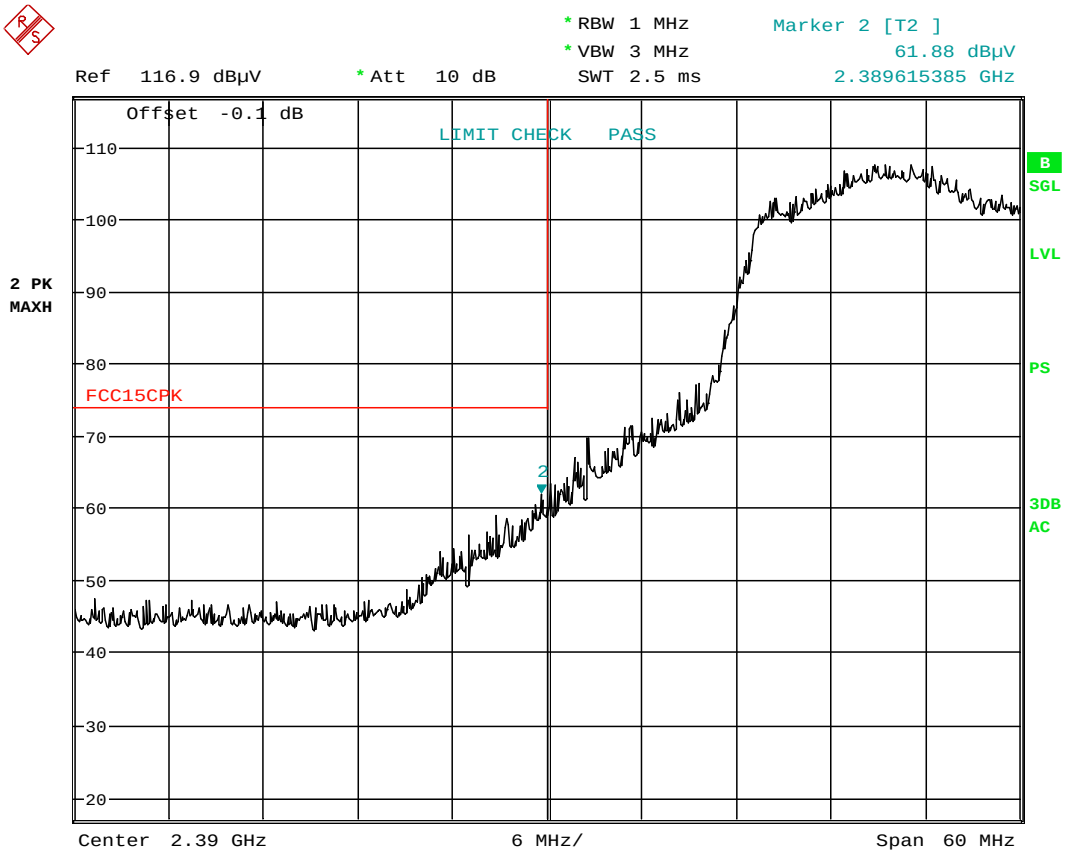
MIMO WCP Radiated Restricted Band Edge Measurements

§15.205 §15.209



Date: 13.JUN.2017 10:25:38

Plot 7-94. Radiated Restricted Band Edge Measurement with WCP (Peak)

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7.8 Radiated Spurious Emissions Measurements – 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 7-20 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 7-20. 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

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Test Setup

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

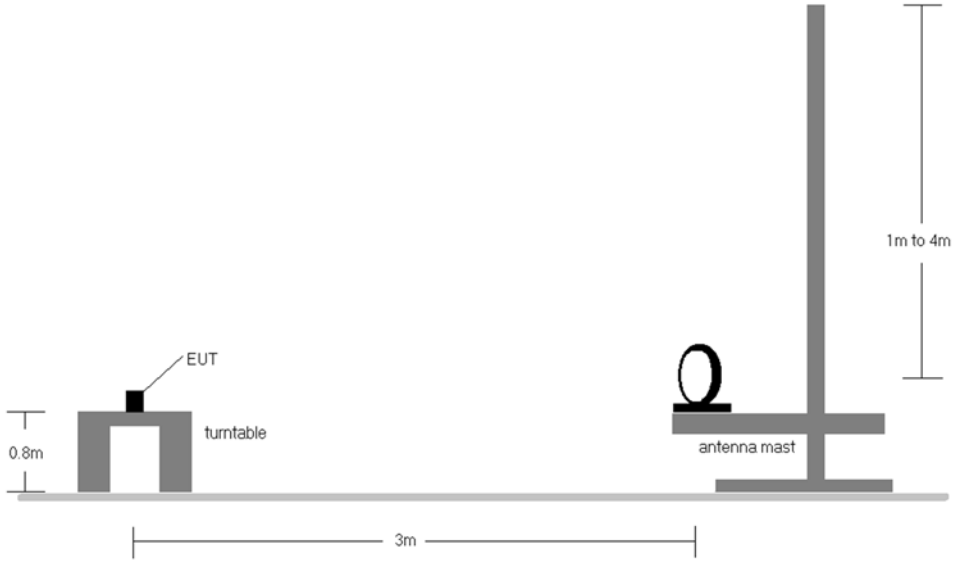

Figure 7-7. Radiated Test Setup < 30Mhz

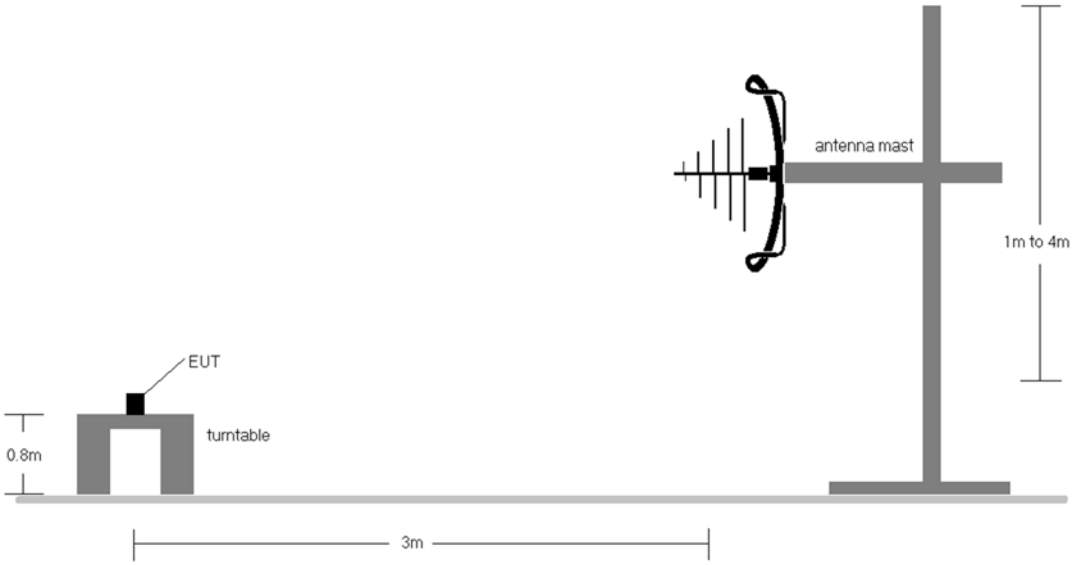

Figure 7-8. Radiated Test Setup < 1GHz

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Test Notes

1. All emissions lying in restricted bands specified in §15.205 are below the limit shown in Table 7-20.
2. The broadband receive antenna is manipulated through vertical and horizontal polarizations during the tests. The EUT is manipulated through three orthogonal planes.
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. The worst-case emissions are reported however emissions whose levels were not within 20dB of the respective limits were not reported.
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. The wide spectrum spurious emissions plots shown on the following pages are used only for the purpose of emission identification. There were no emissions detected in the 30MHz – 1GHz frequency range, as shown in the subsequent plots.

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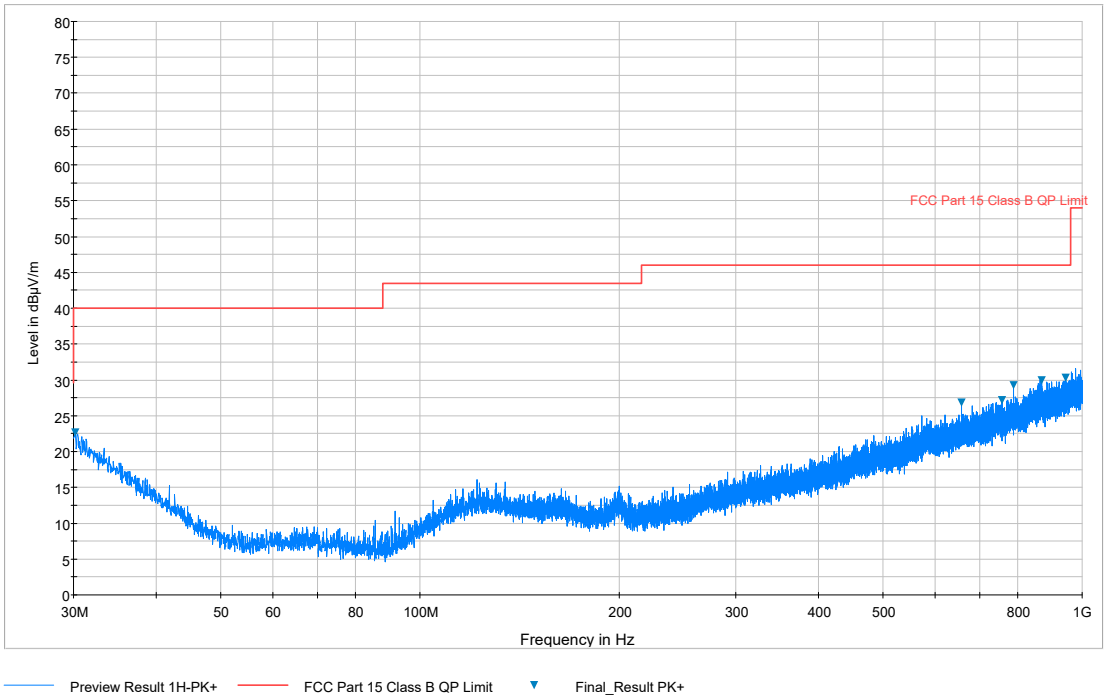
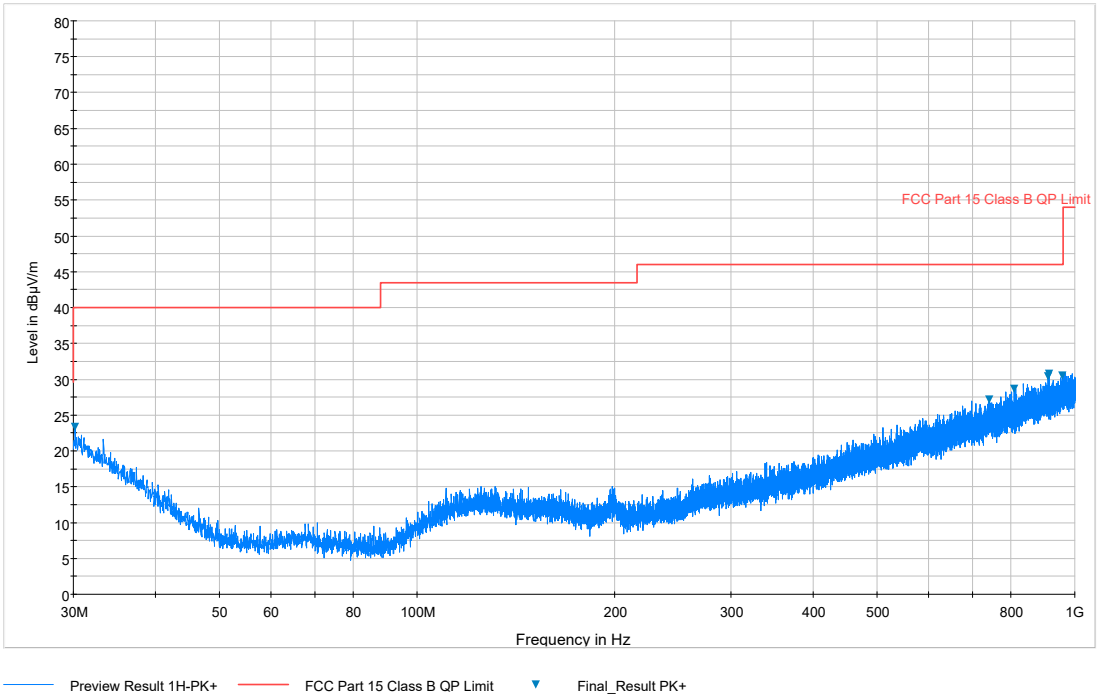
Antenna-1 Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209



Plot 7-95. Radiated Spurious Plot below 1GHz (Pol. H)



Plot 7-96. Radiated Spurious Plot below 1GHz (Pol. V)

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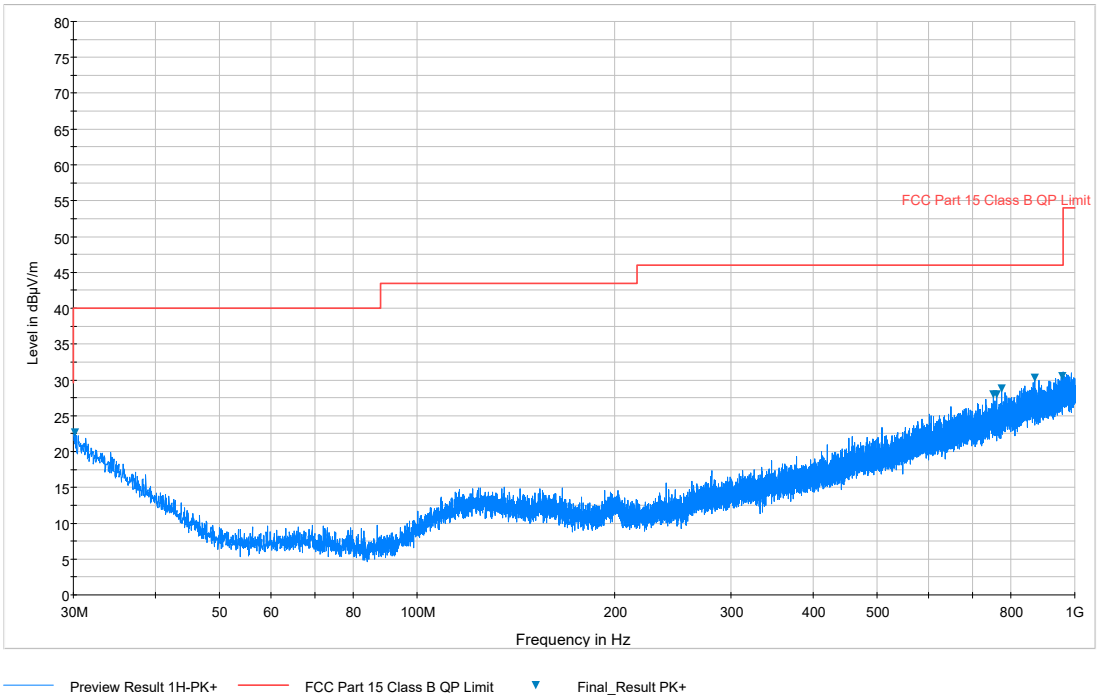
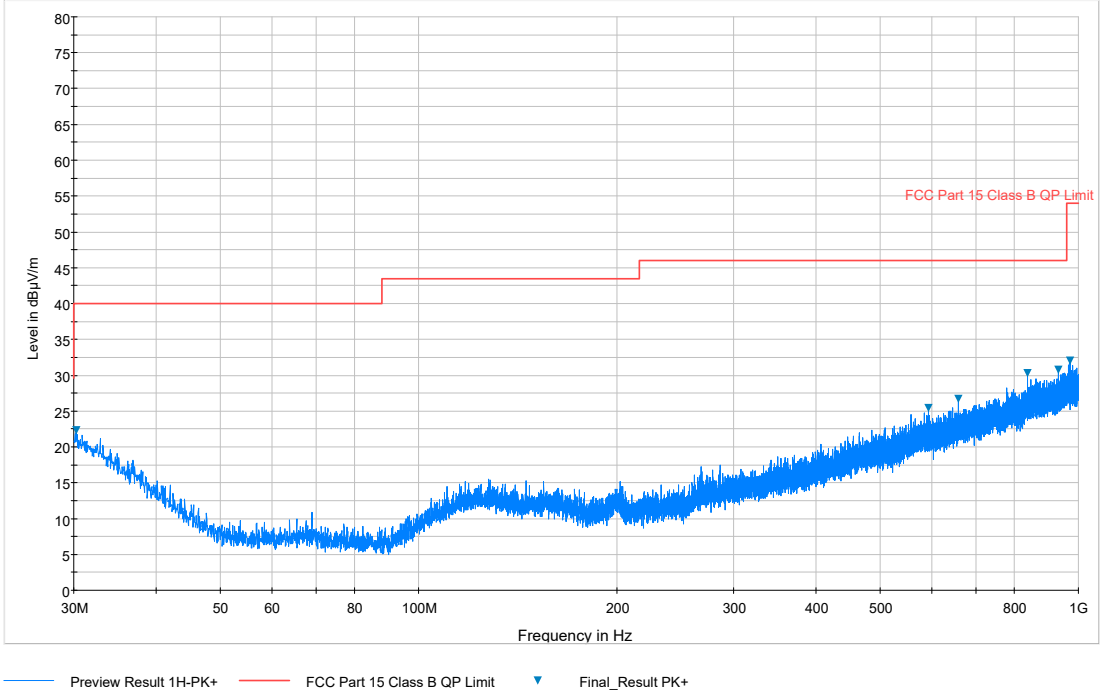
Antenna-2 Radiated Spurious Emissions Measurements (Below 1GHz)

§15.209



Plot 7-97. Radiated Spurious Plot below 1GHz (Pol. H)



Plot 7-98. Radiated Spurious Plot below 1GHz (Pol. V)

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7.9 Line-Conducted Test Data

§15.207

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.

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 7-21. 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

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Test Setup

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

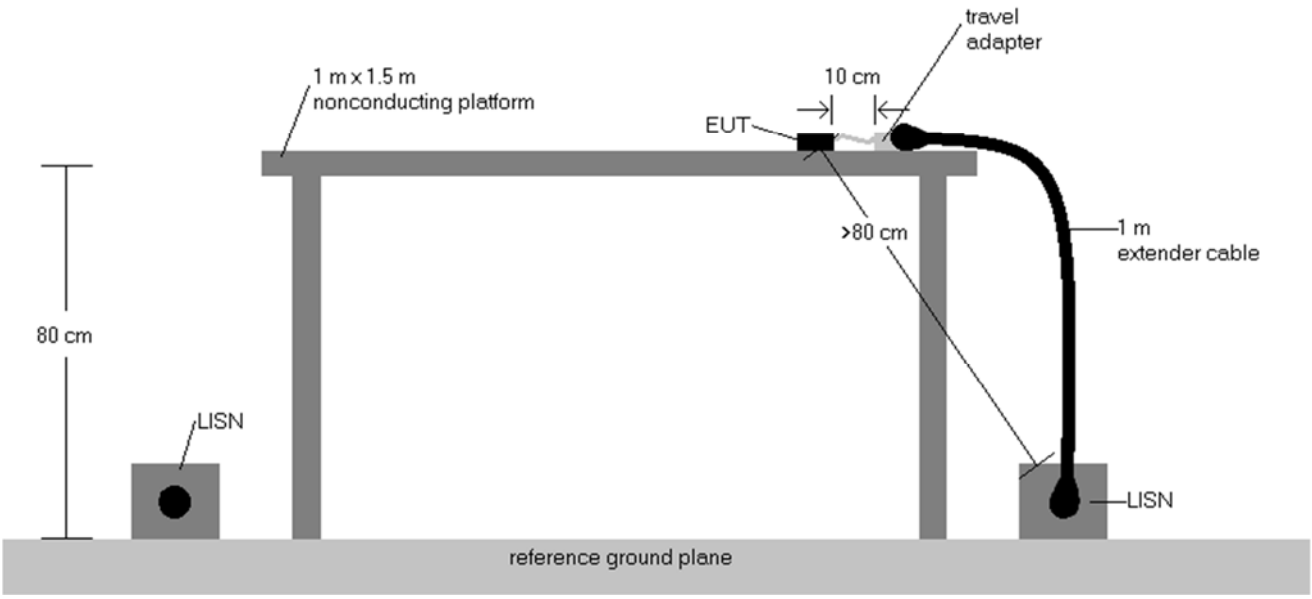

Figure 7-9. Test Instrument & Measurement Setup

Test Notes

1. All modes of operation were investigated and the worst-case emissions are reported 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 15.207.
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.

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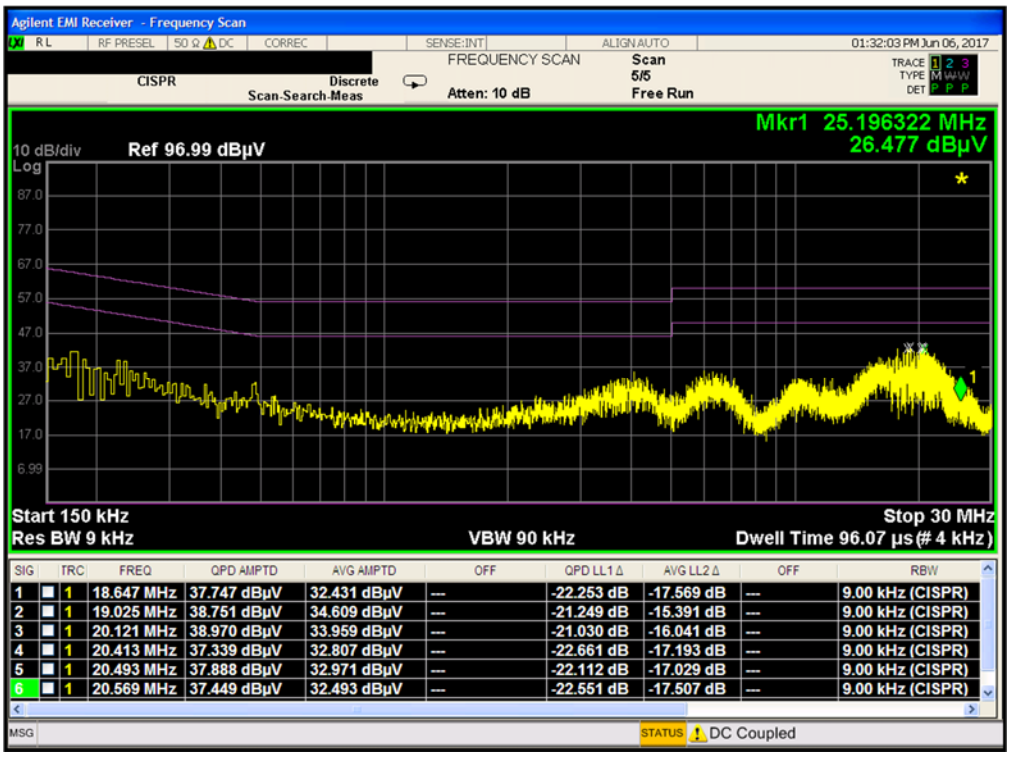
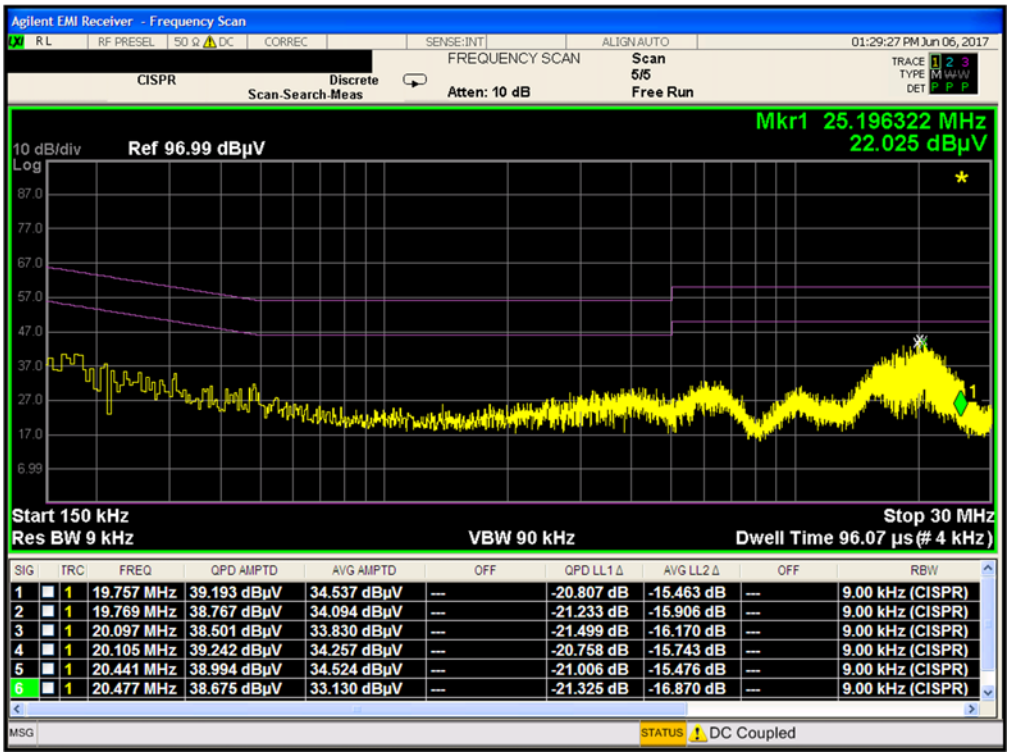


Plot 7-99. Line Conducted Plot with 802.11b (L1)



Plot 7-100. Line Conducted Plot with 802.11b (N)

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8.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Samsung Portable Handset FCC ID: A3LSMN950U** is in compliance with Part 15C of the FCC Rules.

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APPENDIX A. 802.11G DUAL TX

A.1 Summary

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (TX)					
15.205 15.209	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	RADIATED	PASS	Section A.2

Table A.1-1. Summary of Test Results

Notes:

1) This device employs dual transmission in 802.11a and 802.11g modes using CDD. For all test cases, the device was set to transmit from both antennas simultaneously. The data in this section demonstrates compliance to the dual-transmission requirements specified in KDB 662911 v02r01.
2) All data found in this section is compiled from plots found in the main body of this test report.
3) Since this device is able to transmit the same data through both of its antennas in a given symbol period, then, by the definition specified in KDB 662911 v02r01 Section F)1), the transmission symbols are correlated.
4) Since two antennas are supported in this device and a minimum of N_{ss} = 1 antenna can operate at any given time, the maximum array gain for two correlated signals is $10\log_{10}(N_{ant}/N_{ss})$ = 3dB, where N_{ss} is the number of spatial streams and N_{ant} is the total number of antennas.
5) For conducted spurious emissions, per KDB 662911 v02r01 Section E)3)b), the emissions on each individual output complied with its corresponding relative limit for that output, so additional testing was not required for dual transmission operation.

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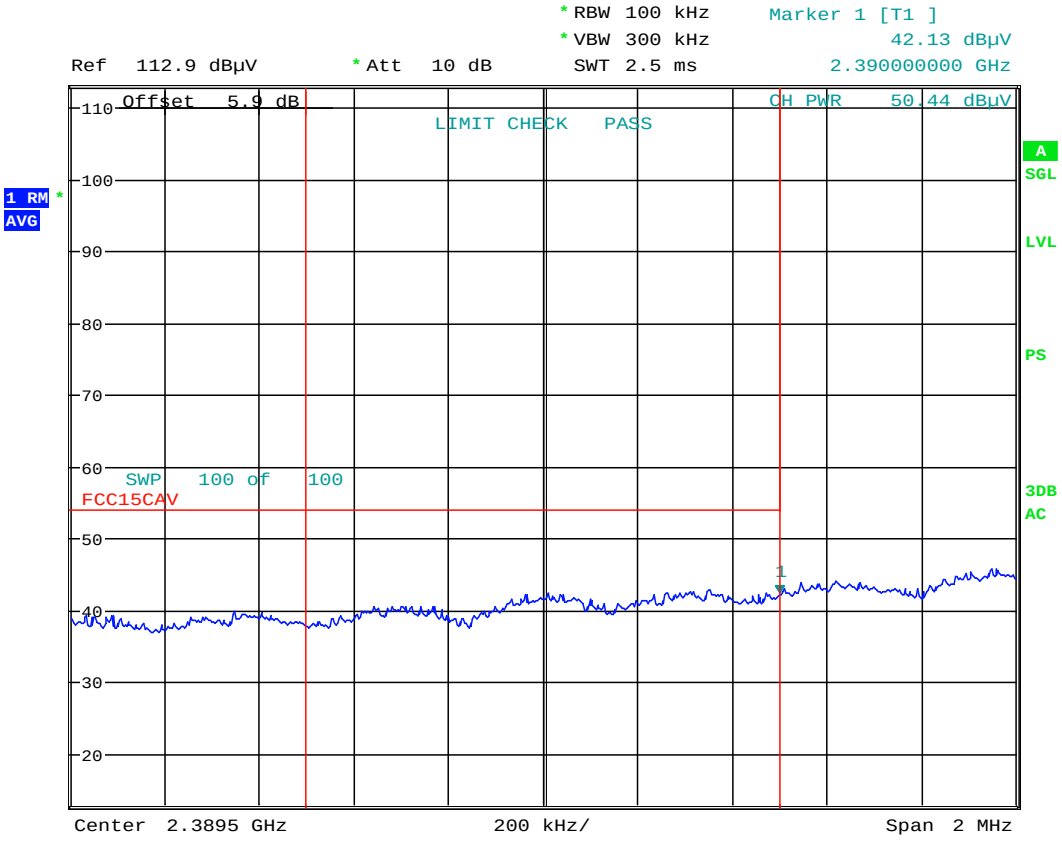
A.2 Dual Tx Radiated Restricted Band Edge Measurements

§15.205 §15.209

The radiated restricted band edge measurements are measured with an EMI test receiver connected to the receive antenna while the EUT is transmitting on both outputs in 802.11g mode.

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



Date: 8.JUN.2017 02:38:53

Plot A2-1. Radiated Restricted Lower Band Edge Measurement (Average)

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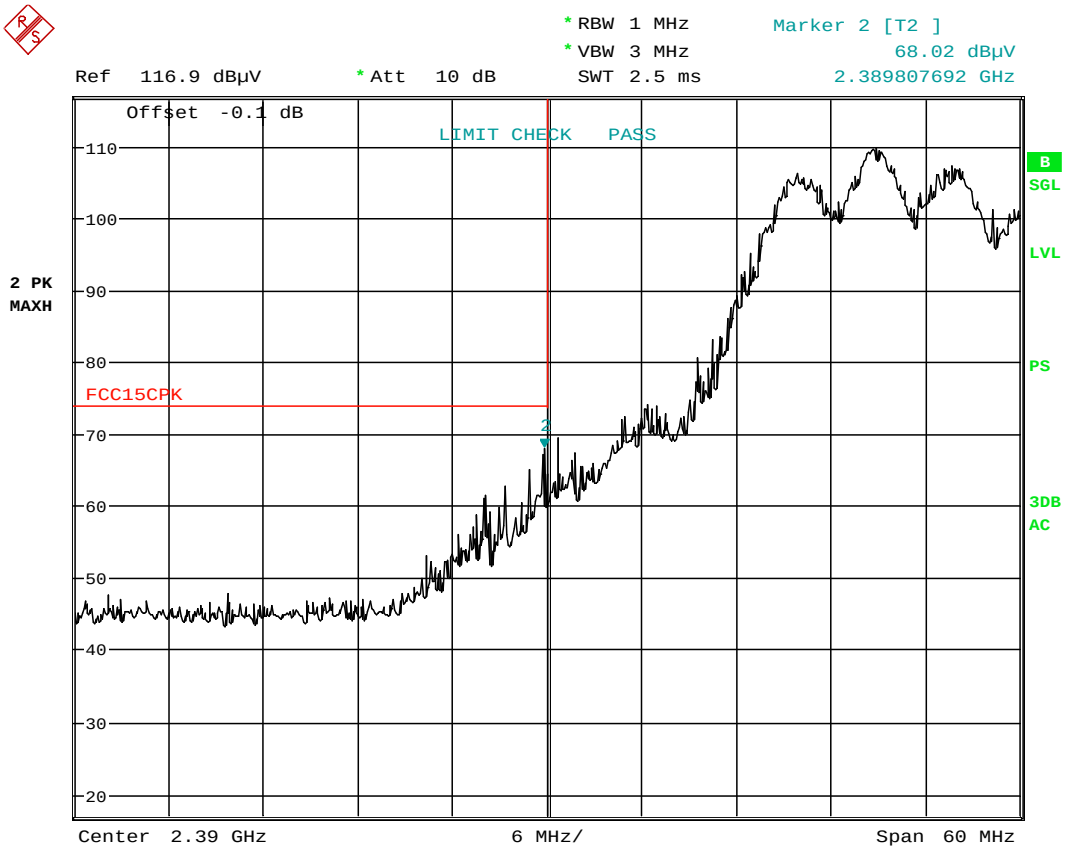
Dual Tx Radiated Restricted Band Edge Measurements

§15.205 §15.209



Date: 13.JUN.2017 02:19:50

Plot A2-2. Radiated Restricted Upper Band Edge Measurement (Peak)

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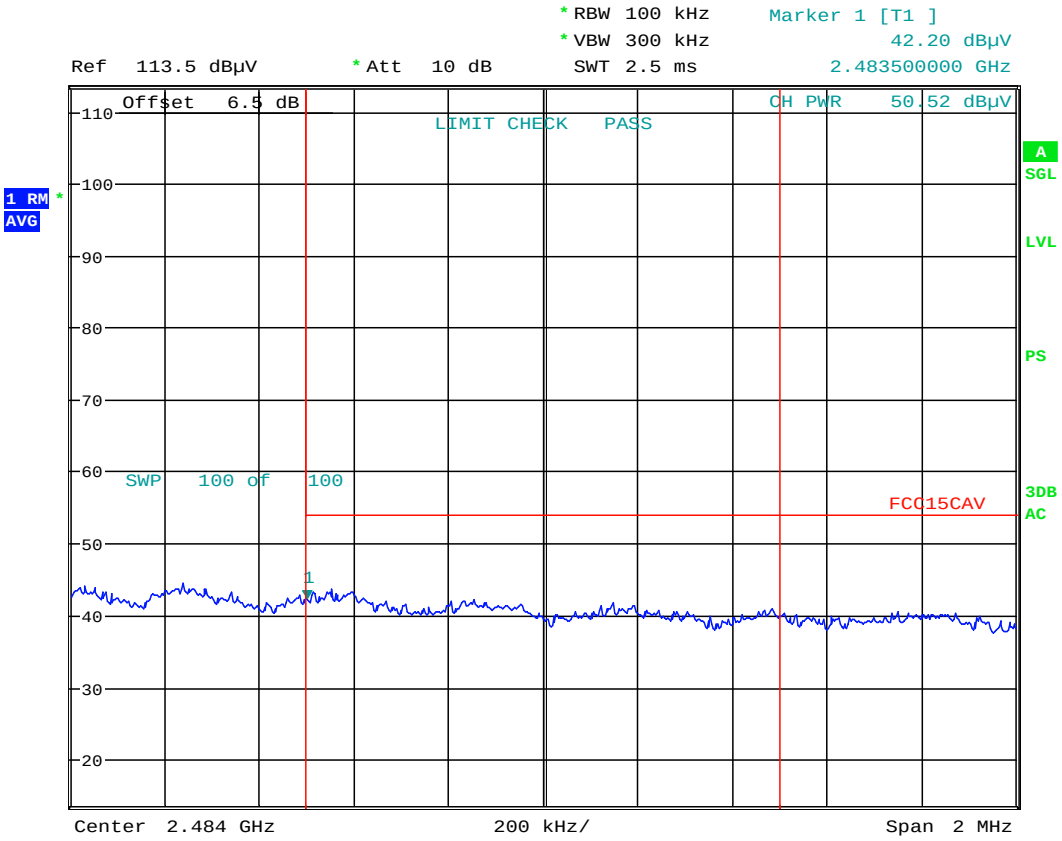
Dual Tx Radiated Restricted Band Edge Measurements

§15.205 §15.209

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



Date: 8.JUN.2017 04:16:31

Plot A2-3. Radiated Restricted Upper Band Edge Measurement (Average)

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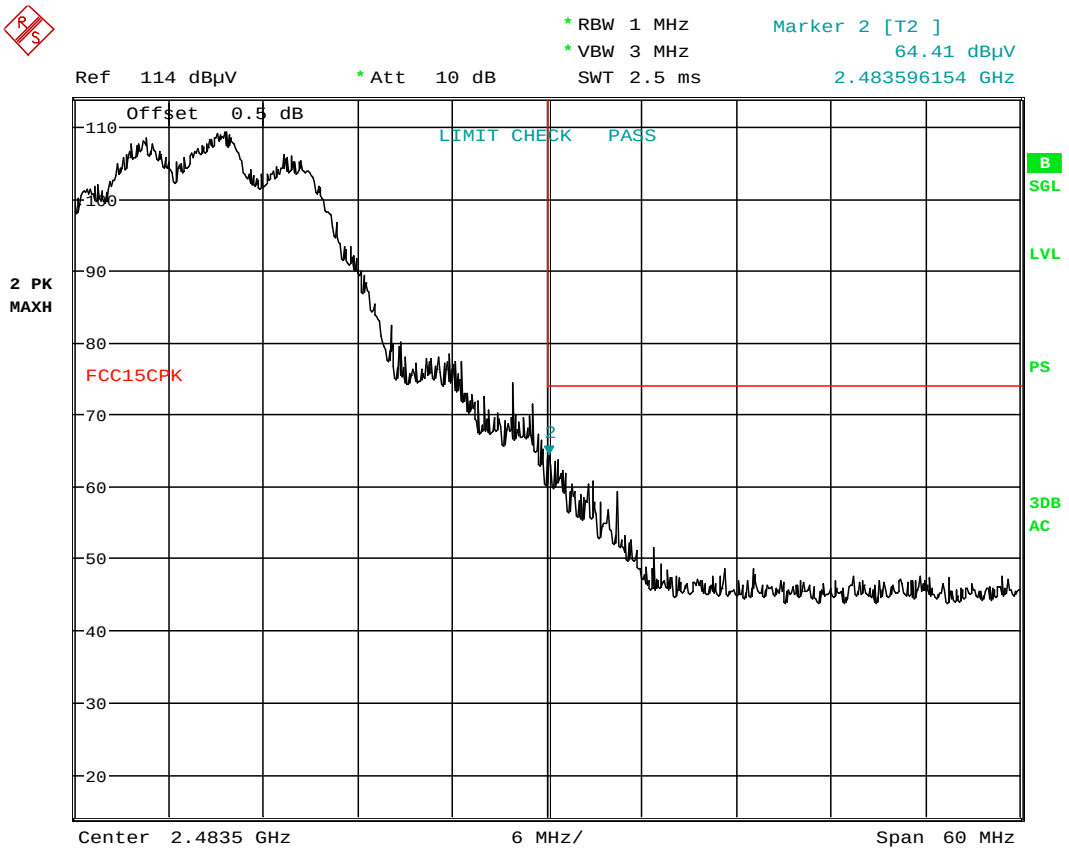

Date: 13.JUN.2017 02:25:22

Plot A2-4. Radiated Restricted Upper Band Edge Measurement (Peak)

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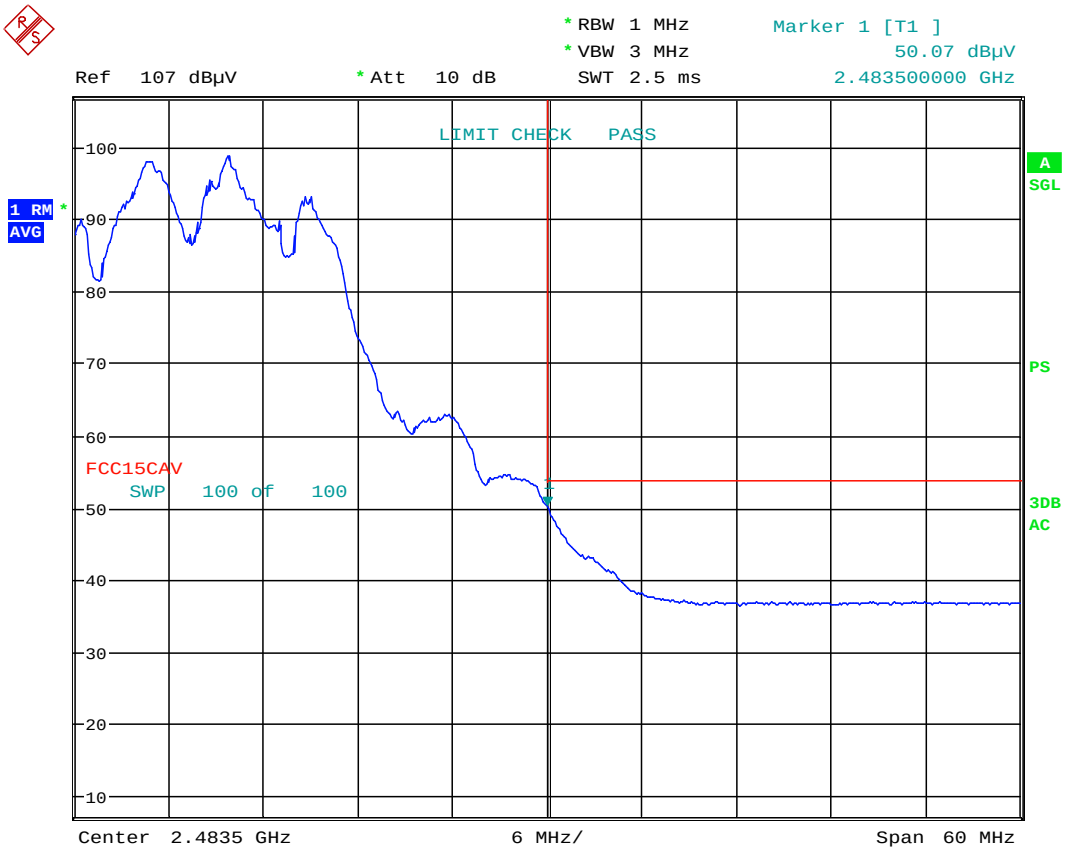
Dual Tx Radiated Restricted Band Edge Measurements

§15.205 §15.209

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



Date: 13.JUN.2017 02:55:15

Plot A2-5. Radiated Restricted Upper Band Edge Measurement with WCP (Average)

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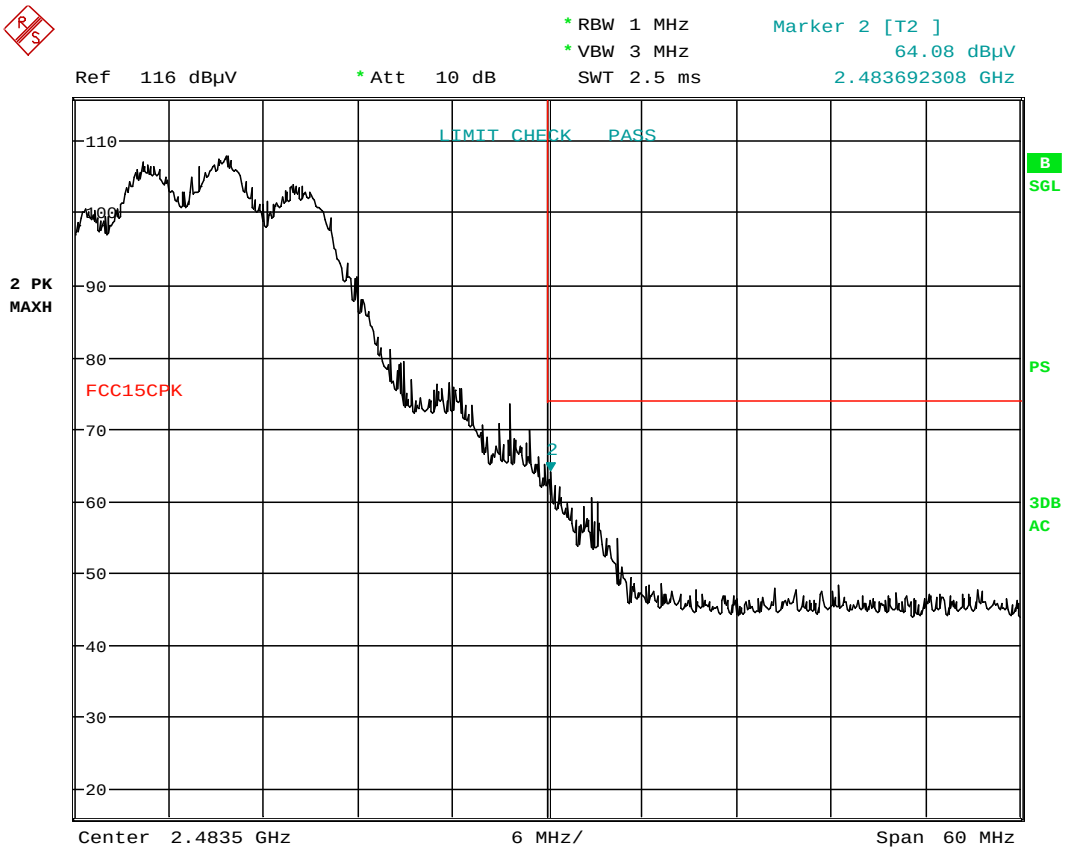

Date: 13.JUN.2017 02:55:34

Plot A2-6. Radiated Restricted Upper Band Edge Measurement with WCP (Peak)

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