



Appendix C

RF Test Data for 2.4GHz WIFI (Conducted Measurement)

Product Name: M5AtomS3U

Trade Mark: M5STACK

Test Model: AtomS3U

Environmental Conditions

Temperature:	24.6° C
Relative Humidity:	52.4%
ATM Pressure:	100.0 kPa
Test Engineer:	Simba Huang
Supervised by:	Seal Chen



Contents

Page

COVER PAGE

1	Duty Cycle	3
1.1	Test Result.....	3
1.2	Test Graphs	4
2	Maximum Conducted Output Power	10
2.1	Test Result.....	10
3	-6dB Bandwidth	11
3.1	Test Result.....	11
3.2	Test Graphs	12
4	Maximum Power Spectral Density Level.....	18
4.1	Test Result.....	18
4.2	Test Graphs	19
5	Band Edge.....	25
5.1	Test Result.....	25
5.2	Test Graphs	26
6	Conducted RF Spurious Emission.....	34
6.1	Test Result.....	34
6.2	Test Graphs	35
7	Restrict Band.....	47
7.1	Test Result.....	47
7.2	Test Graphs	49



1 Duty Cycle

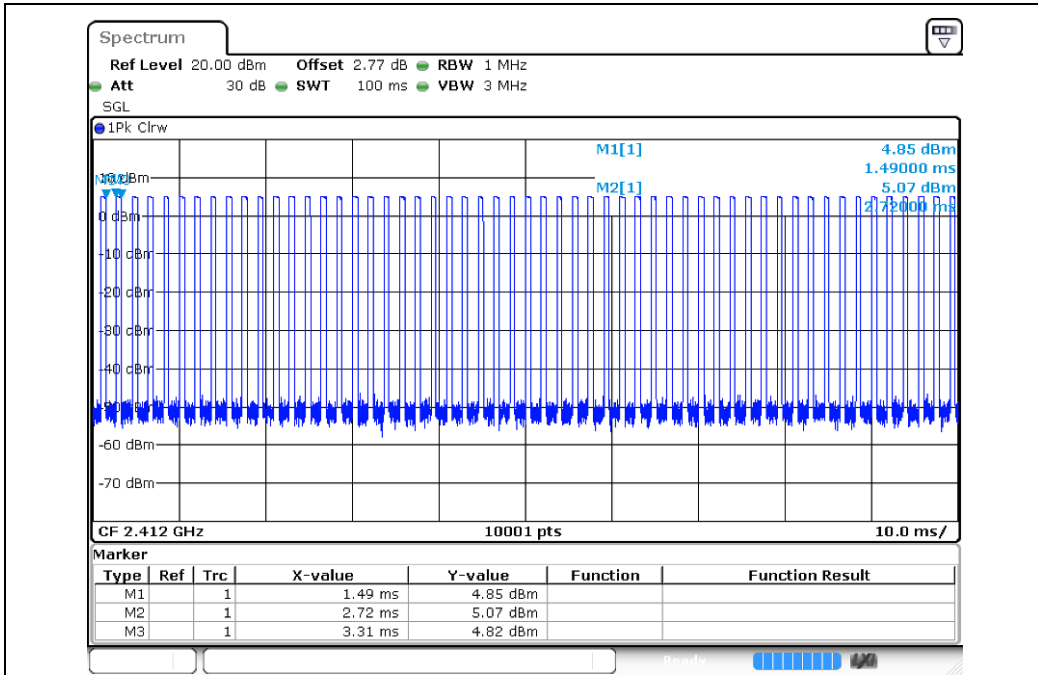
1.1 Test Result

Mode	Frequency (MHz)	Antenna	Duty Cycle (%)	1/T (kHz)
802.11b	2412	Ant1	33.19	1.69
802.11b	2437	Ant1	33.15	1.69
802.11b	2462	Ant1	33.13	1.67
802.11g	2412	Ant1	32.68	1.72
802.11g	2437	Ant1	32.68	1.72
802.11g	2462	Ant1	32.79	1.69
802.11n20	2412	Ant1	31.58	1.79
802.11n20	2437	Ant1	31.92	1.79
802.11n20	2462	Ant1	31.97	1.79
802.11n40	2422	Ant1	32.01	1.75
802.11n40	2437	Ant1	32.09	1.72
802.11n40	2452	Ant1	32.06	1.72

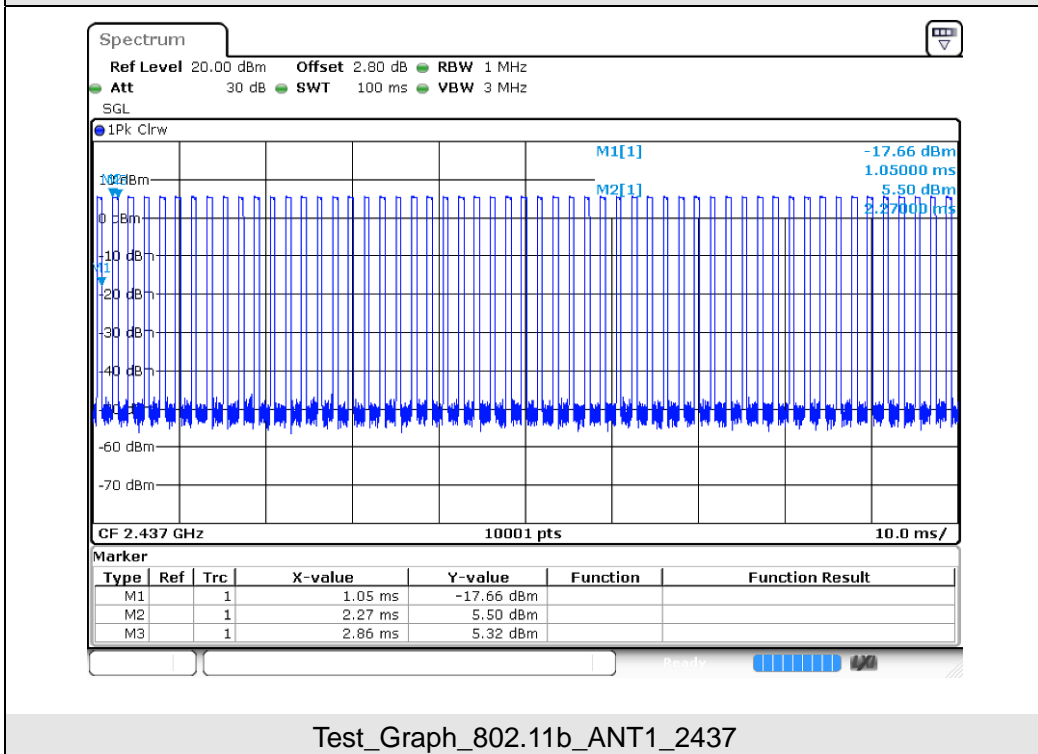


1.2 Test Graphs

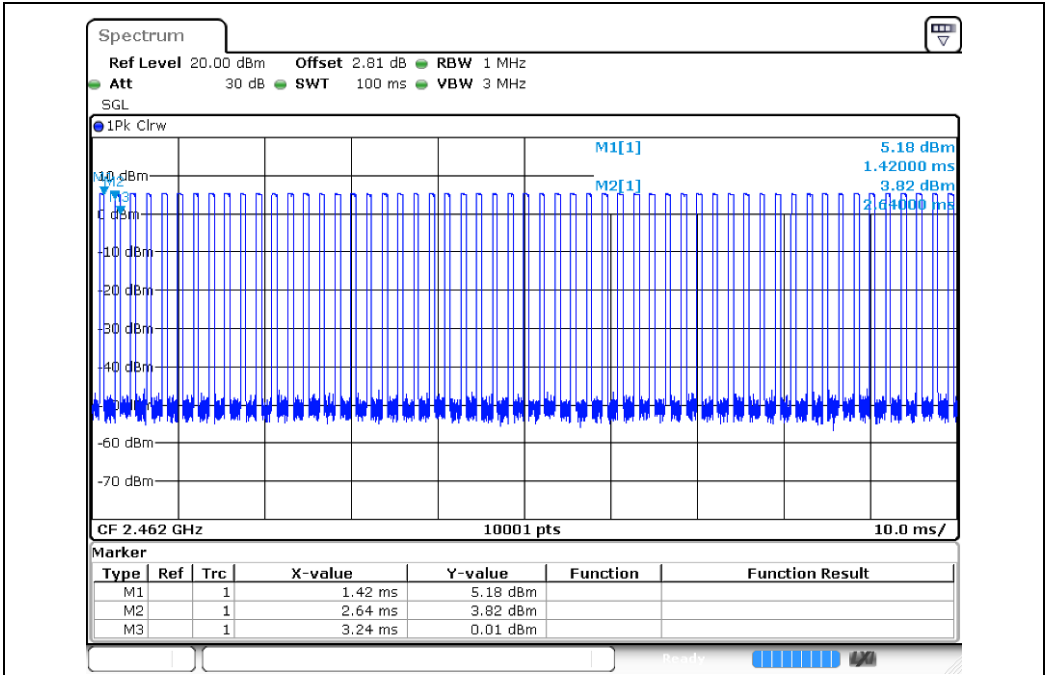
Test Graphs of Duty Cycle



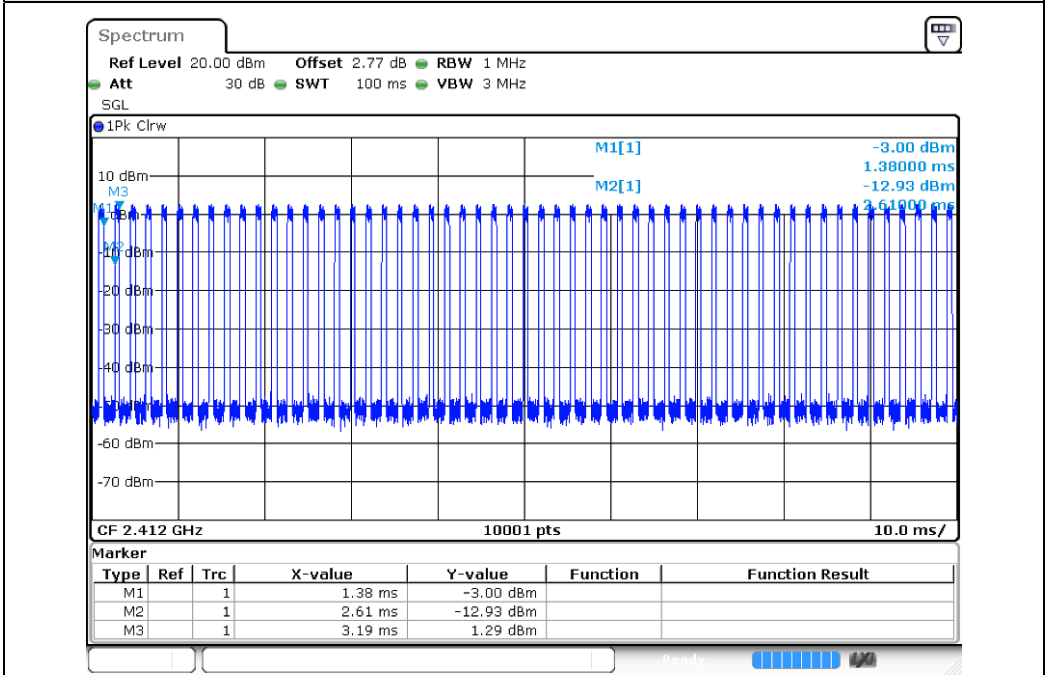
Test_Graph_802.11b_ANT1_2412



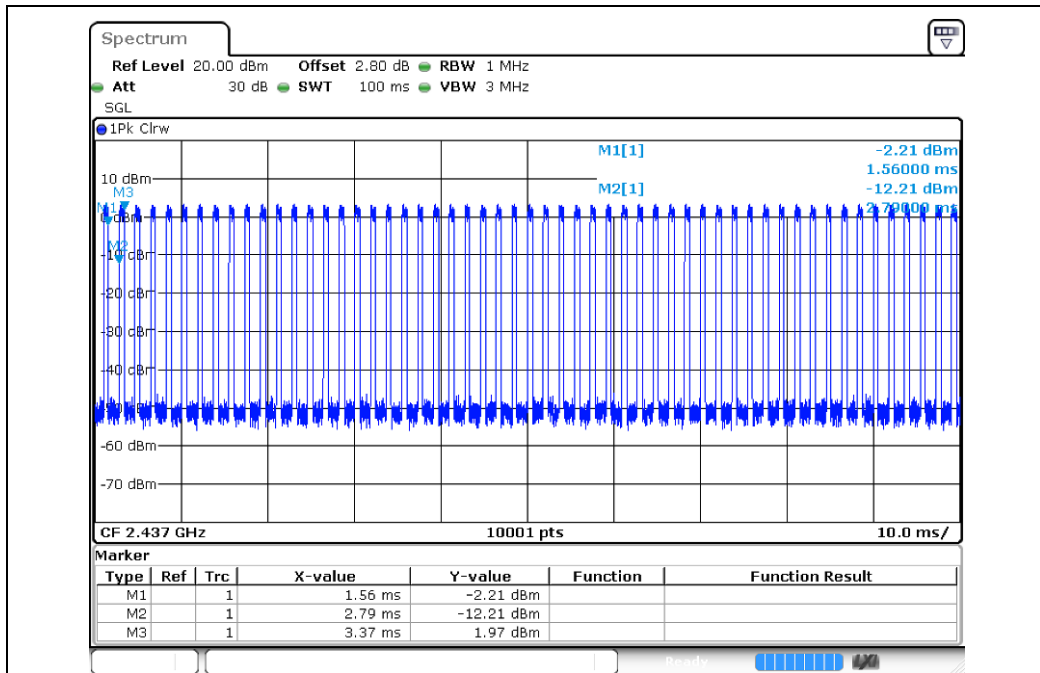
Test_Graph_802.11b_ANT1_2437



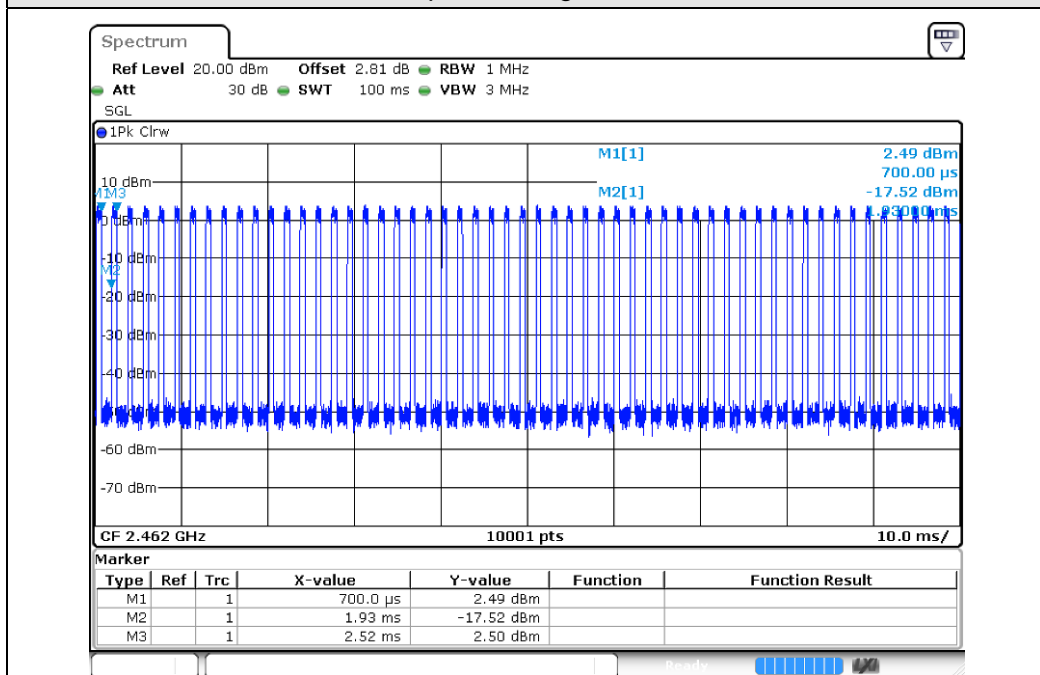
Test_Graph_802.11b_ANT1_2462



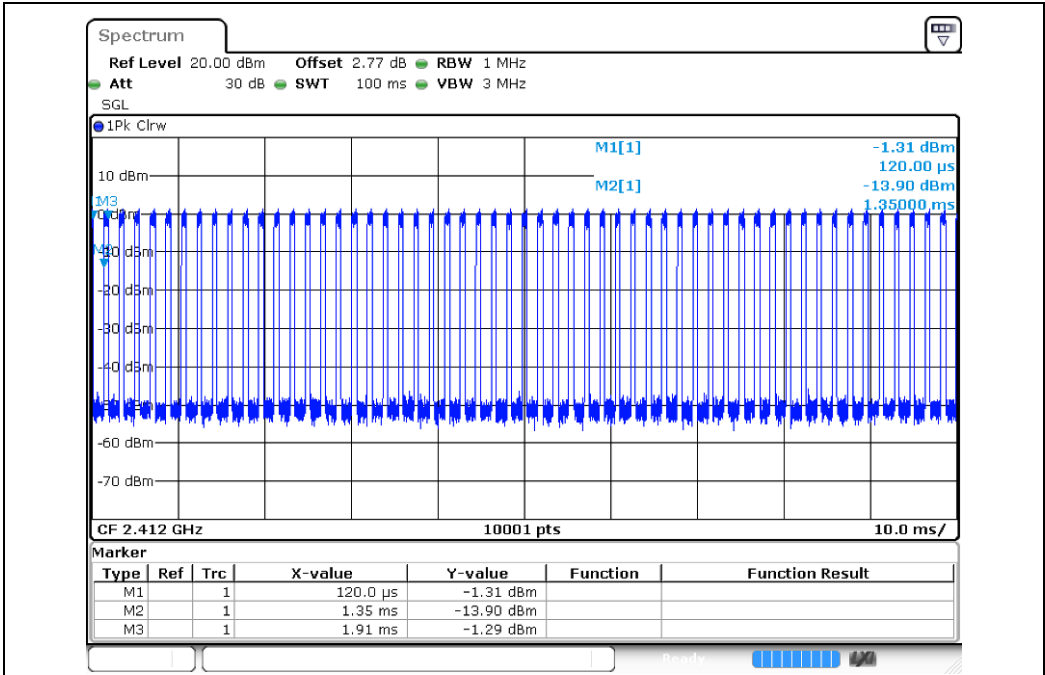
Test_Graph_802.11g_ANT1_2412



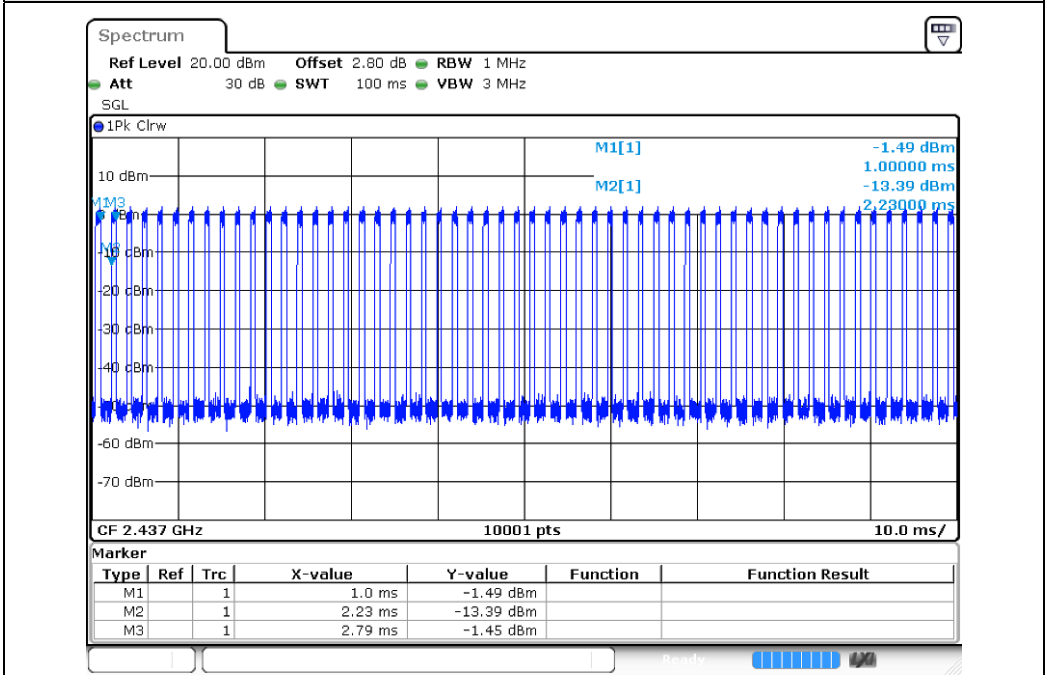
Test_Graph_802.11g_ANT1_2437



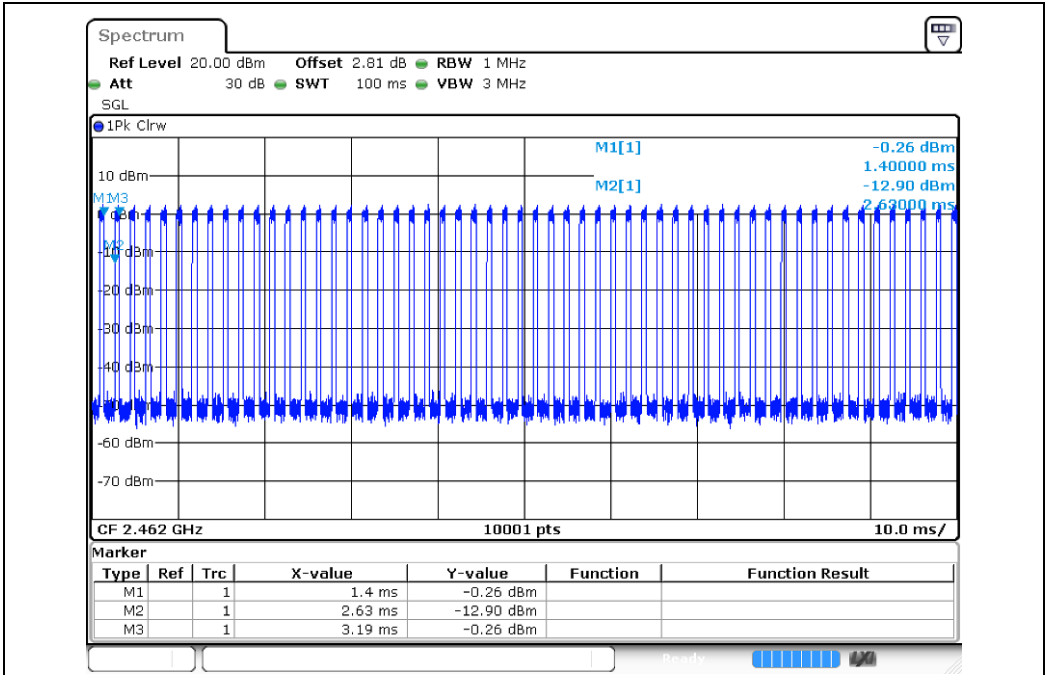
Test_Graph_802.11g_ANT1_2462



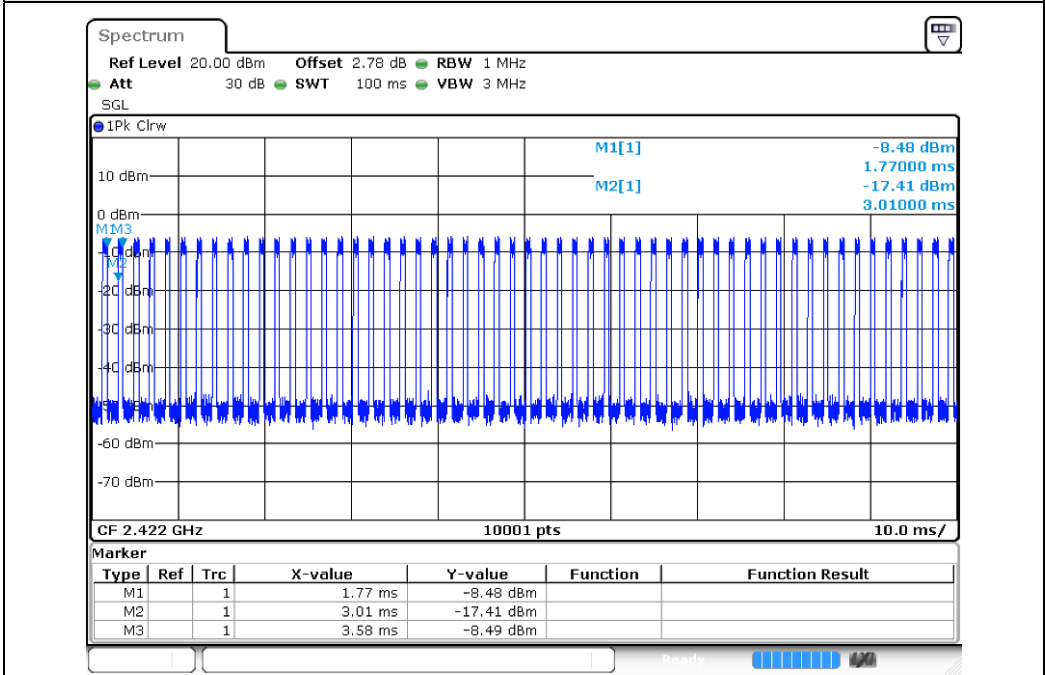
Test_Graph_802.11n20_ANT1_2412



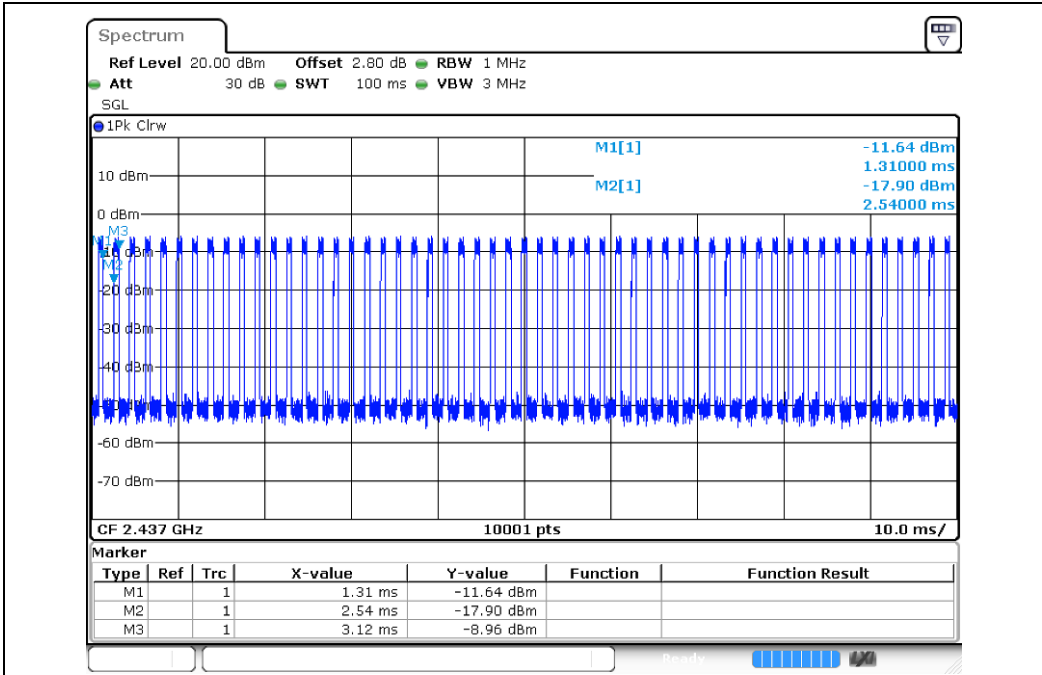
Test_Graph_802.11n20_ANT1_2437



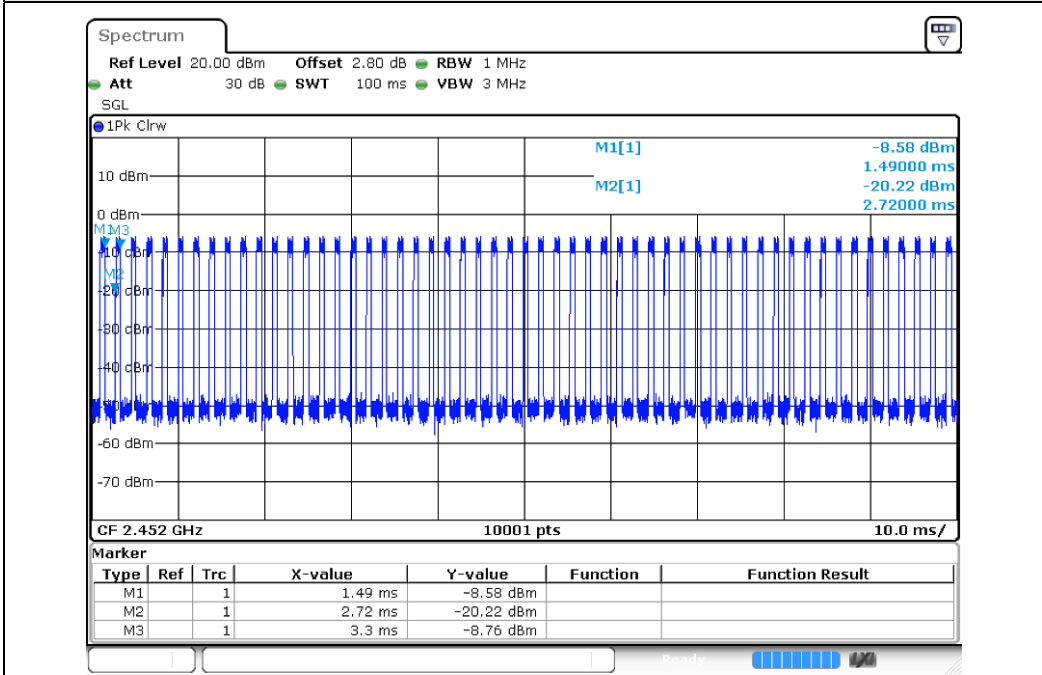
Test_Graph_802.11n20_ANT1_2462



Test_Graph_802.11n40_ANT1_2422



Test_Graph_802.11n40_ANT1_2437



Test_Graph_802.11n40_ANT1_2452



2 Maximum Conducted Output Power

2.1 Test Result

Test Data of Conducted Output Power				
Test Mode	Test Channel (MHz)	Peak Power (dBm)	Limits (dBm)	Pass or Fail
802.11b	2412	14.45	≤30	Pass
	2437	14.94	≤30	Pass
	2462	14.66	≤30	Pass
802.11g	2412	13.24	≤30	Pass
	2437	13.99	≤30	Pass
	2462	14.25	≤30	Pass
802.11n20	2412	11.86	≤30	Pass
	2437	12.34	≤30	Pass
	2462	12.76	≤30	Pass
802.11n40	2422	10.92	≤30	Pass
	2437	11.35	≤30	Pass
	2452	11.35	≤30	Pass



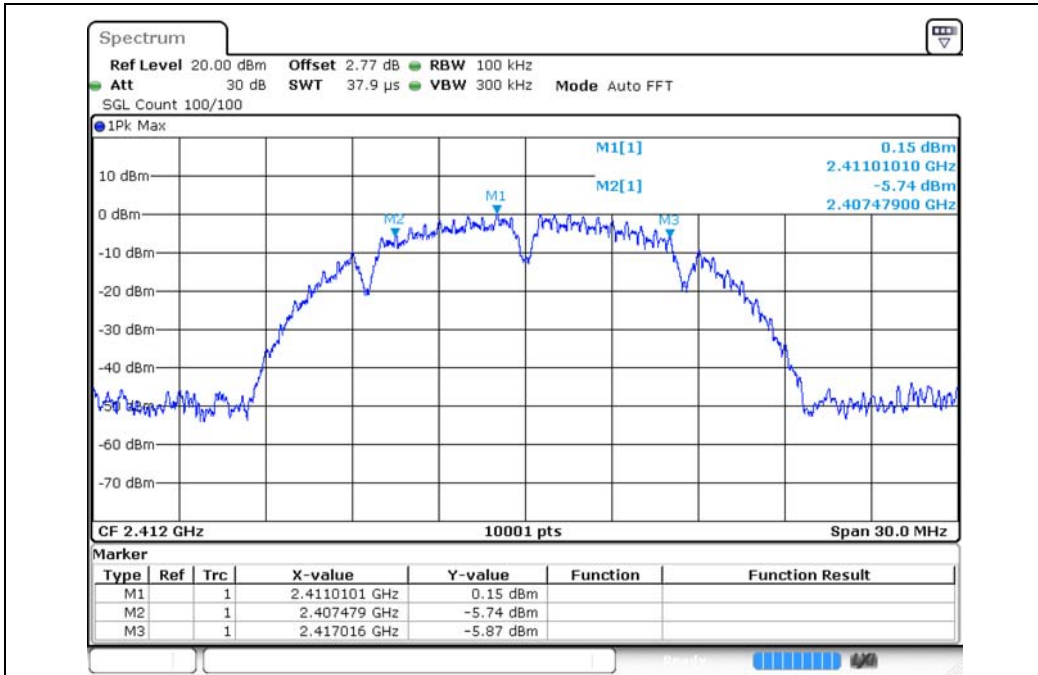
3 -6dB Bandwidth

3.1 Test Result

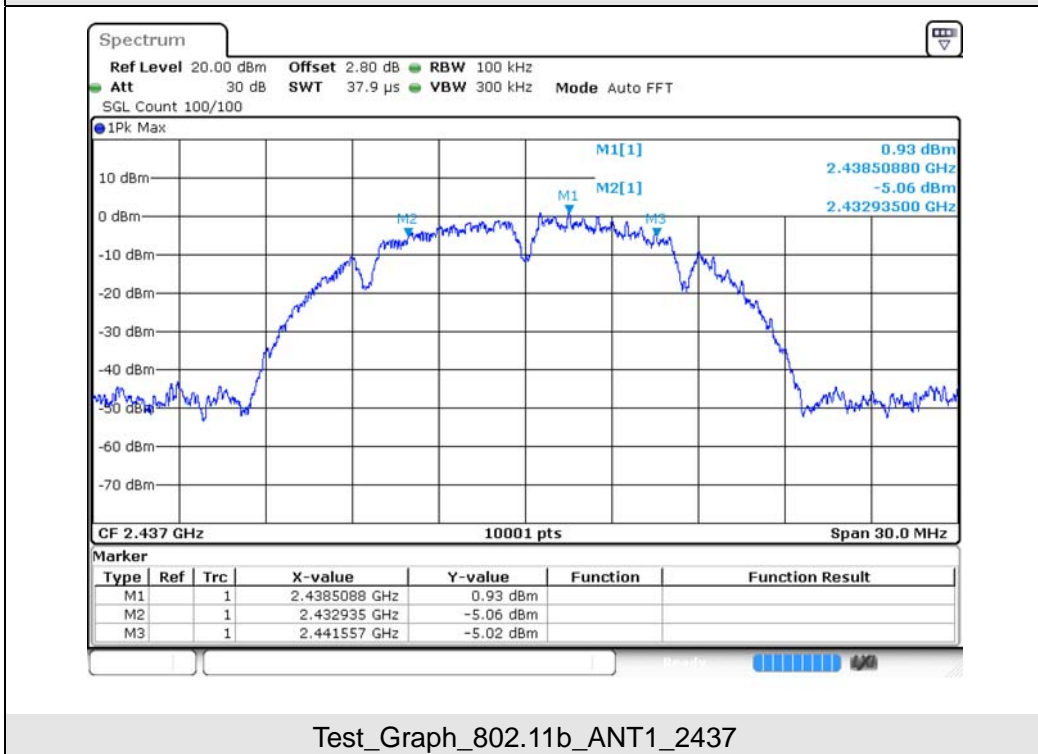
Test Data of Occupied Bandwidth and DTS Bandwidth				
Test Mode	Test Channel (MHz)	-6dB Bandwidth (MHz)	Limits (MHz)	Pass or Fail
802.11b	2412	9.537	≥ 0.5	Pass
	2437	8.622	≥ 0.5	Pass
	2462	8.631	≥ 0.5	Pass
802.11g	2412	16.485	≥ 0.5	Pass
	2437	16.557	≥ 0.5	Pass
	2462	16.293	≥ 0.5	Pass
802.11n20	2412	16.932	≥ 0.5	Pass
	2437	17.568	≥ 0.5	Pass
	2462	17.649	≥ 0.5	Pass
802.11n40	2422	34.08	≥ 0.5	Pass
	2437	35.55	≥ 0.5	Pass
	2452	36.036	≥ 0.5	Pass

3.2 Test Graphs

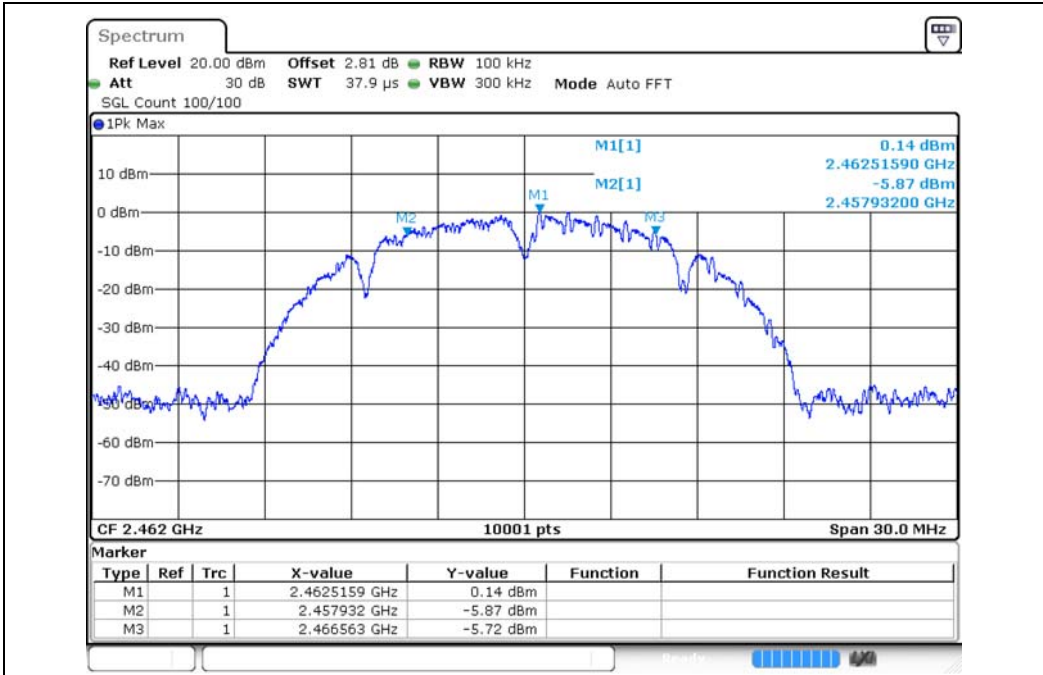
Test Graphs of Occupied Bandwidth



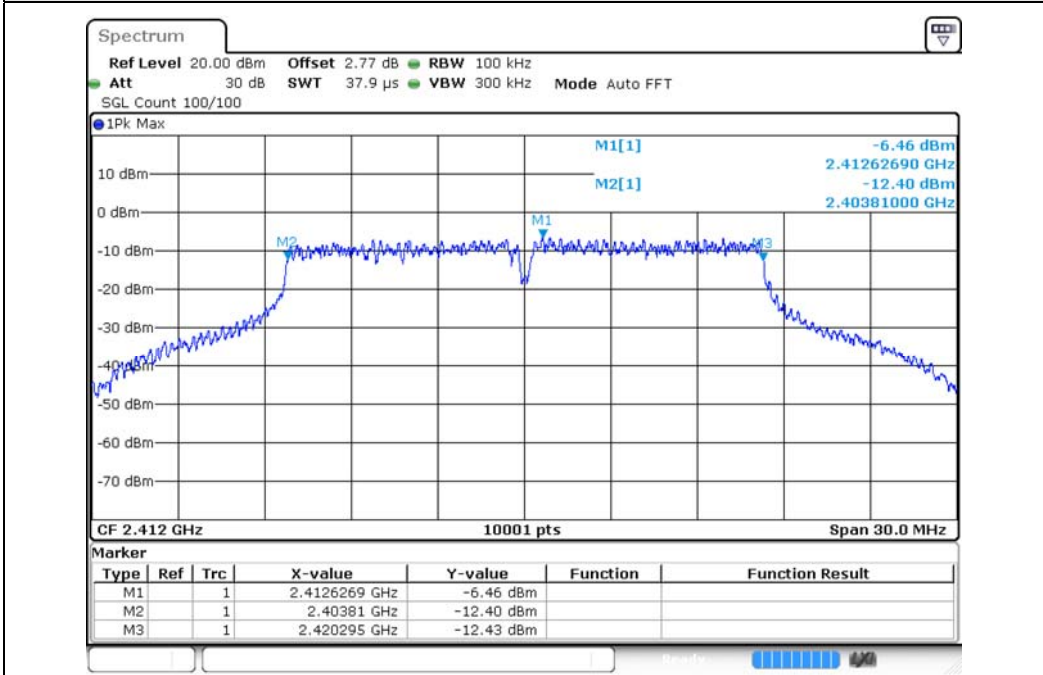
Test_Graph_802.11b_ANT1_2412



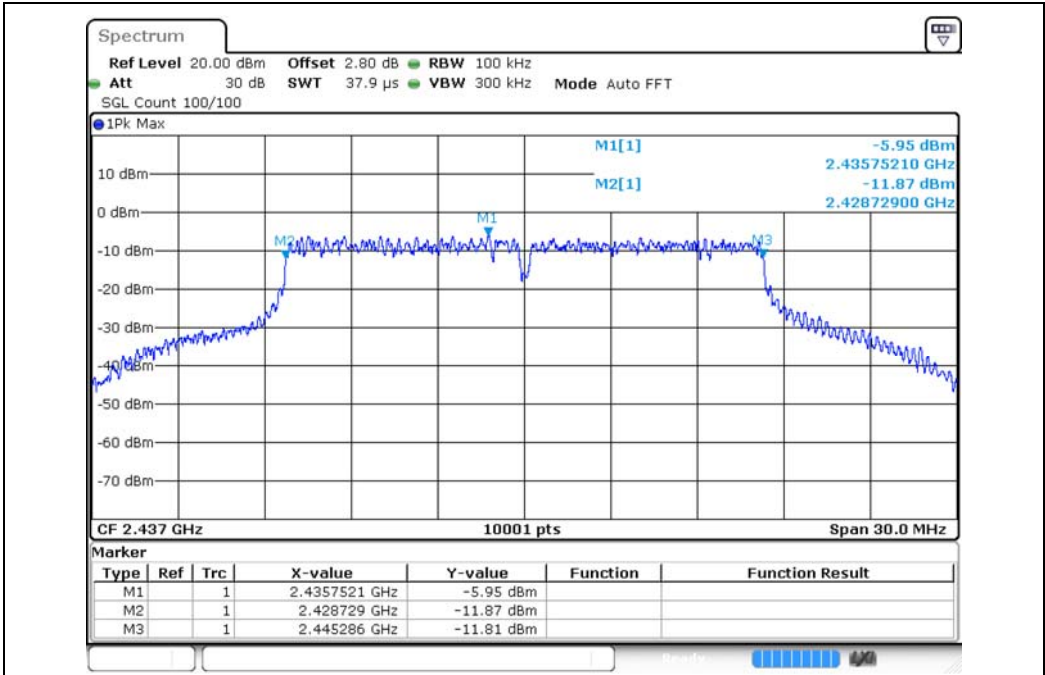
Test_Graph_802.11b_ANT1_2437



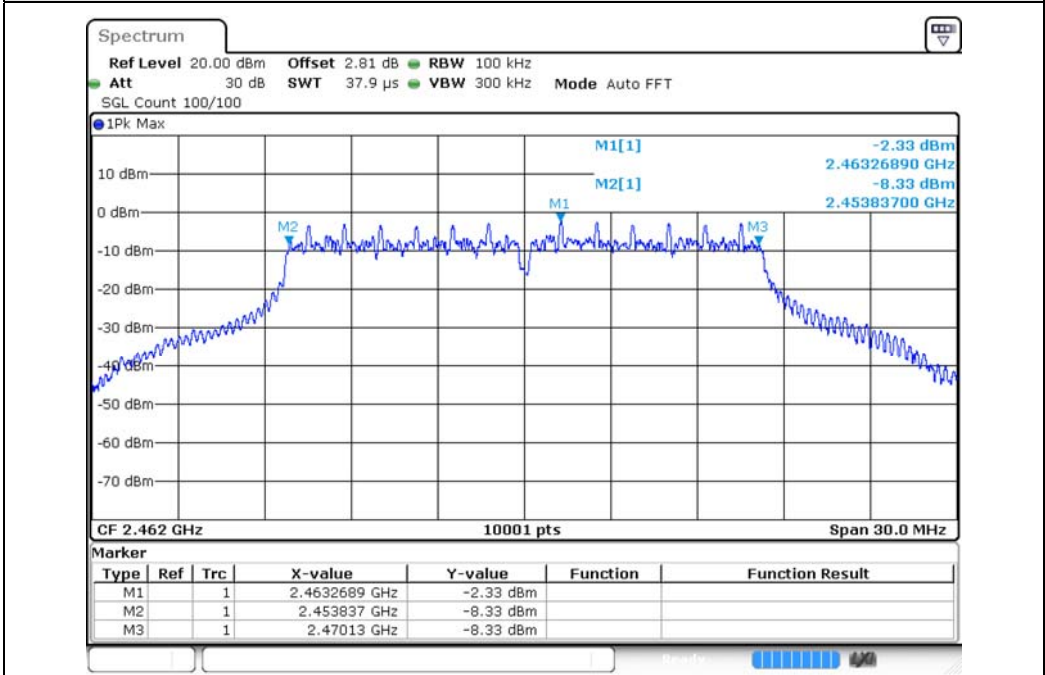
Test_Graph_802.11b_ANT1_2462



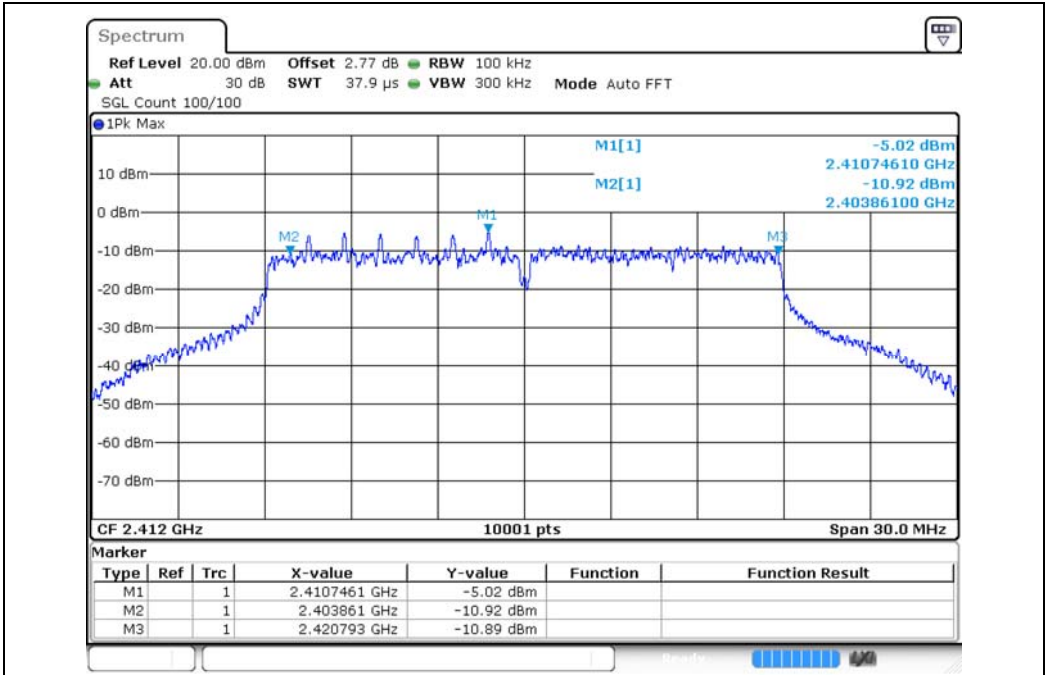
Test_Graph_802.11g_ANT1_2412



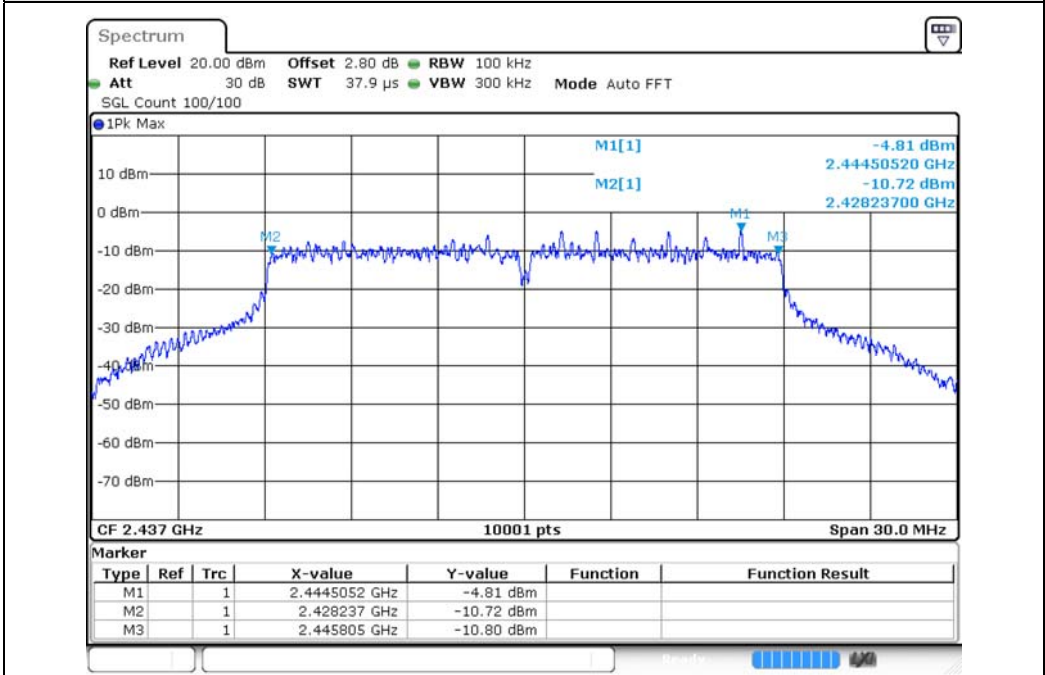
Test_Graph_802.11g_ANT1_2437



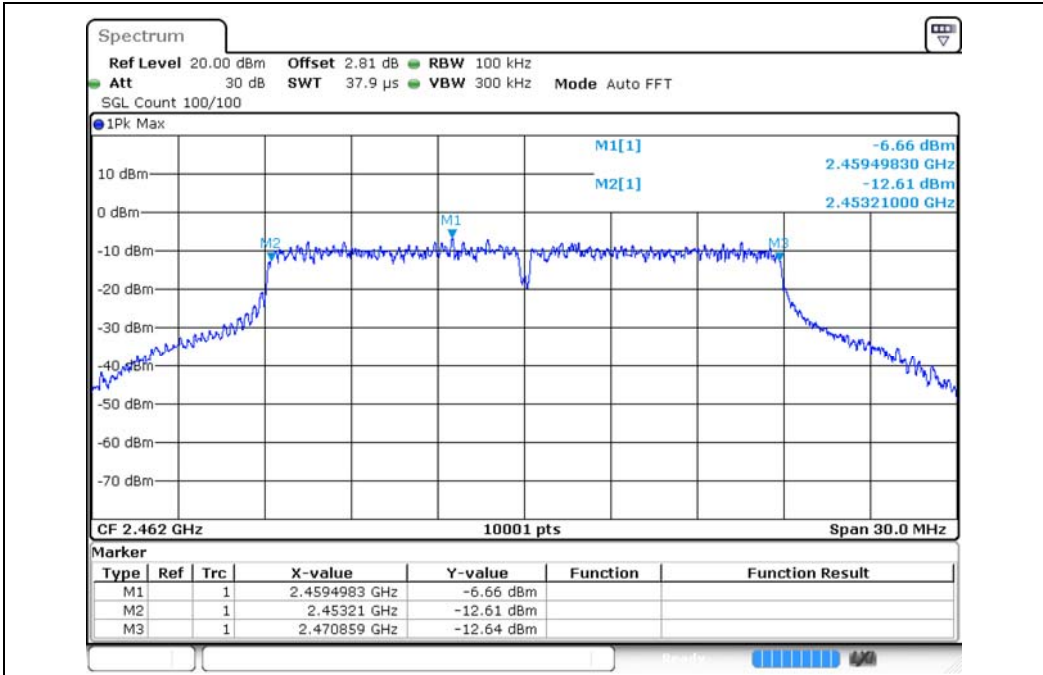
Test_Graph_802.11g_ANT1_2462



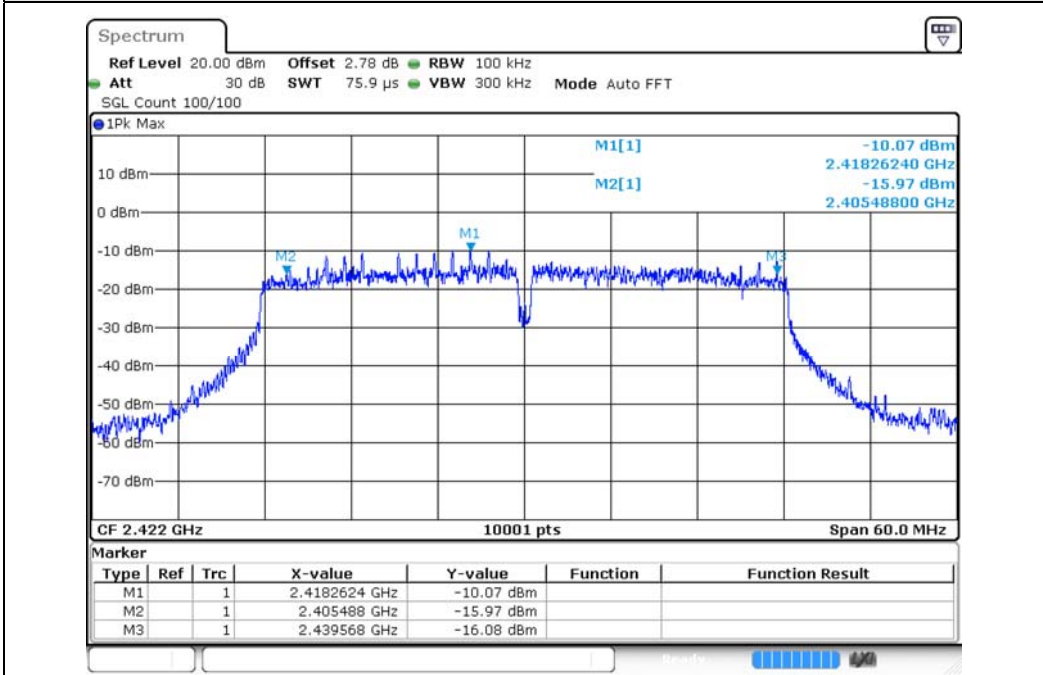
Test_Graph_802.11n20_ANT1_2412



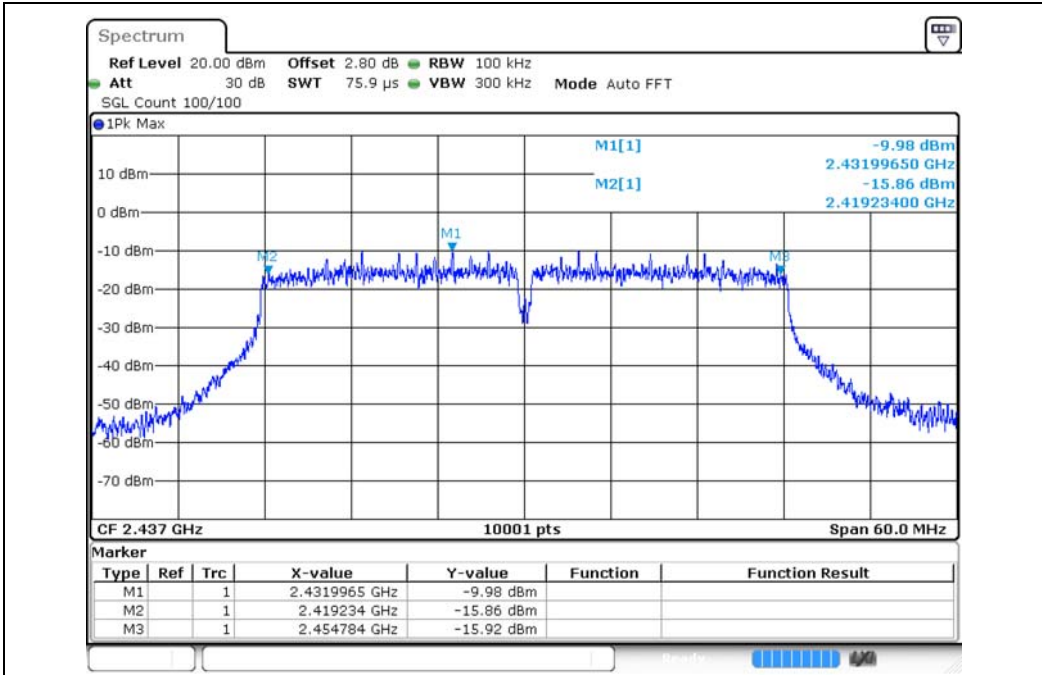
Test_Graph_802.11n20_ANT1_2437



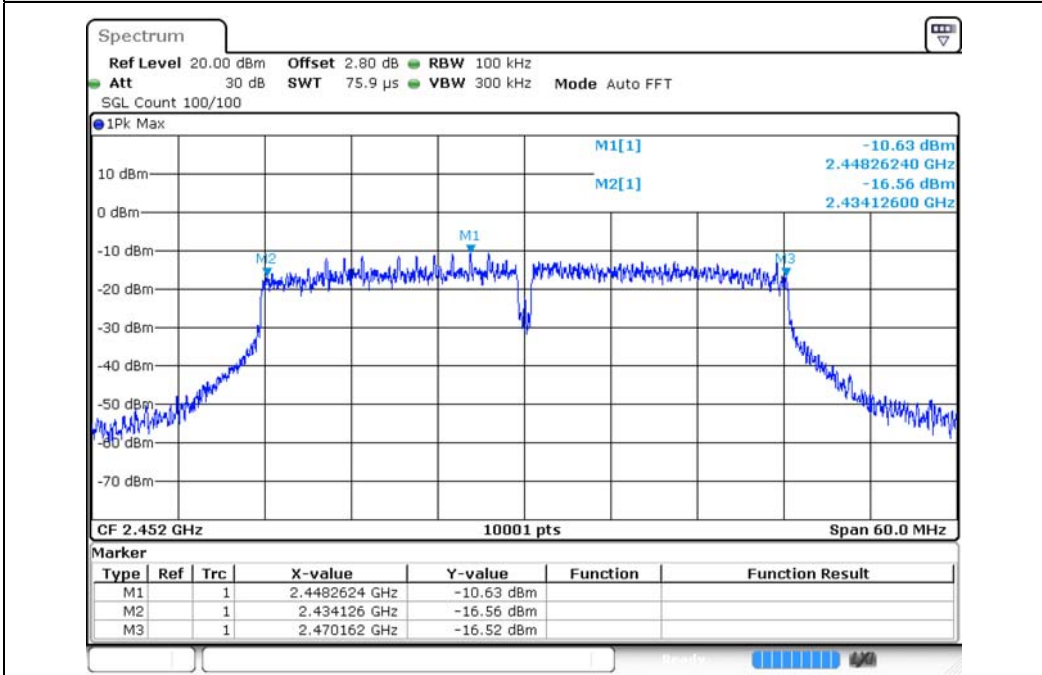
Test_Graph_802.11n20_ANT1_2462



Test_Graph_802.11n40_ANT1_2422



Test_Graph_802.11n40_ANT1_2437



Test_Graph_802.11n40_ANT1_2452

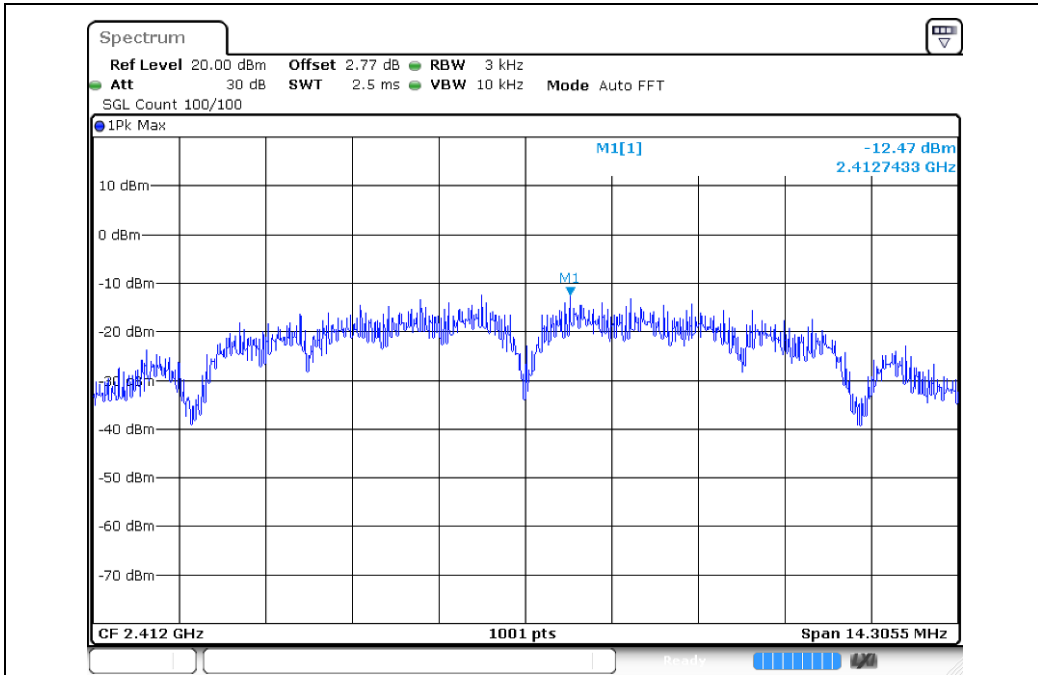
4 Maximum Power Spectral Density Level

4.1 Test Result

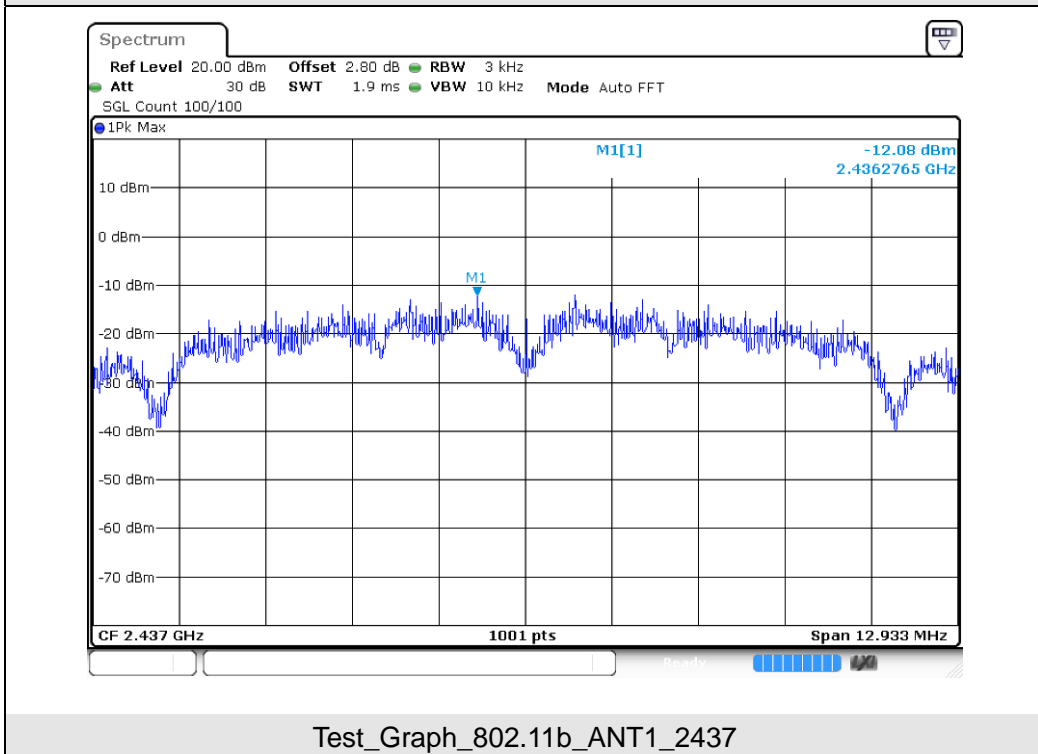
Test Data of Conducted Output Power Spectral Density				
Test Mode	Test Channel	Power density (dBm/3kHz)	Limit (dBm/3kHz)	Pass or Fail
802.11b	2412	-12.47	≤ 8	Pass
	2437	-12.08	≤ 8	Pass
	2462	-12.28	≤ 8	Pass
802.11g	2412	-17.96	≤ 8	Pass
	2437	-17.56	≤ 8	Pass
	2462	-17.17	≤ 8	Pass
802.11n20	2412	-19.49	≤ 8	Pass
	2437	-19.13	≤ 8	Pass
	2462	-18.73	≤ 8	Pass
802.11n40	2422	-23.31	≤ 8	Pass
	2437	-23.28	≤ 8	Pass
	2452	-23.02	≤ 8	Pass

4.2 Test Graphs

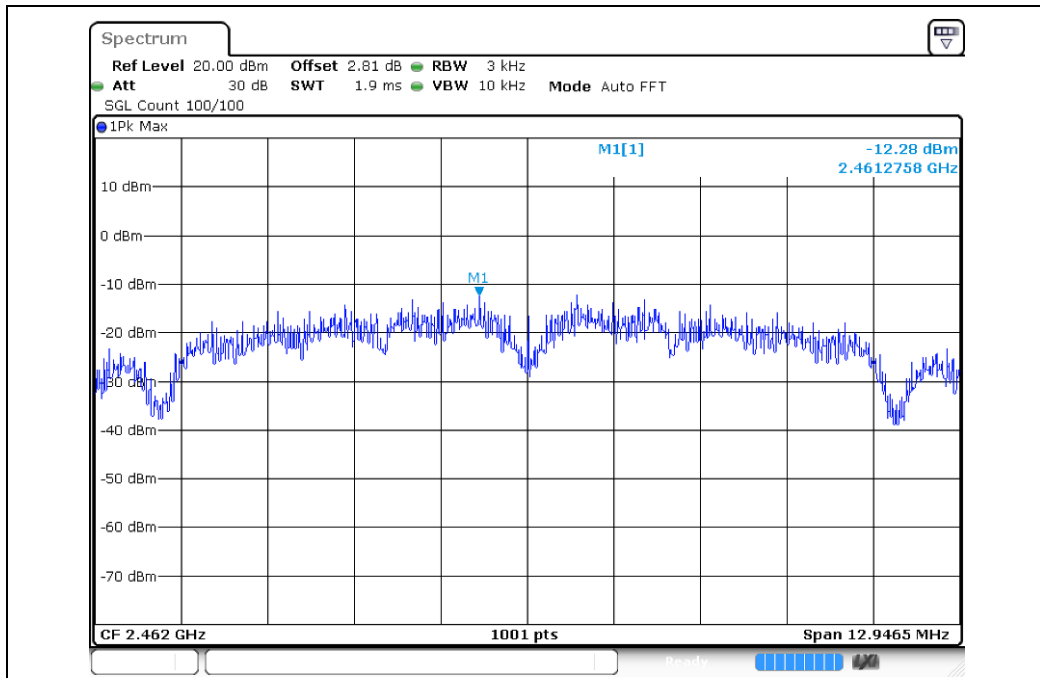
Test Graphs of Conducted Output Power Spectral Density



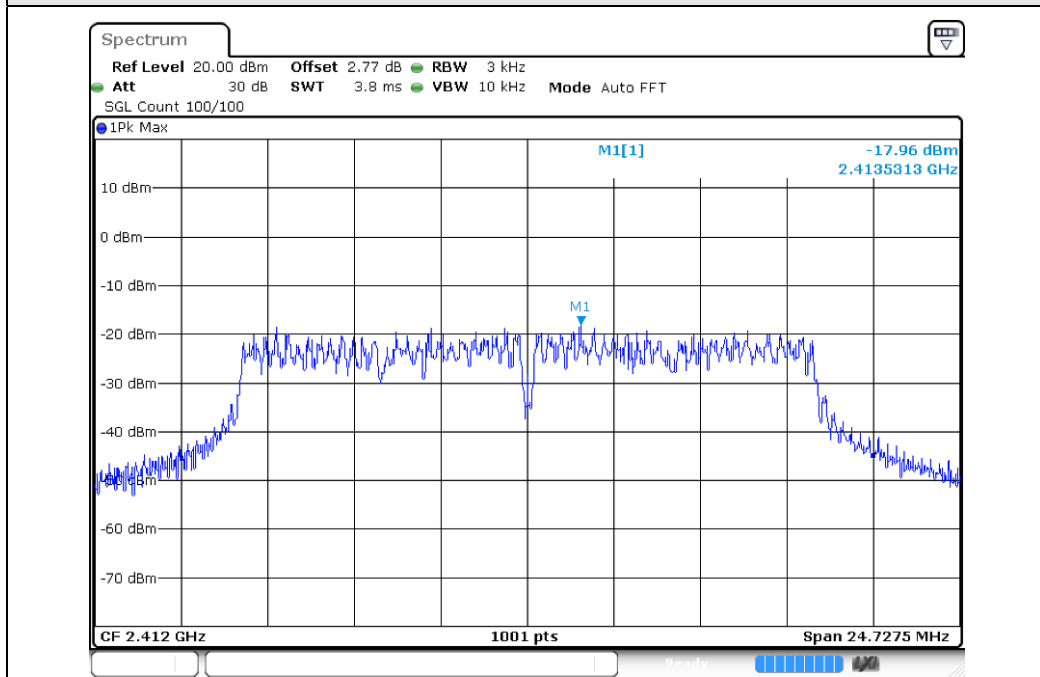
Test_Graph_802.11b_ANT1_2412



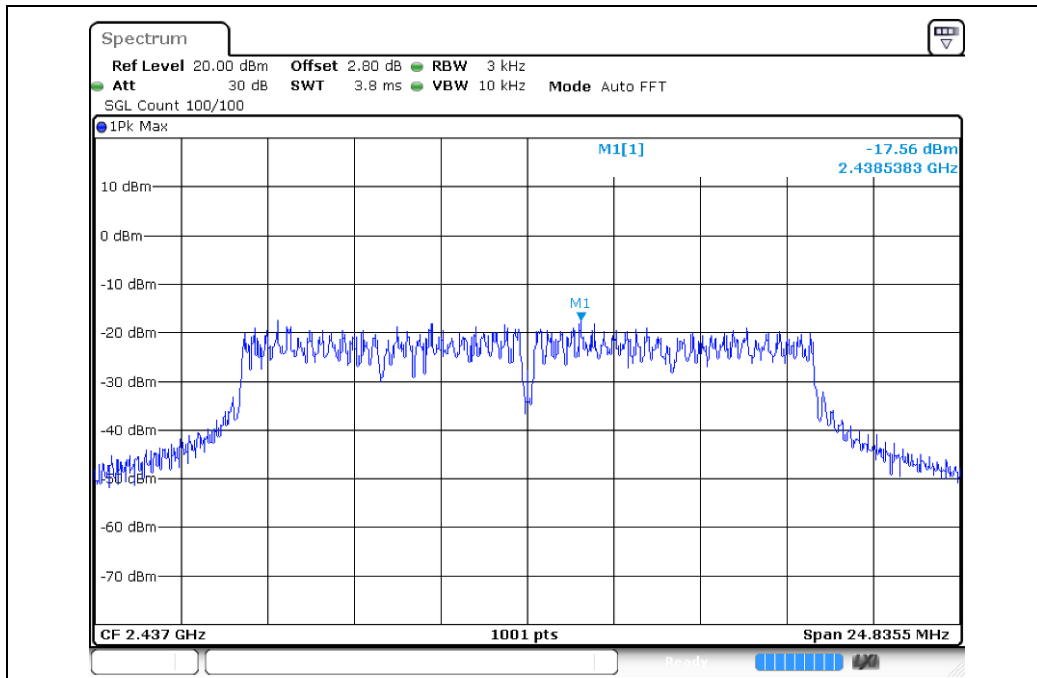
Test_Graph_802.11b_ANT1_2437



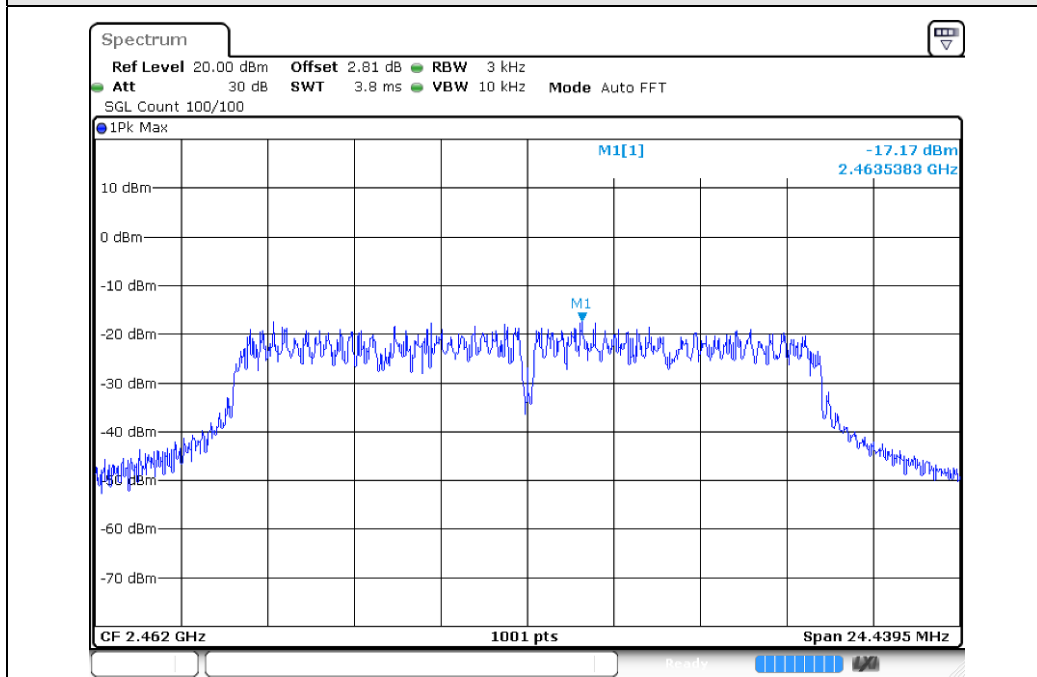
Test_Graph_802.11b_ANT1_2462



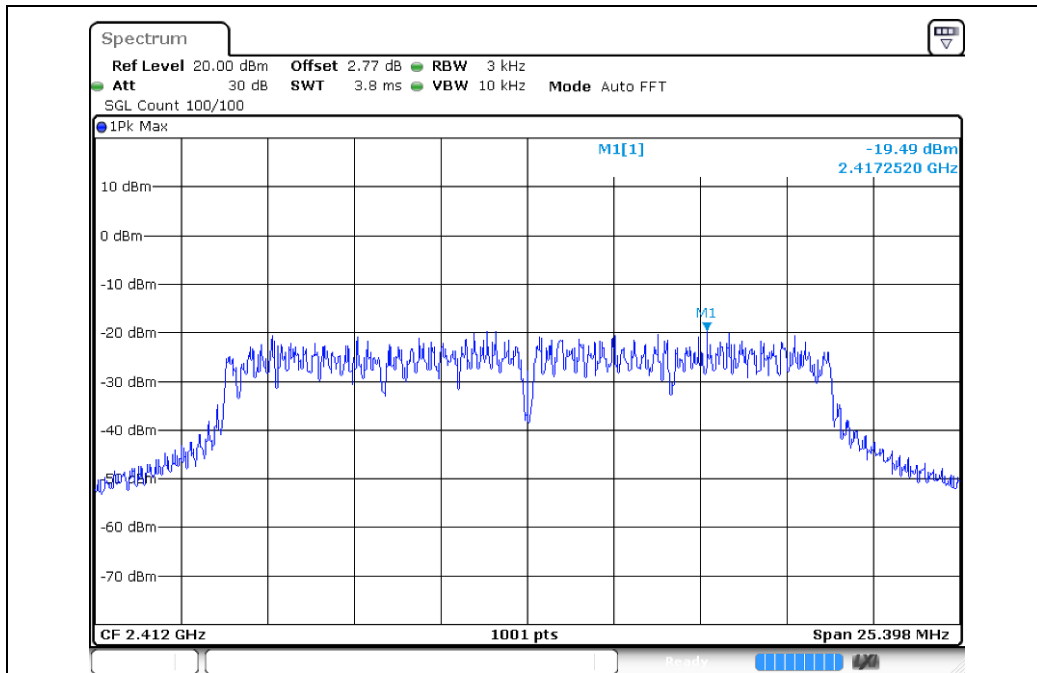
Test_Graph_802.11g_ANT1_2412



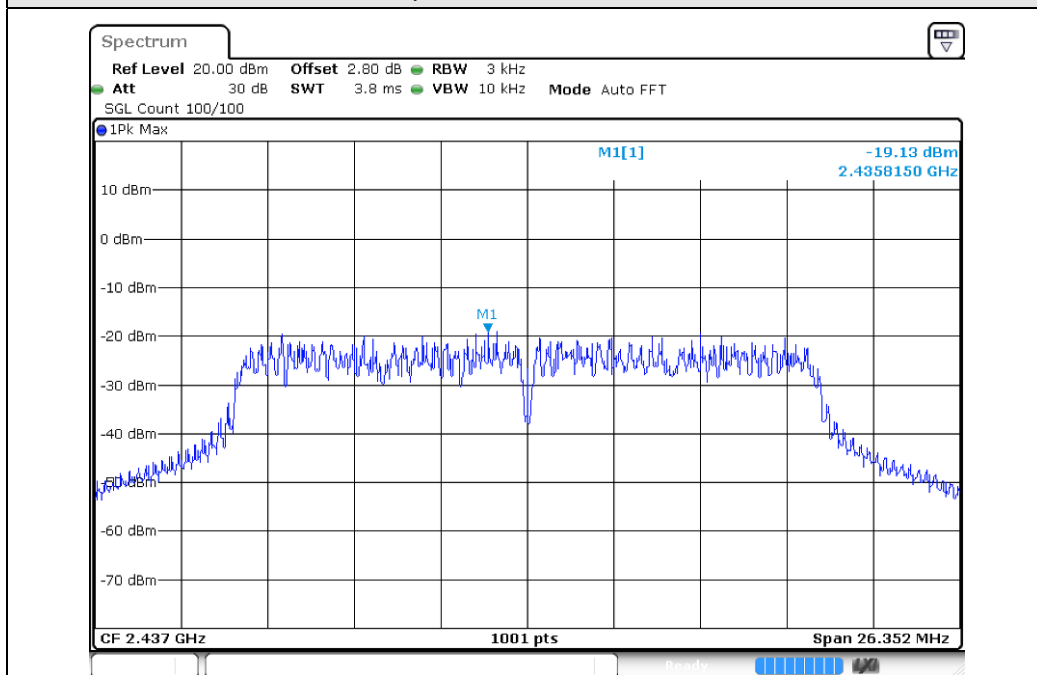
Test_Graph_802.11g_ANT1_2437



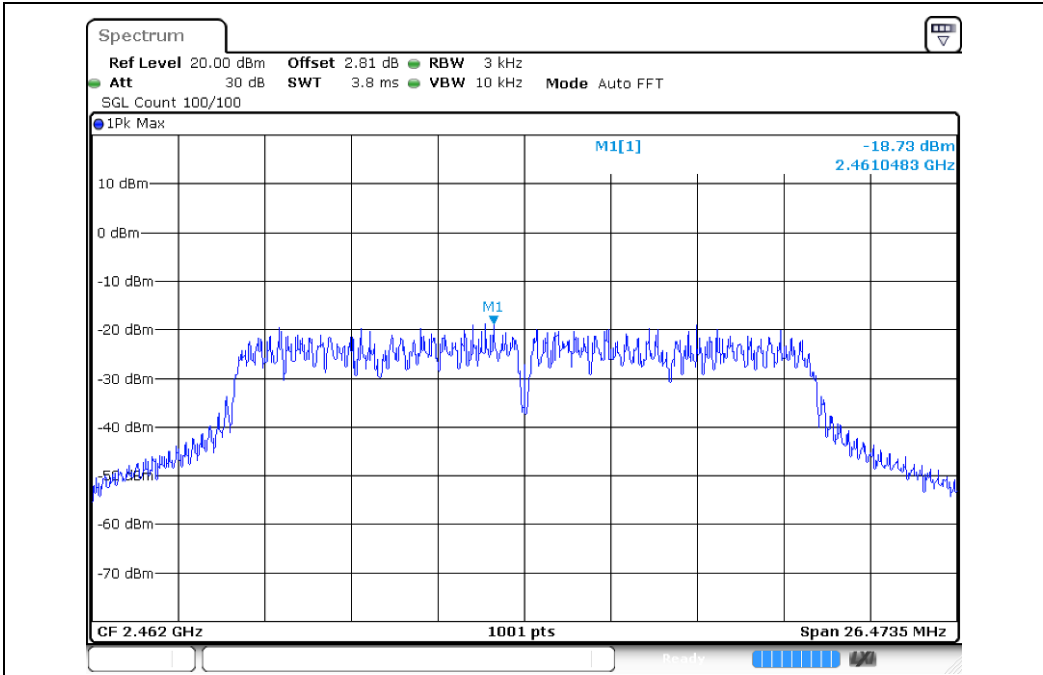
Test_Graph_802.11g_ANT1_2462



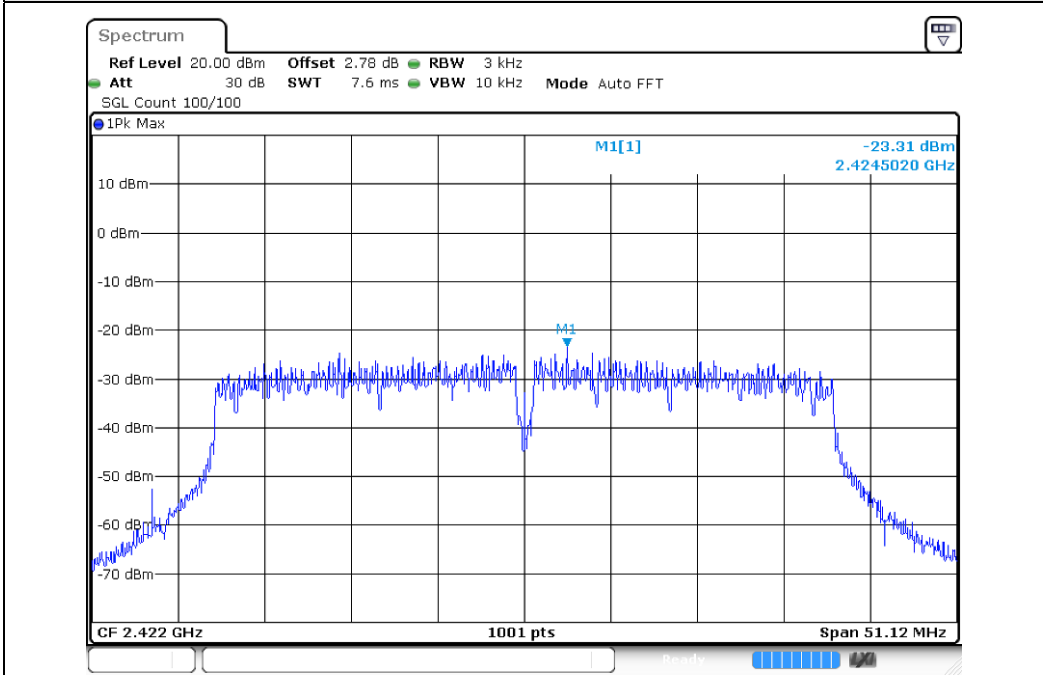
Test_Graph_802.11n20_ANT1_2412



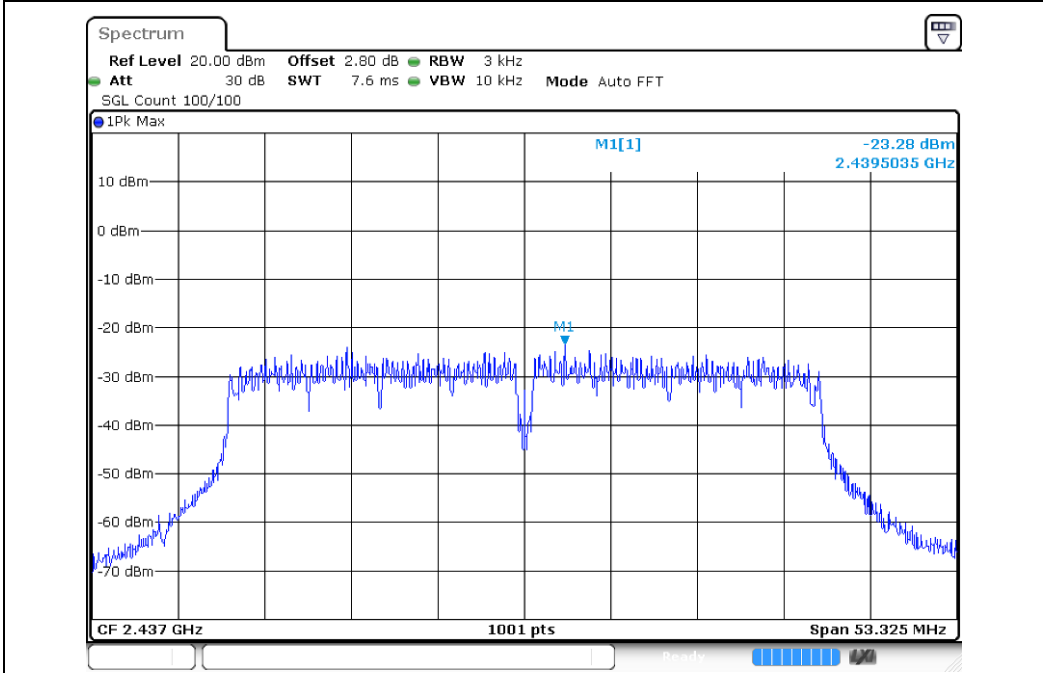
Test_Graph_802.11n20_ANT1_2437



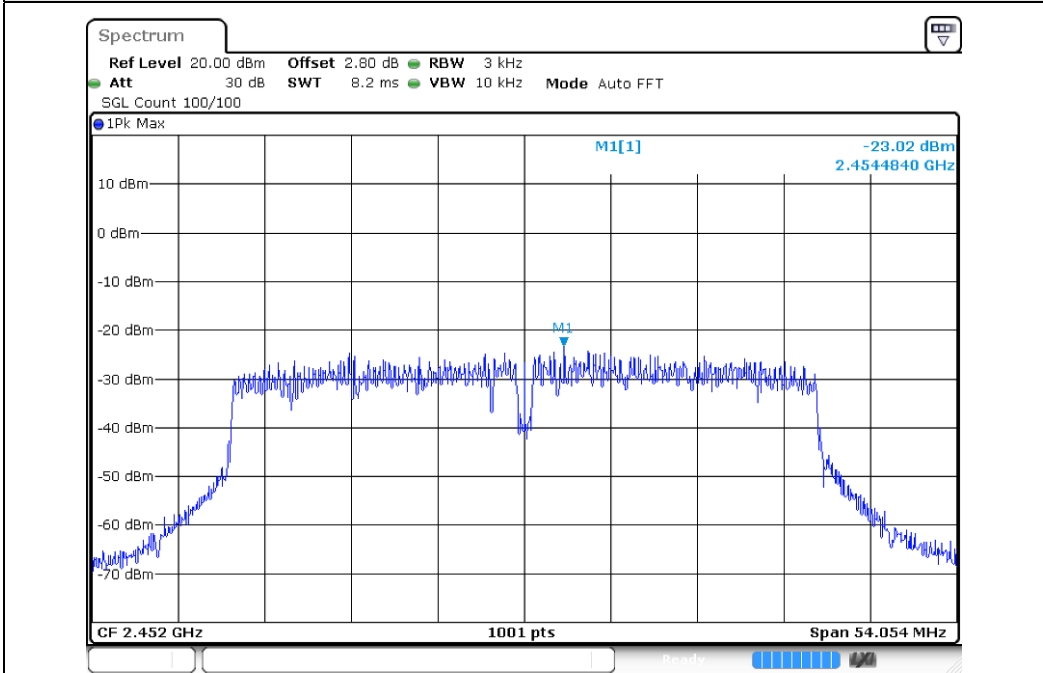
Test_Graph_802.11n20_ANT1_2462



Test_Graph_802.11n40_ANT1_2412



Test_Graph_802.11n40_ANT1_2437



Test_Graph_802.11n40_ANT1_2452

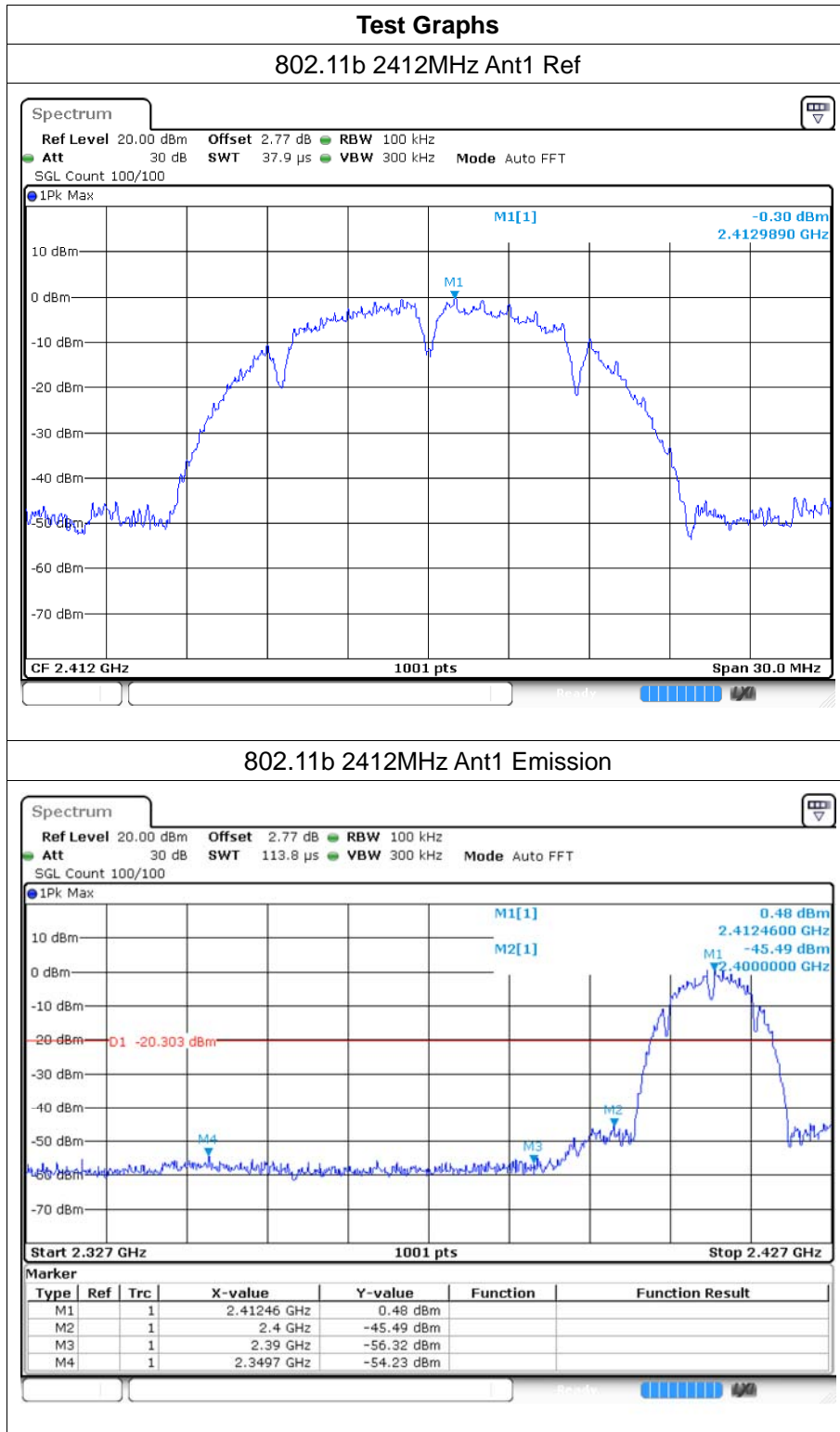


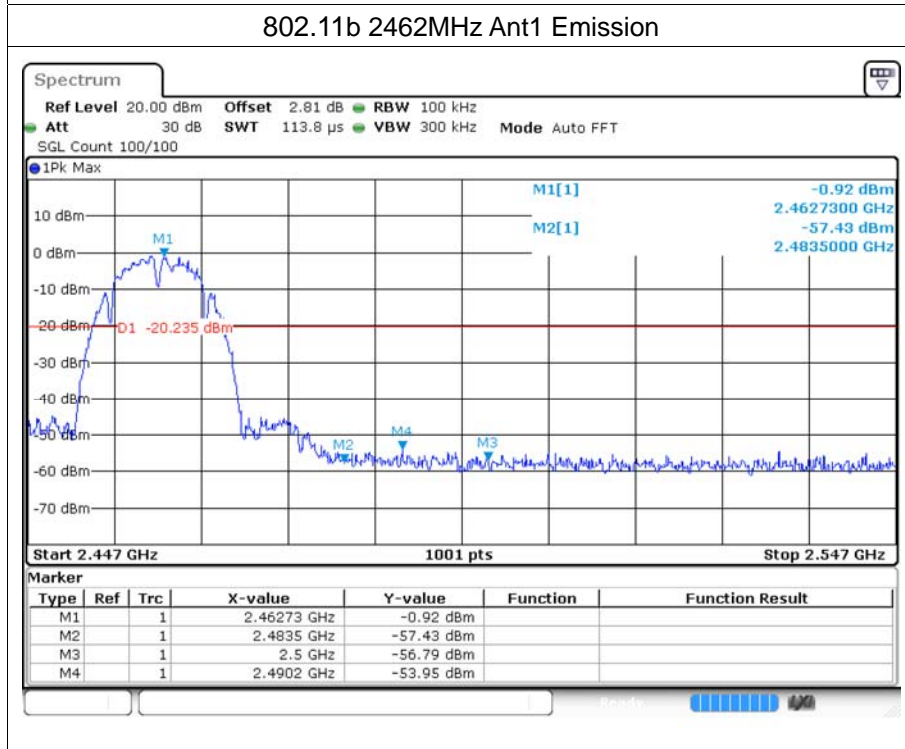
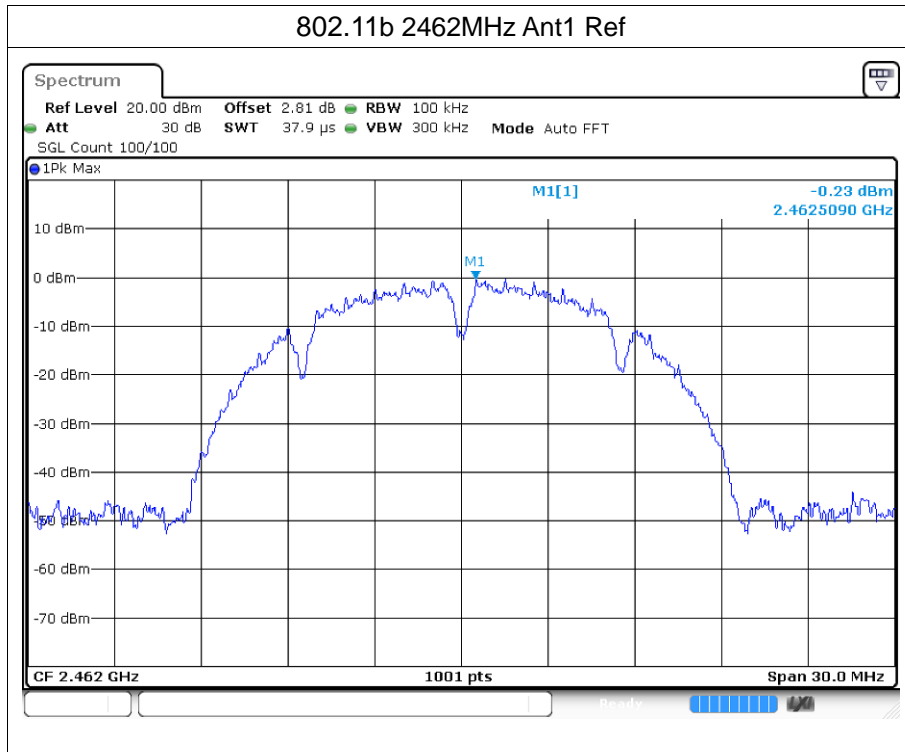
5 Band Edge

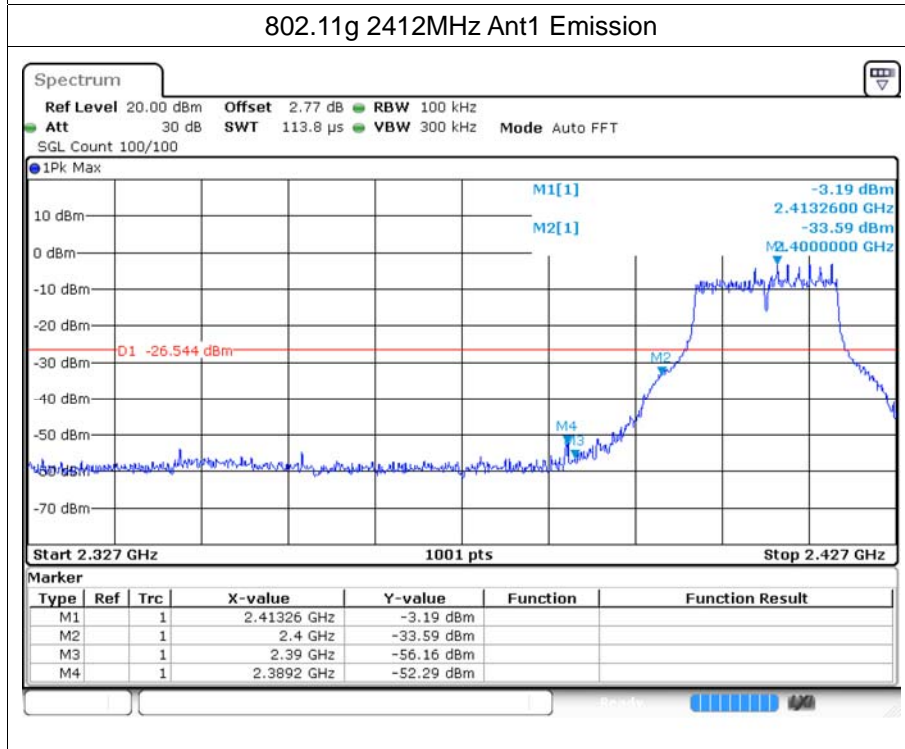
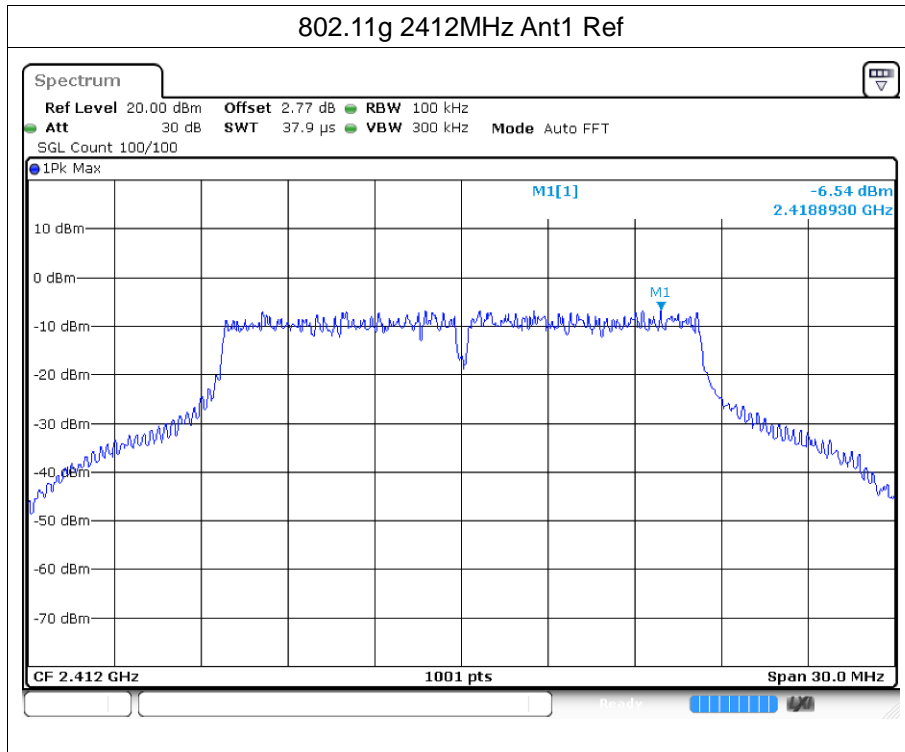
5.1 Test Result

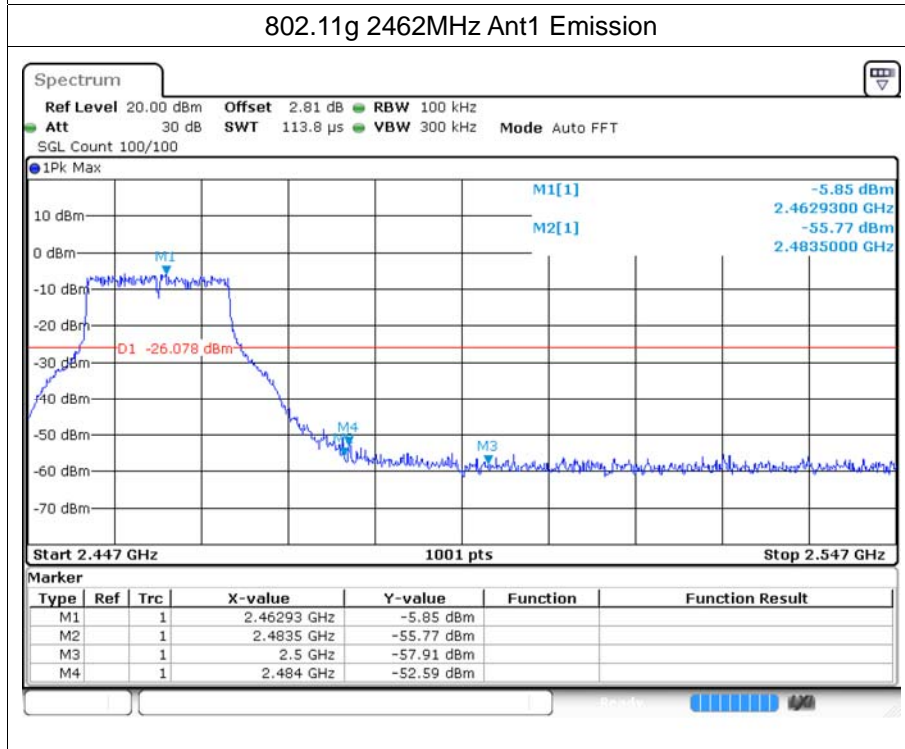
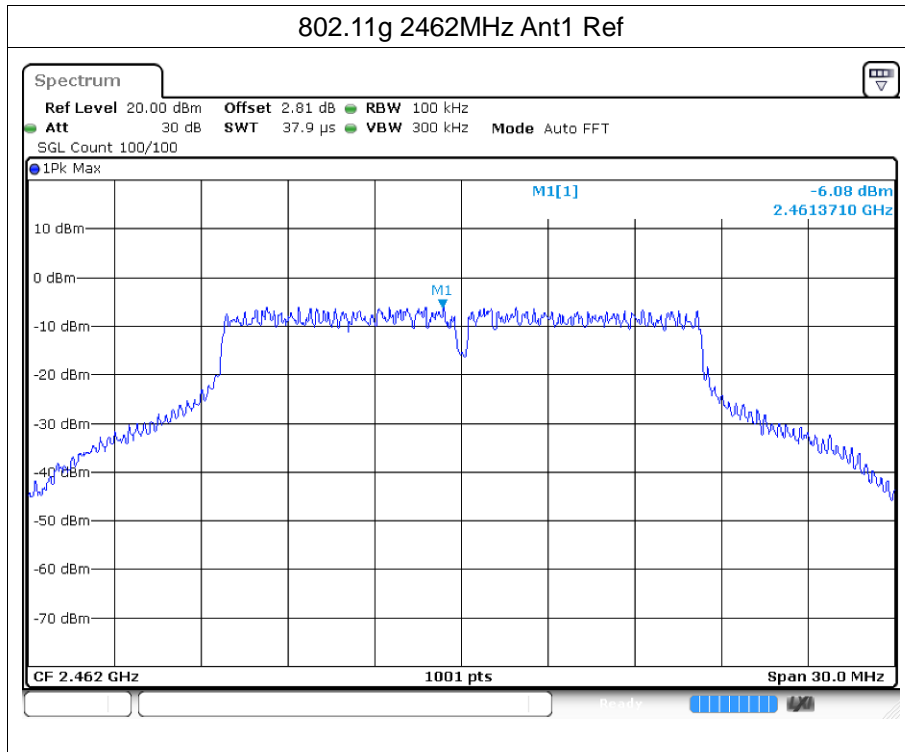
Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
802.11b	2412	Ant1	-53.93	-20	-53.93
802.11b	2462	Ant1	-53.72	-20	Pass
802.11g	2412	Ant1	-45.75	-20	Pass
802.11g	2462	Ant1	-46.51	-20	Pass
802.11n20	2412	Ant1	-47.97	-20	Pass
802.11n20	2462	Ant1	-45.89	-20	Pass
802.11n40	2422	Ant1	-40.3	-20	Pass
802.11n40	2452	Ant1	-37.43	-20	Pass

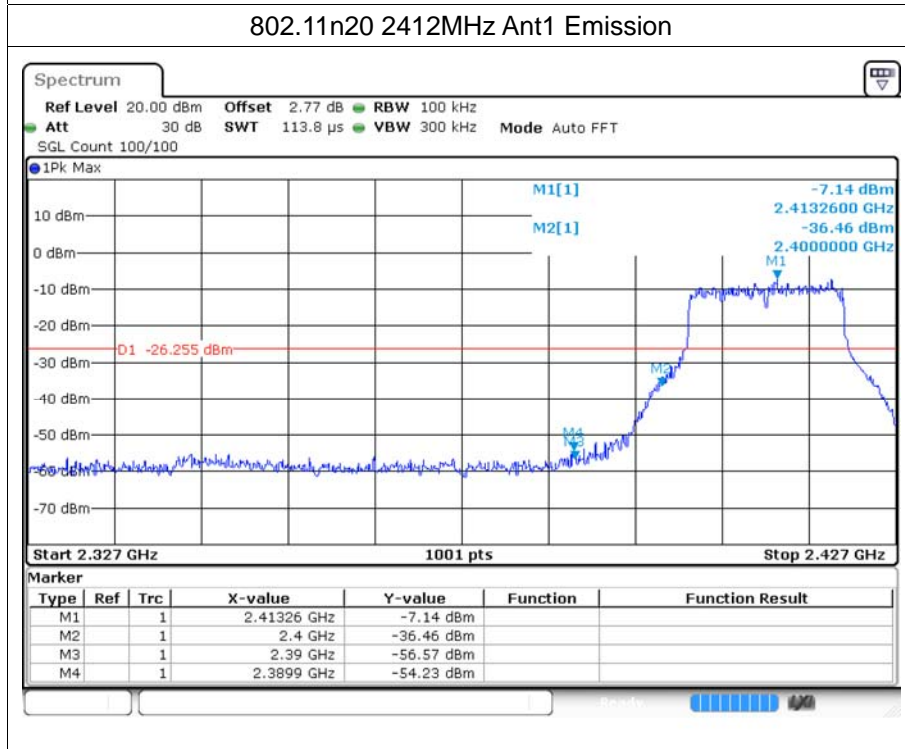
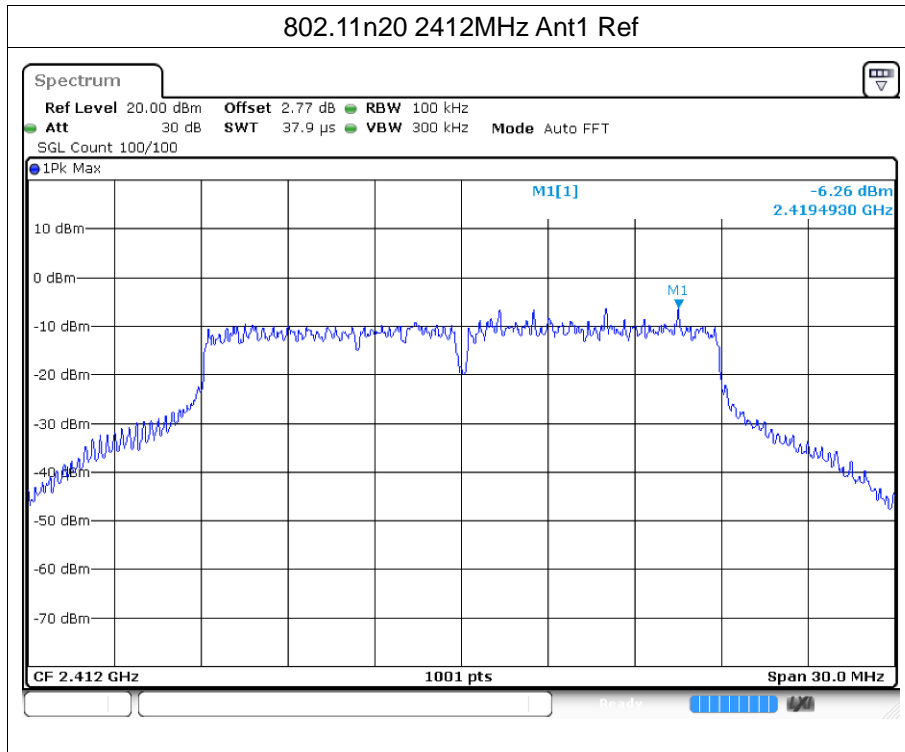
5.2 Test Graphs

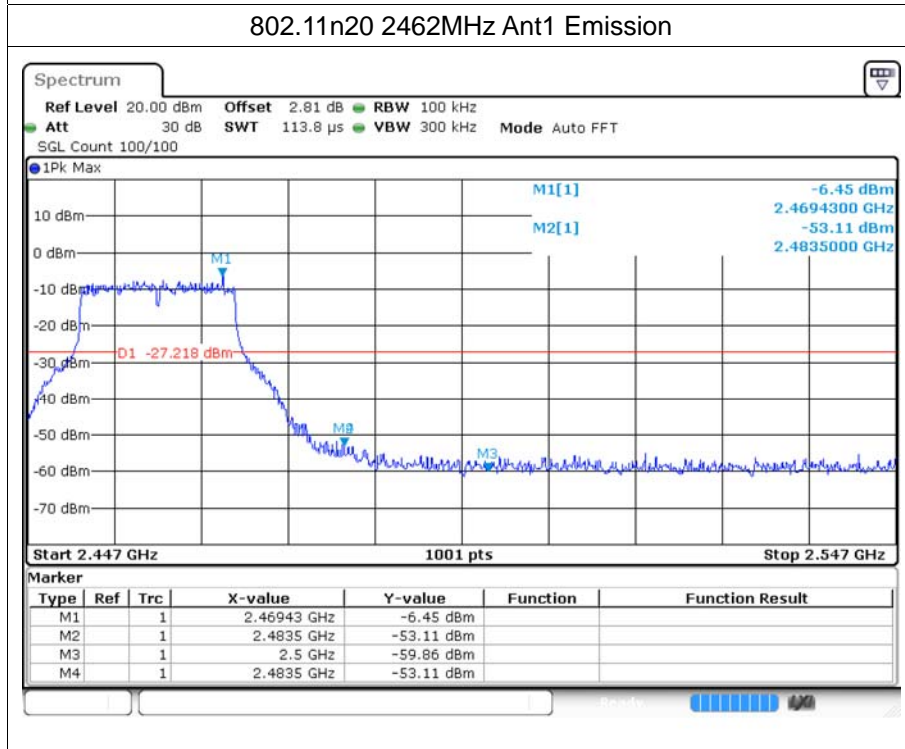
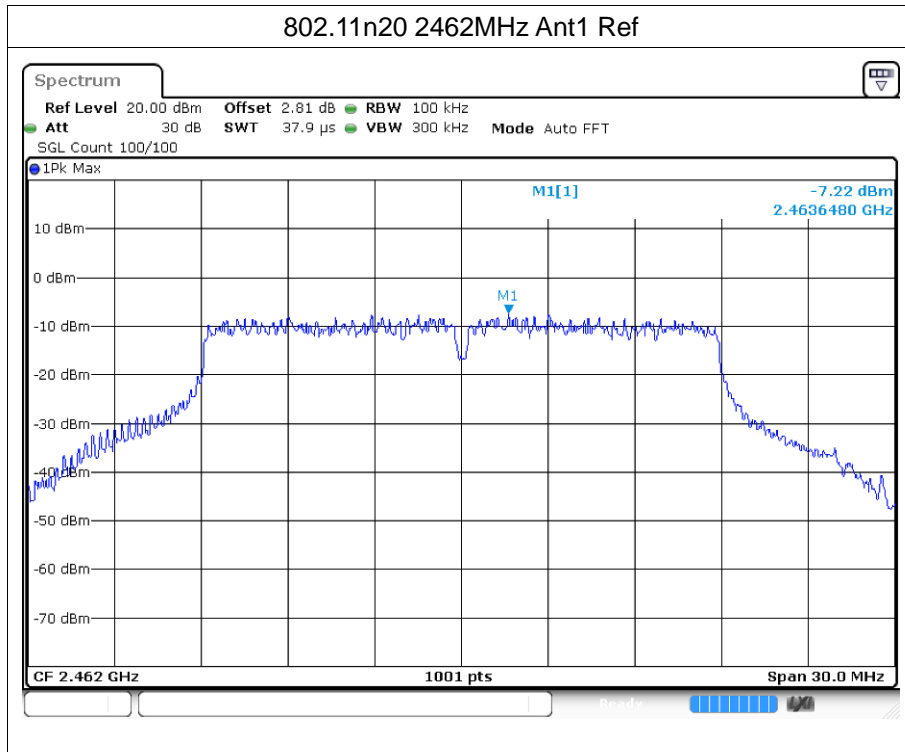


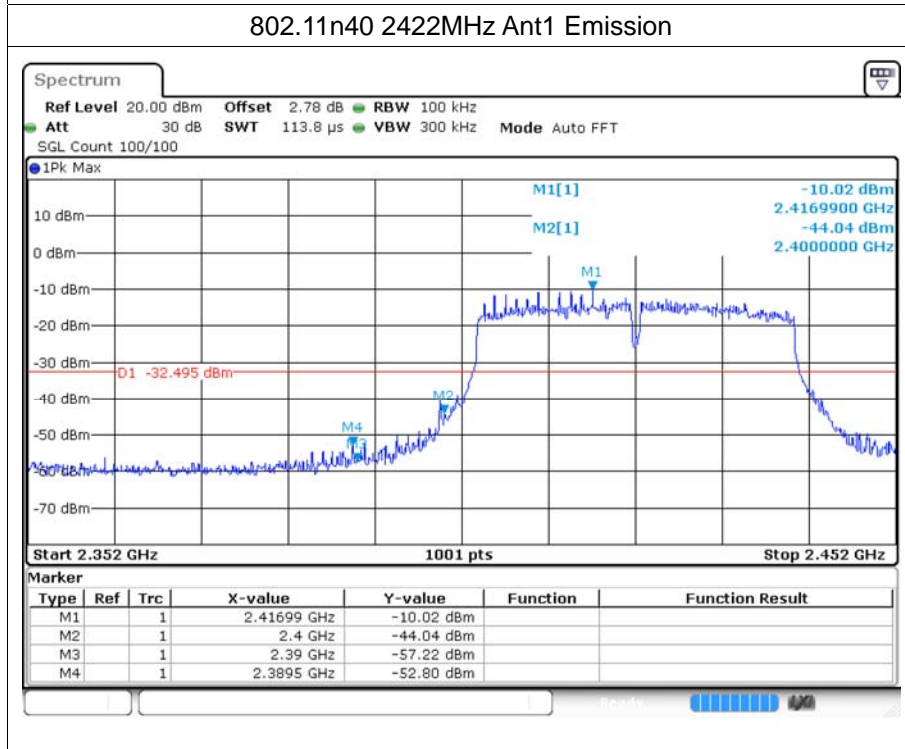
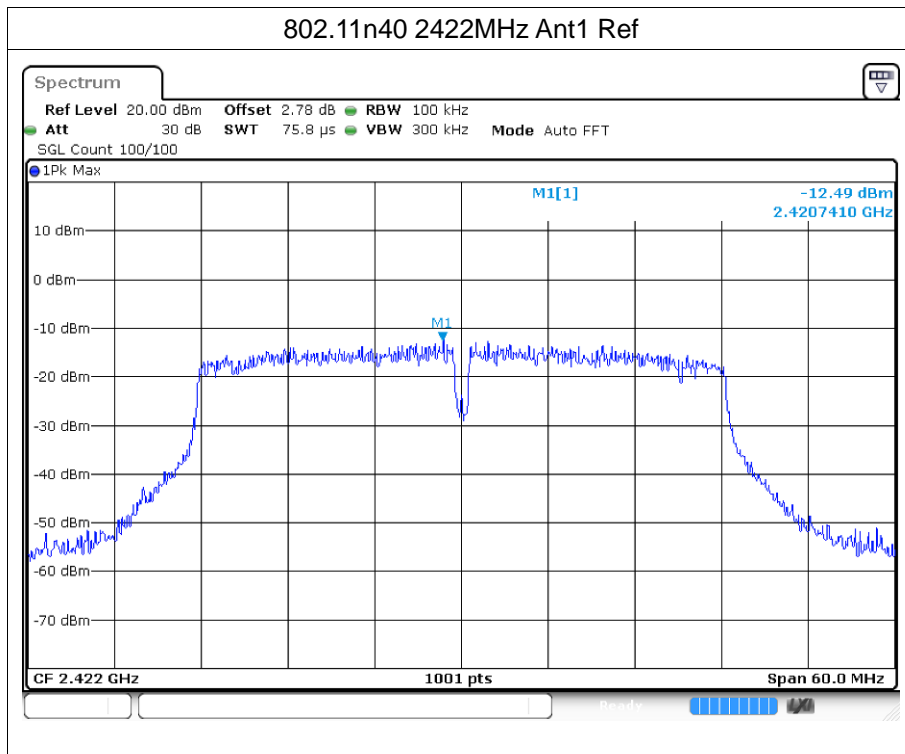


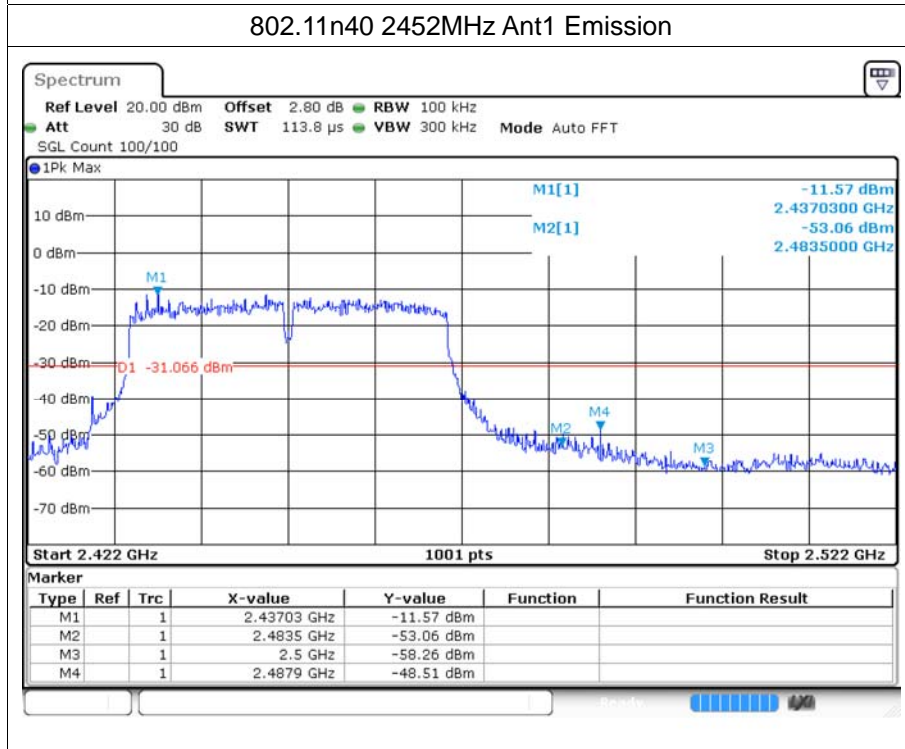
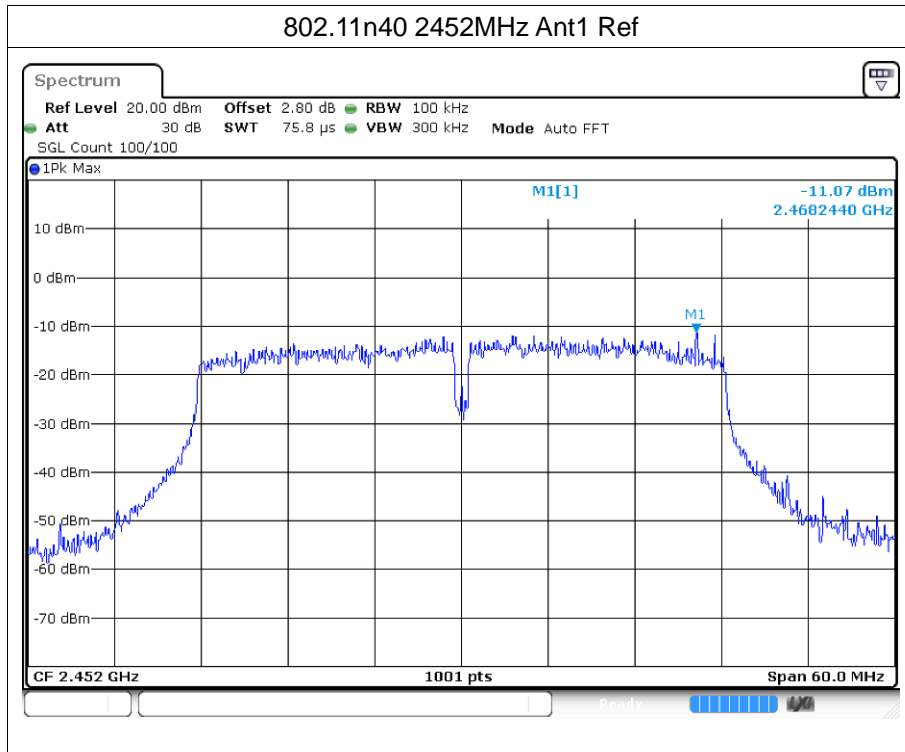












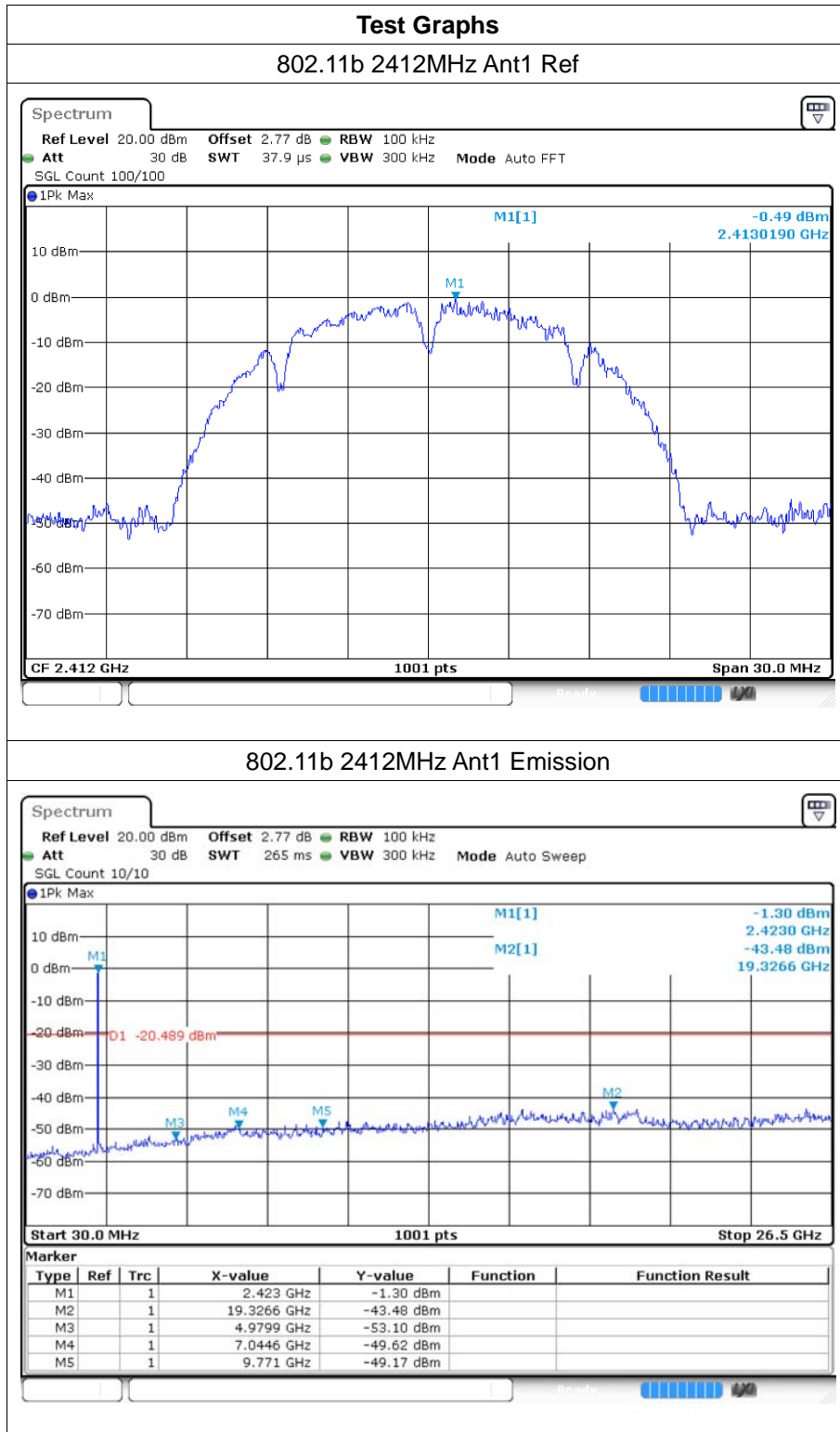


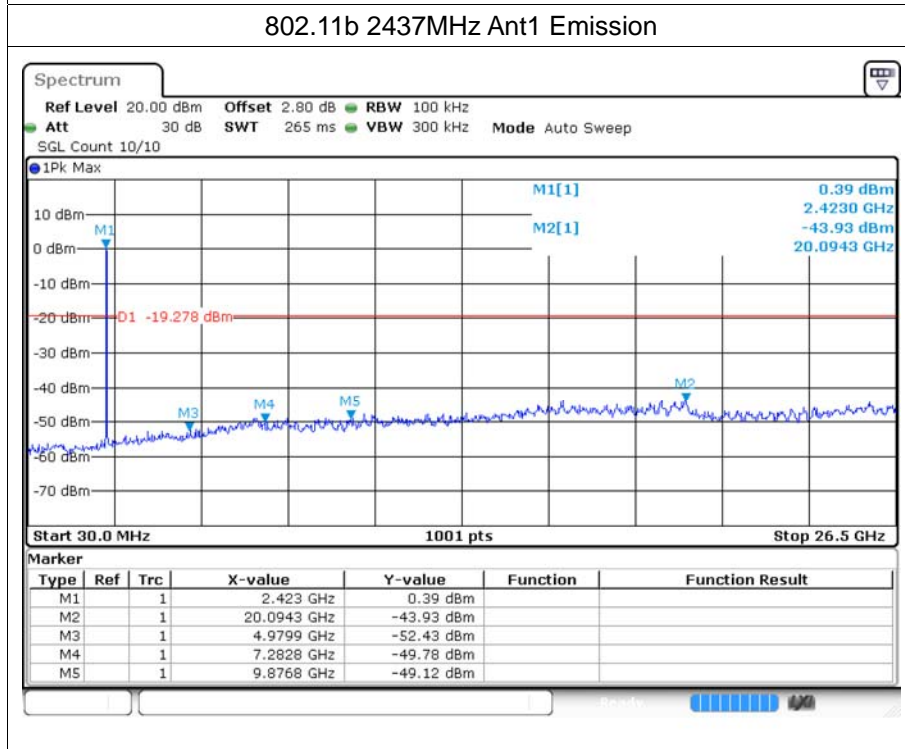
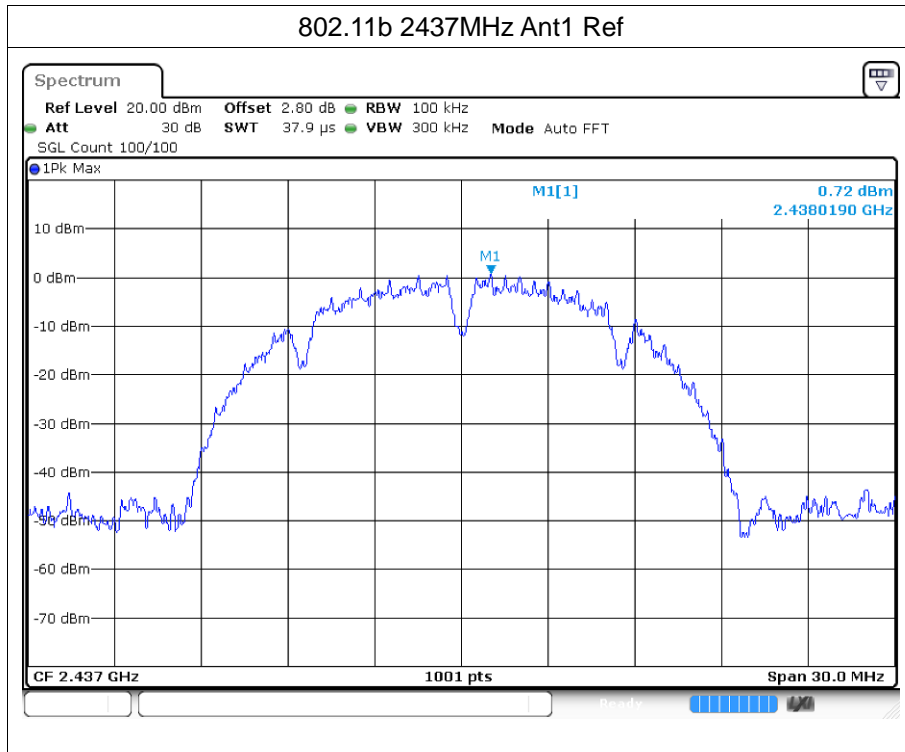
6 Conducted RF Spurious Emission

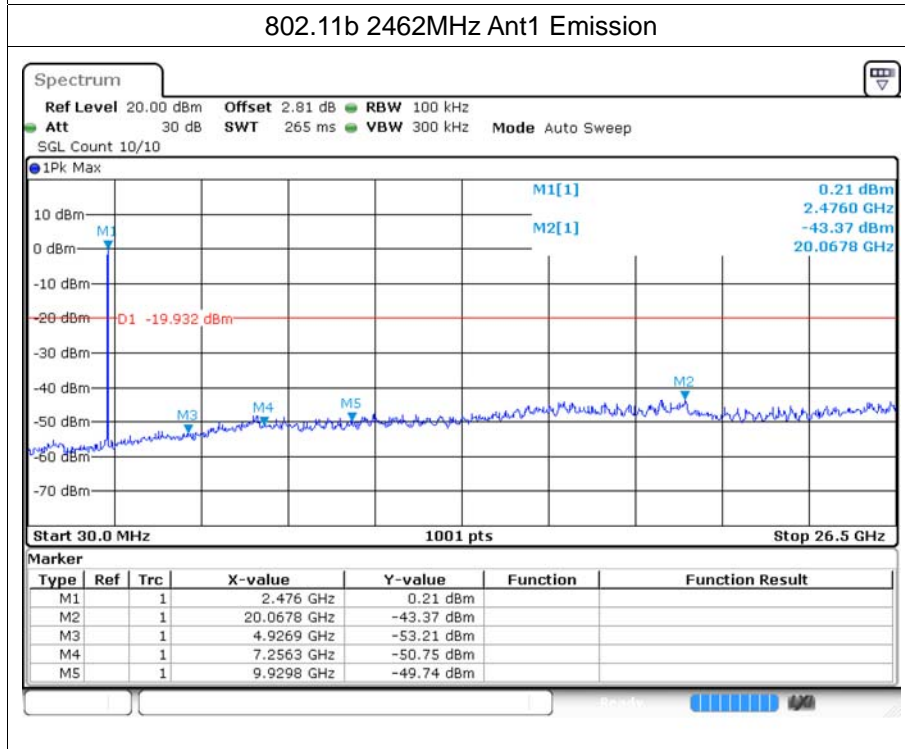
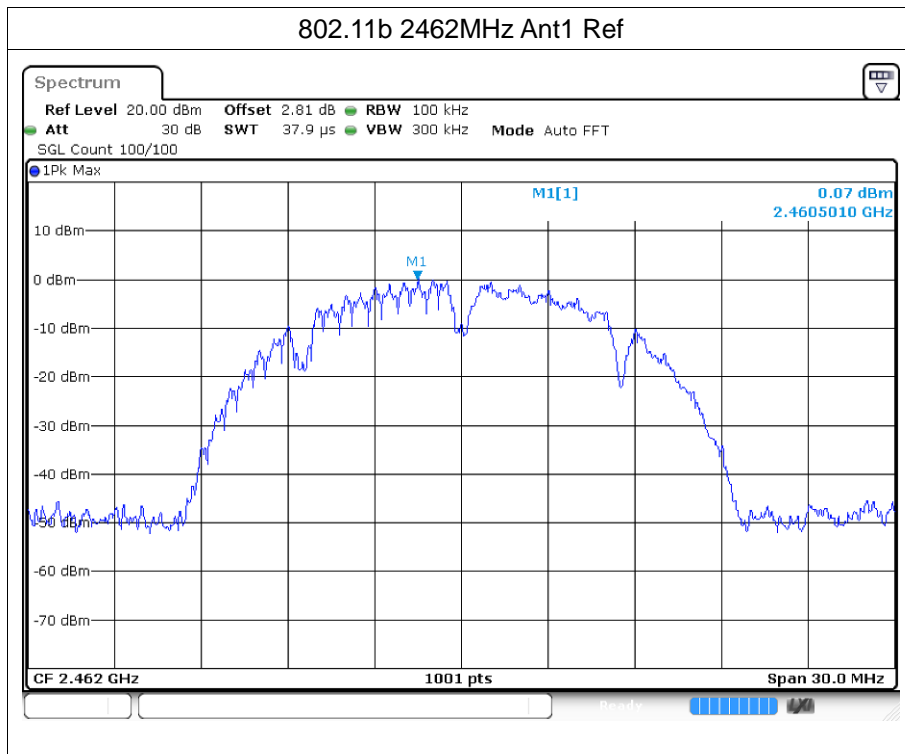
6.1 Test Result

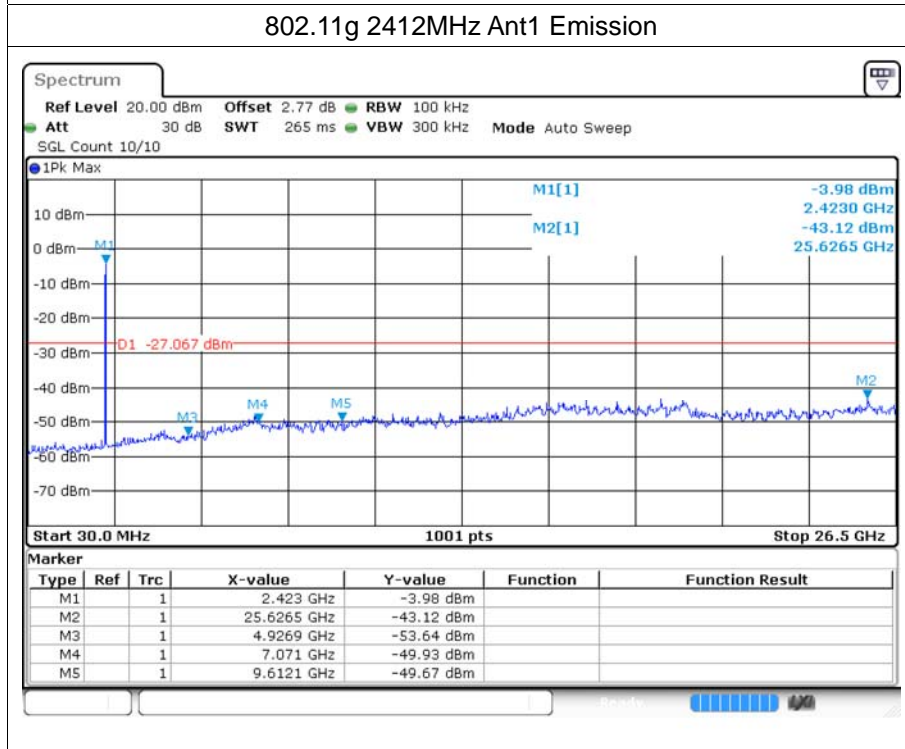
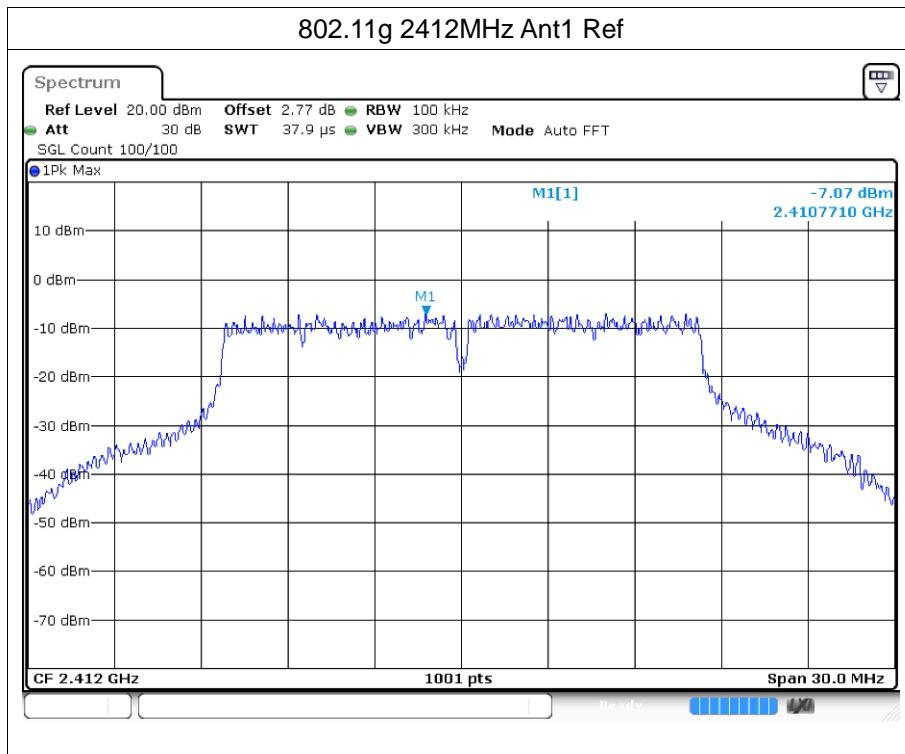
Mode	Frequency (MHz)	Antenna	Max Value (dBc)	Limit (dBc)	Verdict
802.11b	2412	Ant1	-42.99	-20	Pass
802.11b	2437	Ant1	-44.64	-20	Pass
802.11b	2462	Ant1	-43.43	-20	Pass
802.11g	2412	Ant1	-36.04	-20	Pass
802.11g	2437	Ant1	-37.15	-20	Pass
802.11g	2462	Ant1	-40.98	-20	Pass
802.11n20	2412	Ant1	-38.44	-20	Pass
802.11n20	2437	Ant1	-37	-20	Pass
802.11n20	2462	Ant1	-38.88	-20	Pass
802.11n40	2422	Ant1	-34.09	-20	Pass
802.11n40	2437	Ant1	-33.49	-20	Pass
802.11n40	2452	Ant1	-32.8	-20	Pass

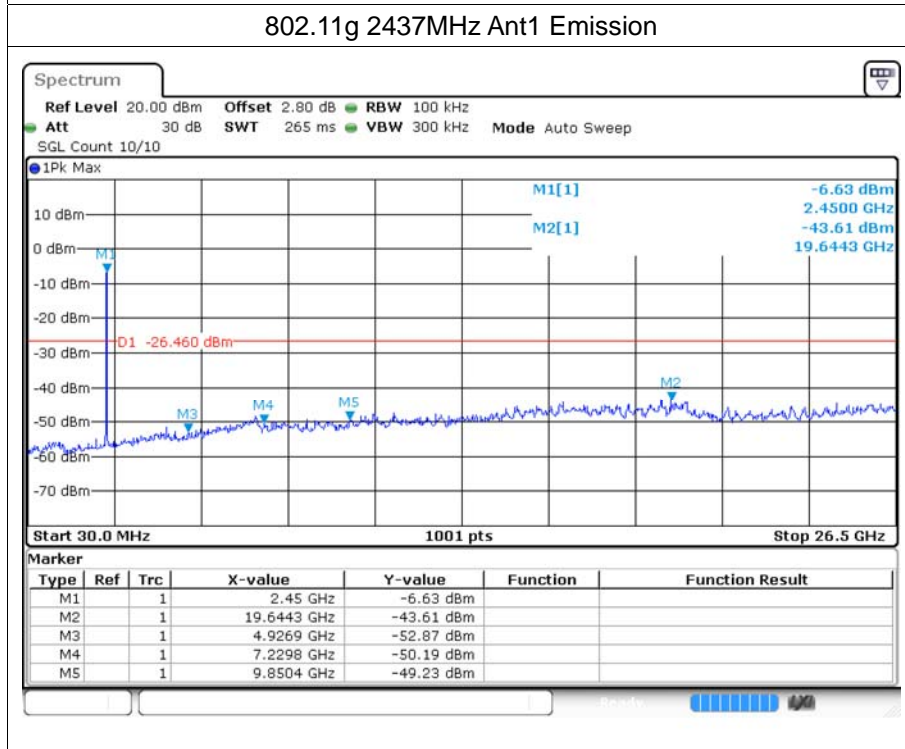
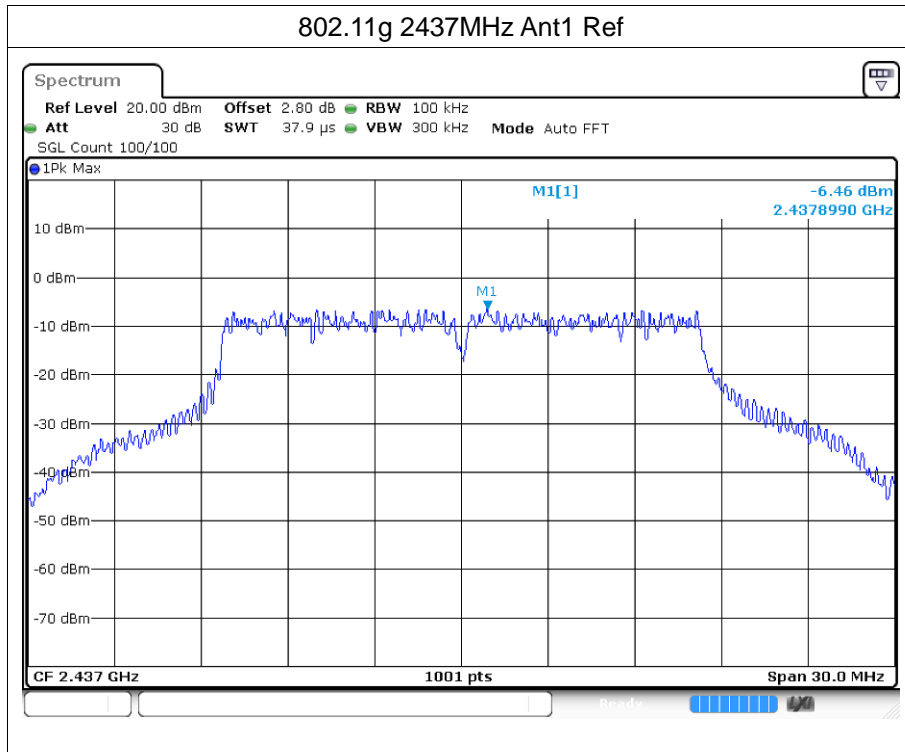
6.2 Test Graphs

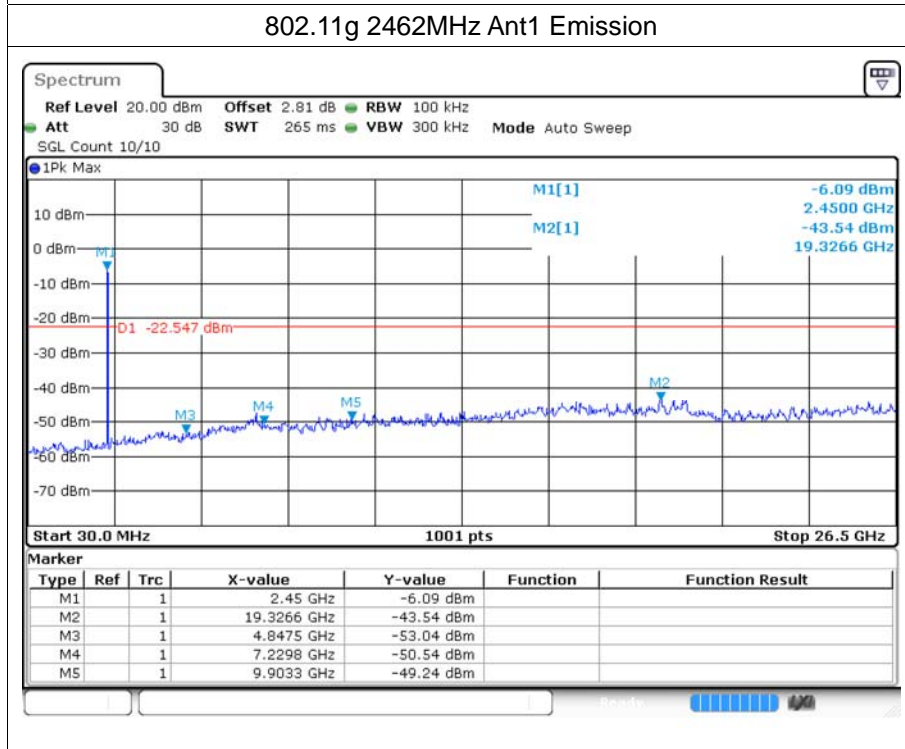
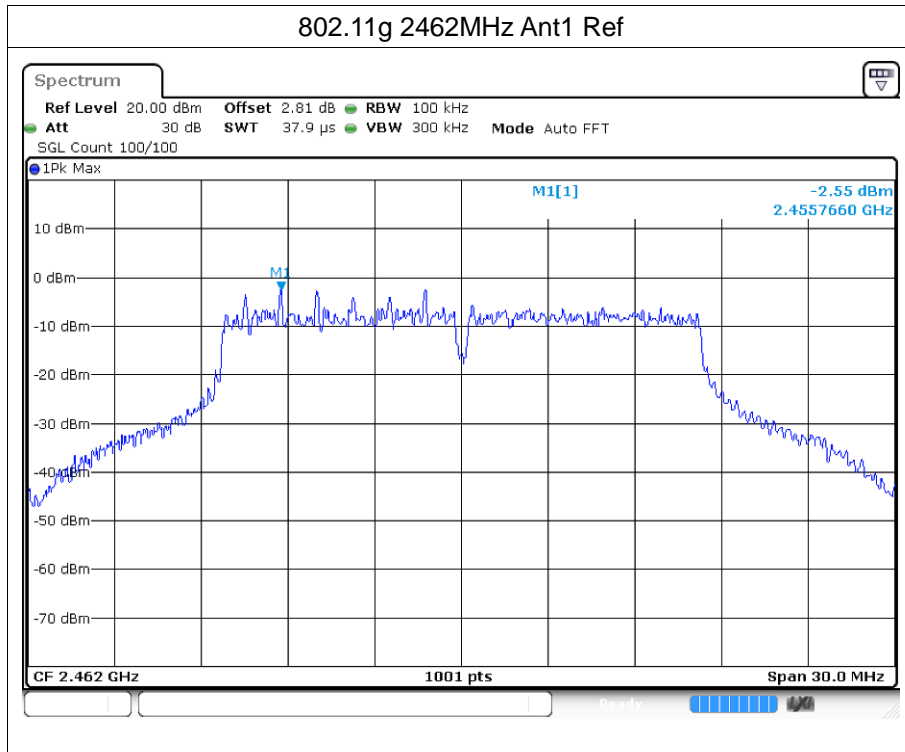


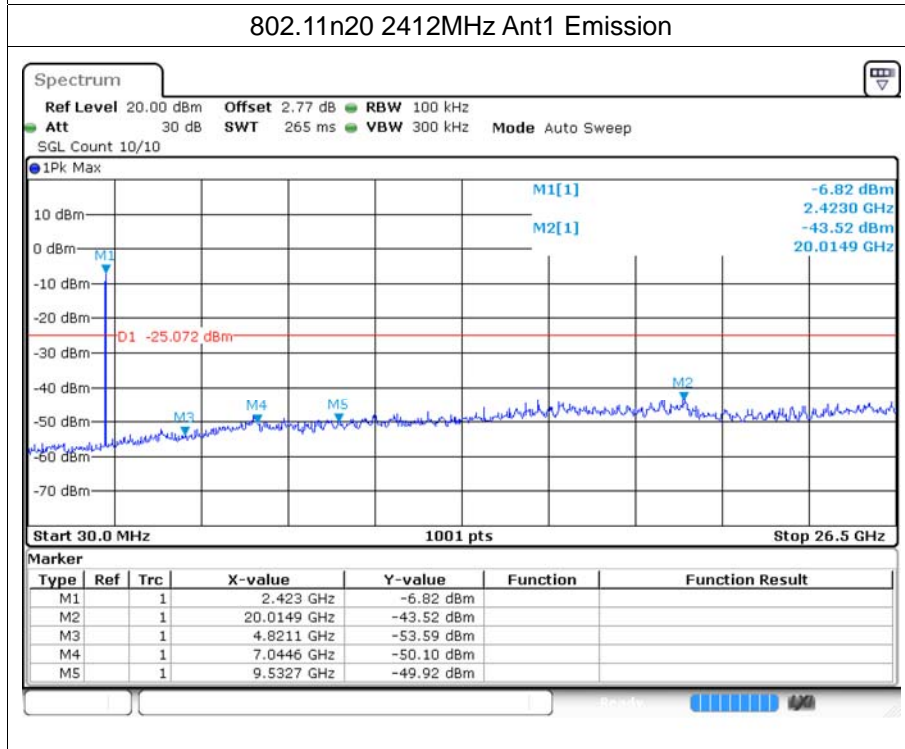
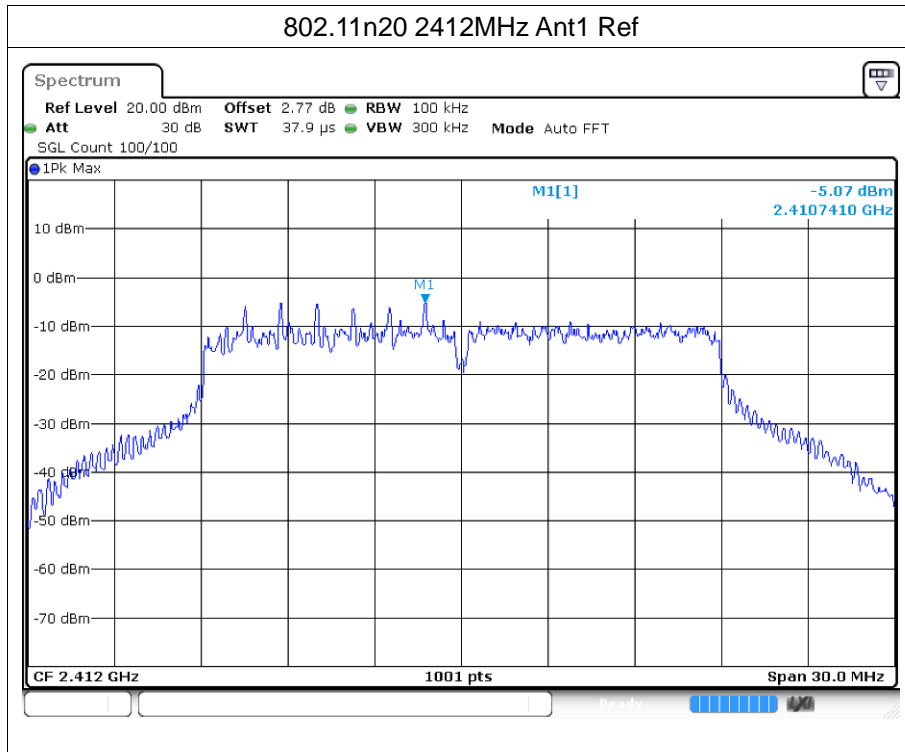


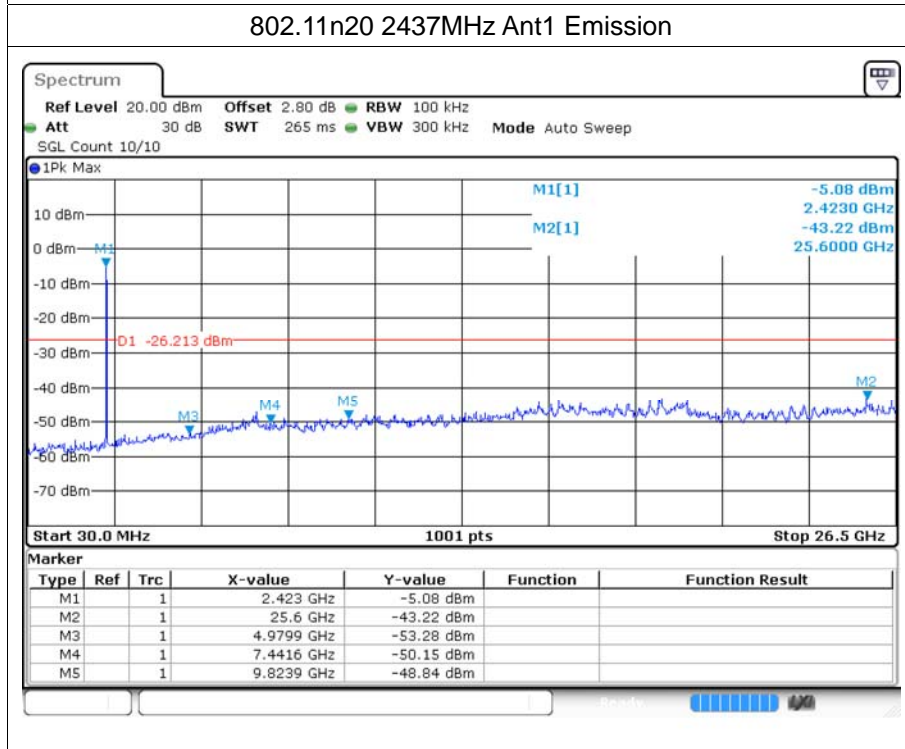
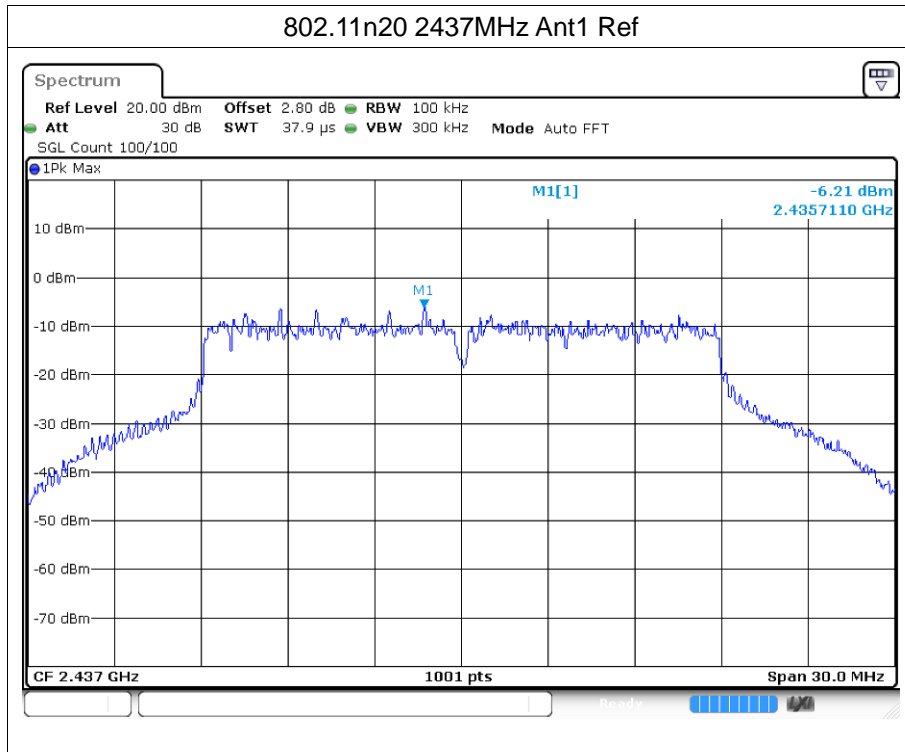


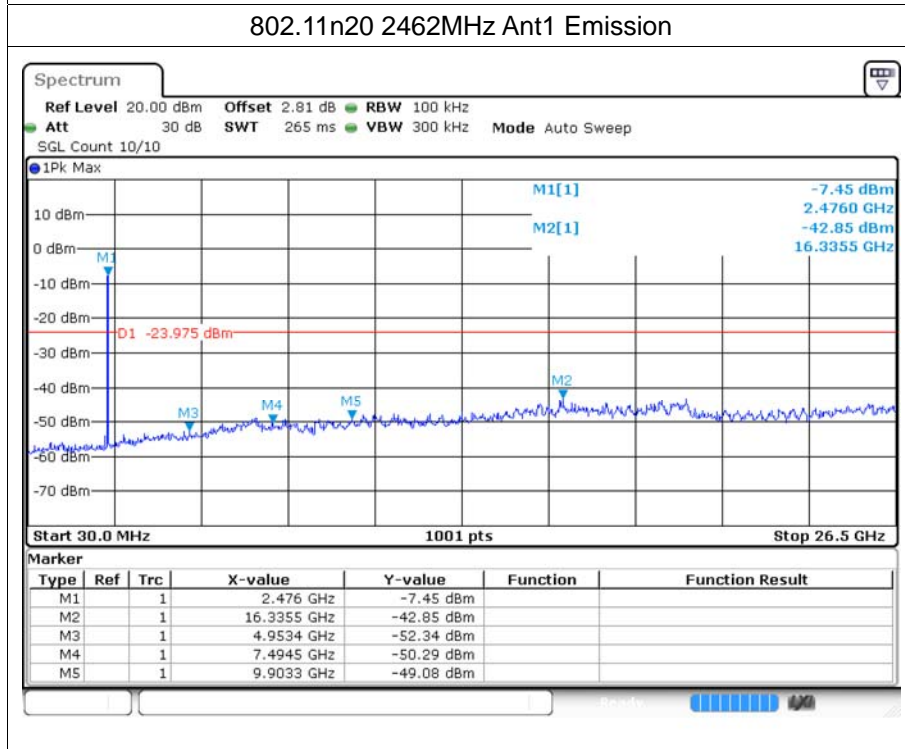
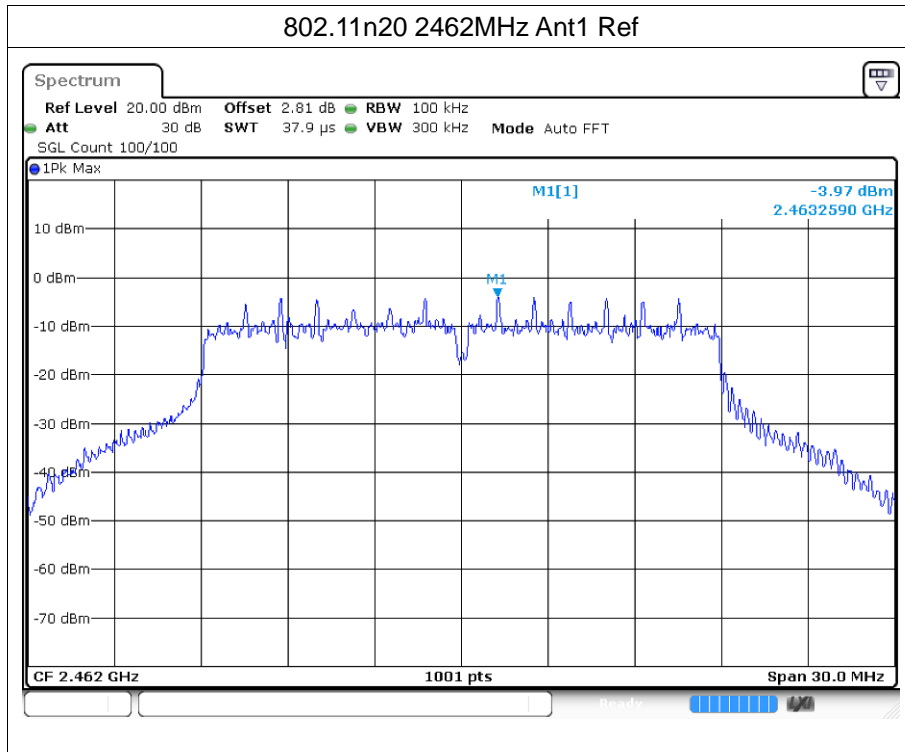


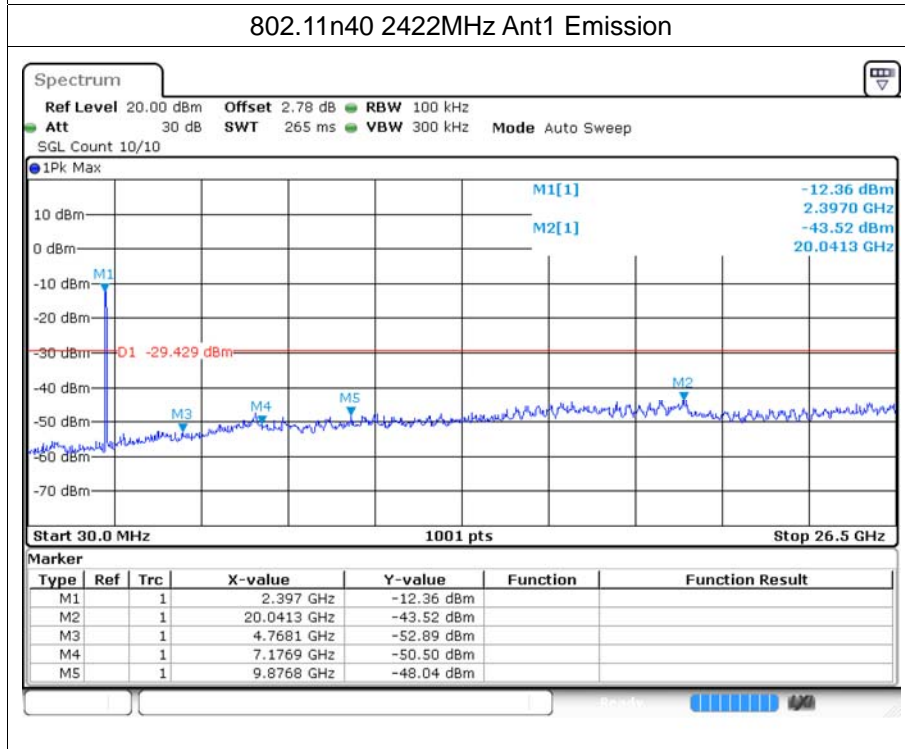
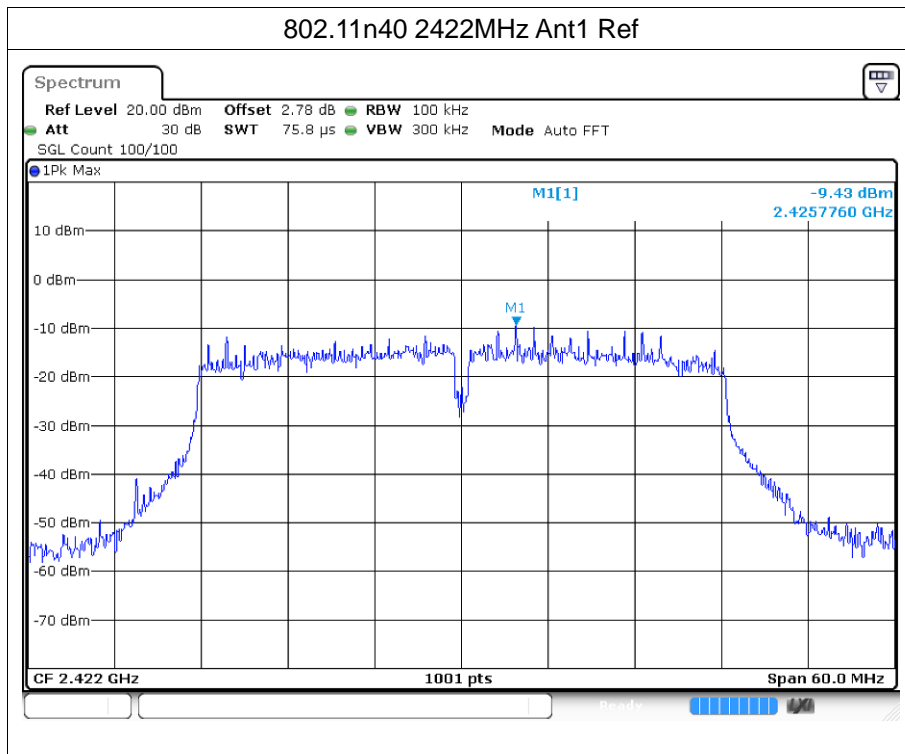


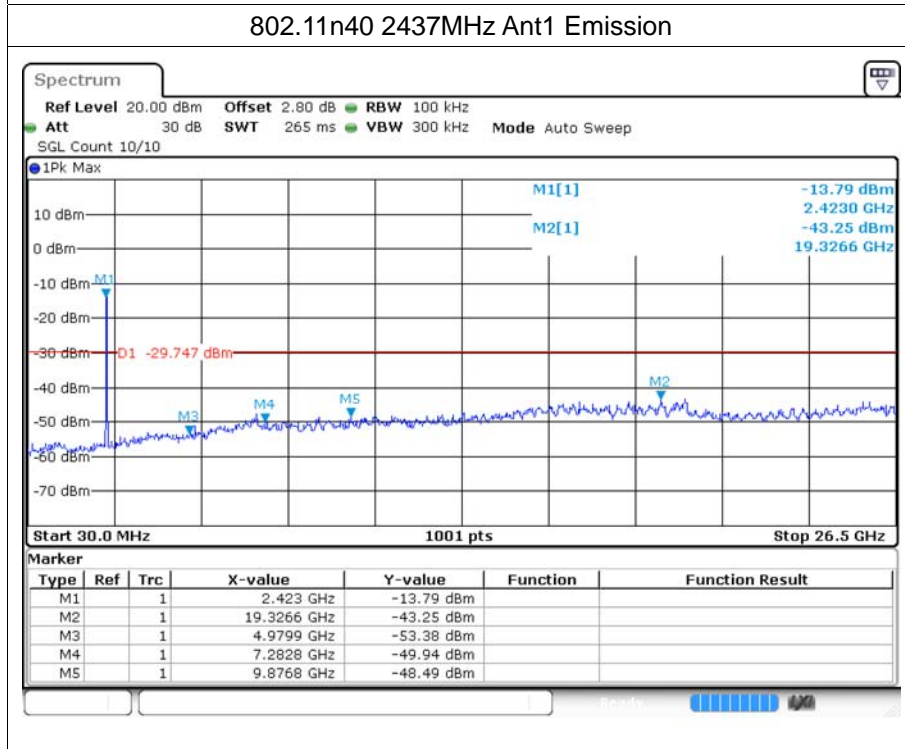
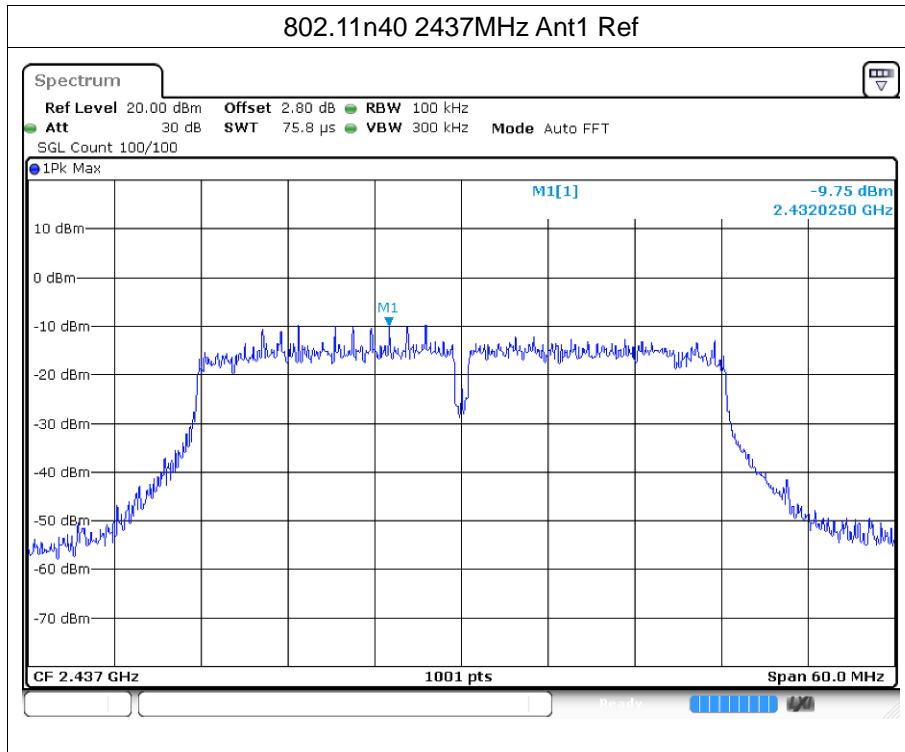


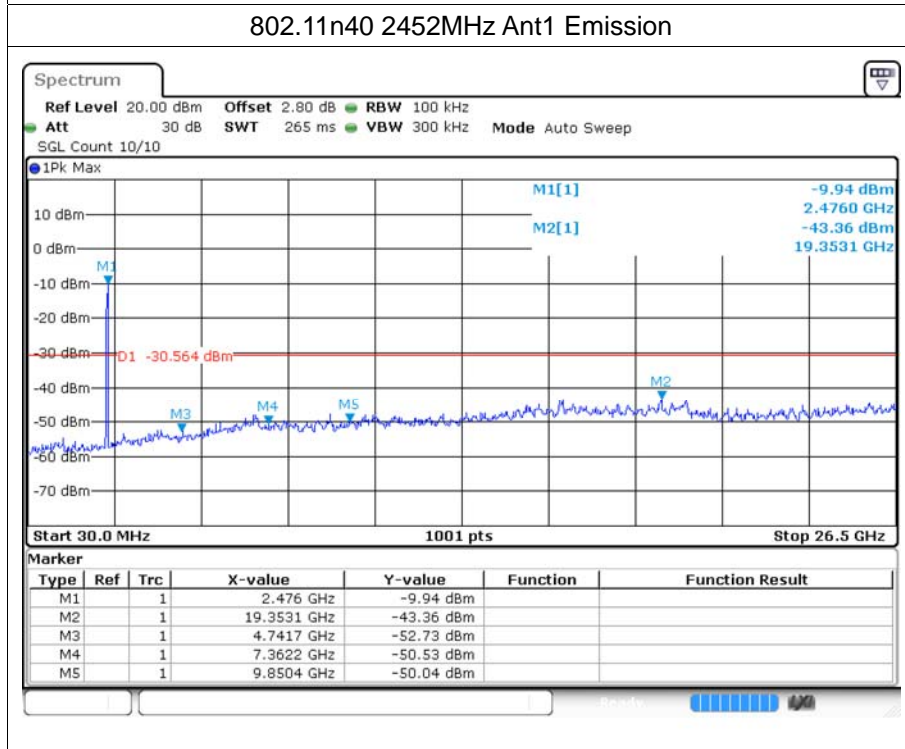
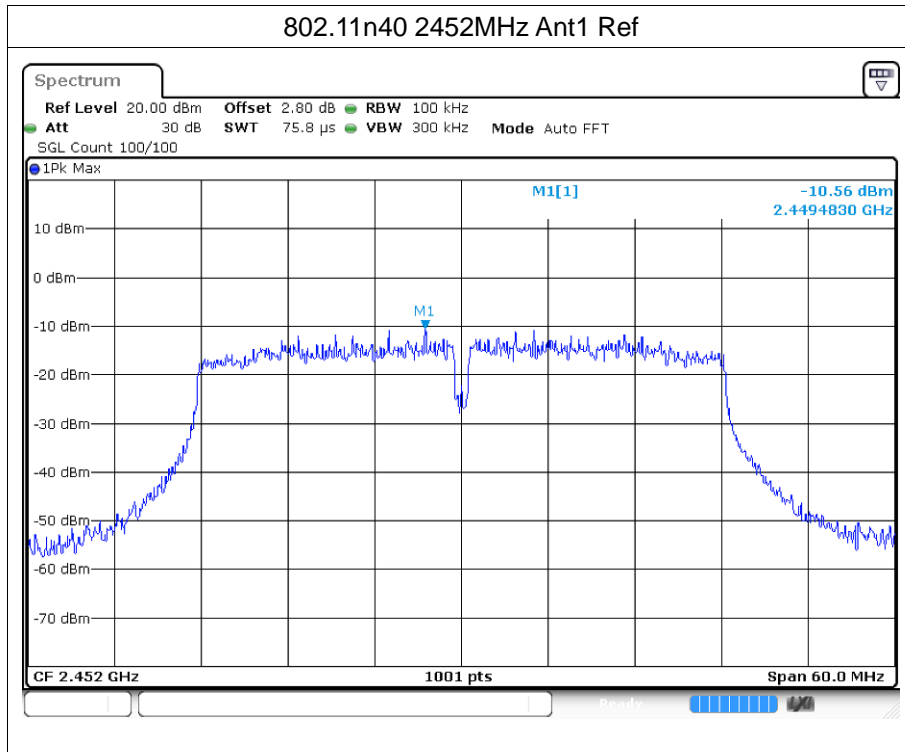














7 Restrict Band

7.1 Test Result

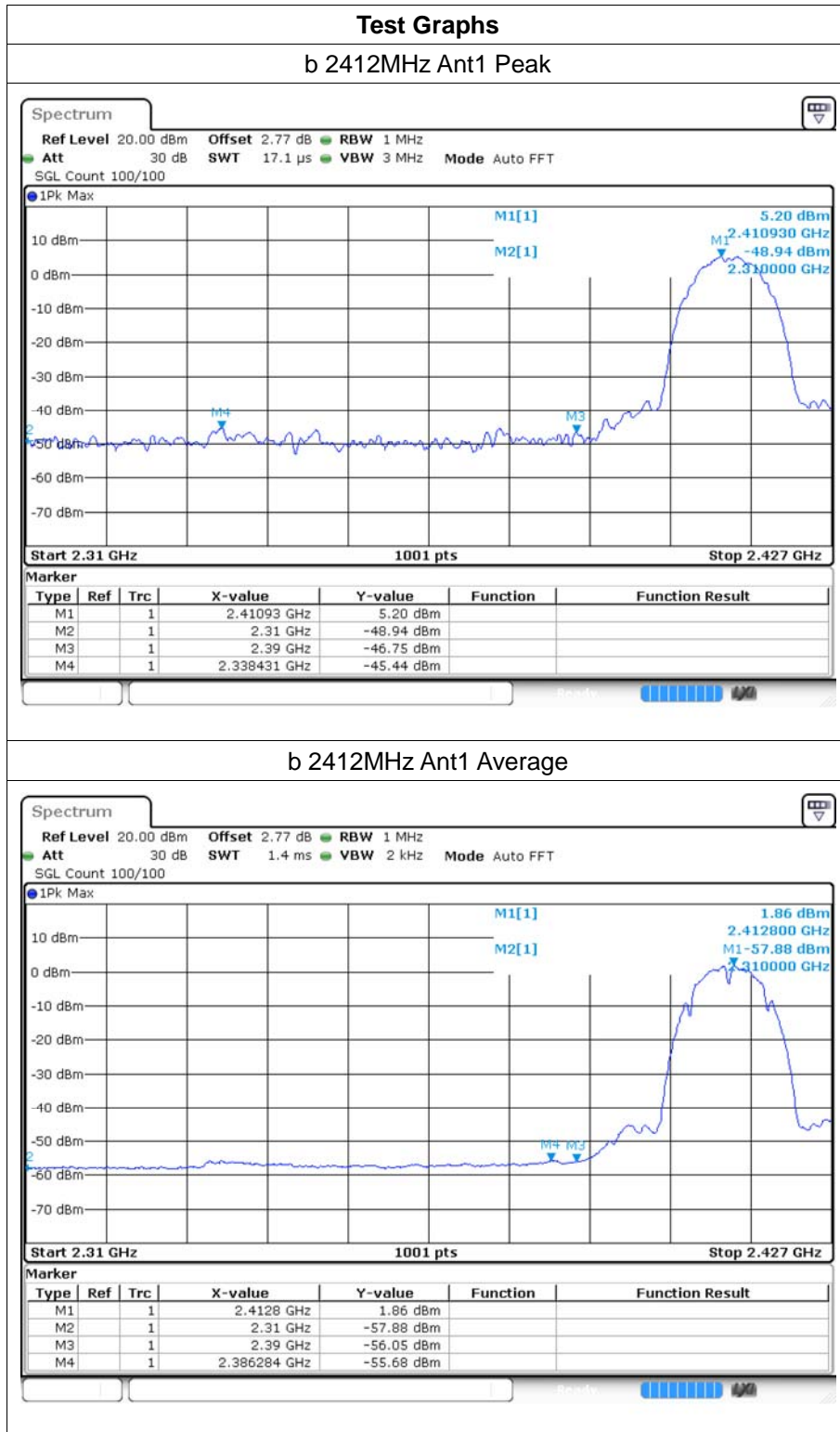
Mode	Frequency (MHz)	Ant.	Spur Freq (MHz)	Power (dBm)	Gain (dBi)	E (dBuV/m)	Detector	Limit (dBuV/m)	Verdict
802.11b	2412	Ant1	2310	-48.93	2.46	48.79	Peak	74	Pass
802.11b	2412	Ant1	2310	-57.88	2.46	39.84	Average	54	Pass
802.11b	2412	Ant1	2338.431	-45.44	2.46	52.28	Peak	74	Pass
802.11b	2412	Ant1	2386.284	-55.68	2.46	42.04	Average	54	Pass
802.11b	2412	Ant1	2390	-46.75	2.46	50.97	Peak	74	Pass
802.11b	2412	Ant1	2390	-56.04	2.46	41.68	Average	54	Pass
802.11b	2462	Ant1	2483.5	-46.12	2.46	51.60	Peak	74	51.14
802.11b	2462	Ant1	2483.5	-55.07	2.46	42.65	Average	54	Pass
802.11b	2462	Ant1	2485.054	-45.59	2.46	52.13	Peak	74	Pass
802.11b	2462	Ant1	2487.704	-54.78	2.46	42.94	Average	54	Pass
802.11b	2462	Ant1	2500	-46.37	2.46	51.35	Peak	74	Pass
802.11b	2462	Ant1	2500	-56.1	2.46	41.62	Average	54	Pass
802.11g	2412	Ant1	2310	-49.34	2.46	48.38	Peak	74	Pass
802.11g	2412	Ant1	2310	-58.29	2.46	39.43	Average	54	Pass
802.11g	2412	Ant1	2389.794	-44.02	2.46	53.70	Peak	74	Pass
802.11g	2412	Ant1	2389.911	-54.9	2.46	42.82	Average	54	Pass
802.11g	2412	Ant1	2390	-44.34	2.46	53.38	Peak	74	Pass
802.11g	2412	Ant1	2390	-54.59	2.46	43.13	Average	54	Pass
802.11g	2462	Ant1	2483.5	-46.41	2.46	51.31	Peak	74	Pass
802.11g	2462	Ant1	2483.5	-52.94	2.46	44.78	Average	54	Pass
802.11g	2462	Ant1	2485.054	-45.93	2.46	51.79	Peak	74	Pass
802.11g	2462	Ant1	2483.517	-52.94	2.46	44.78	Average	54	Pass
802.11g	2462	Ant1	2500	-48.71	2.46	49.01	Peak	74	Pass
802.11g	2462	Ant1	2500	-57.13	2.46	40.59	Average	54	Pass
802.11n20	2412	Ant1	2310	-51.03	2.46	46.69	Peak	74	Pass
802.11n20	2412	Ant1	2310	-58.38	2.46	39.34	Average	54	Pass
802.11n20	2412	Ant1	2343.93	-45.74	2.46	51.98	Peak	74	Pass
802.11n20	2412	Ant1	2389.911	-55.56	2.46	42.16	Average	54	Pass
802.11n20	2412	Ant1	2390	-47.34	2.46	50.38	Peak	74	Pass
802.11n20	2412	Ant1	2390	-55.51	2.46	42.21	Average	54	Pass
802.11n20	2462	Ant1	2483.5	-43.42	2.46	54.30	Peak	74	Pass
802.11n20	2462	Ant1	2483.5	-53.29	2.46	44.43	Average	54	Pass
802.11n20	2462	Ant1	2483.676	-43.17	2.46	54.55	Peak	74	Pass
802.11n20	2462	Ant1	2483.517	-53.29	2.46	44.43	Average	54	Pass
802.11n20	2462	Ant1	2500	-49.81	2.46	47.91	Peak	74	Pass

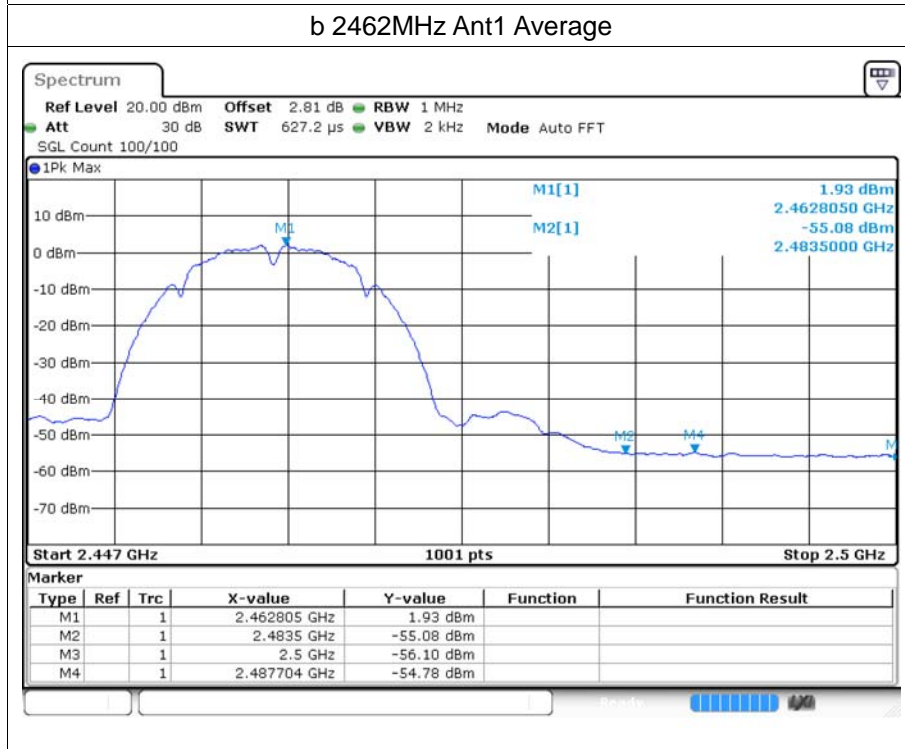
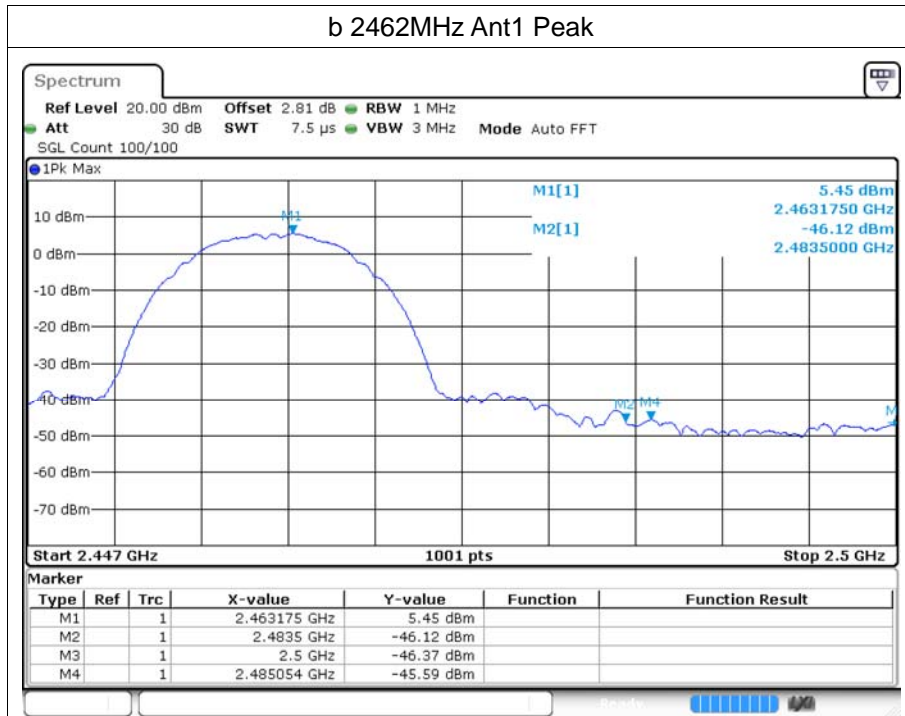


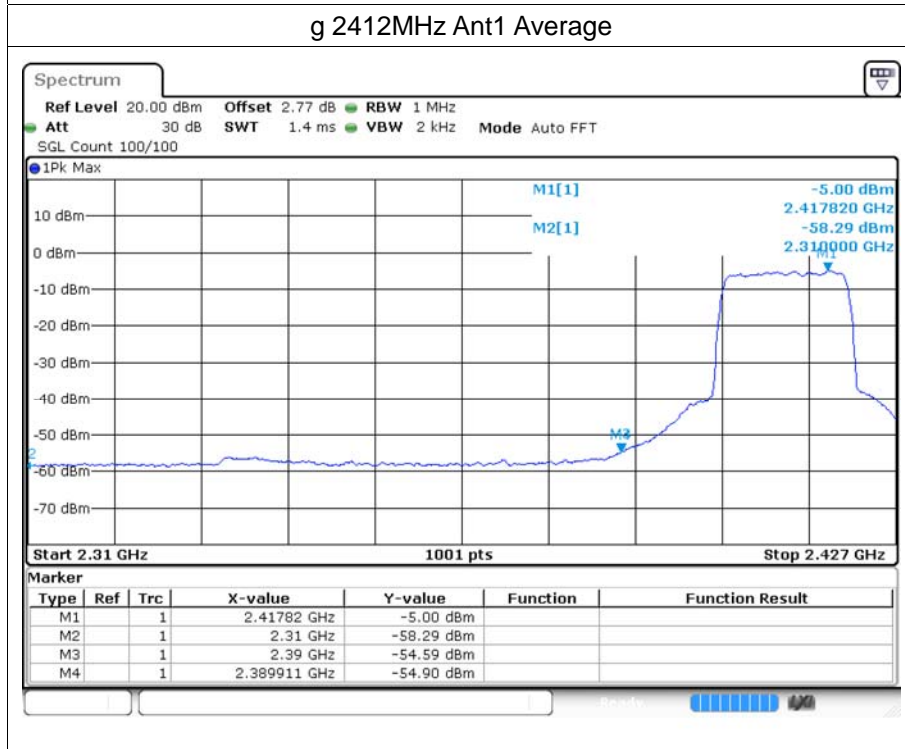
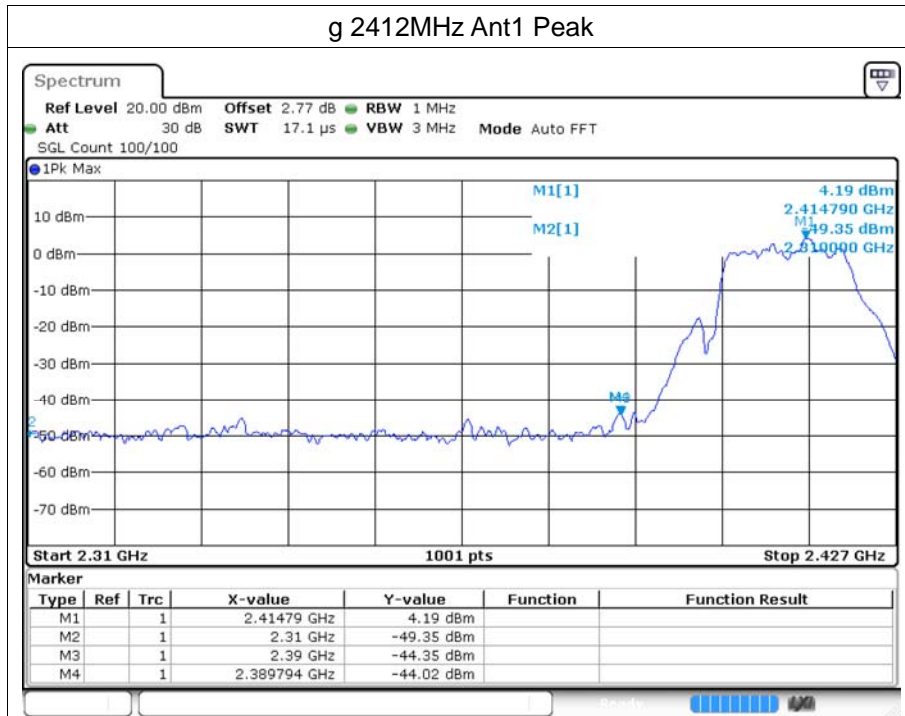
802.11n20	2462	Ant1	2500	-56.79	2.46	40.93	Average	54	Pass
802.11n40	2422	Ant1	2310	-49.93	2.46	47.79	Peak	74	Pass
802.11n40	2422	Ant1	2310	-57.51	2.46	40.21	Average	54	Pass
802.11n40	2422	Ant1	2346.352	-46.36	2.46	51.36	Peak	74	Pass
802.11n40	2422	Ant1	2389.946	-54.99	2.46	42.73	Average	54	Pass
802.11n40	2422	Ant1	2390	-47.15	2.46	50.57	Peak	74	Pass
802.11n40	2422	Ant1	2390	-54.88	2.46	42.84	Average	54	Pass
802.11n40	2452	Ant1	2483.5	-44.57	2.46	53.15	Peak	74	Pass
802.11n40	2452	Ant1	2483.5	-51.8	2.46	45.92	Average	54	Pass
802.11n40	2452	Ant1	2484.478	-42.3	2.46	55.42	Peak	74	Pass
802.11n40	2452	Ant1	2484.088	-51.77	2.46	45.95	Average	54	Pass
802.11n40	2452	Ant1	2500	-50.17	2.46	47.55	Peak	74	Pass
802.11n40	2452	Ant1	2500	-57.13	2.46	40.59	Average	54	Pass

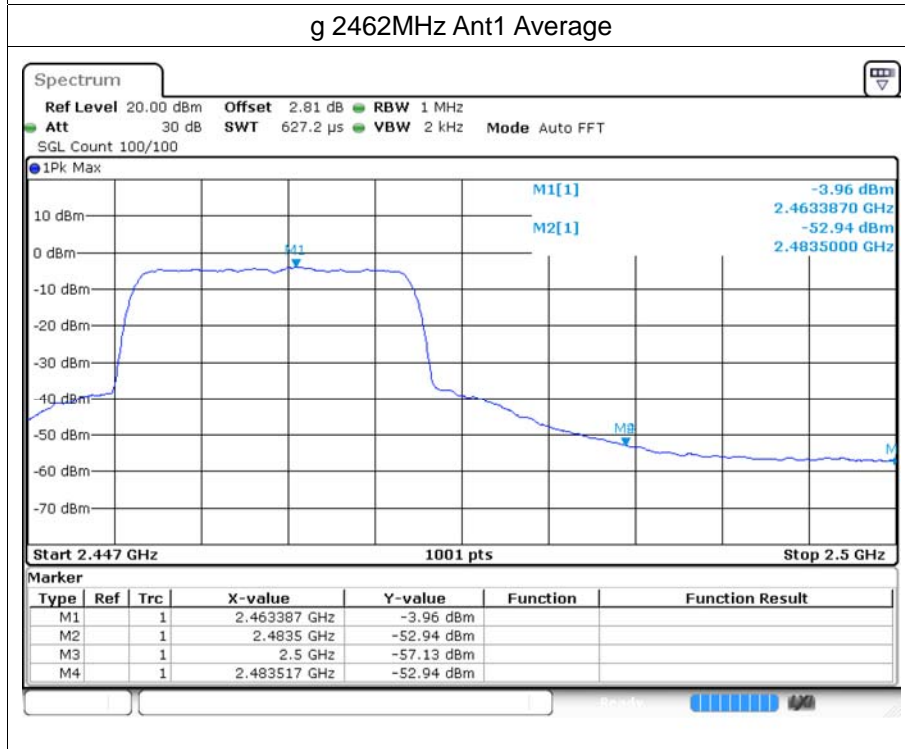
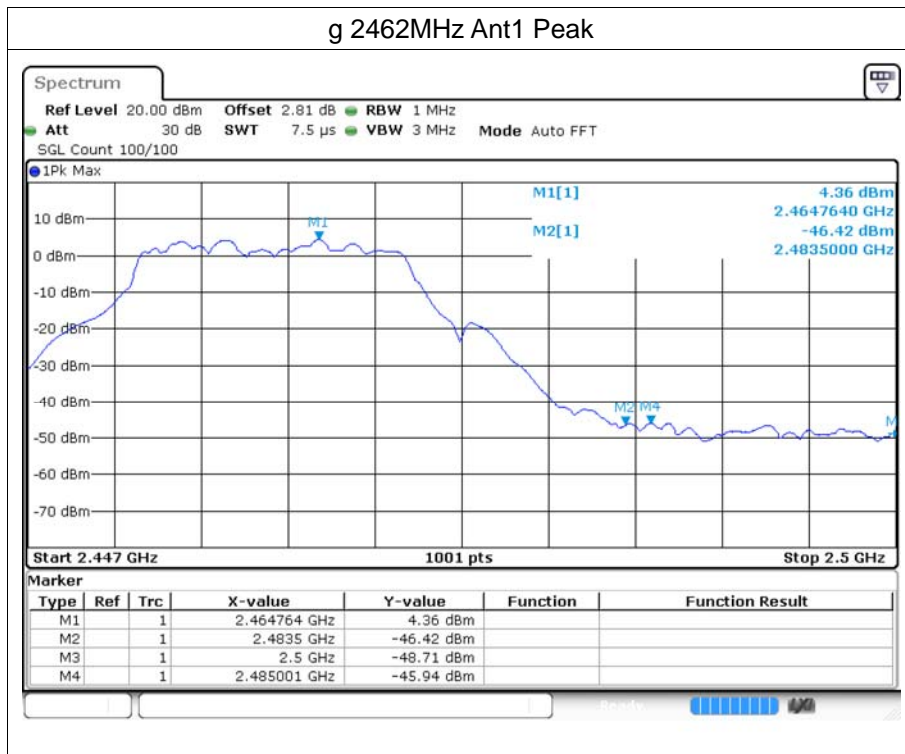


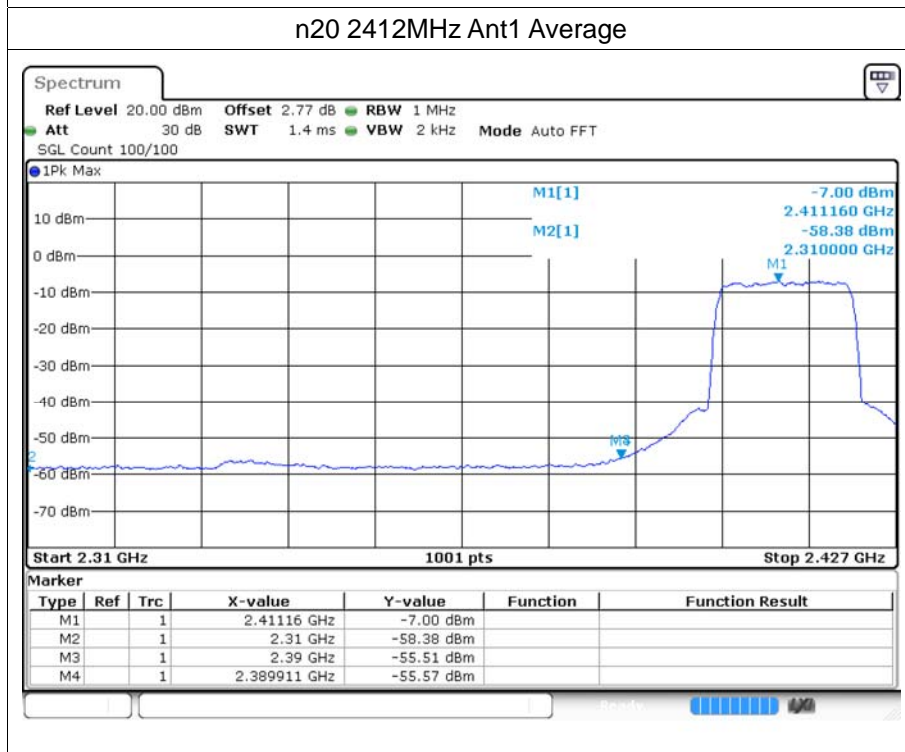
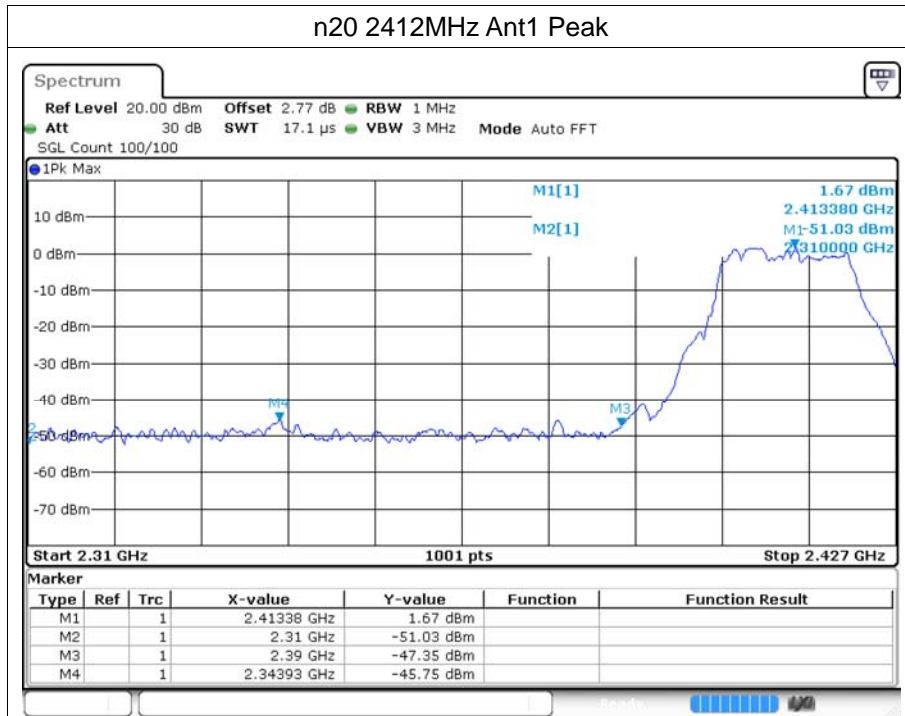
7.2 Test Graphs

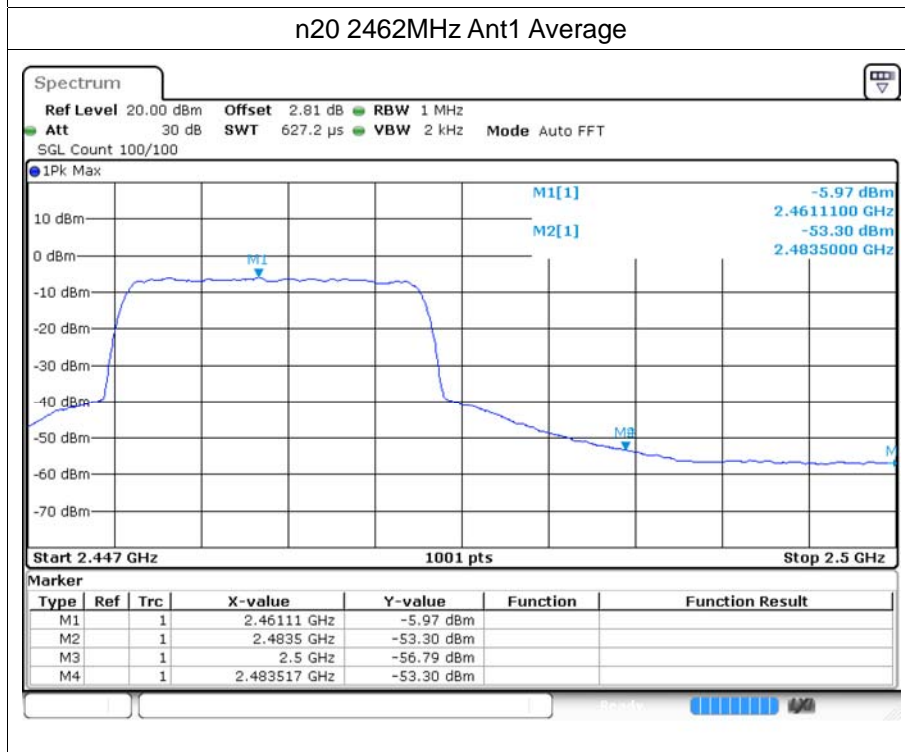
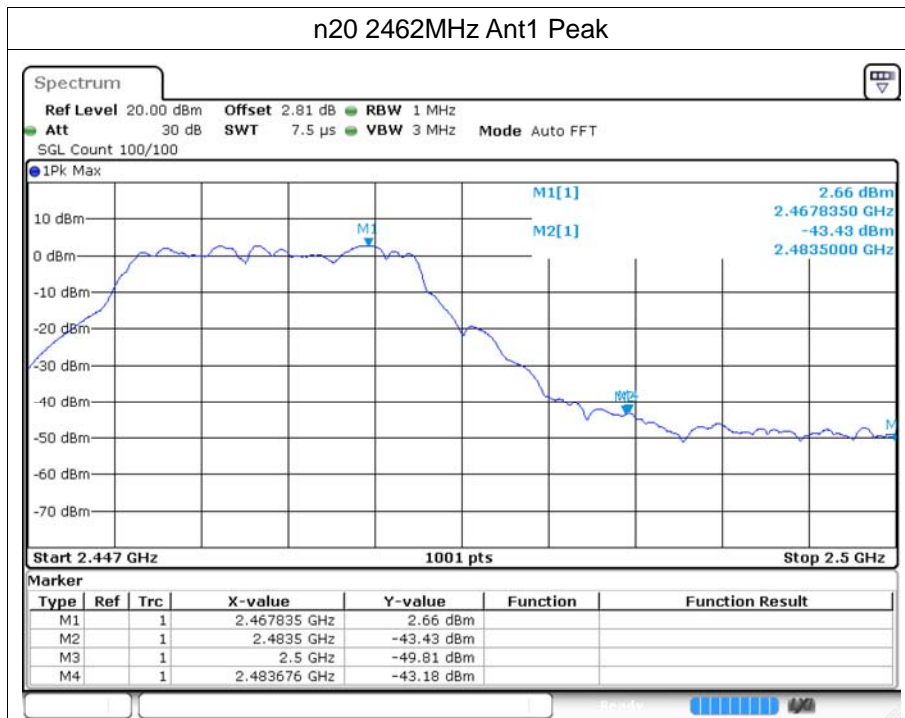


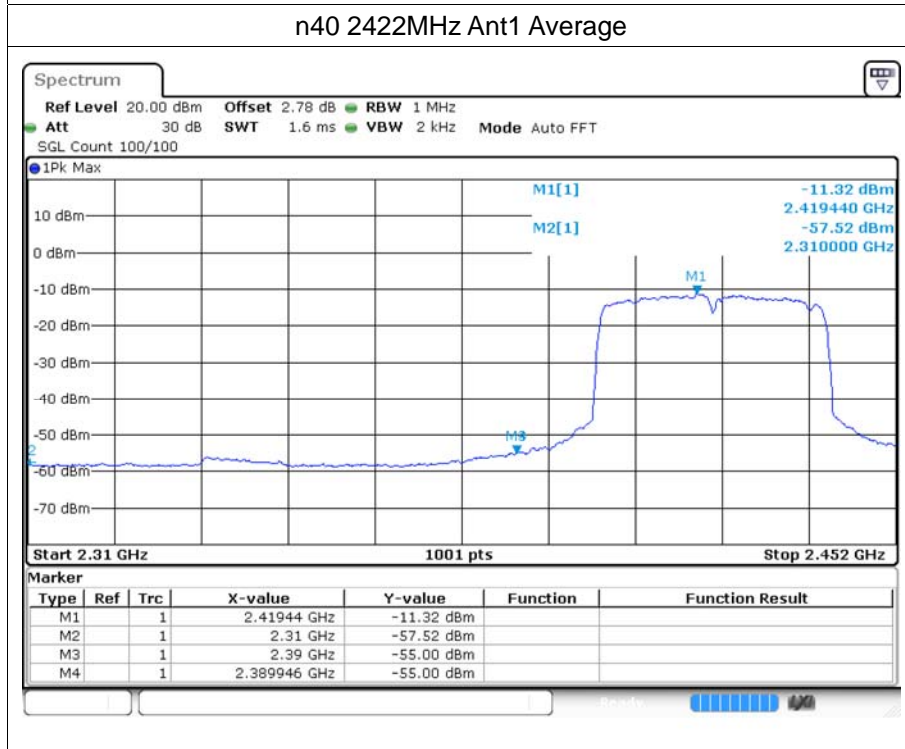
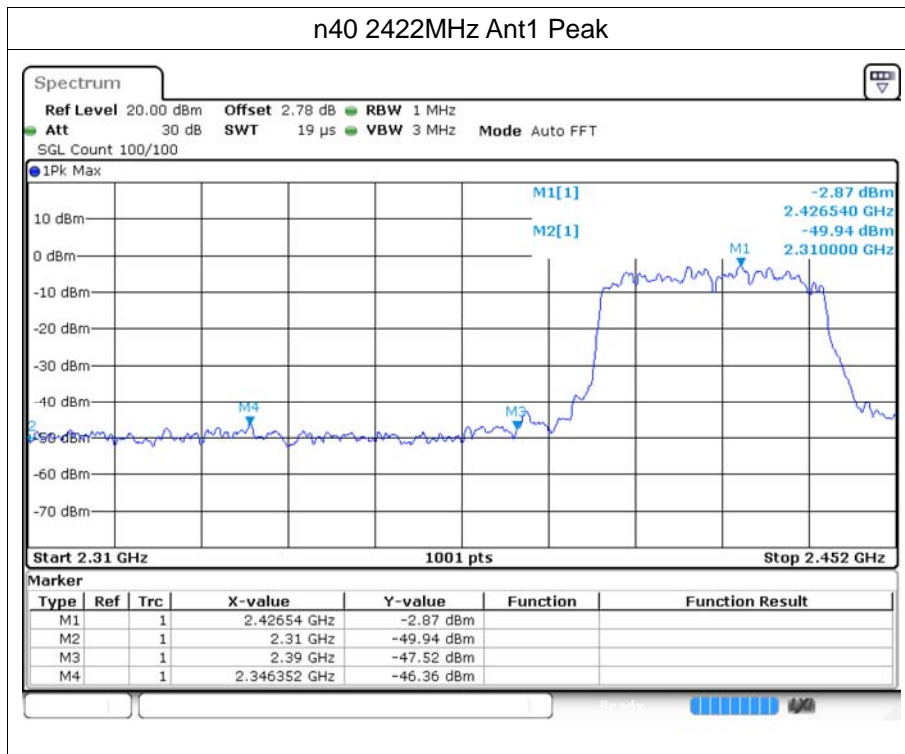


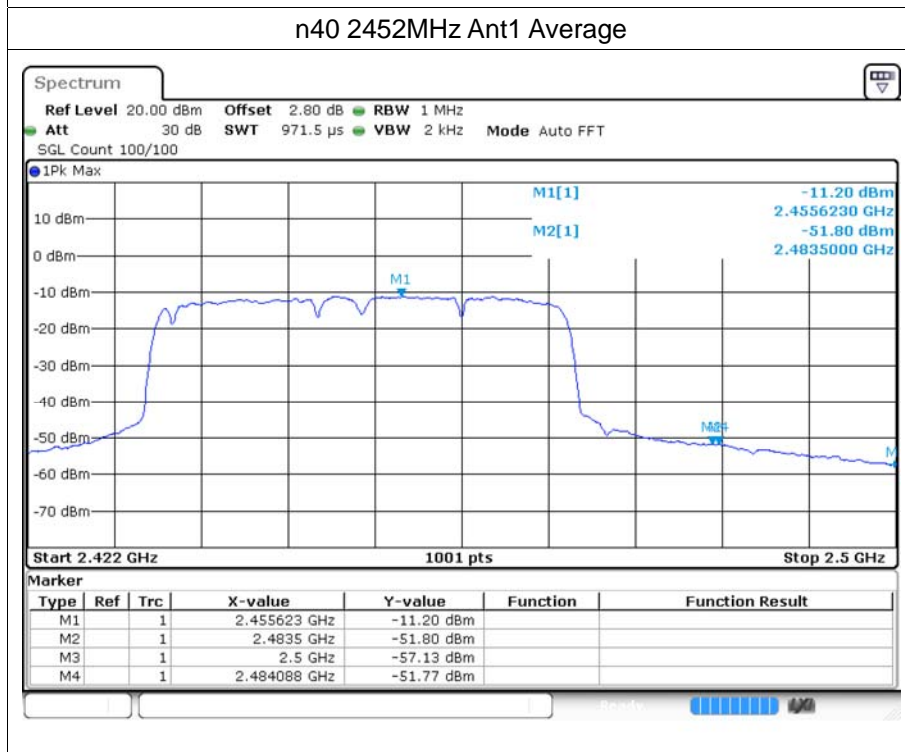
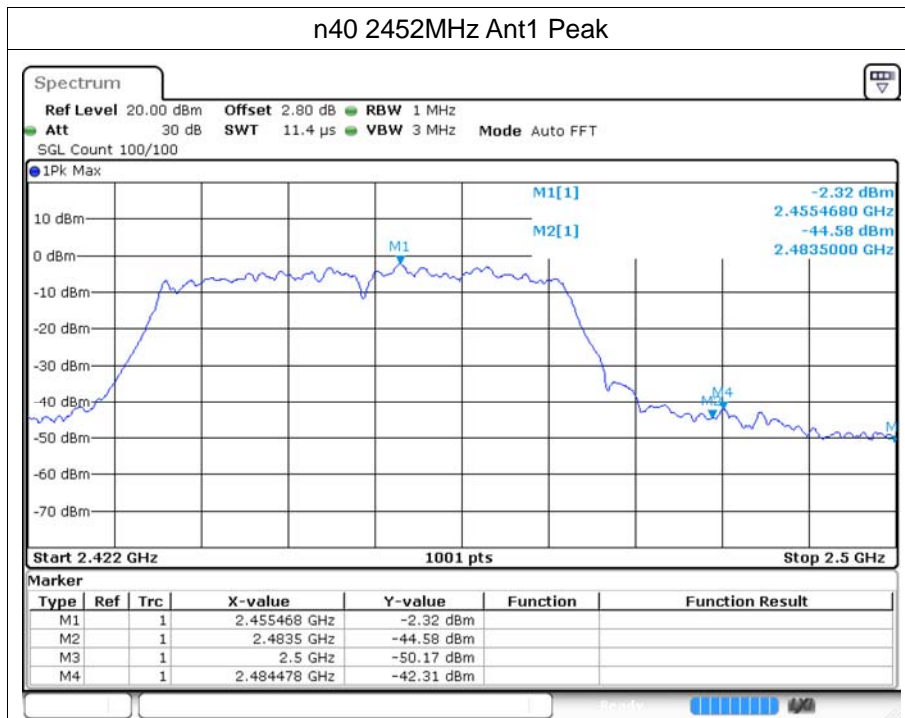












---The End---