

9.6 Conducted Band Edge Emissions

9.6.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

Industry Canada RSS-247 Issue 1 [5.5]

9.6.2 Test Method:

Measurements are performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R03.

Spectrum Analyzer settings:

Band Edge Emissions:

RBW= 100 kHz

VBW $\geq 3 \times$ RBW

Detector= Peak

Averaging type= power (RMS)

Sweep time= Auto

Trace averaging of at least 100 traces

Power computed by integrating the spectrum over 1 MHz using analyzer's band power measurement function.

9.6.3 Limits:

All spurious emissions at least 30 dBc.

9.6.4 Test Result:

Pass.

9.6.5 Test Data:



Plot 9-168. Conducted-Low Band Edge 802.11b Path A (Ch. 1)



Plot 9-169. Conducted-Low Band Edge 802.11g Path A (Ch. 1)



Plot 9-170. Conducted-Low Band Edge 802.11n Path A (Ch. 1)



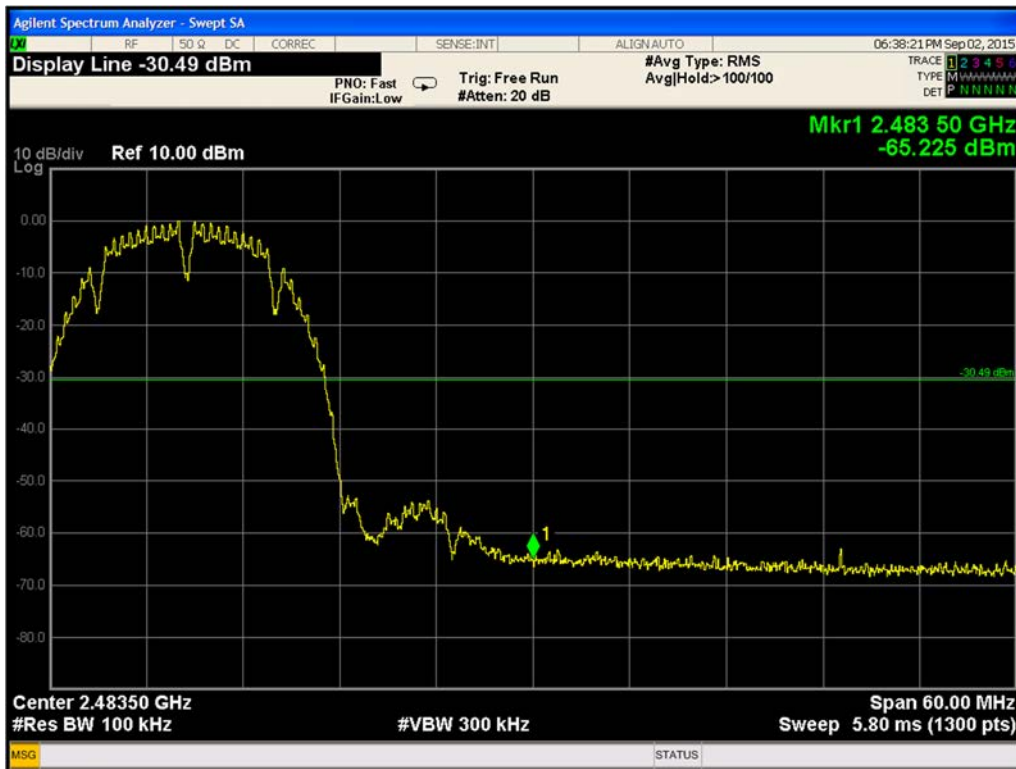
Plot 9-171. Conducted-Low Band Edge 802.11b Path B (Ch. 1)



Plot 9-172. Conducted-Low Band Edge 802.11g Path B (Ch. 1)



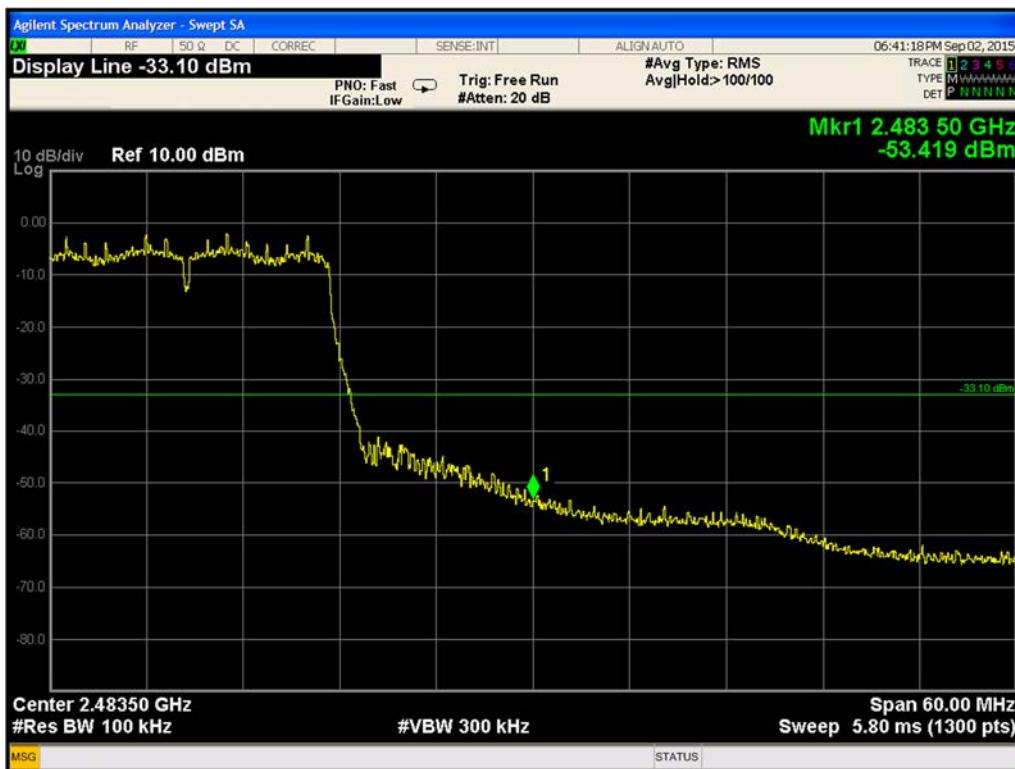
Plot 9-173. Conducted-Low Band Edge 802.11n Path B (Ch. 1)



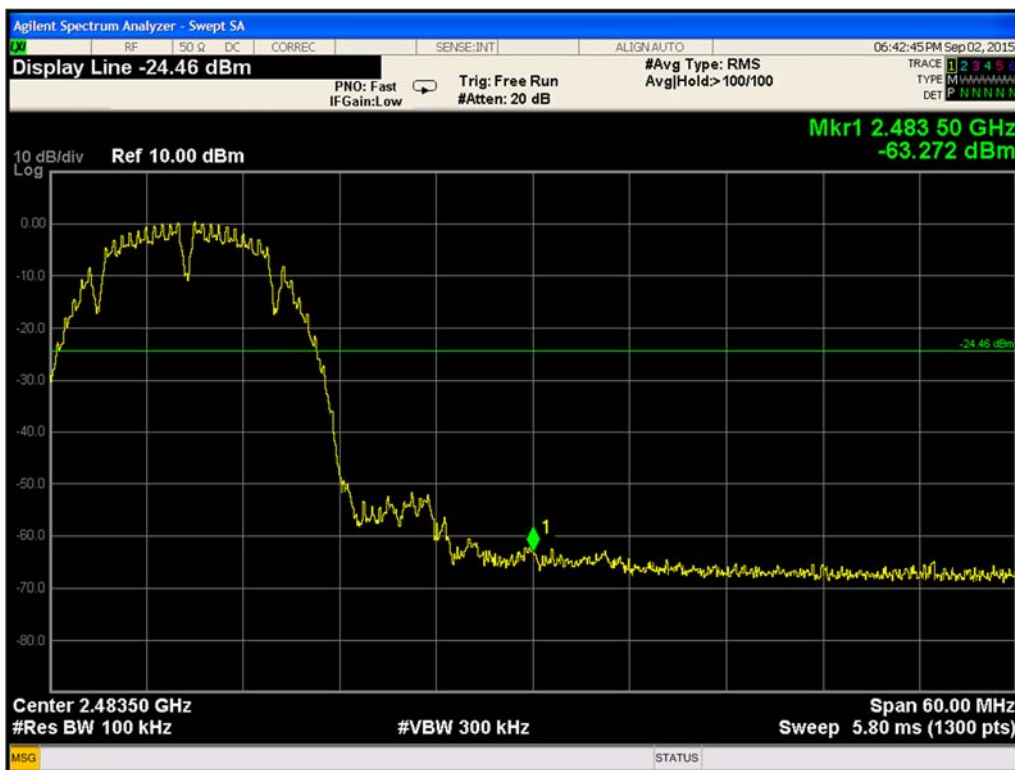
Plot 9-174. Conducted-Upper Band Edge 802.11b Path A (Ch. 11)



Plot 9-175. Conducted-Upper Band Edge 802.11g Path A (Ch. 11)



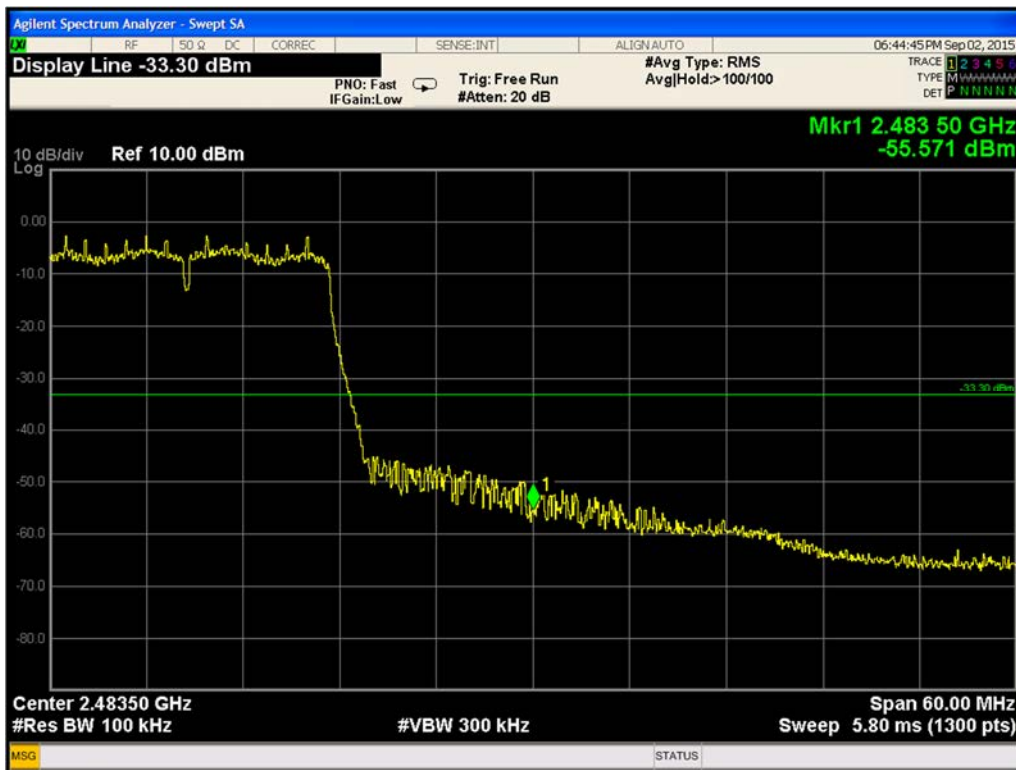
Plot 9-176. Conducted-Upper Band Edge 802.11n Path A (Ch. 11)



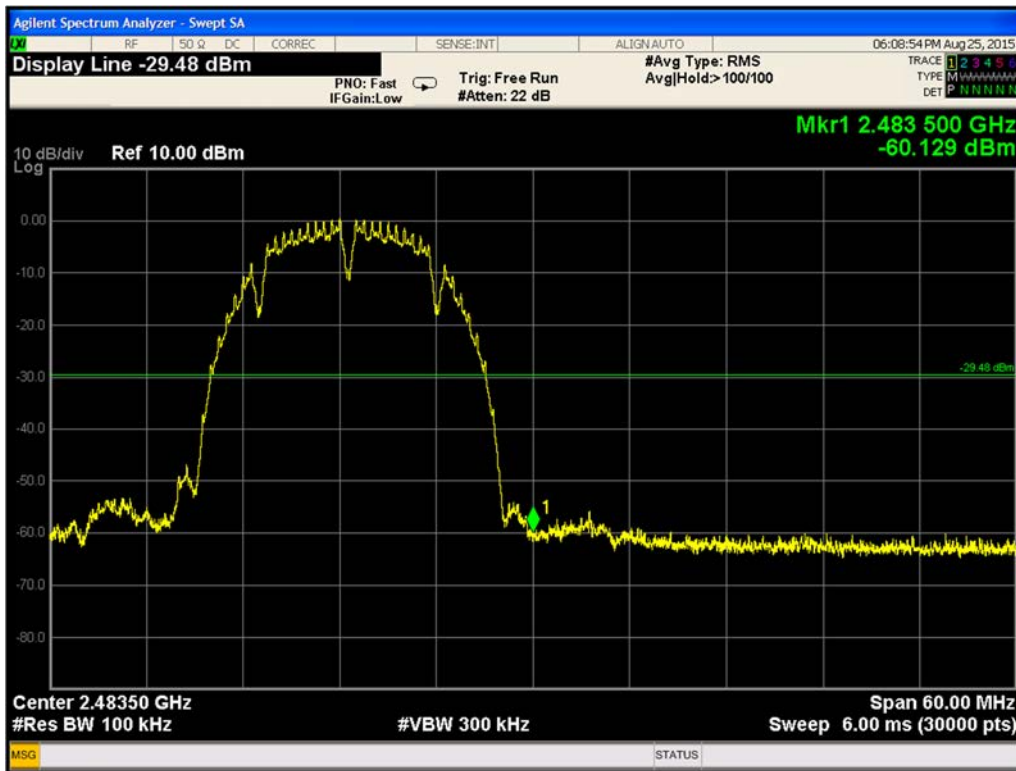
Plot 9-177. Conducted-Upper Band Edge 802.11b Path B (Ch. 11)



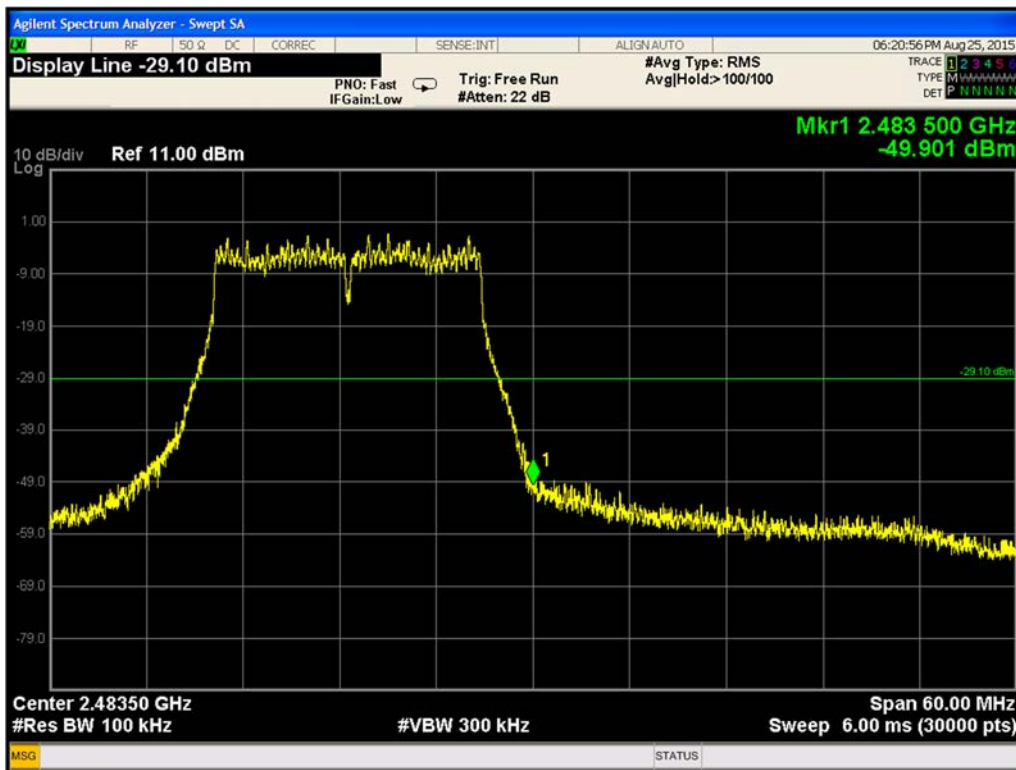
Plot 9-178. Conducted-Upper Band Edge 802.11g Path B (Ch. 11)



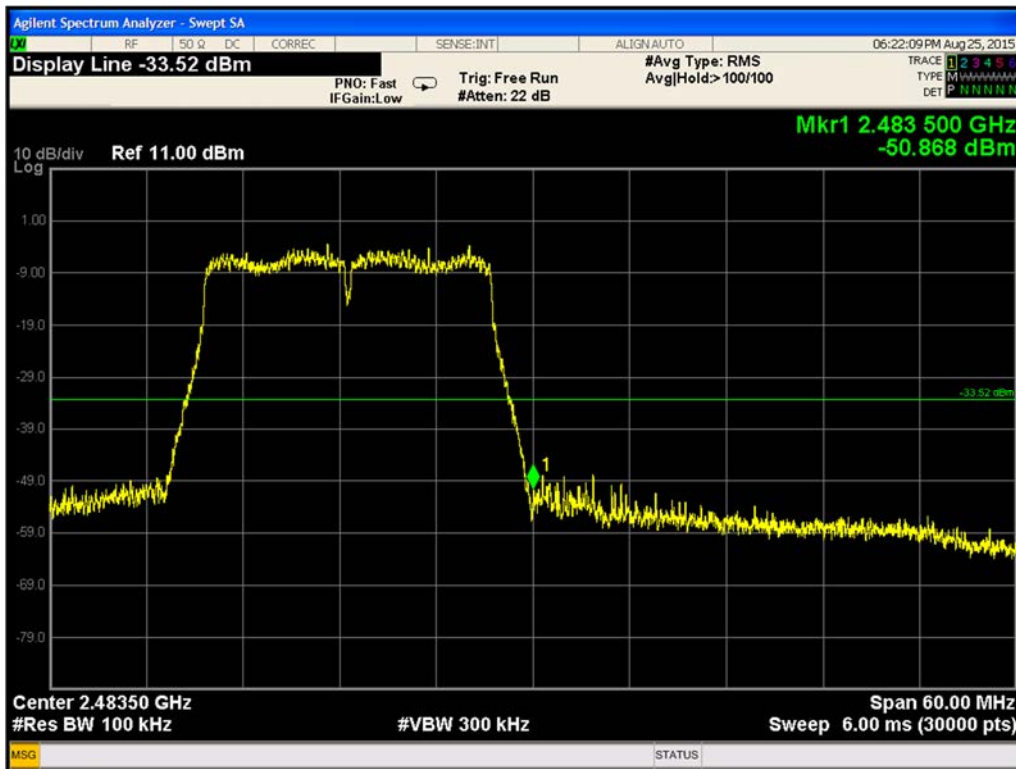
Plot 9-179. Conducted-Upper Band Edge 802.11n Path B (Ch. 11)



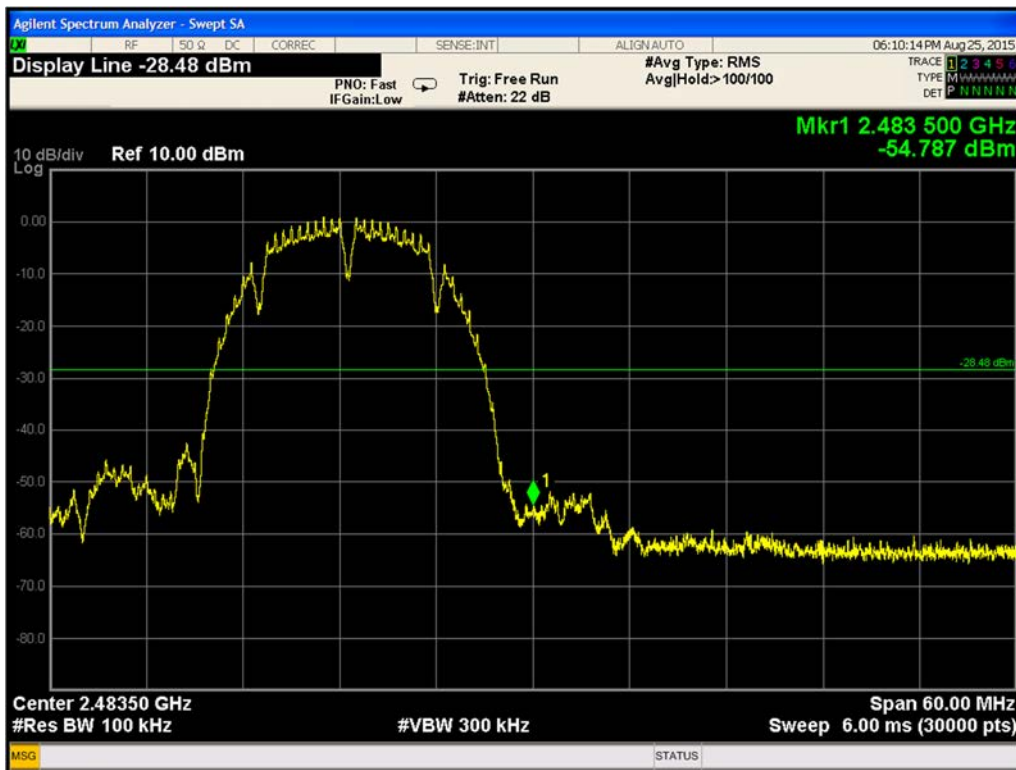
Plot 9-200. Conducted-Upper Band Edge 802.11b Path A (Ch. 13)



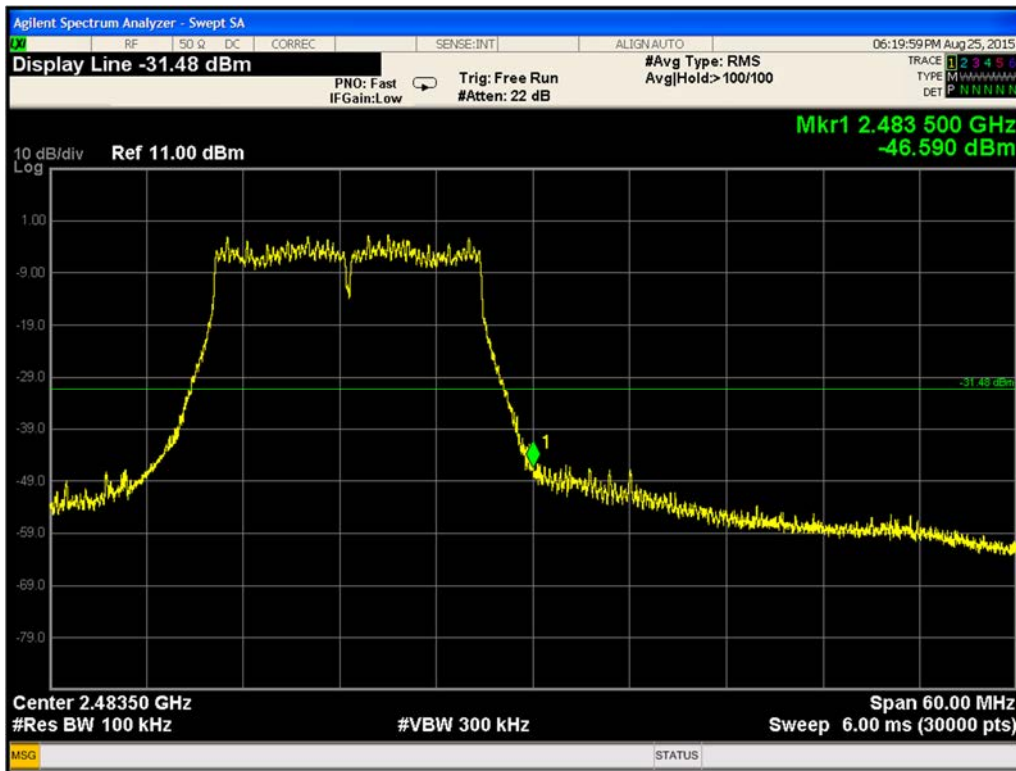
Plot 9-201. Conducted-Upper Band Edge 802.11g Path A (Ch. 13)



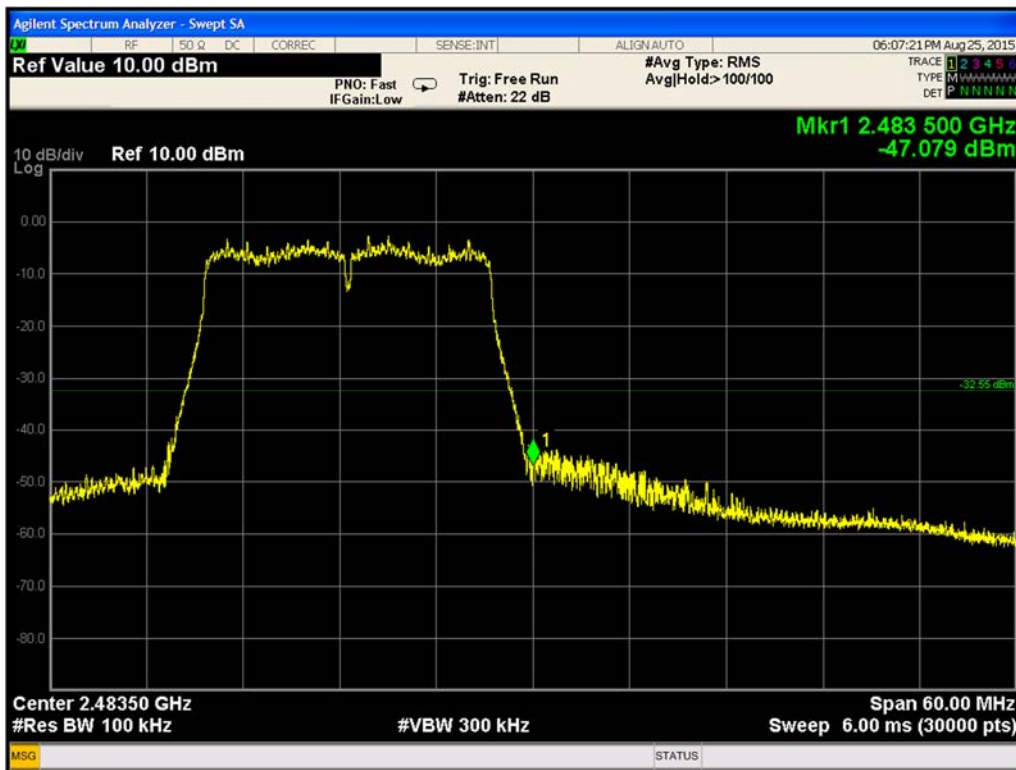
Plot 9-202. Conducted-Upper Band Edge 802.11n Path A (Ch. 13)



Plot 9-203. Conducted-Upper Band Edge 802.11b Path B (Ch. 13)



Plot 9-204. Conducted-Upper Band Edge 802.11g Path B (Ch. 13)



Plot 9-205. Conducted-Upper Band Edge 802.11n Path B (Ch. 13)

9.7 Radiated Spurious and Band Edge Emissions

9.7.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

Industry Canada RSS-247 [5.5] and RSS GEN [8.9]

9.7.2 Test Method:

Measurements are performed according to the procedure defined in KDB 558074- Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247 V03R03 and ANSI C63.10 2013.

Radiated spurious measurements are made from 30MHz to the 10th harmonic of the fundamental frequency of the transmitter. The limit for radiated spurious emissions is per 15.209 and RSS-247 [5.5]. Additionally, emissions found in the restricted bands as listed in 15.205 were tested for compliance per limits in 15.209 and RSS-Gen.

The EUT was tested near the low, middle and high channels of operation in each sub band. Guidelines in ANSI C63.10 2013 were followed with respect to maximizing the emissions. Emissions below 1 GHz were maximized by continuously scanning the unit in three orthogonal orientations. Measurements above 1 GHz were maximized by rotating the EUT about its vertical and horizontal axis. The horizontal axis was varied in 30 degree increments up to 150 degrees in accordance with ANSI C 63.10 2013. Both Horizontal and vertical polarizations were investigated. Worst case maximized data is shown in this test report. The EUT's maximum emissions for measurements below 1GHz were observed to be with the unit placed flat on the table.

A pre-amp and a high pass filter were required for this test, in order to provide the measuring system with sufficient sensitivity. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength.

Radiated Spurious Emissions

Spectrum Analyzer Settings:

30 MHz- 1 GHz:

RBW= 120 kHz

VBW \geq 3 X RBW

Trace Mode: Peak Detector (Max Hold). Final measurements performed using QP Detector.

Span= 30 MHz- 1 GHz

Sweep time= Auto

Above 1 GHz:

RBW= 1 MHz

VBW= 3 MHz

Trace Mode: Peak Detector (Max Hold) and RMS Average Detector (Max Hold)

Span= 1- 18 GHz and 18- 26.5 GHz.

Sweep time= Auto

Restricted Band-Edge Emissions

Spectrum Analyzer Settings:

RBW= 1 MHz

VBW= 3 MHz

Trace Mode: Peak Detector (Max Hold) and RMS Average Detector (Max Hold)

Span= 2310 – 2500 MHz

Sweep Points = 801

Sweep Time = Peak: Auto; Average: 100 s

Sample Calculation:

Field Strength Level: Amplitude (Analyzer level) + AFCL (Antenna Factor and Cable losses) – Amplifier Gain = 50 dBuV + 33 dB – 25 dB = 78dBuV/m

9.7.3 Limits:

Frequency (MHz)	Field Strength (µV/m)	Measurement Distance (meters)	Corrected Field Strength for 3m measurement distance (dBµV/m)
0.009-0.490	2400/F (kHz)	300	48.5- 13.8
0.490-1.705	24000/F (kHz)	30	33.8- 23.0
1.705-30	30	30	29.5
30-88	100	3	40
88-216	150	3	43.5
216-960	200	3	46
960-1000	500	3	54
Above 1000	500	3	54 (Average) 74 (Peak)

9.7.4 Test Result:

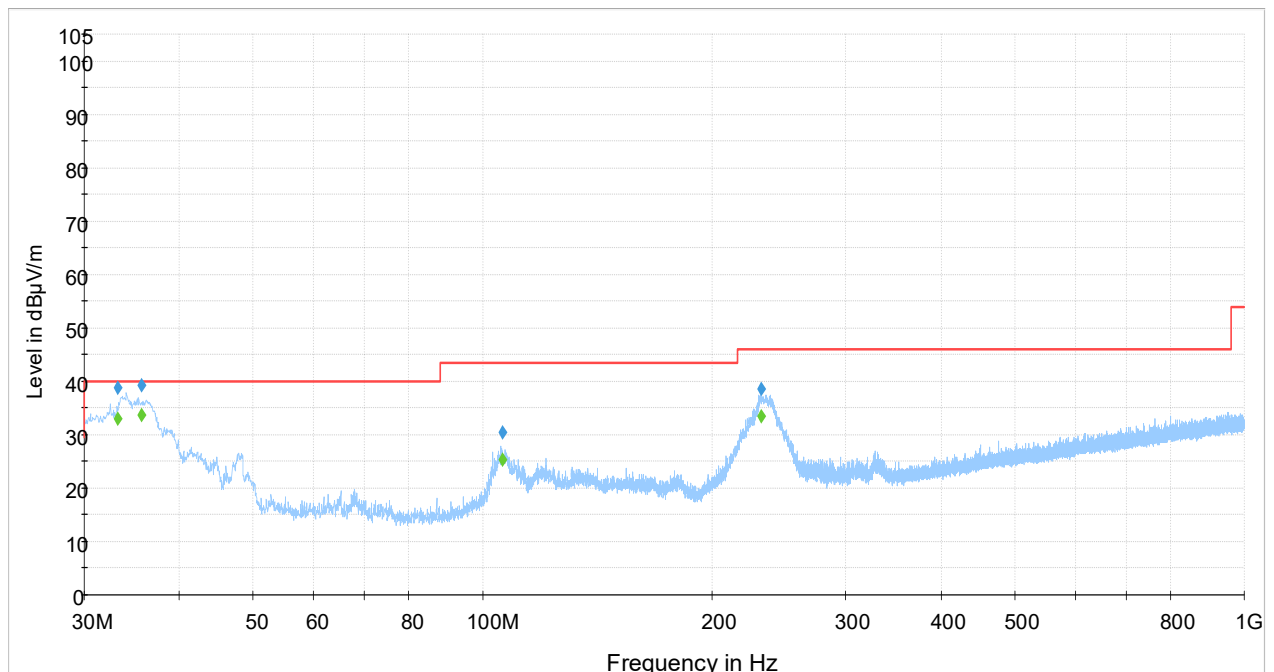
Pass.

9.7.5 Test Data:

9.7.5.1 Emissions in 30 MHz- 1 GHz range

Worst case emissions in mid channel of operation shown here.

RSE 30MHz – 1GHz Quasi Peak Data					
Frequency (MHz)	Raw Quasi Peak Field Strength (dB μ V/m)	Correction Factor (dB)	Corrected Quasi Peak Field Strength (dB μ V/m)	QP Limit (dB μ V/m)	Margin (dB)
33.2	14.6	19.2	33.8	40	-6.92
35.64	16.13	17.6	33.73	40	-6.27
106.21	12.83	12.4	25.23	43.52	-18.29
232.35	21.11	12.4	33.51	46.02	-12.51

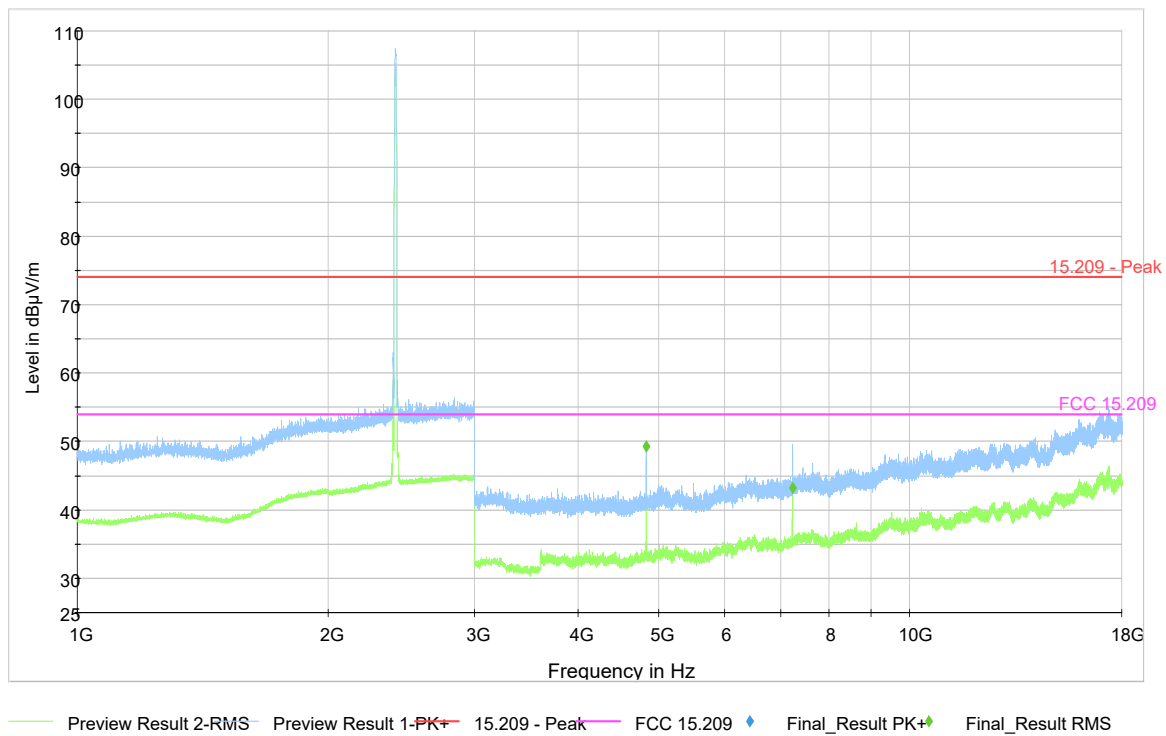


Preview Result 1-PK FCC 15.209 Final_Result PK Final_Result QPK

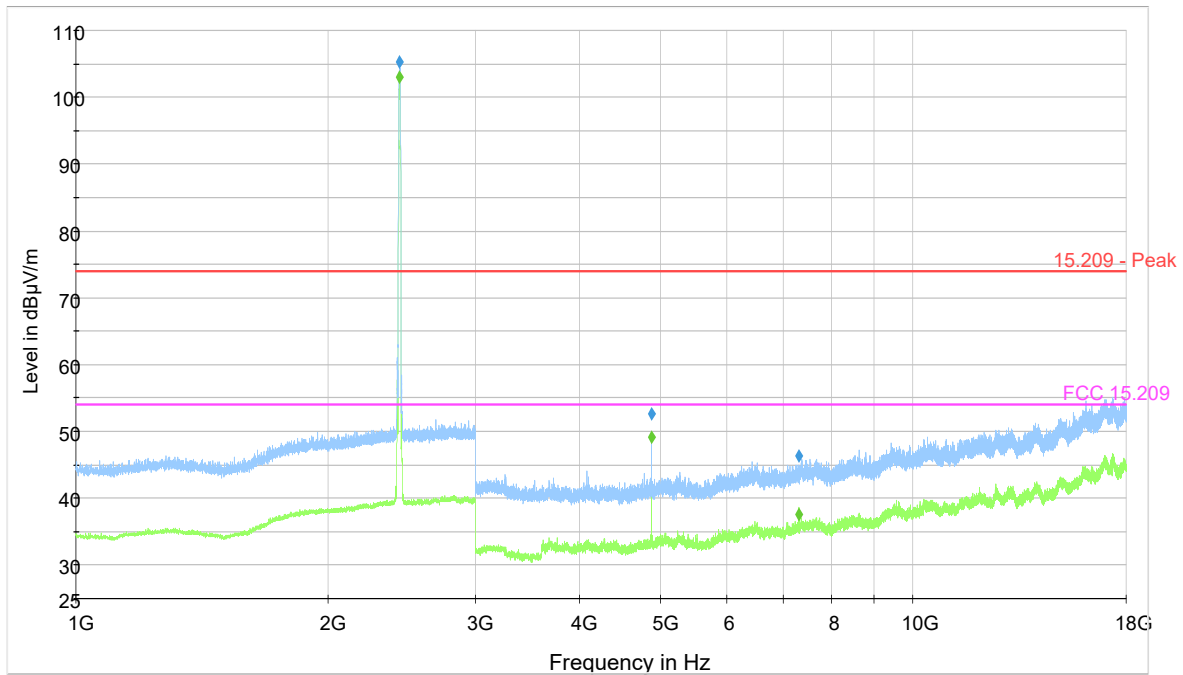
Plot 9-206. Radiated Spurious Emissions (Ch. 12) Chain A and B (30MHz - 1GHz)

9.7.5.2 Emissions in 1-18 GHz range

802.11b RSE 1 - 18GHz Average Data						
Carrier Frequency (MHz)	Frequency (MHz)	Raw Avg. Amplitude (dBμV)	Correction Factor (dB)	Corrected Avg. Field Strength (dBμV/m)	Average Limit (dBμV/m)	Margin (dB)
2412	4824	41.21	8	49.21	54	-4.79
2412	7236.9	31.95	11.2	43.15	54	-10.87
2437	4874	41.26	7.9	49.16	54	-4.83
2437	7312	26.01	11.5	37.51	54	-16.48
2462	4924	45.80	7.8	53.6	54	-0.40
2462	7384.9	30.62	11.7	42.32	54	-11.68
802.11b RSE 1 - 18GHz Peak Data						
Carrier Frequency (MHz)	Frequency (MHz)	Raw Peak Amplitude (dBμV)	Correction Factor (dB)	Corrected Peak Field Strength (dBμV/m)	Peak Limit (dBμV/m)	Margin (dB)
2412	4824	40.86	8	48.86	74	-25.14
2412	7385	35.55	11.7	47.25	74	-26.75
2437	4874	44.65	7.9	52.55	74	-21.45
2437	7314	34.86	11.5	46.36	74	-27.64
2462	4927	43.30	7.8	51.1	74	-22.90
2462	7385.3	35.55	11.7	47.25	74	-26.75

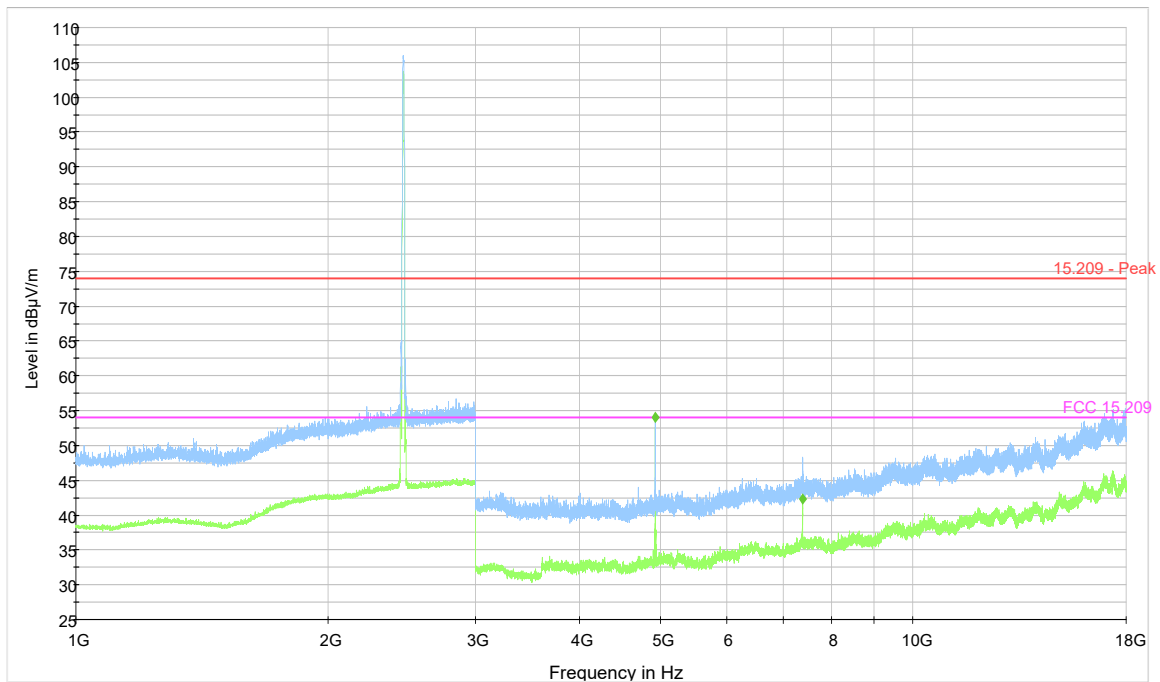


Plot 9-207. Radiated Spurious Emissions 802.11b (Ch. 1) Chain A and B (1-18GHz)



Preview Result 2-RMS Preview Result 1-PK+ 15.209 - Peak FCC 15.209 Final_Result PK+ Final_Result RMS

Plot 9-208. Radiated Spurious Emissions 802.11b (Ch. 6) Chain A and B (1-18GHz)

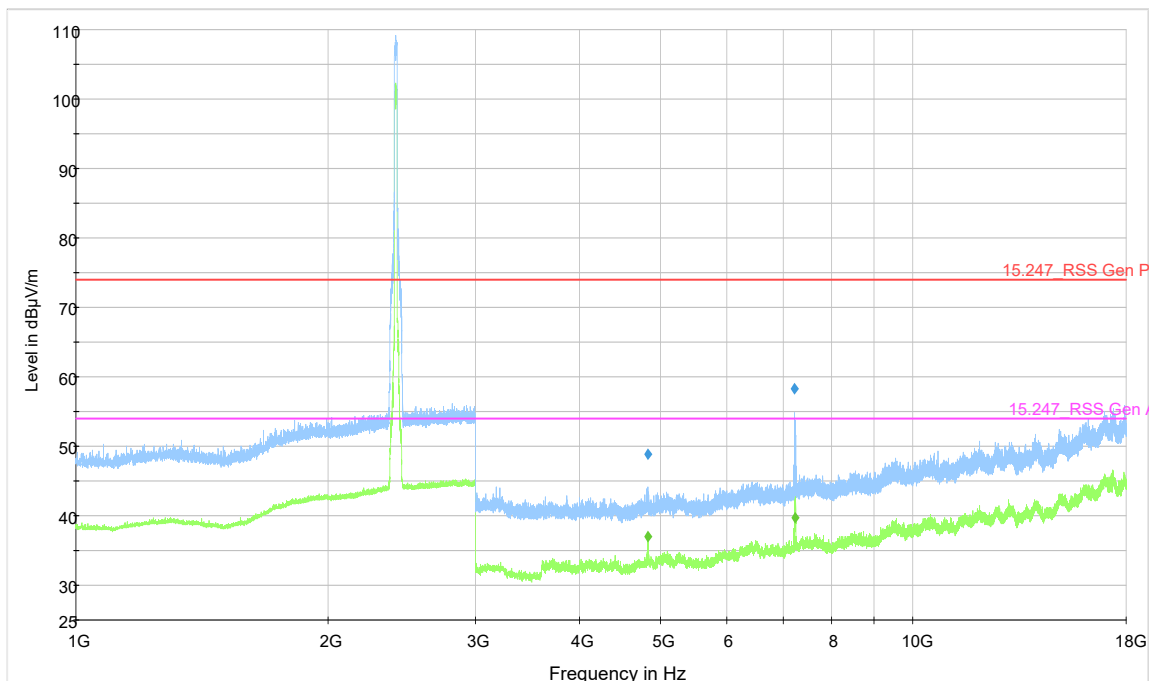


Preview Result 2-RMS Preview Result 1-PK+ 15.209 - Peak FCC 15.209 Final_Result PK+ Final_Result RMS

Plot 9-209. Radiated Spurious Emissions 802.11b (Ch. 11) Chain A and B (1-18GHz)

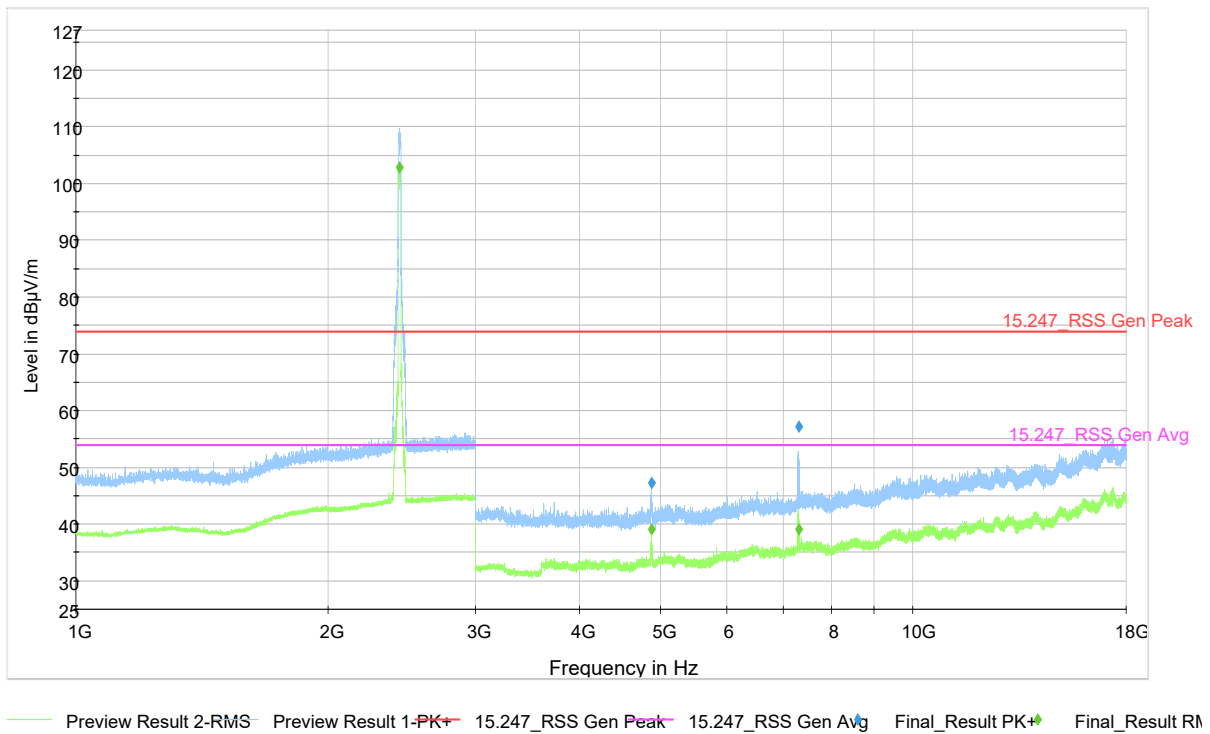
802.11g RSE 1 - 18GHz Average Data						
Carrier Frequency (MHz)	Frequency (MHz)	Raw Avg. Amplitude (dBµV)	Correction Factor (dB)	Corrected Avg. Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
2412	4824.0	29.03	8	37.03	54	-16.97
2412	7231.0	28.5	11.2	39.70	54	-14.3
2437	4874.0	31.09	7.9	38.99	54	-15.01
2437	7307.2	27.56	11.5	39.06	54	-14.94
2462	4944.0	44.29	7.9	52.19	54	-1.81

802.11g RSE 1 - 18GHz Peak Data						
Carrier Frequency (MHz)	Frequency (MHz)	Raw Peak Amplitude (dBµV)	Correction Factor (dB)	Corrected Peak Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
2412	4823.8	40.86	8	48.86	74	-25.14
2412	7231.0	46.25	12	58.25	74	-15.75
2437	4871.8	39.31	7.9	47.21	74	-26.79
2437	7312.0	45.68	11.5	57.18	74	-16.82
2462	4944.0	46.57	7.9	54.47	74	-19.53

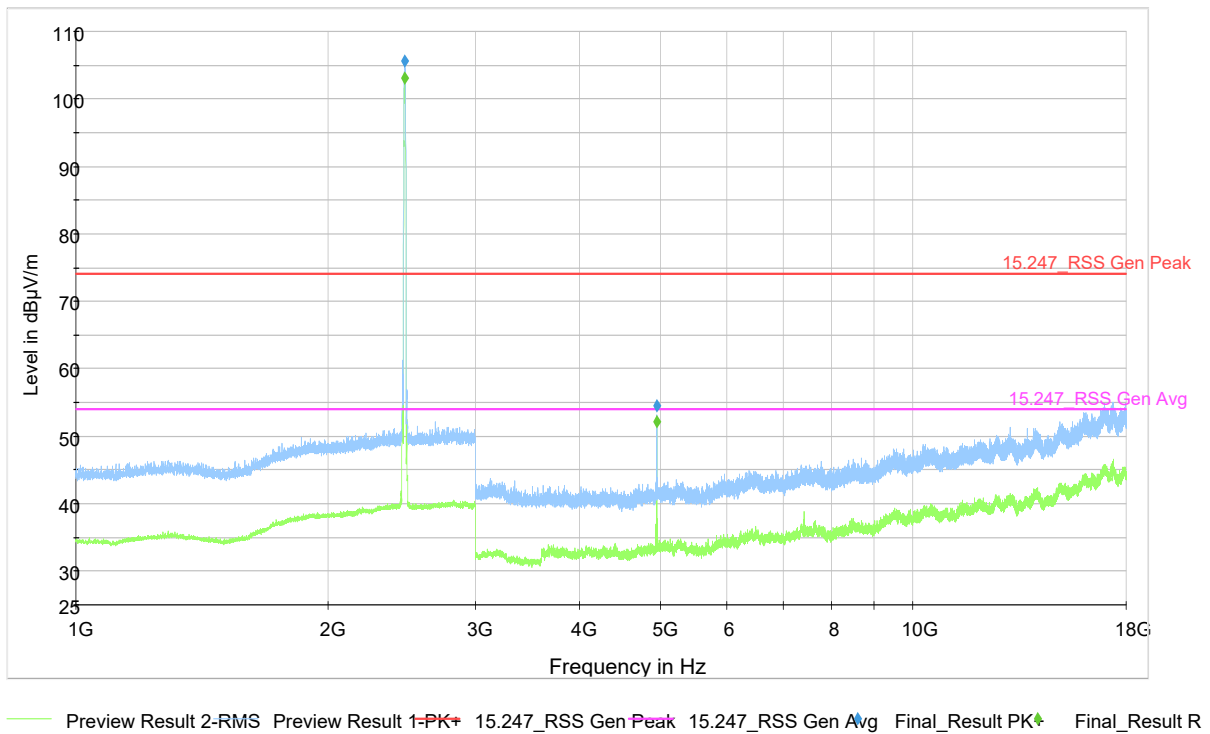


— Preview Result 2-RMS
 — Preview Result 1-PK+
 — 15.247_RSS Gen Peak
 — 15.247_RSS Gen Avg
 ◆ Final_Result PK+
 ◆ Final_Result RM

Plot 9-210. Radiated Spurious Emissions 802.11g (Ch. 1) Chain A and B (1-18GHz)



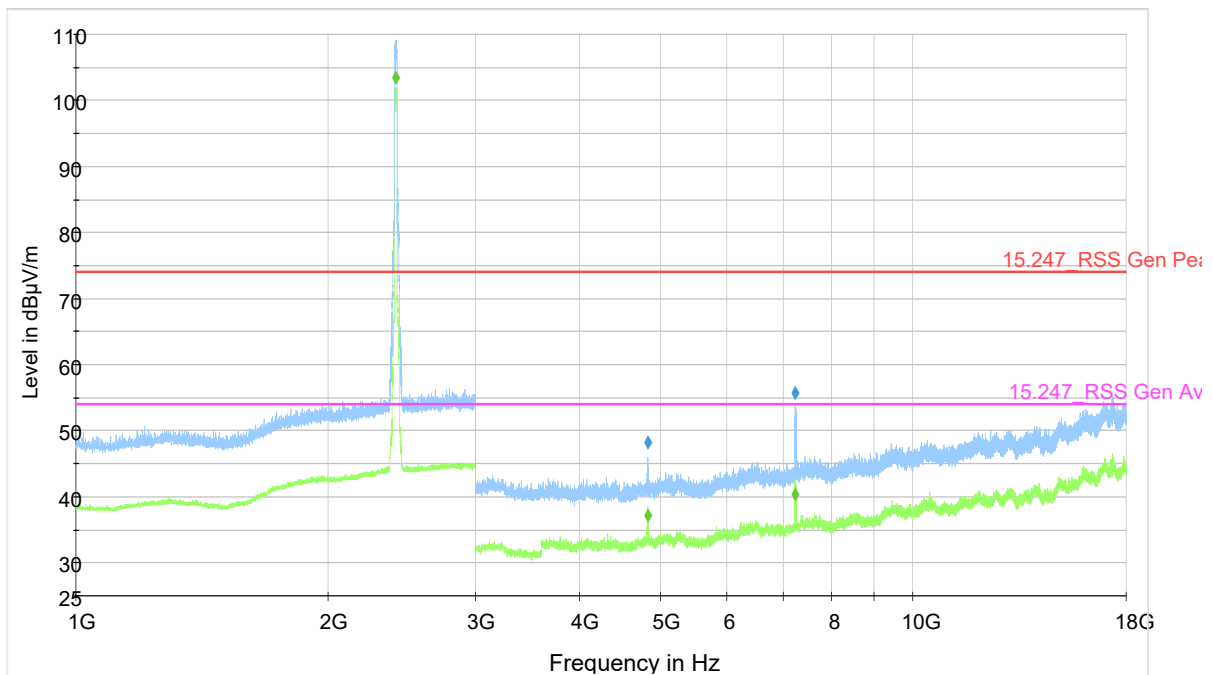
Plot 9-211. Radiated Spurious Emissions 802.11g (Ch. 6) Chain A and B (1-18GHz)



Plot 9-212. Radiated Spurious Emissions 802.11g (Ch. 11) Chain A and B (1-18GHz)

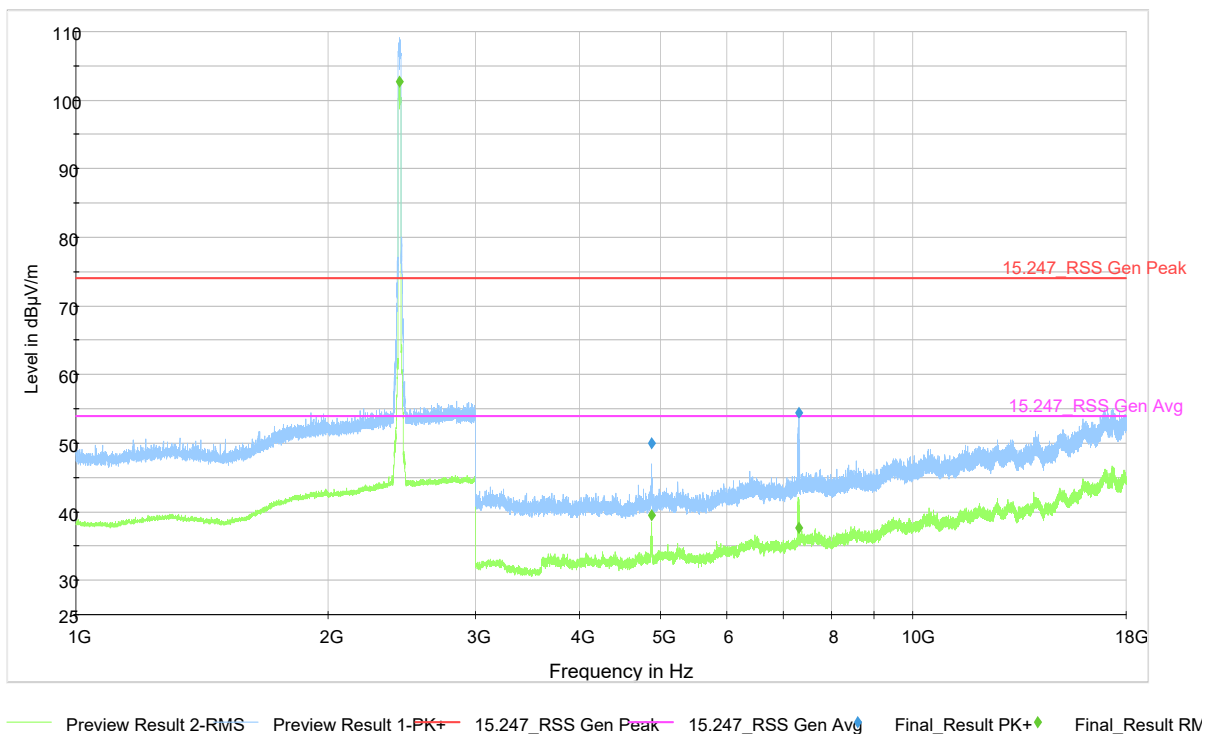
802.11n RSE 1 - 18GHz Average Data						
Carrier Frequency (MHz)	Frequency (MHz)	Raw Avg. Amplitude (dBµV)	Correction Factor (dB)	Corrected Avg. Field Strength (dBµV/m)	Average Limit (dBµV/m)	Margin (dB)
2412	4827.0	29.26	8	37.26	54	-16.74
2412	7235.9	29.17	11.2	40.37	54	-13.63
2437	4873.9	31.58	7.9	39.48	54	-14.52
2437	7309.8	26.1	11.5	37.6	54	-16.4
2462	4927.0	31.17	7.8	38.97	54	-15.03
2462	7382.5	26.31	11.7	38.01	54	-15.99

802.11n RSE 1 - 18GHz Peak Data						
Carrier Frequency (MHz)	Frequency (MHz)	Raw Peak Amplitude (dBµV)	Correction Factor (dB)	Corrected Peak Field Strength (dBµV/m)	Peak Limit (dBµV/m)	Margin (dB)
2412	4827.7	40.27	7.9	48.17	74	-25.83
2412	7241.5	44.56	11.2	55.76	74	-18.24
2437	4872.2	42.14	7.9	50.04	74	-23.96
2437	7310.1	42.89	11.5	54.39	74	-19.61
2462	4926.6	43.3	7.8	51.10	74	-22.9
2462	7381.3	40.82	11.7	52.52	74	-21.48

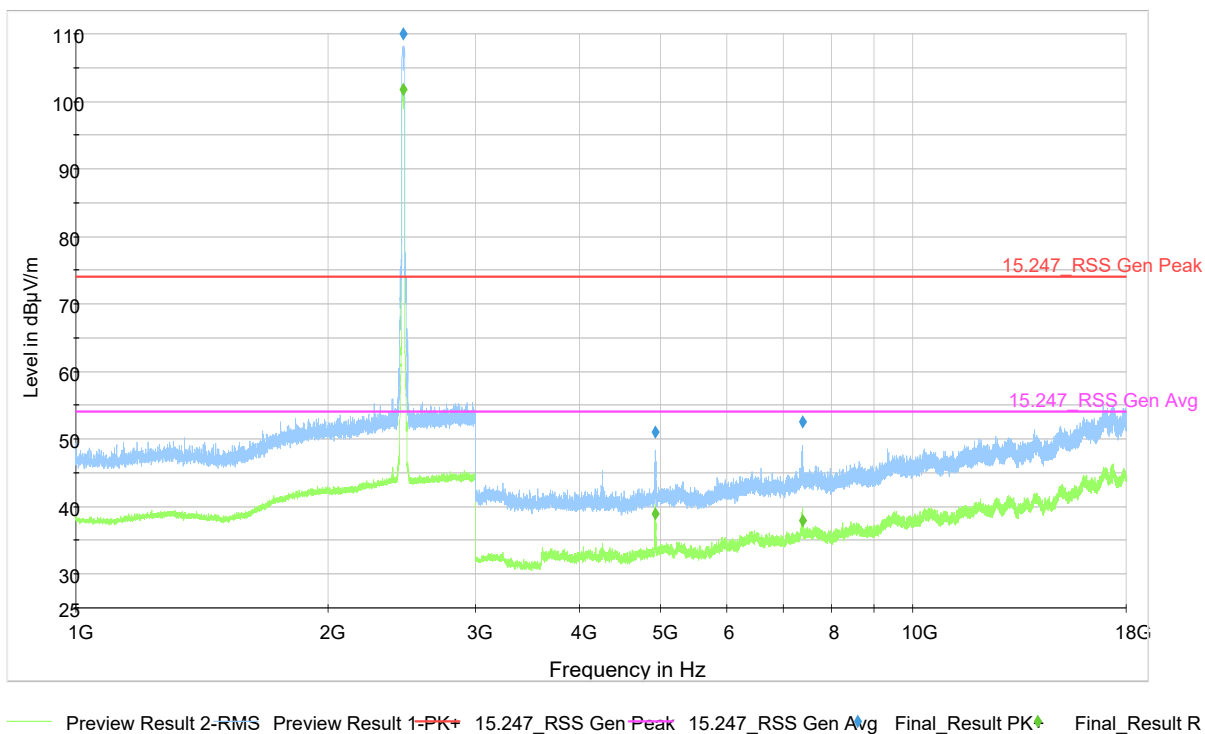


Preview Result 2-RMSPreview Result 1-PK+15.247_RSS GenPeak15.247_RSS GenAvgFinal_Result PK+ Final_Result

Plot 9-213. Radiated Spurious Emissions 802.11n (Ch. 1) Chain A and B (1-18GHz)



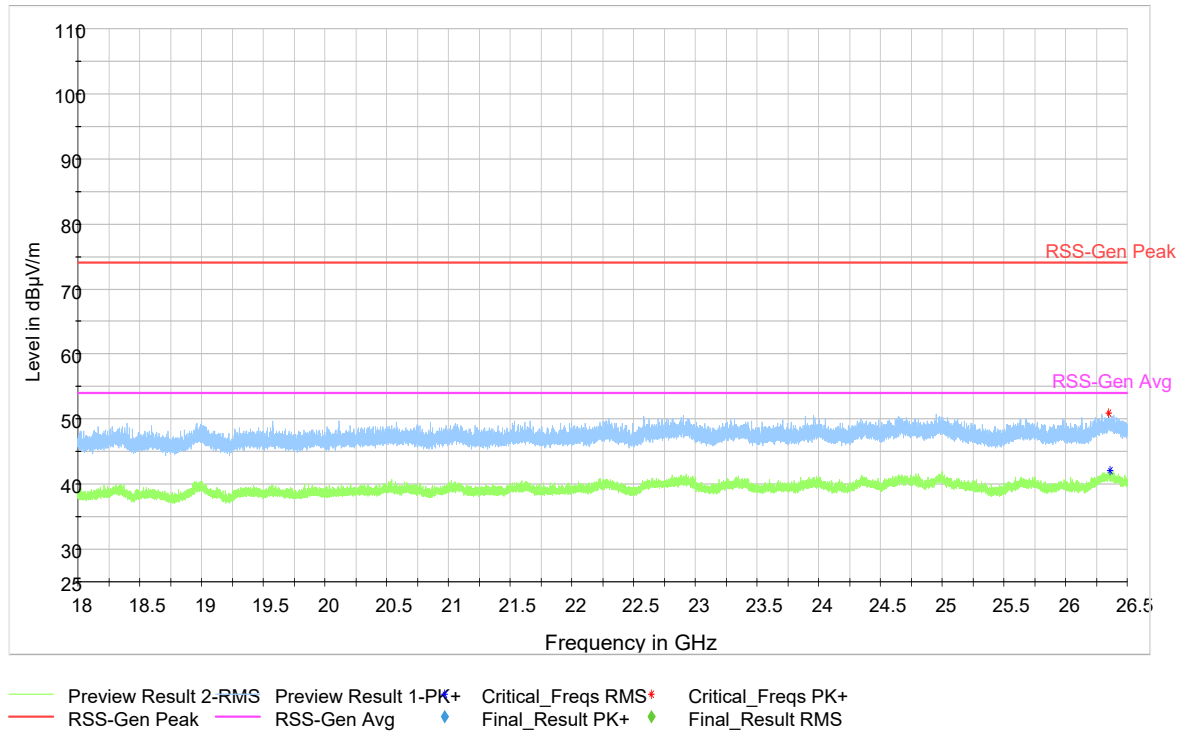
Plot 9-214. Radiated Spurious Emissions 802.11n (Ch. 6) Chain A and B (1-18GHz)



Plot 9-215. Radiated Spurious Emissions 802.11n (Ch. 11) Chain A and B (1-18GHz)

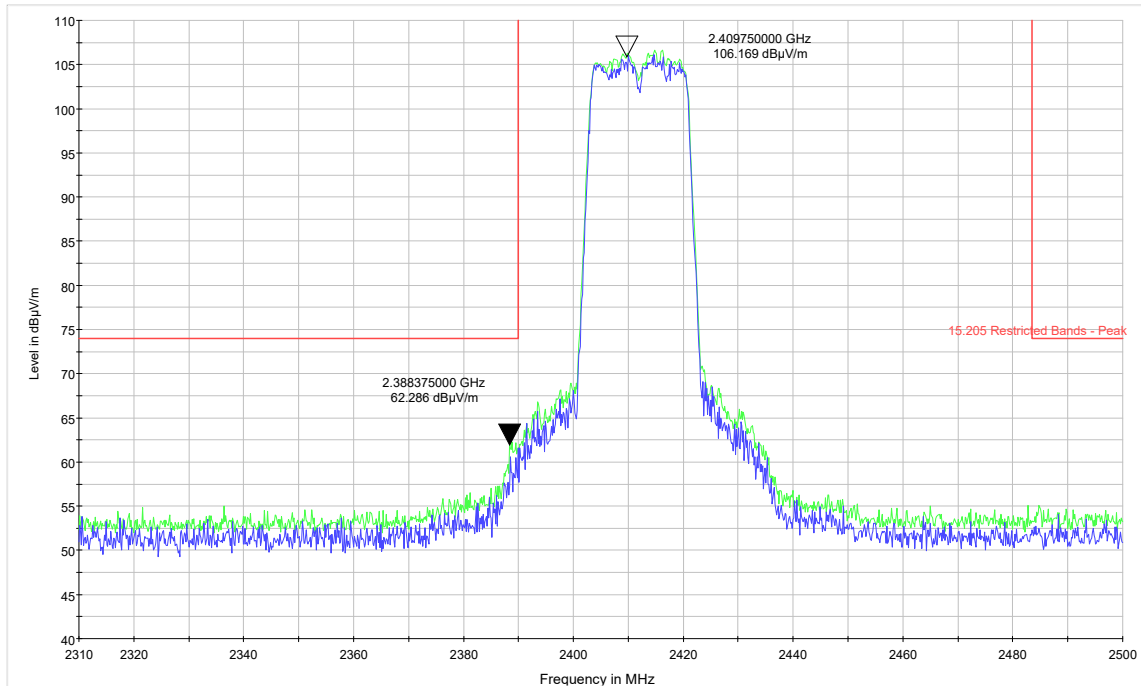
9.7.5.3 Emissions in 18-26.5 GHz range

No significant emissions to report above noise floor.



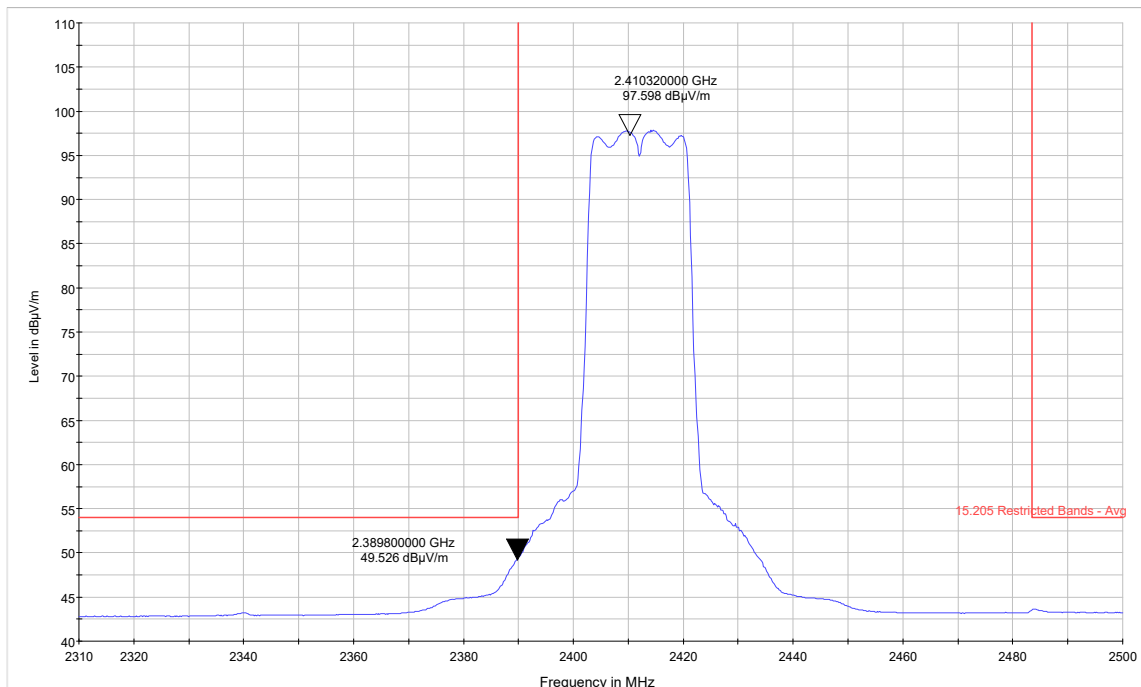
Plot 9-216. Radiated Spurious Emissions (Ch. 11) Chain A and B (18 – 26.5 GHz)

9.7.5.4 Radiated restricted Band-edge emissions



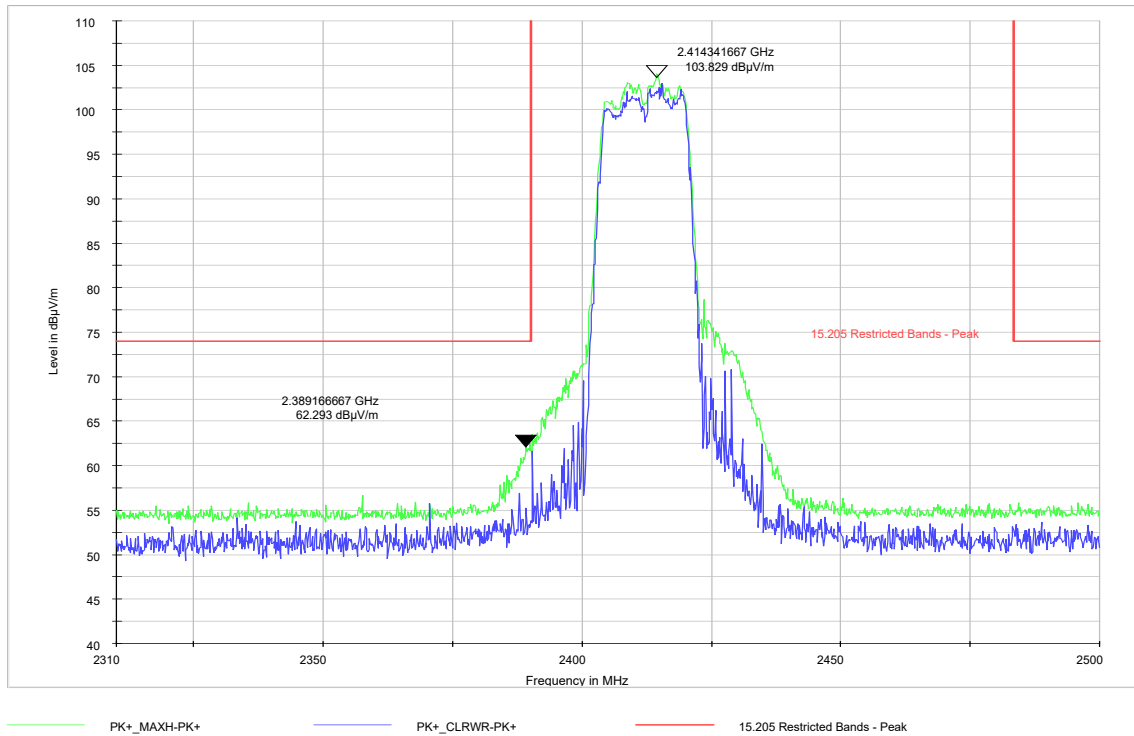
PK+_MAXH-PK+ PK+_CLRWR-PK+ 15.205 Restricted Bands - Peak

Plot 9-217. Radiated Restricted Band Edge 802.11b (Ch. 1) Chain A and B Peak

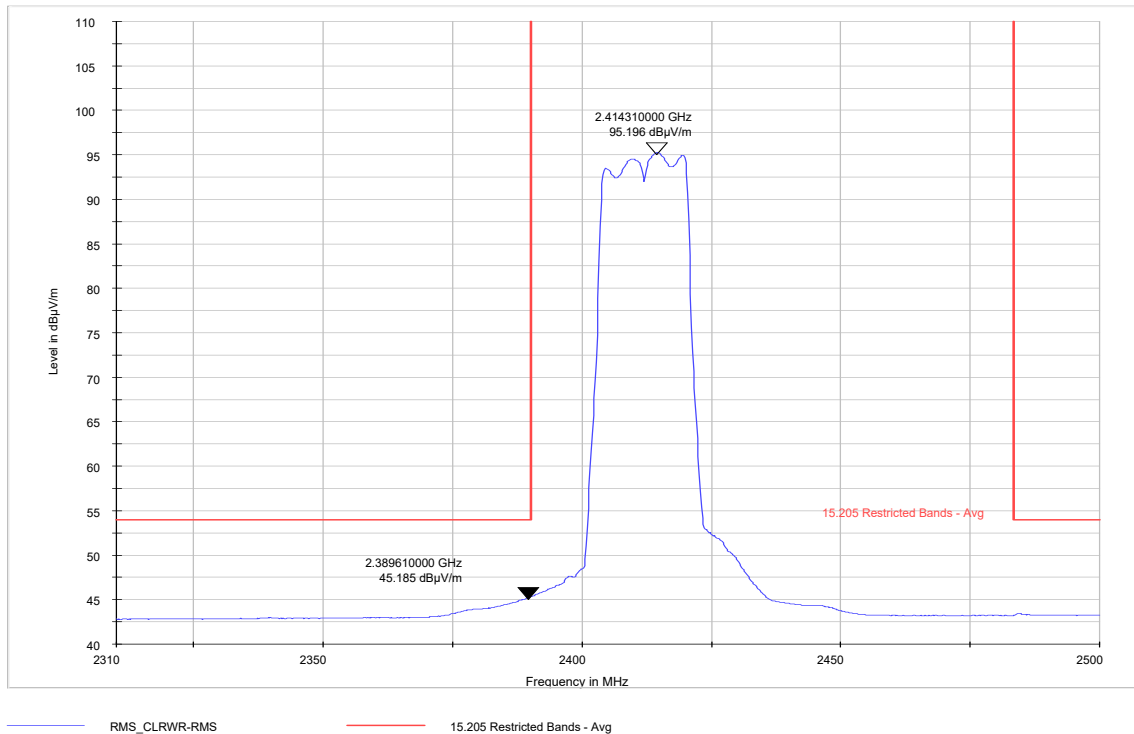


RMS_CLRWR-RMS 15.205 Restricted Bands - Avg

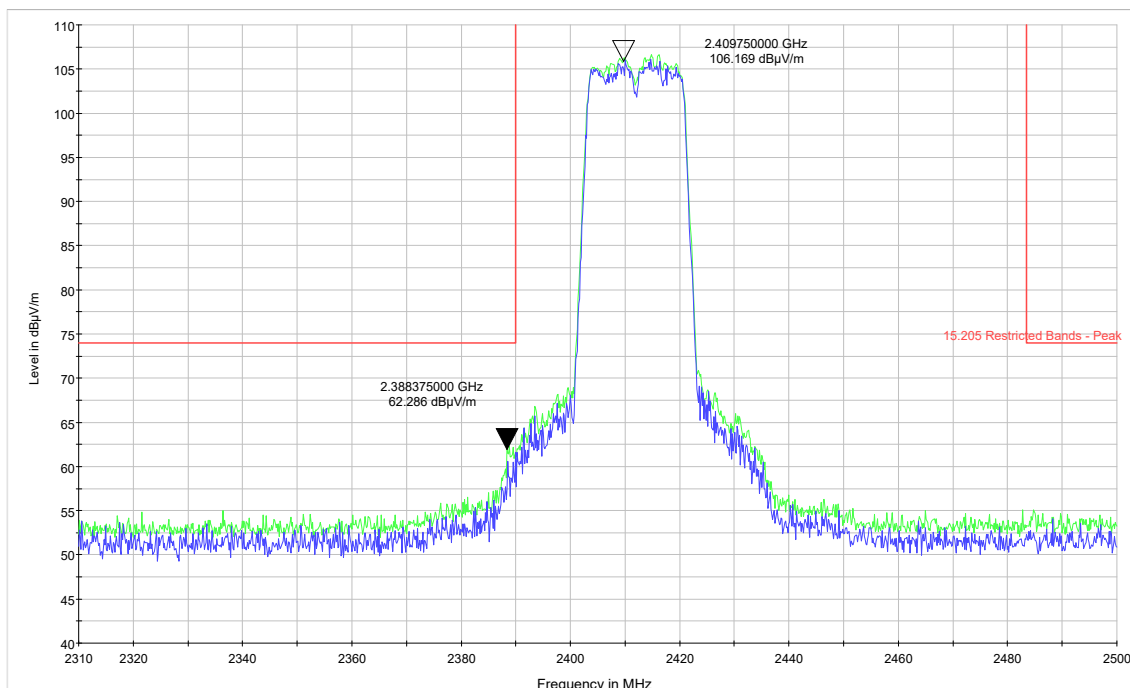
Plot 9-218. Radiated Restricted Band Edge 802.11b (Ch. 1) Chain A and B Average



Plot 9-219. Radiated Restricted Band Edge 802.11g (Ch. 1) Chain A and B Peak

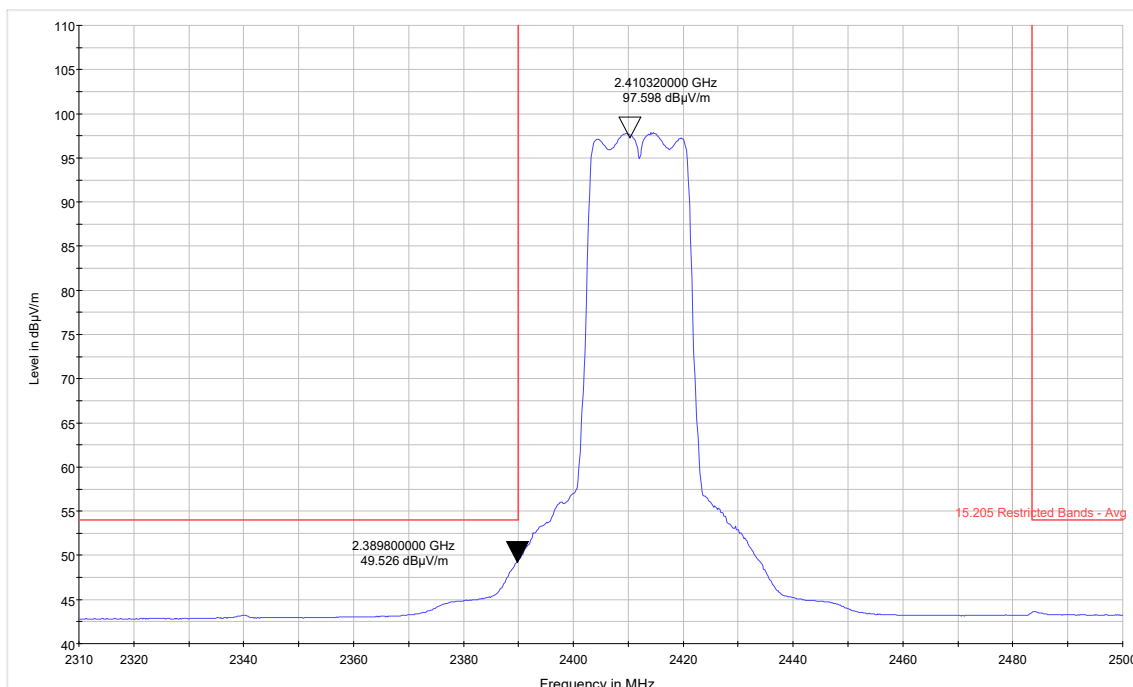


Plot 9-220. Radiated Restricted Band Edge 802.11g (Ch. 1) Chain A and B Average



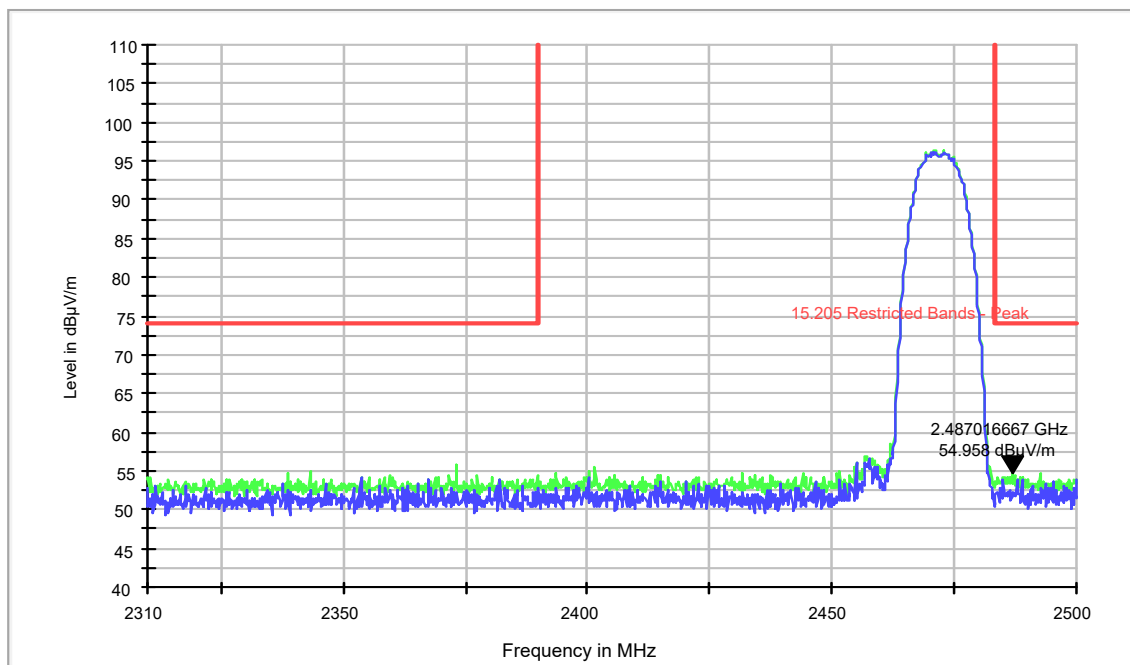
PK+_MAXH-PK+ PK+_CLRWR-PK+ 15.205 Restricted Bands - Peak

Plot 9-221. Radiated Restricted Band Edge 802.11n (Ch. 1) Chain A and B Peak



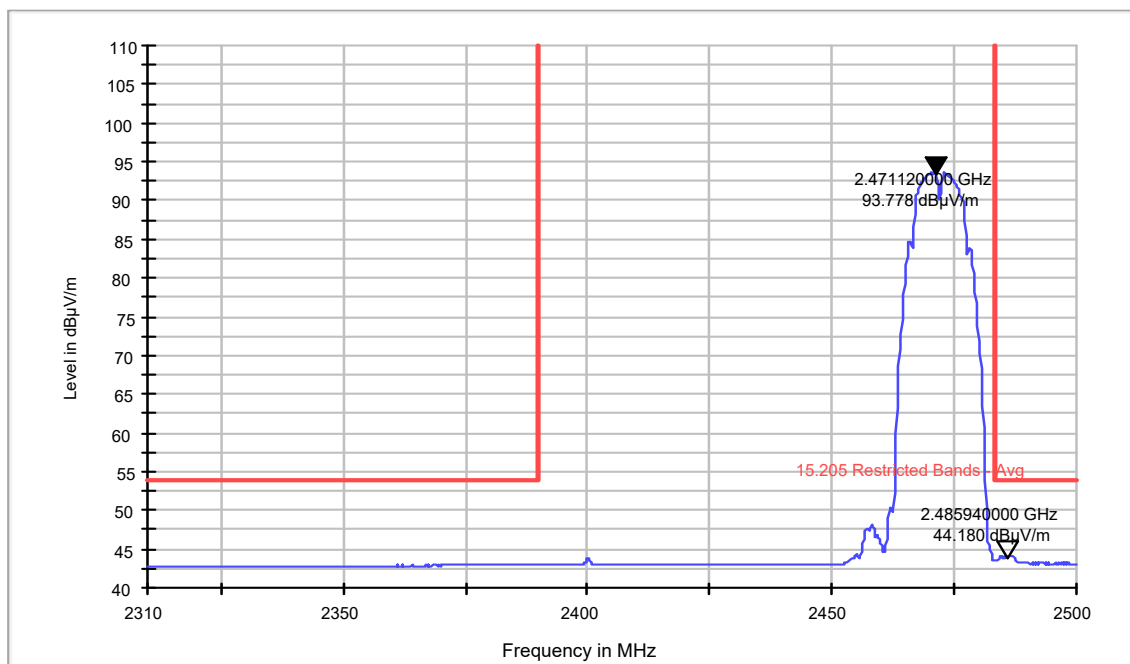
RMS_CLRWR-RMS 15.205 Restricted Bands - Avg

Plot 9-222. Radiated Restricted Band Edge 802.11n (Ch. 1) Chain A and B Average



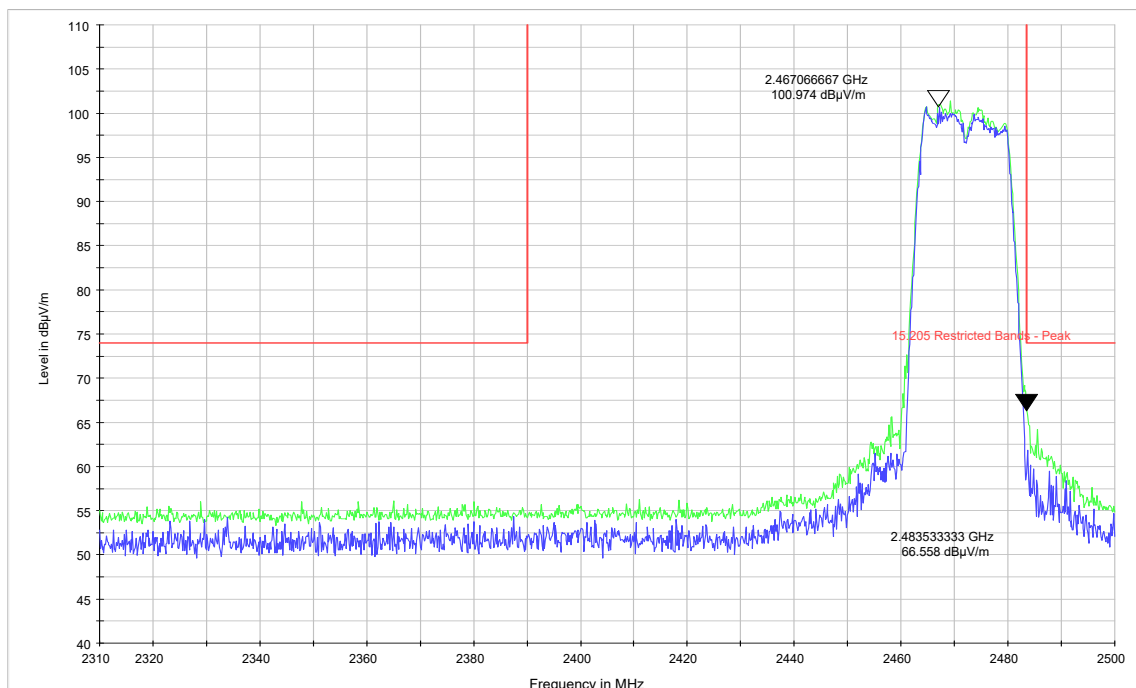
— PK+_MAXH-PK+
 — PK+_CLRWR-PK+
 — 15.205 Restricted Bands - Peak

Plot 9-223. Radiated Restricted Band Edge 802.11b (Ch. 13) Chain A and B Peak



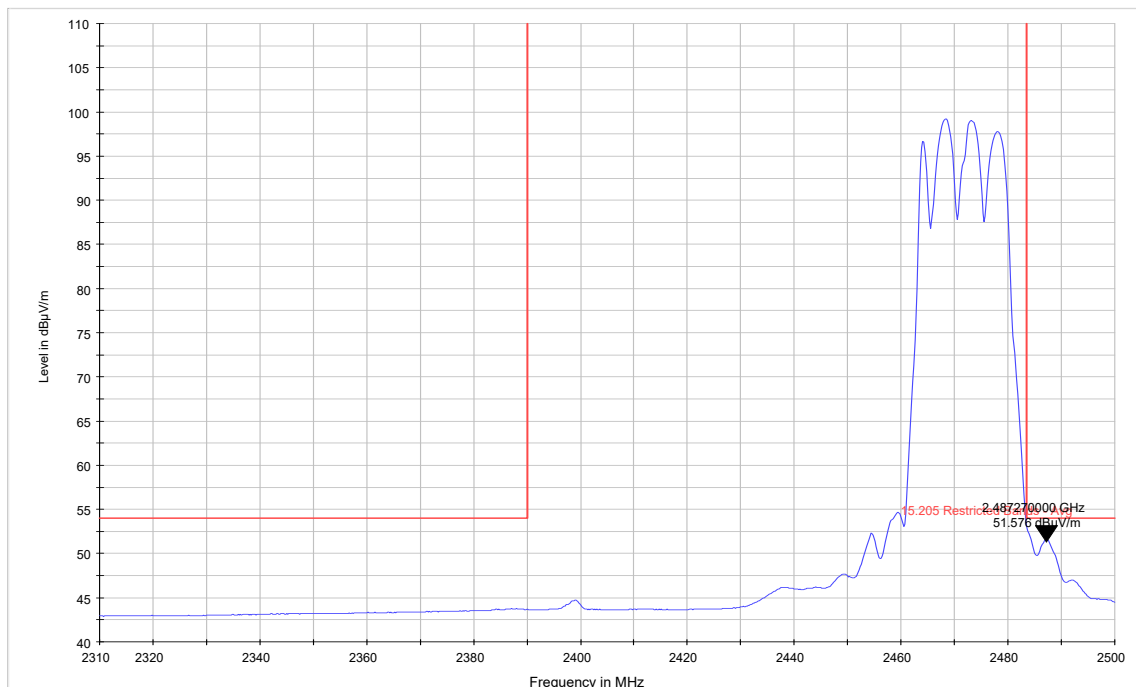
— RMS_CLRWR-RMS
 — 15.205 Restricted Bands - Avg

Plot 9-224. Radiated Restricted Band Edge 802.11b (Ch. 13) Chain A and B Average



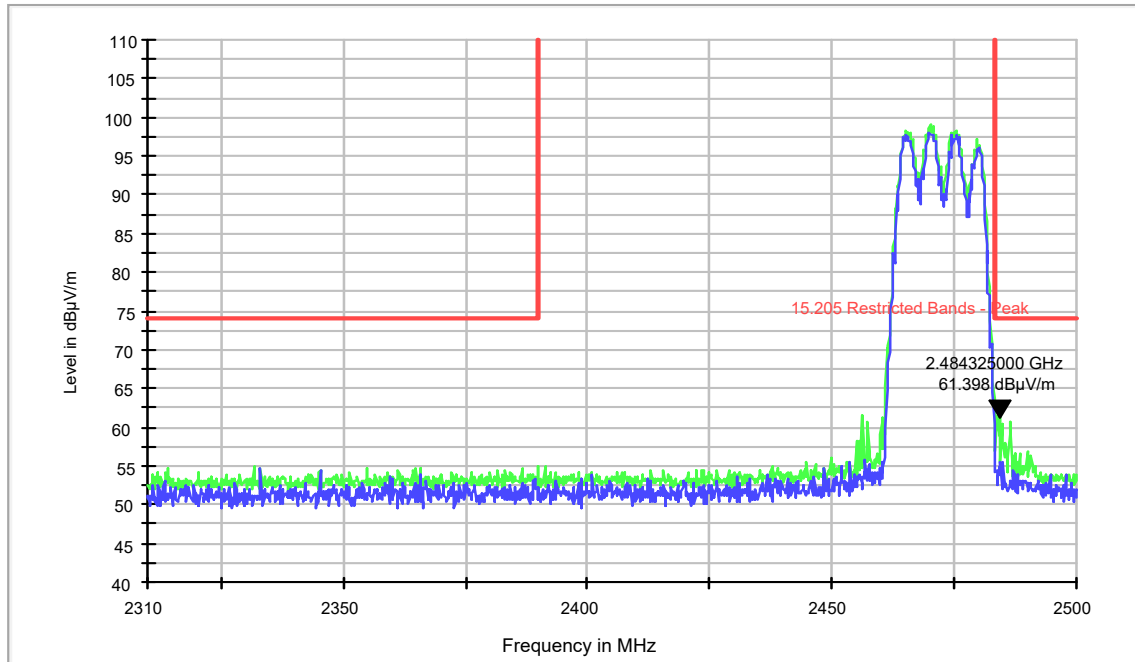
PK+_MAXH-PK+ PK+_CLRWR-PK+ 15.205 Restricted Bands - Peak

Plot 9-225. Radiated Restricted Band Edge 802.11g (Ch. 13) Chain A and B Peak



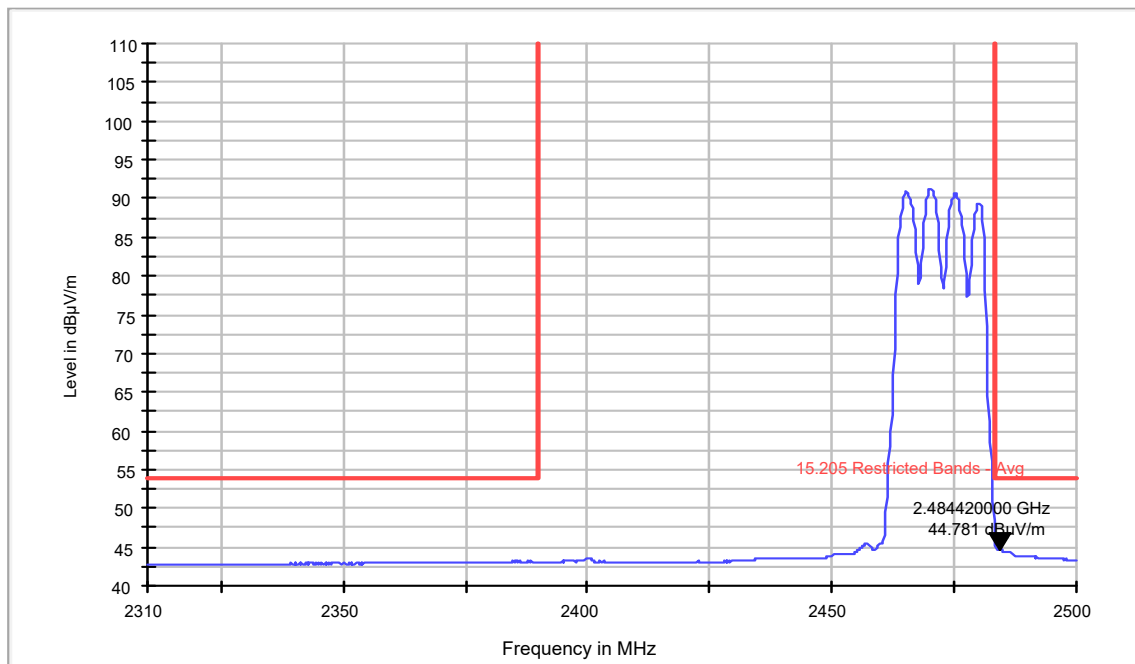
RMS_CLRWR-RMS 15.205 Restricted Bands - Avg

Plot 9-226. Radiated Restricted Band Edge 802.11g (Ch. 13) Chain A and B Average



PK+_MAXH-PK+ PK+_CLRWR-PK+ 15.205 Restricted Bands - Peak

Plot 9-227. Radiated Restricted Band Edge 802.11n (Ch. 13) Chain A and B Peak



RMS_CLRWR-RMS 15.205 Restricted Bands - Avg

Plot 9-228. Radiated Restricted Band Edge 802.11n (Ch. 13) Chain A and B Average

9.8 AC Line Conducted Emissions

9.8.1 Test Requirements

FCC CFR 47 Rule Part 15.207 (a)

Industry Canada RSS Gen [8.8]

9.8.2 Test Method

Conducted power line measurements are made, unless otherwise specified, over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from the EUT power-input terminals that are directly (or indirectly via separate transformer or power supplies) connected to a public power network. Equipment is tested with the power cords that are used under normal operating conditions. These measurements are made using a LISN (Line Impedance Stabilization Network). AC powered peripherals are attached to a second LISN with the 50 ohm measuring port terminated by a 50 ohm resistive load.

EMI Receiver Settings:

150 kHz – 30 MHz:

RBW= 9 kHz

VBW \geq 3 X RBW

Trace Mode: Peak Detector (Max Hold).

Final measurements performed using Quasi-Peak and Average Detectors.

Span= 150 kHz – 30 MHz

Sweep time= Auto

9.8.3 Limit

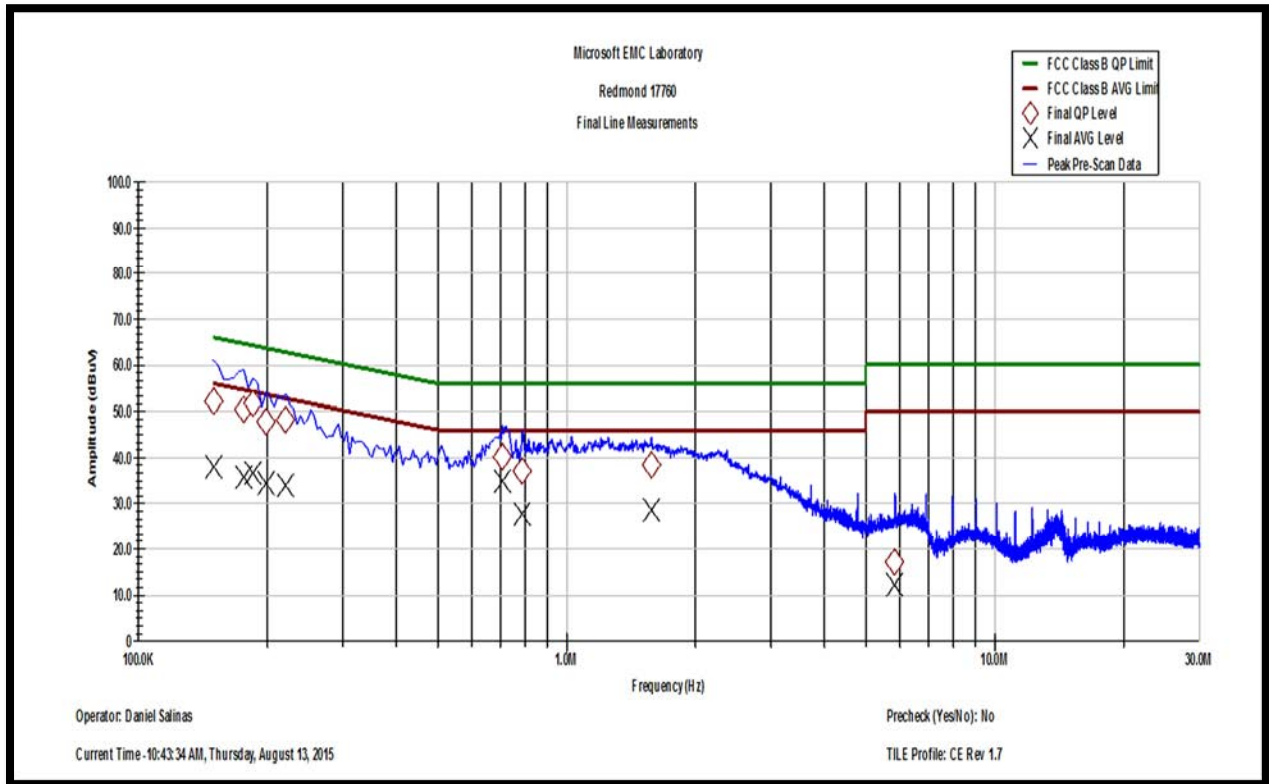
Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

9.8.4 Test Result:

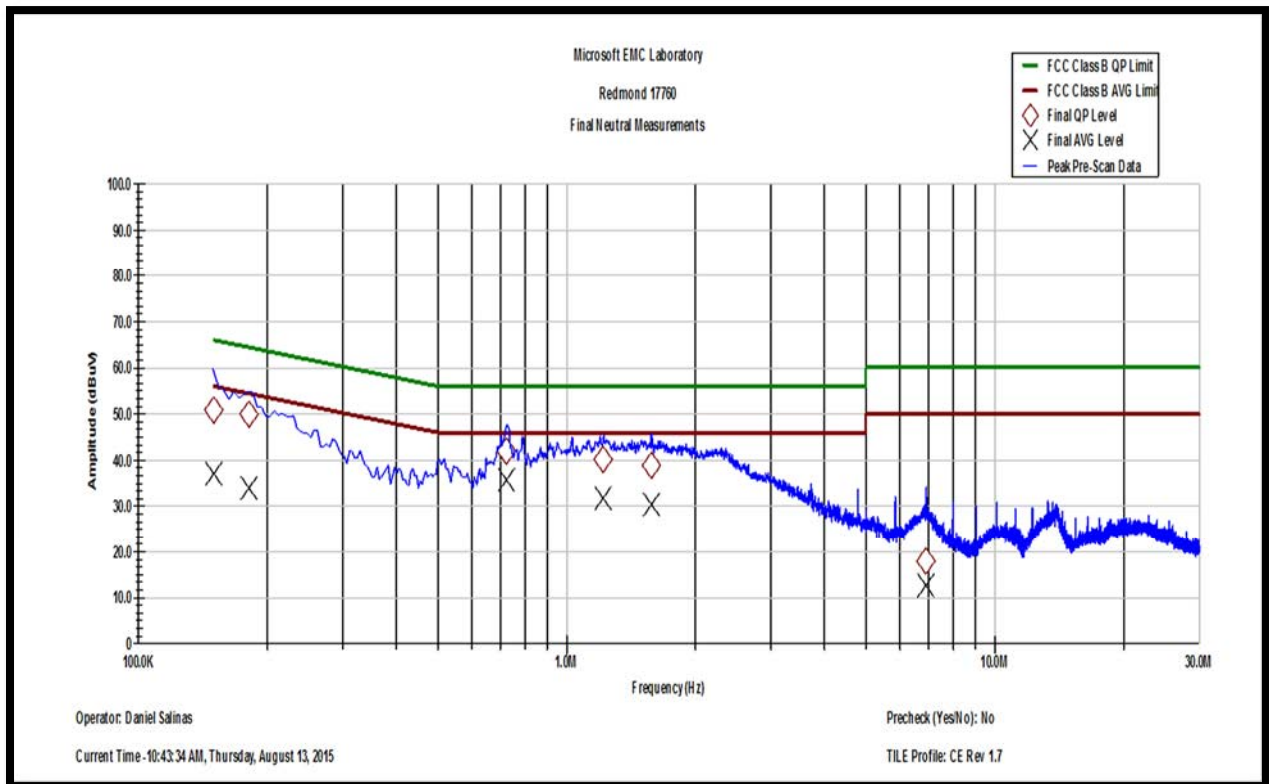
Pass

9.8.5 Test Data:

AC Line Conducted Emission Data							
Frequency (MHz)	QP Net Reading (dB μ V)	AVG Net Reading (dB μ V)	Quasi-Peak Limit (dB μ V)	Average Limit (dB μ V)	Line Tested (L or N)	Quasi-Peak Margin (dB)	Average Margin (dB)
0.15	52.33	37.88	66	56	L	-13.67	-18.12
0.18	50.43	35.93	65.26	55.26	L	-14.83	-19.33
0.19	51.86	36.7	65	55	L	-13.14	-18.3
0.2	47.75	34.21	64.61	54.61	L	-16.86	-20.4
0.22	48.09	33.85	63.97	53.97	L	-15.88	-20.12
0.71	40.4	35.06	56	46	L	-15.6	-10.94
0.79	36.89	27.8	56	46	L	-19.11	-18.2
1.58	38.5	28.74	56	46	L	-17.5	-17.26
5.85	17.27	12.37	60	50	L	-42.73	-37.63
0.15	51.01	37.23	66	56	N	-14.99	-18.77
0.18	50.01	34.15	65.13	55.13	N	-15.12	-20.98
0.72	42.18	35.92	56	46	N	-13.82	-10.08
1.22	40.41	31.68	56	46	N	-15.59	-14.32
1.58	38.96	30.44	56	46	N	-17.04	-15.56
6.92	18.14	12.52	60	50	N	-41.86	-37.48



Plot 9-229. AC Line Conducted Emissions- Line (150 kHz- 30 MHz)



Plot 9-230. AC Line Conducted Emissions- Neutral (150 kHz- 30 MHz)

End of Report