

9.6 Conducted Spurious Emissions

9.6.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

Industry Canada RSS-247 [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 and ANSI C63.10 2013.

Spectrum Analyzer settings:

Identification of Reference Level:

RBW= 100 kHz

VBW $\geq 3 \times$ RBW

Trace Mode= Peak Detector (Max Hold)

Sweep time= Auto

Span ≥ 1.5 times the DTS bandwidth

Peak Marker function to determine the max PSD level.

Conducted Spurious Emissions:

RBW= 1 MHz

VBW $\geq 3 \times$ RBW

Trace Mode= Peak Detector (Max Hold)

Sweep Points = 30,000

Sweep time= Auto

Span= 30 MHz- 12GHz; 12 GHz – 25 GHz

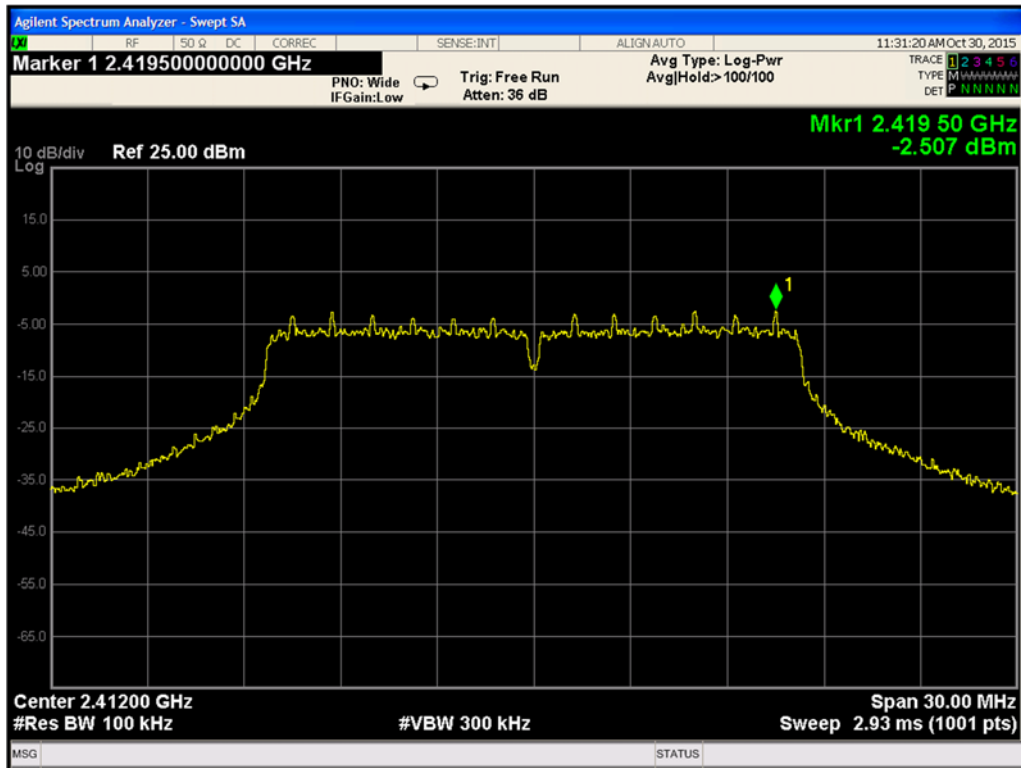
9.6.3 Limits:

All spurious emissions shall be at least 20 dB below the carrier.

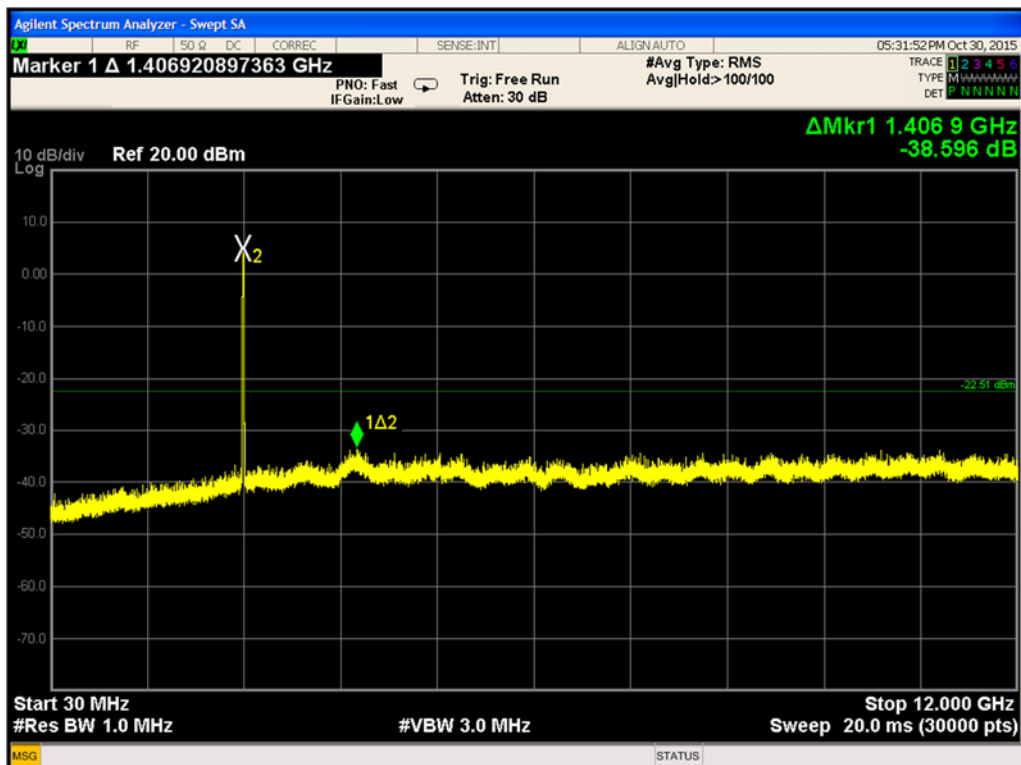
9.6.4 Test Result:

Pass.

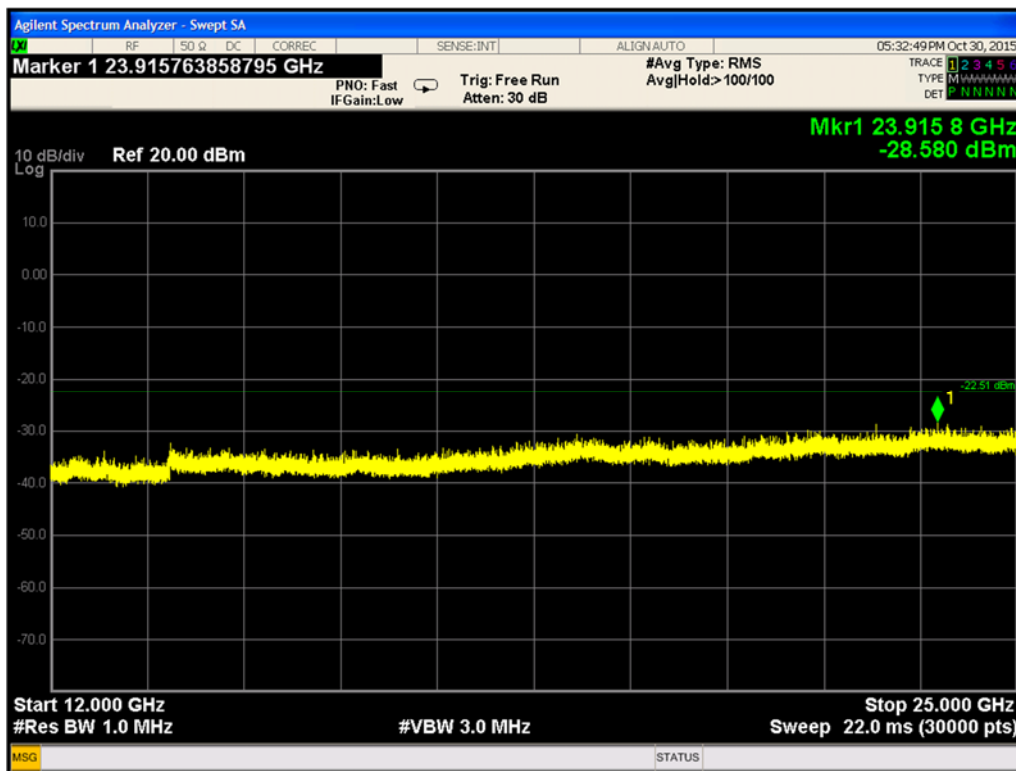
9.6.5 Test Data:



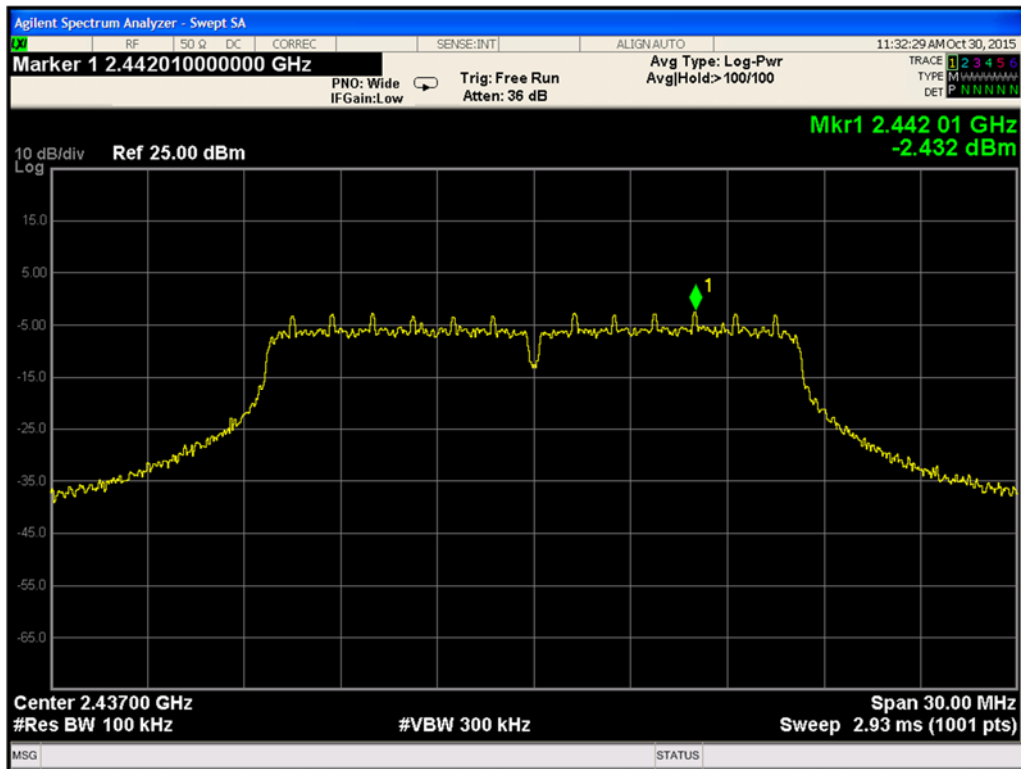
Plot 9-27 Reference Level 802.11g - Ch.1 (2412 MHz)



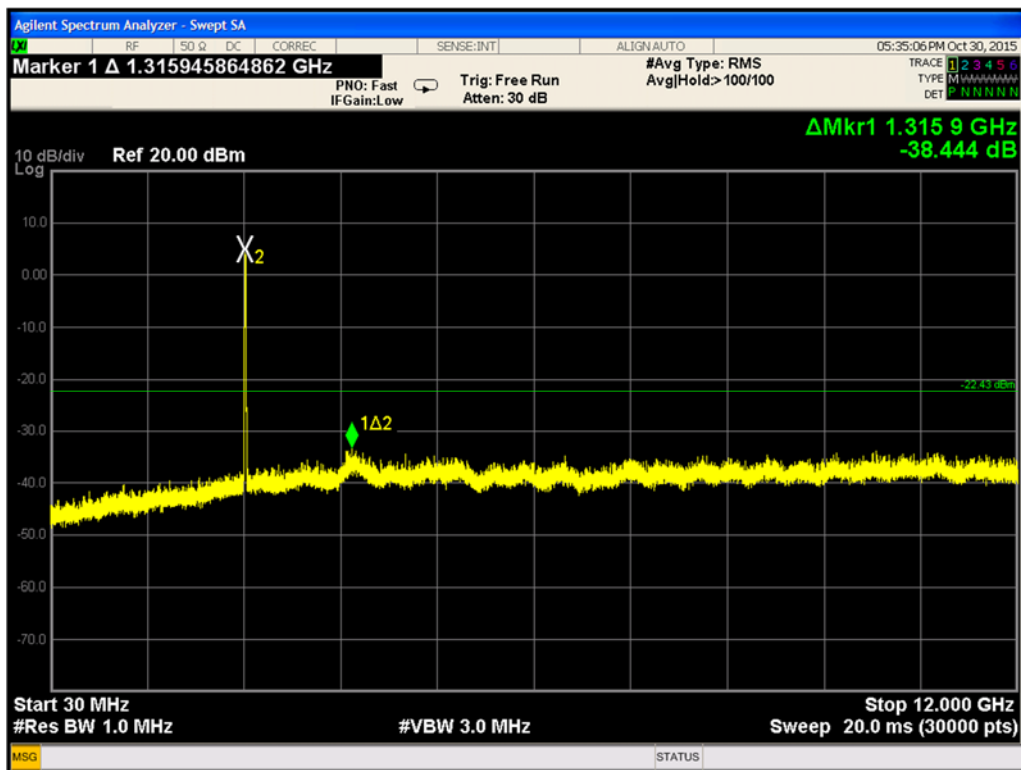
Plot 9-28 Conducted Spurious Emissions 30 - 1000 MHz 802.11g - Ch.1 (2412 MHz)



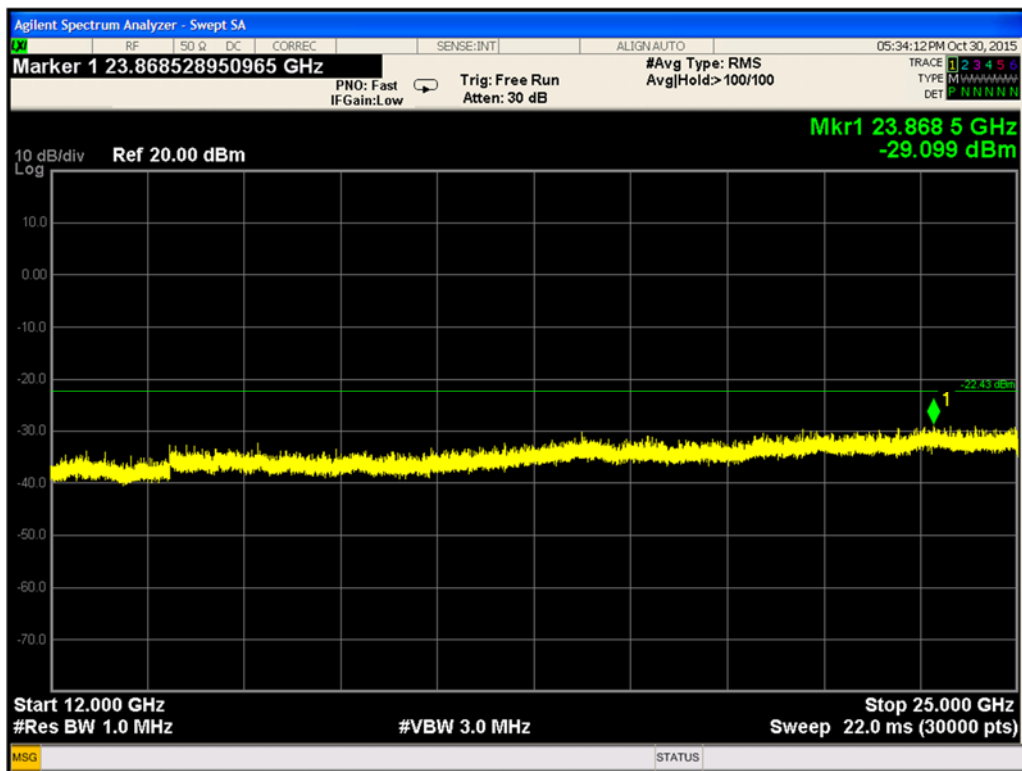
Plot 9-29 Conducted Spurious Emissions 12-25 GHz 802.11g - Ch.1 (2412 MHz)



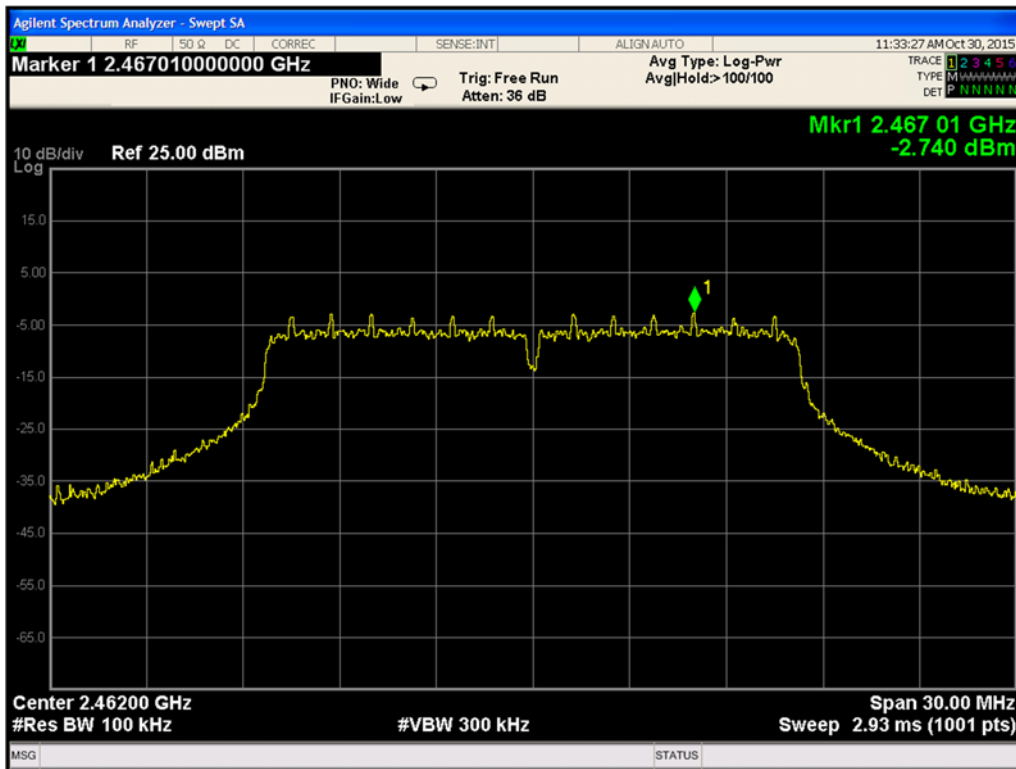
Plot 9-30 Reference Level 802.11g - Ch.6 (2437 MHz)



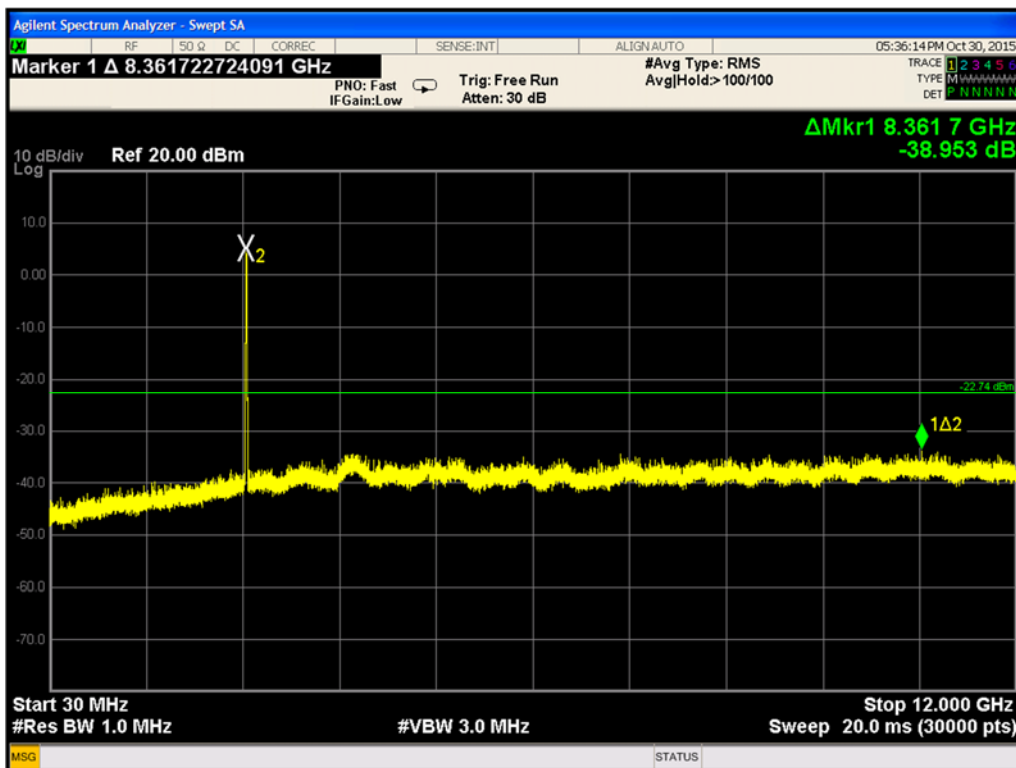
Plot 9-31 Conducted Spurious Emissions 30 - 1000 MHz 802.11g - Ch.6 (2437 MHz)



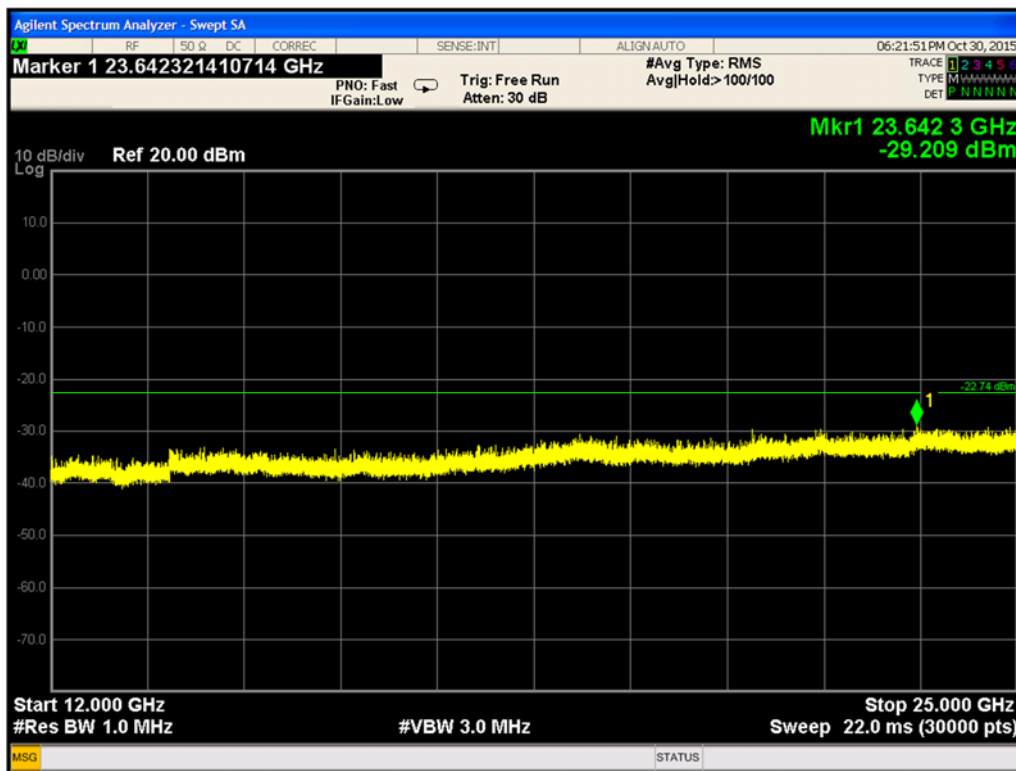
Plot 9-32 Conducted Spurious Emissions 12-25 GHz 802.11g - Ch.6 (2437 MHz)



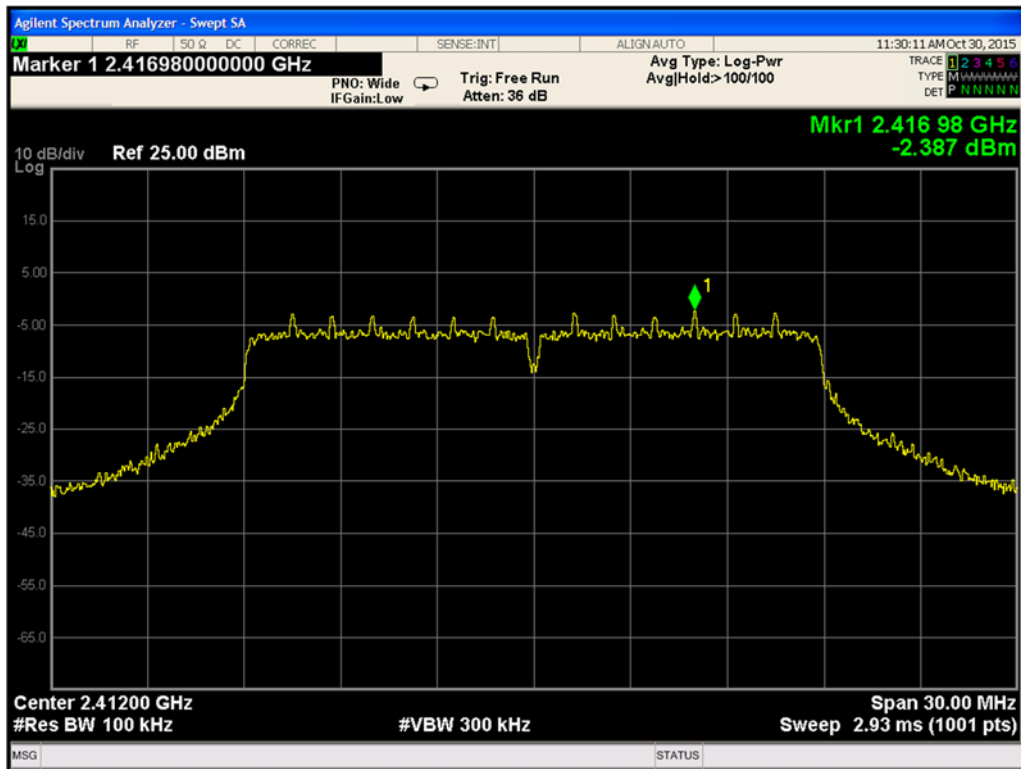
Plot 9-33 Reference Level 802.11g - Ch.11 (2462 MHz)



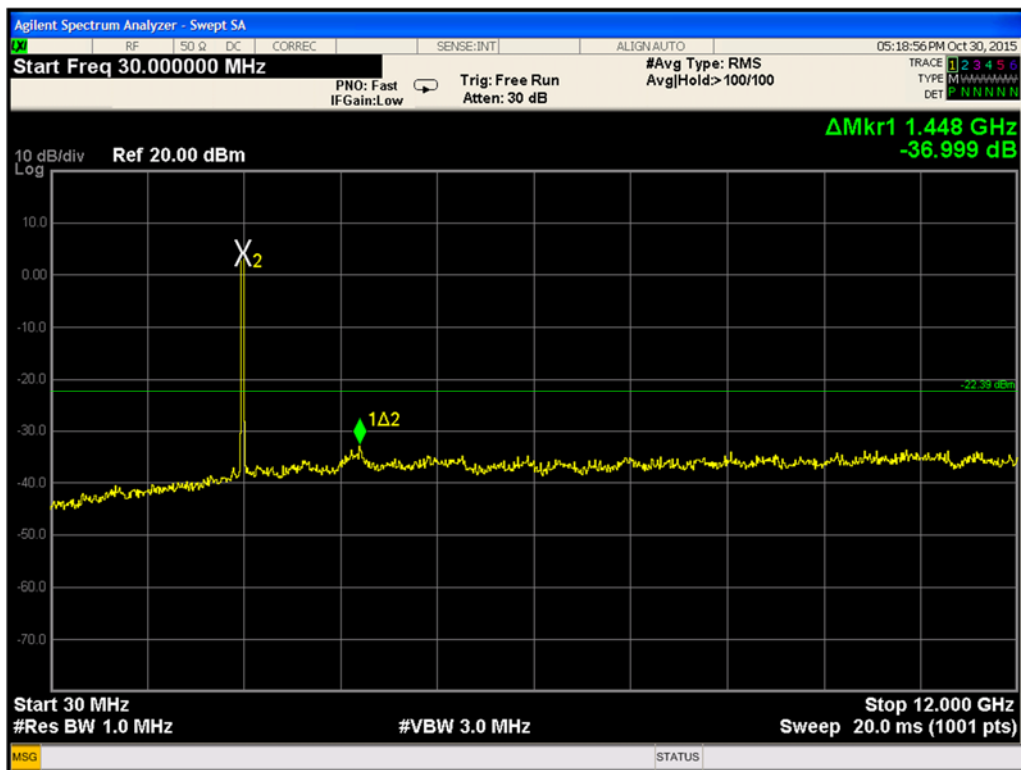
Plot 9-34 Conducted Spurious Emissions 30 - 1000 MHz 802.11g - Ch.11 (2462 MHz)



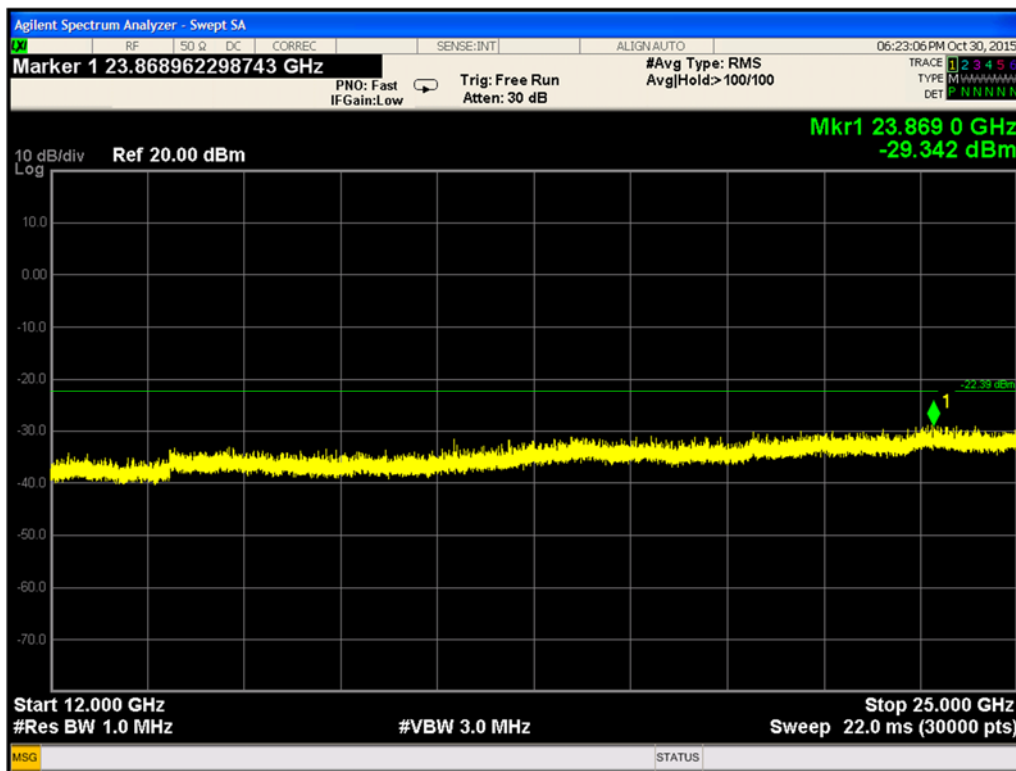
Plot 9-35 Conducted Spurious Emissions 12-25 GHz 802.11g - Ch.11 (2462 MHz)



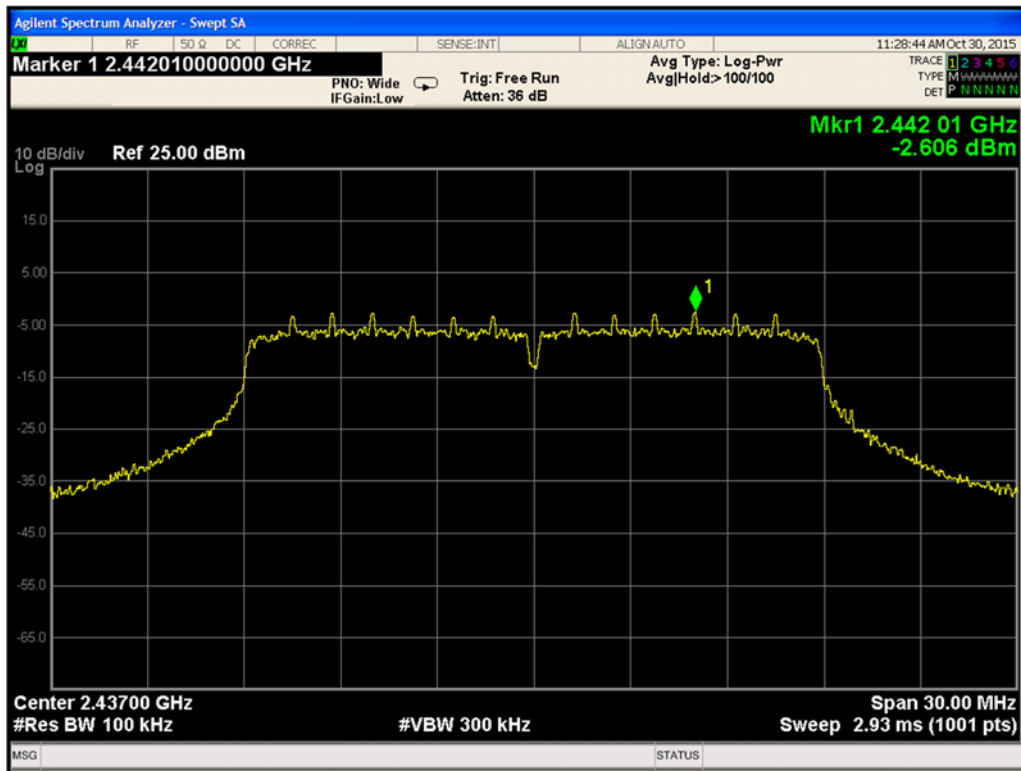
Plot 9-36 Reference Level 802.11n - Ch.1 (2412 MHz)



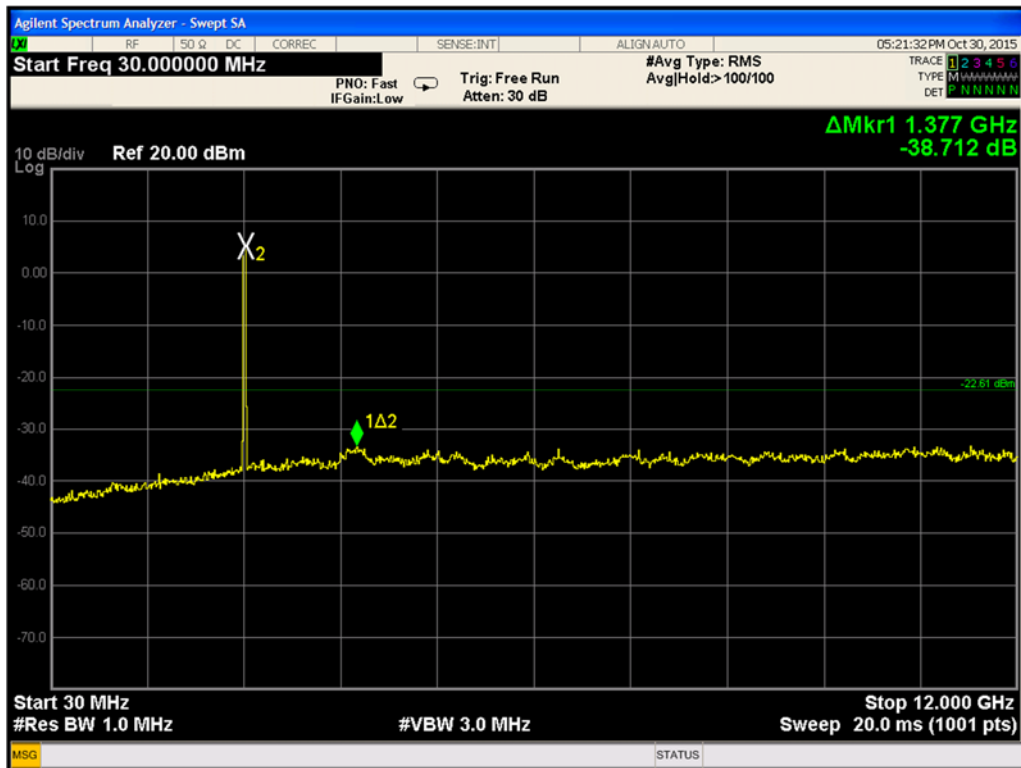
Plot 9-37 Conducted Spurious Emissions 30 - 1000 MHz 802.11n - Ch.1 (2412 MHz)



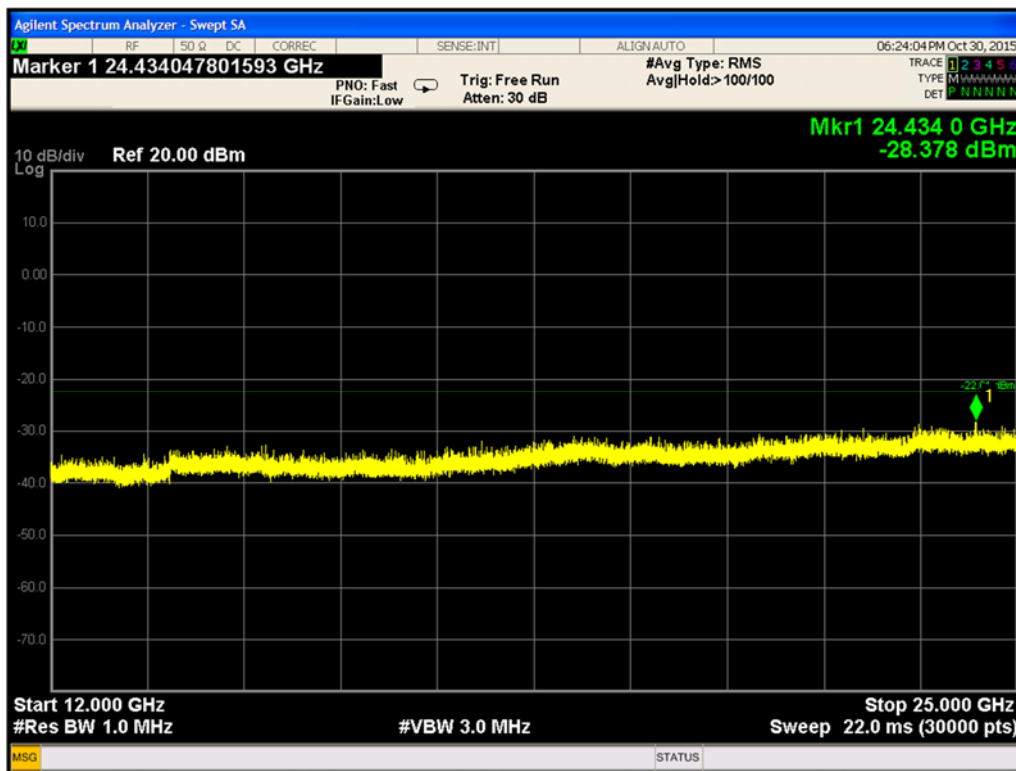
Plot 9-38 Conducted Spurious Emissions 12-25 GHz 802.11n - Ch.1 (2412 MHz)



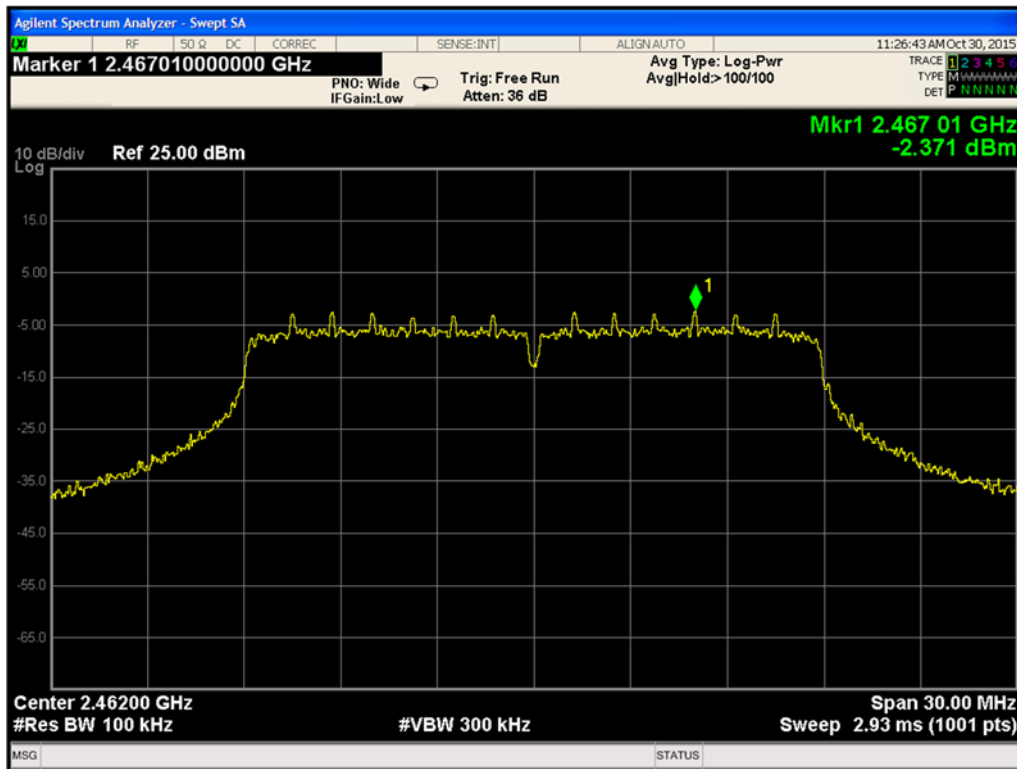
Plot 9-39 Reference Level 802.11n - Ch.6 (2437 MHz)



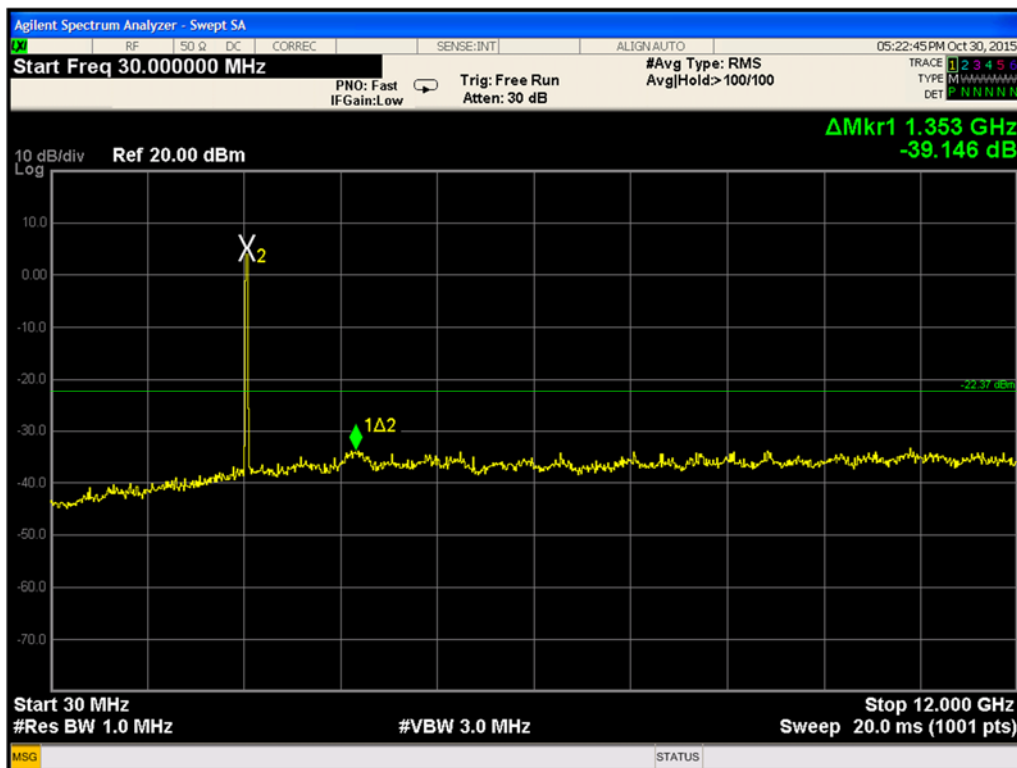
Plot 9-40 Conducted Spurious Emissions 30 - 1000 MHz 802.11n - Ch.6 (2437 MHz)



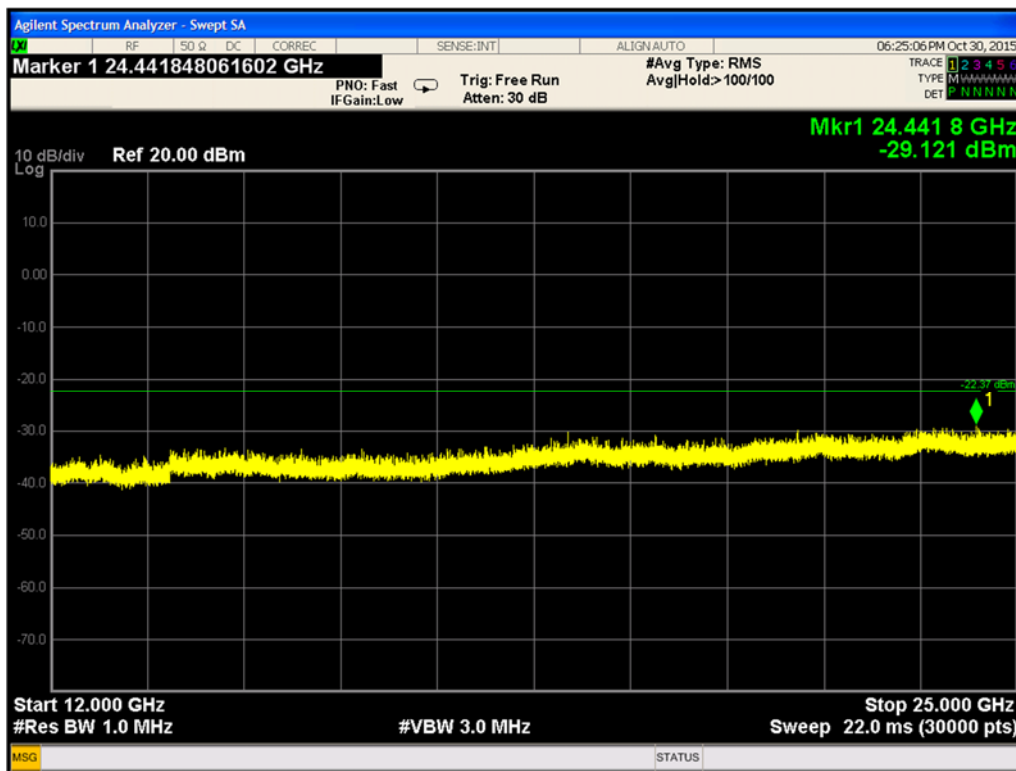
Plot 9-41 Conducted Spurious Emissions 12-25 GHz 802.11n - Ch.6 (2437 MHz)



Plot 9-42 Reference Level 802.11n - Ch.11 (2462 MHz)



Plot 9-43 Conducted Spurious Emissions 30 - 1000 MHz 802.11n - Ch.11 (2462 MHz)



Plot 9-44 Conducted Spurious Emissions 12-25 GHz 802.11n - Ch.11 (2462 MHz)

9.7 Conducted Band Edge Emissions

9.7.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

Industry Canada RSS-247 Issue 1 [5.5]

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) American National Standard of Procedure for Compliance Testing of Unlicensed Wireless Devices.

Spectrum Analyzer settings:

Band Edge Emissions:

RBW= 100 kHz

VBW $\geq 3 \times$ RBW

Detector= Peak

Trace = Max Hold

Sweep time= Auto

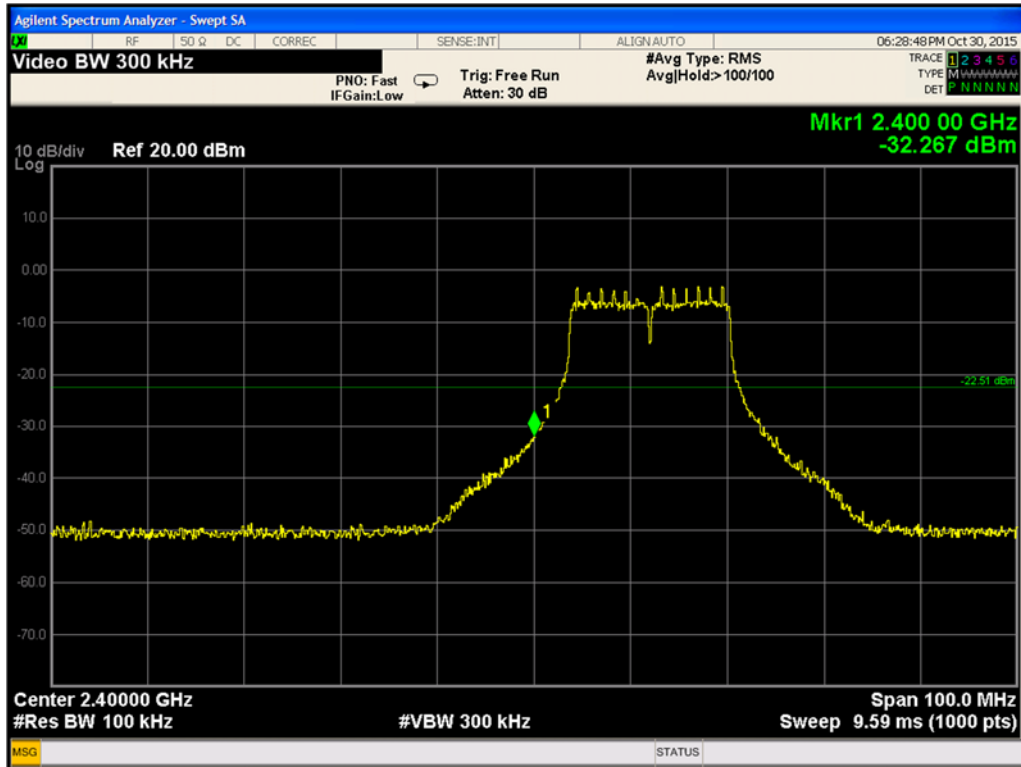
9.7.3 Limits:

All spurious emissions shall be at least 20 dB below the carrier.

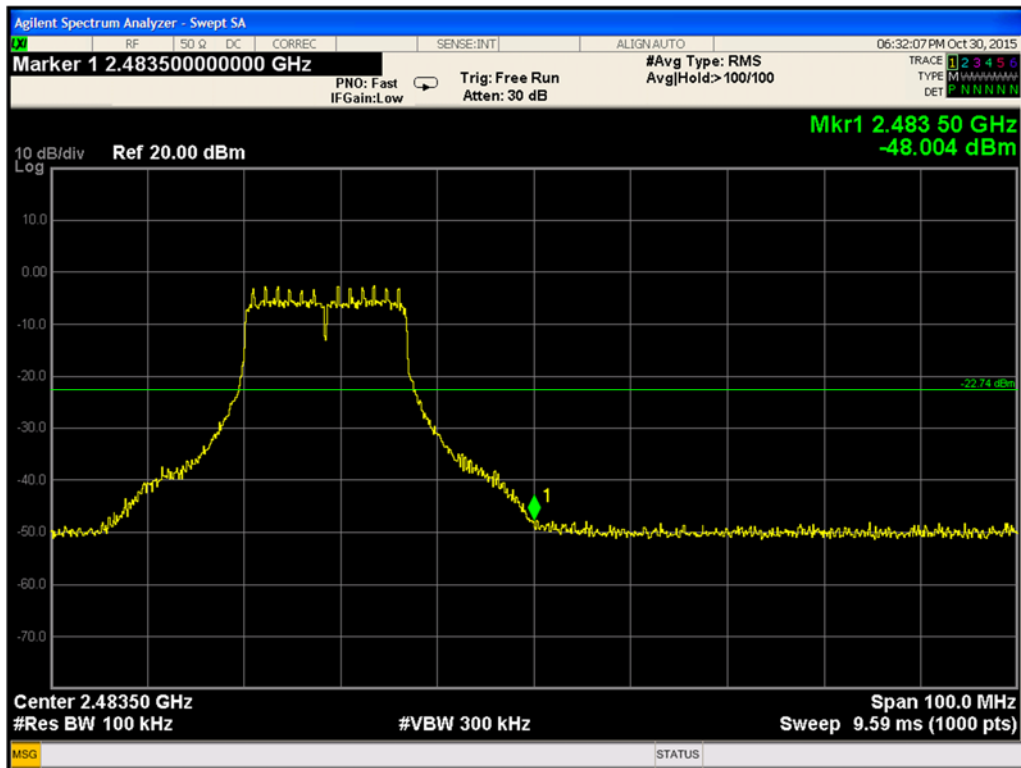
9.7.4 Test Result:

Pass.

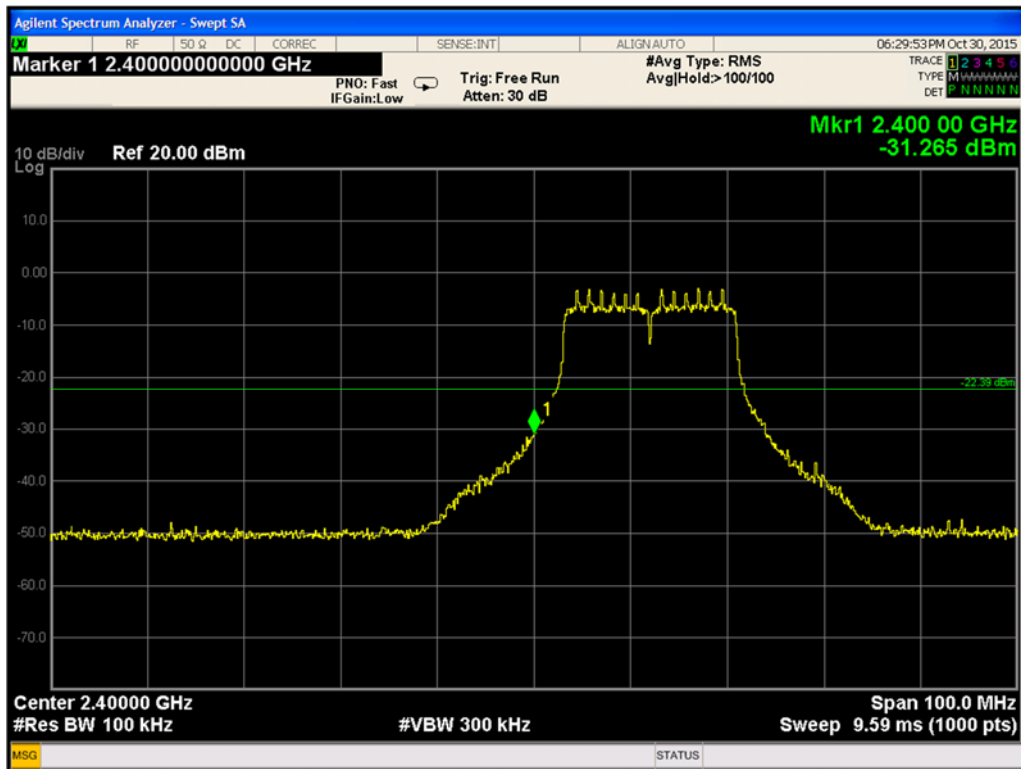
9.7.5 Test Data:



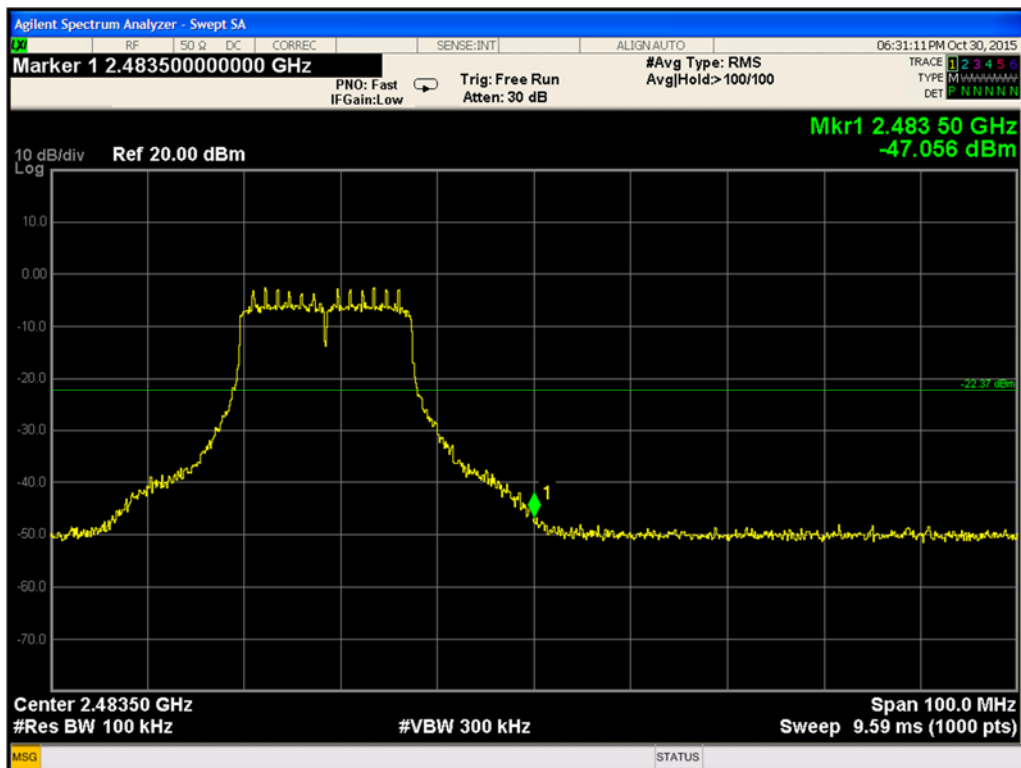
Plot 9-45 Conducted Band Edge 802.11g - Ch. 1 (2412 MHz)



Plot 9-46vConducted Band Edge 802.11g - Ch. 11 (2462 MHz)



Plot 9-47 Conducted Band Edge 802.11n - Ch. 1 (2412 MHz)



Plot 9-48 Conducted Band Edge 802.11n - Ch. 11 (2462 MHz)

9.8 Radiated Spurious and Band Edge Emissions

9.8.1 Test Requirement:

FCC CFR 47 Rule Part 15.247 (d)

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

9.8.2 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) American National Standard of Procedure for Compliance Testing of Unlicensed Wireless Devices.

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 axes. 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 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= 100 kHz

VBW $\geq 3 \times$ RBW

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

Span= 30 MHz- 1000 MHz

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 = 58dBuV/m

9.8.3 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)

9.8.4 Test Result:

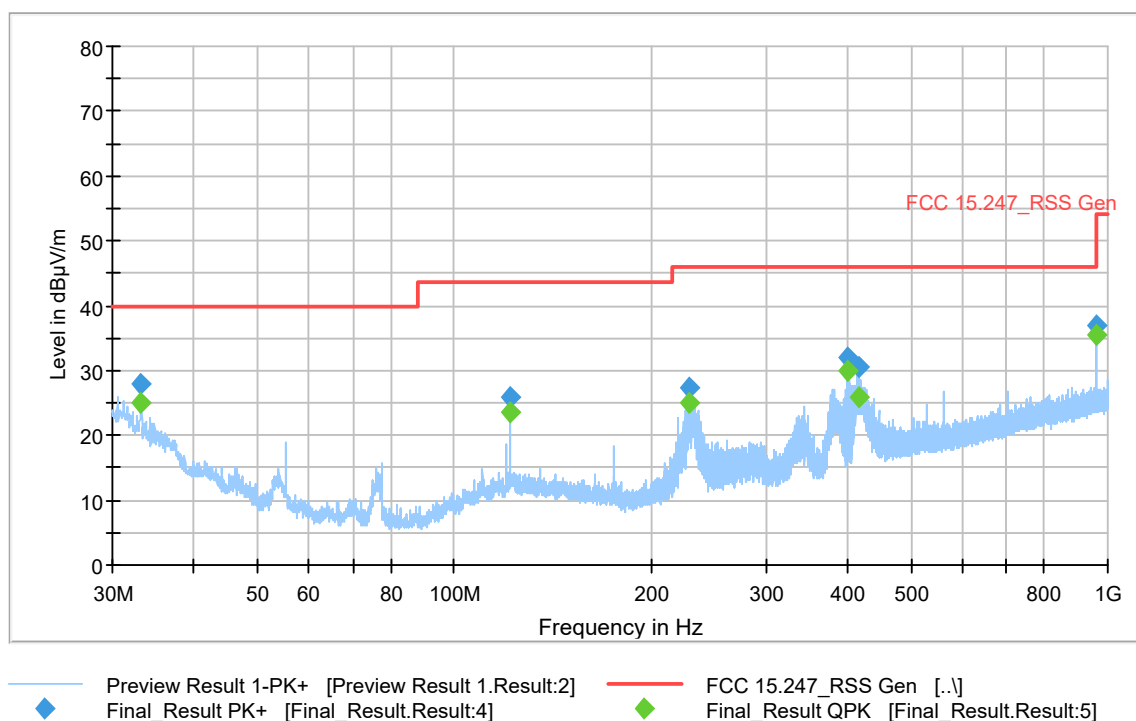
Pass.

9.8.5 Test Data:

9.8.5.1 Emissions in 30 MHz- 1 GHz range

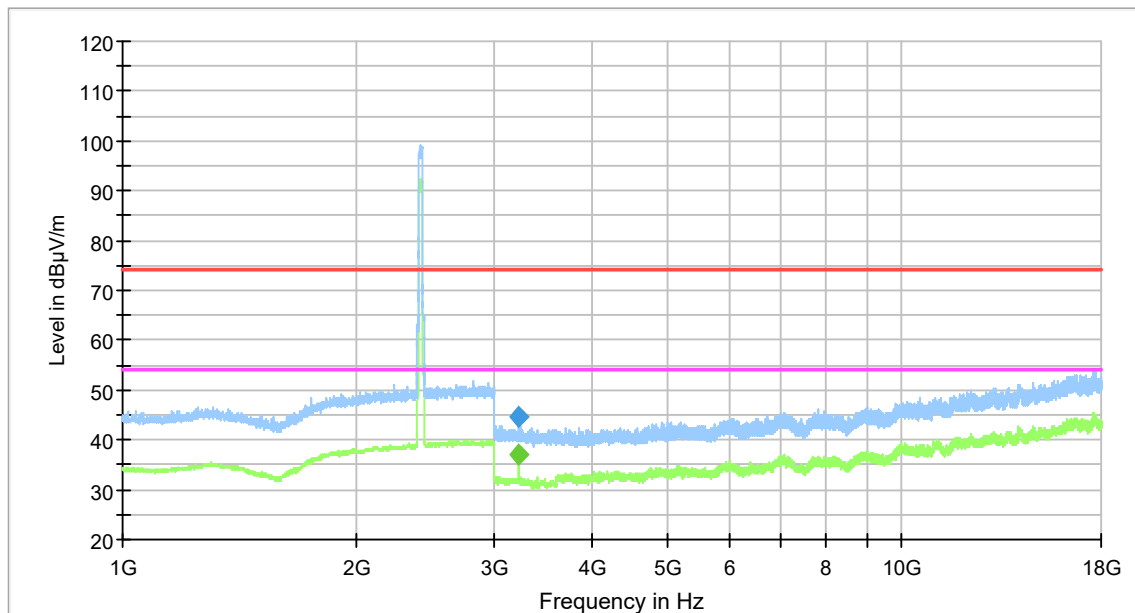
Worst case emissions in mid channel of operation shown here.

RSE 30MHz – 1GHz Quasi Peak Data					
Frequency (MHz)	Raw QP Field Strength (dBμV/m)	Correction Factor (dB)	Corrected QP Field Strength (dBμV/m)	QP Limit (dBμV/m)	Margin (dB)
33.156	35.70	-10.8	24.90	40.00	-15.10
121.66	39.53	-16.0	23.53	43.52	-19.99
229.53	42.38	-17.4	24.98	46.00	-21.02
400.00	41.32	-11.5	29.82	46.00	-16.18
416.80	36.60	-10.8	25.80	46.00	-20.20
959.99	36.93	-1.5	35.43	46.00	-10.57



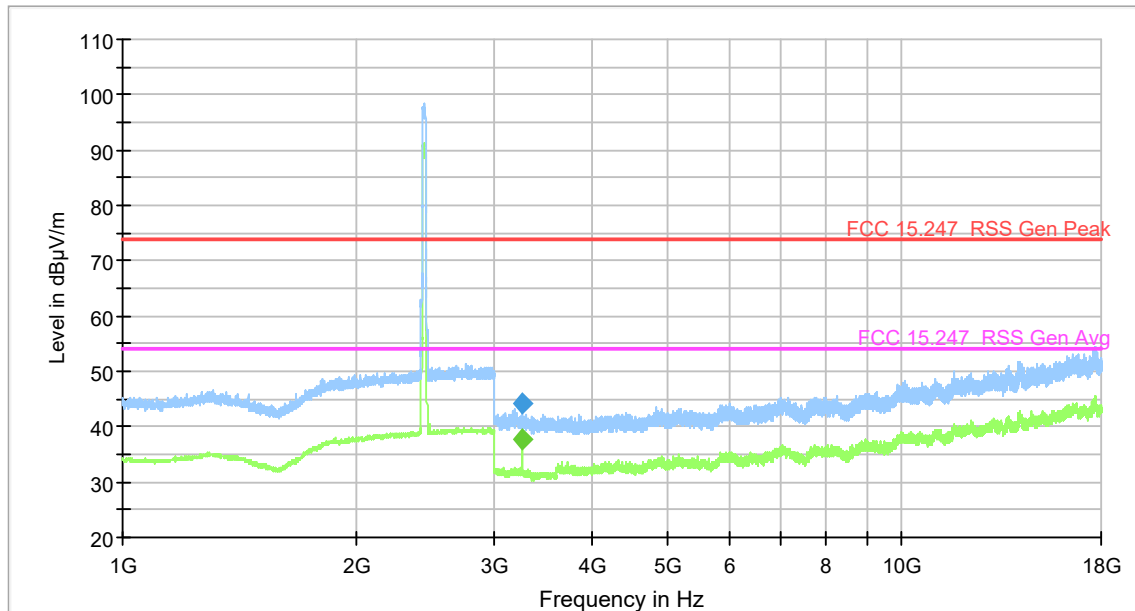
9.8.5.2 Emissions in 1-18 GHz range

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	3215.80	30.25	6.7	36.95	54	-17.05
2437	3249.20	30.98	6.7	37.68	54	-16.32
2462	3282.70	28.54	6.6	35.14	54	-18.86
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	3215.80	37.83	6.7	44.53	74	-29.47
2437	3249.20	37.61	6.7	44.31	74	-29.69
2462	3282.70	36.83	6.6	43.43	74	-30.57



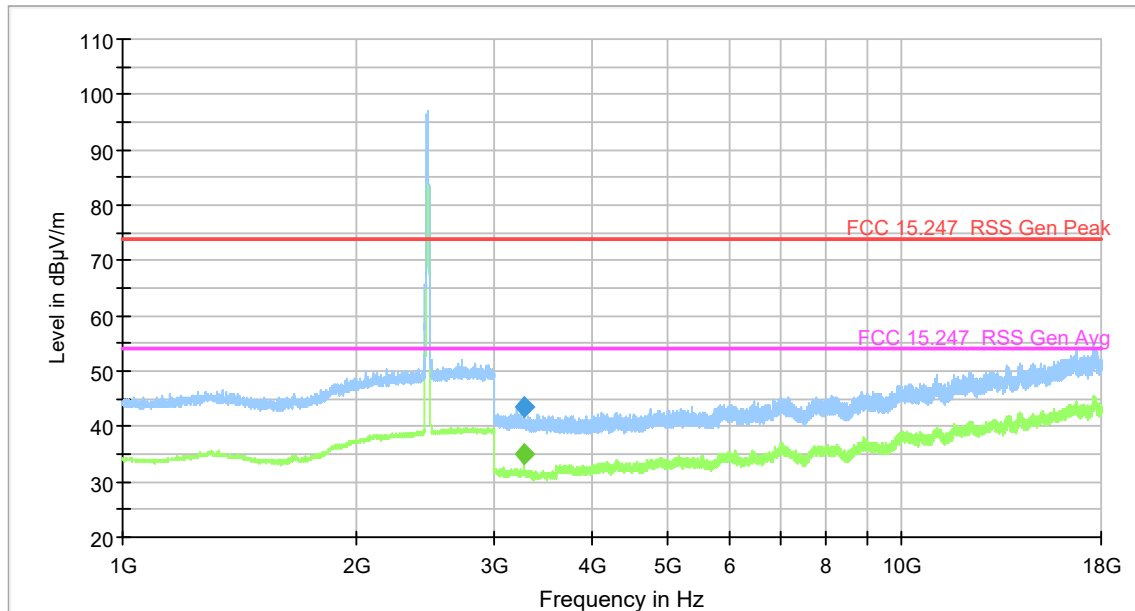
— Preview Result 2-RMS [Preview Result 2.Result:4] — Preview Result 1-PK+ [Preview Result 1.Result:2]
— FCC 15.247_RSS Gen Peak [..] — FCC 15.247_RSS Gen Avg [..]
◆ Final_Result PK+ [Final_Result.Result:4] ◆ Final_Result RMS [Final_Result.Result:5]

Plot 9-50 Radiated Spurious Emission 1-18GHz 802.11g - Ch.1 (2412 MHz)



— Preview Result 2-RMS [Preview Result 2.Result:4] — Preview Result 1-PK+ [Preview Result 1.Result:2]
— FCC 15.247_RSS Gen Peak [..] — FCC 15.247_RSS Gen Avg [..]
◆ Final_Result PK+ [Final_Result.Result:4] ◆ Final_Result RMS [Final_Result.Result:5]

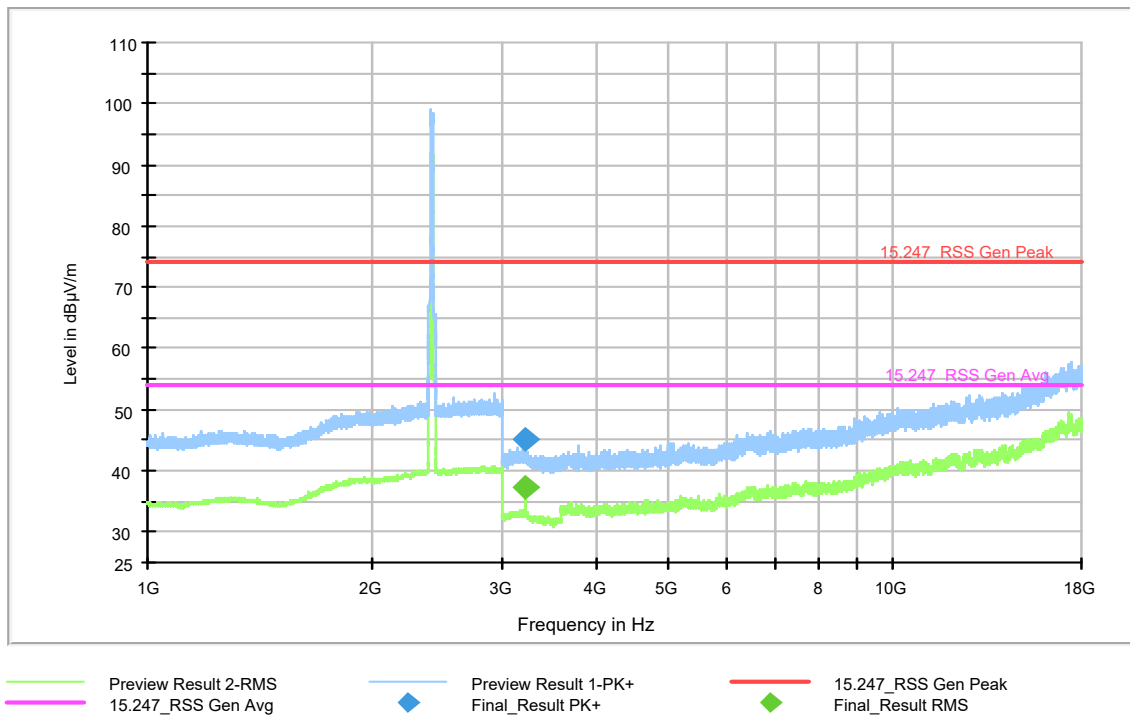
Plot 9-51 Radiated Spurious Emission 1-18GHz 802.11g - Ch.6 (2437 MHz)



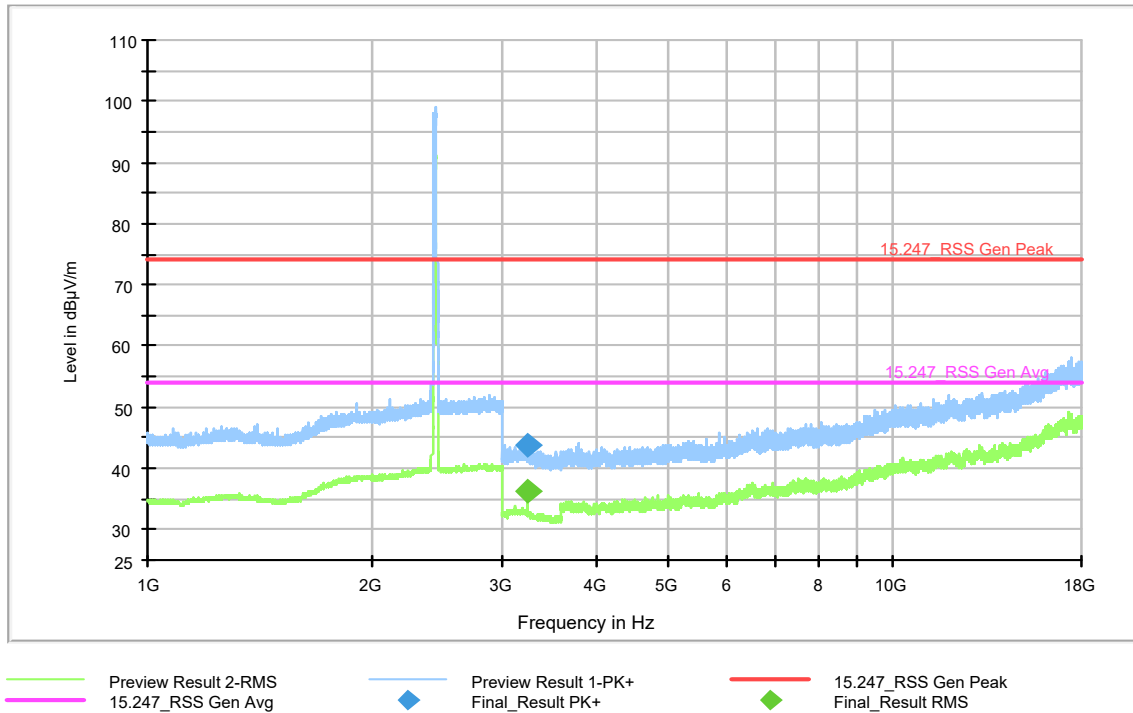
— Preview Result 2-RMS [Preview Result 2.Result:4] — Preview Result 1-PK+ [Preview Result 1.Result:2]
— FCC 15.247_RSS Gen Peak [..] — FCC 15.247_RSS Gen Avg [..]
◆ Final_Result PK+ [Final_Result.Result:4] ◆ Final_Result RMS [Final_Result.Result:5]

Plot 9-52 Radiated Spurious Emission 1-18GHz 802.11g - Ch.11 (2462 MHz)

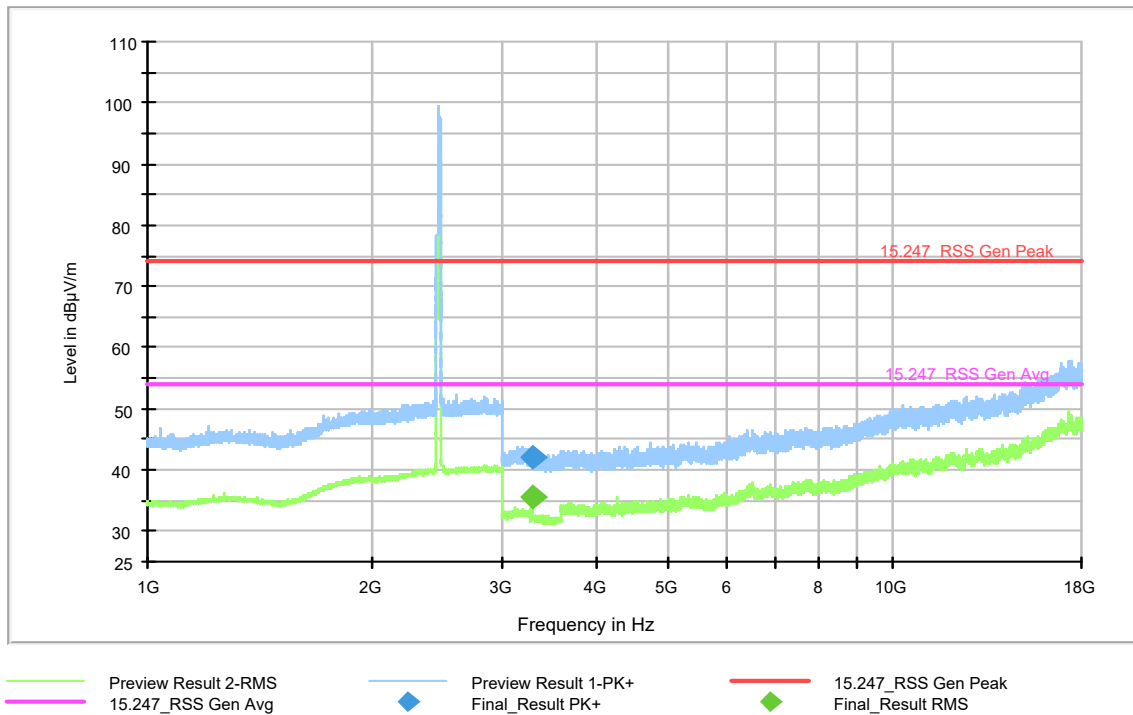
802.11n RSE 1 - 18GHz Average Data						
Carrier Frequency (MHz)	Frequency (MHz)	Raw Avg. Amplitude (dBμV)	Correction Factor (dB)	Corrected Avg. Field Strength (dBμV/m)	Average Limit (dBμV/m)	Margin (dB)
2412	3215.90	30.11	7.3	37.41	54	-16.59
2437	3249.40	29.3	7.1	36.40	54	-17.60
2462	3282.50	28.76	6.7	35.46	54	-18.54
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	3215.90	37.86	7.3	45.16	54	-28.84
2437	3249.40	29.3	7.1	36.40	54	-30.10
2462	3282.60	35.24	6.7	41.94	54	-32.06



Plot 9-53 Radiated Spurious Emission 1-18GHz 802.11n - Ch.1 (2412 MHz)



Plot 9-54 Radiated Spurious Emission 1-18GHz 802.11n - Ch.6 (2437 MHz)

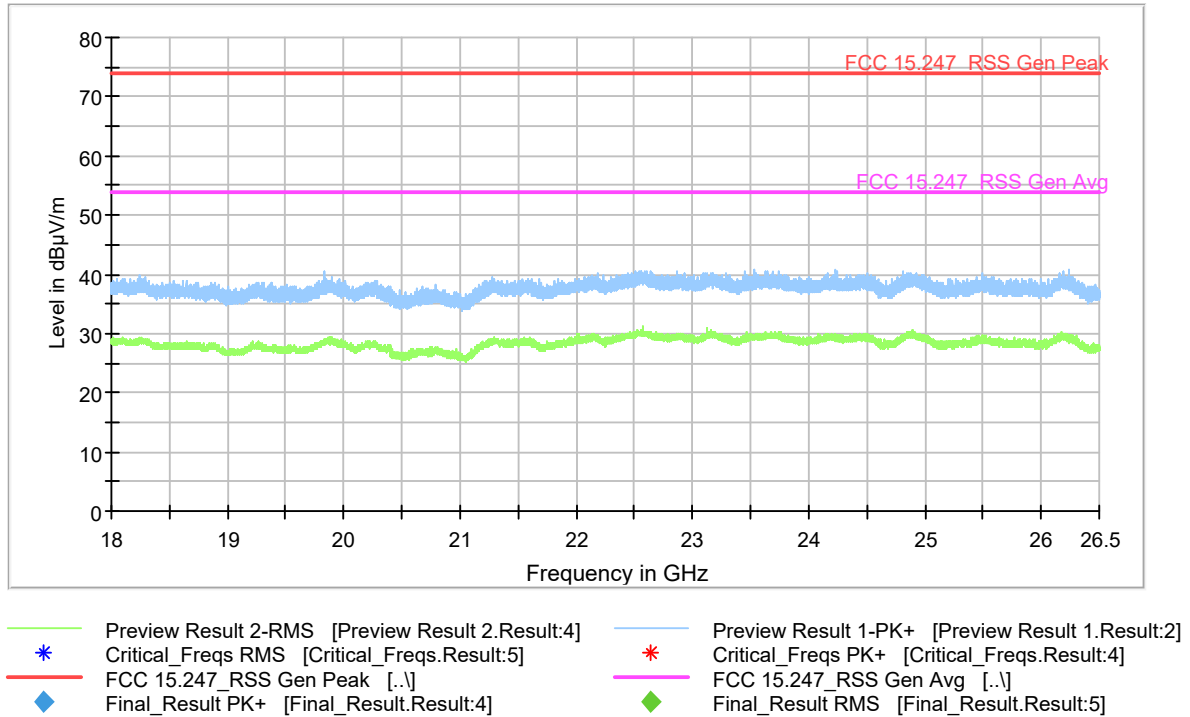


Plot 9-55 Radiated Spurious Emission 1-18GHz 802.11n - Ch.11 (2462 MHz)

9.8.5.3 Emissions in 18-26.5 GHz range

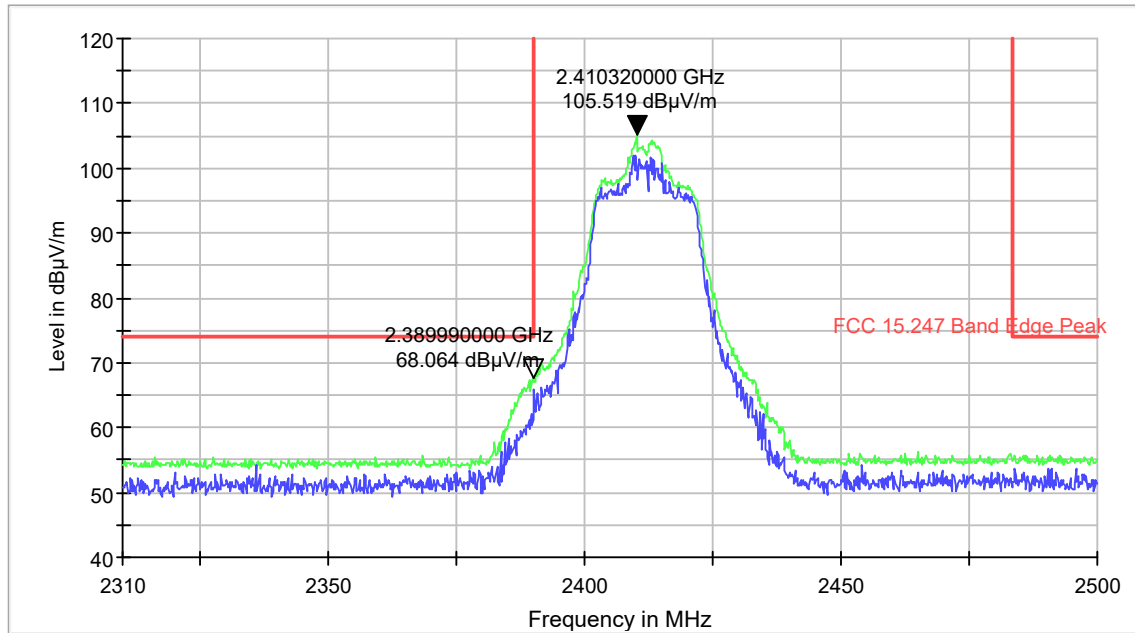
Worst case data from mid channel of operation shown here.

No significant emissions to report above noise floor.

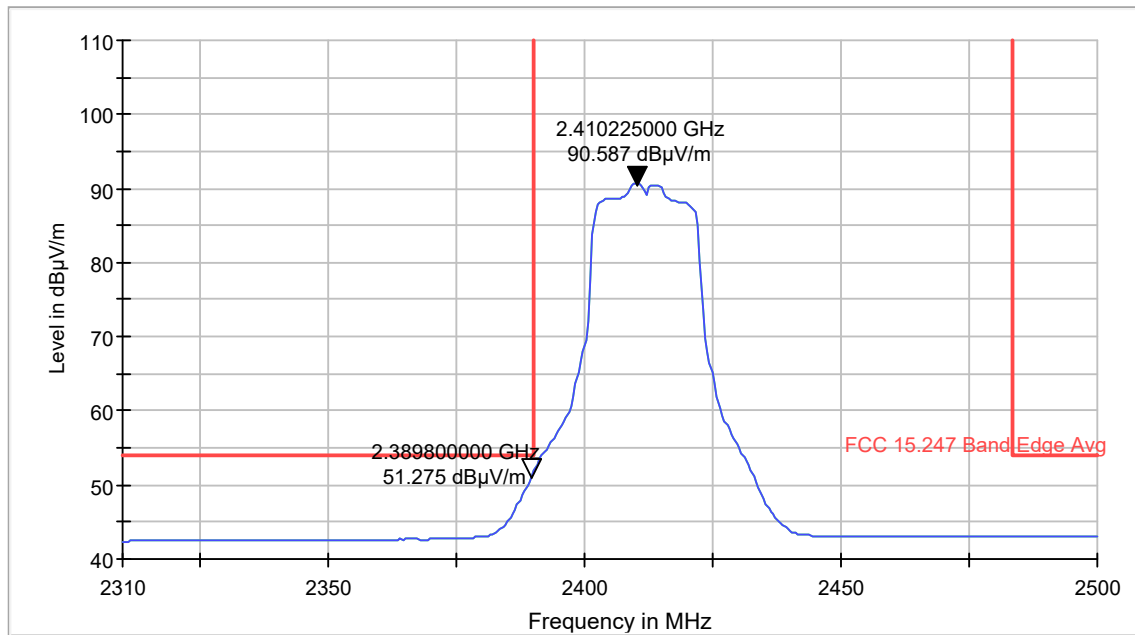


Plot 9-56 Radiated Spurious Emissions 18-26.5GHz 802.11g - Ch.6 (2437 MHz)

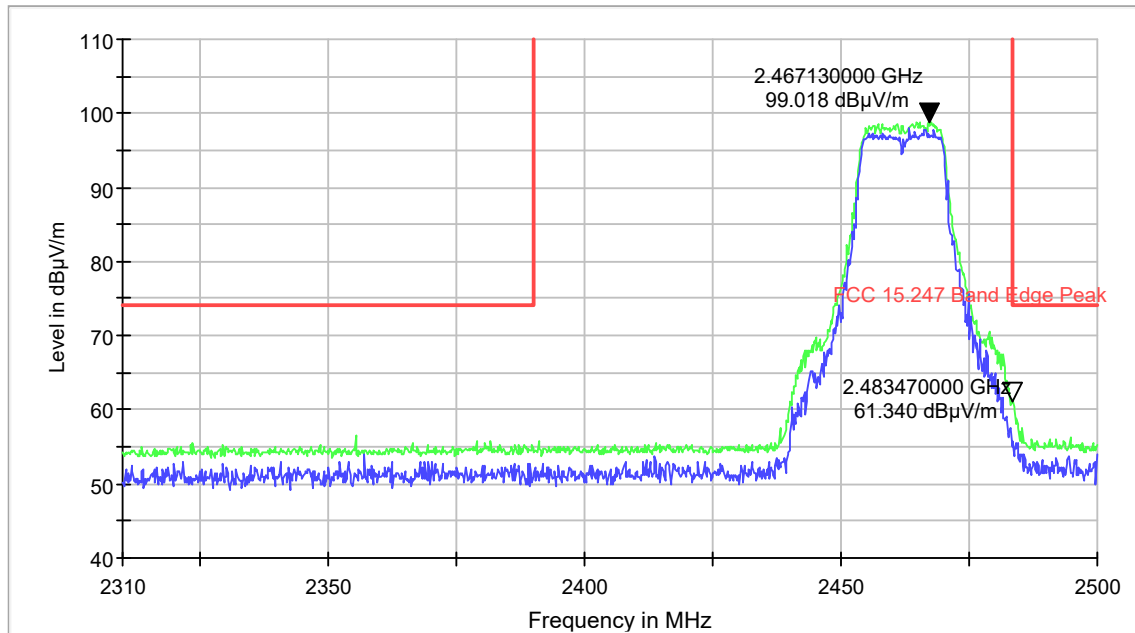
9.8.5.4 Radiated restricted Band-edge emissions



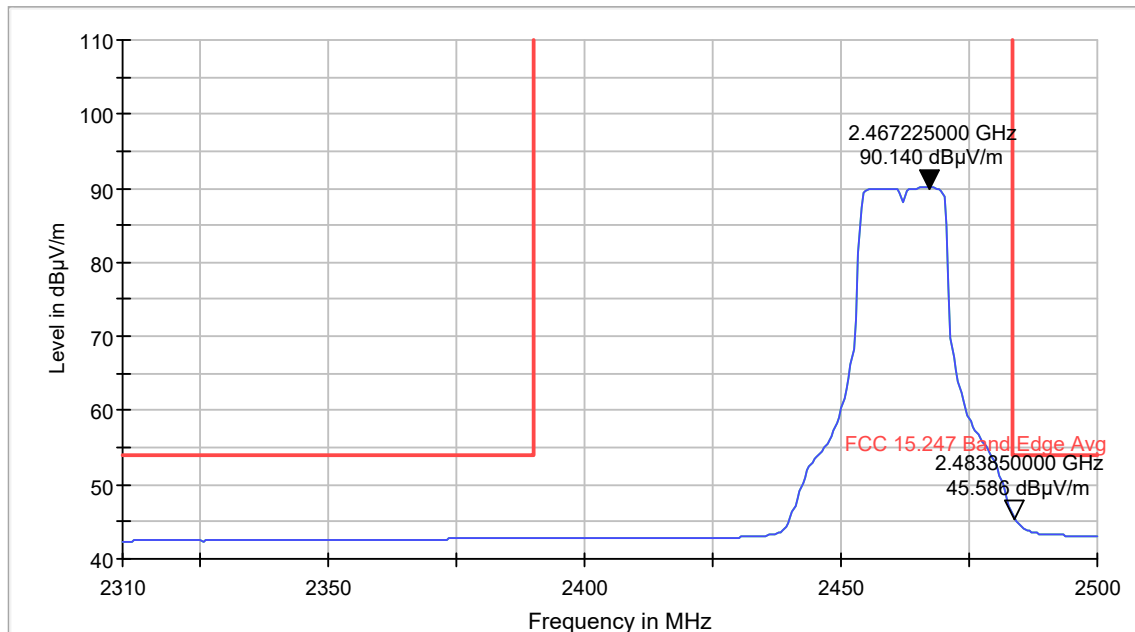
Plot 9-57 Radiated Band Edge Peak 802.11g - Ch.1 (2412 MHz)



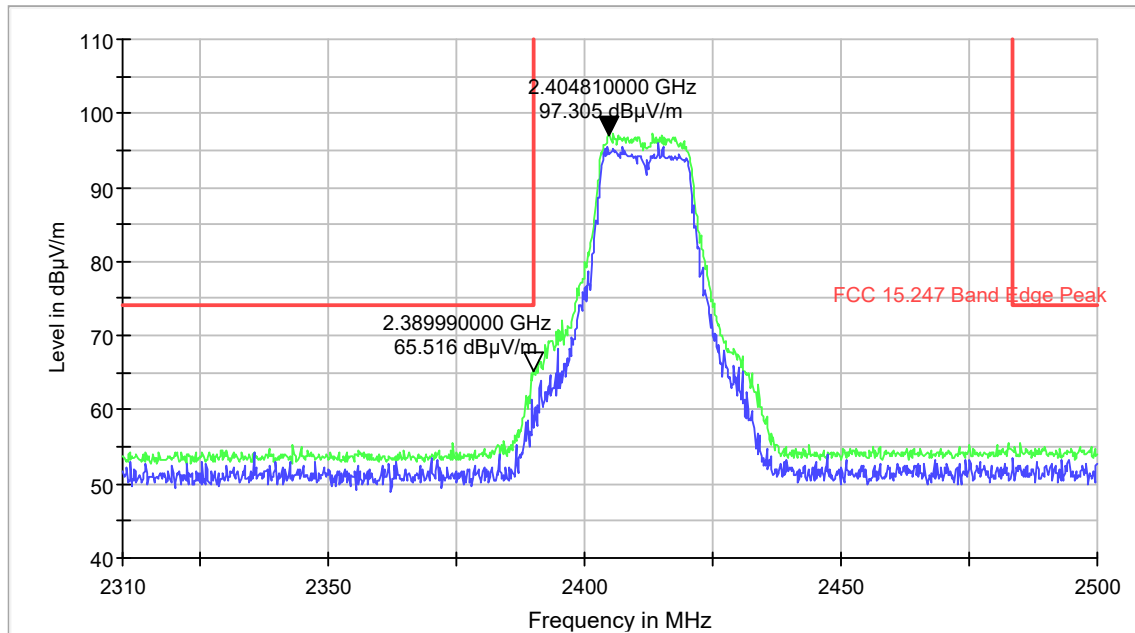
Plot 9-58 Radiated Band Edge Average 802.11g - Ch.1 (2412 MHz)



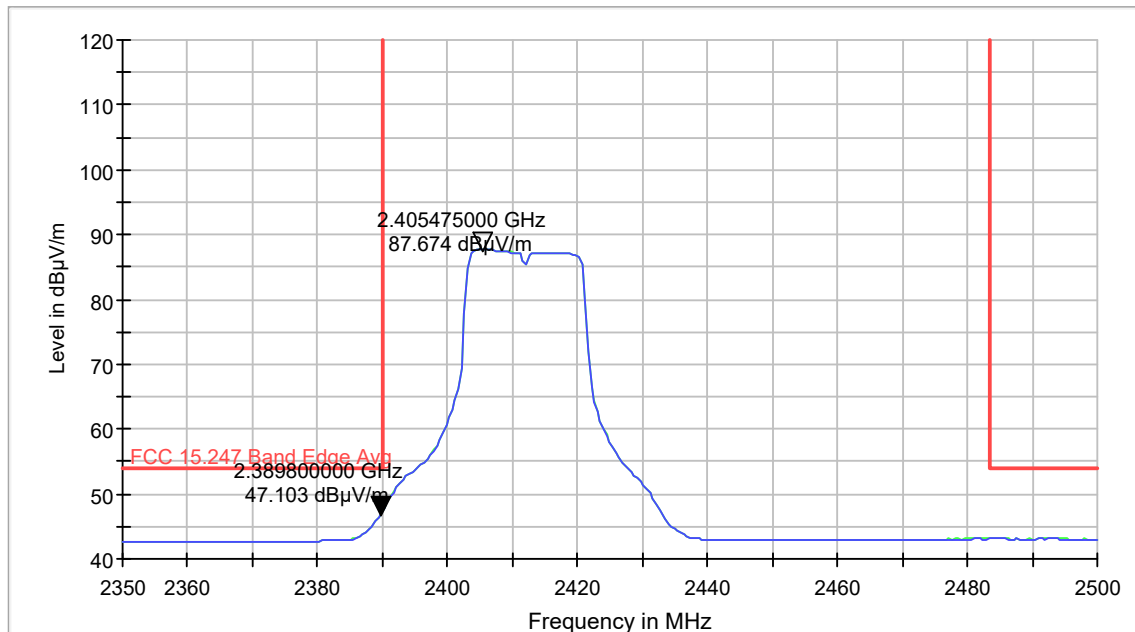
Plot 9-59 Radiated Band Edge Peak 802.11g - Ch.11 (2462 MHz)



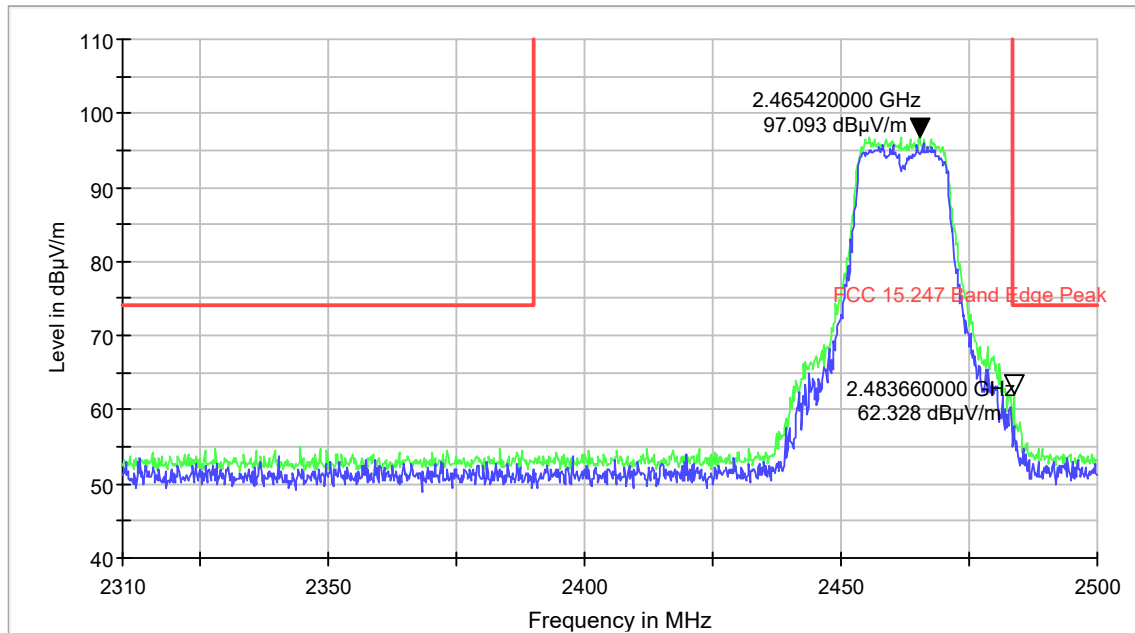
Plot 9-60 Radiated Band Edge Average 802.11g - Ch.11 (2462 MHz)



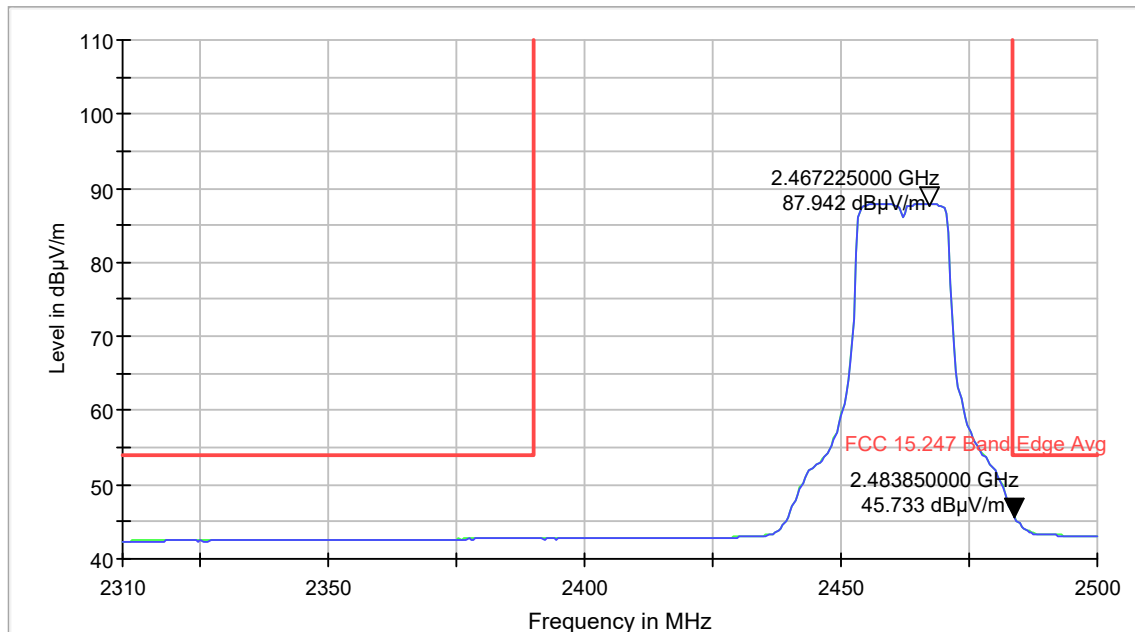
Plot 9-61 Radiated Band Edge Peak 802.11n - Ch.1 (2412 MHz)



Plot 9-62 Radiated Band Edge Average 802.11n - Ch.1 (2412 MHz)



Plot 9-63 Radiated Band Edge Peak 802.11n - Ch.11 (2462 MHz)



Plot 9-64 Radiated Band Edge Average 802.11n - Ch.11 (2462 MHz)

9.9 AC Line Conducted Emissions

9.9.1 Test Requirements

FCC CFR 47 Rule Part 15.207 (a)

Industry Canada RSS Gen [8.8]

9.9.2 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 $\geq 3 \times$ RBW

Trace Mode: Peak Detector (Max Hold).

Final measurements performed using Quasi-Peak and Average Detectors.

Span= 150 kHz – 30 MHz

Sweep time= Auto

9.9.3 Limit

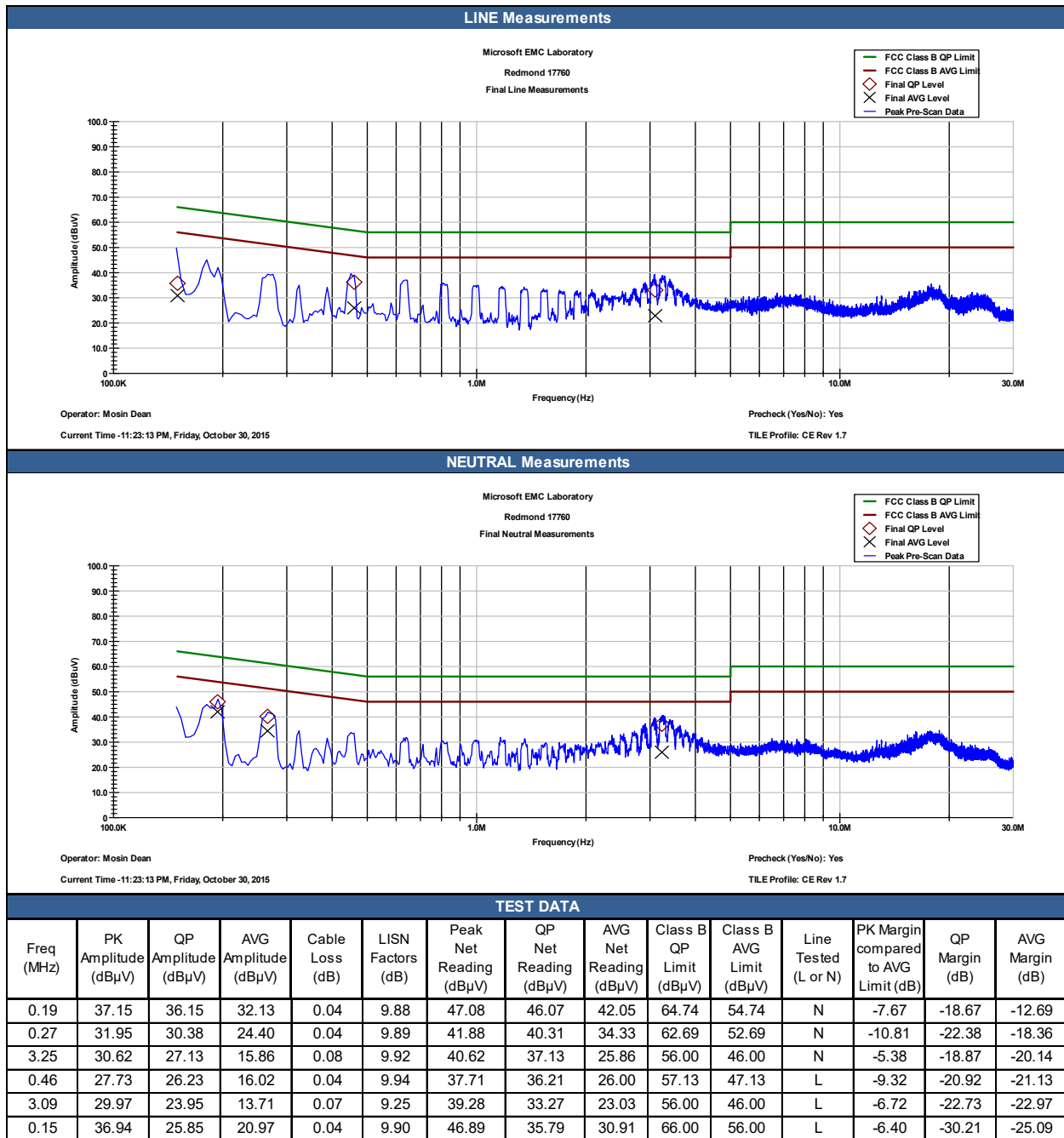
Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

9.9.4 Test Result:

Pass

9.9.5 Test Data:

CONDUCTED EMISSIONS TEST DATASHEET				
MICROSOFT EMC LAB Rev 2.1				
Model Number:	1770		Date:	10/30/2015
Serial Number:	EMC-444-102915-01, EMC-444-102915-02, EMC-444-102915-03, EMC-444-102915-04		Tested By:	Mosin Dean
Product Build Phase:	PV		Customer:	Chaitrali Limaye
Task #:	R209		Temperature (°C):	24.9
Scan:	1		Humidity(%RH):	46.7
Power:	120V AC/60Hz		Bar Pres. (kPa):	100.58
Test Site:	Redmond 17760 Rm 1310		Result:	Pass
TEST EQUIPMENT				
Description	ID	Model	Manufacturer	Calibration/Veridication Due
Analyzer/ Receiver:	EMC-669	ESR 3	Rhode & Schwarz	11/3/2015
EUT LISN:	EMC-057	NNB 51	Teseq	5/9/2016
AE LISN:	EMC-187	NNB 51	Teseq	9/25/2016
Cable:	EMC-367	UFA210A-1-1800-50U50U	Micro-Coax	8/6/2016
TILE Profile:	7.1.0.15	Rev 2.0	ETS-Lindgren	N/A
Environmental Monitor:	EMC-837	PRHTemp2000	Madge Tech	6/24/2016
TEST SPECIFICATIONS/TEST METHOD				
FCC 15.109(g)/ANSI C63.4:2009				
DEVIATION FROM TEST METHOD				
None.				
EUT OPERATING MODES / CONFIGS				
EUT Details: E-444-102915-01; M/N: 1770; S/N: 02990000583529 E-444-102915-02; M/N: 1770; S/N: 02990000133529 E-444-102915-03; M/N: 1770; S/N: 02990000293529 E-444-102915-04; M/N: 1770; S/N: 02990000723529				
EUT Software/ Firmware: FW: 2.0.2383.0				
Support Equipment/ Peripherals: Host; E-444-102915-20; S/N: 08340341022688251148 Host Sensor; E-444-102915-16; S/N: 087418733647 Host PSU; E-444-102915-13; M/N: A12-220P2A; S/N: 1C21Q037562333 Viewsonic External Monitor 27" 4k UHD; E-444-102915-19; M/N: VP2780-4K; S/N: U8K145200038 - connected via HDMI OUT port on console Headset; E-444-102915-07; S/N: P-DVA-427 Headset; E-444-102915-08; S/N: P-DVA-420 Headset; E-444-102915-09; S/N: P-DVA-400 Headset; E-444-102915-10 LG Blu-ray player; E-444-102915-17; M/N: BP730; S/N: 303INXJ376594 - connected via HDMI IN port on console IR Blaster; E-444-102915-18 - connected to console D-Link Router; M/N: E630; S/N: QBNM1C5000474 Test Control Laptop; S/N: PC-056TWP				
Test Software: Test.SRA app; used only to monitor controllers were transmitting button presses continuously via WLAN WLAN 2.4GHz (all 4 controllers wirelessly paired with xbox one console)				



End of Report