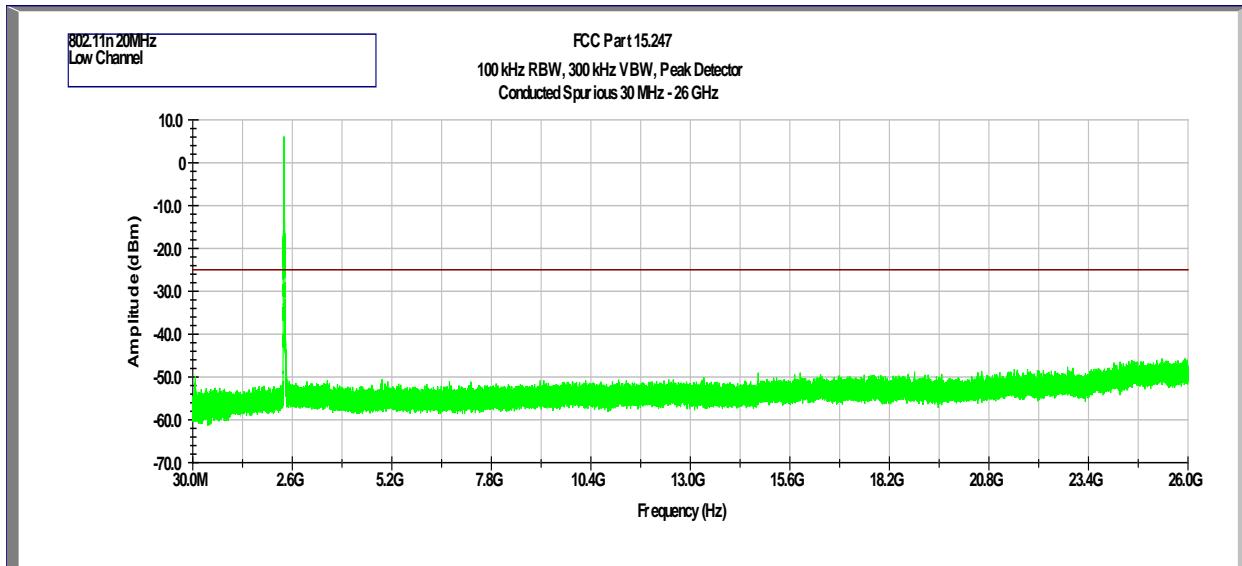
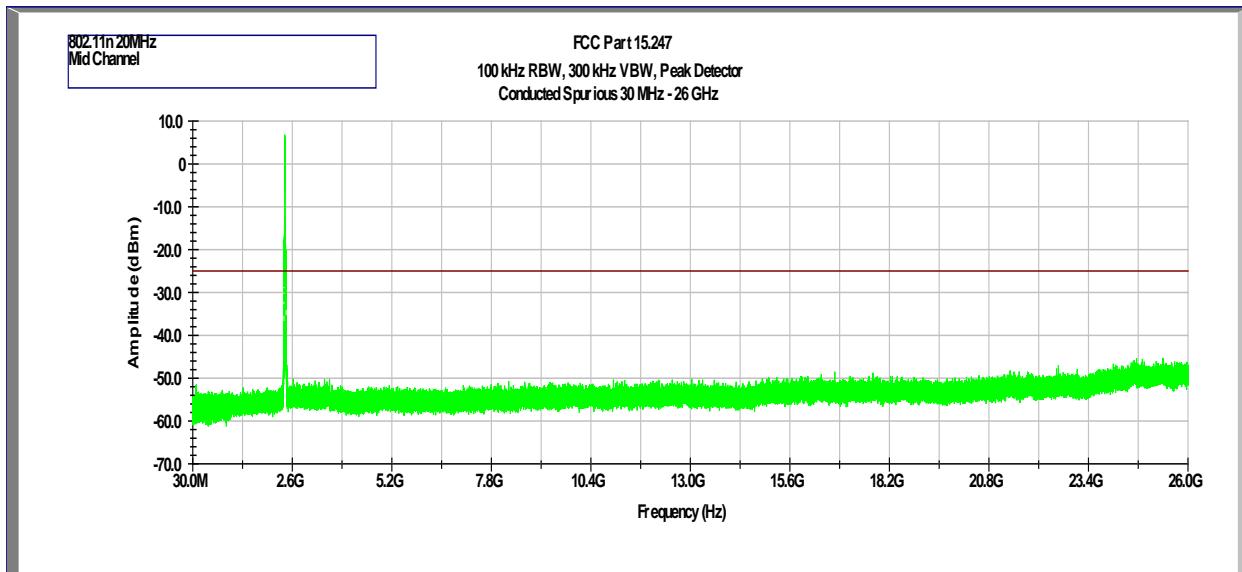


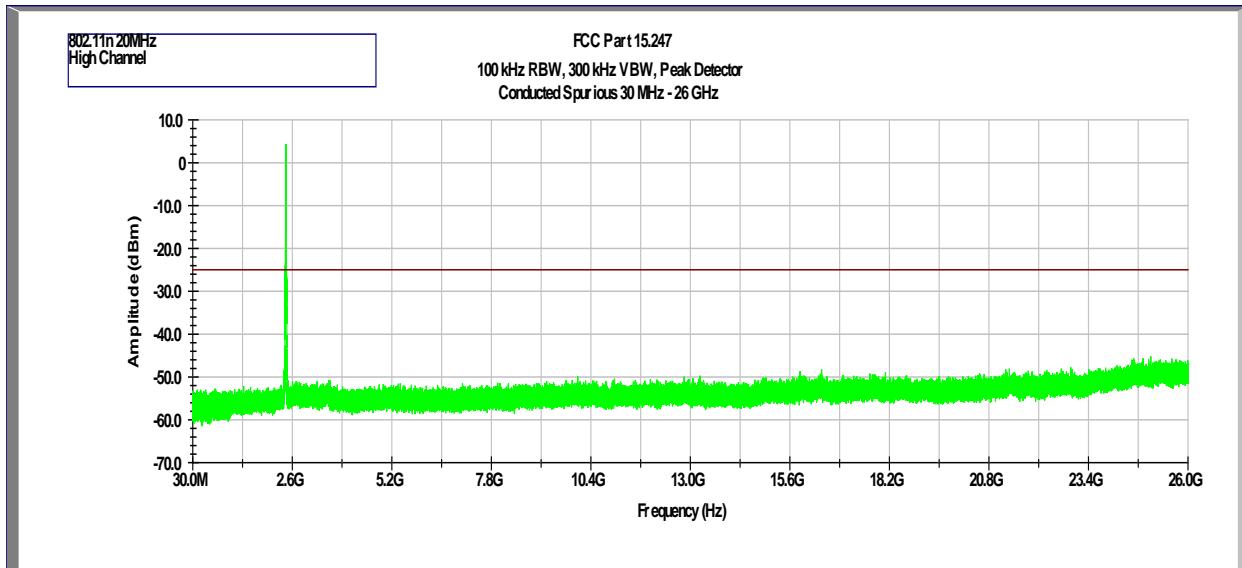
Plot 4.7  
Tx @ 2412MHz 802.11n, 20MHz



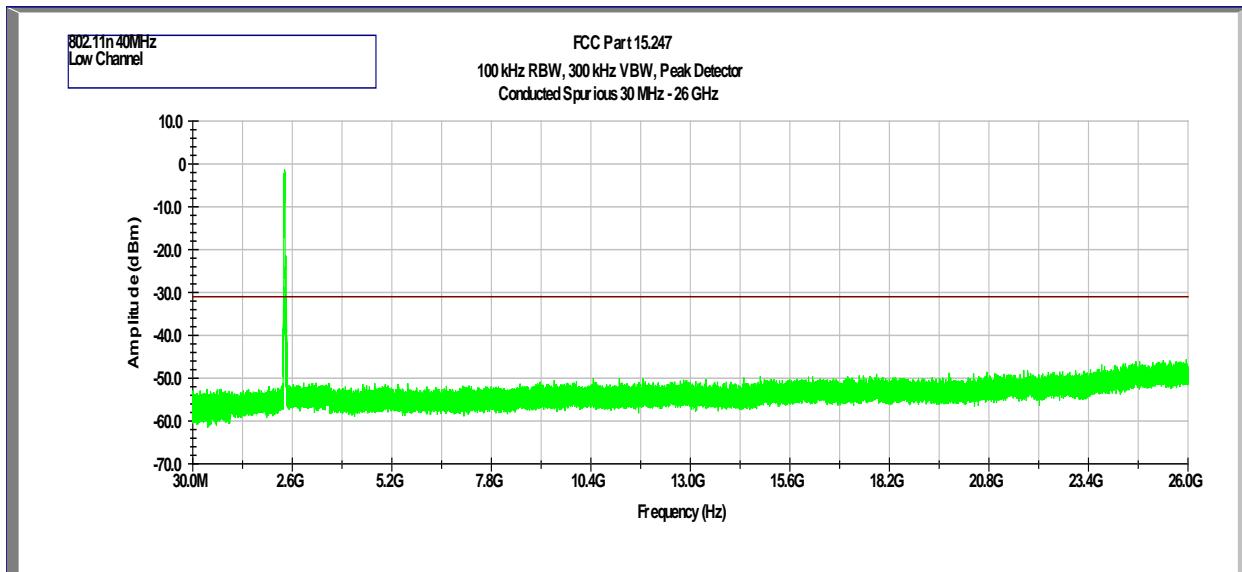
Plot 4.8  
Tx @ 2437MHz 802.11n, 20MHz



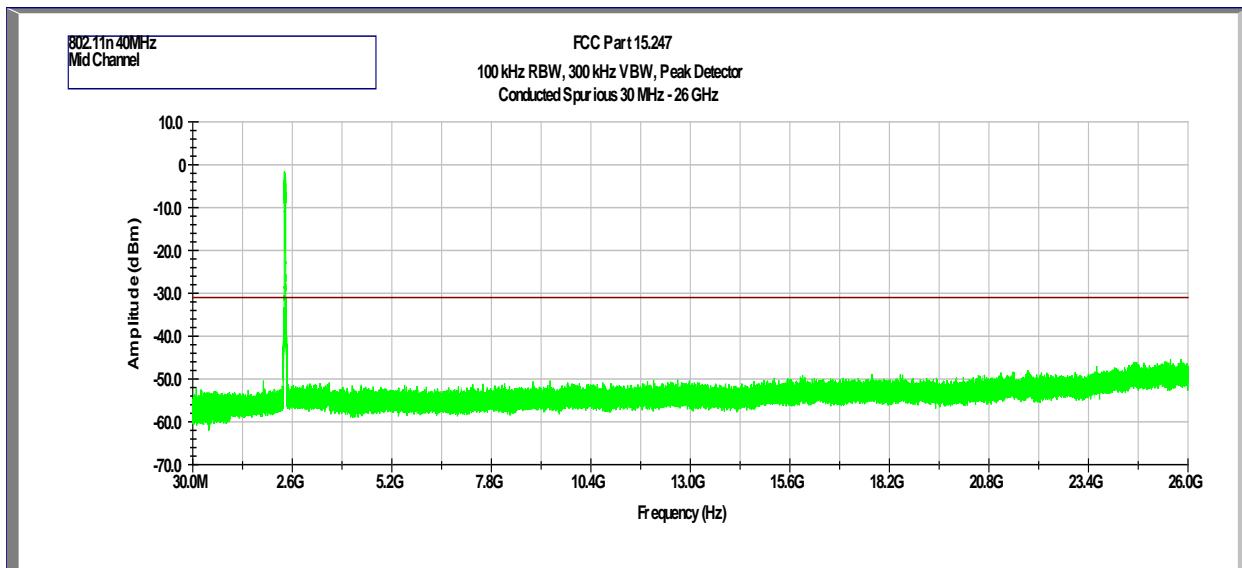
Plot 4.9  
Tx @ 2462MHz 802.11n, 20MHz



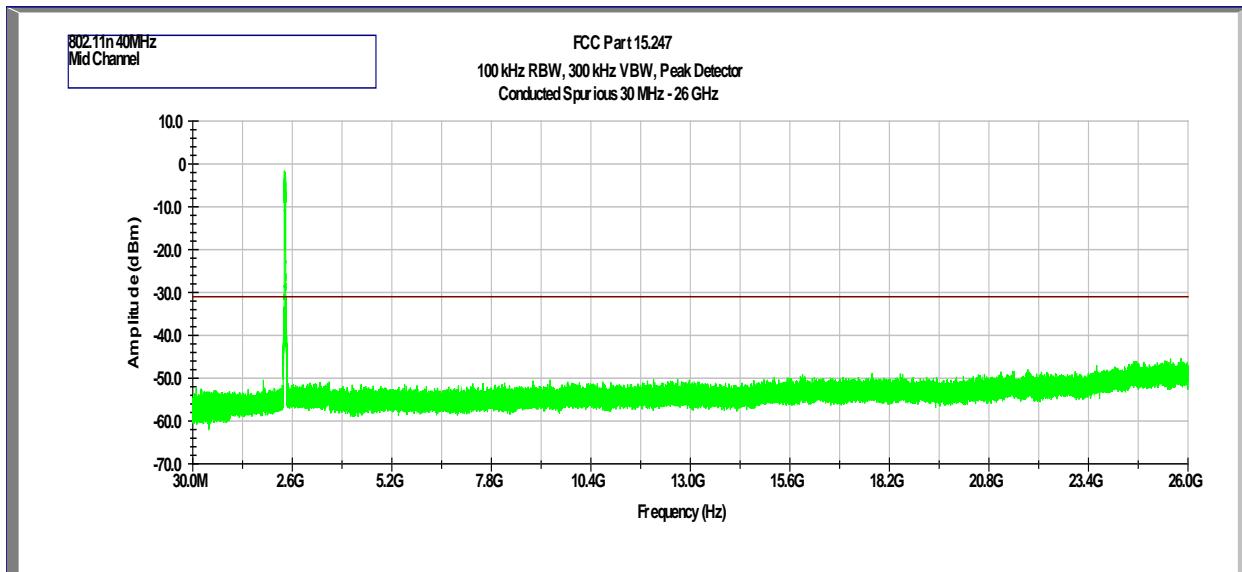
Plot 4.10  
Tx @ 2422MHz 802.11n, 40MHz



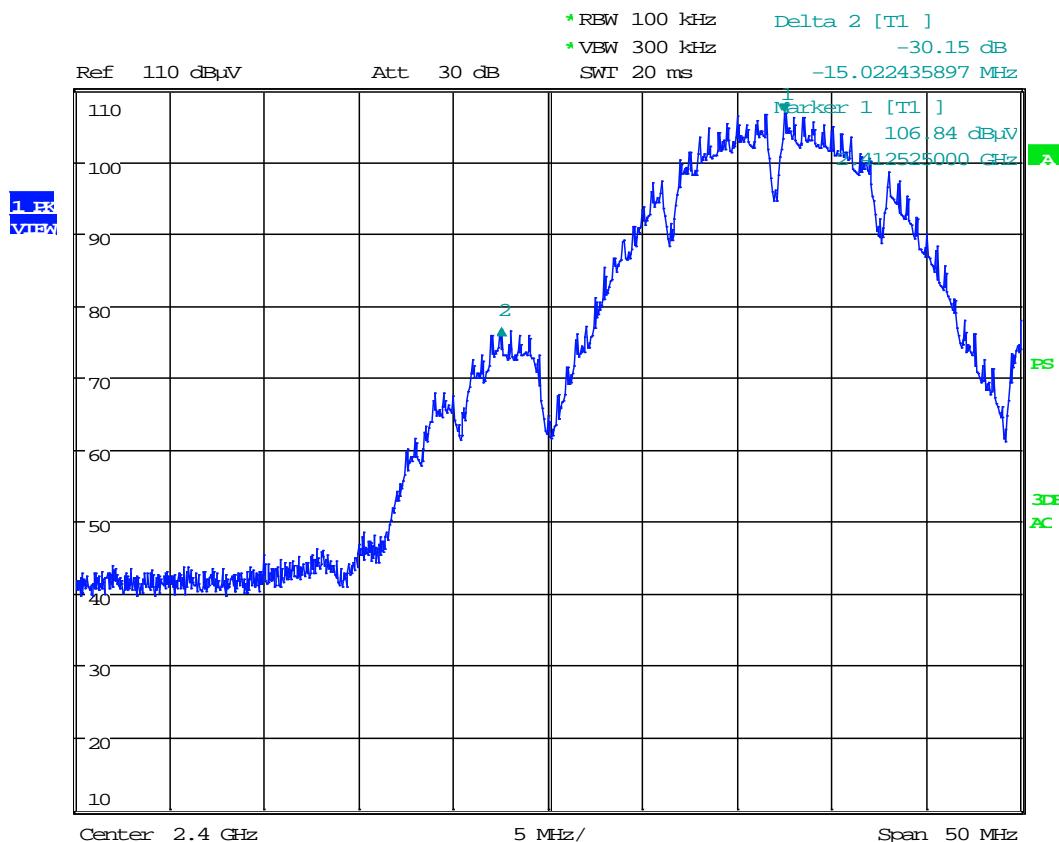
Plot 4.11  
Tx @ 2437MHz 802.11n, 40MHz



Plot 4.12  
Tx @ 2452MHz 802.11n, 40MHz

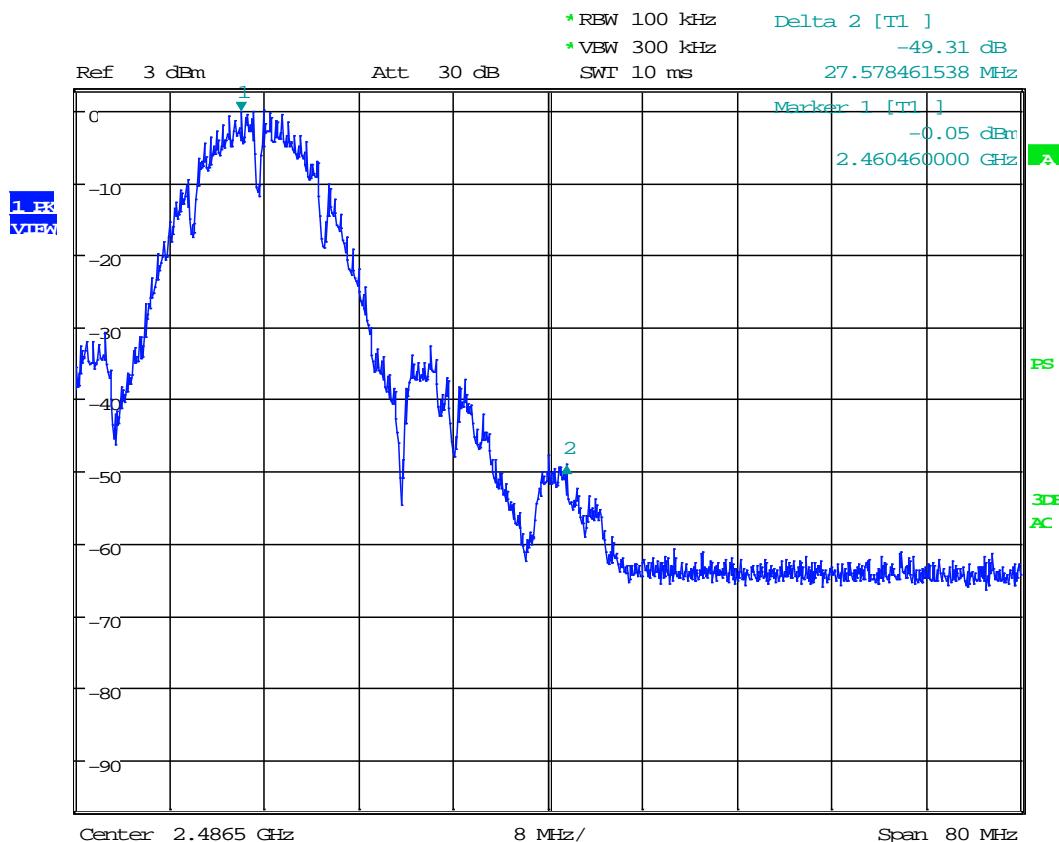


Plot 4.10  
Conducted Band Edge, Tx @ 2412MHz 802.11b



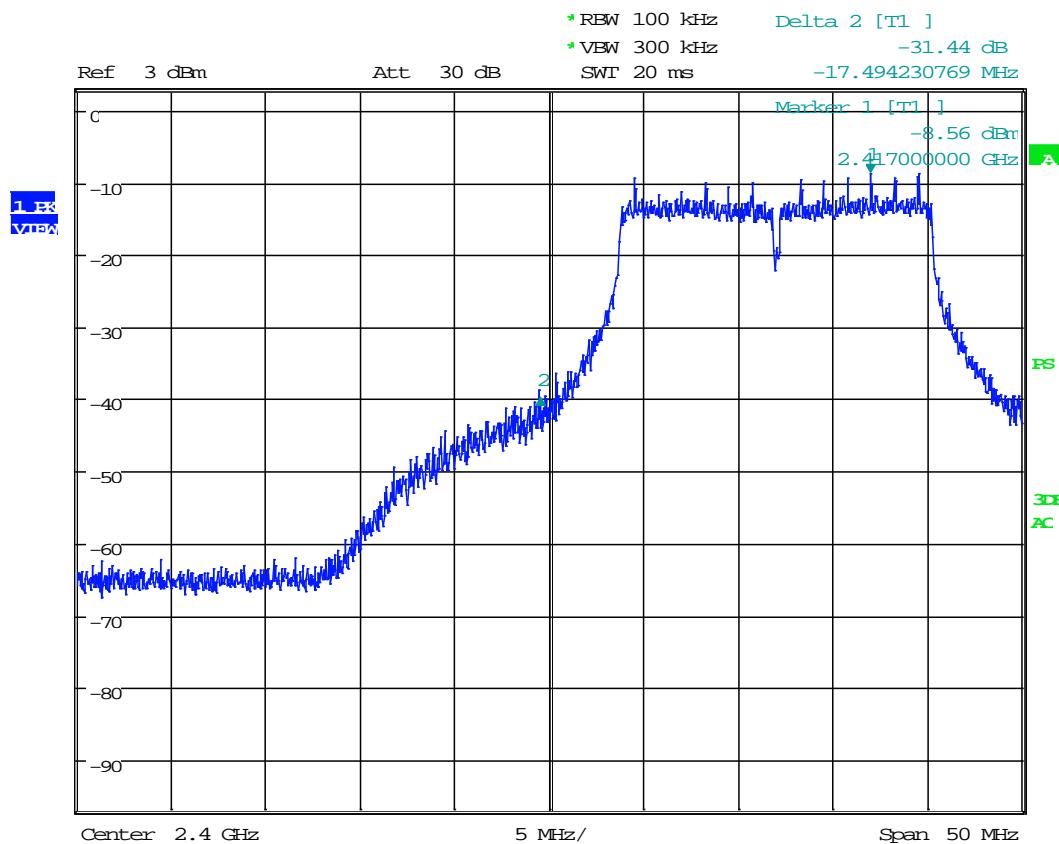
Date: 9.MAR.2016 19:00:04

Plot 4.11  
Conducted Band Edge, Tx @ 2462MHz 802.11b



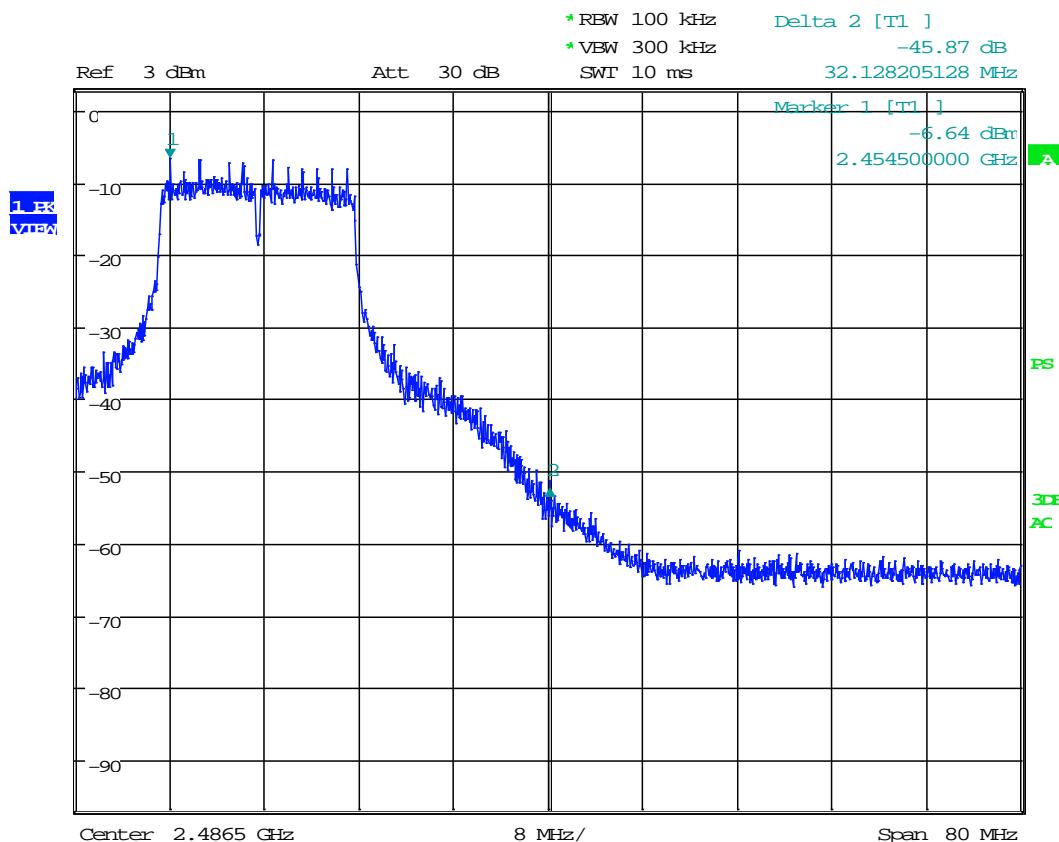
Date: 9.MAR.2016 19:09:49

Plot 4.12  
Conducted Band Edge, Tx @ 2412MHz 802.11g



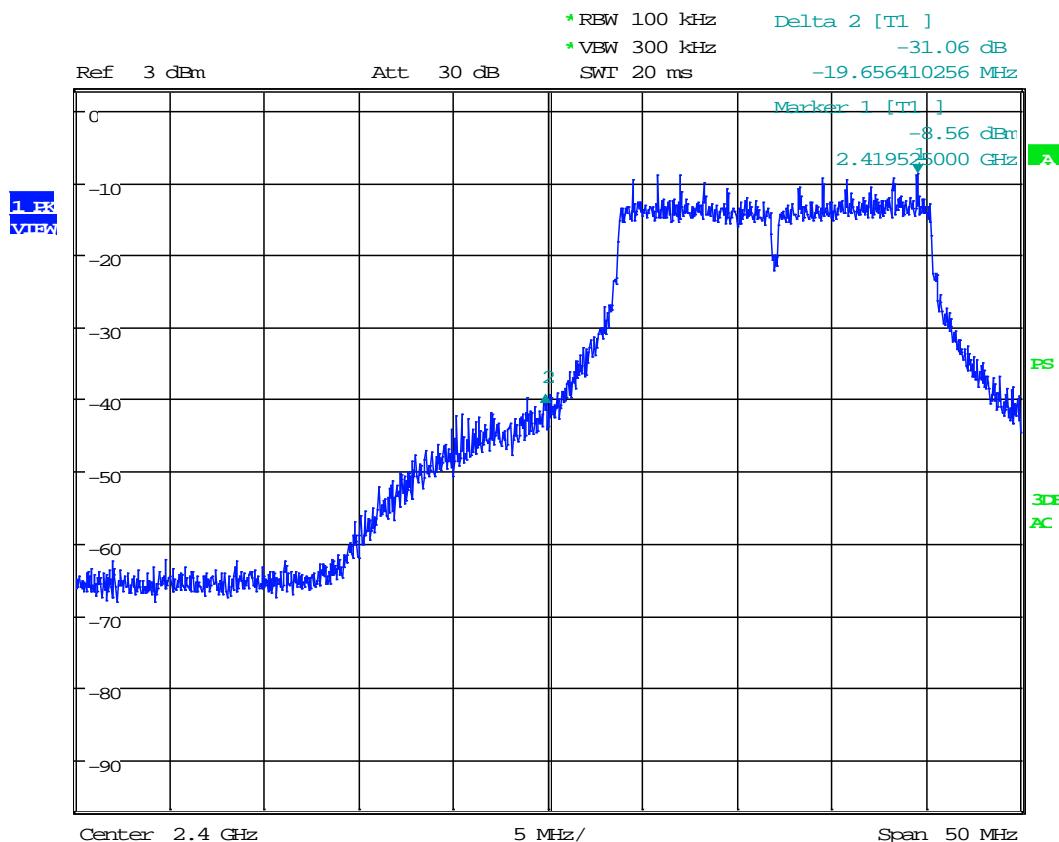
Date: 9.MAR.2016 19:05:11

Plot 4.13  
Conducted Band Edge, Tx @ 2462MHz 802.11g



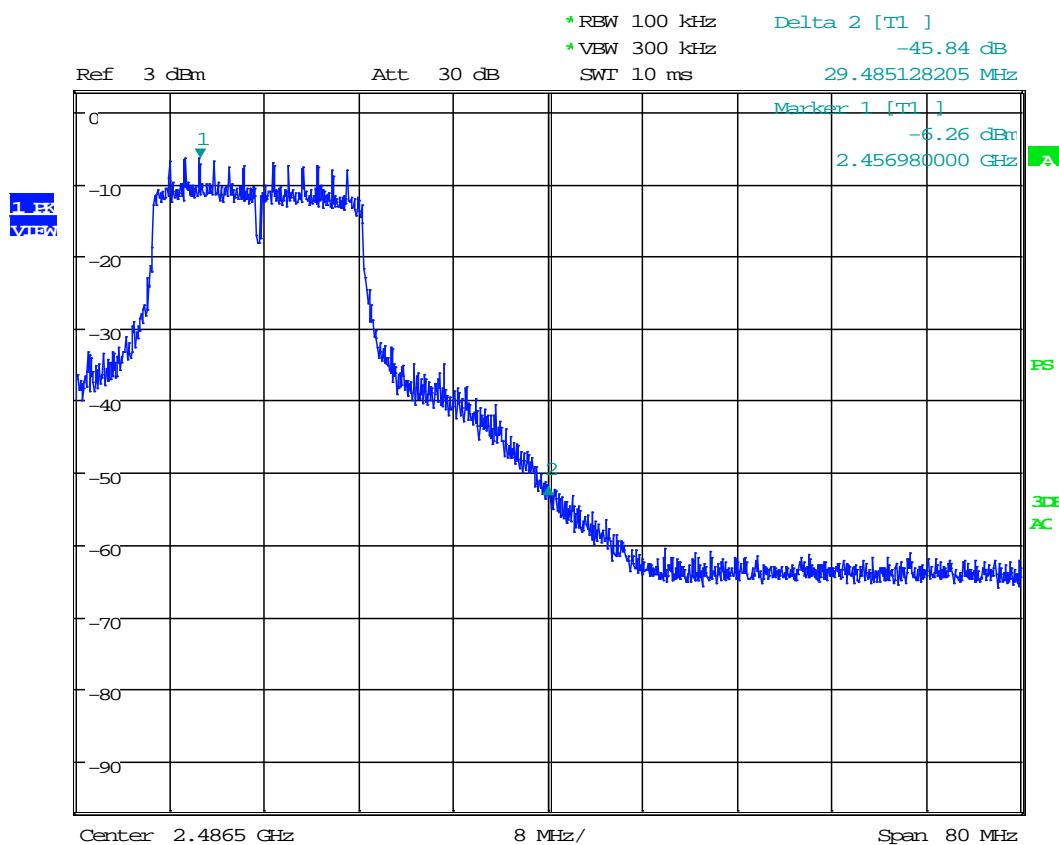
Date: 9.MAR.2016 19:10:49

Plot 4.14  
Conducted Band Edge, Tx @ 2412MHz 802.11n 20MHz



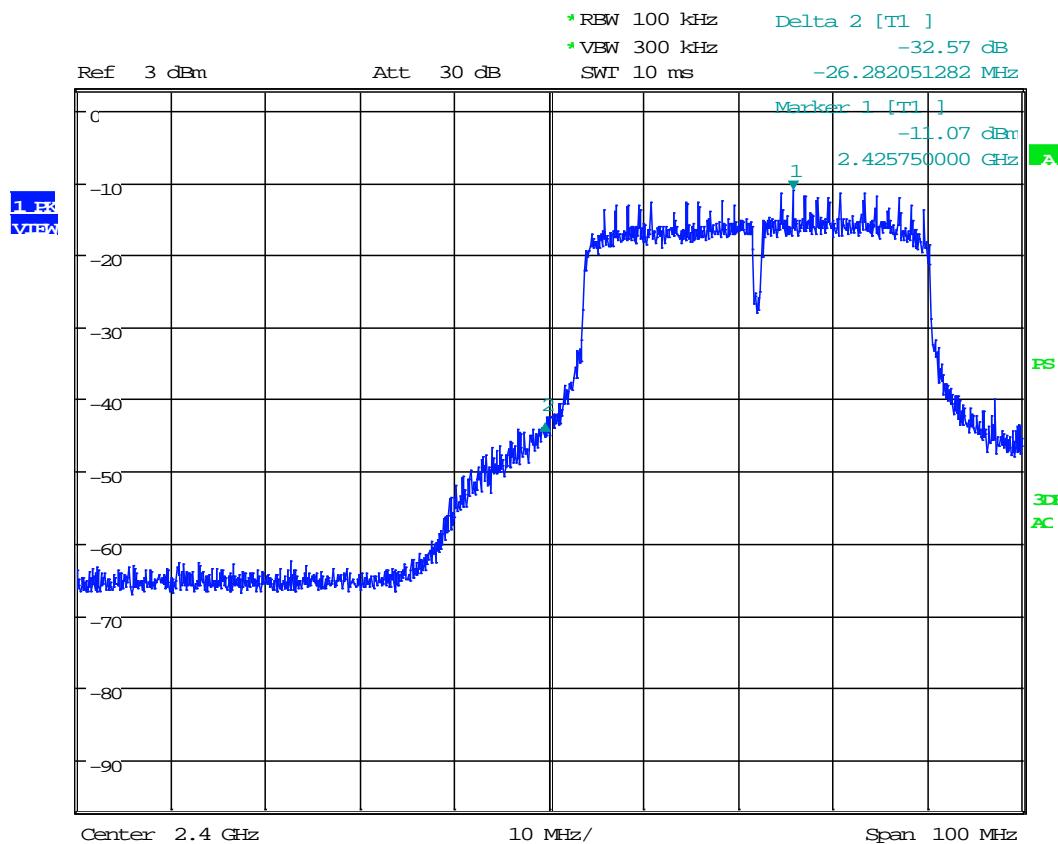
Date: 9.MAR.2016 19:05:58

Plot 4.15  
Conducted Band Edge, Tx @ 2462MHz 802.11n 20MHz



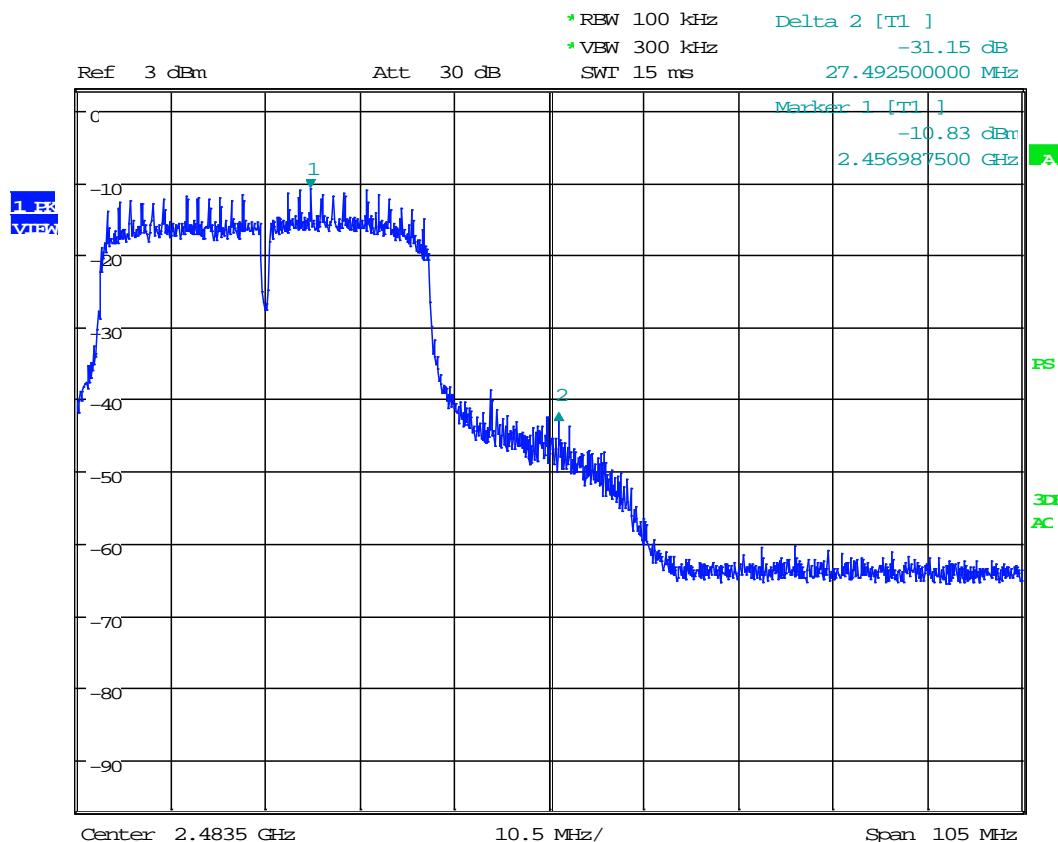
Date: 9.MAR.2016 19:11:35

Plot 4.16  
Conducted Band Edge, Tx @ 2412MHz 802.11n 40MHz



Date: 9.MAR.2016 19:07:35

Plot 4.17  
Conducted Band Edge, Tx @ 2462MHz 802.11n 40MHz



Date: 9.MAR.2016 19:08:34

#### 4.5 Transmitter Radiated Emissions & Antenna Port Emissions FCC Rule 15.247(d), 15.209, 15.205; RSS-247

##### 4.5.1 Requirement

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

For out of band radiated emissions (except for frequencies in restricted bands), in any 100 kHz bandwidths outside the EUT pass-band, the RF power shall be at least 20dB (peak) or 30 dB (average) below that of the maximum in-band 100 kHz emissions.

##### 4.5.2 Procedure – Radiated Emissions

Radiated emission measurements were performed from 30 MHz to 25 GHz according to the procedure described in ANSI C64.10. Spectrum Analyzer Resolution Bandwidth is 100 kHz or greater for frequencies 30 MHz to 1000 MHz, 1 MHz for frequencies above 1000 MHz. Above 1000 MHz Peak and Average measurements were performed.

The EUT is placed on a plastic turntable that is 80 cm in height for below 1000MHz and 1.5m in height for above 1GHz. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). During testing, all cables were manipulated to produce worst-case emissions. The signal is maximized through rotation. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at 3 meters for frequencies above 1 GHz and at 10 meters for frequencies below 1 GHz.

Measurements made from 1 GHz to 18GHz had a 2.4-2.5GHz notch filter in place. A preamp was used from 30MHz to 26GHz.

All measurements were made with a Peak Detector and compared to QP limits for 30MHz – 1GHz and Average limits for 1GHz – 26GHz.

Data is included of the worst-case configuration (the configuration which resulted in the highest emission levels).

#### 4.5.3 Field Strength Calculation

##### Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG; if measurement is performed at a distance other than specified in the rule, a Distance Correction Factor (DCF) shall be added.

Where FS = Field Strength in dB( $\mu$ V/m)

RA = Receiver Amplitude (including preamplifier) in dB( $\mu$ V); AF = Antenna Factor in dB(1/m)

CF = Cable Attenuation Factor in dB; AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB( $\mu$ V) is obtained. The antennas factor of 7.4 dB(1/m) and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving field strength of 32 dB( $\mu$ V/m). This value in dB( $\mu$ V/m) was converted to its corresponding level in  $\mu$ V/m.

RA = 52.0 dB( $\mu$ V)

AF = 7.4 dB(1/m)

CF = 1.6 dB

AG = 29.0 dB

$$FS = 52.0 + 7.4 + 1.6 - 29.0 = 32 \text{ dB}(\mu\text{V}/\text{m}).$$

Level in  $\mu$ V/m = Common Antilogarithm  $[(32 \text{ dB}\mu\text{V}/\text{m})/20] = 39.8 \mu\text{V}/\text{m}$ .

Test Date:	February 4-5 & 7, 2016
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#### 4.5.4 Antenna-port conducted measurements

Antenna-port conducted measurements may also be used as an alternative to radiated measurements for demonstrating compliance in the restricted frequency bands. If conducted measurements are performed, then proper impedance matching must be ensured and an additional radiated test for cabinet/case spurious emissions is required.

#### 4.5.6 General Procedure for conducted measurements in restricted bands

- a) Measure the conducted output power (in dBm) using the detector specified for determining quasi-peak, peak, and average conducted output power, respectively.
- b) Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
- c) Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies  $\leq$  30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies  $>$  1000 MHz).
- d) For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (*e.g.*, Watts, mW).
- e) Convert the resultant EIRP level to an equivalent electric field strength using the following relationship:  
$$E = EIRP - 20\log D + 104.8$$
where:  
E = electric field strength in dB $\mu$ V/m,  
EIRP = equivalent isotropic radiated power in dBm  
D = specified measurement distance in meters.
- f) Compare the resultant electric field strength level to the applicable limit.
- g) Perform radiated spurious emission test

#### 4.5.7 Test Results

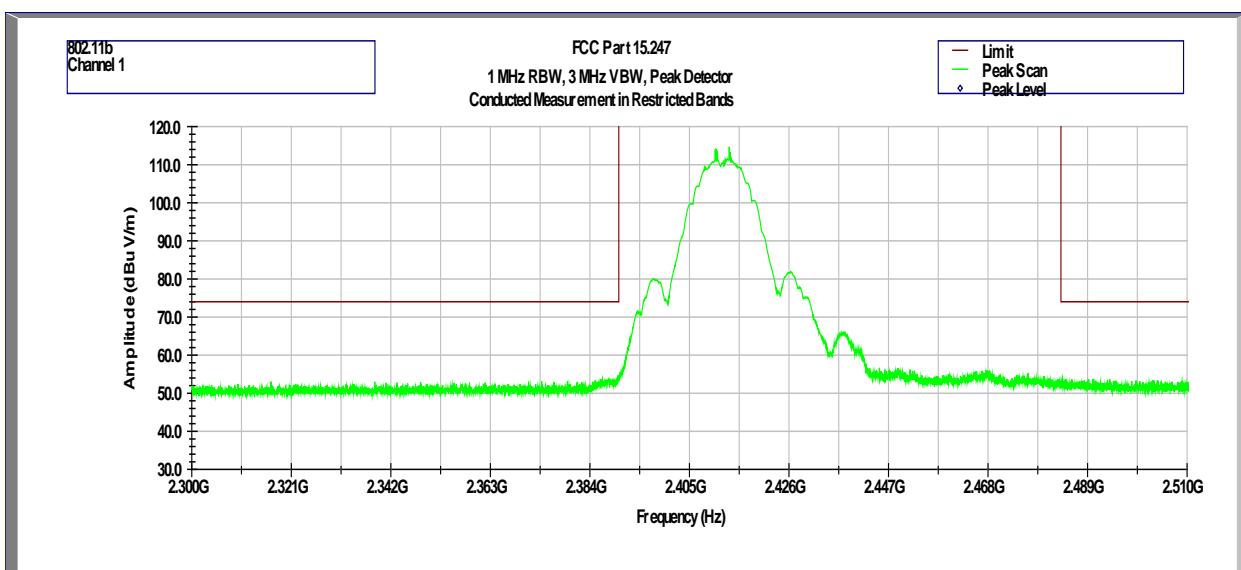
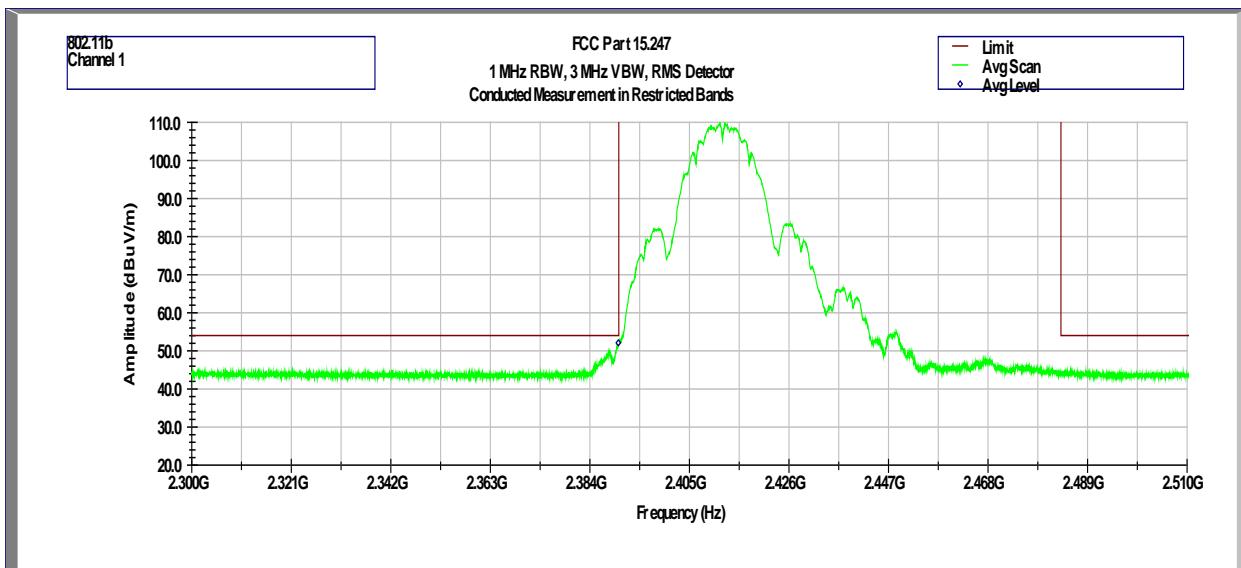
The data on the following pages list the significant emission frequencies, the limit and the margin of compliance where emissions are within 3dB of the limit.

The maximum antenna gain used by the EUT is 1.76 dBi in the 2.4GHz range. As per KDB 558074, the minimum antenna gain for calculating out of band emissions shall be no less than 2.0 dBi. All conducted antenna port plots are corrected with the consideration of a 2.0 dBi Antenna Gain. See KDB 558074 section 12.2.6 for more details.

Radiated emission measurements were performed up to 26GHz. No Emissions were identified when scanned from 18-25 GHz.

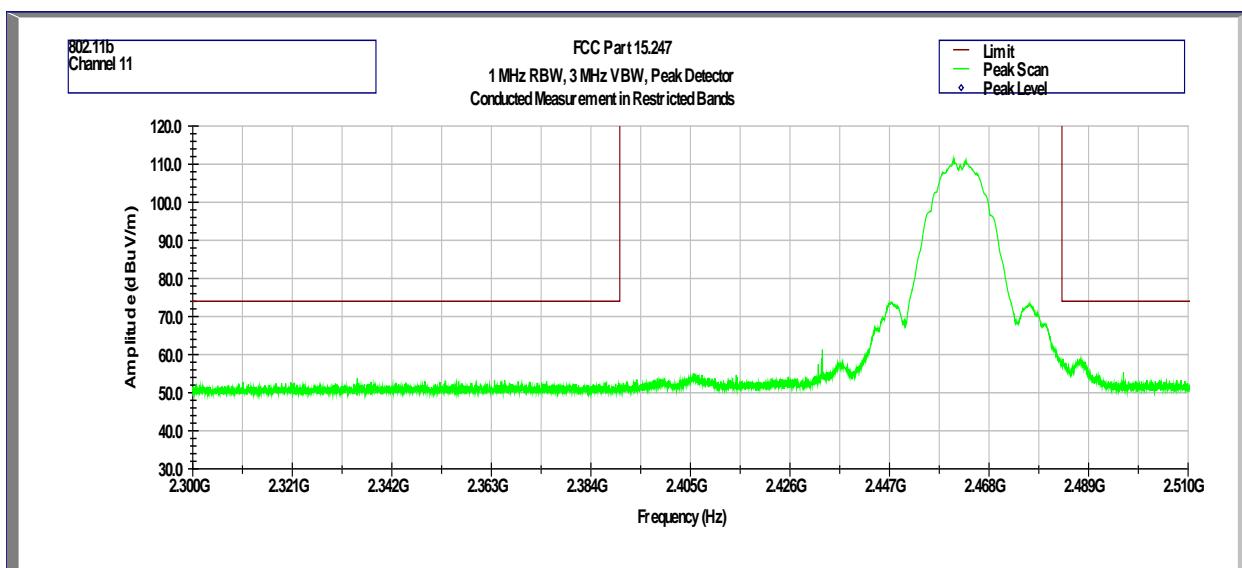
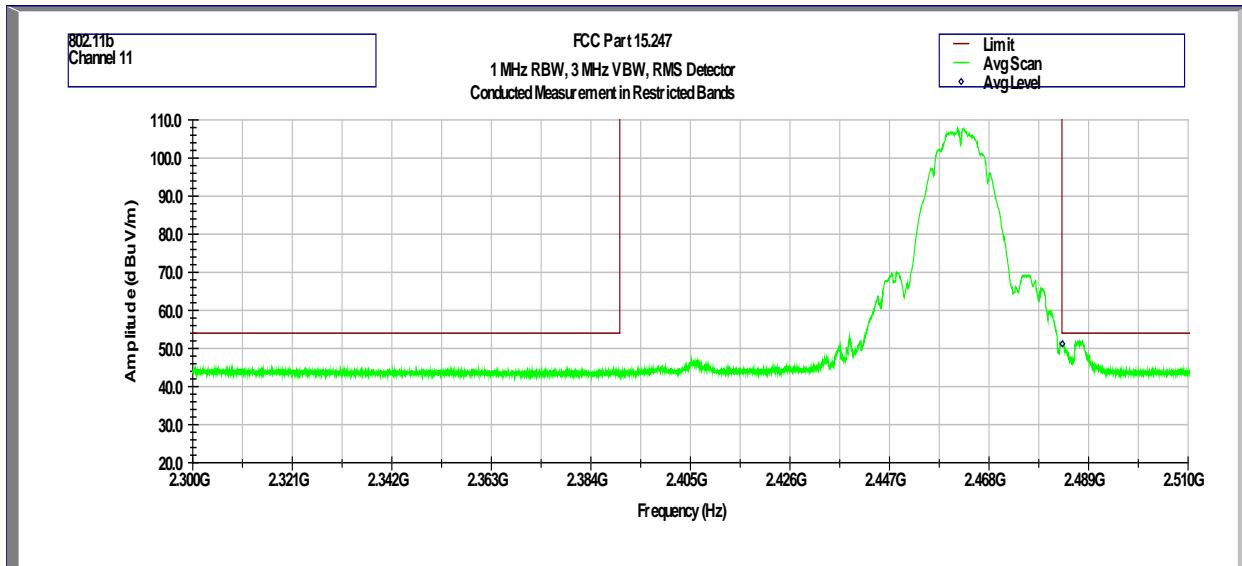
## Test Results: 15.209/15.205 Restricted Band Emissions at Antenna Port

### Out-of-Band Spurious Emissions at the Band Edge - 802.11b, 2412 MHz



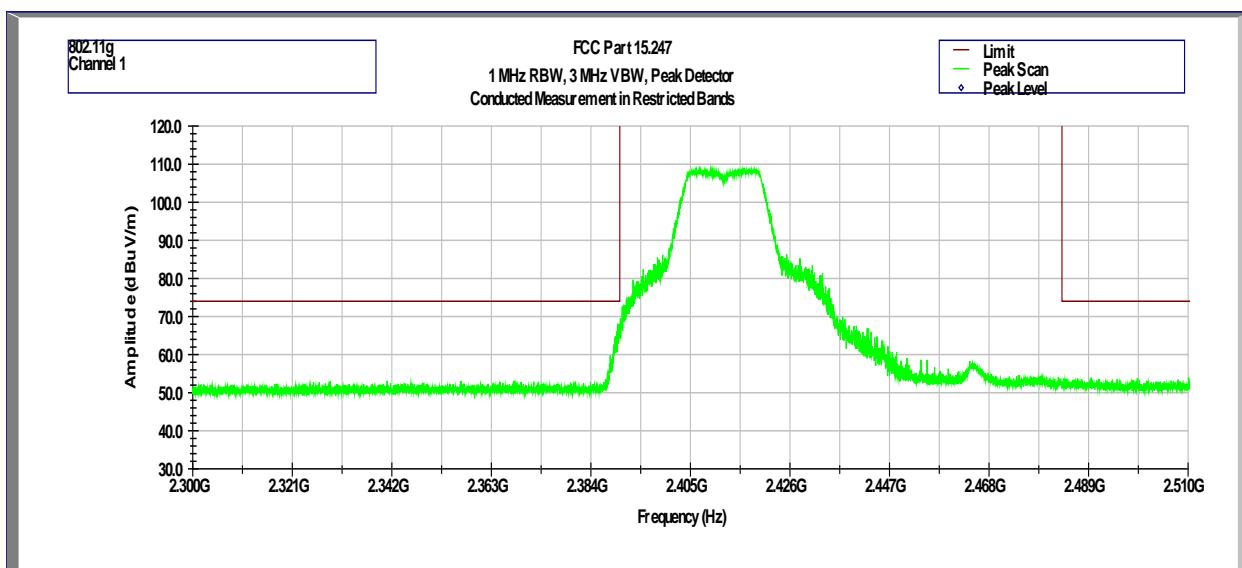
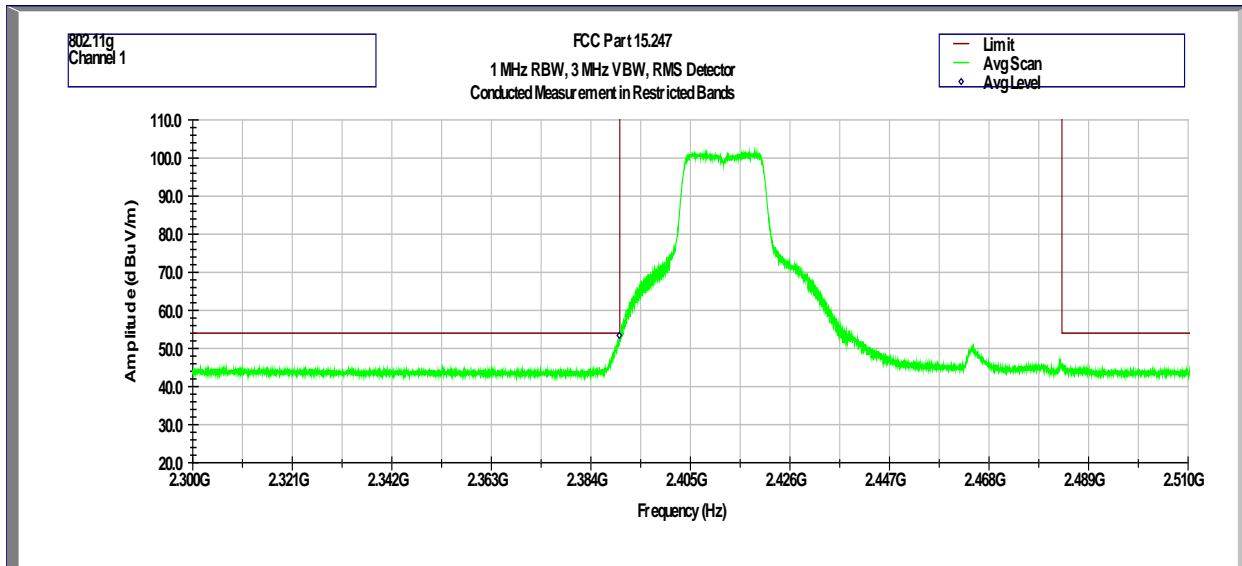
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB $\mu$ V/m	dB $\mu$ V/m	dB		
2.390	52.1	54	-1.9	Avg	Pass

### Out-of-Band Spurious Emissions at the Band Edge - 802.11b, 2462 MHz



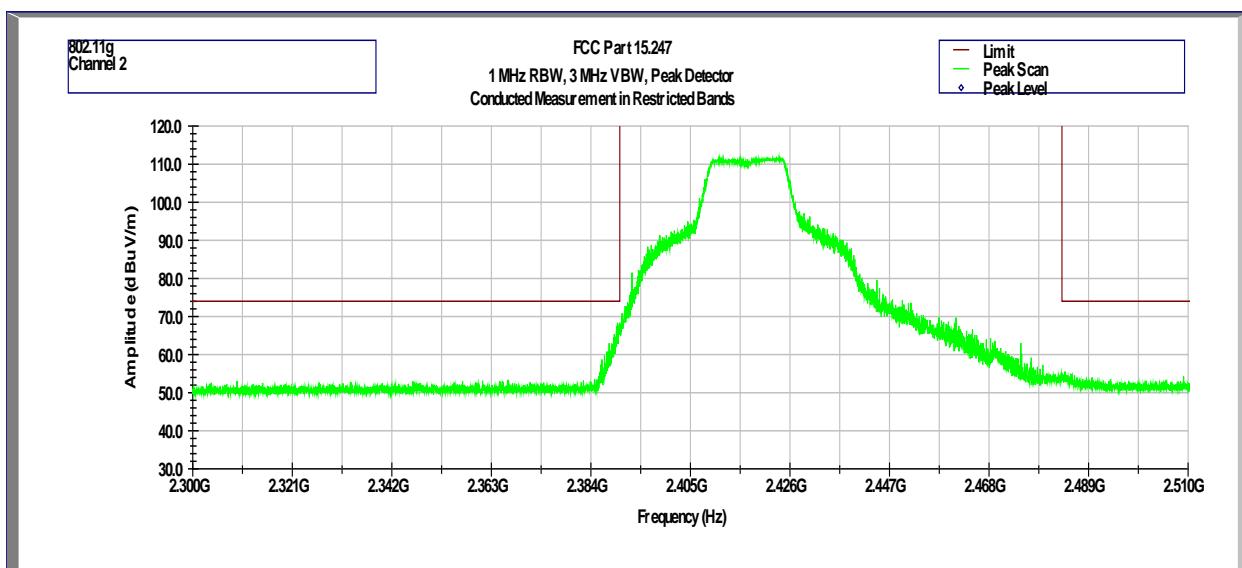
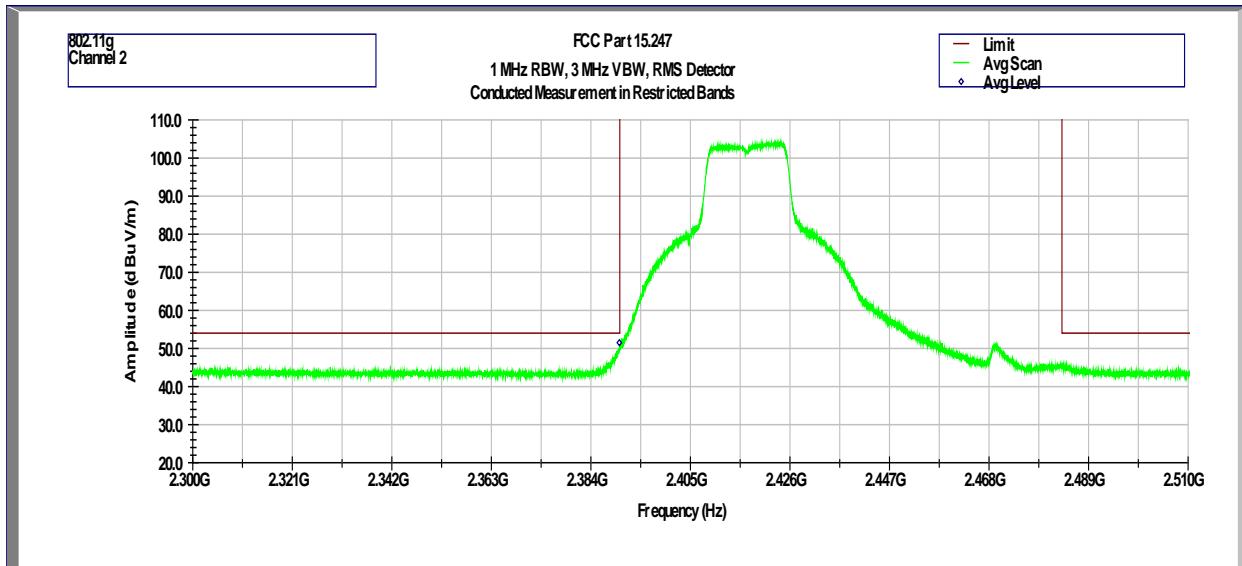
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB $\mu$ V/m	dB $\mu$ V/m	dB	Avg	Pass
2.4835	51.2	54	-2.8	Avg	Pass

### Out-of-Band Spurious Emissions at the Band Edge - 802.11g, 2412 MHz



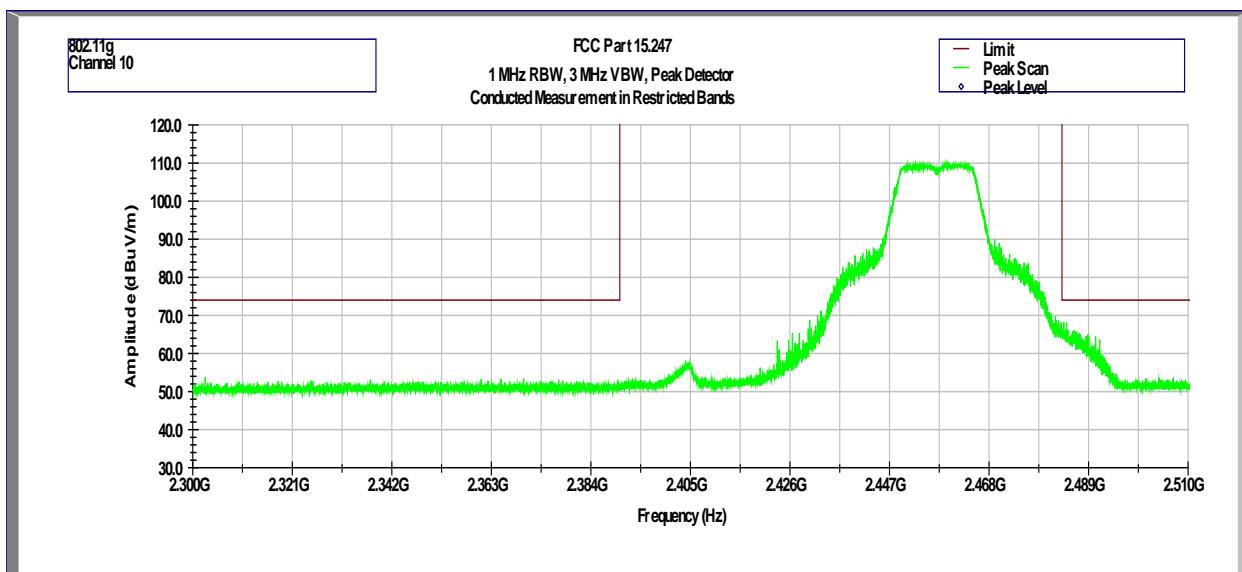
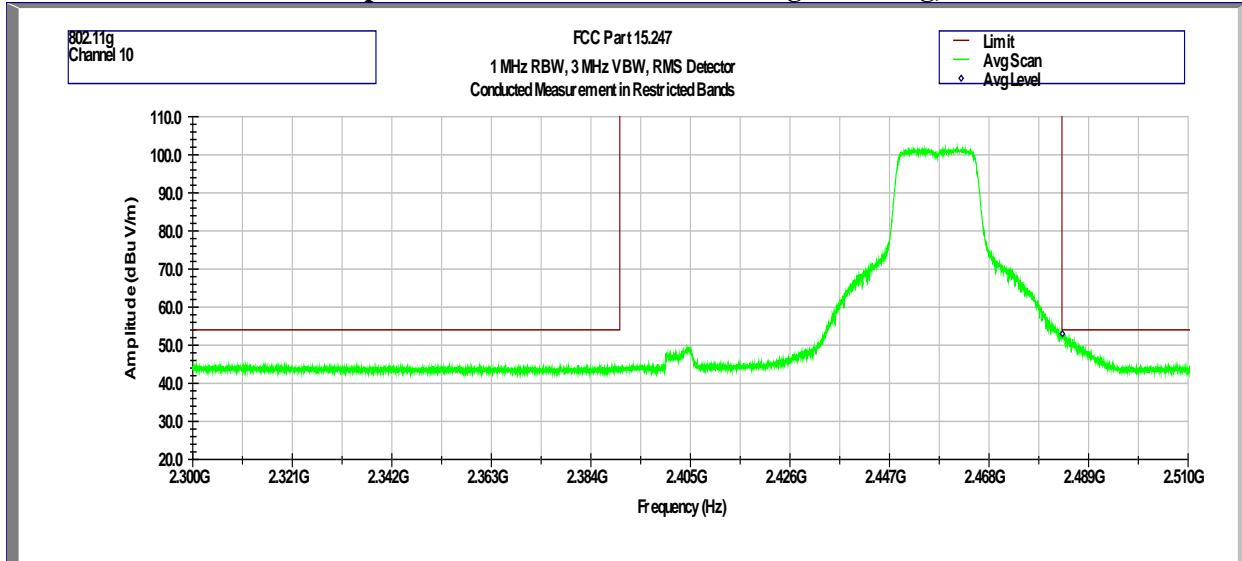
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB $\mu$ V/m	dB $\mu$ V/m	dB		
2.390	53.4	54	-0.6	Avg	Pass

### Out-of-Band Spurious Emissions at the Band Edge - 802.11g, 2417 MHz



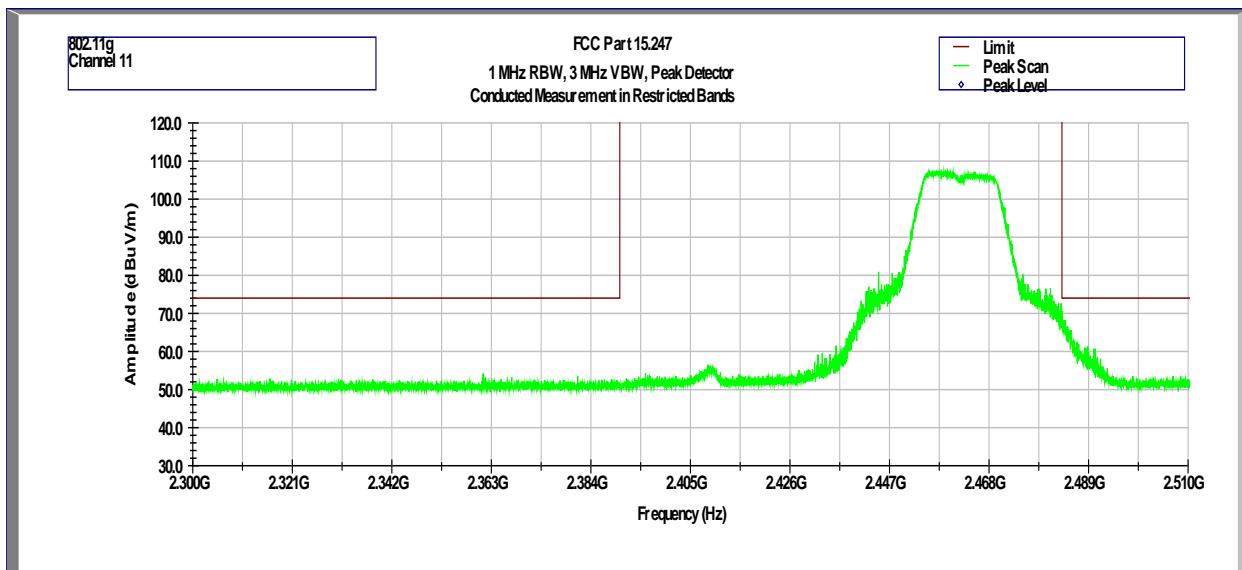
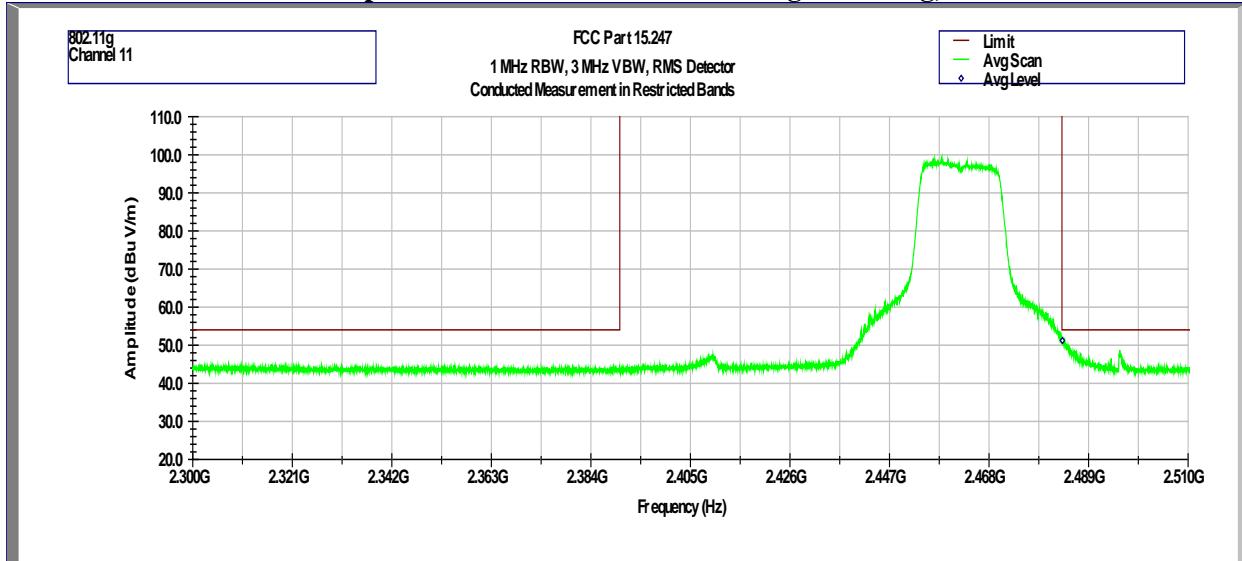
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB $\mu$ V/m	dB $\mu$ V/m	dB		
2.390	51.5	54	-2.5	Avg	Pass

### Out-of-Band Spurious Emissions at the Band Edge - 802.11g, 2457 MHz



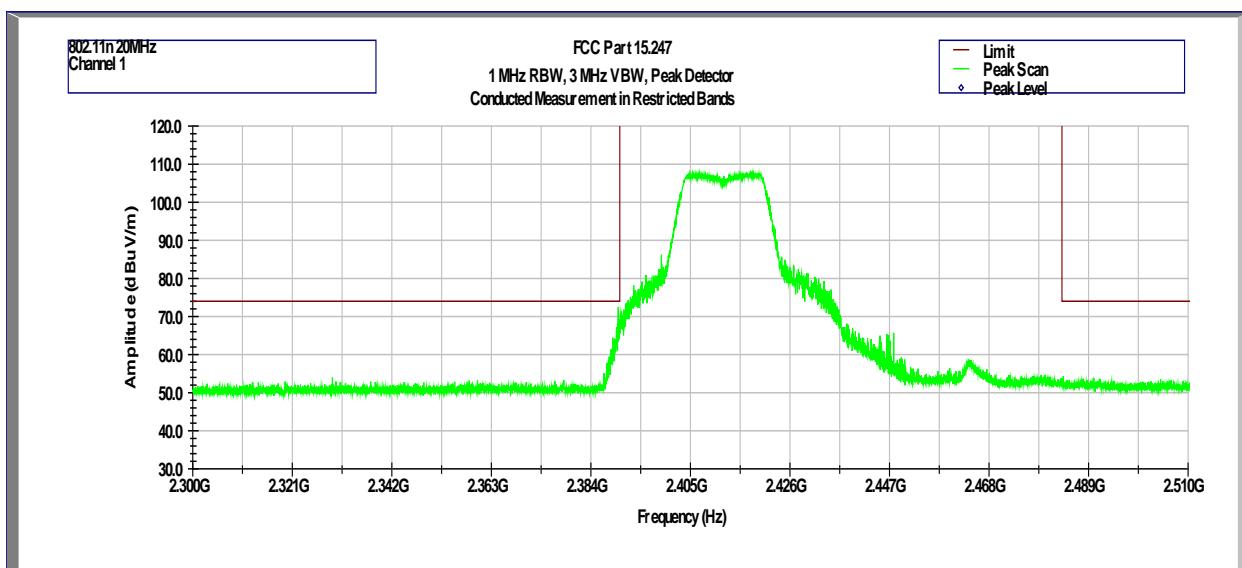
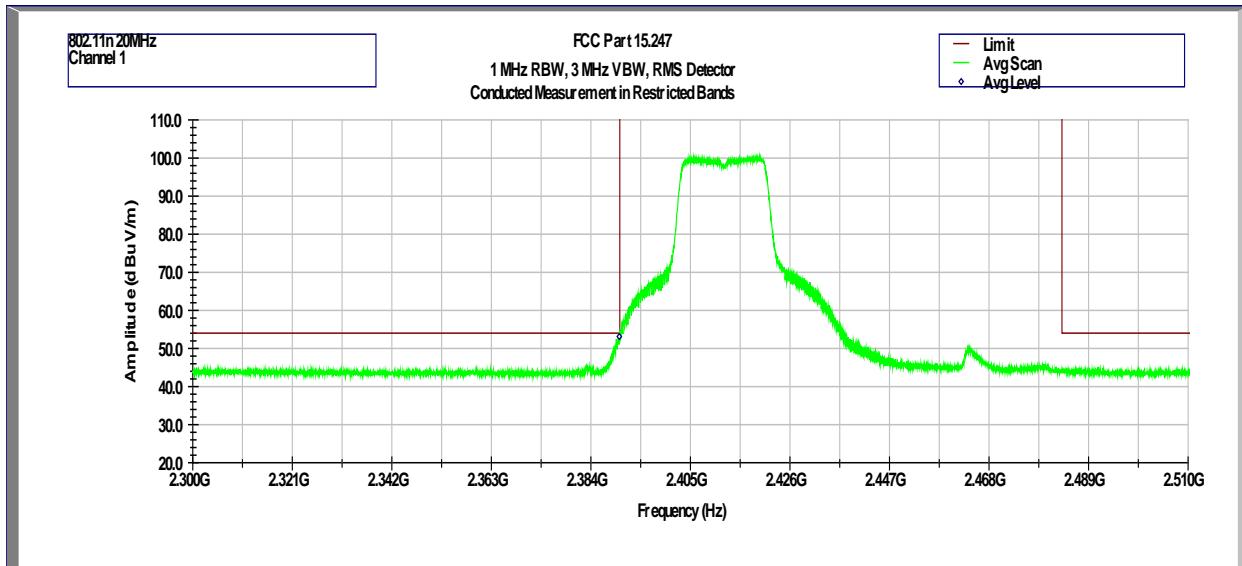
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
	GHz	dB $\mu$ V/m	dB		
2.4835	53.0	54	-1.0	Avg	Pass

### Out-of-Band Spurious Emissions at the Band Edge - 802.11g, 2462 MHz



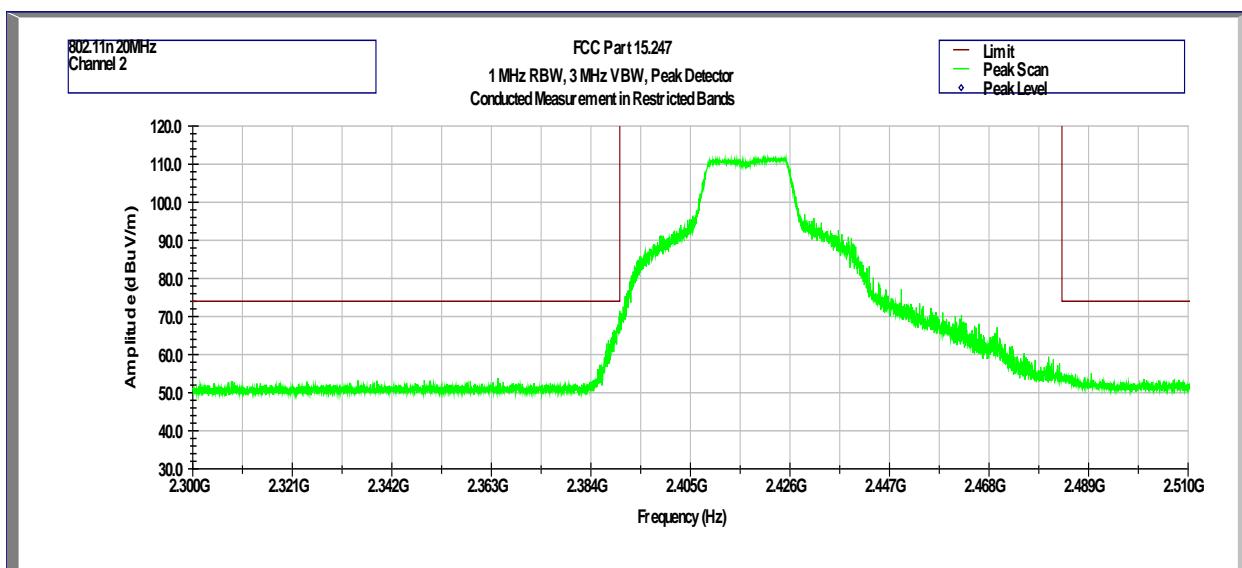
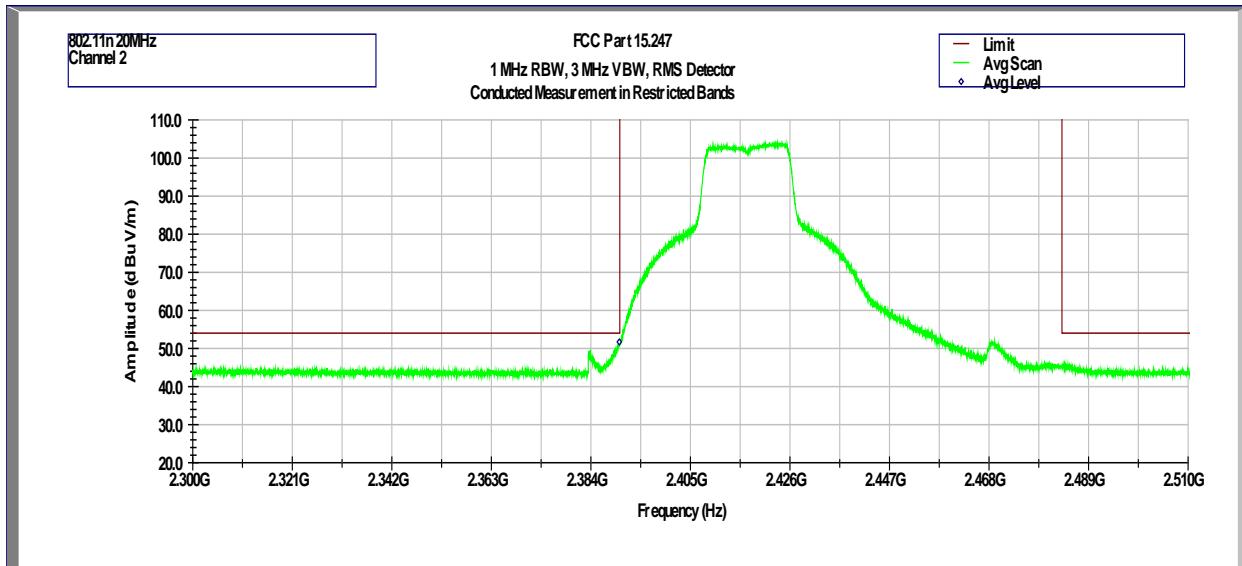
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB $\mu$ V/m	dB $\mu$ V/m	dB		
2.4835	51.2	54	-2.8	Avg	Pass

### Out-of-Band Spurious Emissions at the Band Edge - 802.11n, 20MHz 2412 MHz



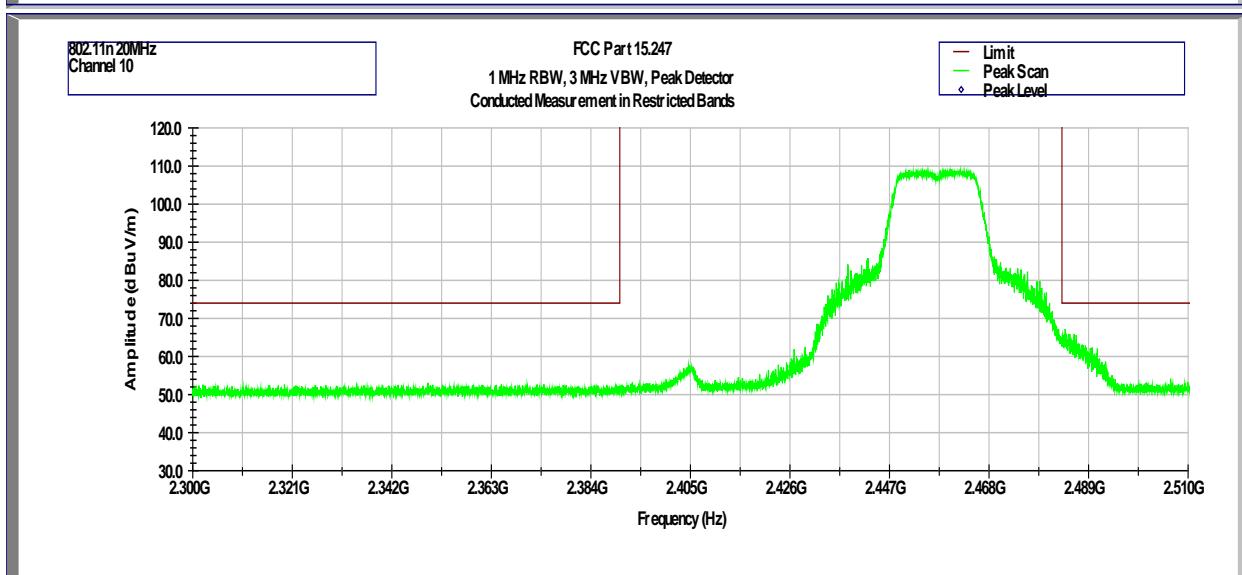
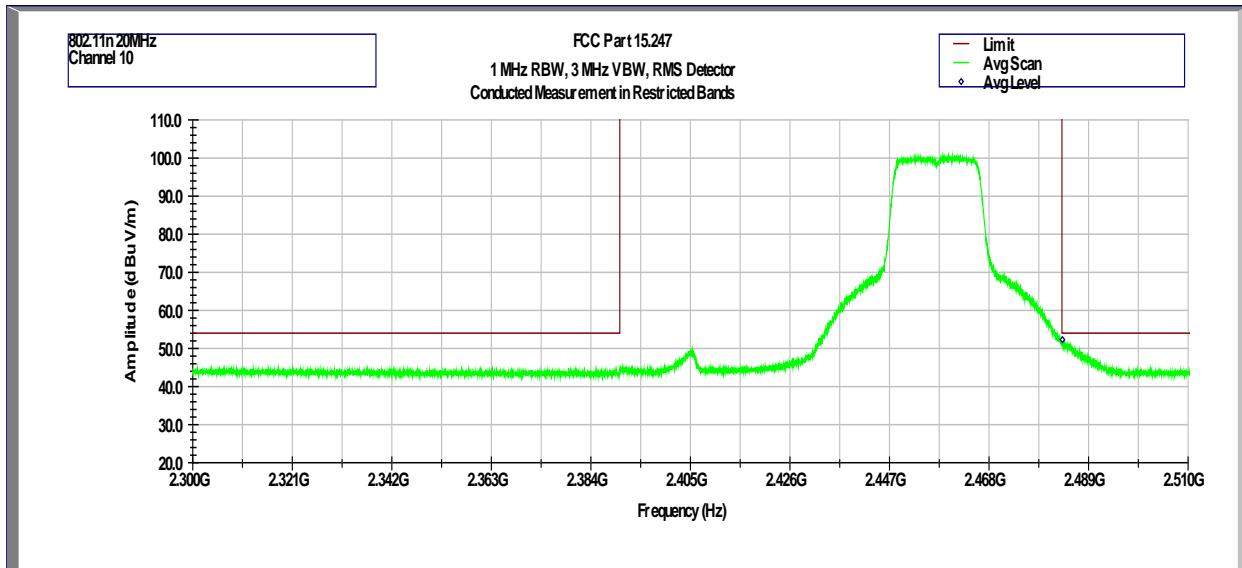
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB $\mu$ V/m	dB $\mu$ V/m	dB		
2.390	53.1	54	-0.9	Avg	Pass

### Out-of-Band Spurious Emissions at the Band Edge - 802.11n, 20MHz 2417 MHz



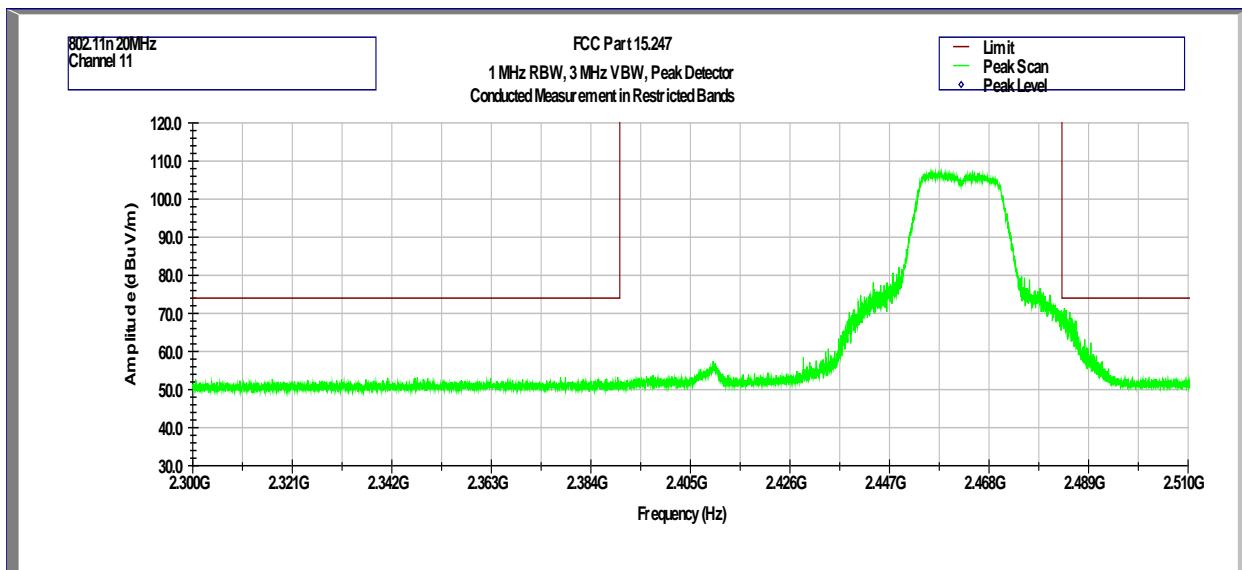
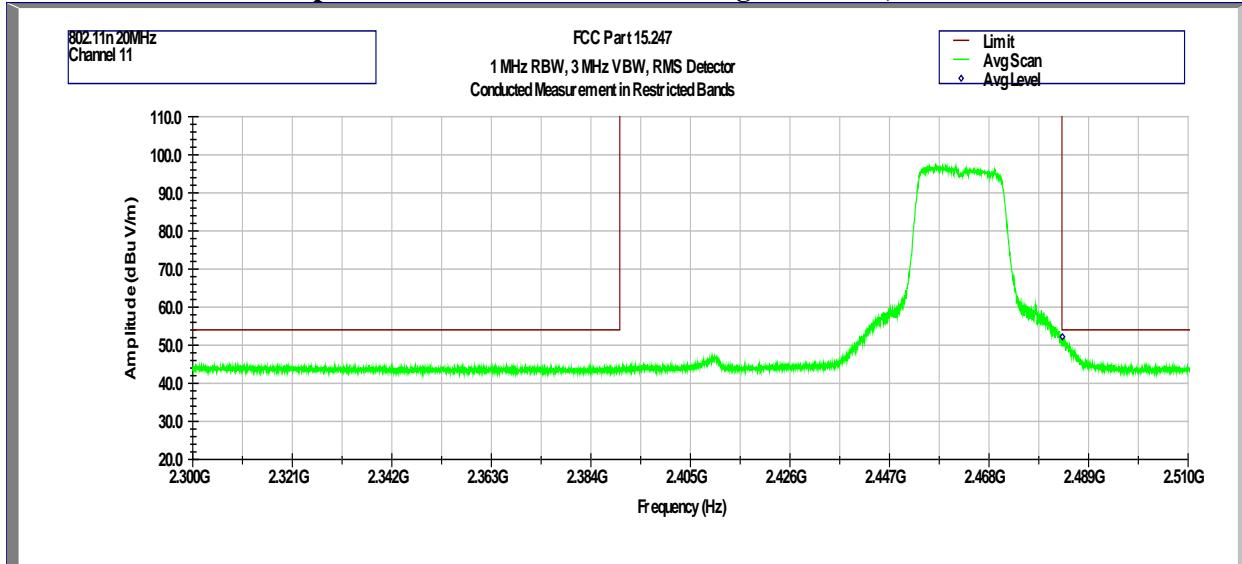
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB $\mu$ V/m	dB $\mu$ V/m	dB		
2.390	51.7	54	-2.3	Avg	Pass

## Out-of-Band Spurious Emissions at the Band Edge - 802.11n, 20MHz 2457 MHz



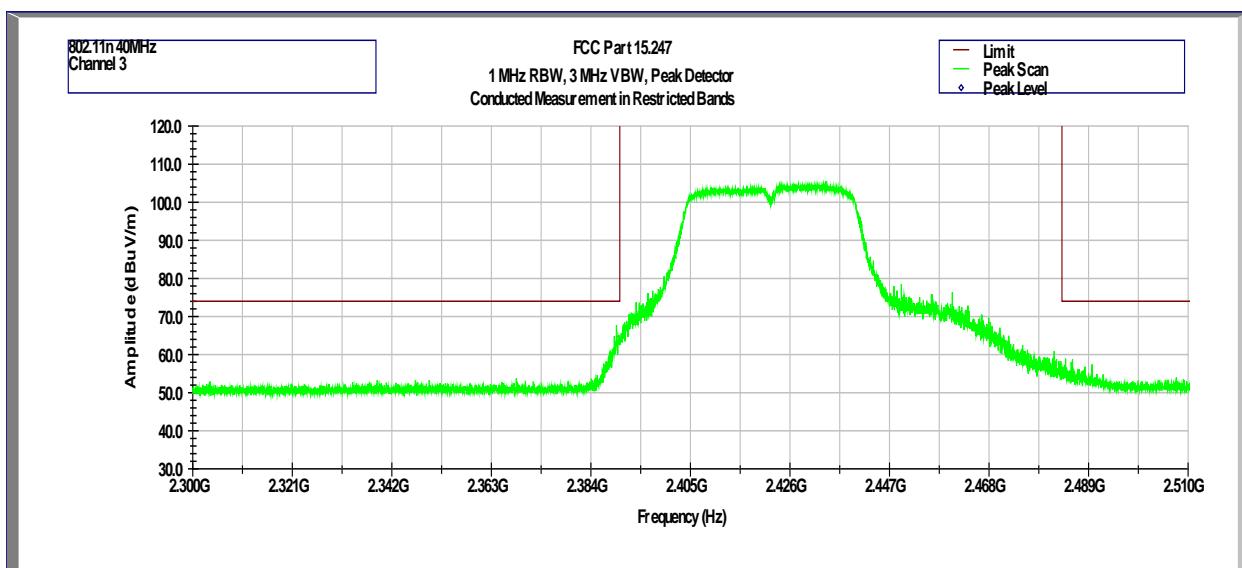
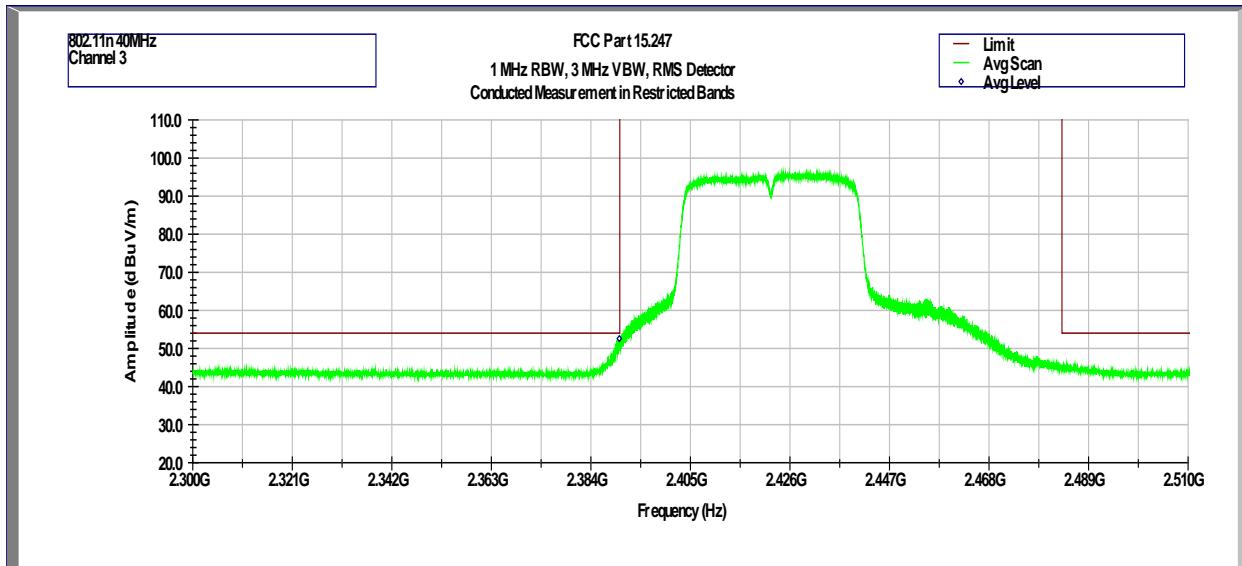
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB $\mu$ V/m	dB $\mu$ V/m	dB		
2.4835	52.3	54	-1.7	Avg	Pass

### Out-of-Band Spurious Emissions at the Band Edge - 802.11n, 20MHz 2462 MHz



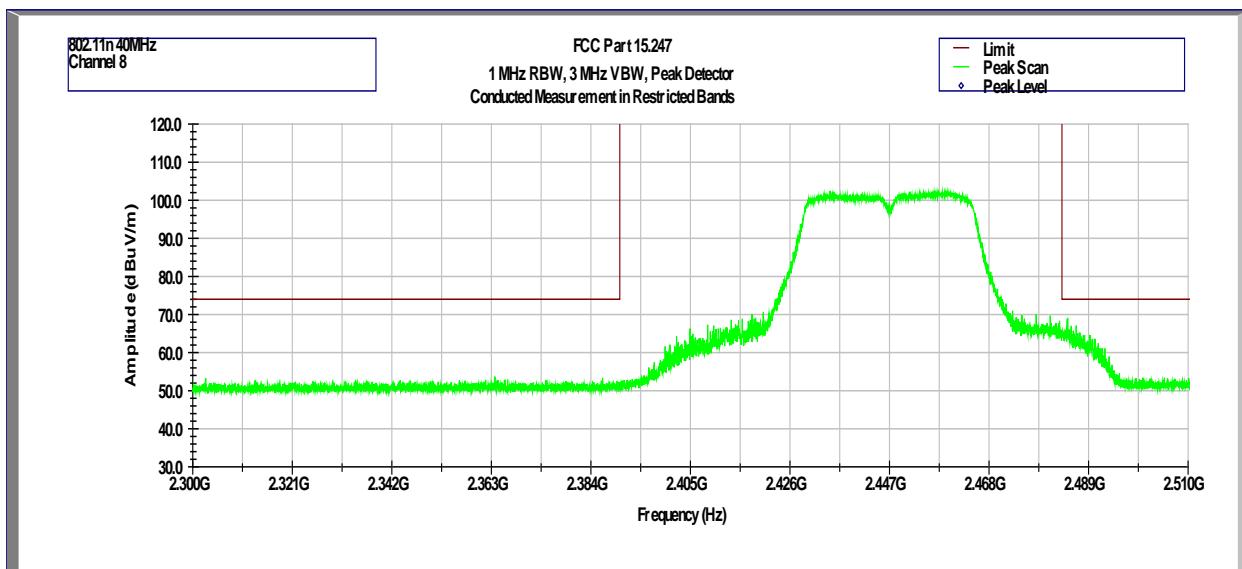
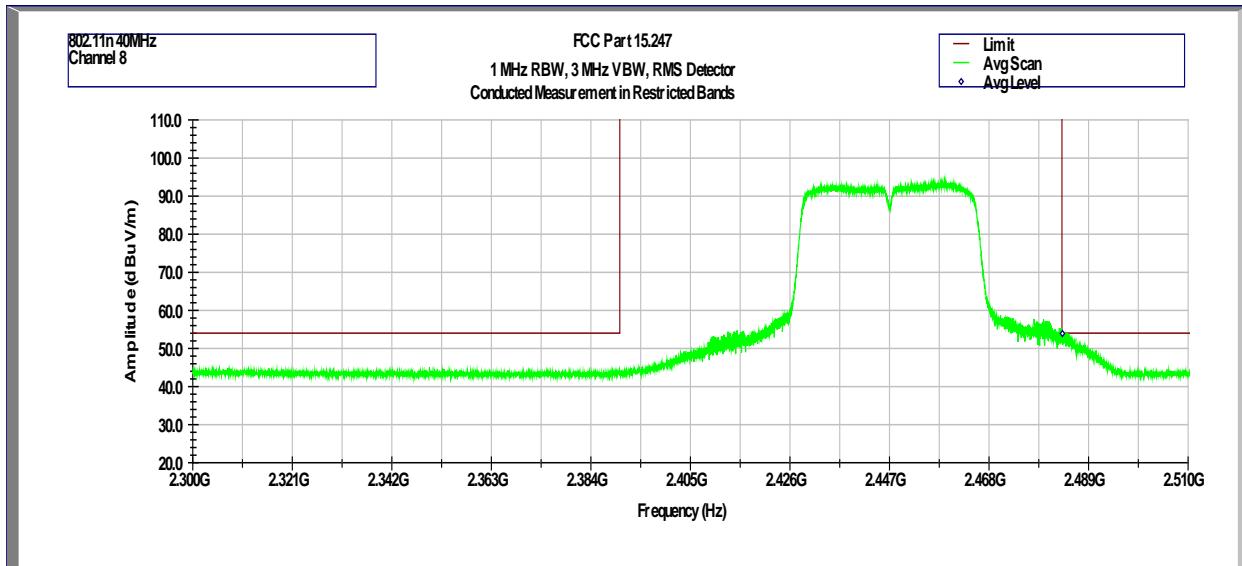
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB $\mu$ V/m	dB $\mu$ V/m	dB		
2.4835	52.2	54	-1.8	Avg	Pass

### Out-of-Band Spurious Emissions at the Band Edge - 802.11n 40MHz, 2422 MHz



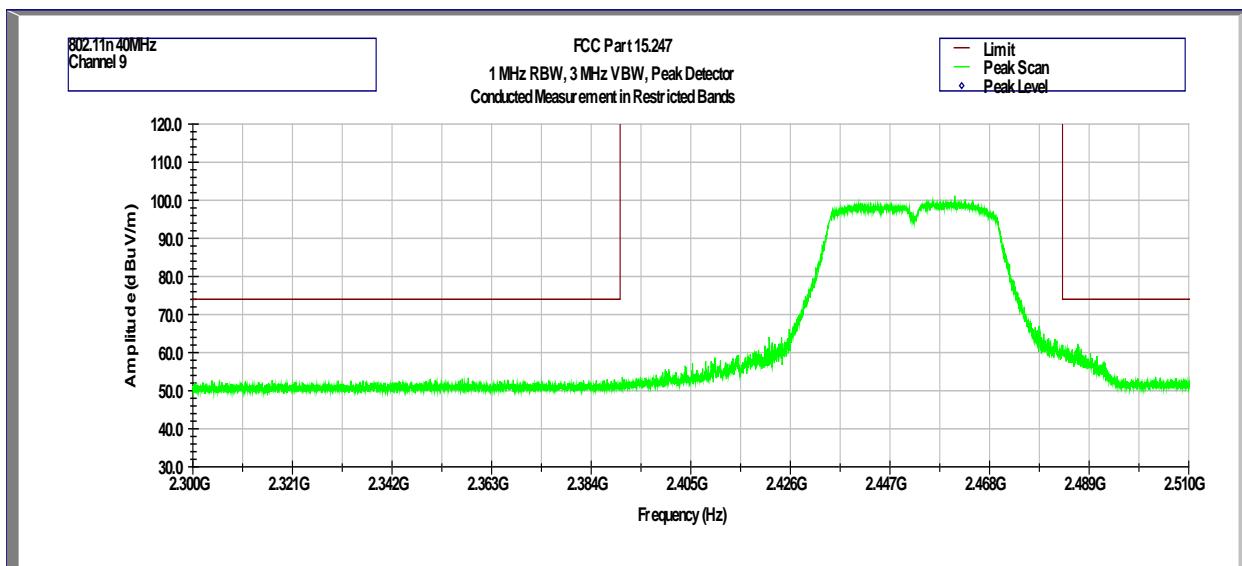
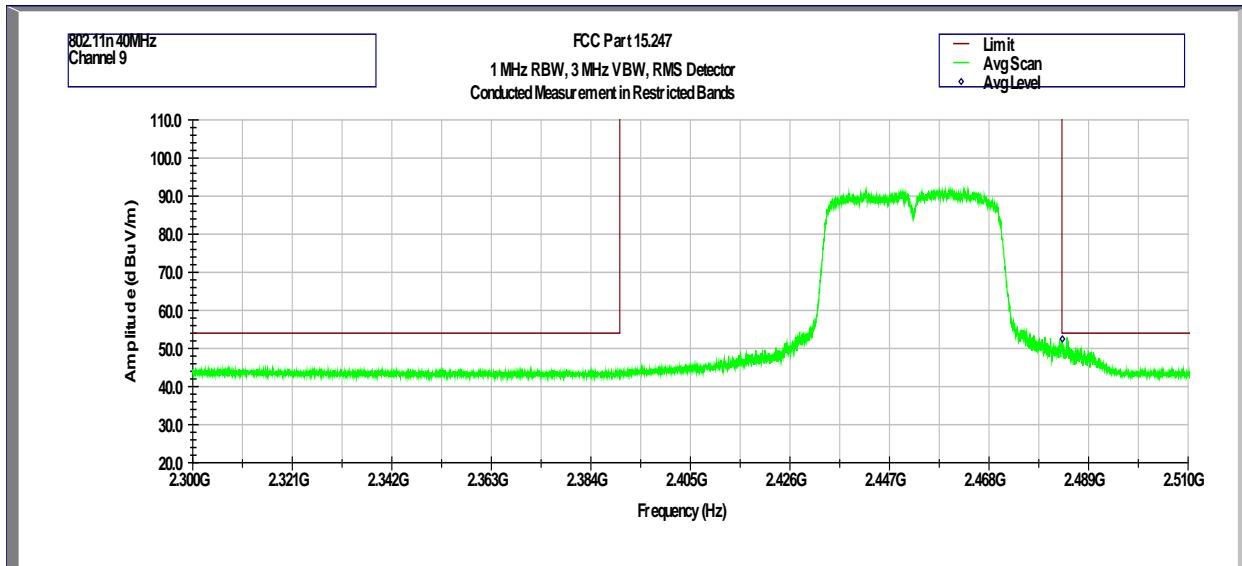
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB $\mu$ V/m	dB $\mu$ V/m	dB		
2.390	52.6	54	-1.4	Avg	Pass

## Out-of-Band Spurious Emissions at the Band Edge - 802.11n 40MHz, 2447 MHz



Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB $\mu$ V/m	dB $\mu$ V/m	dB	Avg	Pass
2.4835	53.9	54	-0.1	Avg	Pass

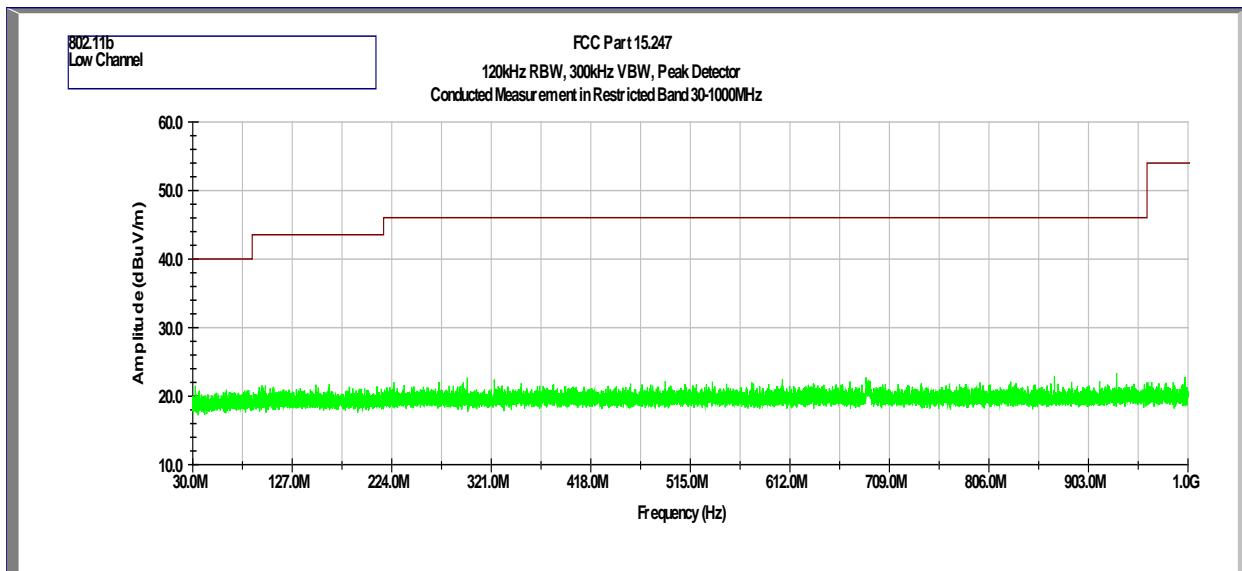
## Out-of-Band Spurious Emissions at the Band Edge - 802.11n 40MHz, 2452 MHz



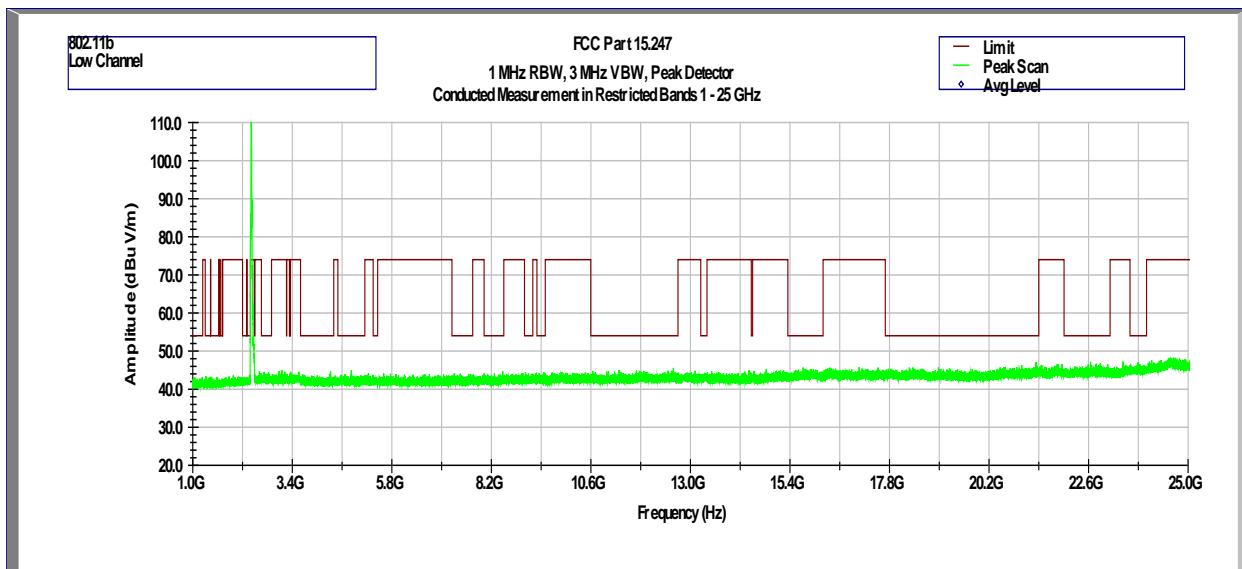
Frequency	Corrected Amplitude	Limit	Margin	Detector	Results
GHz	dB $\mu$ V/m	dB $\mu$ V/m	dB		
2.4835	52.5	54	-1.5	Avg	Pass

**Out-of-Band Conducted Spurious Emissions (at Antenna Port)****Tx @ 2412MHz 802.11b**

Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

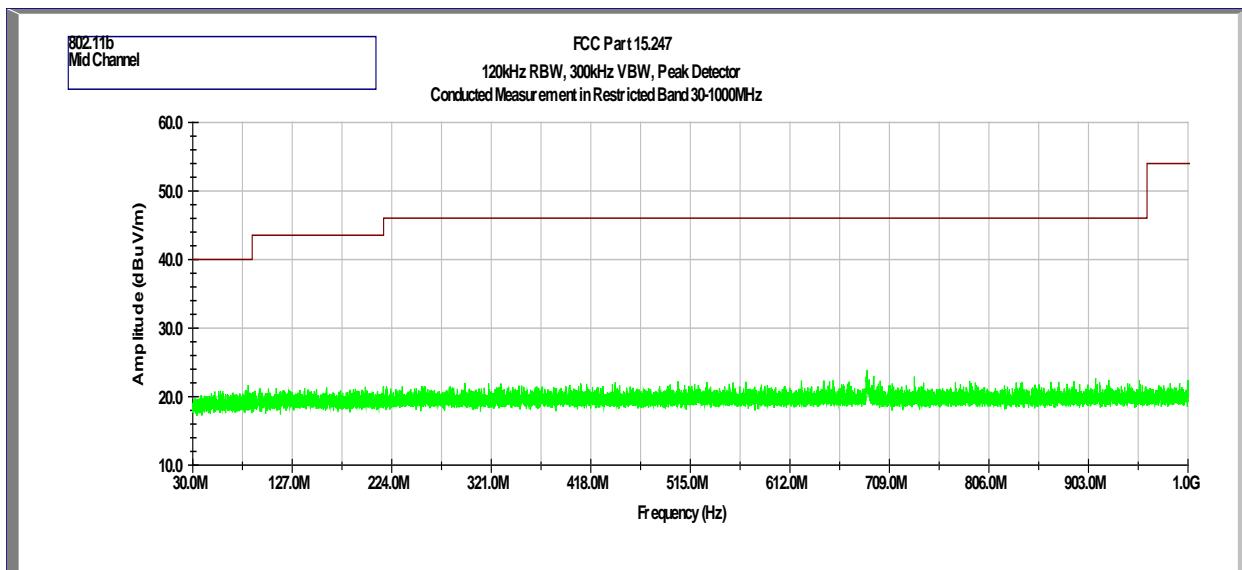


Out-of-Band Spurious Emissions at Antenna Port - 1 GHz to 26 GHz

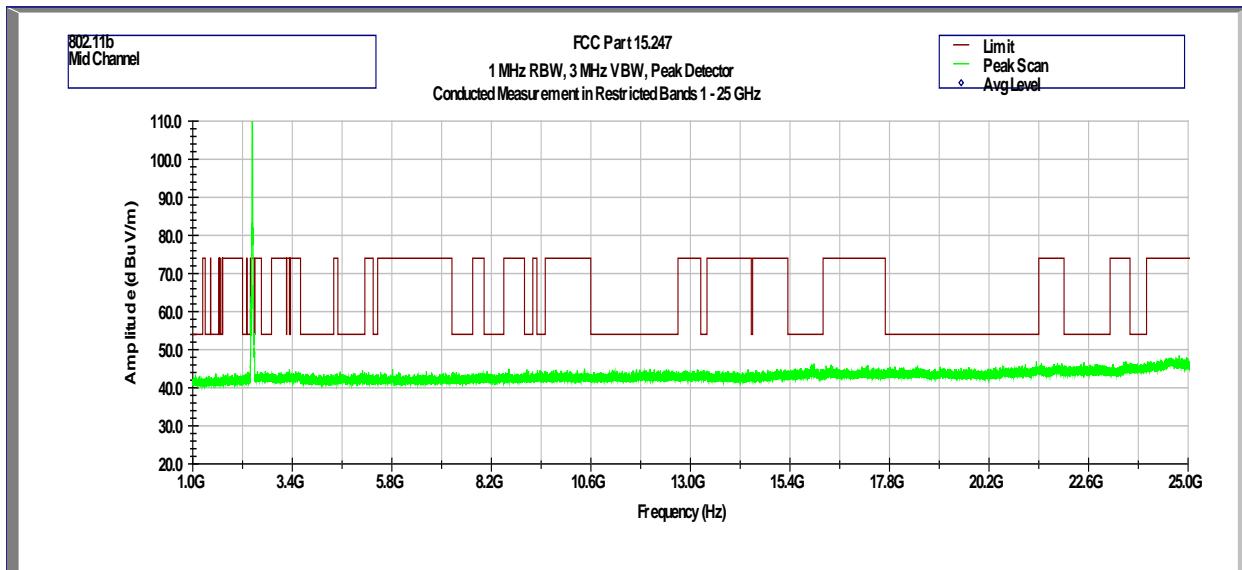


**Tx @ 2437MHz 802.11b**

Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

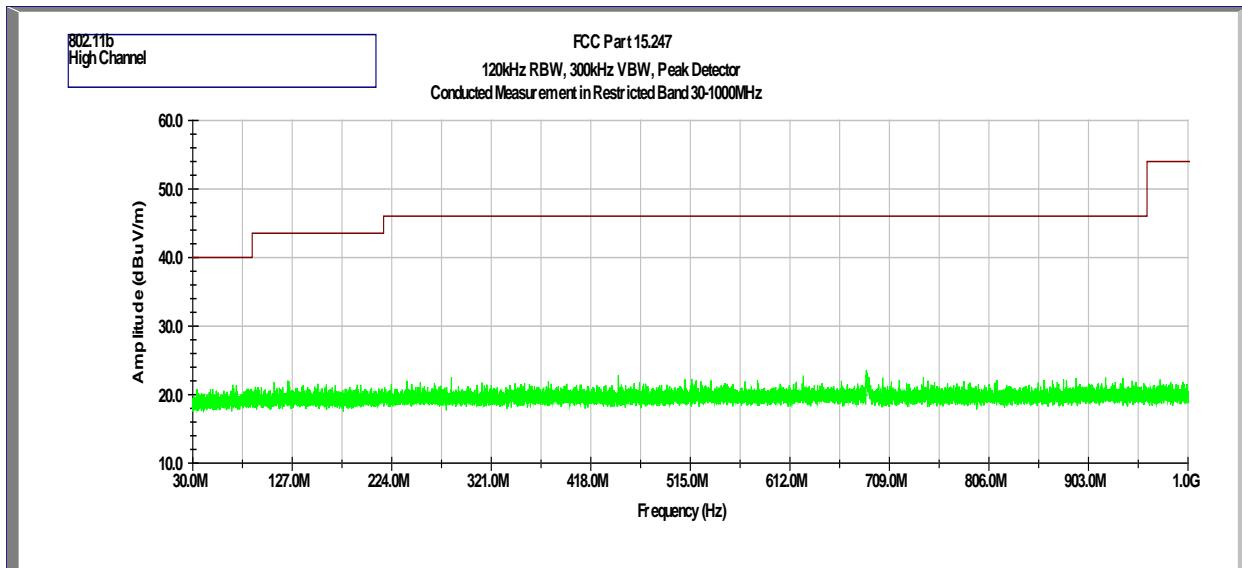


Out-of-Band Spurious Emissions at Antenna Port - 1 GHz to 26 GHz

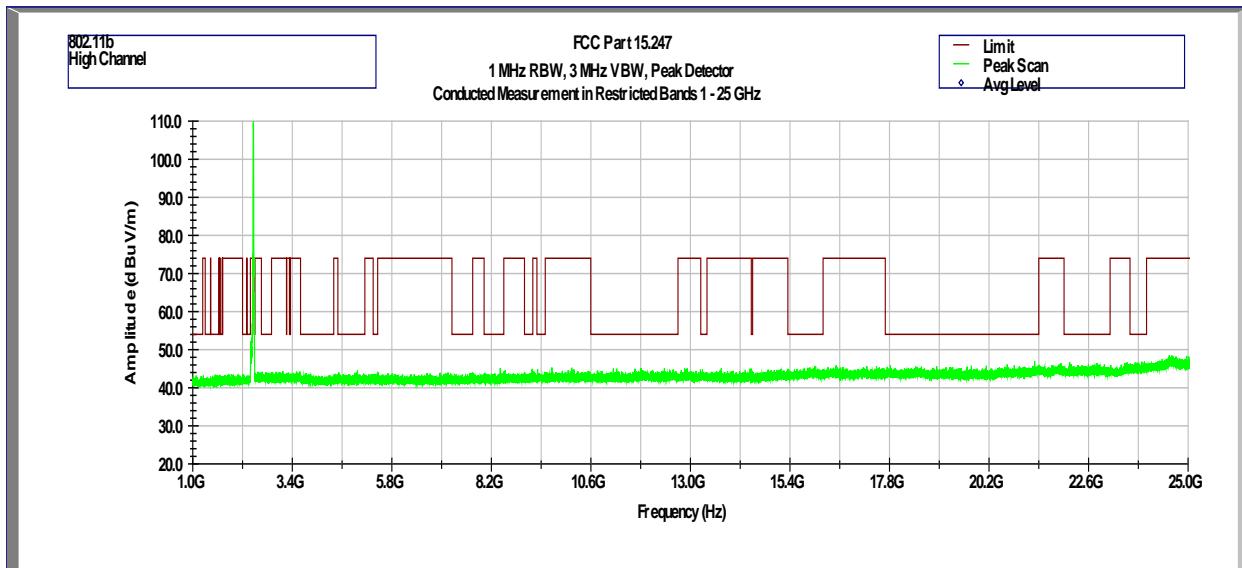


**Tx @ 2462MHz 802.11b**

Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

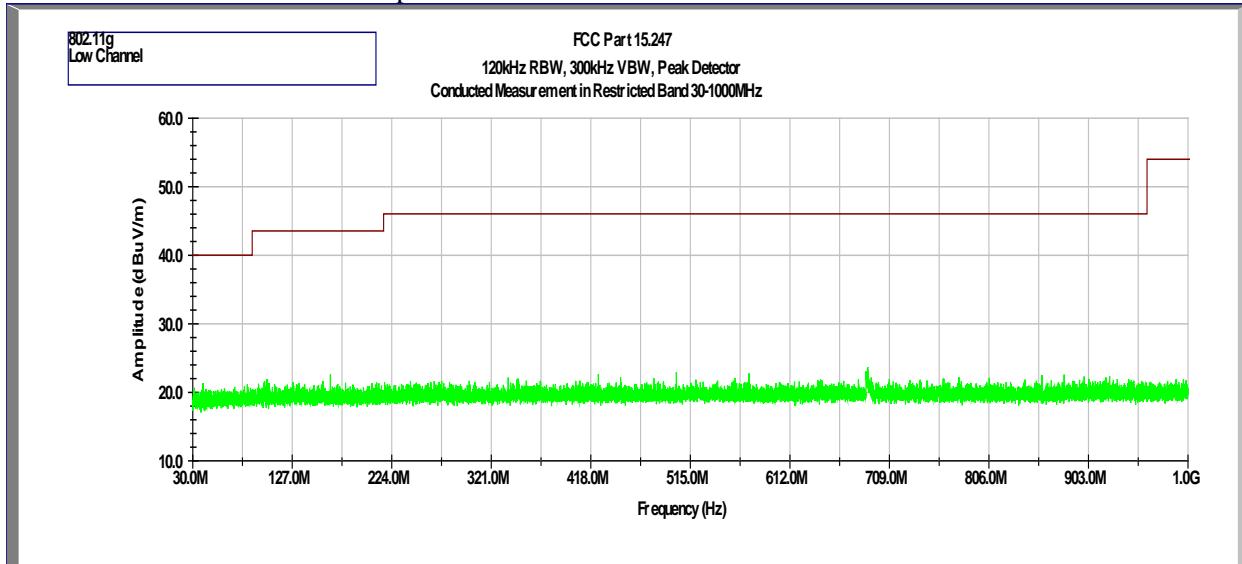


Out-of-Band Spurious Emissions at Antenna Port - 1 GHz to 26 GHz

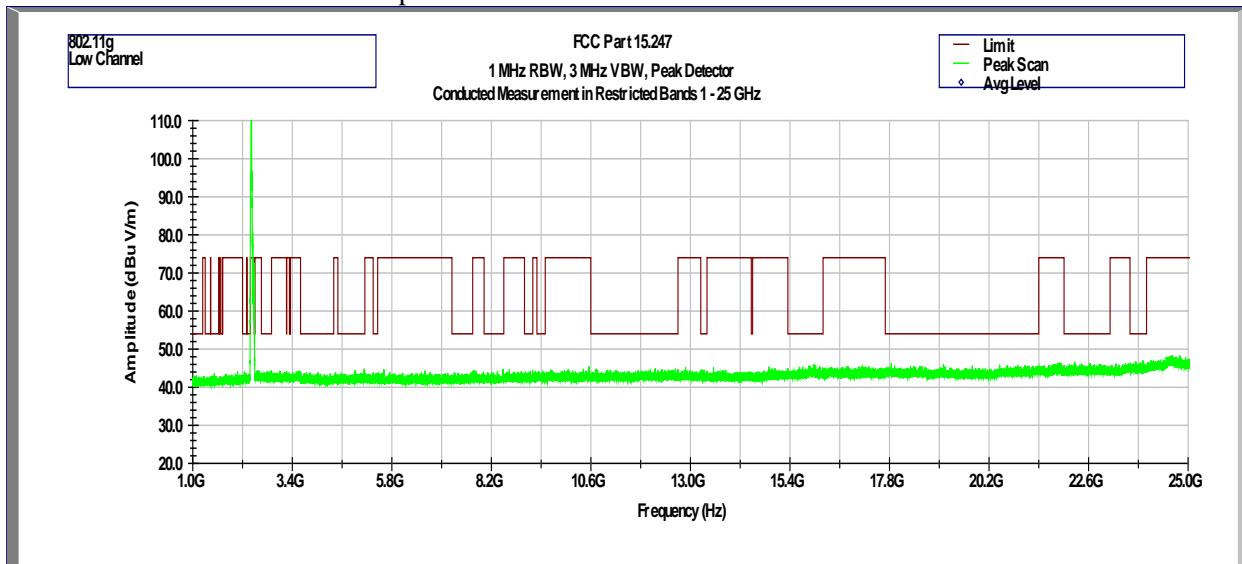


**Tx @ 2412MHz 802.11g**

## Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

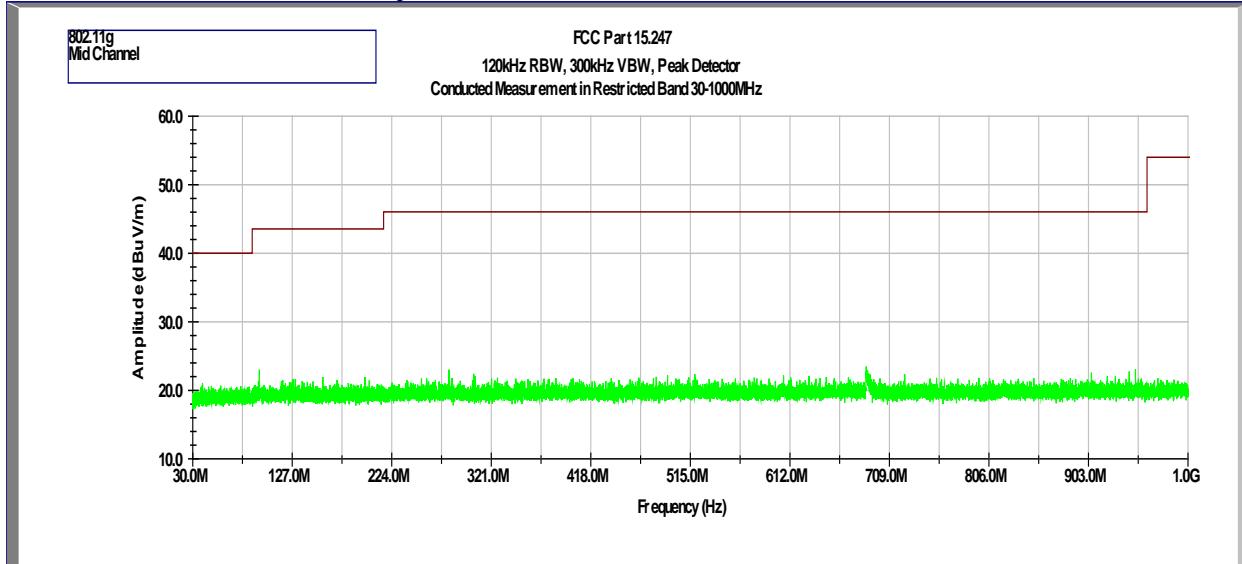


## Out-of-Band Spurious Emissions at Antenna Port - 1 GHz to 26 GHz

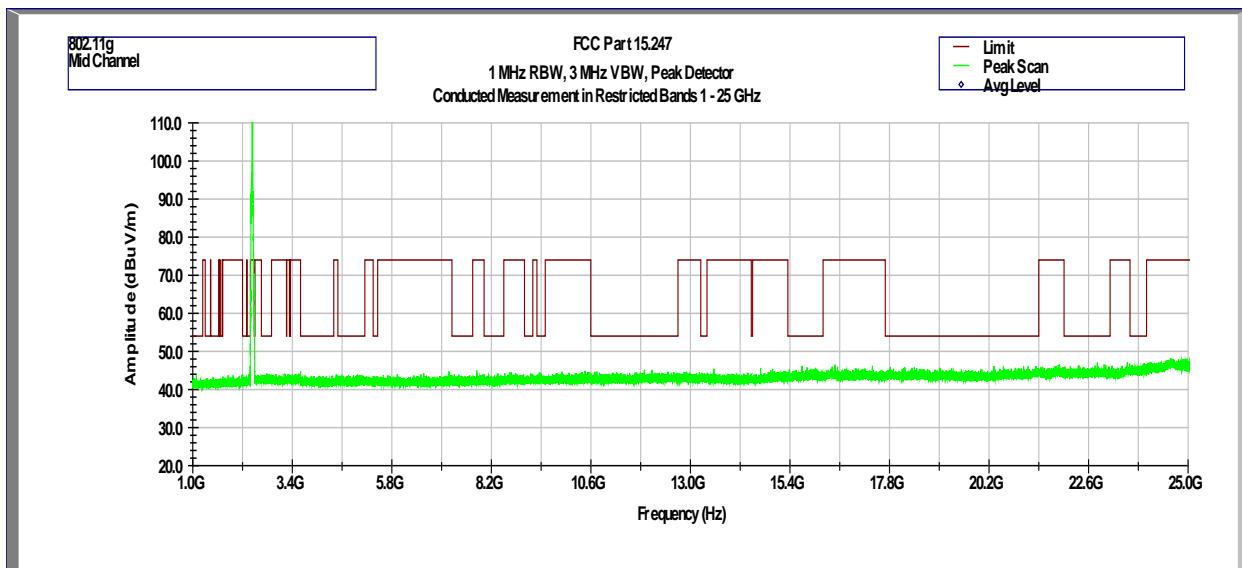


**Tx @ 2437MHz 802.11g**

## Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

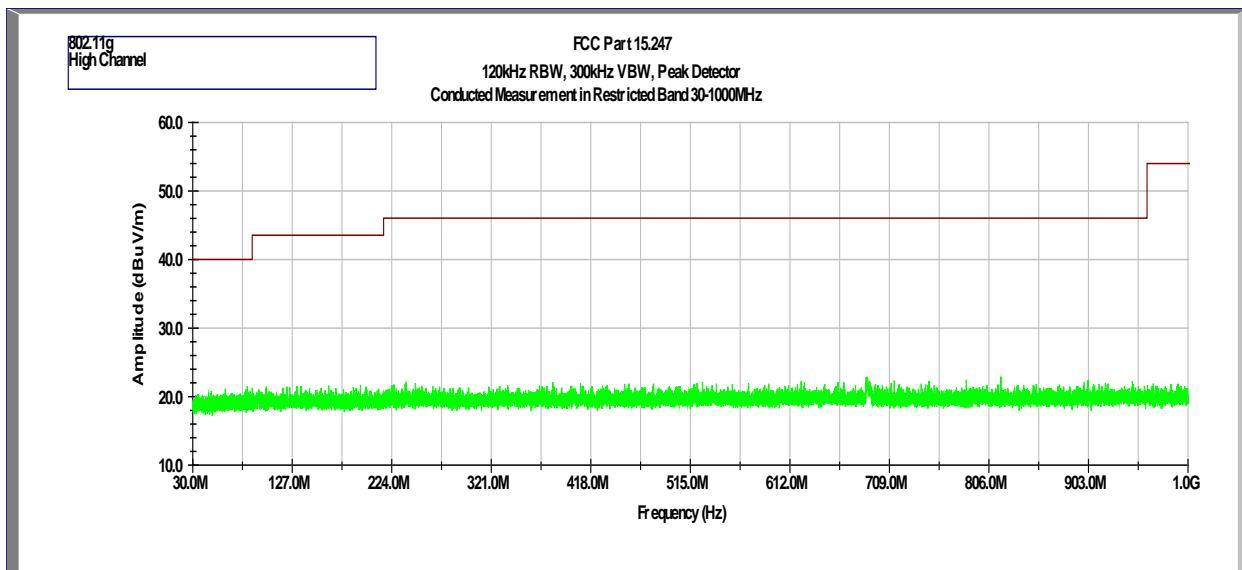


## Out-of-Band Spurious Emissions at Antenna Port - 1 GHz to 26 GHz

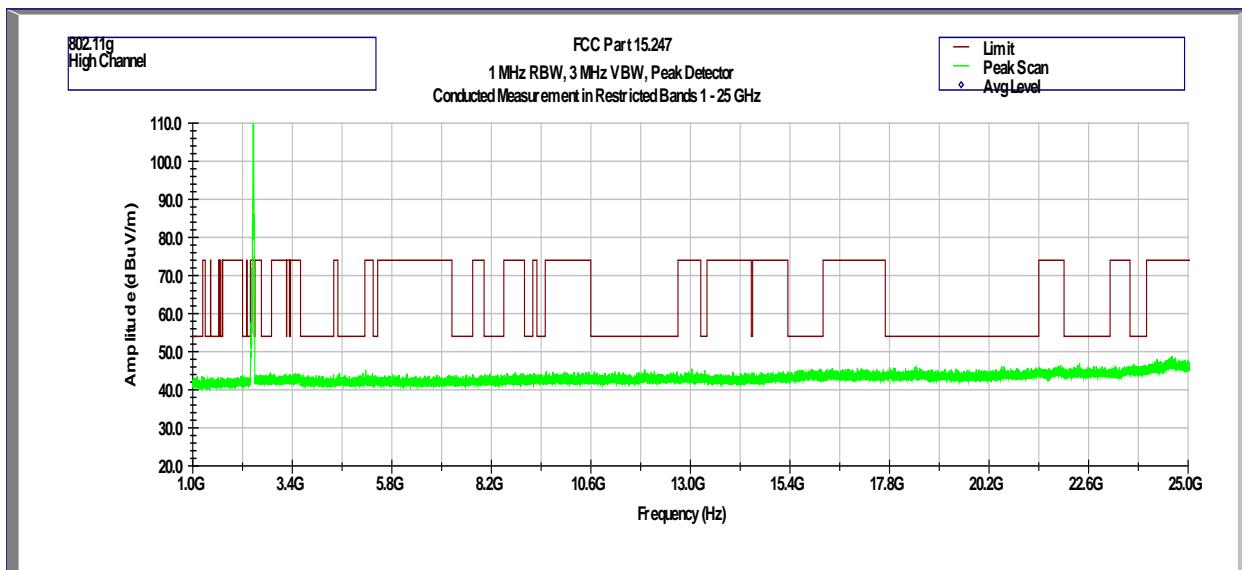


**Tx @ 2462MHz 802.11g**

Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

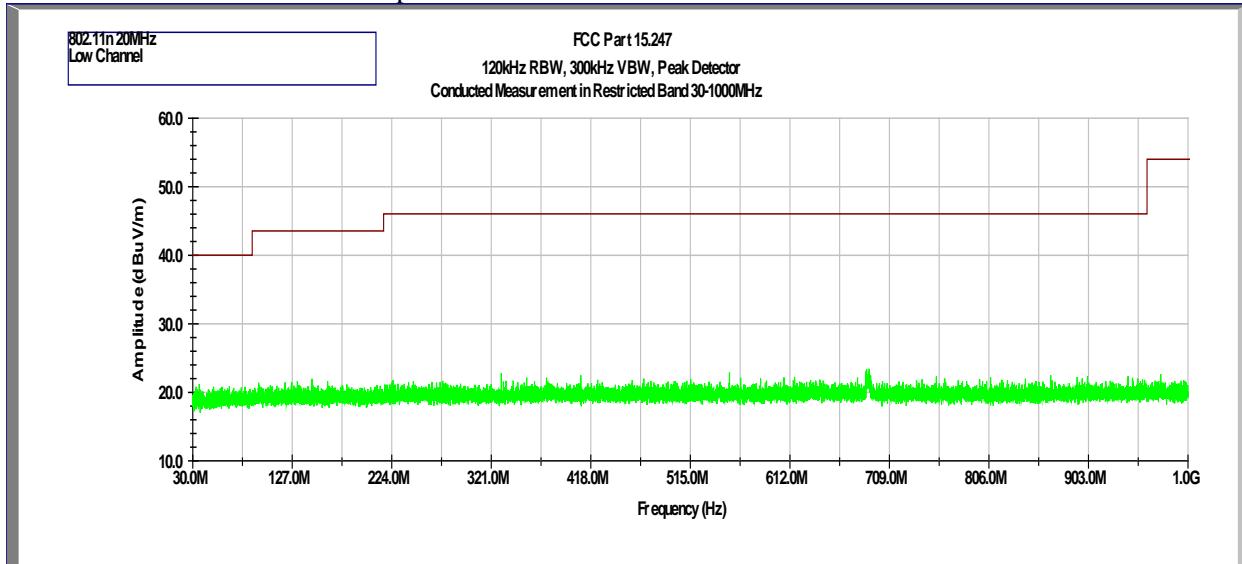


Out-of-Band Spurious Emissions at Antenna Port - 1 GHz to 26 GHz

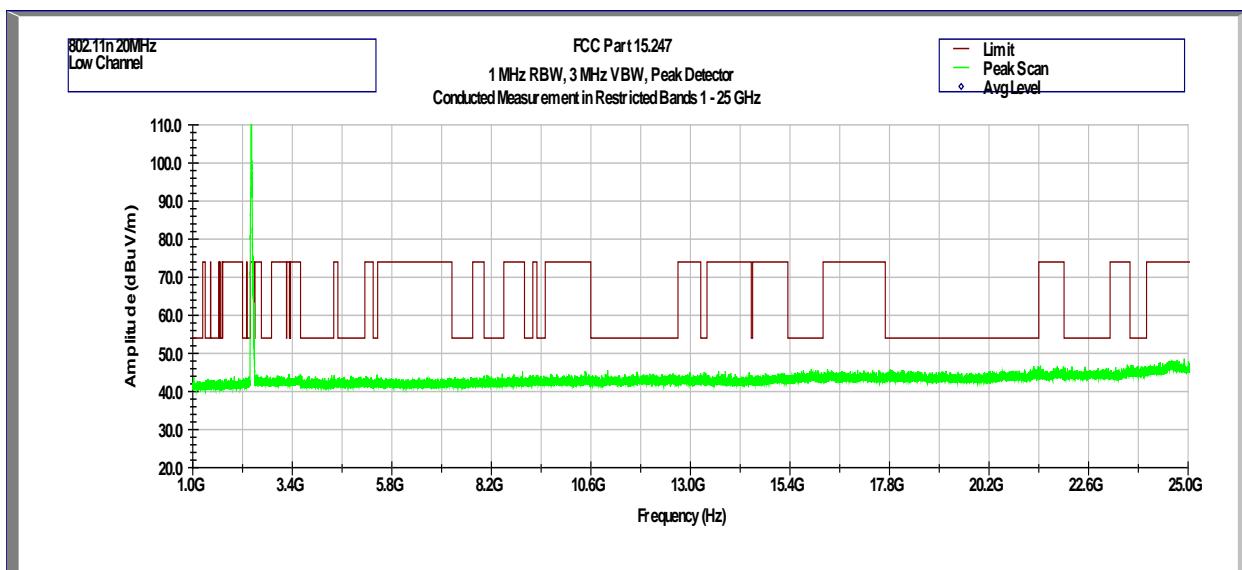


**Tx @ 2412MHz 802.11n 20MHz**

## Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

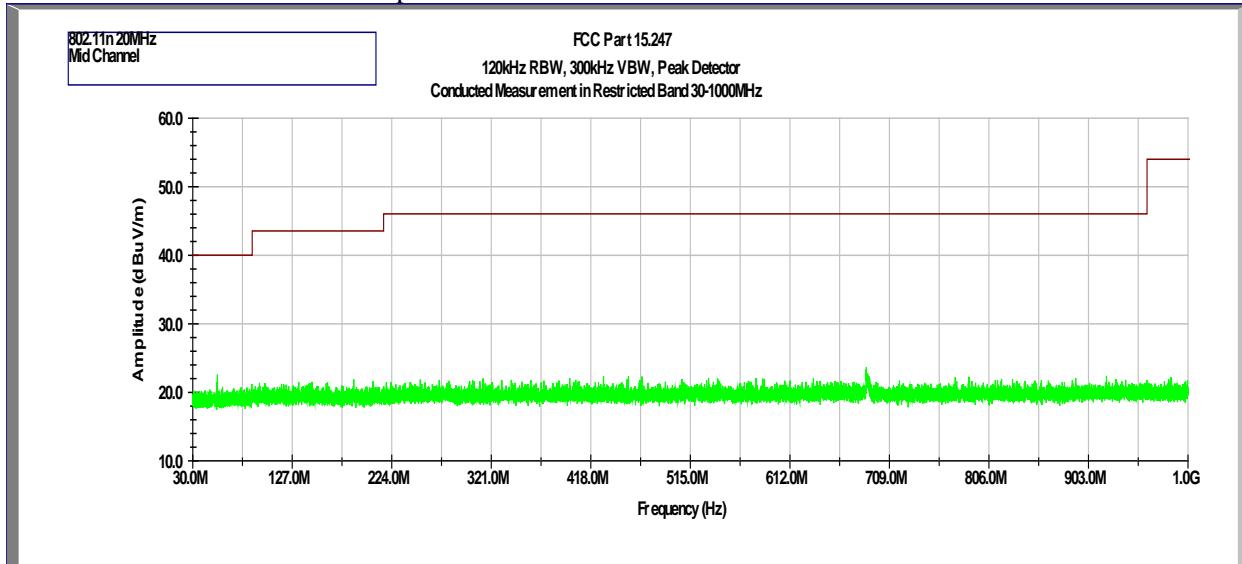


## Out-of-Band Spurious Emissions at Antenna Port - 1 GHz to 26 GHz

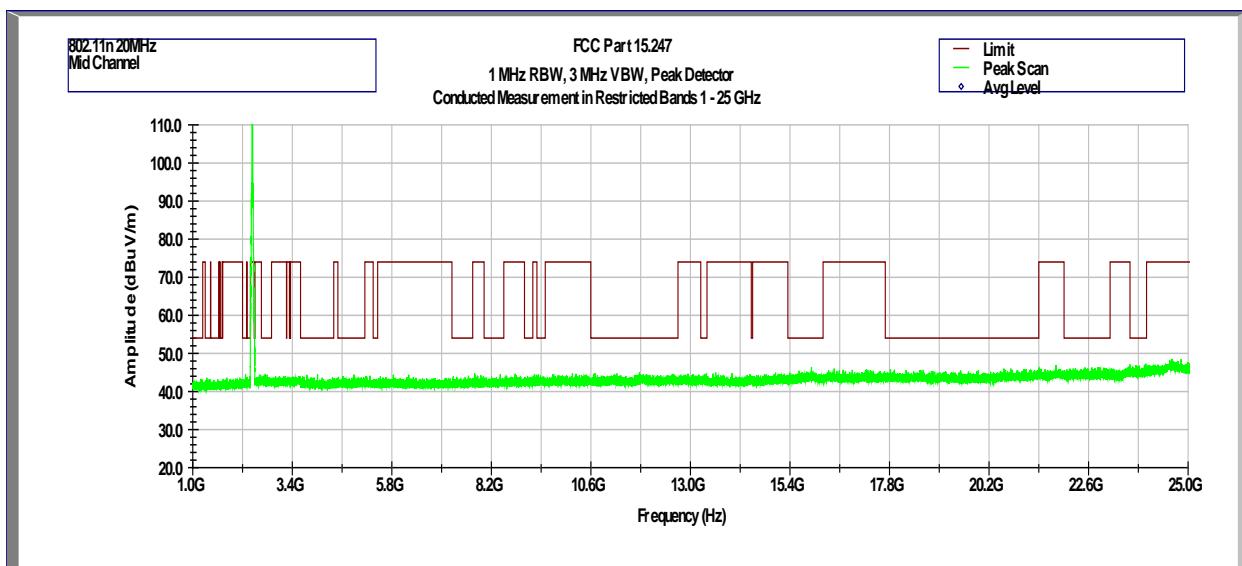


**Tx @ 2437MHz 802.11n 20MHz**

## Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

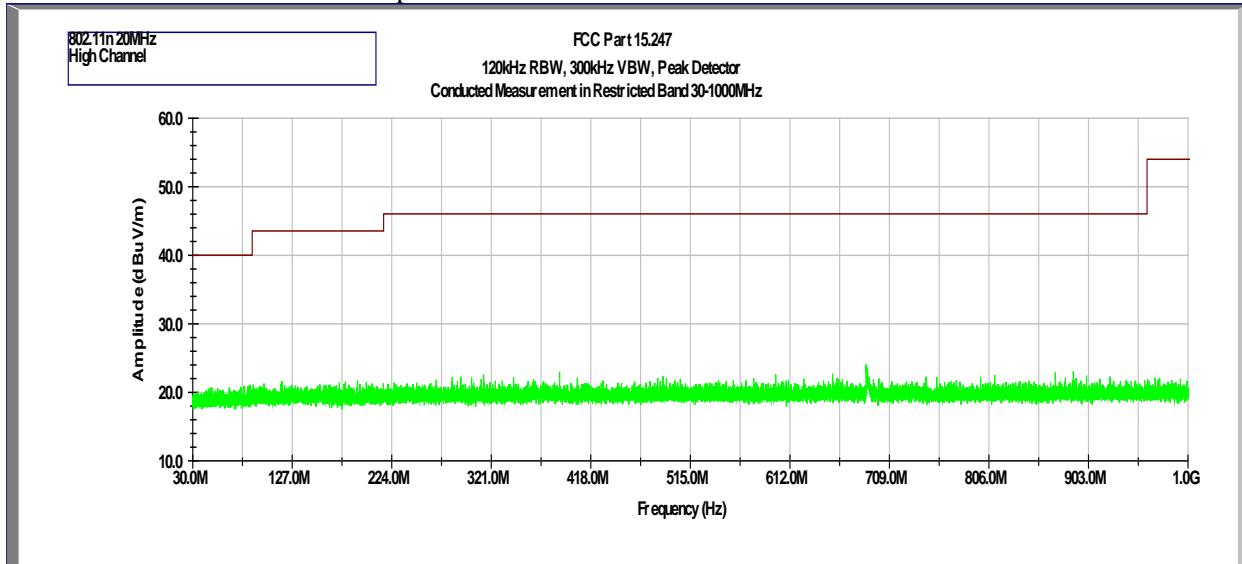


## Out-of-Band Spurious Emissions at Antenna Port - 1 GHz to 26 GHz

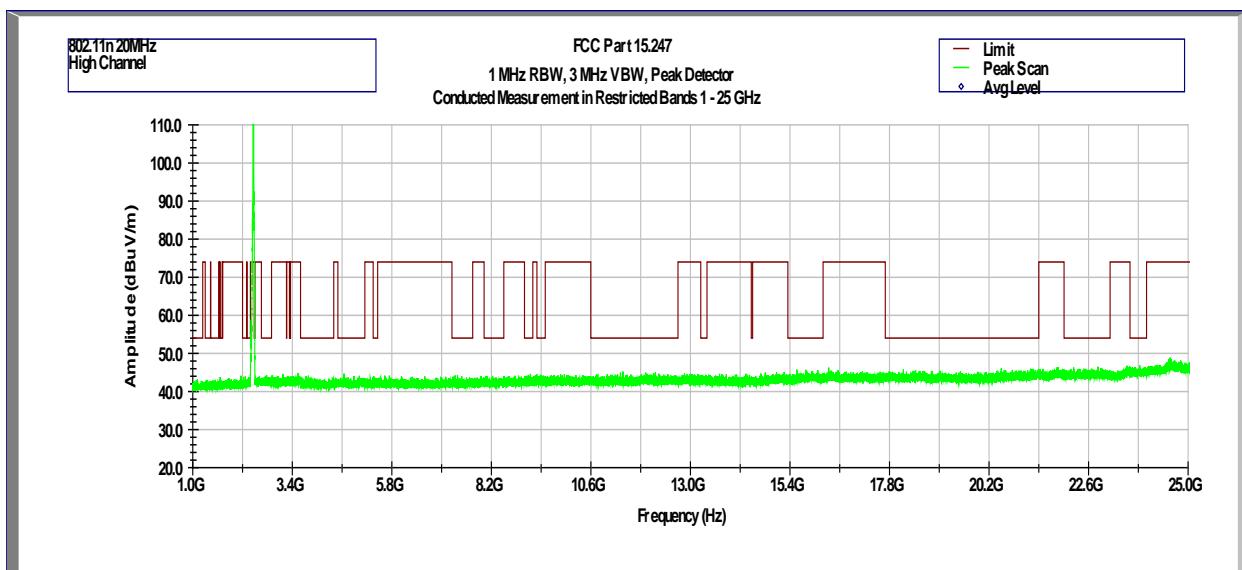


**Tx @ 2462MHz 802.11n 20MHz**

## Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

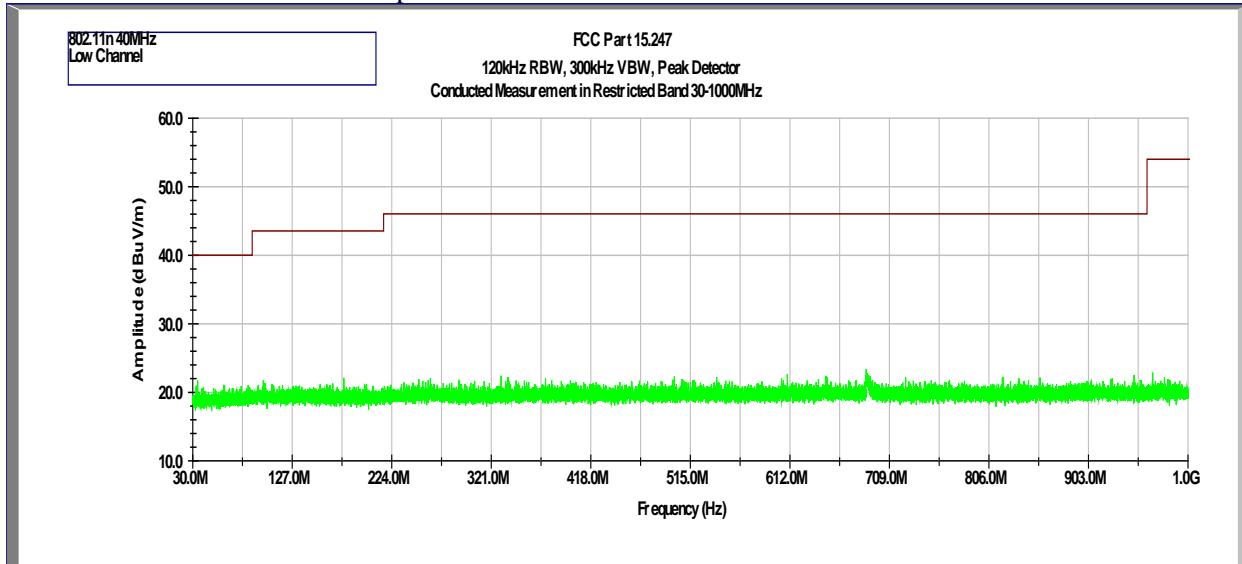


## Out-of-Band Spurious Emissions at Antenna Port - 1 GHz to 26 GHz

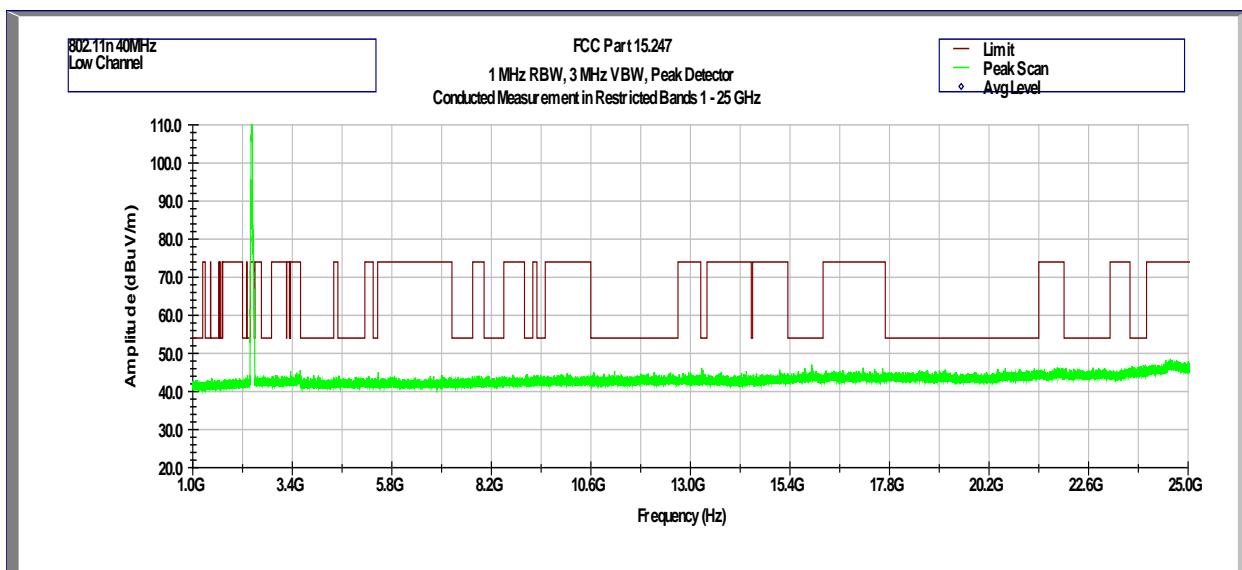


**Tx @ 2422MHz 802.11n 40MHz**

## Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

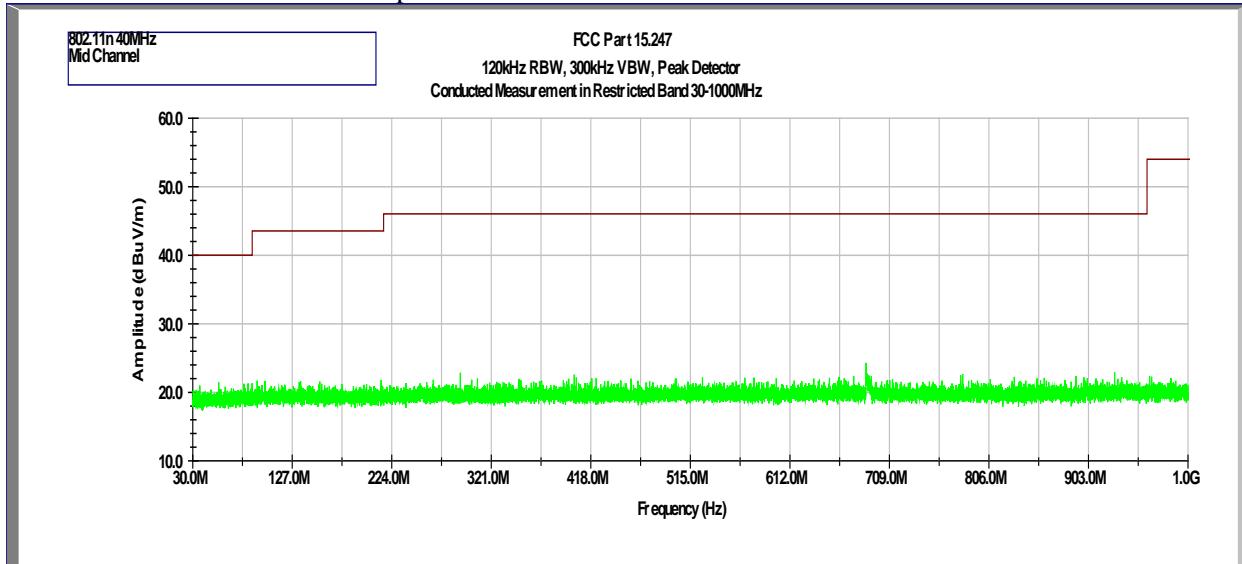


## Out-of-Band Spurious Emissions at Antenna Port - 1 GHz to 26 GHz

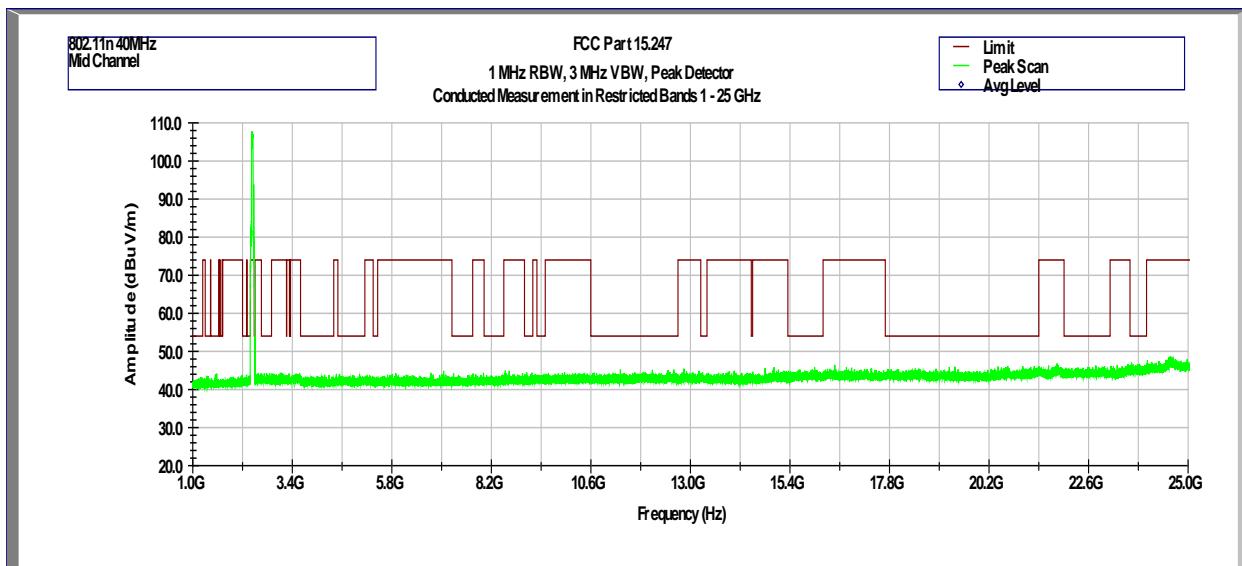


**Tx @ 2437MHz 802.11n 40MHz**

## Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz

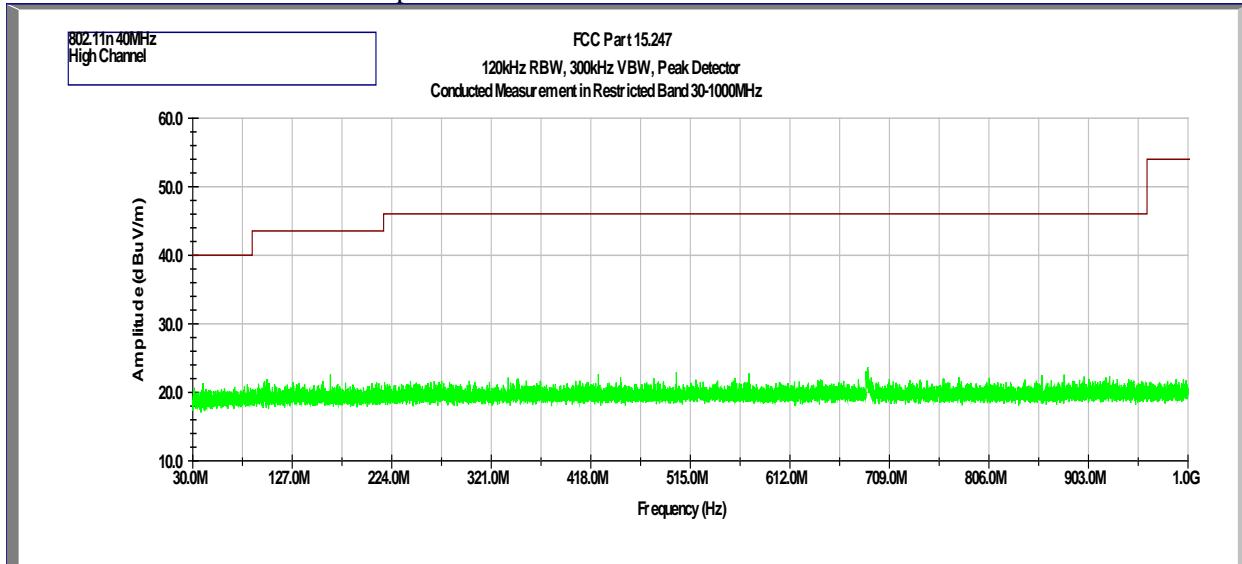


## Out-of-Band Spurious Emissions at Antenna Port - 1 GHz to 26 GHz



**Tx @ 2452MHz 802.11n 40MHz**

## Out-of-Band Spurious Emissions at Antenna Port - 30 MHz to 1 GHz



## Out-of-Band Spurious Emissions at Antenna Port - 1 GHz to 26 GHz

