INDEX

TEST CONDITIONS

POWER SUPPLY (V):

V nonimal: 13.2 Vdc.

Type of Power Supply: DC External (Vechicle Battery).

ANTENNA:

Type of Antenna: External.

Maximum Declared Antenna Gain: 0 dBi

Technology Tested:	WLAN (IEEE 802.11 a/n/ac): U-NII-3 band	
Modes:	802.11a: 6, 9, 12, 18, 24, 36, 48 & 54 Mbps	
	802.11n HT20: MCS0 to MCS7	
	802.11n HT40: MCS0 to MCS7	
	802.11ac VHT20: MCS0 to MCS8	
	802.11ac VHT40: MCS0 to MCS9	
	802.11ac VHT80: MCS0 to MCS9	
Setting of cores / ports:	One port.	
Beamforming:	No	
Frequency Range:	5725 MHz to 5850 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Low: 149	5745
	Middle: 157	5785
	High: 165	5825
Channel Spacing:	40 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Low: 151	5755
	High: 159	5795
Channel Spacing:	80 MHz	
Transmit Channels	Middle: 155	5775

The test set-up was made in accordance to the general provisions of ANSI C63.10: 2013 and FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01 dated 12/14/2017.

The EUT was tested in the following operating mode:

- Continuously transmitting with a modulated carrier at maximum power in all required channels using the supported data rates/modulations types.

The field strength at the band edges was evaluated for each mode individually on the lowest and highest channels at the rated power for the channel under test.

For all modes, the EUT was configured in test mode using a software application. The application was used to enable a continuous transmission and to select the test channels as required. The client supplied scripts to configure the EUT. The customer supplied a document containing the setup instructions.

The worst cases for testing were identified for output power and spurious levels at the band edges which were selected based on preliminary testing that correspond to next data rates:

- 802.11a20: 6 Mbit/s
- 802.11n HT20: MCS0
- 802.11n HT40: MCS0
- 802.11ac VHT20: MCS0
- 802.11ac VHT40: MCS0
- 802.11ac VHT80: MCS0

RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-18 GHz Double ridge horn antenna) is situated at a distance of 3 m and a distance of 1.5m for the frequency range 17 GHz-40 GHz (horn antenna).

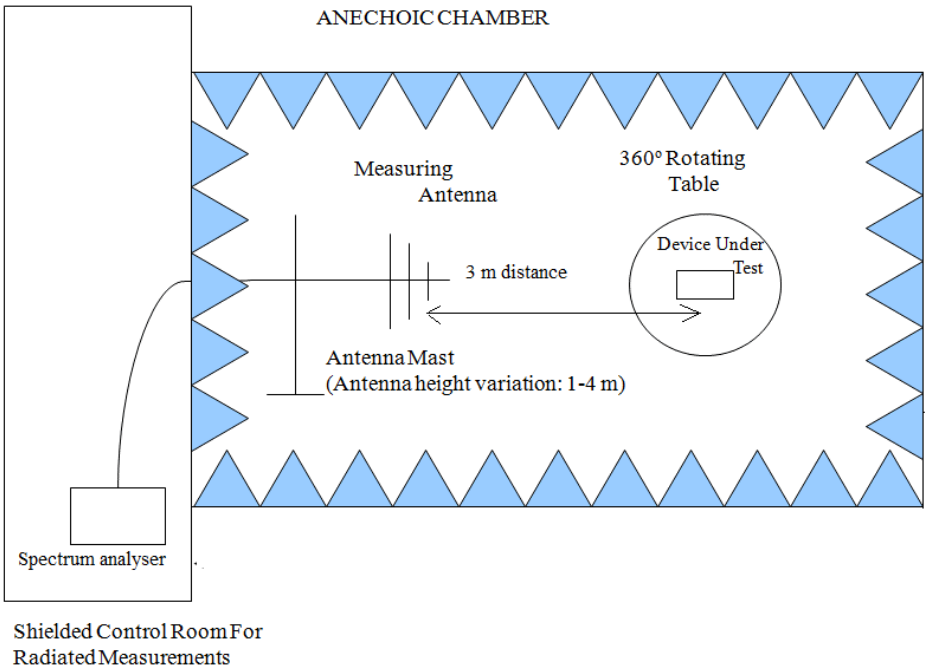
For radiated emissions in the range 17 GHz-40 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find the maximum radiated emission.

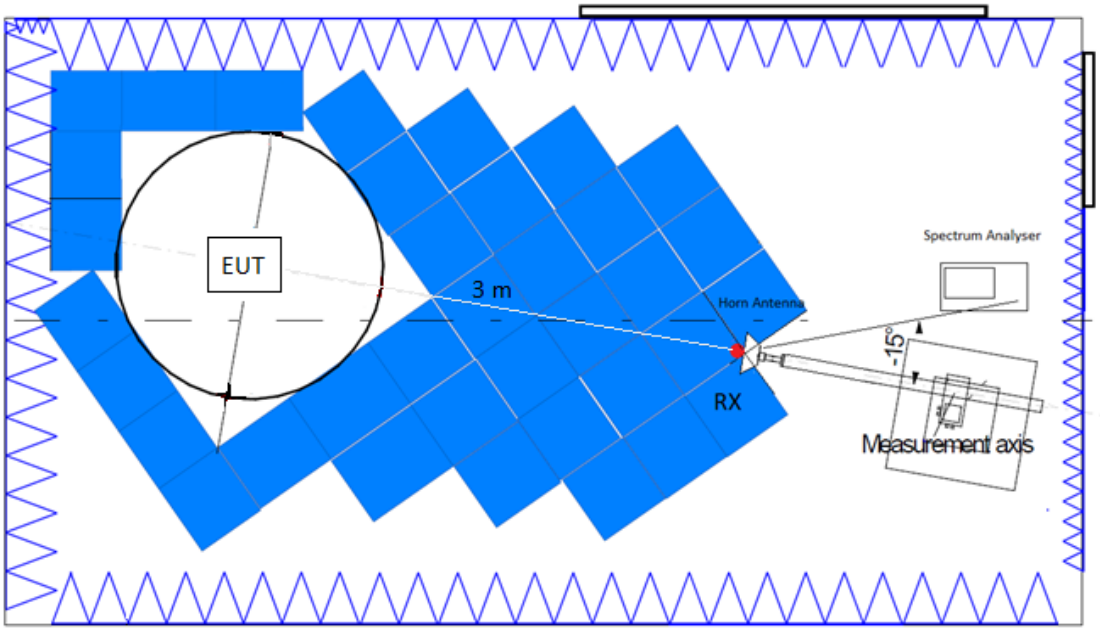
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth / video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

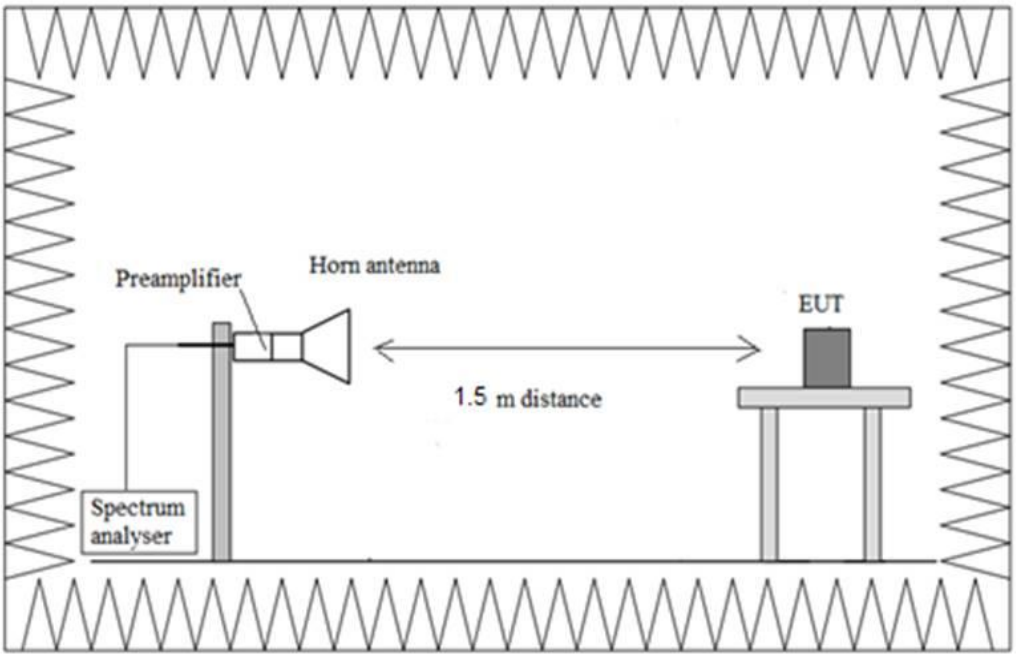
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup f > 17 GHz:



FCC 15.407 (b)(4)(6) / RSS-247 6.2.4.2. Transmitter Out of Band Radiated Emissions and Transmitter Band Edge Radiated Emissions

SPECIFICATION:

For transmitters operating in the 5.725–5.85 GHz band:
All emissions shall be limited to a level of −27 dBm/MHz (68.23 dBµV/m at 3 m distance) at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

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)):

Frequency Range (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	300
1.705 – 30.0	30	-	30
30 – 88	100	40	3
88 – 216	150	43.5	3
216 – 960	200	46	3
960 – 40000	500	54	3

The emission limits shown in the above table are based on measurements employing CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyser. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

OUT OF BAND EMISSIONS:
For spurious emissions outside of the U-NII-3 band edge mask of 5.65-5.925 GHz, the OFDM worst mode case was determined after preliminary measurements of the E.I.R.P. density (radiated).
The Low, Middle and High Channels were tested.

- **Worst case:** **802.11 n20** (MCS0).

Frequency range 30 MHz - 1 GHz (worst case):

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode selected in the EUT.

No spurious frequencies detected at less than 20 dB below the limit.

Frequency range 1 - 40 GHz (worst case):

The results in the next tables show the maximum measured levels in the 1-40 GHz range except the 5.65-5.725 GHz and 5.85-5.925GHz adjacent bands. The results in the adjacent bands was evaluated on the next section.

Spurious frequencies with peak levels above the average limit (54 dBµV/m at 3 m) are measured with an average detector for checking compliance with the average limit.

- LOW CHANNEL. No spurious frequencies at less than 20 dB below the limit.

- MIDDLE CHANNEL. No spurious frequencies at less than 20 dB below the limit

- HIGH CHANNEL. No spurious frequencies at less than 20 dB below the limit.

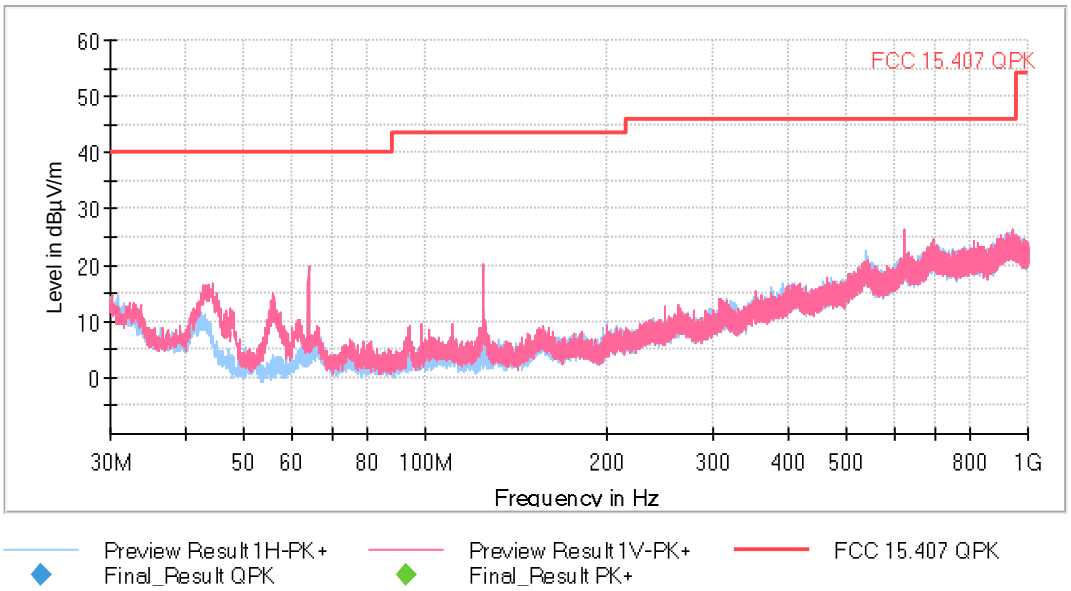
Verdict: PASS

The measurement settings for each range of frequency is as follows:

Subrange	**Step Size**	**Detectors**	**Bandwidth**	**Sweep Time**	**Preamp**
30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB
Subrange	**Step Size**	**Detectors**	**Bandwidth**	**Sweep Time**	**Preamp**
1 GHz - 6,5 GHz	100 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
Subrange	**Step Size**	**Detectors**	**Bandwidth**	**Sweep Time**	**Preamp**
6,5 GHz - 17 GHz	105 kHz	PK+ ; AVG	1 MHz	1 s	30 dB
Subrange	**Step Size**	**Detectors**	**Bandwidth**	**Sweep Time**	**Preamp**
17 GHz - 40 GHz	766,667 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

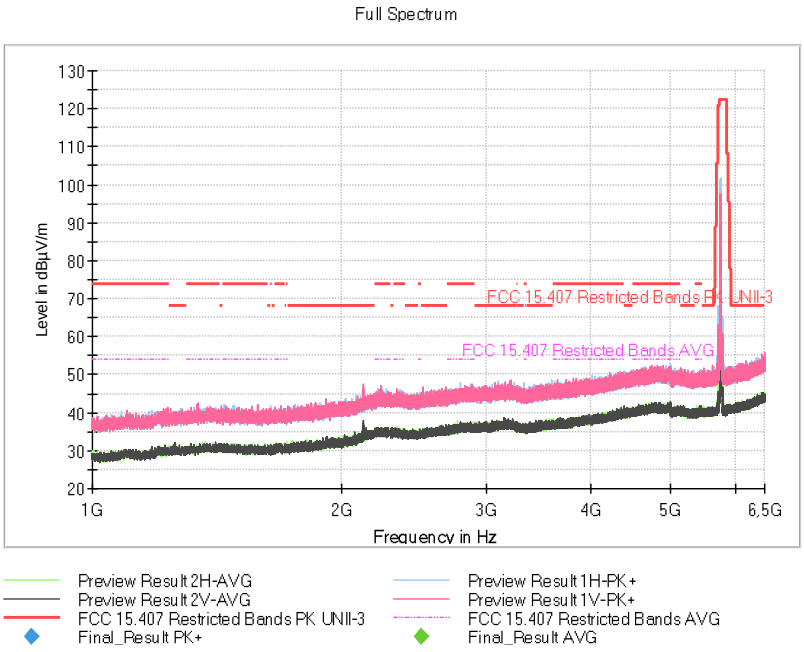
FREQUENCY RANGE 30 MHz - 1 GHz (worst case):

This plot is valid for all the modulation modes and the Low, Middle and High Channels.



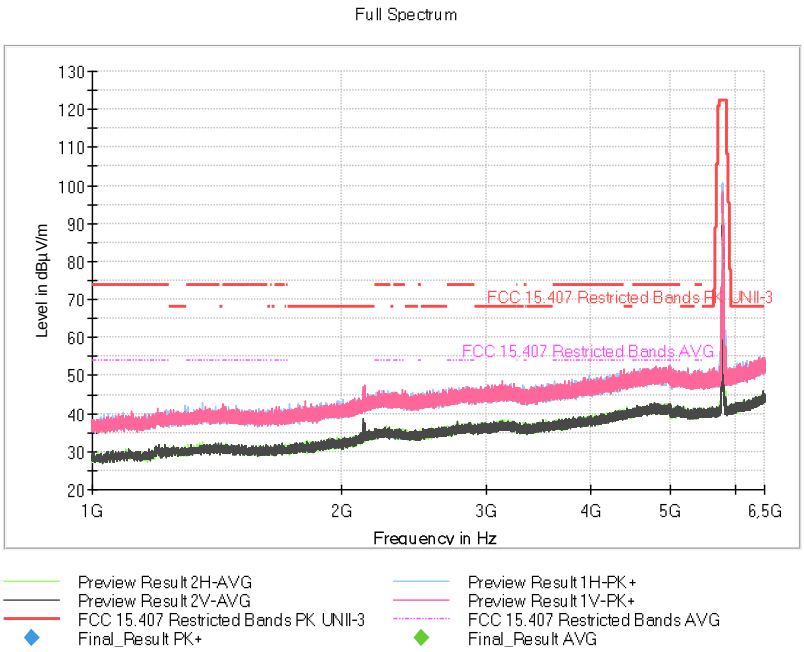
FREQUENCY RANGE 1 - 6.5 GHz (worst case):

- Low Channel:



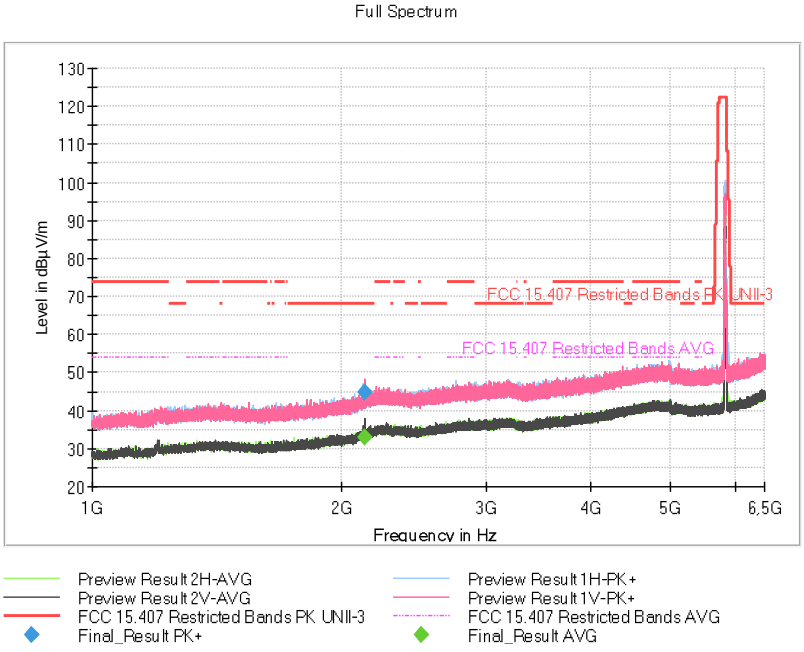
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

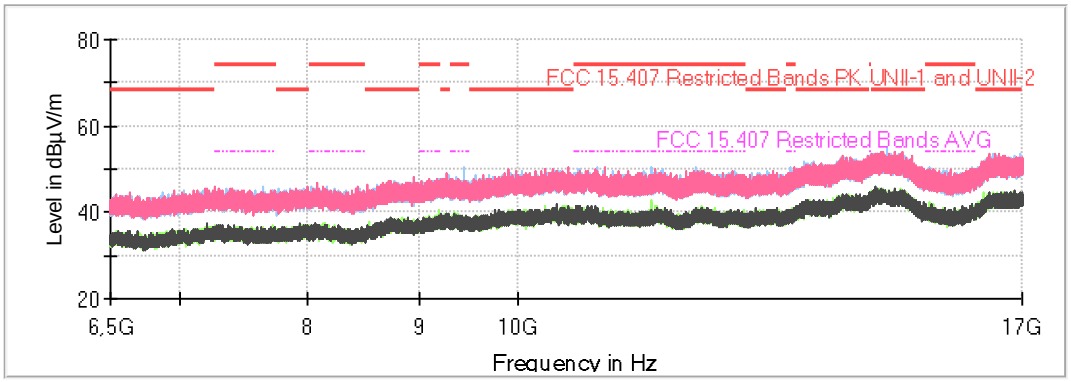
- High Channel:



The peak above the limit is the carrier frequency.

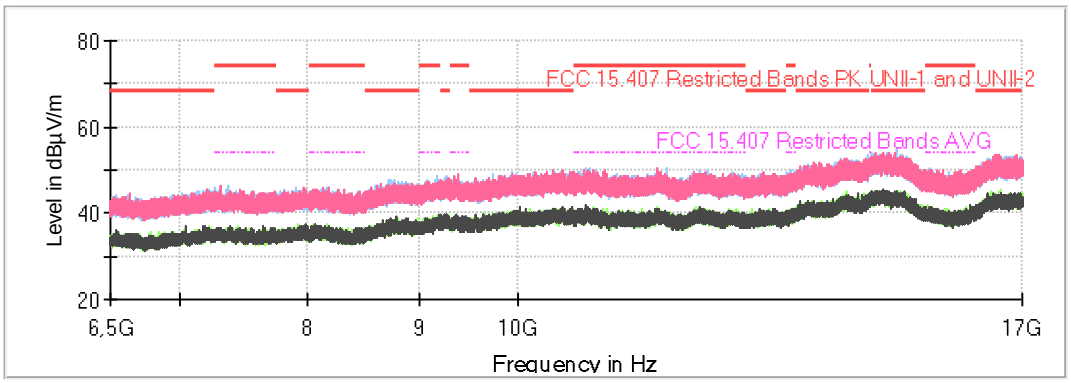
FREQUENCY RANGE 6.5 - 17 GHz (worst case):

- Low Channel:



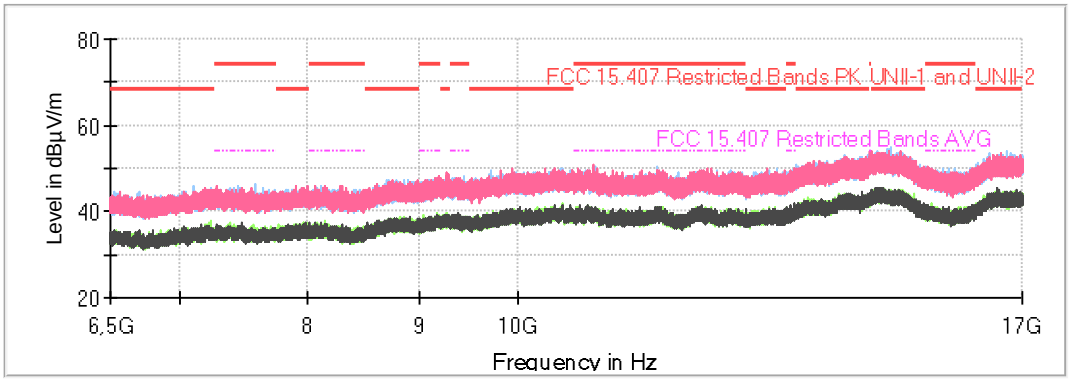
Preview Result 2H-AVG
Preview Result 1H-PK+
Preview Result 2V-AVG
Preview Result 1V-PK+
FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
FCC 15.407 Restricted Bands AVG
Final_Result PK+
Final_Result AVG

- Middle Channel:



Preview Result 2H-AVG
Preview Result 1H-PK+
Preview Result 2V-AVG
Preview Result 1V-PK+
FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
FCC 15.407 Restricted Bands AVG
Final_Result PK+
Final_Result AVG

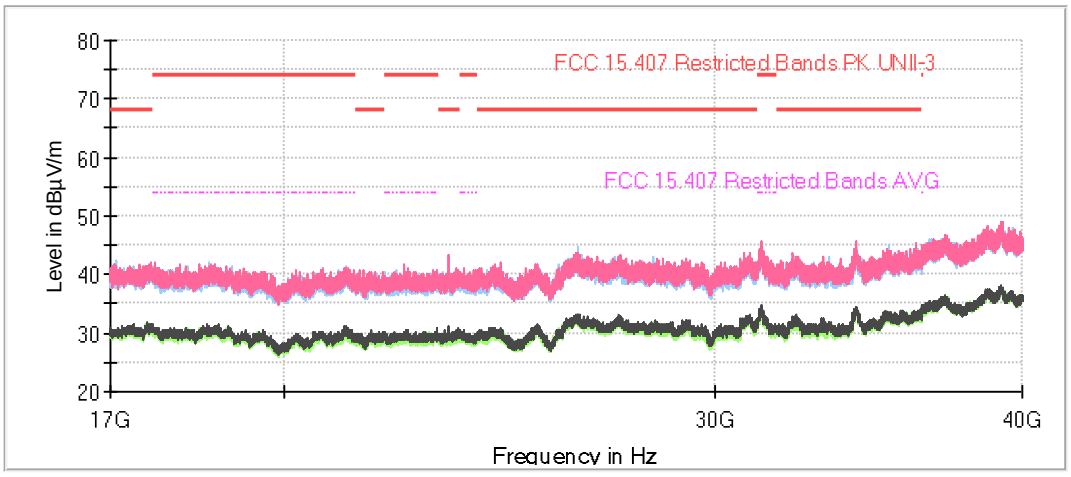
- High Channel:



Preview Result 2H-AVG
Preview Result 1H-PK+
Preview Result 2V-AVG
Preview Result 1V-PK+
FCC 15.407 Restricted Bands PK UNII-1 and UNII-2
FCC 15.407 Restricted Bands AVG
Final_Result PK+
Final_Result AVG

FREQUENCY RANGE 17 - 40 GHz (worst case):

This plot is valid for all the modulation modes and the Low, Middle and High Channels.



Preview Result 2H-AVG
Preview Result 1H-PK+
Preview Result 2V-AVG
Preview Result 1V-PK+
FCC 15.407 Restricted Bands PK UNII-3
FCC 15.407 Restricted Bands AVG
Final_Result PK+
Final_Result AVG

BAND EDGE EMISSIONS:

- **802.11 a20. Spurious emissions inside of the mask 5.65-5.925 GHz:**

- LOW CHANNEL 149 (5745 MHz):

No spurious frequencies at less than 20 dB below the limit.

- MIDDLE CHANNEL 157 (5785 MHz):

No spurious frequencies at less than 20 dB below the limit.

- HIGH CHANNEL 165 (5825 MHz):

No spurious frequencies at less than 20 dB below the limit.

- **802.11 n20. Spurious emissions inside of the mask 5.65-5.925 GHz:**

- LOW CHANNEL 149 (5745 MHz):

No spurious frequencies at less than 20 dB below the limit.

- MIDDLE CHANNEL 157 (5785 MHz):

No spurious frequencies at less than 20 dB below the limit.

- HIGH CHANNEL 165 (5825 MHz):

No spurious frequencies at less than 20 dB below the limit.

- **802.11 ac20. Spurious emissions inside of the mask 5.65-5.925 GHz:**

- LOW CHANNEL 149 (5745 MHz):

No spurious frequencies at less than 20 dB below the limit.

- MIDDLE CHANNEL 157 (5785 MHz):

No spurious frequencies at less than 20 dB below the limit.

- HIGH CHANNEL 165 (5825 MHz):

No spurious frequencies at less than 20 dB below the limit.

- **802.11 n40. Spurious emissions inside of the mask 5.65-5.925 GHz:**

- LOW CHANNEL 151 (5755 MHz):

No spurious frequencies at less than 20 dB below the limit.

- HIGH CHANNEL 159 (5795 MHz):

No spurious frequencies at less than 20 dB below the limit.

- **802.11 ac40. Spurious emissions inside of the mask 5.65-5.925 GHz:**

- LOW CHANNEL 151 (5755 MHz):

No spurious frequencies at less than 20 dB below the limit.

- HIGH CHANNEL 159 (5795 MHz):

No spurious frequencies at less than 20 dB below the limit.

- **802.11 ac80. Spurious emissions inside of the mask 5.65-5.925 GHz:**

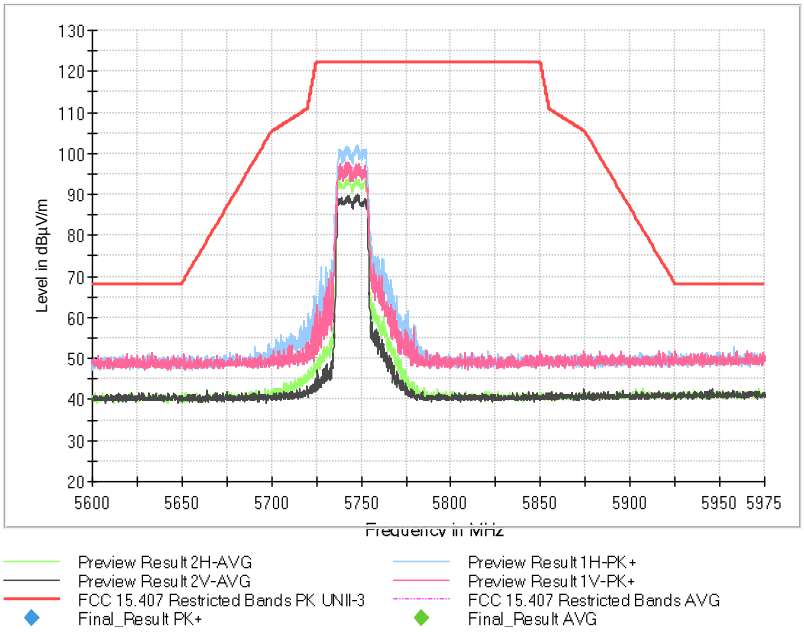
- MIDDLE CHANNEL 155 (5775 MHz):

No spurious frequencies at less than 20 dB below the limit.

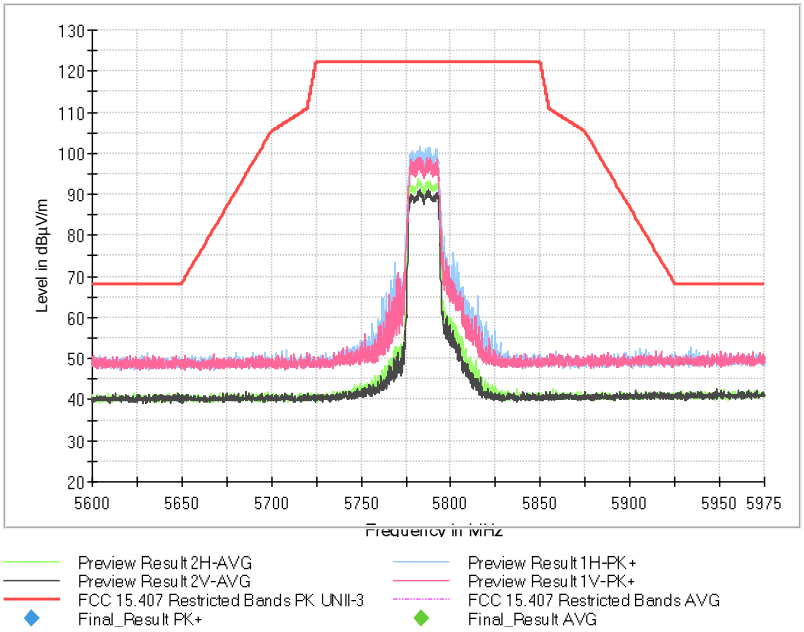
Verdict: PASS

- **802.11 a20:**

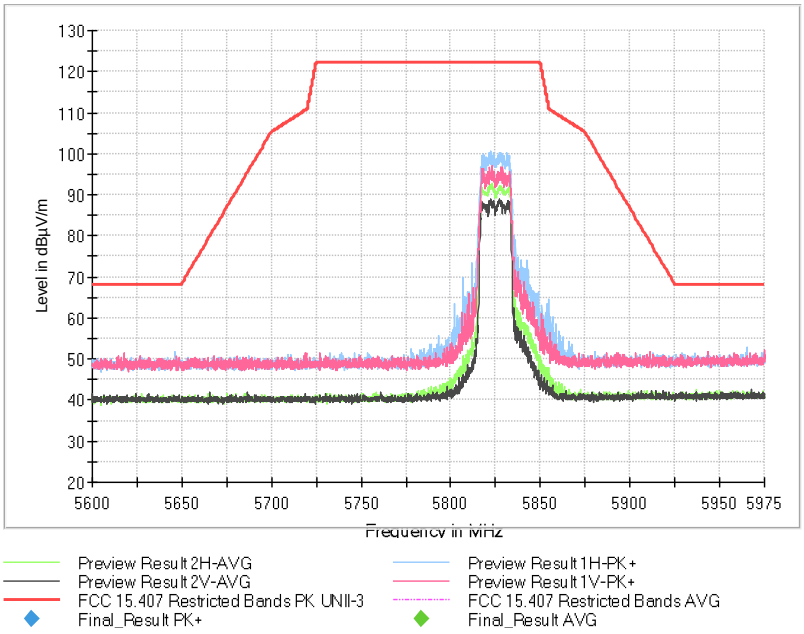
  - Low Channel 149 (5745 MHz):



  - Middle Channel 157 (5785 MHz):

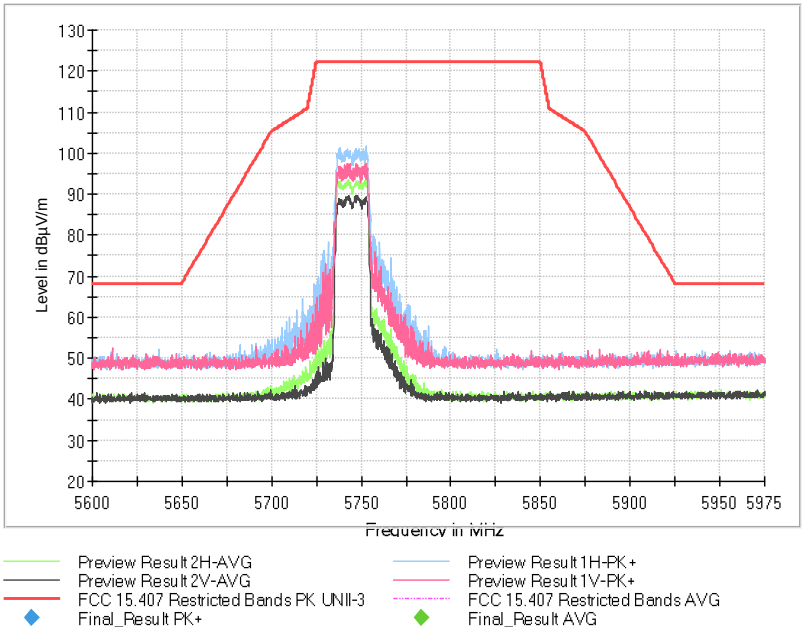


- High Channel 165 (5825 MHz):

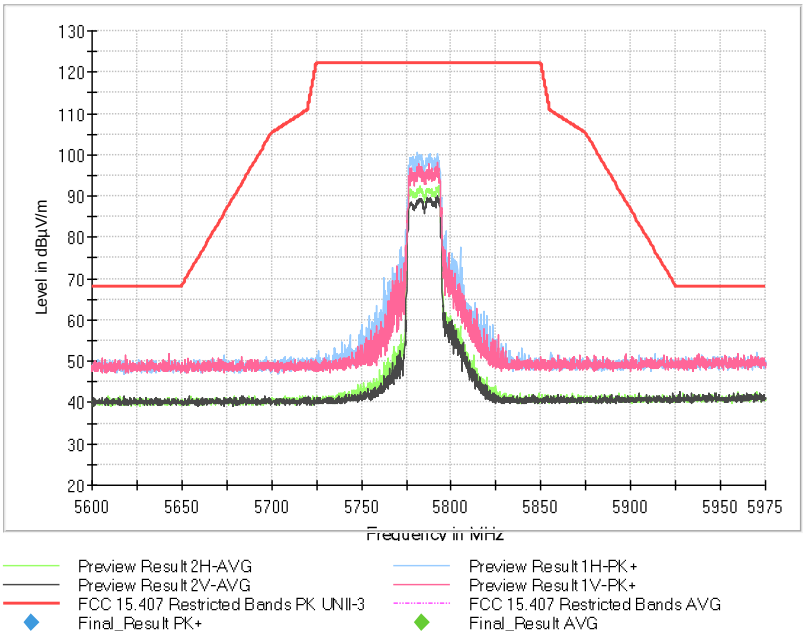


- **802.11 n20:**

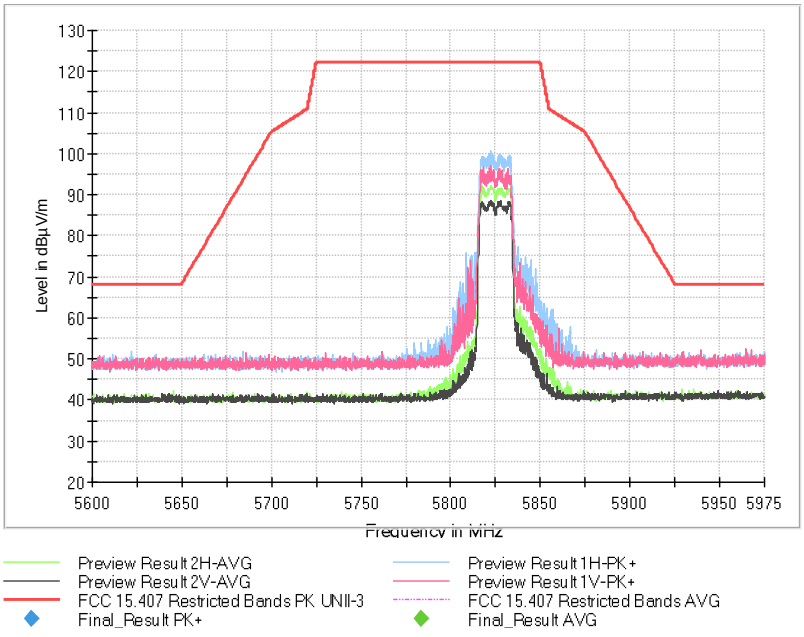
- Low Channel 149 (5745 MHz):



- Middle Channel 157 (5785 MHz):

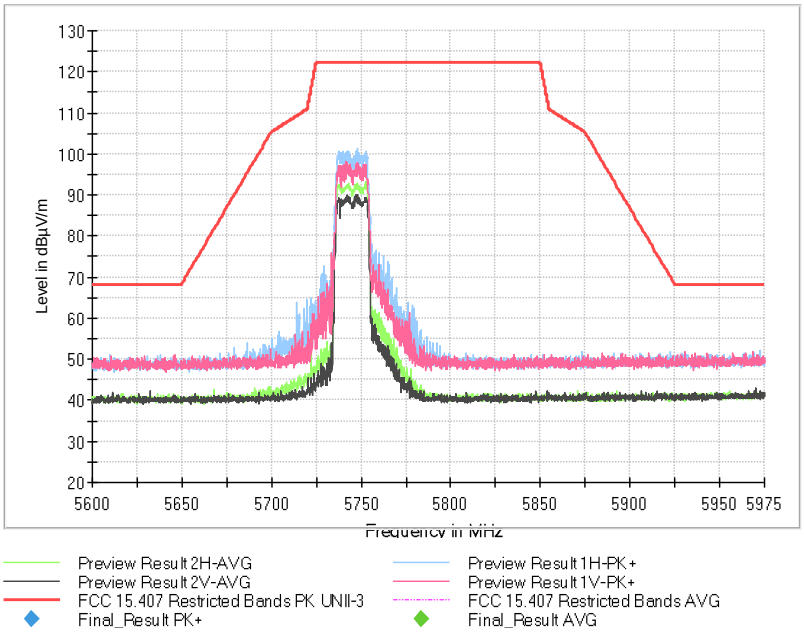


- High Channel 165 (5825 MHz):

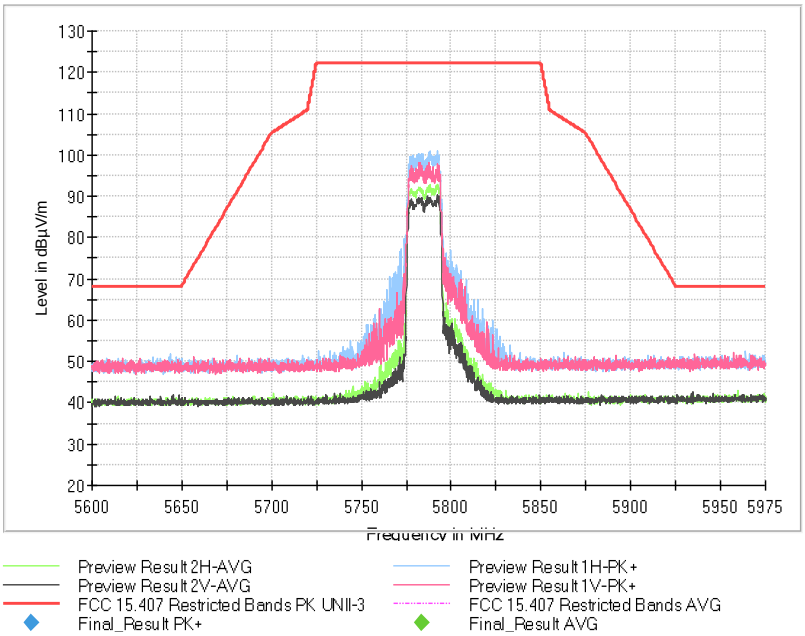


- **802.11 ac20:**

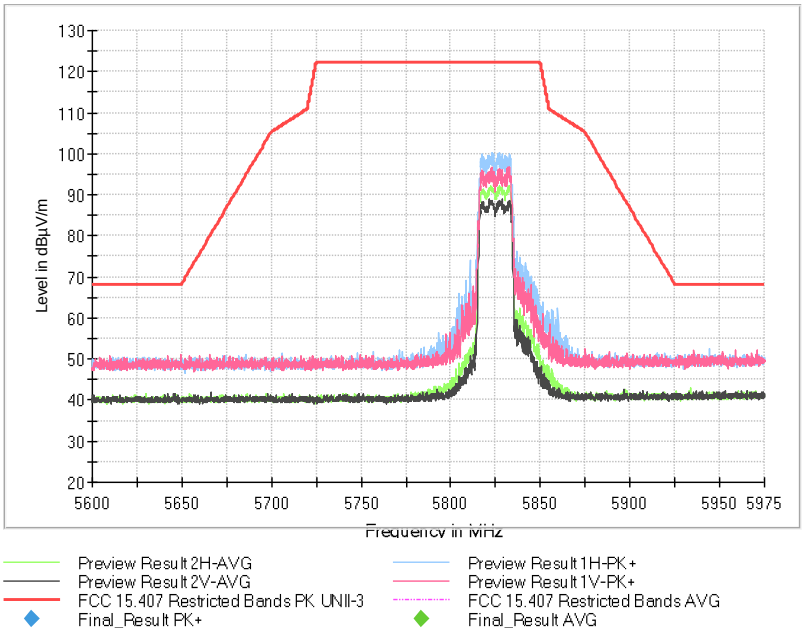
  - Low Channel 149 (5745 MHz):



  - Middle Channel 157 (5785 MHz):

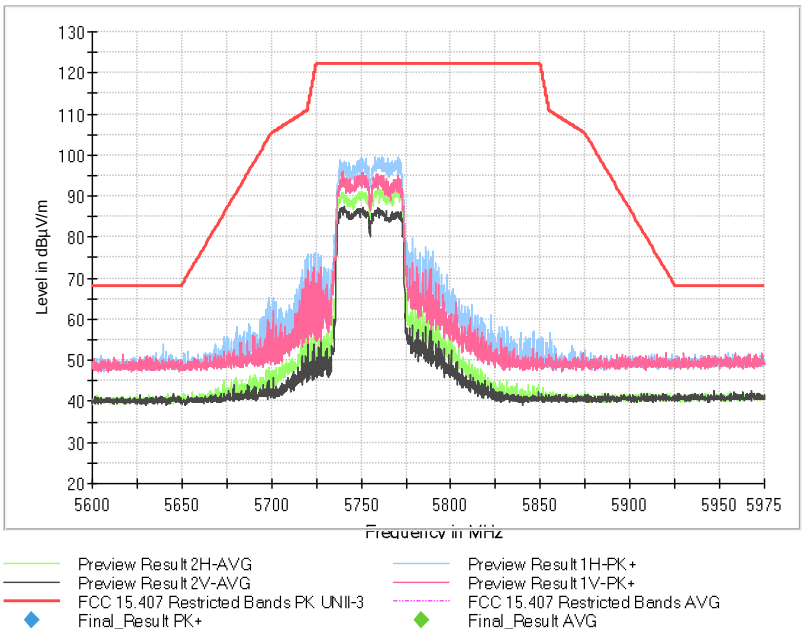


- High Channel 165 (5825 MHz):

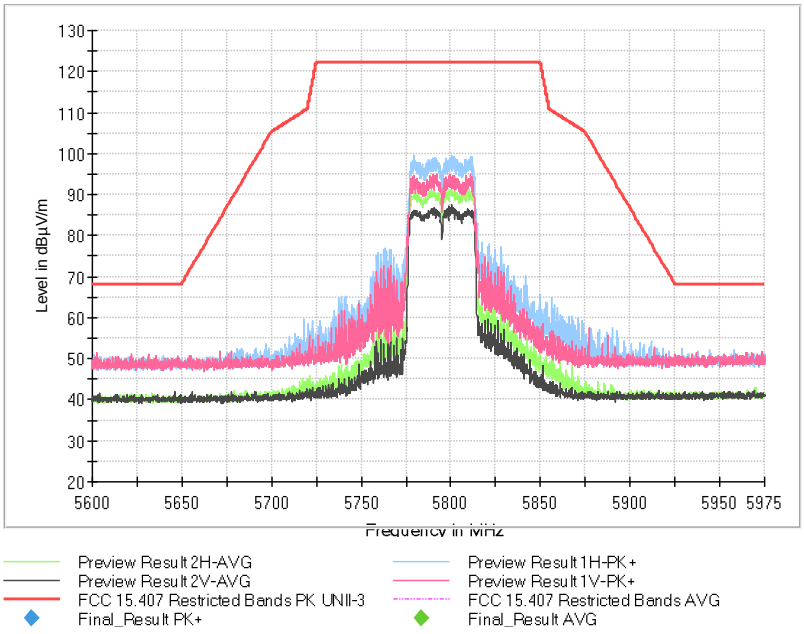


- **802.11 n40:**

- Low Channel 151 (5755 MHz):

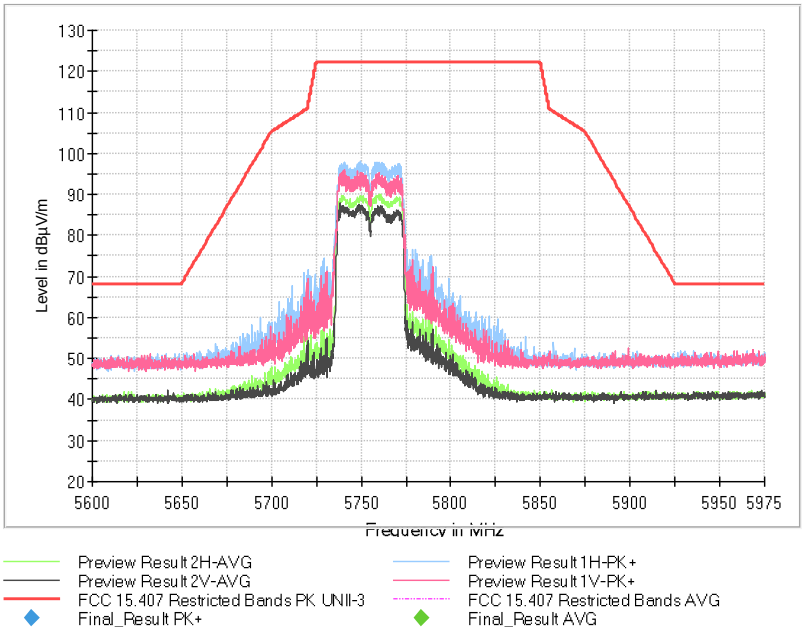


- High Channel 159 (5795 MHz):

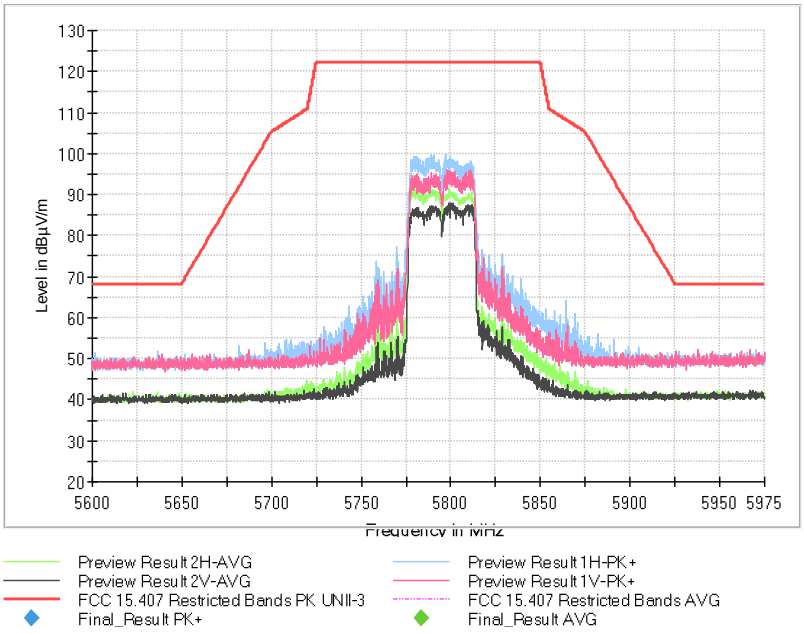


- **802.11 ac40:**

- Low Channel 149 (5745 MHz):



- High Channel 165 (5825 MHz):



- **802.11 ac80:**

- Middle Channel 155 (5775 MHz):