

## FCC 15.407 (b)(4)(6) / RSS-247 6.2.4.2. Transmitter Out of Band 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 360° 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.

All tests were performed in a semi-anechoic chamber at a distance of 1m for the frequency range 1 GHz-40 GHz and a distance of 3m for frequency range 30MHz-1GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum 102nalyser. 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.

- **Test performed on the worst case:** **802.11 a20 (6 Mbps).**

### 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.

Spurious frequencies detected at less than 20 dB below the limit:

| Spurious frequency (MHz) | Emission Level (dBμV/m) | Polarization | Detector   | Measurement Uncertainty (dB) |
|--------------------------|-------------------------|--------------|------------|------------------------------|
| 425.857000               | 26.59                   | V            | Quasi-Peak | <± 5.1                       |
| 585.082500               | 33.66                   | H            | Quasi-Peak | <± 5.1                       |
| 722.919500               | 29.05                   | H            | Quasi-Peak | <± 5.1                       |
| 780.101000               | 30.93                   | H            | Quasi-Peak | <± 5.1                       |

### 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.

- **802.11 a20 (worst case):**

- 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.

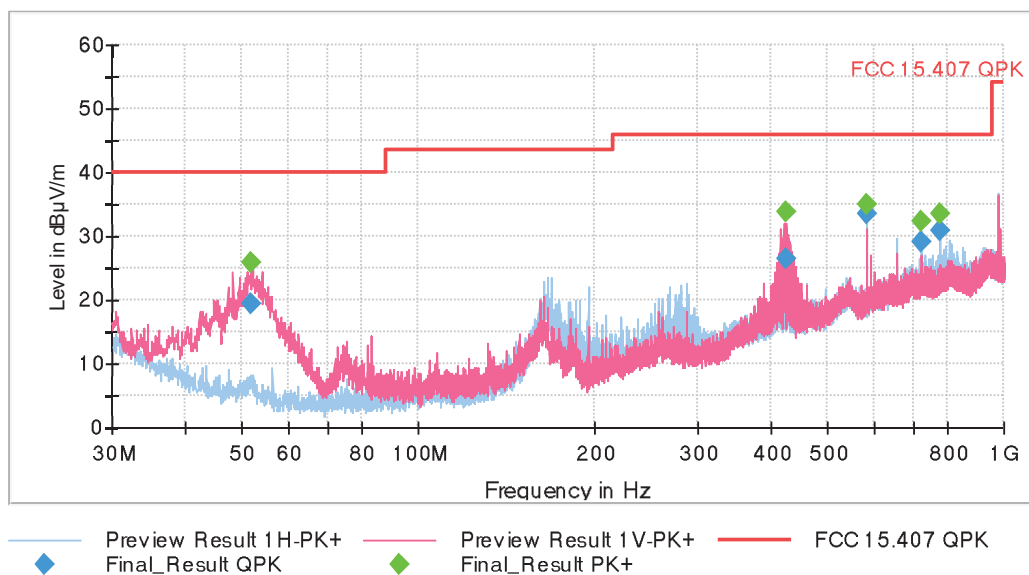
- HIGH CHANNEL. No spurious frequencies at less than 20 dB below the limit.

Measurement Uncertainty (dB):  
1 GHz - 17 GHz <± 4.6  
17 GHz - 26.5 GHz <± 4.89  
26.5 GHz - 40 GHz <± 5.14

Verdict: PASS

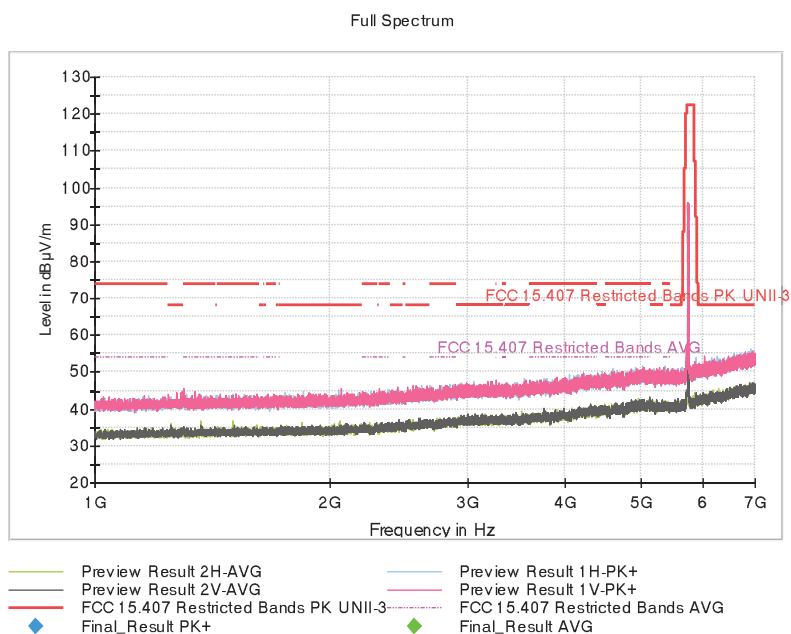
## FREQUENCY RANGE 30 MHz - 1 GHz (worst case):

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



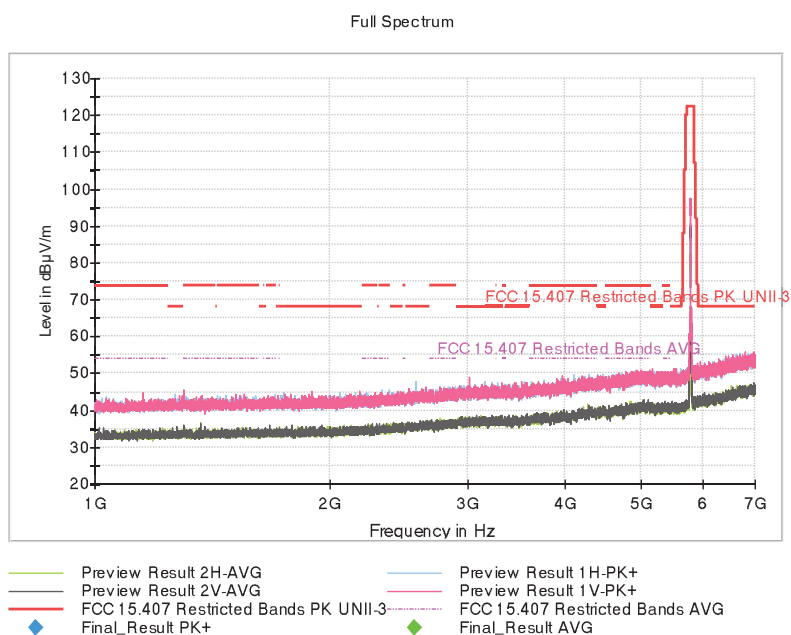
## FREQUENCY RANGE 1 - 7 GHz (worst case):

- Low Channel:



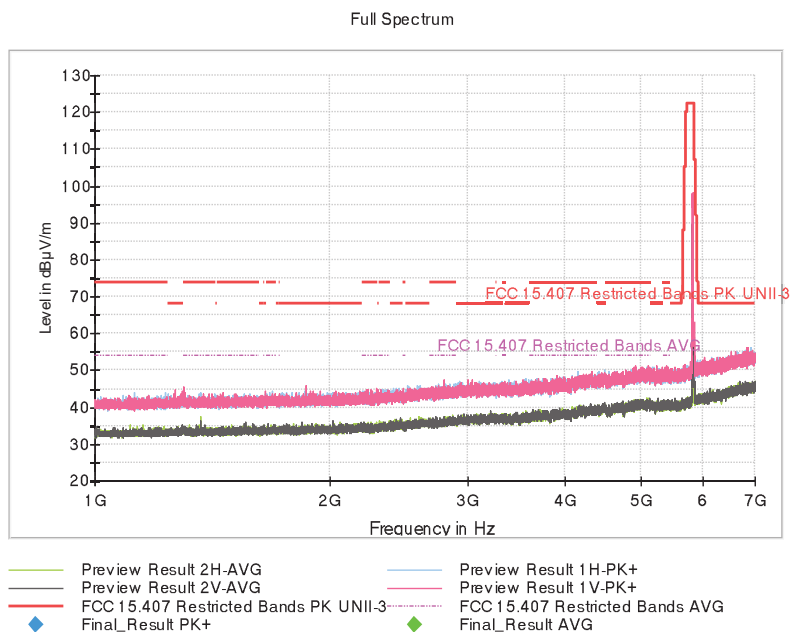
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

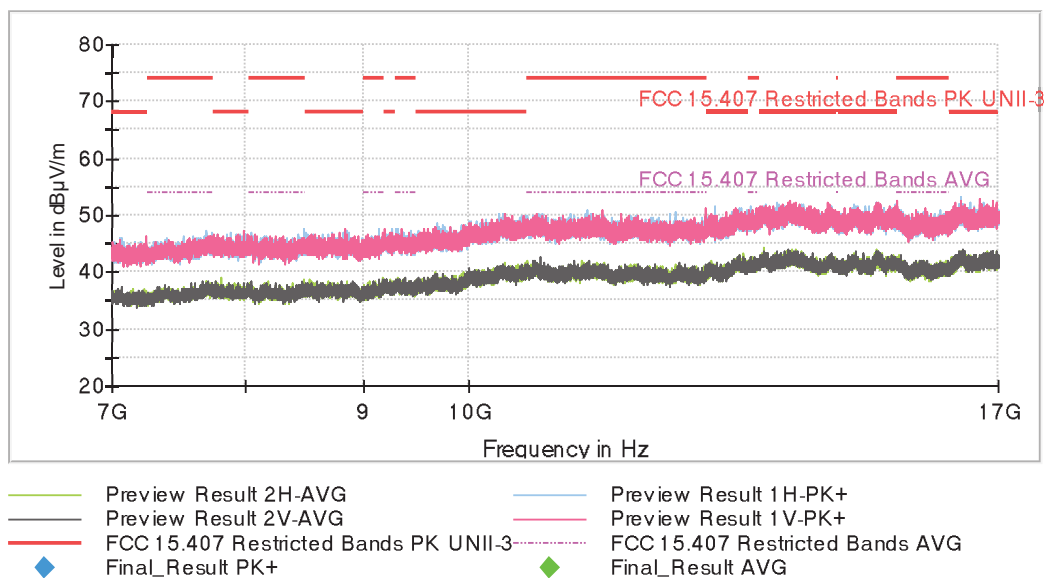
- High Channel:



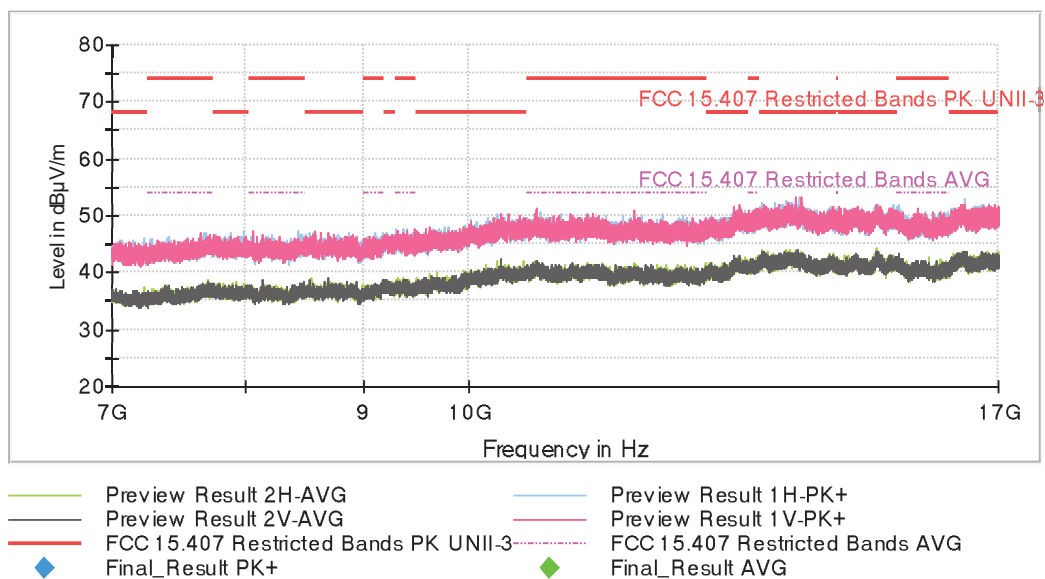
The peak above the limit is the carrier frequency.

#### FREQUENCY RANGE 7 - 17 GHz (worst case):

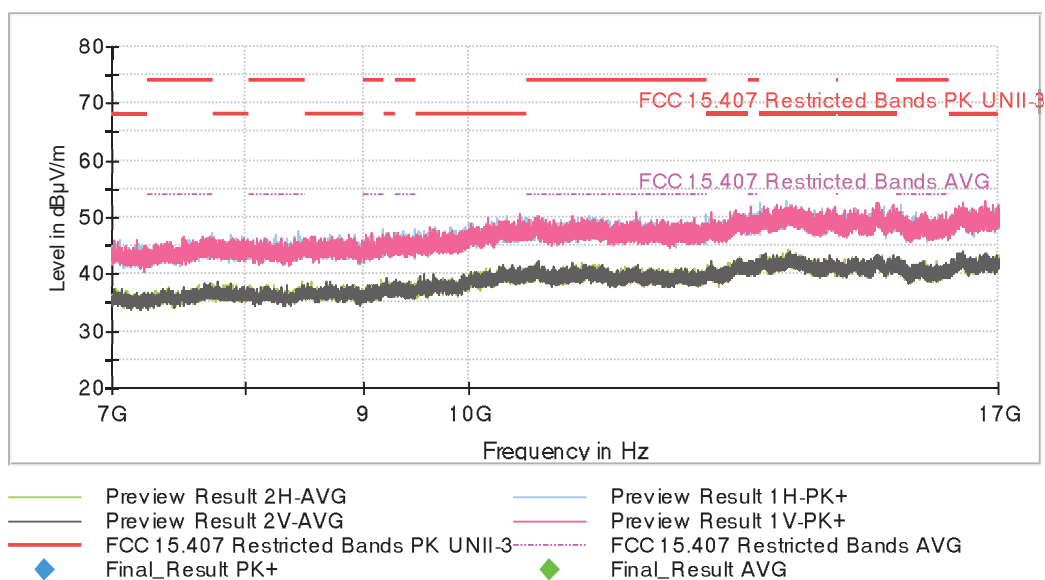
- Low Channel:



- Middle Channel:

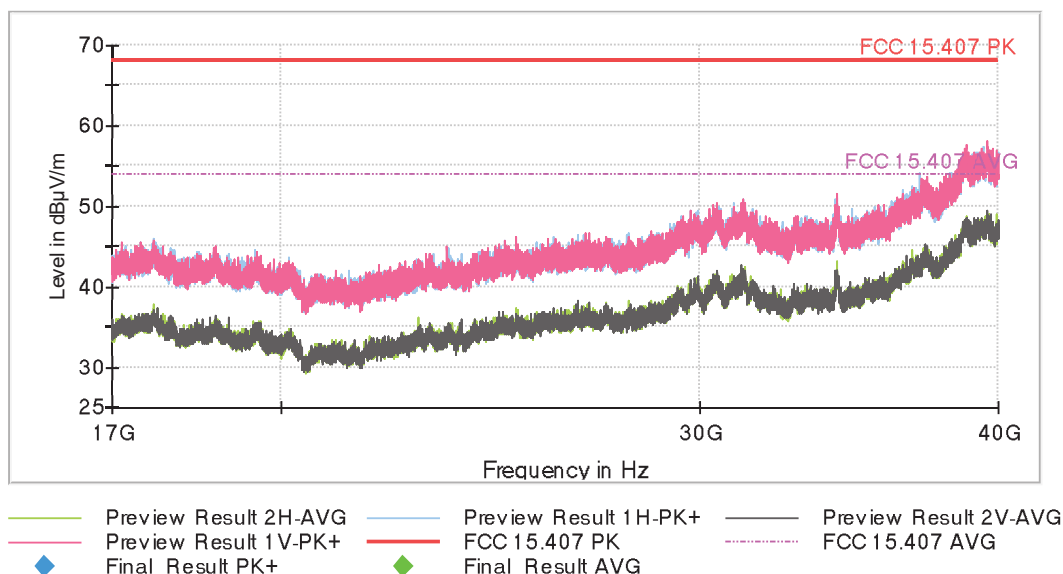


- High Channel:

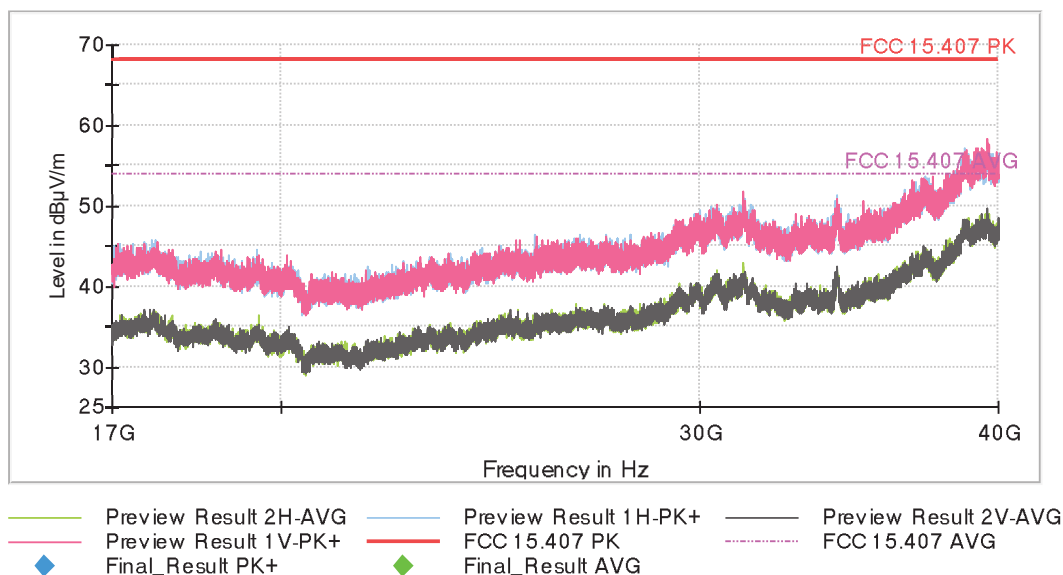


## FREQUENCY RANGE 17 - 40 GHz (worst case):

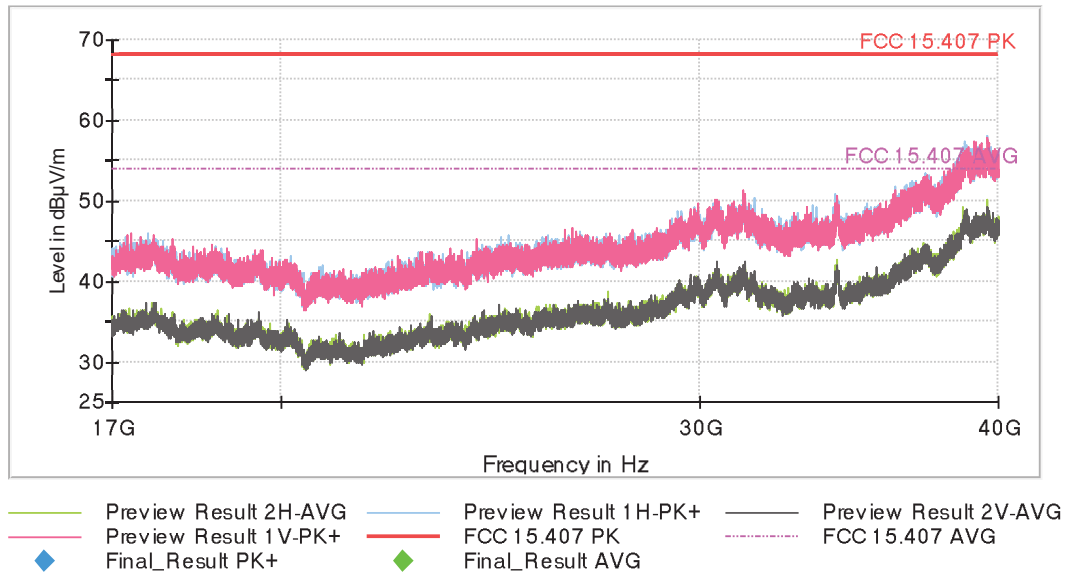
- Low Channel:



- Middle Channel:



- High Channel:



## FCC 15.407 (b)(4) / RSS-247 6.2.4.2. 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) |
|-----------------------|-----------------------|-------------------------|--------------------------|
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| 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 field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Test performed on the following worst cases modes in all relevant tests channels:

- 802.11a20: 6 Mbits.
- 802.11n HT20: MCS0.
- 802.11n HT40: MCS0.
- 802.11ac VHT40: MCS0.
- 802.11ac VHT80: MCS0.

**BAND EDGE EMISSIONS:** For U-NII-3 band edge spurious emissions inside of the mask 5.65-5.925 GHz. The Low, Middle and High Channels were tested for all modes.

- **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):

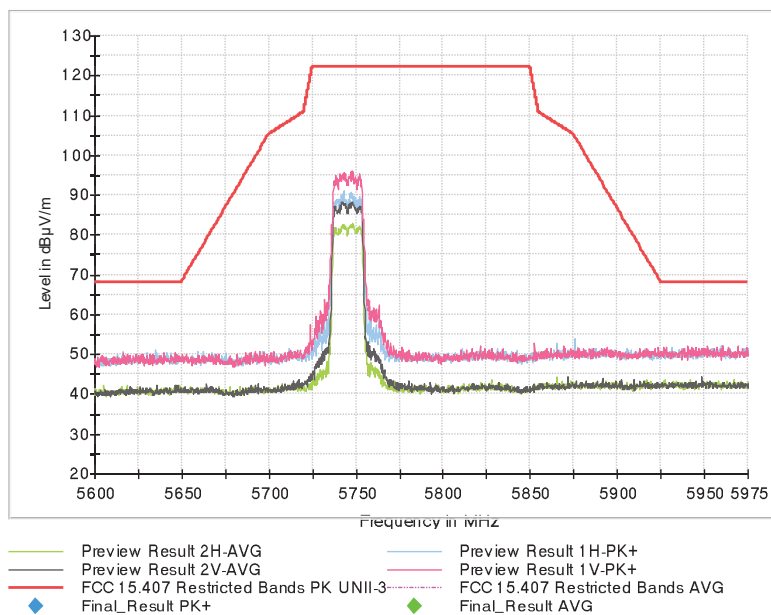
No spurious frequencies at less than 20 dB below the limit.

Measurement Uncertainty (dB)  $< \pm 4.11$

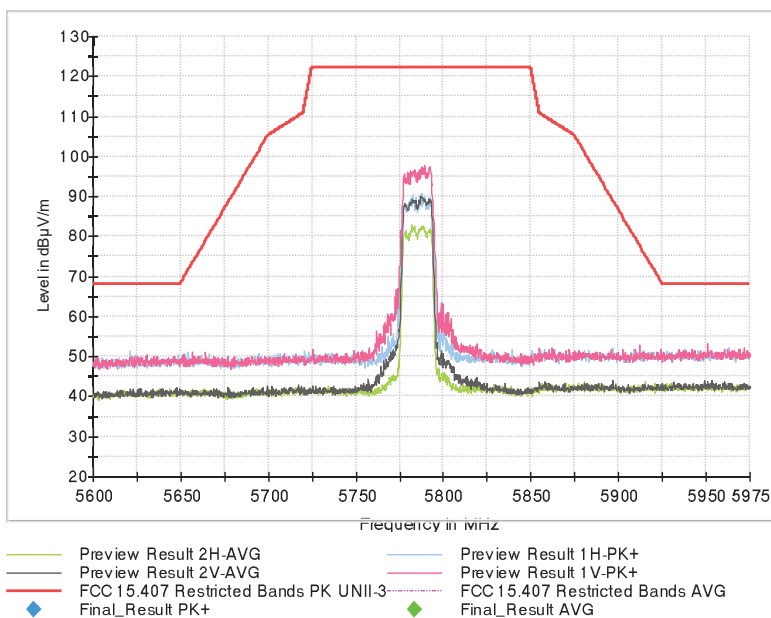
Verdict: PASS

• **802.11 a20:**

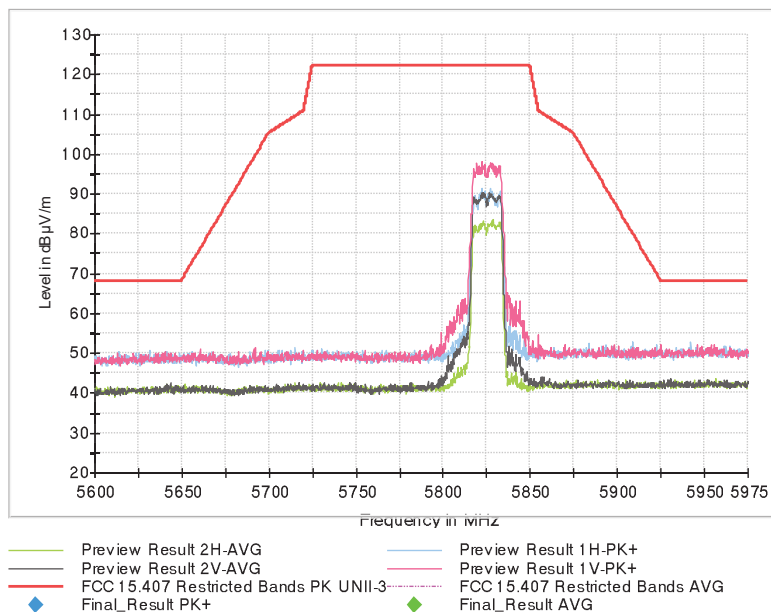
- Low Channel 149 (5745 MHz):



- Middle Channel 157 (5785 MHz):

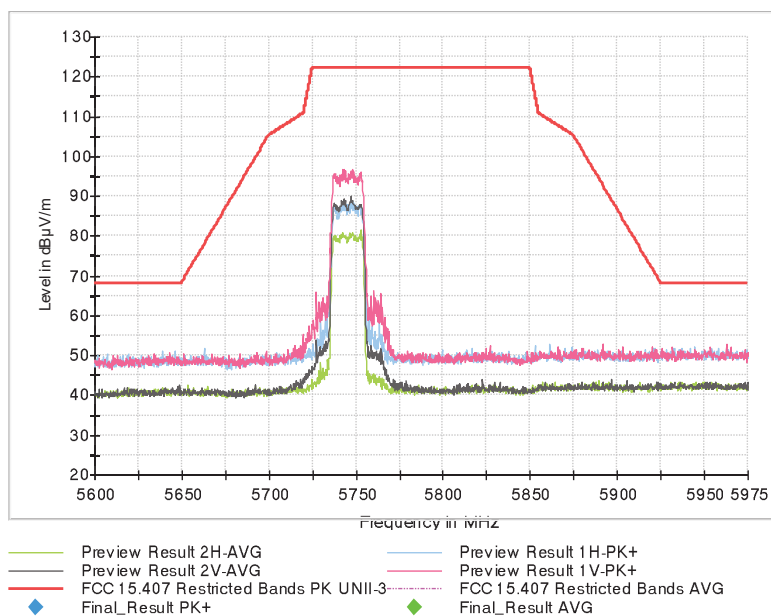


- High Channel 165 (5825 MHz):

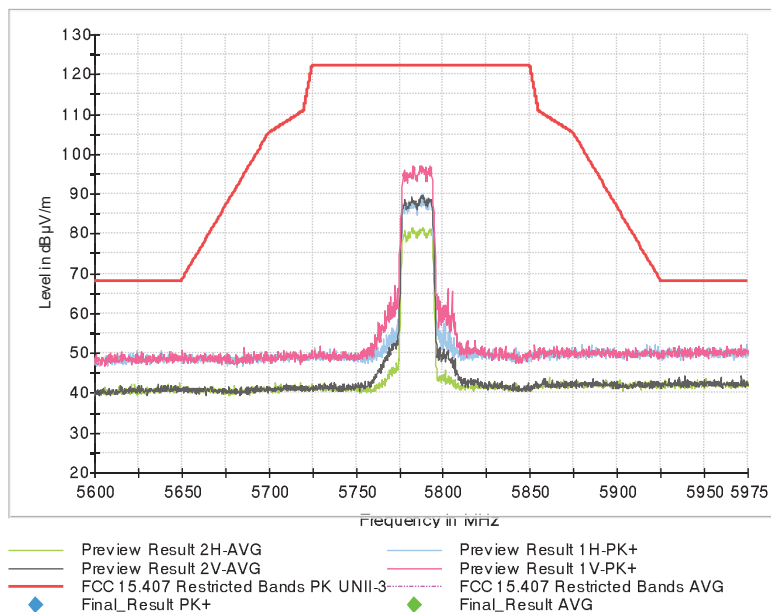


• 802.11 n20:

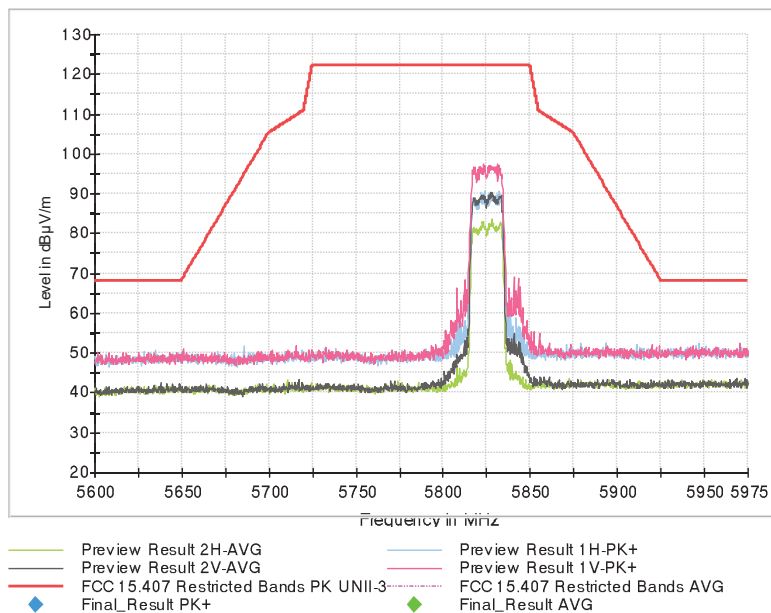
- Low Channel 149 (5745 MHz):



- Middle Channel 157 (5785 MHz):

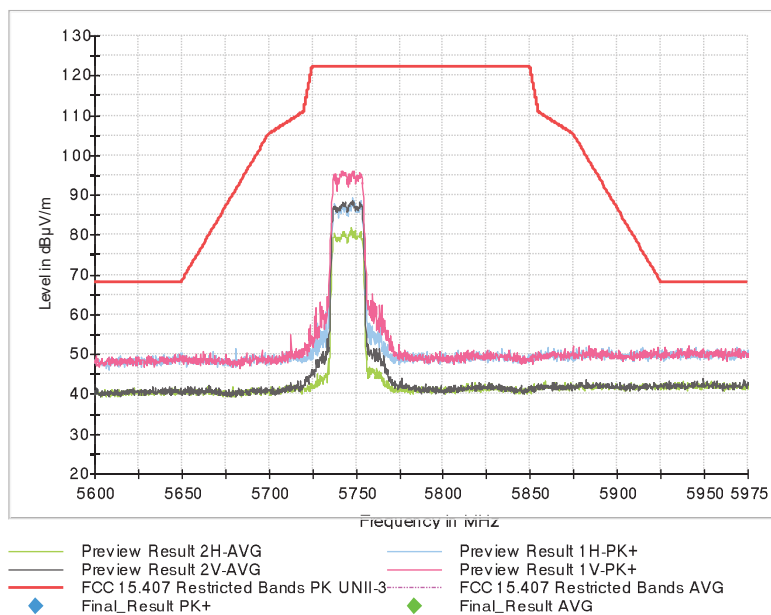


- High Channel 165 (5825 MHz):

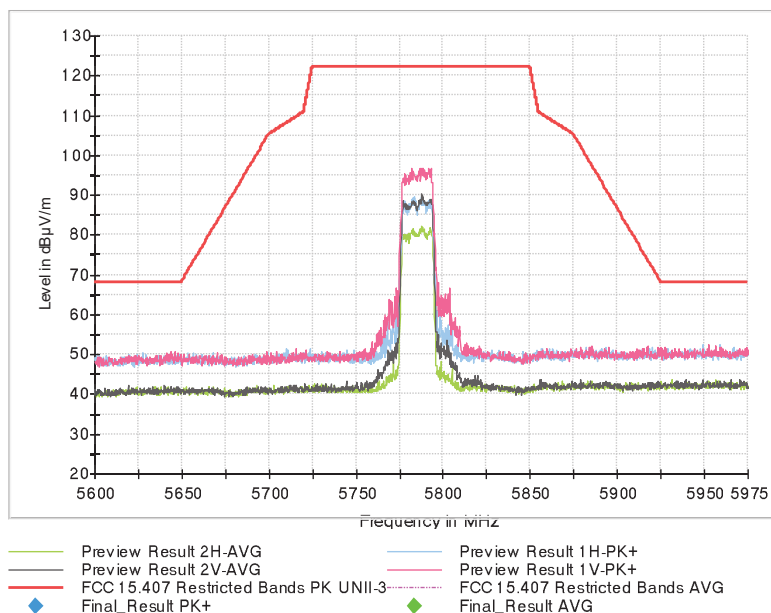


• 802.11 ac20:

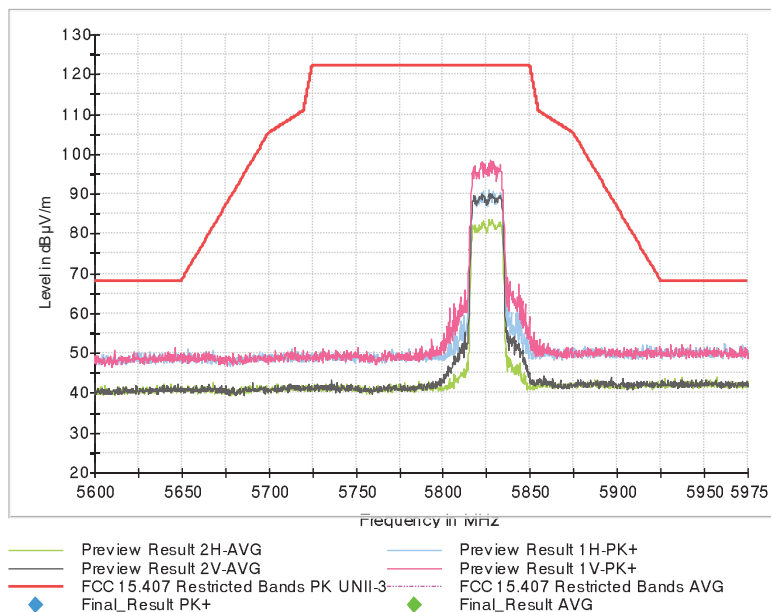
- Low Channel 149 (5745 MHz):



- Middle Channel 157 (5785 MHz):

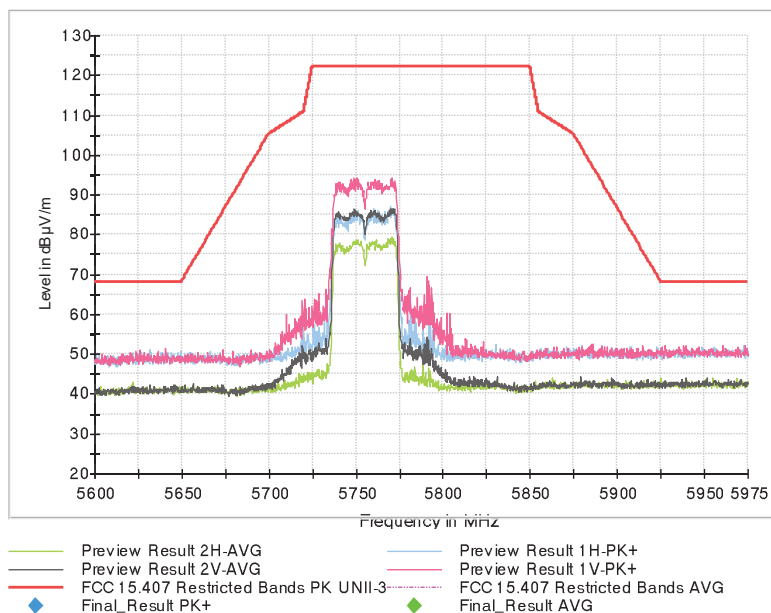


- High Channel 165 (5825 MHz):

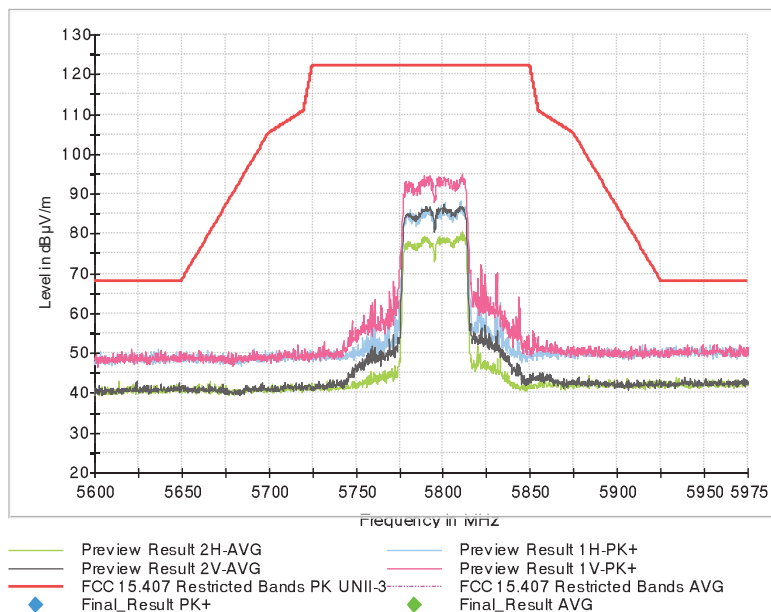


• 802.11 n40:

- Low Channel 151 (5755 MHz):

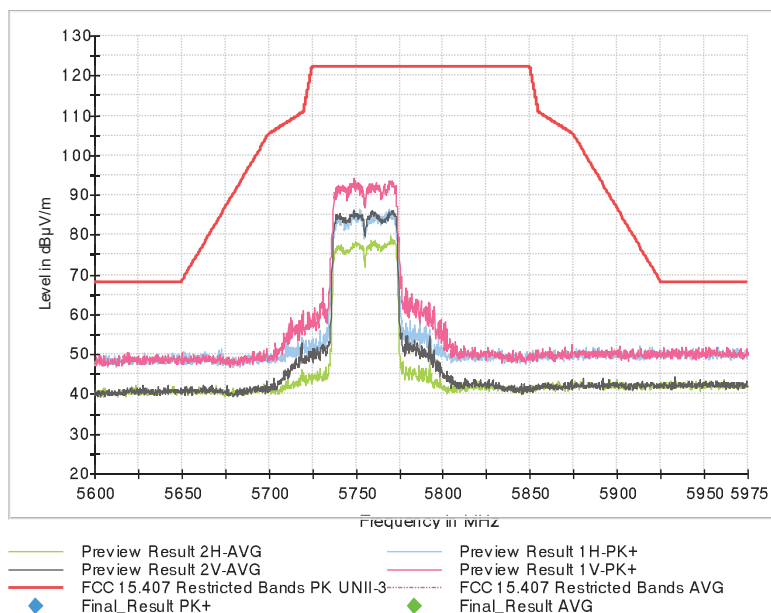


- High Channel 159 (5795 MHz):

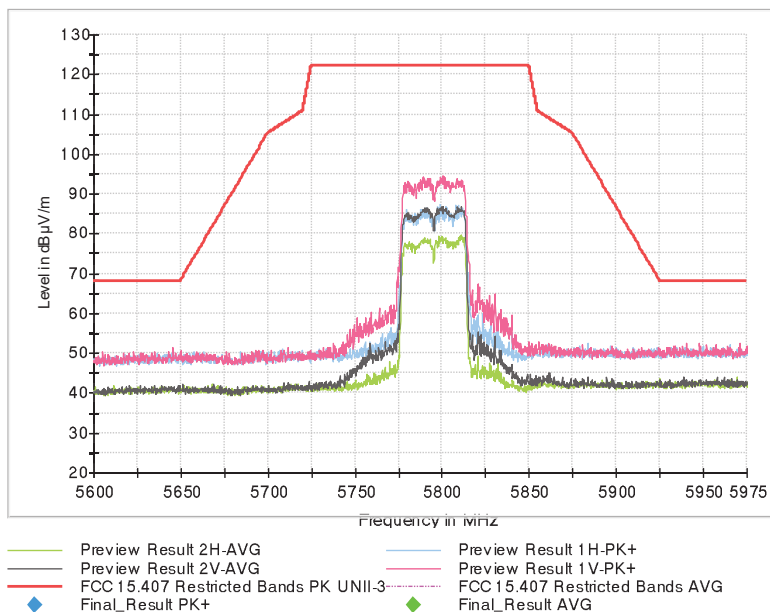


• **802.11 ac40:**

- Low Channel 149 (5745 MHz):



- High Channel 165 (5825 MHz):



• 802.11 ac80:

- Middle Channel 155 (5775 MHz):

