4.5.3 Test Results

Table 9: Emissions at the Band-Edge – Test Results

Test Conditions: Radiated Measurement, Normal Temperature and Voltage							
Antenna Type: FPCB			**Power Setting:** 21 (CCK), 15 (HT20), 9 (HT40)				
Max. Antenna Gain: 2.7 dBi							
Signal State: Modulated at 99.4% (CCK), 96.7% (HT20), and 93.5% (HT40) Duty Cycle.							
Ambient Temp.: 22° C				**Relative Humidity:** 38%			
Lower Restricted Band Edge							
Freq. (MHz)	**Mode**	**Channel**	**Detector (Average/ Peak)**	**Measured (dBuV/m)**	**Limit (dBuV/m)**	**Margin**	**Results**
2374.4	802.11b 1Mbps	1	Average	50.4	54	3.6	Pass
2377.9	802.11b 1Mbps	1	Peak	67.1	74	6.9	Pass
2389.9	802.11n HT20 MCS0	1	Average	49.0	54	5.0	Pass
2389.9	802.11n HT20 MCS0	1	Peak	64.4	74	9.6	Pass
2389.4	802.11n HT40 MCS0	3	Average	50.1	54	3.9	Pass
2389.2	802.11n HT40 MCS0	3	Peak	64.8	74	9.2	Pass
2389.7	802.11ac VHT20 MCS0 (BF)	1	Average	47.7	54	6.3	Pass
2389.3	802.11ac VHT20 MCS0 (BF)	1	Peak	63.8	74	10.2	Pass
2389.7	802.11ac VHT40 MCS0 (BF)	3	Average	49.9	54	4.1	Pass
2388.5	802.11ac VHT40 MCS0 (BF)	3	Peak	65.0	74	9.0	Pass
Upper Restricted Band Edge							
Freq. (MHz)	**Mode**	**Channel**	**Detector (Average/ Peak)**	**Measured (dBuV/m)**	**Limit (dBuV/m)**	**Margin**	**Results**
2495.9	802.11b 1Mbps	11	Average	47.1	54	6.9	Pass
2484.0	802.11b 1Mbps	11	Peak	64.0	74	10.0	Pass
2483.6	802.11n HT20 MCS0	9	Average	49.3	54	4.7	Pass
2484.1	802.11n HT20 MCS0	9	Peak	65.7	74	8.3	Pass
2484.8	802.11n HT40 MCS0	9	Average	45.9	54	8.1	Pass

2484.5	802.11n HT40 MCS0	9	Peak	60.9	74	13.1	Pass
2483.5	802.11ac VHT20 MCS0 (BF)	11	Average	48.2	54	5.8	Pass
2484.1	802.11ac VHT20 MCS0 (BF)	11	Peak	63.5	74	10.5	Pass
2489.2	802.11ac VHT40 MCS0 (BF)	9	Average	45.6	54	8.4	Pass
2483.6	802.11ac VHT40 MCS0 (BF)	9	Peak	61.9	74	12.1	Pass
Note: 1. 2. The DCCF (Average Detector) is included in this table, the following plots are uncorrected							

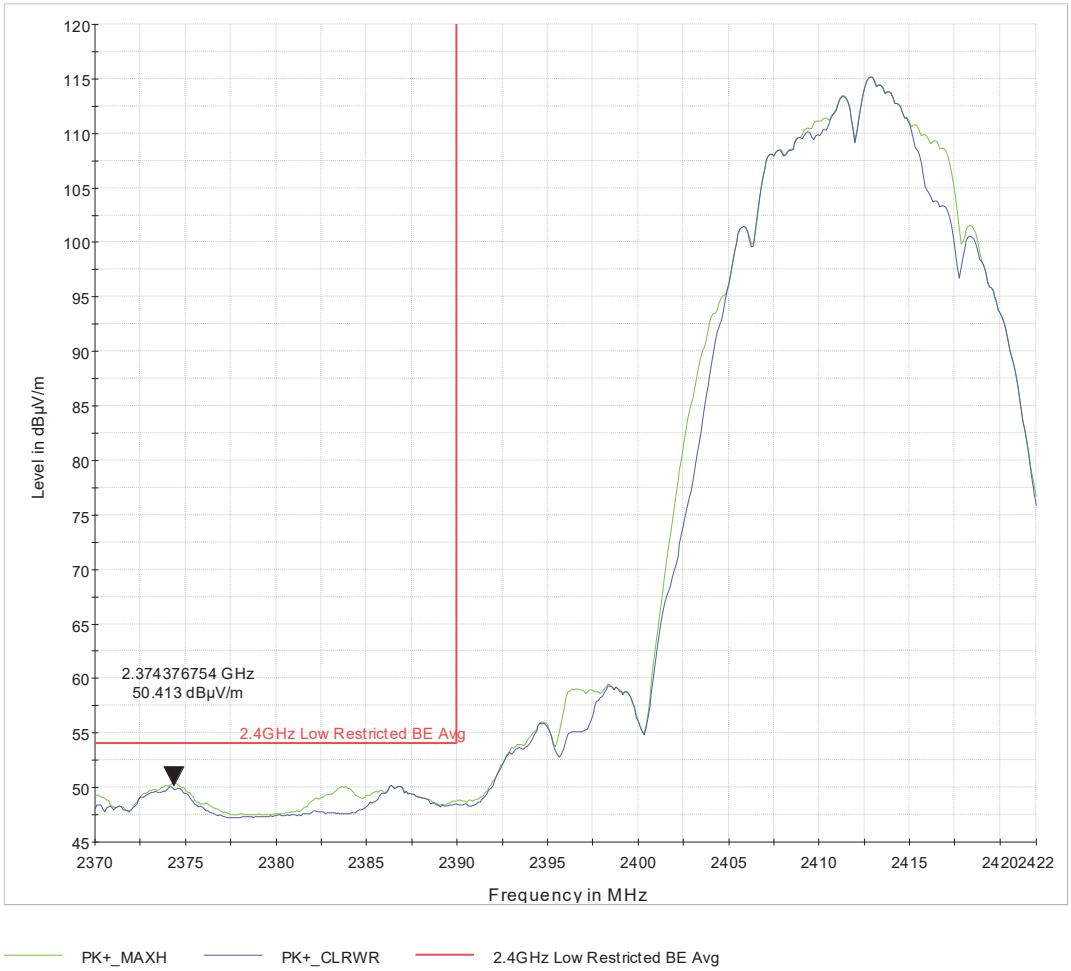


Figure 46: Low Band Edge (restricted) for 802.11b CCK 1mbps at 2412 MHz-Average

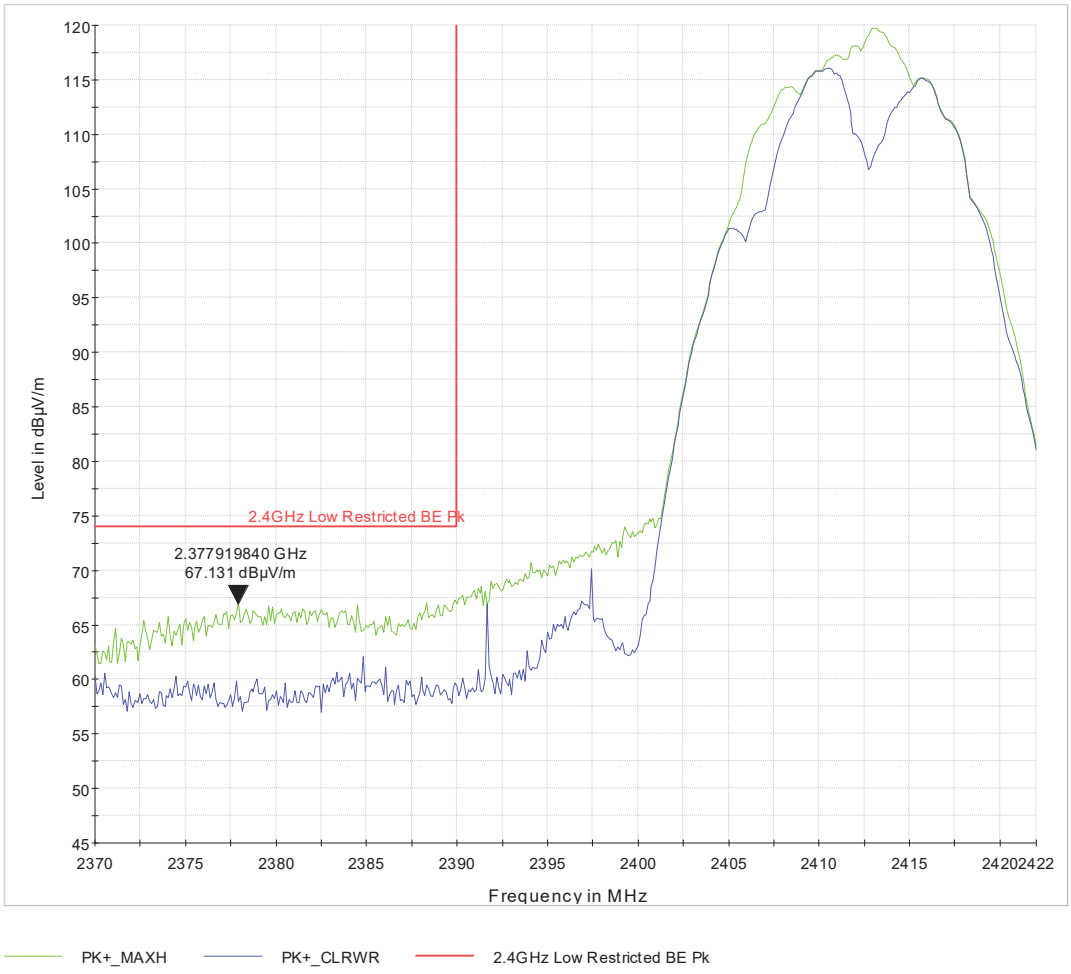


Figure 47: Low Band Edge (restricted) for 802.11b CCK 1mbps at 2412 MHz-Peak

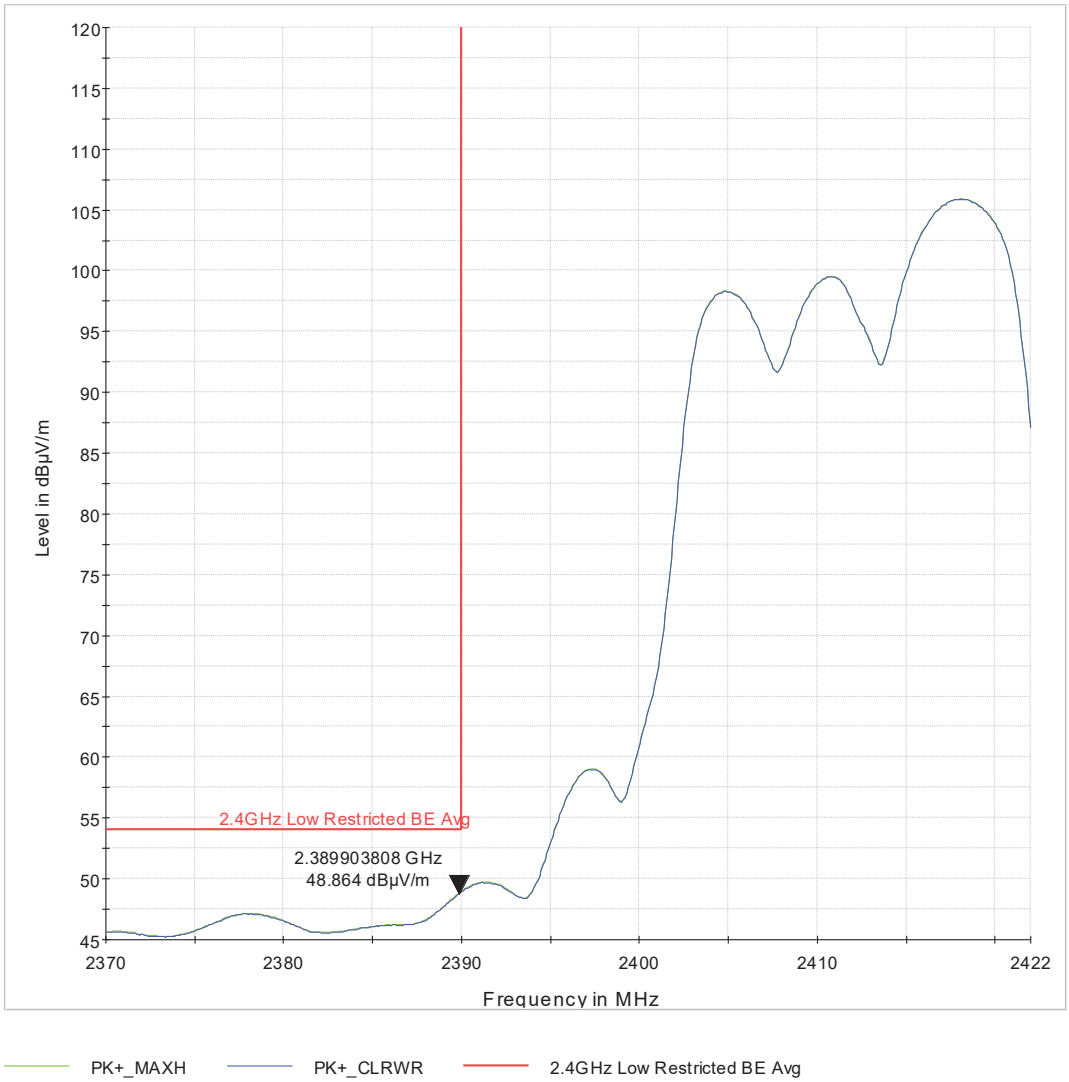


Figure 48: Low Band Edge (restricted) for 802.11n HT20 MCS0 at 2412 MHz-Average

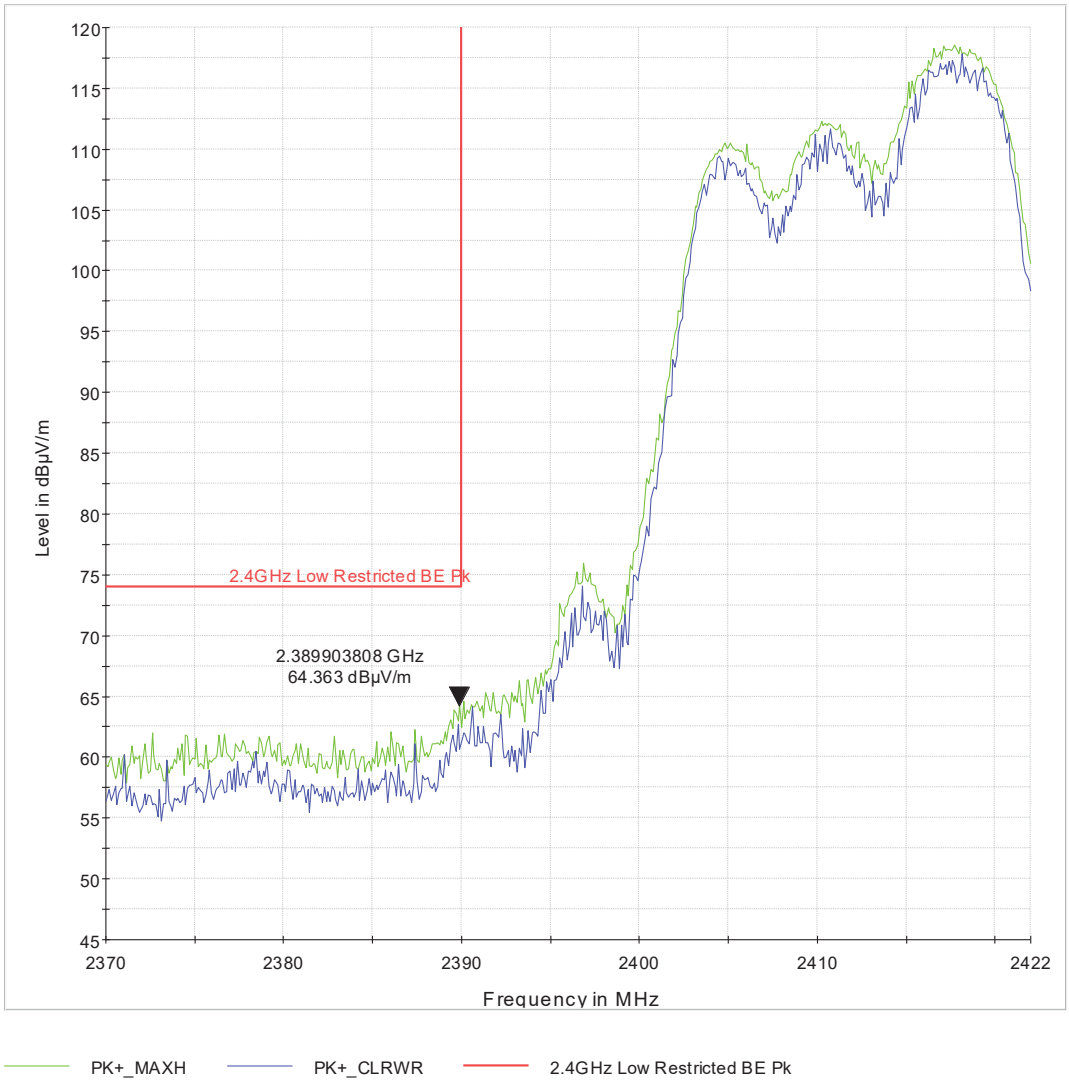


Figure 49: Low Band Edge (restricted) for 802.11n HT20 MCS0 at 2412 MHz-Peak

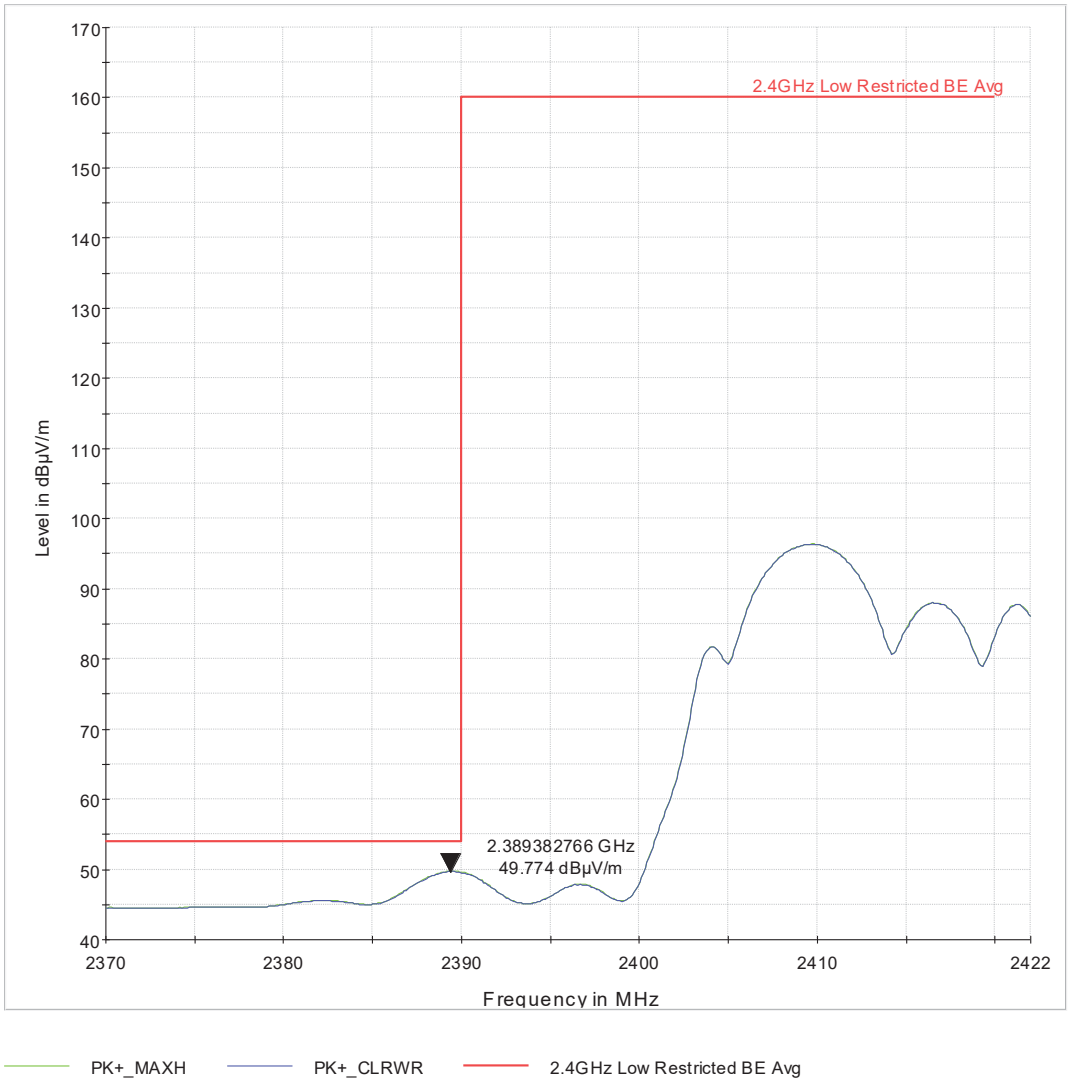


Figure 50: Low Band Edge (restricted) for 802.11n HT40 MCS0 at 2422 MHz-Average

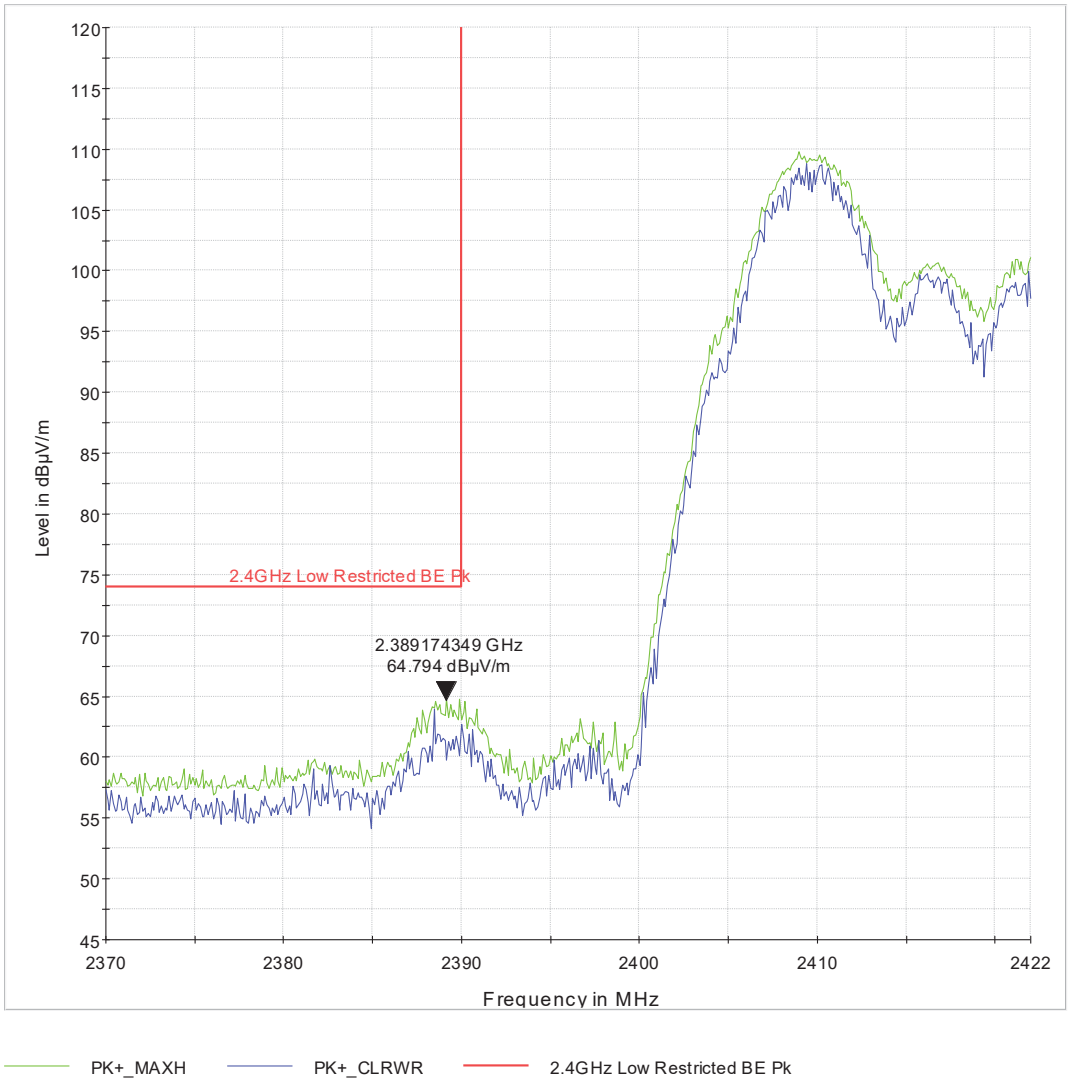


Figure 51: Low Band Edge (restricted) for 802.11n HT40 MCS0 at 2422 MHz-Peak

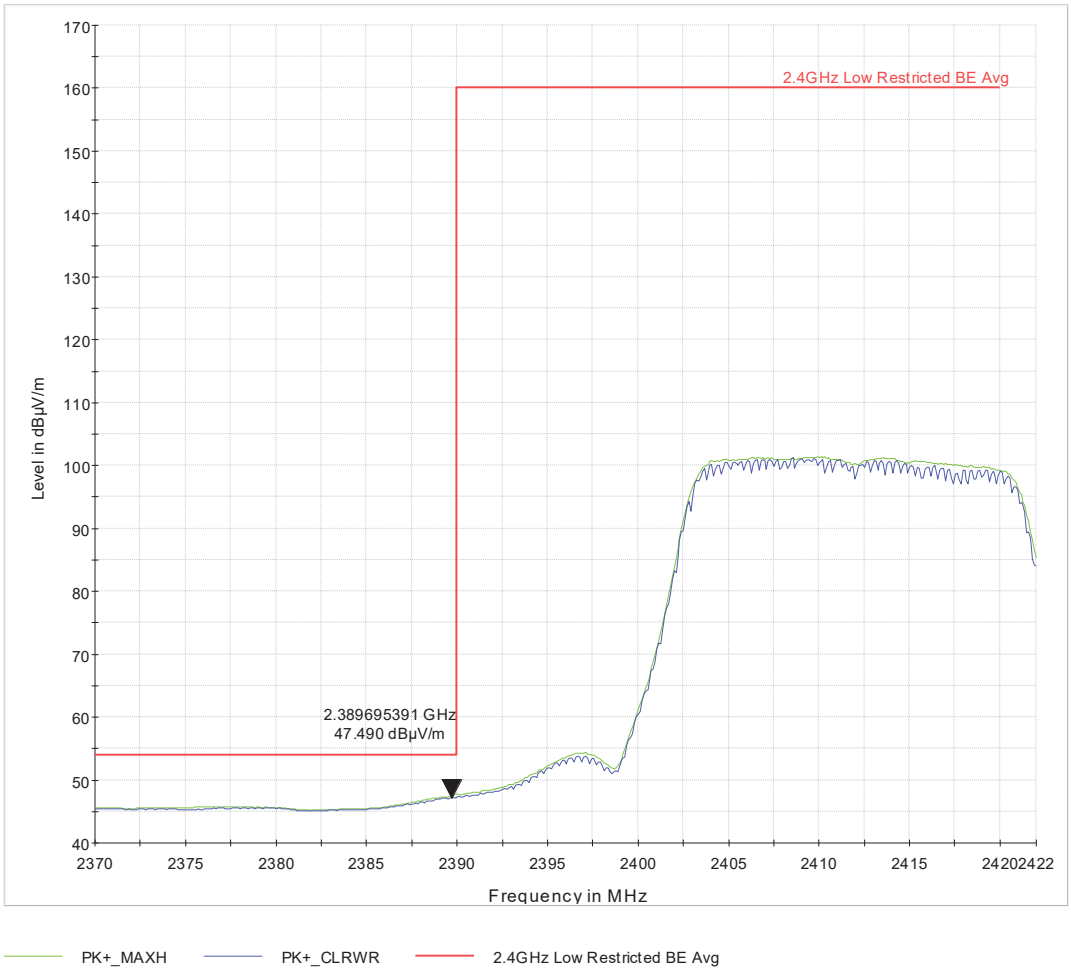


Figure 52: Low Band Edge (restricted) for 802.11ac VHT20 (BF) MCS0 at 2412 MHz-Average

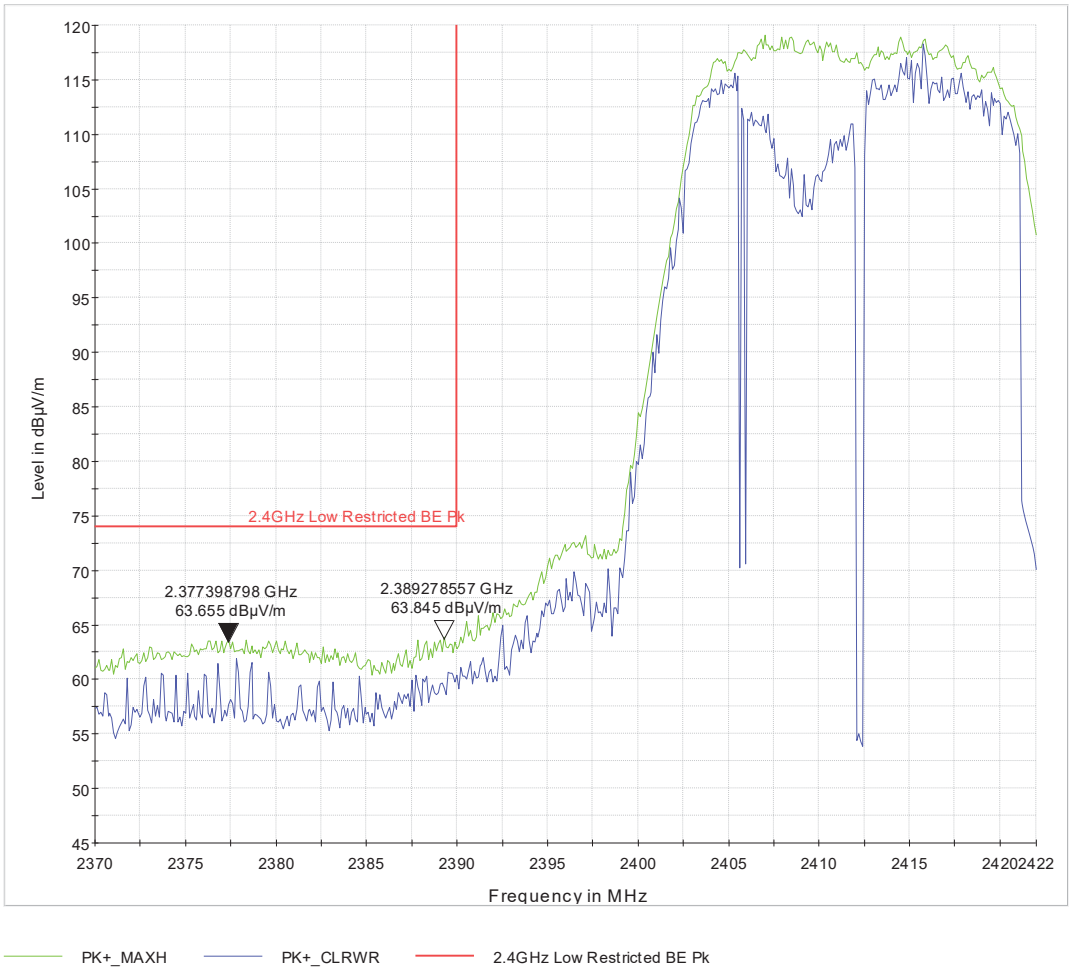


Figure 53: Low Band Edge (restricted) for 802.11ac VHT20 (BF) MCS0 at 2412 MHz-Peak

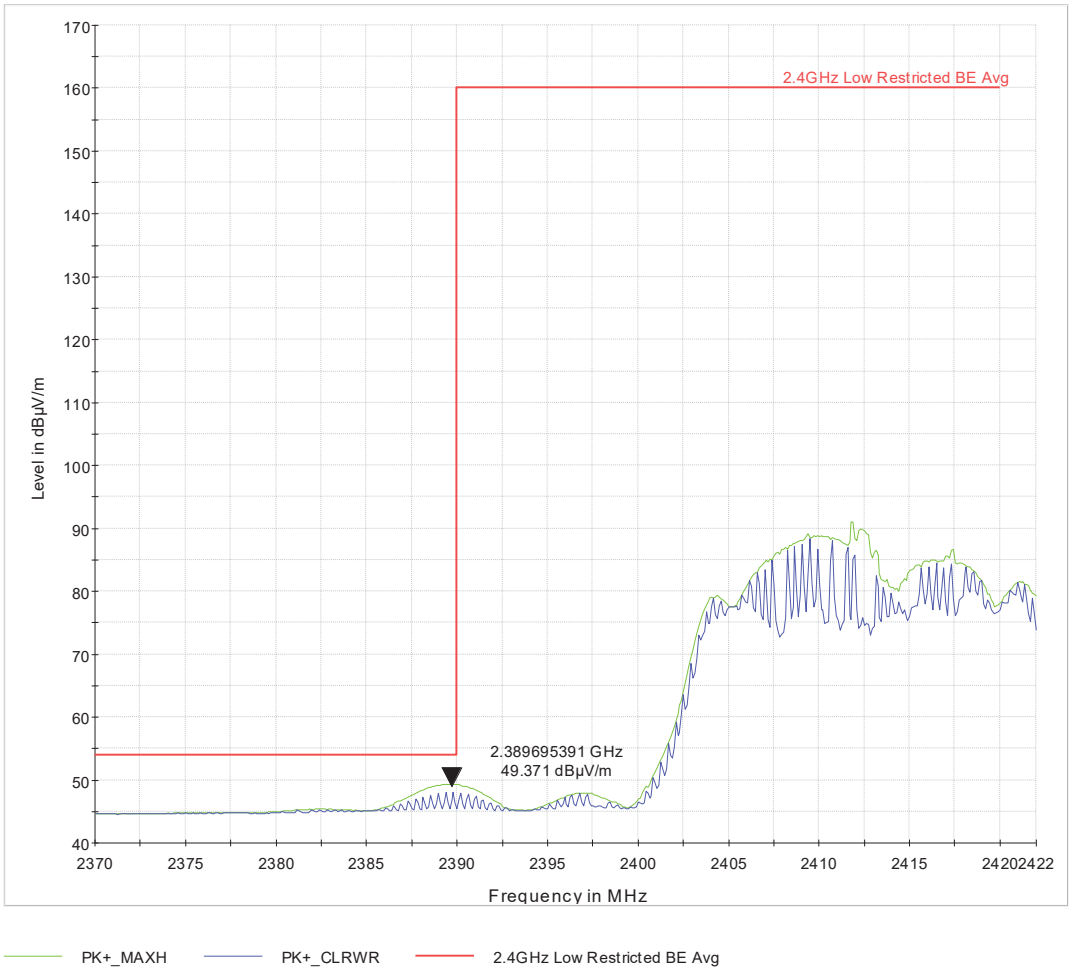


Figure 54: Low Band Edge (restricted) for 802.11ac VHT40 (BF) MCS0 at 2422 MHz-Average

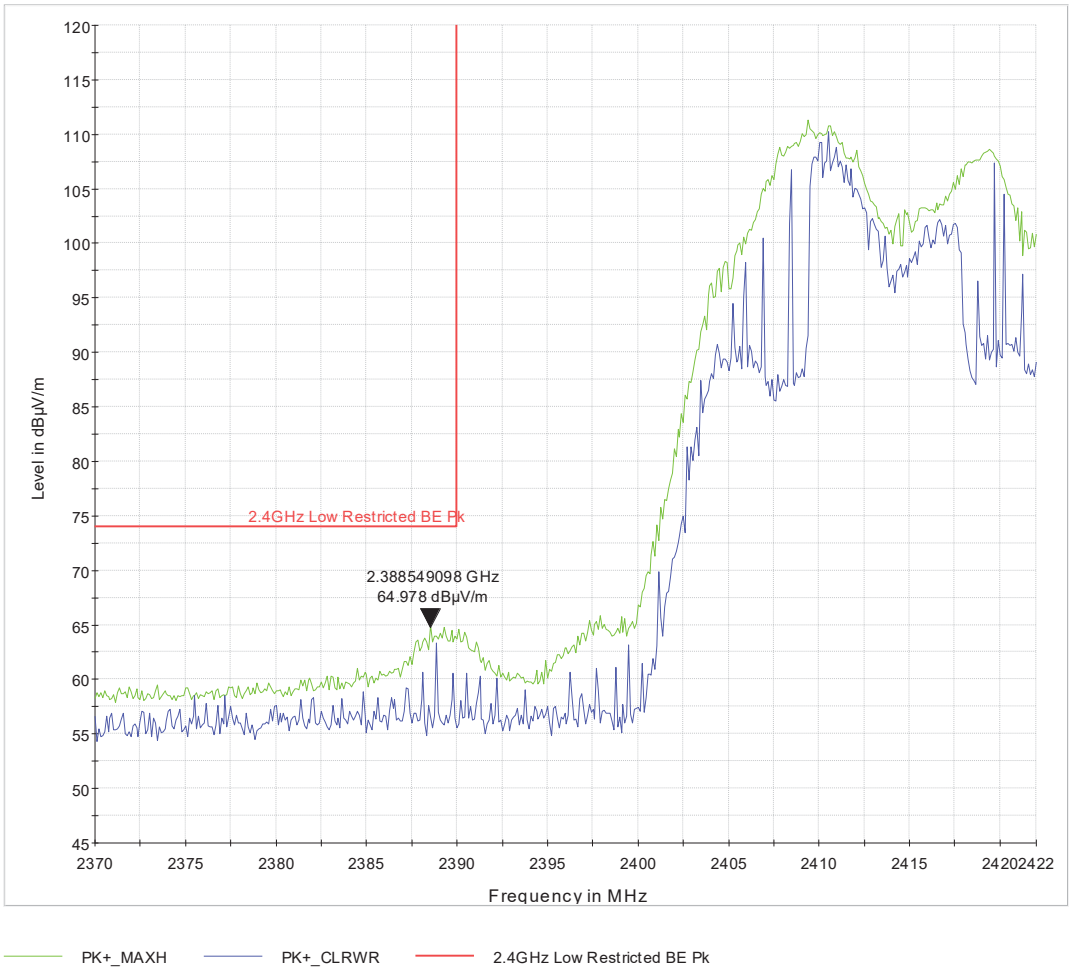


Figure 55: Low Band Edge (restricted) for 802.11ac VHT40 (BF) MCS0 at 2422 MHz-Peak

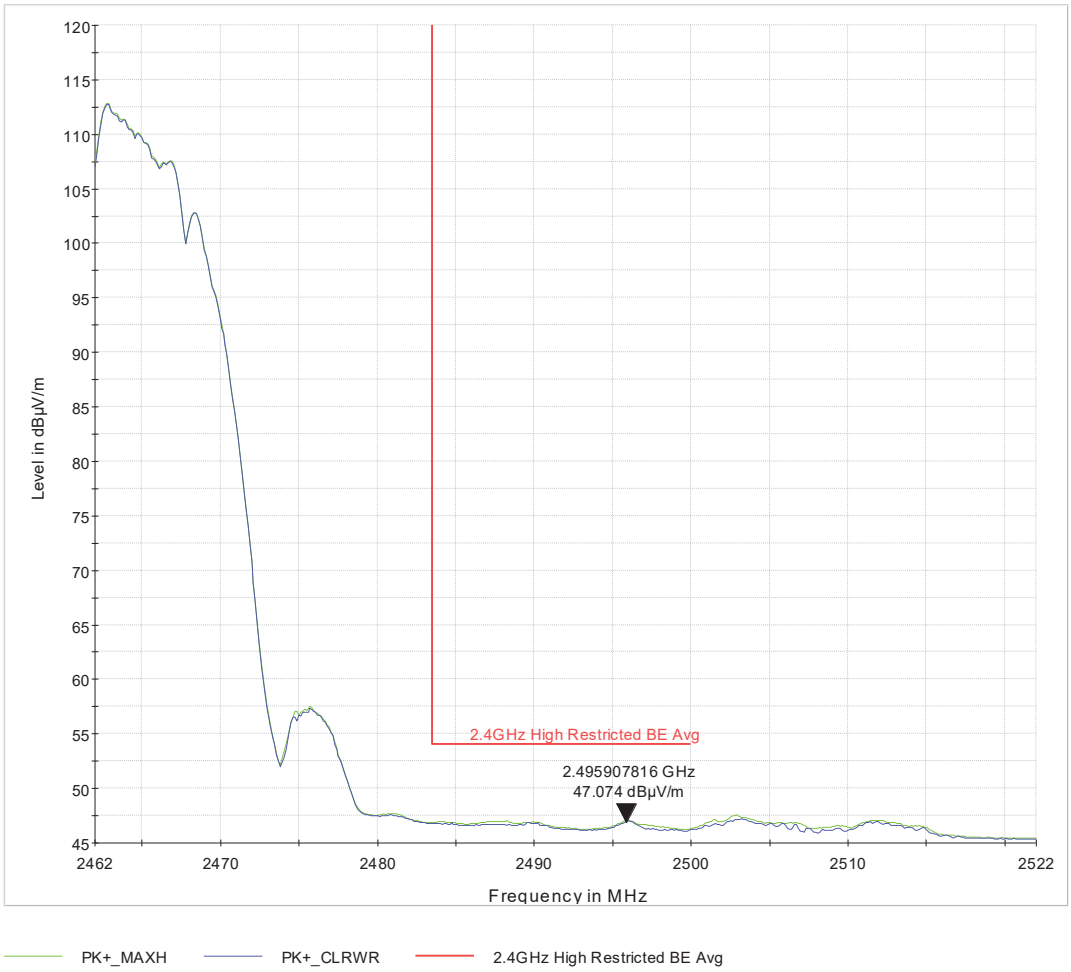


Figure 56: High Band Edge (restricted) for 802.11b CCK 1mbps at 2462 MHz-Average

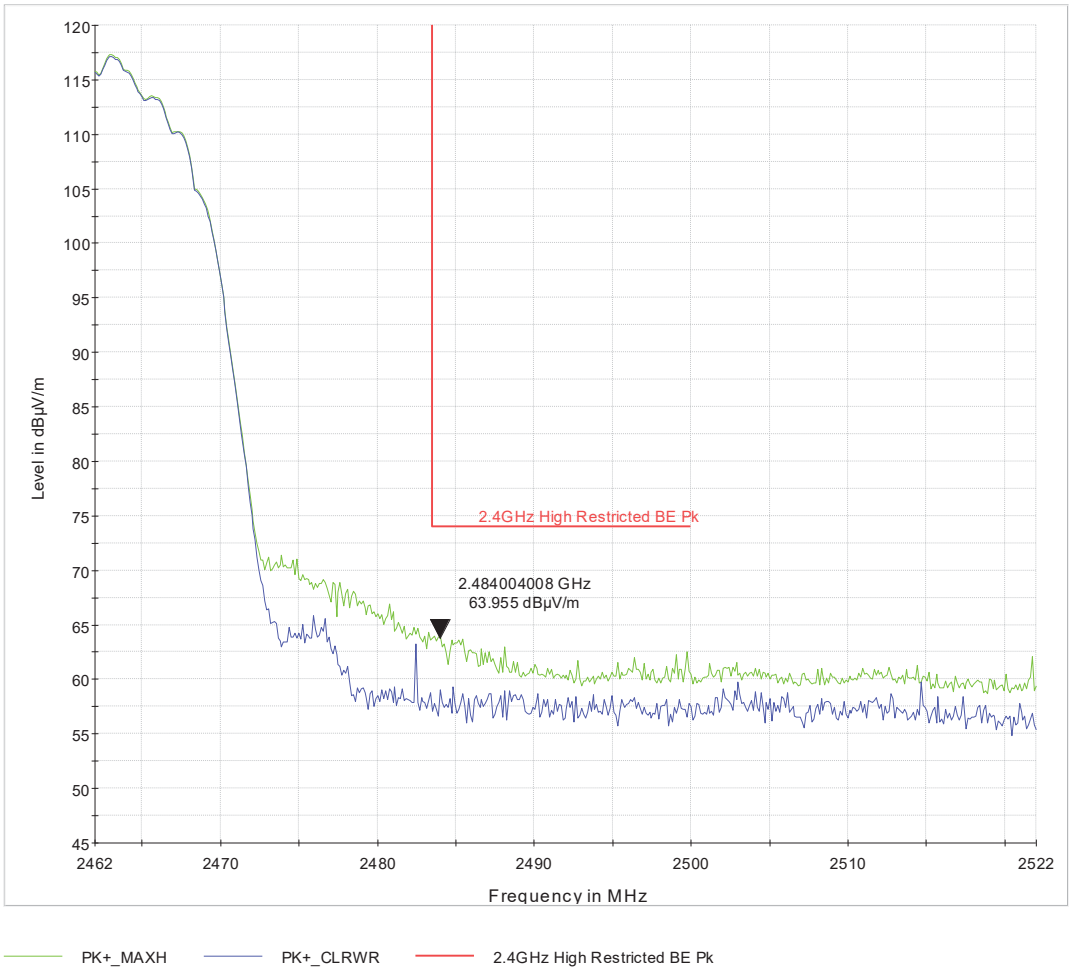


Figure 57: High Band Edge (restricted) for 802.11b CCK 1mbps at 2462 MHz-Peak

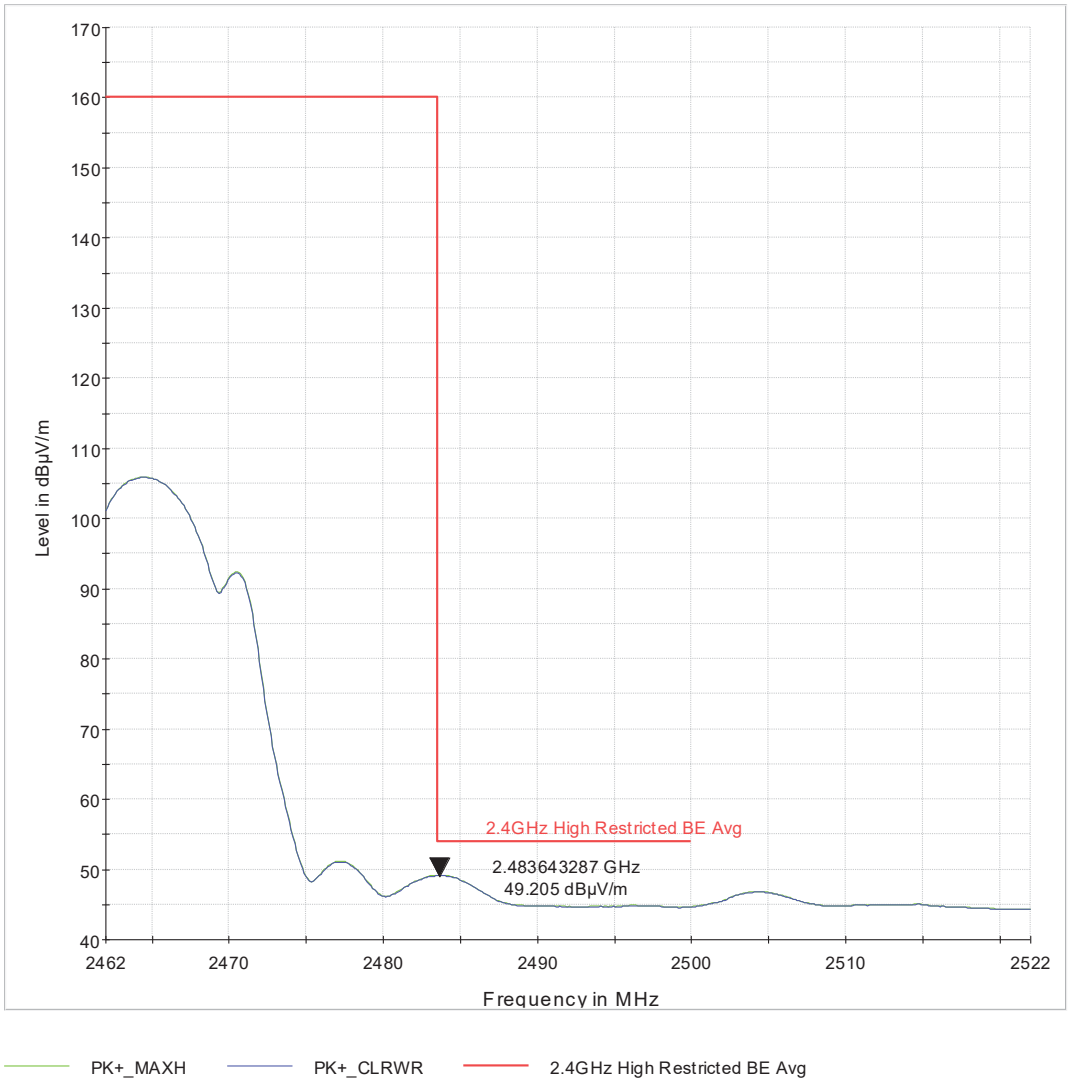


Figure 58: High Band Edge (restricted) for 802.11n HT20 MCS0 at 2462 MHz-Average

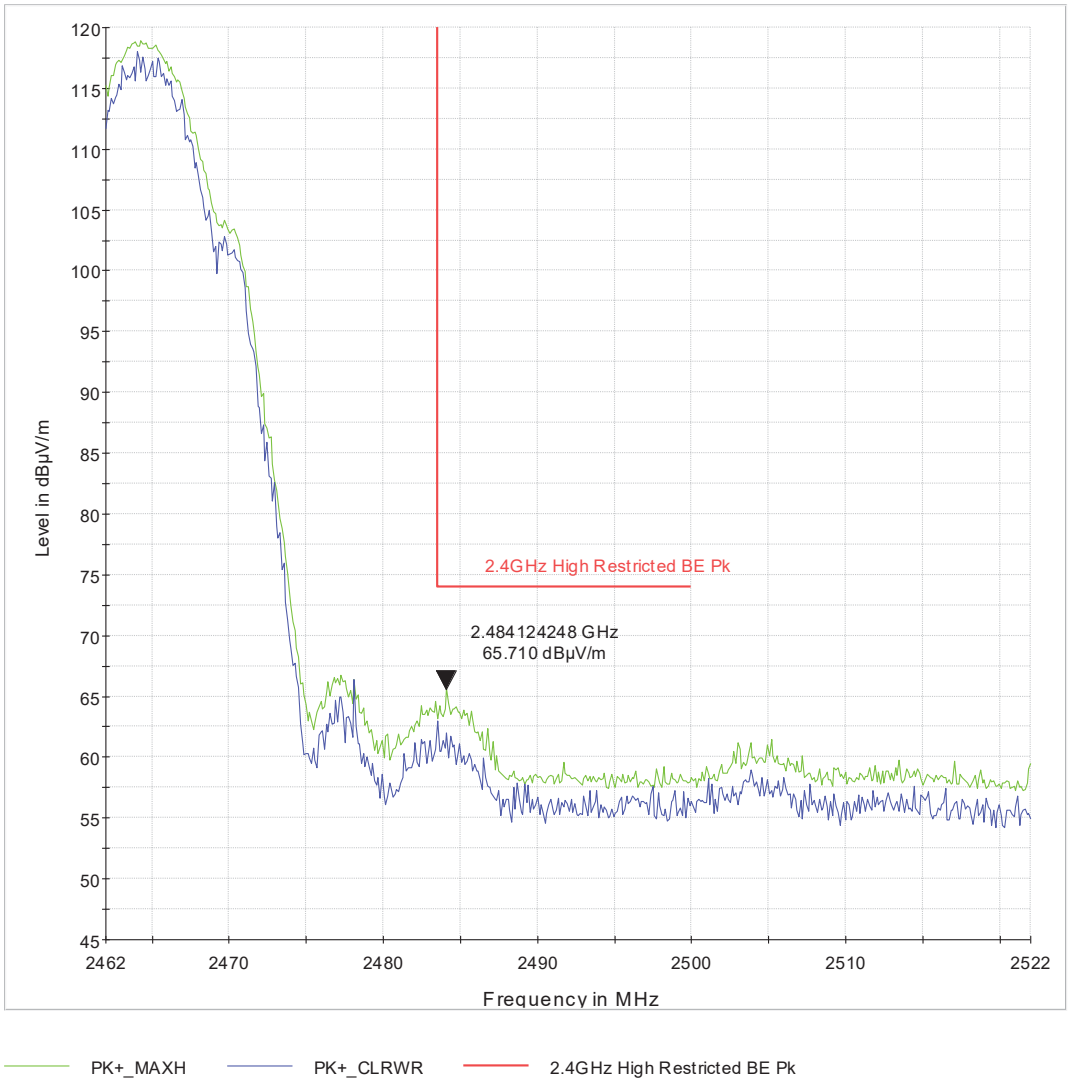


Figure 59: High Band Edge (restricted) for 802.11n HT20 MCS0 at 2462 MHz-Peak

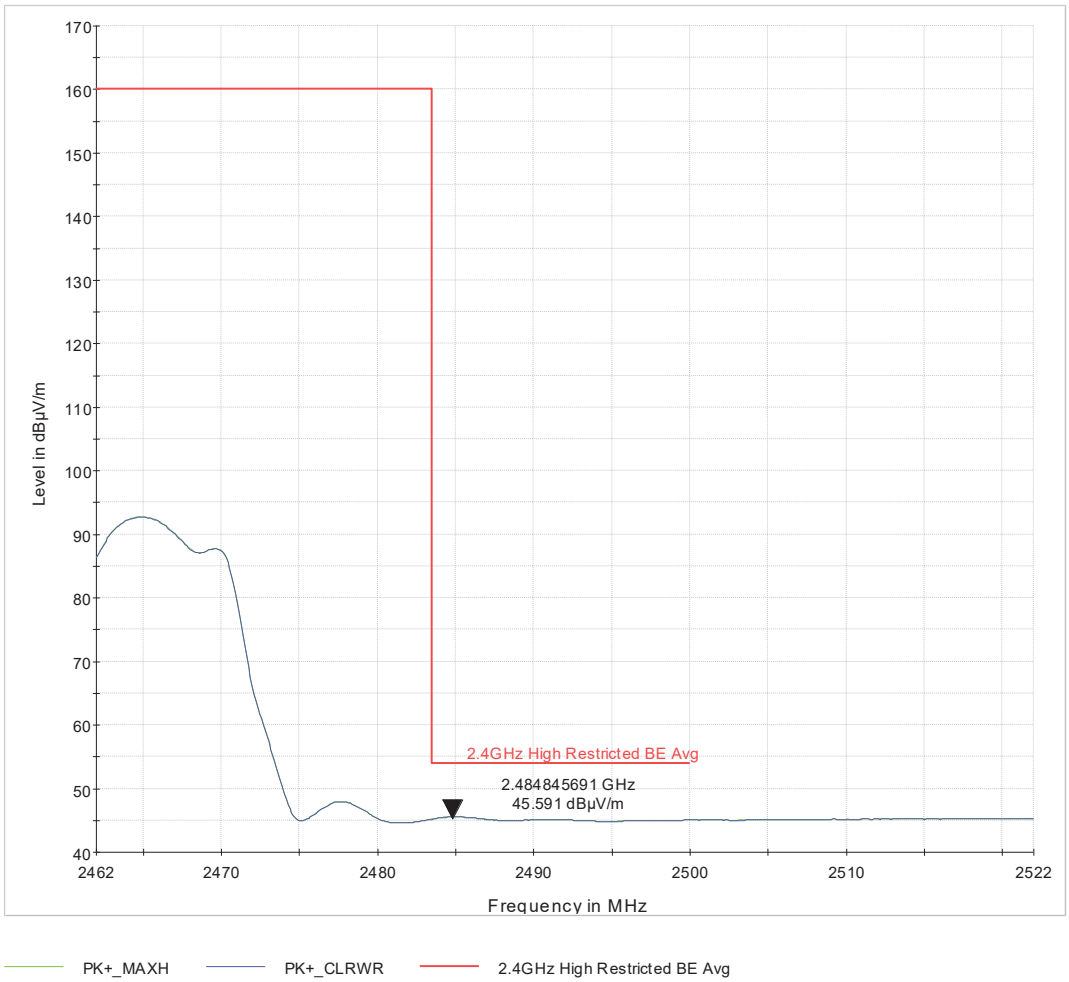


Figure 60: High Band Edge (restricted) for 802.11n HT40 MCS0 at 2452 MHz-Average

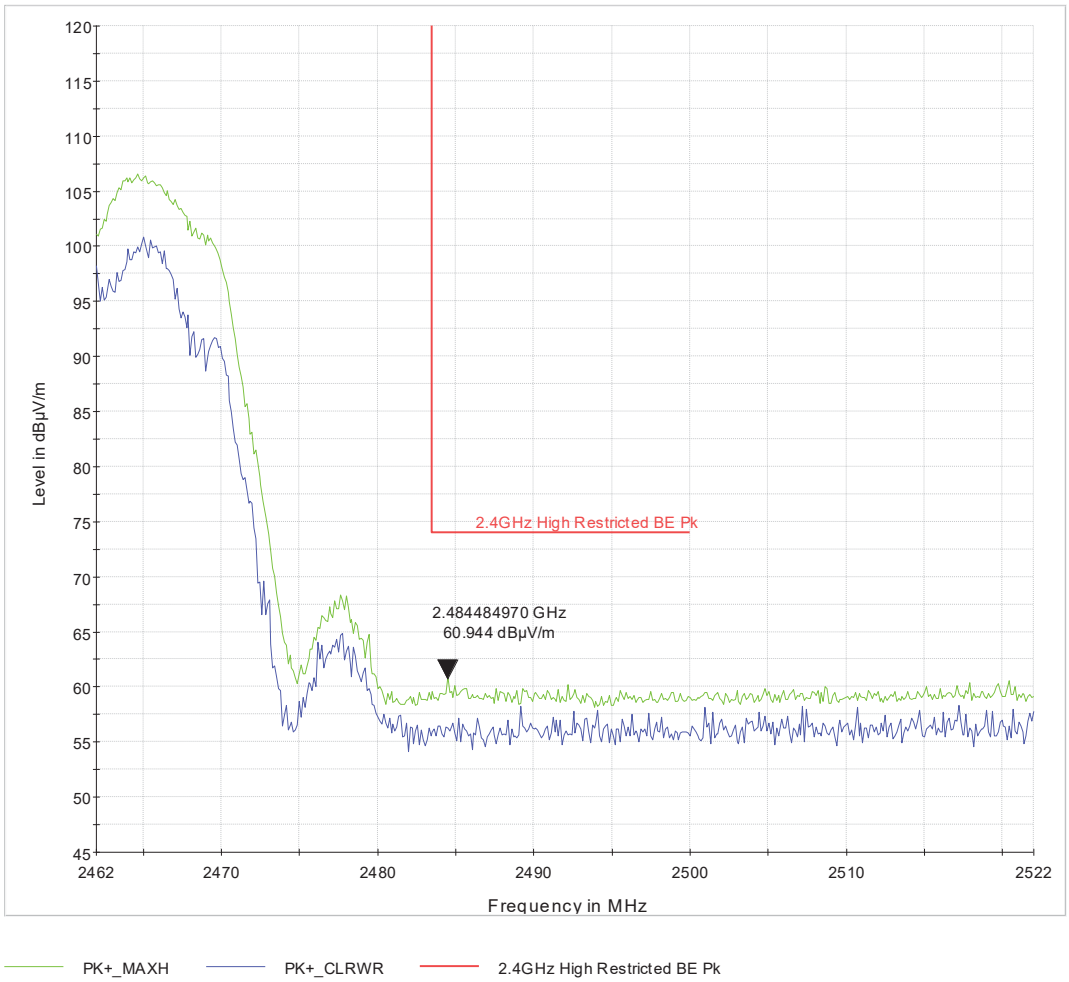


Figure 61: High Band Edge (restricted) for 802.11n HT40 MCS0 at 2452 MHz-Peak

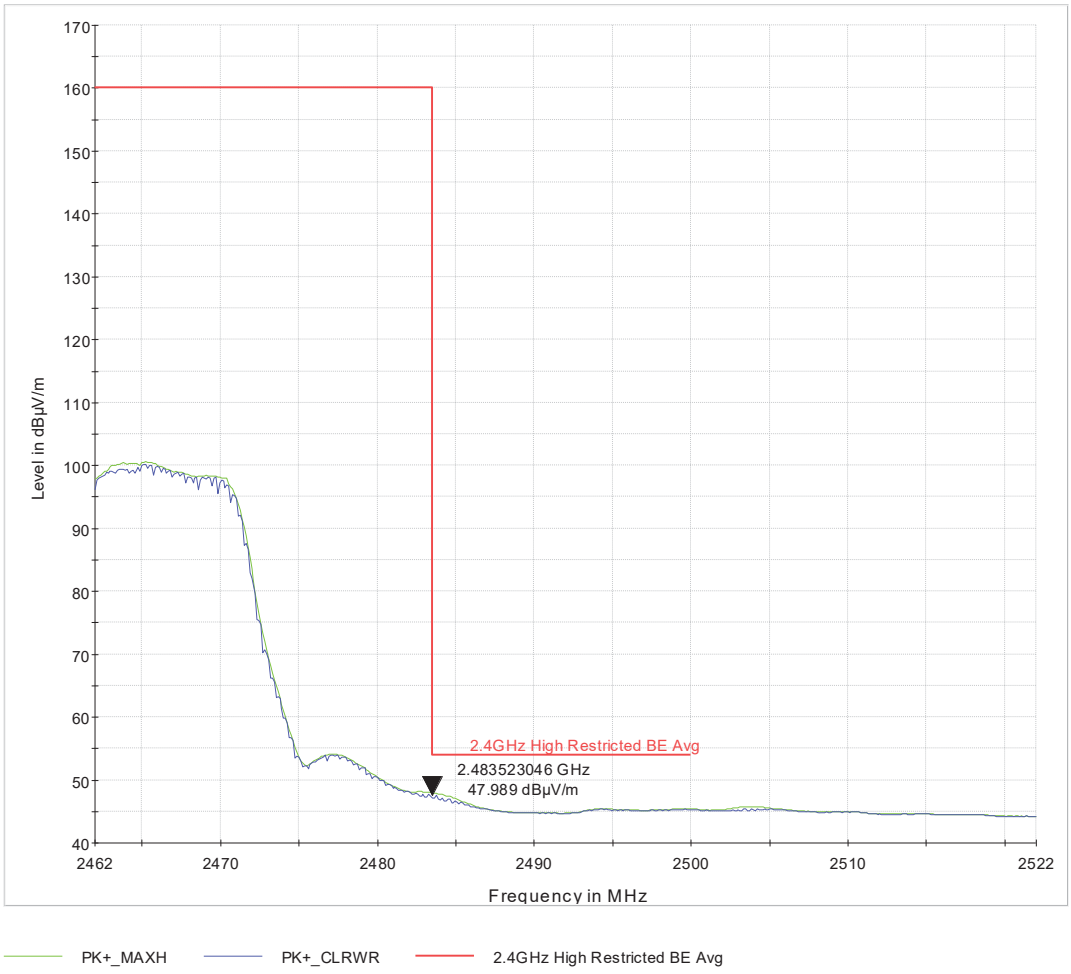


Figure 62: High Band Edge (restricted) for 802.11ac VHT20 (BF) MCS0 at 2462 MHz-Average

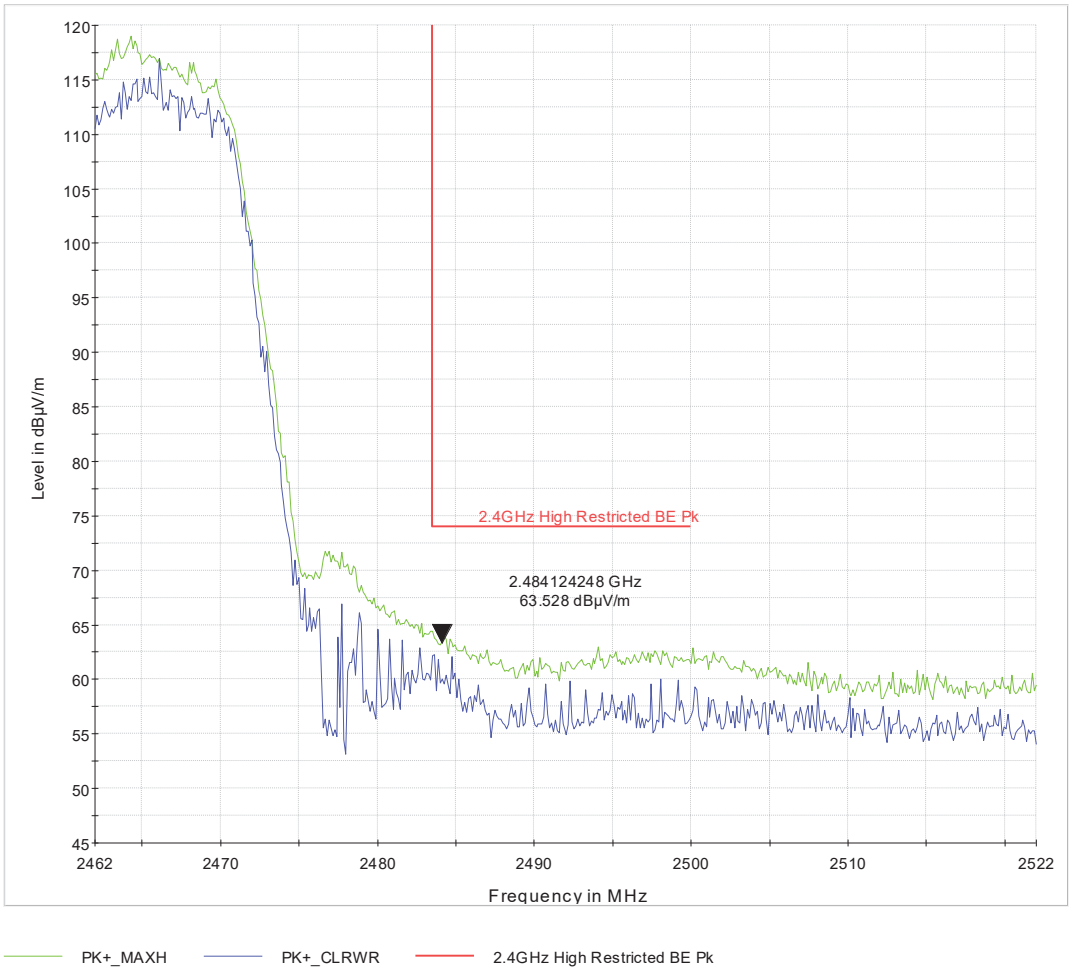


Figure 63: High Band Edge (restricted) for 802.11ac VHT20 (BF) MCS0 at 2462 MHz-Peak

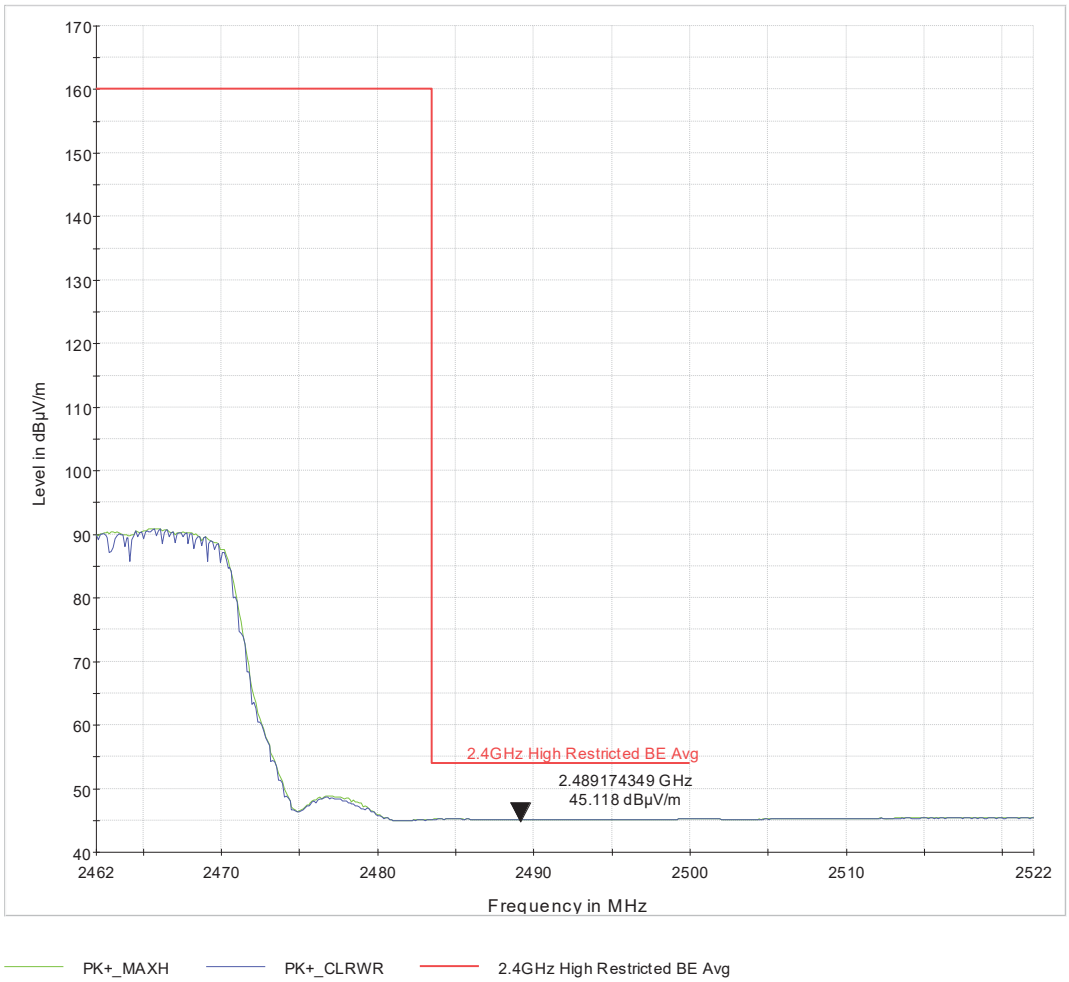


Figure 64: High Band Edge (restricted) for 802.11ac VHT40 (BF) MCS0 at 2452 MHz-Average

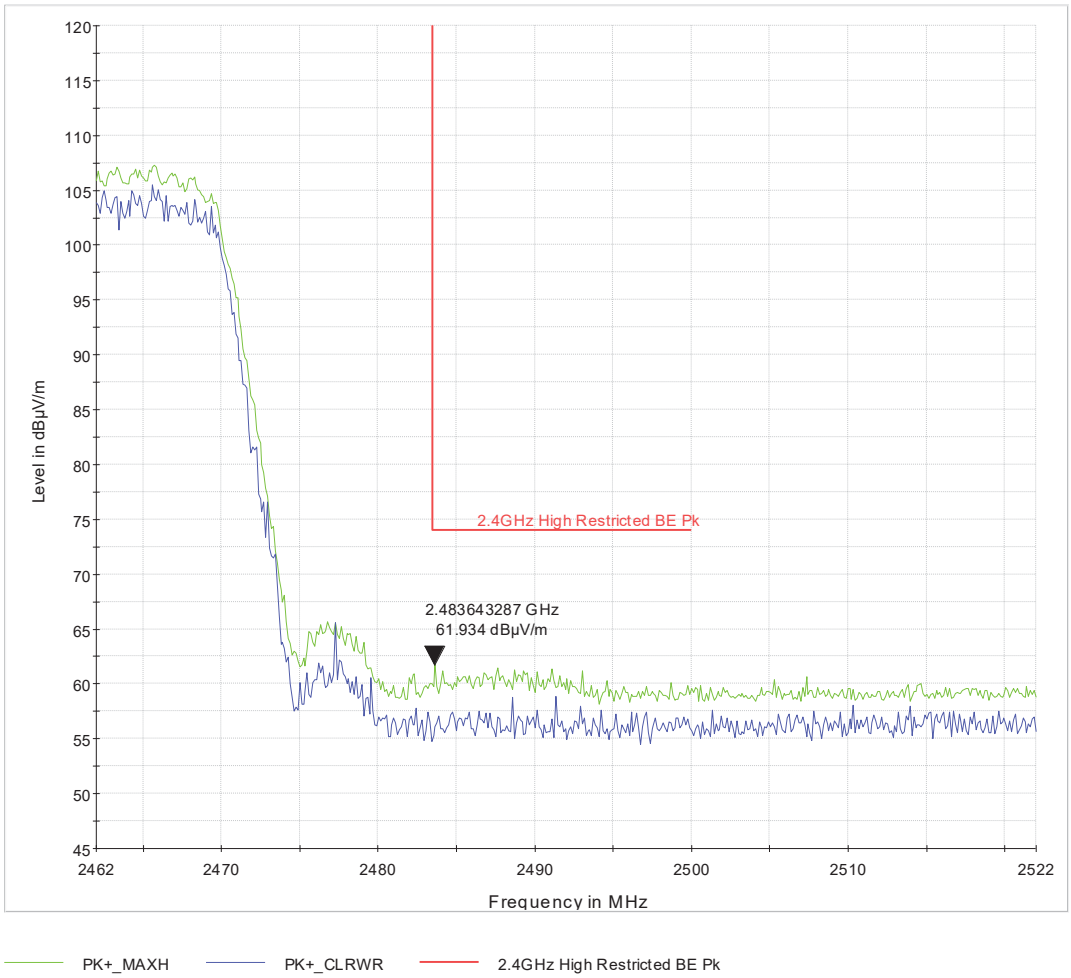


Figure 65: High Band Edge (restricted) for 802.11ac VHT40 (BF) MCS0 at 2452 MHz-Peak

4.6 Transmitter Spurious Emissions

Transmitter spurious emissions are emissions outside the frequency range of the equipment when the equipment is in transmit mode; per requirement of CFR47 15.205, 15.209, 15.247(d), RSS 247 Sect.5.5, RSS-GEN Sect. 8.9 and 8.10.

4.6.1 Test Methodology

4.6.1.1 Preliminary Test

A test program that controls instrumentation and data logging was used to automate the preliminary RF emission test procedure. The frequency range of interest was divided into sub-ranges to yield a frequency resolution of approximately 120 kHz and provide a reading at each frequency for no more than 12° of turntable rotation. For each frequency sub-range the turntable was rotated 360° while peak emission data was recorded and plotted over the frequency range of interest in horizontal and vertical antenna polarization's.

Preliminary emission profile testing was performed inside the anechoic chamber. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the floor. The EUT was positioned as shown in the setup photographs. The receiving antenna was placed at a distance of 3m at a fixed height of 1m. Measurement equipment was located outside of the chamber. A video camera was placed inside the chamber to view the EUT.

Pre-scans were performed to determine the worst data rate / chains.

4.6.1.2 Final Test

For each frequency measured, the peak emission was maximized by manipulating the receiving antenna from 1 to 4 meters above the ground plane and placing it at the position that produced the maximum signal strength reading. The turntable was then rotated through 360° while observing the peak signal and placing the EUT at the position that produced maximum radiation. The six highest emissions relative to the limit were measured unless such emissions were more than 20 dB below the limit. If less than six emissions are within 20 dB of the limit, than the noise level of the receiver is measured at frequencies where emissions are expected. Multiples of all oscillator and microprocessor frequencies were also checked.

Final testing was performed on an NSA compliant test site. The EUT was placed on a 1.0m x 1.5m non-conductive table 80cm (<1 GHz) and 150cm (>1 GHz) above the ground plane. The placement of EUT and cables were the same as for preliminary testing and is shown in the setup photographs.

4.6.1.3 Deviations

None.

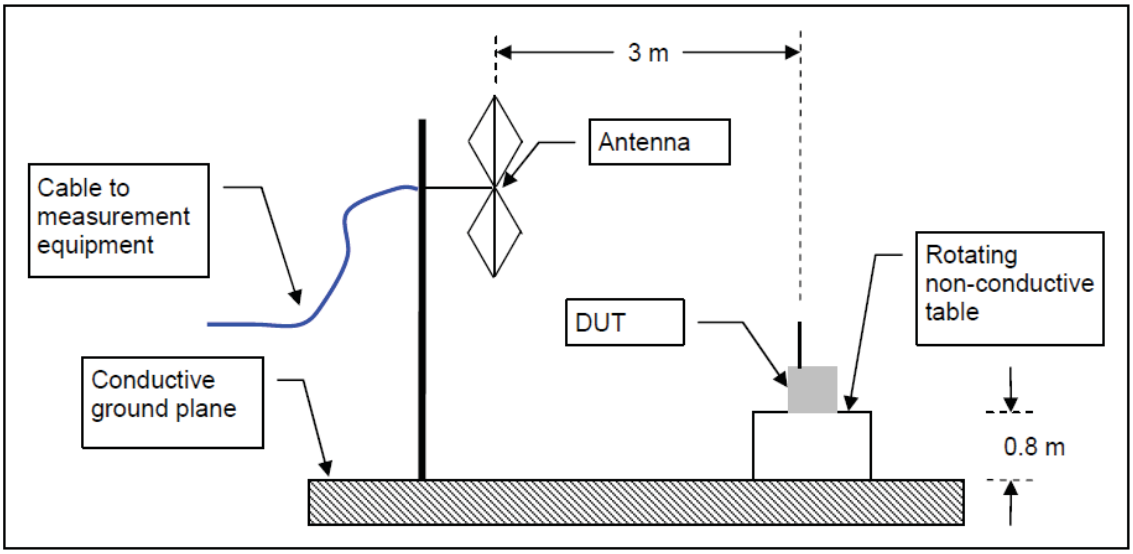
4.6.2 Test Setup:

All modes were tested in 4x4 configuration since all antenna configurations use the same power settings as 4x4 MIMO mode.

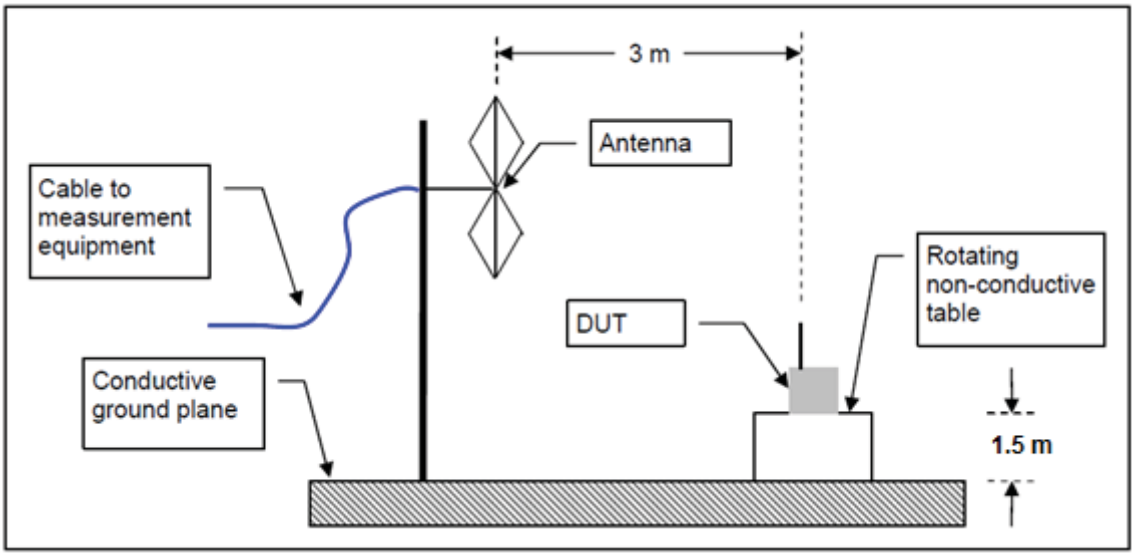
4.6.2.1 CDD Mode

The DUT was stimulated by manufacturer provided test software that is not available to the end user.

9KHz-1GHz

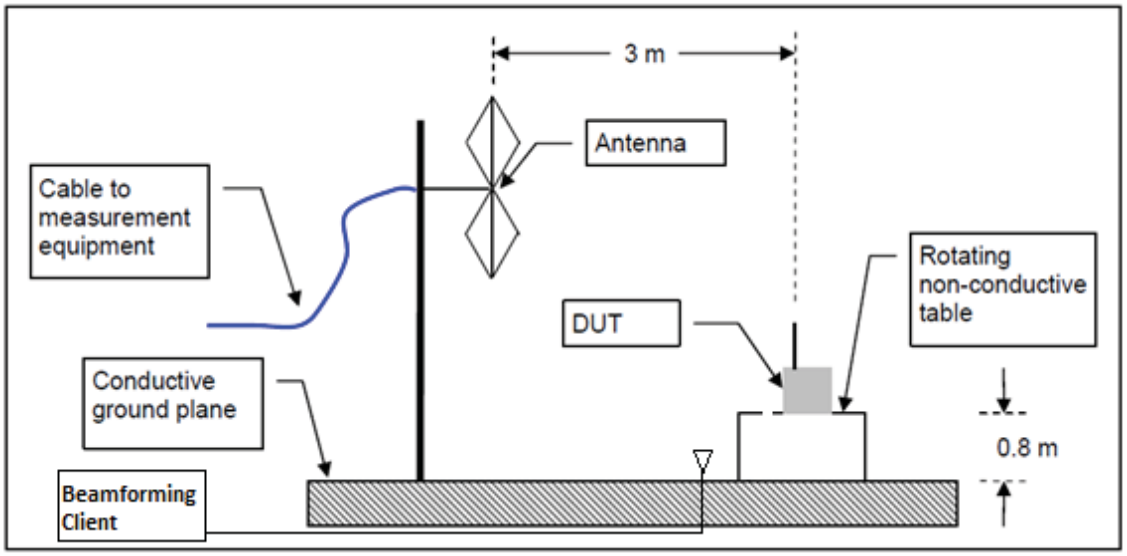


1-25GHz

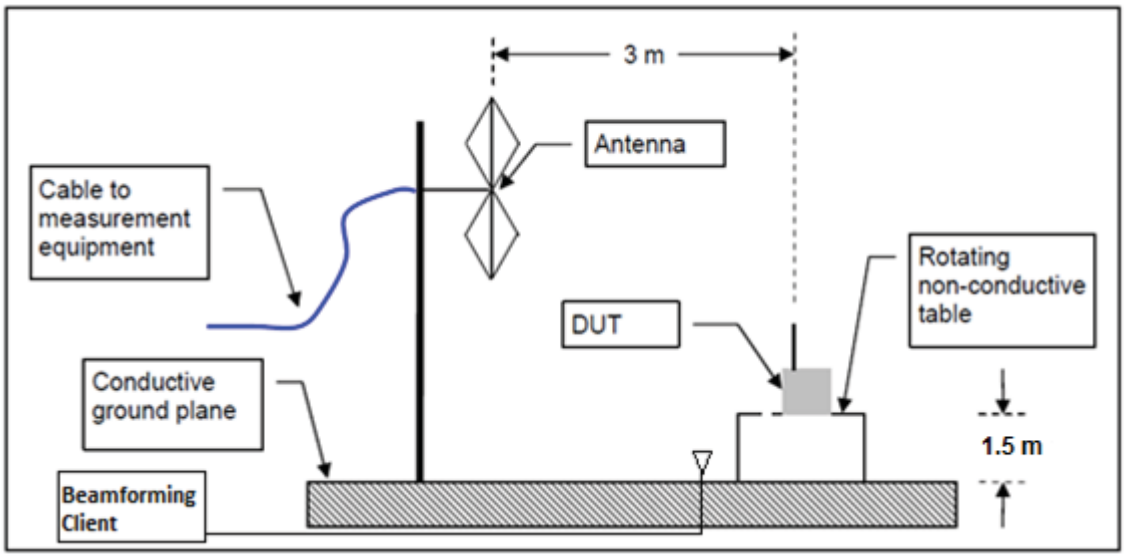


4.6.2.2 Beamforming (BF) Mode

9KHz-1GHz



1-25GHz



A conducted 4x4 MIMO client that supports beamforming was used to lock the beam on the turntable that is 0.3 meters from the EUT and on the 308° position of the turntable. The clients antenna was routed in the chamber and put on the turntable outside the measuring antenna's beamwidth for the fundamental frequency. The EUT uses circular beamforming with a lockable beam as defined in ANSI C63.10-2013 Section 13. Network throughput software tool, iperf3, was

used to stimulate the DUT's transmissions with a maximum duty cycle. It was verified that there were no off times longer than 50% of the time spent on each sweep point during the pre-scans. A customized software tool developed by the manufacturer was used to associate the DUT and the Client to any required data rates, channels and power settings before transmissions were initiated.

All modes were tested in 4x4 configuration

The same power settings and modulations that are used for 802.11n mode are are used for Beamforming mode (802.11ac). Since beamforming is a spatially dependent phenomenon at the fundamental frequency, frequency ranges at the fundamental and higher were investigated.

Iperf3 Command Line for DUT:
iperf -c 192.168.16.1 -p 5021 -i 10 -t 4200 -w 320k -u -b 300M -P 4 -l24000

Iperf3 Command Line for Client (Support Equipment):
iperf3 -s

4.6.3 Transmitter Spurious Emission Limit

The spurious emissions of the transmitter shall not exceed the values in CFR47 Part 15.205, 15.209: 2015 and RSS Gen Sect. 8.9 and 8.10: 2014.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490.....	2400/F(kHz)	300
0.490-1.705.....	24000/F(kHz)	30
1.705-30.0.....	30	30
30-88.....	100 **	3
88-216.....	150 **	3
216-960.....	200 **	3
Above 960.....	500	3

.

4.6.4 Test Results

The final measurement data was taken under the worst case operating modes, configurations, and/or cable positions. It also reflects the results including any modifications and/or special accessories listed in Sections 1.4 and test plan.

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

4.6.4.1 Plots: CDD Mode

4.6.4.1.1 802.11b Mode

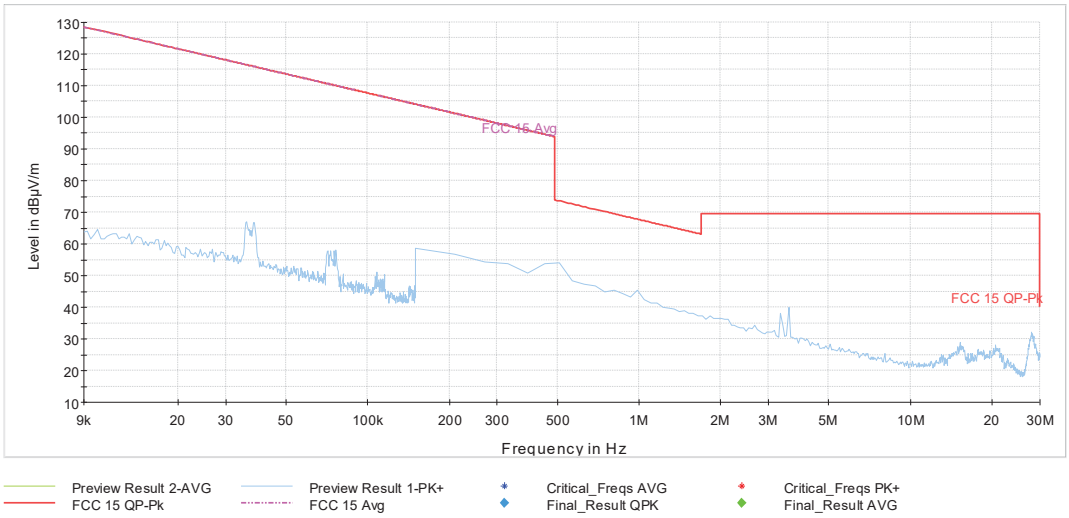


Figure 66: 9KHz-30MHz 802.11b Mode Channel 1

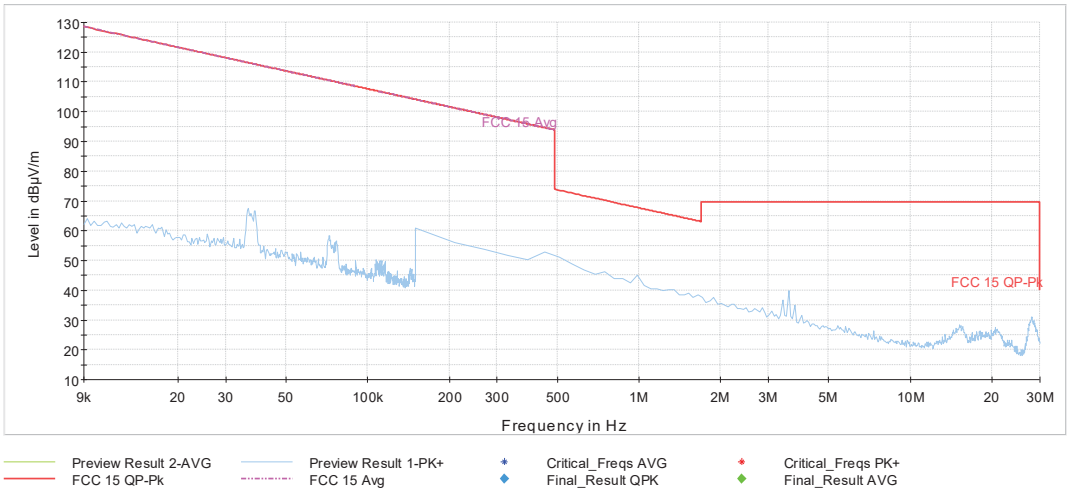


Figure 67: 9KHz-30MHz 802.11b Mode Channel 6

Figure 68: 9KHz-30MHz 802.11b Mode Channel 11

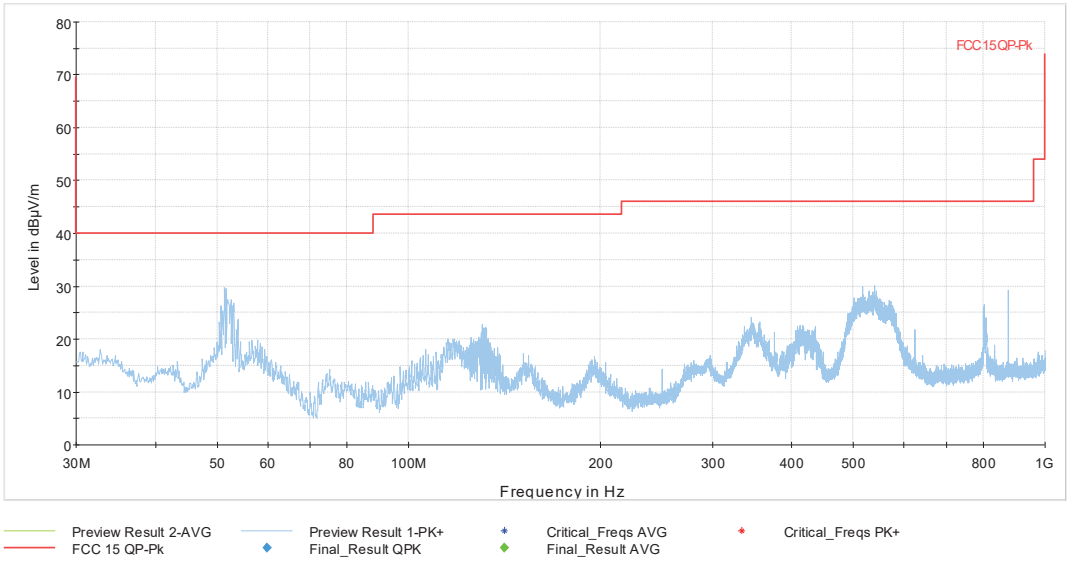


Figure 69: 30MHz-1GHz 802.11b Mode Channel 1

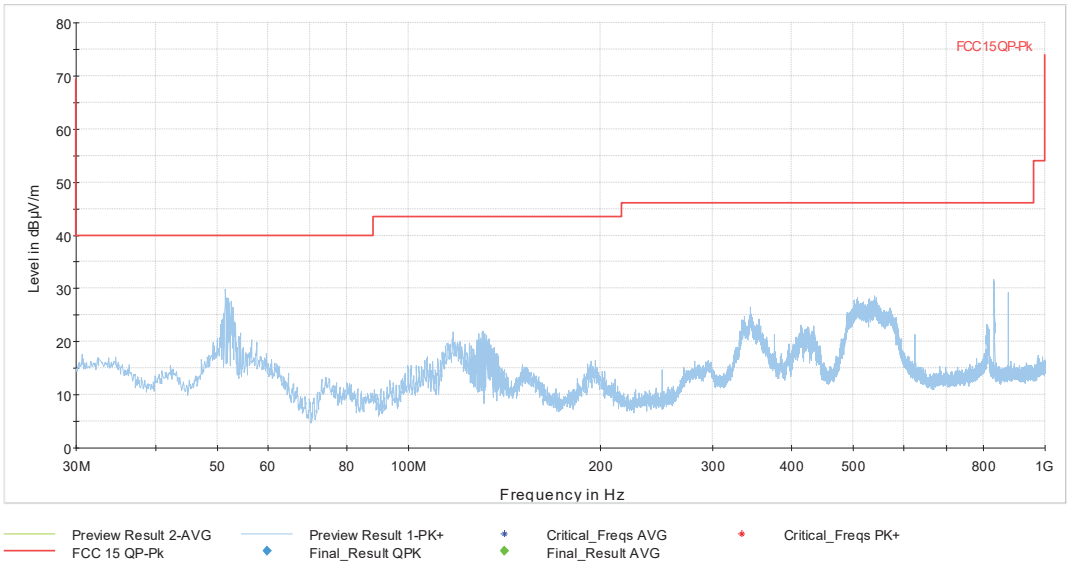


Figure 70: 30MHz-1GHz 802.11b Mode Channel 6

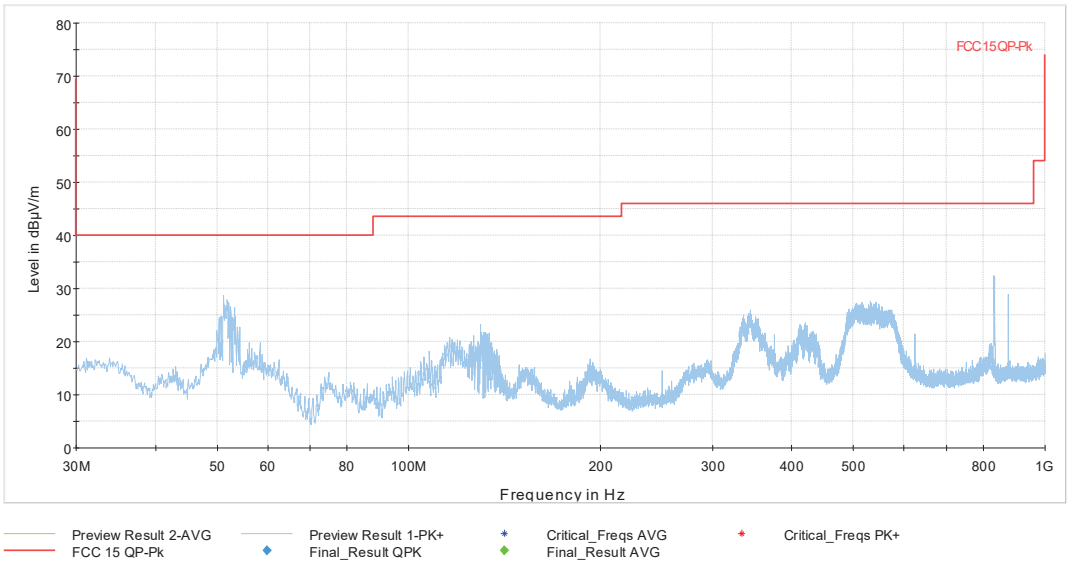
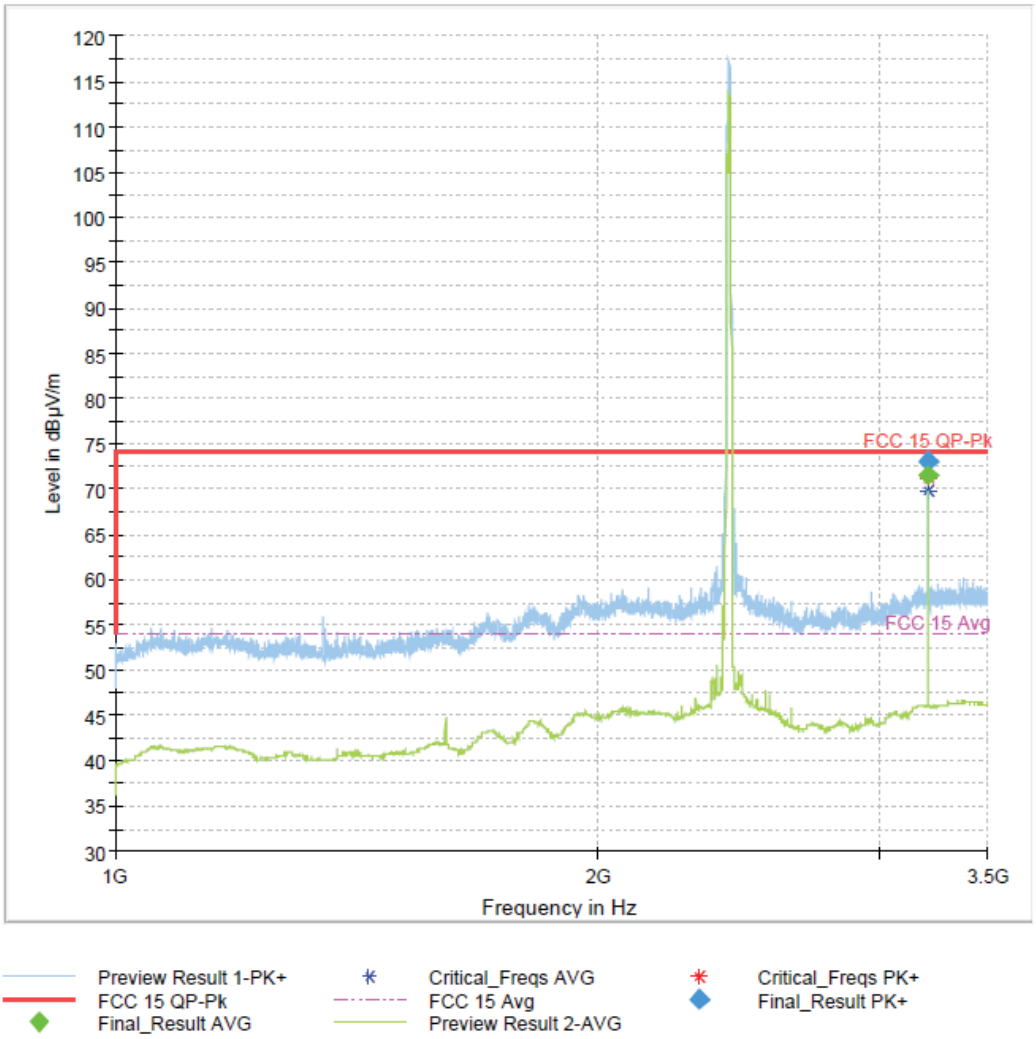


Figure 71: 30MHz-1GHz 802.11b Mode Channel 11

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3215.800000	---	71.57	54.00	-17.57	2.0	1000.000	107.6	V	310.0	33.8
3215.800000	73.05	---	74.00	0.95	2.0	1000.000	107.5	V	311.0	33.8

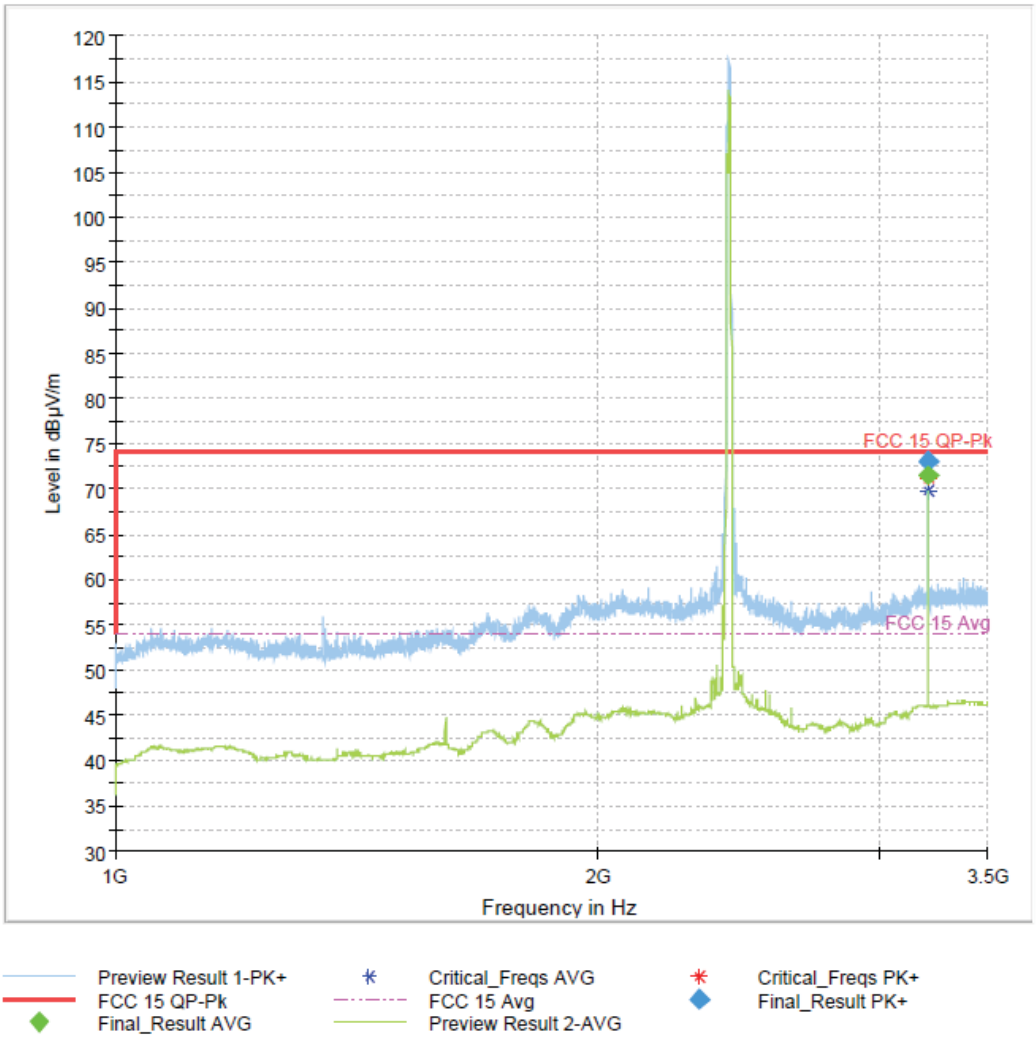


Note: Emissions above limit are the Fundamental and in non-restricted band. The non-restricted band emission is further evaluated in Section 4.4 of this report.

Figure 72: 1-3.5GHz 802.11b Mode Channel 1

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3215.800000	---	71.57	54.00	-17.57	2.0	1000.000	107.6	V	310.0	33.8
3215.800000	73.05	---	74.00	0.95	2.0	1000.000	107.5	V	311.0	33.8

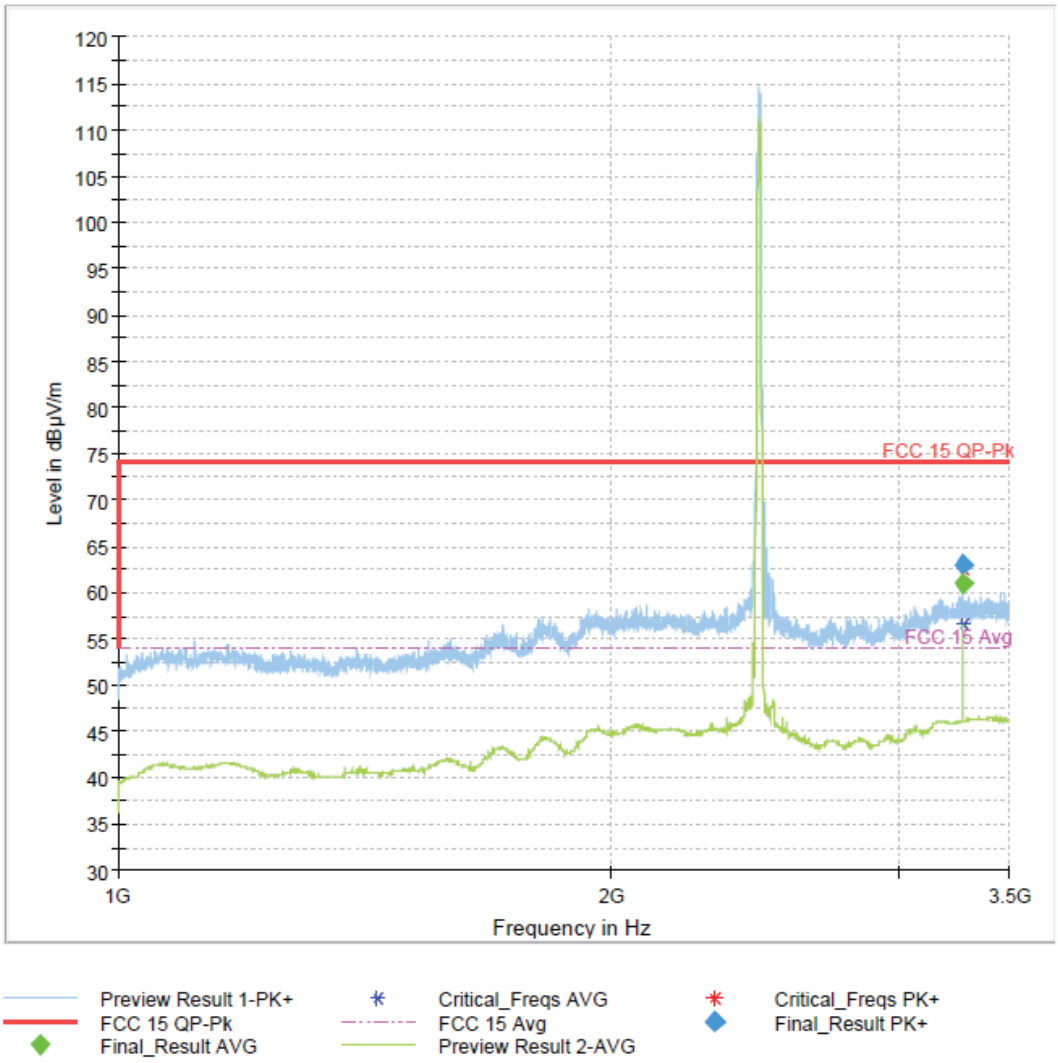


Note: Emissions above limit are the Fundamental and in non-restricted band. The non-restricted band emission is further evaluated in Section 4.4 of this report.

Figure 73: 1-3.5GHz 802.11b Mode Channel 6

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3282.600000	---	60.91	54.00	-6.91	2.0	1000.000	100.0	V	310.0	33.8
3282.600000	63.10	---	74.00	10.90	2.0	1000.000	178.1	V	313.0	33.8



Note: Emissions above limit are the Fundamental and in non-restricted band. The non-restricted band emission is further evaluated in Section 4.4 of this report.

Figure 74: 1-3.5GHz 802.11b Mode Channel 11

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
4824.200000	---	49.36	54.00	4.64	2.0	1000.000	192.7	H	329.0	-13.1

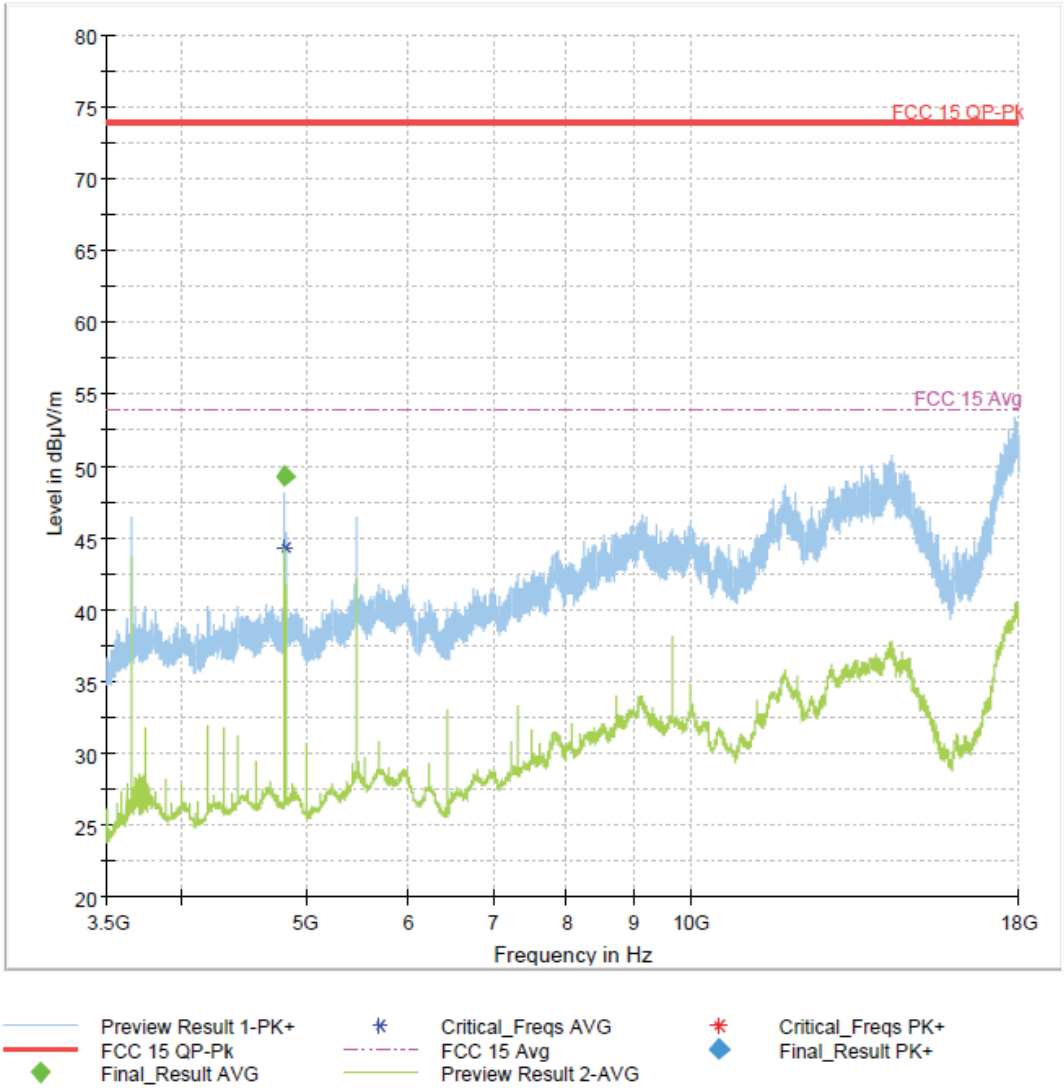


Figure 75: 3.5-18GHz 802.11b Mode Channel 1

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3653.400000	---	49.26	54.00	4.74	2.0	1000.000	269.3	H	129.0	-16.2

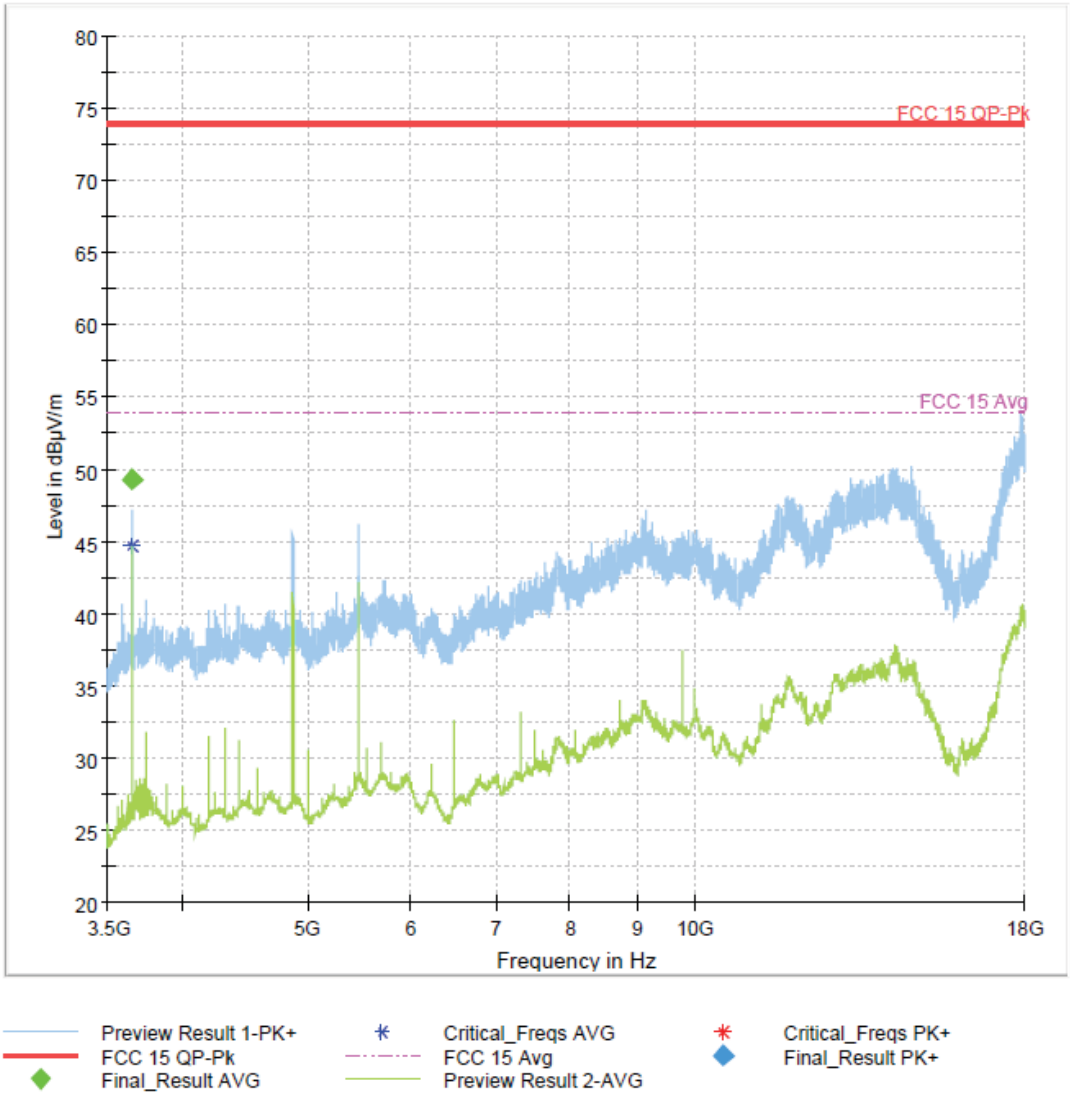


Figure 76: 3.5-18GHz 802.11b Mode Channel 6

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3652.200000	---	47.35	54.00	6.65	2.0	1000.000	317.0	H	125.0	-16.2
4924.200000	---	48.60	54.00	5.40	2.0	1000.000	115.9	V	226.0	-13.4
9848.200000	---	45.64	54.00	8.36	2.0	1000.000	155.0	V	98.0	-2.9

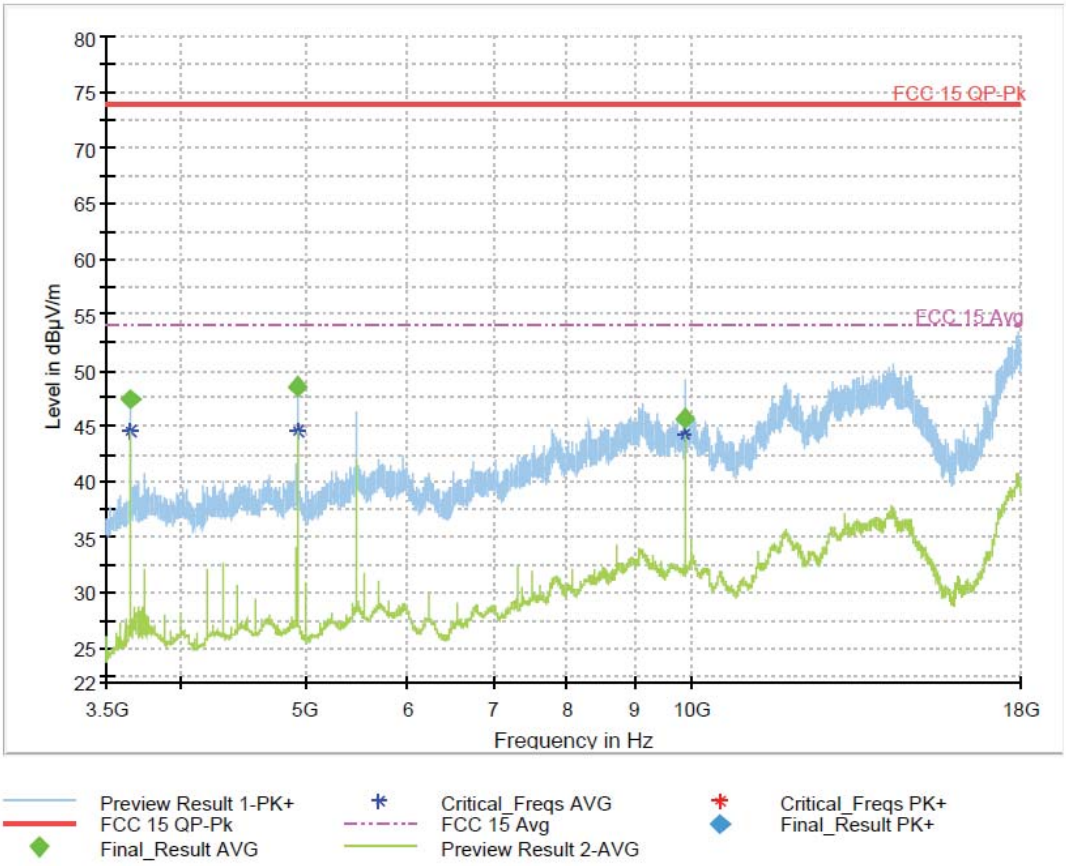


Figure 77: 3.5-18GHz 802.11b Mode Channel 11

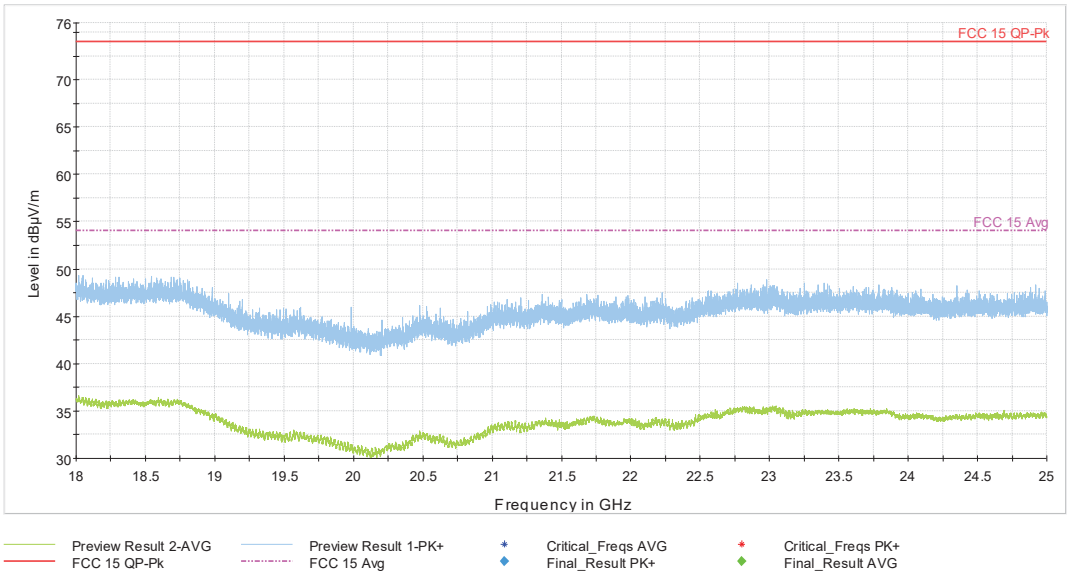


Figure 78: 18-25GHz 802.11b Mode Channel 1

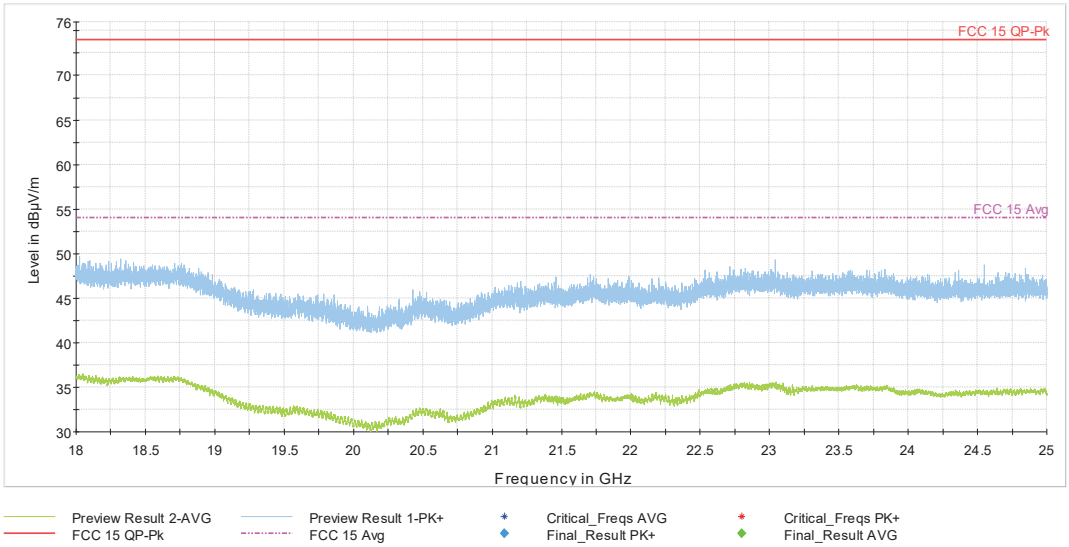


Figure 79: 18-25GHz 802.11b Mode Channel 6

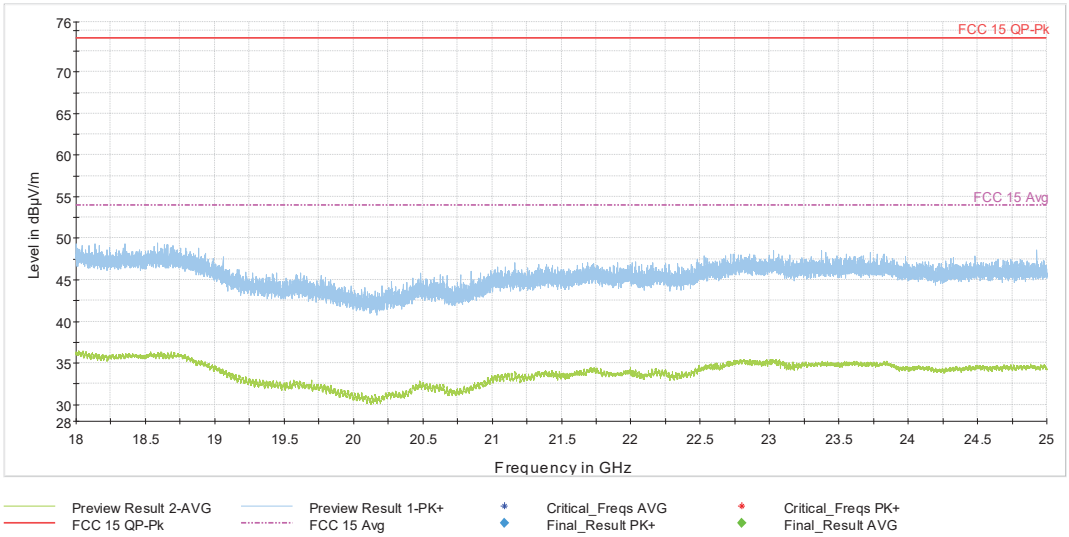


Figure 80: 18-25GHz 802.11b Mode Channel 11

4.6.4.1.2 802.11n HT20 Mode

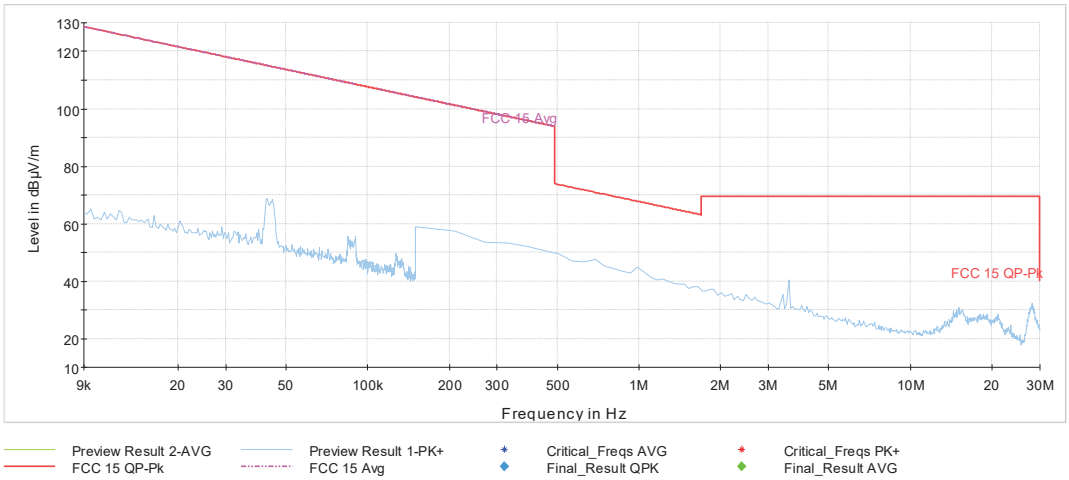


Figure 81: 9KHz-30MHz 802.11n HT20 Mode Channel 1

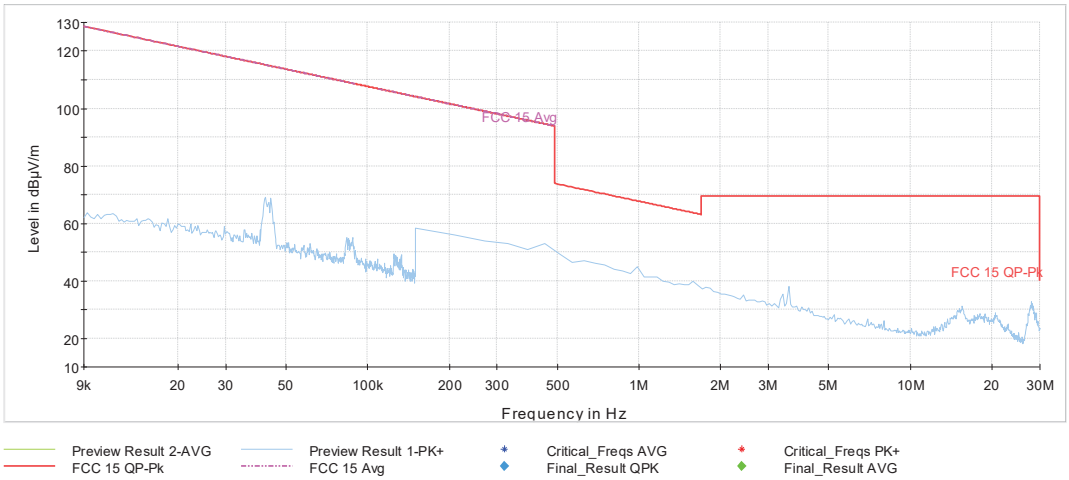


Figure 82: 9KHz-30MHz 802.11n HT20 Mode Channel 6

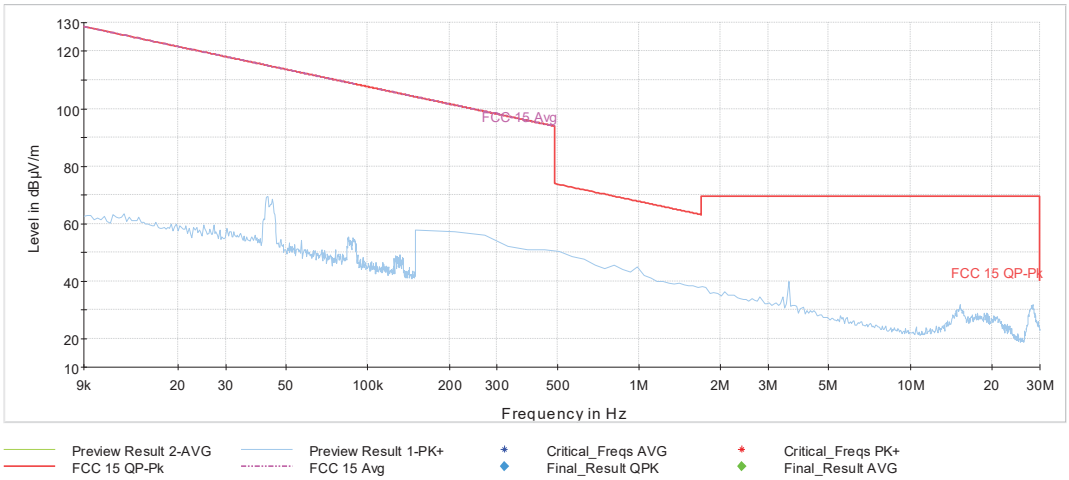


Figure 83: 9KHz-30MHz 802.11n HT20 Mode Channel 11

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
52.840000	25.86	---	40.00	14.14	2.0	100.000	100.0	V	20.0

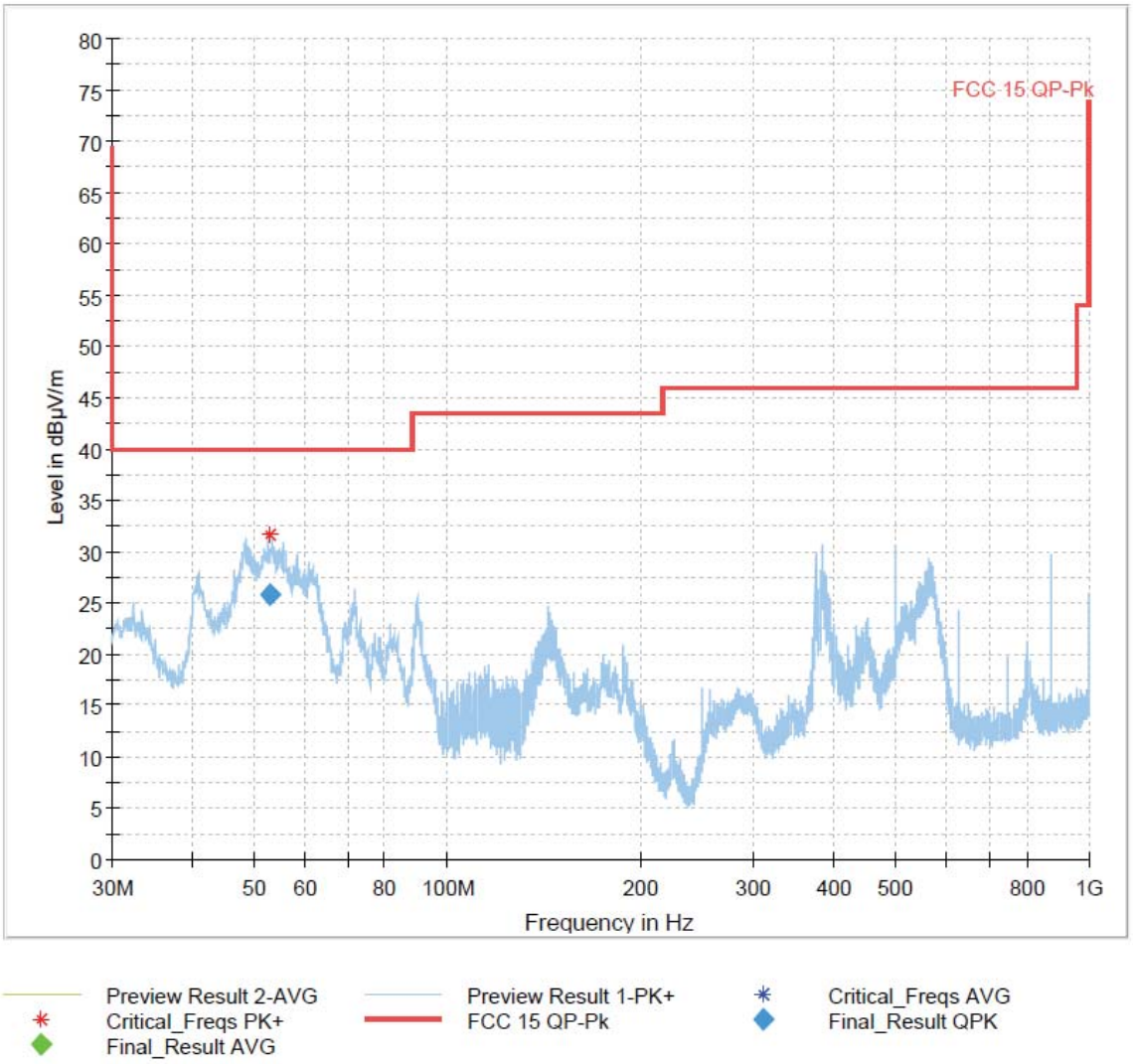


Figure 84: 30MHz-1GHz 802.11n HT20 Mode Channel 1

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
48.360000	25.64	---	40.00	14.36	2.0	100.000	100.0	V	24.0

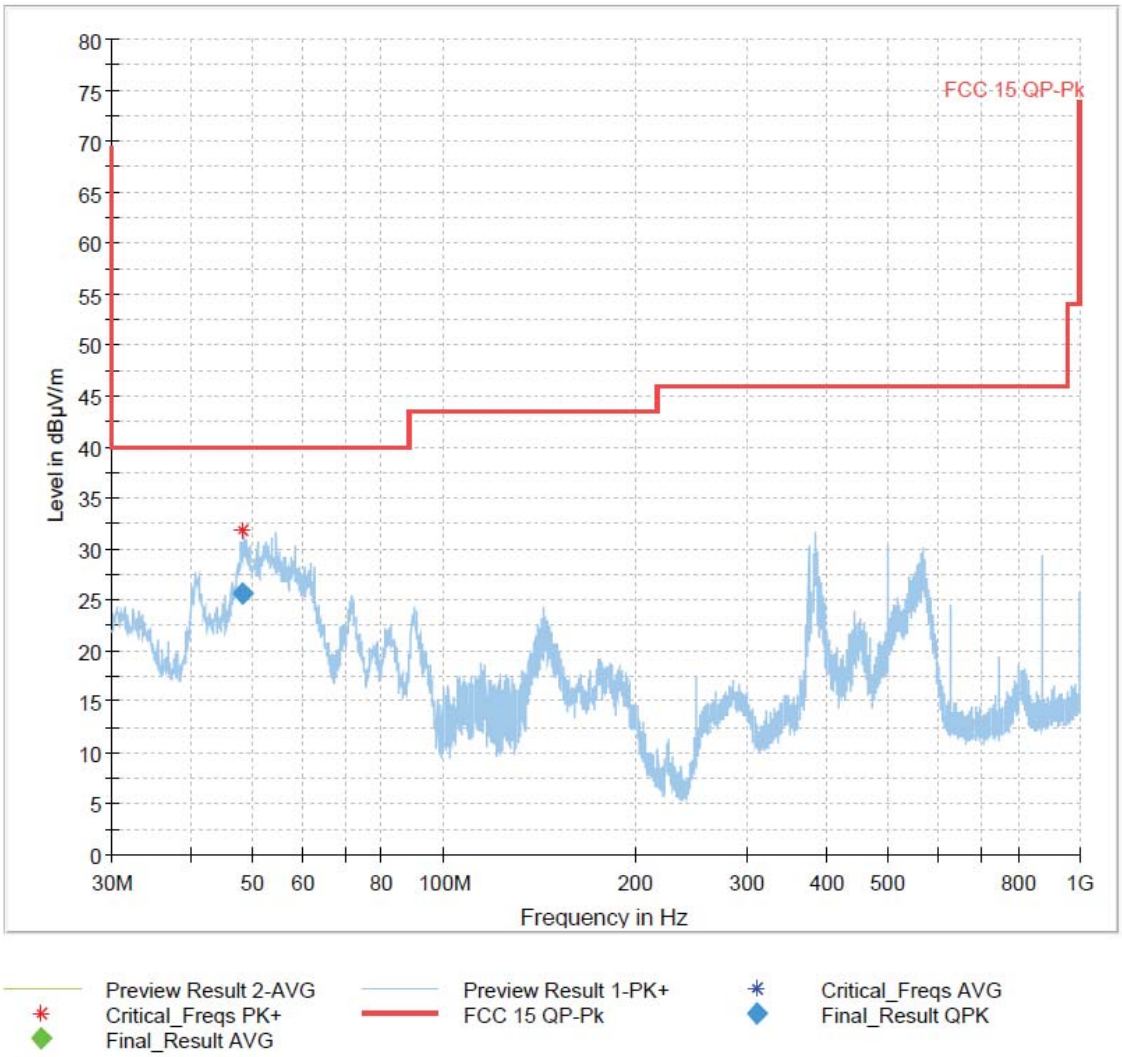


Figure 85: 30MHz-1GHz 802.11n HT20 Mode Channel 6

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
48.680000	25.64	---	40.00	14.36	2.0	100.000	100.0	V	12.0

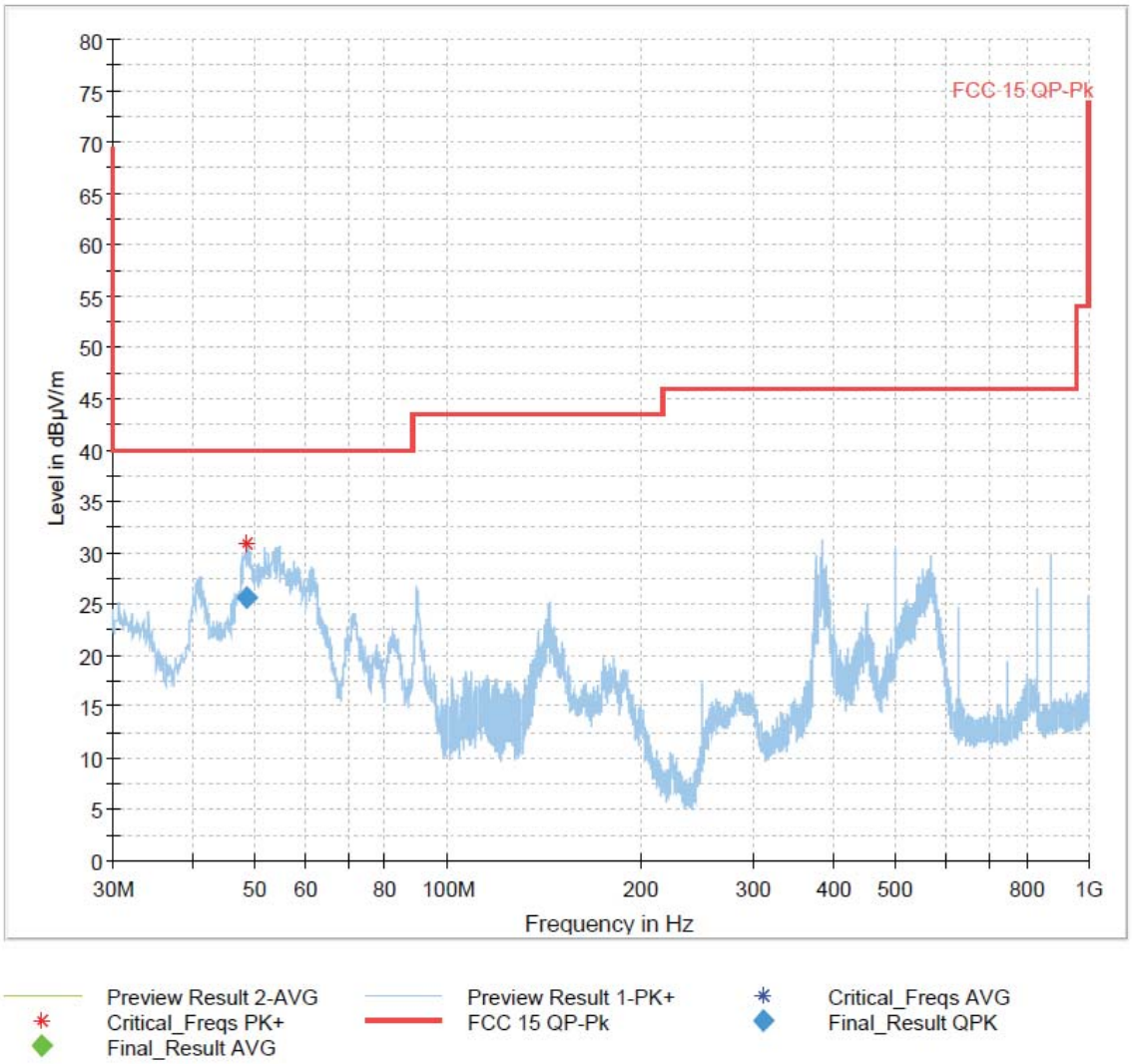
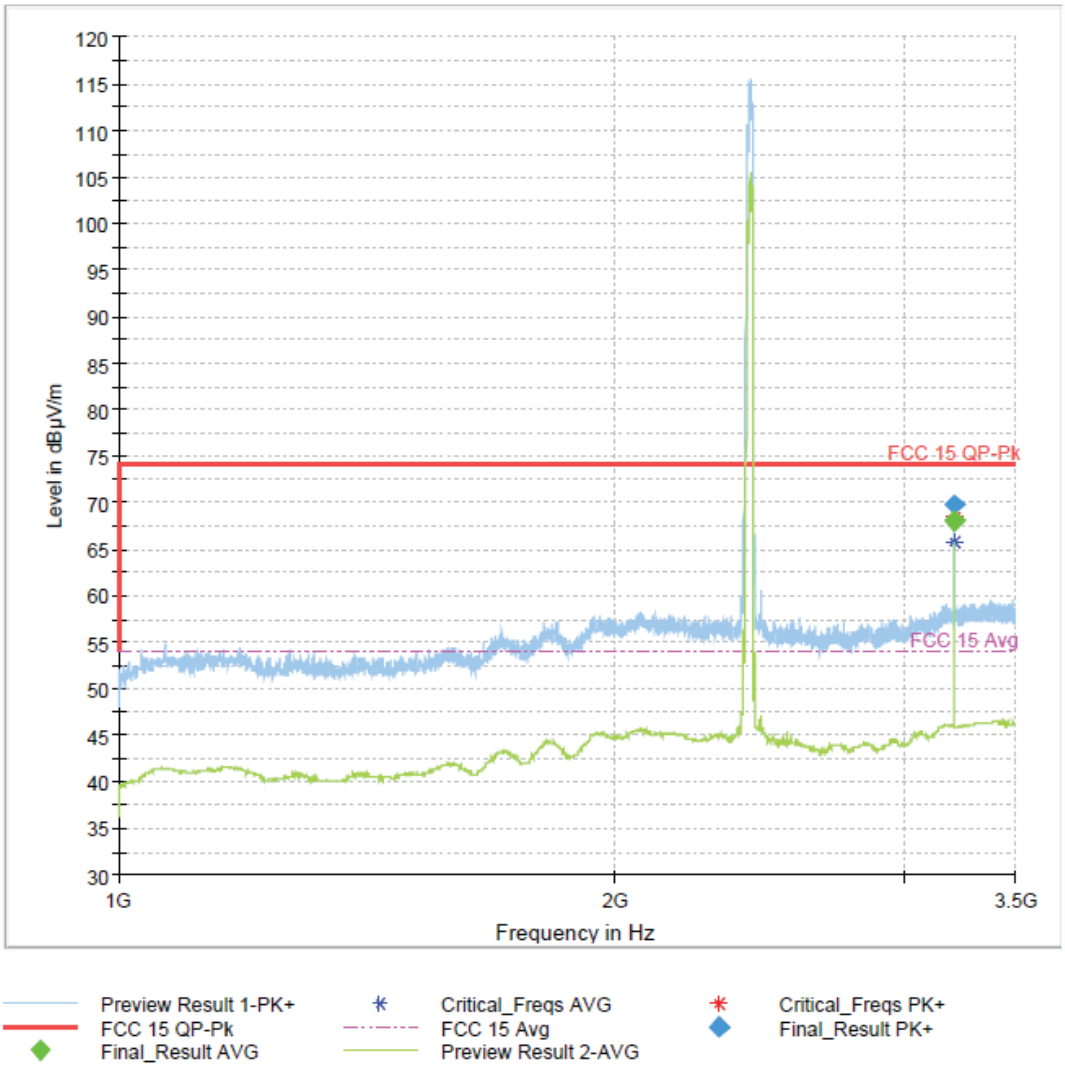


Figure 86: 30MHz-1GHz 802.11n HT20 Mode Channel 11

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3216.200000	---	68.14	54.00	-14.14	2.0	1000.000	107.5	V	310.0	33.8
3216.200000	69.75	---	74.00	4.25	2.0	1000.000	138.8	V	310.0	33.8

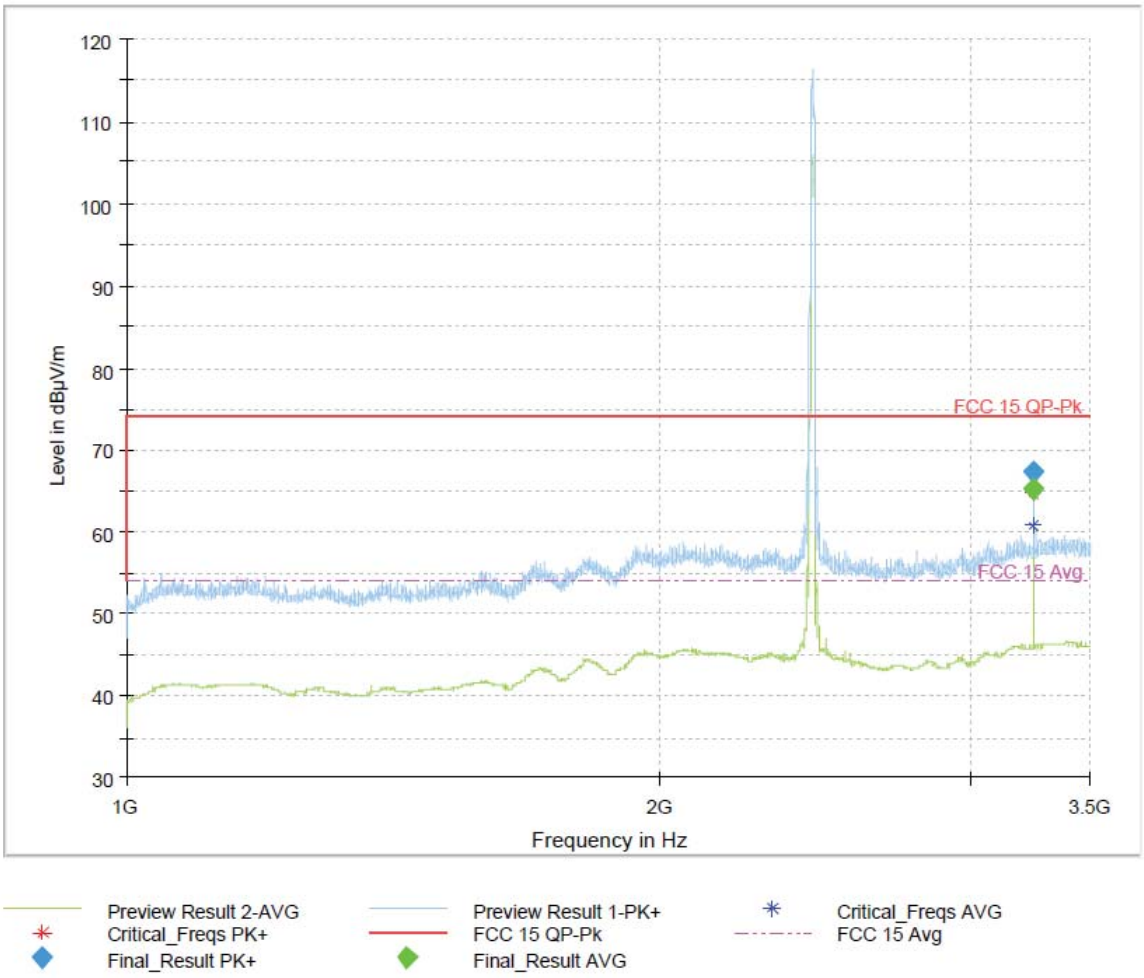


Note: Emissions above limit are the Fundamental and in Non-restricted Band, which is further evaluated in Section 4.4 of this report.

Figure 87: 1-3.5GHz 802.11n HT20 Mode Channel 1

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3249.400000	---	65.21	54.00	-11.21	2.0	1000.000	99.9	V	311.0	33.8
3249.400000	67.32	---	74.00	6.68	2.0	1000.000	100.0	V	313.0	33.8

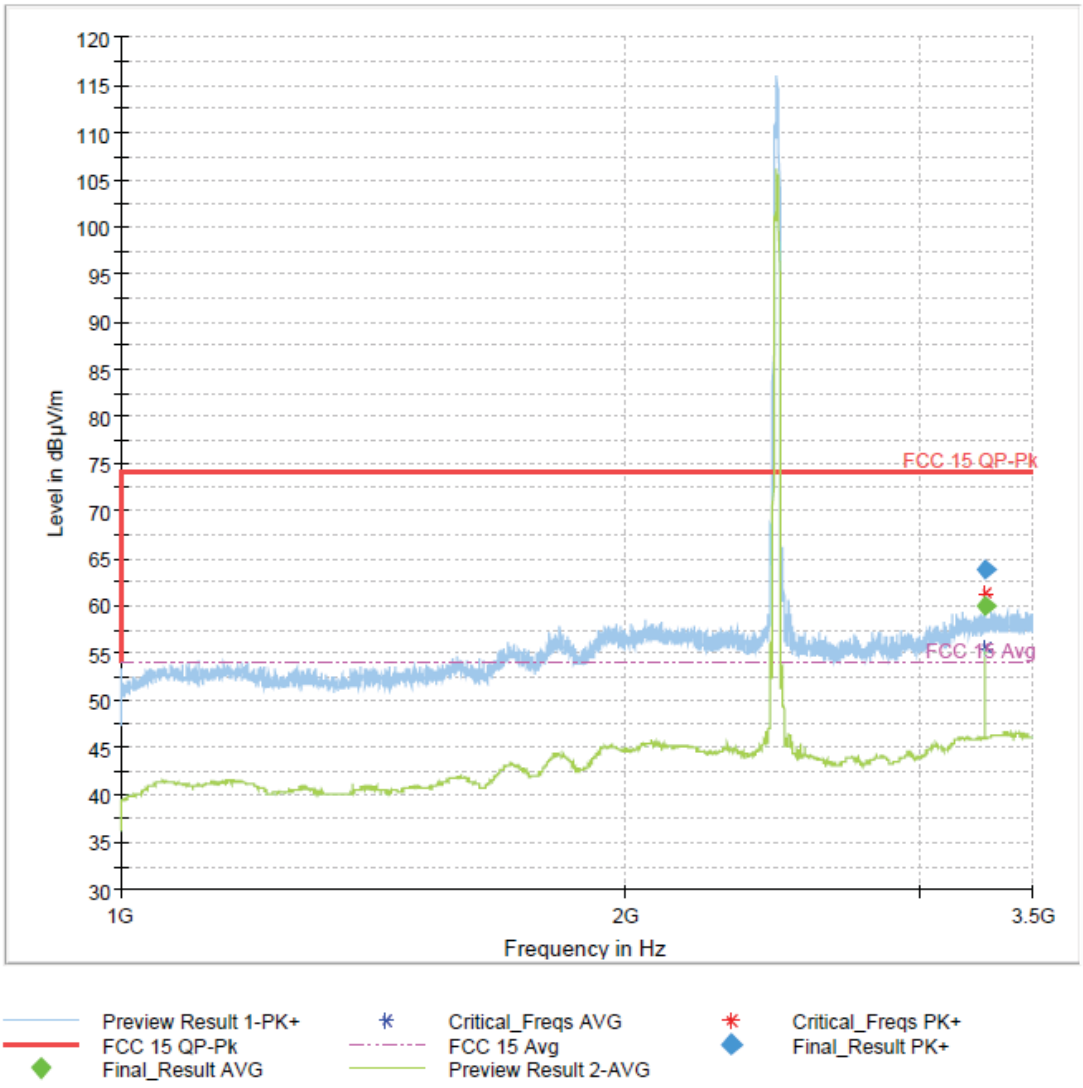


Note: Emissions above limit are the Fundamental and in Non-restricted Band, which is further evaluated in Section 4.4 of this report.

Figure 88: 1-3.5GHz 802.11n HT20 Mode Channel 6

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3282.600000	---	60.03	54.00	-6.03	2.0	1000.000	106.8	V	310.0	33.8
3282.600000	63.78	---	74.00	10.22	2.0	1000.000	114.0	V	309.0	33.8



Note: Emissions above limit are the Fundamental and in Non-restricted Band, which is further evaluated in Section 4.4 of this report.

Figure 89: 1-3.5GHz 802.11n HT20 Mode Channel 11

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
5495.800000	---	29.57	54.00	24.43	2.0	1000.000	149.4	V	92.0

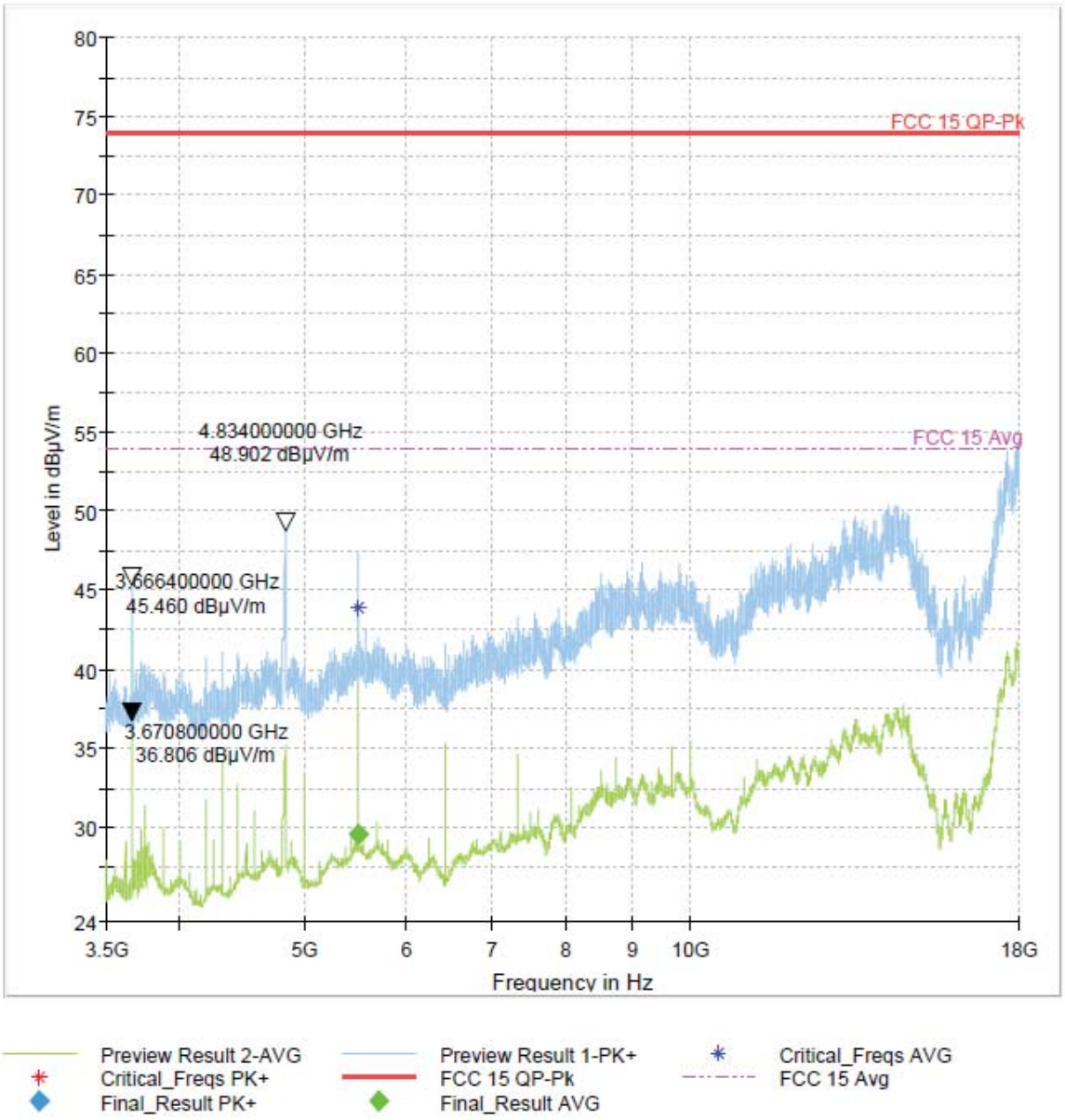


Figure 90: 3.5-18GHz 802.11n HT20 Mode Channel 1

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
3666.600000	---	48.82	54.00	5.18	2.0	1000.000	330.7	H	138.0
5499.800000	---	42.51	54.00	11.49	2.0	1000.000	190.3	V	92.0

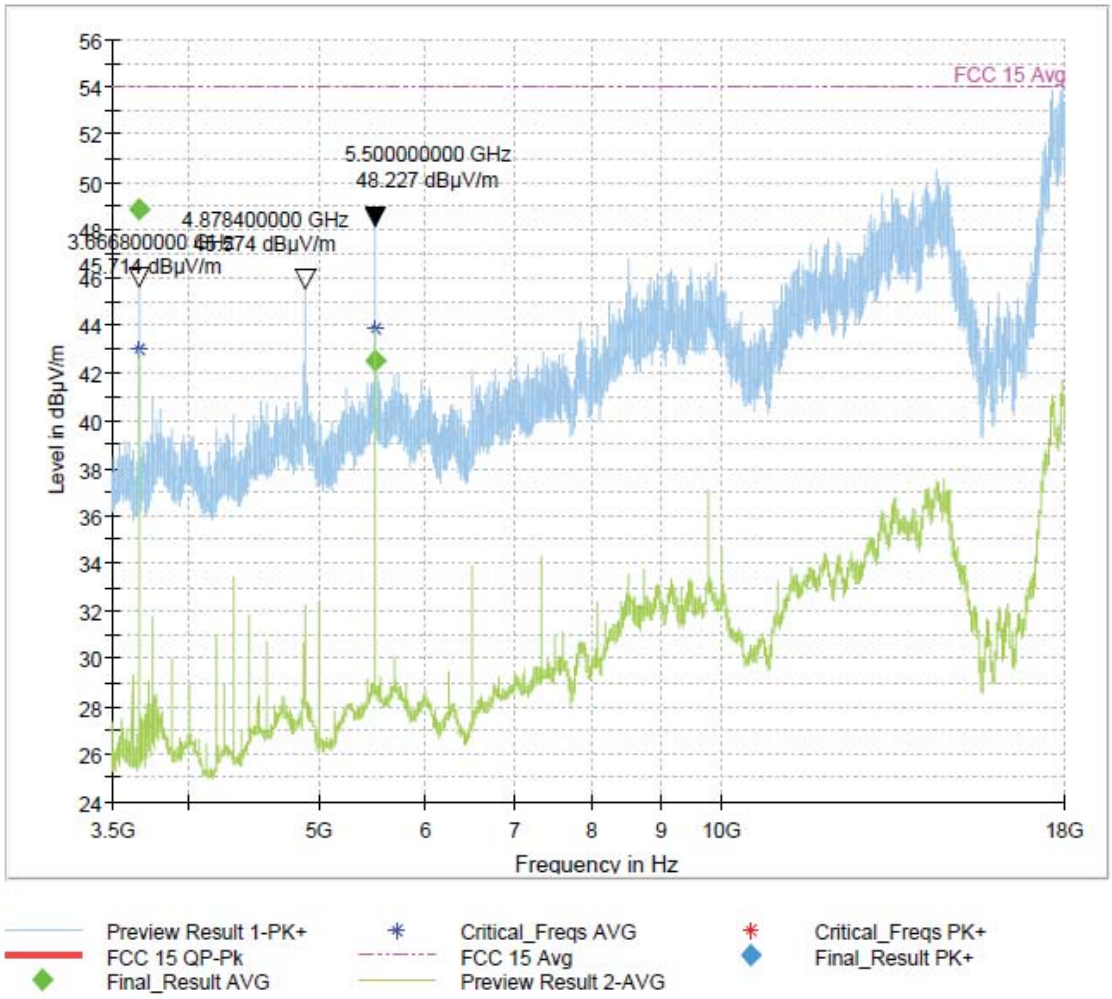


Figure 91: 3.5-18GHz 802.11n HT20 Mode Channel 6

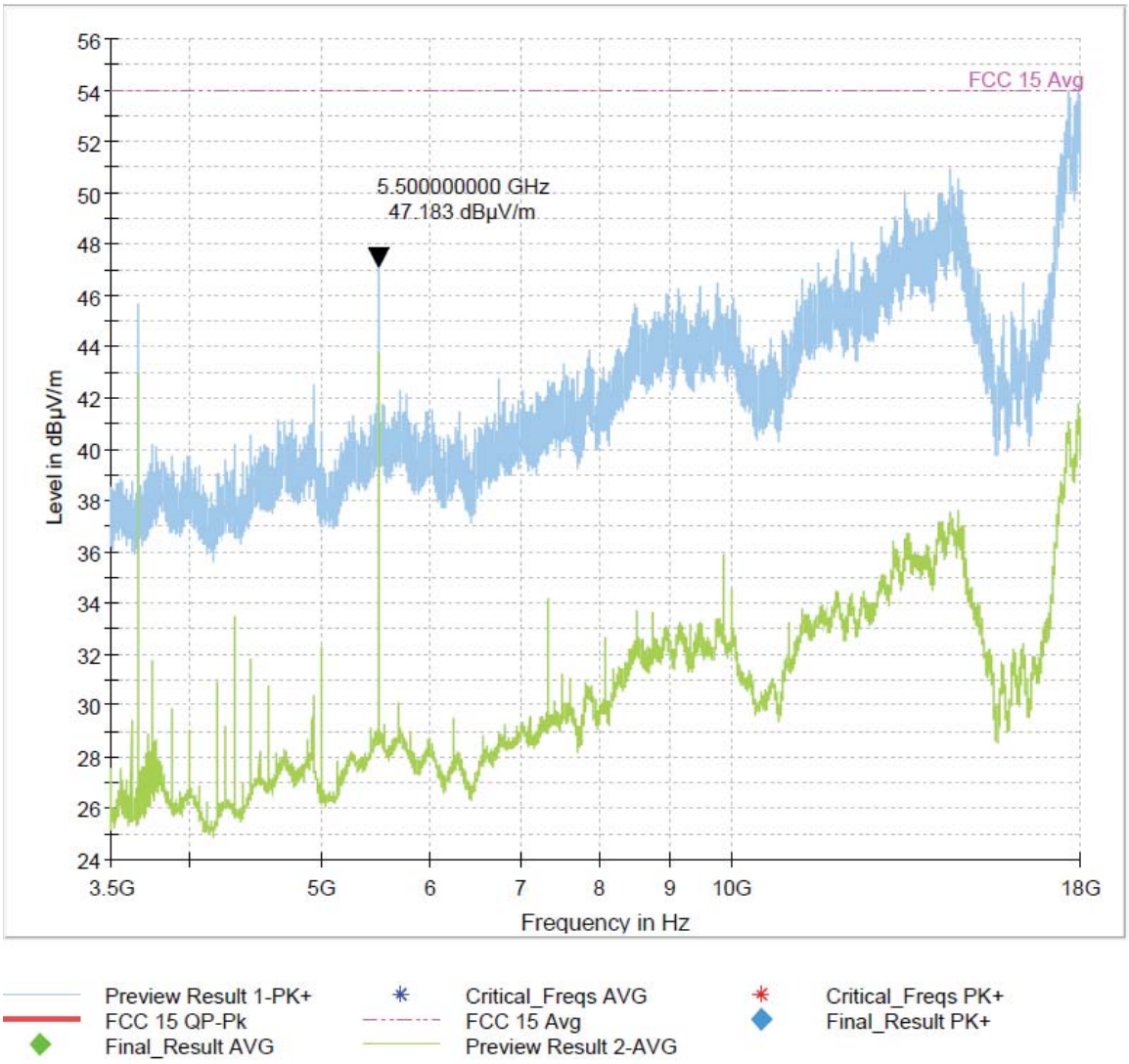


Figure 92: 3.5-18GHz 802.11n HT20 Mode Channel 11

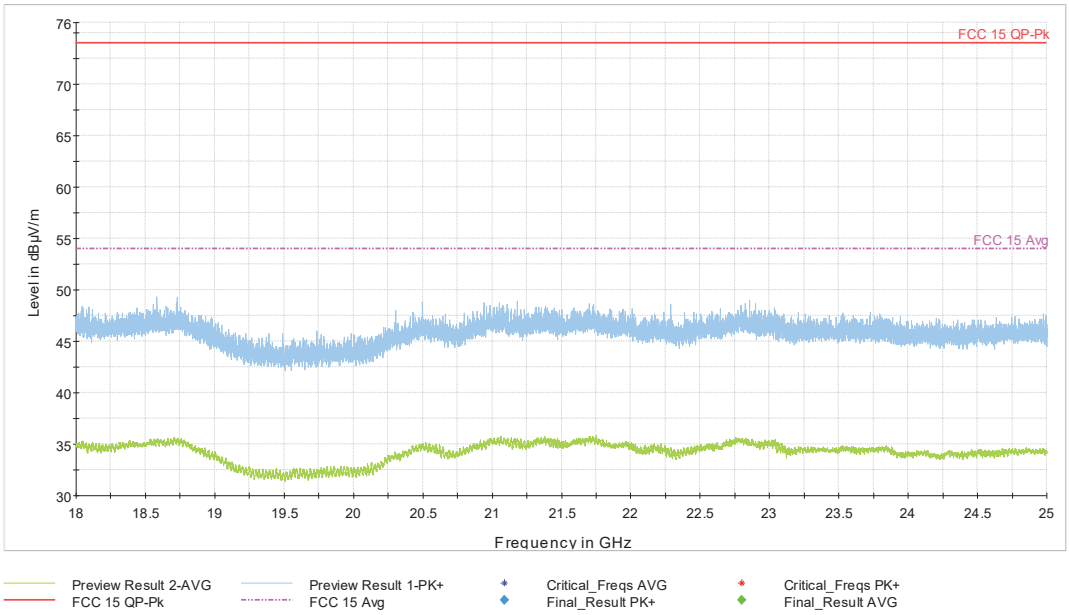


Figure 93: 18-25GHz 802.11n HT20 Mode Channel 1

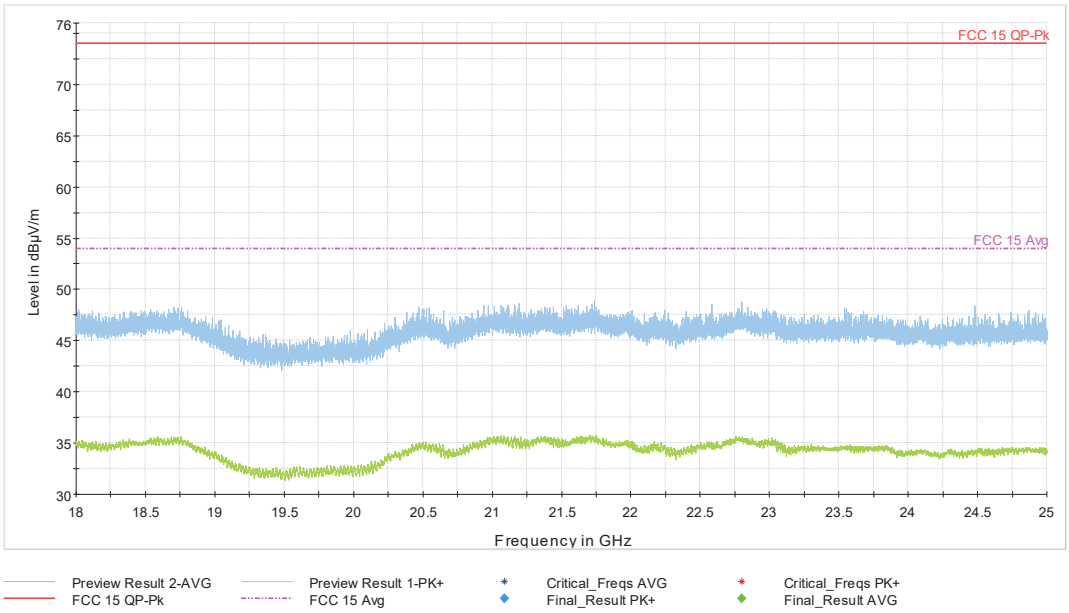


Figure 94: 18-25GHz 802.11n HT20 Mode Channel 6

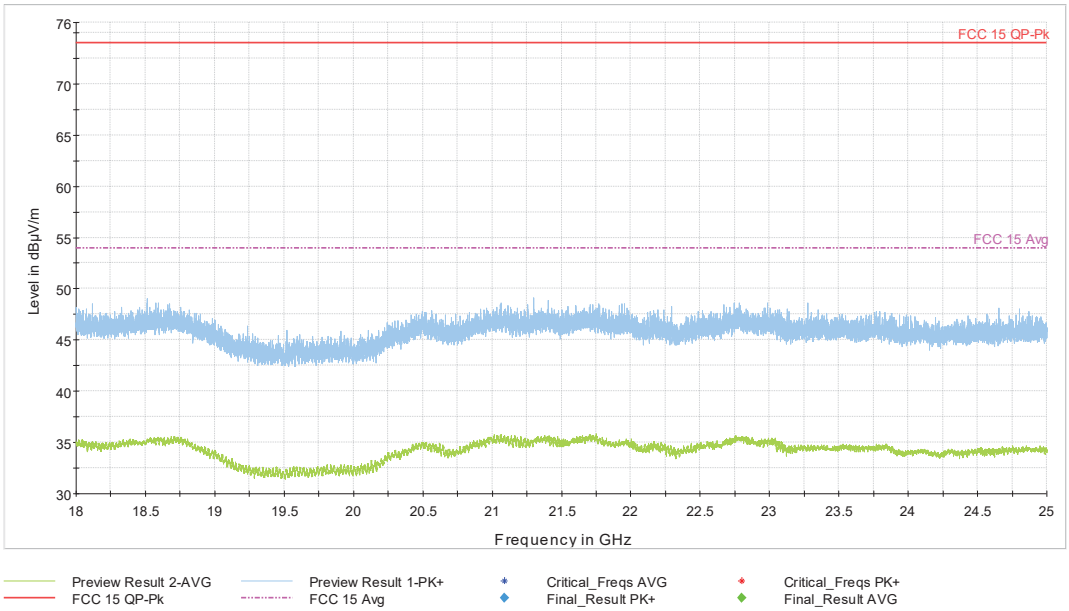


Figure 95: 18-25GHz 802.11n HT20 Mode Channel 11

4.6.4.1.3 802.11n HT40 Mode

Figure 96: 9KHz-30MHz 802.11n HT40 Mode Channel 3

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
51.320000	23.83	---	40.00	16.17	2.0	100.000	100.0	V	12.0

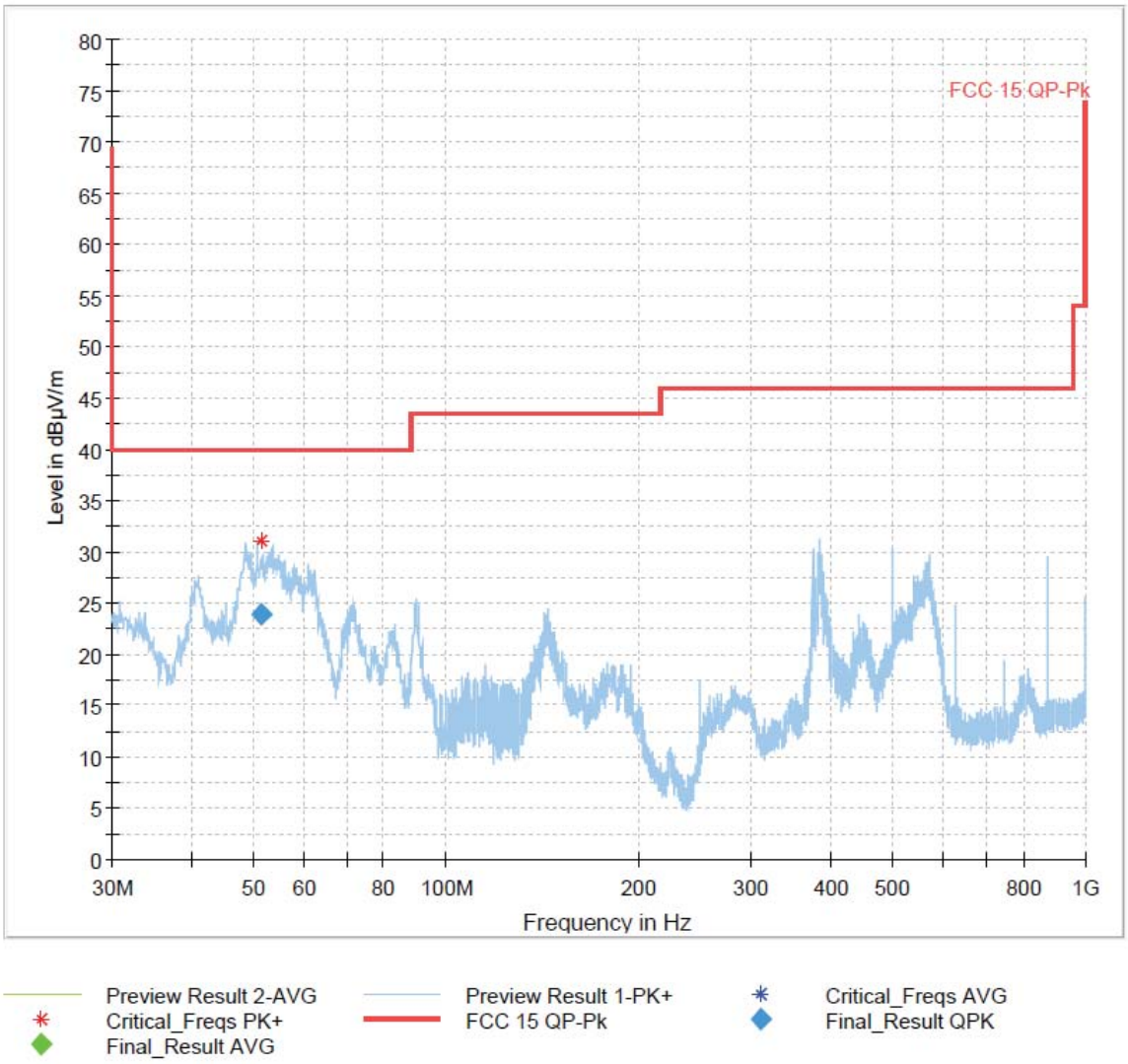
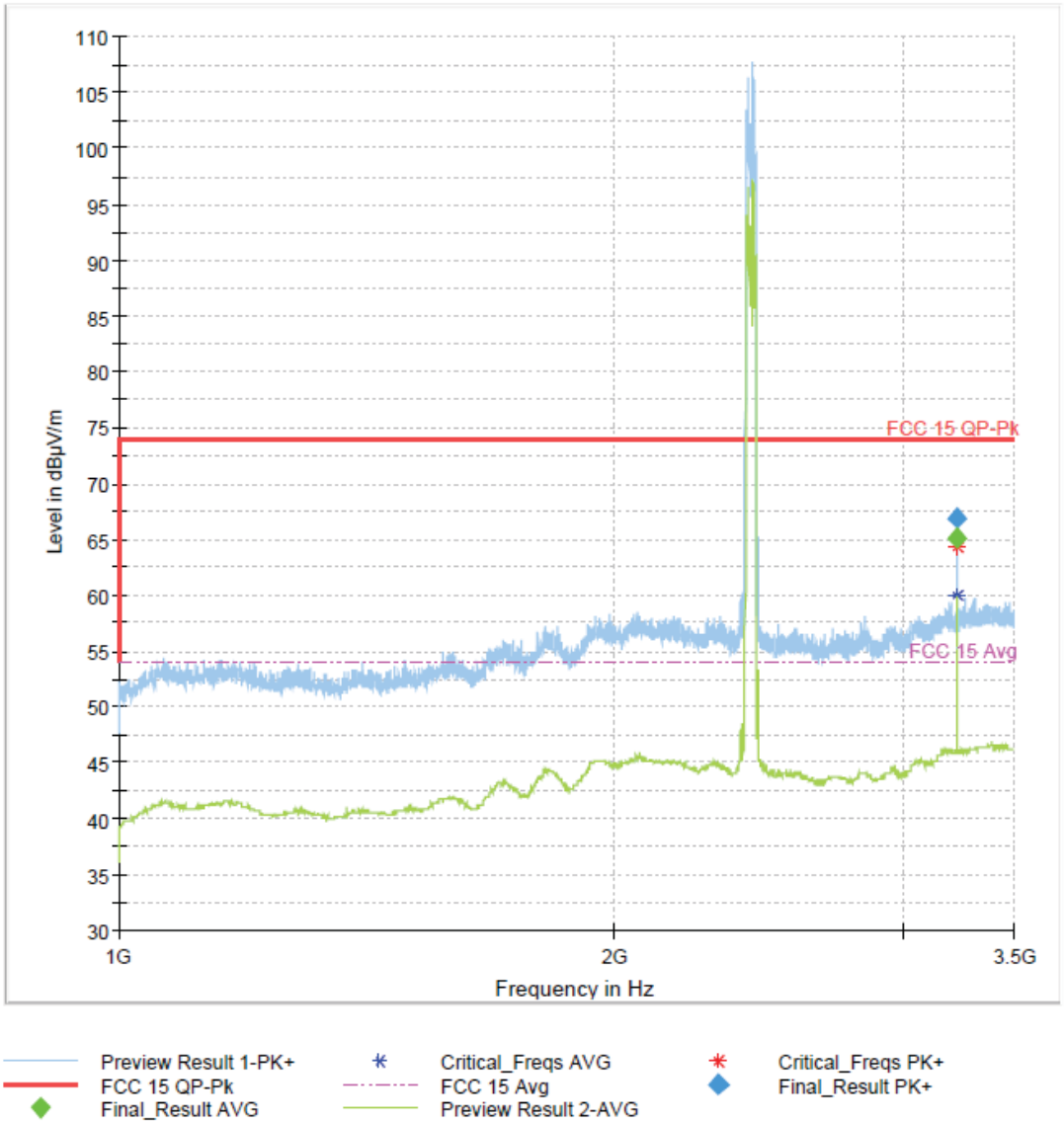


Figure 97: 30MHz-1GHz 802.11n HT40 Mode Channel 3

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3229.400000	---	65.05	54.00	-11.05	2.0	1000.000	106.7	V	311.0	33.8
3229.400000	66.90	---	74.00	7.10	2.0	1000.000	131.3	V	314.0	33.8



Note: Emissions above limit are the Fundamental and in Non-restricted Band, which is further evaluated in Section 4.4 of this report.

Figure 98: 1-3.5GHz 802.11n HT40 Mode Channel 3

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
3666.600000	---	48.49	54.00	5.52	2.0	1000.000	384.3	H	142.0
5499.800000	---	41.73	54.00	12.27	2.0	1000.000	184.1	V	93.0

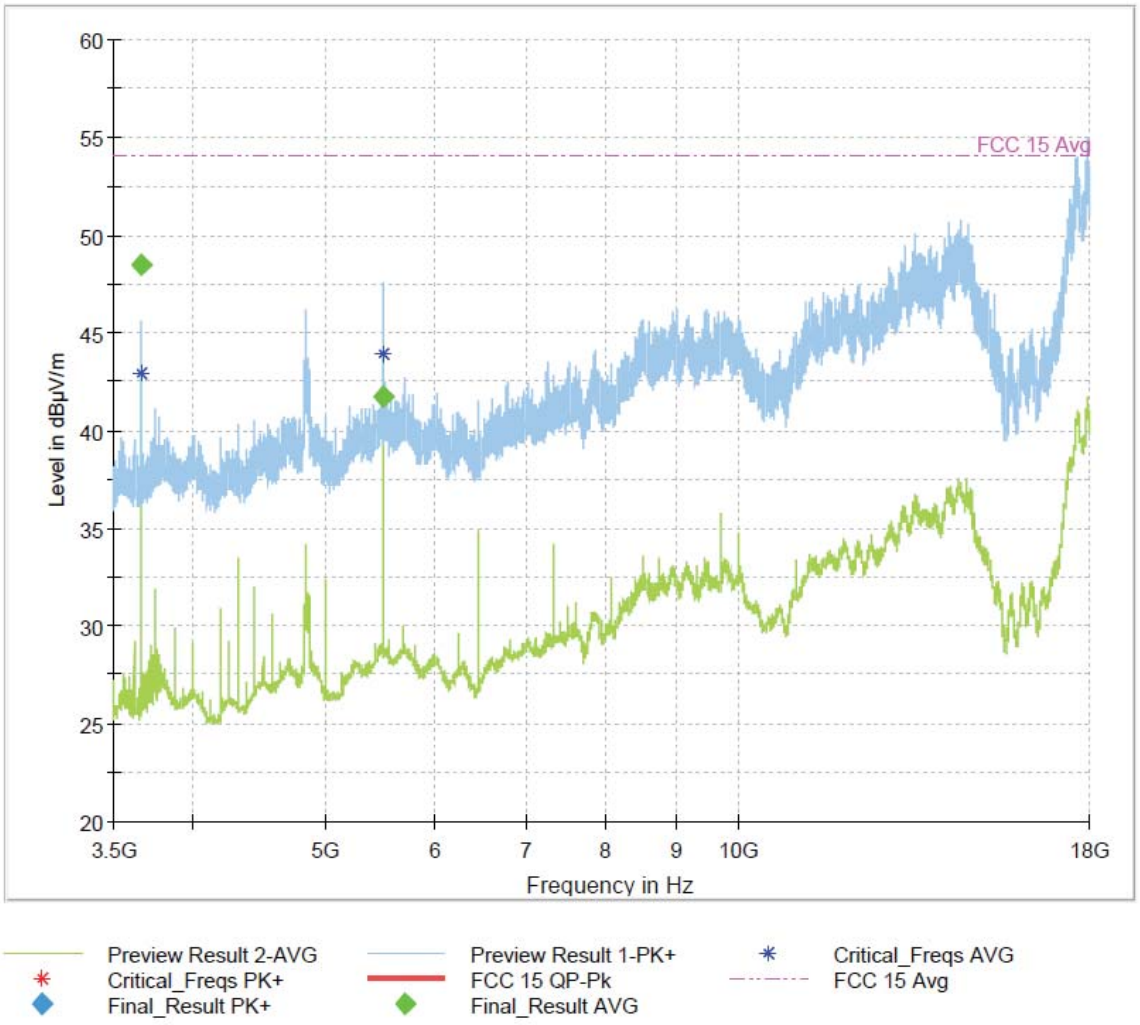


Figure 99: 3.5-18GHz 802.11n HT20 Mode Channel 3

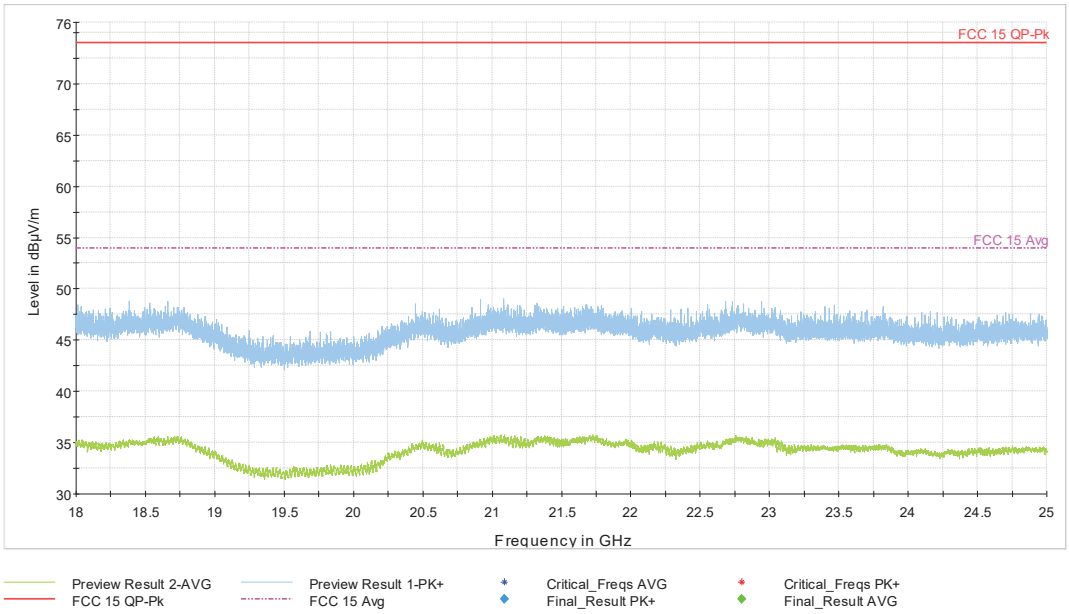


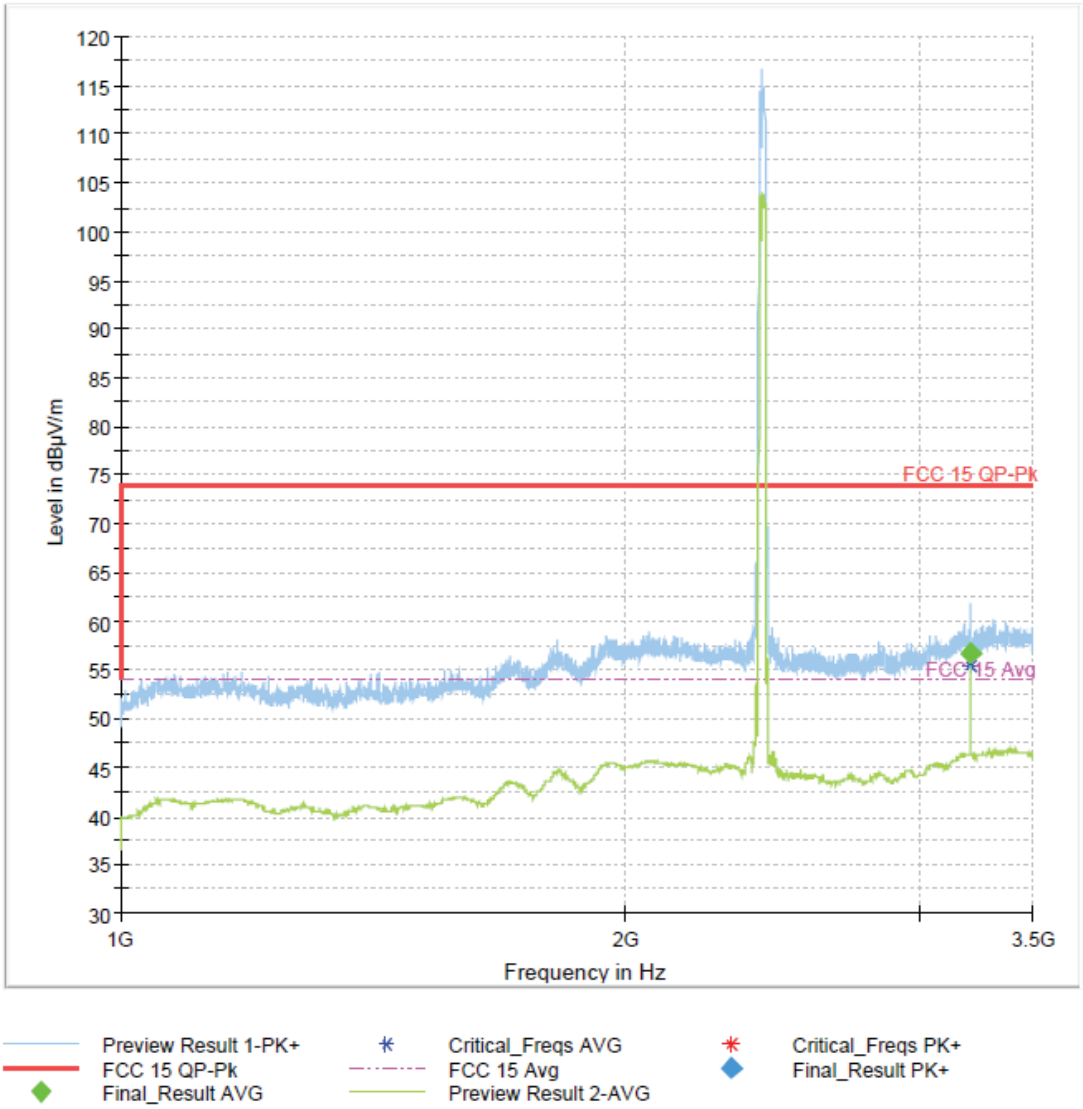
Figure 100: 18-25GHz 802.11n HT20 Mode Channel 3

4.6.4.2 Plots: Beamforming Mode

4.6.4.2.1 802.11ac VHT20 Mode

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3215.800000	---	56.85	54.00	-2.85	2.0	1000.000	232.8	H	17.0	33.8

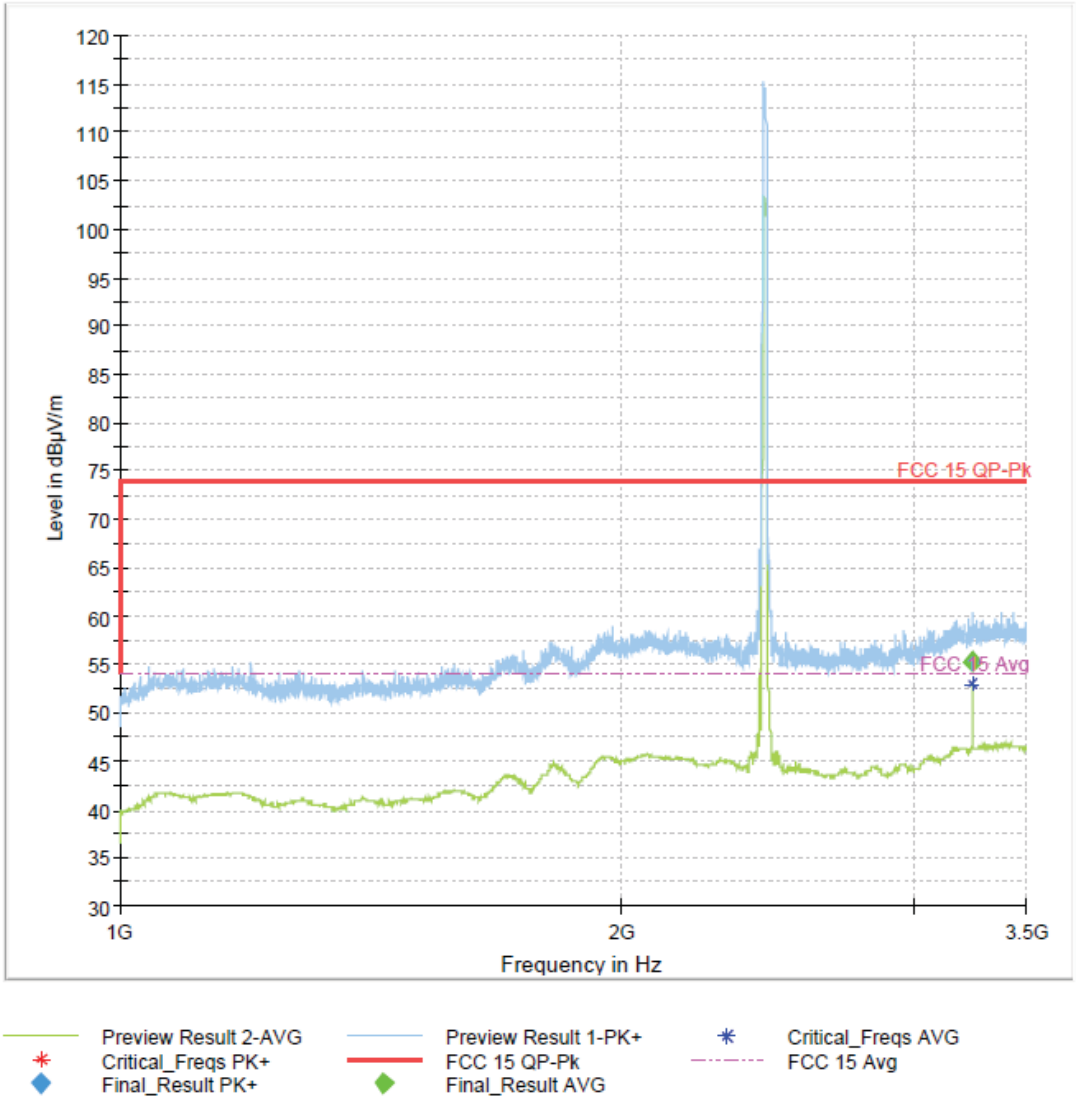


Note: Emissions above limit are the Fundamental and in Non-restricted Band, which is further evaluated in Section 4.4 of this report.

Figure 101: 1-3.5GHz 802.11ac VHT20 Mode Channel 1

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3249.400000	---	55.22	54.00	-1.22	2.0	1000.000	232.3	V	315.0	33.8

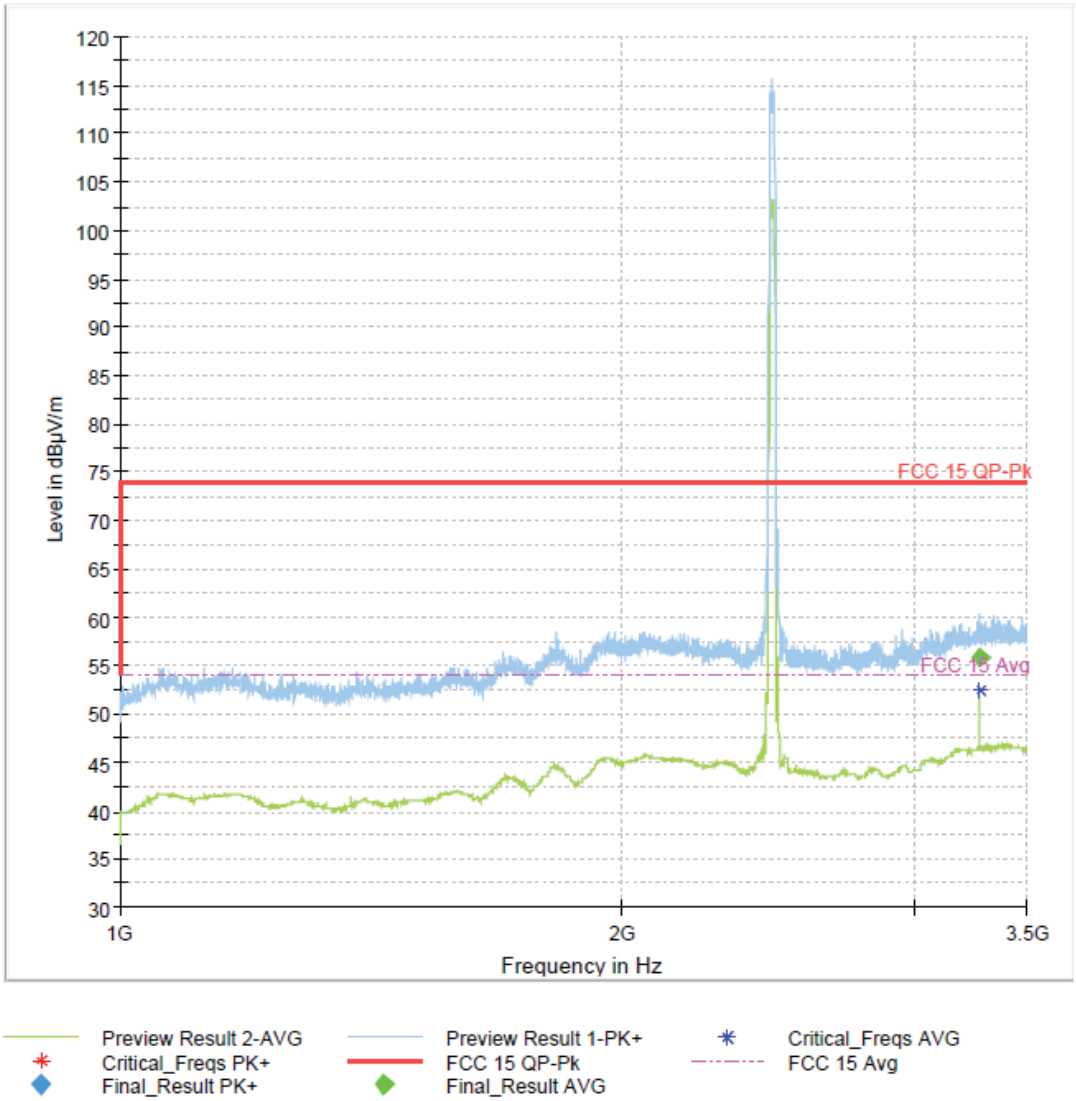


Note: Emissions above limit are the Fundamental and in Non-restricted Band, which is further evaluated in Section 4.4 of this report.

Figure 102: 1-3.5GHz 802.11ac VHT20 Mode Channel 6

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3282.600000	---	55.83	54.00	-1.83	2.0	1000.000	107.5	V	311.0	33.8



Note: Emissions above limit are the Fundamental and in Non-restricted Band, which is further evaluated in Section 4.4 of this report.

Figure 103: 1-3.5GHz 802.11ac VHT20 Mode Channel 11

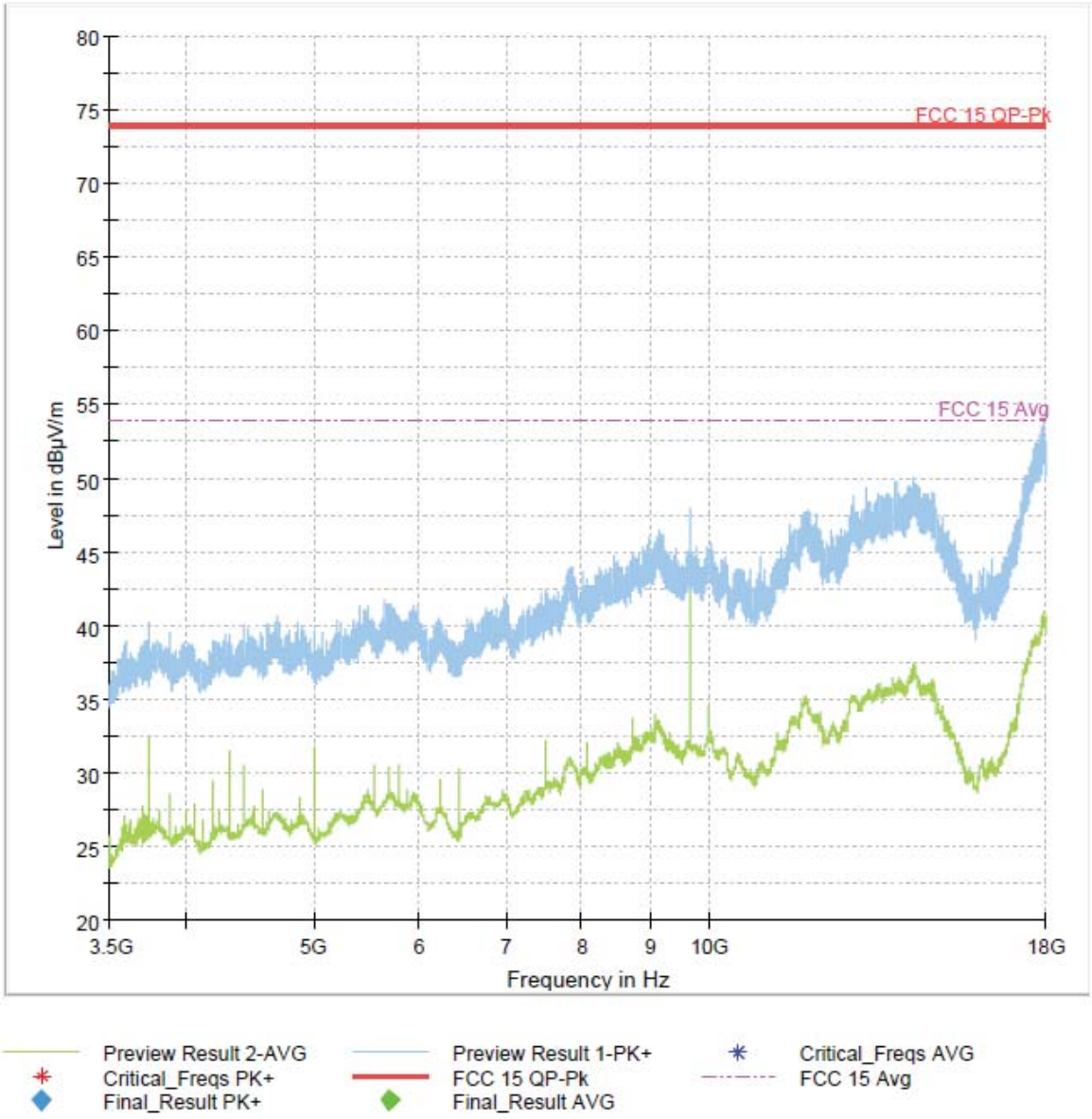


Figure 104: 3.5-18GHz 802.11ac VHT20 Mode Channel 1

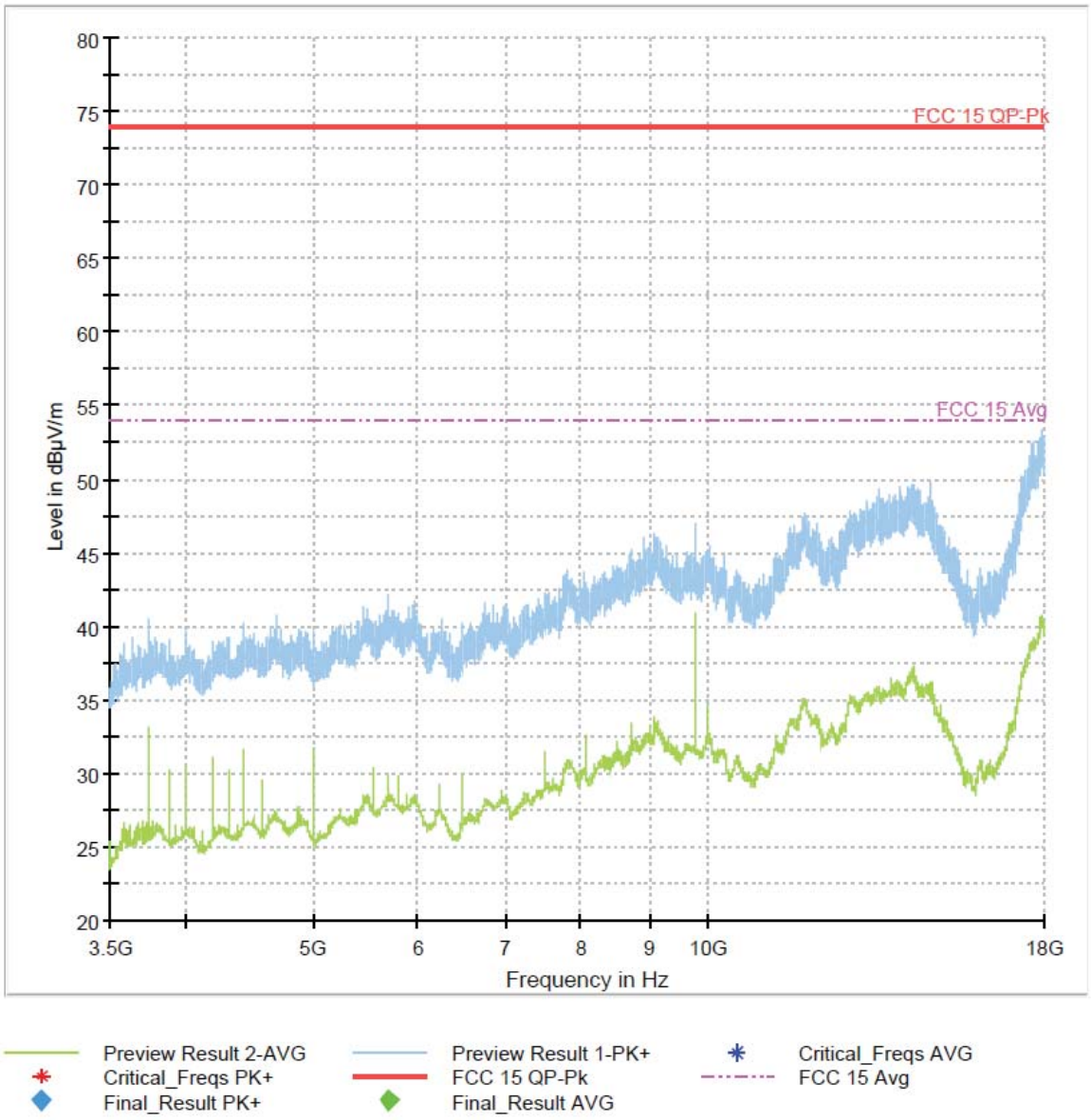


Figure 105: 3.5-18GHz 802.11ac VHT20 Mode Channel 6

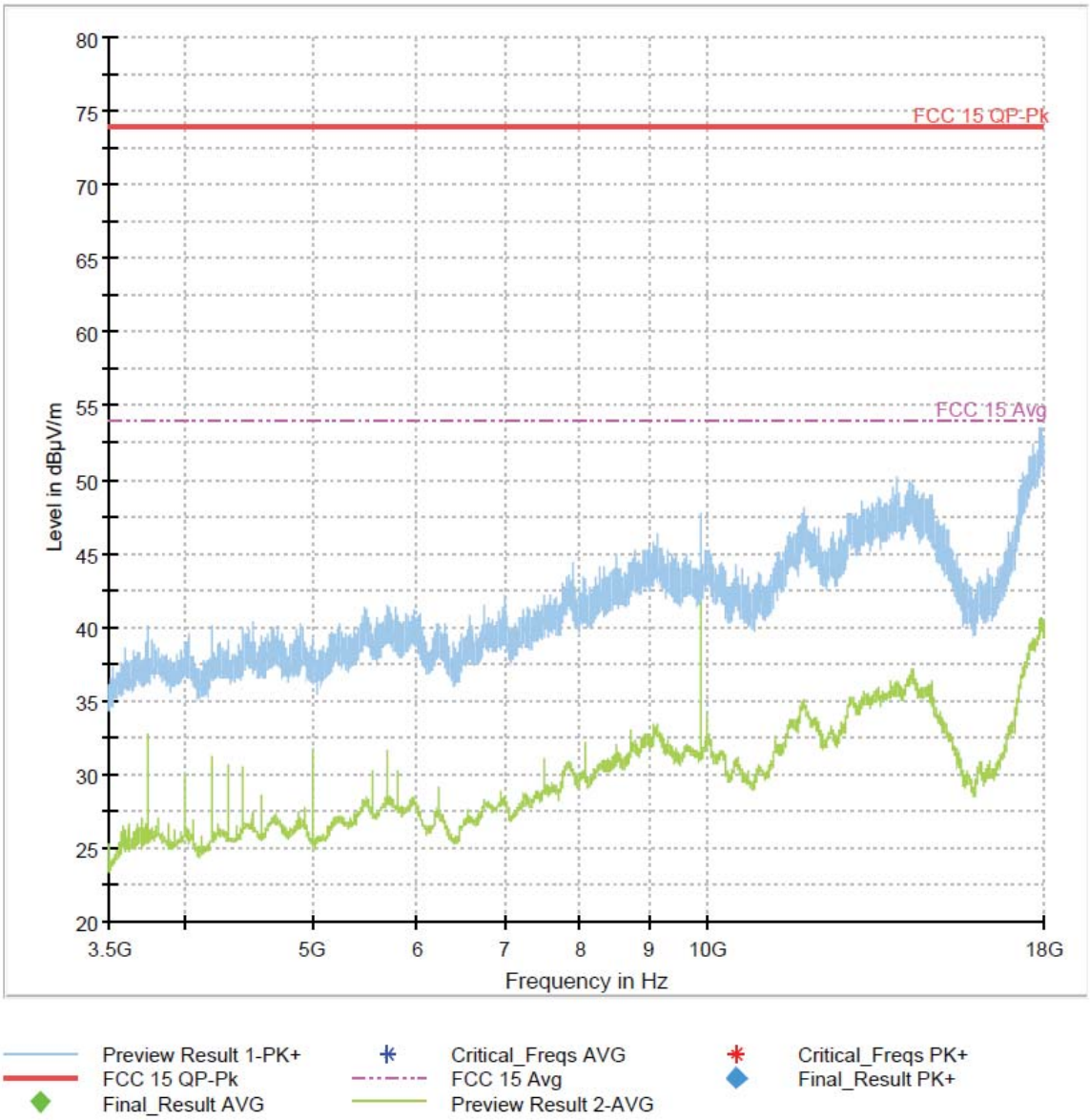


Figure 106: 3.5-18GHz 802.11ac VHT20 Mode Channel 11

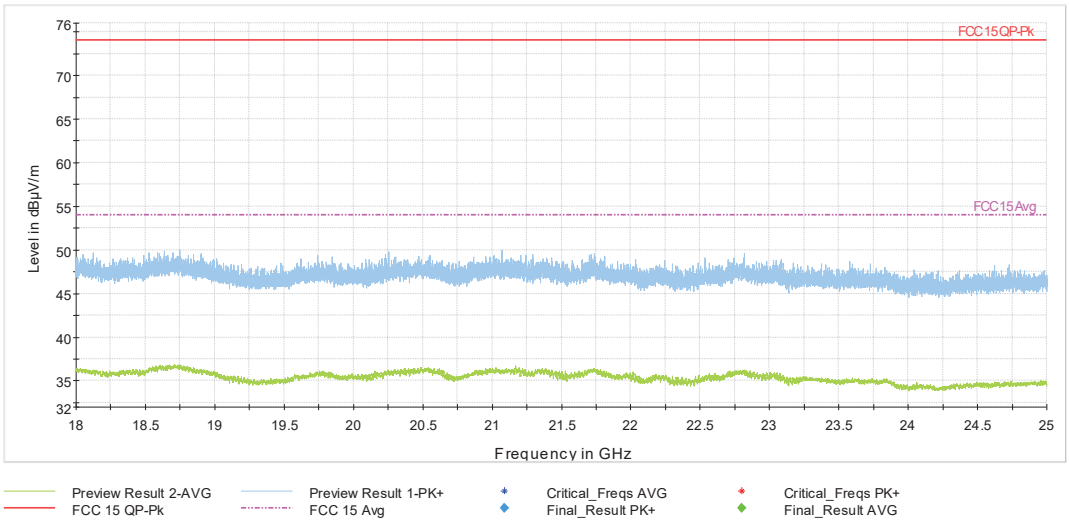


Figure 107: 18-25GHz 802.11ac VHT20 Mode Channel 1

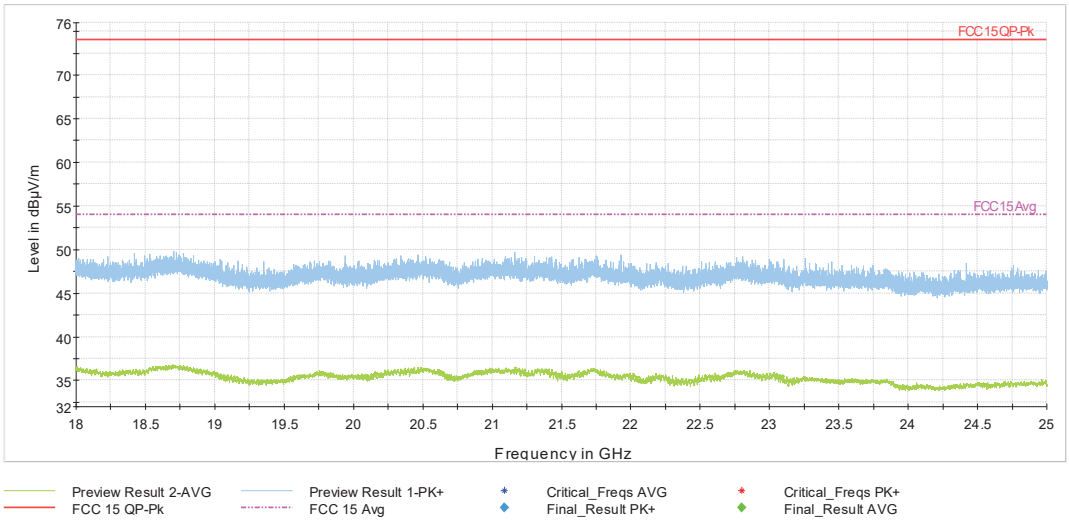


Figure 108: 18-25GHz 802.11ac VHT20 Mode Channel 6

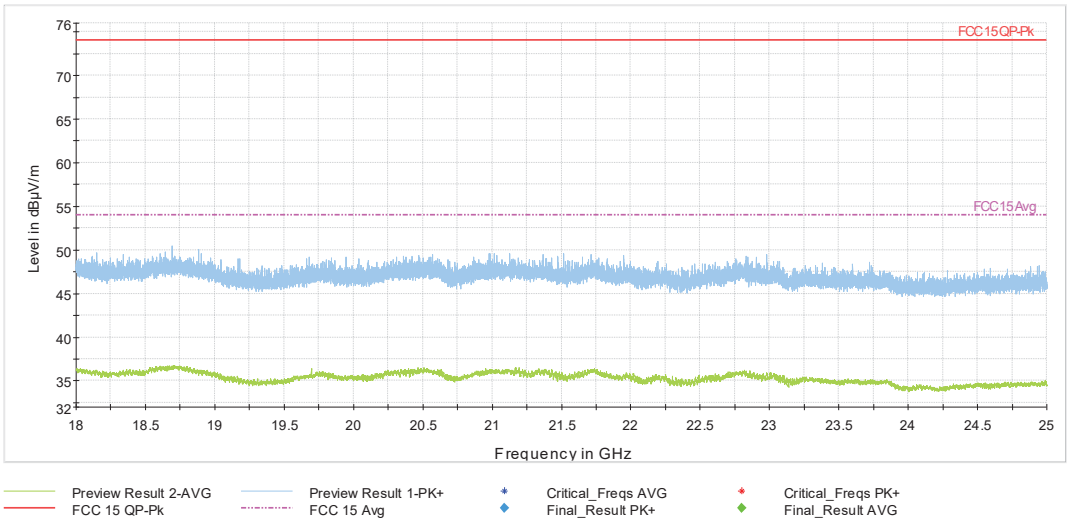
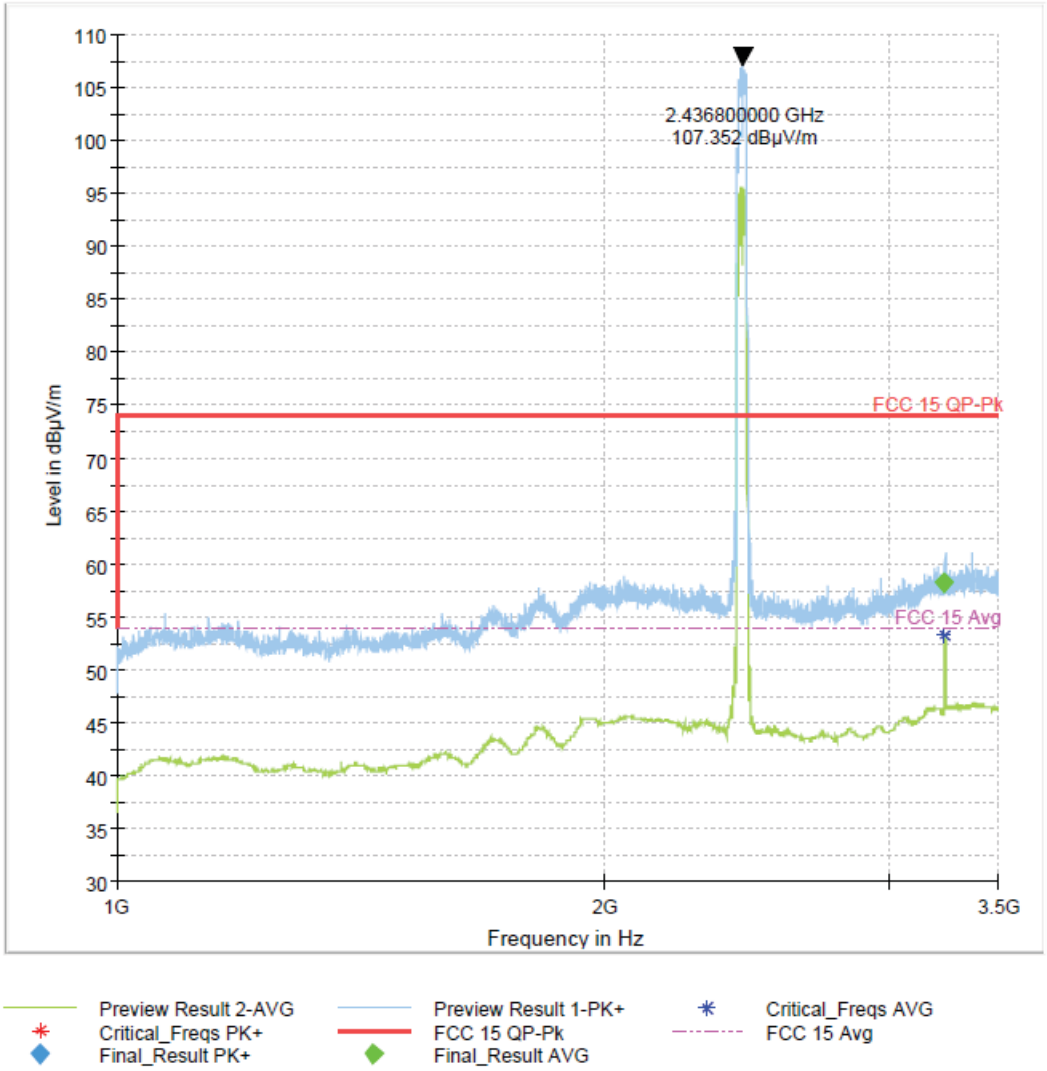


Figure 109: 18-25GHz 802.11ac VHT20 Mode Channel 11

4.6.4.2.2 802.11ac VHT40 Mode

Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
3242.600000	---	58.26	54.00	-4.26	2.0	1000.000	114.5	V	310.0	33.8



Note: Emissions above limit are the Fundamental and in Non-restricted Band, which is further evaluated in Section 4.4 of this report.

Figure 110: 1-3.5GHz 802.11ac VHT40 Mode Channel 3

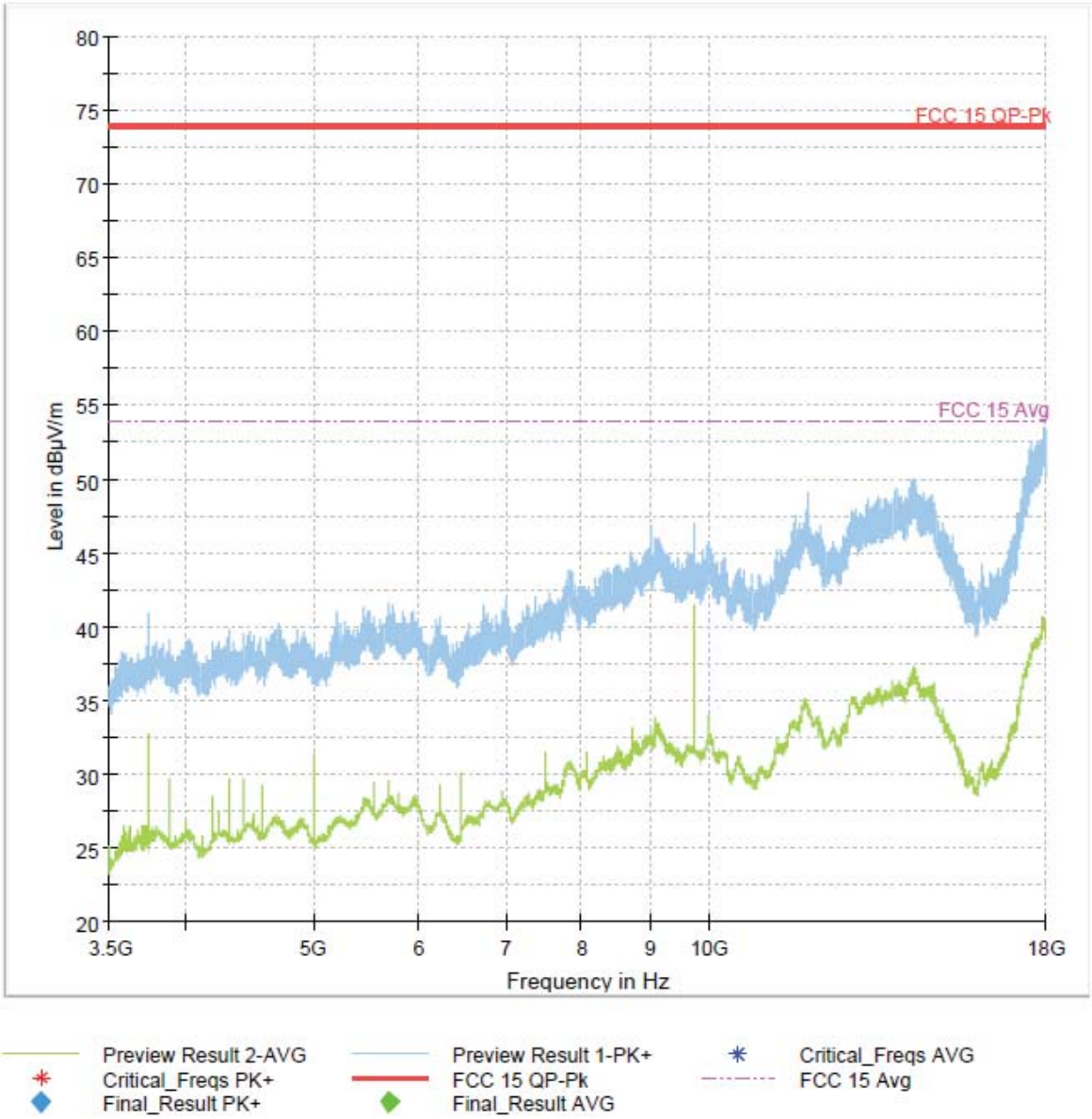


Figure 111: 3.5-18GHz 802.11ac VHT40 Mode Channel 3

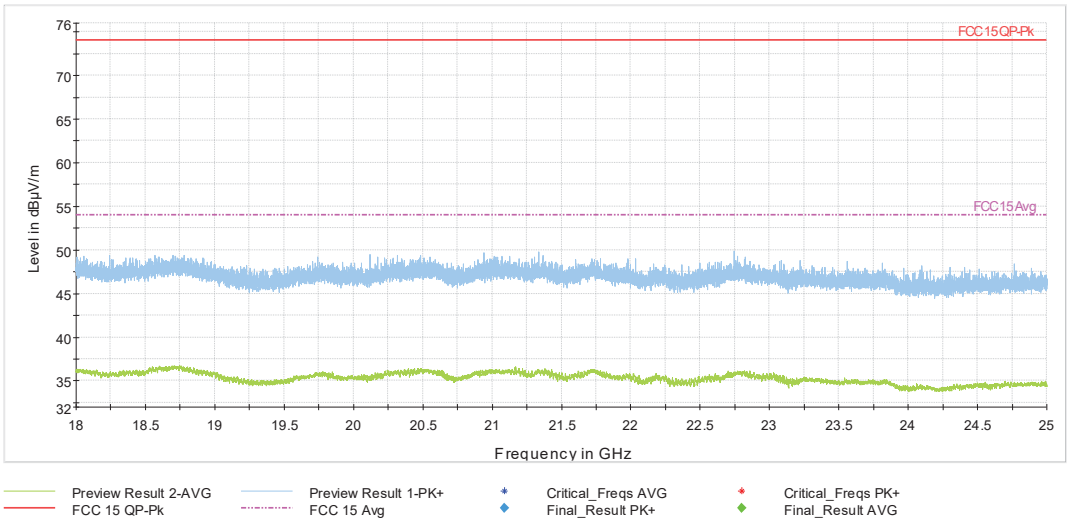


Figure 112: 18-25GHz 802.11ac VHT40 Mode Channel 3

4.7 AC Conducted Emissions

Testing was performed in accordance with ANSI C63.4: 2014. These test methods are listed under the laboratory's A2LA Scope of Accreditation.

This test measures the levels emanating from the EUT's AC input port, thus evaluating the potential for the EUT to cause radio frequency interference to other electronic devices.

The AC conducted emissions of equipment under test shall not exceed the values in CFR47 Part 15.207 and RSS-GEN. Sect. 8.8.

4.7.1 Test Methodology

A test program that controls instrumentation and data logging was used to automate the AC Power Line Conducted emission test procedure. The frequency range of interest was divided into sub-ranges such as to yield a frequency resolution of 9 kHz. Each phase and neutral of the AC power line were measured with respect to ground. Measurements were performed using a set of 50µH / 50Ω LISNs.

Testing is performed in Lab 5. The setup photographs clearly identify which site was used. The vertical ground plane used in the semi-anechoic chamber is a 2m x 2m solid aluminum frame and panel, and it is bonded to the horizontal ground plane.

In the case of tabletop equipment, the EUT is placed on a 1.0m x 1.5m non-conductive table 80cm above the ground plane and 40cm from a vertical ground reference plane. The rear of the EUT was positioned flush with the backside of the table and directly over the LISNs. The power and I/O cables were routed over the edge of the table and bundled approximately 40cm from the ground plane. Support equipment was powered from a separate LISN.

Tests were performed on 802.11b mode which is considered worse case as it has the highest output power. Testing was performed on the middle channel (Channel 6, 2437MHz).

4.7.1.1 Deviations

There were no deviations from this test methodology.

4.7.2 Test Results

As originally tested, the EUT was found to be compliant to the requirements of the test standard(s).

Table 10: AC Conducted Emissions – Test Results

Configuration	Frequency Range	Test Result
Line 1 (Hot)	0.15 to 30 MHz	Pass
Line 2 (Neutral)	0.15 to 30 MHz	Pass

SOP 2 Conducted Emissions

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EUT Name	Norton Core Secure WiFi Router	**Date**	6/15/2018
EUT Model	518	**Temp / Hum in**	22° C / 40% rh
EUT Serial	10041P231551	**Temp / Hum out**	N/A
EUT Config.	TX mode / 802.11b	**Line AC / Freq**	120Vac / 60Hz
Standard	CFR47 Part 15.207 and RSS Gen	**RBW / VBW**	9 kHz / 30 kHz
Lab/LISN	Lab #5 /Com-Power, Line 1	**Performed by**	Benjamin Atsu

Frequency MHz	Raw dBuV	Cable Loss	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail
16.41852	33.14	10.03	43.16	Quasi Peak	Live	60	-16.84	Pass
16.96547	30.44	10.04	40.46	Quasi Peak	Live	60	-19.54	Pass
0.158164	26.42	9.82	36.3	Quasi Peak	Live	65.56	-29.26	Pass
17.48389	27.65	10.04	37.66	Quasi Peak	Live	60	-22.34	Pass
0.20598	28.09	9.83	37.96	Quasi Peak	Live	63.37	-25.4	Pass
18.40189	24.33	10.04	34.34	Quasi Peak	Live	60	-25.66	Pass
16.41852	26.18	10.03	36.2	Average	Live	50	-13.81	Pass
16.96547	23.51	10.04	33.53	Average	Live	50	-16.47	Pass
0.158164	12.6	9.82	22.47	Average	Live	55.56	-33.09	Pass
17.48389	20.75	10.04	30.76	Average	Live	50	-19.24	Pass
0.20598	13.58	9.83	23.45	Average	Live	53.37	-29.92	Pass
18.40189	17.58	10.04	27.6	Average	Live	50	-22.4	Pass

Spec Margin = QP./Ave. - Limit, ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.2$ dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Note:-

SOP 2 Conducted Emissions

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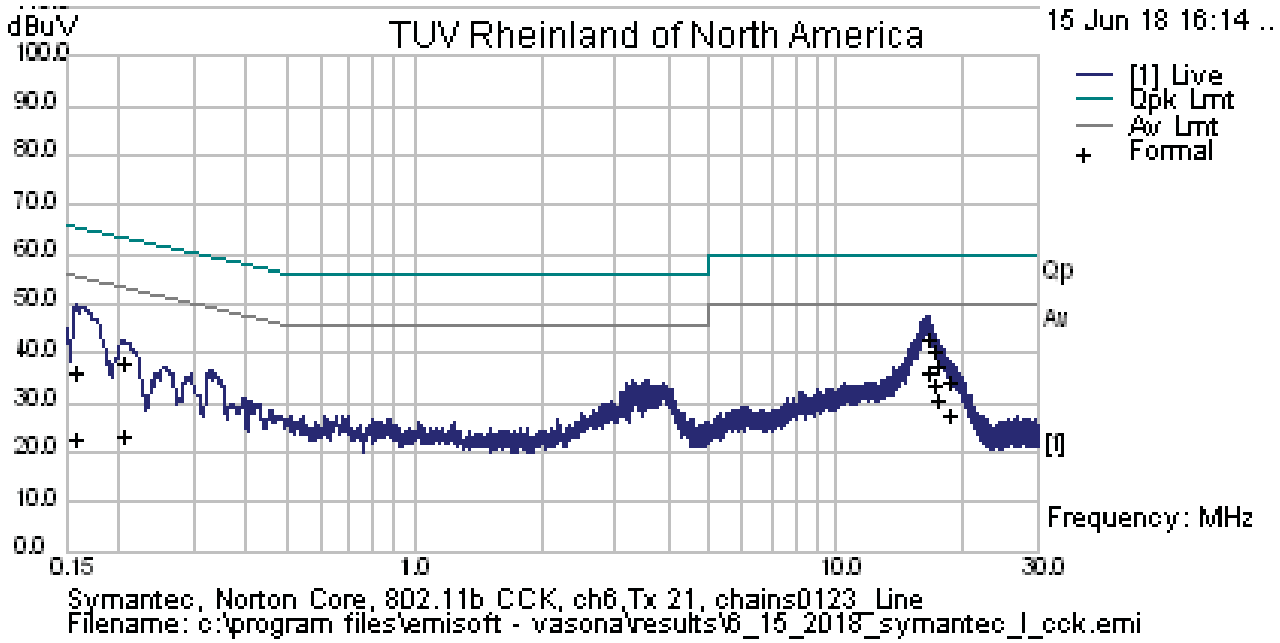
EUT Name	Norton Core Secure WiFi Router	**Date**	6/15/2018
EUT Model	518	**Temp / Hum in**	22° C / 40% rh
EUT Serial	10041P231551	**Temp / Hum out**	N/A
EUT Config.	TX mode / 802.11b	**Line AC**	120Vac / 60Hz
Standard	CFR47 Part 15.207 and RSS Gen	**RBW / VBW**	9 kHz / 30 kHz
Lab/LISN	Lab #5 /Com-Power, Line 1	**Performed by**	Benjamin Atsu

150 kHz to 30 MHz Plot for Line 1 (Live)



Note: Met FCC Class B limit.

SOP 2 Conducted Emissions

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EUT Name	Norton Core Secure WiFi Router	**Date**	6/15/2018
EUT Model	518	**Temp / Hum in**	22° C / 40% rh
EUT Serial	10041P231551	**Temp / Hum out**	N/A
EUT Config.	TX mode / 802.11b	**Line AC / Freq**	120Vac / 60Hz
Standard	CFR47 Part 15.207 and RSS Gen	**RBW / VBW**	9 kHz / 30 kHz
Lab/LISN	Lab #5 /Com-Power, Line 2	**Performed by**	Benjamin Atsu

Frequency MHz	Raw dBuV	Factors dB	Level dBuV	Measurement Type	Line	Limit dBuV	Margin dB	Pass /Fail
16.34971	37.86	10.03	47.87	Quasi Peak	Neutral	60	-12.13	Pass
16.79464	36.06	10.04	46.07	Quasi Peak	Neutral	60	-13.93	Pass
17.24041	33.57	10.04	43.59	Quasi Peak	Neutral	60	-16.41	Pass
17.873	30.9	10.04	40.91	Quasi Peak	Neutral	60	-19.09	Pass
18.69987	28.98	10.05	39	Quasi Peak	Neutral	60	-21	Pass
0.168077	36.28	9.82	46.15	Quasi Peak	Neutral	65.05	-18.9	Pass
16.34971	30.56	10.03	40.58	Average	Neutral	50	-9.42	Pass
16.79464	28.83	10.04	38.85	Average	Neutral	50	-11.15	Pass
17.24041	26.6	10.04	36.62	Average	Neutral	50	-13.38	Pass
17.873	24.08	10.04	34.09	Average	Neutral	50	-15.91	Pass
18.69987	22.04	10.05	32.05	Average	Neutral	50	-17.95	Pass
0.168077	24.43	9.82	34.3	Average	Neutral	55.05	-20.75	Pass

Spec Margin = QP./Ave. - Limit, ± Uncertainty

Combined Standard Uncertainty $u_c(y) = \pm 1.2$ dB Expanded Uncertainty $U = ku_c(y)$ $k = 2$ for 95% confidence

Note: -

SOP 2 Conducted Emissions

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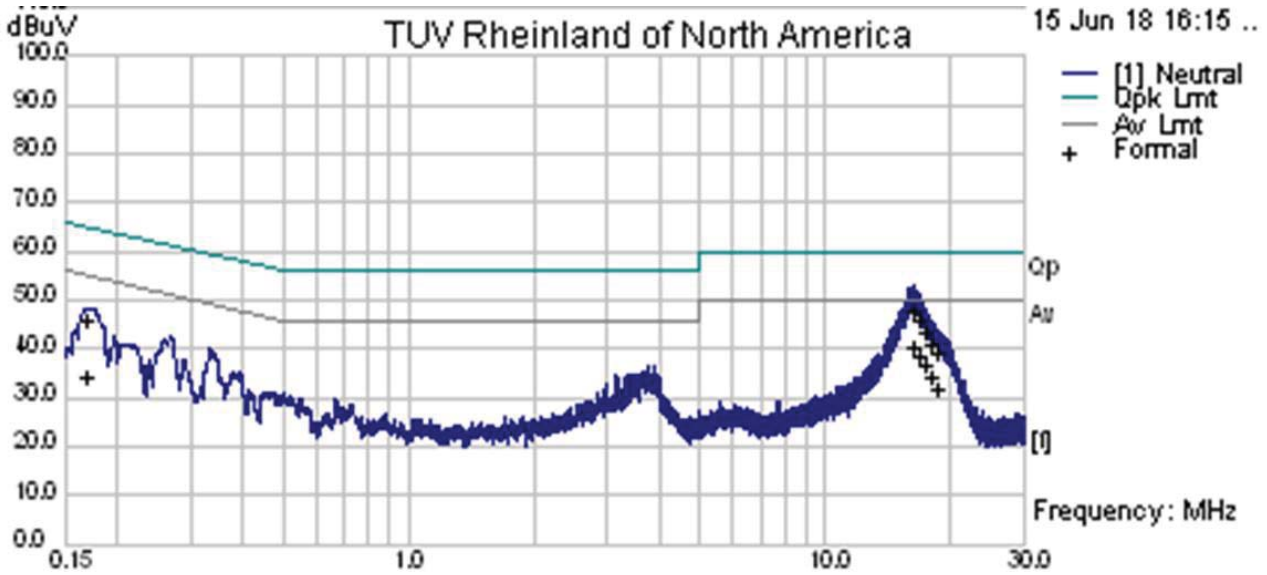
EUT Name	Norton Core Secure WiFi Router	**Date**	6/15/2018
EUT Model	518	**Temp / Hum in**	22° C / 40% rh
EUT Serial	10041P231551	**Temp / Hum out**	N/A
EUT Config.	TX mode / 802.11b	**Line AC**	120Vac / 60Hz
Standard	CFR47 Part 15.207 and RSS Gen	**RBW / VBW**	9 kHz / 30 kHz
Lab/LISN	Lab #5 /Com-Power, Line 2	**Performed by**	Benjamin Atsu

150 kHz to 30 MHz Plot for Line 2 (Neutral)



Note: Met FCC Class B Limit.

5 Test Equipment List

5.1 Equipment List

Equipment	Manufacturer	Model #	Serial/Inst #	Last Cal mm/dd/yyyy	Next Cal mm/dd/yyyy
Bilog Antenna	Sunol Sciences	JB3	A102606	06/15/2016	06/15/2018
Horn Antenna	EMCO	3115	9211-3969	05/16/2017	05/16/2019
Active Horn Antenna	Com-Power	AHA-840	105005	05/26/2017	05/26/2019
Active Loop Antenna	EMCO	6502	00062531	05/17/2017	05/17/2019
LISN	Com-Power	LI-215	12100	01/24/2018	01/24/2019
Spectrum Analyzer	Agilent	N9038A	MY51210195	01/24/2018	01/24/2019
Spectrum Analyzer	Rohde & Schwarz	FSL6	100169	01/13/2018	01/13/2019
EMI Receiver	Rohde & Schwarz	ESIB40	832427/002	01/22/2018	01/22/2019
Thermometer	VWR	61161-378	160702310	08/15/2015	08/15/2018
Vector Signal Generator	Rohde & Schwarz	SMBV100A	257744	9/16/2016	9/16/2019
Thermo Chamber	Espec	BTZ-133	0613436	05/31/2018	05/31/2019
Power Sensors	Rohde & Schwarz	OSP-B157	26160467	01/18/2018	01/18/2019
Amplifier	Sonoma	310N	185516	N/A (See Note)	
Amplifier	Miteq	TTA1800-30-HG	1842452	N/A (See Note)	
Test Software	Rohde & Schwarz	EMC32 v.10.20.01	N/A	N/A	
1.6 GHz Low Pass Filter	K&L Microwave	8L120-X1600-0/09135-0249	UA691-35	N/A (See Note)	
3.5 GHz High Pass Filter	Hewlett Packard	84300-80038	820004	N/A (See Note)	

Note: Equipment is characterized before use.

6 EMC Test Plan

6.1 Introduction

This section provides a description of the Equipment Under Test (EUT), configurations, operating conditions, and performance acceptance criteria. It is an overview of information provided by the manufacturer so that the test laboratory may perform the requested testing.

6.2 Customer

Table 11: Customer Information

Company Name	Symantec Corporation
Address	350 Ellis Street
City, State, Zip	Mountain View, CA 94043
Country	USA

Table 12: Technical Contact Information

Name	Vijay Poojari
E-mail	Vijay_Poojari@symantec.com

6.3 Equipment Under Test (EUT)

The information provided in the following table should be listed as it should appear in the final report. For those products that have only a model name, list the model number as *non-applicable* and vice-versa.

Table 13: EUT Designation

Product Name	Norton Core
Model Number	518
System Name	NA
Product Description	Norton Core is a 4x4 secure wireless router that protects your connected home network, while delivering the highest level of security and performance. It is intended to work as a dual band (2.4GHz and 5GHz) wireless router. The router will be in compliance with regulatory standards of regions it will be operating in.

6.4 Product Specifications

Table 14: EUT Specifications

EUT Specifications	
AC Input	100-240V AC, 50 – 60 Hz
Environment	Indoor
Operating Temperature Range:	0 to 40 degrees C
Multiple Feeds:	☐ Yes and how many ☒ No
Product Marketing Name (PMN)	Norton Core
Hardware Version Identification Number (HVIN)	518
Firmware Version Identification Number (FVIN)	QSDK 5.3
RF Test Software Version	QCAQMSL – QLIV V6.1.291.QPHONEMS
Operating Modes	802.11b 802.11g 802.11n HT20/40 802.11ac VHT20/40 + Beamforming
Transmitter Frequency Band	2.4 GHz – 2.4835 GHz
Max. Power Output (RMS, Conducted)	26.2 dBm (802.11b)
Power Setting @ Operating Channel	See section 4.1.2.
Modulation	CCK (802.11b) and OFDM (802.11g/n/ac)
TX/RX Chain (s)	MIMO 4x4
Directional Gain Type	☒ Correlated (CDD) ☒ Beam-Forming ☐ Other describe:
Type of Equipment	☒ Table Top ☐ Wall-mount ☐ Floor standing cabinet ☐ Other:
Note: All 4 chains will be on / transmitted at all times with the same power levels and antenna gains per chain.	

Table 15: Antenna Information

Number	Antenna Type	Description	Max Gain (dBi)
Antenna 0	Internal, Stamped Metal	2.4GHz WLAN	2.7
Antenna 1	Internal, Stamped Metal	2.4GHz WLAN	
Antenna 2	Internal, Stamped Metal	2.4GHz WLAN	
Antenna 3	Internal, Stamped Metal	2.4GHz WLAN	

Table 16: Interface Specifications

Interface Type	Cabled with what type of cable?	Is the cable shielded?	Maximum potential length of the cable?	Metallic (M), Coax (C), Fiber (F), or Not Applicable?
Ethernet	Ethernet	☐ Yes	☒ Metric: > 3.0m	☒ M

Table 17: Accessory Equipment

Equipment	Manufacturer	Model	Serial	Comment
AC/DC Converter	Delta	21369161 REV2	IFSD79V020C	Power supply that ships with EUT
Note: None.				

Table 18: Ancillary Equipment (used for test purposes only)

Equipment	Manufacturer	Model	Serial	Used for
Laptop	Lenovo	Thinkpad	N/A	Setup EUT operating channels via terminal emulator with Ethernet connection to EUT
Norton Core	Symantec Corporation	518	10040P168521	Client used for Radiated Beamforming measurements
Note: None.				

Table 19: Description of Sample used for Testing

Sample Number	Device	Serial Number	Configuration	Used For
1	Norton Core	10041P625119C	Radiated Sample	TX Spurious Emissions
2	Norton Core	10041P231551	Radiated Sample	AC Mains Conducted Emissions
3	Norton Core	10041P492283	Conducted Sample	All other Conducted measurements
Note: -				

Table 20: Description of Test Configuration used for Radiated Measurement.

Device	Antenna	Mode	Setup Photo (X-Axis)	Setup Photo (Y-Axis)	Setup Photo (Z-Axis)
Norton Core	Stamped Metal	Transmit	EUT upright	N/A	N/A
Note: Manufacturer has declared that the EUT is designed to operate in a fixed, upright position.					

6.5 Test Specifications

Table 21: Test Specifications

Emissions and Immunity	
Standard	**Requirement**
CFR 47 Part 15.247: 2018	All
RSS 247 Issue 2, 2017	All

END OF REPORT