



U-NII-2A, 802.11a, Channel No.: 52



U-NII-2A, 802.11n HT20, Channel No.: 52



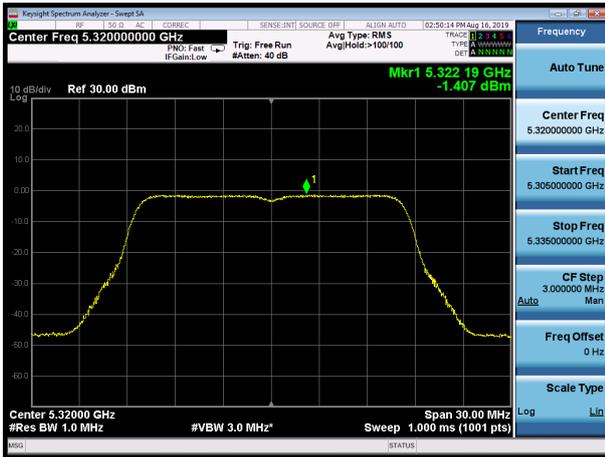
U-NII-2A, 802.11a, Channel No.: 60



U-NII-2A, 802.11n HT20, Channel No.: 60



U-NII-2A, 802.11a, Channel No.: 64

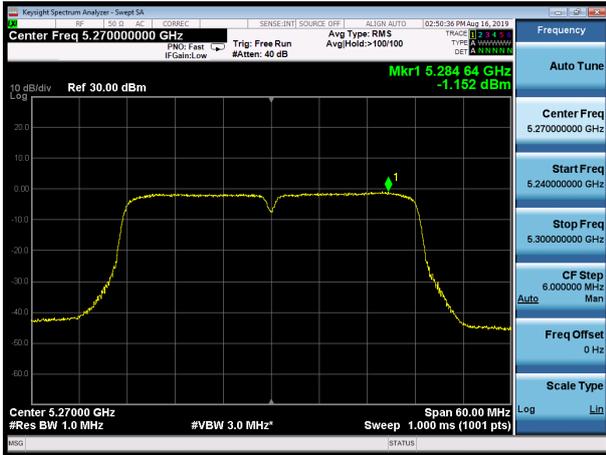


U-NII-2A, 802.11n HT20, Channel No.: 64





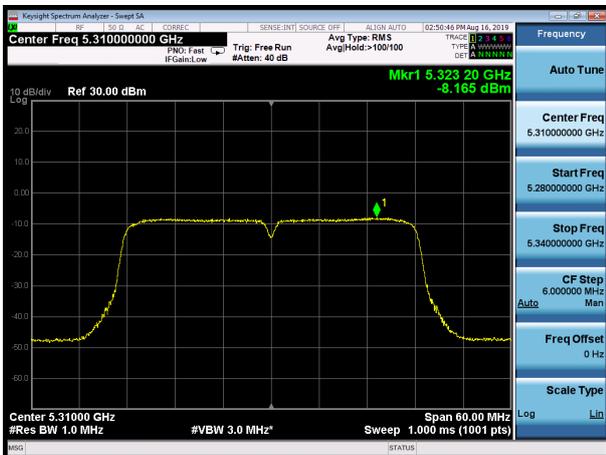
U-NII-2A, 802.11n HT40, Channel No.: 54



U-NII-2A, 802.11ac VHT20, Channel No.: 52



U-NII-2A, 802.11n HT40, Channel No.: 62



U-NII-2A, 802.11ac VHT20, Channel No.: 60

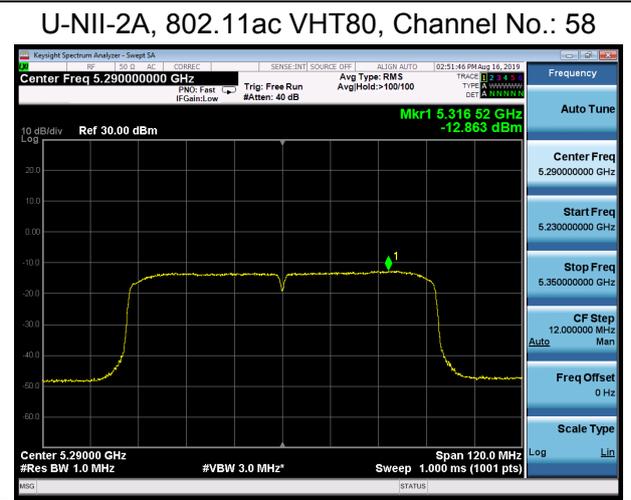
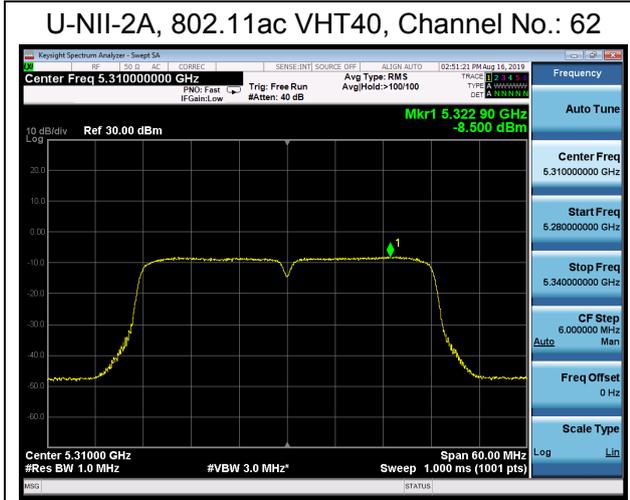


U-NII-2A, 802.11ac VHT40, Channel No.: 54



U-NII-2A, 802.11ac VHT20, Channel No.: 64







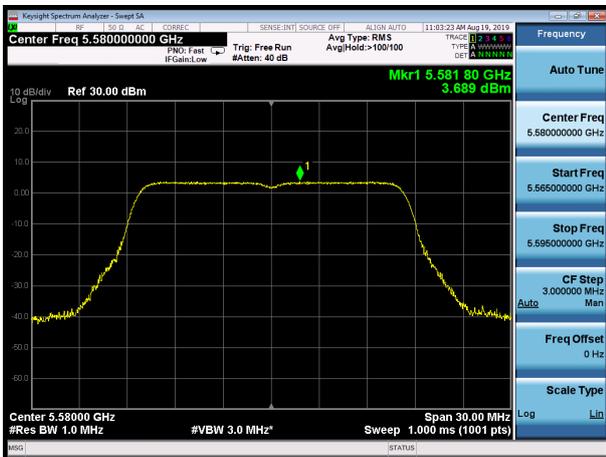
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U-NII-2C, 802.11n HT20, Channel No.: 100



U-NII-2C, 802.11a, Channel No.: 116



U-NII-2C, 802.11n HT20, Channel No.: 116



U-NII-2C, 802.11a, Channel No.: 140

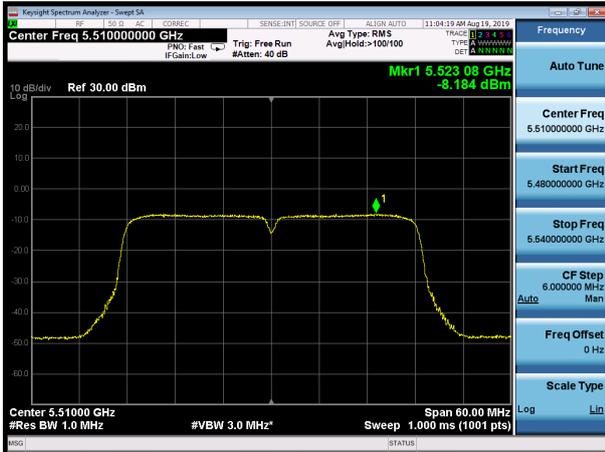


U-NII-2C, 802.11n HT20, Channel No.: 140





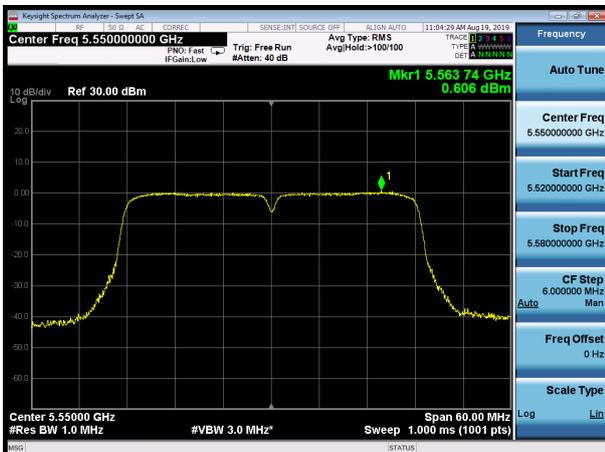
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U-NII-2C, 802.11ac VHT20, Channel No.: 100



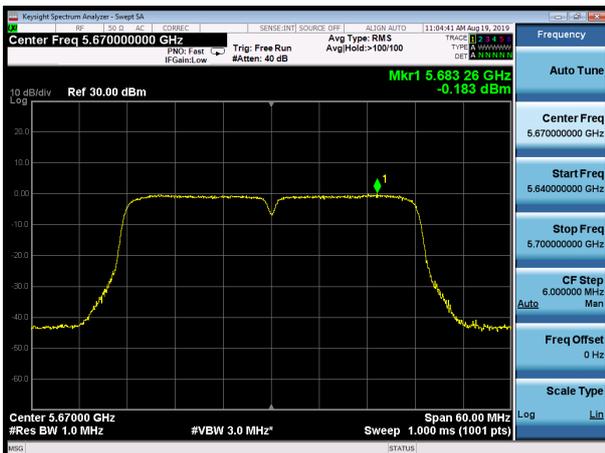
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U-NII-2C, 802.11ac VHT20, Channel No.: 116

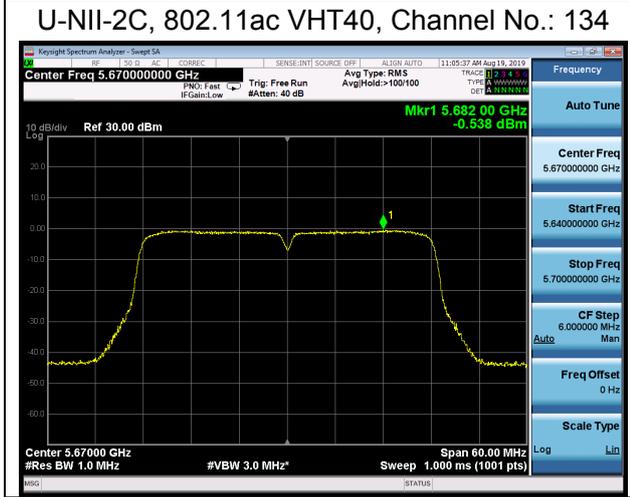
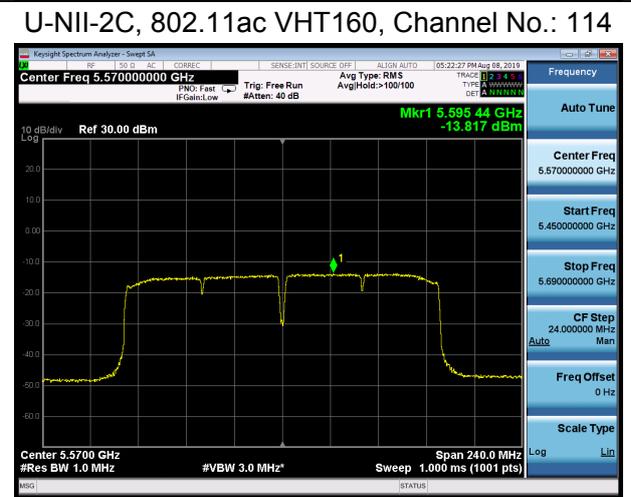
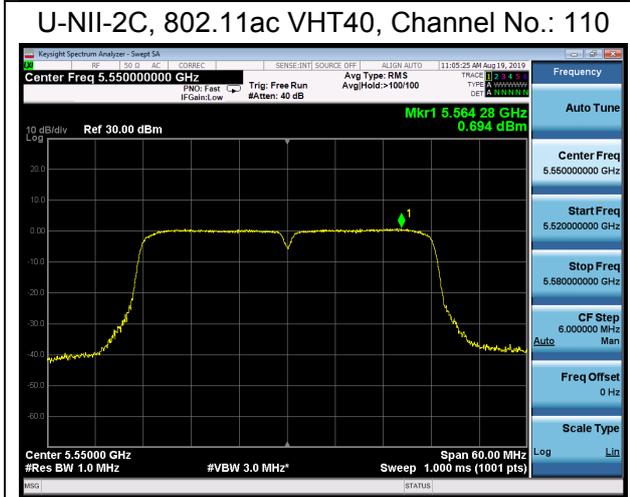
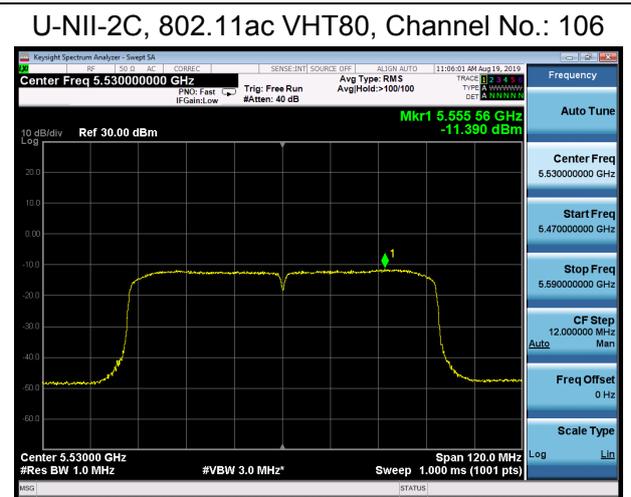
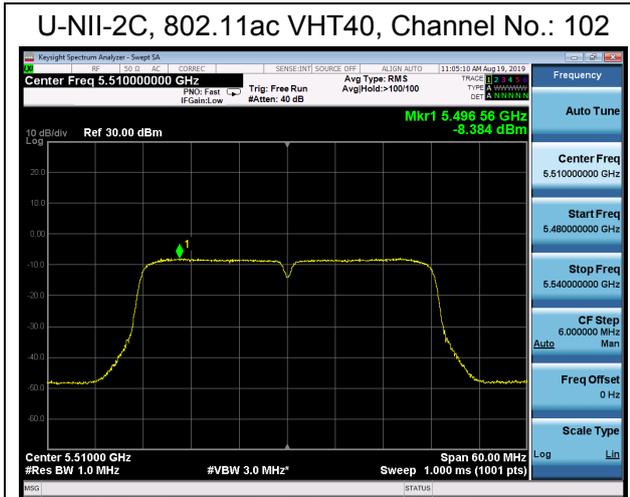


U-NII-2C, 802.11n HT40, Channel No.: 134



U-NII-2C, 802.11ac VHT20, Channel No.: 140







U-NII-3, 802.11a, Channel No.: 149



U-NII-3, 802.11n HT20, Channel No.: 149



U-NII-3, 802.11a, Channel No.: 157



U-NII-3, 802.11n HT20, Channel No.: 157



U-NII-3, 802.11a, Channel No.: 165

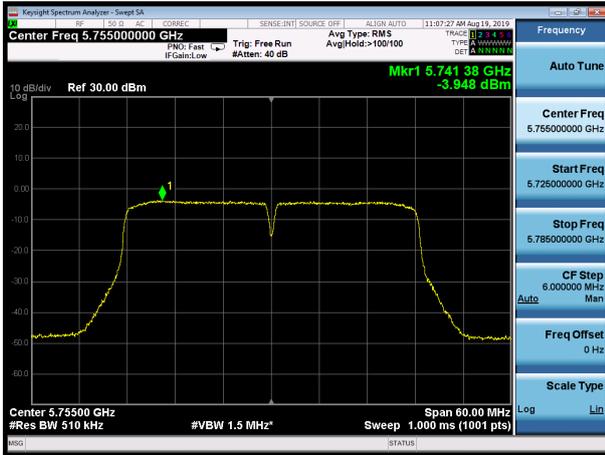


U-NII-3, 802.11n HT20, Channel No.: 165





U-NII-3, 802.11n HT40, Channel No.: 151



U-NII-3, 802.11ac VHT20, Channel No.: 149



U-NII-3, 802.11n HT40, Channel No.: 159



U-NII-3, 802.11ac VHT20, Channel No.: 157

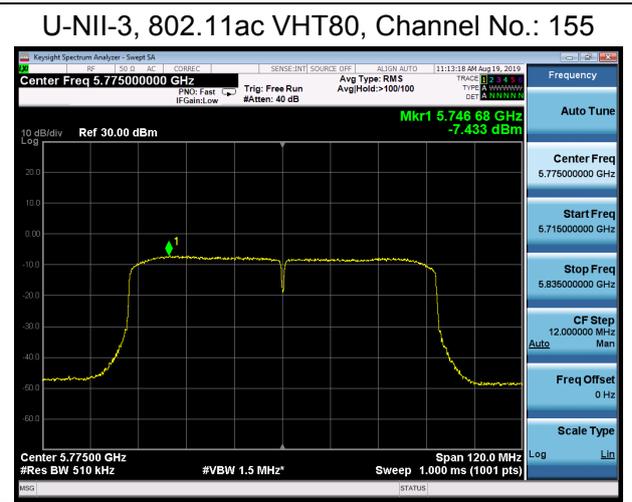
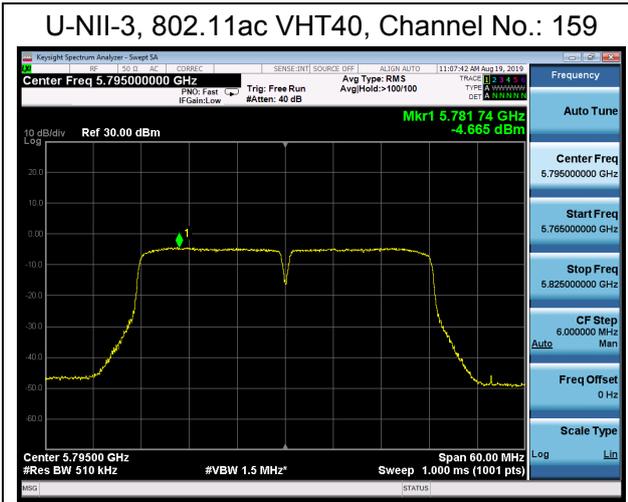


U-NII-3, 802.11ac VHT40, Channel No.: 151



U-NII-3, 802.11ac VHT20, Channel No.: 165

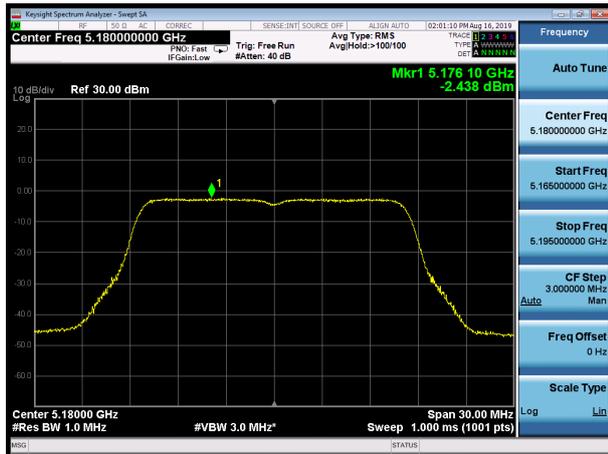




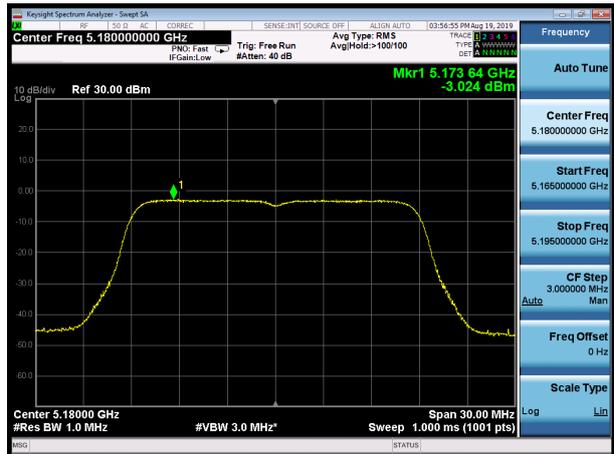


MIMO Antenna 2

U-NII-1, 802.11a, Channel No.: 36



U-NII-1, 802.11n HT20, Channel No.: 36



U-NII-1, 802.11a, Channel No.: 40



U-NII-1, 802.11n HT20, Channel No.: 40



U-NII-1, 802.11a, Channel No.: 48

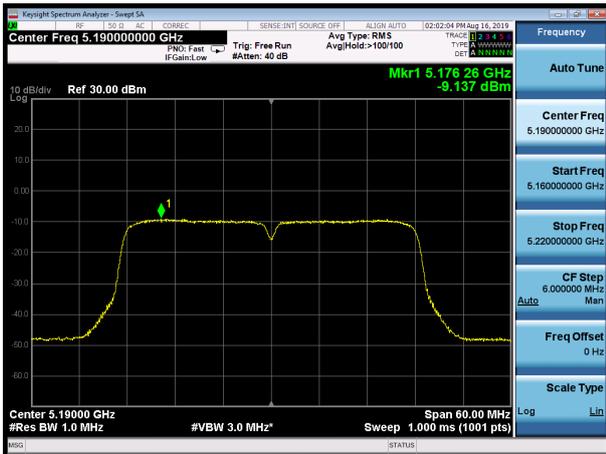


U-NII-1, 802.11n HT20, Channel No.: 48





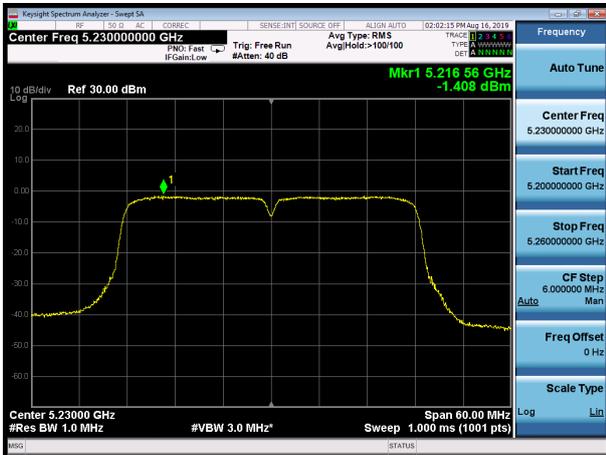
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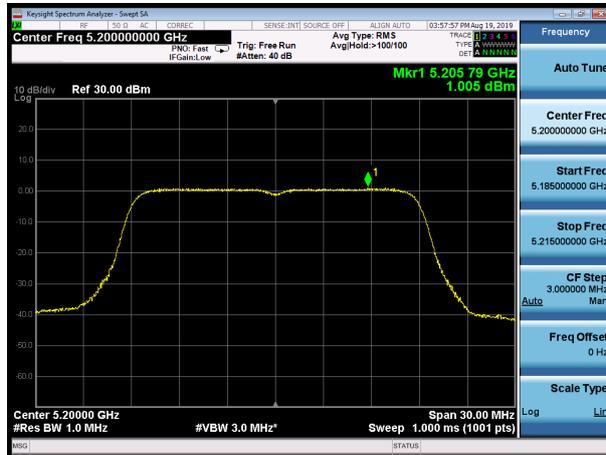
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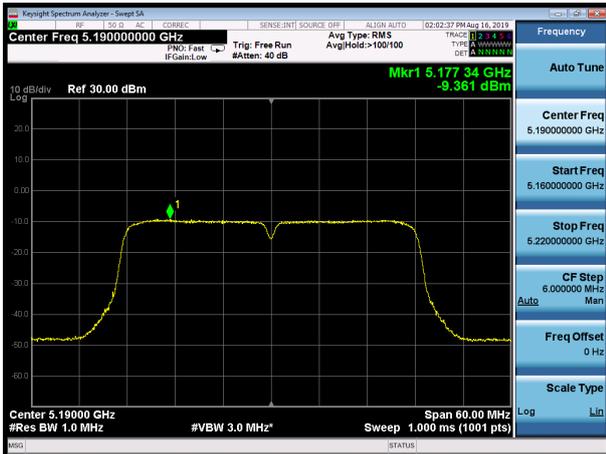
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U-NII-1, 802.11ac VHT20, Channel No.: 40



U-NII-1, 802.11ac VHT40, Channel No.: 38

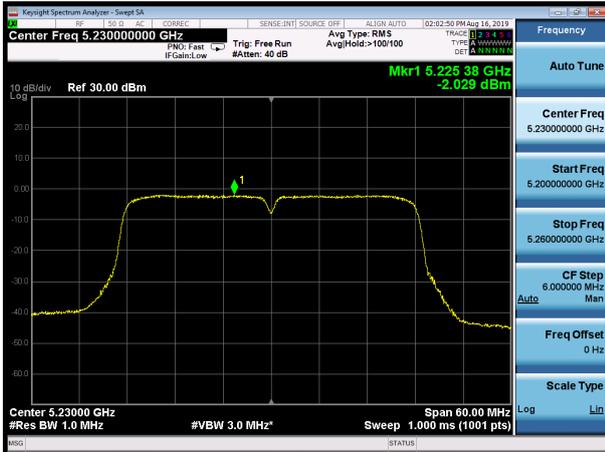


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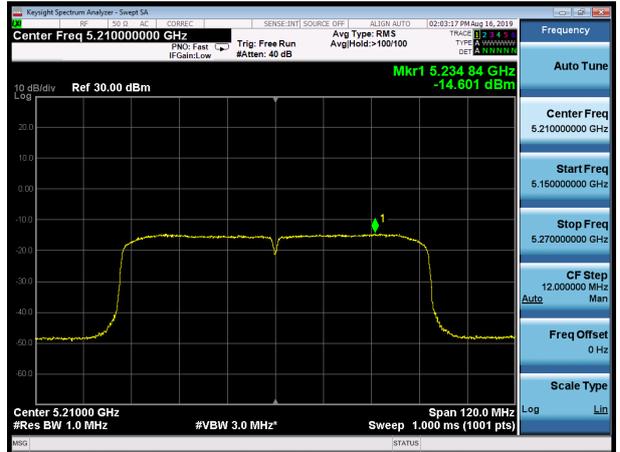




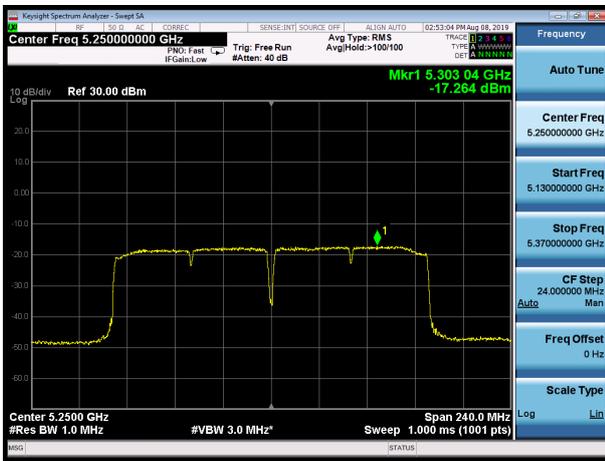
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U-NII-1, 802.11ac VHT80, Channel No.: 42



U-NII-1, 802.11ac VHT160, Channel No.: 50

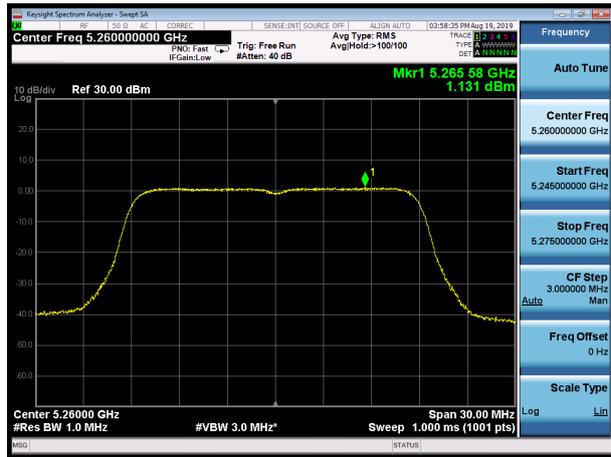




U-NII-2A, 802.11a, Channel No.: 52



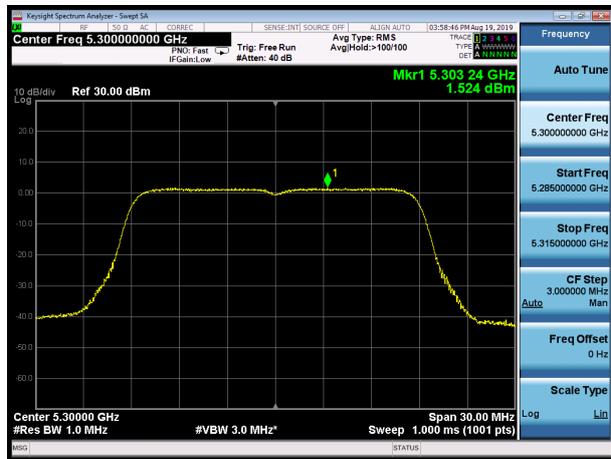
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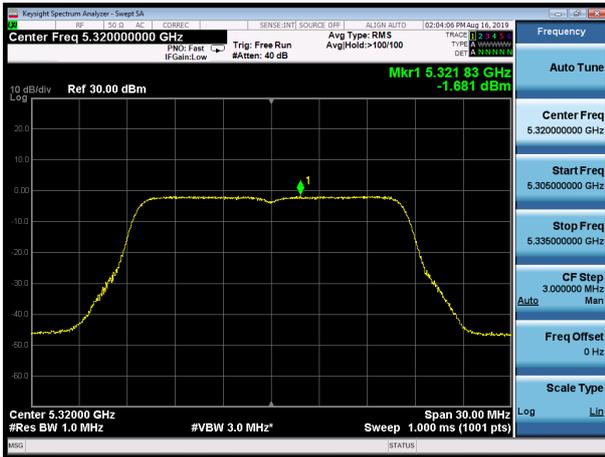
U-NII-2A, 802.11a, Channel No.: 60



U-NII-2A, 802.11n HT20, Channel No.: 60



U-NII-2A, 802.11a, Channel No.: 64

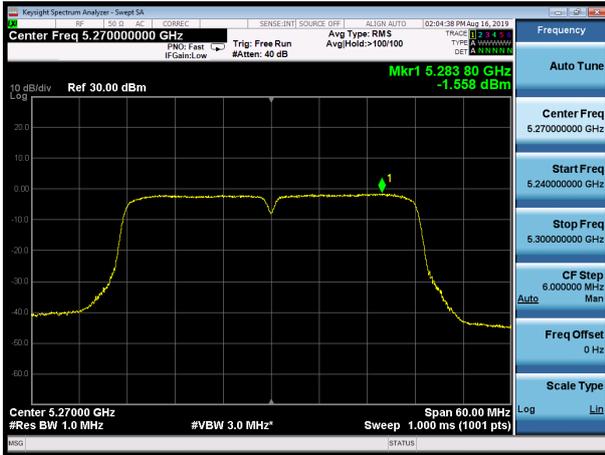


U-NII-2A, 802.11n HT20, Channel No.: 64

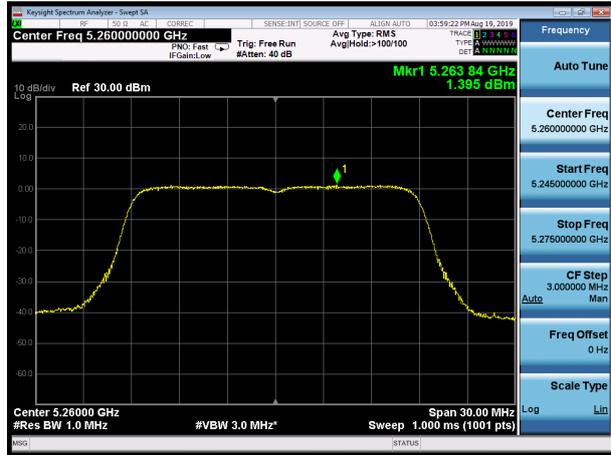




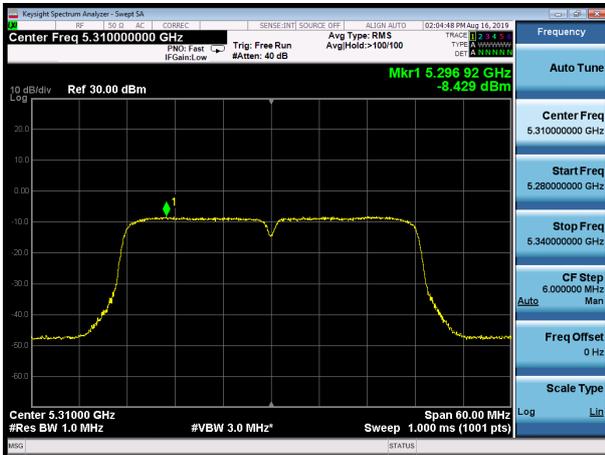
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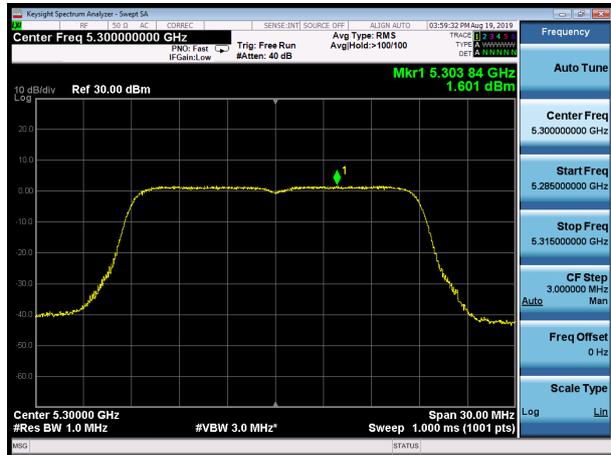
U-NII-2A, 802.11ac VHT20, Channel No.: 52



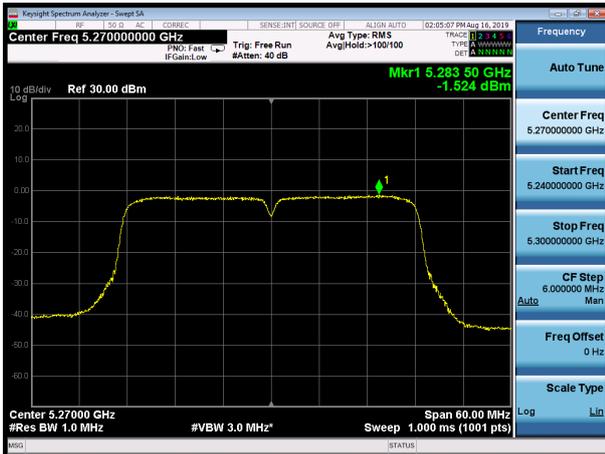
U-NII-2A, 802.11n HT40, Channel No.: 62



U-NII-2A, 802.11ac VHT20, Channel No.: 60

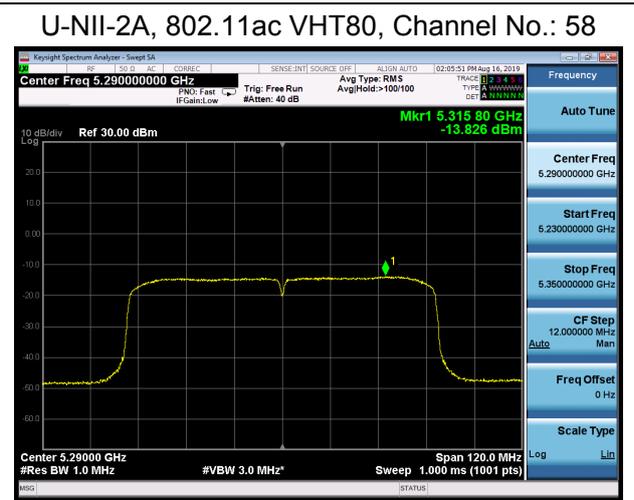
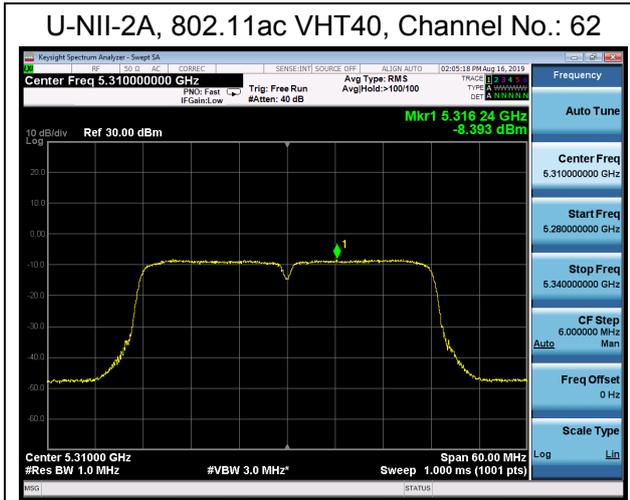


U-NII-2A, 802.11ac VHT40, Channel No.: 54



U-NII-2A, 802.11ac VHT20, Channel No.: 64







U-NII-2C, 802.11a, Channel No.: 100



U-NII-2C, 802.11n HT20, Channel No.: 100



U-NII-2C, 802.11a, Channel No.: 116



U-NII-2C, 802.11n HT20, Channel No.: 116

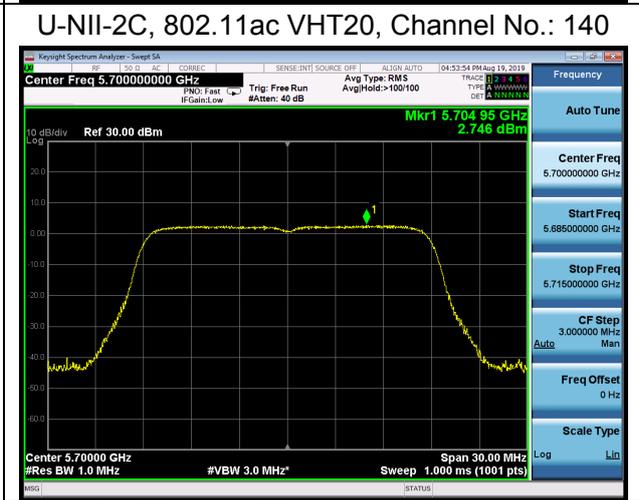
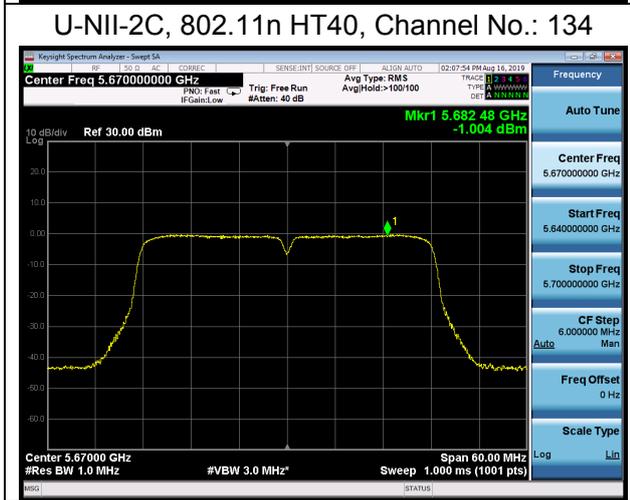
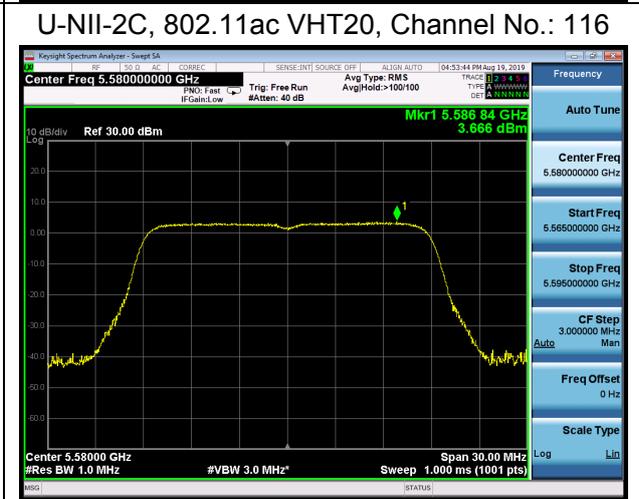
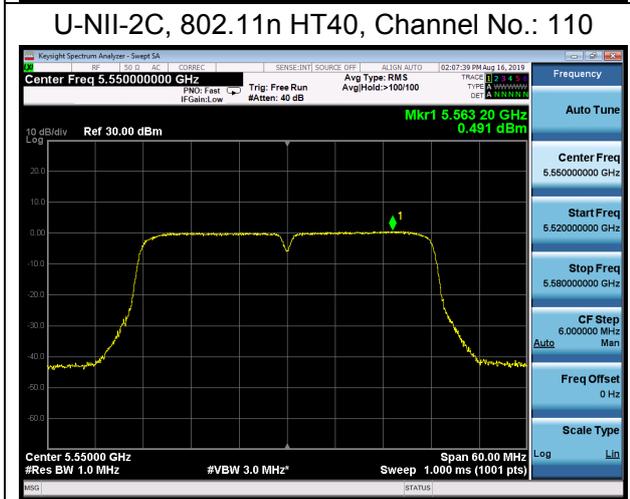
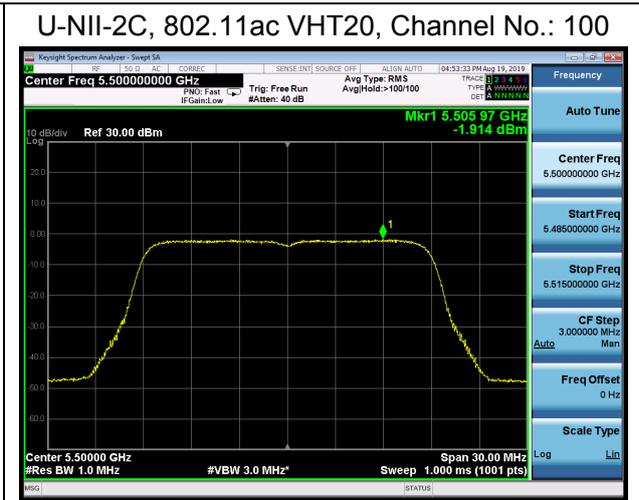
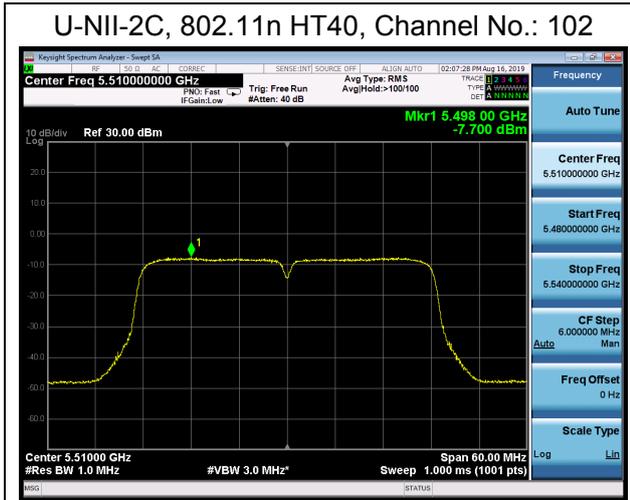


U-NII-2C, 802.11a, Channel No.: 140



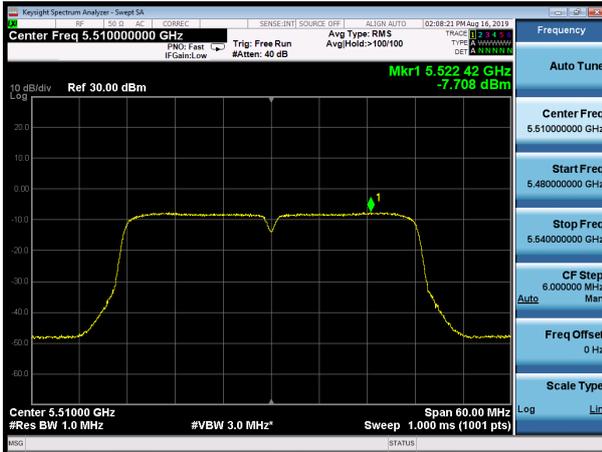
U-NII-2C, 802.11n HT20, Channel No.: 140



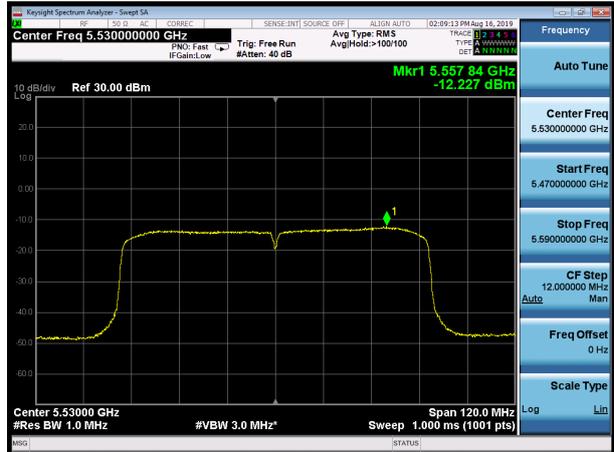




U-NII-2C, 802.11ac VHT40, Channel No.: 102



U-NII-2C, 802.11ac VHT80, Channel No.: 106



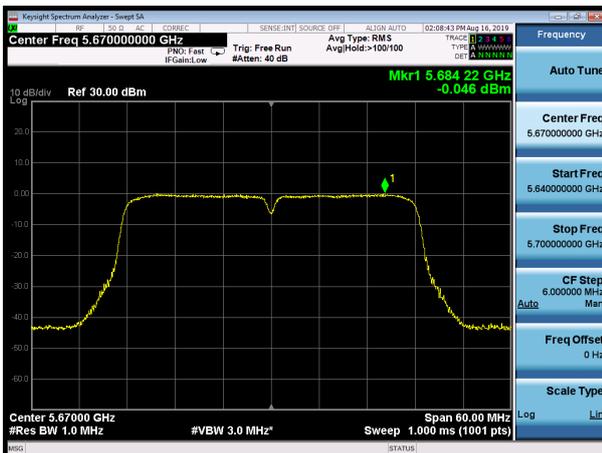
U-NII-2C, 802.11ac VHT40, Channel No.: 110



U-NII-2C, 802.11ac VHT160, Channel No.: 114



U-NII-2C, 802.11ac VHT40, Channel No.: 134





U-NII-3, 802.11a, Channel No.: 149



U-NII-3, 802.11n HT20, Channel No.: 149



U-NII-3, 802.11a, Channel No.: 157



U-NII-3, 802.11n HT20, Channel No.: 157



U-NII-3, 802.11a, Channel No.: 165



U-NII-3, 802.11n HT20, Channel No.: 165





U-NII-3, 802.11n HT40, Channel No.: 151



U-NII-3, 802.11ac VHT20, Channel No.: 149



U-NII-3, 802.11n HT40, Channel No.: 159



U-NII-3, 802.11ac VHT20, Channel No.: 157

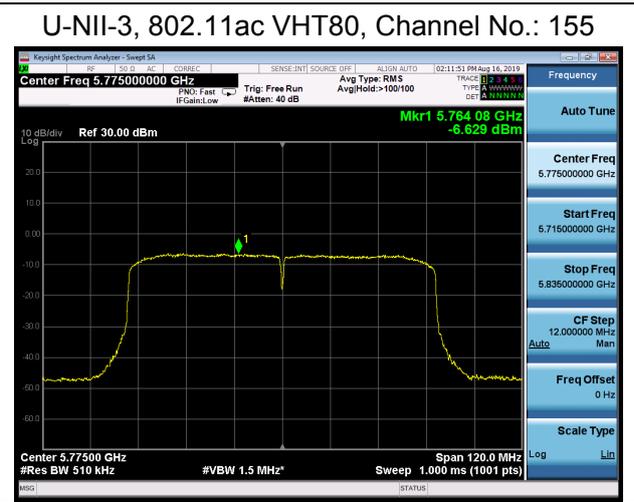
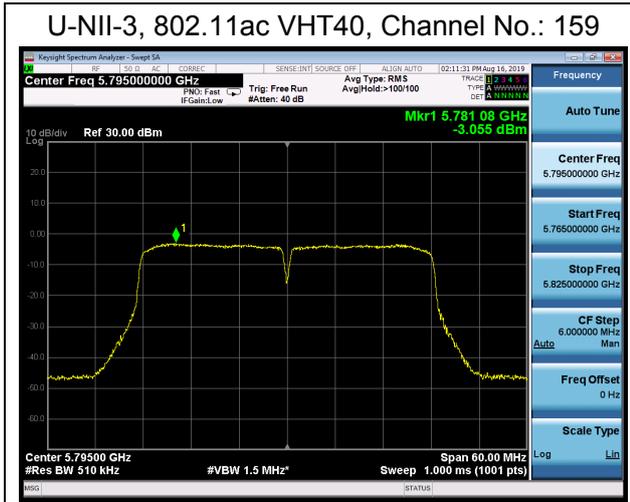


U-NII-3, 802.11ac VHT40, Channel No.: 151



U-NII-3, 802.11ac VHT20, Channel No.: 165





5.5. Unwanted Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10-2013. The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna. The radiated emissions measurements were made in a typical installation configuration. Sweep the whole frequency band range from 9kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

During the test, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.

Set the spectrum analyzer in the following:

Below 1GHz (detector: Peak and Quasi-Peak)

RBW=100kHz / VBW=300kHz / Sweep=AUTO

Above 1GHz (detector: Peak):

I) Peak emission levels are measured by setting the instrument as follows:

- 1) RBW = 1 MHz.
- 2) VBW \geq [3 \times RBW]
- 3) Detector = peak.
- 4) Sweep time = auto.
- 5) Trace mode = max hold.
- 6) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, then the time required for the trace to stabilize will increase by a factor of approximately 1 / D, where D is the duty cycle.

II) Average emission levels are measured by setting the instrument as follows:

- a) RBW = 1 MHz.
- b) VBW \geq [3 \times RBW].
- c) Detector = RMS (power averaging), if [span / (# of points in sweep)] \leq RBW / 2. Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
- d) Averaging type = power (i.e., rms) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)



e) Sweep time = auto.

f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of $1 / D$, where D is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)

g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:

1) If power averaging (rms) mode was used in the preceding step e), then the correction factor is $[10 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is $[20 \log (1 / D)]$, where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

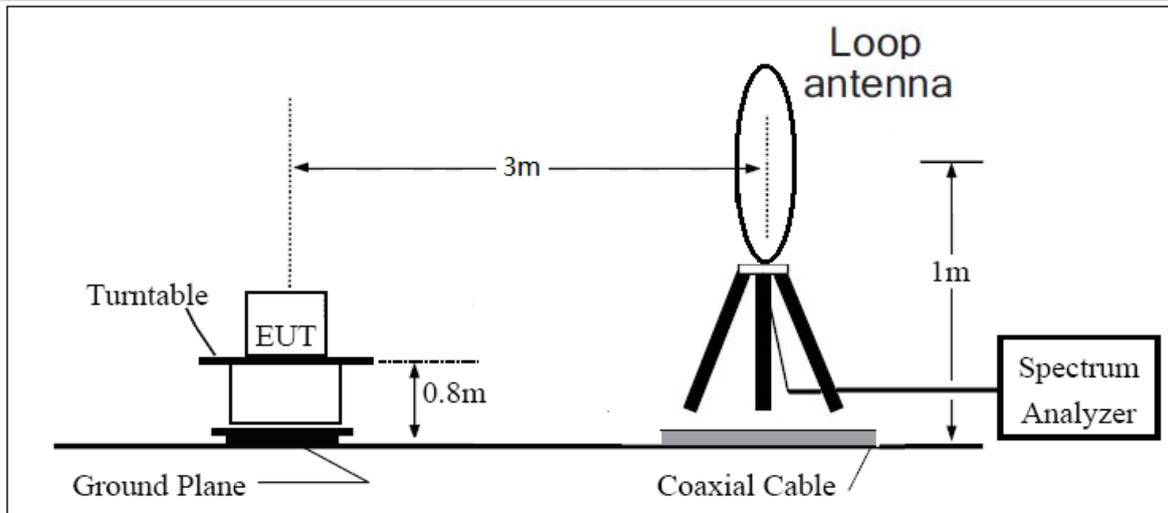
3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission.

Reduce the video bandwidth until no significant variations in the displayed signal are observed in subsequent traces, provided the video bandwidth is no less than 1 Hz. For regulatory requirements that specify averaging only over the transmit duration (e.g., digital transmission system [DTS] and Unlicensed National Information Infrastructure [U-NII]), the video bandwidth shall be greater than $[1 / (\text{minimum transmitter on time})]$ and no less than 1 Hz.

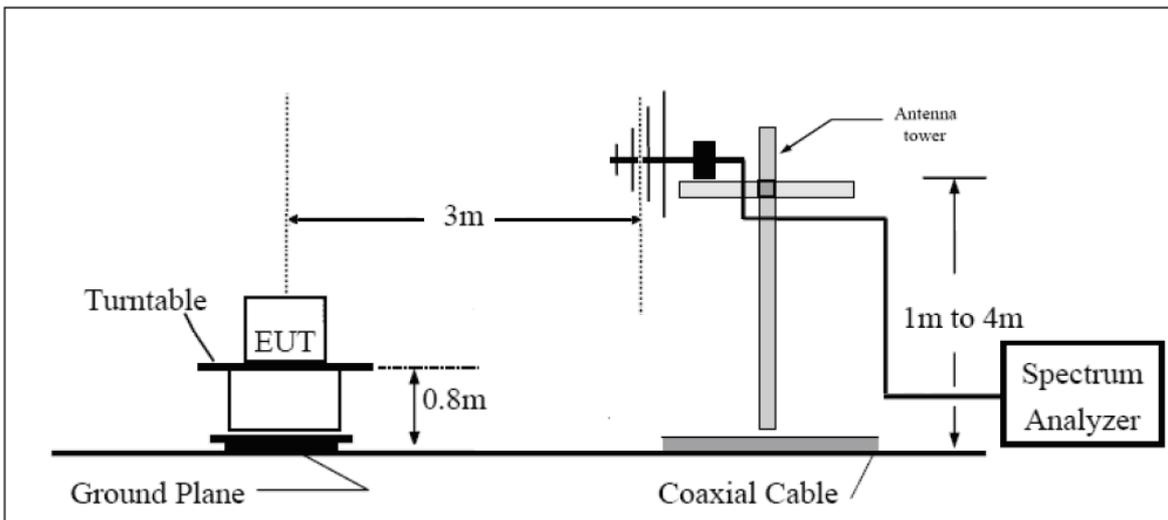
The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the loop antenna is vertical, others antenna are vertical and horizontal.

The test is in transmitting mode.

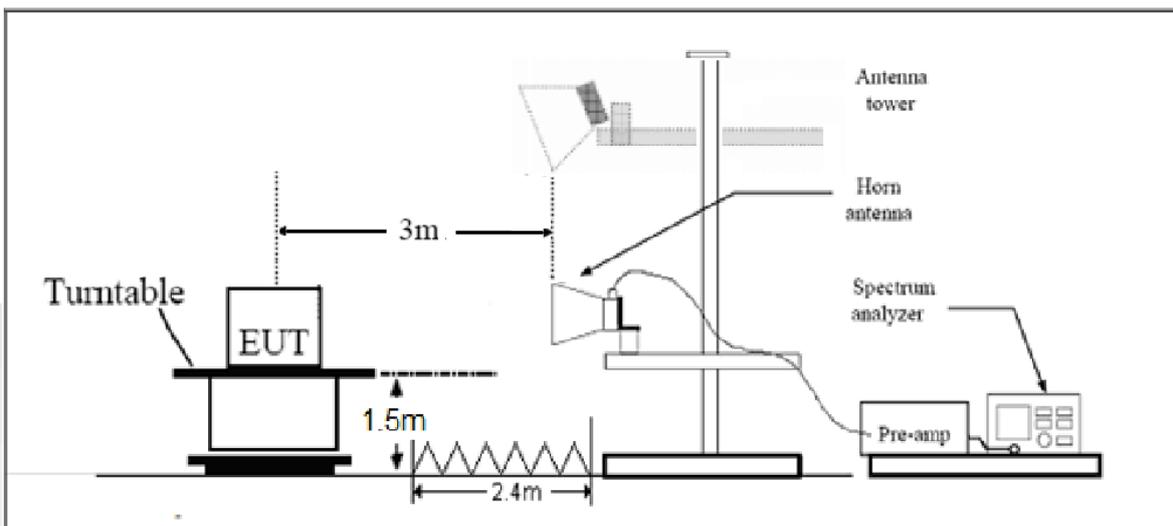
9KHz~~~30MHz



30MHz~~~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

- (1) For transmitters operating in the 5725-5850 MHz band: All emissions shall be limited to a level of -27 dBm/MHz 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.
- (2) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz(68.2dBμV/m).
- (3) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz(68.2dBμV/m).
- (4) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz(68.2dBμV/m).

Note: the following formula is used to convert the EIRP to field strength

§1、 $E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] - 20 \log(d[\text{meters}]) + 104.77$, where E = field strength and

d = distance at which field strength limit is specified in the rules;

§2、 $E[\text{dB}\mu\text{V}/\text{m}] = \text{EIRP}[\text{dBm}] + 95.2$, for d = 3 meters

- (5) Unwanted spurious emissions fallen in restricted bands per FCC Part15.205 shall comply with the general field strength limits set forth in § 15.209 as below table.

Frequency of emission (MHz)	Field strength(uV/m)	Field strength(dBuV/m)
0.009–0.490	2400/F(kHz)	/
0.490–1.705	24000/F(kHz)	/
1.705–30.0	30	/
30-88	100	40
88-216	150	43.5
216-960	200	46
Above960	500	54



MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)
13.36 - 13.41			

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.02 dB
200MHz-1GHz	3.28 dB
1GHz-18G	3.70 dB
18GHz-26.5GHz	5.78 dB
26.5G-40GHz	5.82 dB

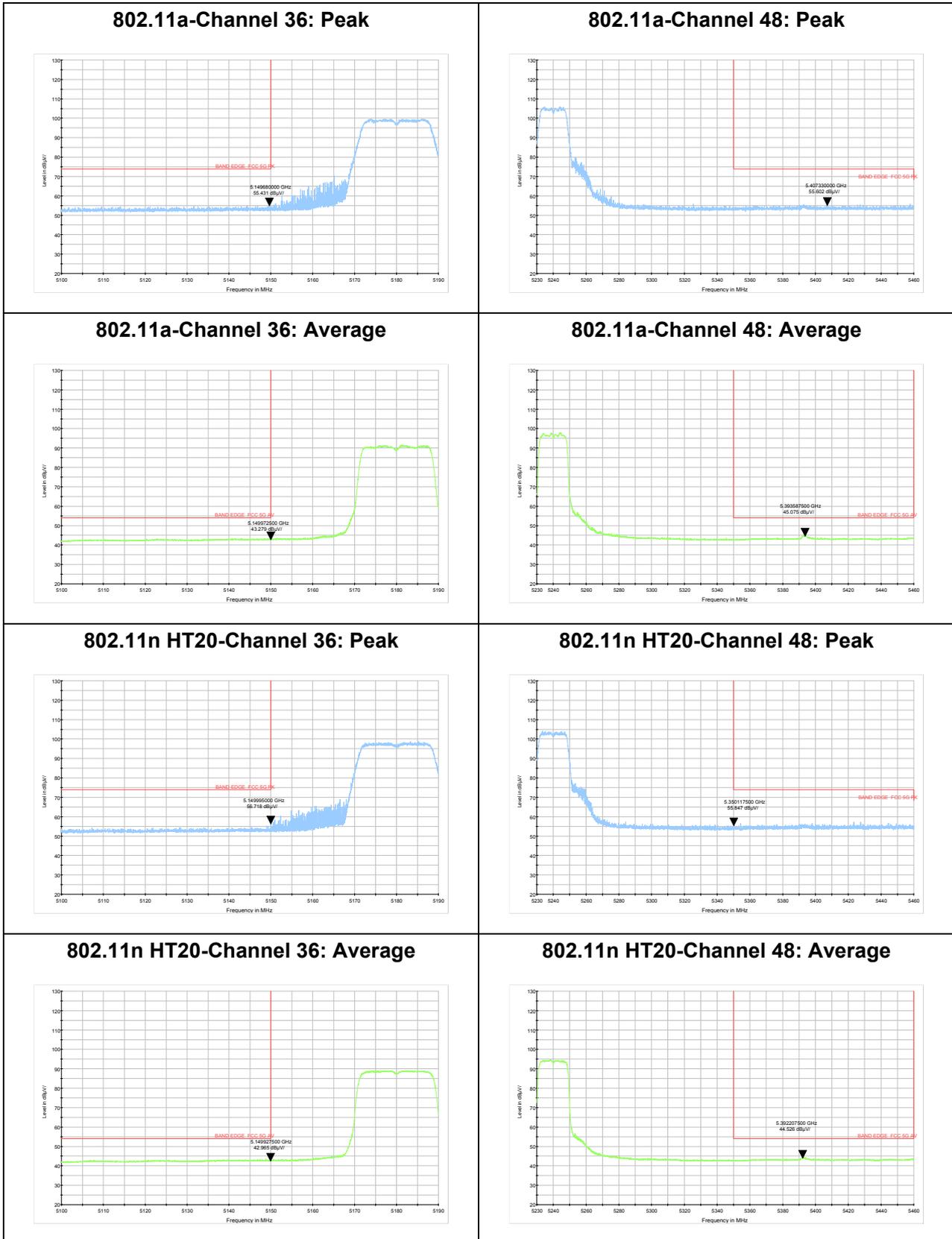


Test Results:

The modulation and bandwidth are similar for 802.11n mode for 20MHz/40MHz and 802.11ac mode for V20MHz/V40MHz, therefore investigated worst case to representative mode in test report.

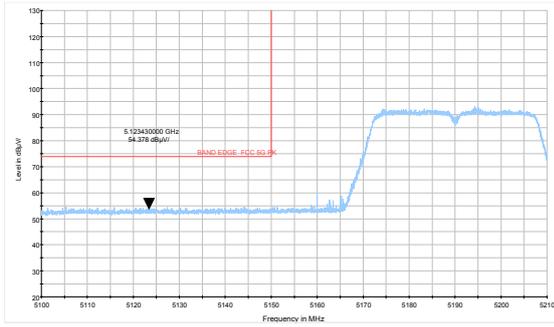
The signal beyond the limit is carrier.

U-NII-1

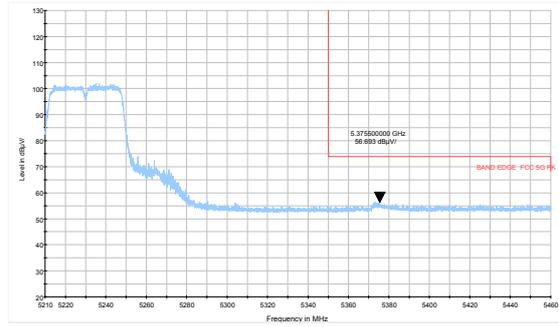




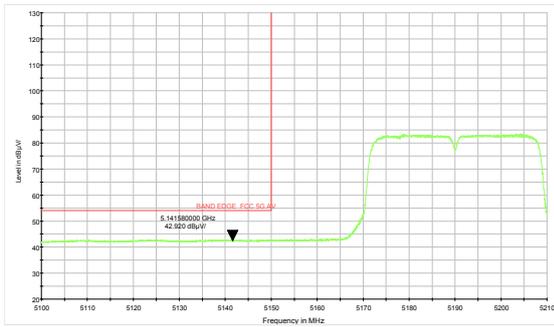
802.11n HT40-Channel 38: Peak



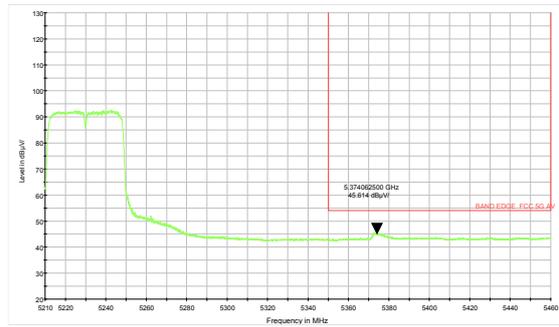
802.11n HT40-Channel 46: Peak



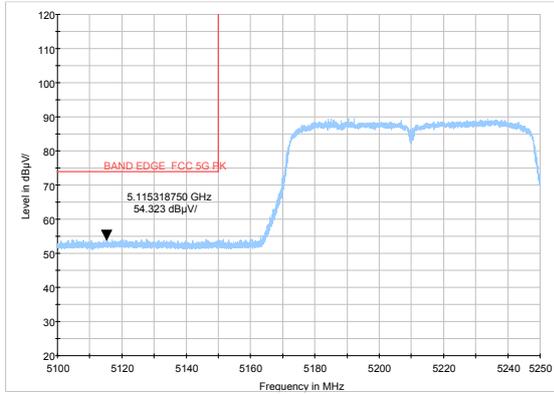
802.11n HT40-Channel 38: Average



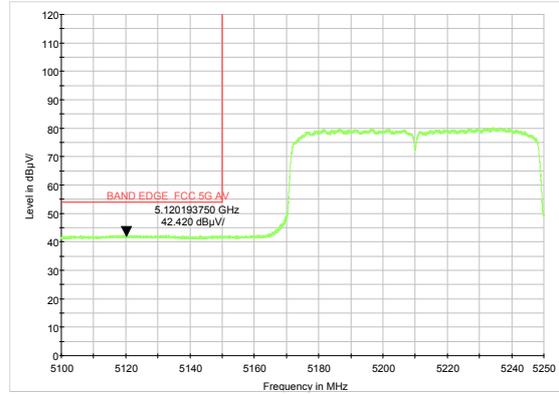
802.11n HT40-Channel 46: Average



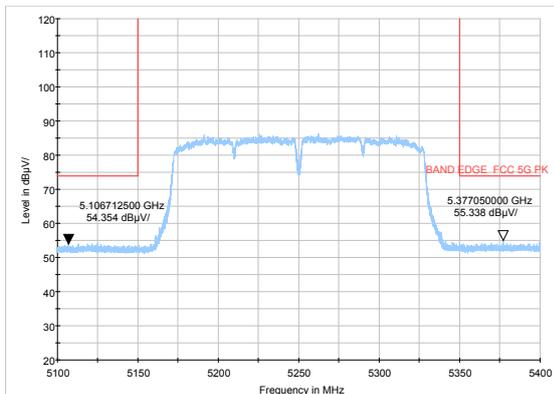
802.11ac VHT80 -Channel 42: Peak



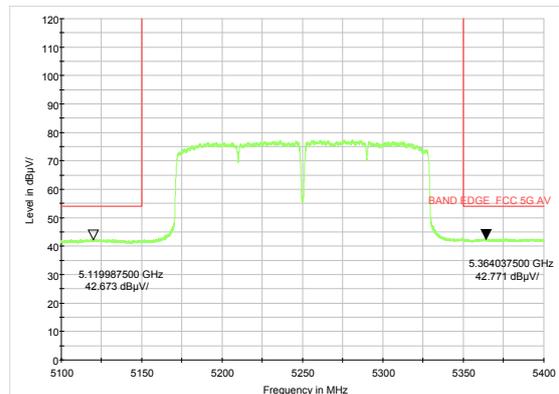
802.11ac VHT80- Channel 42: Average



802.11ac VHT160 -Channel 50: Peak



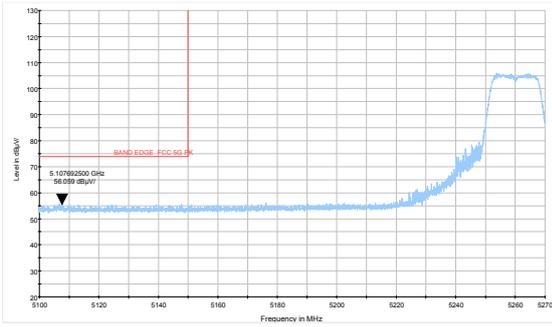
802.11ac VHT160 -Channel 50: Average



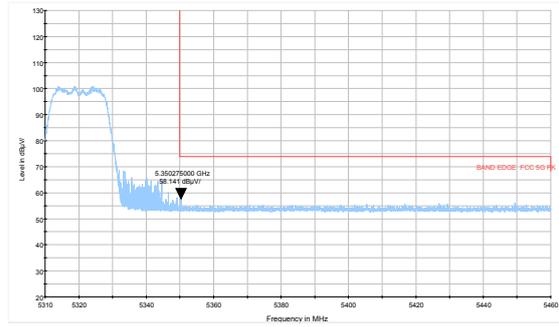


U-NII-2A

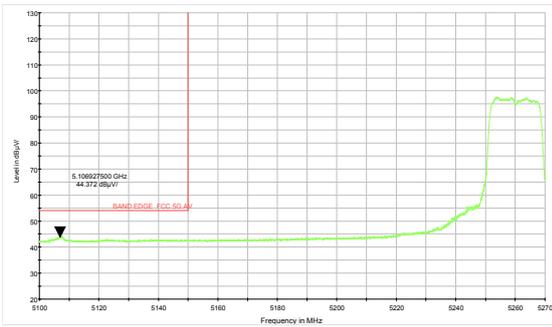
802.11a-Channel 52: Peak



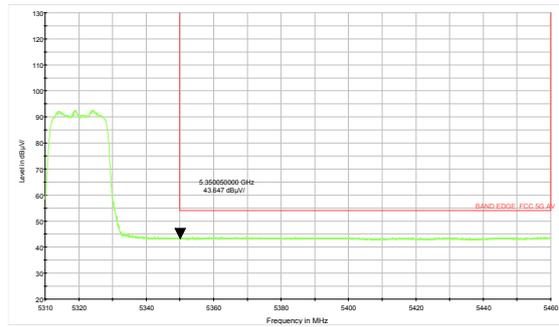
802.11a-Channel 64: Peak



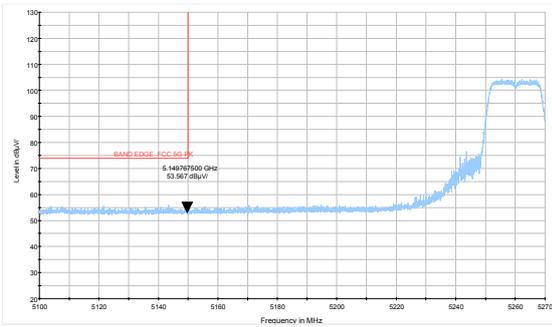
802.11a-Channel 52: Average



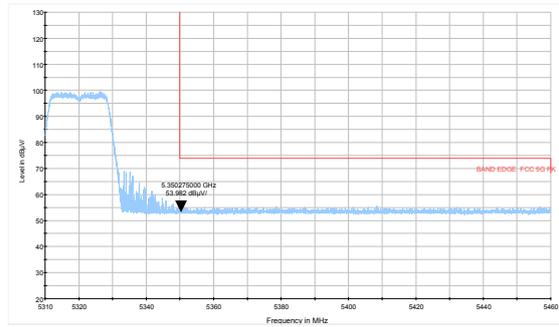
802.11a-Channel 64: Average



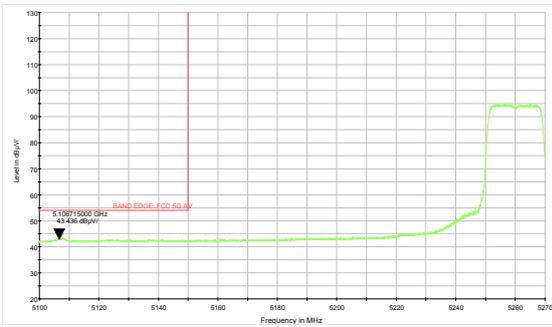
802.11n HT20-Channel 52: Peak



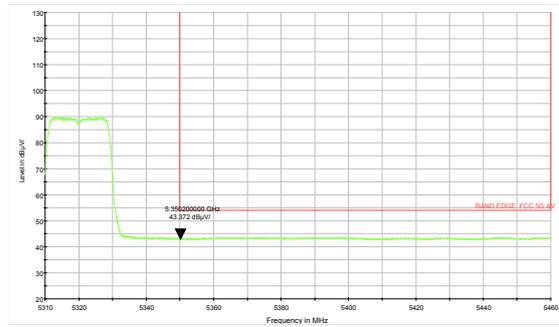
802.11n HT20-Channel 64: Peak



802.11n HT20-Channel 52: Average

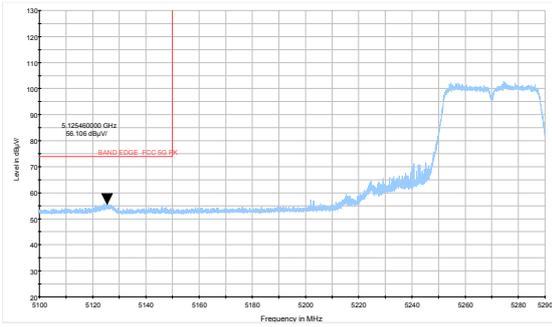


802.11n HT20-Channel 64: Average

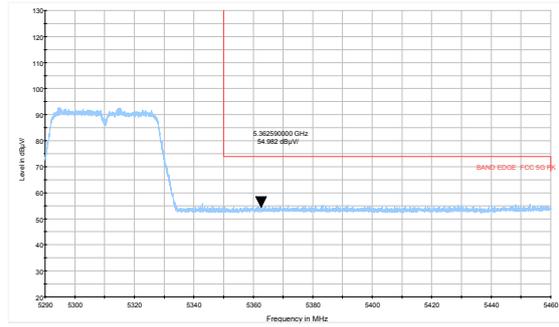




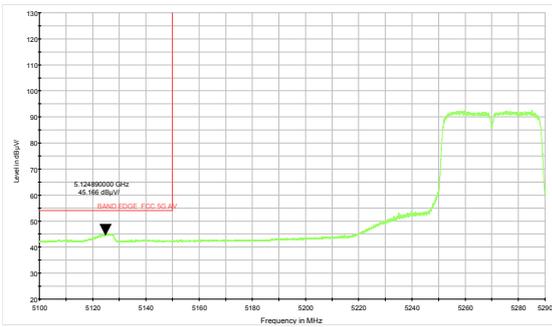
802.11n HT40-Channel 54: Peak



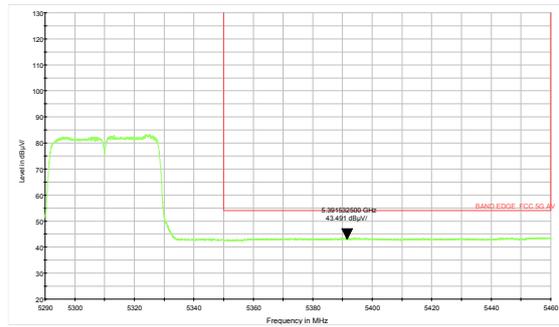
802.11n HT40-Channel 62: Peak



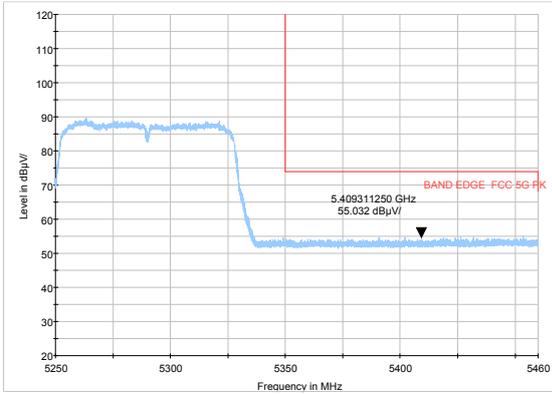
802.11n HT40-Channel 54: Average



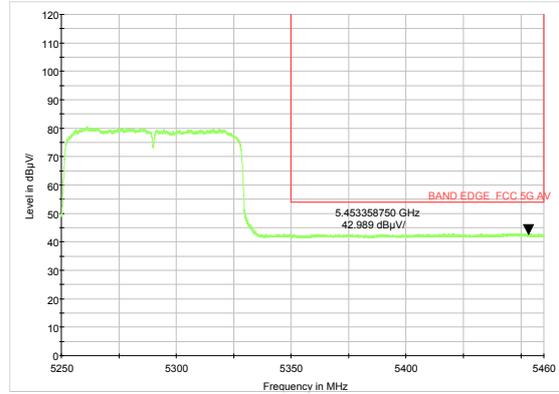
802.11n HT40-Channel 62: Average



802.11ac VHT80 -Channel 58: Peak



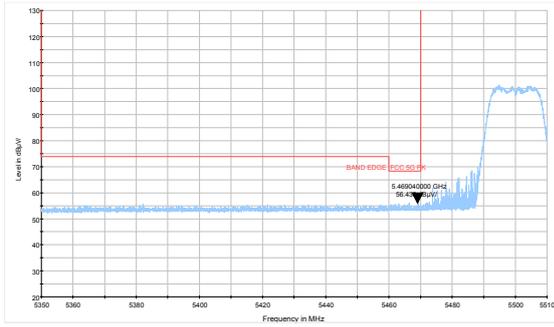
802.11ac VHT80- Channel 58: Average



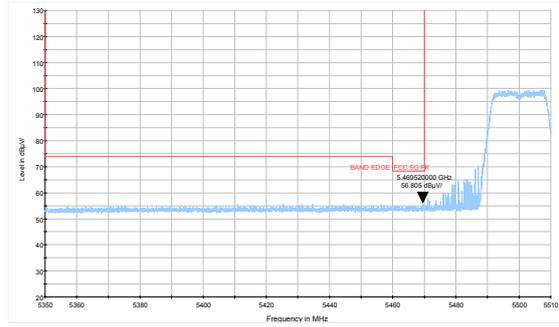


U-NII-2C

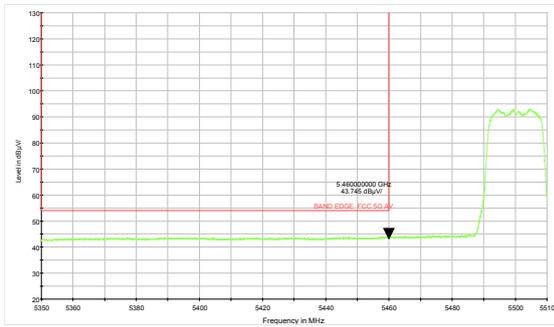
802.11a-Channel 100: Peak



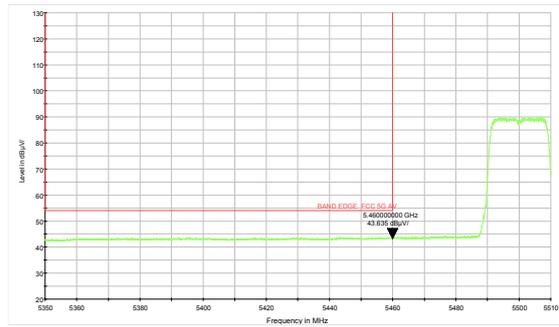
802.11n HT20-Channel 100: Peak



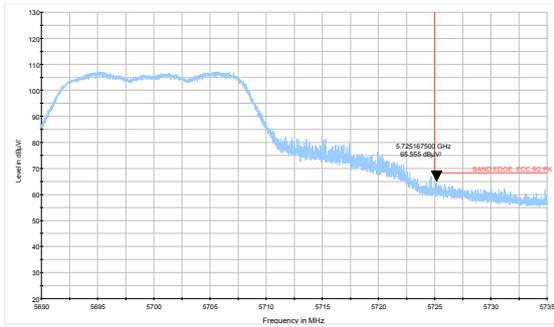
802.11a-Channel 100: Average



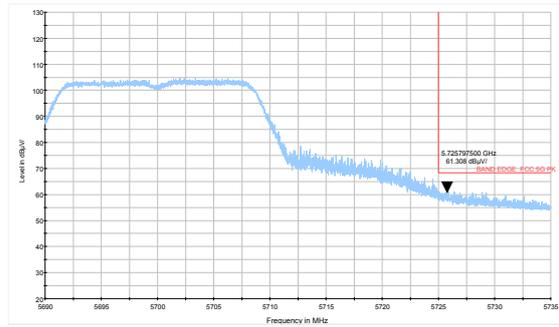
802.11n HT20-Channel 100: Average



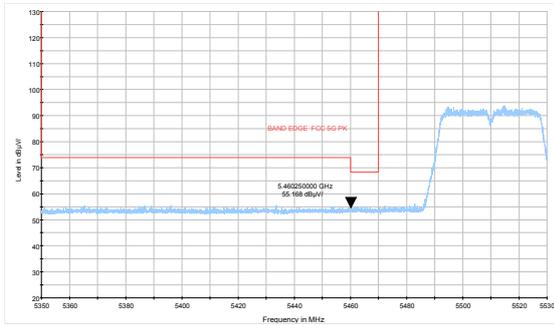
802.11a-Channel 140: Peak



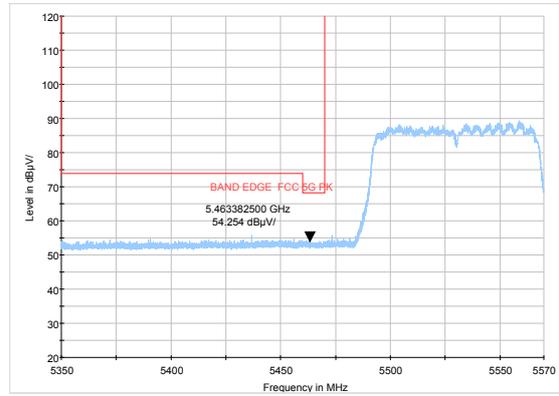
802.11n HT20-Channel 140: Peak



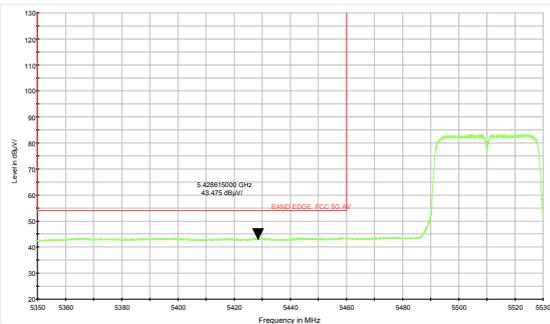
802.11n HT40-Channel 102: Peak



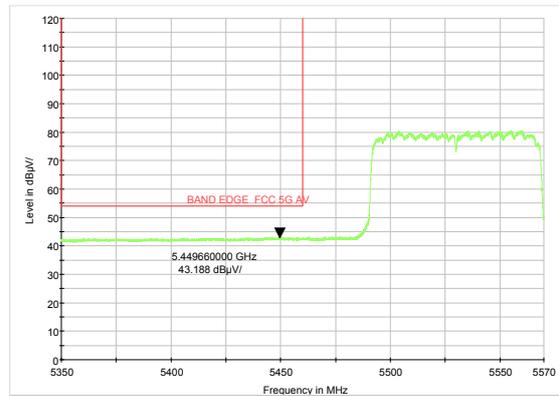
802.11ac VHT80 –Channel 106: Peak



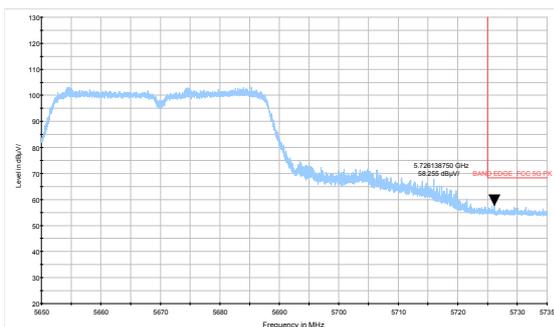
802.11n HT40-Channel 102: Average



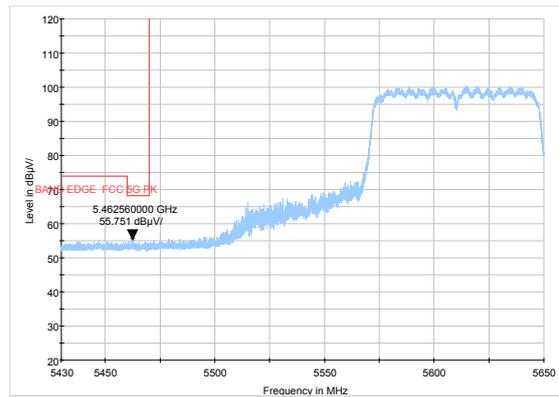
802.11ac VHT80- Channel 106: Average



802.11n HT40-Channel 134: Peak

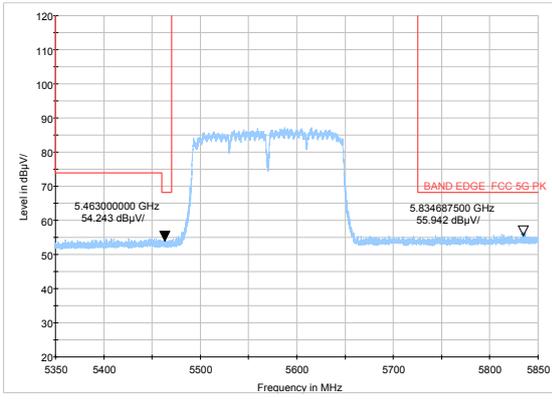


802.11ac VHT80- Channel 122: Peak

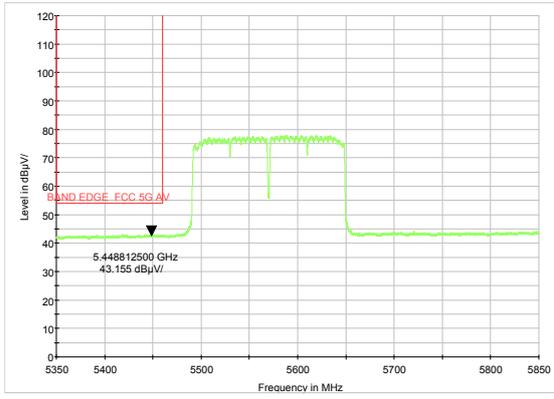




802.11ac VHT160- Channel 114: Peak



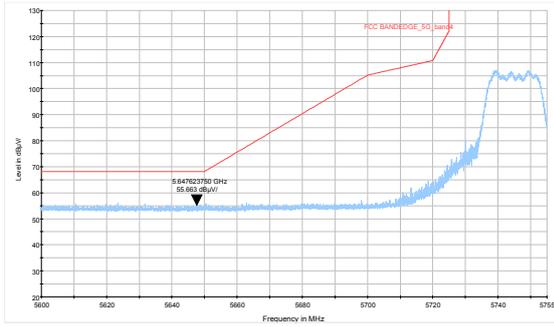
802.11ac VHT160- Channel 114: Average



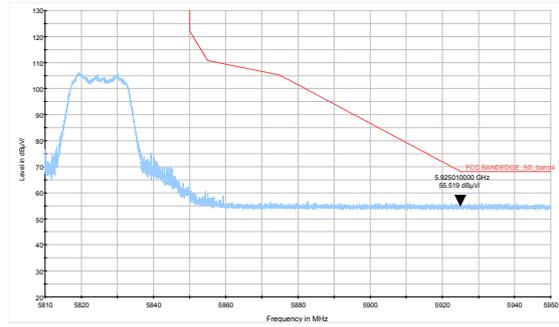


U-NII-3

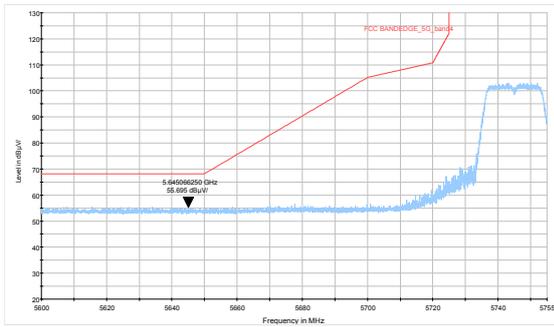
802.11a-Channel 149: Peak



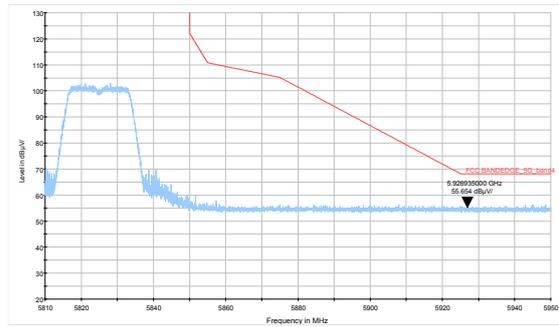
802.11a-Channel 165: Peak



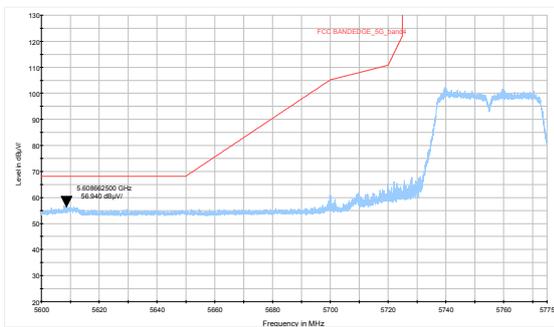
802.11n HT20-Channel 149: Peak



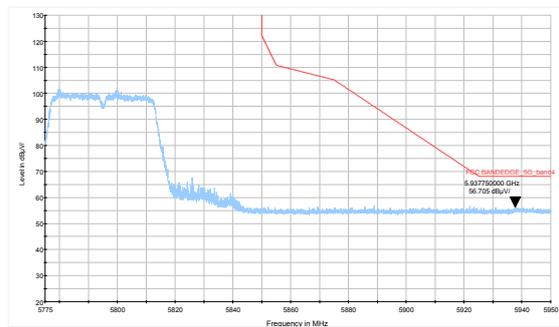
802.11n HT20-Channel 165: Peak



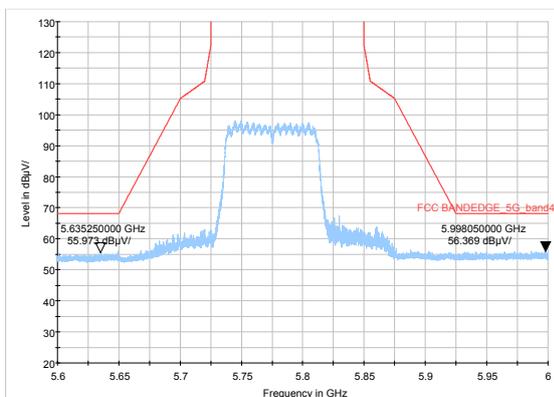
802.11n HT40-Channel 151: Peak



802.11n HT40-Channel 159: Peak



802.11ac VHT80- Channel 155: Peak





Result of RE

Test result

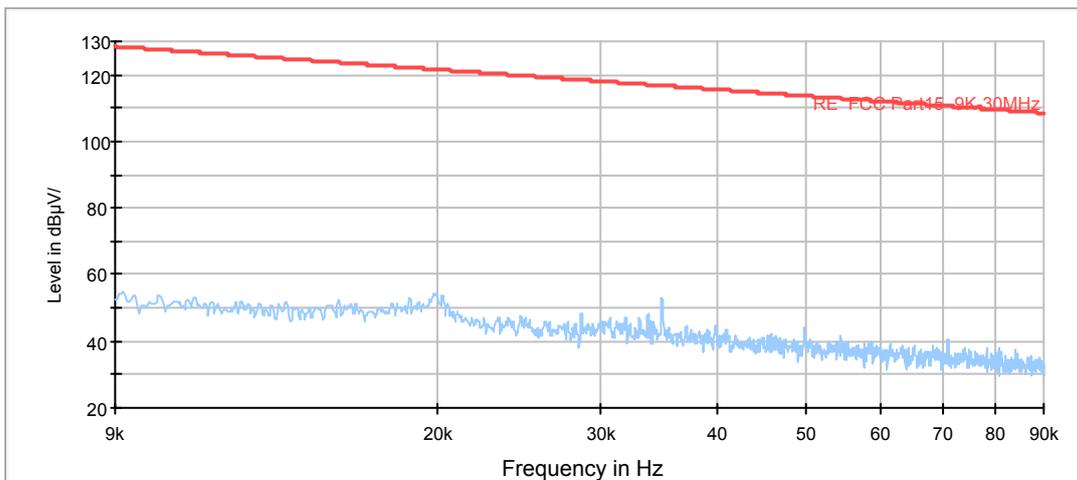
Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, the Emissions in the frequency band 9kHz-30MHz and 26.5GHz-40GHz are more than 20dB below the limit are not reported.

After the pretest, MIMO was selected as the worst antenna.

During the test, the Radiates Emission from 30MHz to 1GHz was performed in all modes with all channels, 802.11a, Channel 116 are selected as the worst condition. The test data of the worst-case condition was recorded in this report.

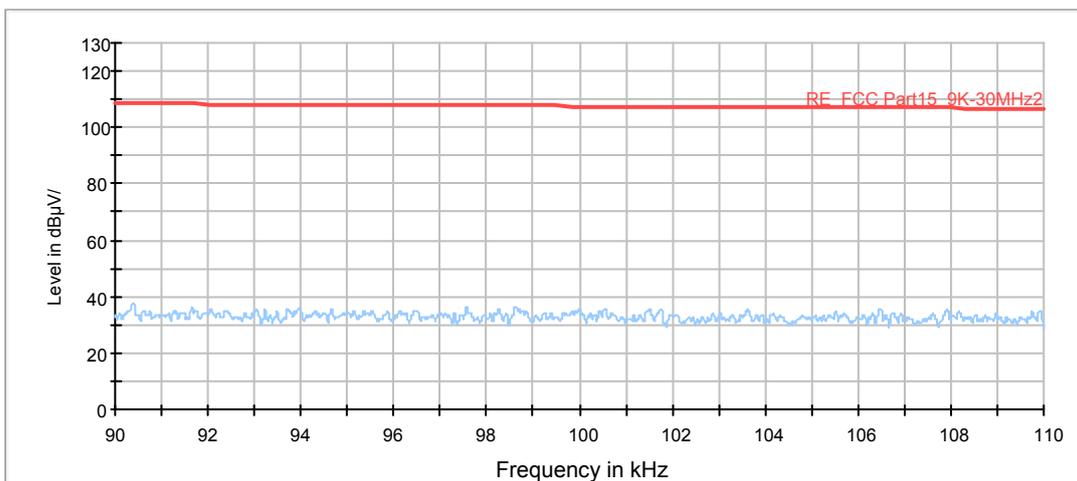
Continuous TX mode:

FCC RE 9K-90KHz AV



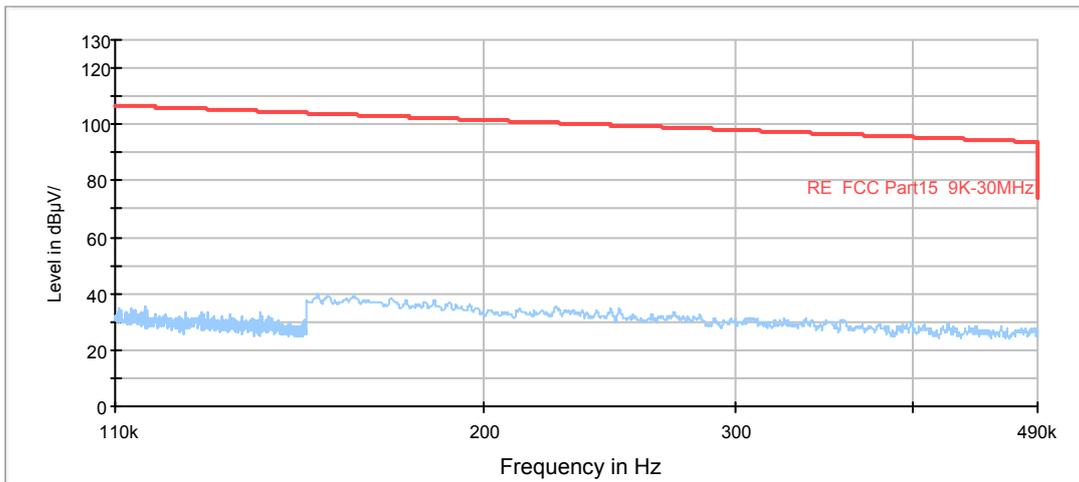
Radiates Emission from 9KHz to 90KHz

FCC RE 90K-110KHz QP



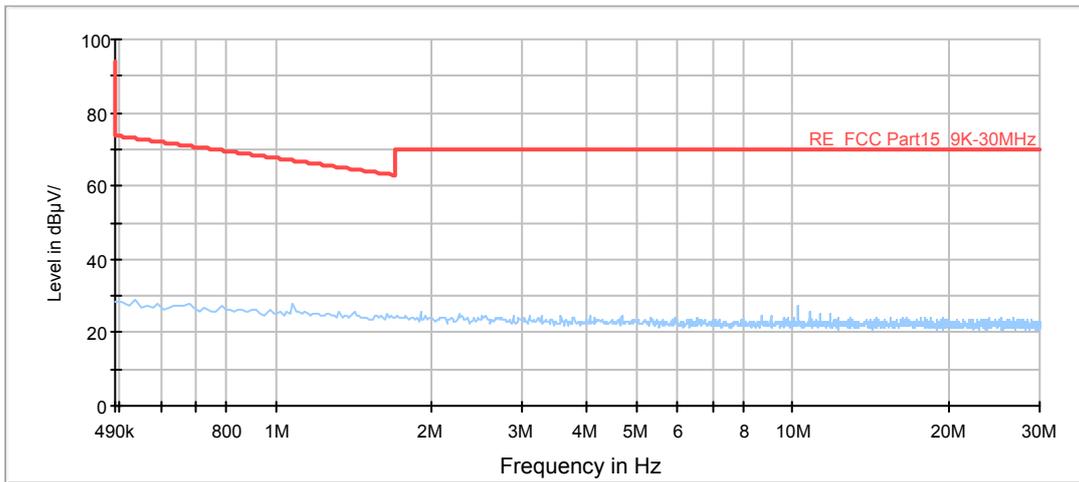
Radiates Emission from 90KHz to 110KHz

FCC RE 110K-490KHz AV

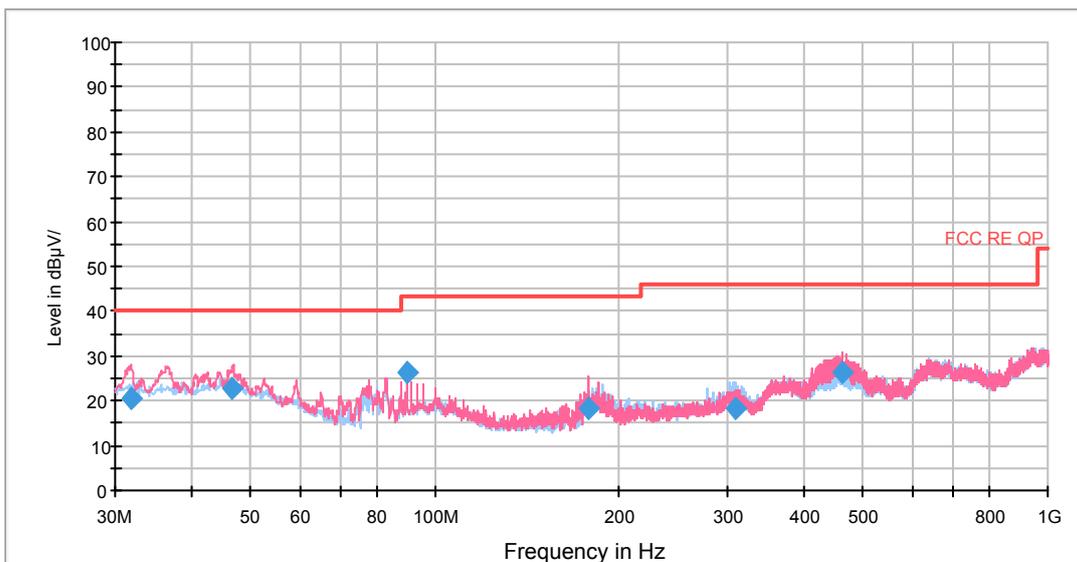


Radiates Emission from 110KHz to 490KHz

FCC RE 490K-30MHz QP



Radiates Emission from 490KHz to 30MHz



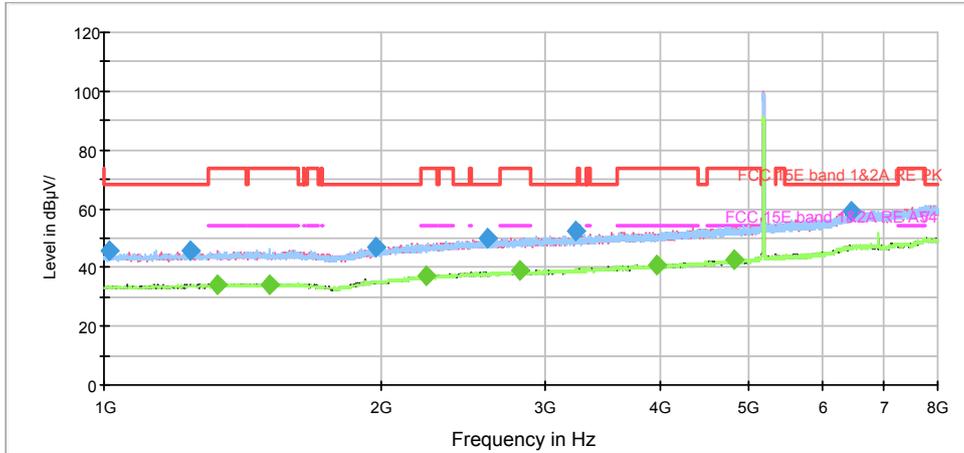
Radiates Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
31.819203	20.5	100.0	V	109.0	-3.1	19.5	40.0
46.615669	22.6	175.0	V	12.0	-4.2	17.4	40.0
89.912756	26.4	125.0	V	113.0	-10.4	17.1	43.5
178.241134	18.3	100.0	V	289.0	-14.2	25.2	43.5
309.746500	18.3	100.0	H	311.0	-8.4	27.7	46.0
460.967250	26.2	100.0	V	191.0	-6.9	19.8	46.0

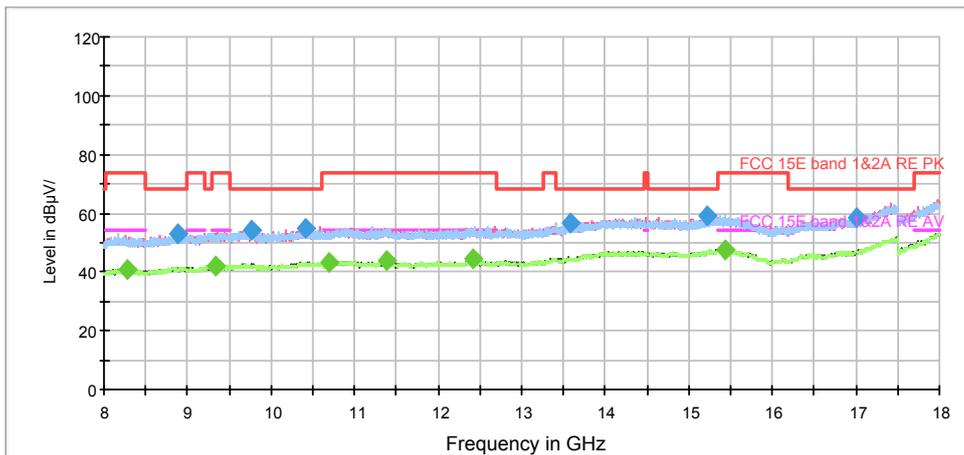
Remark: 1. Correction Factor = Antenna factor+ Insertion loss(cable loss+amplifier gain)
 2. Margin = Limit – Quasi-Peak



802.11a CH36



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 8GHz



Radiates Emission from 8GHz to 18GHz



Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1015.750000	45.4	100.0	V	122.0	-1.8	22.8	68.2
1239.750000	45.8	100.0	V	104.0	-1.1	22.4	68.2
1969.500000	46.8	200.0	H	0.0	1.0	21.4	68.2
2598.625000	49.8	100.0	V	356.0	3.8	18.4	68.2
3247.875000	52.3	100.0	H	105.0	5.4	15.9	68.2
6460.000000	58.8	100.0	V	0.0	14.6	9.4	68.2

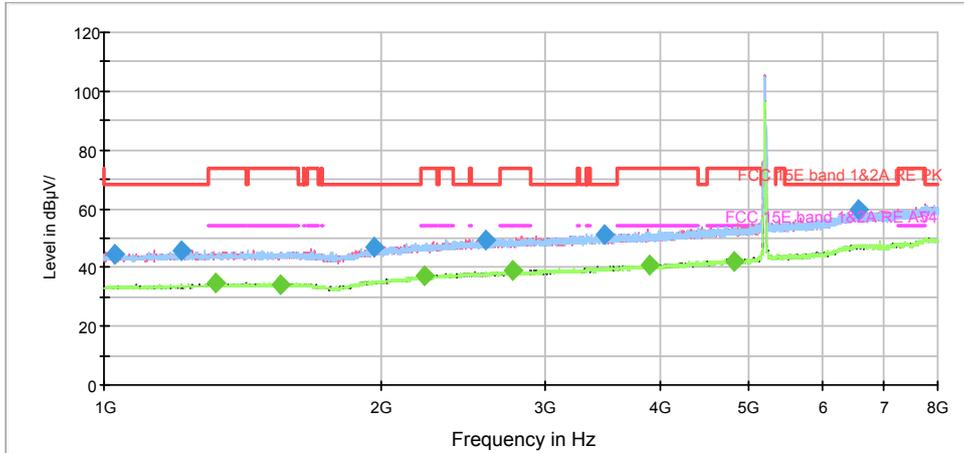
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1327.250000	34.4	100.0	H	0.0	-0.9	19.6	54.0
1513.625000	34.2	200.0	V	148.0	-0.4	19.8	54.0
2232.875000	36.9	100.0	V	358.0	2.4	17.1	54.0
2823.500000	38.7	200.0	V	329.0	4.4	15.3	54.0
3972.375000	40.9	100.0	H	4.0	7.1	13.1	54.0
4818.500000	42.5	100.0	H	70.0	9.4	11.5	54.0

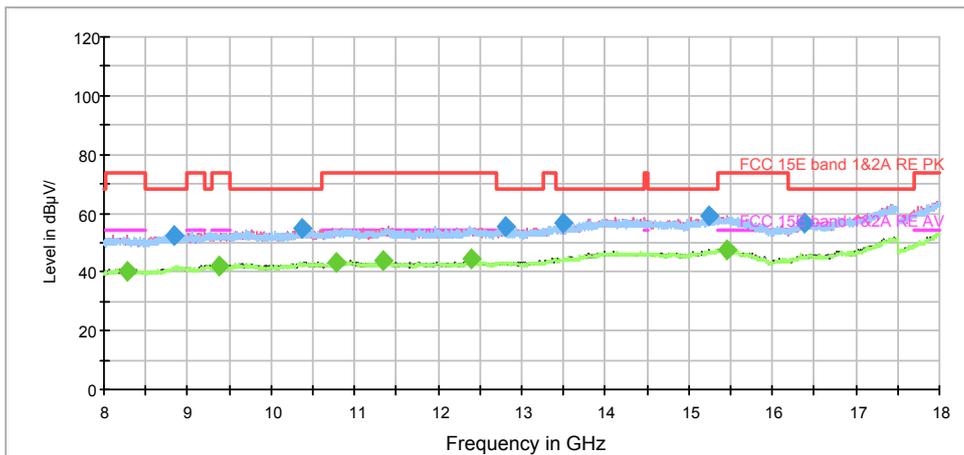
Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)



802.11a CH40



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 8GHz



Radiates Emission from 8GHz to 18GHz