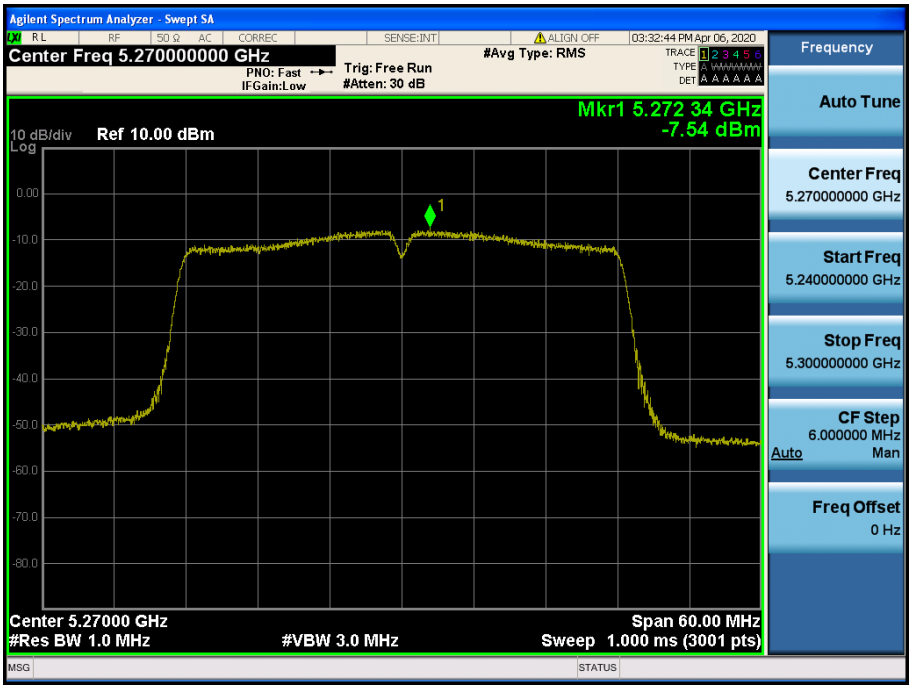
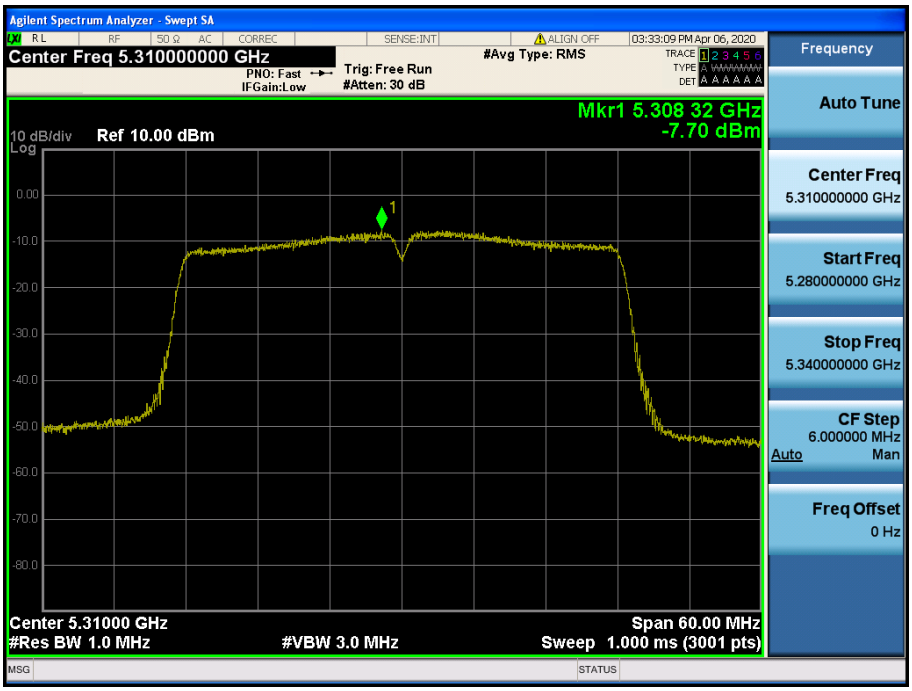
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.54



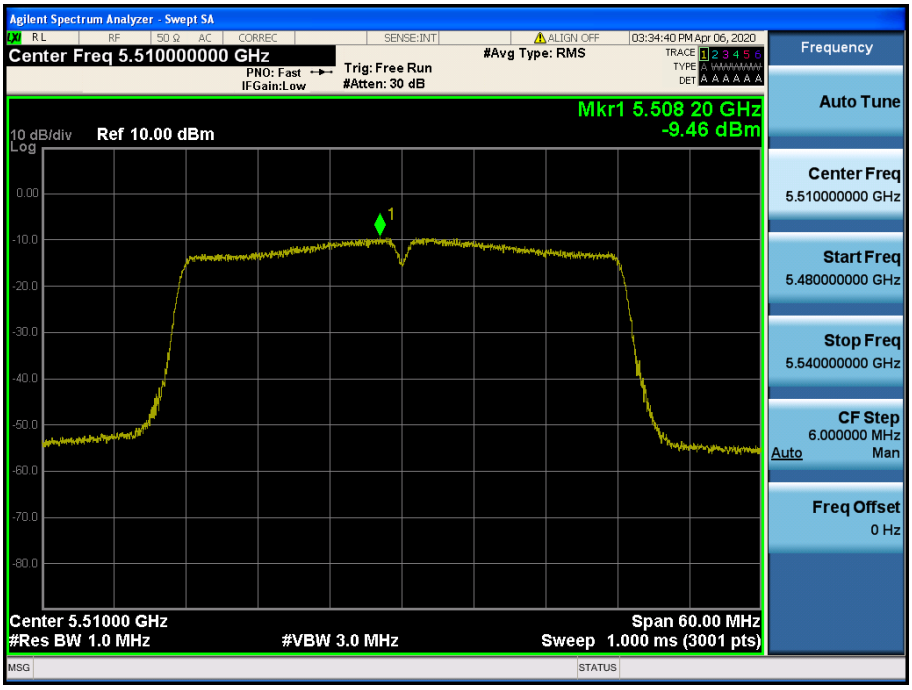
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.62



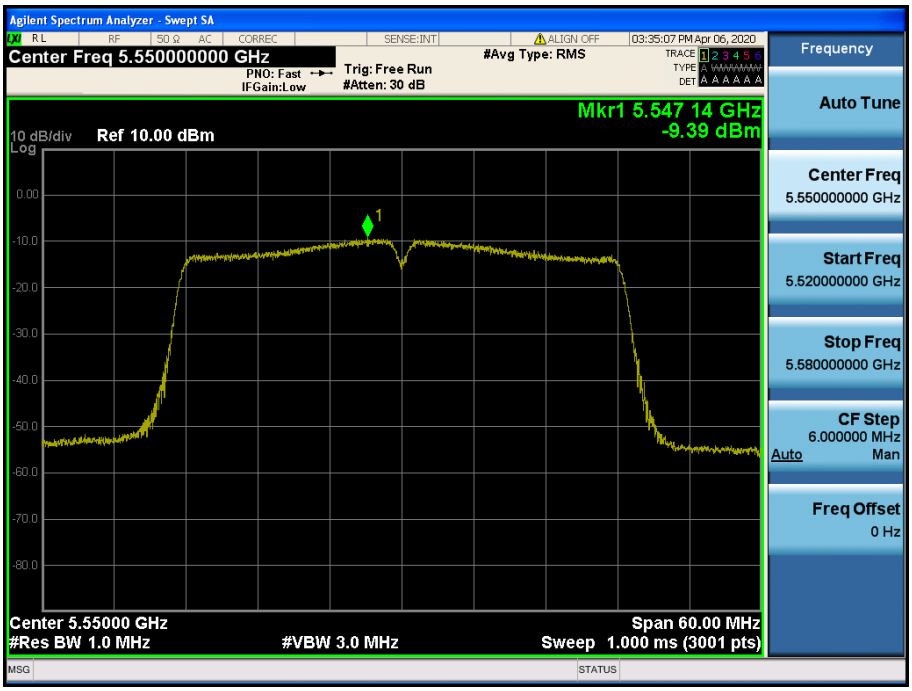
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.102

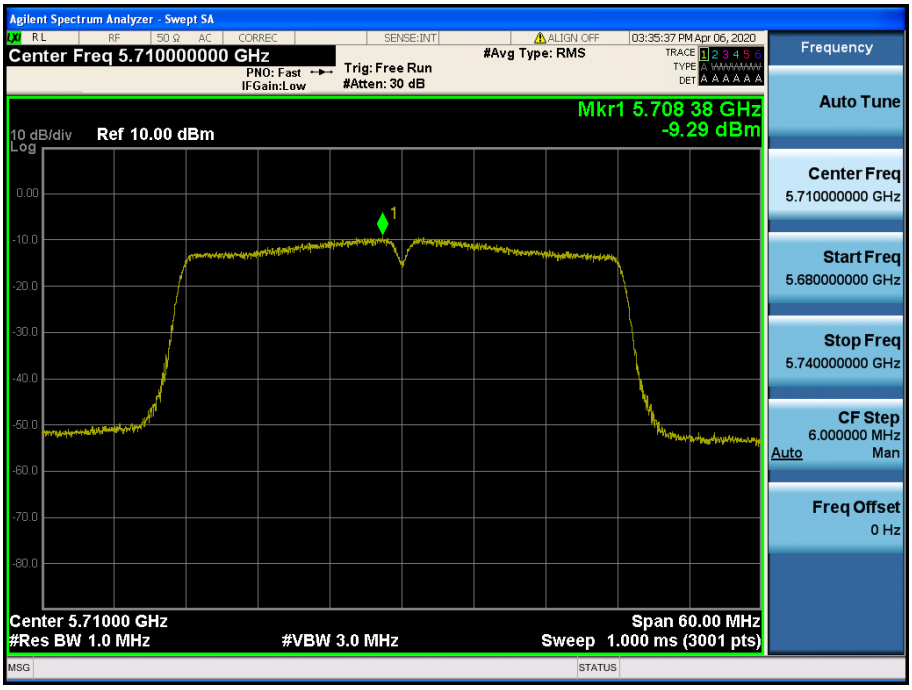


Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.110

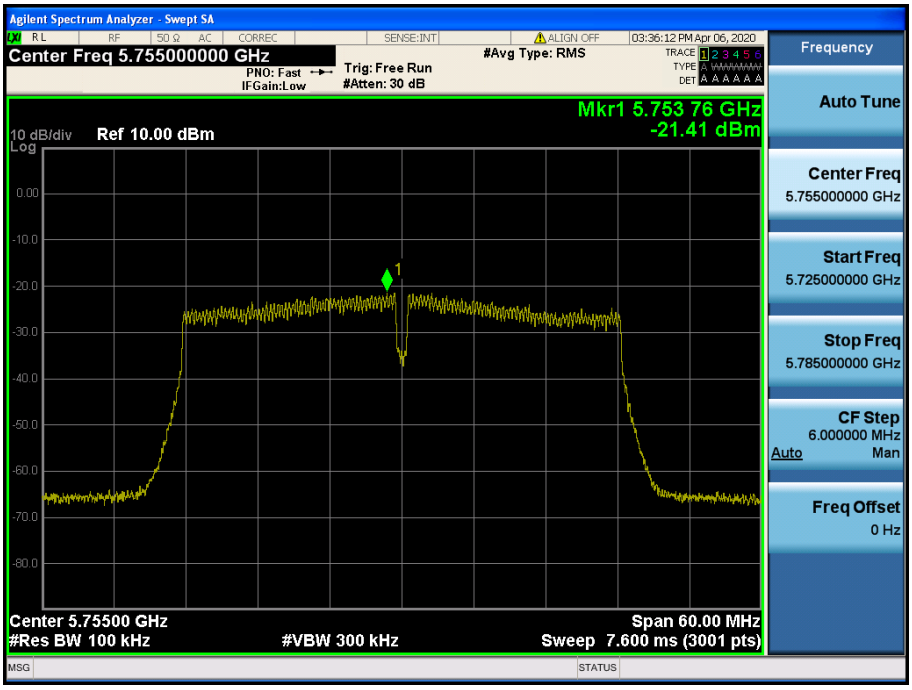


Maximum Power Spectral Density Test Mode: 802.11n HT40 & Ch.142



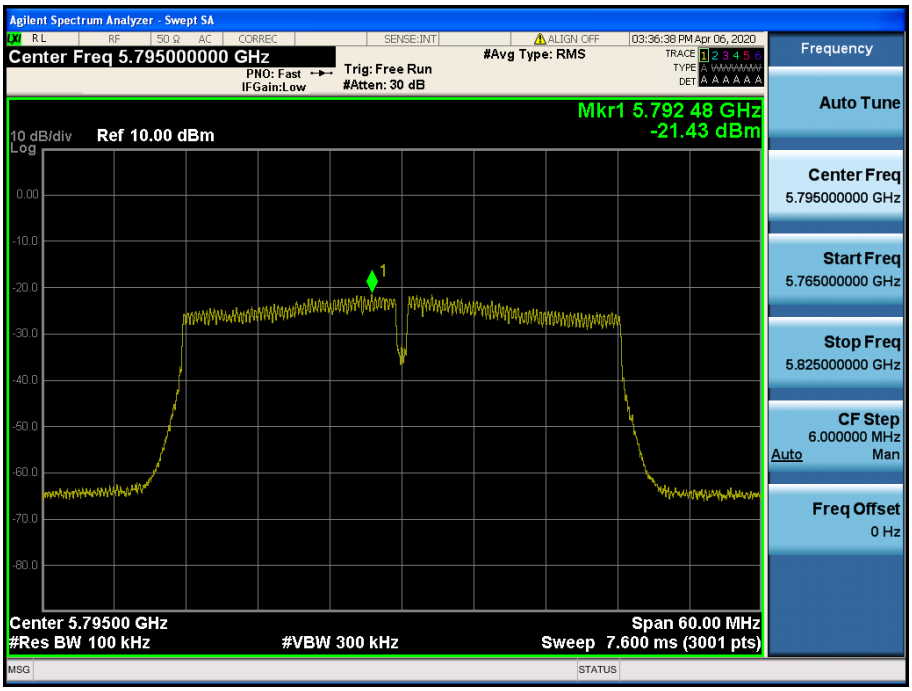
Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.151



Maximum Power Spectral Density

Test Mode: 802.11n HT40 & Ch.159



Maximum Power Spectral Density Test Mode: 802.11ac VHT80 & Ch.42

Maximum Power Spectral Density Test Mode: 802.11ac VHT80 & Ch.58

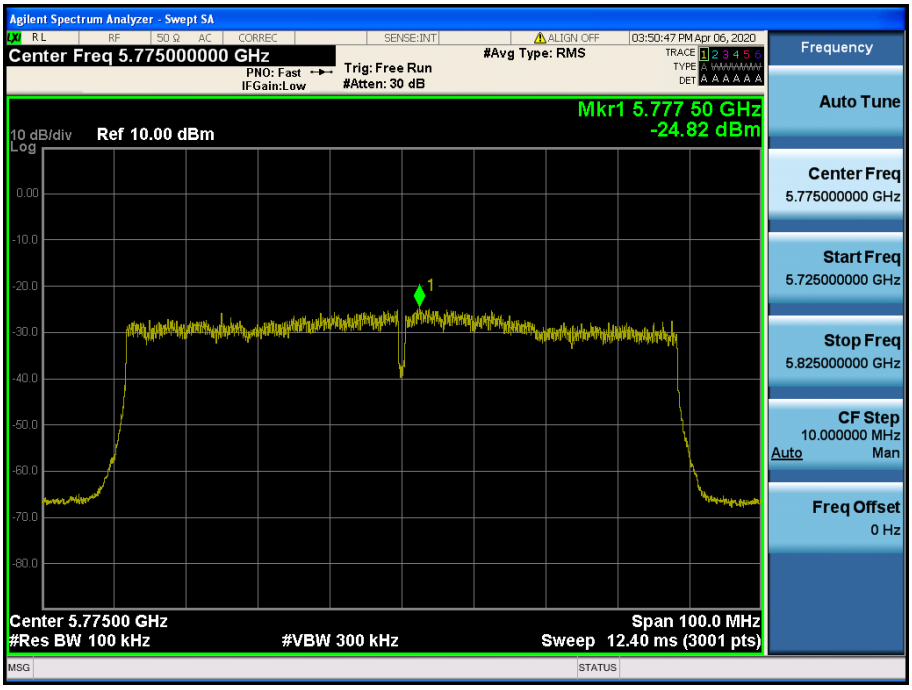
Maximum Power Spectral Density

Test Mode: 802.11ac VHT80 & Ch.106

Maximum Power Spectral Density

Test Mode: 802.11ac VHT80 & Ch.138

Maximum Power Spectral Density Test Mode: 802.11ac VHT80 & Ch.155



8.5 Radiated Spurious Emission Measurements

▣ Test Requirements

▪ **FCC Part 15.209(a) and (b)**

Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
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

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

▪ **FCC Part 15.205 (a):** Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	MHz	GHz	GHz
0.009 ~ 0.110	8.41425 ~ 8.41475	108 ~ 121.94	1300 ~ 1427	4.5 ~ 5.15	14.47 ~ 14.5
0.495 ~ 0.505	12.29 ~ 12.293	123 ~ 138	1435 ~ 1626.5	5.35 ~ 5.46	15.35 ~ 16.2
2.1735 ~ 2.1905	12.51975 ~	149.9 ~ 150.05	1645.5 ~ 1646.5	7.25 ~ 7.75	17.7 ~ 21.4
4.125 ~ 4.128	12.52025	160.52475 ~	1660 ~ 1710	8.025 ~ 8.5	22.01 ~ 23.12
4.17725 ~ 4.17775	12.57675 ~	160.52525	1718.8 ~ 1722.2	9.0 ~ 9.2	23.6 ~ 24.0
4.20725 ~ 4.20775	12.57725	160.7 ~ 160.9	2200 ~ 2300	9.3 ~ 9.5	31.2 ~ 31.8
6.215 ~ 6.218	13.36 ~ 13.41	162.0125 ~ 167.17	2310 ~ 2390	10.6 ~ 12.7	36.43 ~ 36.5
6.26775 ~ 6.26825	16.42 ~ 16.423	167.72 ~ 173.2	2483.5 ~ 2500	13.25 ~ 13.4	Above 38.6
6.31175 ~ 6.31225	16.69475 ~	240 ~ 285	2655 ~ 2900		
8.291 ~ 8.294	16.69525	322 ~ 335.4	3260 ~ 3267		
8.362 ~ 8.366	16.80425 ~	399.90 ~ 410	3332 ~ 3339		
8.37625 ~ 8.38675	16.80475	608 ~ 614	3345.8 ~ 3358		
	25.5 ~ 25.67	960 ~ 1240	3600 ~ 4000		
	37.5 ~ 38.25				
	73 ~ 74.6				
	74.8 ~ 75.2				

▪ **FCC Part 15.205(b):** The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

▪ **FCC Part 15.407 (b):** Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) 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 **EIRP of -27 dBm/MHz**.
(2) 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 **EIRP of -27 dBm/MHz**.
(3) 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 **EIRP of -27 dBm/MHz.**
(4) For transmitters operating in the **5.725-5.85 GHz 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.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
(6) Unwanted emissions **below 1 GHz** must comply with the general field strength limits set forth in **Section 15.209**. Further, any U-NII devices using an **AC power line** are required to comply also with the conducted limits set forth in **Section 15.207**.
(7) The provisions of §15.205 apply to intentional radiators operating under this section
(8) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the upper and lower frequency band edges as the design of the equipment permits.

▣ Test Configuration

Refer to the APPENDIX I.

▣ Test Procedure

1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m.
2. The turn table shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 1m or 3 m away from the receiving antenna, which is varied from 1m to 4 m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.

Radiated spurious emission measured using following Measurement Procedure **of KDB789033 D02v02r01**

► General Requirements for Unwanted Emissions Measurements

The following requirements apply to all unwanted emissions measurements, both in and outside of the restricted bands:

▪ EUT Duty Cycle

(1) The EUT shall be configured or modified to **transmit continuously** except as stated in (ii), below. The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (**to no lower than 98 percent**) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

(2) If **continuous transmission (or at least 98 percent duty cycle) cannot be achieved** due to hardware limitations of the EUT (e.g., overheating), the following additions to the measurement and reporting procedures are required:

- The EUT shall be configured to operate at the maximum achievable duty cycle.
- Measure the duty cycle, x, of the transmitter output signal.
- Adjustments to measurement procedures (e.g., increasing test time and number of traces averaged) shall be performed as described in the procedures below.
- The test report shall include the following additional information:
  - The reason for the duty cycle limitation.
  - The duty cycle achieved for testing and the associated transmit duration and interval between transmissions.
  - The sweep time and the amount of time used for trace stabilization during max-hold measurements for peak emission measurements.

(3) Reduction of the measured emission amplitude levels to account for operational duty factor is not permitted. Compliance is based on emission levels occurring during transmission - not on an average across on and off times of the transmitter.

► **Measurements below 1000 MHz**

a) Follow the requirements in section II.G.3, “General Requirements for Unwanted Emissions Measurements”.

b) Compliance shall be demonstrated using **CISPR quasi-peak detection**; however, **peak detection** is permitted as an alternative to quasi-peak detection.

► **Measurements Above 1000 MHz (Peak)**

a) Follow the requirements in section II.G.3, “General Requirements for Unwanted Emissions Measurements”.

b) Peak emission levels are measured by setting the analyzer as follows:

(i) **RBW = 1 MHz.**

(ii) **VBW ≥ 3 MHz.**

(iii) **Detector = Peak.**

(iv) Sweep time = Auto.

(v) Trace mode = Max hold.

(vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

► **Measurements Above 1000 MHz (Method AD)**

(i) **RBW = 1 MHz.**

(ii) **VBW ≥ 3 MHz.**

(iii) **Detector = RMS**, if span / (# of points in sweep) ≤ RBW / 2. Satisfying this condition may require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, the detector mode shall be set to peak.

(iv) Averaging type = power (i.e., RMS)

• As an alternative, the detector and averaging type may be set for linear voltage averaging. Some analyzers require linear display mode in order to use linear voltage averaging. Log or dB averaging shall not be used.

(v) Sweep time = Auto.

(vi) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, the number of traces shall be increased by a factor of 1/x, where x is the duty cycle. For example, with 50 percent duty cycle, at least 200 traces shall be averaged.

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

• **If power averaging (RMS) mode was used in step (iv) above, the correction factor is 10 log(1/x), where x is the duty cycle.** For example, if the transmit duty cycle was 50 percent, then 3 dB must be added to the measured emission levels.

• If linear voltage averaging mode was used in step (iv) above, the correction factor is 20 log (1/x), where x is the duty cycle. For example, if the transmit duty cycle was 50 percent, then 6 dB must be added to the measured emission levels.

• If a specific emission is demonstrated to be continuous (100 percent duty cycle) rather than turning on and off with the transmit cycle, no duty cycle correction is required for that emission.

Please refer to Appendix II for the duty correction factor

▣ Test Results:

Radiated Spurious Emissions data(9 kHz ~ 40 GHz) : *802.11a*

Band	Tested Channel	Freq. (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
U-NII 1	36 (5180 MHz)	5144.16	V	X	PK	49.59	1.98	N/A	N/A	51.57	74.00	22.43
		5149.40	V	X	AV	38.92	1.99	0.25	N/A	41.16	54.00	12.84
		10358.47	H	X	PK	44.09	10.83	N/A	N/A	54.92	68.20	13.28
	40 (5200 MHz)	10400.60	H	X	PK	44.16	10.63	N/A	N/A	54.79	68.20	13.41
	48 (5240 MHz)	10480.88	H	X	PK	44.33	10.62	N/A	N/A	54.95	68.20	13.25
U-NII 2A	52 (5260 MHz)	10519.36	H	X	PK	44.47	10.72	N/A	N/A	55.19	68.20	13.01
	60 (5300 MHz)	10600.22	H	X	PK	43.96	10.74	N/A	N/A	54.70	74.00	19.30
		10602.06	H	X	AV	33.78	10.75	0.25	N/A	44.78	54.00	9.22
	64 (5320 MHz)	5359.00	V	X	PK	48.57	3.03	N/A	N/A	51.60	74.00	22.40
		5353.00	V	X	AV	38.61	3.03	0.25	N/A	41.89	54.00	12.11
		10639.86	H	X	PK	43.01	10.82	N/A	N/A	53.83	74.00	20.17
		10638.22	H	X	AV	32.61	10.82	0.25	N/A	43.68	54.00	10.32

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Information of Distance Factor
   For finding emissions, the test distance might be reduced from 3 m to 1 m. In this case, the distance factor (-9.54 dB) is applied to the result.
   - Calculation of distance factor = 20 log(applied distance / required distance) = **20 log(1 m / 3 m)** = **-9.54 dB**
   When distance factor is "N/A", the distance is 3 m and distance factor is not applied.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
4. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27 dBm + 95.2 = 68.2 dBuV/m

Radiated Spurious Emissions data(9 kHz ~ 40 GHz) : *802.11a*

Band	Tested Channel	Freq. (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
U-NII 2C	100 (5500 MHz)	5457.47	V	X	PK	48.32	3.14	N/A	N/A	51.46	74.00	22.54
		5457.44	V	X	AV	38.01	3.14	0.25	N/A	41.40	54.00	12.60
		5467.96	V	X	PK	48.77	3.17	N/A	N/A	51.94	68.20	16.26
		10999.64	H	X	PK	44.78	10.95	N/A	N/A	55.73	74.00	18.27
		10999.22	H	X	AV	33.76	10.95	0.25	N/A	44.96	54.00	9.04
	116 (5580 MHz)	11158.10	H	X	PK	44.42	10.97	N/A	N/A	55.39	74.00	18.61
		11158.75	H	X	AV	33.62	10.97	0.25	N/A	44.84	54.00	9.16
	144 (5720 MHz)	11440.47	H	X	PK	44.04	11.14	N/A	N/A	55.18	74.00	18.82
		11438.06	H	X	AV	33.61	11.14	0.25	N/A	45.00	54.00	9.00
U-NII 3	149 (5745 MHz)	5724.51	V	X	PK	48.30	2.98	N/A	N/A	51.28	78.20	26.92
		5713.01	V	X	PK	48.23	3.17	N/A	N/A	51.40	68.20	16.80
		11490.48	H	X	PK	44.51	11.33	N/A	N/A	55.84	74.00	18.16
		11491.87	H	X	AV	33.92	11.33	0.25	N/A	45.50	54.00	8.50
	157 (5785 MHz)	11571.25	H	X	PK	44.91	11.64	N/A	N/A	56.55	74.00	17.45
		11568.49	H	X	AV	34.19	11.62	0.25	N/A	46.06	54.00	7.94
	165 (5825 MHz)	5852.76	V	X	PK	48.43	3.69	N/A	N/A	52.12	78.20	26.08
		5861.67	V	X	PK	48.21	3.68	N/A	N/A	51.89	68.20	16.31
		11649.08	H	X	PK	44.35	11.85	N/A	N/A	56.20	74.00	17.80
		11649.38	H	X	AV	33.99	11.85	0.25	N/A	46.09	54.00	7.91

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Information of Distance Factor
   For finding emissions, the test distance might be reduced from 3 m to 1 m. In this case, the distance factor (-9.54 dB) is applied to the result.
   - Calculation of distance factor = 20 log(applied distance / required distance) = **20 log(1 m / 3 m)** = **-9.54 dB**
   When distance factor is “N/A”, the distance is 3 m and distance factor is not applied.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
4. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27 dBm + 95.2 = 68.2 dBuV/m

Radiated Spurious Emissions data(9 kHz ~ 40 GHz) : *802.11n(HT20)*

Band	Tested Channel	Freq. (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
U-NII 1	36 (5180 MHz)	5149.45	V	X	PK	49.14	1.99	N/A	N/A	51.13	74.00	22.87
		5149.44	V	X	AV	38.60	1.99	0.24	N/A	40.83	54.00	13.17
		10362.20	H	X	PK	43.79	10.81	N/A	N/A	54.60	68.20	13.60
	40 (5200 MHz)	10399.57	H	X	PK	43.06	10.63	N/A	N/A	53.69	68.20	14.51
	48 (5240 MHz)	10481.76	H	X	PK	43.60	10.62	N/A	N/A	54.22	68.20	13.98
U-NII 2A	52 (5260 MHz)	10519.61	H	X	PK	43.31	10.72	N/A	N/A	54.03	68.20	14.17
	60 (5300 MHz)	10601.86	H	X	PK	43.65	10.75	N/A	N/A	54.40	74.00	19.60
		10600.78	H	X	AV	33.04	10.74	0.24	N/A	44.02	54.00	9.98
	64 (5320 MHz)	5354.48	V	X	PK	48.38	3.03	N/A	N/A	51.41	74.00	22.59
		5352.30	V	X	AV	38.07	3.03	0.24	N/A	41.34	54.00	12.66
		10638.87	H	X	PK	43.06	10.82	N/A	N/A	53.88	74.00	20.12
		10640.71	H	X	AV	32.84	10.82	0.24	N/A	43.90	54.00	10.10

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Information of Distance Factor
   For finding emissions, the test distance might be reduced from 3 m to 1 m. In this case, the distance factor (-9.54 dB) is applied to the result.
   - Calculation of distance factor = 20 log(applied distance / required distance) = **20 log(1 m / 3 m)** = **-9.54 dB**
   When distance factor is "N/A", the distance is 3 m and distance factor is not applied.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
4. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27 dBm + 95.2 = 68.2 dBuV/m

Radiated Spurious Emissions data(9 kHz ~ 40 GHz) : *802.11n(HT20)*

Band	Tested Channel	Freq. (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
U-NII 2C	100 (5500 MHz)	5452.79	V	X	PK	49.97	3.14	N/A	N/A	53.11	74.00	20.89
		5457.65	V	X	AV	37.96	3.15	0.24	N/A	41.35	54.00	12.65
		5463.69	V	X	PK	48.24	3.16	N/A	N/A	51.40	68.20	16.80
		10999.49	H	X	PK	43.86	10.95	N/A	N/A	54.81	74.00	19.19
		11001.14	H	X	AV	33.76	10.95	0.24	N/A	44.95	54.00	9.05
	116 (5580 MHz)	11160.66	H	X	PK	44.59	10.97	N/A	N/A	55.56	74.00	18.44
		11159.39	H	X	AV	33.76	10.97	0.24	N/A	44.97	54.00	9.03
	144 (5720 MHz)	11441.33	H	X	PK	43.89	11.15	N/A	N/A	55.04	74.00	18.96
		11438.25	H	X	AV	33.38	11.14	0.24	N/A	44.76	54.00	9.24
U-NII 3	149 (5745 MHz)	5714.28	V	X	PK	47.96	3.17	N/A	N/A	51.13	68.20	17.07
		5722.47	V	X	PK	48.02	3.02	N/A	N/A	51.04	78.20	27.16
		11491.34	H	X	PK	44.00	11.33	N/A	N/A	55.33	74.00	18.67
		11490.11	H	X	AV	33.51	11.32	0.24	N/A	45.07	54.00	8.93
	157 (5785 MHz)	11572.17	H	X	PK	44.51	11.64	N/A	N/A	56.15	74.00	17.85
		11569.46	H	X	AV	33.59	11.63	0.24	N/A	45.46	54.00	8.54
	165 (5825 MHz)	5853.80	V	X	PK	48.22	3.69	N/A	N/A	51.91	78.20	26.29
		5864.25	V	X	PK	47.92	3.61	N/A	N/A	51.53	68.20	16.67
		11649.93	H	X	PK	43.94	11.85	N/A	N/A	55.79	74.00	18.21
		11649.28	H	X	AV	33.68	11.85	0.24	N/A	45.77	54.00	8.23

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Information of Distance Factor
   For finding emissions, the test distance might be reduced from 3 m to 1 m. In this case, the distance factor (-9.54 dB) is applied to the result.
   - Calculation of distance factor = 20 log(applied distance / required distance) = **20 log(1 m / 3 m)** = **-9.54 dB**
   When distance factor is “N/A”, the distance is 3 m and distance factor is not applied.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
4. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27 dBm + 95.2 = 68.2 dBuV/m

Radiated Spurious Emissions data(9 kHz ~ 40 GHz) : *802.11n(HT40)*

Band	Tested Channel	Freq. (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
U-NII 1	38 (5190 MHz)	5148.88	V	X	PK	48.86	1.99	N/A	N/A	50.85	74.00	23.15
		5148.88	V	X	AV	38.53	1.99	0.49	N/A	41.01	54.00	12.99
		10378.64	H	X	PK	43.54	10.73	N/A	N/A	54.27	68.20	13.93
	46 (5230 MHz)	10459.48	H	X	PK	44.25	10.59	N/A	N/A	54.84	68.20	13.36
U-NII 2A	54 (5270 MHz)	10539.19	H	X	PK	44.12	10.80	N/A	N/A	54.92	68.20	13.28
	62 (5310 MHz)	5354.90	V	X	PK	48.33	3.03	N/A	N/A	51.36	74.00	22.64
		5352.63	V	X	AV	38.25	3.03	0.49	N/A	41.77	54.00	12.23
		10619.35	H	X	PK	42.94	10.78	N/A	N/A	53.72	74.00	20.28
		10619.56	H	X	AV	32.87	10.78	0.49	N/A	44.14	54.00	9.86

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Information of Distance Factor
   For finding emissions, the test distance might be reduced from 3 m to 1 m. In this case, the distance factor (-9.54 dB) is applied to the result.
   - Calculation of distance factor = 20 log(applied distance / required distance) = **20 log(1 m / 3 m)** = **-9.54 dB**
   When distance factor is “N/A”, the distance is 3 m and distance factor is not applied.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
4. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27 dBm + 95.2 = 68.2 dBuV/m

Radiated Spurious Emissions data(9 kHz ~ 40 GHz) : *802.11n(HT40)*

Band	Tested Channel	Freq. (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
U-NII 2C	102 (5510 MHz)	5457.26	V	X	PK	47.83	3.14	N/A	N/A	50.97	74.00	23.03
		5459.65	V	X	AV	37.80	3.15	0.49	N/A	41.44	54.00	12.56
		5469.47	V	X	PK	47.26	3.17	N/A	N/A	50.43	68.20	17.77
		11019.88	H	X	PK	43.99	10.90	N/A	N/A	54.89	74.00	19.11
		11020.49	H	X	AV	33.94	10.90	0.49	N/A	45.33	54.00	8.67
	110 (5550 MHz)	11098.23	H	X	PK	43.91	10.91	N/A	N/A	54.82	74.00	19.18
		11098.62	H	X	AV	33.67	10.91	0.49	N/A	45.07	54.00	8.93
	142 (5710 MHz)	11420.99	H	X	PK	44.54	11.07	N/A	N/A	55.61	74.00	18.39
		11418.63	H	X	AV	33.47	11.07	0.49	N/A	45.03	54.00	8.97
U-NII 3	151 (5755 MHz)	5710.87	V	X	PK	48.62	3.17	N/A	N/A	51.79	68.20	16.41
		5723.07	V	X	PK	48.38	3.01	N/A	N/A	51.39	78.20	26.81
		11510.31	H	X	PK	44.89	11.39	N/A	N/A	56.28	74.00	17.72
		11511.40	H	X	AV	33.93	11.40	0.49	N/A	45.82	54.00	8.18
	159 (5795 MHz)	5857.72	V	X	PK	48.97	3.72	N/A	N/A	52.69	78.20	25.51
		5864.72	V	X	PK	47.96	3.60	N/A	N/A	51.56	68.20	16.64
		11589.53	H	X	PK	44.59	11.73	N/A	N/A	56.32	74.00	17.68
		11589.03	H	X	AV	33.79	11.73	0.49	N/A	46.01	54.00	7.99

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Information of Distance Factor
   For finding emissions, the test distance might be reduced from 3 m to 1 m. In this case, the distance factor (-9.54 dB) is applied to the result.
   - Calculation of distance factor = 20 log(applied distance / required distance) = **20 log(1 m / 3 m)** = **-9.54 dB**
   When distance factor is "N/A", the distance is 3 m and distance factor is not applied.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
4. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27 dBm + 95.2 = 68.2 dBuV/m

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Radiated Spurious Emissions data(9 kHz ~ 40 GHz) : *802.11ac(VHT80)*

Band	Tested Channel	Freq. (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
U-NII 1	42 (5210 MHz)	5148.50	V	X	PK	47.82	1.99	N/A	N/A	49.81	74.00	24.19
		5148.64	V	X	AV	38.19	1.99	0.84	N/A	41.02	54.00	12.98
		10419.52	H	X	PK	44.19	10.61	N/A	N/A	54.80	68.20	13.40
U-NII 2A	58 (5290 MHz)	5352.76	V	X	PK	48.47	3.03	N/A	N/A	51.50	74.00	22.50
		5350.53	V	X	AV	37.86	3.03	0.84	N/A	41.73	54.00	12.27
		10581.33	H	X	PK	43.42	10.78	N/A	N/A	54.20	68.20	14.00

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Information of Distance Factor
   For finding emissions, the test distance might be reduced from 3 m to 1 m. In this case, the distance factor (-9.54 dB) is applied to the result.
   - Calculation of distance factor = 20 log(applied distance / required distance) = **20 log(1 m / 3 m)** = **-9.54 dB**
   When distance factor is "N/A", the distance is 3 m and distance factor is not applied.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
4. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27 dBm + 95.2 = 68.2 dBuV/m

Radiated Spurious Emissions data(9 kHz ~ 40 GHz) *802.11ac(VHT80)*

Band	Tested Channel	Freq. (MHz)	ANT Pol	EUT Position (Axis)	Detector Mode	Reading (dBuV)	T.F (dB/m)	DCCF (dB)	DCF (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
U-NII 2C	106 (5530 MHz)	5458.36	V	X	PK	47.85	3.15	N/A	N/A	51.00	74.00	23.00
		5459.80	V	X	AV	37.72	3.15	0.84	N/A	41.71	54.00	12.29
		5463.67	V	X	PK	48.99	3.16	N/A	N/A	52.15	68.20	16.05
		11058.17	H	X	PK	43.79	10.84	N/A	N/A	54.63	74.00	19.37
		11057.67	H	X	AV	33.82	10.84	0.84	N/A	45.50	54.00	8.50
	138 (5690 MHz)	11377.97	H	X	PK	44.42	11.01	N/A	N/A	55.43	74.00	18.57
		11378.48	H	X	AV	33.98	11.01	0.84	N/A	45.83	54.00	8.17
U-NII 3	155 (5775 MHz)	5714.30	V	X	PK	47.74	3.17	N/A	N/A	50.91	68.20	17.29
		5724.51	V	X	PK	47.97	2.98	N/A	N/A	50.95	78.20	27.25
		5857.96	V	X	PK	49.23	3.72	N/A	N/A	52.95	78.20	25.25
		5863.06	V	X	PK	48.83	3.64	N/A	N/A	52.47	68.20	15.73
		11549.35	H	X	PK	43.68	11.52	N/A	N/A	55.20	74.00	18.80
		11551.71	H	X	AV	33.52	11.53	0.84	N/A	45.89	54.00	8.11

Note.

1. No other spurious and harmonic emissions were found greater than listed emissions on above table.
2. Information of Distance Factor
   For finding emissions, the test distance might be reduced from 3 m to 1 m. In this case, the distance factor (-9.54 dB) is applied to the result.
   - Calculation of distance factor = 20 log(applied distance / required distance) = **20 log(1 m / 3 m)** = **-9.54 dB**
   When distance factor is "N/A", the distance is 3 m and distance factor is not applied.
3. Sample Calculation.
   Margin = Limit – Result / Result = Reading + T.F+ DCCF + DCF / T.F = AF + CL – AG
   Where, T.F = Total Factor, AF = Antenna Factor, CL = Cable Loss, AG = Amplifier Gain,
   DCCF = Duty Cycle Correction Factor, DCF = Distance Correction Factor
4. The limit is converted to field strength.
   E[dBuV/m] = EIRP[dBm] + 95.2 dB = -27 dBm + 95.2 = 68.2 dBuV/m

8.6 AC Conducted Emissions

▣ Test Requirements and limit, §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN).

Frequency Range (MHz)	Conducted Limit (dBuV)	
	Quasi-Peak	Average
0.15 ~ 0.5	66 to 56 *	56 to 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency

Compliance with this provision shall be based on the measurement of the radio frequency voltage between each power line (LINE and NEUTRAL) and ground at the power terminals.

▣ Test Configuration

NA

▣ Test Procedure

Conducted emissions from the EUT were measured according to the ANSI C63.10-2013.

1. The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

▣ Test Results:

NA

9. LIST OF TEST EQUIPMENT

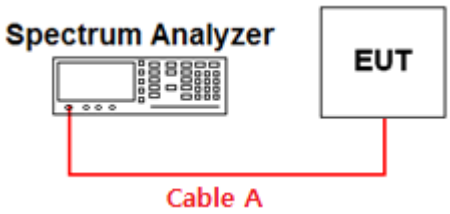
Type	Manufacturer	Model	Cal.Date (yy/mm/dd)	Next.Cal.Date (yy/mm/dd)	S/N
Spectrum Analyzer	Agilent Technologies	N9020A	19/12/16	20/12/16	MY49060056
Spectrum Analyzer	Agilent Technologies	N9020A	19/12/16	20/12/16	MY48011700
Spectrum Analyzer	Agilent Technologies	N9020A	19/12/16	20/12/16	MY48010133
Spectrum Analyzer	Agilent Technologies	N9030A	19/12/16	20/12/16	MY53310140
DC Power Supply	Agilent Technologies	66332A	19/06/25	20/06/25	MY43001173
DC Power Supply	SM techno	SDP30-5D	19/06/24	20/06/24	305DMG305
Multimeter	FLUKE	17B	19/12/16	20/12/16	26030065WS
Signal Generator	Rohde Schwarz	SMBV100A	19/12/16	20/12/16	255571
Signal Generator	ANRITSU	MG3695C	19/12/16	20/12/16	173501
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-1
Thermohygrometer	BODYCOM	BJ5478	19/12/18	20/12/18	120612-2
Thermohygrometer	BODYCOM	BJ5478	19/06/25	20/06/25	N/A
Loop Antenna	Schwarzbeck	FMZB1513	20/02/19	22/02/19	1513-128
BILOG ANTENNA	Schwarzbeck	VULB 9160	19/04/23	21/04/23	9160-3362
Horn Antenna	ETS-Lindgren	3115	20/01/30	22/01/30	6419
Horn Antenna	A.H.Systems Inc.	SAS-574	19/07/03	21/07/03	155
PreAmplifier	tsj	MLA-0118-B01-40	19/12/16	20/12/16	1852267
PreAmplifier	tsj	MLA-1840-J02-45	19/06/27	20/06/27	16966-10728
PreAmplifier	H.P	8447D	19/12/16	20/12/16	2944A07774
High Pass Filter	Wainwright Instruments	WHKX12-935-1000-15000-40SS	19/06/26	20/06/26	8
High Pass Filter	Wainwright Instruments	WHKX10-2838-3300-18000-60SS	19/06/26	20/06/26	1
High Pass Filter	Wainwright Instruments	WHNX8.0/26.5-6SS	19/06/27	20/06/27	3
Attenuator	Hefei Shunze	SS5T2.92-10-40	19/06/27	20/06/27	16012202
Attenuator	SRTechnology	F01-B0606-01	19/06/27	20/06/27	13092403
Attenuator	Aeroflex/Weinschel	20515	19/06/27	20/06/27	Y2370
Attenuator	SMAJK	SMAJK-2-3	19/06/27	20/06/27	2
Power Meter & Wide Bandwidth Sensor	Anritsu	ML2495A MA2490A	19/06/24	20/06/24	1306007 1249001
EMI Receiver	ROHDE&SCHWARZ	ESW44	19/07/30	20/07/30	101645
Cable	Junkosha	MWX241	20/01/13	21/01/13	G-04
Cable	Junkosha	MWX241	20/01/13	21/01/13	G-07
Cable	DT&C	Cable	20/01/13	21/01/13	G-13
Cable	DT&C	Cable	20/01/13	21/01/13	G-14
Cable	HUBER+SUHNER	SUCOFLEX 104	20/01/13	21/01/13	G-15
Cable	Radiall	TESTPRO3	20/01/16	21/01/16	M-01
Cable	Junkosha	MWX315	20/01/16	21/01/16	M-05
Cable	Junkosha	MWX221	20/01/16	21/01/16	M-06
Cable	Radiall	TESTPRO3	20/01/15	21/01/15	RF-64
Test Software	tsj	Radiated Emission Measurement	N/A	N/A	Version 2.00.0177

Note1: The measurement antennas were calibrated in accordance to the requirements of ANSI C63.5-2017
Note2: The cable is not a regular calibration item, so it has been calibrated by DT & C itself.

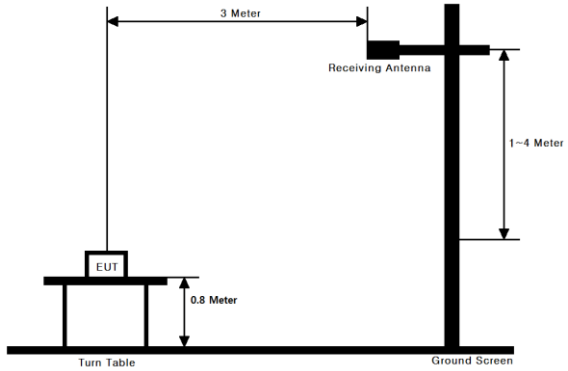
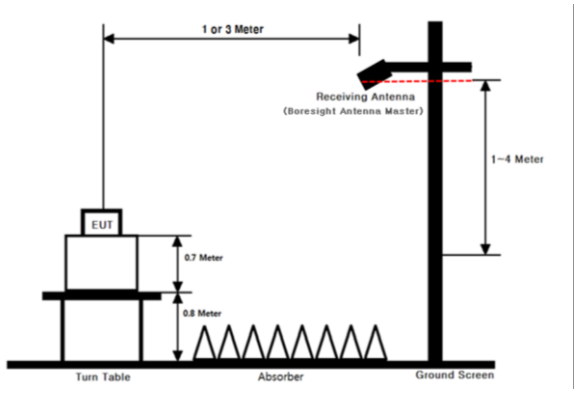
APPENDIX I

Test set up Diagram

▪ Conducted Measurement



▪ Radiated Measurement

Below 1GHz	Above 1GHz
	

APPENDIX II

Duty Cycle Information

▣ Test Procedure

Duty Cycle [X = On Time / (On + Off time)] is measured using Measurement Procedure **of KDB789033 D02v02r01**

1. Set the center frequency of the spectrum analyzer to the center frequency of the transmission.
2. Set RBW ≥ EBW if possible; otherwise, set RBW to the largest available value.
3. Set VBW ≥ RBW. Set detector = peak.
4. Note : The zero-span measurement method shall not be used unless both **RBW and VBW are > 50/*T***, where *T* is defined in section II.B.1.a), and **the number of sweep points across duration *T* exceeds 100**. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if *T* ≤ 16.7 microseconds.)

   T : The minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
   (***T* = On time** of the above table since the EUT operates with above fixed Duty Cycle and it is the minimum On time)

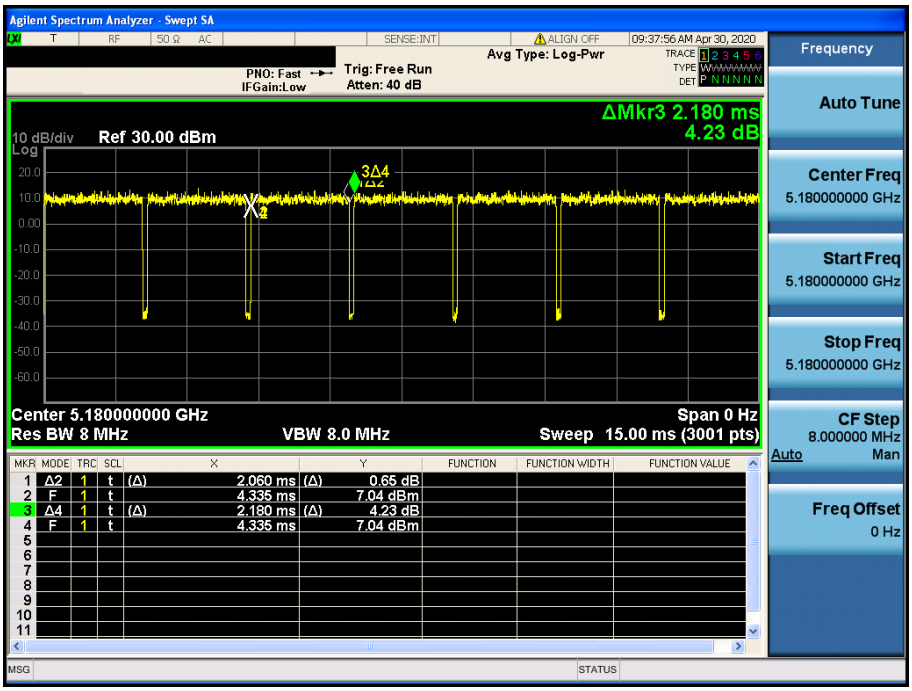
▣ Test Results:

Duty cycle

Mode	Data Rate	Tested Frequency [MHz]	Maximum Achievable Duty Cycle (*x*) = On / (On+Off)			Duty Cycle Correction Factor [dB]	50/*T* [kHz]
			On Time [ms]	(On+Off) Time [ms]	*x*		
802.11a	6Mbps	5180	2.060	2.180	0.9450	0.25	24.27
802.11n (HT20)	MCS0	5180	1.908	2.015	0.9469	0.24	26.21
802.11n (HT40)	MCS0	5190	0.943	1.057	0.8924	0.49	53.01
802.11ac (VHT80)	MCS0	5210	0.460	0.558	0.8239	0.84	108.70

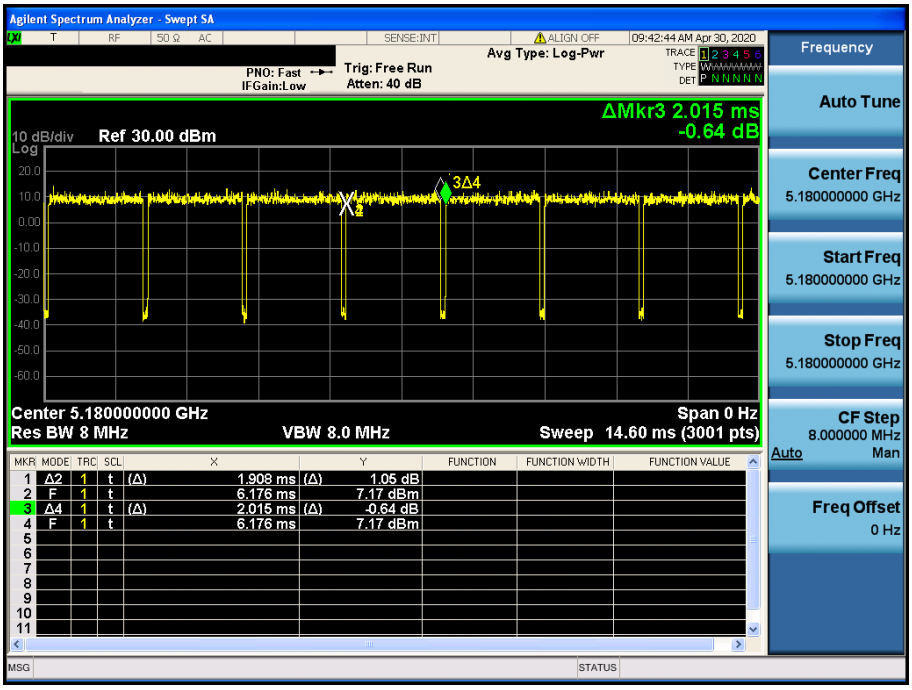
Duty Cycle

Test Mode: 802.11a & Ch.36

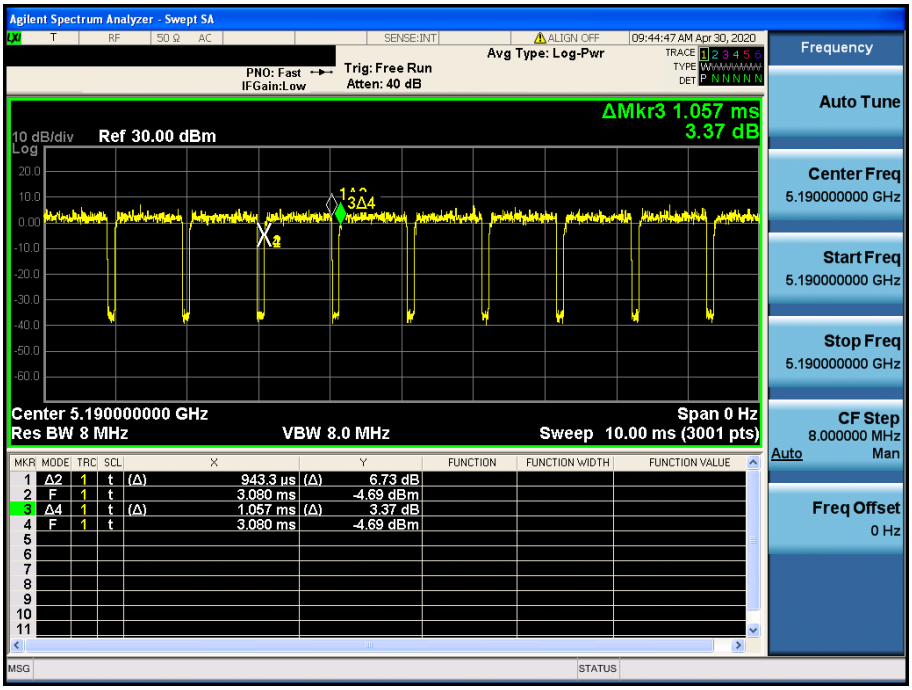


Duty Cycle

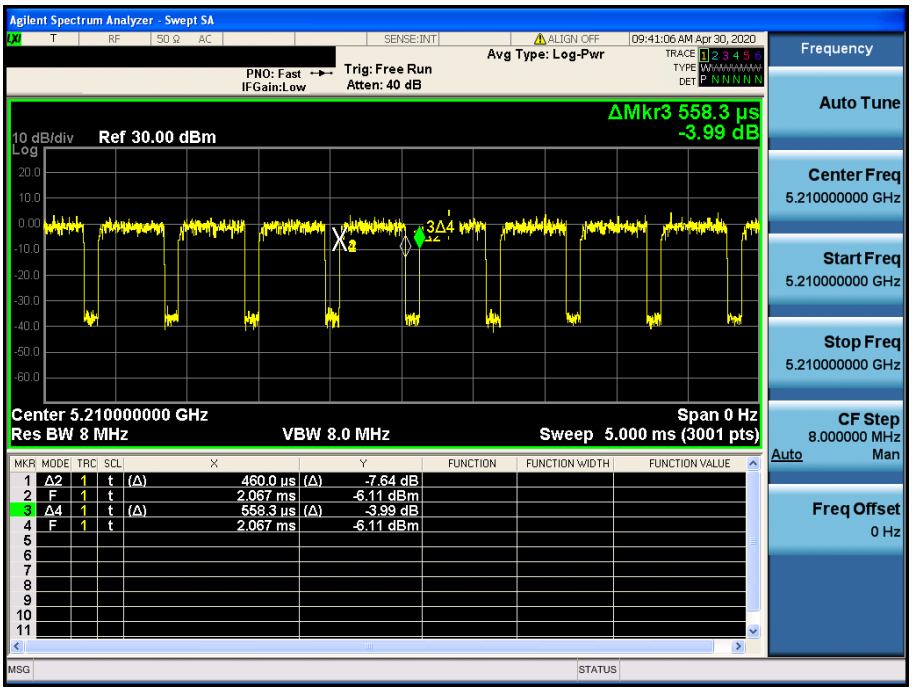
Test Mode: 802.11n HT20 & Ch.36



Duty Cycle Test Mode: 802.11n HT40 & Ch.38



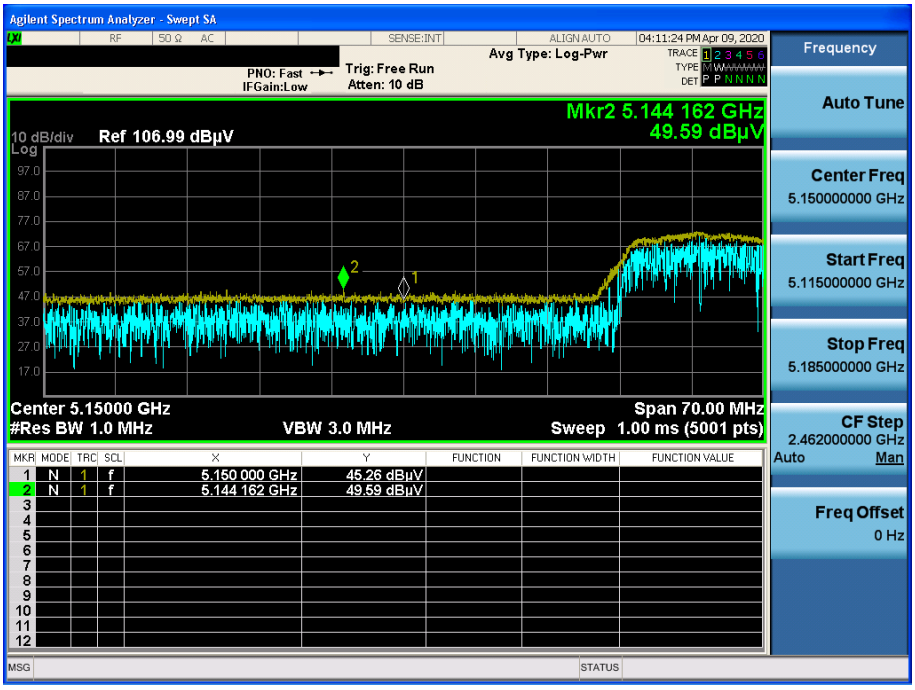
Duty Cycle Test Mode: 802.11ac VHT80 & Ch.42



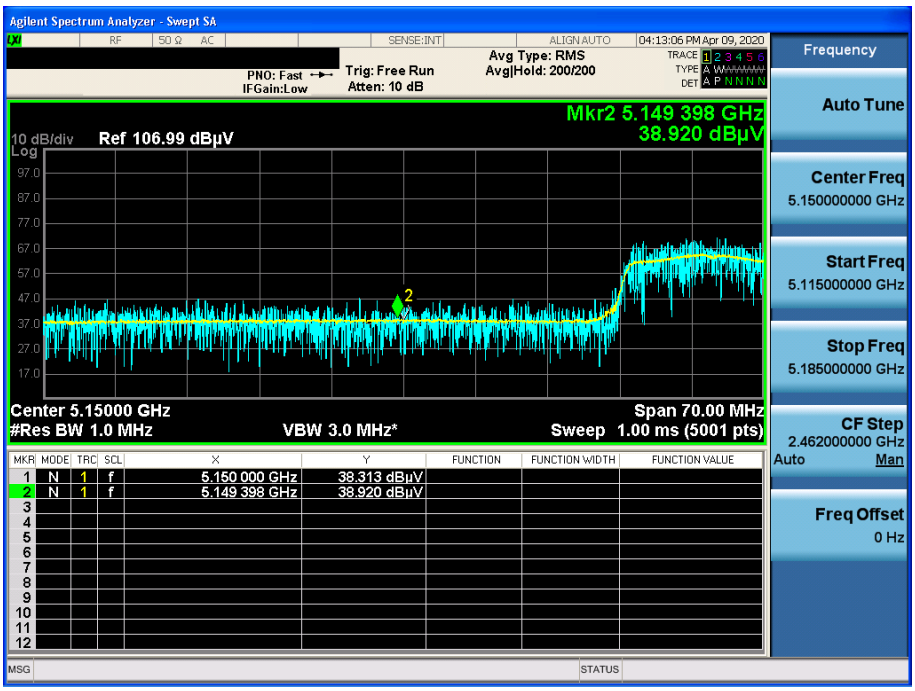
APPENDIX III

Unwanted Emissions (Radiated) Test Plot

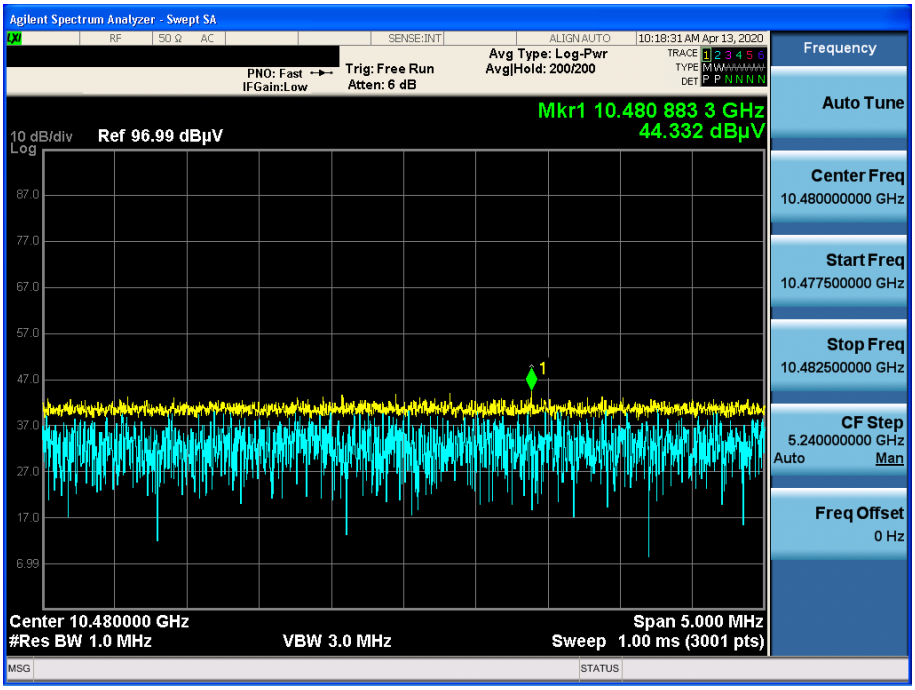
802.11a & U-NII 1 & Ch.36 & X axis & Ver Detector Mode : PK



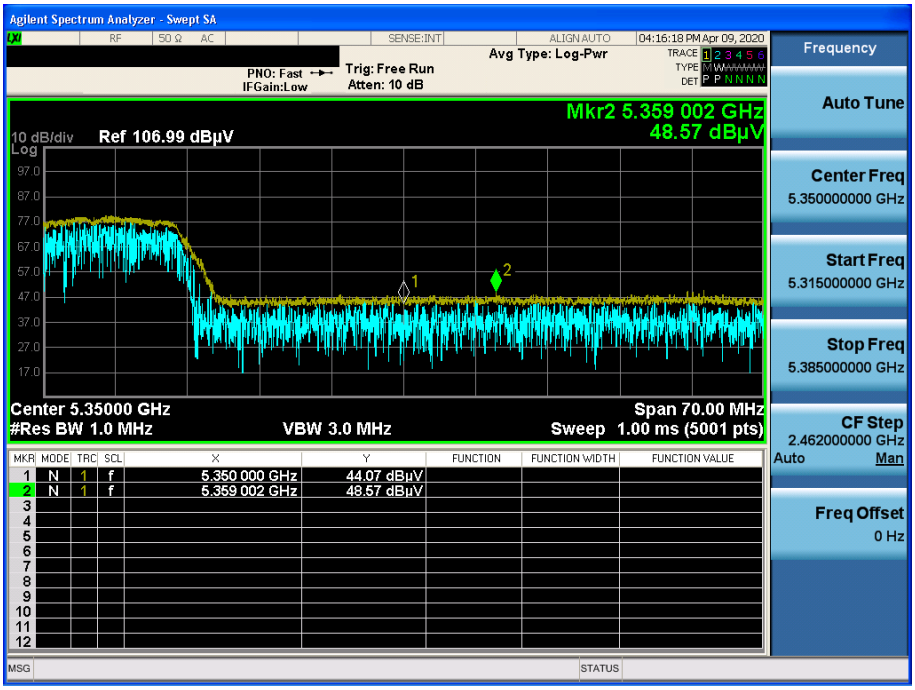
802.11a & U-NII 1 & Ch.36 & X axis & Ver Detector Mode : AV



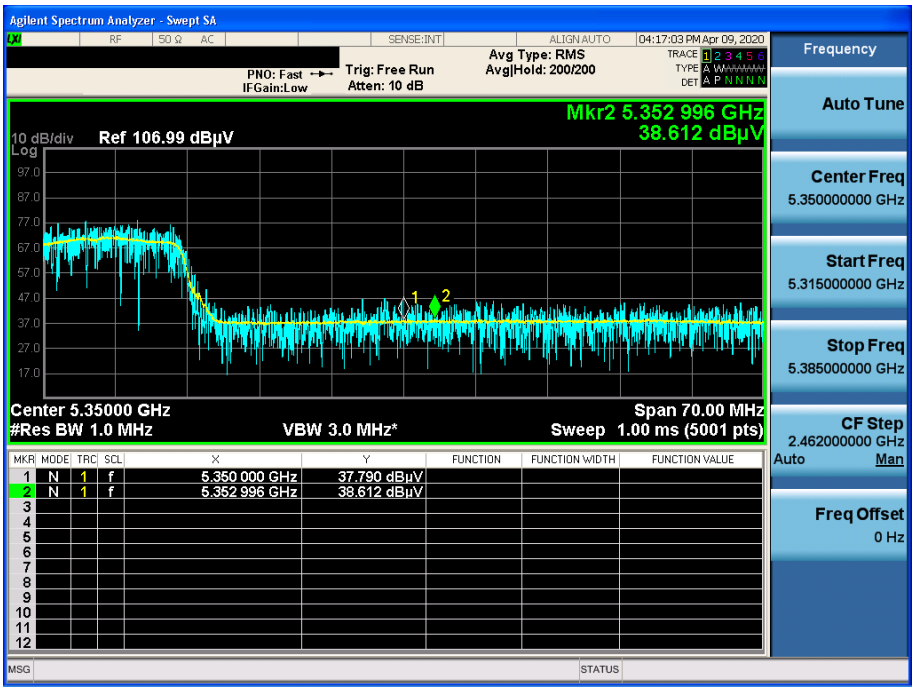
802.11a & U-NII 1 & Ch.48 & X axis & Hor **Detector Mode : PK**



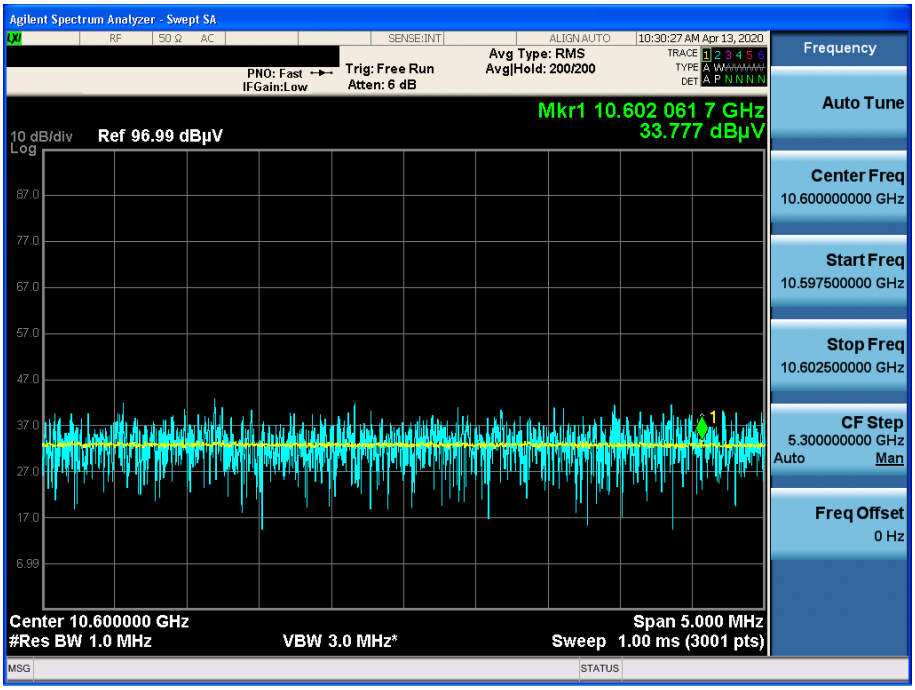
802.11a & U-NII 2A & Ch.64 & X axis & Hor **Detector Mode : PK**



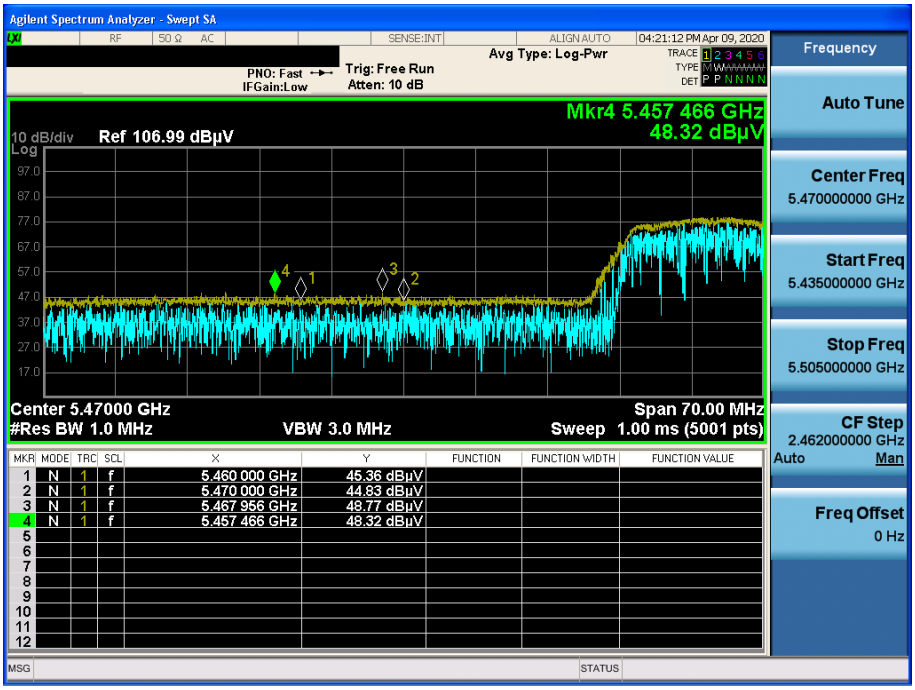
802.11a & U-NII 2A & Ch.64 & X axis & Hor **Detector Mode : AV**



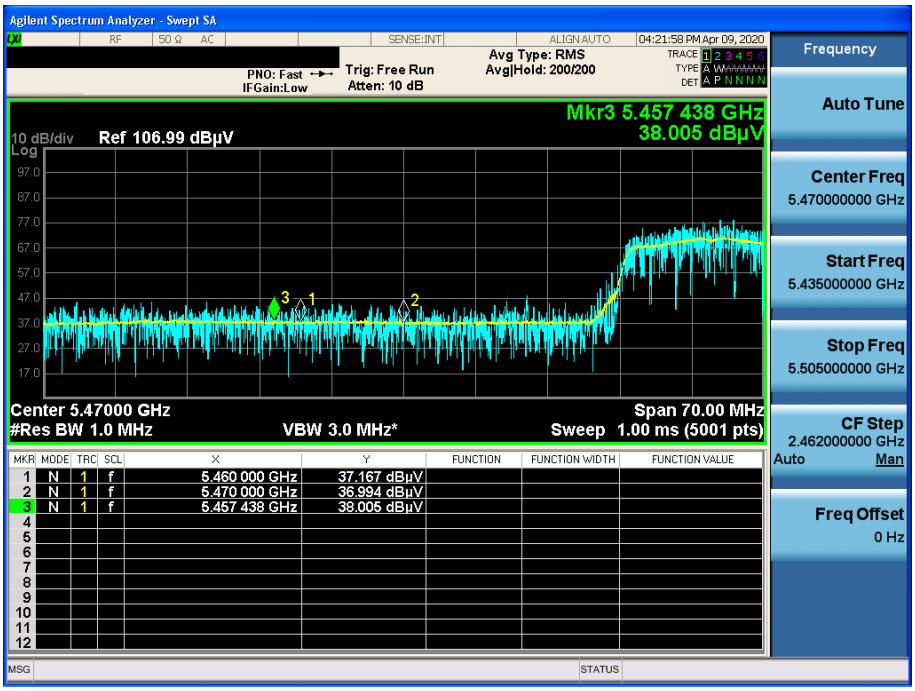
802.11a & U-NII 2A & Ch.60 & X axis & Hor **Detector Mode : AV**



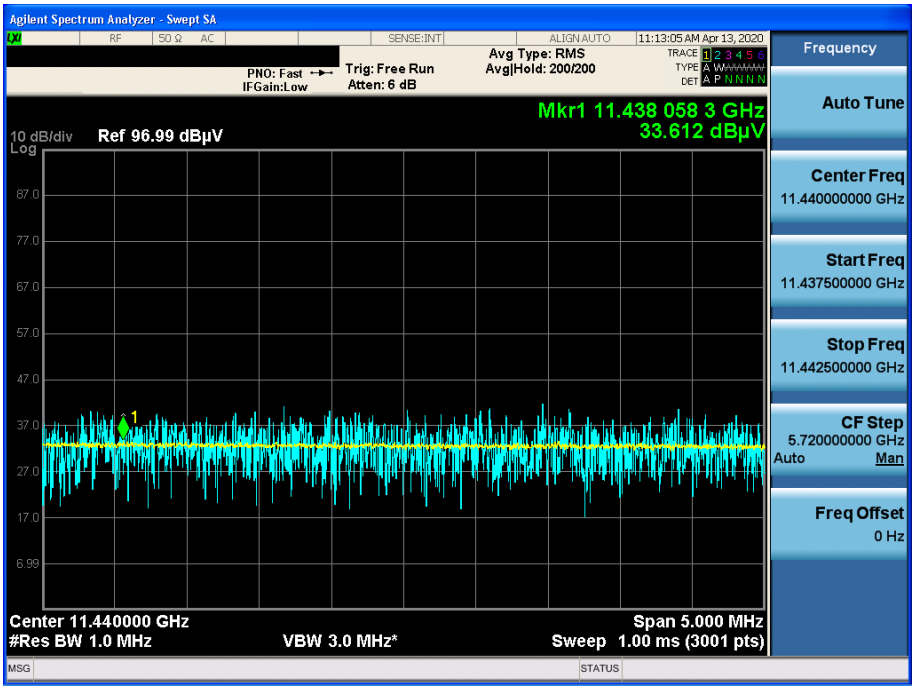
802.11a & U-NII 2C & Ch.100 & X axis & Ver **Detector Mode : PK**



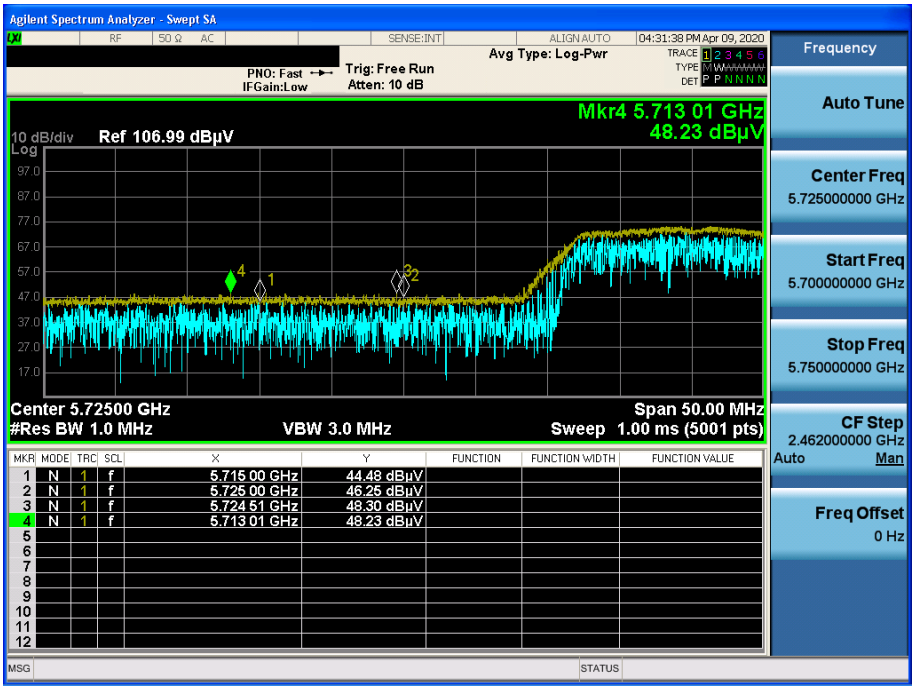
802.11a & U-NII 2C & Ch.100 & X axis & Ver **Detector Mode : AV**



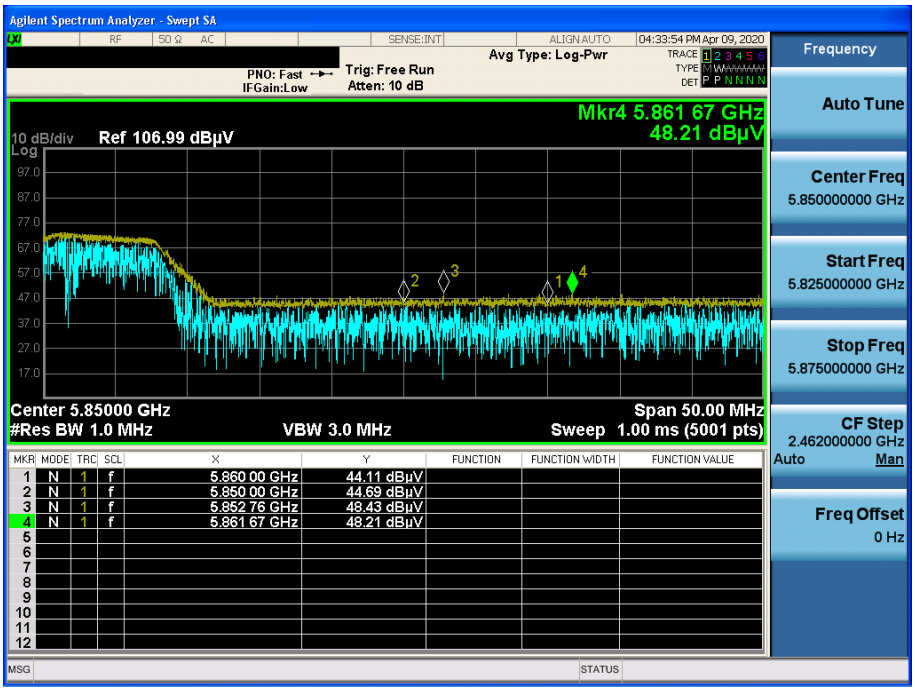
802.11a & U-NII 2C & Ch.144 & X axis & Hor **Detector Mode : AV**



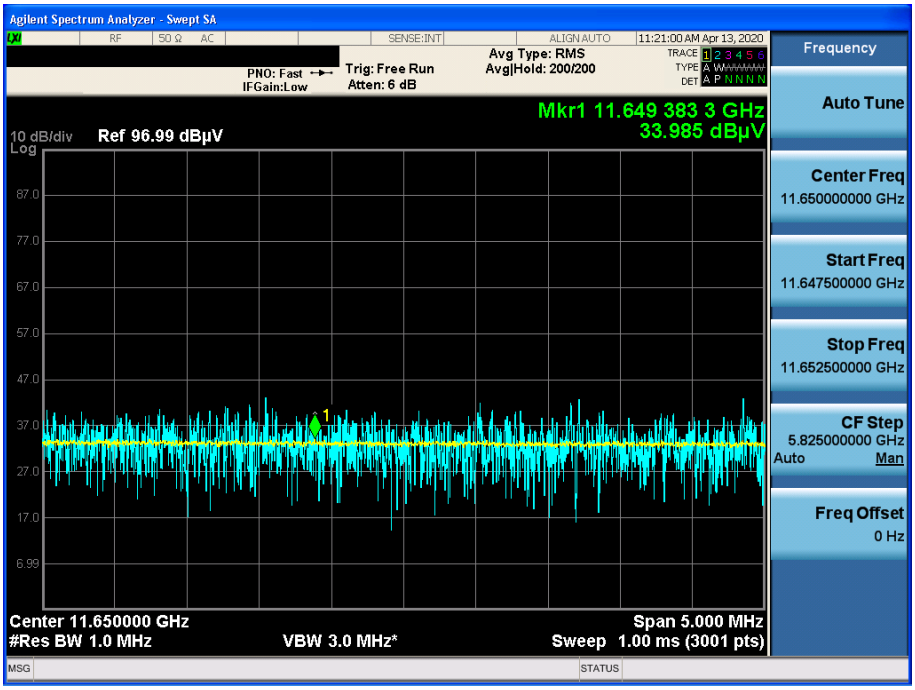
802.11a & U-NII 3 & Ch.149 & X axis & Ver **Detector Mode : PK**



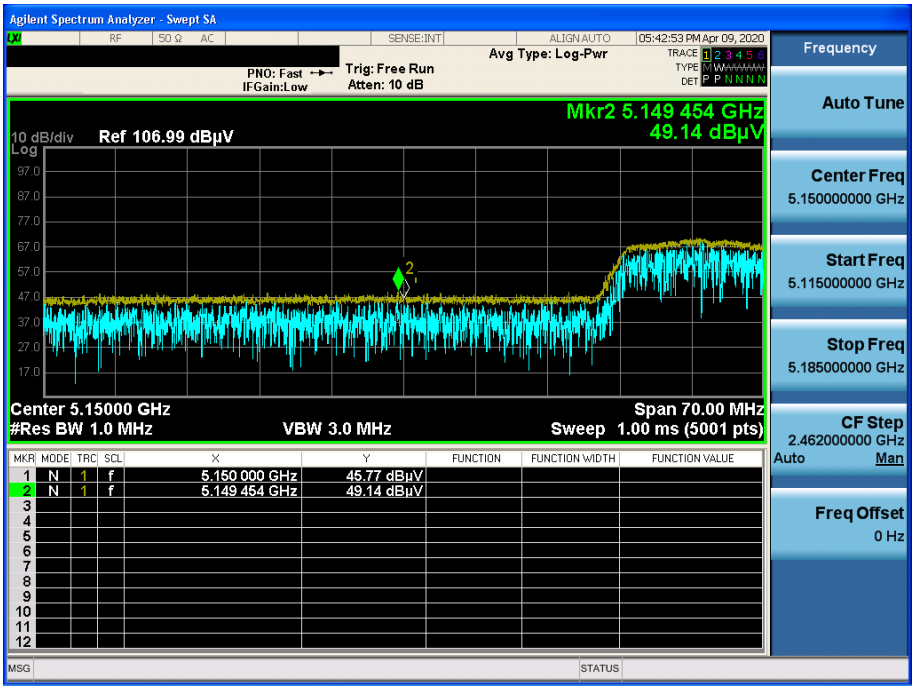
802.11a & U-NII 3 & Ch.165 & X axis & Ver **Detector Mode : PK**



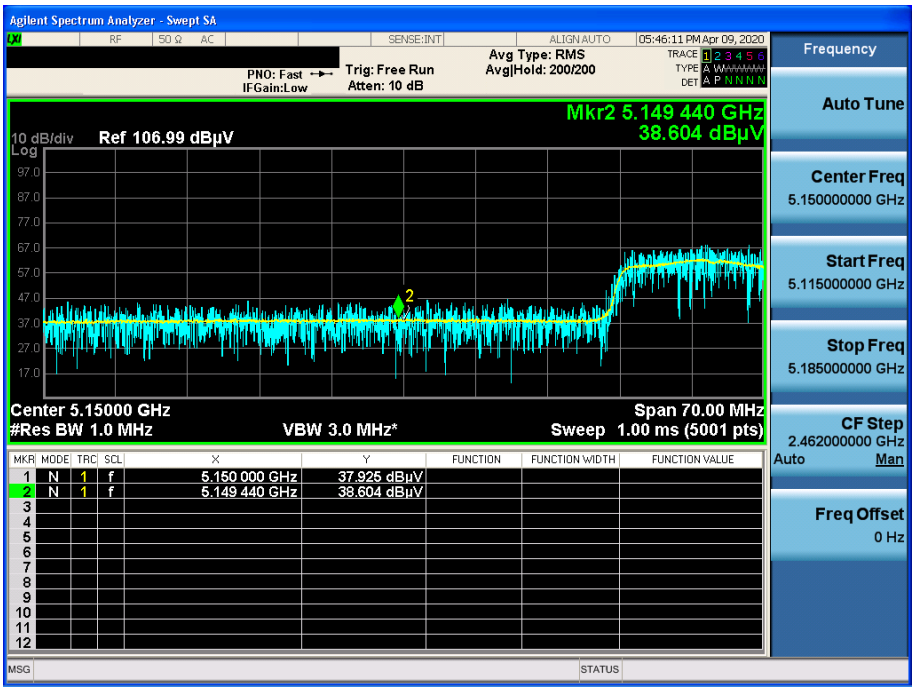
802.11a & U-NII 3 & Ch.165 & X axis & Hor **Detector Mode : AV**



802.11n(HT20) & U-NII 1 & Ch.36 & X axis & Ver Detector Mode : PK



802.11n(HT20) & U-NII 1 & Ch.36 & X axis & Ver Detector Mode : AV



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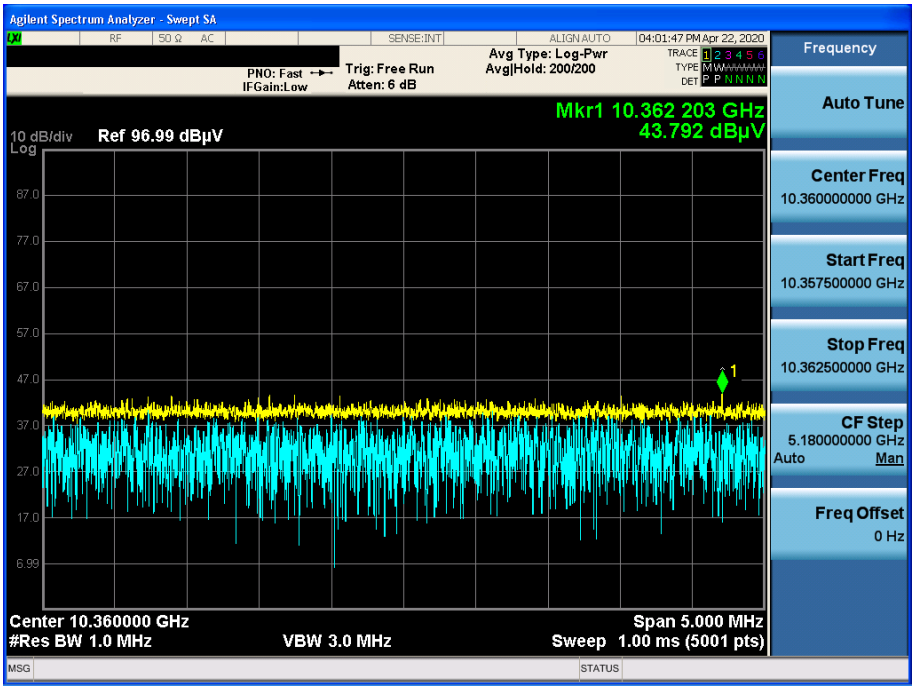
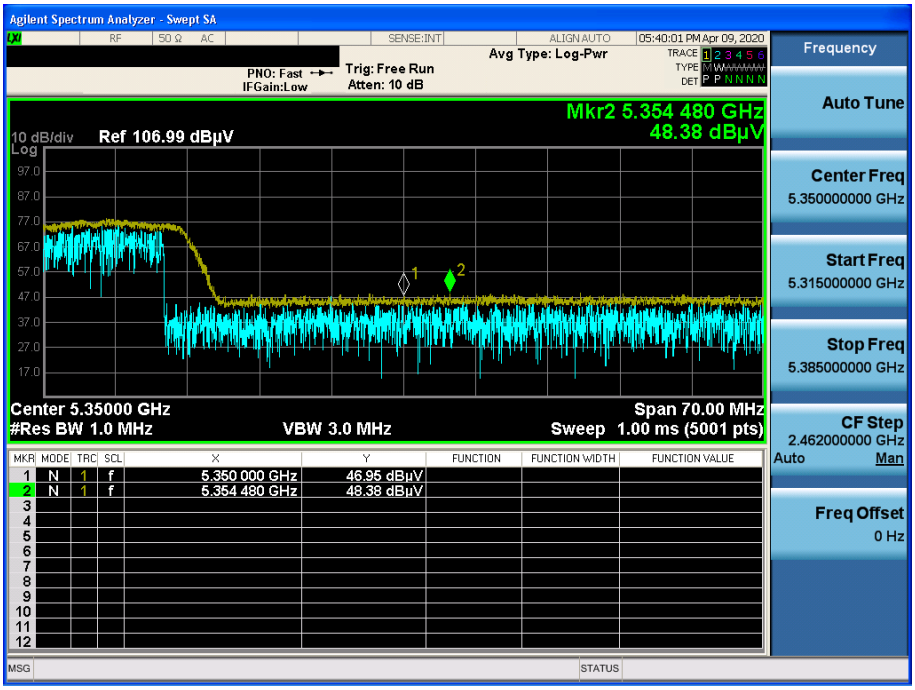


802.11n(HT20) & U-NII 2A & Ch.64 & X axis & Ver Detector Mode : PK



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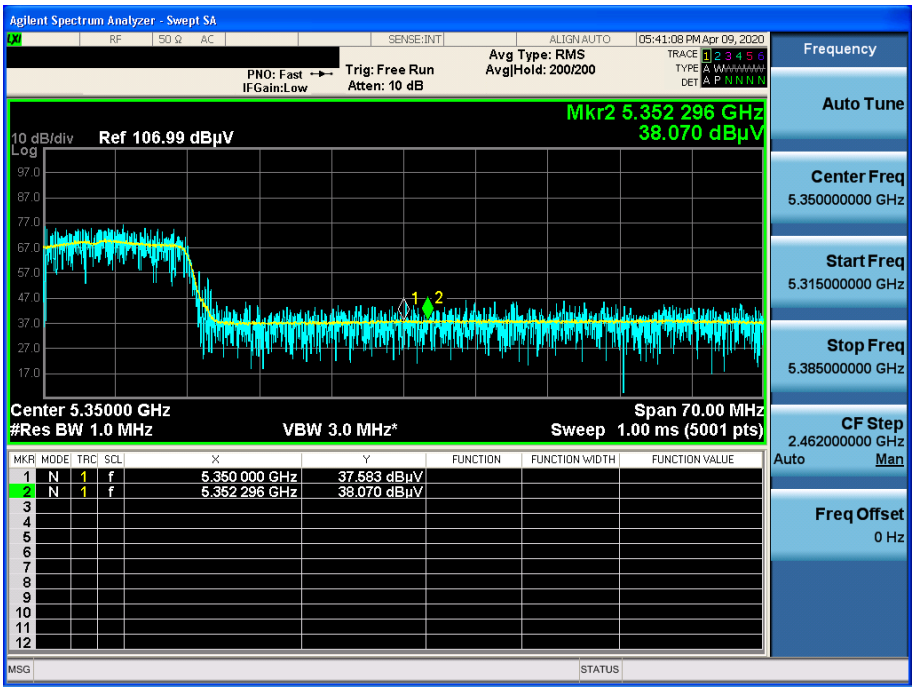
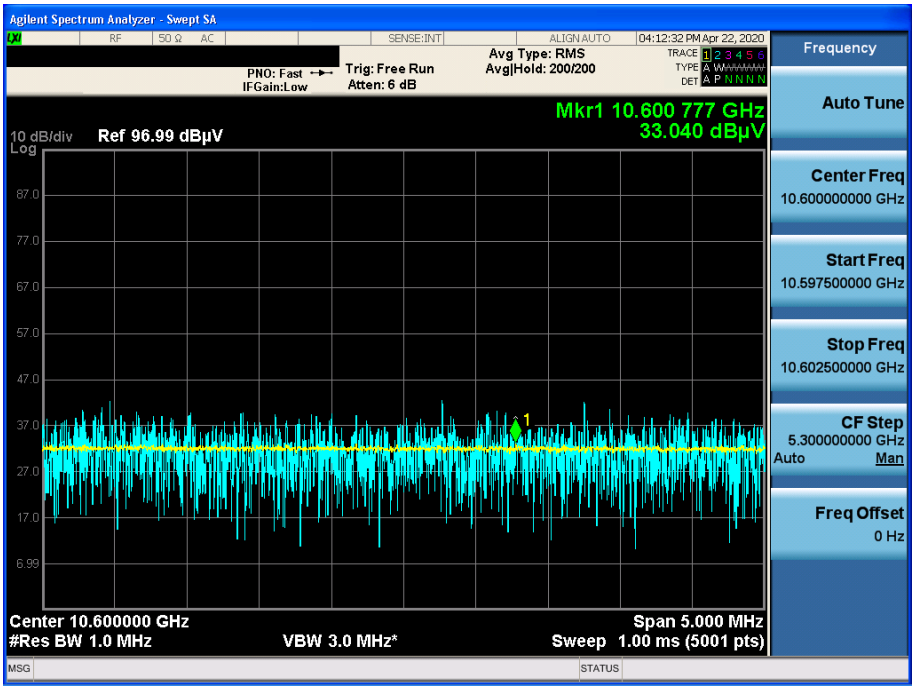
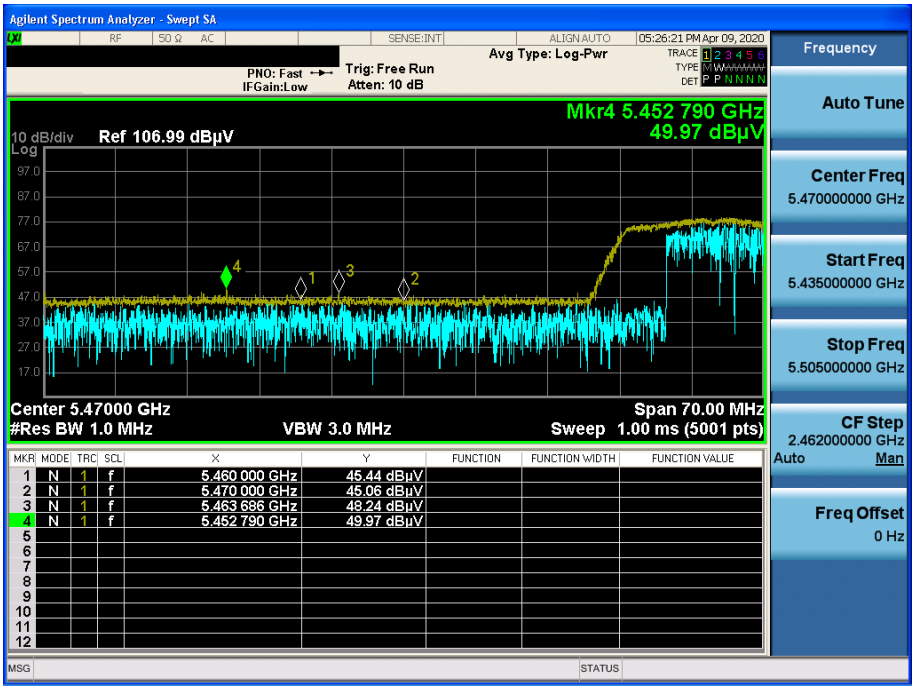


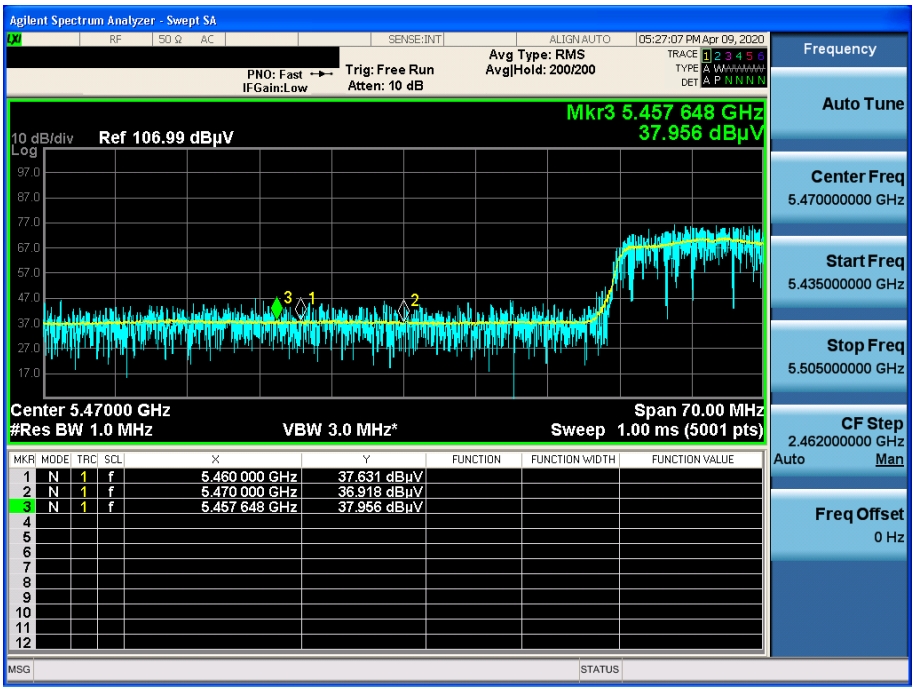
802.11n(HT20) & U-NII 2A & Ch.60 & X axis & Hor Detector Mode : AV



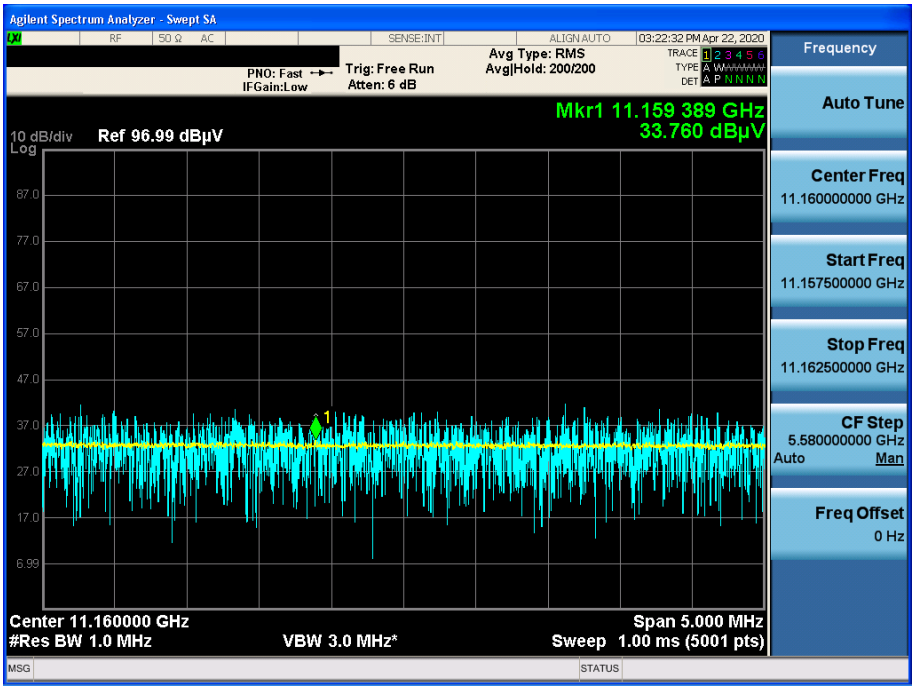
802.11n(HT20) & U-NII 2C & Ch.100 & X axis & Ver Detector Mode : PK



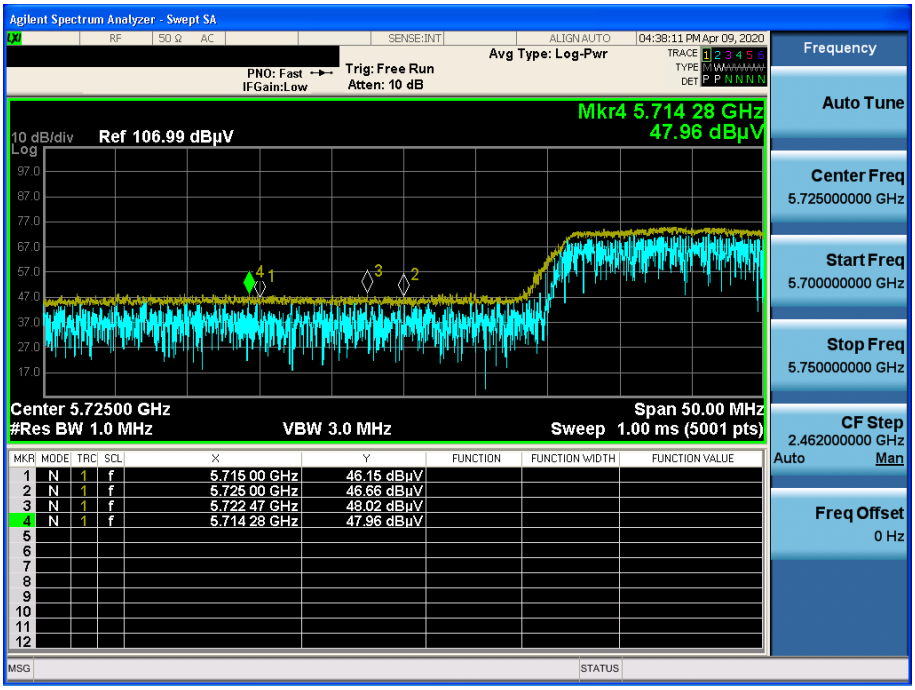
802.11n(HT20) & U-NII 2C & Ch.100 & X axis & Ver Detector Mode : AV



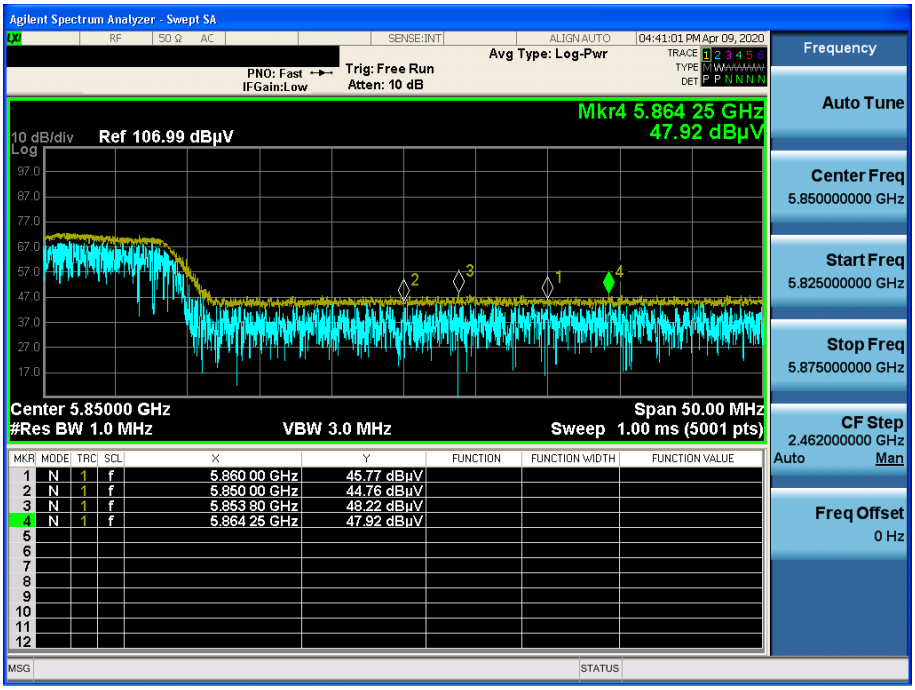
802.11n(HT20) & U-NII 2C & Ch.100 & X axis & Ver Detector Mode : AV



802.11n(HT20) & U-NII 3 & Ch.149 & X axis & Ver Detector Mode : PK



802.11n(HT20) & U-NII 3 & Ch.165 & X axis & Ver Detector Mode : PK



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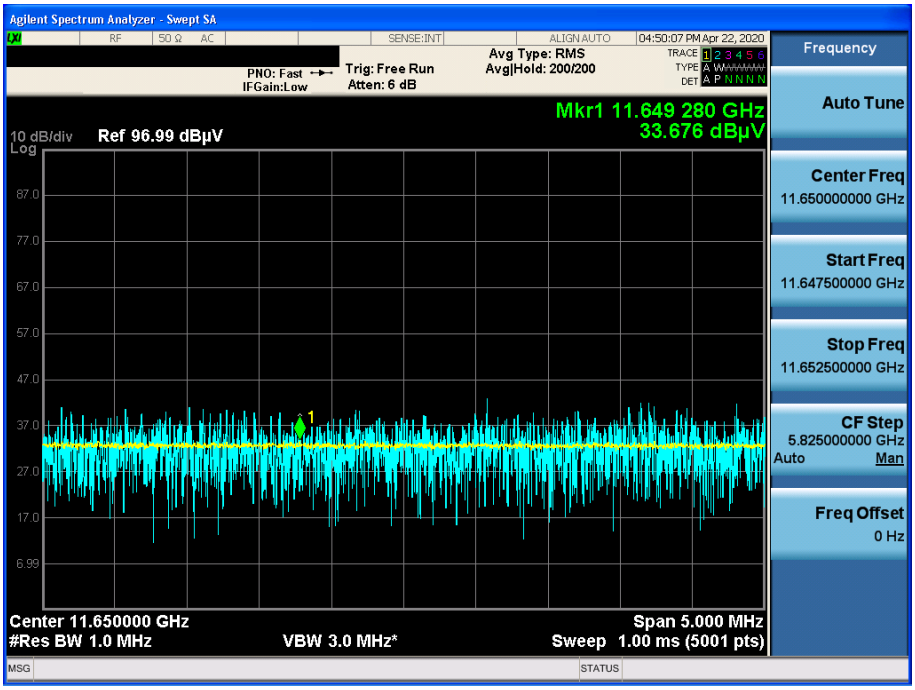
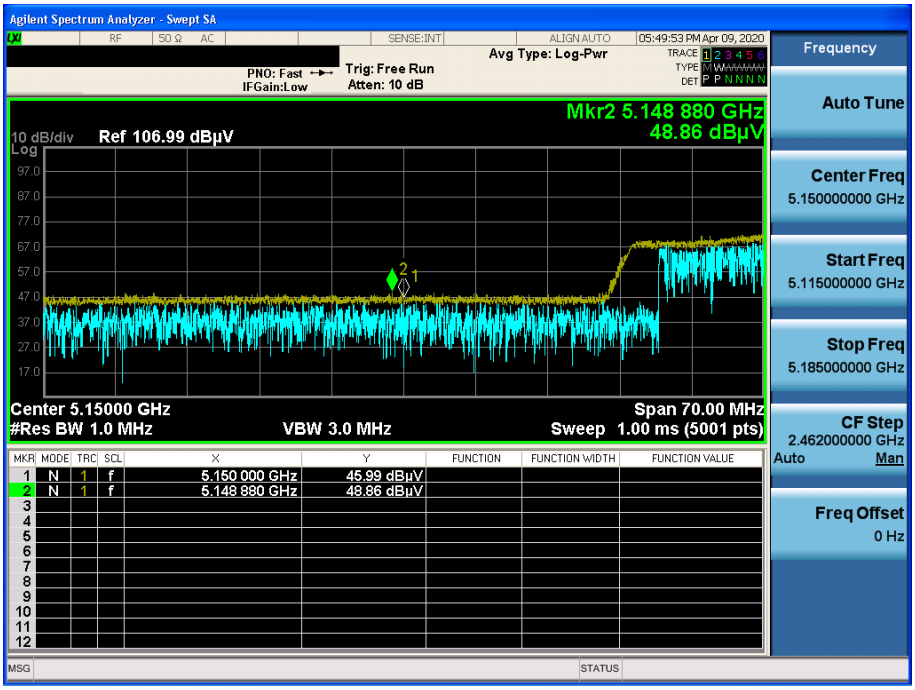
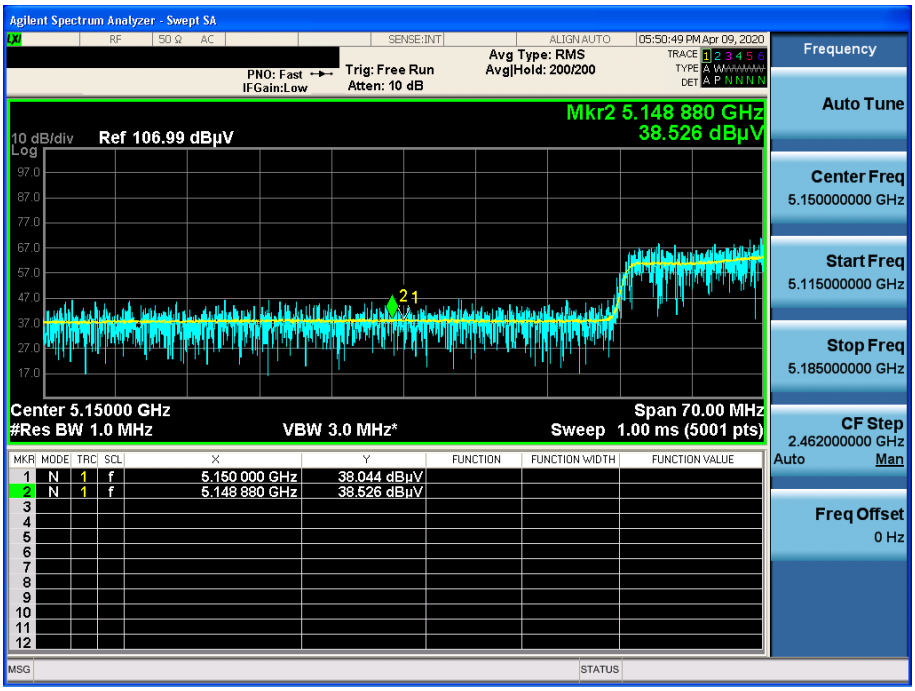


802.11n(HT40) & U-NII 1 & Ch.38 & X axis & Ver Detector Mode : PK



802.11n(HT40) & U-NII 1 & Ch.38 & X axis & Ver Detector Mode : AV



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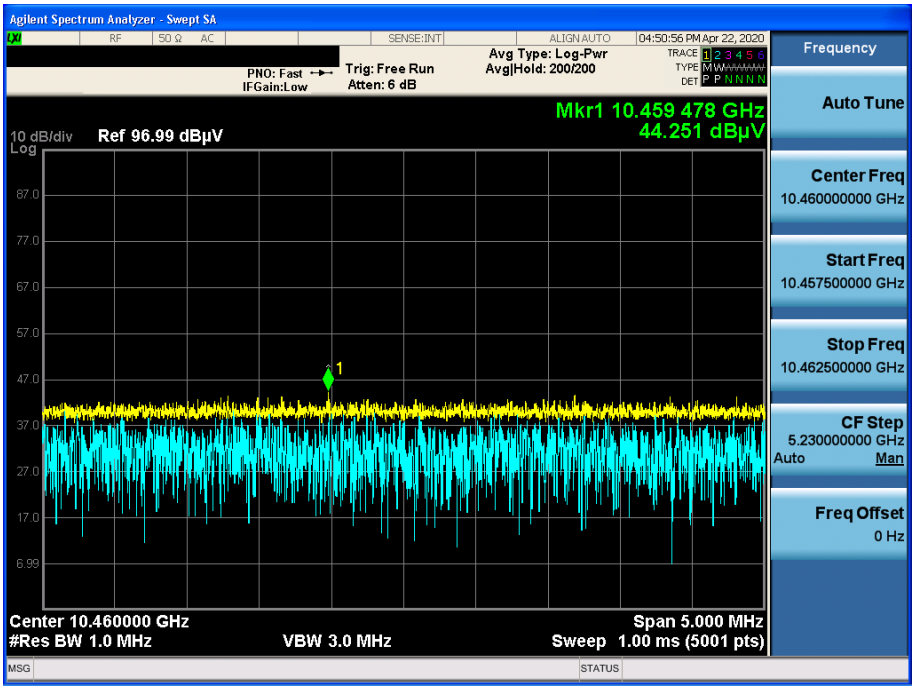
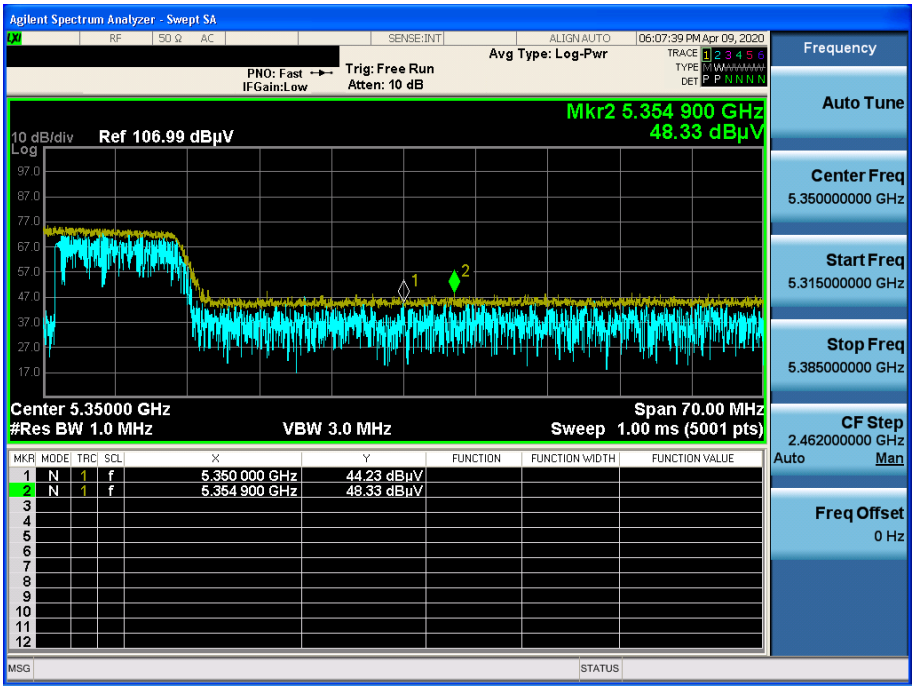
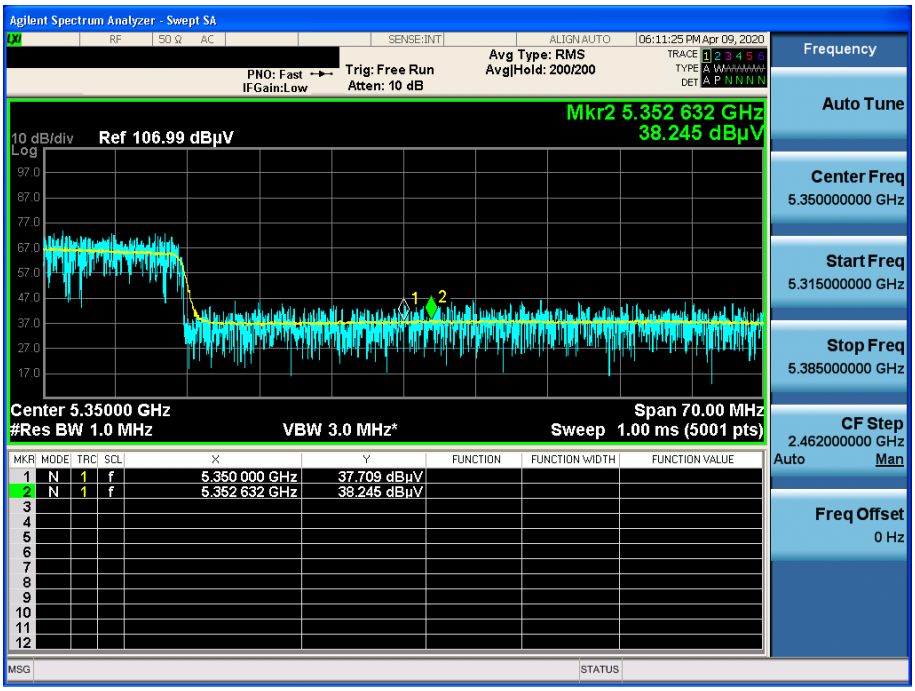


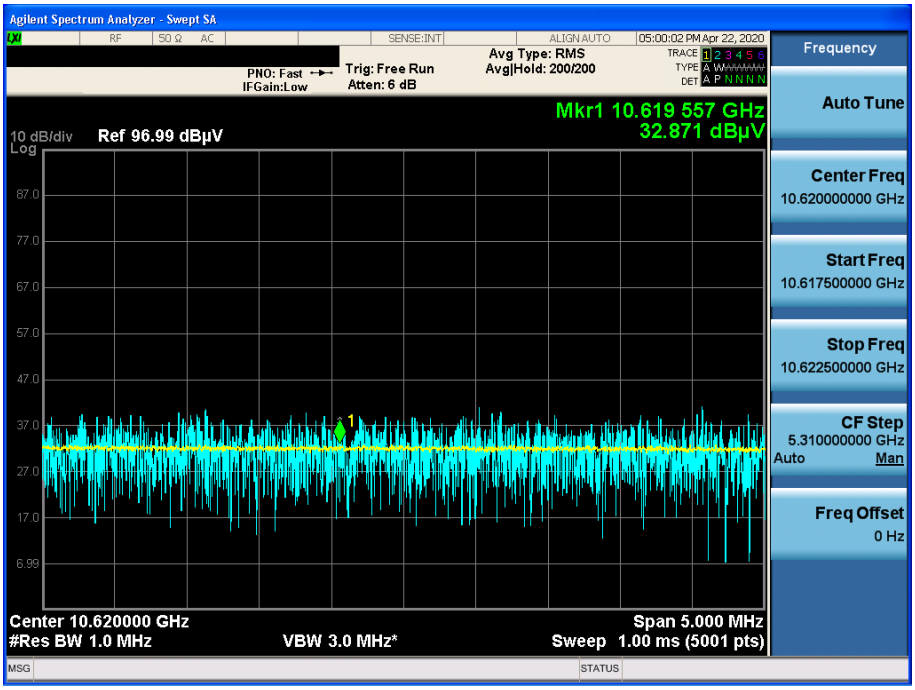
802.11n(HT40) & U-NII 2A & Ch.62 & X axis & Ver Detector Mode : PK



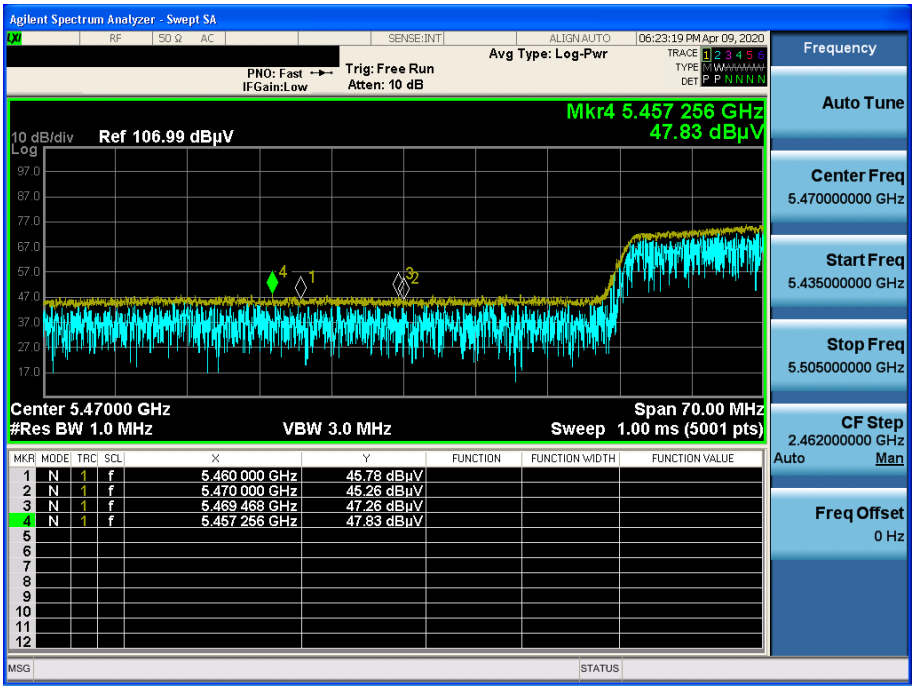
802.11n(HT40) & U-NII 2A & Ch.62 & X axis & Ver Detector Mode : AV



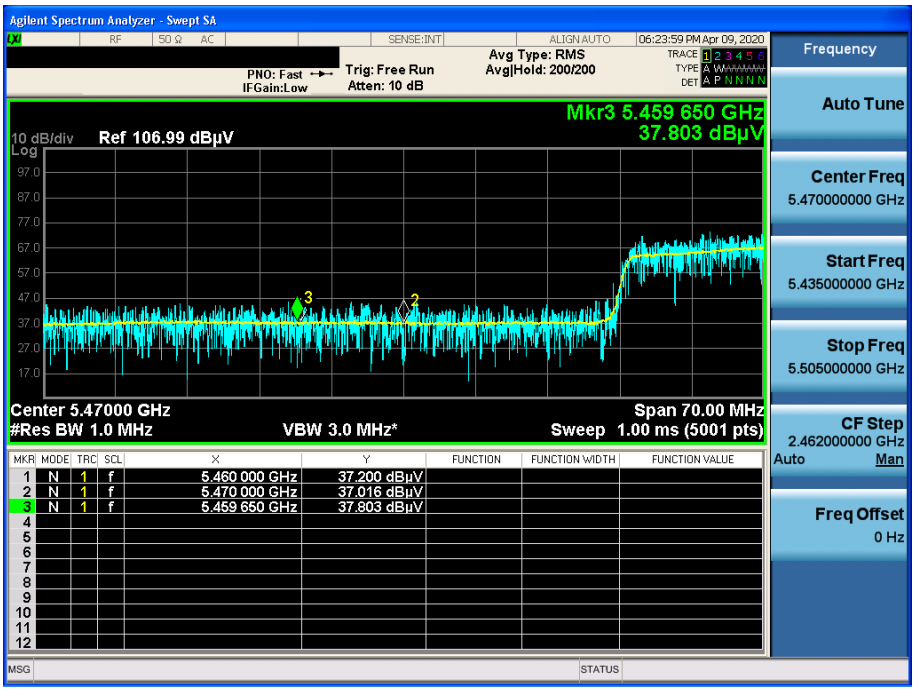
802.11n(HT40) & U-NII 2A & Ch.62 & X axis & Hor Detector Mode : AV



802.11n(HT40) & U-NII 2C & Ch.102 & X axis & Ver Detector Mode : PK



802.11n(HT40) & U-NII 2C & Ch.102 & X axis & Ver Detector Mode : AV



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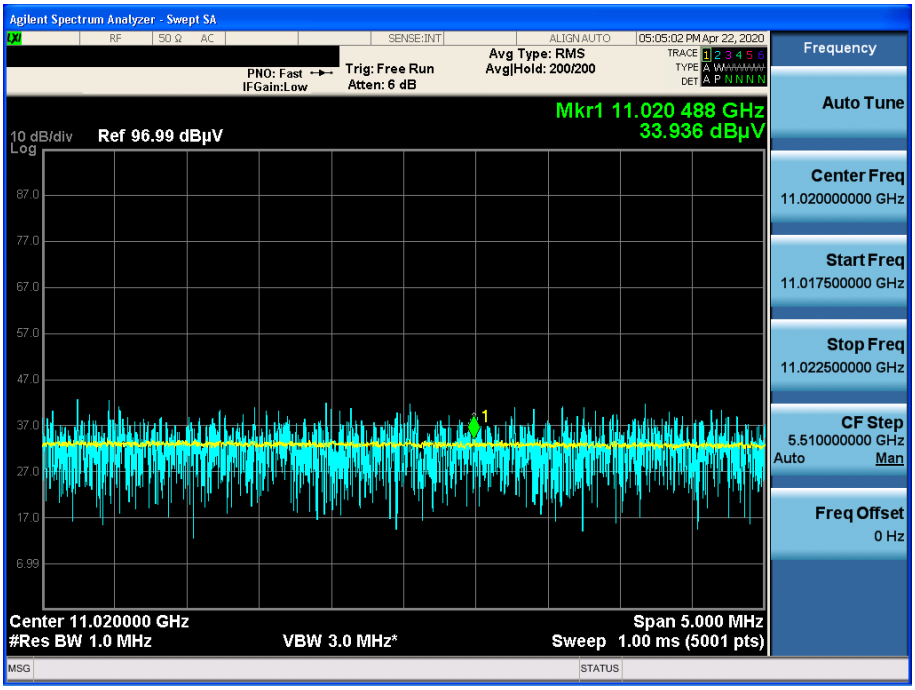
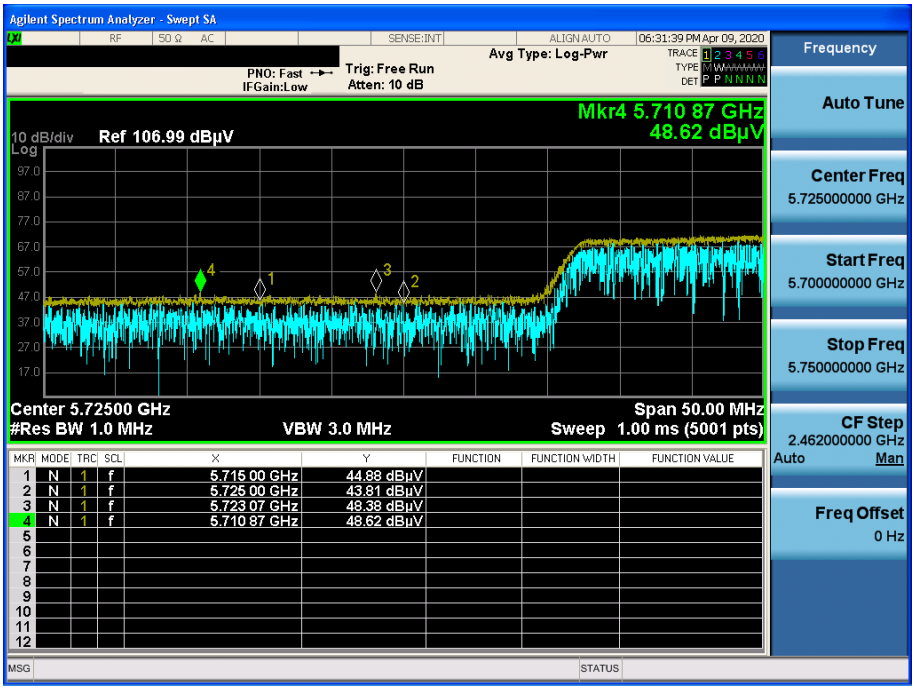
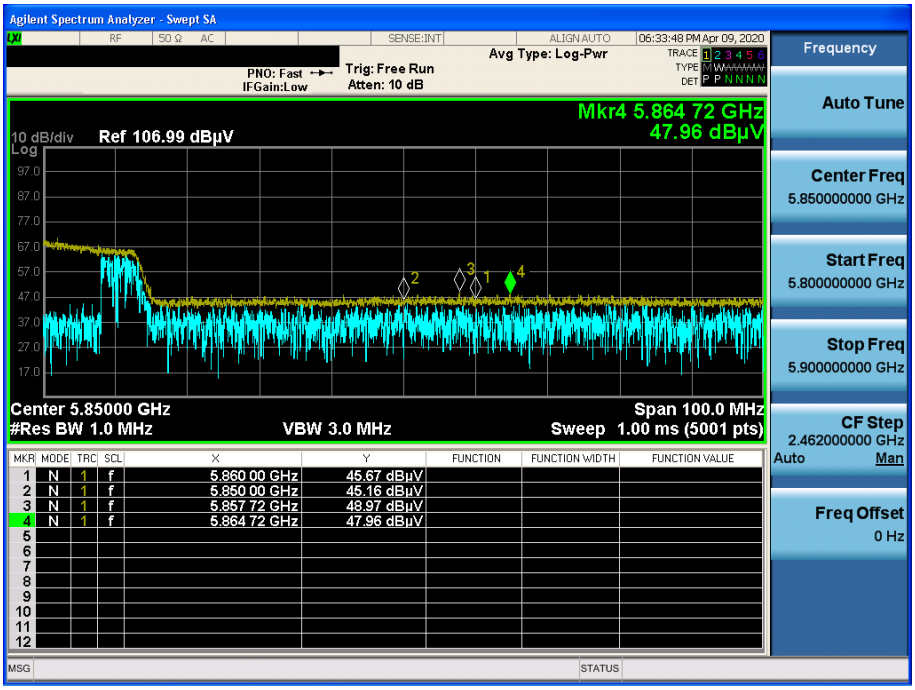


802.11n(HT40) & U-NII 3 & Ch.151 & X axis & Ver Detector Mode : PK



802.11n(HT40) & U-NII 3 & Ch.159 & X axis & Ver Detector Mode : PK



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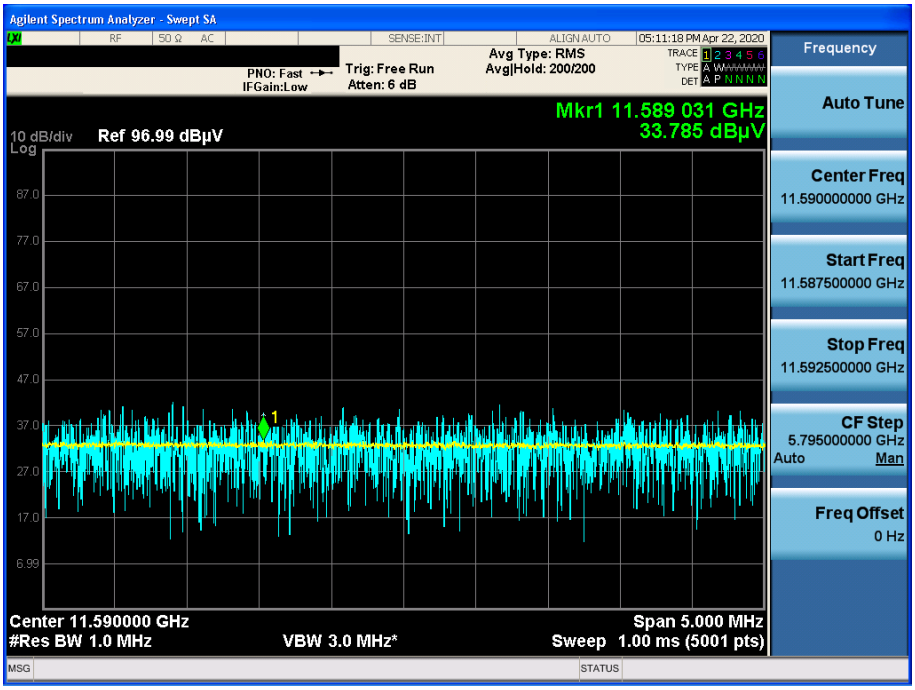
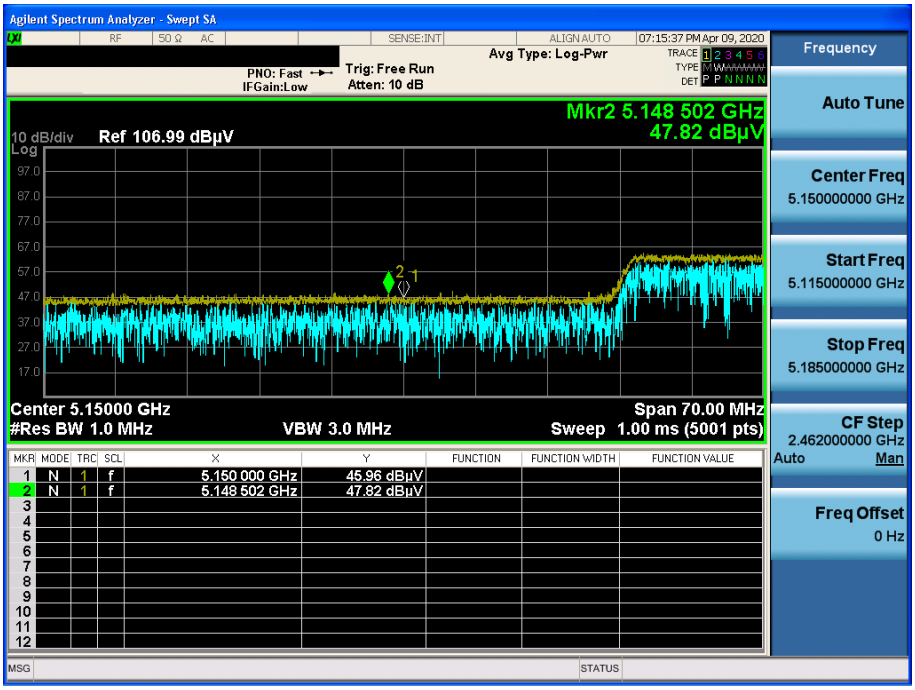
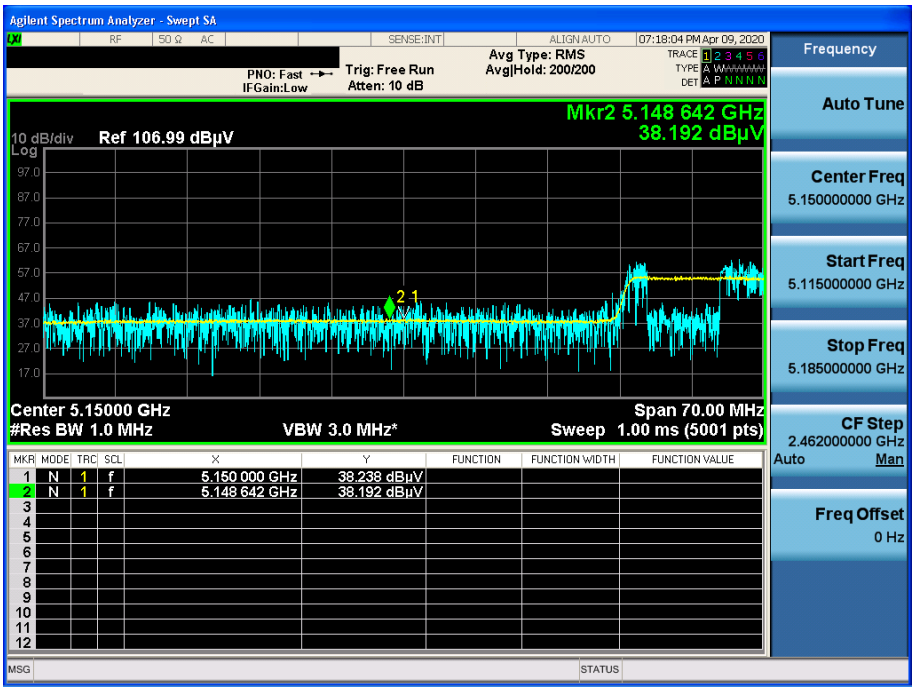


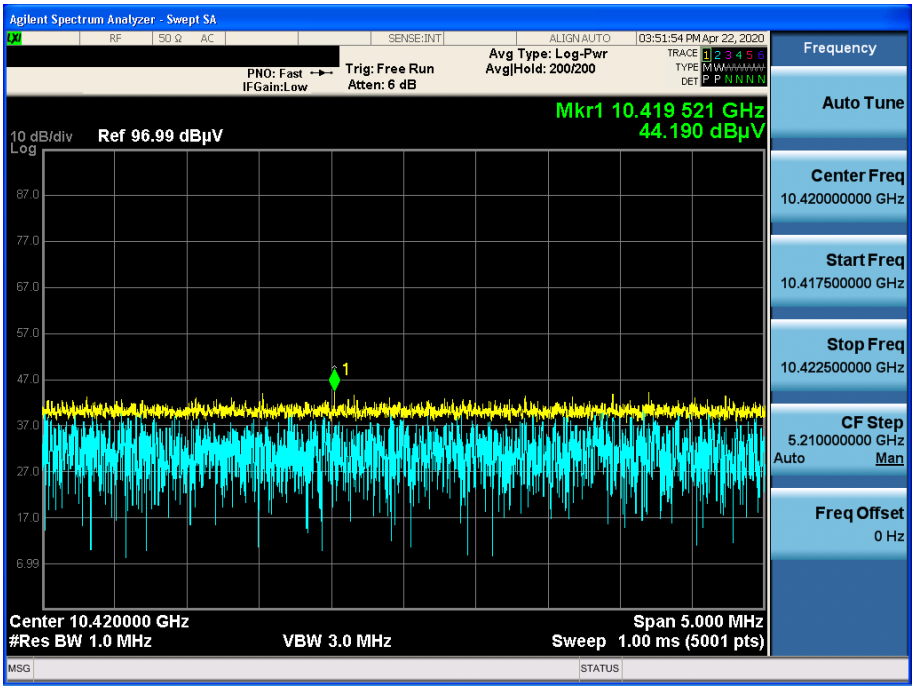
802.11ac(VHT80) & U-NII 1 & Ch.42 & X axis & Ver Detector Mode : PK



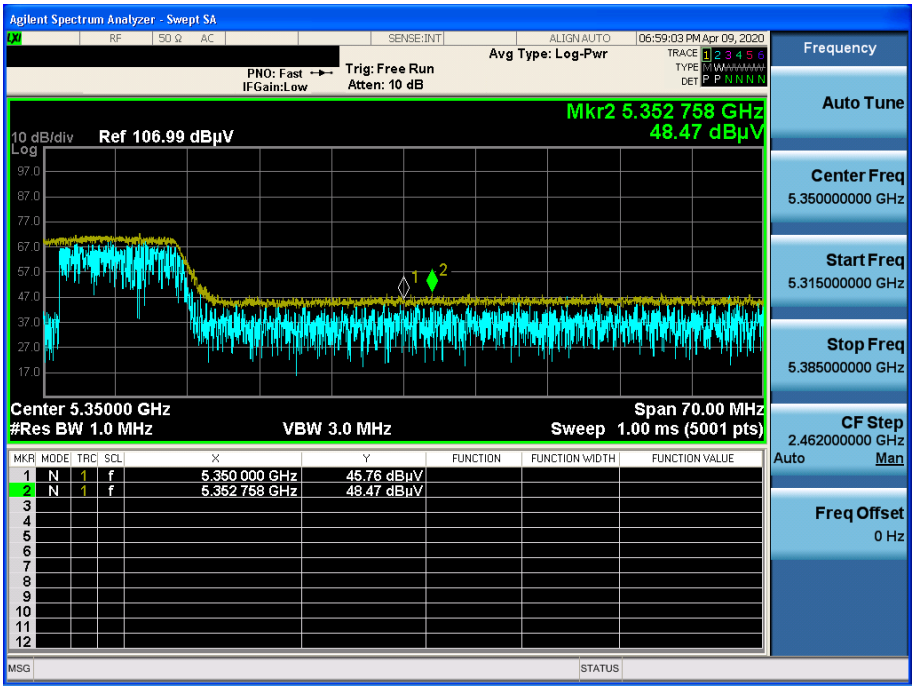
802.11ac(VHT80) & U-NII 1 & Ch.42 & X axis & Ver Detector Mode : AV



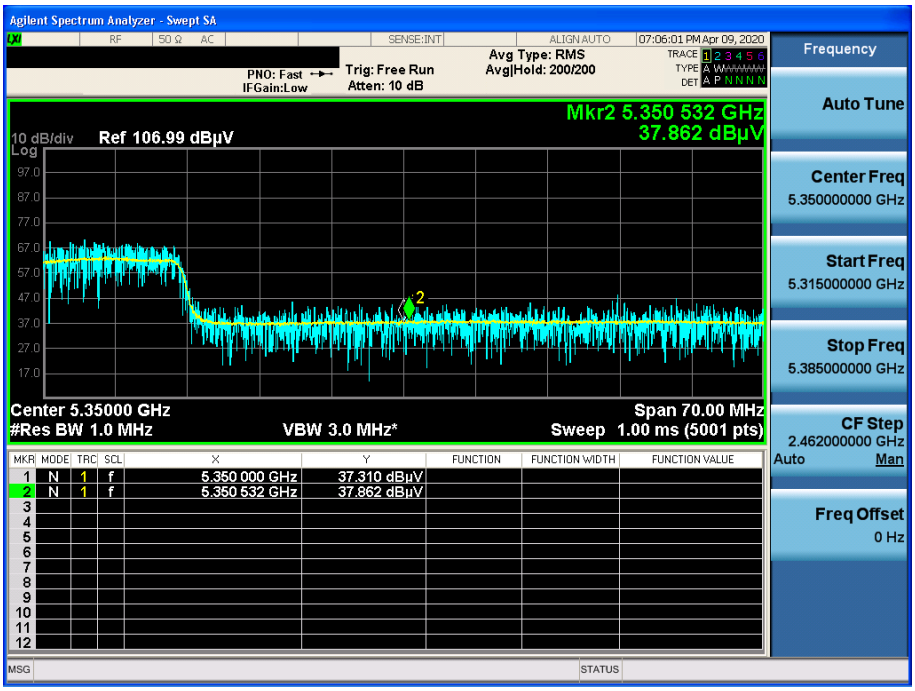
802.11ac(VHT80) & U-NII 1 & Ch.42 & X axis & Hor Detector Mode : PK



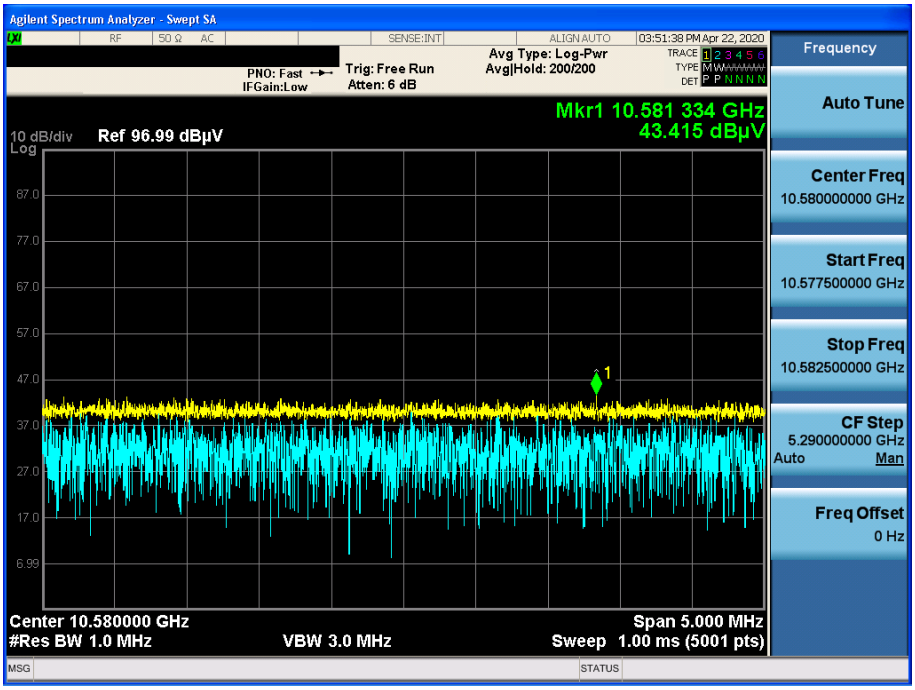
802.11ac(VHT80) & U-NII 2A & Ch.58 & X axis & Ver Detector Mode : PK



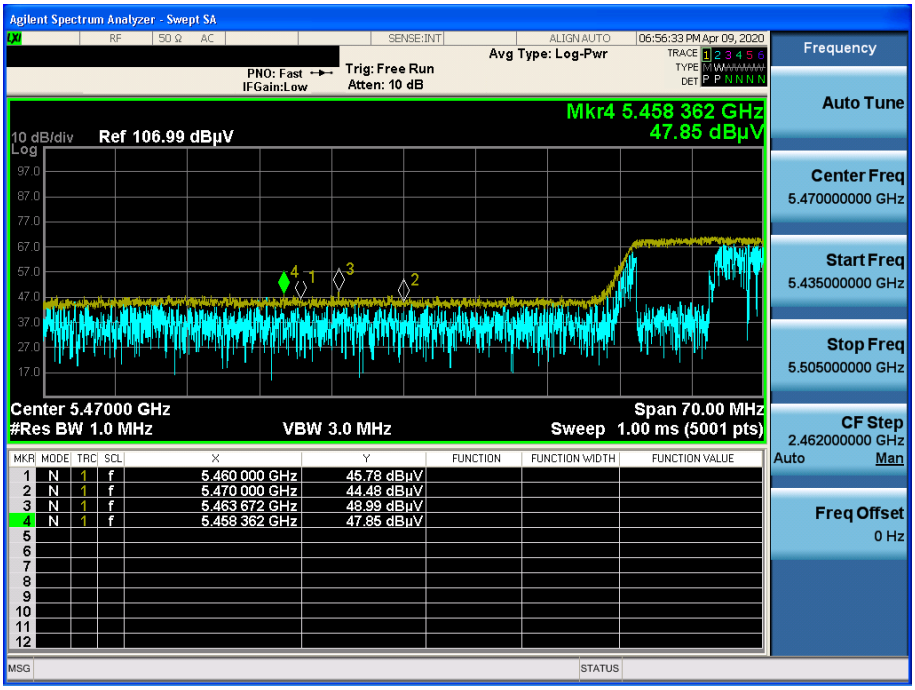
802.11ac(VHT80) & U-NII 2A & Ch.58 & X axis & Ver Detector Mode : AV



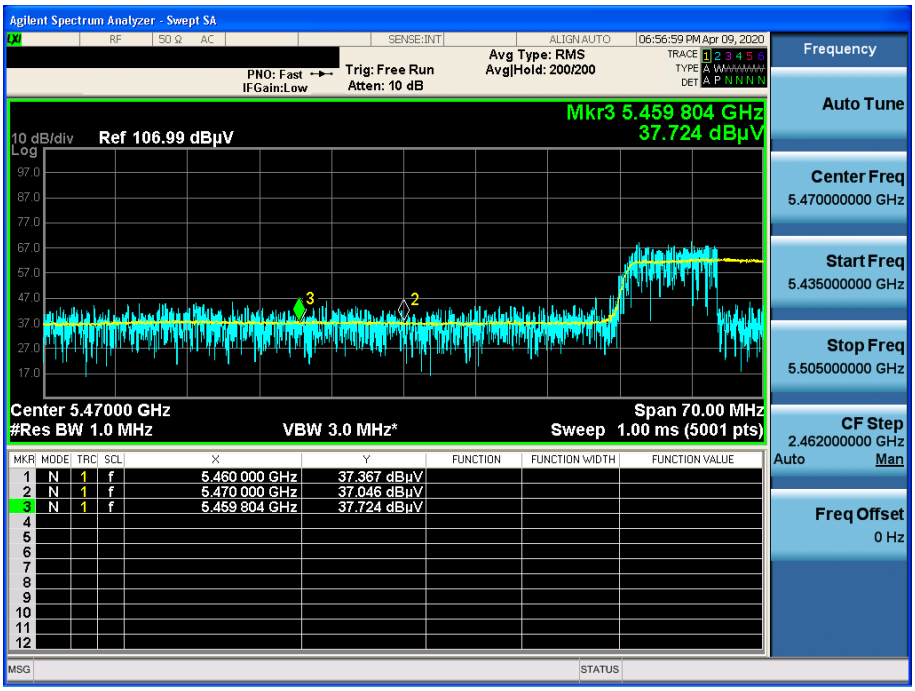
802.11ac(VHT80) & U-NII 2A & Ch.58 & X axis & Hor Detector Mode : PK



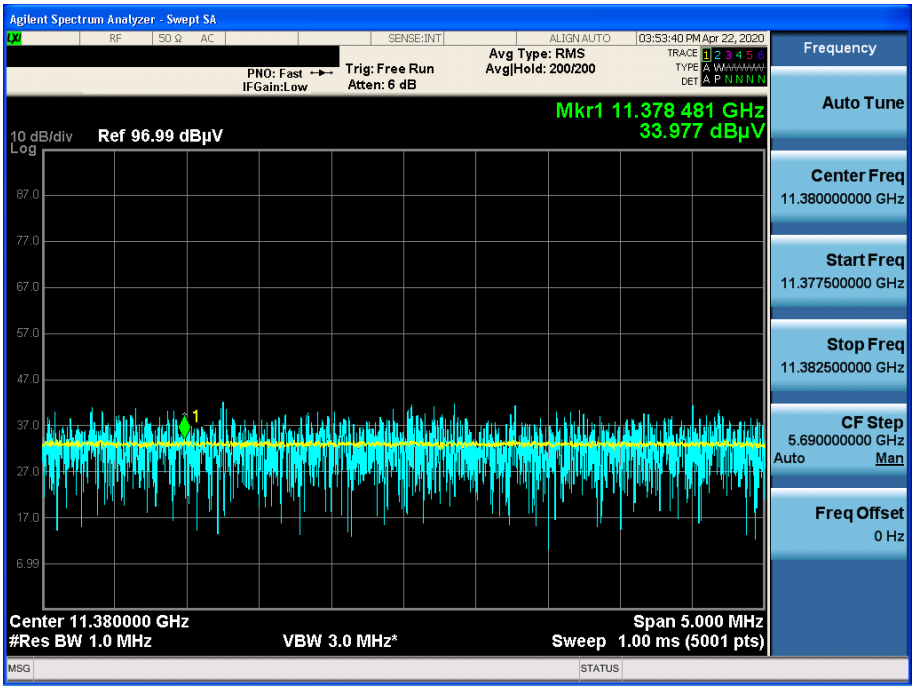
802.11ac(VHT80) & U-NII 2C & Ch.106 & X axis & Ver Detector Mode : PK



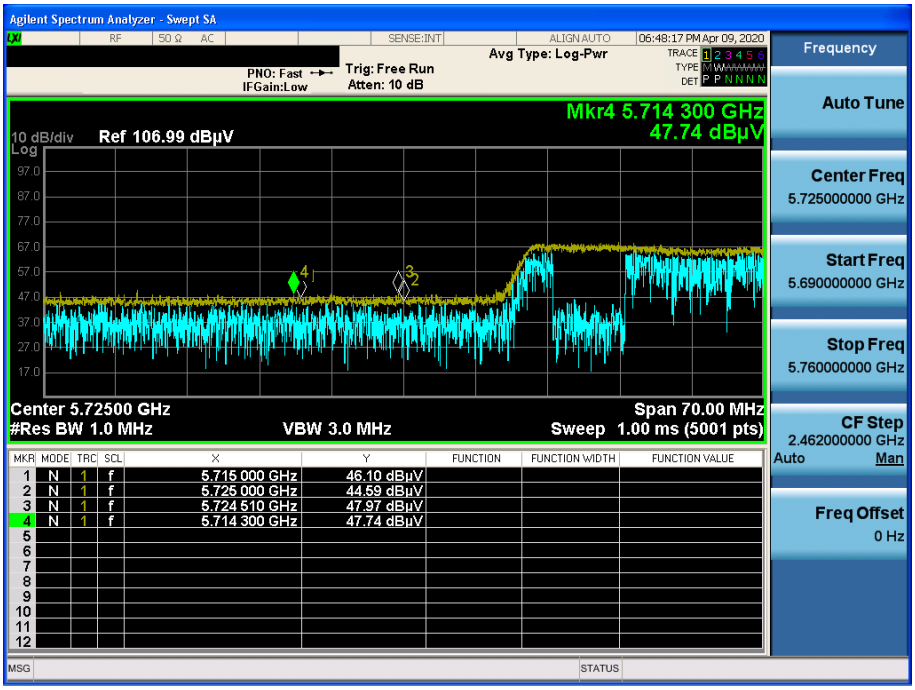
802.11ac(VHT80) & U-NII 2C & Ch.106 & X axis & Ver Detector Mode : AV



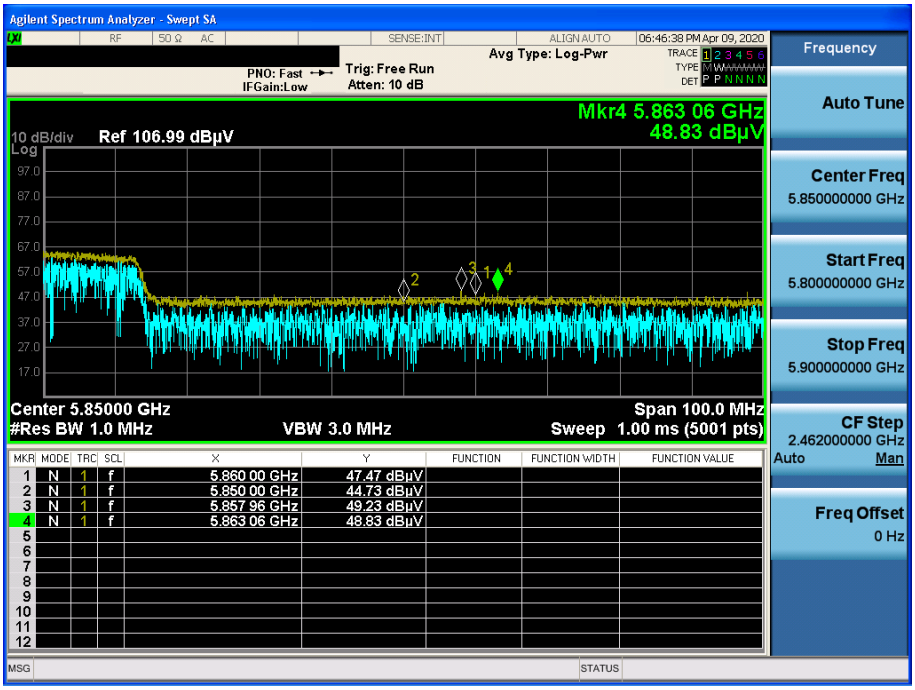
802.11ac(VHT80) & U-NII 2C & Ch.138 & X axis & Hor Detector Mode : AV



802.11ac(VHT80) & U-NII 3 & Ch.155 & X axis & Ver Detector Mode : PK



802.11ac(VHT80) & U-NII 3 & Ch.155 & X axis & Ver Detector Mode : PK



802.11ac(VHT80) & U-NII 3 & Ch.155 & X axis & Hor Detector Mode : AV