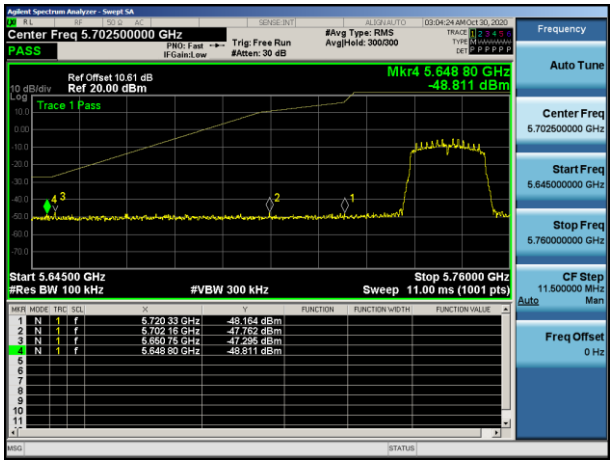
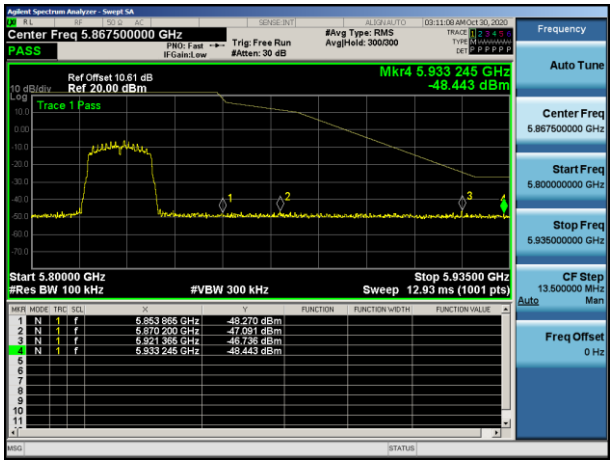
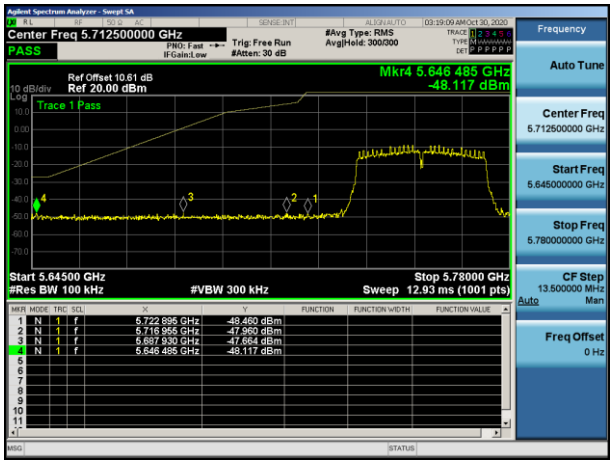
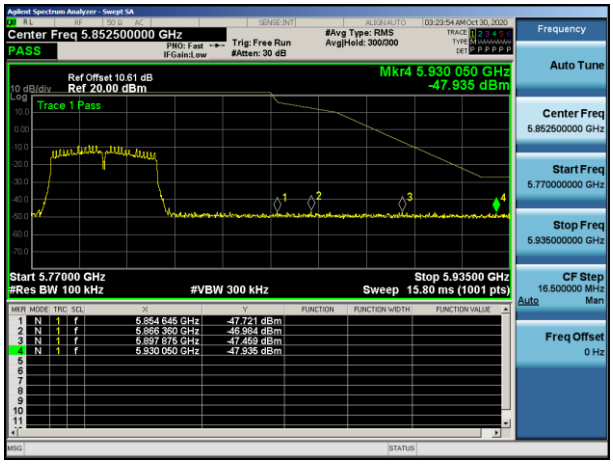
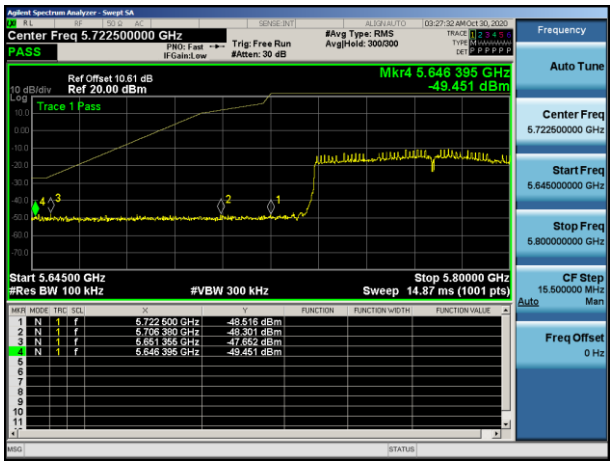
11ac20	
Band edge-Left	Band edge-Right
	

11ac40	
Band edge-Left	Band edge-Right
	

11ac80	
Band edge-Left	Band edge-Right
	

5.8 Power spectral density

5.8.1 Limit

For the band 5.15-5.25 GHz

For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.25-5.35 GHz and 5.47-5.725 GHz

The maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz

The maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.8.2 Test procedure

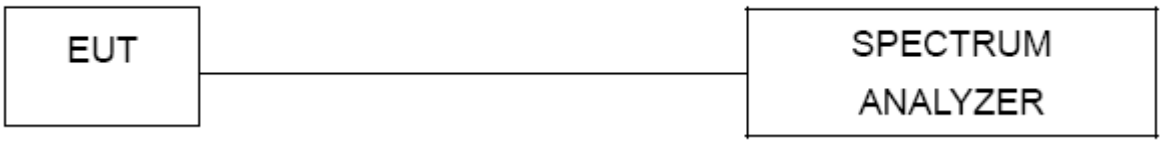
For U-NII-1

1. Set analyzer center frequency to NII channel center frequency.
2. Set the RBW ≥ 1MHz.
3. Set the VBW ≥ 3 x RBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

For U-NII-3

1. Set analyzer center frequency to NII channel center frequency.
2. Set the RBW ≥ 510kHz.
3. Set the VBW ≥ 3 x RBW.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum amplitude level.

5.8.3 Test setup



5.8.4 Test results

Note1: For FCC standard, if transmitting antennas of directional gain greater than 6 dBi are used, all band of the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note 2: Transmitting antennas of directional gain in U-NII-1 (5150 MHz to 5250 MHz) is 6.01 dBi

Formulas: Directional gain = G_{ANT} + Array Gain, Array Gain = 10 log(N_{ANT}/NSS) dB, NSS =1, G_{ANT} set equal to the gain of the antenna having the highest gain.

Note 3: The total PSD method used the sum spectra maxima across the outputs.

For U-NII-1

Mode	Channel	Frequency(MHz)	Measurement PSD (dBm/MHz)		Total PSD of antennas	Limit (dBm/MHz)	Result
			ANTA	ANTB			
11a	CH36	5180	7.474	4.463	/	11	Pass
11a	CH44	5220	6.055	4.616	/	11	Pass
11a	CH48	5240	8.309	4.426	/	11	Pass
11n(HT20)	CH36	5180	2.580	4.066	6.40	10.99	Pass
11n(HT20)	CH44	5220	3.161	3.063	6.12	10.99	Pass
11n(HT20)	CH48	5240	3.401	3.245	6.33	10.99	Pass
11n(HT40)	CH38	5190	-1.500	-1.306	1.61	10.99	Pass
11n(HT40)	CH46	5230	-1.010	-0.405	2.31	10.99	Pass
11ac(HT20)	CH36	5180	3.752	2.901	6.36	10.99	Pass
11ac (HT20)	CH40	5200	2.548	3.034	5.81	10.99	Pass
11ac (HT20)	CH48	5240	3.756	0.688	5.50	10.99	Pass
11ac (HT40)	CH38	5190	-0.356	-1.082	2.31	10.99	Pass
11ac (HT40)	CH46	5230	-0.711	-0.409	2.45	10.99	Pass
11ac (HT80)	CH46	5230	-3.082	-0.562	1.37	10.99	Pass

Note: if transmitting antennas of directional gain greater than 6 dBi are used, then the limit should be reduced.

Because the directional gain = 6.01dB > 6.0 dBi, the limit should be calculated as below:

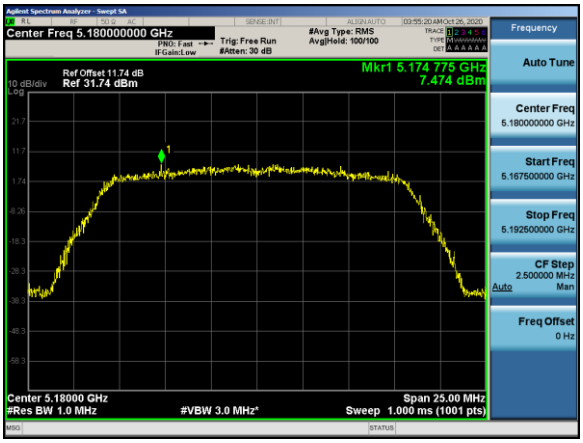
Limit = 11 dBm/3kHz - (ANT Gain + 10*Log(N=2) - 6dBi)

= 11 dBm/3kHz - (3 + 3.01 - 6) dBi = 10.99 dBm/3kHz

Test plots

For U-NII-1
ANT A

11a CH36

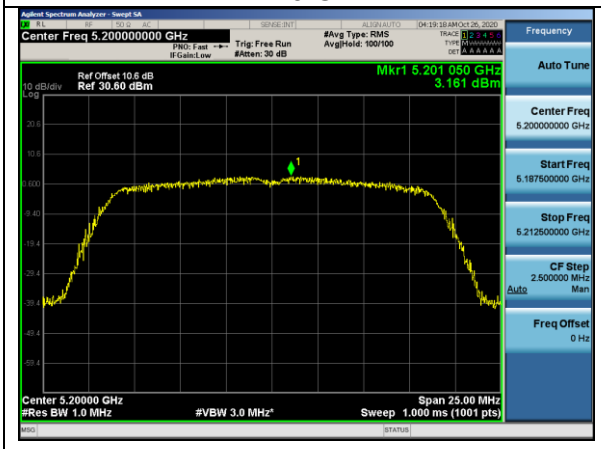


11a CH44

11a CH48

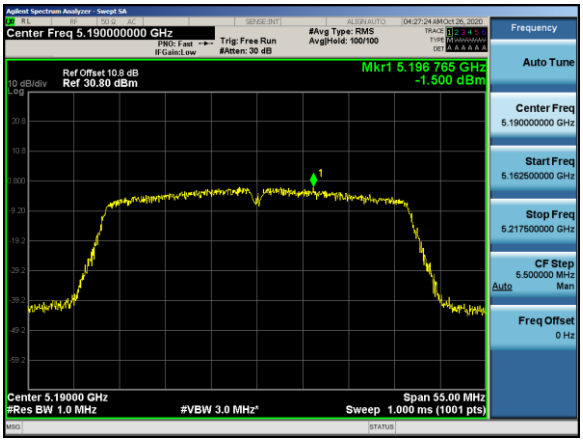
11n20 CH36

11n20 CH44



11n20 CH48

11n40 CH38

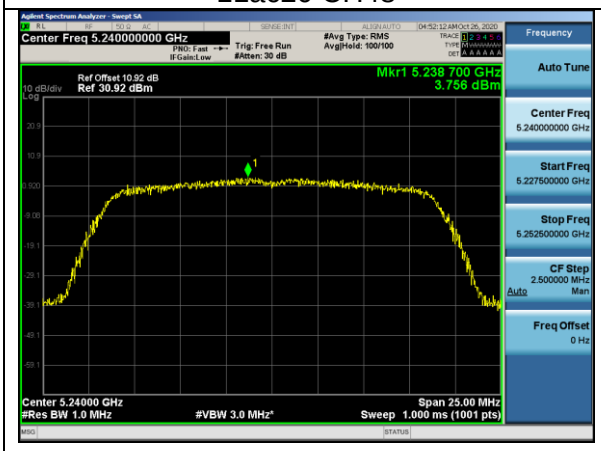


11n40 CH46

11ac20 CH36

11ac20 CH40

11ac20 CH48

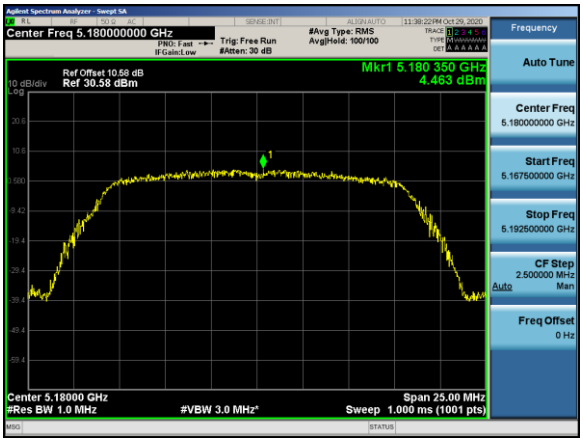


11ac40 CH38

11ac40 CH46	11ac80 CH46

ANT B

11a CH36

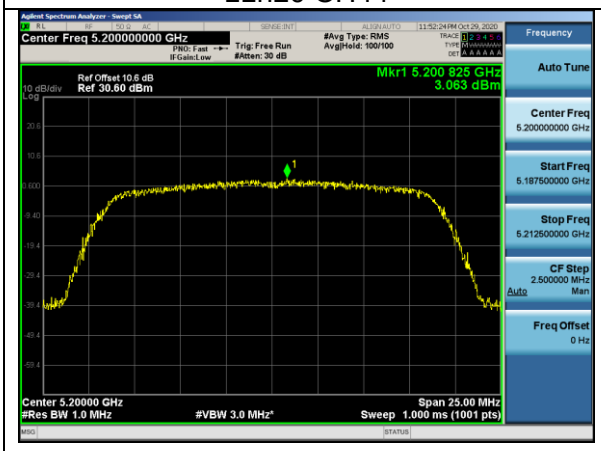


11a CH44

11a CH48

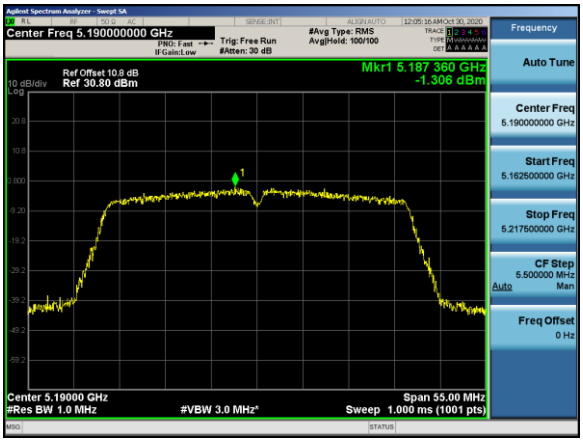
11n20 CH36

11n20 CH44

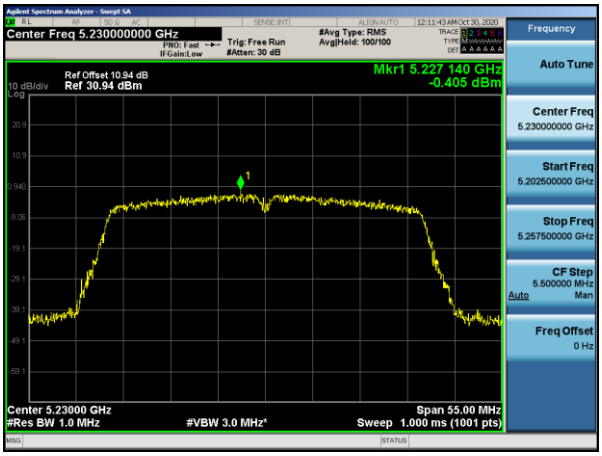


11n20 CH48

11n40 CH38



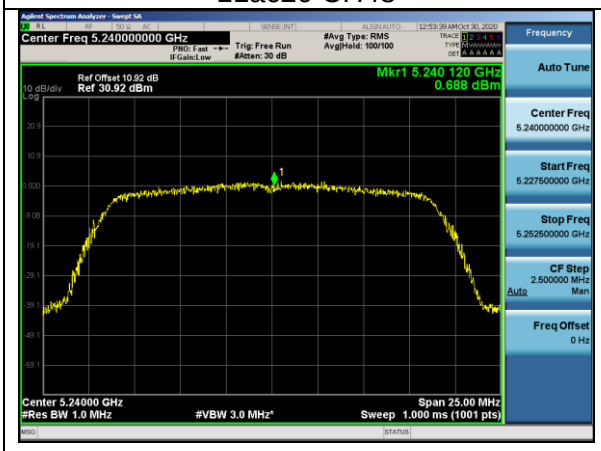
11n40 CH46



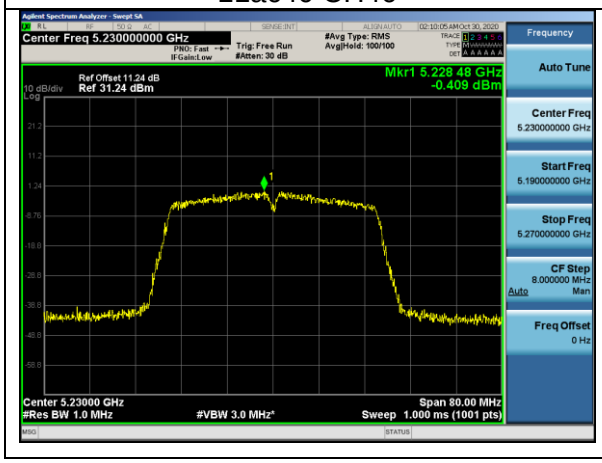
11ac20 CH36

11ac20 CH40

11ac20 CH48



11ac40 CH38

11ac40 CH46	11ac80 CH46
	

For U-NII-3

Mode	Channel	Frequency (MHz)	PSD (dBm/510kHz)		PSD (dBm/500kHz)		Total PSD of antennas	Limit (dBm/500kHz)	Result
			ANTA	ANTB	ANTA	ANTB			
11a	CH149	5745	2.648	4.827	1.804	2.979	/	30	Pass
11a	CH157	5785	0.420	4.233	1.080	2.598	/	30	Pass
11a	CH165	5825	3.034	3.490	1.972	2.190	/	30	Pass
11n20	CH149	5745	-2.399	-2.404	0.564	0.564	3.57	29.99	Pass
11n20	CH157	5785	-1.933	-3.007	0.628	0.491	3.57	29.99	Pass
11n20	CH165	5825	-3.042	-2.238	0.487	0.586	3.55	29.99	Pass
11n40	CH151	5755	-5.673	-4.891	0.266	0.318	3.30	29.99	Pass
11n40	CH159	5795	-5.328	-5.411	0.287	0.282	3.29	29.99	Pass
11ac20	CH149	5745	-1.955	-1.783	0.625	0.650	3.65	29.99	Pass
11ac20	CH157	5785	-2.343	-2.012	0.572	0.617	3.60	29.99	Pass
11ac20	CH165	5825	-2.321	-2.409	0.575	0.563	3.58	29.99	Pass
11ac40	CH151	5755	-4.293	-4.704	0.365	0.332	3.36	29.99	Pass
11ac40	CH159	5795	-4.045	-5.837	0.386	0.256	3.33	29.99	Pass
11ac80	CH159	5775	-7.089	-7.074	0.192	0.192	3.20	29.99	Pass
Note: If the measurement is X dBm/510kHz, thus X dBm/510kHz = $(10^{X/10})$*(500 / 510) dBm/500kHz									

Note: if transmitting antennas of directional gain greater than 6 dBi are used, then the limit should be reduced.
Because the directional gain = 6.01dB > 6.0 dBi, the limit should be calculated as below:
Limit = 30 dBm/500kHz - (ANT Gain + 10*Log(N=2) - 6dBi)
= 30 dBm/500kHz - (3 + 3.01 - 6) dBi = 29.99 dBm/3kHz

Test plots

For U-NII-3
ANT A

11a CH149

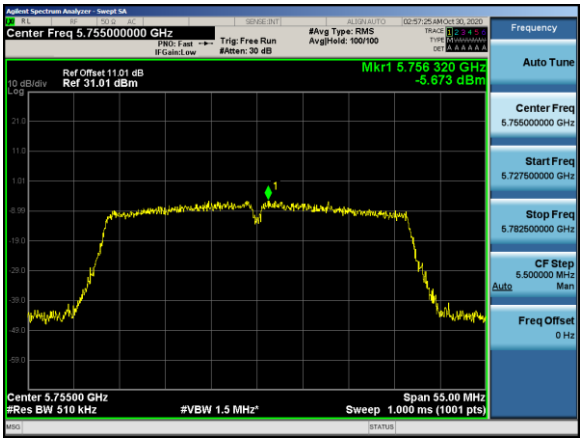
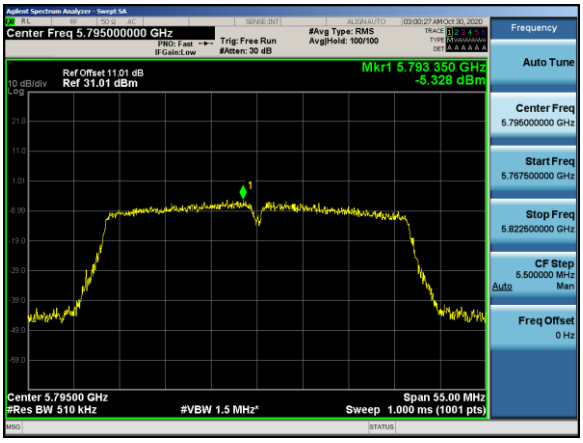
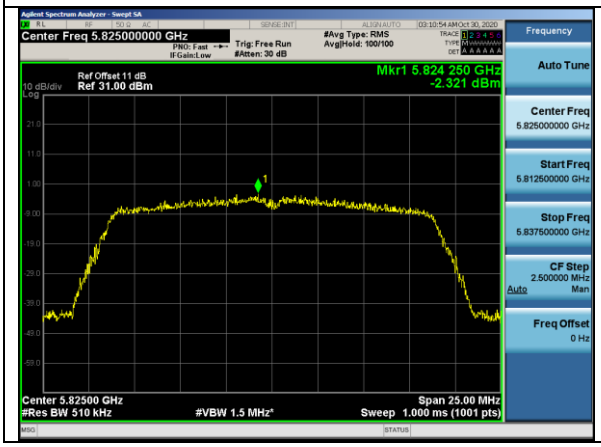
11a CH157

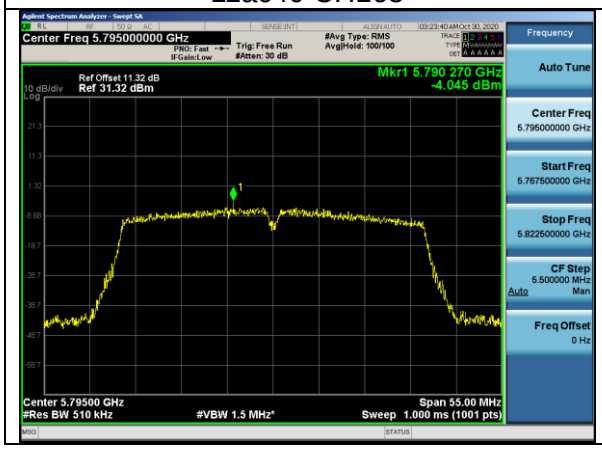
11a CH165

11n20 CH149

11n20 CH157

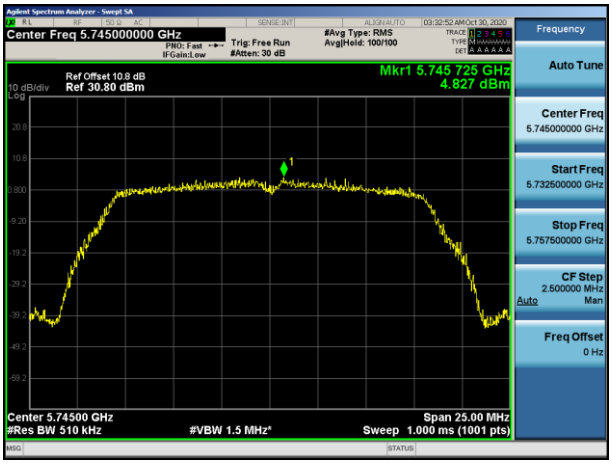
11n20 CH165

11n40 CH151	11n40 CH159
	
11ac20 CH149	11ac20 CH157
11ac20 CH165	11ac40 CH151
	

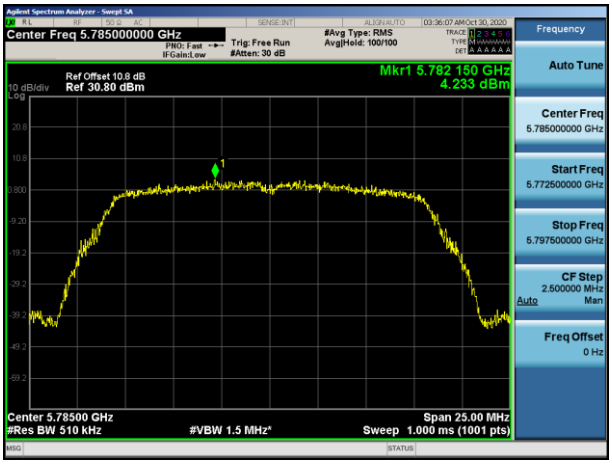
11ac40 CH165	11ac80 CH151
	

ANT B

11a CH149



11a CH157

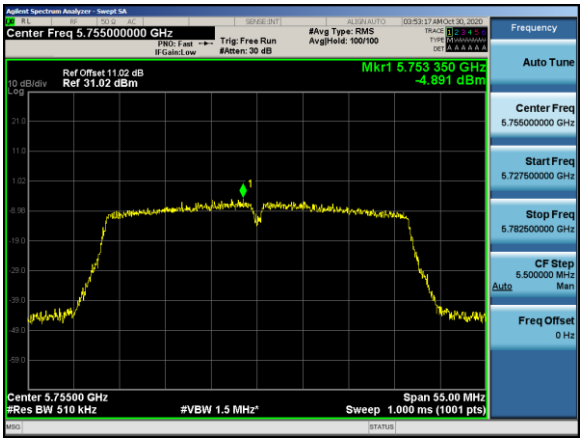
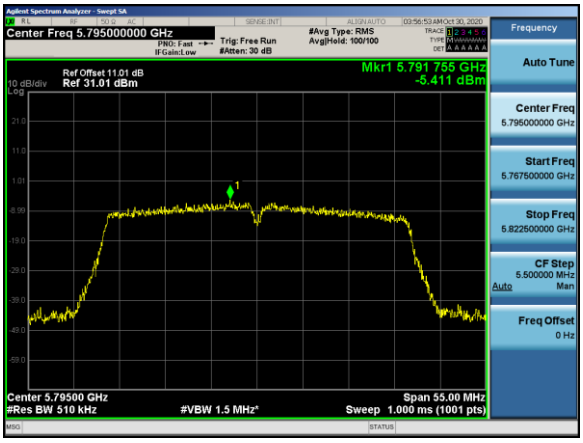
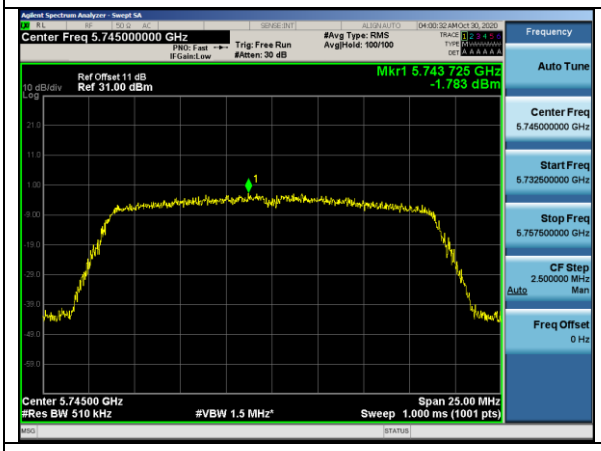


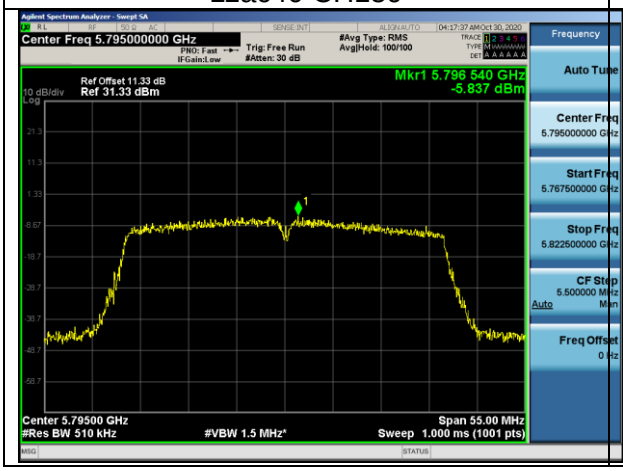
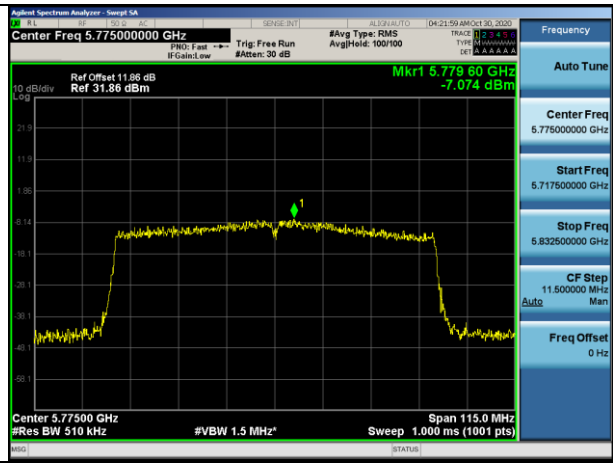
11a CH165

11n20 CH149

11n20 CH157

11n20 CH165

11n40 CH151	11n40 CH159
	
11ac20 CH149	**11ac20 CH157**
	
11ac20 CH165	**11ac40 CH151**

11ac40 CH159	11ac80 CH159
	

5.9 Frequency Stability Measurement

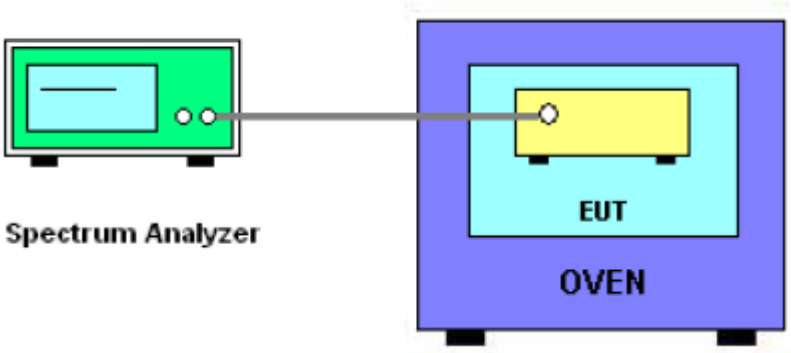
5.9.1 Limit

Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

5.9.2 Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyzer.
2. EUT have transmitted absence of modulation signal and fixed channelize.
3. Set the spectrum analyzer span to view the entire absence of modulation emissions bandwidth.
4. Set RBW = 10 kHz, VBW = 10 kHz with peak detector and max hold settings.
5. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 10_6 ppm and the limit is less than ±20ppm (IEEE 802.11nspecification).
6. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
7. Extreme temperature is -20°C~70°C.

5.9.3 Test Setup Layout



5.9.4 EUT Operation during Test

The EUT was programmed to be in continuously un-modulation transmitting mode.

5.9.5 TEST RESULTS

Note1: The antenna A and antenna B have been tested. The report only shows the worst antenna. The worst case is ANT A.

ANT A

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	5.00	5180.0142	5180	0.0142	-2.7413
		V max (V)	5.75	5180.0196	5180	0.0196	-3.7838
		V min (V)	4.25	5180.0113	5180	0.0113	-2.1815
Limits				within 5150-5250MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	5	T (°C)	-20	5180.0126	5180	0.0126	-2.4344
		T (°C)	-10	5180.0142	5180	0.0142	-2.7413
		T (°C)	0	5180.0116	5180	0.0116	-2.2394
		T (°C)	10	5180.0132	5180	0.0132	-2.5483
		T (°C)	20	5180.0126	5180	0.0126	-2.4324
		T (°C)	30	5180.0137	5180	0.0137	-2.6448
		T (°C)	40	5180.0120	5180	0.0120	-2.3166
		T (°C)	50	5180.0124	5180	0.0124	-2.3938
		T (°C)	60	5180.0141	5180	0.0141	-2.7220
		T (°C)	70	5180.0145	5180	0.0145	-2.7992
Limits				within 5150-5250MHz			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	5.00	5200.0124	5200	0.0124	-2.3846
		V max (V)	5.75	5200.0113	5200	0.0113	-2.1731
		V min (V)	4.25	5200.0124	5200	0.0124	-2.3846
Limits				within 5150-5250MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	5	T (°C)	-20	5200.0110	5200	0.0110	-2.1154
		T (°C)	-10	5200.0125	5200	0.0125	-2.4038
		T (°C)	0	5200.0134	5200	0.0134	-2.5769
		T (°C)	10	5200.0132	5200	0.0132	-2.5385
		T (°C)	20	5200.0147	5200	0.0147	-2.8269
		T (°C)	30	5200.0141	5200	0.0141	-2.7115
		T (°C)	40	5200.0140	5200	0.0140	-2.6923
		T (°C)	50	5200.0132	5200	0.0132	-2.5385
		T (°C)	60	5200.0129	5200	0.0129	-2.4808
		T (°C)	70	5200.0119	5200	0.0119	-2.2885
Limits				within 5150-5250MHz			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	5.00	5240.0124	5240	0.0124	-2.3664
		V max (V)	5.75	5240.0119	5240	0.0119	-2.2710
		V min (V)	4.25	5240.0134	5240	0.0134	-2.5573
Limits				within 5150-5250MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	5	T (°C)	-20	5240.0133	5240	0.0133	-2.5382
		T (°C)	-10	5240.0134	5240	0.0134	-2.5573
		T (°C)	0	5240.0117	5240	0.0117	-2.2328
		T (°C)	10	5240.0124	5240	0.0124	-2.3664
		T (°C)	20	5240.0142	5240	0.0142	-2.7099
		T (°C)	30	5240.0147	5240	0.0147	-2.8053
		T (°C)	40	5240.0121	5240	0.0121	-2.3092
		T (°C)	50	5240.0116	5240	0.0116	-2.2137
		T (°C)	60	5240.0131	5240	0.0131	-2.5000
		T (°C)	70	5240.0129	5240	0.0129	-2.4618
Limits				within 5150-5250MHz			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	5.00	5745.00706	5745	0.00706	-1.2283
		V max (V)	5.75	5745.00740	5745	0.00740	-1.2885
		V min (V)	4.25	5745.00140	5745	0.00140	-0.2439
Limits				within 5725-5850MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	5	T (°C)	-20	5745.00936	5745	0.00936	-1.6294
		T (°C)	-10	5745.00899	5745	0.00899	-1.5656
		T (°C)	0	5745.01025	5745	0.01025	-1.7837
		T (°C)	10	5745.00708	5745	0.00708	-1.2315
		T (°C)	20	5745.00793	5745	0.00793	-1.3806
		T (°C)	30	5745.00951	5745	0.00951	-1.6546
		T (°C)	40	5745.00039	5745	0.00039	-0.0686
		T (°C)	50	5745.00713	5745	0.00713	-1.2402
		T (°C)	60	5745.00774	5745	0.00774	-1.3474
		T (°C)	70	5745.00706	5745	0.00706	-1.2295
Limits				within 5725-5850MHz			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	5.00	5785.00053	5785	0.00053	-0.0917
		V max (V)	5.75	5785.00576	5785	0.00576	-0.9964
		V min (V)	4.25	5785.00755	5785	0.00755	-1.3058
Limits				within 5725-5850MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	5	T (°C)	-20	5785.00169	5785	0.00169	-0.2915
		T (°C)	-10	5785.00196	5785	0.00196	-0.3380
		T (°C)	0	5785.00649	5785	0.00649	-1.1216
		T (°C)	10	5785.01174	5785	0.01174	-2.0287
		T (°C)	20	5785.00186	5785	0.00186	-0.3223
		T (°C)	30	5785.00625	5785	0.00625	-1.0809
		T (°C)	40	5785.00957	5785	0.00957	-1.6543
		T (°C)	50	5785.01349	5785	0.01349	-2.3316
		T (°C)	60	5785.00882	5785	0.00882	-1.5246
		T (°C)	70	5785.00867	5785	0.00867	-1.4985
Limits				within 5725-5850MHz			
Result				Complies			

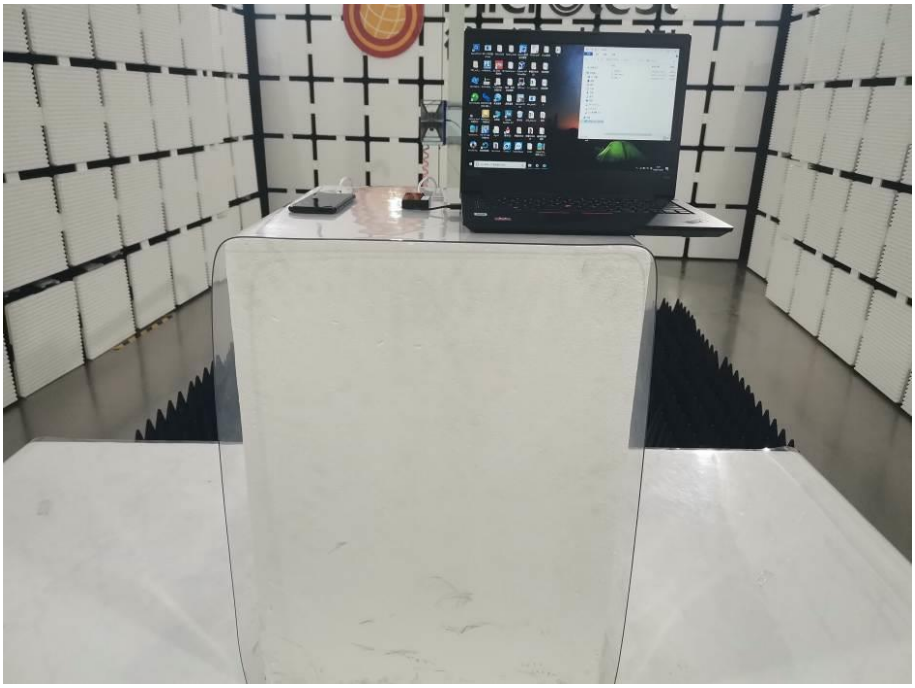
Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	5.00	5825.00609	5825	0.00609	-1.0463
		V max (V)	5.75	5825.00523	5825	0.00523	-0.8986
		V min (V)	4.25	5825.00229	5825	0.00229	-0.3928
Limits				within 5725-5850MHz			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	5	T (°C)	-20	5825.00022	5825	0.00022	-0.0371
		T (°C)	-10	5825.00623	5825	0.00623	-1.0697
		T (°C)	0	5825.00437	5825	0.00437	-0.7498
		T (°C)	10	5825.00914	5825	0.00914	-1.5685
		T (°C)	20	5825.00227	5825	0.00227	-0.3902
		T (°C)	30	5825.01281	5825	0.01281	-2.1989
		T (°C)	40	5825.00758	5825	0.00758	-1.3011
		T (°C)	50	5825.00919	5825	0.00919	-1.5784
		T (°C)	60	5825.00779	5825	0.00779	-1.3365
		T (°C)	70	5825.00017	5825	0.00017	-0.0292
Limits				within 5725-5850MHz			
Result				Complies			

Photographs of the Test Setup

Radiated emission


Conducted emission

Photographs of the EUT

See the APPENDIX 1: EUT PHOTO in the report No.: MTi20091717-2E1-1.

----END OF REPORT----