

(Channel 159, 5795MHz, 802.11ac (VHT40))

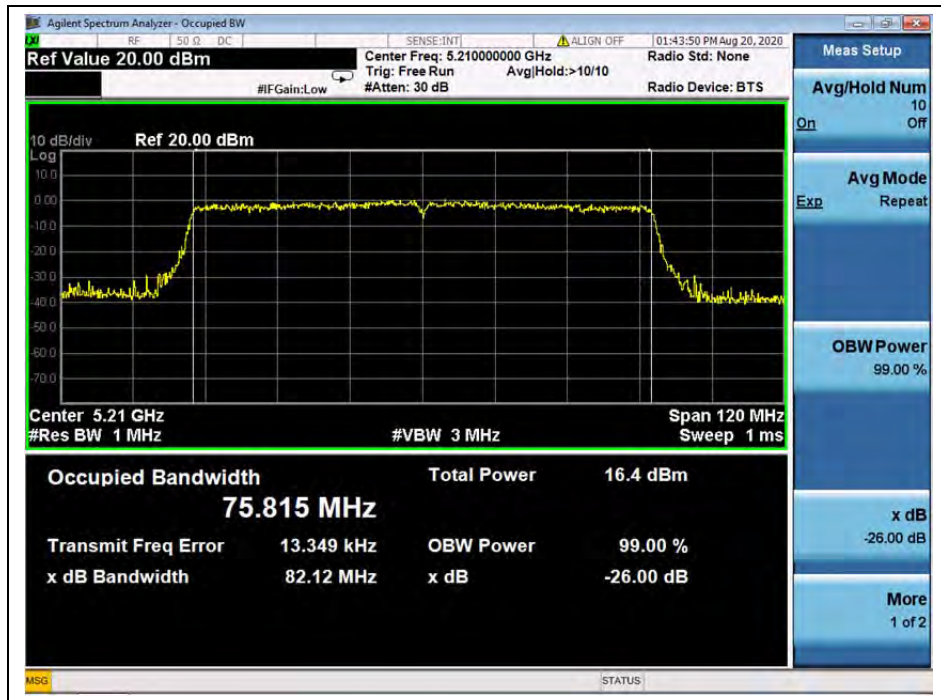


802.11ac (VHT80) Test mode

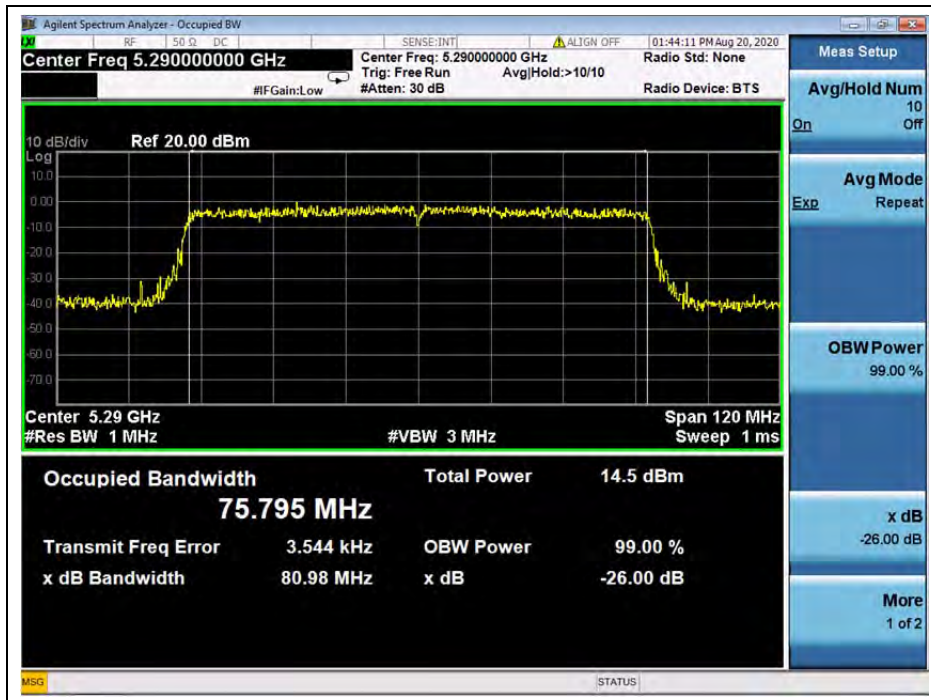
A. Test Verdict:

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
42	5210	82.12
58	5290	80.98
106	5530	82.29
122	5610	80.01
138	5690	81.26
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)
138	5690	75.74
155	5775	75.67

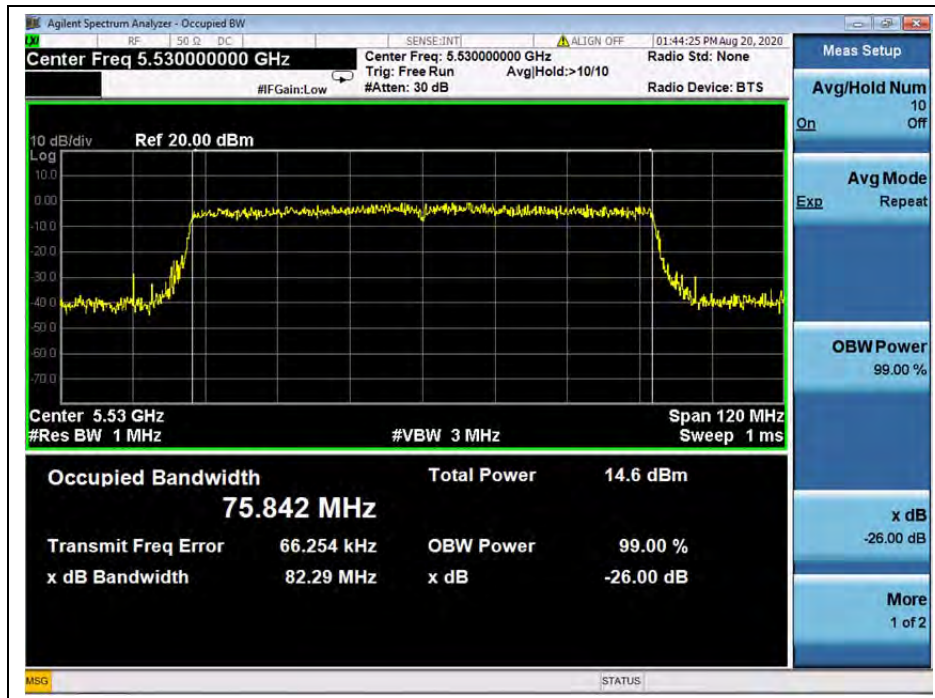
B. Test Plot:



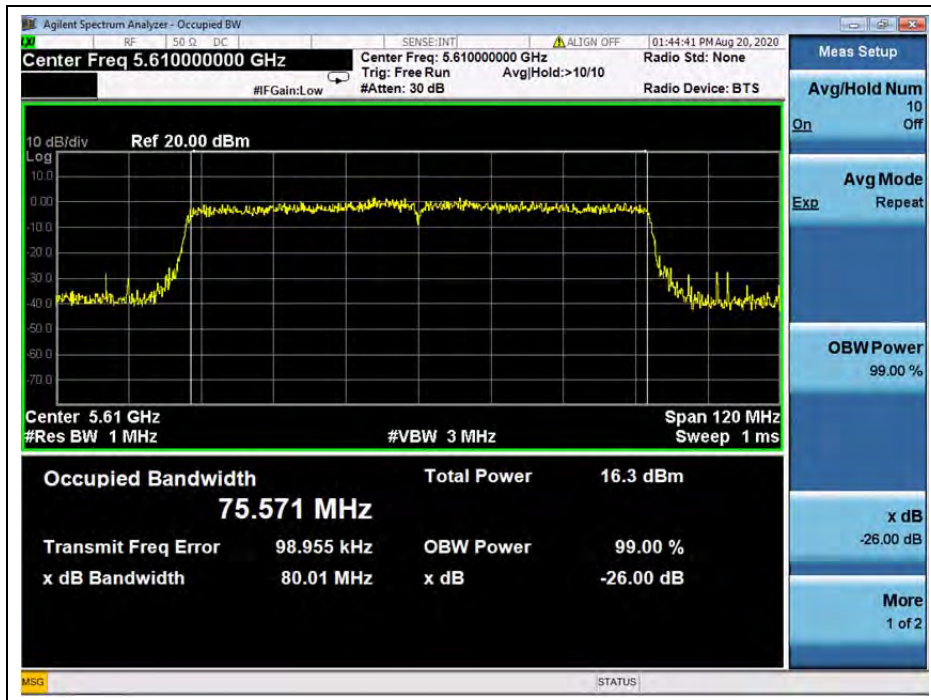
(Channel 42, 5210MHz, 802.11ac (VHT80))



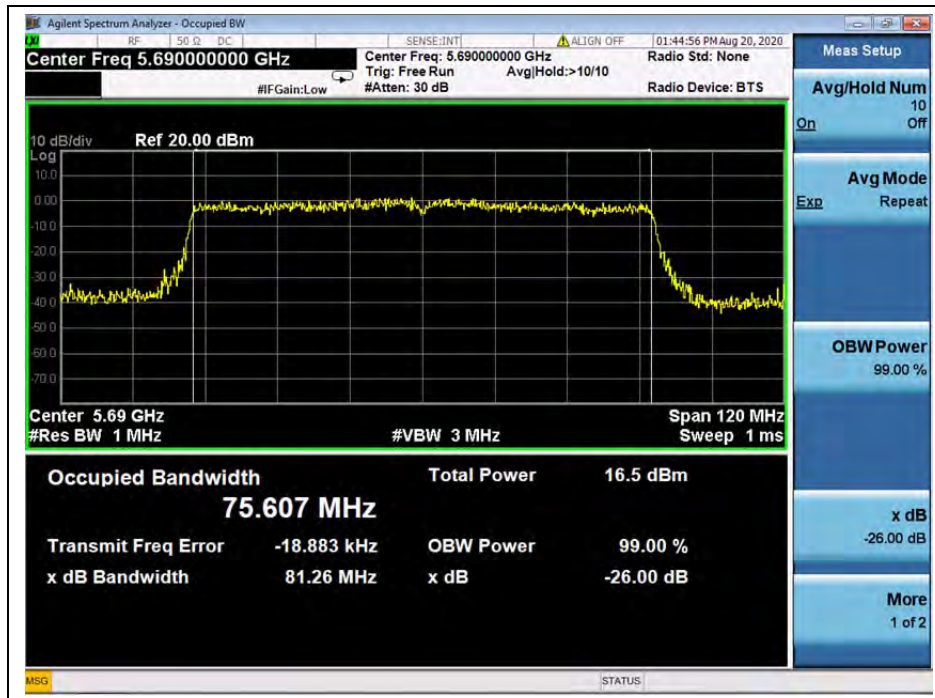
(Channel 58, 5290MHz, 802.11ac (VHT80))



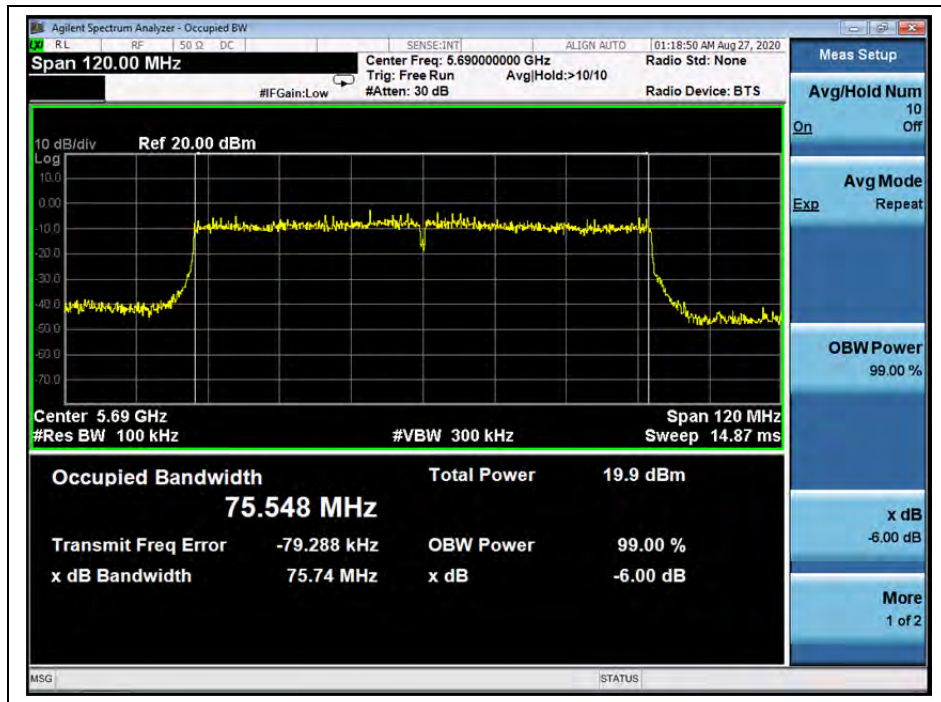
(Channel 106, 5530MHz, 802.11ac (VHT80))



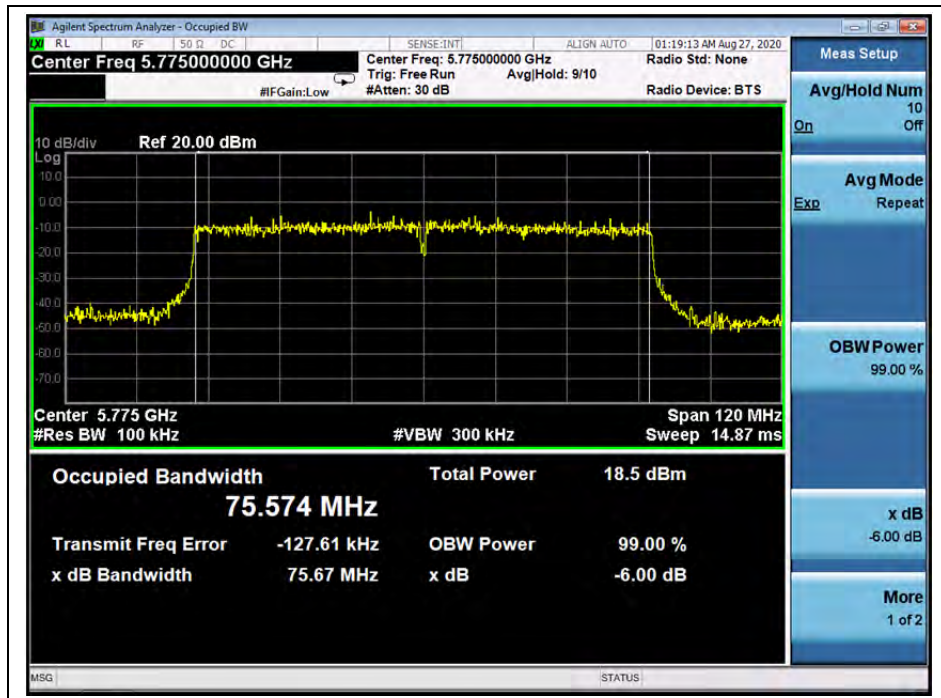
(Channel 122, 5610MHz, 802.11ac (VHT80))



(Channel 138, 5690MHz, 802.11ac (VHT80))



(Channel 138, 5690MHz, 802.11ac (VHT80))



(Channel 155, 5775MHz, 802.11ac (VHT80))

2.5. Peak Power Spectral Density

2.5.1. Requirement

(1) For client devices in the 5.15-5.25 GHz band, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band.

(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum power spectral density shall not exceed 11dBm in any 1 megahertz band.

(3) For the band 5.725-5.85 GHz, the maximum power spectral density shall not exceed 30dBm in any 500kHz band.

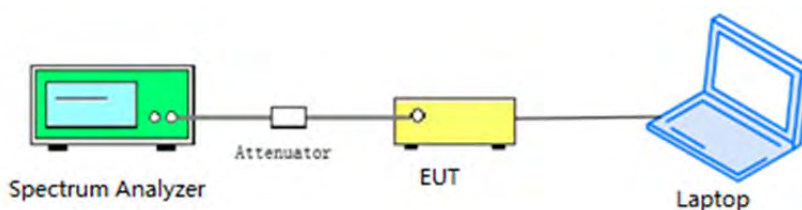
If transmitting antennas of directional gain greater than 6dBi are used, the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

(4) According to KDB662911D01 Measure-and-sum technique, the conducted emission level (e.g., transmit power or power in specified bandwidth) is measured at each antenna port. The measured results at the various antenna ports are then summed mathematically to determine the total emission level from the device. Summing is performed in units that are directly proportional to power.

(5) According to KDB 662911 D01, the directional gain = $G_{ANT} + 10\log(N_{ANT})$ dBi, where G_{ANT} is the antenna gain in dBi, N_{ANT} is the number of outputs.

2.5.2. Test Description

Test Setup:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.



2.5.3. Test Procedure

KDB 789033 Section F) Maximum Power Spectral Density (PSD) Method SA-1 was used in order to prove compliance

- 1) Set span to encompass the entire 26-dB emission bandwidth
- 2) Set RBW = 1MHz. Set VBW ≥ 3MHz
- 3) Number of points in sweep ≥ 2 Span / RBW. Sweep time = auto
- 4) Detector = Peak
- 5) Trace mode=Max hold
- 6) Record the max value

2.5.4. Test Result

802.11a Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
36	5180	6.04	0.07	6.11	11	PASS
44	5220	4.70		4.77		
48	5240	4.59		4.66		
52	5260	4.68		4.75		
60	5300	4.48		4.55		
64	5320	4.71		4.78		
100	5500	3.99		4.06		
120	5600	5.95		6.02		
144	5720	5.57		5.64		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
144	5720	3.11	0.07	3.18	30	PASS
149	5745	3.12		3.19		
157	5785	3.13		3.20		
165	5825	3.94		4.01		



B.Test Plot:



(Channel 36, 5180MHz, 802.11a)



(Channel 44, 5220MHz, 802.11a)



(Channel 48, 5240MHz, 802.11a)



(Channel 52, 5260MHz, 802.11a)



(Channel 60, 5300MHz, 802.11a)



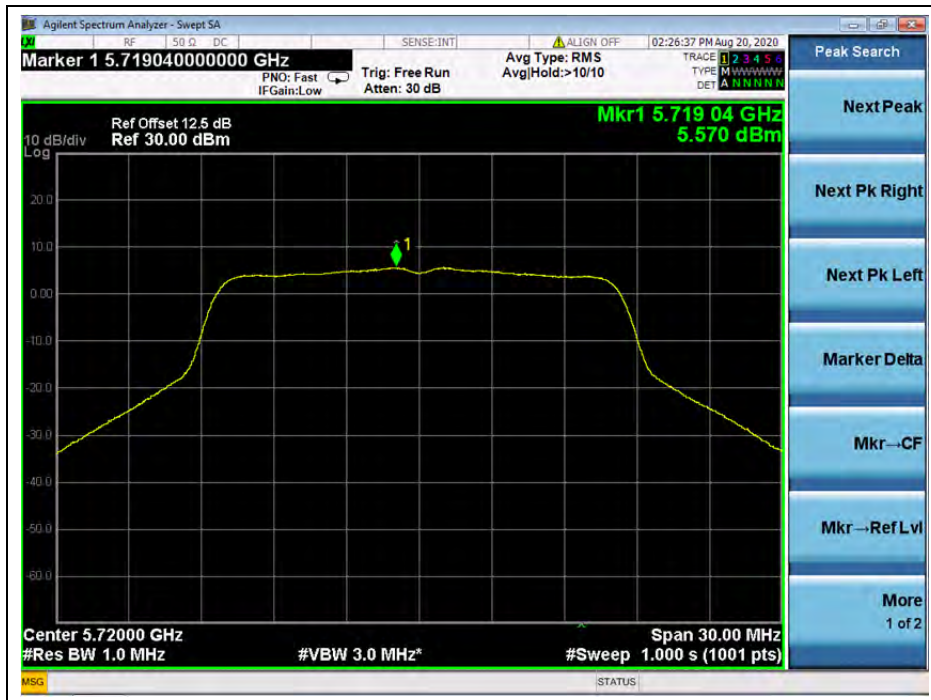
(Channel 64, 5320MHz, 802.11a)



(Channel 100, 5500MHz, 802.11a)



(Channel 120, 5600MHz, 802.11a)



(Channel 144, 5720MHz, 802.11a)



(Channel 144, 5720MHz, 802.11a)



(Channel 149, 5745MHz, 802.11a)



(Channel 157, 5785MHz, 802.11a)



(Channel 165, 5825MHz, 802.11a)



802.11n (HT20) Mode

A.Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
36	5180	3.05	0.08	3.13	11	PASS
44	5220	2.56		2.64		
48	5240	2.15		2.23		
52	5260	2.04		2.12		
60	5300	2.44		2.52		
64	5320	2.05		2.13		
100	5500	1.88		1.96		
120	5600	4.01		4.09		
144	5720	3.82		3.90		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
144	5720	1.05	0.08	1.13	30	PASS
149	5745	0.67		0.75		
157	5785	0.84		0.92		
165	5825	1.25		1.33		

B.Test Plot:



(Channel 36, 5180MHz, 802.11n (HT20))



(Channel 44, 5220MHz, 802.11n (HT20))



(Channel 48, 5240MHz, 802.11n (HT20))



(Channel 52, 5260MHz, 802.11n (HT20))



(Channel 60, 5300MHz, 802.11n (HT20))



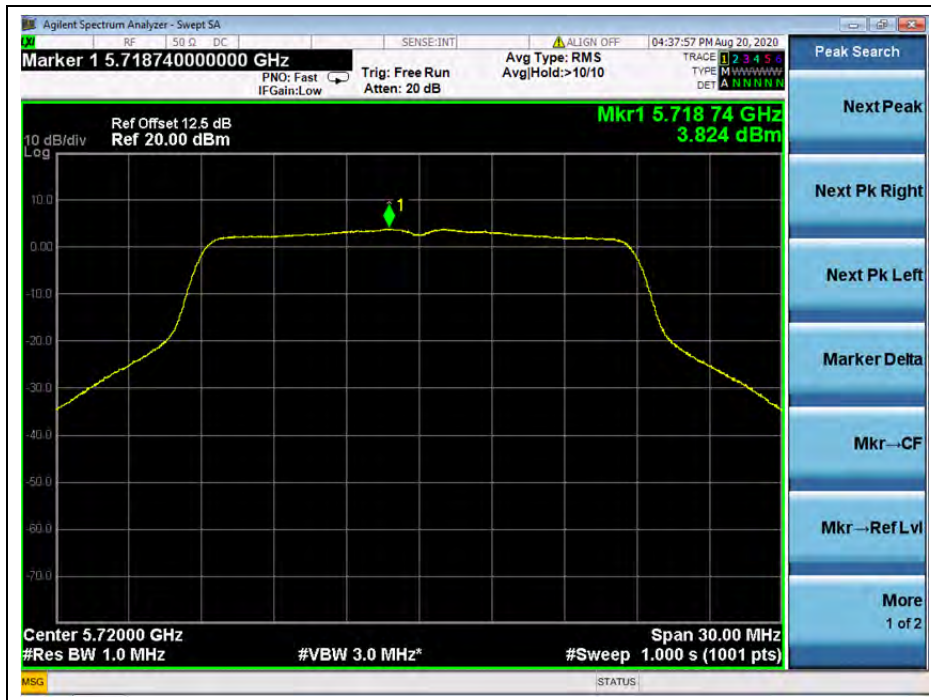
(Channel 64, 5320MHz, 802.11n (HT20))



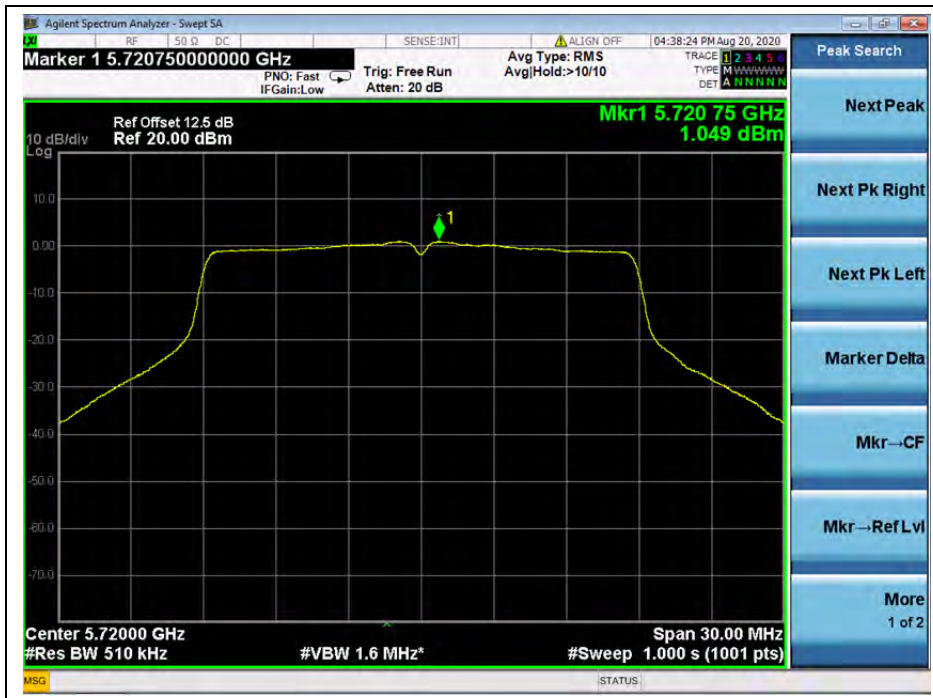
(Channel 100, 5500MHz, 802.11n (HT20))



(Channel 120, 5600MHz, 802.11n (HT20))



(Channel 144, 5720MHz, 802.11n (HT20))



(Channel 144, 5720MHz, 802.11n (HT20))



(Channel 149, 5745MHz, 802.11n (HT20))



(Channel 157, 5785MHz, 802.11n (HT20))



(Channel 165, 5825MHz, 802.11n (HT20))



802.11n (HT40) Mode

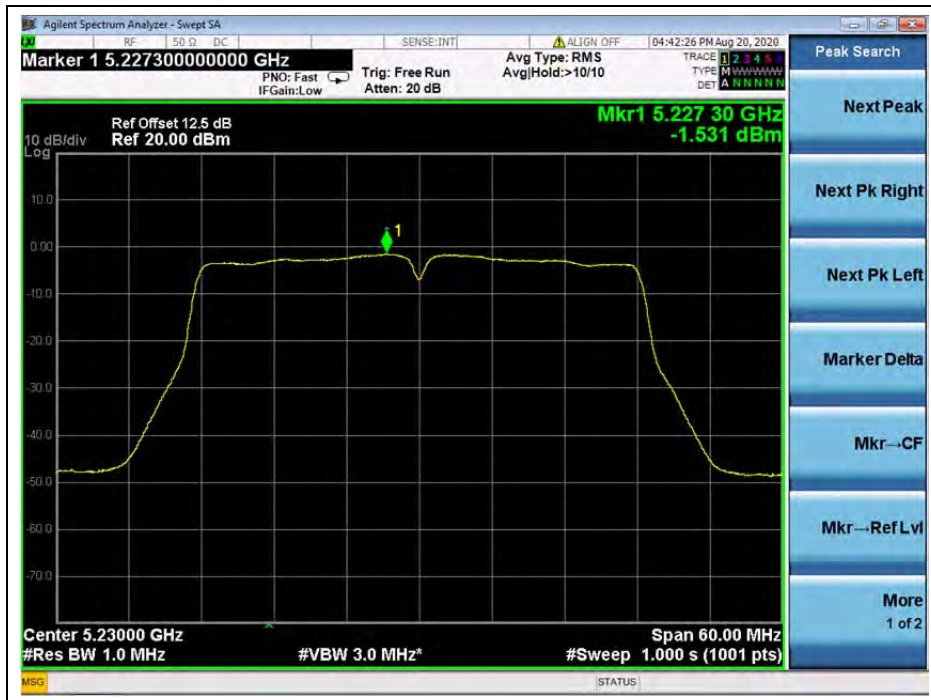
A. Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
38	5190	-1.01	0.16	-0.85	11	PASS
46	5230	-1.53		-1.37		
54	5270	-1.63		-1.47		
62	5310	-1.70		-1.54		
102	5510	-2.70		-2.54		
126	5630	-0.51		-0.35		
142	5710	-0.68		-0.52		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
142	5710	-3.52	0.16	-3.36	30	PASS
151	5755	-3.87		-3.71		
159	5795	-3.32		-3.16		

B. Test Plot:



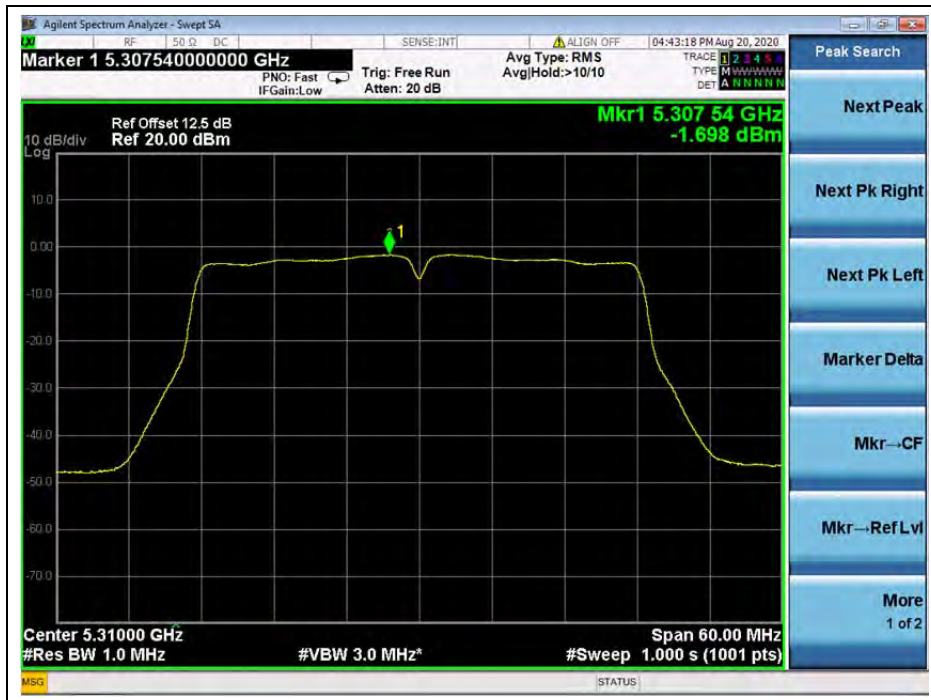
(Channel 38, 5190MHz, 802.11n (HT40))



(Channel 46, 5230MHz, 802.11n (HT40))



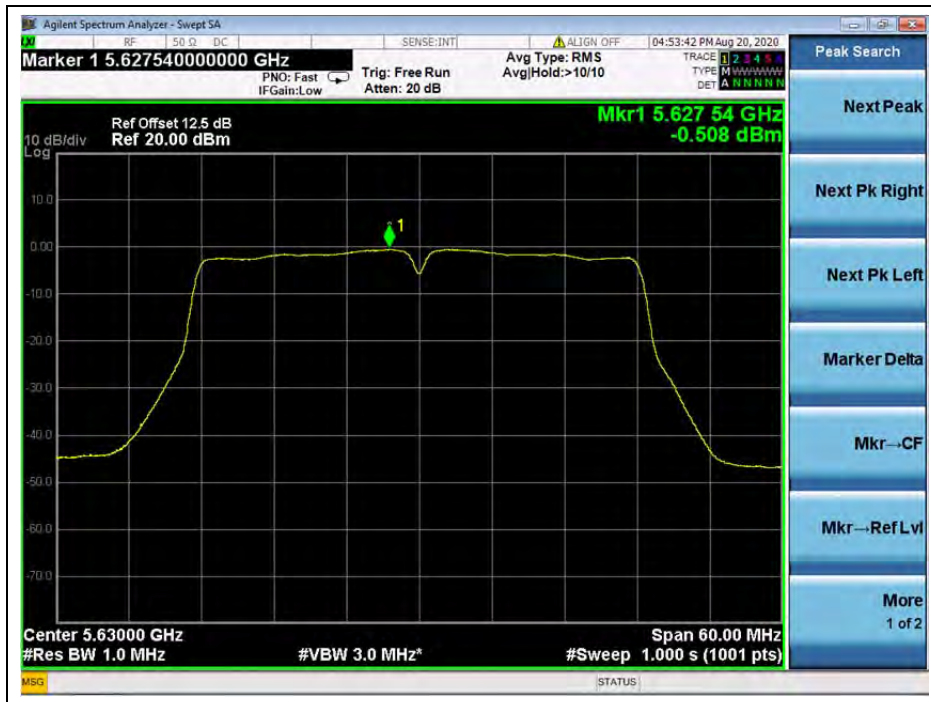
(Channel 54, 5270MHz, 802.11n (HT40))



(Channel 62, 5310MHz, 802.11n (HT40))



(Channel 102, 5510MHz, 802.11n (HT40))



(Channel 126, 5630 MHz, 802.11n (HT40))



(Channel 142, 5710MHz, 802.11n (HT40))



(Channel 142, 5710MHz, 802.11n (HT40))



(Channel 151, 5755MHz, 802.11n (HT40))



(Channel 159, 5795MHz, 802.11n (HT40))



802.11ac (VHT20) Mode

A.Test Verdict:

Channel	Frequency (MHz)	Measured PPSD (dBm/MHz)	Duty Factor	Corrected PPSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
36	5180	3.53	0.12	3.65	11	PASS
44	5220	2.78		2.90		
48	5240	2.15		2.27		
52	5260	2.54		2.66		
60	5300	2.49		2.61		
64	5320	1.90		2.02		
100	5500	1.81		1.93		
120	5600	3.72		3.84		
144	5720	3.27		3.39		
Channel	Frequency (MHz)	Measured PPSD (dBm/500KHz)	Duty Factor	Corrected PPSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
144	5720	0.78	0.12	0.90	30	PASS
149	5745	0.60		0.72		
157	5785	1.09		1.21		
165	5825	1.38		1.50		



B.Test Plot:



(Channel 36, 5180MHz, 802.11ac (VHT20))



(Channel 44, 5220MHz, 802.11ac (VHT20))



(Channel 48, 5240MHz, 802.11ac (VHT20))



(Channel 52, 5260MHz, 802.11ac (VHT20))



(Channel 60, 5300MHz, 802.11ac (VHT20))



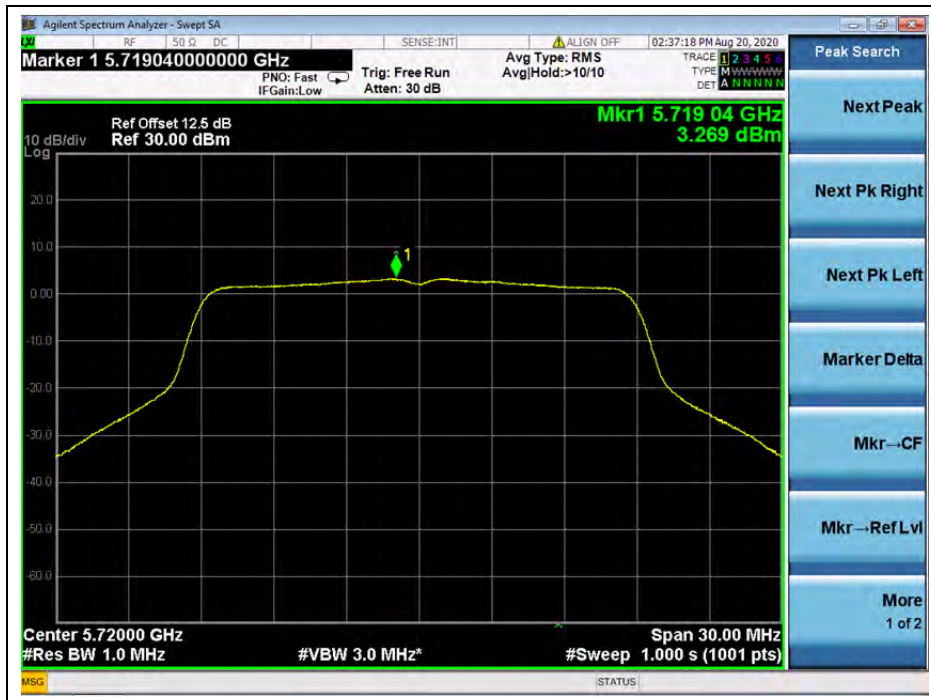
(Channel 64, 5320MHz, 802.11ac (VHT20))



(Channel 100, 5500MHz, 802.11ac (VHT20))



(Channel 120, 5600MHz, 802.11ac (VHT20))



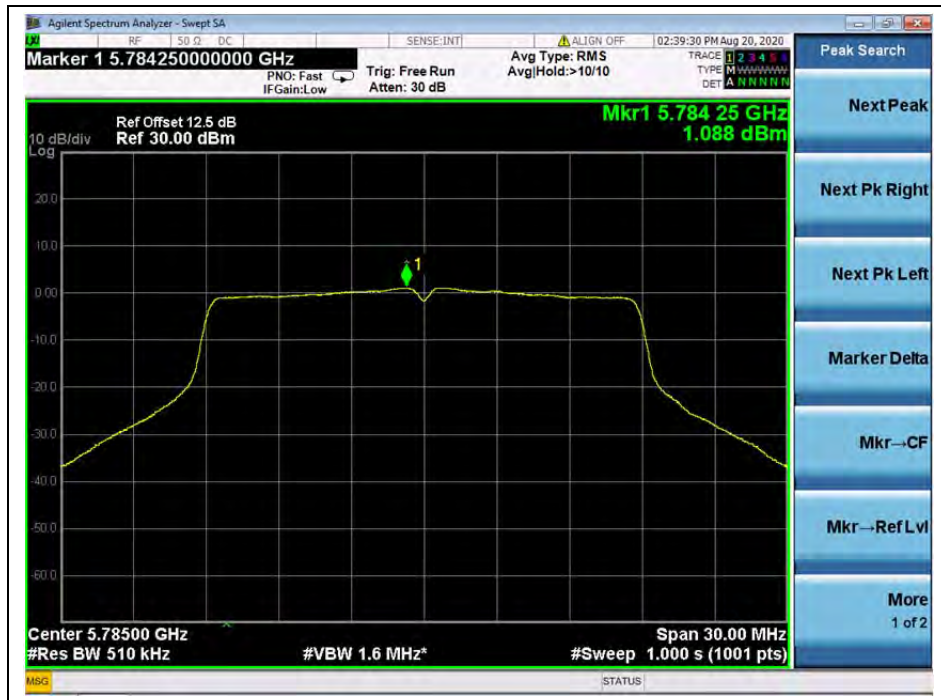
(Channel 144, 5720MHz, 802.11ac (VHT20))



(Channel 144, 5720MHz, 802.11ac(VHT20))



(Channel 149, 5745MHz, 802.11ac (VHT20))



(Channel 157, 5785MHz, 802.11ac (VHT20))



802.11ac (VHT40) Mode

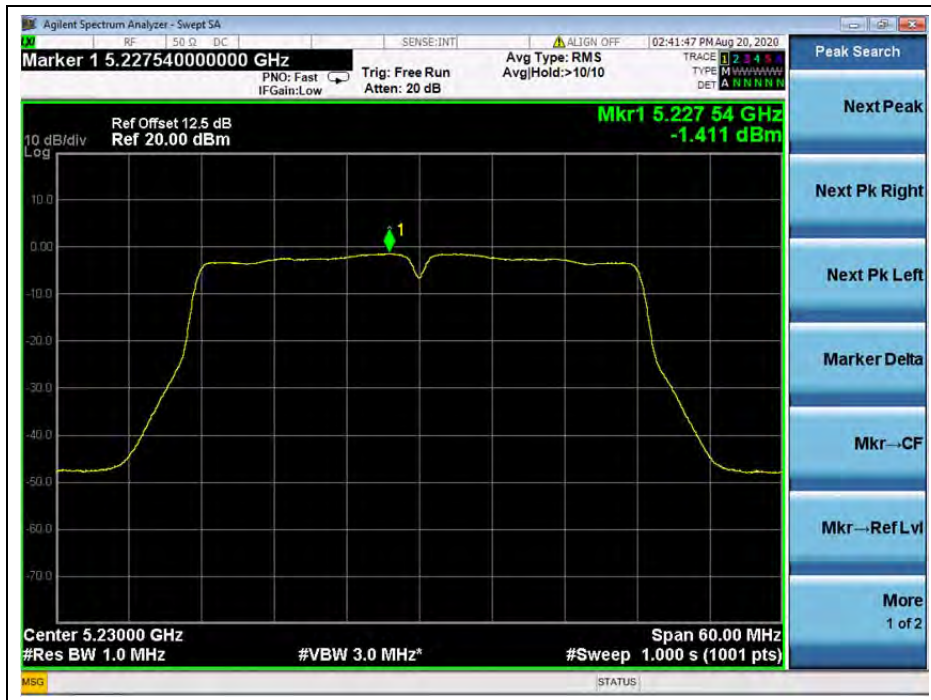
A. Test Verdict:

Channel	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Corrected PSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
38	5190	-1.29	0.16	-1.13	11	PASS
46	5230	-1.41		-1.25		
54	5270	-1.70		-1.54		
62	5310	-1.95		-1.79		
102	5510	-2.22		-2.06		
126	5630	-0.28		-0.12		
142	5710	-0.34		-0.18		
Channel	Frequency (MHz)	Measured PSD (dBm/500KHz)	Duty Factor	Corrected PSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
142	5710	-2.91	0.16	-2.75	30	PASS
151	5755	-2.69		-2.53		
155	5795	-2.56		-2.40		

B. Test Plot:



(Channel 38, 5190MHz, 802.11ac (VHT40))



(Channel 46, 5230MHz, 802.11ac (VHT40))



(Channel 54, 5270MHz, 802.11ac (VHT40))



(Channel 62, 5310MHz, 802.11ac (VHT40))



(Channel 102, 5510MHz, 802.11ac (VHT40))



(Channel 126, 5630MHz, 802.11ac (VHT40))



(Channel 142, 5710MHz, 802.11ac (VHT40))



(Channel 142, 5710MHz, 802.11ac (VHT40))



(Channel 151, 5755MHz, 802.11ac (VHT40))



(Channel 159, 5795MHz, 802.11ac (VHT40))

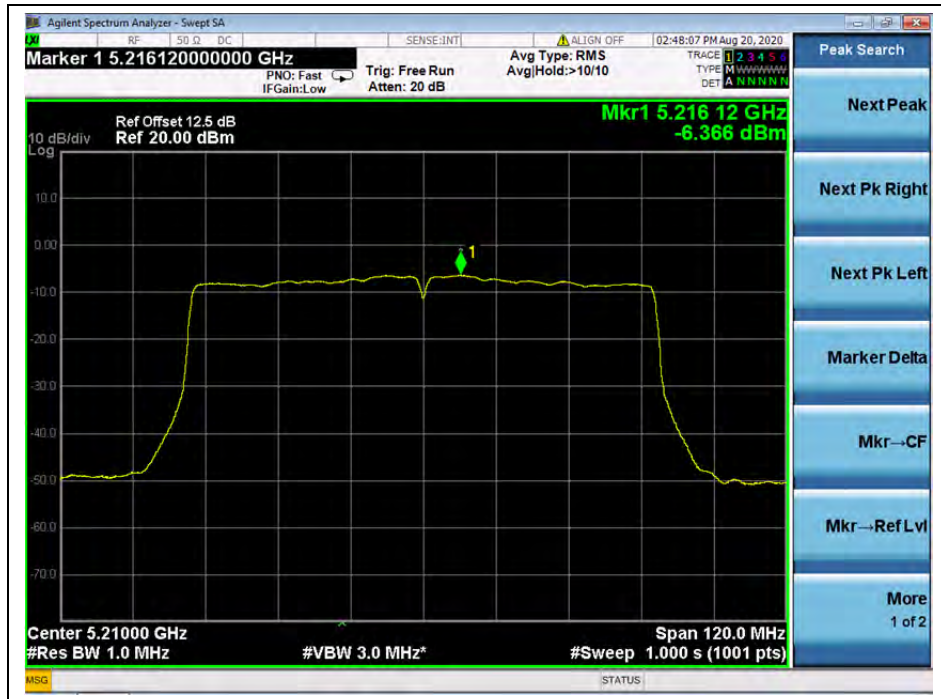


802.11ac (VHT80) Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured PSD (dBm/MHz)	Duty Factor	Corrected PSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
42	5210	-6.37	0.36	-6.01	11	PASS
58	5290	-6.47		-6.11		
106	5530	-6.56		-6.20		
122	5610	-4.81		-4.45		
138	5690	-5.19		-4.83		
Channel	Frequency (MHz)	Measured PSD (dBm/500KHz)	Duty Factor	Corrected PSD (dBm/500KHz)	Limit (dBm/500KHz)	Verdict
138	5690	-8.37	0.36	-8.01	30	PASS
155	5775	-8.35		-7.99		

B. Test Plot:



(Channel 42, 5210MHz, 802.11ac (VHT80))



(Channel 58, 5290MHz, 802.11ac (VHT80))



(Channel 106, 5530MHz, 802.11ac (VHT80))



(Channel 122, 5610MHz, 802.11ac (VHT80))



(Channel 138, 5690MHz, 802.11ac (VHT80))



(Channel 138, 5690MHz, 802.11ac (VHT80))



(Channel 155, 5775MHz, 802.11ac (VHT80))



2.6. Frequency Stability

2.6.1. Requirement

Manufacturers 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.

2.6.2. Test Procedure

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between 5°C to 40°C. The temperature was incremented by 10° intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded. Data for the worst case channel is shown below.

2.6.3. Test Result

U-NII-1 (Ch. 36) 5180MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Fre. Dev. (kHz)	Deviation (ppm)
100%	3.87	+20(Ref)	23	4.440
100%		-30	30	5.792
100%		-20	28	5.405
100%		-10	26	5.019
100%		0	24	4.633
100%		+10	26	5.019
100%		+20	24	4.633
100%		+30	23	4.440
100%		+40	28	5.405
100%		+50	23	4.440
85%		3.29	+20	30
115%	4.45	+20	28	5.405



U-NII-2A (Ch. 52)				
5260MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Fre. Dev. (kHz)	Deviation (ppm)
100%	3.87	+20(Ref)	20	3.802
100%		-30	22	4.183
100%		-20	24	4.563
100%		-10	24	4.563
100%		0	23	4.373
100%		+10	18	3.422
100%		+20	20	3.802
100%		+30	27	5.133
100%		+40	29	5.513
100%		+50	25	4.753
85%	3.29	+20	21	3.992
115%	4.45	+20	19	3.612

U-NII-2C (Ch. 100)				
5500MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Fre. Dev. (kHz)	Deviation (ppm)
100%	3.87	+20(Ref)	21	3.818
100%		-30	25	4.545
100%		-20	30	5.455
100%		-10	28	5.091
100%		0	22	4.000
100%		+10	24	4.364
100%		+20	23	4.182
100%		+30	30	5.455
100%		+40	35	6.364
100%		+50	25	4.545
85%	3.29	+20	30	5.455
115%	4.45	+20	27	4.909



U-NII-3 (Ch. 149)				
5745MHz				
VOLTAGE (%)	POWER (VDC)	TEMP (°C)	Fre. Dev. (kHz)	Deviation (ppm)
100%	3.87	+20(Ref)	22	3.829
100%		-30	26	4.526
100%		-20	28	4.874
100%		-10	24	4.178
100%		0	30	5.222
100%		+10	26	4.526
100%		+20	27	4.700
100%		+30	27	4.700
100%		+40	29	5.048
100%		+50	30	5.222
85%	3.29	+20	29	5.048
115%	4.45	+20	31	5.396

2.7. Conducted Emission

2.7.1. Requirement

According to FCC section 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 within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

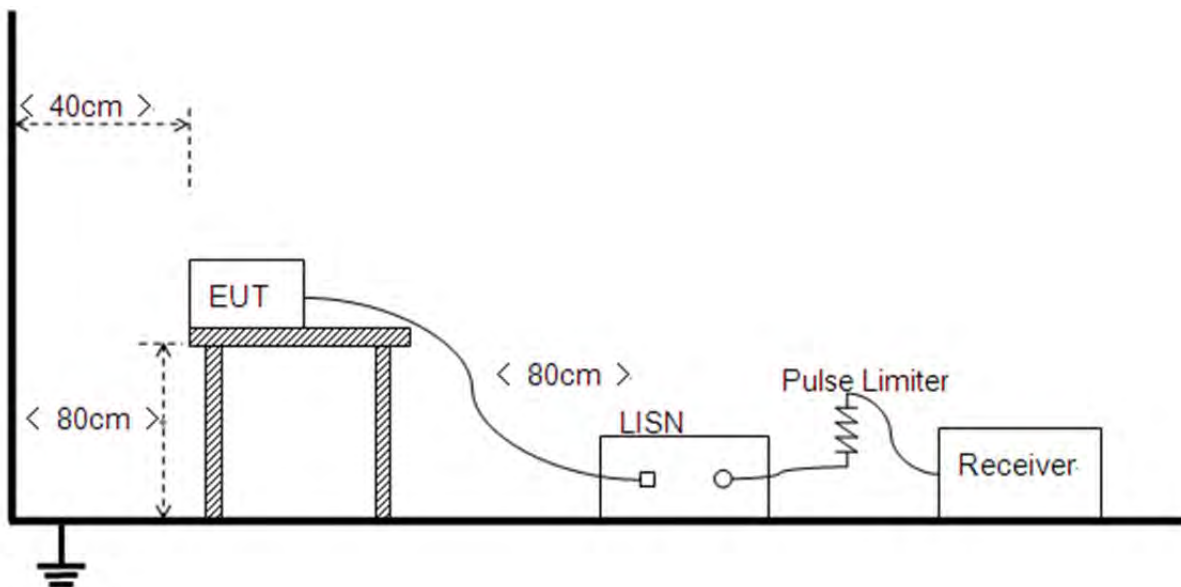
Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

Note:

- (a) The lower limit shall apply at the band edges.
- (b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.7.2. Test Description

Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.10: 2013.



2.7.3. Test Result

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and Plot below.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hz were considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

A. Test Setup:

Test Mode: EUT+ADAPTER++EARPHONE+ WIFI TX

Test Voltage: AC 120V/60Hz

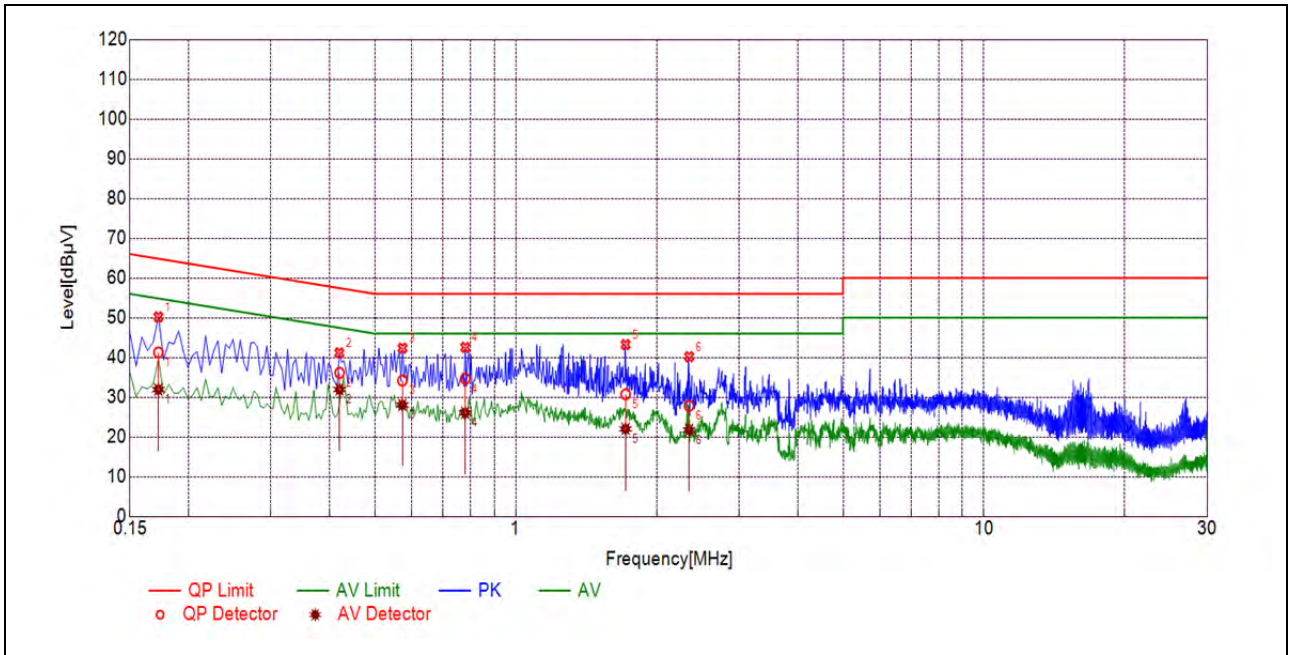
The measurement results are obtained as below:

$$E \text{ [dB}\mu\text{V]} = U_R + L_{\text{Cable loss}} \text{ [dB]} + A_{\text{Factor}}$$

U_R : Receiver Reading

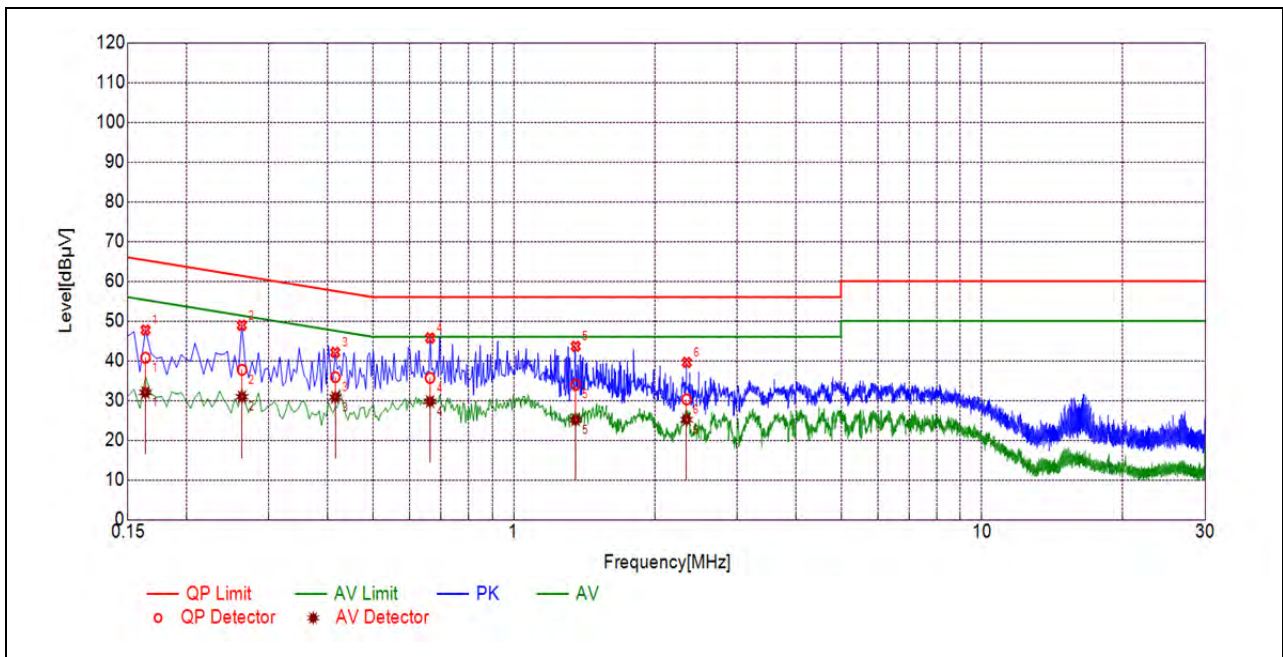
A_{Factor} : Voltage division factor of LISN

B.Test Plot:



(L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1724	41.26	31.91	64.84	54.84	Line	PASS
2	0.4203	36.14	31.94	57.44	47.44		PASS
3	0.5725	34.20	28.05	56.00	46.00		PASS
4	0.7800	34.66	26.09	56.00	46.00		PASS
5	1.7158	30.74	22.03	56.00	46.00		PASS
6	2.3447	27.84	21.78	56.00	46.00		PASS



(N Phase)

NO.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1634	40.77	32.02	65.29	55.29	Neutral	PASS
2	0.2627	37.72	30.91	61.35	51.35		PASS
3	0.4158	35.86	30.83	57.53	47.53		PASS
4	0.6624	35.68	29.76	56.00	46.00		PASS
5	1.3559	33.96	25.13	56.00	46.00		PASS
6	2.3395	30.28	25.18	56.00	46.00		PASS