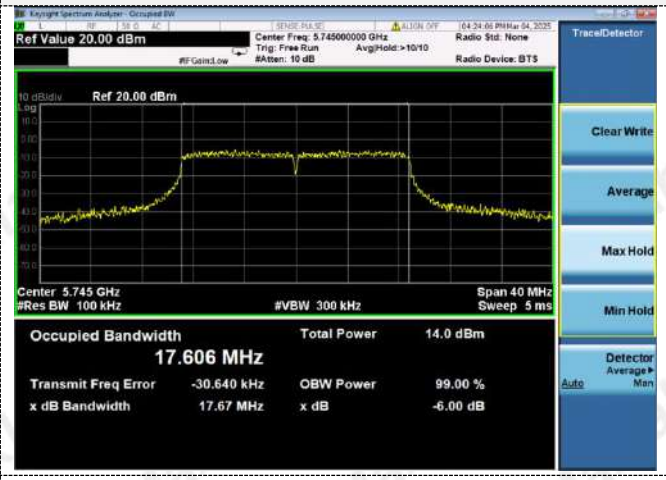
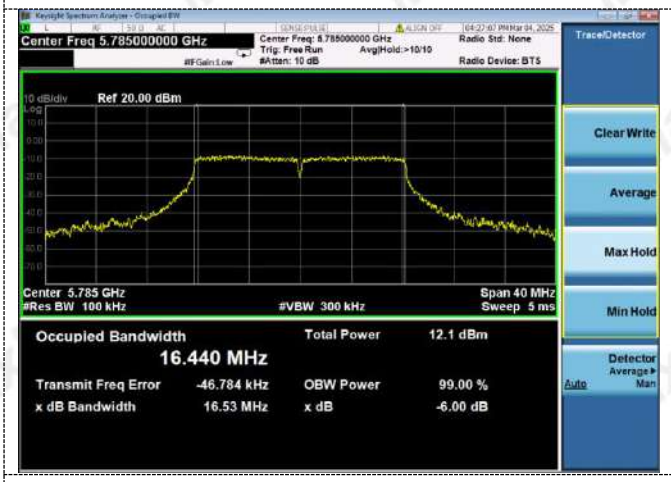
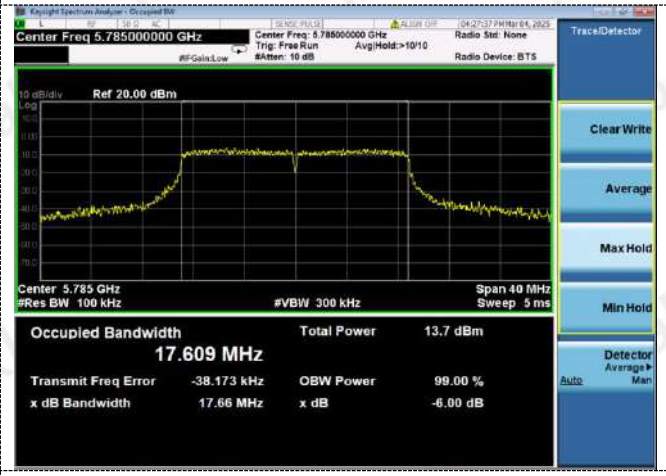
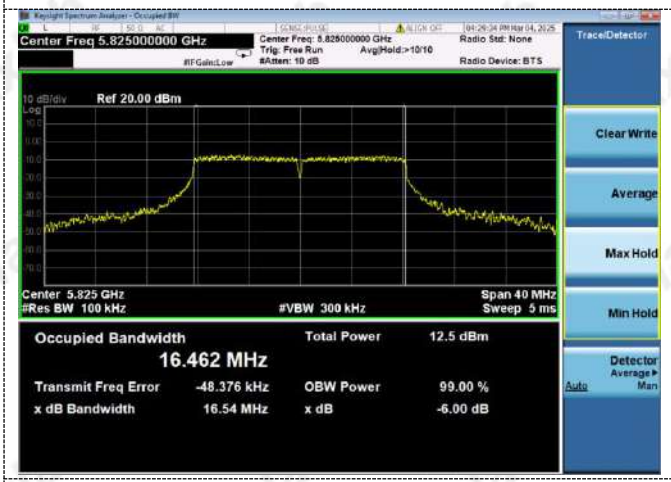
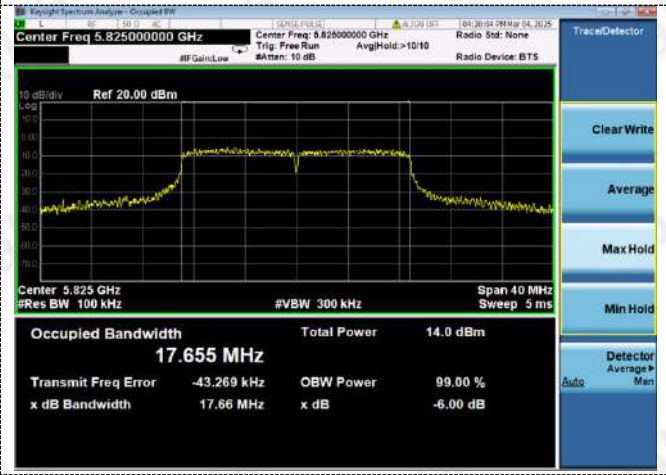
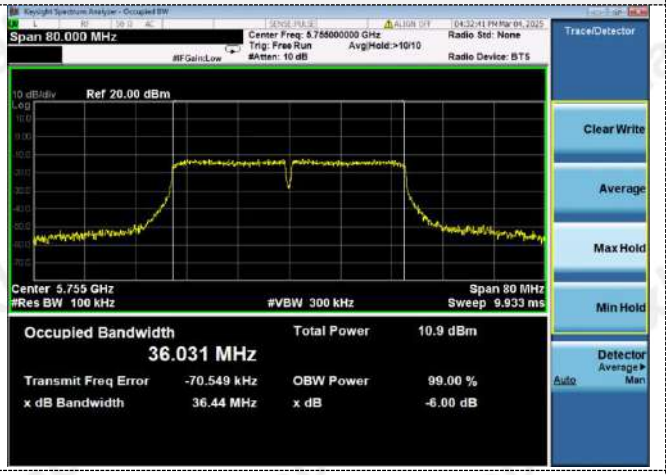
Both ANT 1/2/3 have been test, The worst data is Antenna 1, only shown Antenna 1 Plot.

802.11a	802.11n(HT20)
	
CH149	CH149
	
CH157	CH157
	
CH165	CH165

802.11n(HT40)



CH151

802.11ac(HT20)

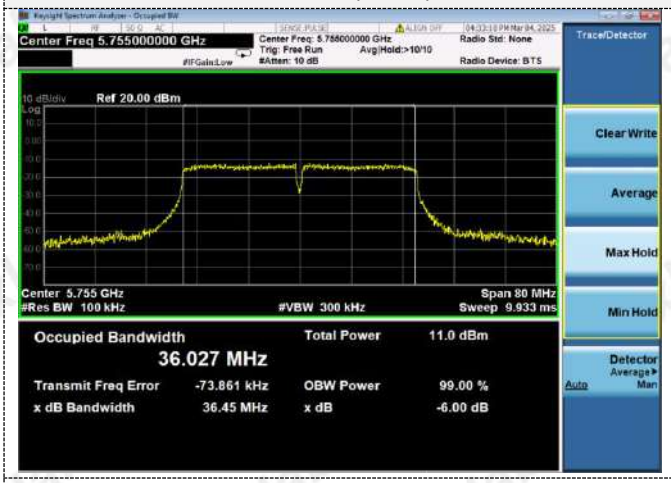
CH149

CH159

CH157

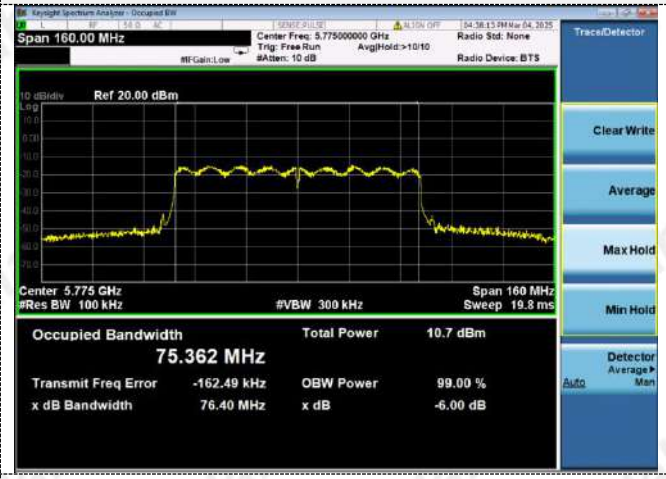
CH165

802.11ac(HT40)

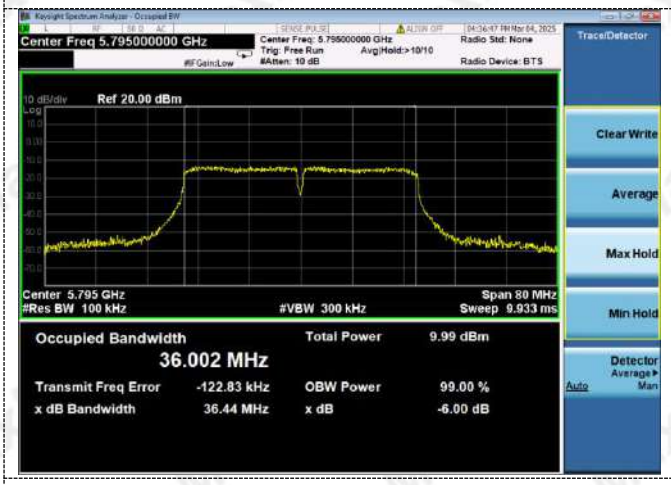


CH151

802.11ac(HT80)



CH155

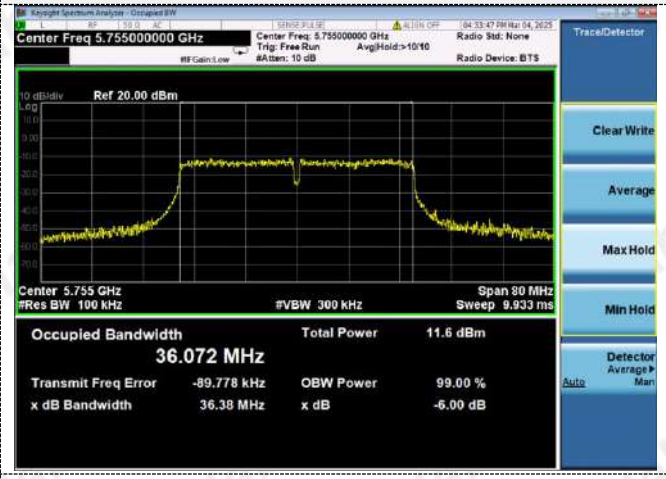


CH159

802.11ax(HT20)

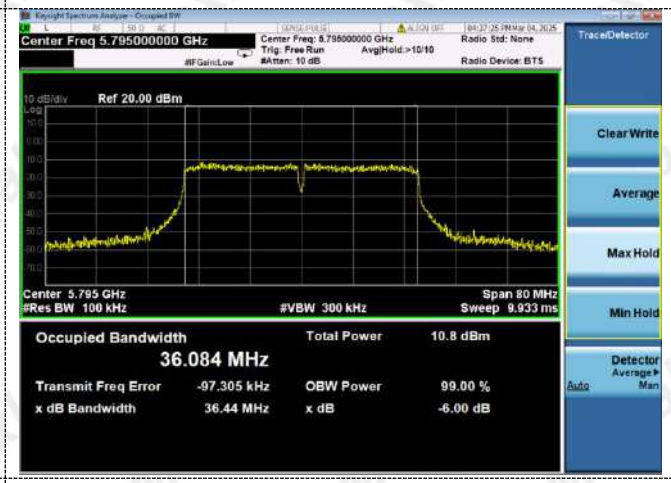
CH149

802.11ax(HT40)



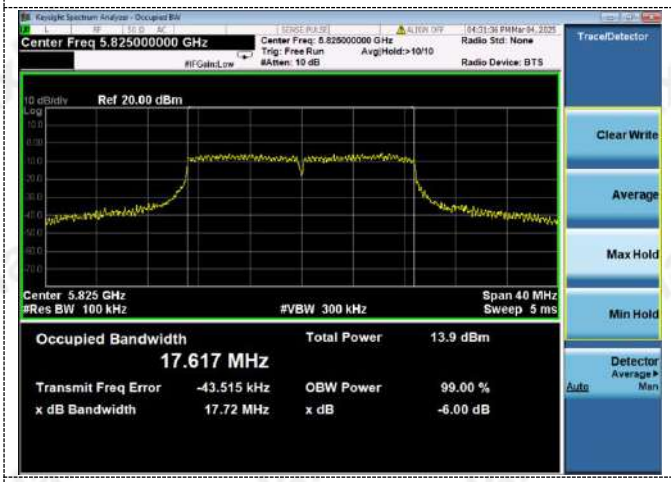
CH151

CH157

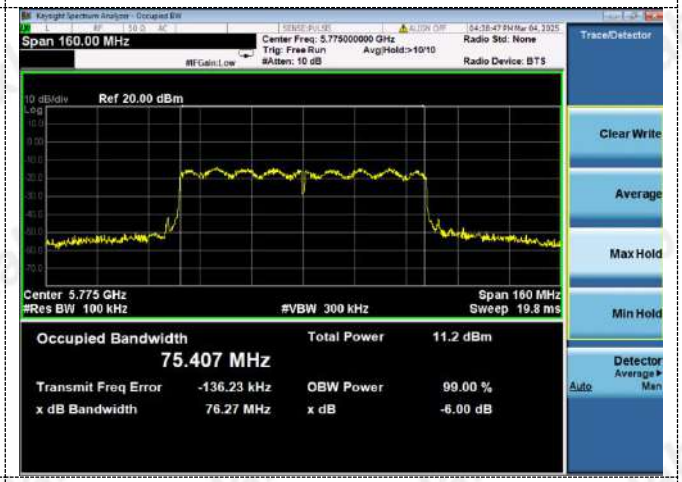


CH159

802.11ax(HT80)



CH165



CH155

4.7 Out of Band Emissions

4.7.1 Applicable Standard

According to FCC §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 e.i.r.p. of −27 dBm/MHz.
(2) For transmitters operating in the 5.725-5.850 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.

4.7.2 Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

4.7.3 DEVIATION FROM STANDARD

No deviation.

4.7.4 TEST SETUP

4.7.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

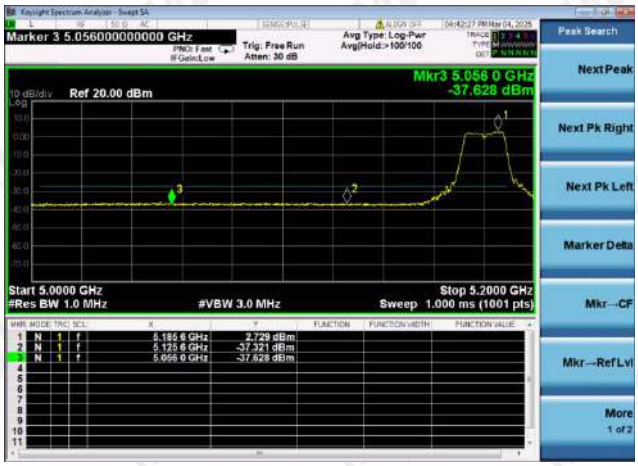
4.7.6 TEST RESULTS

Temperature:	26 ℃	Relative Humidity:	54%
Pressure:	1012 hPa	Test Voltage :	DC 12V

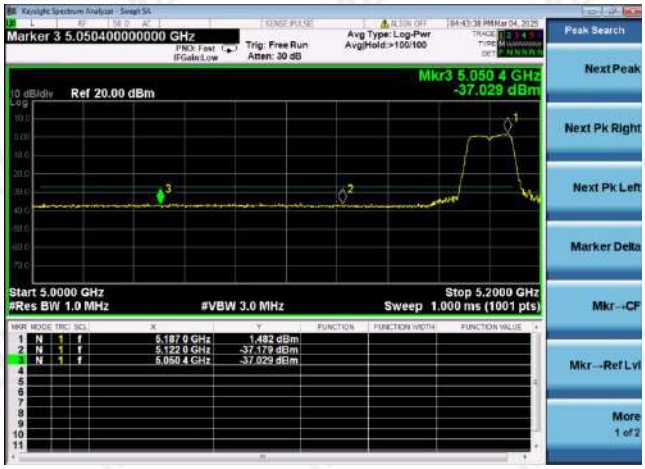
Note: Both ANT 1/2/3 have been test, Only show the worst data of ANT 1

5.180~5.240 GHz

(802.11a) Band Edge, Left Side



(802.11n20) Band Edge, Left Side

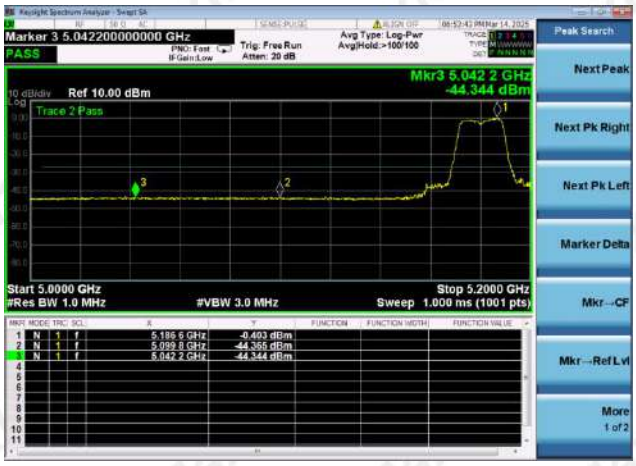


(802.11a) Band Edge, Right Side

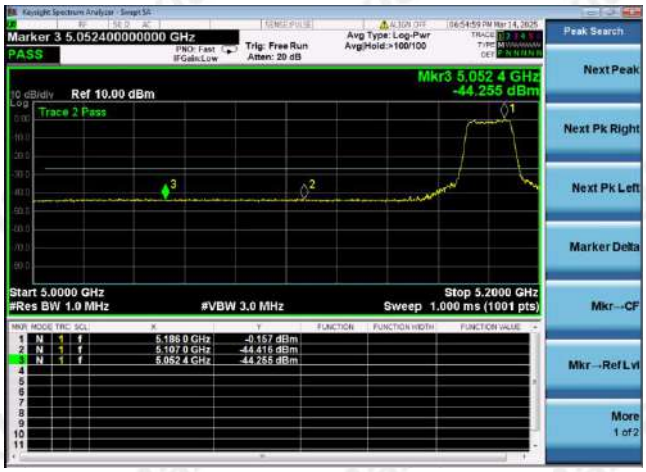
(802.11n20) Band Edge, Right Side

5.180~5.240 GHz

(802.11ac20) Band Edge, Left Side



(802.11 ax20) Band Edge, Left Side

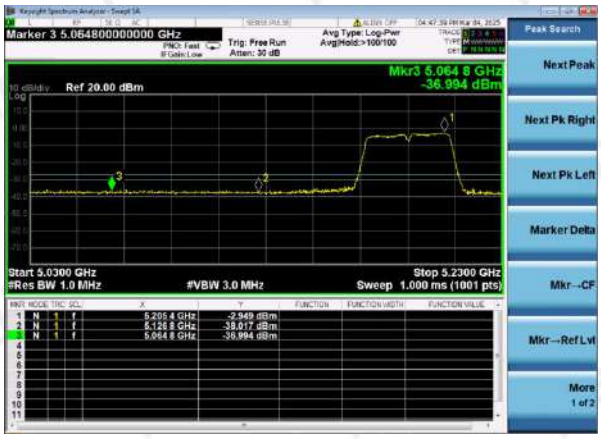


(802.11ac20) Band Edge, Right Side

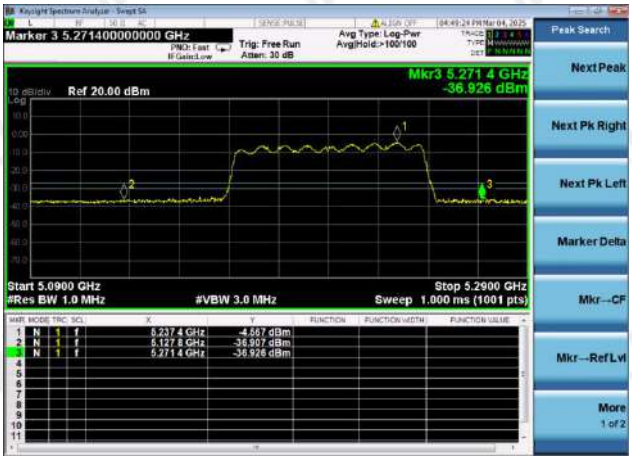
(802.11ax20) Band Edge, Right Side

5.180~5.240 GHz

(802.11n40) Band Edge, Left Side

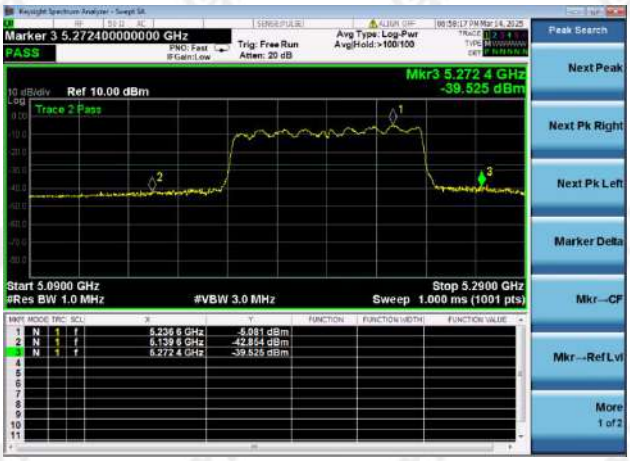


(802.11ac80) Band Edge



(802.11n40) Band Edge, Right Side

(802.11ax80) Band Edge



5.180~5.240 GHz

(802.11ac40) Band Edge, Left Side

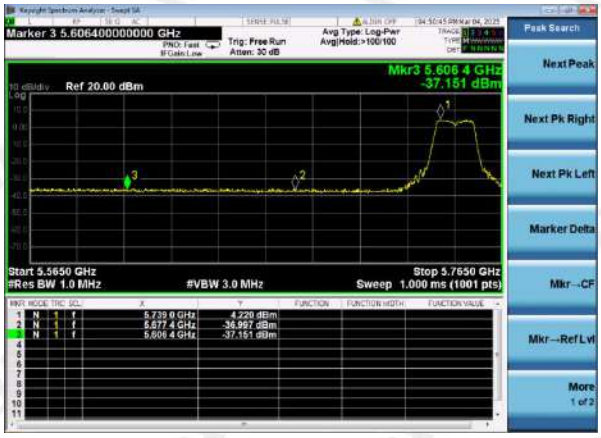
(802.11ax40) Band Edge, Left Side

(802.11ac40) Band Edge, Right Side

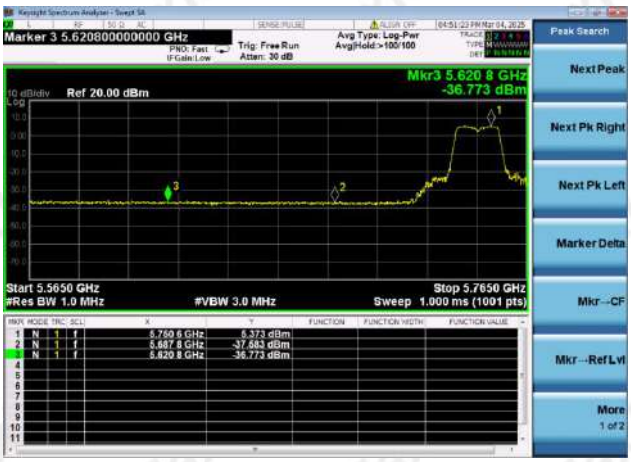
(802.11ax40) Band Edge, Right Side

5.745~5.825 GHz

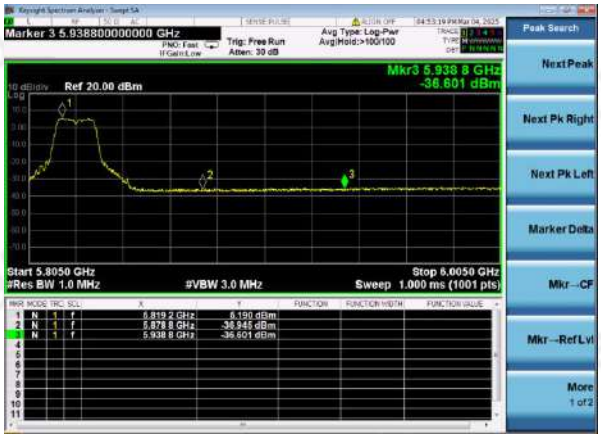
(802.11a) Band Edge, Left Side



(802.11n20) Band Edge, Left Side



(802.11a) Band Edge, Right Side



(802.11n20) Band Edge, Right Side

(802.11a) & 802.11n20 Band Edge, Left Side

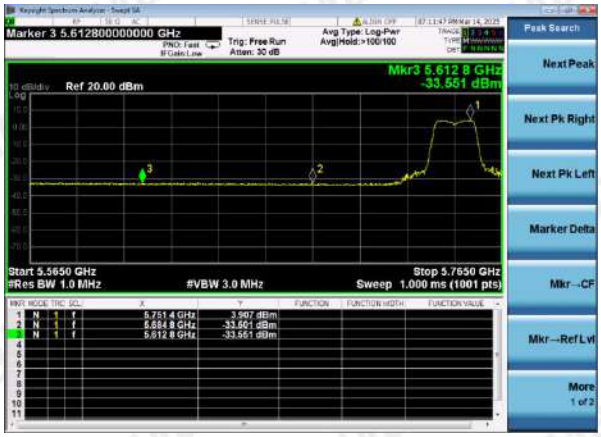
Frequency(GHz)	Limit (dbm)	Rate (dBm/MHz)	Test Results(dbm) 802.11a	Test Results(dbm) 802.11n20
5.5650~5.6500	-27	0	-37.151	-37.583
5.6500~5.7000	-27~10.6	15.6	-37.151	-37.583
5.7000~5.7200	10.6~15.6	10	-36.997	-36.773
5.7200~5.7250	15.6~27	27	-36.997	-36.773
5.7250~5.7650	27	0	4.222	5.373

(802.11a) & 802.11n20 Band Edge, Right Side

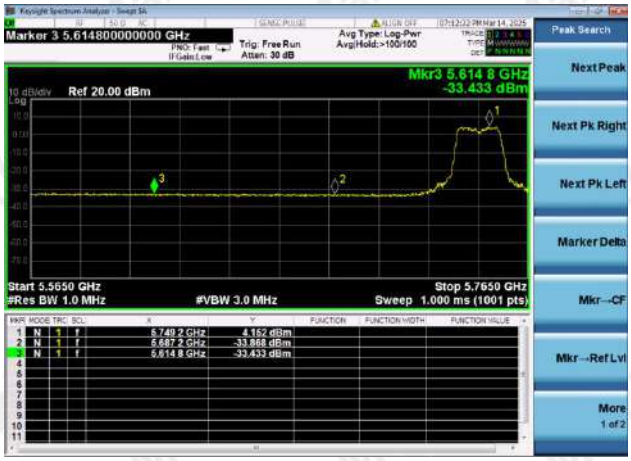
Frequency(GHz)	Limit (dbm)	Rate (dBm/MHz)	Test Results(dbm) 802.11a	Test Results(dbm) 802.11n20
5.8050~5.8500	27	0	5.190	5.953
5.8500~5.8550	27~15.6	27	-36.601	-36.148
5.8550~5.8750	15.6~10.6	10	-36.601	-36.148
5.8750~5.9250	10.6~-27	10.6	-36.945	-36.476
5.9250~6.0050	-27	0	-36.945	-36.476

5.745~5.825 GHz

(802.11ac20) Band Edge, Left Side



(802.11ax20) Band Edge, Left Side



(802.11ac20) Band Edge, Right Side

(802.11ax20) Band Edge, Right Side

(802.11ac) & 802.11ax20 Band Edge, Left Side

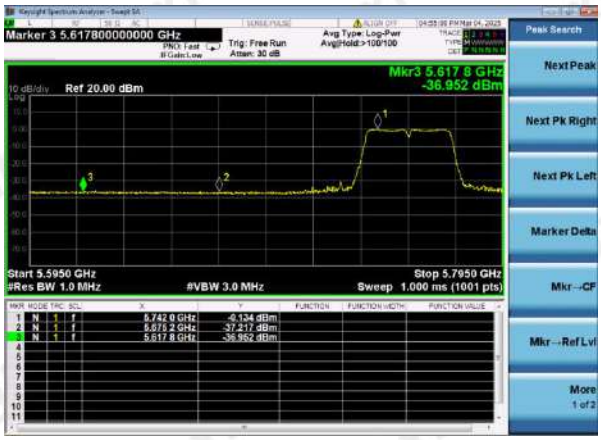
Frequency(GHz)	Limit (dbm)	Rate (dBm/MHz)	Test Results(dbm) 802.11ac	Test Results(dbm) 802.11ax20
5.5650~5.6500	-27	0	-33.551	-33.433
5.6500~5.7000	-27~10.6	15.6	-33.551	-33.433
5.7000~5.7200	10.6~15.6	10	-33.501	-33.868
5.7200~5.7250	15.6~27	27	-33.501	-33.868
5.7250~5.7650	27	0	3.907	4.152

(802.11ac) & 802.11ax20 Band Edge, Right Side

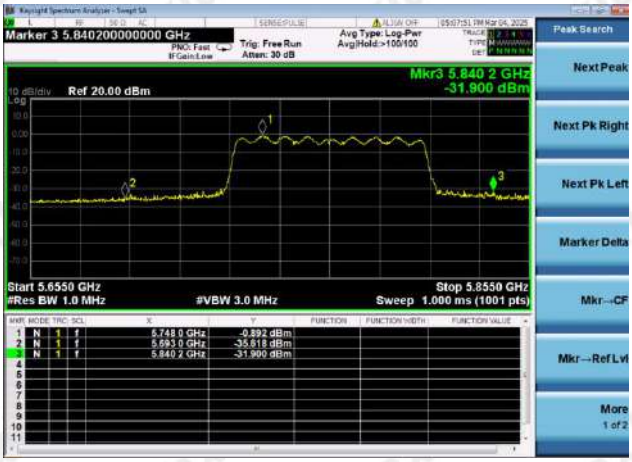
Frequency(GHz)	Limit (dbm)	Rate (dBm/MHz)	Test Results(dbm) 802.11ac	Test Results(dbm) 802.11ax20
5.8050~5.8500	27	0	5.005	5.821
5.8500~5.8550	27~15.6	27	-33.727	-32.778
5.8550~5.8750	15.6~10.6	10	-33.727	-32.778
5.8750~5.9250	10.6~-27	10.6	-32.897	-33.279
5.9250~6.0050	-27	0	-32.897	-33.279

5.745~5.825 GHz

(802.11n40) Band Edge, Left Side

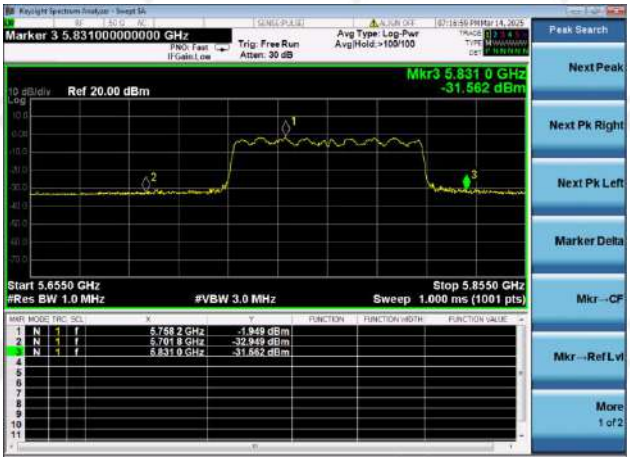


(802.11ac80) Band Edge



(802.11n40) Band Edge, Right Side

(802.11ax80) Band Edge



(802.11n40) Band Edge, Left Side

Frequency(GHz)	Limit (dbm)	Rate (dBm/MHz)	Test Results(dbm)
5.5950~5.6500	-27	0	-37.217
5.6500~5.7000	-27~10.6	15.6	-37.217
5.7000~5.7200	10.6~15.6	10	-36.952
5.7200~5.7250	15.6~27	27	-36.952
5.7250~5.7950	27	0	-0.134

(802.11n40) Band Edge, Right Side

Frequency(GHz)	Limit (dbm)	Rate (dBm/MHz)	Test Results(dbm)
5.7550~5.8500	27	0	-0.203
5.8500~5.8550	27~15.6	27	-35.772
5.8550~5.8750	15.6~10.6	10	-35.772
5.8750~5.9250	10.6~-27	10.6	-36.578
5.9250~5.9550	-27	0	-36.578

(802.11ac/ax80) Band Edge

Frequency(GHz)	Limit (dbm)	Rate (dBm/MHz)	Test Results/ ac80(dbm)	Test Results/ ax80(dbm)
5.6500~5.7000	-27~10.6	15.6	-31.900	-32.949
5.7000~5.7200	10.6~15.6	10	-31.900	-32.949
5.7200~5.7250	15.6~27	27	-31.900	-32.949
5.7250~5.8500	27	0	-0.892	-1.949
5.8500~5.8550	27~15.6	27	-35.618	-31.562

5.745~5.825 GHz

(802.11ac40) Band Edge, Left Side

(802.11ax40) Band Edge, Left Side

(802.11ac40) Band Edge, Right Side

(802.11ax40) Band Edge, Right Side

(802.11ac/ax40) Band Edge, Left Side

Frequency(GHz)	Limit (dbm)	Rate (dBm/MHz)	Test Results/ ac40(dbm)	Test Results/ ax40(dbm)
5.5950~5.6500	-27	0	-33.507	-34.350
5.6500~5.7000	-27~10.6	15.6	-33.507	-34.350
5.7000~5.7200	10.6~15.6	10	-33.509	-33.276
5.7200~5.7250	15.6~27	27	-33.509	-33.276
5.7250~5.7950	27	0	-1.530	-0.478

(802.11ac/ax40) Band Edge, Right Side

Frequency(GHz)	Limit (dbm)	Rate (dBm/MHz)	Test Results/ ac40(dbm)	Test Results/ ax40(dbm)
5.7550~5.8500	27	0	-1.365	-0.299
5.8500~5.8550	27~15.6	27	-33.552	-33.377
5.8550~5.8750	15.6~10.6	10	-33.552	-33.377
5.8750~5.9250	10.6~-27	10.6	-33.202	-33.586
5.9250~5.9550	-27	0	-33.202	-33.586

4.8 SPURIOUS RF CONDUCTED EMISSIONS

4.8.1 Conformance Limit

Frequency Band (MHz)	Limit
5150 - 5250	Outside of the 5.15-5.35 GHz band: e.i.r.p. -27 dBm
5250 - 5350	Outside of the 5.15-5.35 GHz band: e.i.r.p. -27 dBm
5470 - 5725	Outside of the 5.47-5.725 GHz band: e.i.r.p. -27 dBm
5725 - 5850	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.

4.8.2 Measuring Instruments

The Measuring equipment is listed in the section 6.3 of this test report.

4.8.3 Test Setup

4.8.4 Test Procedure

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=1MHz and VBW= 3MHz to measure the peak field strength, and measure frequency range from 30MHz to 40GHz.

4.8.5 Test Results

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and band edge measurement data.

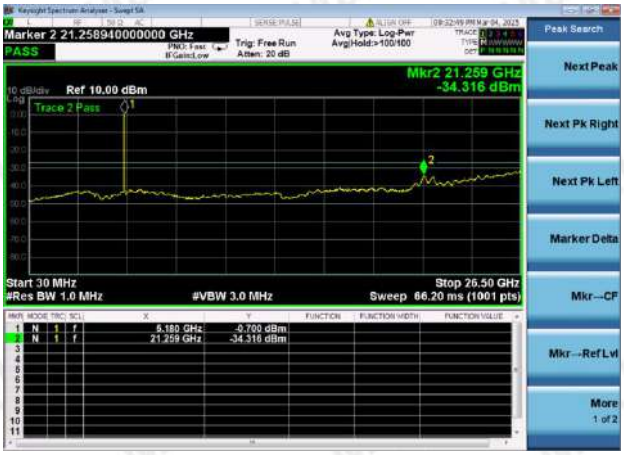
At 26.5GHz to 40GHz, the amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

5.2G

Test Plot

802.11a on channel 36

802.11n20 on channel 36

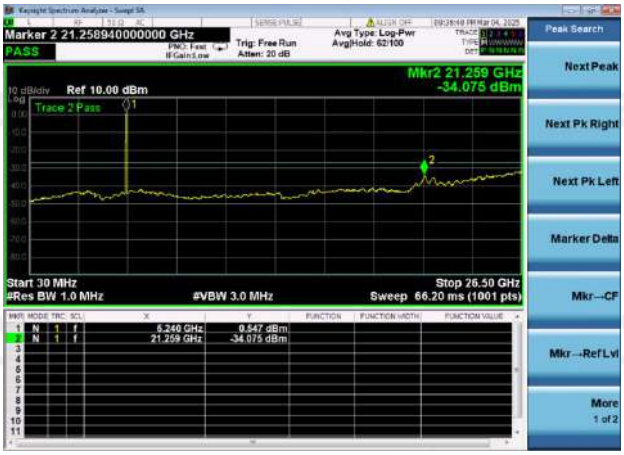


802.11a on channel 40

802.11n20 on channel 40

802.11a on channel 48

802.11n20 on channel 48



Test Plot

802.11ac20 on channel 36

802.11 ax20 on channel 36

802.11ac20 on channel 40

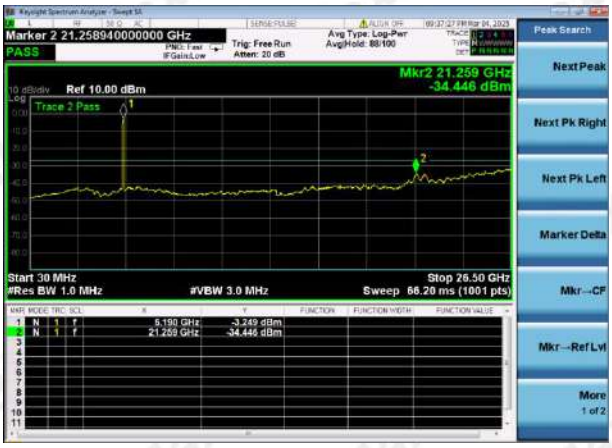
802.11 ax20 on channel 40

802.11ac20 on channel 48

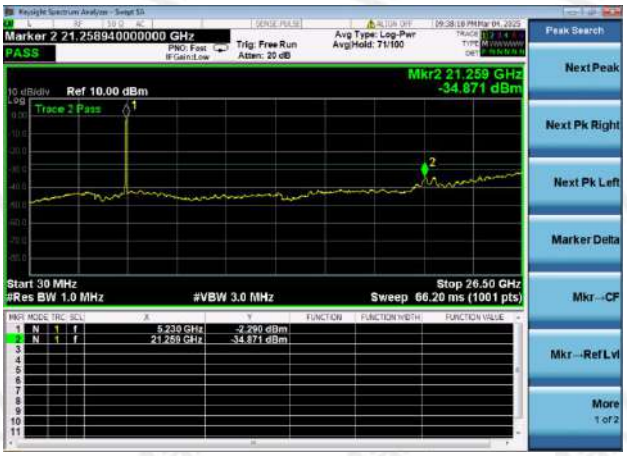
802.11 ax20 on channel 48

Test Plot

802.11n40 on channel 38



802.11n40 on channel 46



802.11ac80 on channel 42

802.11ax80 on channel 42

Test Plot

802.11 ac40 on channel 38

802.11 ac40 on channel 46

802.11ax40 on channel 38

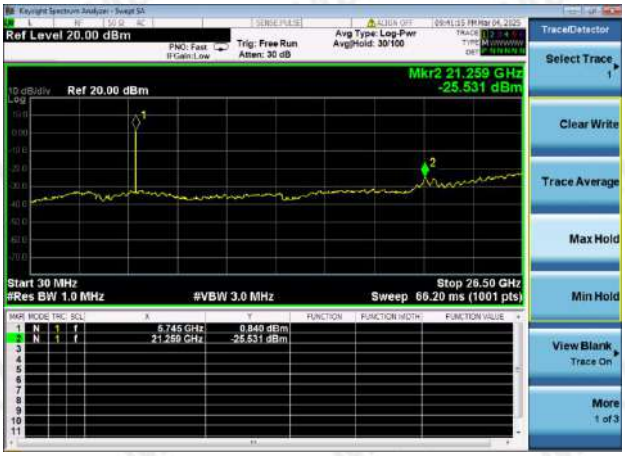
802.11ax40 on channel 46

5.8G

Test Plot

802.11a on channel 149

802.11n20 on channel 149

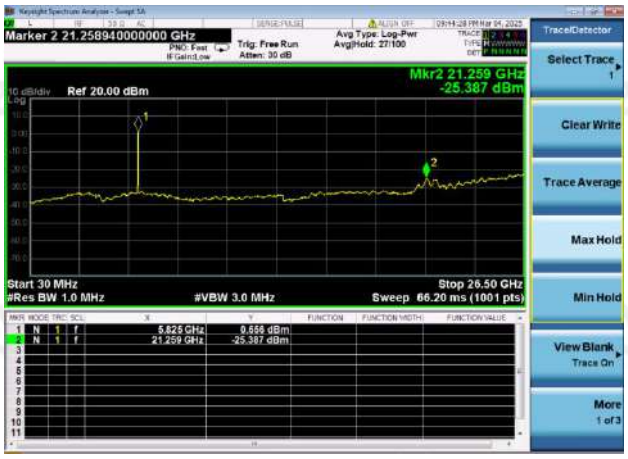


802.11a on channel 157

802.11n20 on channel 157

802.11a on channel 165

802.11n20 on channel 165



802.11ac20 on channel 149

802.11 ax20 on channel 149

802.11ac20 on channel 157

802.11 ax20 on channel 157

802.11ac20 on channel 165

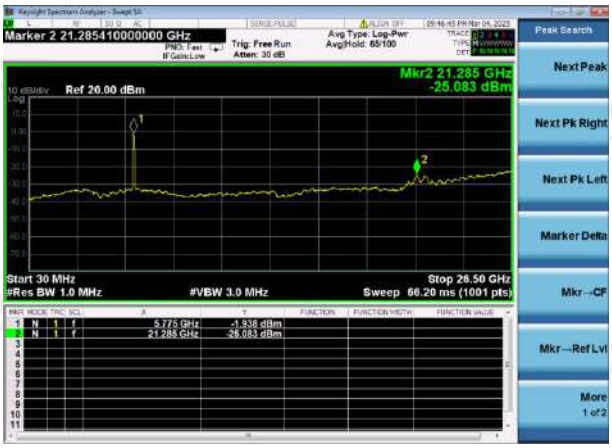
802.11 ax20 on channel 165

Test Plot

802.11n40 on channel 151

802.11n40 on channel 159

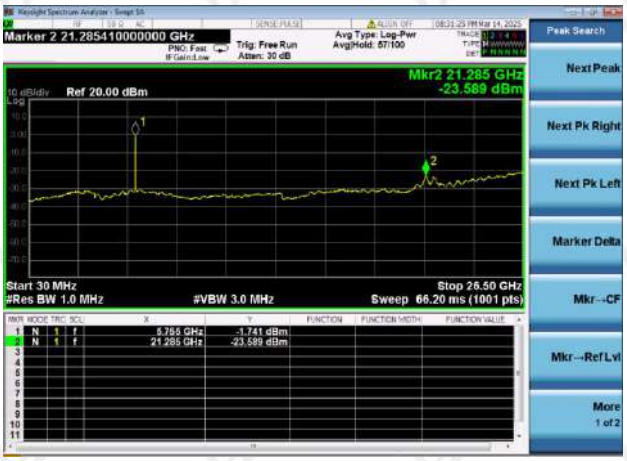
802.11ac80 on channel 155



802.11 ax80 on channel 155

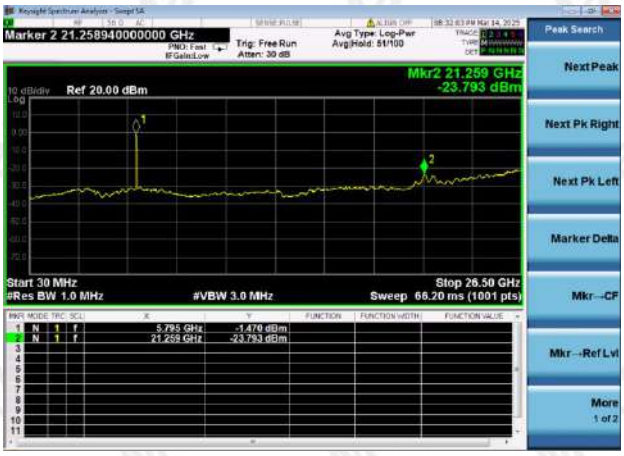
802.11ac40 on channel 151

802.11ax40 on channel 151



802.11ac40 on channel 159

802.11ax40 on channel 159



Frequency (GHz)	Limit (dbm)	Rate (dBm/MHz)	Test Results(dbm) 802.11a on channel 149	Test Results(dbm) 802.11n20 on channel 149
0.030~5.7650	/	/	-25.211	-25.531
5.5650~5.6500	-27	0	-25.211	-25.531
5.6500~5.7000	-27~10.6	15.6	-25.211	-25.531
5.7000~5.7200	10.6~15.6	10	-25.211	-25.531
5.7200~5.7250	15.6~27	27	-25.211	-25.531
5.7250~5.7650	27	0	1.368	0.840
5.7650~26.5	/	/	-25.211	-25.531
Frequency (GHz)	**Limit (dbm)**	**Rate (dBm/MHz)**	**Test Results(dbm) 802.11a on channel 157**	**Test Results(dbm) 802.11n20 on channel 157**
0.030~5.7550	/	/	-24.821	-25.190
5.7550~5.8500	27	0	3.427	1.178
5.8500~5.8550	27~15.6	27	-24.821	-25.190
5.8550~5.8750	15.6~10.6	10	-24.821	-25.190
5.8750~5.9250	10.6~-27	10.6	-24.821	-25.190
5.9250~5.9550	-27	0	-24.821	-25.190
5.9550~26.5	/	/	-24.821	-25.190
Frequency (GHz)	**Limit (dbm)**	**Rate (dBm/MHz)**	**Test Results(dbm) 802.11a on channel 165**	**Test Results(dbm) 802.11n20 on channel 165**
0.030~5.8050	/	/	-24.735	-25.387
5.8050~5.8500	27	0	2.860	0.656
5.8500~5.8550	27~15.6	27	-24.735	-25.387
5.8550~5.8750	15.6~10.6	10	-24.735	-25.387
5.8750~5.9250	10.6~-27	10.6	-24.735	-25.387
5.9250~6.0050	-27	0	-24.735	-25.387
6.0050~26.5	/	/	-24.735	-25.387
Frequency (GHz)	**Limit (dbm)**	**Rate (dBm/MHz)**	**Test Results(dbm) 802.11n40 on channel 151**	**Test Results(dbm) 802.11n40 on channel 159**
0.030~5.7550	/	/	-24.871	-25.285
5.7550~5.8500	27	0	0.197	-1.339
5.8500~5.8550	27~15.6	27	-24.871	-25.285
5.8550~5.8750	15.6~10.6	10	-24.871	-25.285
5.8750~5.9250	10.6~-27	10.6	-24.871	-25.285
5.9250~5.9550	-27	0	-24.871	-25.285
5.9550~26.5	/	/	-24.871	-25.285
Frequency (GHz)	**Limit (dbm)**	**Rate (dBm/MHz)**	**Test Results(dbm) 802.11ac80 on channel 155**	
0.030~5.6500	/	/	-25.083	
5.6500~5.7000	-27~10.6	15.6	-25.083	
5.7000~5.7200	10.6~15.6	10	-25.083	
5.7200~5.7250	15.6~27	27	-25.083	
5.7250~5.8500	27	0	-1.938	
5.8500~5.8550	27~15.6	27	-25.083	
5.8550~26.5	/	/	-25.083	

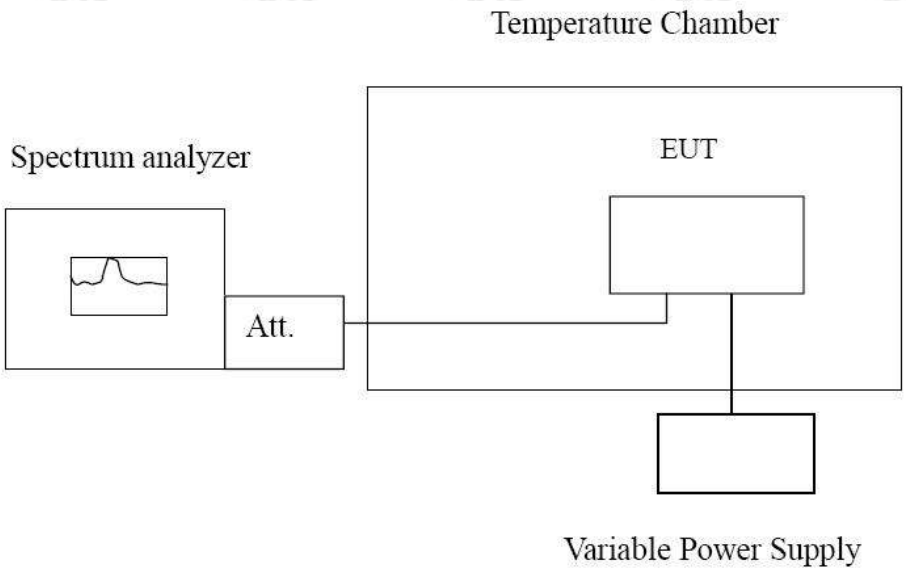
Frequency (GHz)	Limit (dbm)	Rate (dBm/MHz)	Test Results(dbm) 802.11ac20 on channel 149	Test Results(dbm) 802.11ax20 on channel 149
0.030~5.7650	/	/	-41.063	-33.254
5.5650~5.6500	-27	0	-41.063	-33.254
5.6500~5.7000	-27~10.6	15.6	-41.063	-33.254
5.7000~5.7200	10.6~15.6	10	-41.063	-33.254
5.7200~5.7250	15.6~27	27	-41.063	-33.254
5.7250~5.7650	27	0	3.493	3.594
5.7650~26.5	/	/	-33.266	-33.254
Frequency (GHz)	**Limit (dbm)**	**Rate (dBm/MHz)**	**Test Results(dbm) 802.11ac20 on channel 157**	**Test Results(dbm) 802.11ax20 on channel 157**
0.030~5.7550	/	/	-31.200	-23.362
5.7550~5.8500	27	0	3.665	3.901
5.8500~5.8550	27~15.6	27	-23.227	-32.017
5.8550~5.8750	15.6~10.6	10	-23.227	-32.017
5.8750~5.9250	10.6~-27	10.6	-23.227	-32.017
5.9250~5.9550	-27	0	-23.227	-32.017
5.9550~26.5	/	/	-23.227	-32.017
Frequency (GHz)	**Limit (dbm)**	**Rate (dBm/MHz)**	**Test Results(dbm) 802.11ac20 on channel 165**	**Test Results(dbm) 802.11ax20 on channel 165**
0.030~5.8050	/	/	-24.177	-23.698
5.8050~5.8500	27	0	4.266	3.814
5.8500~5.8550	27~15.6	27	-31.387	-30.730
5.8550~5.8750	15.6~10.6	10	-31.387	-30.730
5.8750~5.9250	10.6~-27	10.6	-31.387	-30.730
5.9250~6.0050	-27	0	-31.387	-30.730
6.0050~26.5	/	/	-31.387	-30.730
Frequency (GHz)	**Limit (dbm)**	**Rate (dBm/MHz)**	**Test Results(dbm) 802.11ac40 on channel 151**	**Test Results(dbm) 802.11ac40 on channel 159**
0.030~5.7550	/	/	-23.594	-23.589
5.7550~5.8500	27	0	-2.054	-1.741
5.8500~5.8550	27~15.6	27	-23.594	-23.589
5.8550~5.8750	15.6~10.6	10	-23.594	-23.589
5.8750~5.9250	10.6~-27	10.6	-23.594	-23.589
5.9250~5.9550	-27	0	-23.594	-23.589
5.9550~26.5	/	/	-23.594	-23.589
Frequency (GHz)	**Limit (dbm)**	**Rate (dBm/MHz)**	**Test Results(dbm) 802.11ax40 on channel 151**	**Test Results(dbm) 802.11ax40 on channel 159**
0.030~5.7550	/	/	-23.679	-23.793
5.7550~5.8500	27	0	-3.006	-1.470
5.8500~5.8550	27~15.6	27	-23.679	-23.793
5.8550~5.8750	15.6~10.6	10	-23.679	-23.793
5.8750~5.9250	10.6~-27	10.6	-23.679	-23.793
5.9250~5.9550	-27	0	-23.679	-23.793
5.9550~26.5	/	/	-23.679	-23.793
Frequency (GHz)	**Limit (dbm)**	**Rate (dBm/MHz)**	**Test Results(dbm) 802.11ax80 on channel 155**	
0.030~5.6500	/	/	-23.733	
5.6500~5.7000	-27~10.6	15.6	-23.733	
5.7000~5.7200	10.6~15.6	10	-23.733	
5.7200~5.7250	15.6~27	27	-23.733	
5.7250~5.8500	27	0	-3.616	
5.8500~5.8550	27~15.6	27	-31.823	
5.8550~26.5	/	/	-31.823	

4.9 Frequency Stability

Limit

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 users manual.

TEST CONFIGURATION



TEST PROCEDURE

Frequency Stability under Temperature Variations:
The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 25℃ operating frequency as reference frequency. Turn EUT off and set the chamber temperature to -30℃. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10℃ increased per stage until the highest temperature of +50℃ reached.

Frequency Stability under Voltage Variations:
Set chamber temperature to 25℃. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, record the maximum frequency change.

Reference Frequency: 802.11ac channel=36 frequency=5180MHz					
Voltage (V)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
12.0	-30	67.71	0.013	Within the band of operation	Pass
	-20	81.35	0.016		
	-10	104.13	0.020		
	0	82.95	0.016		
	10	93.44	0.018		
	20	48.27	0.009		
	30	71.92	0.014		
	40	77.52	0.015		
	50	82.22	0.016		
13.8	25	97.84	0.019		
10.2	25	54.38	0.010		

Reference Frequency: 802.11ac channel=149 frequency=5745MHz					
Voltage (V)	Temperature (℃)	Frequency error		Limit (ppm)	Result
		Hz	ppm		
12.0	-30	108.22	0.019	Within the band of operation	Pass
	-20	89.51	0.016		
	-10	49.27	0.009		
	0	62.58	0.011		
	10	56.98	0.010		
	20	51.16	0.009		
	30	52.57	0.009		
	40	84.92	0.015		
	50	109.91	0.019		
13.8	25	54.60	0.010		
10.2	25	53.89	0.009		

4.10 Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited

Test Result:

The EUT has three 5G WIFI external antenna (Antenna 1/2/3 gain: 6.0dBi) and R-SMA antenna connector. It comply with the standard requirement.

Remark:The antenna gain is provided by the customer, if the data provided by the customer is not accurate, MAXLAB Testing Co.,Ltd. does not assume any responsibility.

5 Test Setup Photos of the EUT

Reference to the appendix I for details.

6 Photos of the EUT

Reference to the appendix II for details.

********** End of Report **********