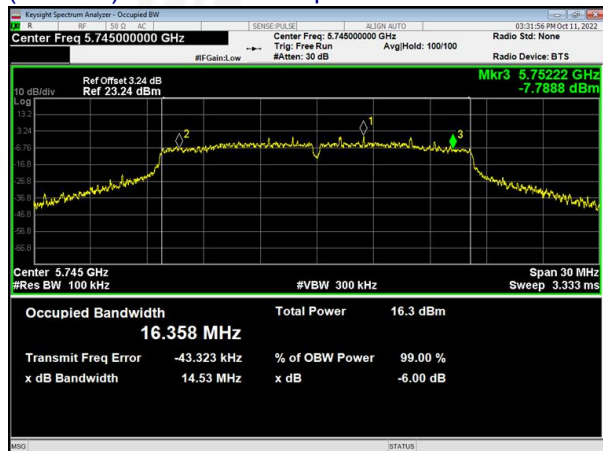


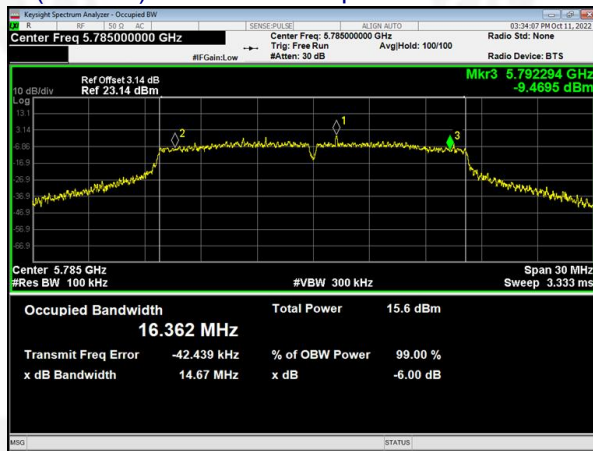


Test plot

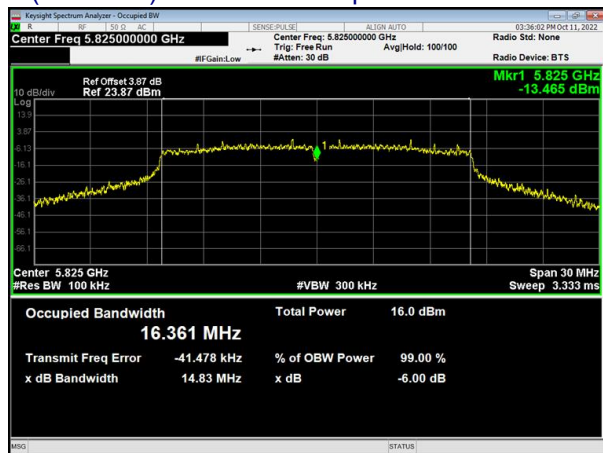
(802.11a) 6dB Bandwidth plot on channel 149



(802.11a) 6dB Bandwidth plot on channel 157



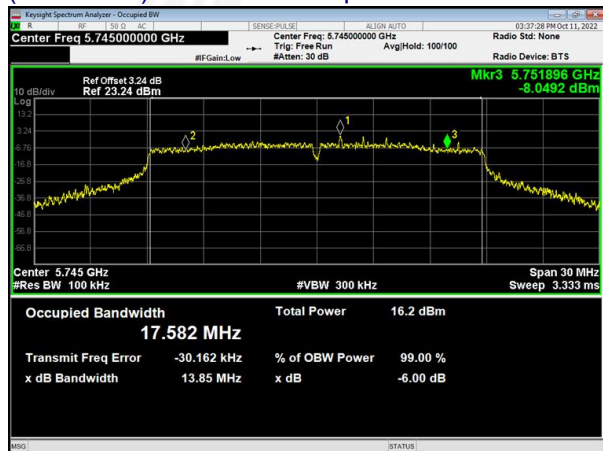
(802.11a) 6dB Bandwidth plot on channel 165



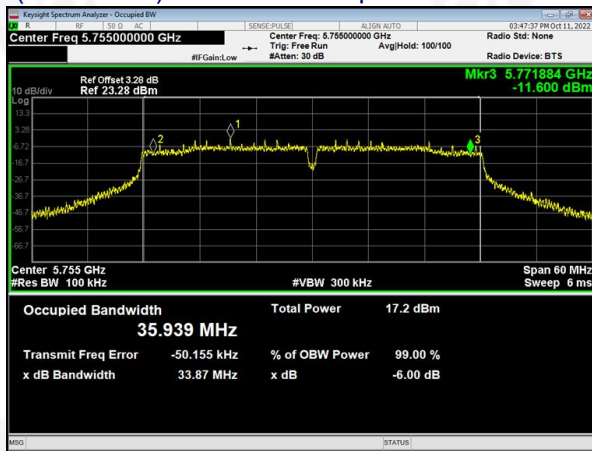


Test plot

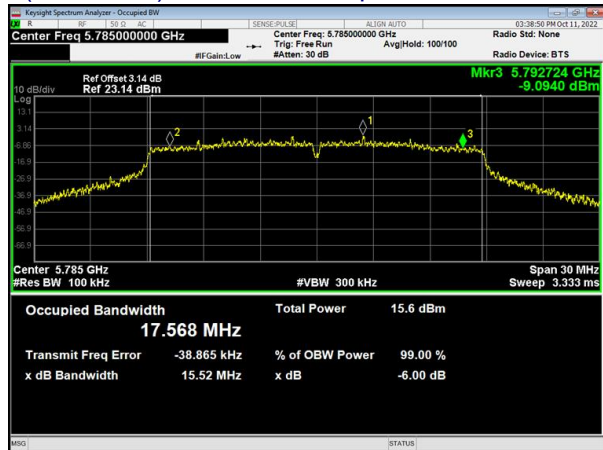
(802.11n20) 6dB Bandwidth plot on channel 149



(802.11 n40) 6dB Bandwidth plot on channel 151



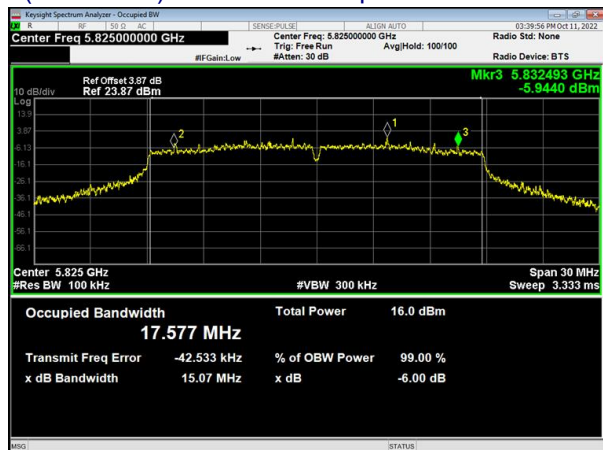
(802.11n20) 6dB Bandwidth plot on channel 157



(802.11 n40) 6dB Bandwidth plot on channel 159



(802.11n20) 6dB Bandwidth plot on channel 165





Test plot

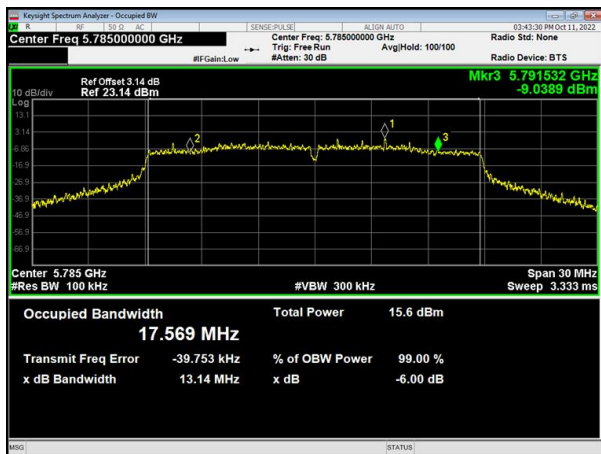
(802.11ac20) 6dB Bandwidth plot on channel 149



(802.11 ac40) 6dB Bandwidth plot on channel 151



(802.11ac20) 6dB Bandwidth plot on channel 157



(802.11 ac40) 6dB Bandwidth plot on channel 159



(802.11ac20) 6dB Bandwidth plot on channel 165





7. MAXIMUM CONDUCTED OUTPUT POWER

7.1 PPLIED PROCEDURES / LIMIT

According to FCC §15.407

The maximum conducted output power should not exceed:

Frequency Band(MHz)	Limit
5150~5250	250mW
5725~5850	1W

7.2 TEST PROCEDURE

The EUT was directly connected to the Power meter

1. Device Configuration

If possible, configure or modify the operation of the EUT so that it transmits continuously at its maximum power control level (see section II.B.).

a) 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.

b) If continuous transmission (or at least 98 percent duty cycle) cannot be achieved due to hardware limitations (e.g., overheating), the EUT shall be operated at its maximum power control level with the transmit duration as long as possible and the duty cycle as high as possible.

2. Measurement using a Spectrum Analyzer or EMI Receiver (SA)

Measurement of maximum conducted output power using a spectrum analyzer requires integrating the spectrum across a frequency span that encompasses, at a minimum, either the EBW or the 99-percent occupied bandwidth of the signal.¹ However, the EBW must be used to determine bandwidth dependent limits on maximum conducted output power in accordance with § 15.407(a).

a) The test method shall be selected as follows: (i) Method SA-1 or SA-1 Alternative (averaging with the EUT transmitting at full power throughout each sweep) shall be applied if either of the following conditions can be satisfied:

- The EUT transmits continuously (or with a duty cycle ≥ 98 percent).
- Sweep triggering or gating can be implemented in a way that the device transmits at the maximum power control level throughout the duration of each of the instrument sweeps to be averaged. This condition can generally be achieved by triggering the instrument's sweep if the duration of the sweep (with the analyzer configured as in Method SA-1, below) is equal to or shorter than the duration T of each transmission from the EUT and if those transmissions exhibit full power throughout their durations.

(ii) Method SA-2 or SA-2 Alternative (averaging across on and off times of the EUT transmissions, followed by duty cycle correction) shall be applied if the conditions of (i) cannot be achieved and the transmissions exhibit a constant duty cycle during the measurement duration. Duty cycle will be considered to be constant if variations are less than ± 2 percent.

(iii) Method SA-3 (RMS measurement with max hold) or SA-3 Alternative (reduced VBW with max hold) shall be applied if the conditions of (i) and (ii) cannot be achieved.

b) Method SA-1 (trace averaging with the EUT transmitting at full power throughout each sweep): (i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(ii) Set RBW = 1 MHz.

(iii) Set VBW ≥ 3 MHz.

(iv) Number of points in sweep ≥ 2 Span / RBW. (This ensures that bin-to-bin spacing is $\leq$ RBW/2, so that narrowband signals are not lost between frequency bins.)

(v) Sweep time = auto.

(vi) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.

(vii) If transmit duty cycle < 98 percent, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98 percent, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run".

(viii) Trace average at least 100 traces in power averaging (i.e., RMS) mode.



(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum

7.3 DEVIATION FROM STANDARD

No deviation.

7.4 TEST SETUP



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.



7.6 TEST RESULTS

Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1012 hPa	Test Voltage :	DC 12V
Test Mode :	TX		

Test Channel	Frequency	Maximum output power	LIMIT	Result
	(MHz)	(dBm)	dBm	
TX 802.11 a Mode				
CH36	5180	7.595	23.98	Pass
CH40	5200	7.875	23.98	Pass
CH48	5240	8.078	23.98	Pass
TX 802.11 n20M Mode				
CH36	5180	6.978	23.98	Pass
CH40	5200	7.739	23.98	Pass
CH48	5240	7.931	23.98	Pass
TX 802.11 n40M Mode				
CH38	5190	3.860	23.98	Pass
CH46	5230	9.343	23.98	Pass
TX 802.11 ac20M Mode				
CH36	5180	6.649	23.98	Pass
CH40	5200	7.647	23.98	Pass
CH48	5240	7.846	23.98	Pass
TX 802.11 ac40M Mode				
CH38	5190	3.759	23.98	Pass
CH46	5230	9.318	23.98	Pass



Test Channel	Frequency	Maximum output power.	LIMIT	Result
	(MHz)	(dBm)	dBm	
TX 802.11 a Mode				
CH149	5745	10.355	30	Pass
CH157	5785	9.567	30	Pass
CH165	5825	10.266	30	Pass
TX 802.11 n20M Mode				
CH149	5745	10.381	30	Pass
CH157	5785	9.675	30	Pass
CH165	5825	10.096	30	Pass
TX 802.11 n40M Mode				
CH151	5755	10.689	30	Pass
CH159	5795	9.968	30	Pass
TX 802.11 ac20M Mode				
CH149	5745	10.396	30	Pass
CH157	5785	9.763	30	Pass
CH165	5825	10.174	30	Pass
TX 802.11 ac40M Mode				
CH151	5755	10.659	30	Pass
CH159	5795	9.979	30	Pass



8.OUT OF BAND EMISSIONS

8.1 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)

(i) 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.

8.2 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.

8.3 DEVIATION FROM STANDARD

No deviation.

8.4 TEST SETUP





8.5 EUT OPERATION CONDITIONS

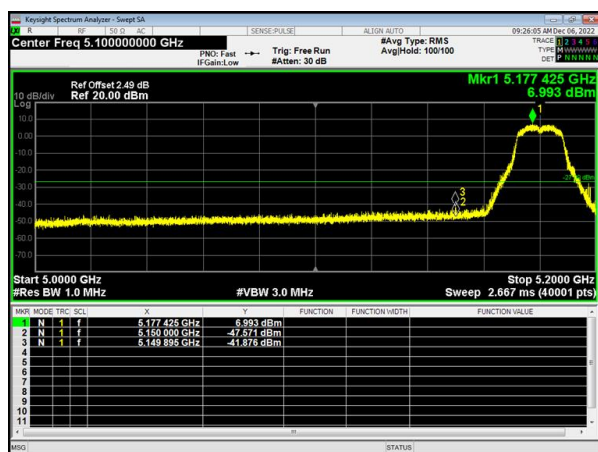
The EUT tested system was configured as the statements of 2.4 Unless otherwise a special operating condition is specified in the follows during the testing.

8.6 TEST RESULTS

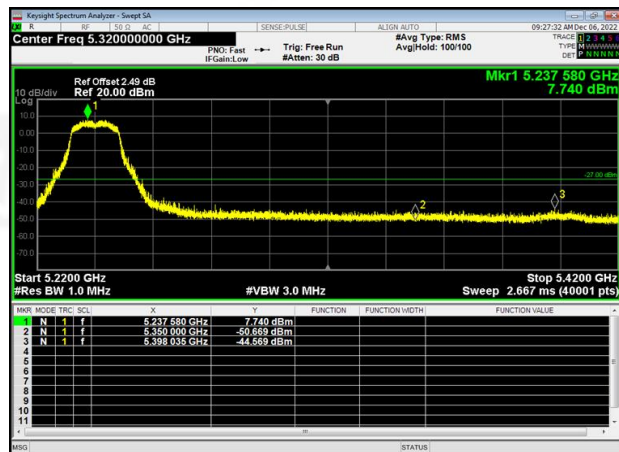
Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1012 hPa	Test Voltage :	DC 12V

5.180~5.240 GHz

(802.11a) Band Edge, Left Side

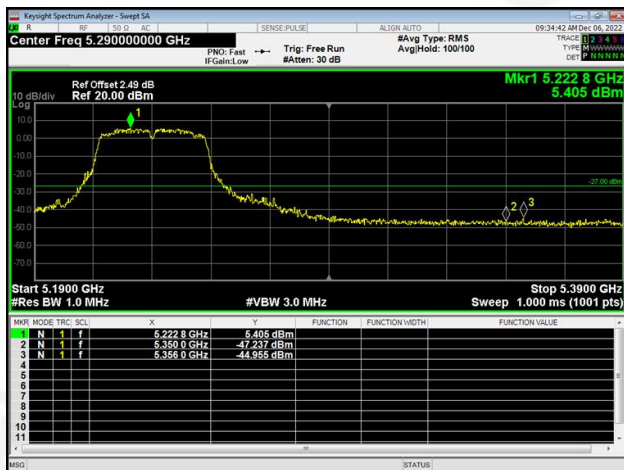


(802.11a) Band Edge, Left Side





(802.11n20) Band Edge, Left Side





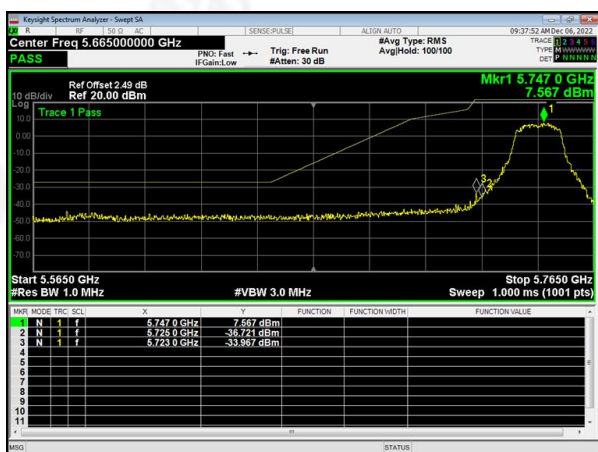
(802.1ac20) Band Edge, Left Side



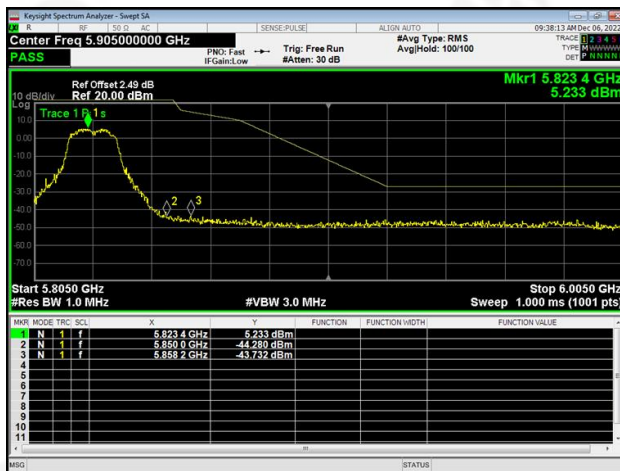


5.745~5.825 GHz

(802.11a) Band Edge, Left Side



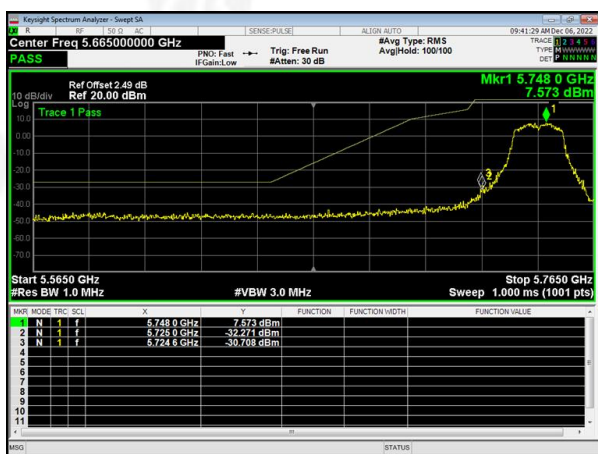
(802.11a) Band Edge, Left Side



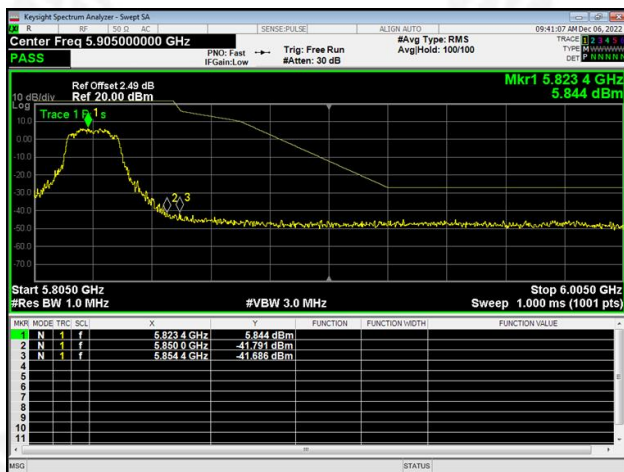


5.745~5.825 GHz

(802.11n20) Band Edge, Left Side



(802.11n20) Band Edge, Right Side



(802.11n40) Band Edge, Left Side



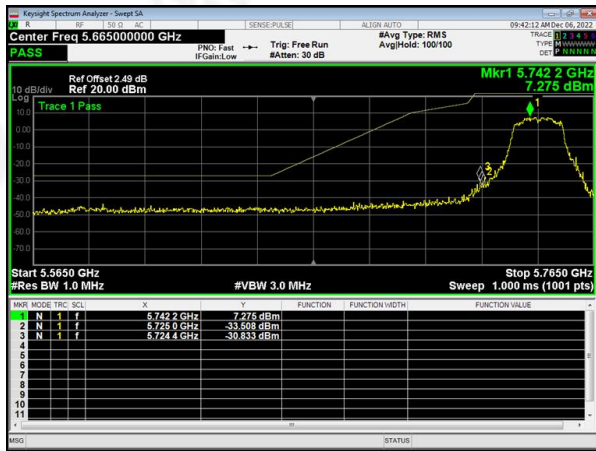
(802.11n40) Band Edge, Right Side



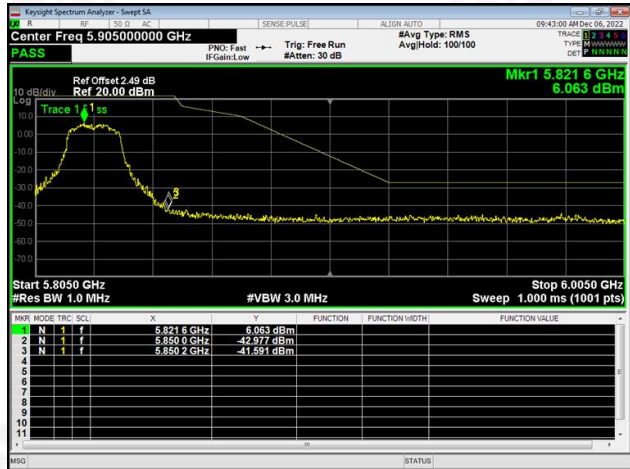


5.745~5.825 GHz

(802.11ac20) Band Edge, Left Side



(802.11ac20) Band Edge, Right Side



(802.11ac40) Band Edge, Left Side



(802.11ac40) Band Edge, Right Side





9.SPURIOUS RF CONDUCTED EMISSIONS

9.1 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.

9.2 MEASURING INSTRUMENTS

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

9.3 TEST SETUP



9.4 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 26.5GHz.

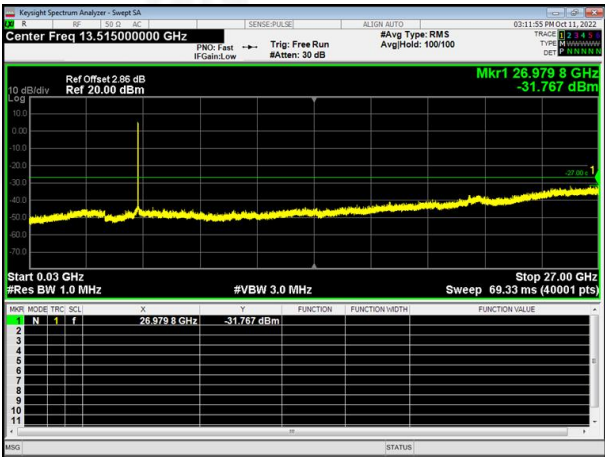
9.5 TEST RESULTS

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. And above 26.5GHz of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported. The lowest, middle and highest channels are tested to verify the spurious emissions and band edge measurement data.

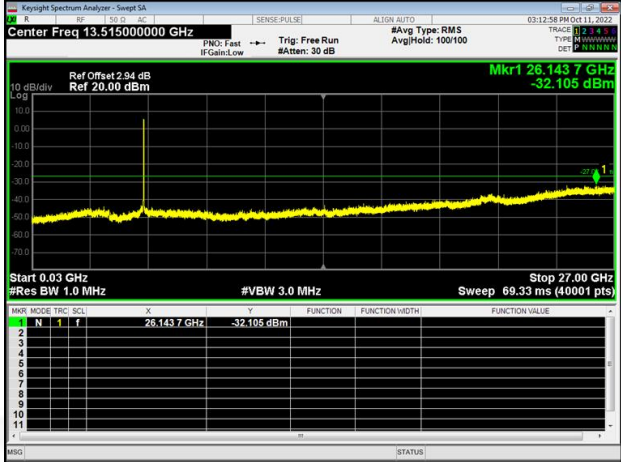


5.2G
Test Plot

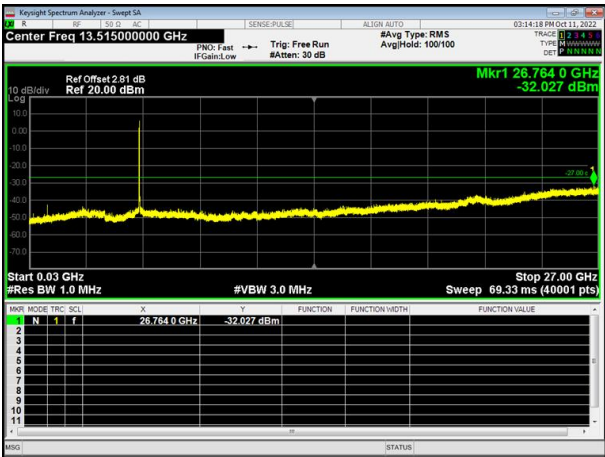
802.11a on channel 36



802.11a on channel 40



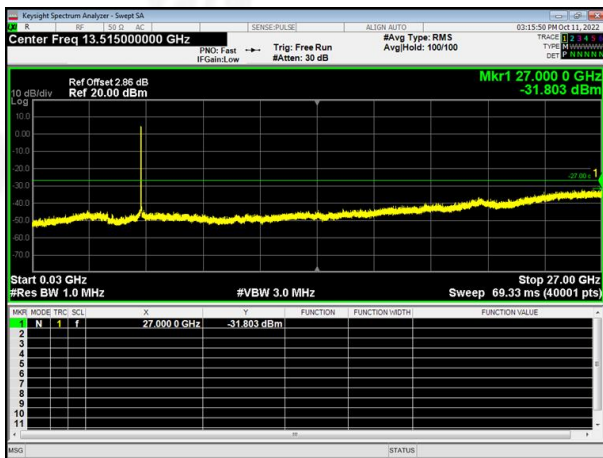
802.11a on channel 48



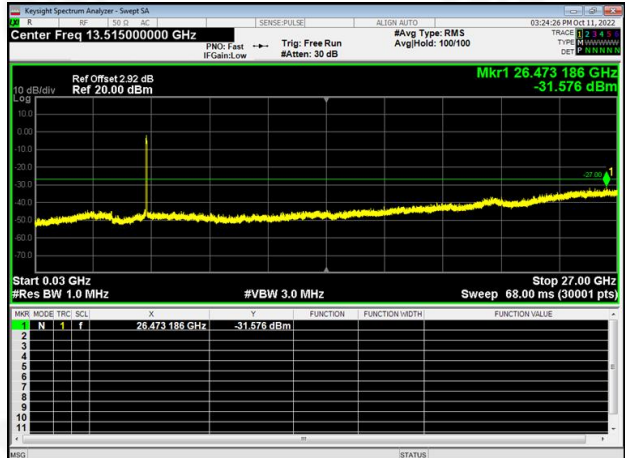


Test Plot

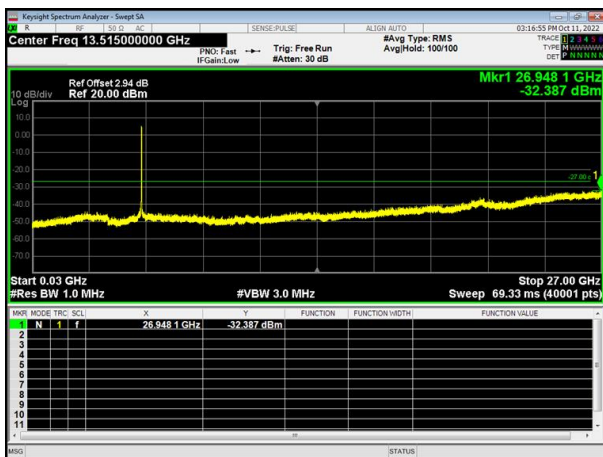
802.11n20 on channel 36



802.11n20 on channel 40



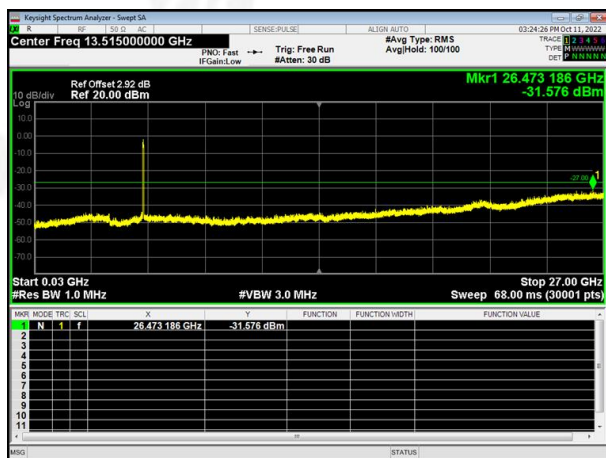
802.11n20 on channel 48



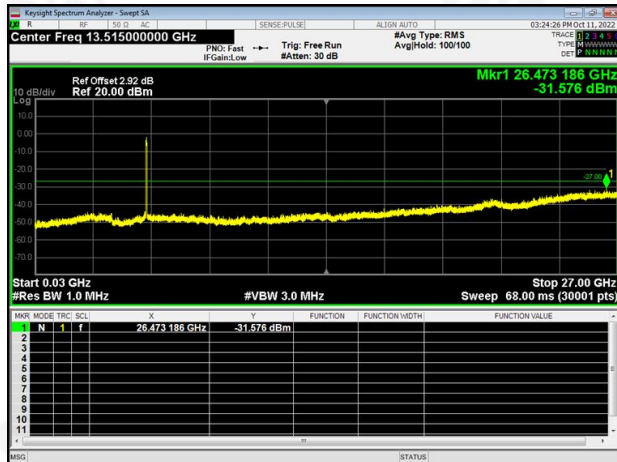


Test Plot

802.11n40 on channel 38



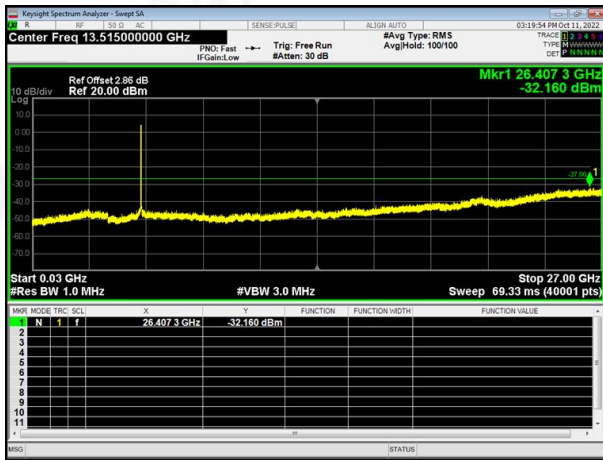
802.11n40 on channel 46



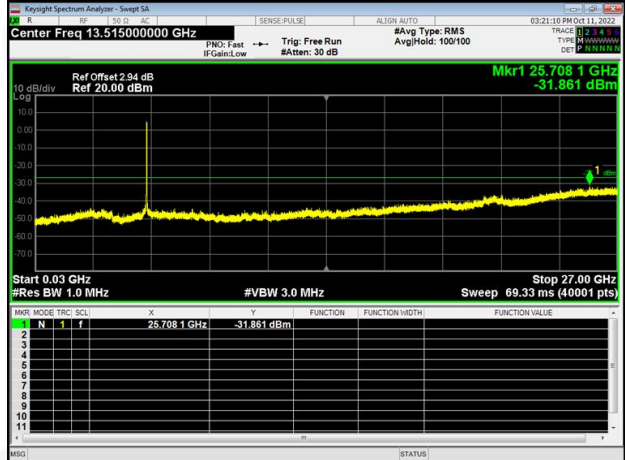


Test Plot

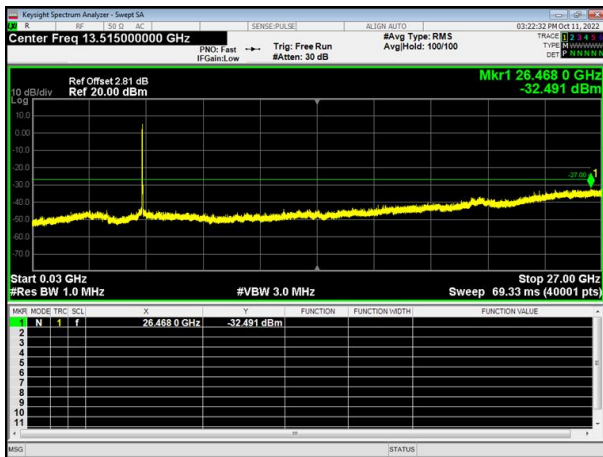
802.11ac20 on channel 36



802.11ac20 on channel 40



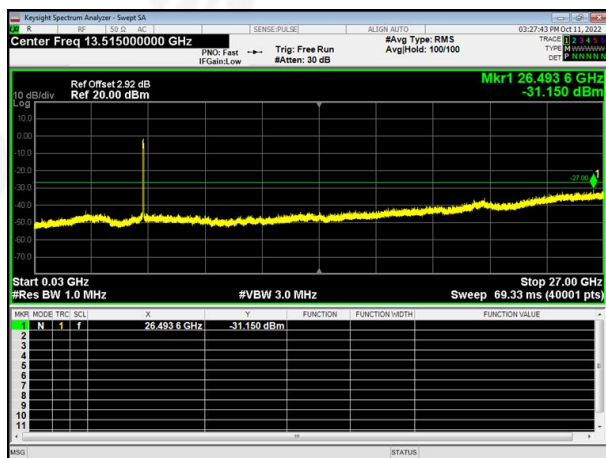
802.11ac20 on channel 48



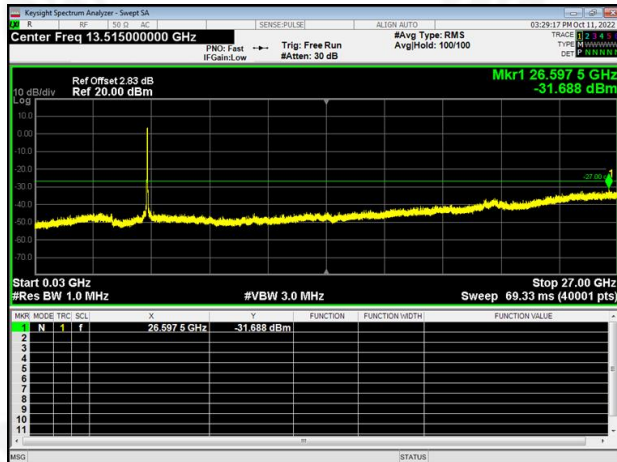


Test Plot

802.11ac40 on channel 38



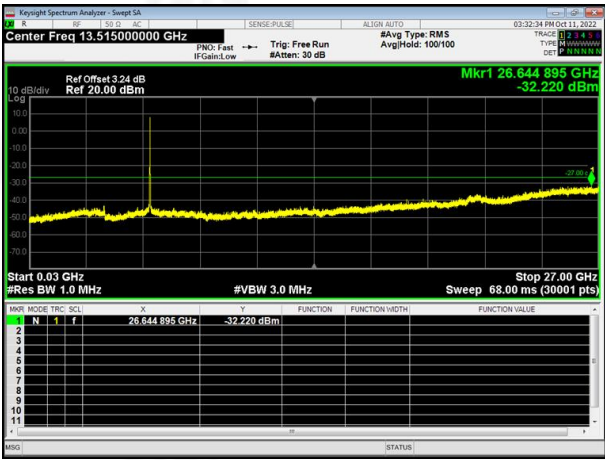
802.11ac40 on channel 46



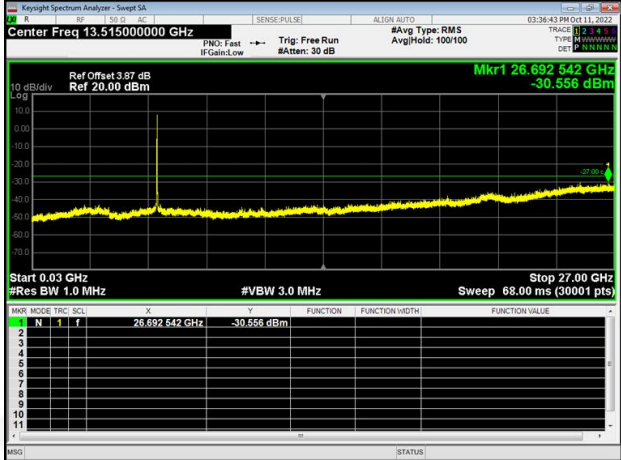


5.8G
Test Plot

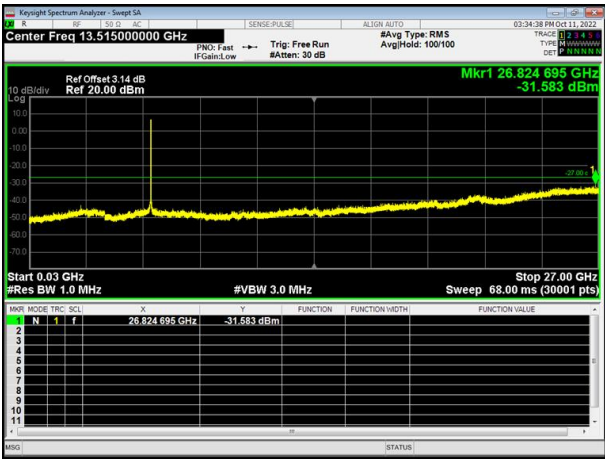
802.11a on channel 149



802.11a on channel 165



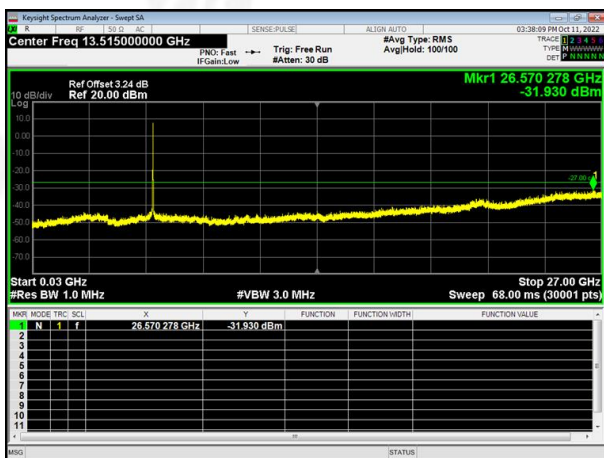
802.11a on channel 157



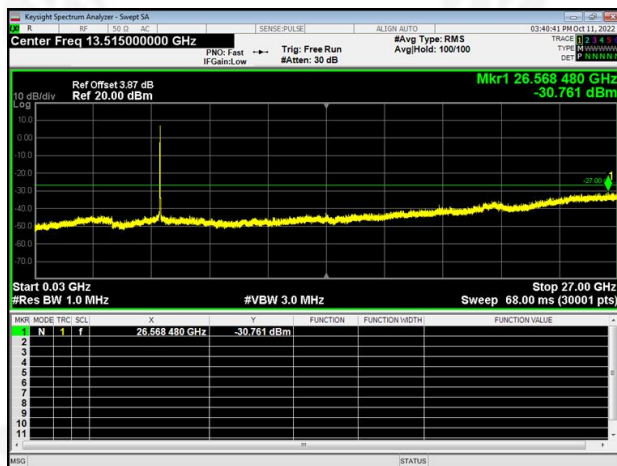


Test Plot

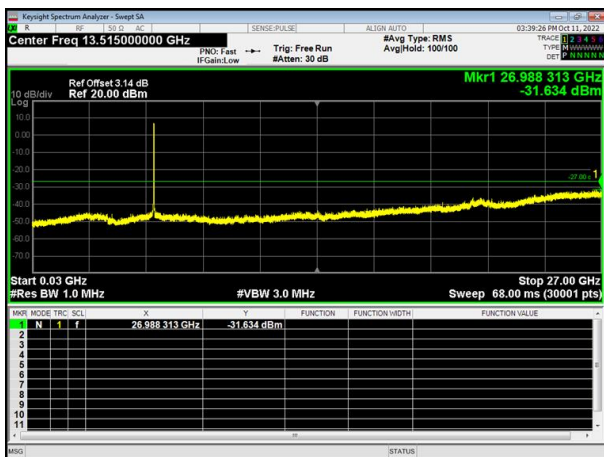
802.11n20 on channel 149



802.11n20 on channel 165



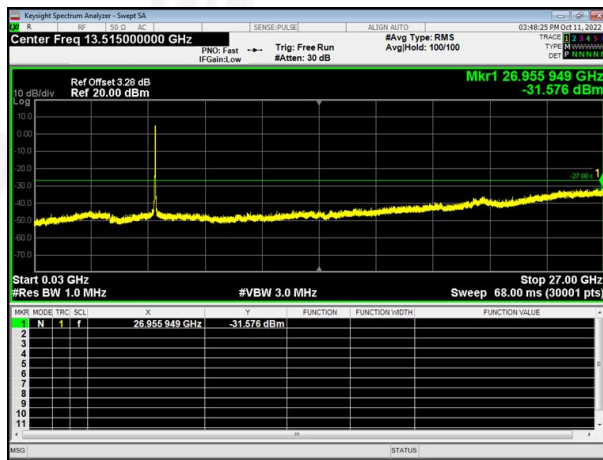
802.11n20 on channel 157



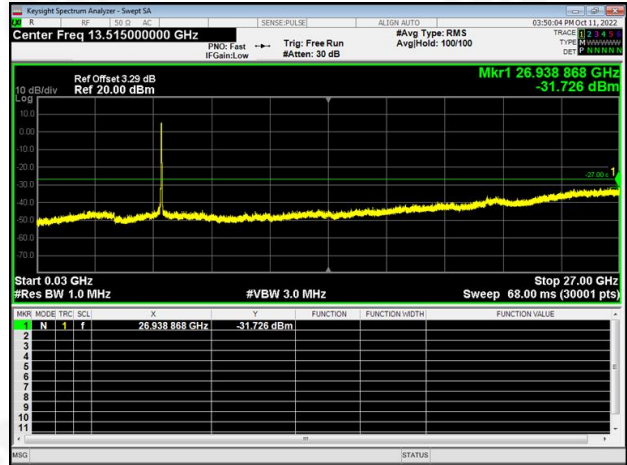


Test Plot

802.11n40 on channel 151



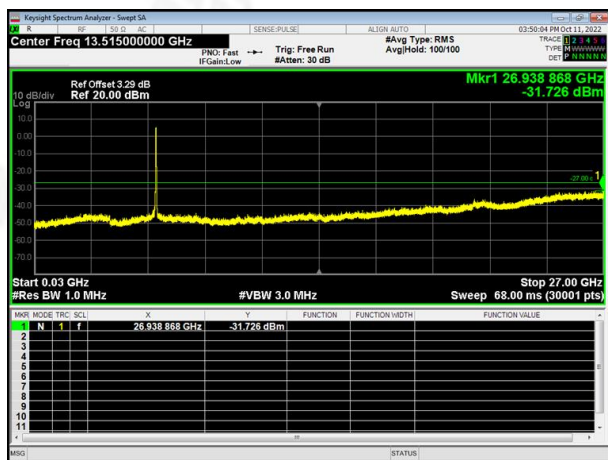
802.11n40 on channel 159



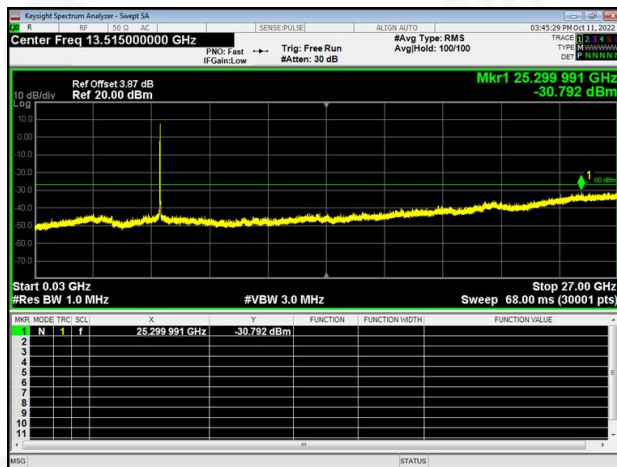


Test Plot

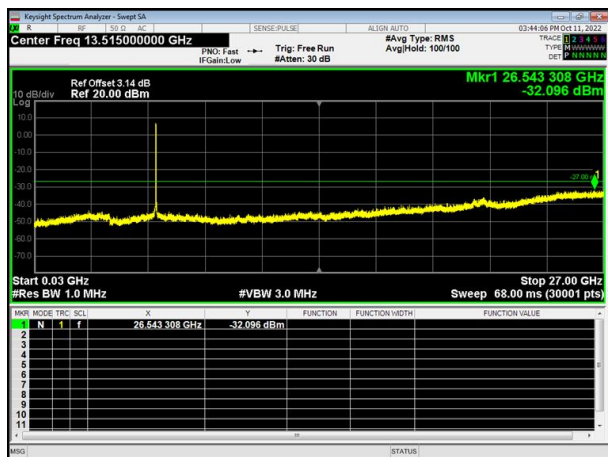
802.11ac20 on channel 149



802.11ac20 on channel 165



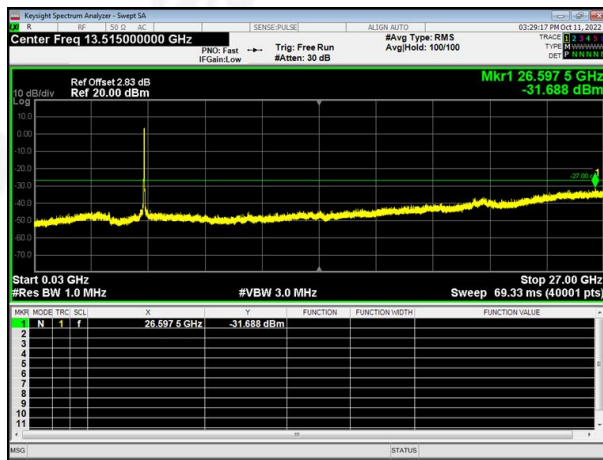
802.11ac20 on channel 157



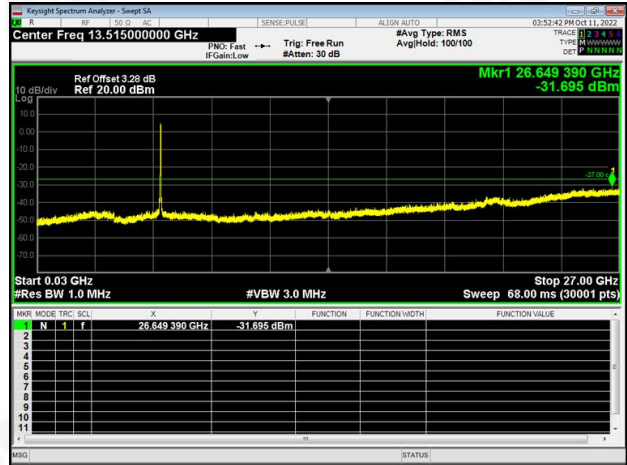


Test Plot

802.11ac40 on channel 151



802.11ac40 on channel 159





10. Frequency Stability Measurement

10.1 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.

The transmitter center frequency tolerance shall be ± 20 ppm maximum for the 5 GHz band (IEEE 802.11n specification).

10.2 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 maxhold settings.
5. f_c is declaring of channel frequency. Then the frequency error formula is $(f_c - f)/f_c \times 10^6$ ppm and the limit is less than ± 20 ppm (IEEE 802.11n specification).
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 $-20^\circ\text{C} \sim 70^\circ\text{C}$.

10.3 TEST SETUP LAYOUT



10.4 EUT OPERATION DURING TEST

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

10.5 TEST RESULTS

Temperature :	26 °C	Relative Humidity :	54%
Pressure :	1012 hPa	Test Voltage :	DC 12V
Test Mode :	TX		

5.2G
802.11a

Reference Frequency(Middle Channel): 5200MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	120	55	0.00963
40	120	46	0.00731
30	120	34	0.00584
20	120	28	0.00425
10	120	21	0.00391
0	120	15	0.00242
-10	120	17	0.00236
-20	120	22	0.00374
-30	120	38	0.00591

802.11n_HT20

Reference Frequency(Middle Channel): 5200MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	120	54	0.00952
40	120	43	0.00727
30	120	31	0.00552
20	120	25	0.00414
10	120	24	0.00381
0	120	13	0.00206
-10	120	12	0.00223
-20	120	22	0.00365
-30	120	33	0.00554



802.11n_HT40

Reference Frequency(Middle Channel): 5190MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	120	60	0.01052
40	120	53	0.00931
30	120	43	0.00726
20	120	45	0.00757
10	120	33	0.00585
0	120	31	0.00551
-10	120	33	0.00583
-20	120	41	0.00725
-30	120	52	0.00881

802.11 ac20

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	120	62	0.01088
40	120	52	0.00881
30	120	44	0.00742
20	120	33	0.00552
10	120	24	0.00397
0	120	25	0.00444
-10	120	23	0.00383
-20	120	35	0.00621
-30	120	44	0.00744



802.11ac40

Reference Frequency(Middle Channel): 5190MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	120	61	0.01053
40	120	52	0.00900
30	120	43	0.00745
20	120	44	0.00759
10	120	34	0.00587
0	120	22	0.00380
-10	120	36	0.00622
-20	120	43	0.00743
-30	120	51	0.00880

So, Frequency Stability Versus Input Voltage is:

802.11a

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	120	56	0.00962
	120	45	0.00730
	120	37	0.00590

802.11n_HT20

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	120	55	0.00951
	120	42	0.00726
	120	32	0.00553

802.11n_HT40

Reference Frequency(Middle Channel): 5190 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	120	42	0.00725
	120	44	0.00759
	120	42	0.00725



802.11ac20

Reference Frequency(Middle Channel): 5200 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	120	34	0.00588
	120	32	0.00553
	120	33	0.00570

802.11ac40

Reference Frequency(Middle Channel): 5190 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	120	42	0.00725
	120	32	0.00553
	120	42	0.00725

5.8G

802.11a

Reference Frequency(Middle Channel): 5785MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	120	45	0.00757
40	120	26	0.00432
30	120	37	0.00575
20	120	22	0.00433
10	120	15	0.00256
0	120	14	0.00225
-10	120	16	0.00236
-20	120	24	0.00371
-30	120	37	0.00568

802.11n_HT20

Reference Frequency(Middle Channel): 5785MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	120	42	0.00726
40	120	24	0.00415



30	120	32	0.00553
20	120	24	0.00415
10	120	13	0.00225
0	120	12	0.00207
-10	120	13	0.00225
-20	120	21	0.00363
-30	120	32	0.00553



802.11n_HT40

Reference Frequency(Middle Channel): 5795MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	120	61	0.01053
40	120	54	0.00932
30	120	42	0.00725
20	120	44	0.00759
10	120	34	0.00587
0	120	32	0.00552
-10	120	34	0.00587
-20	120	42	0.00725
-30	120	51	0.00880

802.11ac20

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	120	43	0.00743
40	120	51	0.00882
30	120	23	0.00398
20	120	26	0.00449
10	120	23	0.00398
0	120	26	0.00449
-10	120	22	0.00380
-20	120	36	0.00622
-30	120	26	0.00449



802.11ac40

Reference Frequency(Middle Channel): 5795MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
50	120	61	0.01053
40	120	24	0.00415
30	120	32	0.00553
20	120	24	0.00415
10	120	34	0.00587
0	120	32	0.00552
-10	120	34	0.00587
-20	120	34	0.00589
-30	120	32	0.00554



So, Frequency Stability Versus Input Voltage is:

802.11a

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	120	37	0.00575
	120	24	0.00415
	120	32	0.00553

802.11n_HT20

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	120	33	0.00570
	120	21	0.00363
	120	43	0.00743

802.11n_HT40

Reference Frequency(Middle Channel): 5795 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	120	42	0.00725
	120	44	0.00759
	120	43	0.00743

802.11ac20

Reference Frequency(Middle Channel): 5785 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	120	55	0.00951
	120	32	0.00553
	120	33	0.00570



802.11ac40

Reference Frequency(Middle Channel): 5795 MHz			
Environment Temperature (°C)	Power Supplied (VAC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
20	120	32	0.00553
	120	33	0.00570
	120	43	0.00743



11.ANTENNA REQUIREMENT

Standard requirement:	FCC Part15 C Section 15.203
15.203 requirement: 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.	
EUT Antenna:	
The antenna is External Antenna, the best case gain of the antenna is 2.49 dBi, reference to the appendix II for details	



12. TEST SETUP PHOTO

Reference to the appendix I for details.

13. EUT CONSTRUCTIONAL DETAILS

Reference to the appendix II for details.

***** END OF REPORT *****