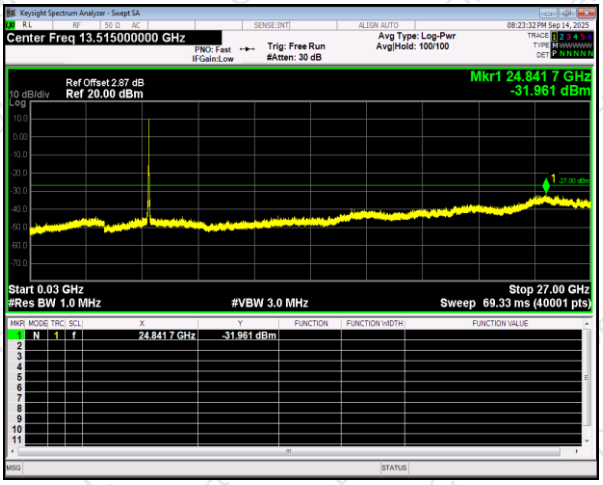
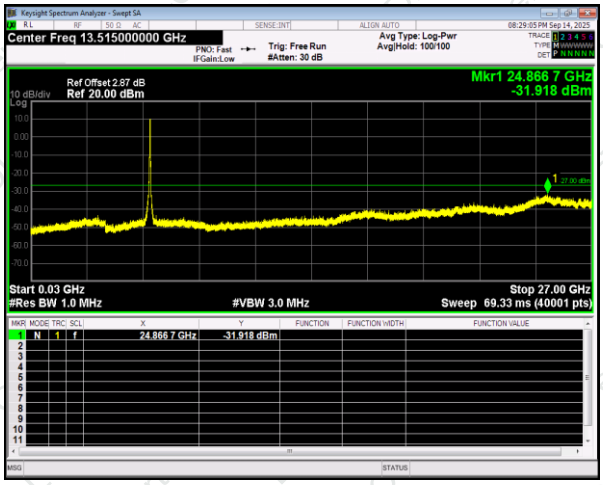
5.8G Test Plot

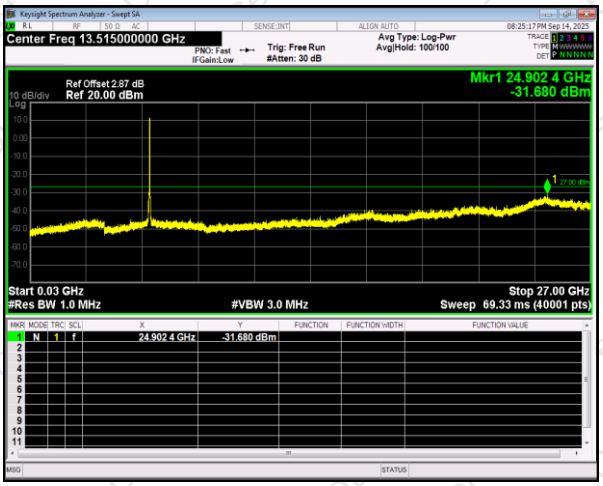
802.11n20 on channel 149



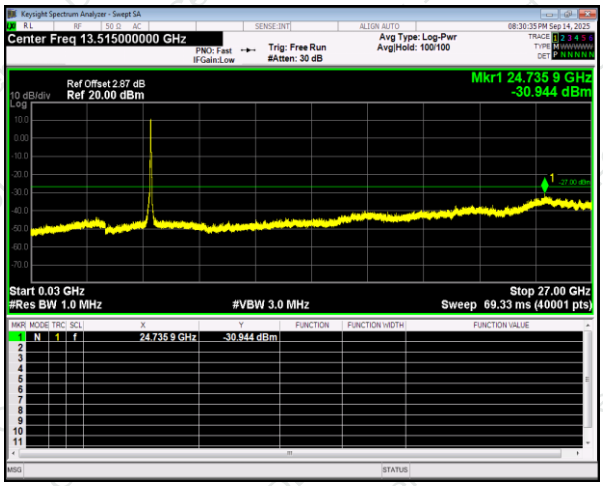
802.11n40 on channel 151



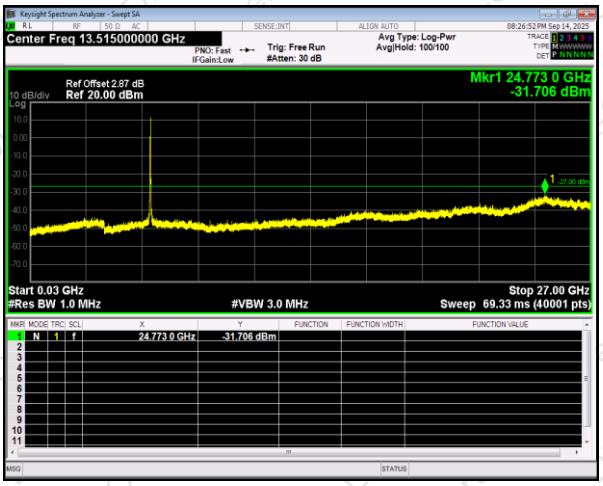
802.11n20 on channel 157



802.11n40 on channel 159

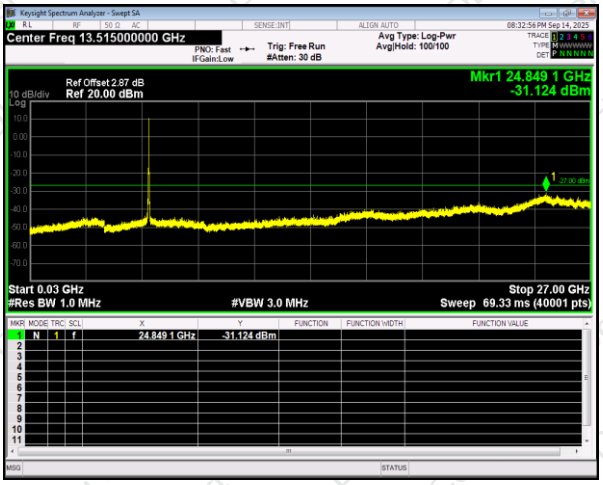


802.11n20 on channel 165

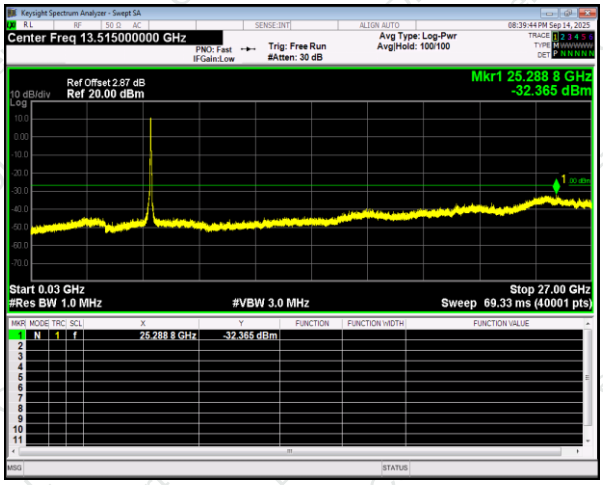


5.8G Test Plot

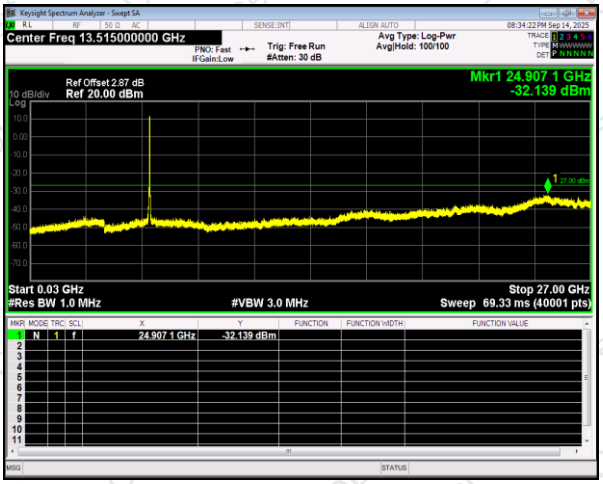
802.11ac20 on channel 149



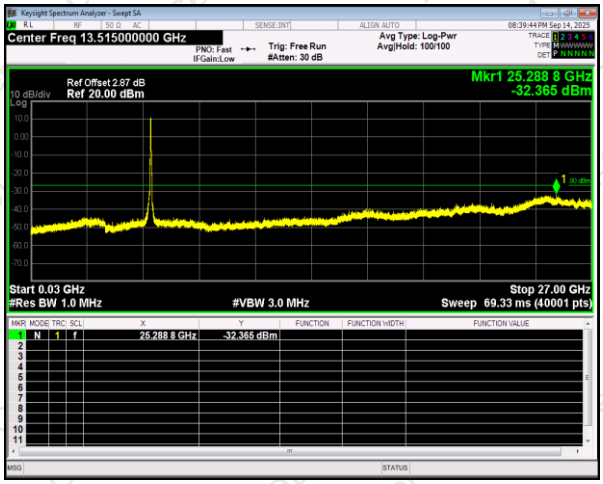
802.11ac40 on channel 151



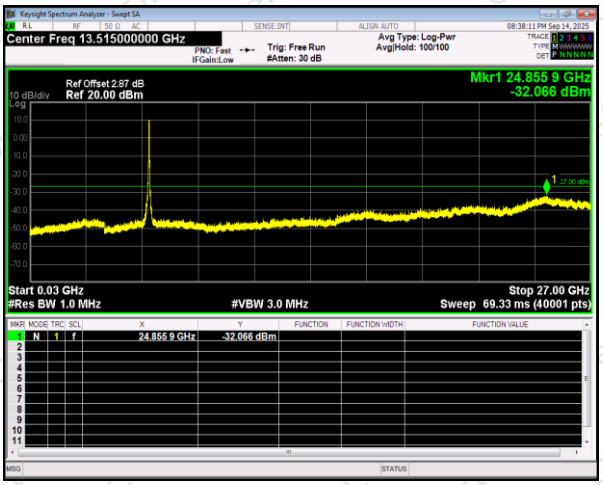
802.11ac20 on channel 157



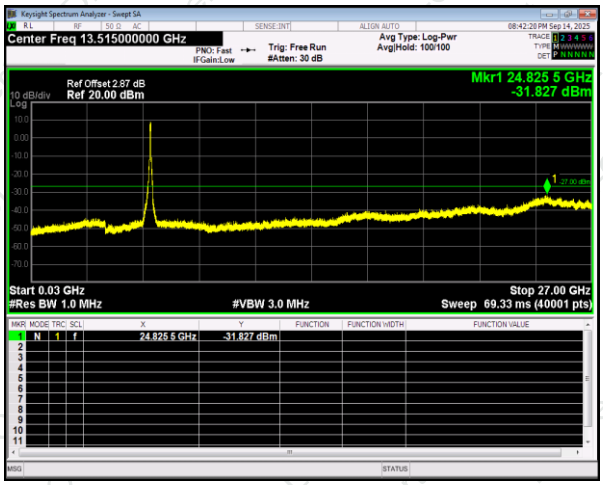
802.11ac40 on channel 159



802.11ac20 on channel 165



802.11ac80 on channel 155



10.Frequency Stability Measurement

10.1 LIMIT

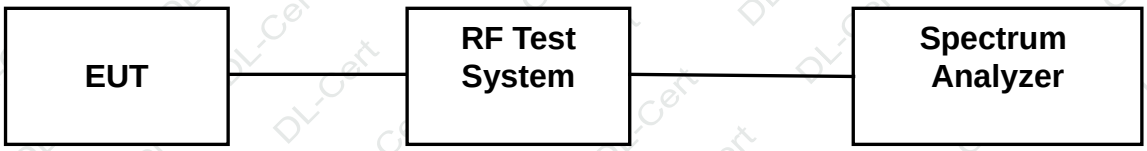
Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

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. fc is declaring of channel frequency. Then the frequency error formula is (fc-f)/fc × 106 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.

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 ℃	Relative Humidity：	54%
Pressure：	1012 hPa	Test Voltage ：	DC 12V
Test Band ：	5.2G & 5.8G		
Note: All channels have been tested, and only the worst test data is recorded in this report.			

5.2G:

802.11a

Reference Frequency(Middle Channel): 5180MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
-20	12	56	0.01002
-10	12	45	0.00766
10	12	33	0.00616
20	12	28	0.00459
30	12	24	0.00427
40	12	15	0.00279
50	12	14	0.00271
60	12	24	0.00408
70	12	37	0.00630

802.11 n20

Reference Frequency(Middle Channel): 5180 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
-20	12	62	0.01121
-10	12	52	0.00918
10	12	42	0.00782
20	12	32	0.00587
30	12	23	0.00432
40	12	26	0.00483
50	12	22	0.00414
60	12	36	0.00656
70	12	40	0.00787

802.11n40

Reference Frequency(Middle Channel): 5190MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
-20	12	61	0.01087
-10	12	52	0.00902
10	12	43	0.00779
20	12	44	0.00793
30	12	34	0.00621
40	12	22	0.00414
50	12	36	0.00656
60	12	43	0.00777
70	12	51	0.00914

802.11ac20

Reference Frequency(Middle Channel): 5180MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
-20	12	57	0.00919
-10	12	43	0.00694
10	12	31	0.00523
20	12	25	0.00382
30	12	24	0.00348
40	12	13	0.00171
50	12	14	0.00193
60	12	20	0.00328
70	12	33	0.00527

802.11 ac40

Reference Frequency(Middle Channel): 5190 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
-20	12	65	0.01058
-10	12	52	0.00851
10	12	44	0.00707
20	12	33	0.00521
30	12	25	0.00362
40	12	27	0.00413
50	12	23	0.00348
60	12	38	0.00591
70	12	45	0.00713

802.11ac80

Reference Frequency(Middle Channel): 5210MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
-20	12	63	0.01057
-10	12	52	0.00866
10	12	43	0.00711
20	12	41	0.00676
30	12	36	0.00589
40	12	32	0.0052
50	12	34	0.00555
60	12	43	0.00711
70	12	52	0.00851

So, Frequency Stability Versus Input Voltage is:

802.11a

Reference Frequency(Middle Channel): 5180 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
-20	12	56	0.01002
40	12	45	0.00766
70	12	33	0.00616

802.11n20

Reference Frequency(Middle Channel): 5180 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
-20	12	62	0.01121
40	12	52	0.00918
70	12	42	0.00782

802.11n40

Reference Frequency(Middle Channel): 5190 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
-20	12	61	0.01087
40	12	52	0.00902
70	12	51	0.00914

802.11ac20

Reference Frequency(Middle Channel): 5180 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
-20	12	57	0.00919
40	12	43	0.00694
70	12	33	0.00527

802.11ac40

Reference Frequency(Middle Channel): 5190 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
-20	12	65	0.01058
40	12	52	0.00851
70	12	45	0.00713

802.11ac80

Reference Frequency(Middle Channel): 5210 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
-20	12	63	0.01057
40	12	52	0.00866
70	12	52	0.00851

5.8G:

802.11a

Reference Frequency(Middle Channel): 5745MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
-20	12	46	0.00815
-10	12	27	0.00757
10	12	36	0.00462
20	12	23	0.00419
30	12	14	0.00306
40	12	16	0.00324
50	12	13	0.00342
60	12	27	0.00443
70	12	38	0.00632

802.11n20

Reference Frequency(Middle Channel): 5745MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
-20	12	42	0.00658
-10	12	24	0.00534
10	12	32	0.00385
20	12	24	0.00347
30	12	13	0.00157
40	12	12	0.00139
50	12	13	0.00157
60	12	21	0.00295
70	12	32	0.00543

802.11n40

Reference Frequency(Middle Channel): 5755MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
-20	12	62	0.00953
-10	12	54	0.00801
10	12	42	0.00725
20	12	44	0.00759
30	12	34	0.00587
40	12	32	0.00552
50	12	34	0.00587
60	12	42	0.00725
70	12	51	0.00884

802.11ac20

Reference Frequency(Middle Channel): 5745 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
-20	12	43	0.00709
-10	12	51	0.00648
10	12	23	0.00375
20	12	26	0.00515
30	12	23	0.00374
40	12	26	0.00415
50	12	22	0.00346
60	12	36	0.00588
70	12	26	0.00462

802.11ac40

Reference Frequency(Middle Channel): 5755MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
-20	12	60	0.00675
-10	12	55	0.00614
10	12	47	0.00341
20	12	45	0.00481
30	12	32	0.0034
40	12	26	0.00381
50	12	38	0.00312
60	12	43	0.00554
70	12	54	0.00428

802.11ac80

Reference Frequency(Middle Channel): 5775MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		MCF	Error (ppm)
-20	12	52	0.00866
-10	12	41	0.00705
10	12	43	0.00711
20	12	41	0.00676
30	12	36	0.00589
40	12	32	0.0052
50	12	34	0.00555
60	12	32	0.0052
70	12	52	0.00866

So, Frequency Stability Versus Input Voltage is:

802.11a

Reference Frequency(Middle Channel): 5745 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
-20	12	46	0.00815
40	12	27	0.00757
70	12	38	0.00632

802.11n20

Reference Frequency(Middle Channel): 5745 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
-20	12	42	0.00658
40	12	24	0.00534
70	12	32	0.00543

802.11n40

Reference Frequency(Middle Channel): 5755 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
-20	12	62	0.00953
40	12	54	0.00801
70	12	51	0.00884

802.11ac20

Reference Frequency(Middle Channel): 5745 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
-20	12	43	0.00709
40	12	51	0.00648
70	12	36	0.00588

802.11ac40

Reference Frequency(Middle Channel): 5755 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
-20	12	60	0.00675
40	12	55	0.00614
70	12	43	0.00554

802.11ac80

Reference Frequency(Middle Channel): 5775 MHz			
Environment Temperature (°C)	Power Supplied (VDC)	Frequency Measure with Time Elapsed	
		Frequency	Error (ppm)
-20	12	52	0.00866
40	12	41	0.00705
70	12	52	0.00866

11. DUTY CYCLE

11.1 APPLIED PROCEDURES / LIMIT

Measurements of duty cycle and transmission duration shall be performed using one of the following techniques:

a) A diode detector and an oscilloscope that together have a sufficiently short response time to permit accurate measurements of the ON and OFF times of the transmitted signal.

b) The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the ON and OFF times of the transmitted signal:

1) Set the center frequency of the instrument to the center frequency of the transmission.

2) Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value.

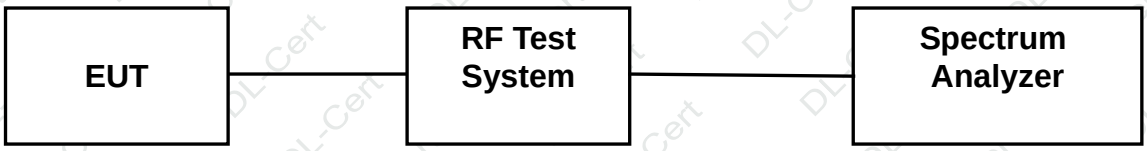
3) Set VBW ≥ RBW. Set detector = peak or average.

4) The zero-span measurement method shall not be used unless both RBW and VBW are > 50/*T* and the number of sweep points across duration *T* exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring the duty cycle shall not be used if $T \leq 16.7$ µs.)

11.2 DEVIATION FROM STANDARD

No deviation.

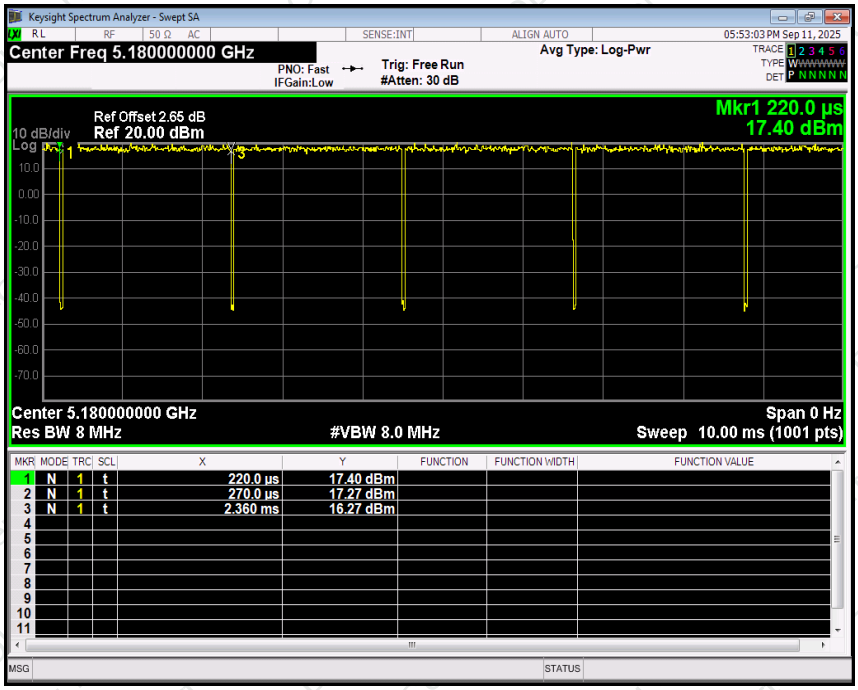
11.3 TEST SETUP



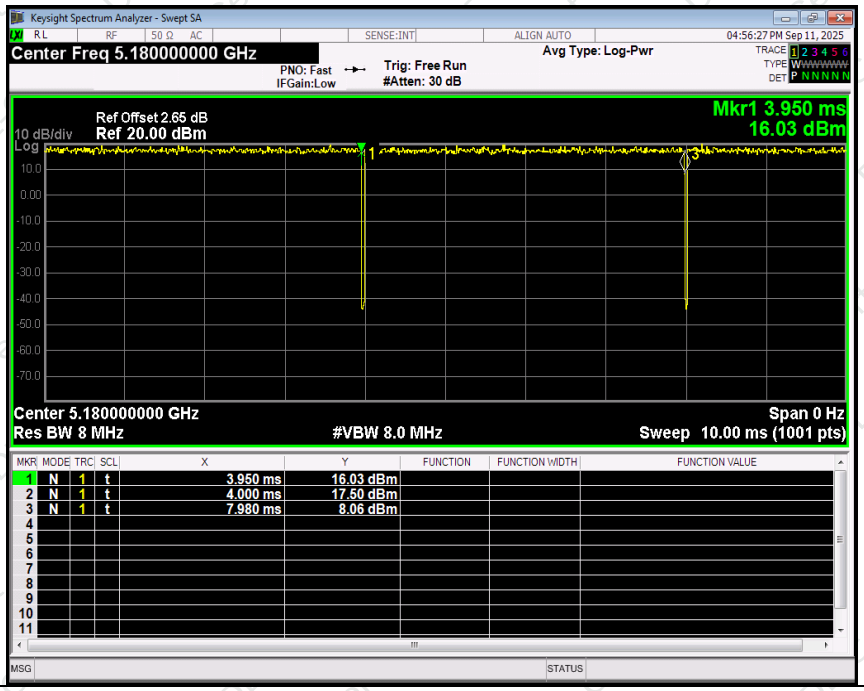
11.4 TEST RESULTS

5.2G				
Mode	Frequency (MHz)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Result
802.11a	5180	98.12	0.08	Pass
802.11n20	5180	99.00	0.04	Pass
802.11n40	5190	98.76	0.05	Pass
802.11ac20	5180	98.75	0.05	Pass
802.11ac40	5190	98.75	0.05	Pass
802.11ac80	5210	98.76	0.05	Pass

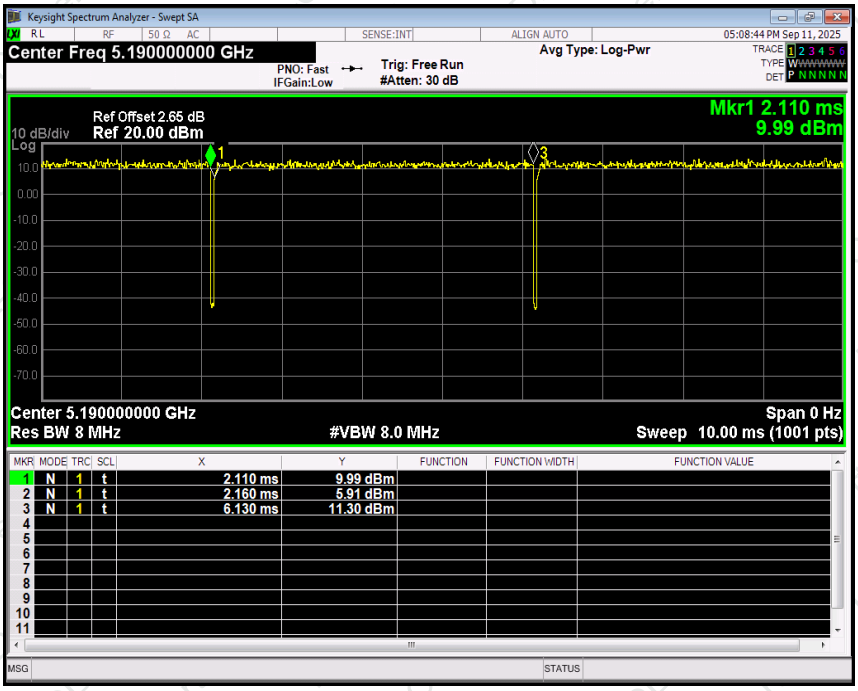
802.11a



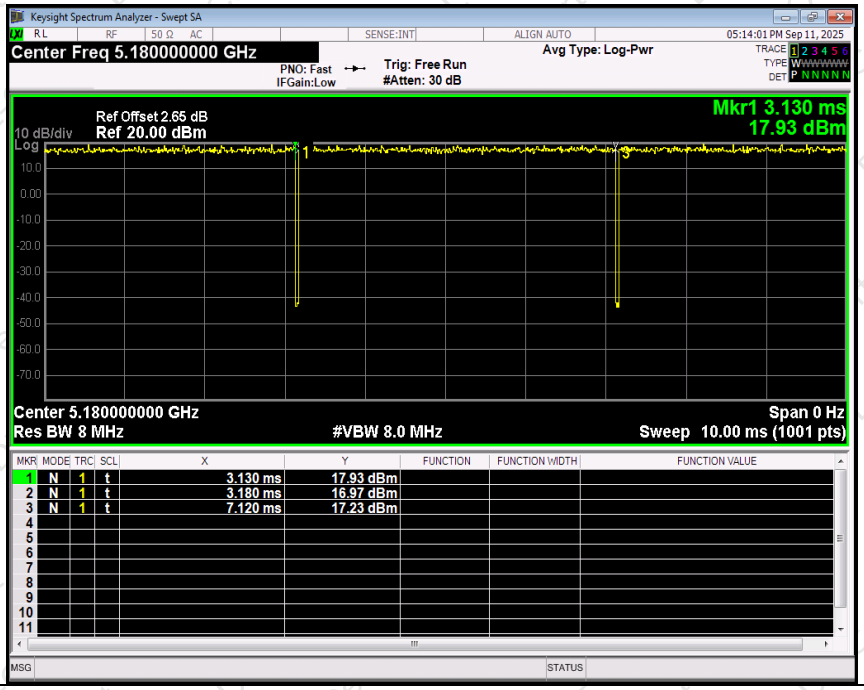
802.11n20



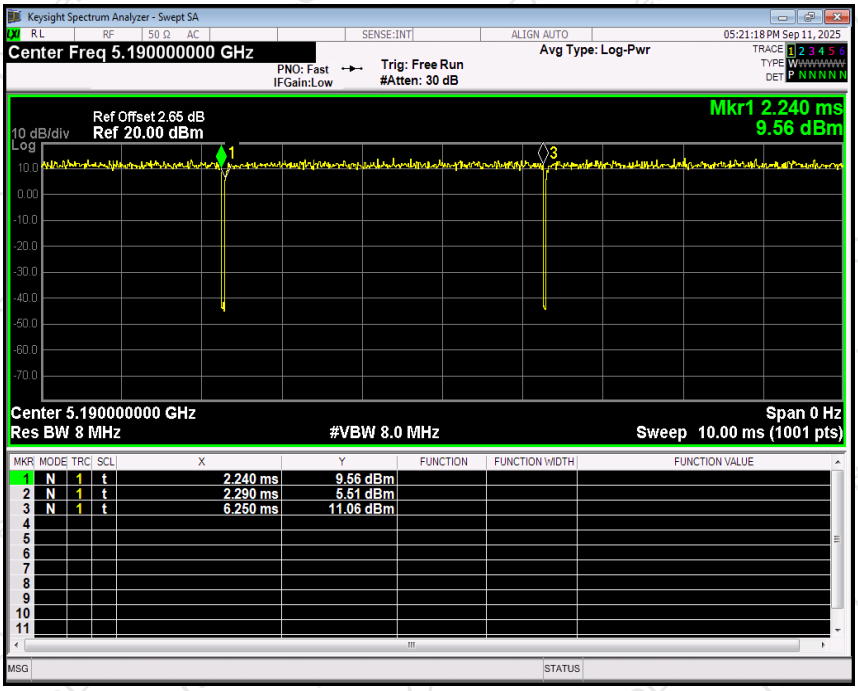
802.11n40



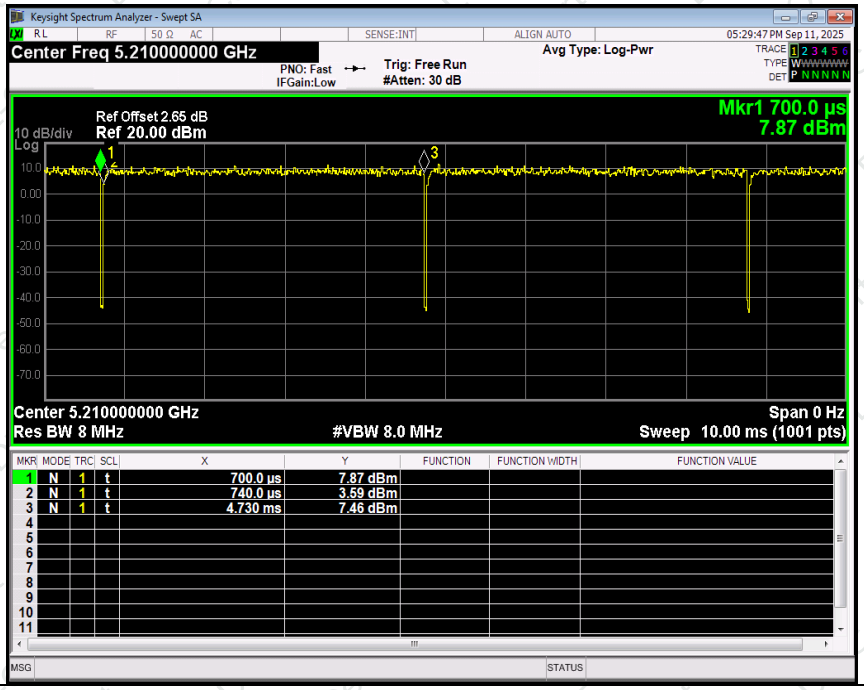
802.11ac20



802.11ac40



802.11ac80



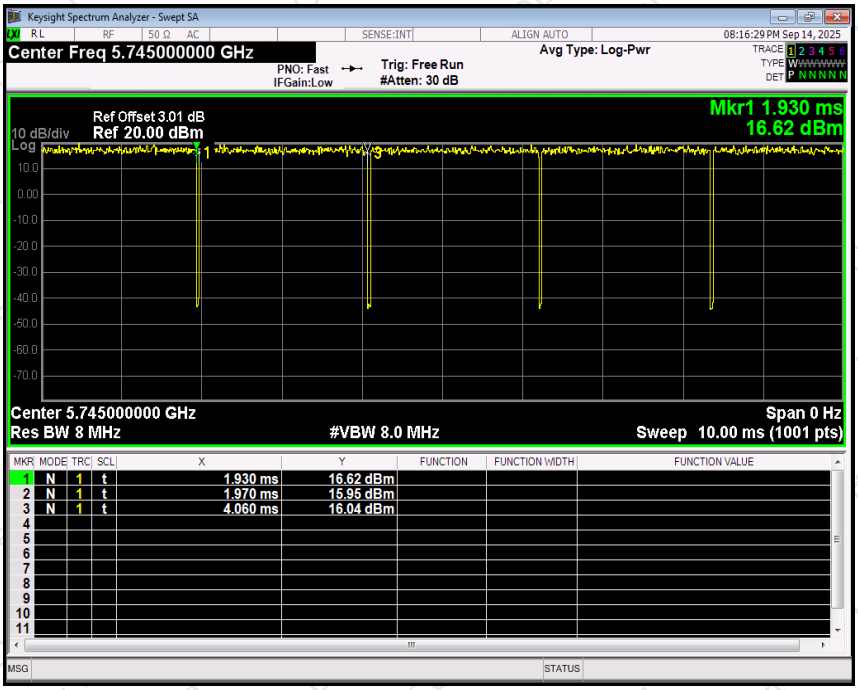
Note: All channel have been tested, and the report only reflects the worst case data.

Duty Cycle= Ton /Total*100%

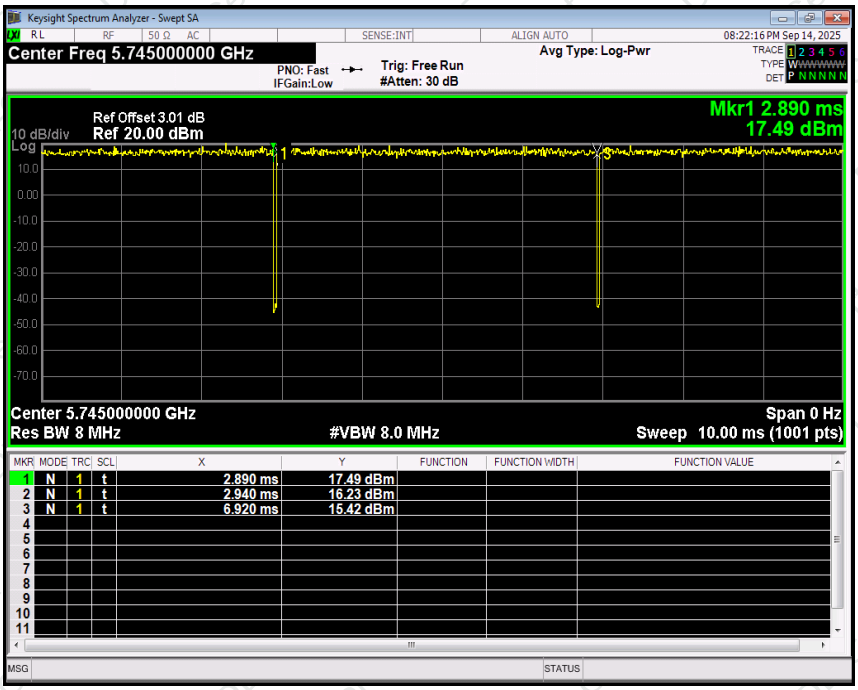
Duty Cycle Correction Factor = 10log (1/Duty Cycle)

5.8G				
Mode	Frequency (MHz)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	Result
802.11a	5745	98.12	0.08	Pass
802.11n20	5745	98.76	0.05	Pass
802.11n40	5755	98.76	0.05	Pass
802.11ac20	5745	98.75	0.05	Pass
802.11ac40	5755	99.00	0.04	Pass
802.11ac80	5775	98.76	0.05	Pass

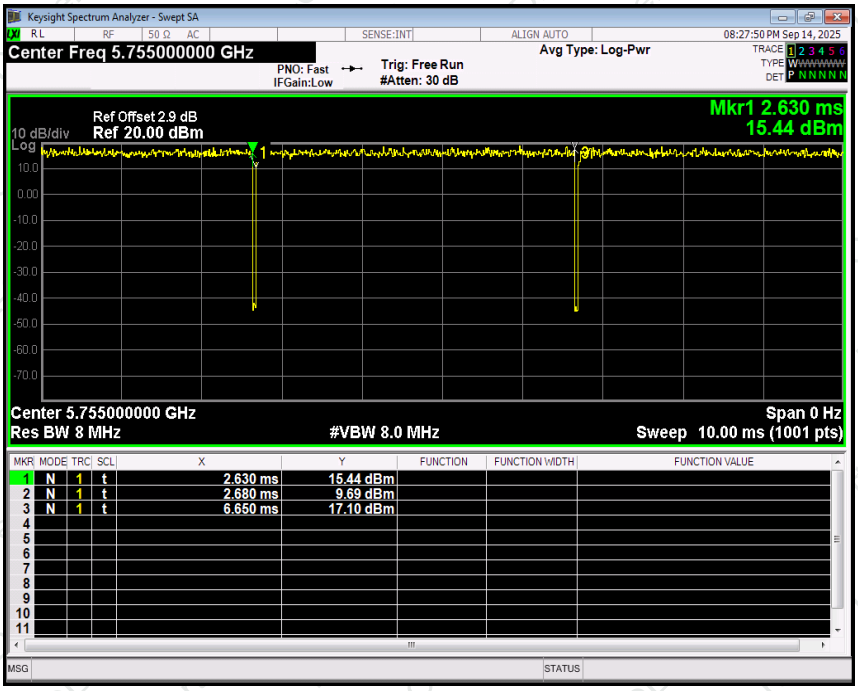
802.11a



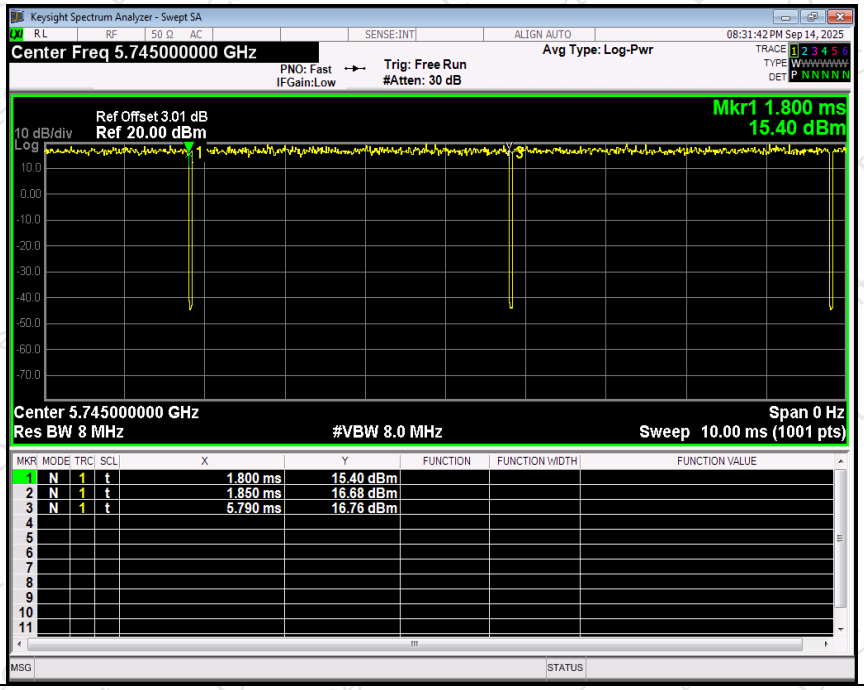
802.11n20



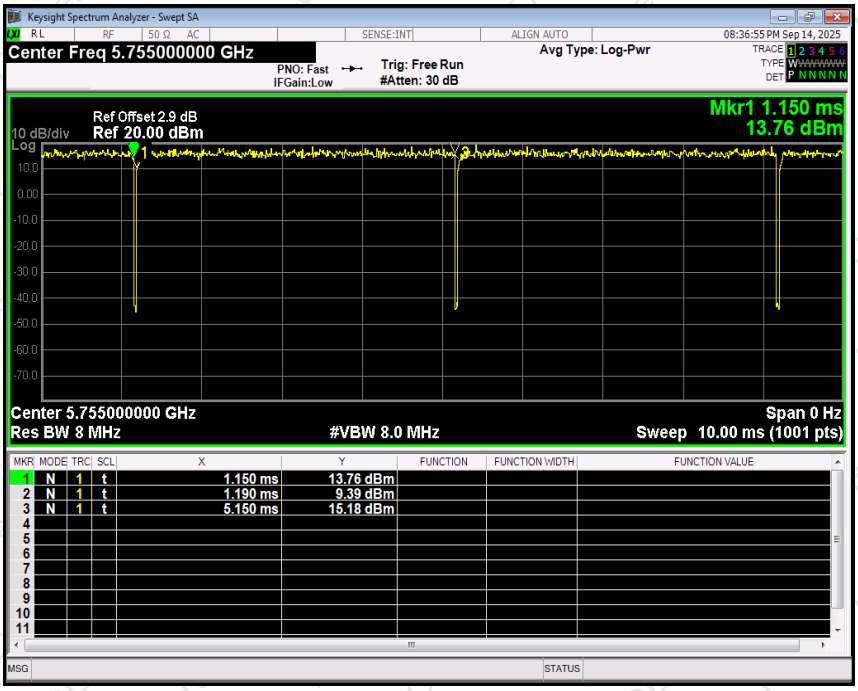
802.11n40



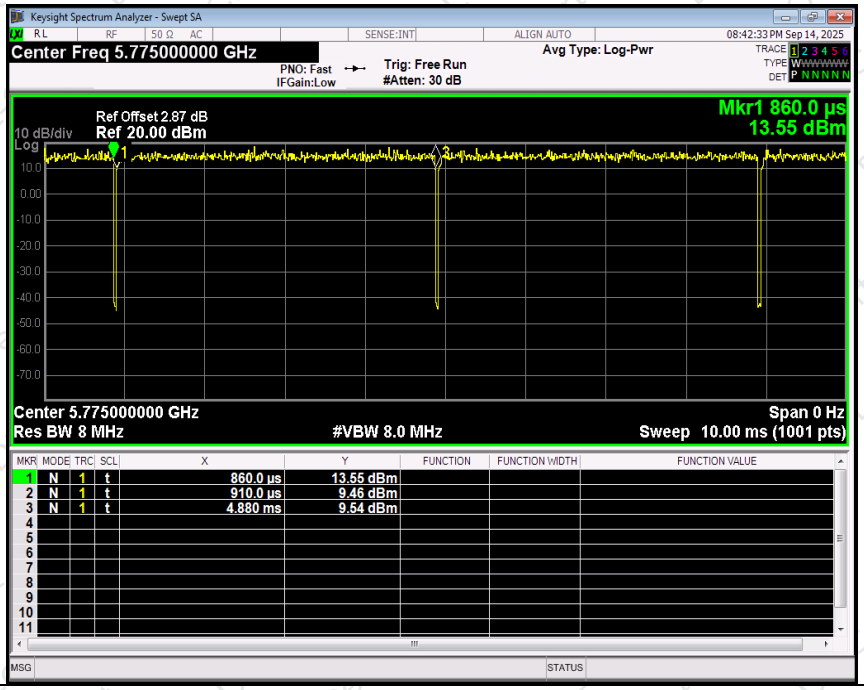
802.11ac20



802.11ac40



802.11ac80



Note: All channel have been tested, and the report only reflects the worst case data.

Duty Cycle= Ton /Total*100%

Duty Cycle Correction Factor = 10log (1/Duty Cycle)

12.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 FPC antenna, the best case gain of the antenna is 3.95dBi (Max), reference to the appendix II for details	

13. TEST SETUP PHOTO

Reference to the appendix I for details.

14. EUT CONSTRUCTIONAL DETAILS

Reference to the appendix II for details.

※※※※※ END OF REPORT ※※※※※