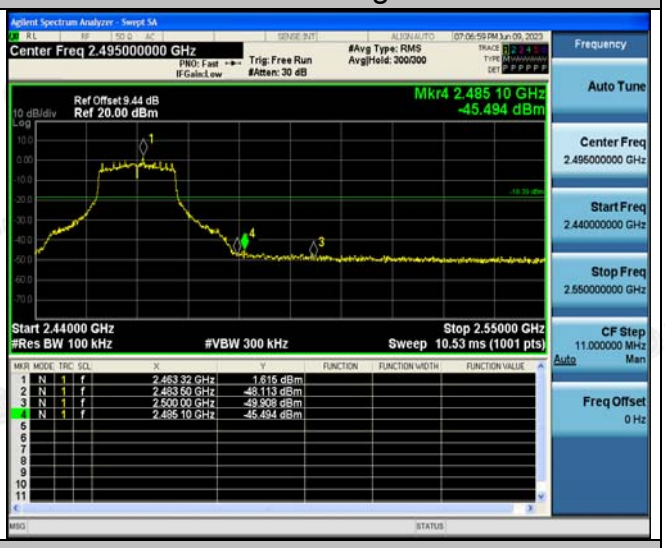
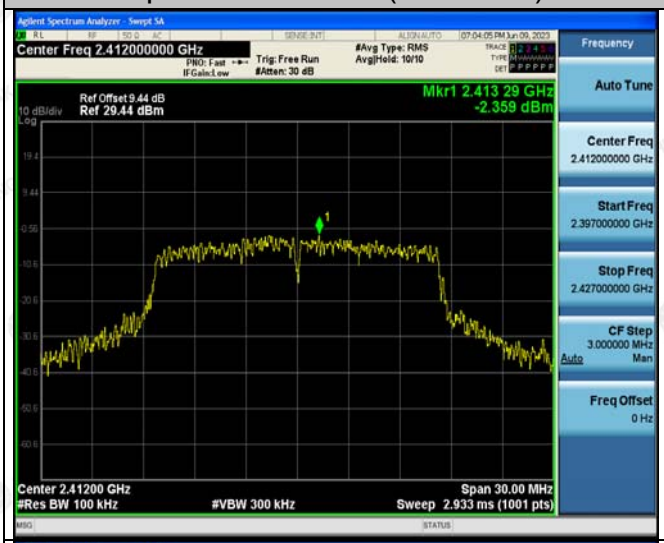
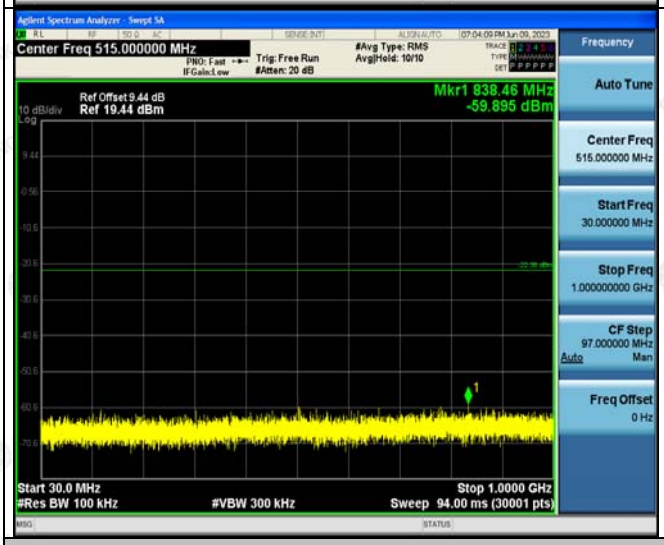
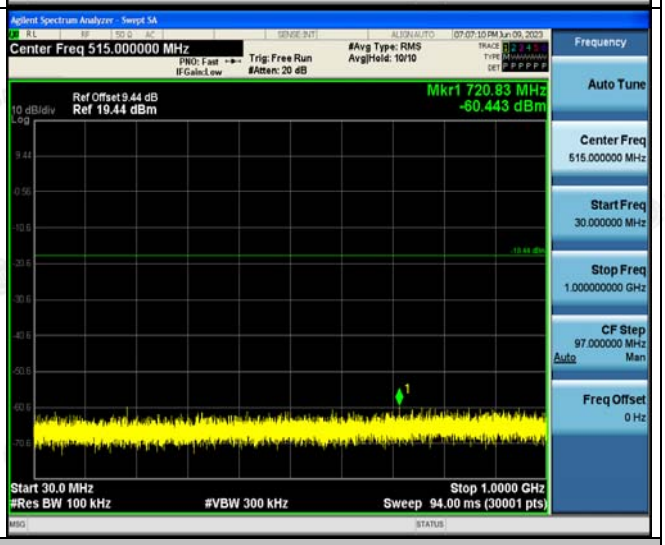
802.11g Modulation

Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious emission(2412MHz)	Spurious emission(2462MHz)
	
	

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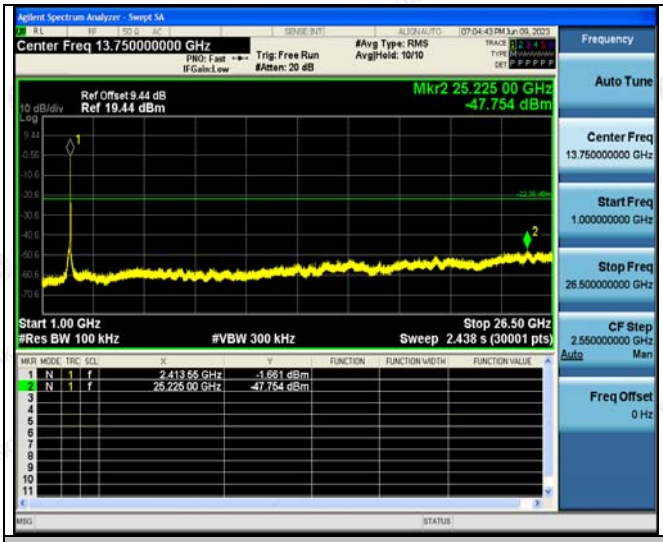
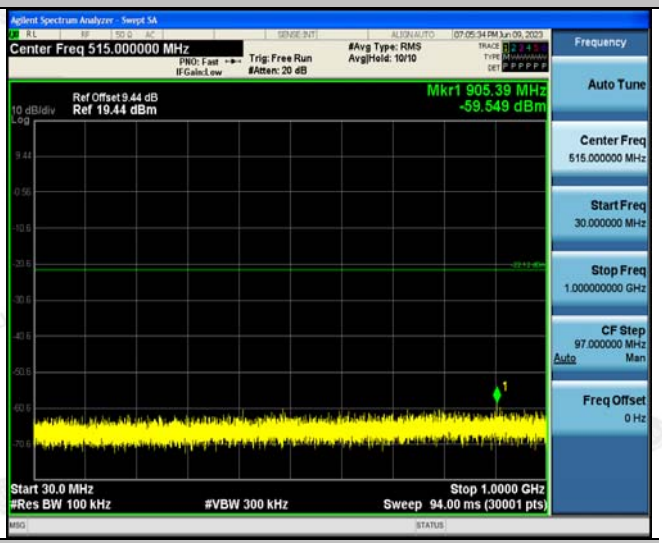


Spurious emission(2437MHz)



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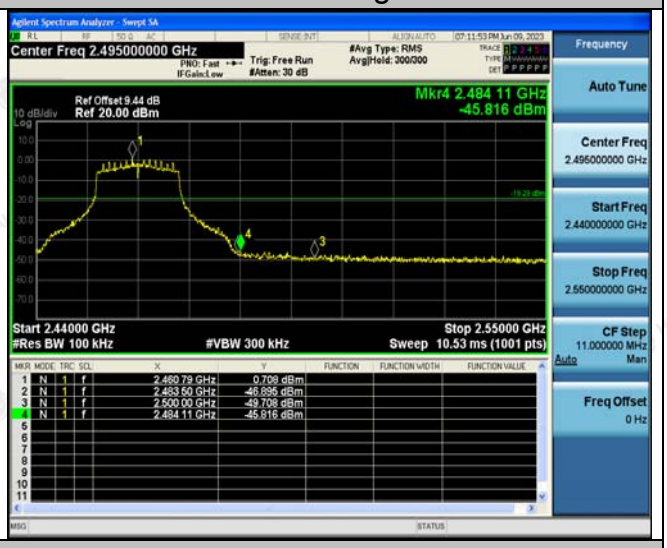
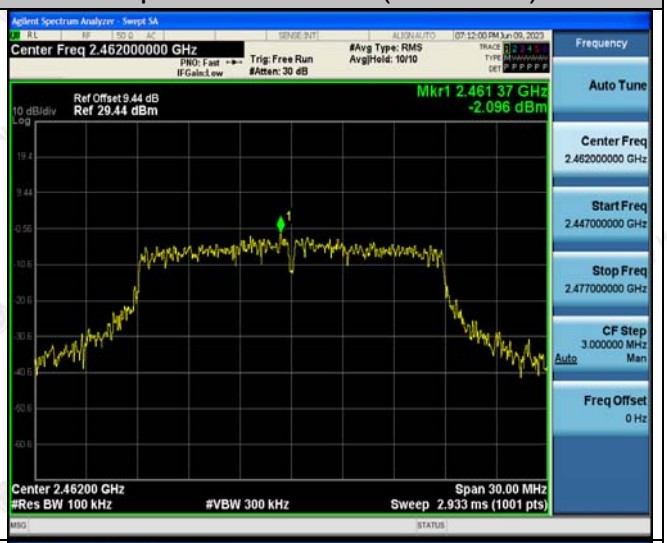
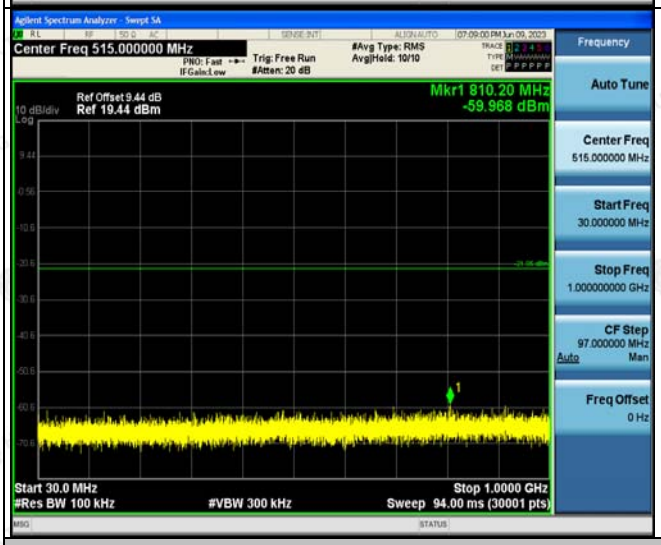
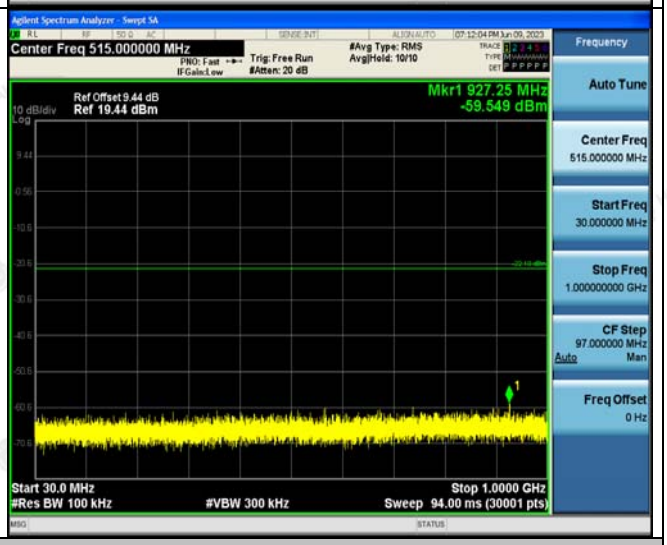
802.11n (HT20) Modulation

Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious emission(2412MHz)	Spurious emission(2462MHz)
	
	

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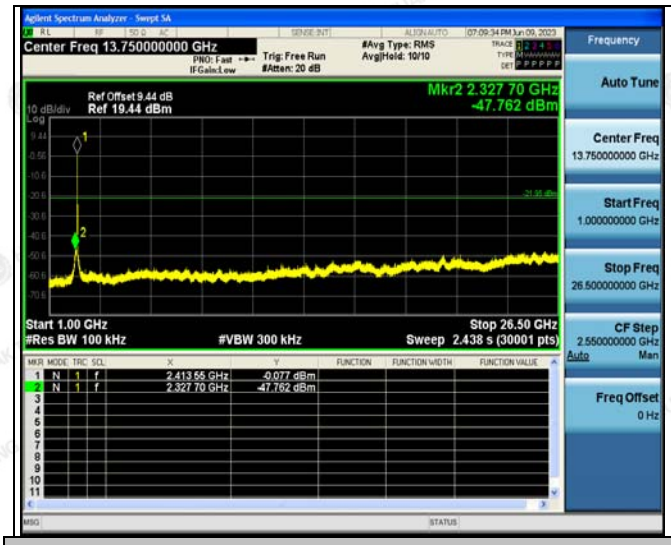
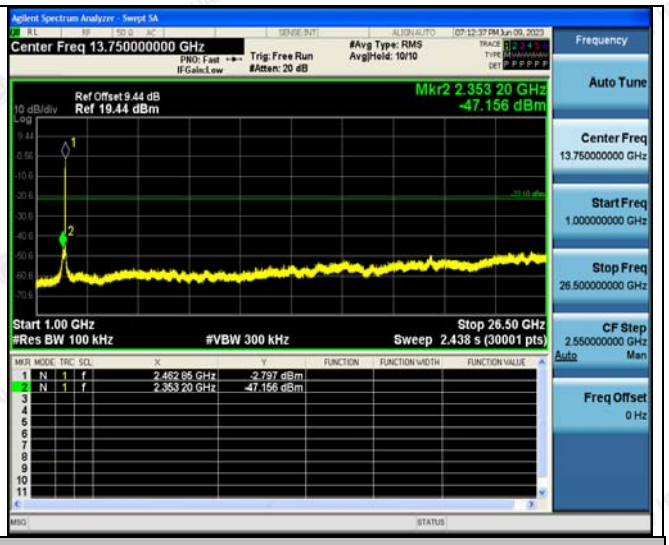
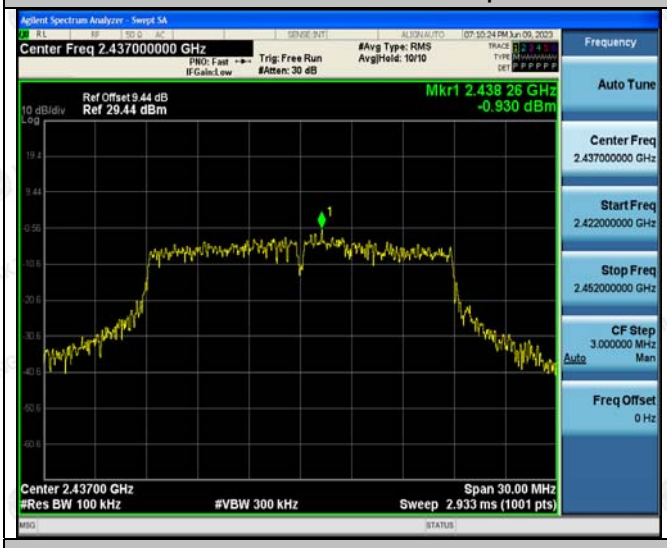
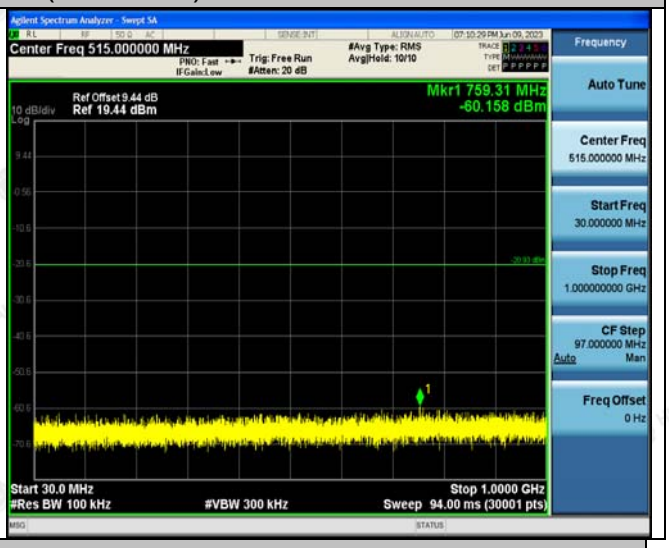




Spurious emission(2437MHz)





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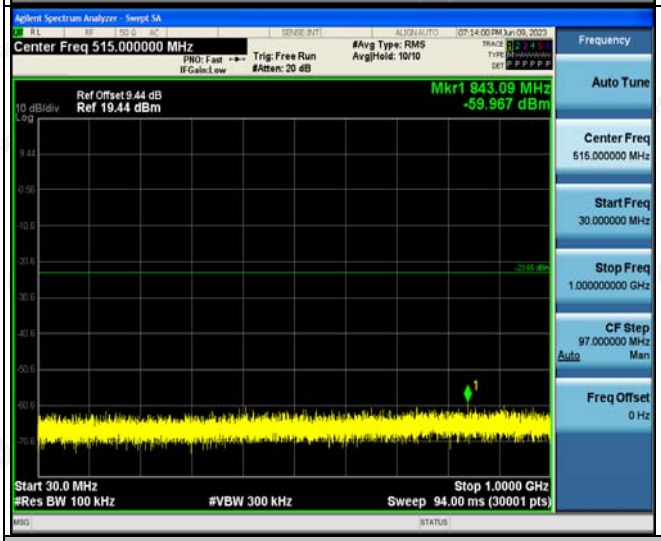
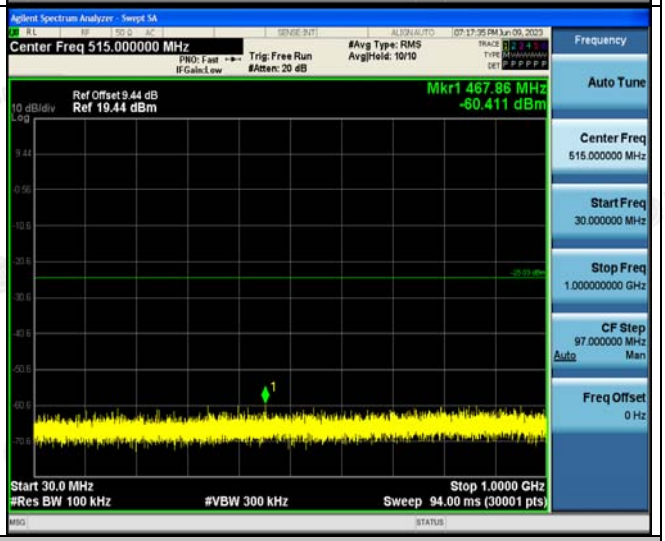
802.11n (HT40) Modulation

Lowest Channel	Highest Channel
Band Edge	Band Edge
Spurious emission(2422MHz)	Spurious emission(2452MHz)
	

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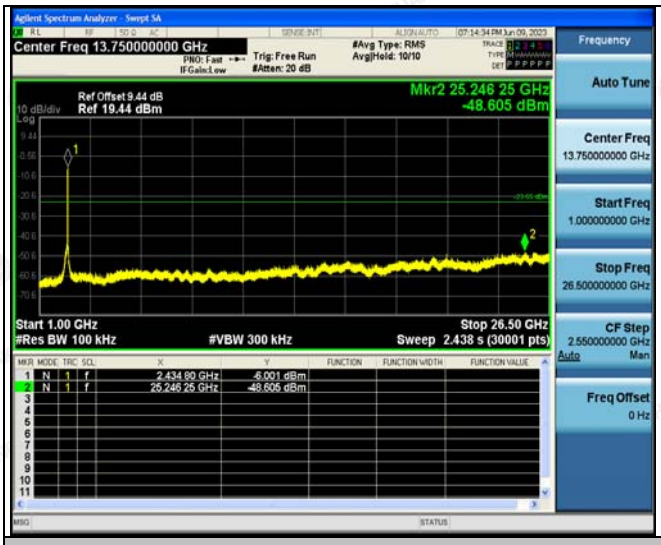
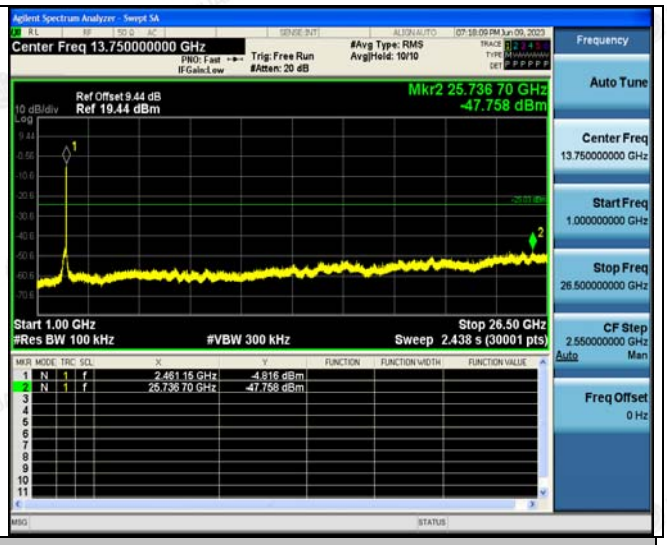
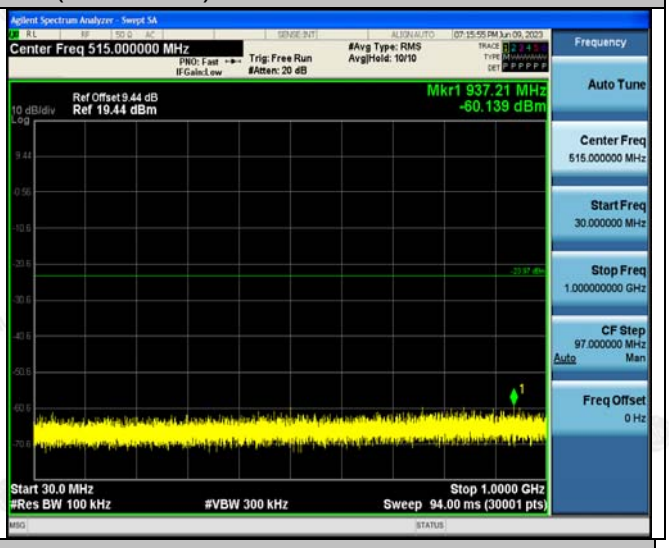




Spurious emission(2437MHz)



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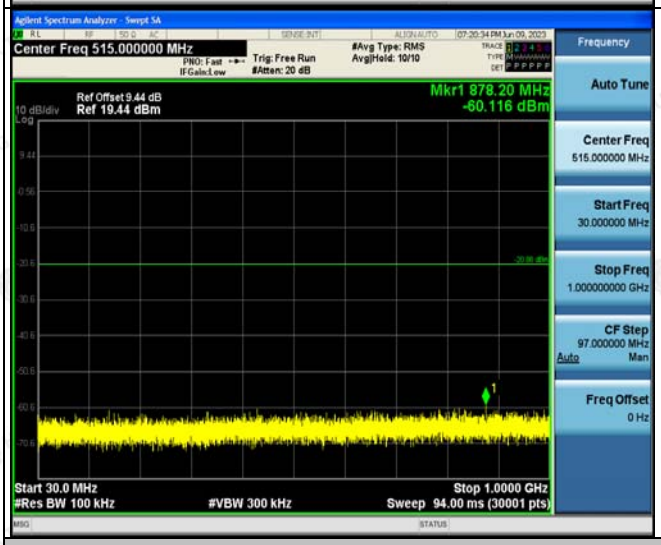
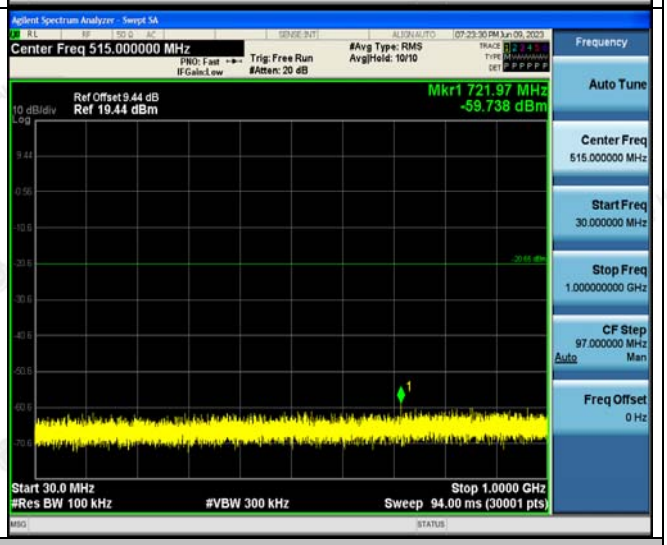
802.11ax (HT20) Modulation

Lowest Channel	Highest Channel
Band Edge	Band Edge
Spurious emission(2412MHz)	Spurious emission(2462MHz)
	

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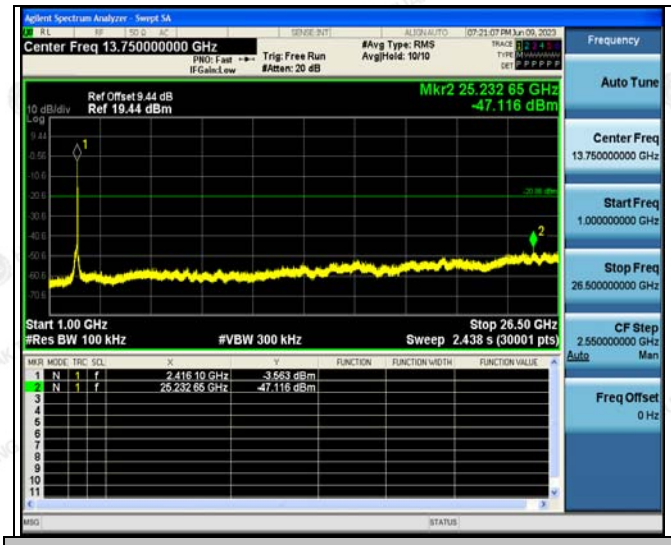
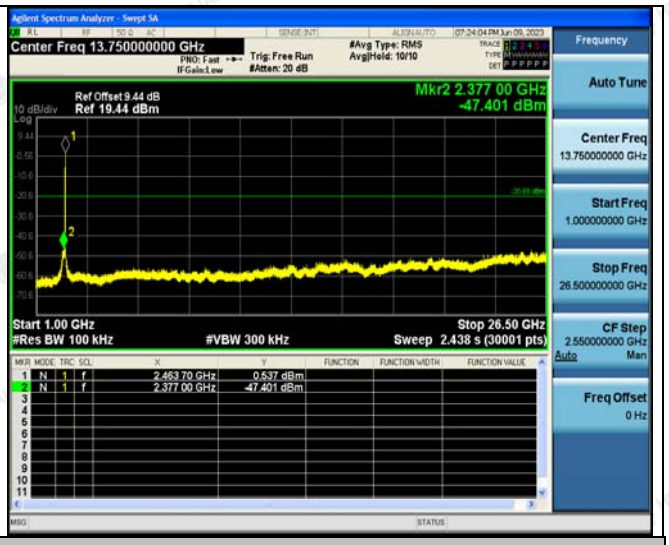
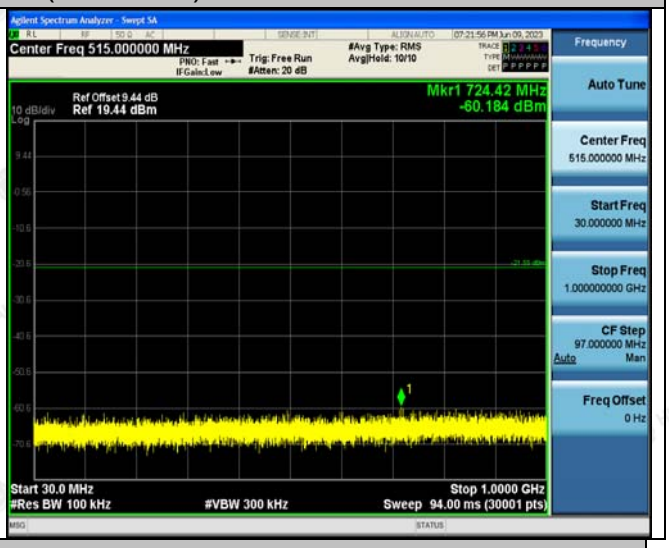
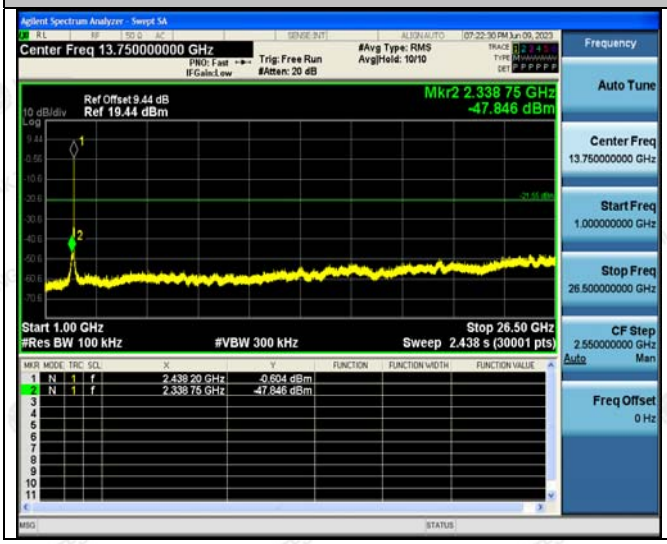




Spurious emission(2437MHz)





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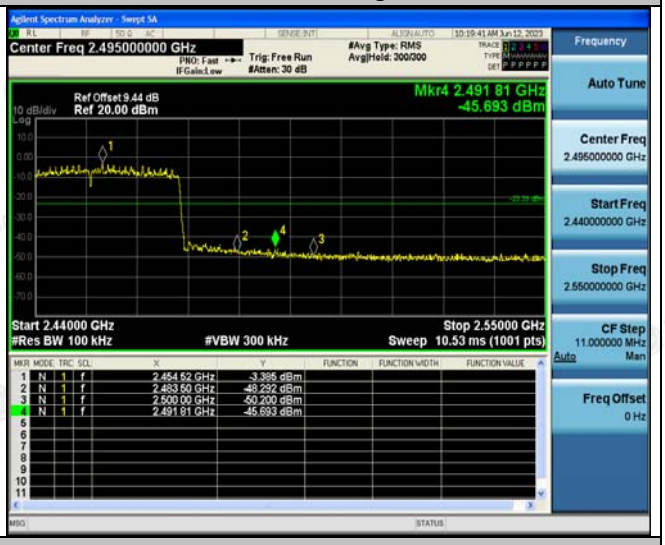
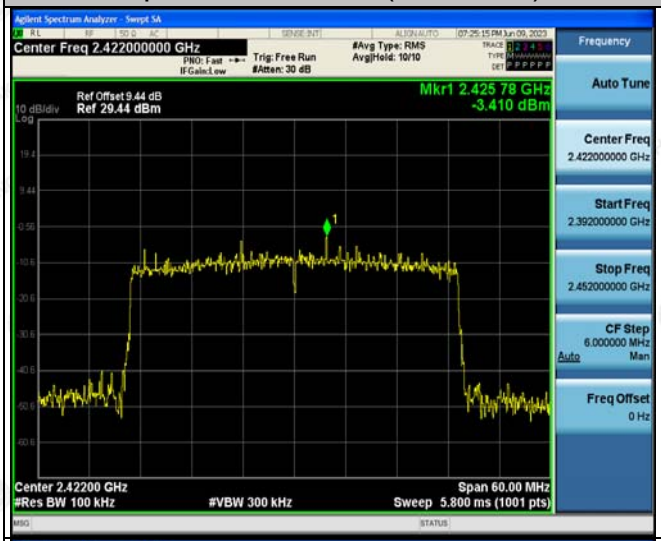
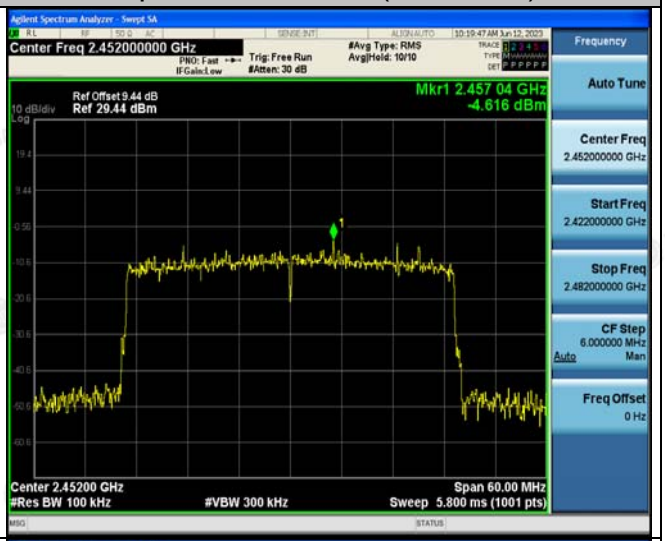
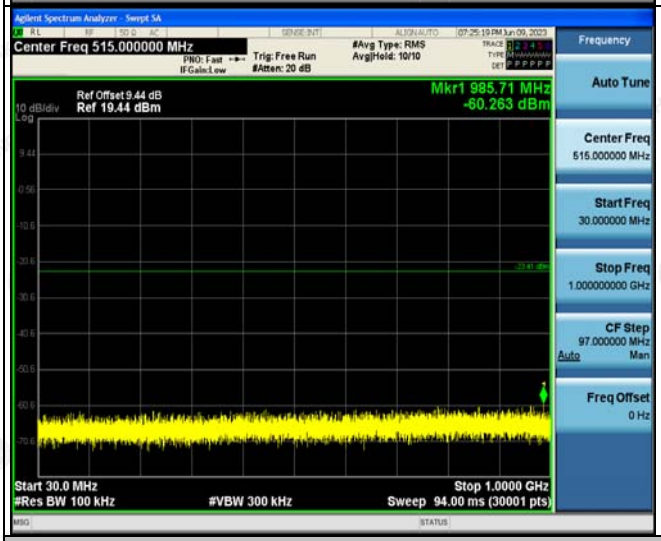
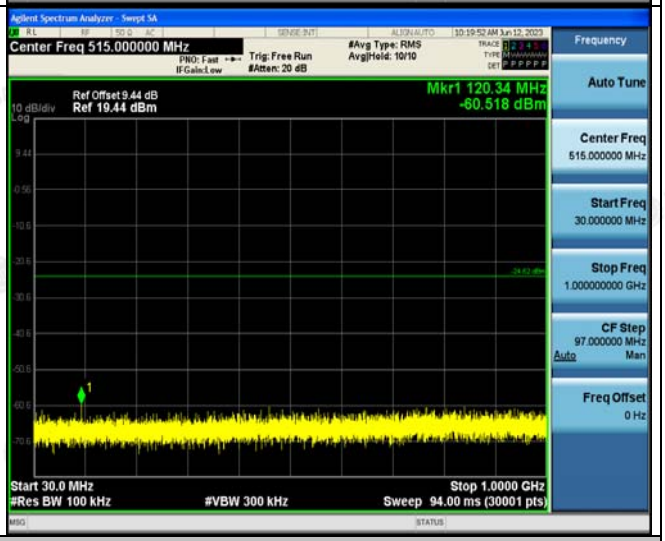
802.11ax (HT40) Modulation

Lowest Channel	Highest Channel
Band Edge	Band Edge
	
Spurious emission(2422MHz)	Spurious emission(2452MHz)
	
	

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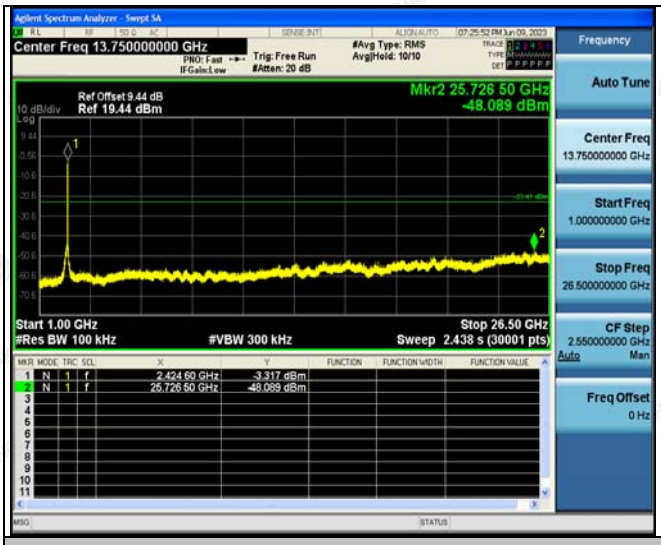
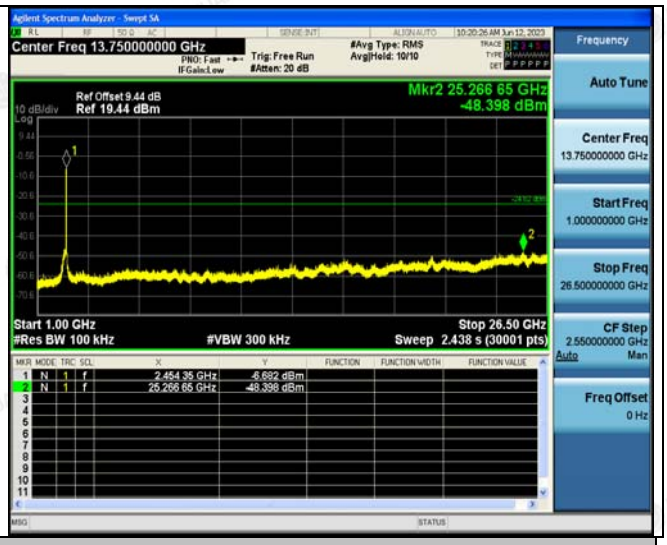
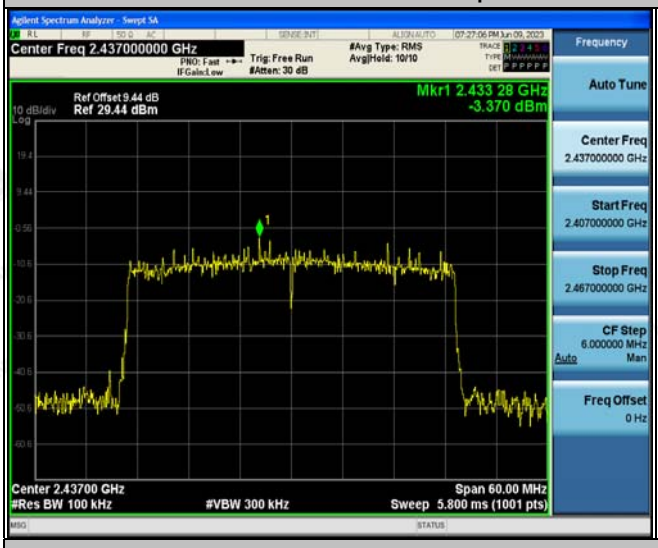
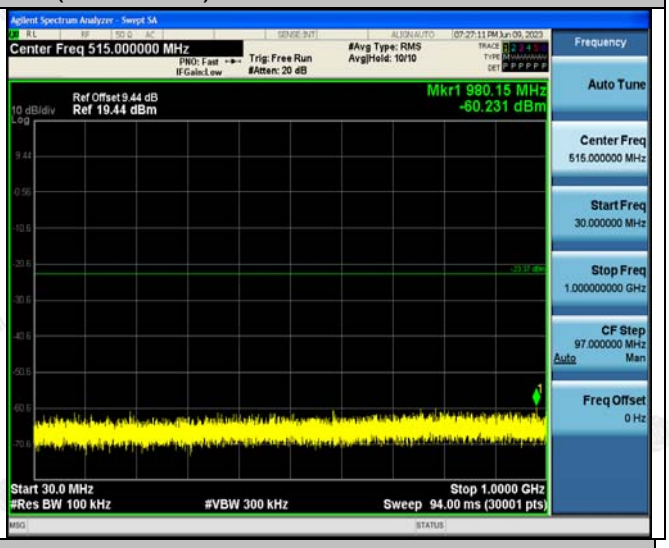
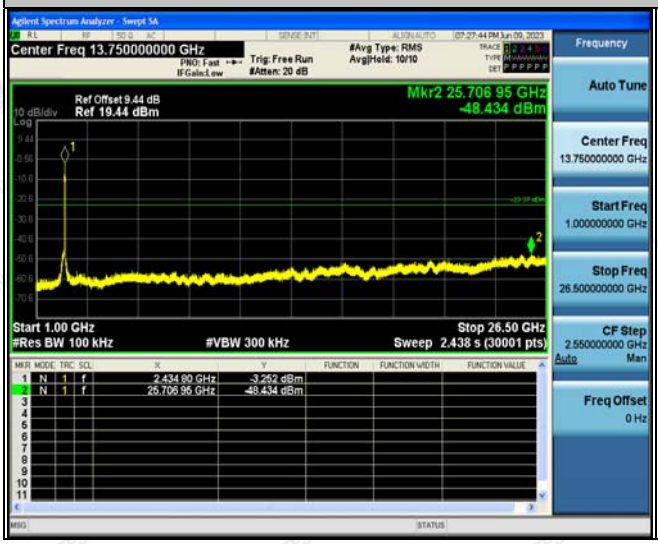




Spurious emission(2437MHz)







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4.6. Radiated Spurious Emission Measurement

4.6.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.209
Test Method:	ANSI C63.10: 2013
Frequency Range:	9 kHz to 25 GHz
Measurement Distance:	3 m
Antenna Polarization:	Horizontal & Vertical
Operation mode:	Transmitting mode with modulation
Receiver Setup:	

Frequency	Detector	RBW	VBW	Remark
9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value
150kHz-30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value
30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak Value
Above 1GHz	Peak	1MHz	3MHz	Peak Value
	Peak	1MHz	10Hz	Average Value

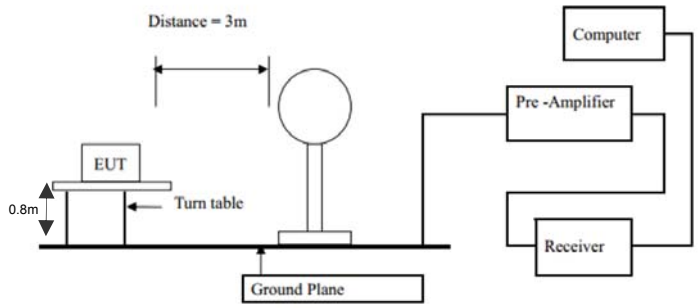
Limit:

Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009-0.490	2400/F(KHz)	300
0.490-1.705	24000/F(KHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)	Detector
Above 1GHz	500	3	Average
	5000	3	Peak

Test setup:

For radiated emissions below 30MHz



30MHz to 1GHz

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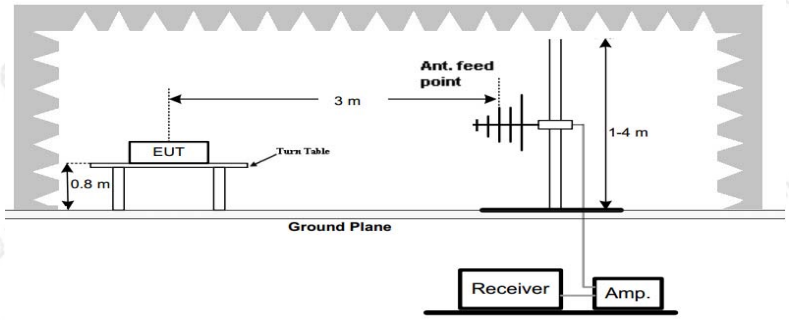
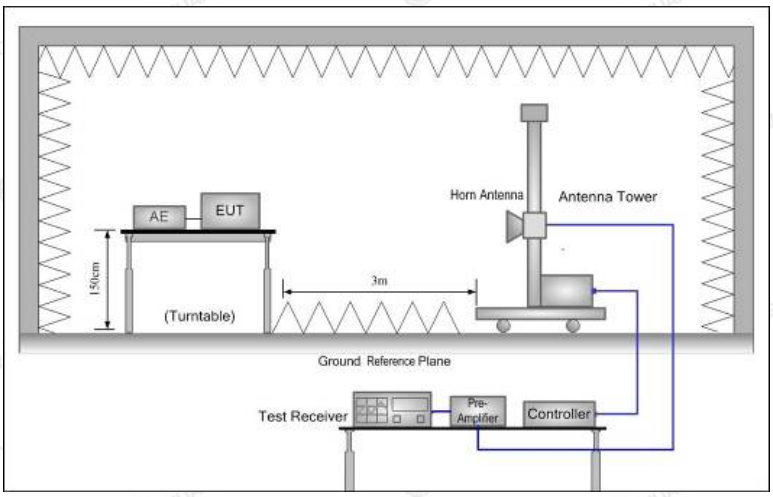


Above 1GHz


</td>
</tr>
<tr>
<td>Test Procedure:</td>
<td>1. For the radiated emission test below 1GHz:
The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level.
For the radiated emission test above 1GHz:
Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m</td>
</tr>
</table>

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	above the ground or reference ground plane. 3. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level 4. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported. 5. Use the following spectrum analyzer settings: (1) Span shall wide enough to fully capture the emission being measured; (2) Set RBW=100 kHz for f < 1 GHz; VBW ≥RBW; Sweep = auto; Detector function = peak; Trace = max hold; (3) Set RBW = 1 MHz, VBW= 3MHz for f 1 GHz for peak measurement. For average measurement: VBW = 10 Hz, when duty cycle is no less than 98 percent. VBW ≥ 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
Test results:	PASS

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4.6.2. Test Instruments

Radiated Emission Test Site (966)					
Name of Equipment	**Manufacturer**	**Model**	**Serial Number**	**Calibration Date**	**Calibration Due**
Receiver	R&S	ESR-7	HKE-010	Feb. 17, 2023	Feb. 16, 2024
Spectrum analyzer	Agilent	N9020A	HKE-048	Feb. 17, 2023	Feb. 16, 2024
Preamplifier	EMCI	EMC051845 SE	HKE-015	Feb. 17, 2023	Feb. 16, 2024
Preamplifier	Agilent	83051A	HKE-016	Feb. 17, 2023	Feb. 16, 2024
Loop antenna	Schwarzbeck	FMZB 1519 B	HKE-014	Feb. 17, 2023	Feb. 16, 2024
Broadband antenna	Schwarzbeck	VULB 9163	HKE-012	Feb. 17, 2023	Feb. 16, 2024
Horn antenna	Schwarzbeck	9120D	HKE-013	Feb. 17, 2023	Feb. 16, 2024
Antenna Mast	Keleto	CC-A-4M	N/A	N/A	N/A
Position controller	Taiwan MF	MF7802	HKE-011	Feb. 17, 2023	Feb. 16, 2024
Radiated test software	Tonscend	TS+ Rev 2.5.0.0	HKE-082	N/A	N/A
RF cable (9KHz-1GHz)	Times	381806-001	N/A	N/A	N/A
RF cable	Times	1-40G	HKE-034	Feb. 17, 2023	Feb. 16, 2024
Horn Antenna	Schewarzbeck	BBHA 9170	HKE-017	Feb. 17, 2023	Feb. 16, 2024

Note: *The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).*

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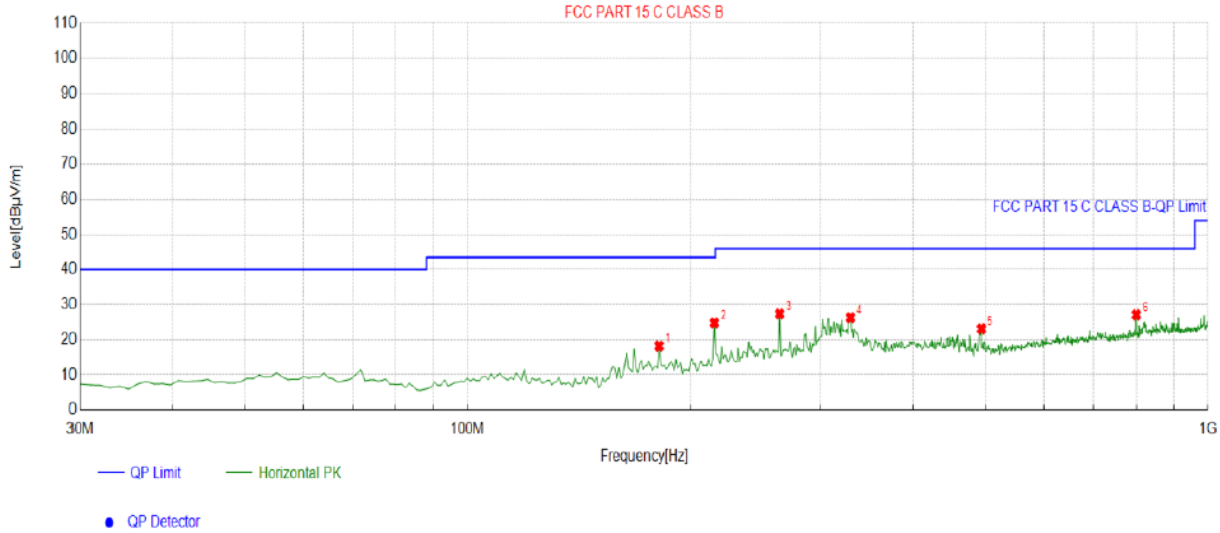
4.6.3. Test Data

Please refer to following diagram for individual
Below 1GHz

All the test modes completed for test. only the worst result of 802.11b at 2412MHz was reported as below:

Horizontal



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	181.4715	-16.94	35.15	18.21	43.50	25.29	100	107	Horizontal
2	215.4555	-14.43	39.25	24.82	43.50	18.68	100	72	Horizontal
3	264.0040	-12.71	40.08	27.37	46.00	18.63	100	272	Horizontal
4	329.0591	-11.59	37.90	26.31	46.00	19.69	100	216	Horizontal
5	494.1241	-7.29	30.38	23.09	46.00	22.91	100	312	Horizontal
6	799.9800	-1.81	28.91	27.10	46.00	18.90	100	152	Horizontal

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

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Vertical

Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	163.9940	-17.19	37.95	20.76	43.50	22.74	100	195	Vertical
2	215.4555	-14.43	30.12	15.69	43.50	27.81	100	230	Vertical
3	264.0040	-12.71	30.70	17.99	46.00	28.01	100	22	Vertical
4	328.0881	-11.59	33.83	22.24	46.00	23.76	100	64	Vertical
5	492.1822	-7.43	34.34	26.91	46.00	19.09	100	187	Vertical
6	987.3774	0.38	27.75	28.13	54.00	25.87	100	32	Vertical

Remark: Factor = Cable loss + Antenna factor – Preamplifier; Level = Reading + Factor; Margin = Limit – Level

Remark：
(1) Measuring frequencies from 9 KHz to the 1 GHz, Radiated emission test from 9KHz to 30MHz was verified, and no any emission was found except system noise floor.
(2) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(3) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.

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Above 1GHz

RADIATED EMISSION TEST

LOW CH1 (802.11b Mode)/2412

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	56.24	-3.64	52.6	74	-21.4	peak
4824	39.86	-3.64	36.22	54	-17.78	AVG
7236	55.58	-0.95	54.63	74	-19.37	peak
7236	39.86	-0.95	38.91	54	-15.09	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	57.73	-3.64	54.09	74	-19.91	peak
4824	41.26	-3.64	37.62	54	-16.38	AVG
7236	54.09	-0.95	53.14	74	-20.86	peak
7236	40.85	-0.95	39.9	54	-14.1	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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MID CH6 (802.11b Mode)/2437

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	57.06	-3.51	53.55	74	-20.45	peak
4874	45.60	-3.51	42.09	54	-11.91	AVG
7311	53.75	-0.82	52.93	74	-21.07	peak
7311	40.73	-0.82	39.91	54	-14.09	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	57.33	-3.51	53.82	74	-20.18	peak
4874	44.41	-3.51	40.9	54	-13.1	AVG
7311	55.43	-0.82	54.61	74	-19.39	peak
7311	42.44	-0.82	41.62	54	-12.38	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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HIGH CH11 (802.11b Mode)/2462

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	56.96	-3.43	53.53	74	-20.47	peak
4924	43.84	-3.43	40.41	54	-13.59	AVG
7386	55.91	-0.75	55.16	74	-18.84	peak
7386	43.06	-0.75	42.31	54	-11.69	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	57.93	-3.43	54.5	74	-19.5	peak
4924	43.67	-3.43	40.24	54	-13.76	AVG
7386	53.92	-0.75	53.17	74	-20.83	peak
7386	40.94	-0.75	40.19	54	-13.81	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4)The emissions are attenuated more than 20dB below the permissible limits are not record in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissions of ANT.1 are reported.

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LOW CH1 (802.11g Mode)/2412

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	56.39	-3.64	52.75	74	-21.25	peak
4824	45.74	-3.64	42.1	54	-11.9	AVG
7236	55.17	-0.95	54.22	74	-19.78	peak
7236	41.19	-0.95	40.24	54	-13.76	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	55.62	-3.64	51.98	74	-22.02	peak
4824	45.11	-3.64	41.47	54	-12.53	AVG
7236	53.63	-0.95	52.68	74	-21.32	peak
7236	40.86	-0.95	39.91	54	-14.09	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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MID CH6 (802.11g Mode)/2437

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	57.16	-3.51	53.65	74	-20.35	peak
4874	43.44	-3.51	39.93	54	-14.07	AVG
7311	55.81	-0.82	54.99	74	-19.01	peak
7311	40.52	-0.82	39.7	54	-14.3	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	58.25	-3.51	54.74	74	-19.26	peak
4874	44.46	-3.51	40.95	54	-13.05	AVG
7311	55.94	-0.82	55.12	74	-18.88	peak
7311	42.07	-0.82	41.25	54	-12.75	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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HIGH CH11 (802.11g Mode)/2462

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	58.15	-3.43	54.72	74	-19.28	peak
4924	42.97	-3.43	39.54	54	-14.46	AVG
7386	55.17	-0.75	54.42	74	-19.58	peak
7386	40.82	-0.75	40.07	54	-13.93	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	56.49	-3.43	53.06	74	-20.94	peak
4924	45.62	-3.43	42.19	54	-11.81	AVG
7386	54.36	-0.75	53.61	74	-20.39	peak
7386	40.73	-0.75	39.98	54	-14.02	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4)The emissions are attenuated more than 20dB below the permissible limits are not record in the report
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissions of ANT.1 are reported.

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LOW CH1 (802.11n/H20 Mode)/2412

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	57.18	-3.64	53.54	74	-20.46	peak
4824	45	-3.64	41.36	54	-12.64	AVG
7236	54.17	-0.95	53.22	74	-20.78	peak
7236	42.89	-0.95	41.94	54	-12.06	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	56.79	-3.64	53.15	74	-20.85	peak
4824	44.09	-3.64	40.45	54	-13.55	AVG
7236	53.55	-0.95	52.6	74	-21.4	peak
7236	43.24	-0.95	42.29	54	-11.71	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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MID CH6 (802.11n/H20 Mode)/2437

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874.00	56.42	-3.51	52.91	74.00	-21.09	peak
4874.00	44.51	-3.51	41.00	54.00	-13.00	AVG
7311.00	55.86	-0.82	55.04	74.00	-18.96	peak
7311.00	41.21	-0.82	40.39	54.00	-13.61	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874.00	57.67	-3.51	54.16	74.00	-19.84	peak
4874.00	43.01	-3.51	39.50	54.00	-14.50	AVG
7311.00	54.31	-0.82	53.49	74.00	-20.51	peak
7311.00	42.02	-0.82	41.20	54.00	-12.80	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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HIGH CH11 (802.11n/H20 Mode)/2462

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	57.47	-3.43	54.04	74	-19.96	peak
4924	44.74	-3.43	41.31	54	-12.69	AVG
7386	55.04	-0.75	54.29	74	-19.71	peak
7386	40.53	-0.75	39.78	54	-14.22	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	57.99	-3.43	54.56	74	-19.44	peak
4924	44.02	-3.43	40.59	54	-13.41	AVG
7386	55.67	-0.75	54.92	74	-19.08	peak
7386	41.75	-0.75	41	54	-13	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4)The emissions are attenuated more than 20dB below the permissible limits are not record in the report
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissions of ANT.1 are reported.

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LOW CH3 (802.11n/H40 Mode)/2422

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4844	57.81	-3.63	54.18	74	-19.82	peak
4844	45.29	-3.63	41.66	54	-12.34	AVG
7266	53.21	-0.94	52.27	74	-21.73	peak
7266	42.66	-0.94	41.72	54	-12.28	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4844	58.35	-3.63	54.72	74	-19.28	peak
4844	44.01	-3.63	40.38	54	-13.62	AVG
7266	55.19	-0.94	54.25	74	-19.75	peak
7266	42.70	-0.94	41.76	54	-12.24	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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MID CH6 (802.11n/H40 Mode)/2437

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	57.88	-3.51	54.37	74	-19.63	peak
4874	43.79	-3.51	40.28	54	-13.72	AVG
7311	55.14	-0.82	54.32	74	-19.68	peak
7311	42.08	-0.82	41.26	54	-12.74	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	56.83	-3.51	53.32	74	-20.68	peak
4874	44.61	-3.51	41.1	54	-12.9	AVG
7311	56.02	-0.82	55.2	74	-18.8	peak
7311	42.29	-0.82	41.47	54	-12.53	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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HIGH CH9 (802.11n/H40 Mode)/2452
Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4904	56.88	-3.43	53.45	74	-20.55	peak
4904	45.74	-3.43	42.31	54	-11.69	AVG
7356	55.62	-0.75	54.87	74	-19.13	peak
7356	42.69	-0.75	41.94	54	-12.06	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4904	57.51	-3.43	54.08	74	-19.92	peak
4904	44.36	-3.43	40.93	54	-13.07	AVG
7356	54.71	-0.75	53.96	74	-20.04	peak
7356	42.4	-0.75	41.65	54	-12.35	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not record in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissions of MIMO are reported.

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LOW CH1 (802.11ax/H20 Mode)/2412

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	58.48	-3.64	54.84	74	-19.16	peak
4824	45.67	-3.64	42.03	54	-11.97	AVG
7236	53.91	-0.95	52.96	74	-21.04	peak
7236	42.64	-0.95	41.69	54	-12.31	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4824	55.64	-3.64	52	74	-22	peak
4824	43.48	-3.64	39.84	54	-14.16	AVG
7236	53.71	-0.95	52.76	74	-21.24	peak
7236	43.22	-0.95	42.27	54	-11.73	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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MID CH6 (802.11ax/H20 Mode)/2437

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874.00	57.59	-3.51	54.08	74.00	-19.92	peak
4874.00	44.60	-3.51	41.09	54.00	-12.91	AVG
7311.00	54.80	-0.82	53.98	74.00	-20.02	peak
7311.00	42.92	-0.82	42.10	54.00	-11.90	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874.00	56.53	-3.51	53.02	74.00	-20.98	peak
4874.00	43.07	-3.51	39.56	54.00	-14.44	AVG
7311.00	54.62	-0.82	53.80	74.00	-20.20	peak
7311.00	42.23	-0.82	41.41	54.00	-12.59	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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HIGH CH11 (802.11ax/H20 Mode)/2462

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	56.36	-3.43	52.93	74	-21.07	peak
4924	44.49	-3.43	41.06	54	-12.94	AVG
7386	56.03	-0.75	55.28	74	-18.72	peak
7386	43.34	-0.75	42.59	54	-11.41	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4924	58.04	-3.43	54.61	74	-19.39	peak
4924	45.22	-3.43	41.79	54	-12.21	AVG
7386	54.59	-0.75	53.84	74	-20.16	peak
7386	43.13	-0.75	42.38	54	-11.62	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4)The emissions are attenuated more than 20dB below the permissible limits are not record in the report
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissions of ANT.1 are reported.

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LOW CH3 (802.11ax/H40 Mode)/2422

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4844	57.48	-3.63	53.85	74	-20.15	peak
4844	43.97	-3.63	40.34	54	-13.66	AVG
7266	53.80	-0.94	52.86	74	-21.14	peak
7266	41.80	-0.94	40.86	54	-13.14	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4844	56.62	-3.63	52.99	74	-21.01	peak
4844	45.25	-3.63	41.62	54	-12.38	AVG
7266	55.28	-0.94	54.34	74	-19.66	peak
7266	41.81	-0.94	40.87	54	-13.13	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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MID CH6 (802.11ax/H40 Mode)/2437

Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	56.29	-3.51	52.78	74	-21.22	peak
4874	43.14	-3.51	39.63	54	-14.37	AVG
7311	53.86	-0.82	53.04	74	-20.96	peak
7311	41.6	-0.82	40.78	54	-13.22	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4874	56.74	-3.51	53.23	74	-20.77	peak
4874	43.47	-3.51	39.96	54	-14.04	AVG
7311	53.14	-0.82	52.32	74	-21.68	peak
7311	40.56	-0.82	39.74	54	-14.26	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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HIGH CH9 (802.11ax/H40 Mode)/2452
Horizontal:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4904	57.48	-3.43	54.05	74	-19.95	peak
4904	45.51	-3.43	42.08	54	-11.92	AVG
7356	54.09	-0.75	53.34	74	-20.66	peak
7356	41.74	-0.75	40.99	54	-13.01	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
4904	58.38	-3.43	54.95	74	-19.05	peak
4904	43.76	-3.43	40.33	54	-13.67	AVG
7356	53.78	-0.75	53.03	74	-20.97	peak
7356	42.63	-0.75	41.88	54	-12.12	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Remark：
(1) Measuring frequencies from 1 GHz to the 25 GHz。
(2) “F” denotes fundamental frequency; “H” denotes spurious frequency. “E” denotes band edge frequency.
(3) * denotes emission frequency which appearing within the Restricted Bands specified in provision of 15.205, then the general radiated emission limits in 15.209 apply.
(4) The emissions are attenuated more than 20dB below the permissible limits are not record in the report.
(5) The IF bandwidth of EMI Test Receiver between 30MHz to 1GHz was 120KHz, 1 MHz for measuring above 1 GHz, below 30MHz was 10KHz.
(6) When the test results of Peak Detected below the limits of Average Detected, the Average Detected is not need completed. For example: Top Channel at Fundamental 73.16dBuV/m(PK Value) <93.98(AV Limit), at harmonic 53.20 dBuV/m(PK Value) <54 dBuV/m(AV Limit), the Average Detected not need to completed.
(7)All modes of operation were investigated and the worst-case emissions of MIMO are reported.

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Test Result of Radiated Spurious at Band edges

All modes of operation were investigated and the worst-case of MIMO are reported.

Operation Mode:
802.11b Mode TX CH Low (2412MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	52.14	-5.81	46.33	74	-27.67	peak
2310	/	-5.81	/	54	/	AVG
2390	53.64	-5.84	47.8	74	-26.2	peak
2390	/	-5.84	/	54	/	AVG
2400	57.16	-5.84	51.32	74	-22.68	peak
2400	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	55.19	-5.81	49.38	74	-24.62	peak
2310	/	-5.81	/	54	/	AVG
2390	54.35	-5.84	48.51	74	-25.49	peak
2390	/	-5.84	/	54	/	AVG
2400	56.23	-5.84	50.39	74	-23.61	peak
2400	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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Operation Mode: TX CH High (2462MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	54.16	-5.65	48.51	74	-25.49	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	55.67	-5.65	50.02	74	-23.98	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	54.39	-5.65	48.74	74	-25.26	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	54.16	-5.65	48.51	74	-25.49	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

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Operation Mode: 802.11g Mode TX CH Low (2412MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	55.03	-5.81	49.22	74	-24.78	peak
2310	/	-5.81	/	54	/	AVG
2390	54.16	-5.84	48.32	74	-25.68	peak
2390	/	-5.84	/	54	/	AVG
2400	53.39	-5.84	47.55	74	-26.45	peak
2400	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	53.19	-5.81	47.38	74	-26.62	peak
2310	/	-5.81	/	54	/	AVG
2390	54.37	-5.84	48.53	74	-25.47	peak
2390	/	-5.84	/	54	/	AVG
2400	55.78	-5.84	49.94	74	-24.06	peak
2400	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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Operation Mode: TX CH High (2462MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	56.37	-5.65	50.72	74	-23.28	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	55.02	-5.65	49.37	74	-24.63	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	54.17	-5.65	48.52	74	-25.48	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	55.03	-5.65	49.38	74	-24.62	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

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Operation Mode: 802.11n/H20 Mode TX CH Low (2412MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	54.02	-5.81	48.21	74	-25.79	peak
2310	/	-5.81	/	54	/	AVG
2390	53.94	-5.84	48.1	74	-25.9	peak
2390	/	-5.84	/	54	/	AVG
2400	54.27	-5.84	48.43	74	-25.57	peak
2400	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	55.02	-5.81	49.21	74	-24.79	peak
2310	/	-5.81	/	54	/	AVG
2390	54.16	-5.84	48.32	74	-25.68	peak
2390	/	-5.84	/	54	/	AVG
2400	53.92	-5.84	48.08	74	-25.92	peak
2400	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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Operation Mode: TX CH High (2462MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	53.14	-5.65	47.49	74	-26.51	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	54.27	-5.65	48.62	74	-25.38	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	53.67	-5.65	48.02	74	-25.98	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	54.19	-5.65	48.54	74	-25.46	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

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Operation Mode: 802.11n/H40 Mode TX CH Low (2422MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	54.19	-5.81	48.38	74	-25.62	peak
2310	/	-5.81	/	54	/	AVG
2390	55.37	-5.84	49.53	74	-24.47	peak
2390	/	-5.84	/	54	/	AVG
2400	56.92	-5.84	51.08	74	-22.92	peak
2400	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2310	53.47	-5.81	47.66	74	-26.34	peak
2310	/	-5.81	/	54	/	AVG
2390	52.36	-5.84	46.52	74	-27.48	peak
2390	/	-5.84	/	54	/	AVG
2400	55.91	-5.84	50.07	74	-23.93	peak
2400	/	-5.84	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

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Operation Mode: TX CH High (2452MHz)

Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	54.02	-5.65	48.37	74	-25.63	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	55.34	-5.65	49.69	74	-24.31	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						

Vertical:

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector Type
2483.50	54.17	-5.65	48.52	74	-25.48	peak
2483.50	/	-5.65	/	54	/	AVG
2500.00	55.39	-5.65	49.74	74	-24.26	peak
2500.00	/	-5.65	/	54	/	AVG
Remark: Factor = Antenna Factor + Cable Loss – Pre-amplifier; Level = Reading + Factor; Margin = Level – Limit						
Remark: All the other emissions not reported were too low to read and deemed to comply with FCC limit.						

Remark:
1. If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.
2. In restricted bands of operation, the spurious emissions below the permissible value more than 20dB.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

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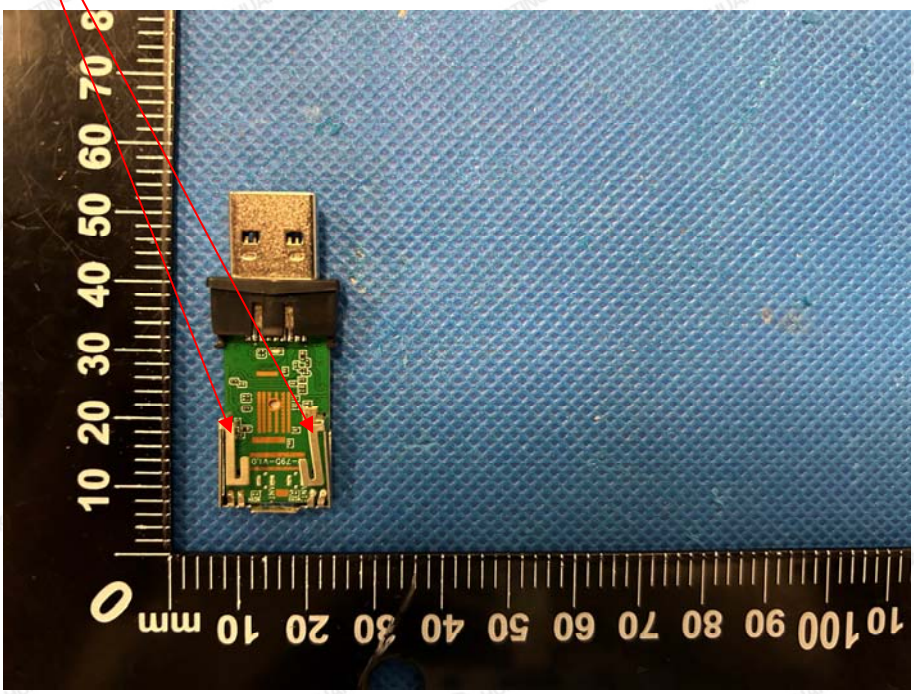
4.7. ANTENNA REQUIREMENT

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. And according to FCC 47 CFR Section 15.247, if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance.
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction
The antenna used in this product is a Shrapnel antenna, which permanently attached. It conforms to the standard requirements. and the best case gain of the antenna is Antenna port 1: 2.22dBi and Antenna port 2: 2.22dBi.

WIFI ANTENNA



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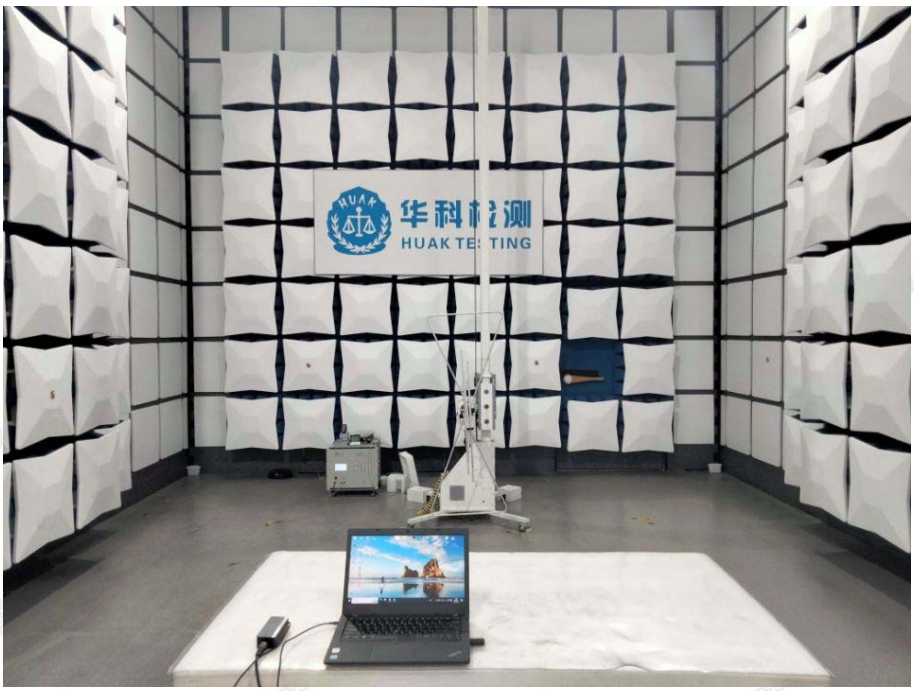
PHOTOGRAPH OF TEST

Radiated Emission



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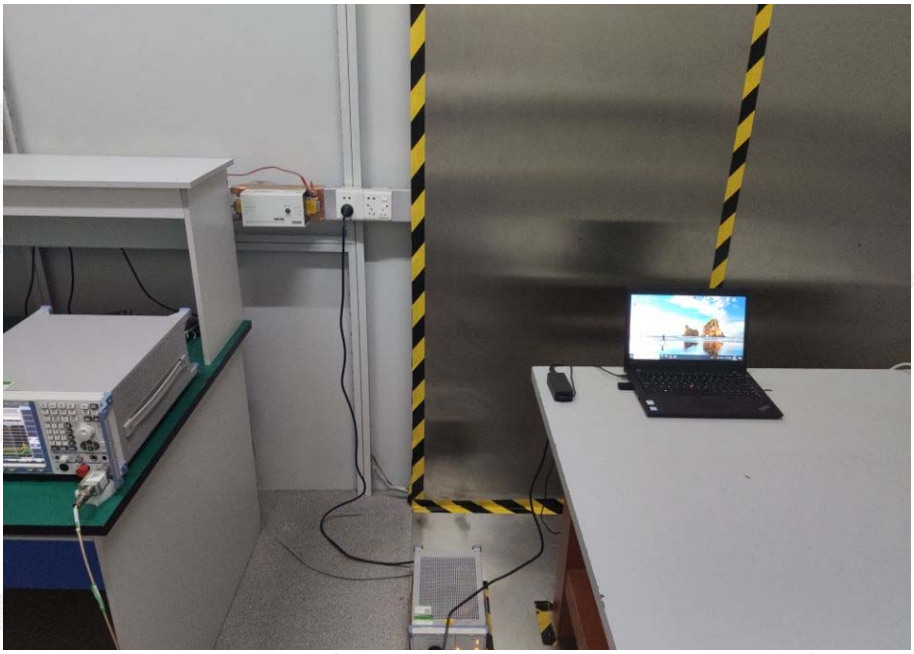
Conducted Emission



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4.8. PHOTOS OF THE EUT

Reference to the report: ANNEX A of external photos and ANNEX B of internal photos

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

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