



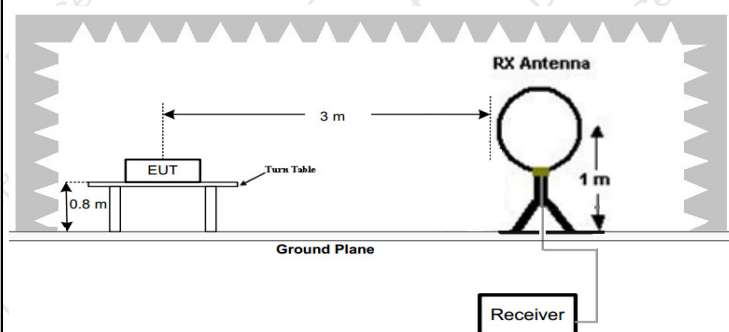
4.6 Spurious Emission

4.6.1. Test Specification

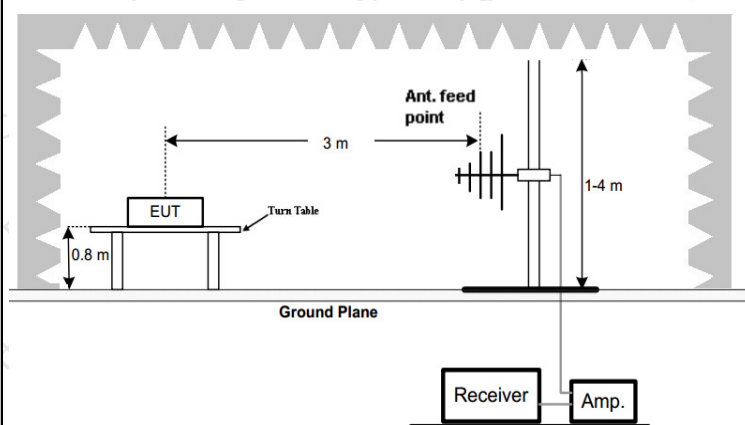
Test Requirement:	FCC CFR47 Part 15 Section 15.407 & 15.209 & 15.205				
Test Method:	KDB 789033 D02 v02r01				
Frequency Range:	9kHz to 40GHz				
Measurement Distance:	3 m				
Antenna Polarization:	Horizontal & Vertical				
Operation mode:	Transmitting mode with modulation				
Receiver Setup:	Frequency	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:	(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz. (2) For transmitters operating in the 5.25-5.35 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. (3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of -27 dBm/MHz. (4) For transmitters operating in the 5.725-5.85 GHz band: (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. The limit of frequency below 1GHz and which fall in restricted bands should comply 15.209.				

**Test Setup:**

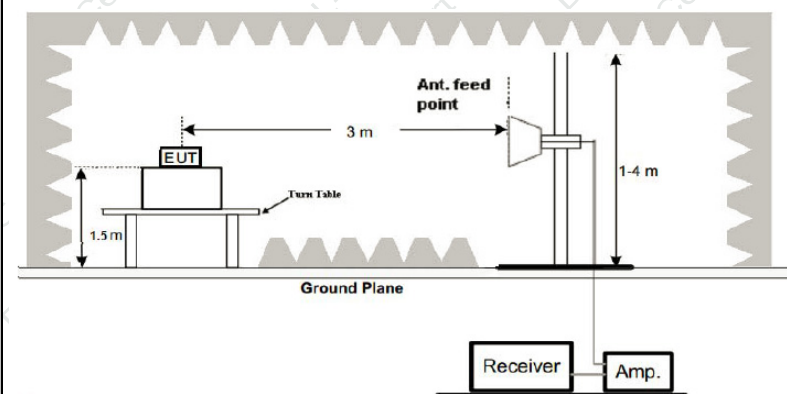
For radiated emissions below 30MHz



30MHz to 1GHz



Above 1GHz



**Test Procedure:**

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Test Results:

PASS

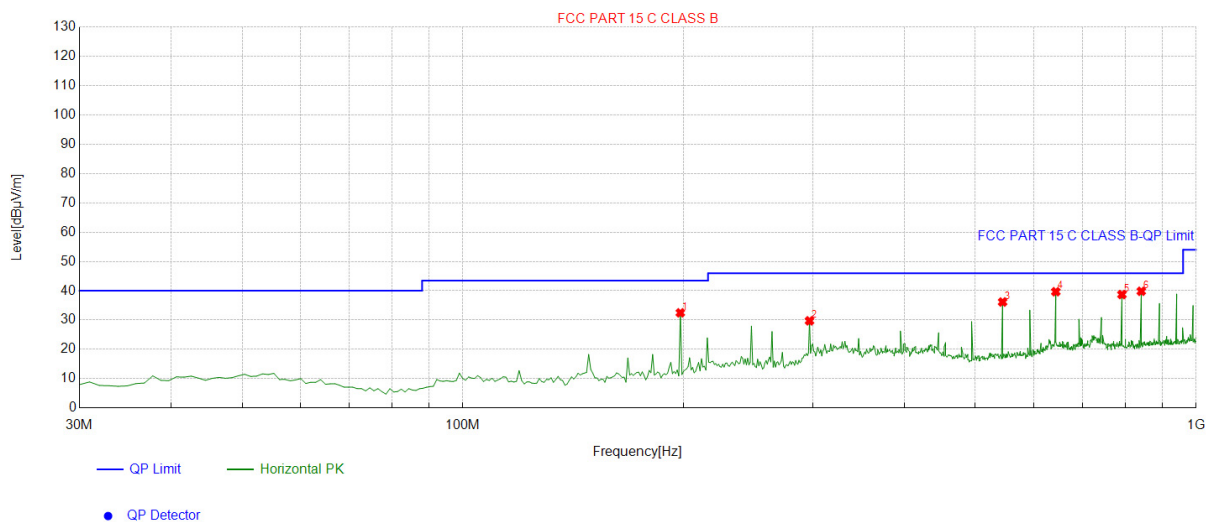


4.6.2. Test Data

Below 1GHz Test Results

All the test modes completed for test. Only the worst mode of 802.11a Low channel TX is reflected.

Antenna polarity: Horizontal



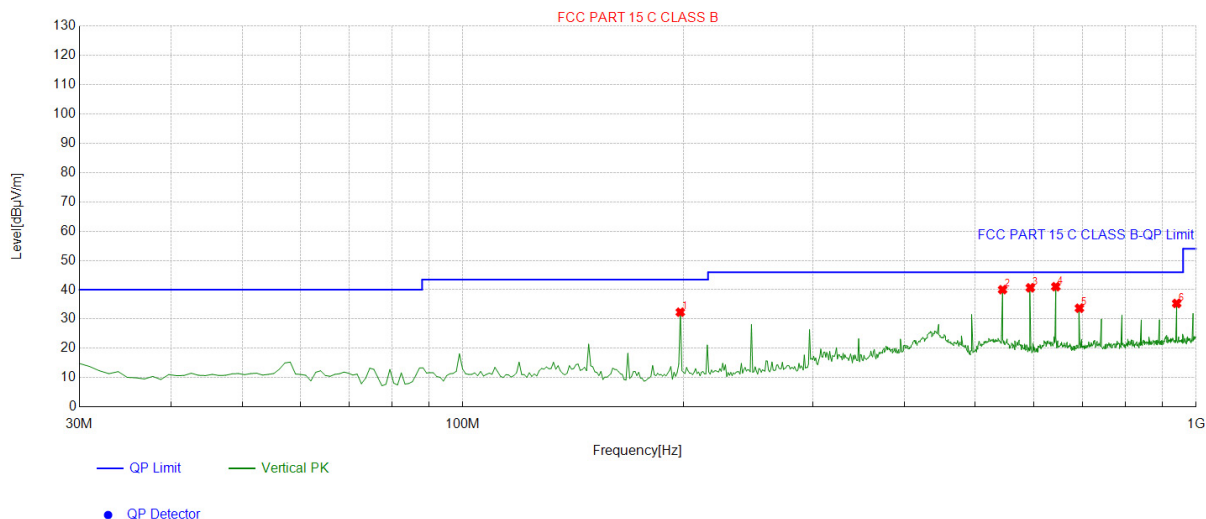
Suspected List

NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	197.978	-14.56	47.04	32.48	43.50	11.02	100	132	Horizontal
2	297.017	-12.08	41.83	29.75	46.00	16.25	100	103	Horizontal
3	544.615	-6.82	42.99	36.17	46.00	9.83	100	355	Horizontal
4	643.654	-4.87	44.55	39.68	46.00	6.32	100	204	Horizontal
5	792.212	-2.59	41.30	38.71	46.00	7.29	100	355	Horizontal
6	841.732	-2.20	42.03	39.83	46.00	6.17	100	16	Horizontal

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



Antenna polarity: Vertical



Suspected List									
NO.	Freq. [MHz]	Factor [dB]	Reading [dBμV/m]	Level [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity
1	197.978	-14.56	46.91	32.35	43.50	11.15	100	219	Vertical
2	544.615	-6.82	46.86	40.04	46.00	5.96	100	122	Vertical
3	594.134	-5.70	46.38	40.68	46.00	5.32	100	356	Vertical
4	643.654	-4.87	45.93	41.06	46.00	4.94	100	1	Vertical
5	693.173	-4.35	38.05	33.70	46.00	12.30	100	353	Vertical
6	940.771	-0.99	36.33	35.34	46.00	10.66	100	3	Vertical

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

Harmonics and Spurious Emissions

Frequency Range (9 kHz-30MHz)

Frequency (MHz)	Level@3m (dBμV/m)	Limit@3m (dBμV/m)
--	--	--
--	--	--
--	--	--
--	--	--

Note: 1. Emission Level=Reading+ Cable loss-Antenna factor-Amp factor

2. The emission levels are 20 dB below the limit value, which are not reported. It is deemed to comply with the requirement

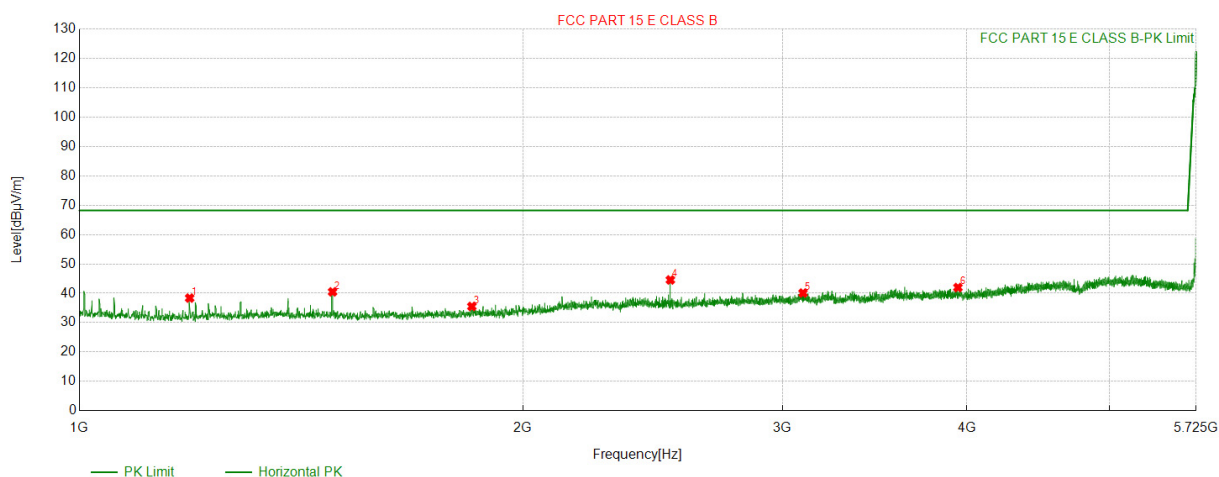


Above 1GHz Test Results

All the test modes completed for test. Only the worst mode of 802.11a Low channel TX is reflected.

For 1GHz to 5.725GHz

Antenna polarity: Horizontal

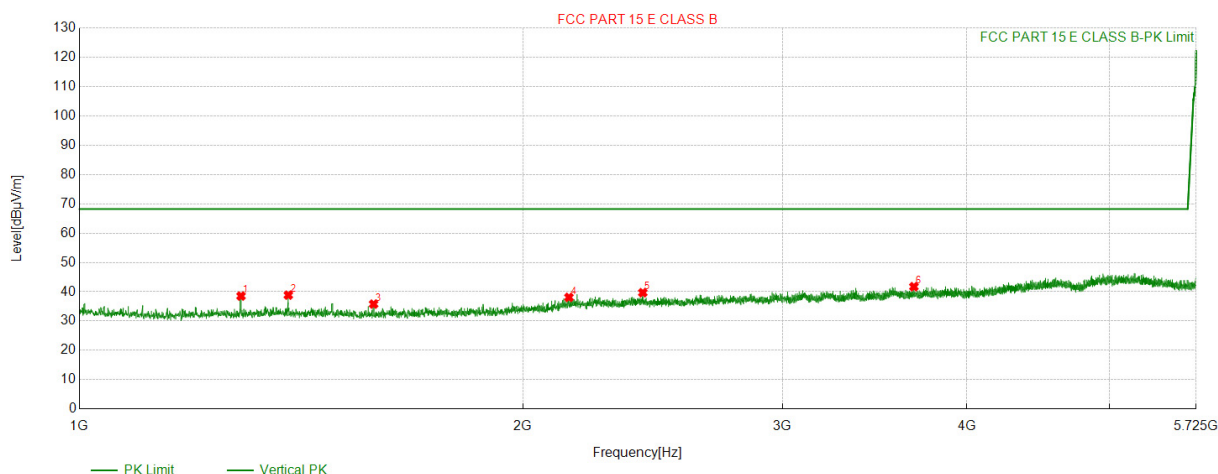


Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1188.074	57.30	38.38	-18.92	68.20	29.82	150	110	Horizontal
2	1485.306	58.90	40.49	-18.41	68.20	27.71	150	70	Horizontal
3	1846.332	53.27	35.53	-17.74	68.20	32.67	150	210	Horizontal
4	2517.822	59.27	44.56	-14.71	68.20	23.64	150	230	Horizontal
5	3097.637	52.70	40.10	-12.60	68.20	28.10	150	120	Horizontal
6	3945.860	51.76	41.98	-9.78	68.20	26.22	150	10	Horizontal

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



Antenna polarity: Vertical



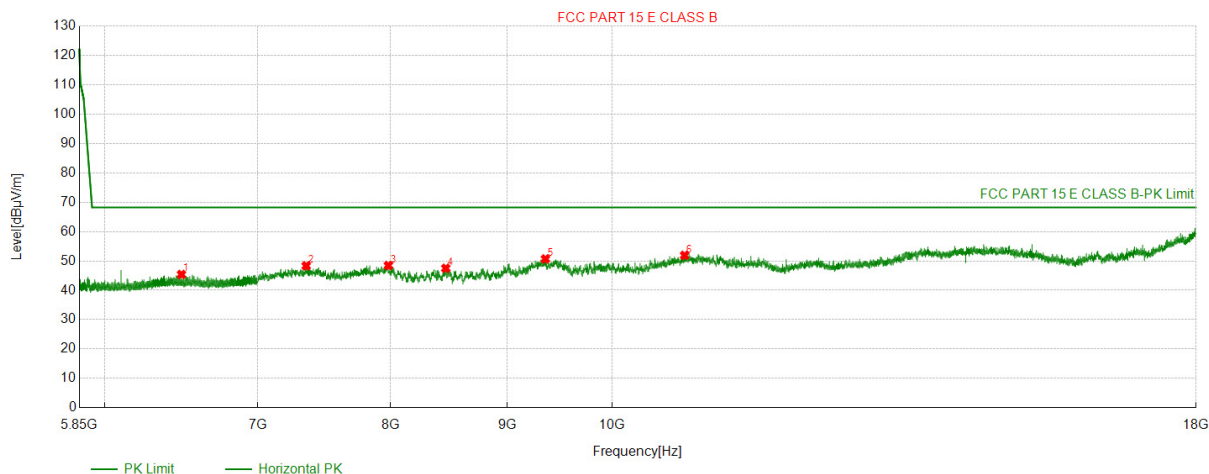
Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	1287.309	57.02	38.55	-18.47	68.20	29.65	150	40	Vertical
2	1386.071	56.94	38.86	-18.08	68.20	29.34	150	130	Vertical
3	1583.596	54.37	35.79	-18.58	68.20	32.41	150	200	Vertical
4	2148.762	53.35	38.09	-15.26	68.20	30.11	150	50	Vertical
5	2411.499	54.07	39.68	-14.39	68.20	28.52	150	130	Vertical
6	3683.596	52.32	41.73	-10.59	68.20	26.47	150	190	Vertical

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



For 5.85GHz to 18GHz

Antenna polarity: Horizontal

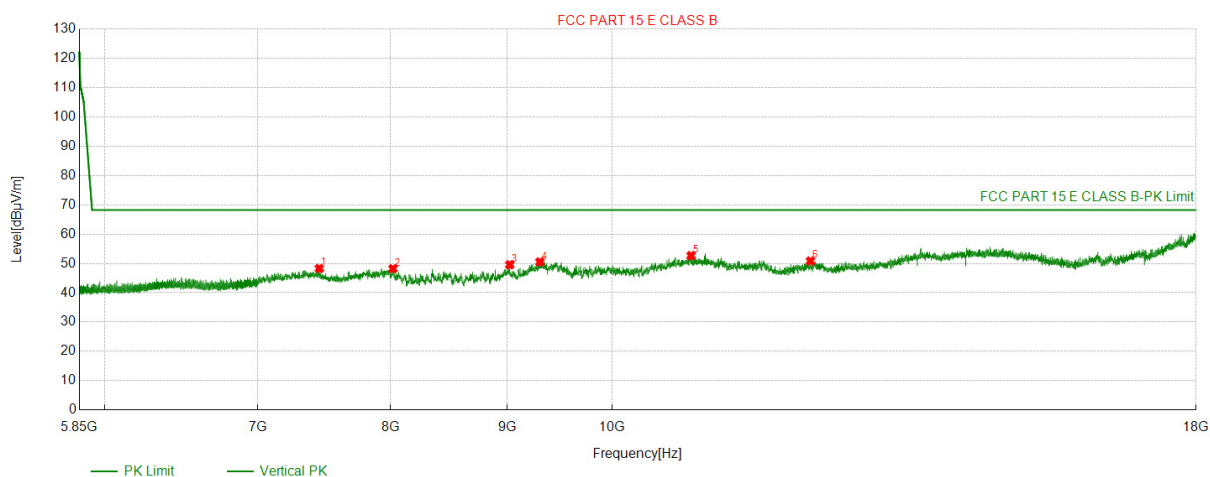


Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	6483.138	51.88	45.39	-6.49	68.20	22.81	150	88	Horizontal
2	7349.835	51.47	48.32	-3.15	68.20	19.88	150	124	Horizontal
3	7983.498	50.32	48.45	-1.87	68.20	19.75	150	5	Horizontal
4	8458.746	49.33	47.50	-1.83	68.20	20.70	150	320	Horizontal
5	9350.935	50.92	50.68	-0.24	68.20	17.52	150	110	Horizontal
6	10756.87	49.88	51.90	2.02	68.20	16.30	150	5	Horizontal

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



Antenna polarity: Vertical



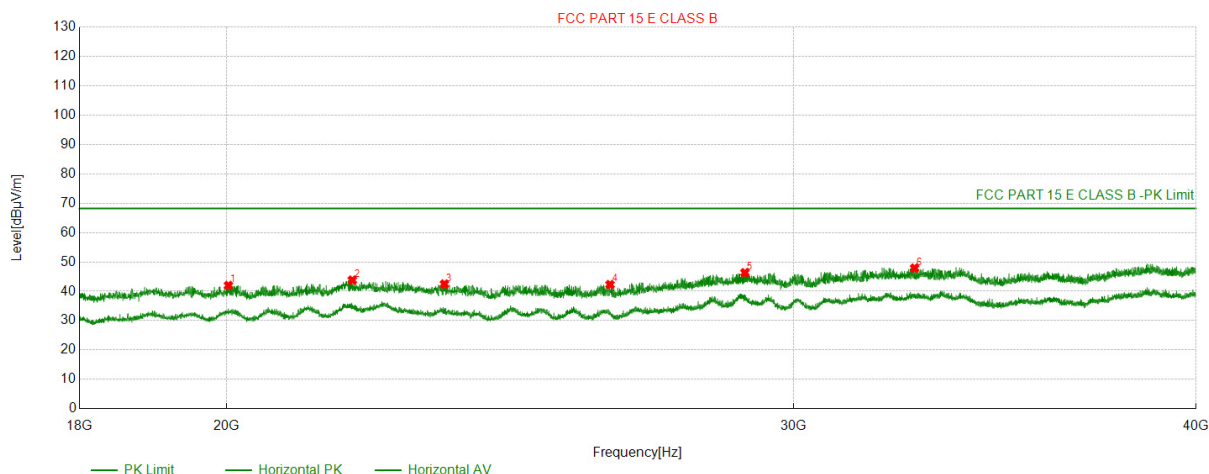
Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	7447.745	51.30	48.28	-3.02	68.20	19.92	150	148	Vertical
2	8020.902	50.02	48.22	-1.80	68.20	19.98	150	103	Vertical
3	9020.902	50.99	49.55	-1.44	68.20	18.65	150	280	Vertical
4	9299.230	50.87	50.52	-0.35	68.20	17.68	150	71	Vertical
5	10827.28	50.47	52.66	2.19	68.20	15.54	150	17	Vertical
6	12209.02	48.05	50.82	2.77	68.20	17.38	150	180	Vertical

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



For 18GHz to 40GHz

Antenna polarity: Horizontal

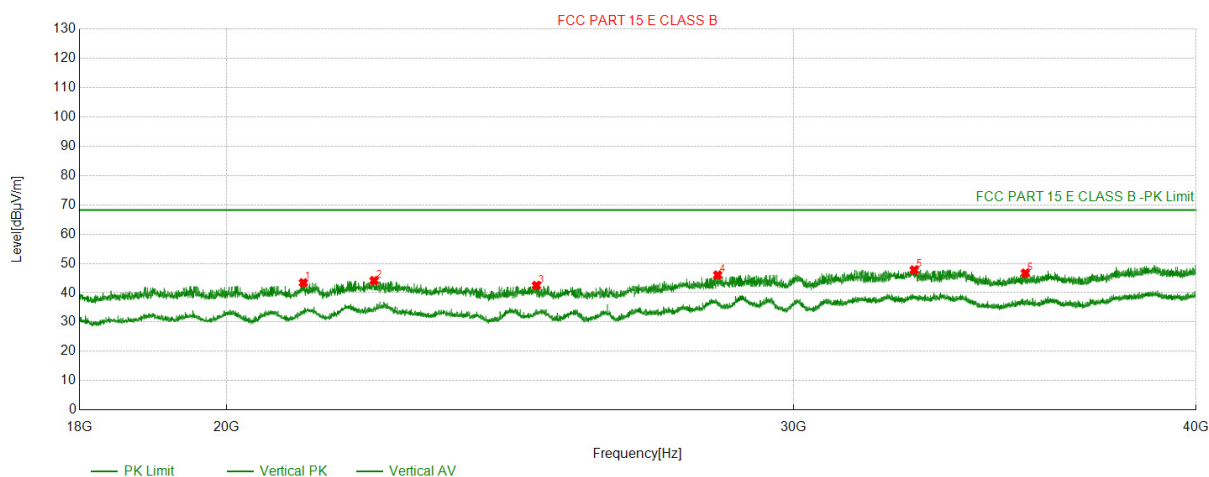


Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	20024.202	35.80	41.99	6.19	68.20	26.21	150	50	Horizontal
2	21878.988	38.18	43.81	5.63	68.20	24.39	150	350	Horizontal
3	23368.537	36.80	42.47	5.67	68.20	25.73	150	80	Horizontal
4	26305.831	35.41	42.29	6.88	68.20	25.91	150	160	Horizontal
5	28970.297	37.30	46.32	9.02	68.20	21.88	150	170	Horizontal
6	32706.271	37.32	47.89	10.57	68.20	20.31	150	50	Horizontal

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



Antenna polarity: Vertical



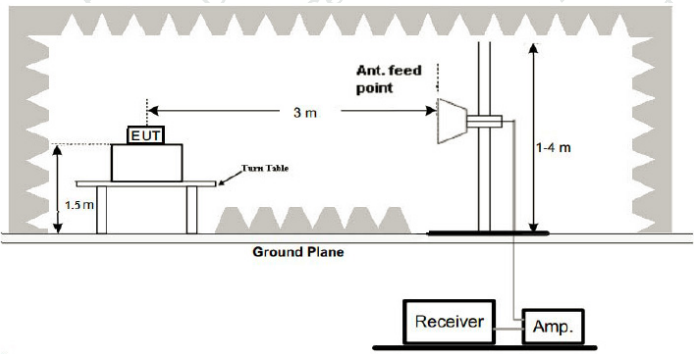
Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	21126.513	38.09	43.40	5.31	68.20	24.80	150	340	Vertical
2	22222.222	38.40	44.14	5.74	68.20	24.06	150	150	Vertical
3	24957.096	36.13	42.49	6.36	68.20	25.71	150	300	Vertical
4	28411.441	37.33	46.04	8.71	68.20	22.16	150	0	Vertical
5	32697.470	37.18	47.75	10.57	68.20	20.45	150	140	Vertical
6	35401.540	37.37	46.69	9.32	68.20	21.51	150	110	Vertical

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



4.7 Band Edge

4.7.1. Test Specification

Test Requirement:	FCC CFR47 Part 15E Section 15.407
Test Method:	ANSI C63.10: 2020
Limit:	(1) For transmitters operating in the 5.725-5.85 GHz band: (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. The limit of frequency below 1GHz and which fall in restricted bands should complies 15.209.
Test Setup:	 The diagram illustrates the test setup. An EUT (Equipment Under Test) is placed on a turn table, which is 1.5m high. The turn table is 3m away from the antenna feed point. The antenna is mounted on a tower, with a height of 1-4m. The ground plane is indicated. A receiver and amplifier (Amp.) are connected to the antenna.
Test Mode:	Transmitting mode with modulation
Test Procedure:	1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.



	5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi peak or average method as specified and then reported in a data sheet.
Test Result:	PASS

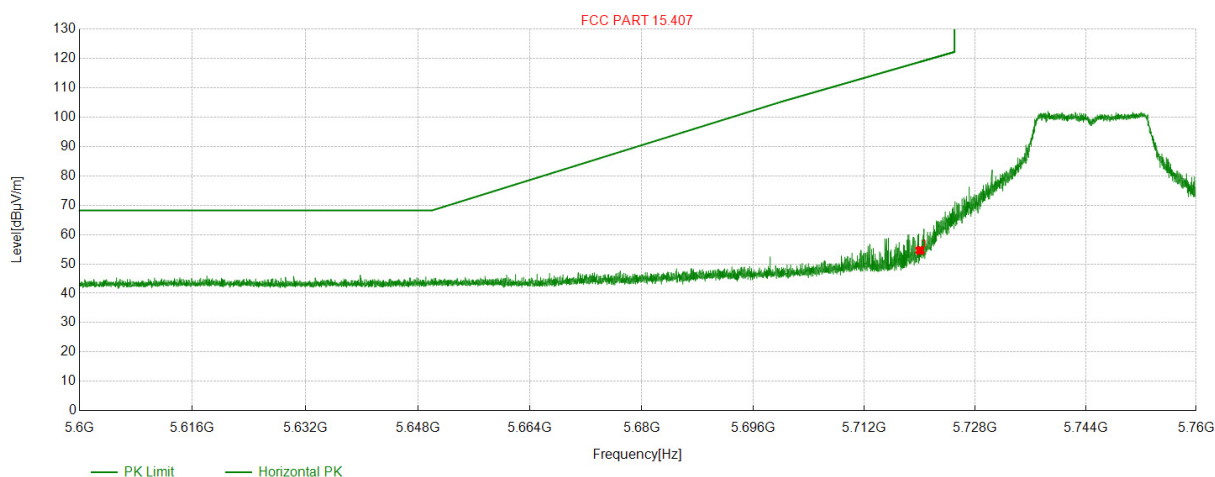


4.7.2. Test Data

All the test modes completed for test. Only the worst mode of 802.11a Low channel TX is reflected.

802.11n(HT20)-5745

Antenna polarity: Horizontal

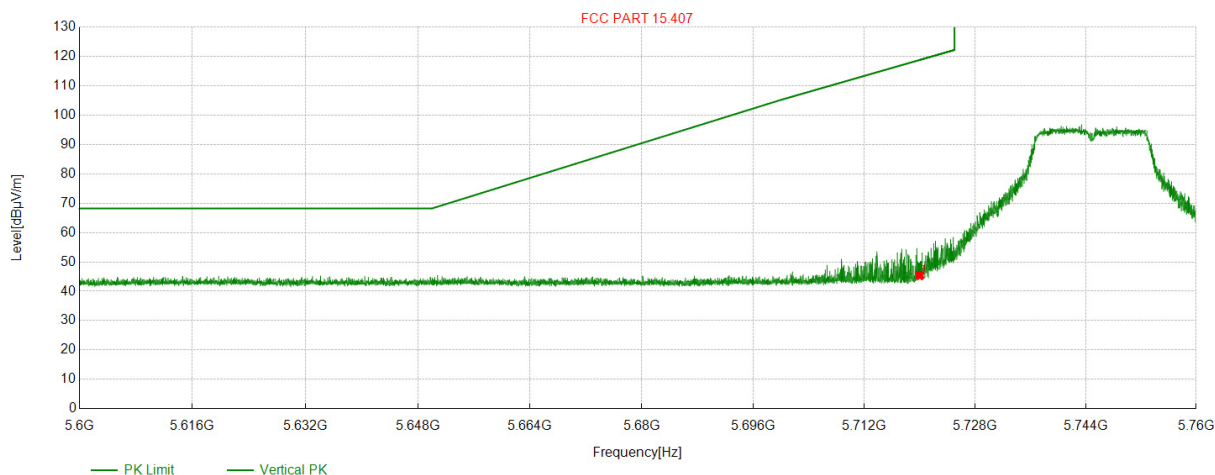


Suspected Data List									
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	5720.000	60.70	54.63	-6.07	118.81	64.18	150	62	Horizontal

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



Antenna polarity: Vertical



Suspected Data List

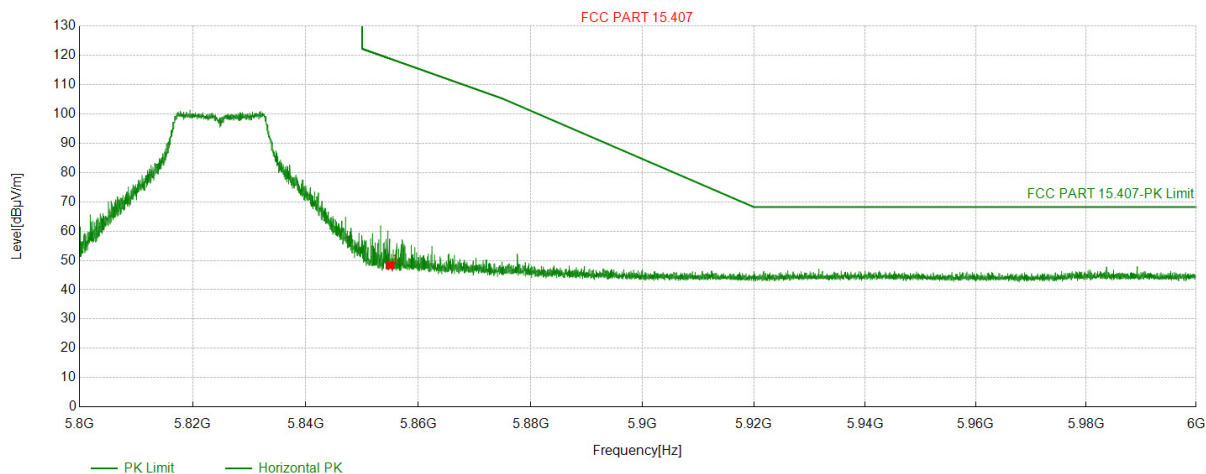
NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	5720.000	51.47	45.40	-6.07	118.81	73.41	150	289	Vertical

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



802.11n(HT20)-5825

Antenna polarity: Horizontal



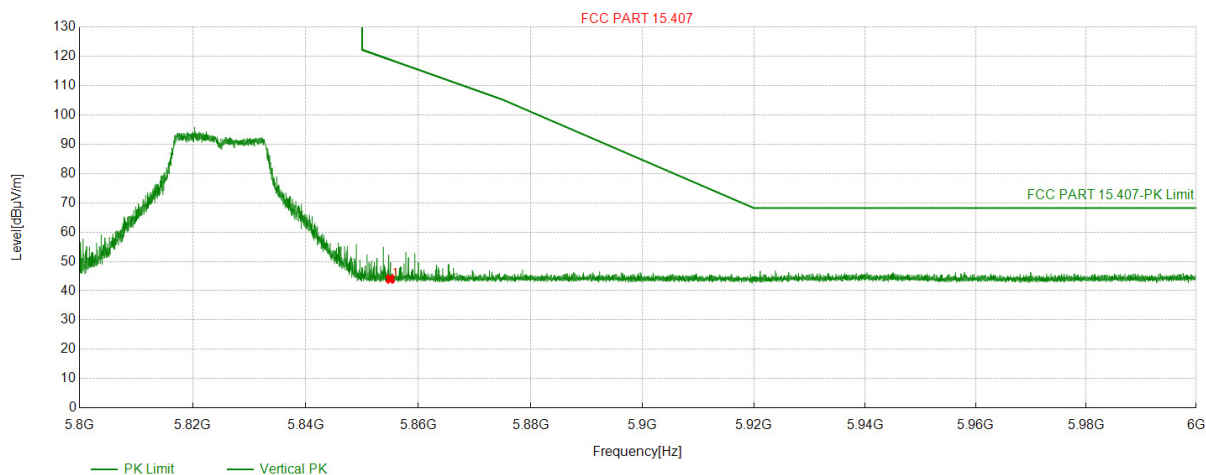
Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	5855.000	54.12	48.33	-5.79	118.80	70.47	150	87	Horizontal

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



Antenna polarity: Vertical



Suspected Data List

NO.	Freq. [MHz]	Reading [dBμV/m]	PK Level [dBμV/m]	Factor [dB]	PK Limit [dBμV/m]	PK Margin [dB]	Height [cm]	Angle [°]	Polarity
1	5855.000	49.77	43.98	-5.79	118.80	74.82	150	298	Vertical

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



4.8 Frequency Stability Measurement

4.8.1. Test Specification

Test Requirement:	FCC Part15 Section 15.407(g)
Test Method:	ANSI C63.10: 2020
Limit:	The frequency tolerance shall be maintained within the band of operation frequency over a temperature variation of 0 degrees to 35 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.
Test Setup:	<pre>graph LR; SA[Spectrum Analyzer] --- TC[Temperature Chamber]; subgraph TC; EUT[EUT]; end; EUT --- P[AC/DC Power supply];</pre>
Test Procedure:	- The EUT was placed inside the environmental test chamber and powered by nominal AC/DC voltage. - Turn the EUT on and couple its output to a spectrum analyzer. - Turn the EUT off and set the chamber to the highest temperature specified. - Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. - Repeat step 2 and 3 with the temperature chamber set to the lowest temperature. - The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.
Test Result:	PASS
Remark:	N/A



4.8.2. Test Result

Mode	Voltage (V)	FHL (5745MHz)	Deviation (KHz)	FHH (5825MHz)	Deviation (KHz)
5.8G Band	4.25V	5744.979	-21	5824.994	-6
	5.00V	5745.021	21	5825.003	3
	5.75V	5744.966	-34	5824.991	-9

Mode	Temperature (°C)	FHL (5745MHz)	Deviation (KHz)	FHH (5825MHz)	Deviation (KHz)
5.8G Band	-30	5744.987	-13	5825.025	25
	-20	5744.989	-11	5825.023	23
	-10	5744.996	-4	5825.012	12
	0	5744.973	-27	5825.019	19
	10	5744.993	-7	5824.969	-31
	20	5745.012	12	5824.977	-23
	30	5744.999	-1	5824.980	-20
	40	5744.987	-13	5824.997	-3
	50	5745.022	22	5824.983	-17



4.9 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.

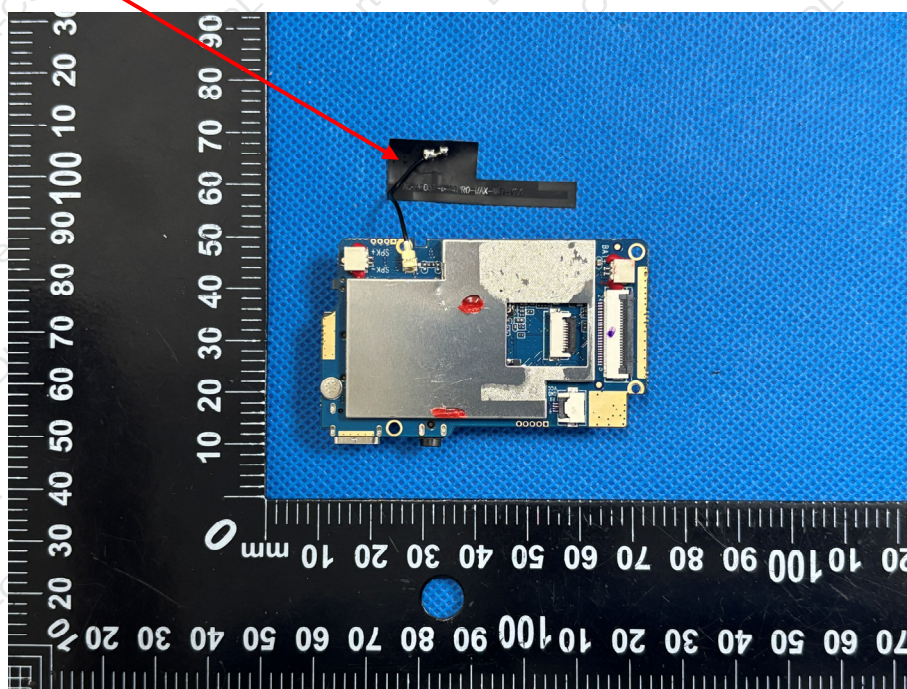
Refer to statement below for compliance.

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 FPC Antenna, need professional installation, not easy to remove. It conforms to the standard requirements. The directional gains of antenna used for transmitting is 1.49dBi.

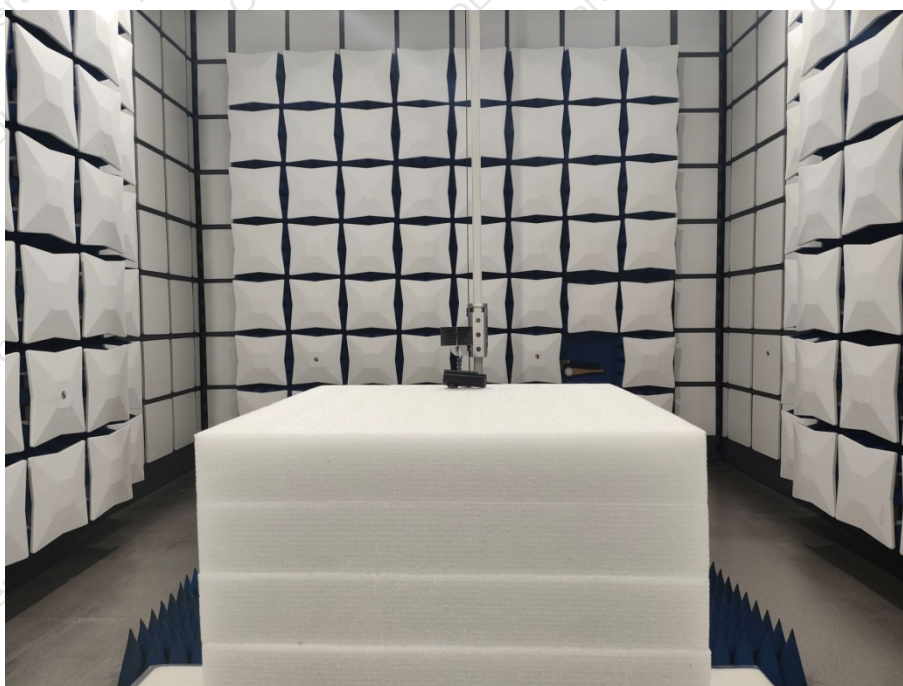
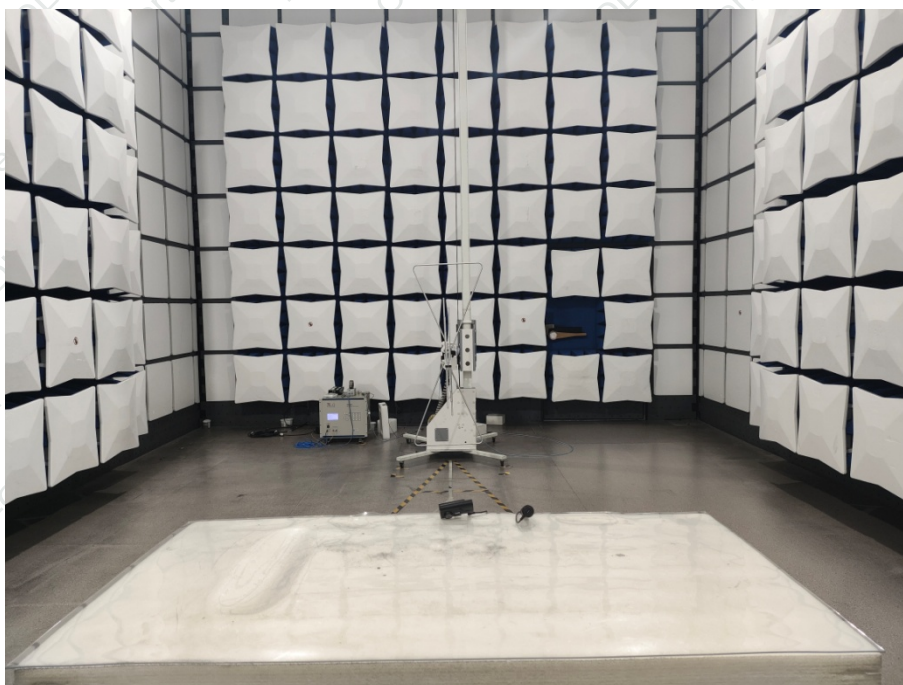
WIFI ANTENNA





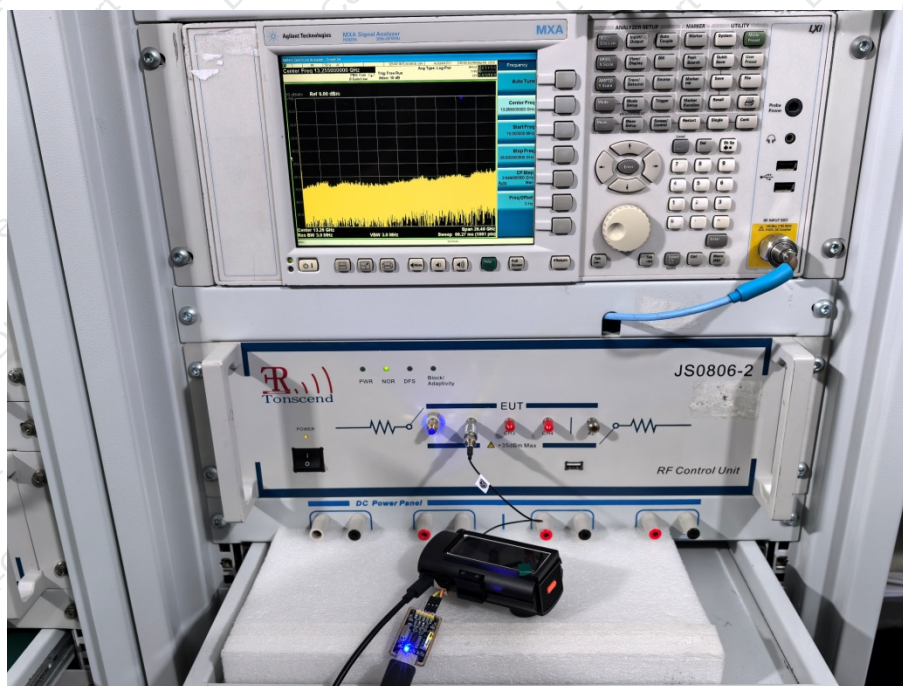
5. Test Setup Photos of the EUT

Radiated Emission





RF Conducted Emission





6. Photos of the EUT

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

-----End of test report-----