



EMC TEST REPORT

Report No.: 20240617G10725X-W1

Product Name: HOVERAir X1Smart

FCC ID: 2AIDW-ZZ-H-1-003

IC ID: 21647-ZZH1003

Trade Name: ZERO ZERO ROBOTICS

Model No. : ZZ-H-1-002

Applicant: Shenzhen Zero Zero Infinity Technology Co., Ltd.

Address: 4th Floor, Qianhai E-metro Tower, Shenzhen-Hong Kong Cooperation Zone, Shenzhen, China

Received Date: 2024.06.18

Dates of Testing: 2024.06.18~2024.06.24

Issued by: CCIC Southern Testing Co., Ltd.

Lab Location: Electronic Testing Building, No. 43 Shahe Road, Xili Street, Nanshan District, Shenzhen, Guangdong, China.

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Test Report

Product Name..... HOVERAir X1Smart

Model No. ZZ-H-1-002

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Applicant Address..... 4th Floor,Qianhai E-metro Tower,Shenzhen-Hong Kong Cooperation Zone, Shenzhen,China

Manufacturer Shenzhen Zero Zero Infinity Technology Co., Ltd.

Manufacturer Address 4th Floor,Qianhai E-metro Tower,Shenzhen-Hong Kong Cooperation Zone, Shenzhen,China

Test Standards..... 47 CFR Part 15 Subpart B
ICES-003 Issue 7

Test Result..... PASS

Tested by Sun Jiaohui
Sun Jiaohui, Test Engineer 2024.07.19

Reviewed by Chris You
Chris You, Senior Engineer 2024.07.19

Approved by Wang Shijie
Wang Shijie, Manager 2024.07.19



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Change History		
Issue	Date	Reason for change
1.0	2024.07.19	First edition



1. GENERAL INFORMATION

1.1 EUT Description

EUT Name.:	HOVERAir X1Smart
Hardware Version:	H130_HMB_V21
Software Version:	ZZ_IMG_H121_V7.6.1/7.0.62
Power Supply:	AC adapter Model No: A839-200150C-US1 I/P: 100-240V~50/60Hz, 0.8A O/P: 5V---3A 9V---3A 12V---2.5A 15V---2A 20V---1.5A Manufacturer: Dongguan Aohai Technology Co., Ltd.

Note1: The EUT is a HOVERAir X1Smart;

Note2: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.



1.2 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart B:

No.	Identity	Document Title
1	47 CFR Part 15 Subpart B	Radio Frequency Devices
2	ICES-003 Issue 7	Information Technology Equipment (Including Digital Apparatus) — Limits and Methods of Measurement

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Result
1	15.107	Conducted Emission	PASS
2	15.109	Radiated Emission	PASS
3	ICES 003 Issue 7 Section3.2.1	Conducted Emission	PASS
4	ICES 003 Issue 7 Section3.2.2	Radiated Emission	PASS

NOTE:

(1) The EUT has been tested according to 47 CFR Part 15 Subpart B, Class B. The test procedure is according to ANSI C63.4:2014.

(2) The EUT has been tested according to ICES 003 Issue 7. The test procedure is according to ANSI C63.4:2014.



1.3 Facilities and Accreditations

1.3.1 Facilities

FCC-Registration No.: CN1283

CCIC Southern Testing Co., Ltd EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Designation Number: CN1283, valid time is until Jun 30th, 2025.

ISED Registration: 11185A-1

CCIC Southern Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 11185A-1 on Aug. 04, 2016, valid time is until Jun 30th, 2025.

A2LA Code: 5721.01

CCIC-SET is a third party testing organization accredited by A2LA according to ISO/IEC 17025. The accreditation certificate number is 5721.01.

1.3.2 Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	15 °C - 35 °C
Relative Humidity (%):	25% -75%
Atmospheric Pressure (kPa):	86kPa-106kPa

1.3.3 Measurement Uncertainty

The uncertainty is calculated using the methods suggested in the "Guide to the Expression of Uncertainty in Measurement" (GUM) published by ISO.

Uncertainty of Conducted Emission:	Uc = 3.2 dB (k=2)
Uncertainty of Radiated Emission: (30MHz~1GHz)	Uc = 5.8 dB (k=2)
Uncertainty of Radiated Emission: (1~6GHz)	Uc = 5.1 dB (k=2)
Uncertainty of Radiated Emission: (6~18GHz)	Uc = 5.5 dB (k=2)



2. TEST CONDITIONS SETTING

2.1 Test Peripherals

The following is a listing of the EUT and peripherals utilized during the performance of EMC test:

Support Equipment:

Description	Brand name	Model	Serial No.	FCCID
Battery	/	ZZ-H-3-002	/	/

Support Cable:

Description	Shield Type	Ferrite Core	Length
AC Power Cable	Un- shielding	/	0.8m

2.2 Test Mode

The EUT have the following typical setups during the test:

Setup1: Bluetooth + charger;

Setup2: 2.4G WIFI + charger;

Setup3: 5G WIFI + charger;

Setup4: Bluetooth + Battery;

Setup5: 2.4G WIFI + Battery;

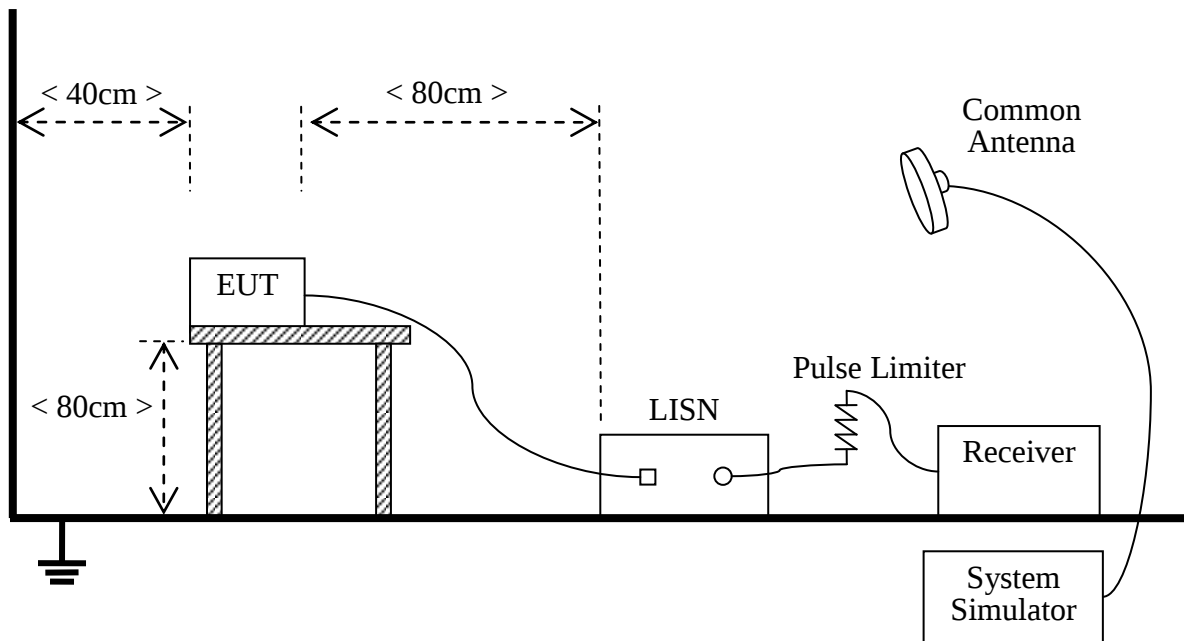
Setup6: 5G WIFI + Battery;

Setup7: Idle + Battery;

2.3 Test Setup and Equipments List

2.3.1 Conducted Emission

A. Test Setup:



The EUT is placed on a 0.8m high insulating table, which stands on the grounded conducting floor, and keeps 0.4m away from the grounded conducting wall. The EUT is connected to the power mains through a LISN which provides $50\Omega/50\mu\text{H}$ of coupling impedance for the measuring instrument. The Common Antenna is used for the call between the EUT and the System Simulator (SS). A Pulse Limiter is used to protect the measuring instrument. The factors of the whole test system are calibrated to correct the reading.

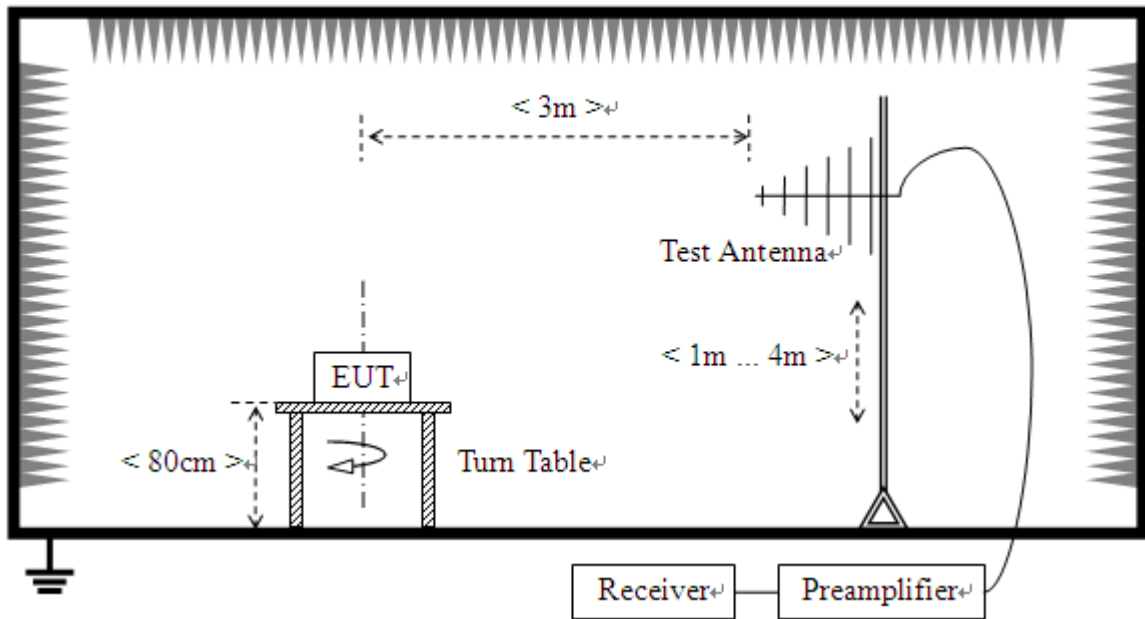
B. Equipments List:

Description	Manufacturer	Model	Serial No.	Calibration Date	Calibration Due. Date
Test Receiver	KEYSIGHT	N9038A	A141202036	2024.06.05	2025.06.04
LISN	ROHDE&SCHWARZ	ENV216	A140701847	2024.05.23	2025.05.22
Cable	MATCHING PAD	W7	/	2023.08.02	2024.08.02

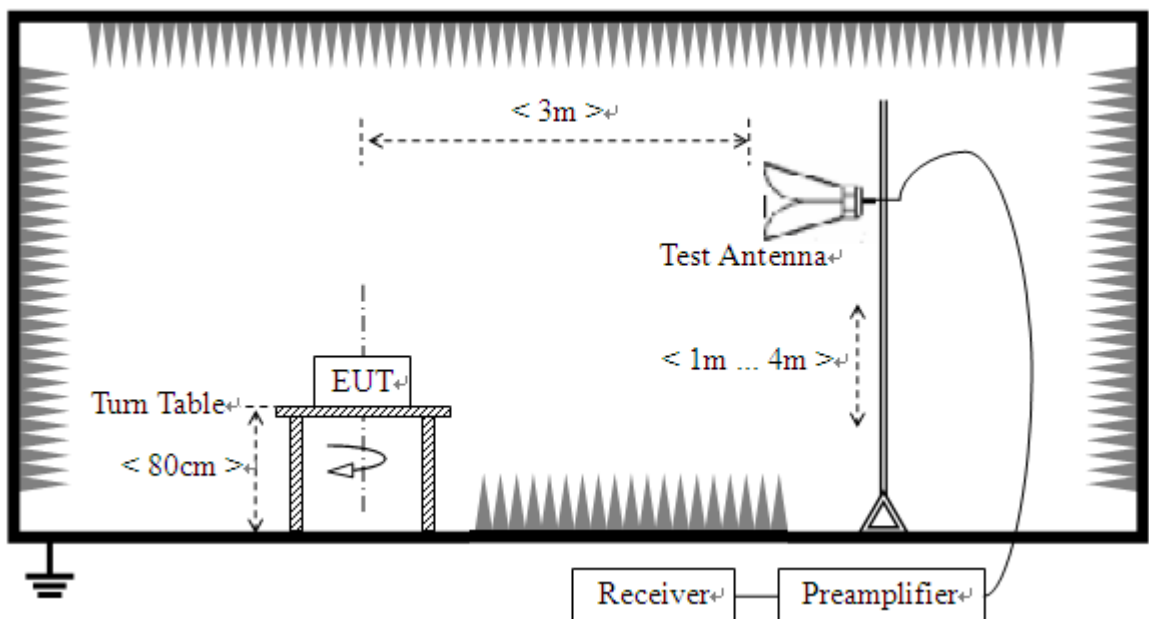
2.3.2 Radiated Emission

A. Test Setup:

- 1) For radiated emissions from 30MHz to 1GHz



- 2) For radiated emissions above 1GHz



**B. Test Procedure**

The test is performed in a 3m Semi-Anechoic Chamber; the antenna factor, cable loss and so on of the site (factors) is calculated to correct the reading. The EUT is placed on a 0.8m high insulating Turn Table, and keeps 3m away from the Test Antenna, which is mounted on a variable-height antenna master tower.

For the test Antenna:

- 1) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength. The emission levels at both horizontal and vertical polarizations should be tested.

C. Equipments List:

Description	Manufacturer	Model	Serial No.	Calibration Date	Calibration Due. Date
EMI Test Receiver	ROHDE&SCHWARZ	ESIB7	A0501375	2024.02.29	2025.02.28
Broadband Ant.	ETC	MCTD2786	A240204135	2024.01.19	2025.01.18
3M Anechoic Chamber	Albatross	SAC-3MAC 9*6*6m	A0412375	2024.02.28	2027.02.27
EMI Test Receiver	ROHDE&SCHWARZ	ESW26	A180502935	2024.05.24	2025.05.23
5M Anechoic Chamber	Albatross	SAC-5MAC 12.8x6.8x6.4m	A0304210	2024.08.02	2026.08.01
EMI Horn Ant.	ROHDE&SCHWARZ	HF906	A0304225	2022.04.12	2025.04.11

3. 47 CFR PART 15B REQUIREMENTS

3.1 Conducted Emission

3.1.1 Requirement

According to FCC section 15.107, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

Note:

- The limit subjects to the Class B digital device.
- The lower limit shall apply at the band edges.
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

3.1.2 Test Description

See section 2.3.1 of this report.

3.1.3 Test Result

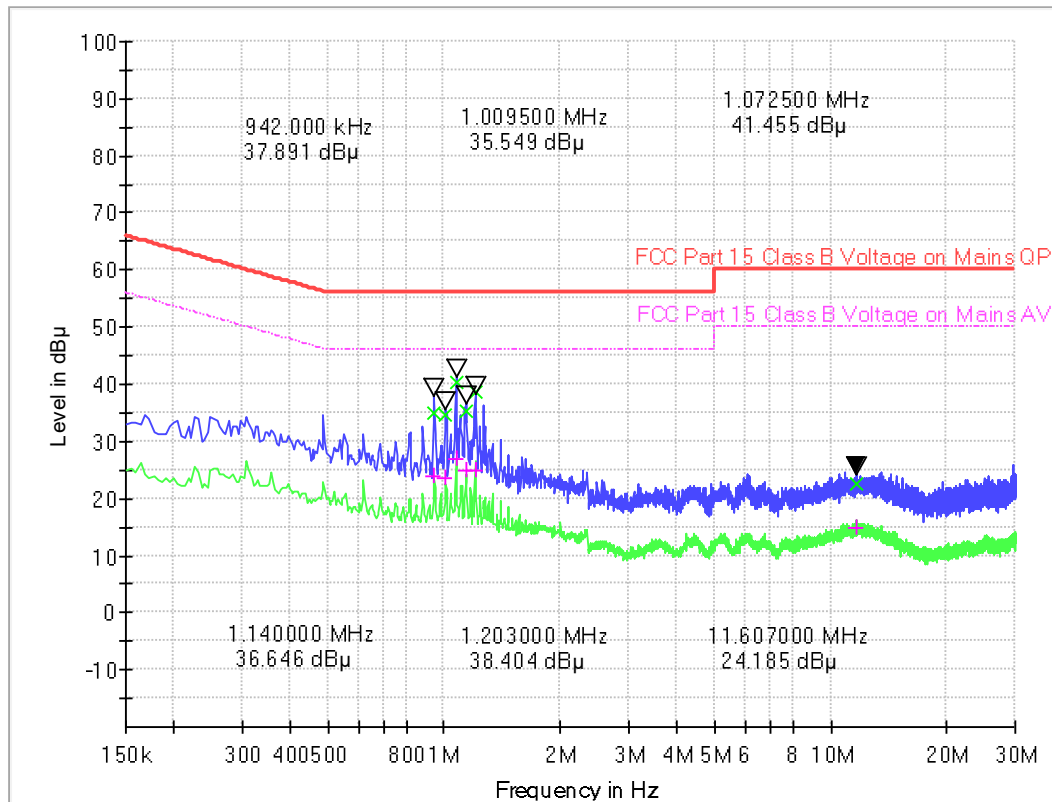
The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. All test modes are considered, refer to recorded points and plots below.

Note:

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a Nominal 230V AC, 50/60Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

Test voltage and frequency (230V AC, 60Hz)

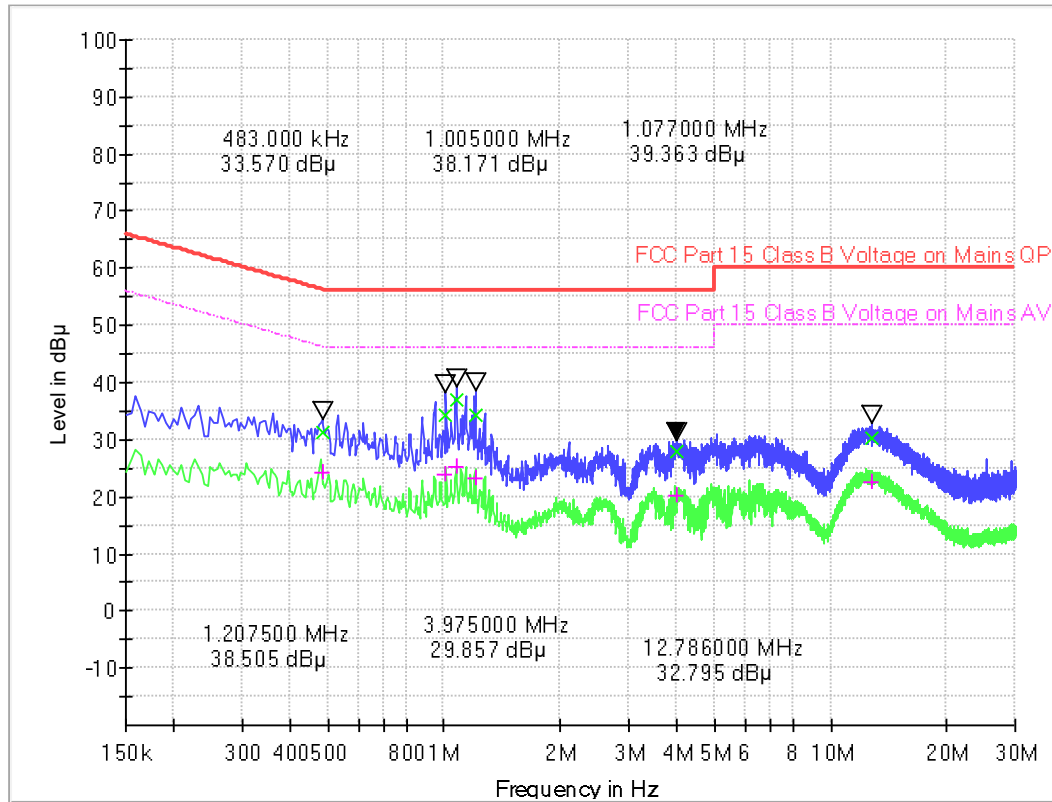
A. Mains terminal disturbance voltage, L phase, Setup 1



(Plot A: L Phase)

Frequency (MHz)	QuasiPeak (dB μ V)	CAverage (dB μ V)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dB μ V)
0.942000	35.09	23.75	0.2	10.2	20.91	56.0	22.25	46.0
1.009500	34.74	23.72	0.2	10.2	21.26	56.0	22.28	46.0
1.072500	40.37	27.00	0.2	10.2	15.63	56.0	19.00	46.0
1.140000	35.46	25.08	0.2	10.2	20.54	56.0	20.92	46.0
1.203000	38.59	25.04	0.2	10.2	17.41	56.0	20.96	46.0
11.607000	22.66	14.73	0.5	10.5	37.34	60.0	35.27	50.0

B. Mains terminal disturbance voltage, N phase, Setup 1



(Plot B: N Phase)

Frequency (MHz)	QuasiPeak (dB μ V)	CAverage (dB μ V)	Cabel Loss (dB)	Corr. (dB)	Margin - QPK	Limit - QPK	Margin - AV	Limit - AV (dB μ V)
0.483000	31.28	24.29	0.1	10.1	25.01	56.3	22.00	46.3
1.005000	34.17	23.99	0.2	10.2	21.83	56.0	22.01	46.0
1.077000	36.89	25.17	0.2	10.2	19.11	56.0	20.83	46.0
1.207500	34.28	23.31	0.2	10.2	21.72	56.0	22.69	46.0
3.975000	28.05	20.21	0.5	10.5	27.95	56.0	25.79	46.0
12.786000	30.20	22.55	0.5	10.5	29.80	60.0	27.45	50.0

3.2 Radiated Emission

3.2.1 Requirement

According to FCC section 15.109, the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency range (MHz)	Field Strength		Field Strength Limitation at 3m Measurement Dist	
	$\mu\text{V/m}$	Dist	($\mu\text{V/m}$)	($\text{dB}\mu\text{V/m}$)
30.0 - 88.0	100	3m	100	$20\log 100$
88.0 - 216.0	150	3m	150	$20\log 150$
216.0 - 960.0	200	3m	200	$20\log 200$
Above 960.0	500	3m	500	$20\log 500$

According to ICES-003 the field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values:

Frequency range (MHz)	Field Strength Limitation at 3m Measurement Dist	
	Class A(3m) QP ($\text{dB}\mu\text{V/m}$)	Class B(3m) QP ($\text{dB}\mu\text{V/m}$)
30 - 88	49.0	40.0
88 - 216	53.5	43.5
216 - 230	56.5	46.0
230 - 960	56.5	47.0
960-1000	60.0	54.0
Frequency range (MHz)	Field Strength Limitation at 3m Measurement Dist	
	Class A(3m) ($\text{dB}\mu\text{V/m}$)	Class B(3m) ($\text{dB}\mu\text{V/m}$)
Above 1G	60(AV) /80(PK)	54(AV) /74(PK)

- For frequencies above 1000MHz, the field strength limits are based on average detector. When average radiated emission measurements are specified in this part, including emission measurements below 1000MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules.
- Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength.
- For below 1G: QP detector RBW 120 kHz, VBW 300 kHz.



For Above 1G: PK detector RBW 1MHz, VBW 3MHz for PK value; AV detector RBW 1MHz, VBW 10Hz for AV value.

Note:

- 1) The tighter limit shall apply at the boundary between two frequency range.
- 2) Limitation expressed in dBuV/m is calculated by $20\log \text{Emission Level}(\mu\text{V/m})$.
- 3) If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula of $Ld1 = Ld2 * (d2/d1)^2$.

Example:

F.S Limit at 30m distance is 30uV/m, then F.S Limitation at 3m distance is adjusted as

$$Ld1 = L1 = 30\mu\text{V/m} * (10)^2 = 100 * 30\mu\text{V/m}.$$

3.2.2 Test Description

See section 2.3.2 of this report.

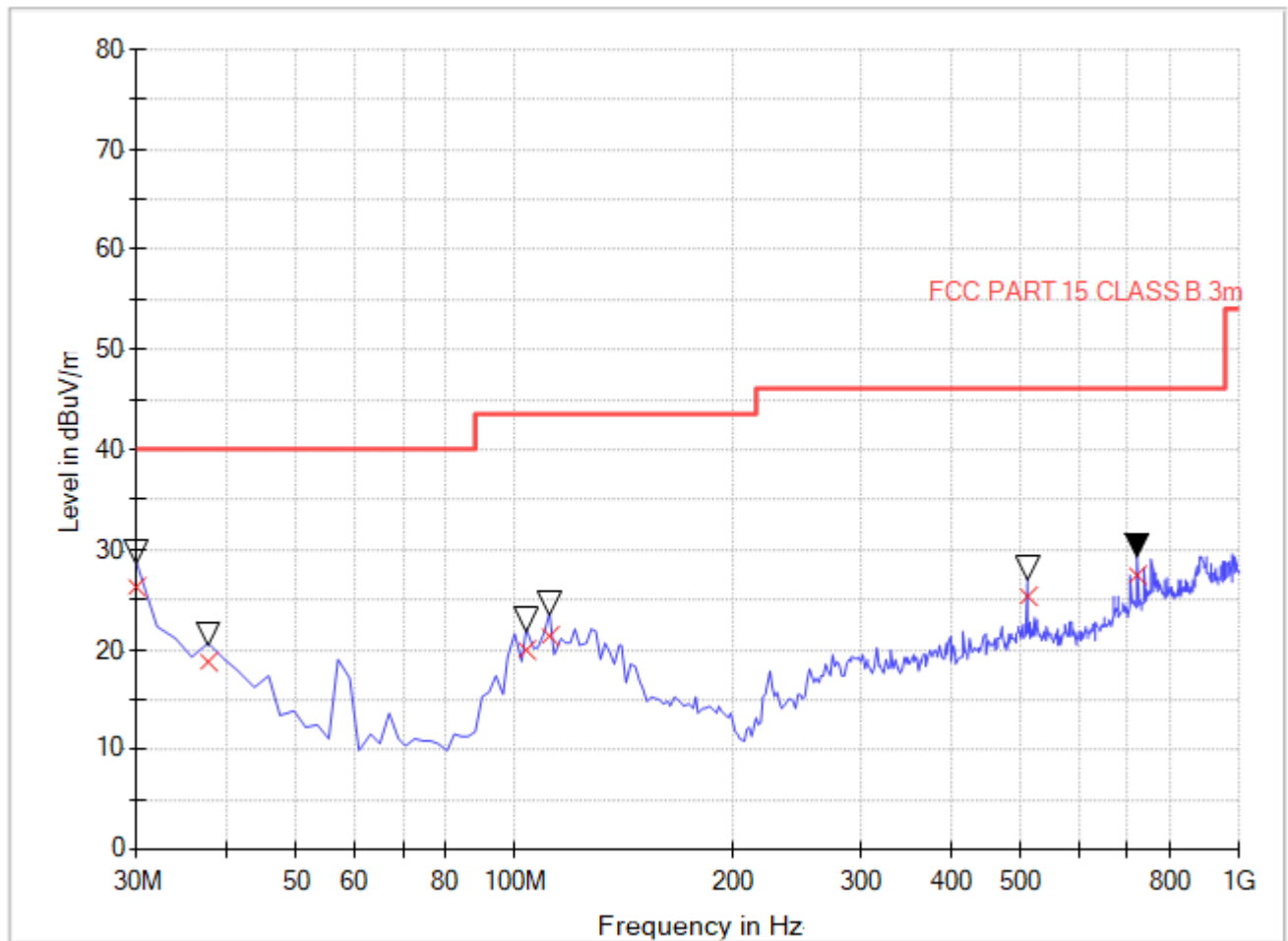
3.2.3 Test Result

The maximum radiated emission is searched using PK, QP and AV detectors; the emission levels more than the limits, and that have narrow margins from the limits will be re-measured with AV and QP detectors. Both the vertical and the horizontal polarizations of the Test Antenna are considered to perform the tests. All test modes are considered, refer to recorded points and plots below.

The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

Note: All radiated emission tests were performed in X, Y, Z axis direction, and only the worst axis test condition was recorded in this test report.

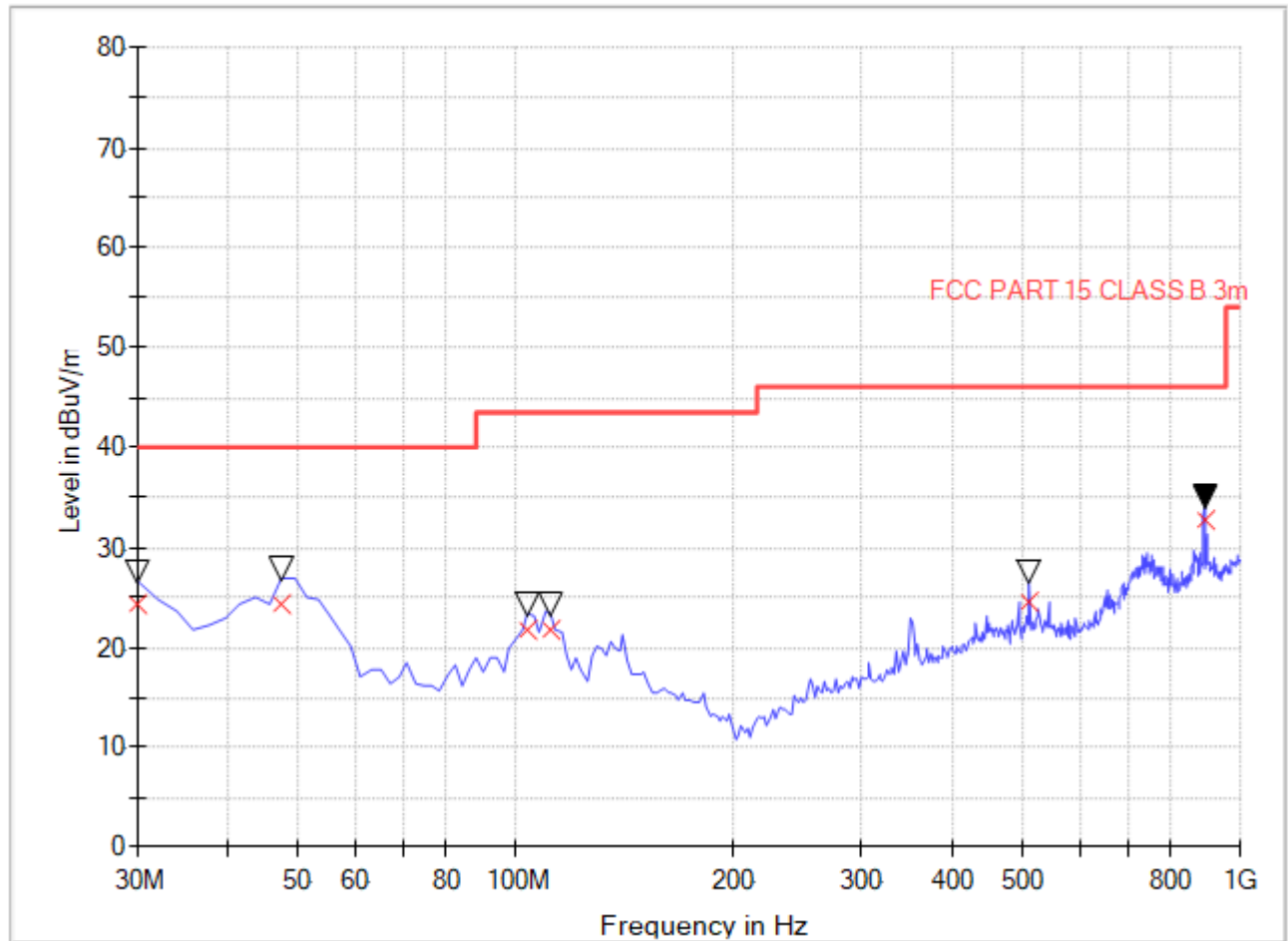
A. Radiation disturbances, antenna polarization: Horizontal, Setup1



(Plot C: Test Antenna Horizontal 30M - 1G)

Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Margin (dB)	Antenna	Cable Loss(dB)	ANT. Factor(dB)	Verdict
30.00	26.11	120.000	105	40.0	13.89	Horizontal	0.5	18.8	Pass
37.76	18.72	120.000	102	40.0	21.28	Horizontal	0.5	14.2	Pass
103.88	19.83	120.000	104	43.5	23.67	Horizontal	0.9	10.3	Pass
111.64	21.22	120.000	107	43.5	22.28	Horizontal	1.0	10.9	Pass
510.16	25.28	120.000	101	46.0	20.72	Horizontal	1.5	18.2	Pass
723.96	27.36	120.000	104	46.0	18.64	Horizontal	1.8	20.2	Pass

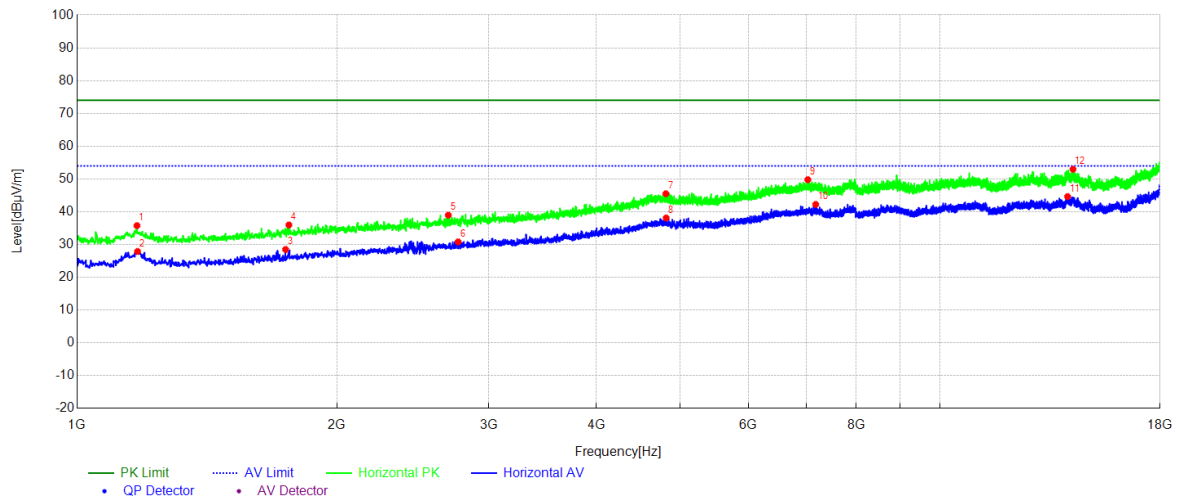
B. Radiation disturbances, antenna polarization: Vertical, Setup1



(Plot D: Test Antenna Vertical 30M - 1G)

Frequency (MHz)	QuasiPeak (dB μ V/m)	Bandwidth (kHz)	Antenna height (cm)	Limit (dB μ V/m)	Margin (dB)	Antenna	Cable Loss(dB)	ANT. Factor(dB)	Verdict
30.00	24.30	120.000	107	40.0	15.70	Vertical	0.5	18.8	Pass
47.48	24.36	120.000	104	40.0	15.64	Vertical	0.5	9.3	Pass
103.88	21.70	120.000	102	43.5	21.80	Vertical	0.9	10.3	Pass
111.64	21.64	120.000	105	43.5	21.86	Vertical	1.0	10.9	Pass
512.08	24.47	120.000	103	46.0	21.53	Vertical	1.5	18.2	Pass
893.08	32.68	120.000	106	46.0	13.32	Vertical	2.1	22.0	Pass

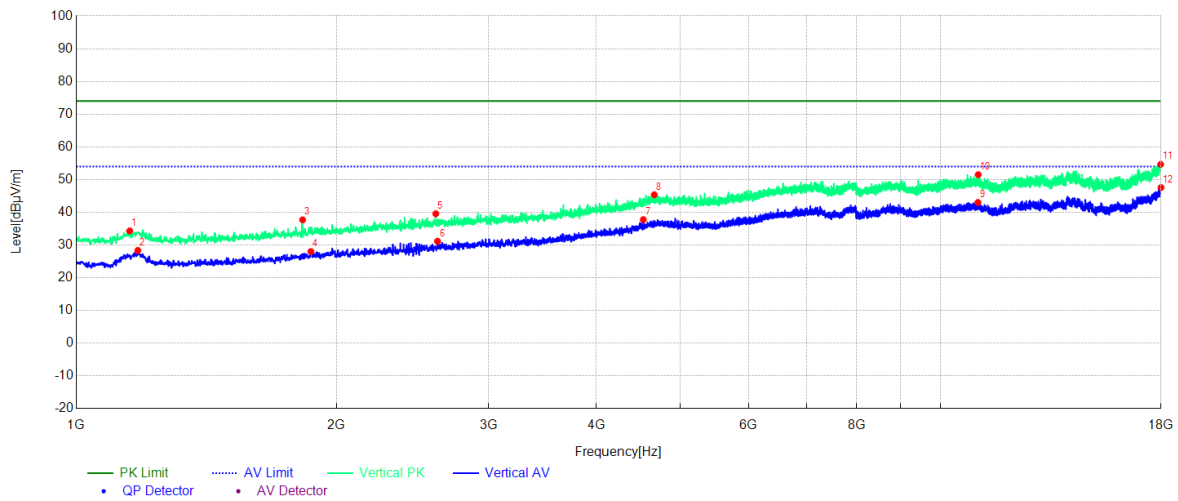
A. Radiation disturbances, antenna polarization: Horizontal, Setup1



(Plot M: Test Antenna Horizontal 1G – 18G)

NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin[dB μV/m]	Trace	Height [cm]	Angle [°]	Polarity
1	1173.42	35.77	-15.07	74.00	38.23	PK	106	245	Horizontal
2	1175.12	27.89	-15.06	54.00	26.11	AV	107	123	Horizontal
3	1744.67	28.50	-13.03	54.00	25.50	AV	105	21	Horizontal
4	1759.98	35.97	-12.96	74.00	38.03	PK	103	57	Horizontal
5	2693.37	38.95	-9.48	74.00	35.05	PK	104	313	Horizontal
6	2764.78	30.81	-9.44	54.00	23.19	AV	106	154	Horizontal
7	4813.48	45.49	-0.92	74.00	28.51	PK	102	122	Horizontal
8	4816.88	38.11	-0.94	54.00	15.89	AV	108	339	Horizontal
9	7030.50	49.79	3.37	74.00	24.21	PK	101	244	Horizontal
10	7180.12	42.24	3.47	54.00	11.76	AV	103	225	Horizontal
11	14062.41	44.63	9.35	54.00	9.37	AV	106	222	Horizontal
12	14266.43	52.96	9.73	74.00	21.04	PK	104	326	Horizontal

B. Radiation disturbances, antenna polarization: Vertical, Setup1



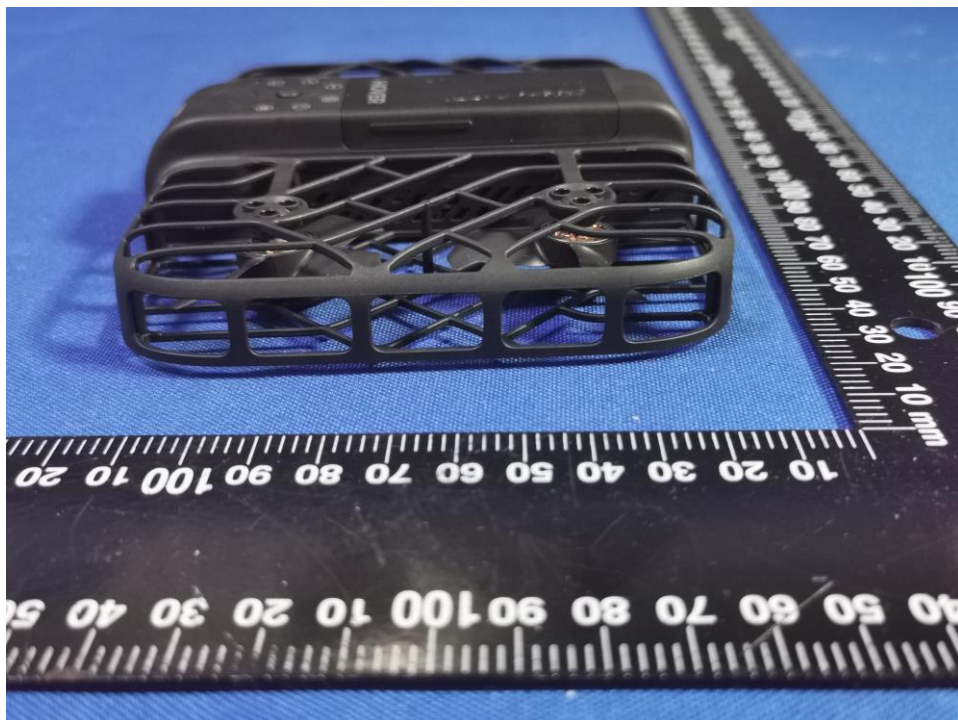
(Plot N: Test Antenna Vertical 1G – 18G)

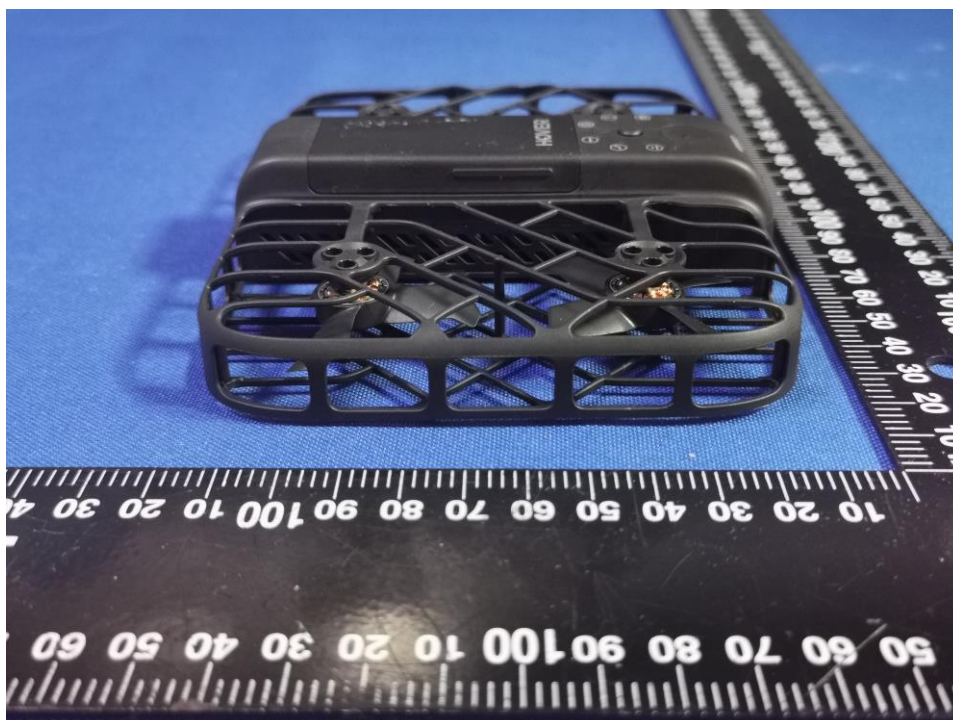
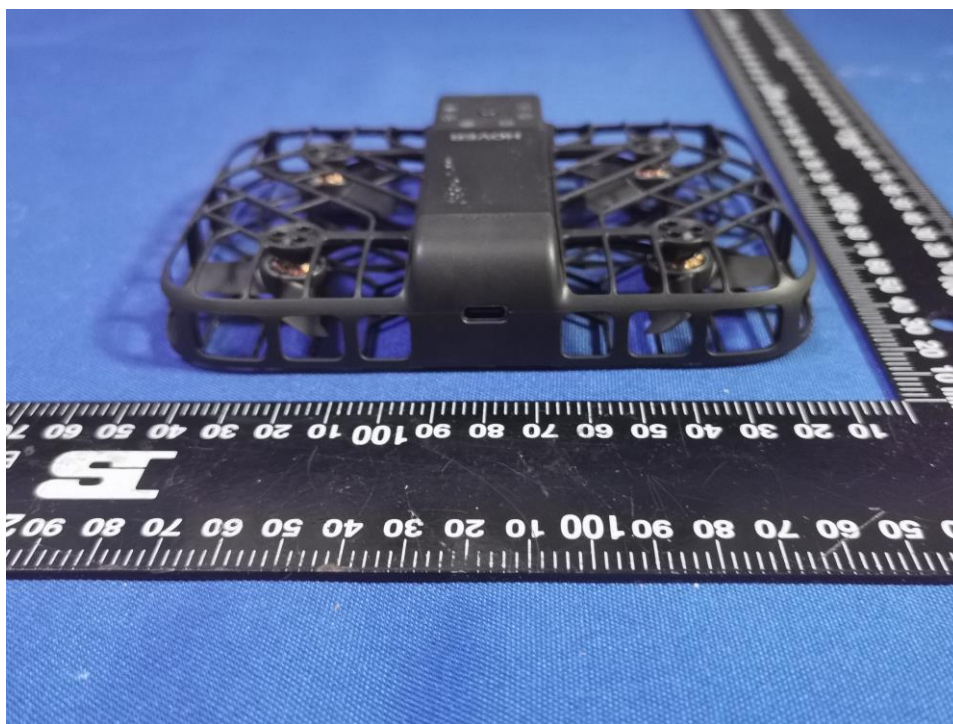
NO.	Freq. [MHz]	Level [dBμV/m]	Factor [dB]	Limit [dBμV/m]	Margin[dB μV/m]	Trace	Height [cm]	Angle [°]	Polarity
1	1153.02	34.32	-15.11	74.00	39.68	PK	104	71	Vertical
2	1178.52	28.35	-15.05	54.00	25.65	AV	103	304	Vertical
3	1827.98	37.70	-12.61	74.00	36.30	PK	105	339	Vertical
4	1868.79	28.02	-12.44	54.00	25.98	AV	107	113	Vertical
5	2606.66	39.56	-9.92	74.00	34.44	PK	103	335	Vertical
6	2618.56	31.17	-9.87	54.00	22.83	AV	104	117	Vertical
7	4531.25	37.77	-2.06	54.00	16.23	AV	103	332	Vertical
8	4665.57	45.36	-1.24	74.00	28.64	PK	108	246	Vertical
9	11051.41	43.01	6.61	54.00	10.99	AV	101	113	Vertical
10	11059.91	51.50	6.60	74.00	22.50	PK	106	204	Vertical
11	17981.30	54.66	14.82	74.00	19.34	PK	104	242	Vertical
12	18000.00	47.57	14.86	54.00	6.43	AV	107	58	Vertical

Appendix I: Photographs of the EUT

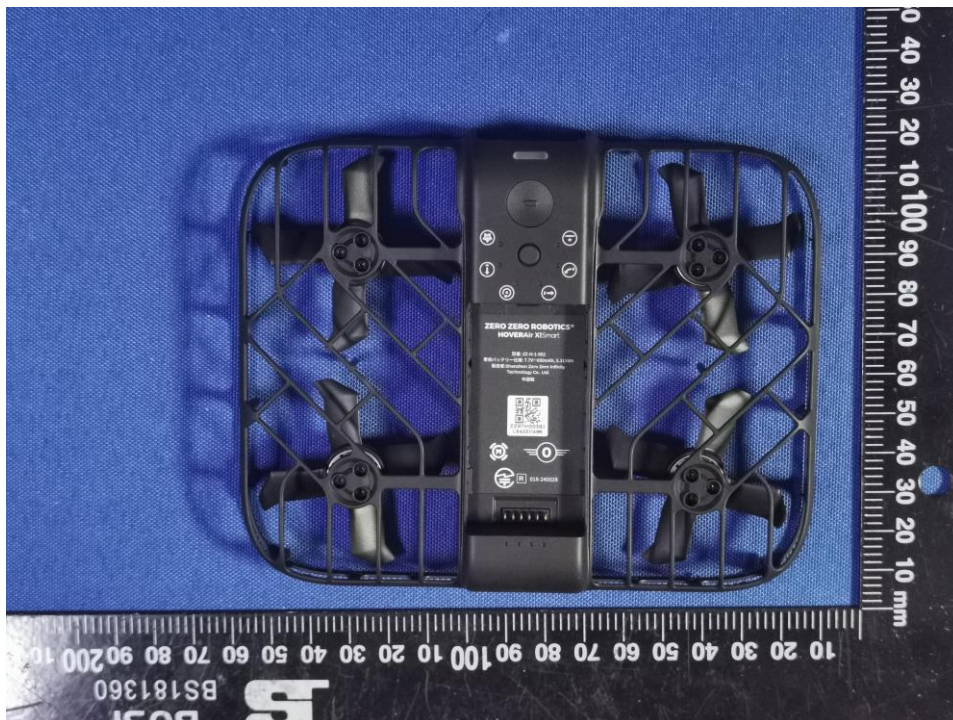


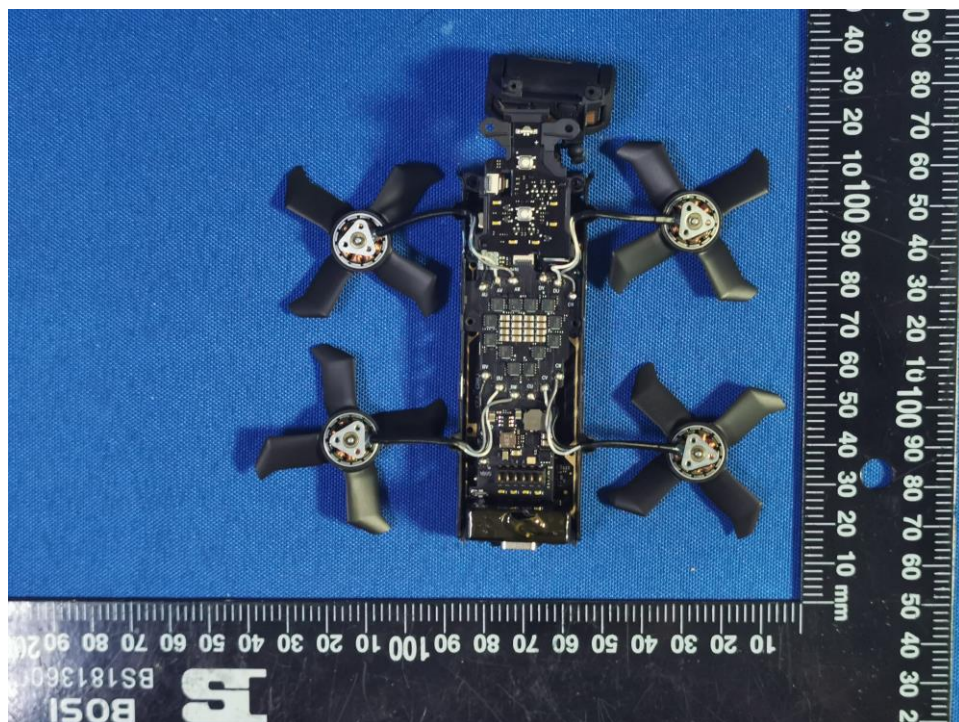
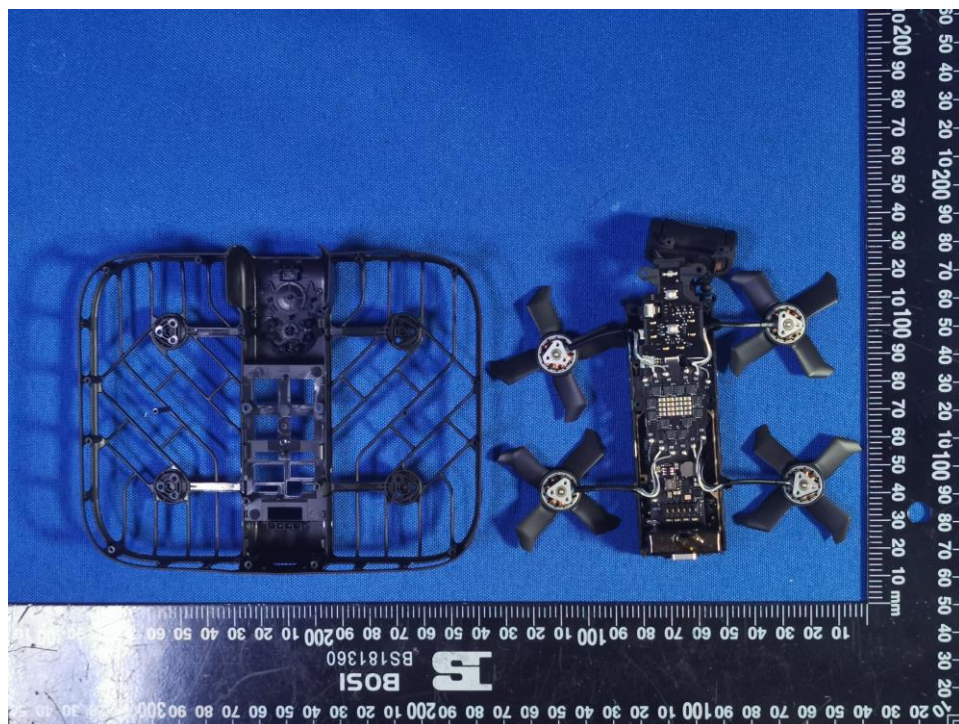


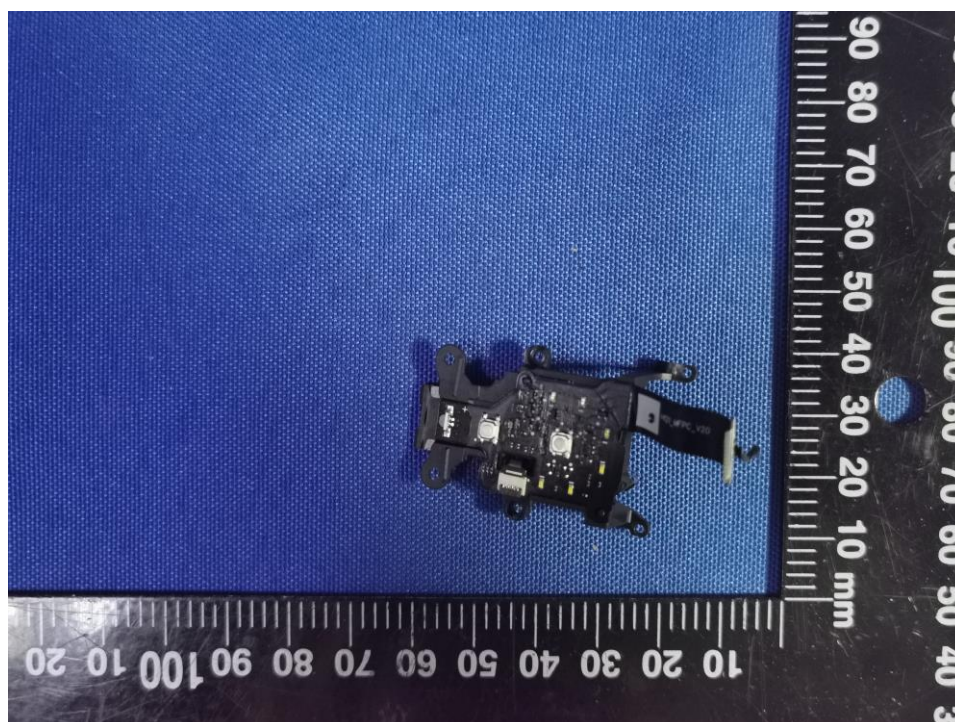


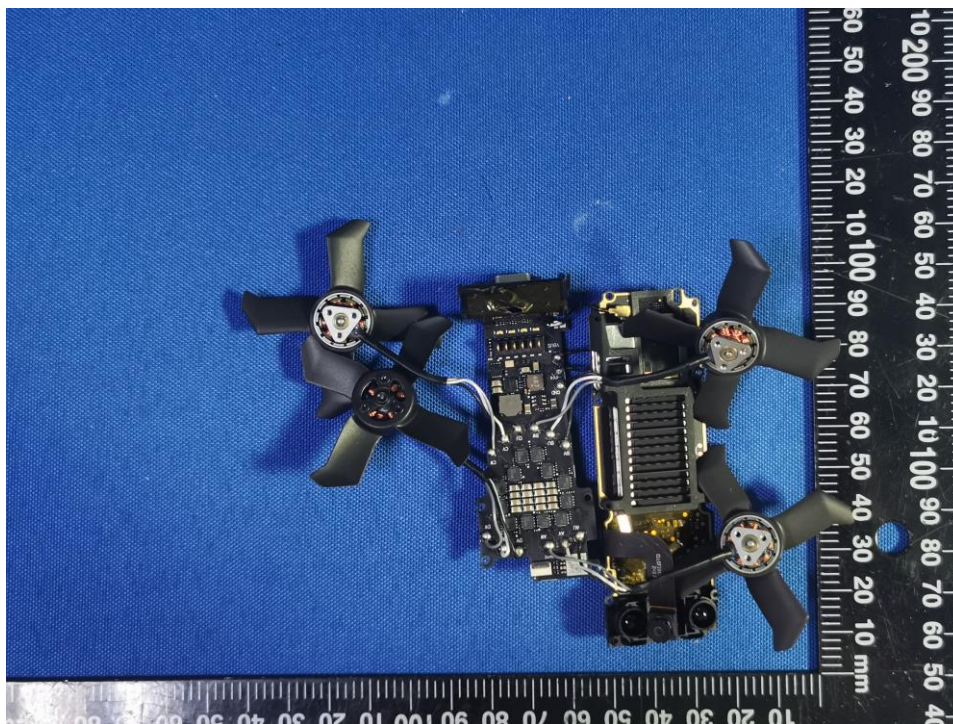
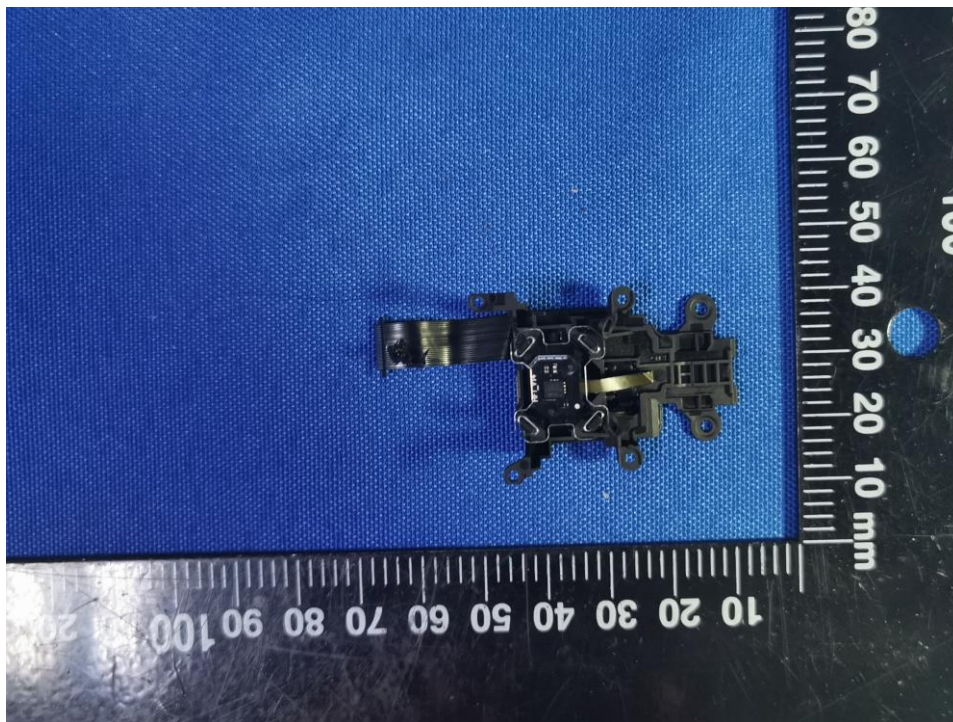


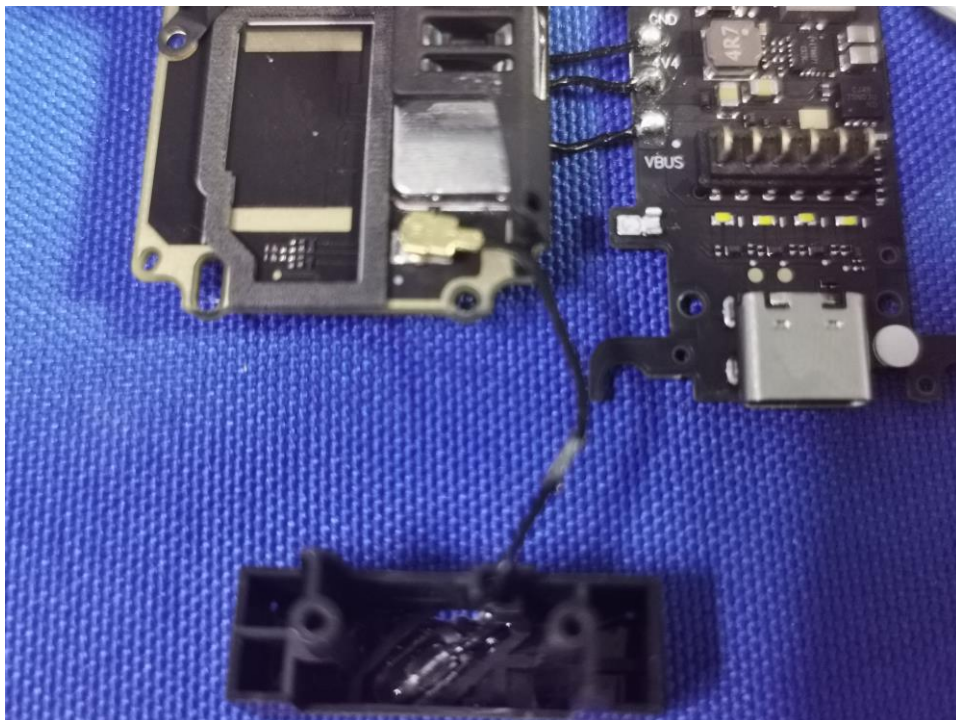
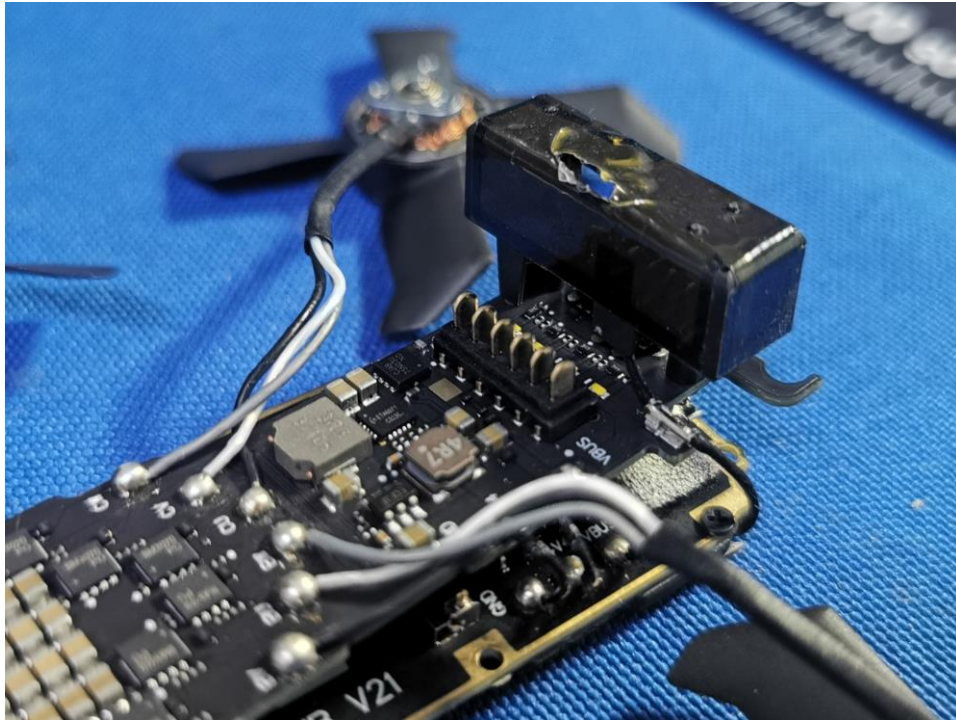


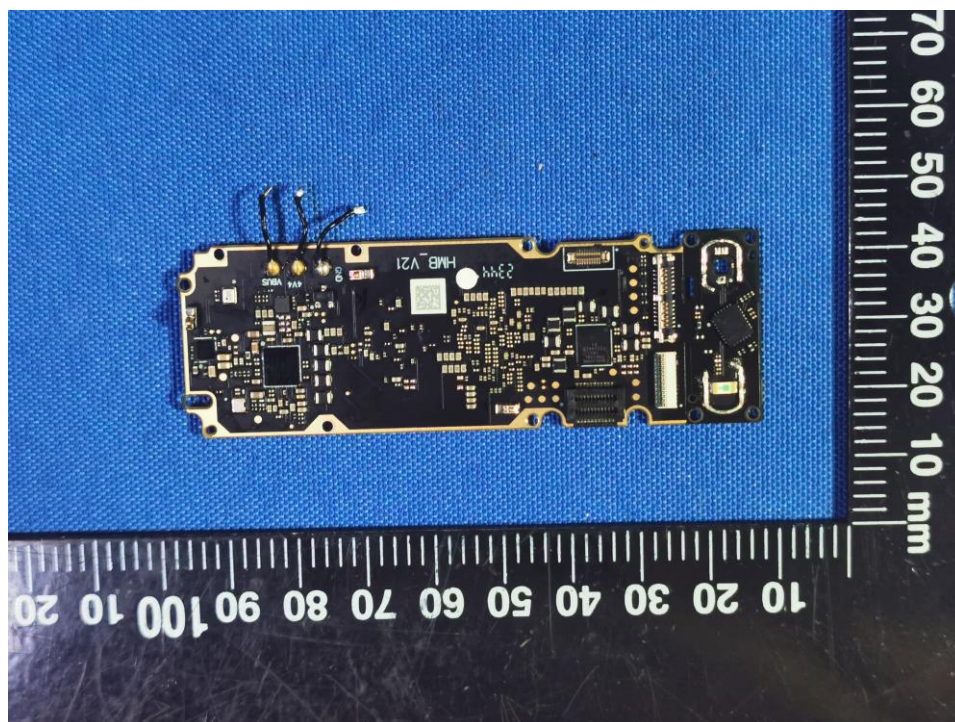
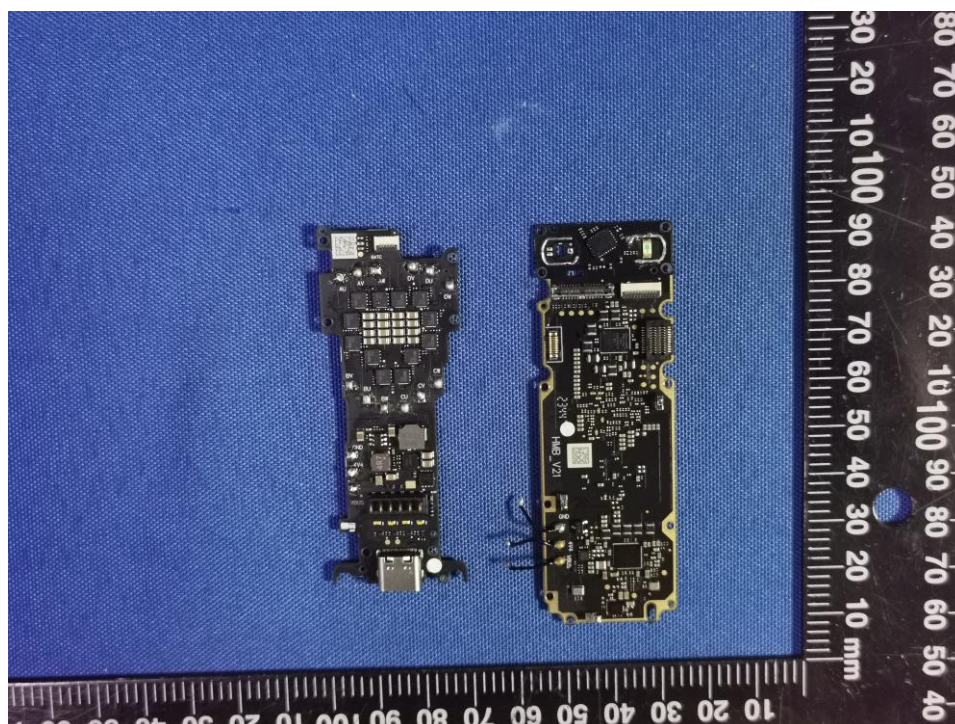


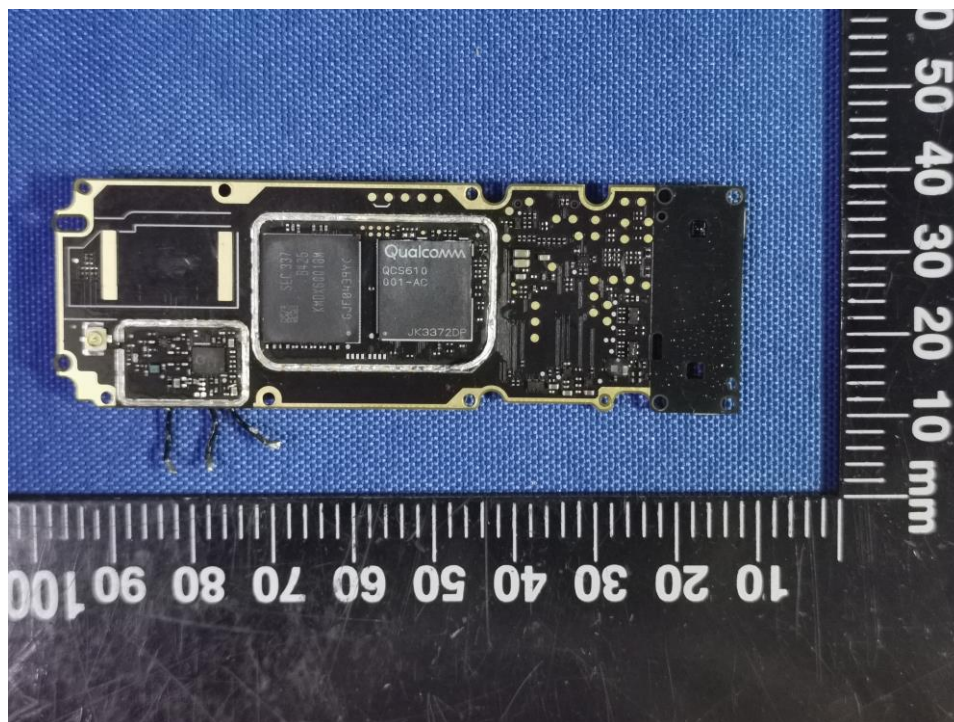


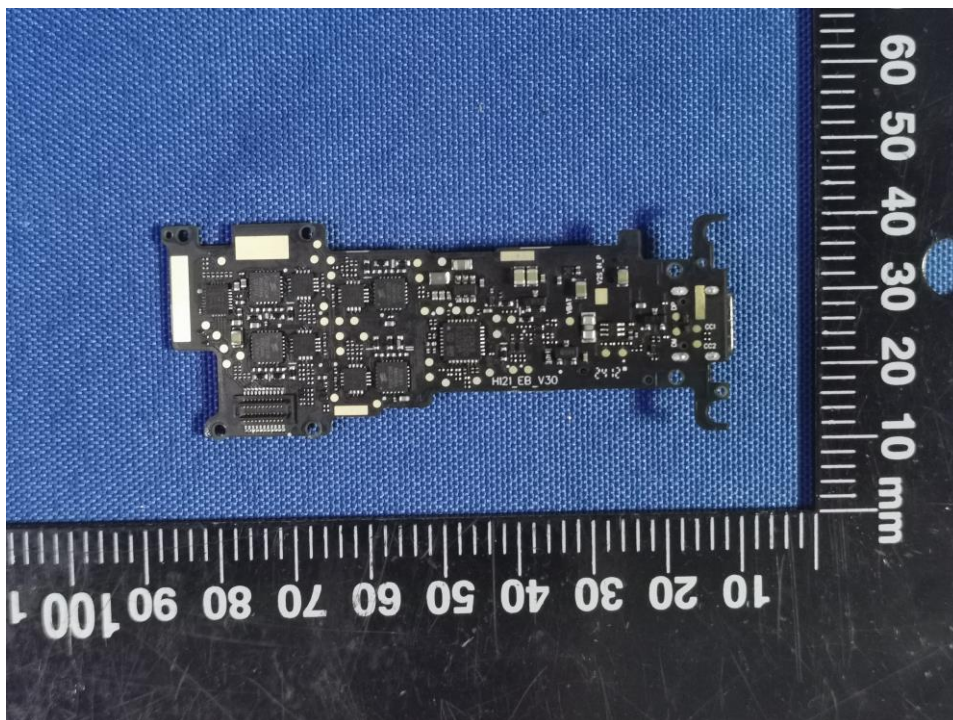
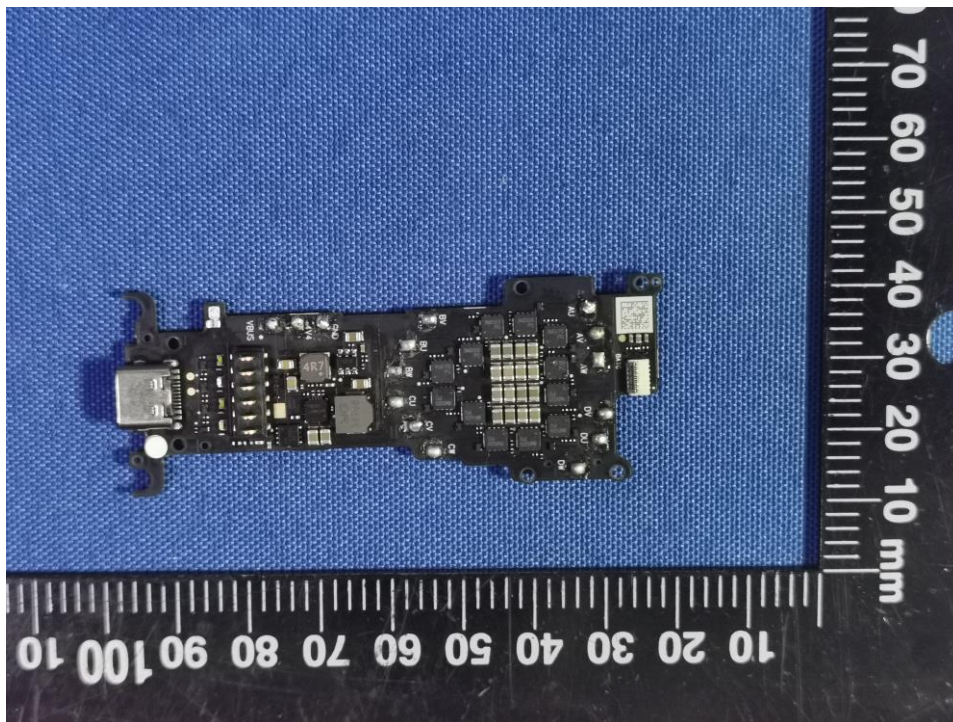










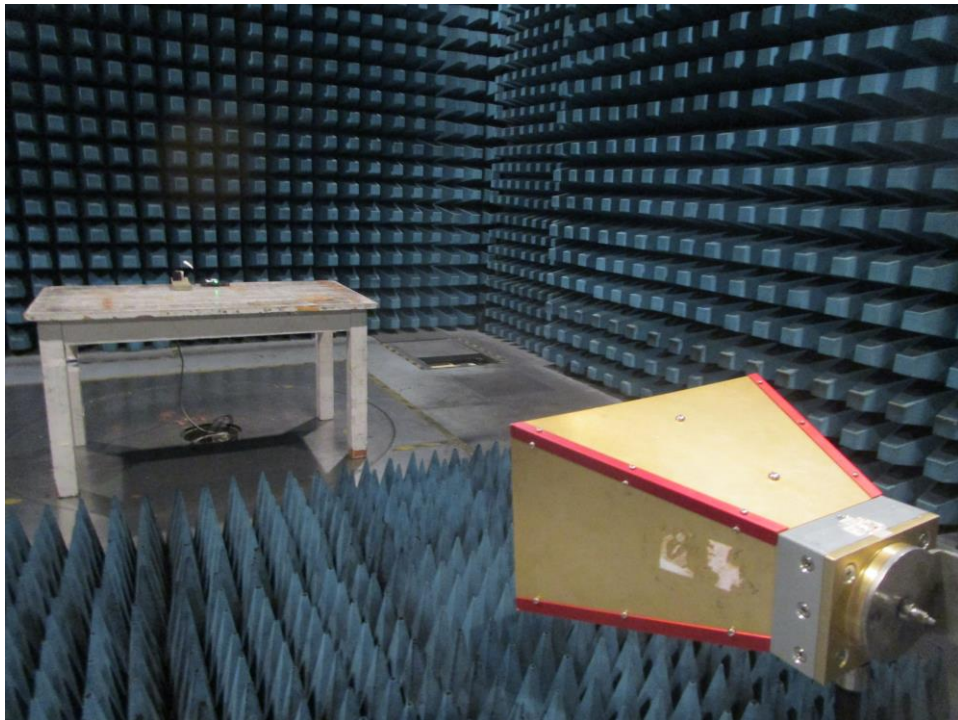


Appendix II: Photographs of EMC Test Configuration

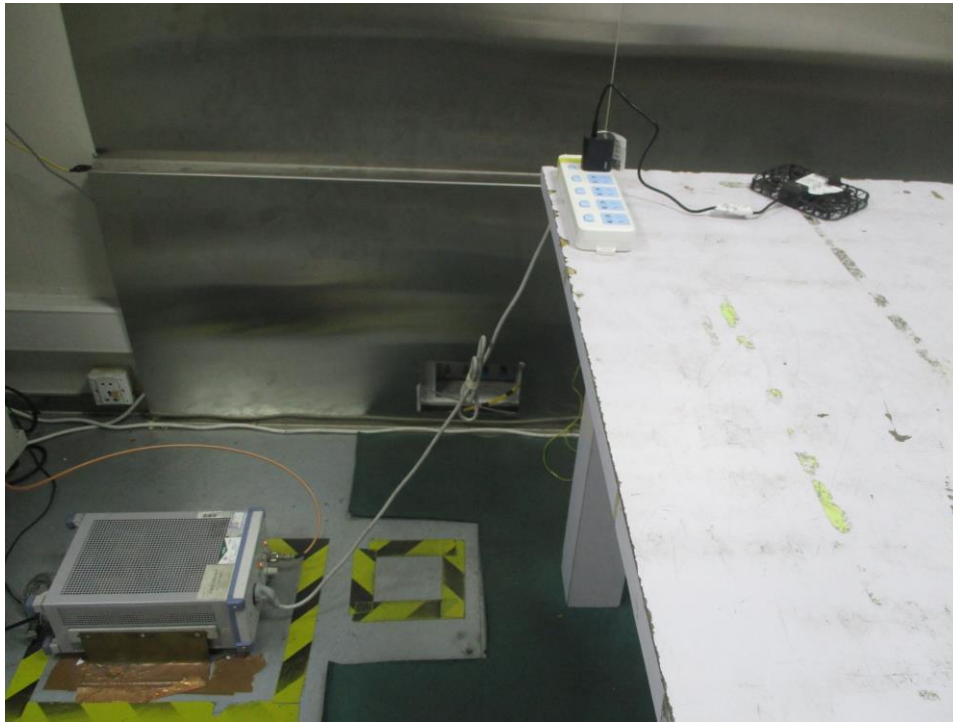
1. Radiated Emission Measurement below 1GHz



2. Radiated Emission Measurement above 1GHz



3. Conducted emission at AC mains input/output port Measurement



-----End of Report-----