Verification

On Behalf of

For

HOLYBRO(H.K.) LIMITED

Pixhawk 4 GPS module

Model No.: HG-C05, HG-C

Prepared For	:	HOLYBRO(H.K.) LIMITED
Address	:	RM 1902 EASEY COMM BLDG253-261 HENNESSY RD WANCHAI HONG KONG
Prepared By	:	Shenzhen Anbotek Compliance Laboratory Limited
Address	:	1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102 Tel: (86)755-26066440 Fax: (86) 755-26066440
Report Number	:	SZAWW180503010-01
Date of Test	:	May 22~Jun. 05, 2018
Date of Report	:	Jun. 05, 2018

Contents

1. General Information....4
1.1. Client Information....4
1.2. Description of Device (EUT)....4
1.3. Auxiliary Equipment Used During Test....4
1.4. Description of Test Modes....5
1.6. Description Of Test Setup....6
1.7. Test Equipment List....7
1.8. Measurement Uncertainty....8
1.9. Description of Test Facility....8
2. Summary of Test Results....9
3. Conducted Emission Test....10
3.1. Test Standard and Limit....10
3.2. Test Setup....10
3.3. Test Procedure....10
3.4. Test Data....10
4. Radiation Spurious Emission and Band Edge....13
4.1. Test Standard and Limit....13
4.2. Test Setup....13
4.3. Test Procedure....14
4.4. Test Data....15
APPENDIX I -- TEST SETUP PHOTOGRAPH....18
APPENDIX II -- EXTERNAL PHOTOGRAPH....19
APPENDIX III -- INTERNAL PHOTOGRAPH....22

TEST REPORT

Applicant	:	HOLYBRO(H.K.) LIMITED
Manufacturer	:	Shenzhen HolyBro Hobby Technical Co.,LTD
Product Name	:	Pixhawk 4 GPS module
Model No.	:	HG-C05, HG-C
Trade Mark	:	Holybro
Rating(s)	:	DC 5V, 150mA

Test Standard(s)	**:**	**FCC Rules and Regulations Part 15 Subpart B: 2017**
Test Method(s)	**:**	**ANSI C63.4-2014**

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited To determine the maximum emission levels emanating from the device. The maximum emission levels are compared to the FCC Part 15 Subpart B Class B limits both radiated and conducted emissions. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited Is assumed full responsibility for the accuracy and completeness of these measurements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test : : May 22~Jun. 05, 2018

Prepared by : (Tested Engineer / Winkey Wang)

Reviewer : : (Project Manager / Tangcy. T)

Approved & Authorized Signer : : (Manager / Tom Chen)

1. General Information

1.1. Client Information

Applicant	:	HOLYBRO(H.K.) LIMITED
Address	:	RM 1902 EASEY COMM BLDG253-261 HENNESSY RD WANCHAI HONG KONG
Manufacturer	:	Shenzhen HolyBro Hobby Technical Co.,LTD
Address	:	Floor 4, Jiang Hai Industry District, No.7 Yonghe Road, Shi Yan Town, Bao'an District, Shenzhen City, Guangdong Province, China

1.2. Description of Device (EUT)

Product Name	:	Pixhawk 4 GPS module
Model No.	:	HG-C05, HG-C (Note: All samples are the same except for appearance, so we are only ready to test "HG-C05").
Trade Mark	:	Holybro
Test Power Supply	:	AC 120V, 60Hz for adapter / AC 240V, 60Hz for adapter
Operation Frequency:	:	1575.42MHz
Antenna Type	:	Ceramic Antenna
Antenna Gain(Peak)	:	5 dBi
Product Description	:	N/A
Remark: (1) For a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.		

1.3. Auxiliary Equipment Used During Test

Adapter	:	Manufacturer: ZTE M/N: STC-A2050I1000USBA-C S/N: 201202102100876 Input: 100-240V~50/60Hz 0.3A Output: DC 5V, 1000mA

1.4. Description of Test Modes

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

For Radiated Emission	
Final Test Mode	Description
Mode 1	GPS Mode

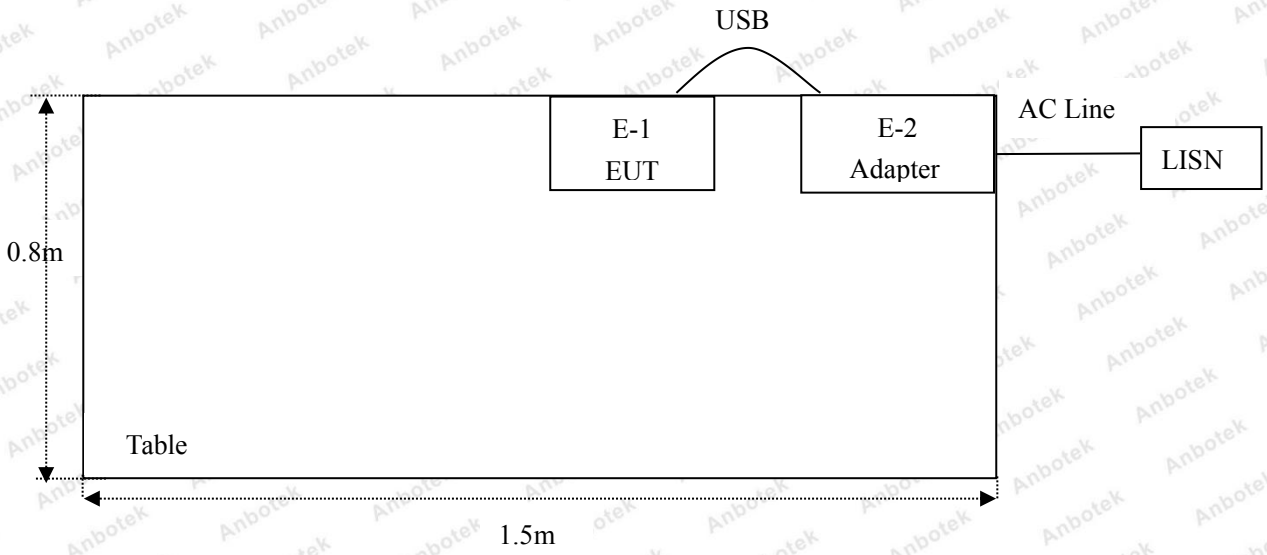
Note:

(1) The measurements are performed at the highest, middle, lowest available channels.

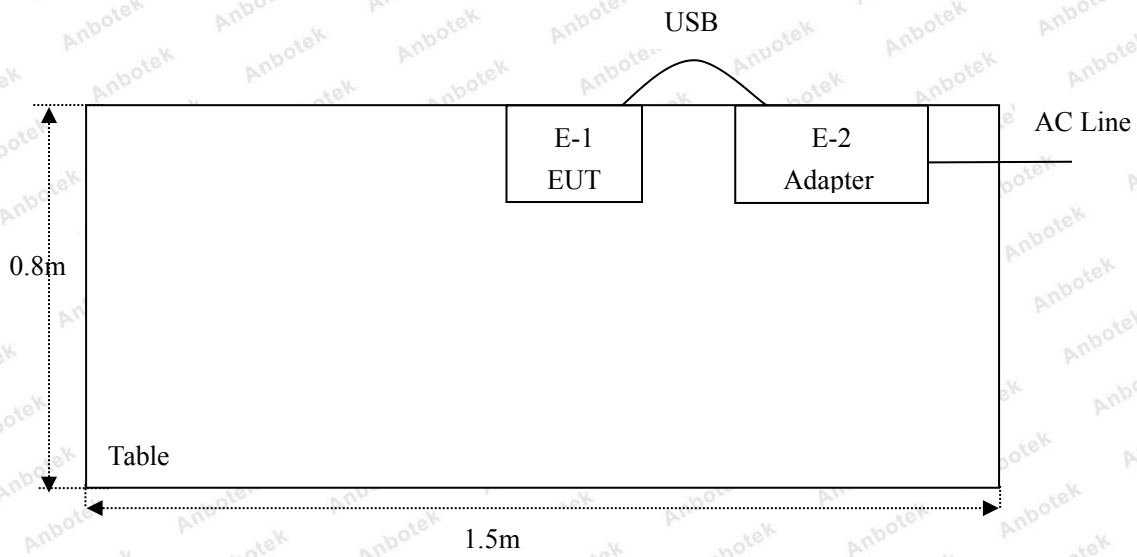
(2)The data rate was set in 1Mbps for radiated emission due to the highest RF output power.

1.6. Description Of Test Setup

CE



RE



1.7. Test Equipment List

Conducted Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	L.I.S.N. Artificial Mains Network	Rohde & Schwarz	ENV216	100055	Nov. 17, 2017	1 Year
2.	EMI Test Receiver	Rohde & Schwarz	ESCI	100627	Nov. 17, 2017	1 Year
3.	RF Switching Unit	Compliance Direction	RSU-M2	38303	Nov. 17, 2017	1 Year
4.	Software Name EZ-EMC	Ferrari Tcchnology	ANB-03A	N/A	N/A	N/A

Radiated Emission Measurement

Item	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Cal. Interval
1.	EMI Test Receiver	Rohde & Schwarz	ESPI	101604	Nov. 17, 2017	1 Year
2.	Bilog Broadband Antenna	Schwarzbeck	VULB9163	VULB 9163-289	Nov. 20, 2017	1 Year
3.	Pre-amplifier	SONOMA	310N	186860	Nov. 17, 2017	1 Year
4.	Software Name EZ-EMC	Ferrari Tcchnology	ANB-03A	N/A	N/A	N/A

1.8. Measurement Uncertainty

Radiation Uncertainty	:	Ur = 3.9 dB (Horizontal)
		Ur = 3.8 dB (Vertical)
Conduction Uncertainty	:	Uc = 3.4dB

1.9. Description of Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

FCC-Registration No.: 184111

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registed and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No. 184111, July 31, 2017.

ISED-Registration No.: 8058A-1

Shenzhen Anbotek Compliance Laboratory Limited, EMC Laboratory has been registered and fully described in a report filed with the (ISED) Innovation, Science and Economic Development Canada. The acceptance letter from the ISED is maintained in our files. Registration 8058A-1, June 13, 2016.

Test Location

All Emissions tests were performed

Shenzhen Anbotek Compliance Laboratory Limited. at 1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102

2. Summary of Test Results

Test Items	Test Mode	Status
Power Line Conducted Emission Test (150KHz To 30MHz)	Mode 1	P
Radiated Emission Test (30MHz To 1000MHz)	Mode 1	P
P) Indicates that the through the test. N) Don't test.		

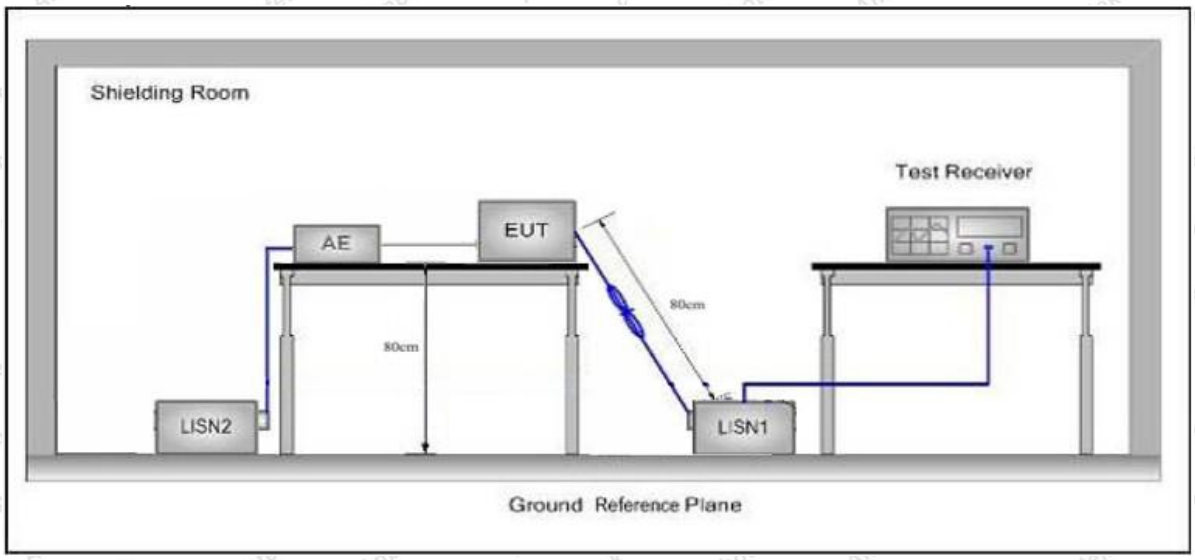
3. Conducted Emission Test

3.1. Test Standard and Limit

Test Standard	FCC Part15 Section 15.107		
Test Limit	Frequency	Maximum RF Line Voltage (dBuV)	
		Quasi-peak Level	Average Level
	150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
	500kHz~5MHz	56	46
	5MHz~30MHz	60	50

Remark: (1) *Decreasing linearly with logarithm of the frequency.
(2) The lower limit shall apply at the transition frequency.

3.2. Test Setup



3.3. Test Procedure

The EUT system is connected to the power mains through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm coupling impedance for the EUT system. Please refer the block diagram of the test setup and photographs. Both sides of AC line are checked to find out the maximum conducted emission. In order to find the maximum emission levels, the relative positions of equipment and all of the interface cables shall be changed according to FCC ANSI C63.10-2013 on Conducted Emission Measurement.

The bandwidth of test receiver (ESCI) set at 9kHz.

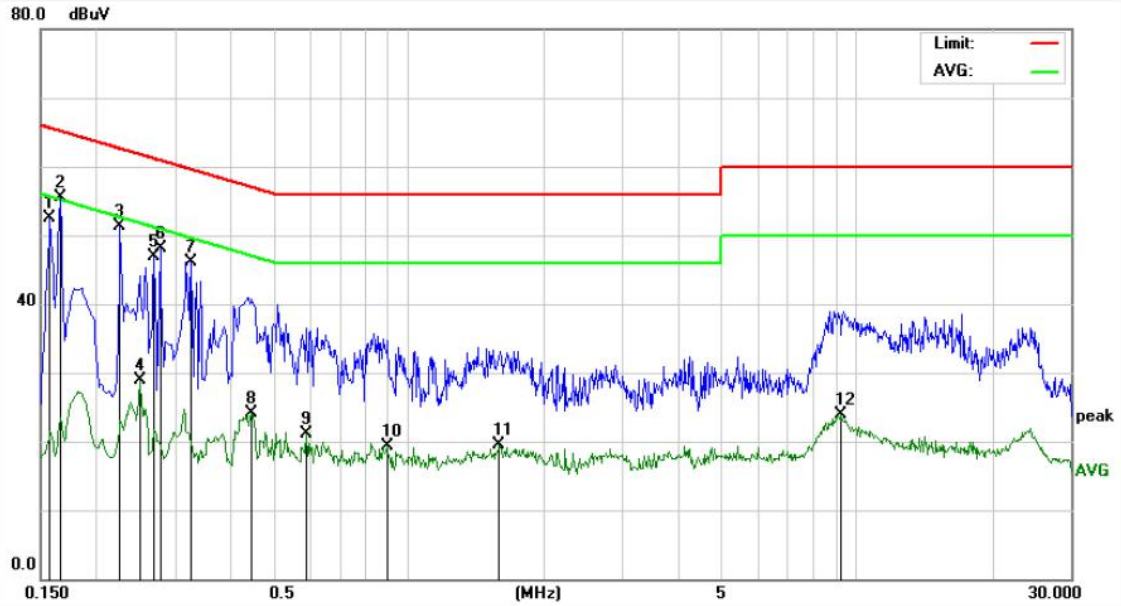
The frequency range from 150kHz to 30MHz is checked.

3.4. Test Data

Please to see the following pages

Conducted Emission Test Data

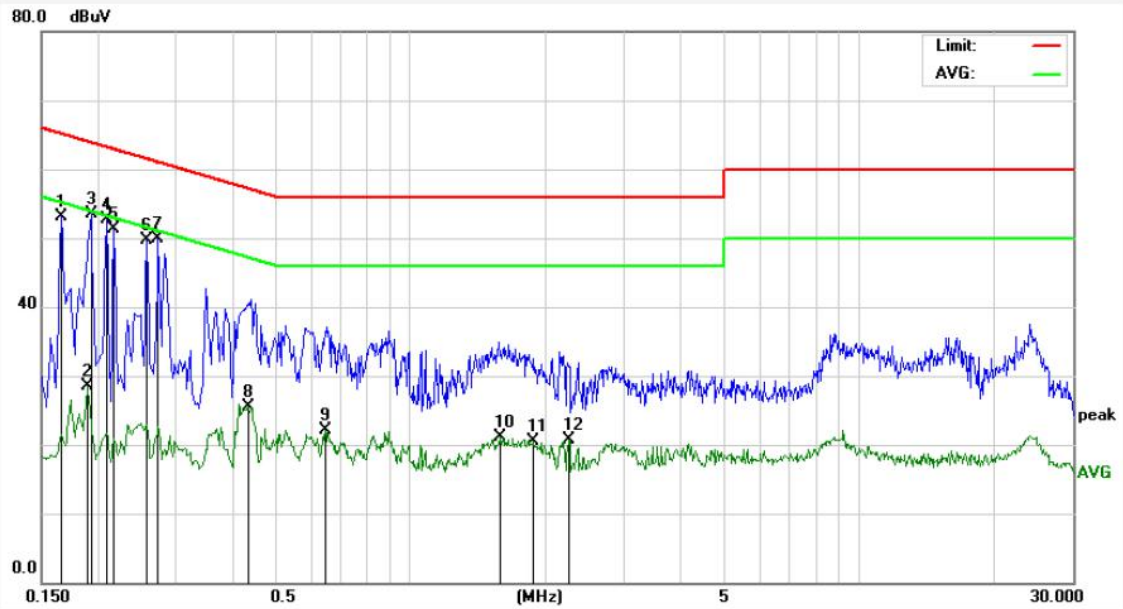
Test Site: 1# Shielded Room
Operating Condition: GPS Mode
Test Specification: AC 120V, 60Hz for adapter
Comment: Live Line
Tem.:22.5℃ Hum.:57%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1580	32.63	19.90	52.53	65.56	-13.03	QP	
2	0.1660	35.69	19.90	55.59	65.15	-9.56	QP	
3	0.2260	31.48	19.89	51.37	62.59	-11.22	QP	
4	0.2500	9.08	19.89	28.97	51.75	-22.78	AVG	
5	0.2700	27.01	19.89	46.90	61.12	-14.22	QP	
6	0.2779	28.19	19.89	48.08	60.88	-12.80	QP	
7	0.3260	26.19	19.90	46.09	59.55	-13.46	QP	
8	0.4460	4.14	19.96	24.10	46.95	-22.85	AVG	
9	0.5899	1.06	20.01	21.07	46.00	-24.93	AVG	
10	0.8940	-0.81	20.09	19.28	46.00	-26.72	AVG	
11	1.5900	-0.64	20.13	19.49	46.00	-26.51	AVG	
12	9.1740	3.66	20.32	23.98	50.00	-26.02	AVG	

Conducted Emission Test Data

Test Site: 1# Shielded Room
Operating Condition: GPS Mode
Test Specification: AC 120V, 60Hz for adapter
Comment: Neutral Line
Tem.:22.5℃ Hum.:57%



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Over Limit (dB)	Detector	Remark
1	0.1660	33.30	19.90	53.20	65.15	-11.95	QP	
2	0.1900	8.62	19.90	28.52	54.03	-25.51	AVG	
3	0.1940	33.57	19.90	53.47	63.86	-10.39	QP	
4	0.2100	32.76	19.90	52.66	63.20	-10.54	QP	
5	0.2180	31.45	19.90	51.35	62.89	-11.54	QP	
6	0.2580	29.86	19.89	49.75	61.49	-11.74	QP	
7	0.2740	29.97	19.89	49.86	60.99	-11.13	QP	
8	0.4340	5.62	19.95	25.57	47.18	-21.61	AVG	
9	0.6460	2.00	20.02	22.02	46.00	-23.98	AVG	
10	1.5820	1.02	20.13	21.15	46.00	-24.85	AVG	
11	1.8820	0.28	20.14	20.42	46.00	-25.58	AVG	
12	2.2580	0.52	20.15	20.67	46.00	-25.33	AVG	

4. Radiation Spurious Emission and Band Edge

4.1. Test Standard and Limit

Test Standard	FCC Part15 C Section 15.109				
Test Limit	Frequency (MHz)	Field strength (microvolt/meter)	Limit (dBuV/m)	Remark	Measurement distance (m)
	0.009MHz~0.490MHz	2400/F(kHz)	-	-	300
	0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
	1.705MHz-30MHz	30	-	-	30
	30MHz~88MHz	100	40.0	Quasi-peak	3
	88MHz~216MHz	150	43.5	Quasi-peak	3
	216MHz~960MHz	200	46.0	Quasi-peak	3
	960MHz~1000MHz	500	54.0	Quasi-peak	3
	Above 1000MHz	500	54.0	Average	3
		-	74.0	Peak	3

Remark:

(1)The lower limit shall apply at the transition frequency.

(2) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

4.2. Test Setup

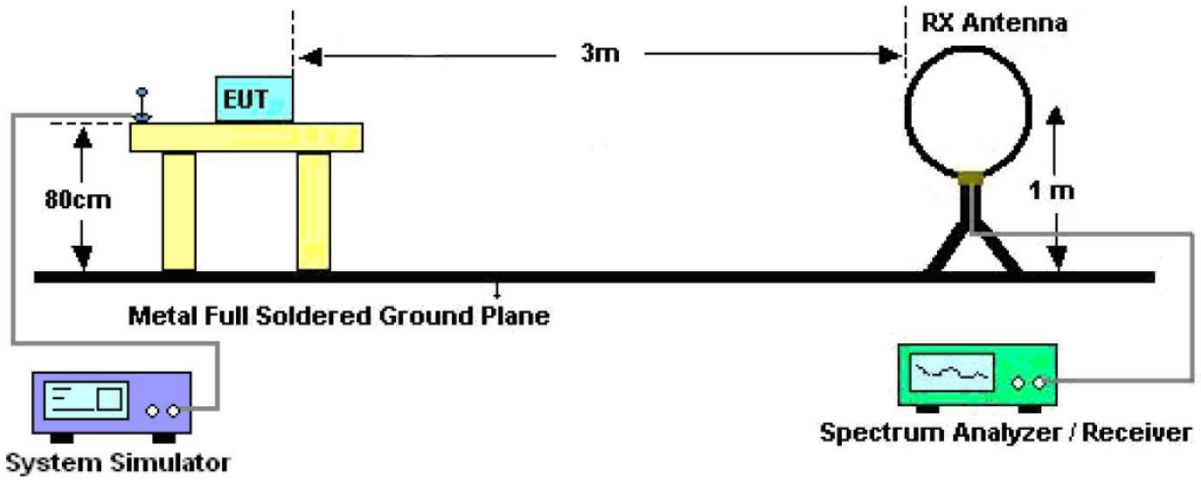


Figure 1. Below 30MHz

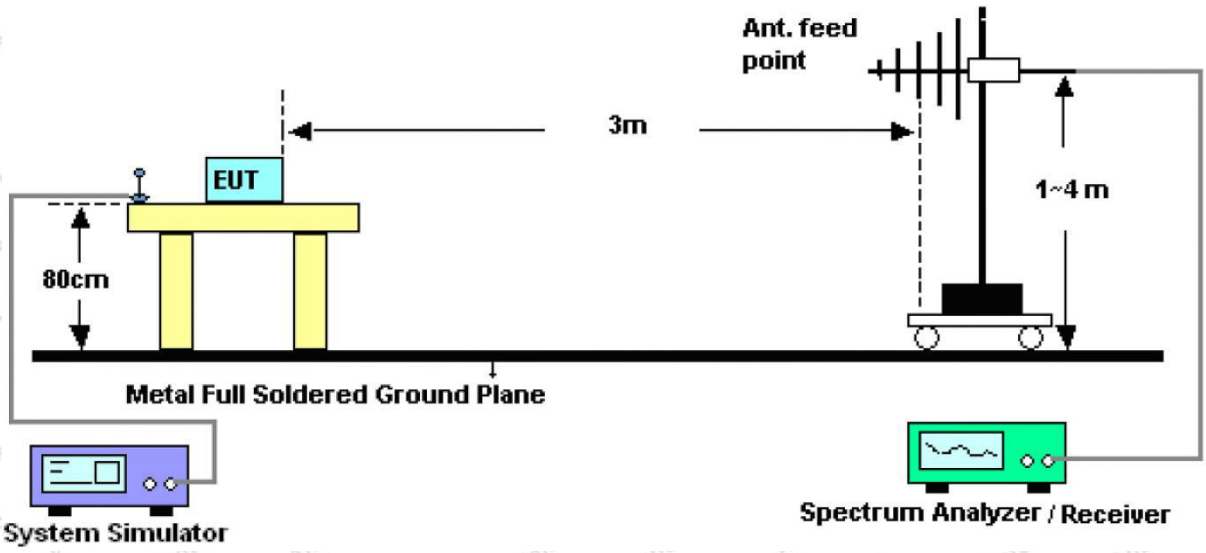


Figure 2. 30MHz to 1GHz

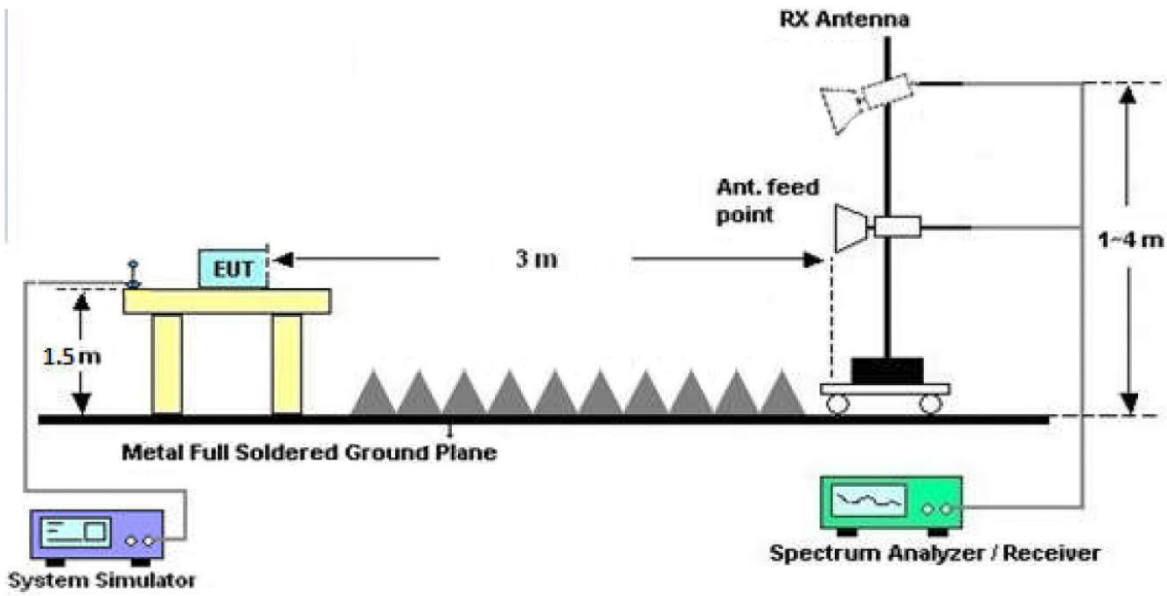


Figure 3. Above 1 GHz

4.3. Test Procedure

For below 1GHz: The EUT is placed on a turntable, which is 0.8m above the ground plane.

For above 1GHz: The EUT is placed on a turntable, which is 1.5m above the ground plane.

The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT is set 3 meters away from the receiving antenna which is mounted on a antenna tower. The antenna can be moved up and down from 1 to 4 meters to find out the maximum emission level. Rotated the EUT through three orthogonal axes to determine the maximum emissions, both horizontal and vertical polarization of the antenna are set on test. The EUT is tested in 9*6*6 Chamber. The device is evaluated in xyz orientation.

For the radiated emission test above 1GHz:

Place the measurement antenna 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 above the ground or reference ground plane.

For 9kHz to 150kHz, Set the spectrum analyzer as:
RBW = 200Hz, VBW =1kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 150kHz to 30MHz, Set the spectrum analyzer as:
RBW = 9KHz, VBW =30kHz, Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For 30MHz to 1000MHz, Set the spectrum analyzer as:
RBW = 100kHz, VBW =300kHz,Detector= Quasi-Peak, Trace mode= Max hold, Sweep- auto couple.

For above 1GHz,Set the spectrum analyzer as:
RBW =1MHz, VBW =10Hz, Detector= Peak, Trace mode= Max hold, Sweep- auto couple.

4.4. Test Data

PASS

The test results of 9kHz-30MHz was attenuated more than 20dB below the permissible limits, so the results don't record in the report.

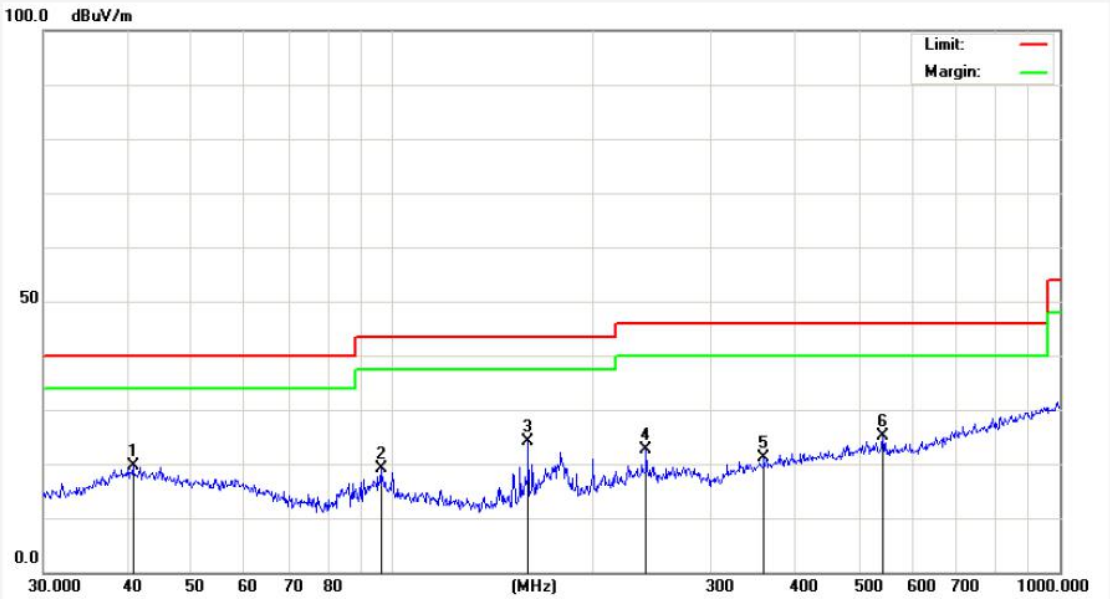
Test Results (30~1000MHz)

Job No.:	SZAWW180503010-01	Temp.(℃)/Hum.(%RH):	23.3℃/54%RH
Standard:	FCC PART 15B	Power Source:	AC 120V, 60Hz for adapter
Test Mode:	Mode 1	Polarization:	Horizontal

No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	41.8596	35.14	-14.72	20.42	40.00	-19.58	QP	300	12	
2	96.0986	55.88	-21.12	34.76	43.50	-8.74	QP	300	124	
3	118.1860	51.46	-21.20	30.26	43.50	-13.24	QP	300	156	
4	162.0414	52.85	-20.60	32.25	43.50	-11.25	QP	300	215	
5	178.7582	53.91	-19.81	34.10	43.50	-9.40	QP	300	265	
6	238.3102	48.97	-17.65	31.32	46.00	-14.68	QP	300	360	

Test Results (30~1000MHz)

Job No.:	SZAWW180503010-01	Temp.(℃)/Hum.(%RH):	23.3℃/54%RH
Standard:	FCC PART 15B	Power Source:	AC 120V, 60Hz for adapter
Test Mode:	Mode 1	Polarization:	Vertical

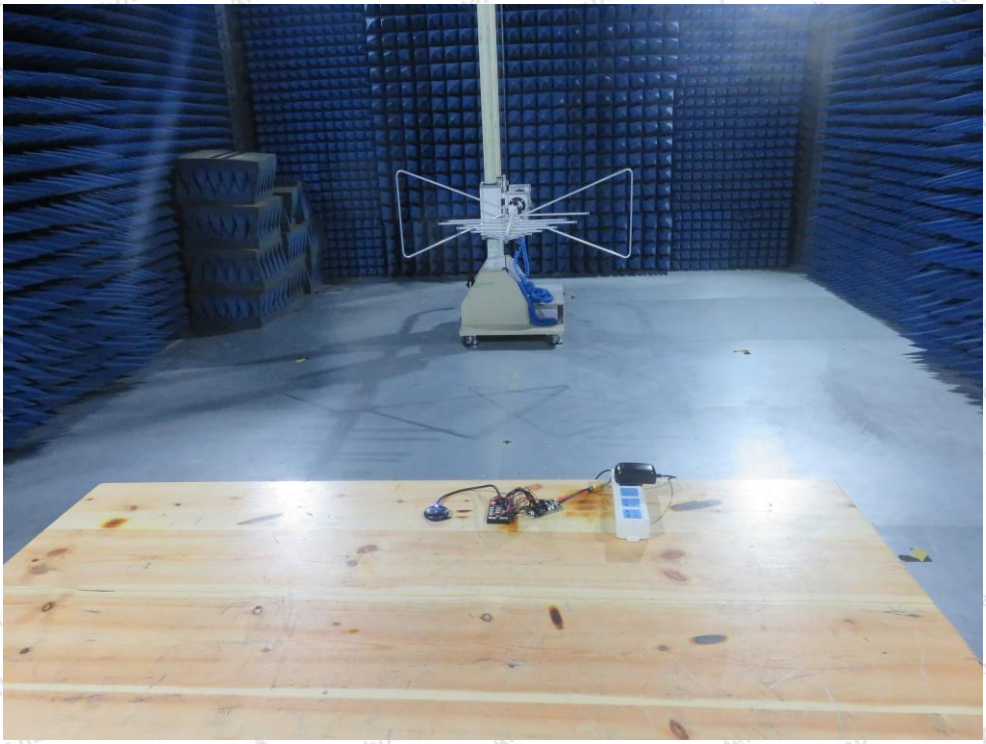


No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/	Over Limit (dB)	Detector	Height (cm)	degree (deg)	Remark
1	40.8446	33.19	-13.54	19.65	40.00	-20.35	QP	300	12	
2	96.0986	34.35	-15.12	19.23	43.50	-24.27	QP	300	124	
3	159.7844	41.12	-16.88	24.24	43.50	-19.26	QP	300	156	
4	239.9874	36.01	-13.49	22.52	46.00	-23.48	QP	300	215	
5	360.4476	33.66	-12.65	21.01	46.00	-24.99	QP	300	312	
6	543.2742	35.22	-10.20	25.02	46.00	-20.98	QP	300	360	

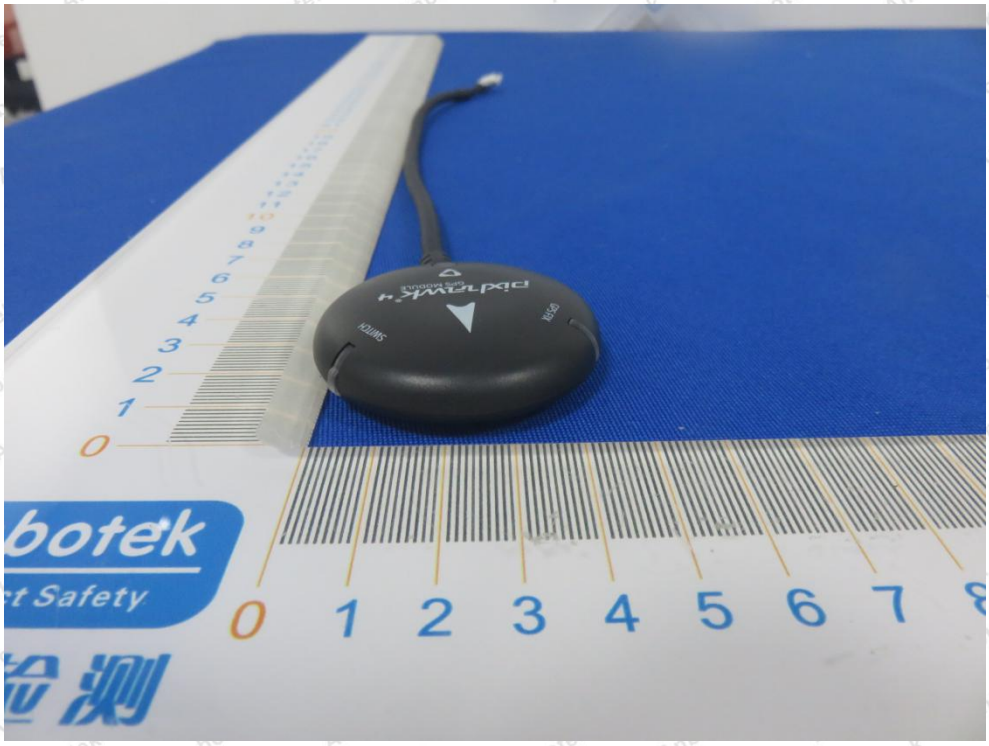
APPENDIX I -- TEST SETUP PHOTOGRAPH

Photo of Conducted Emission Test

Photo of Radiation Emission Test



APPENDIX II -- EXTERNAL PHOTOGRAPH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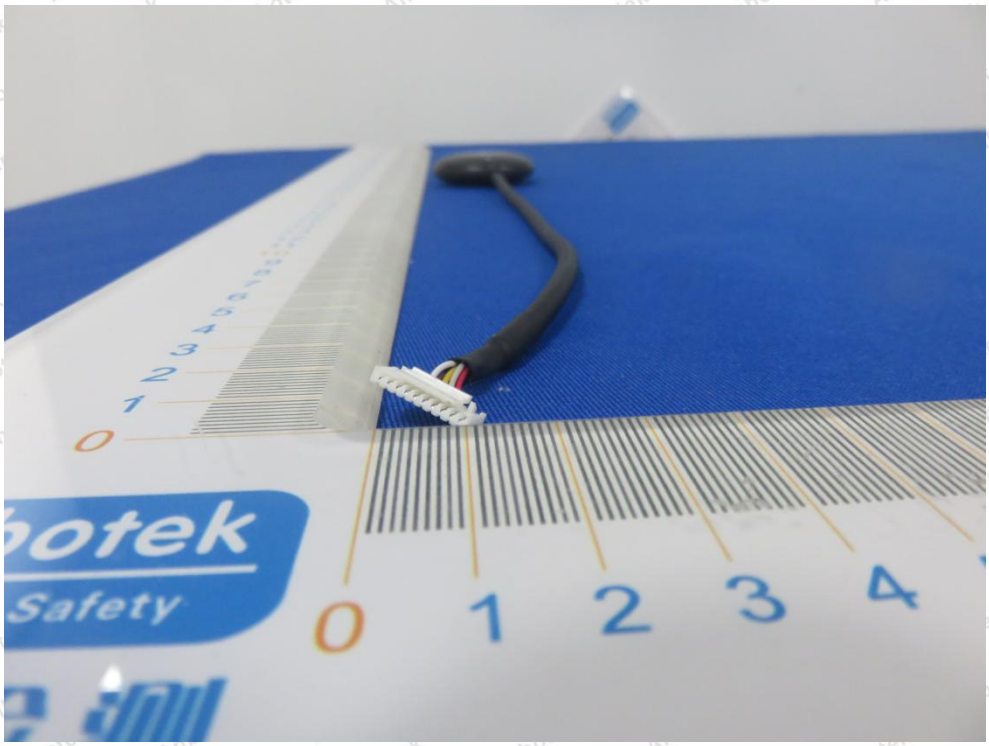
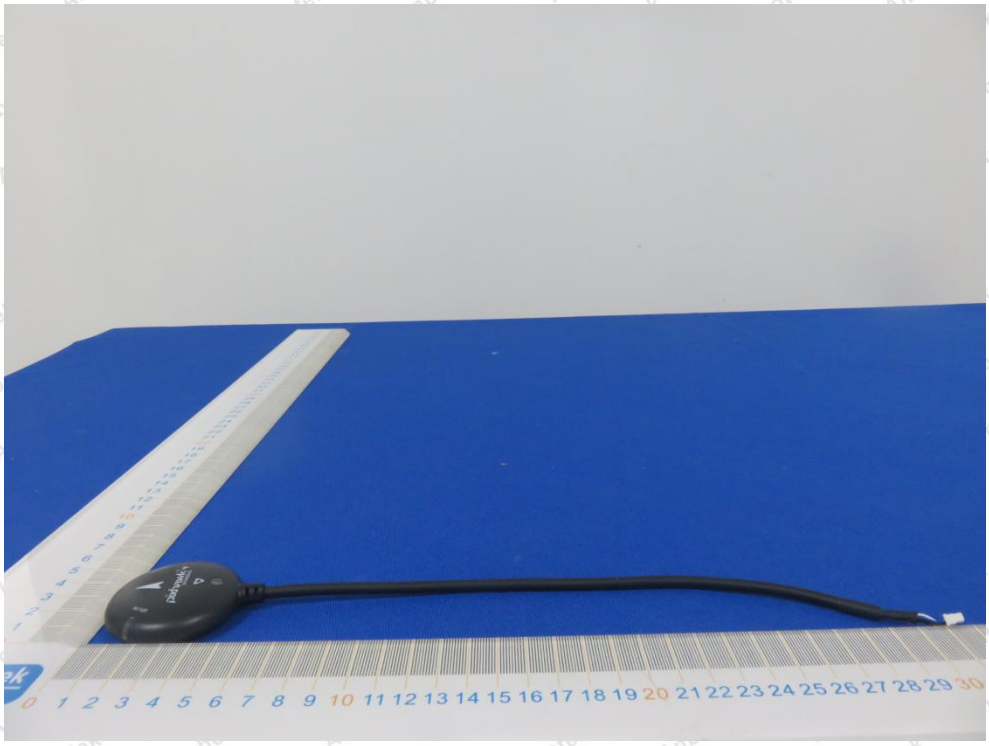
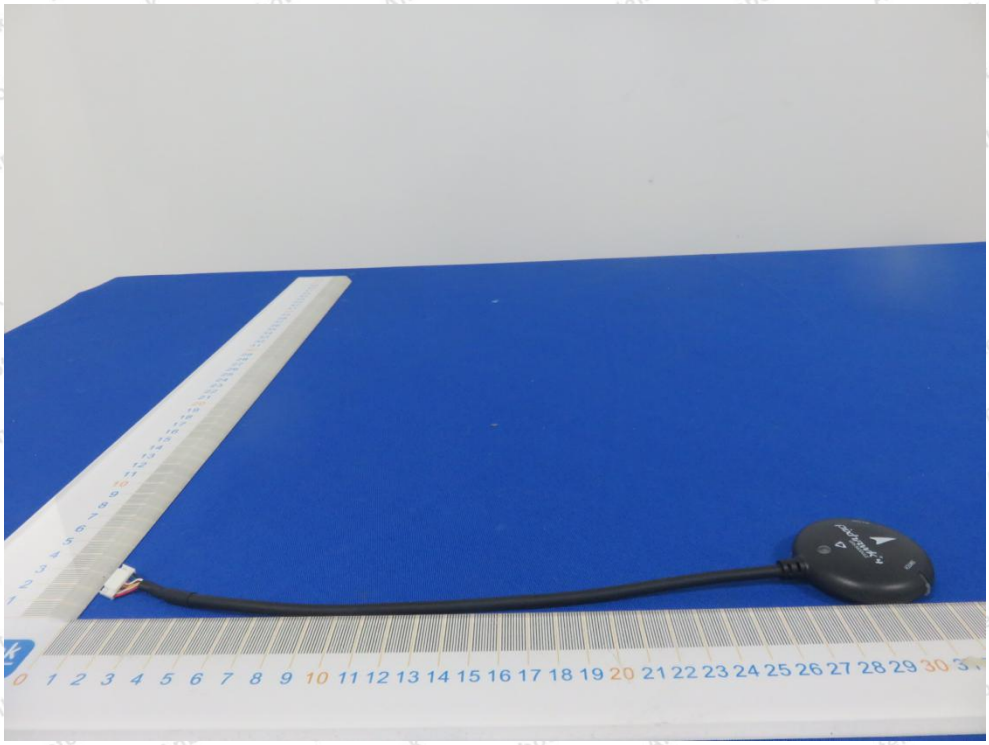
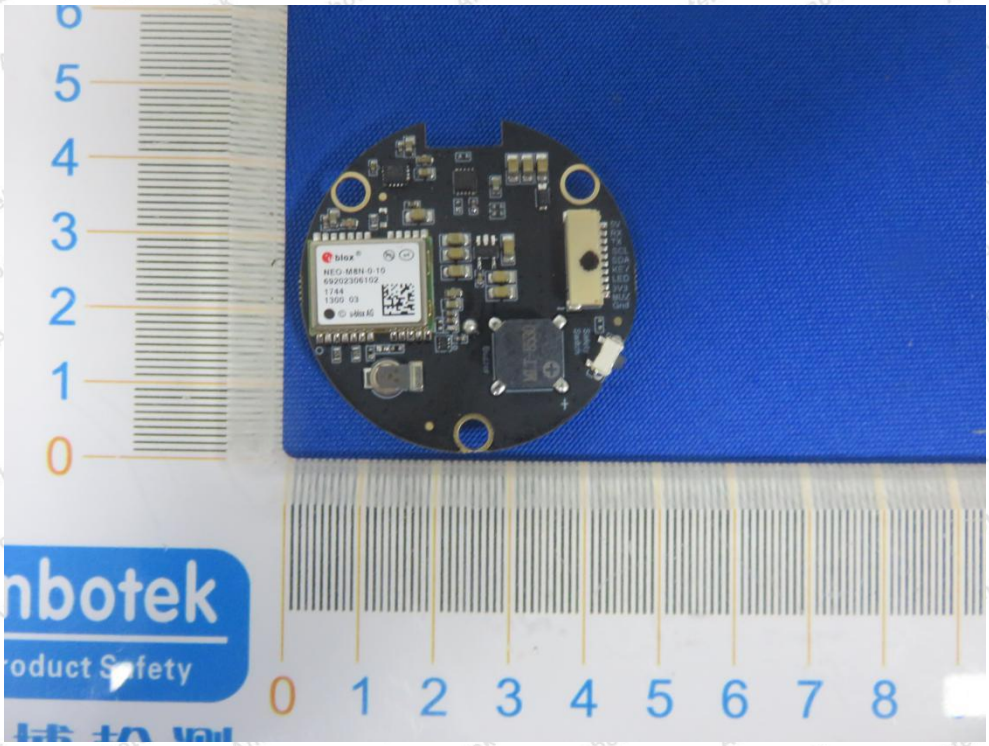
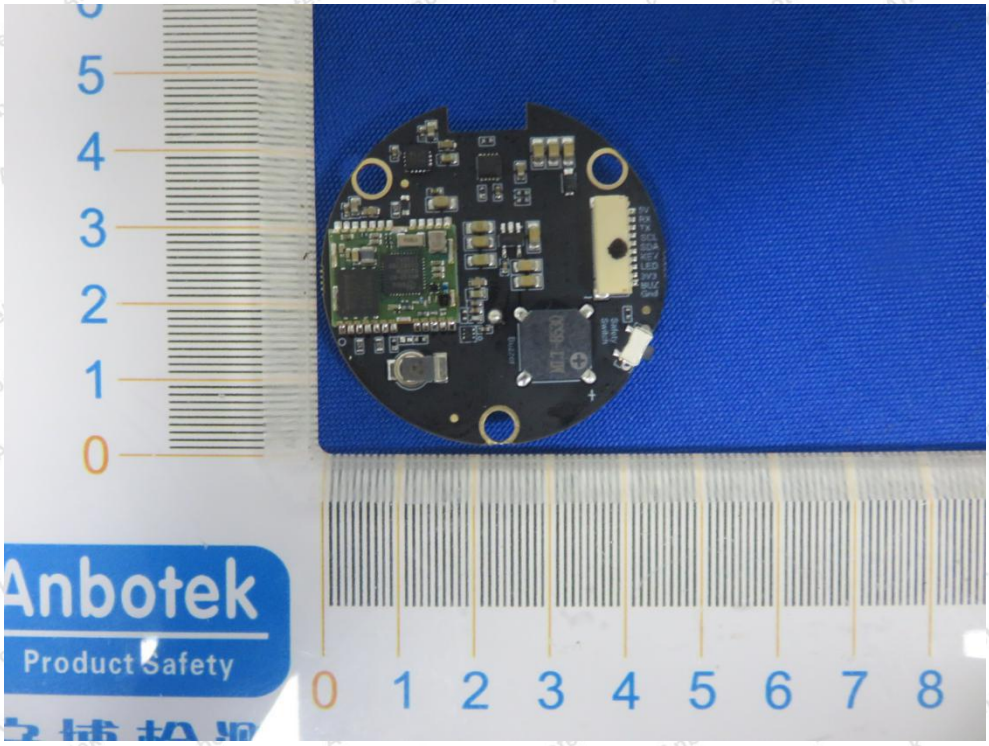

0 1 2 3 4

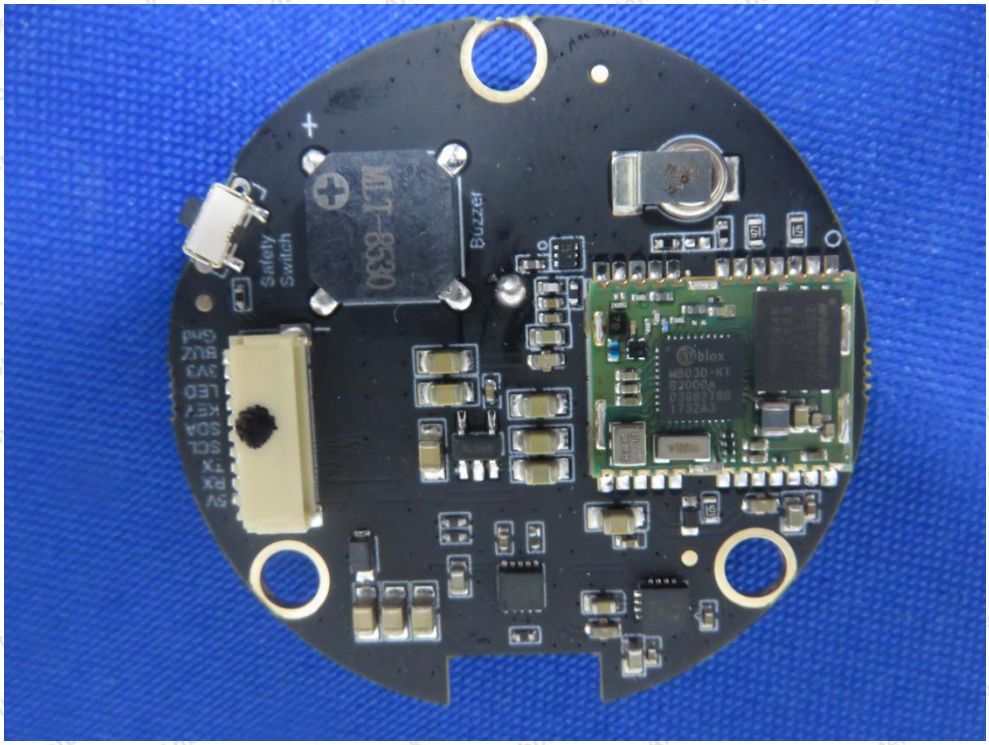


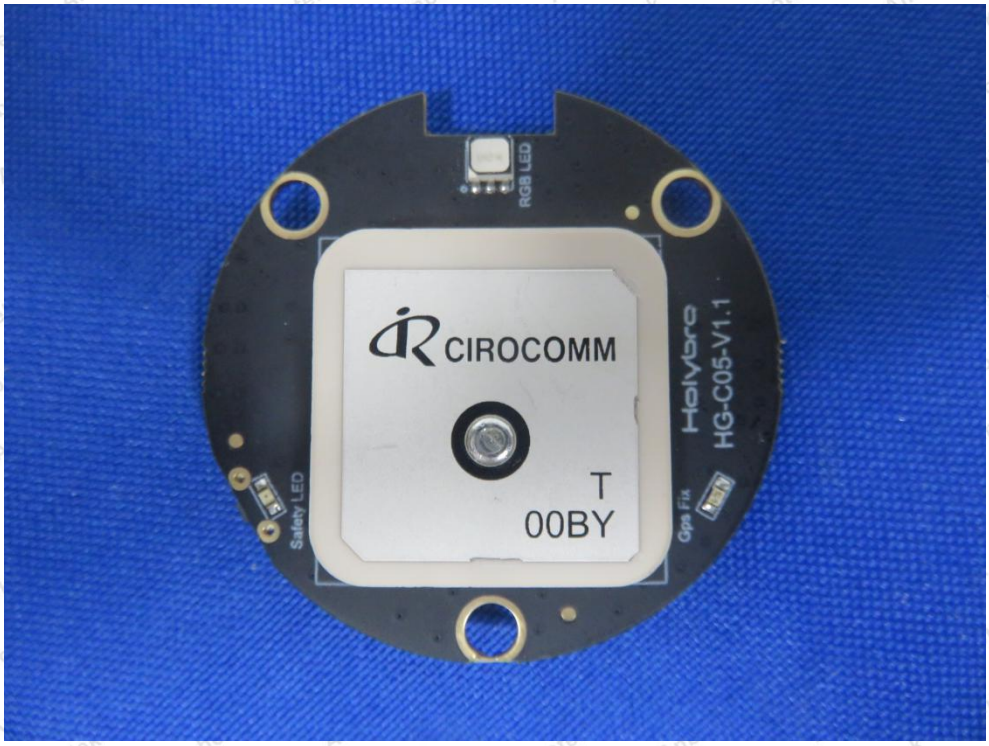


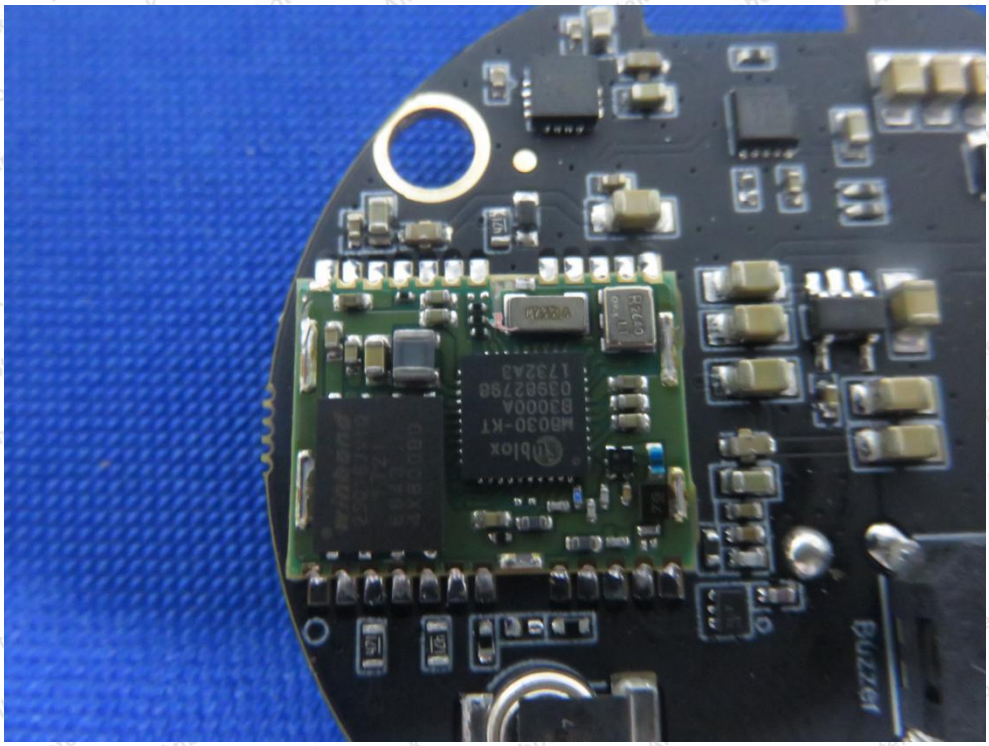
APPENDIX III -- INTERNAL PHOTOGRAPH




Anbotek
Product Safety


Safety Switch
Buzzer





End of Report