

FCC TEST REPORT
FOR

Shenzhen Merrytek Technology Co., LTD

Motion Sensor

Test Model No.: MC079D RC2 A

Additional Model No.: MC079D RC2 B, MC628D RC

Prepared for	: Shenzhen Merrytek Technology Co., LTD
Address	: Rm 101-1101, 17th Building, Dianda Guyuan Industrial Park, Mashantou Community, Matian Street, Guangming District, Shenzhen, China, 518106
Prepared by	: Shenzhen LCS Compliance Testing Laboratory Ltd
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Date of receipt of test sample	: November 12, 2021
Number of tested samples	: 1
Sample number	: 200527070A100
Date of Test	: November 12, 2021 ~ November 23, 2021
Date of Report	: November 25, 2021

FCC TEST REPORT

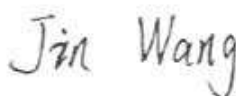
FCC CFR 47 PART 15 C (15.249)

Report Reference No. : LCS200527070AEA100
Date of Issue..... : November 25, 2021
Testing Laboratory Name..... : Shenzhen LCS Compliance Testing Laboratory Ltd.
**Address..... : 101, 201 Bldg A & 301 Bldg C, Juji Industrial Park Shajing Street,
Baoan District, Shenzhen, China**
**Testing Location/ Procedure..... : Full application of Harmonised standards ■
Partial application of Harmonised standards □
Other standard testing method □**
Applicant's Name..... : Shenzhen Merrytek Technology Co., LTD
**Address..... : Rm 101-1101, 17th Building, Dianda Guyuan Industrial Park,
Mashantou Community, Matian Street, Guangming District,
Shenzhen, China, 518106**
Test Specification
Standard..... : FCC CFR 47 PART 15 C (15.249) / ANSI C63.10
Test Report Form No..... : LCSEMC-1.0
TRF Originator..... : Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF..... : Dated 2011-03
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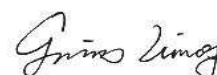
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Test Item Description..... : Motion Sensor
Trade Mark..... : 
Test Model..... : MC079D RC2 A
**Ratings..... : Input : 12Vdc
Output : 0-10Vdc**
Result : Positive
Compiled by:


Diamond.Lu/ File administrators

Supervised by:


Jin Wang/ Technique principal

Approved by:


Gavin Liang/ Manager

FCC -- TEST REPORT

Test Report No. :	LCS200527070AEA100	<u>November 25, 2021</u> Date of issue
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Test Model..... : MC079D RC2 A

EUT..... : Motion Sensor

Applicant..... : Shenzhen Merrytek Technology Co., LTD

Address..... : Rm 101-1101, 17th Building, Dianda Guyuan Industrial Park,
Mashantou Community, Matian Street, Guangming District,
Shenzhen, China, 518106

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Manufacturer..... : Shenzhen Merrytek Technology Co., LTD

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Address..... : Rm 101-1101, 17th Building, Dianda Guyuan Industrial Park,
Mashantou Community, Matian Street, Guangming District,
Shenzhen, China, 518106

Telephone..... : /

Fax..... : /

Test Result	Positive
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The test report merely corresponds to the test sample.

It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
000	November 25, 2021	Initial Issue	Gavin Liang

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1.6 Measurement Uncertainty

Test Item		Frequency Range	Uncertainty	Note
Radiation Uncertainty	:	9KHz~30MHz	3.10dB	(1)
		30MHz~200MHz	2.96dB	(1)
		200MHz~1000MHz	3.10dB	(1)
		1GHz~26.5GHz	3.80dB	(1)
		26.5GHz~40GHz	3.90dB	(1)
Conduction Uncertainty	:	150kHz~30MHz	1.63dB	(1)
Power disturbance	:	30MHz~300MHz	1.60dB	(1)

(1). This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1.7 Description of Test Modes

The EUT operates in the unlicensed ISM band at 5.8GHz. The following operating modes were applied for the related test items.

All test modes were tested, only the result of the worst case was recorded in the report.

The EUT is considered a portable unit and was set to transmit at 100% duty cycle. It was pre-tested on the positioned of each 3 axis. The worst case was found positioned on X-plane.

Mode of operations	Transmitting frequency (MHz)
ASK	5761
For Conducted Emission	
Test Mode	TX Mode
For Radiated Emission	
Test Mode	TX Mode

Worst-case mode and channel used for 9 KHz-1000 MHz radiated emissions was the mode and channel with the highest output power, which was determined to be TX-5761MHz.

***Note: Using a temporary antenna connector for the EUT when the conducted measurements are performed.

1.8. Channel List and Frequency:

Test Mode	Channel	Frequency Range (MHz)
TX	1	5761
Standby	--	--

2. TEST METHODOLOGY

All measurements contained in this report were conducted with ANSI C63.10: 2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

The radiated testing was performed at an antenna-to-EUT distance of 3 meters. All radiated and conducted emissions measurement was performed at Shenzhen LCS Compliance Testing Laboratory Ltd.

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to its specifications, the EUT must comply with the requirements of the Section 15.203, 15.205, 15.207, 15.209 and 15.249 under the FCC Rules Part 15 Subpart C.

This Class II permissive change Application, the difference with the original is:

1. Add DC 12V voltage and regulator tube circuit,
2. Updated the address of applicant, manufacturer and factory.

The changes are not related with the other RF parameter, only radiation emissions were retested.

2.3 General Test Procedures

2.3.1 Conducted Emissions

The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in FCC ANSI C63.10 for Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using Quasi-peak and average detector modes.

2.3.2 Radiated Emissions

The EUT is placed on a turn table, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in FCC MP-5 for radiated emission.

3. SYSTEM TEST CONFIGURATION

3.1 Justification

The system was configured for testing in a continuous transmit condition. Continuous transmitting.
The EUT After the power is switched on, the hand is placed over the microwave module, and the continuous transmit signal.

3.2 EUT Exercise Software

N/A.

3.3. Special Accessories

N/A.

3.4 Block Diagram/Schematics

Please refer to the related document.

3.5 Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

3.6 Test Setup

Please refer to the test setup photo.

4. SUMMARY OF TEST RESULT

FCC Rules	Description Of Test	Result
§15.203	Antenna Requirement	Compliant*
§15.207(a)	Power Line Conducted Emissions	N/A
§15.205(a), §15.209(a), §15.249(a), §15.249(c)	Radiated Emissions Measurement	Compliant
§15.205	Band Edges Measurement	N/A
§15.249, §15.215	20 dB Bandwidth	N/A

Remark;

Compliant*: The Class II permissive change Application have not effected the result.

N/A: The device was powered by battery when user operates the device

** - Restricted bands far away from fundamental frequency, results within radiated emission.

5. SUMMARY OF TEST EQUIPMENT

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	MXA Signal Analyzer	Agilent	N9020A	MY49100060	2020-11-17	2021-11-16
					2021-11-16	2022-11-15
2	DC Power Supply	Agilent	E3642A	N/A	2020-11-26	2021-11-25
3	Temperature & Humidity Chamber	GUANGZHOU GOGN WEN	GDS-100	70932	2021-10-07	2022-10-06
4	EMI Test Software	Farad	EZ	/	N/A	N/A
5	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2021-06-21	2022-06-20
6	Positioning Controller	MF	MF7082	MF78020803	2021-06-21	2022-06-20
7	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2021-07-25	2024-07-24
8	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2021-07-25	2024-07-24
9	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2021-07-01	2024-06-30
10	EMI Test Receiver	R&S	ESR 7	101181	2021-06-21	2022-06-20
11	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2020-11-17	2021-11-16
					2021-11-16	2022-11-15
12	Broadband Preamplifier	/	BP-01M18G	P190501	2021-06-21	2022-06-20
13	EMI Test Receiver	R&S	ESPI	101840	2021-06-21	2022-06-20
14	Artificial Mains	R&S	ENV216	101288	2021-06-21	2022-06-20
15	10dB Attenuator	SCHWARZBECK	MTS-IMP-136	261115-001-0032	2021-06-21	2022-06-20

6. RADIATED EMISSION MEASUREMENT

6.1. Standard Applicable

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) and 15.249 limit in the table below has to be followed.

Fundamental Frequency	Field Strength of fundamental (millivolts/meter)	Field Strength of harmonics (microvolts/meter)
902-928 MHz	50	500
2400-2483.5 MHz	50	500
5725-5875 MHz	50	500
24.0-24.25 GHz	250	2500

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

6.2. Instruments Setting

Please refer to equipment list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10 th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/T kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/T kHz for Average

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB/VB 200Hz/1KHz for QP/AVG
Start ~ Stop Frequency	150kHz~30MHz / RB/VB 9kHz/30KHz for QP/AVG
Start ~ Stop Frequency	30MHz~1000MHz / RB/VB 120kHz/1MHz for QP

6.3. Test Procedure

1) Sequence of testing 9 kHz to 30 MHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
- If the EUT is a floor standing device, it is placed on the ground.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1.0 meter.
- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:

- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).
- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QPK detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.

- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 to 3 meter.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ($\pm 45^\circ$) and antenna movement between 1 and 4 meter.
- The final measurement will be done with QP detector with an EMI receiver.
- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 3 meter.
- The EUT was set into operation.

Premeasurement:

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height scan range is 1 meter to 2.5 meter.
- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:

- The final measurement will be performed with minimum the six highest peaks.
- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position ($\pm 45^\circ$) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:

- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables were positioned to simulate normal operation conditions
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- The measurement distance is 1 meter.
- The EUT was set into operation.

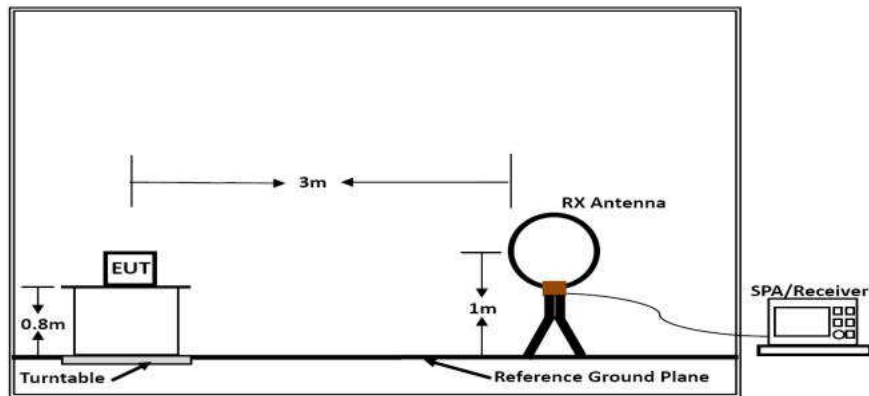
Premeasurement:

- The antenna is moved spherical over the EUT in different polarizations of the antenna.

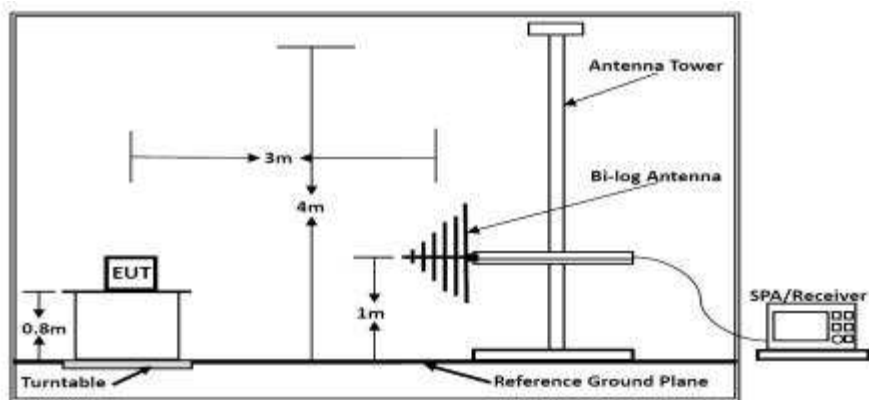
Final measurement:

- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

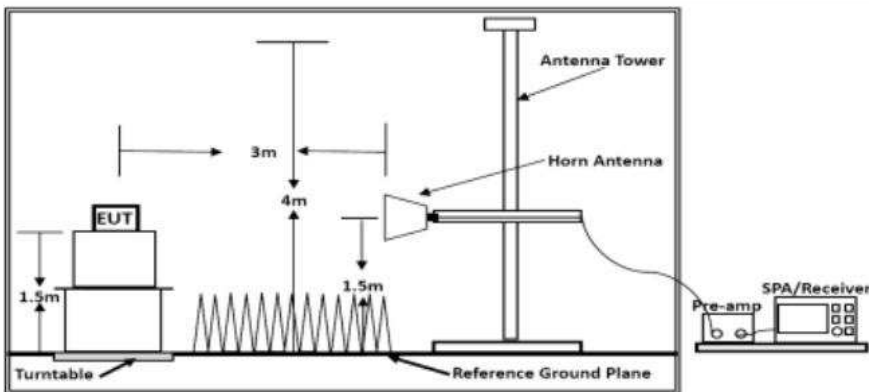
6.4. Block Diagram of Test Setup



Below 30MHz



Below 1GHz



Above 1GHz

Above 18 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3m to 1m.

Distance extrapolation factor = $20 \log (\text{specific distance [3m]} / \text{test distance [1m]})$ (dB);

6.5. Test Results of Radiated Emissions (9 KHz~30MHz)

Frequency (MHz)	Level (dBuV)	Over Limit (dB)	Over Limit (dBuV)	Remark
-	-	-	-	See Note

Note:

The radiated emissions from 9 KHz to 30 MHz are at least 20dB below the official limit and no need to report.

Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);

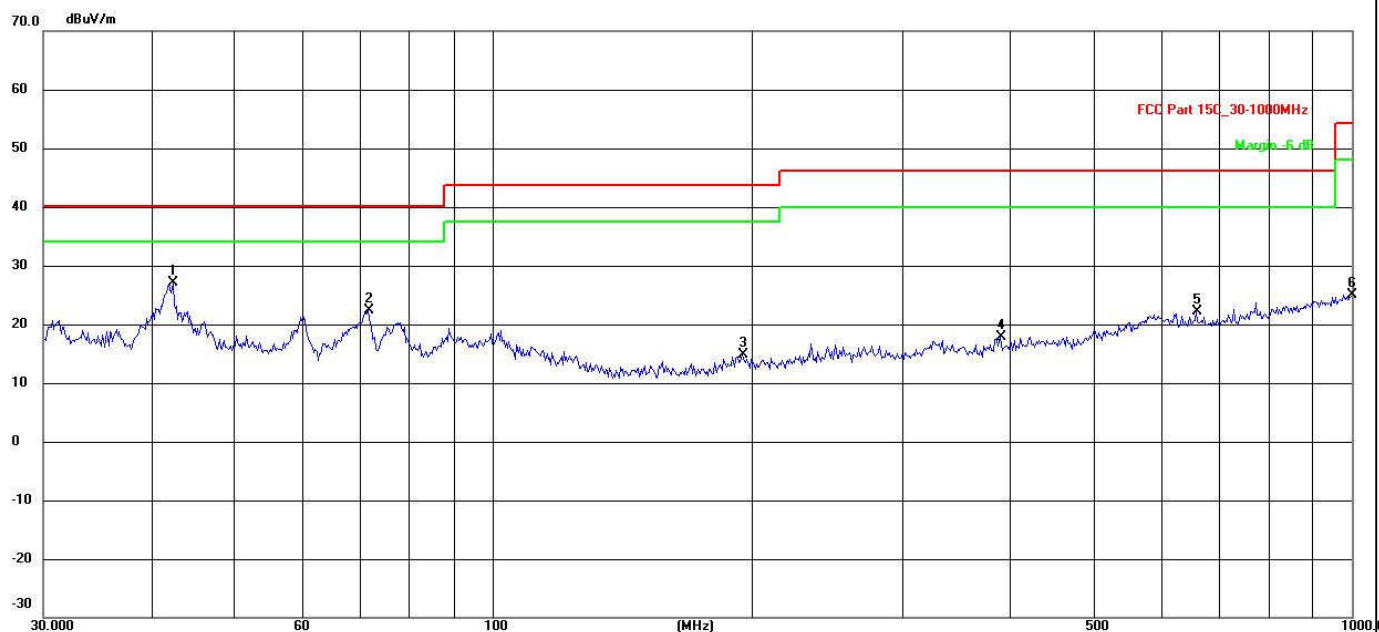
Limit line = specific limits (dBuV) + distance extrapolation factor.

6.6. Results of Radiated Emissions (30 MHz – 1000 MHz)

Temperature	23.6℃	Humidity	54.1%
Test Engineer	Kay.Hu	Test Mode	TX

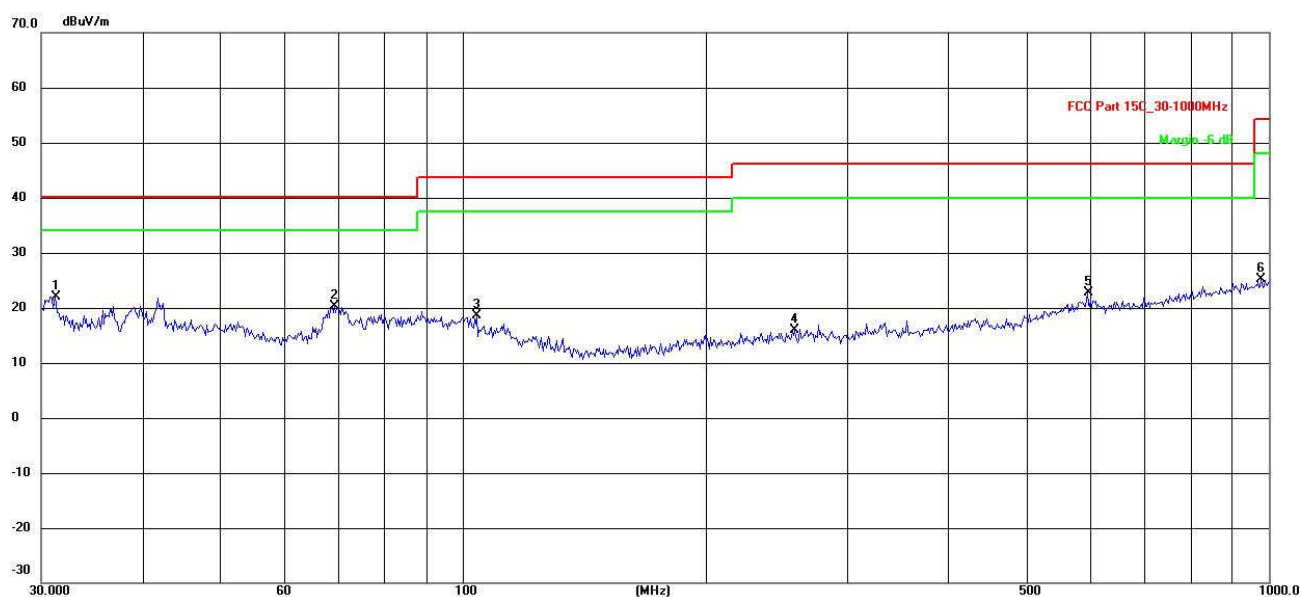
For MC079D RC2 A

Vertical



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1 *	42.4508	57.02	-29.95	27.07	40.00	-12.93	QP
2	71.5806	53.35	-30.90	22.45	40.00	-17.55	QP
3	195.1365	44.77	-30.01	14.76	43.50	-28.74	QP
4	389.3549	44.40	-26.54	17.86	46.00	-28.14	QP
5	658.8362	44.22	-22.09	22.13	46.00	-23.87	QP
6	1000.0000	42.81	-17.72	25.09	54.00	-28.91	QP

Horizontal



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.
1 *	31.1798	53.05	-31.01	22.04	40.00	-17.96	QP
2	69.3568	51.28	-31.02	20.26	40.00	-19.74	QP
3	104.1701	46.20	-27.65	18.55	43.50	-24.95	QP
4	258.3264	43.95	-27.93	16.02	46.00	-29.98	QP
5	595.1329	44.58	-21.76	22.82	46.00	-23.18	QP
6	979.1804	43.15	-18.00	25.15	54.00	-28.85	QP

Note:

- 1). Pre-scan all modes and recorded the worst case results in this report.
- 2). Emission level (dBuV/m) = 20 log Emission level (uV/m).
- 3). Level=Reading level + Factor
Margin=Level - Limit

6.7. Results for Radiated Emissions (1 – 26 GHz)

Field Strength of Fundamental (TX-5761MHz)						
Frequency (MHz)	Pol.	Measure Result (PK, dBuV/m)	Measure Result (AVG, dBuV/m)	Peak Limit (dBuV/m)	AVG Limit (dBuV/m)	Result
5761	H	77.03	63.59	114.00	94.00	PASS
5761	V	72.64	59.76	114.00	94.00	PASS

Freq. MHz	Reading dBuV	Ant. Fac dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
11522	50.97	33.26	35.14	3.98	53.07	74.00	-20.93	Peak	Horizontal
11522	37.80	33.26	35.14	3.98	39.90	54.00	-14.10	Average	Horizontal
11522	52.18	33.26	35.14	3.98	54.28	74.00	-19.72	Peak	Vertical
11522	38.88	33.26	35.14	3.98	40.98	54.00	-13.02	Average	Vertical

Notes:

- 1). Measuring frequencies from 9 KHz - 10th harmonic (ex. 40GHz), No emission found between lowest internal used/generated frequency to 30 MHz.
- 2). Radiated emissions measured in frequency range from 9 KHz - 10th harmonic (ex. 40GHz) were made with an instrument using Peak detector mode.
- 3). 18~40GHz at least have 20dB margin. No recording in the test report.

Measured=Reading level - Pre.factor + Ant. Factor + cable loss

Margin=measured - limited

8. TEST SETUP PHOTOGRAPHS

Photo of Radiated Emissions Measurement

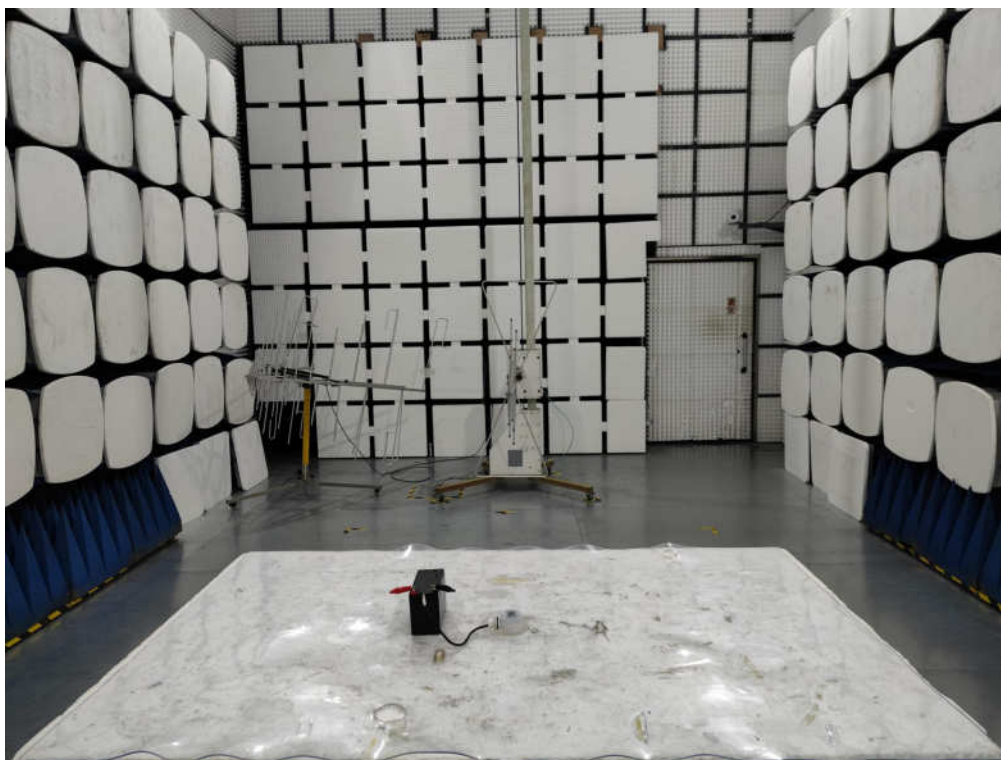


Fig. 1



Fig. 2

9. EXTERIOR PHOTOGRAPHS OF THE EUT

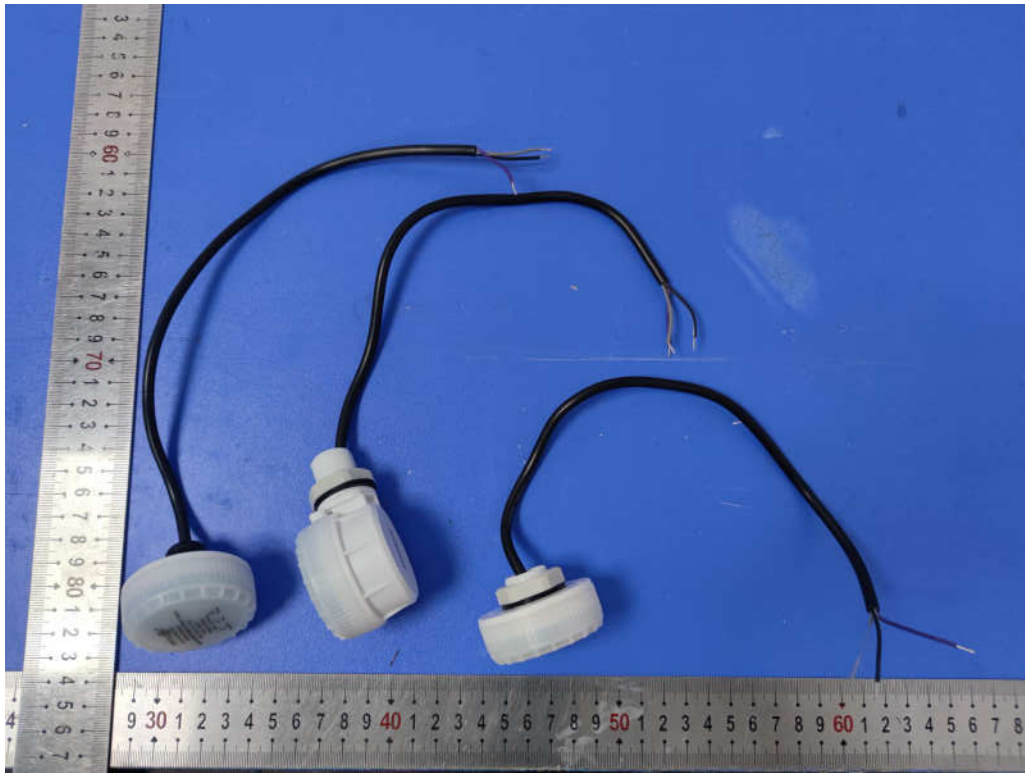


Fig. 1

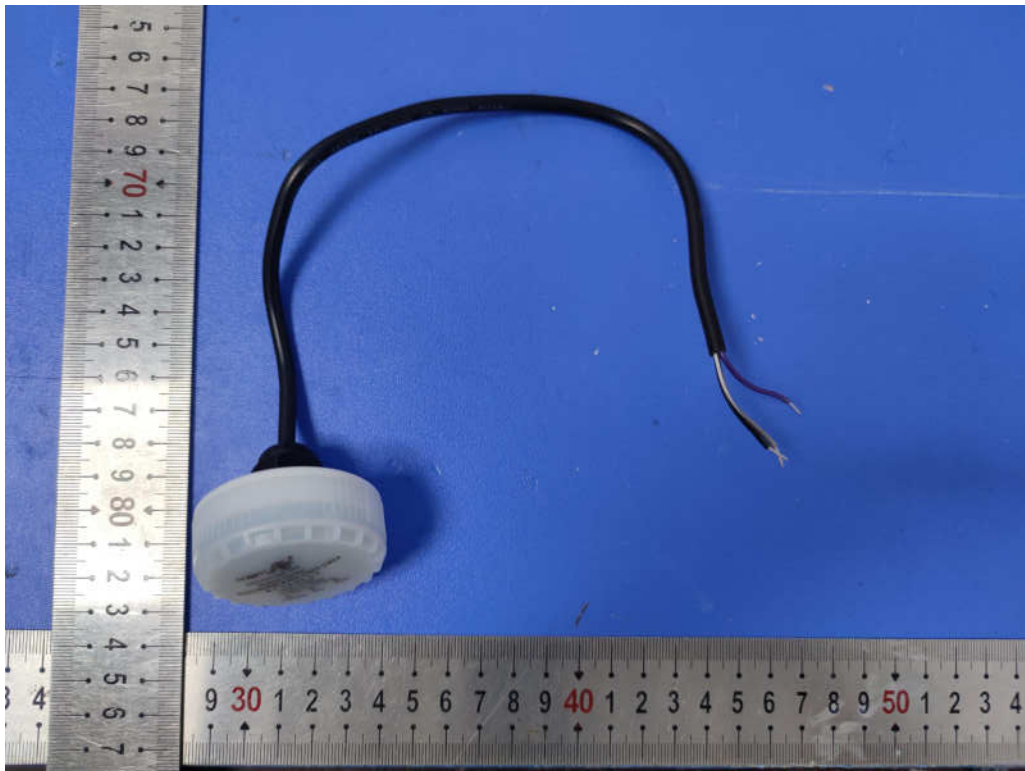


Fig. 2

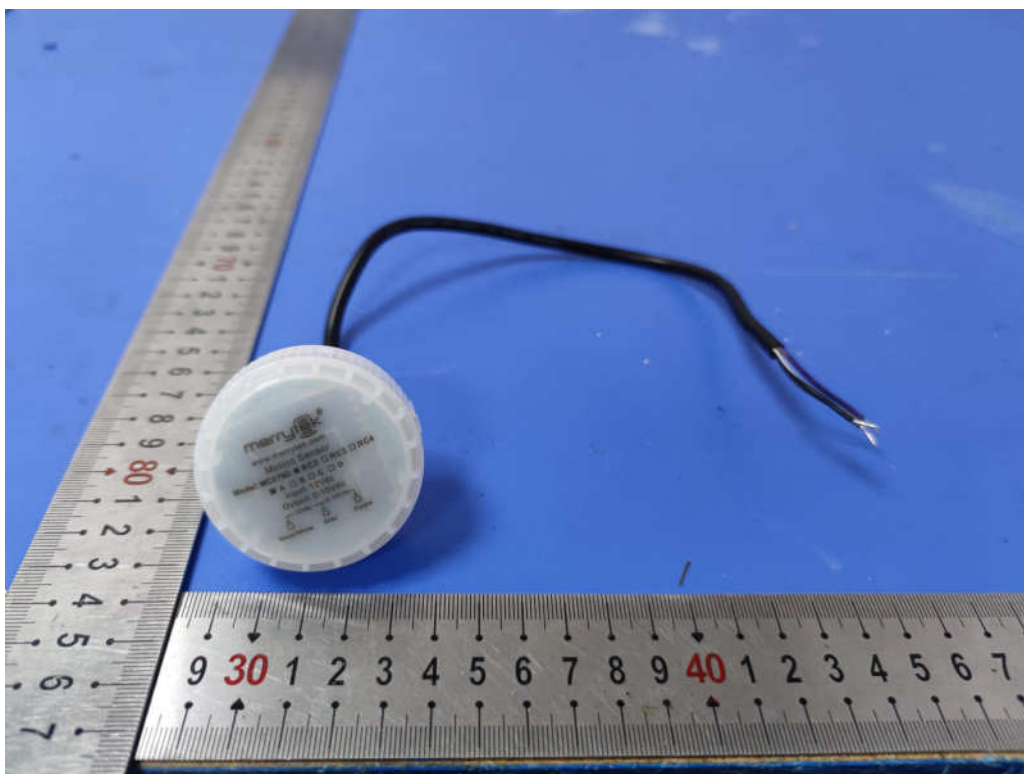


Fig. 3

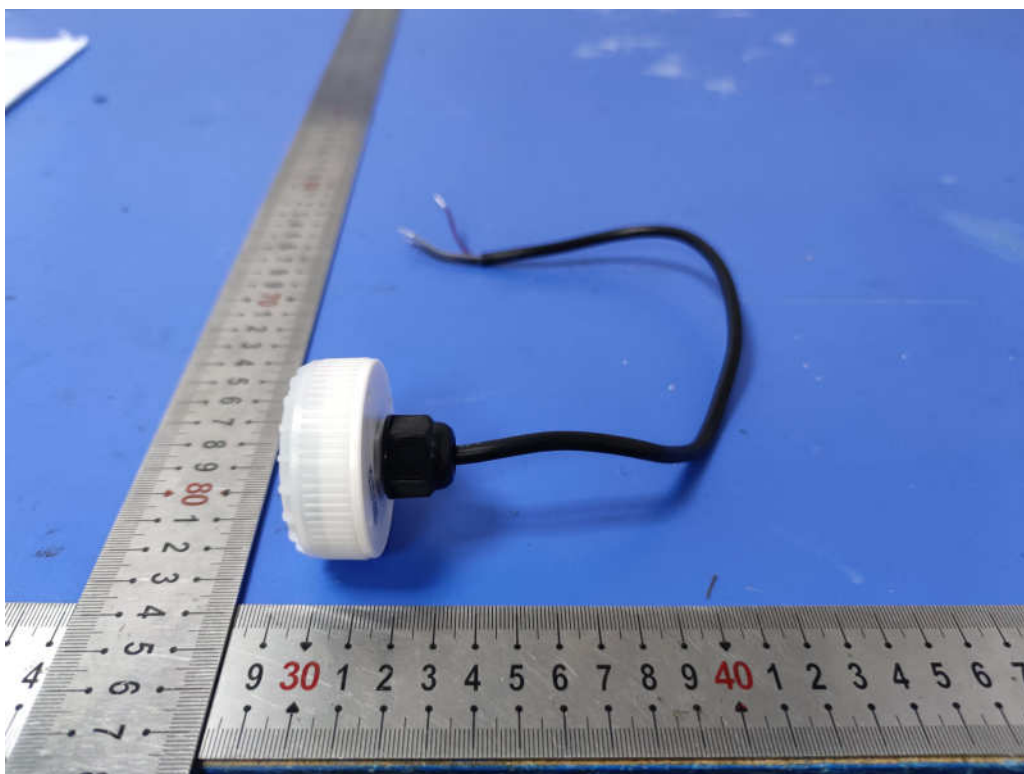


Fig. 4

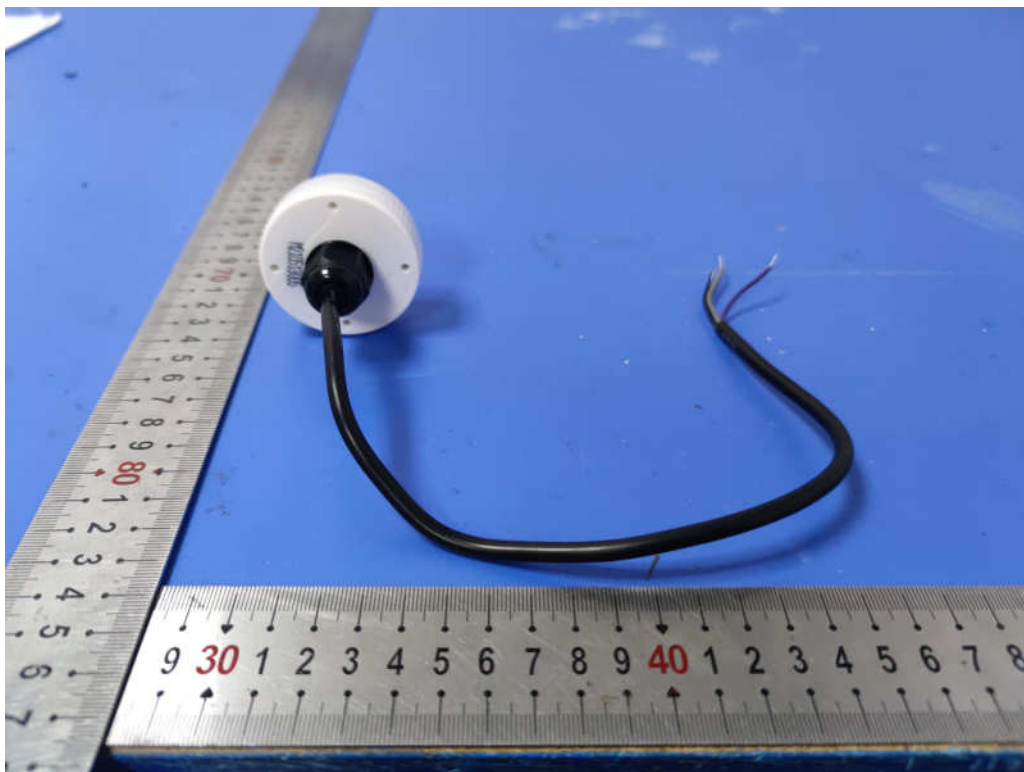


Fig. 5

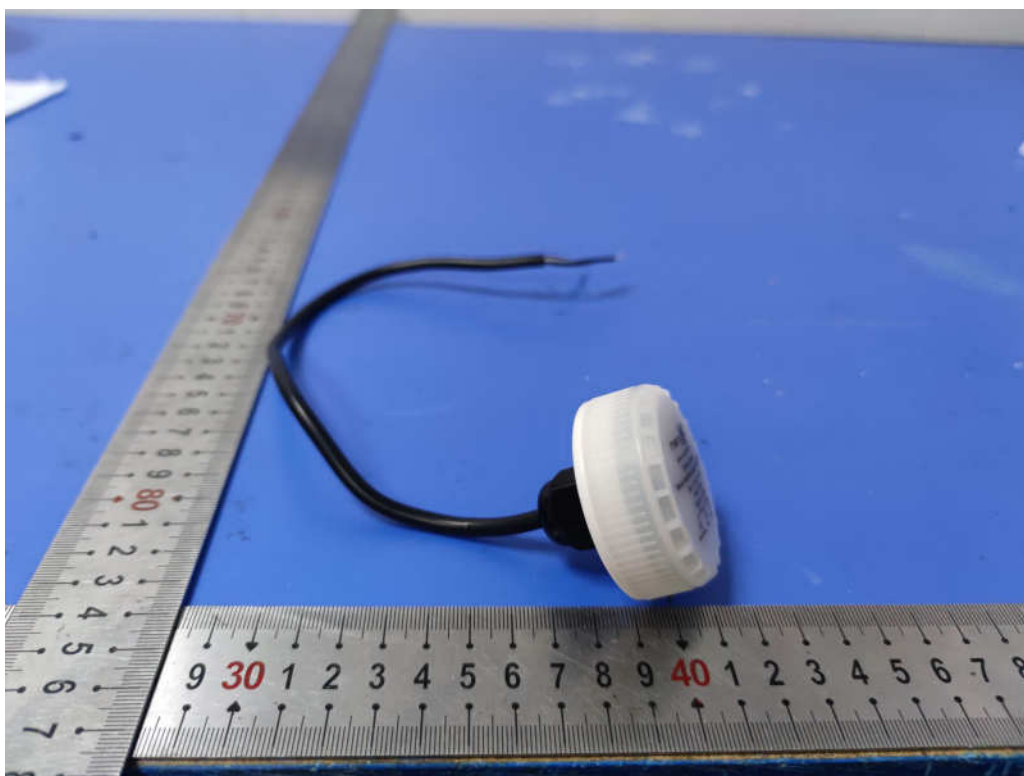


Fig. 6

10. INTERIOR PHOTOGRAPHS OF THE EUT

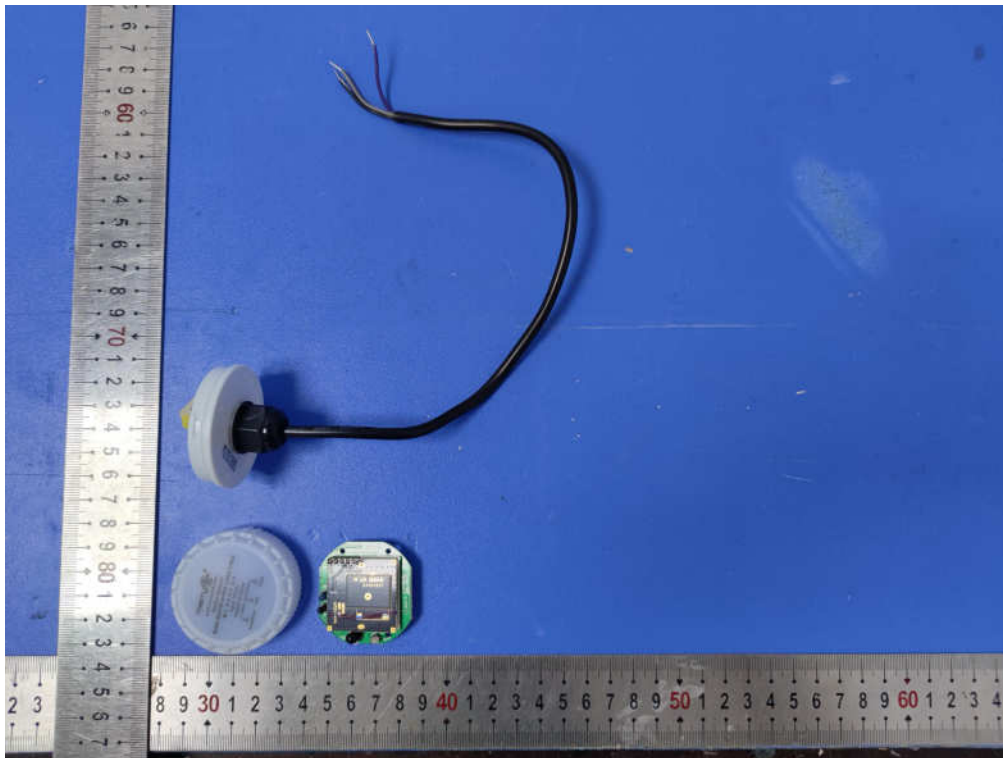


Fig. 1

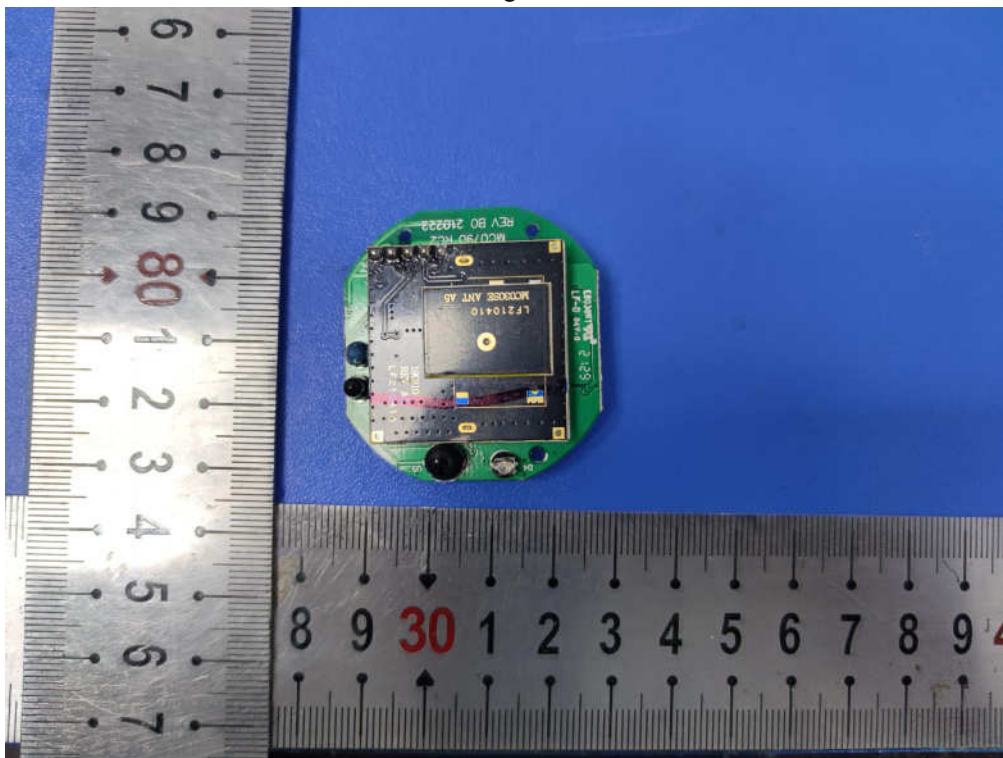


Fig. 2

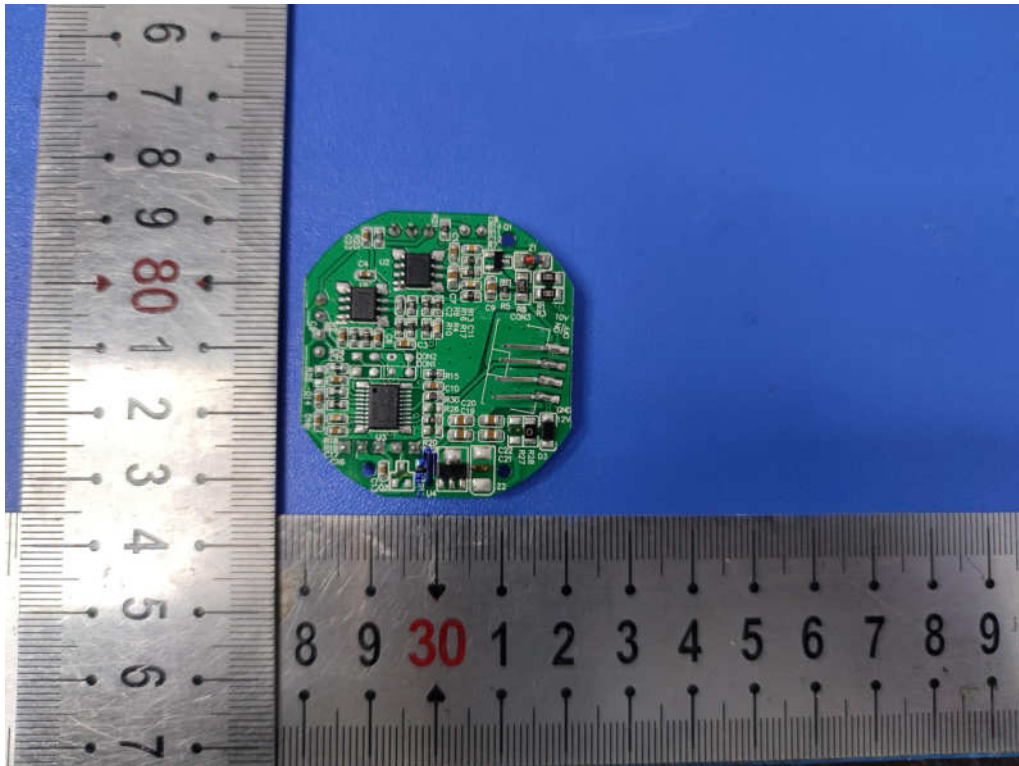


Fig. 3

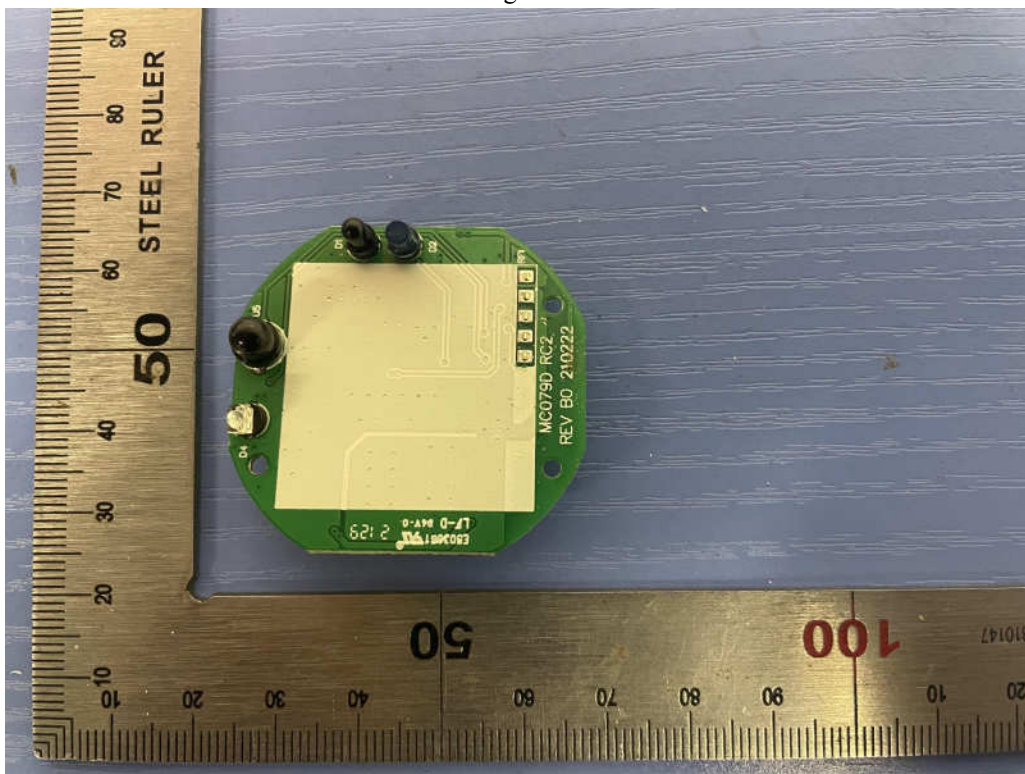


Fig. 4

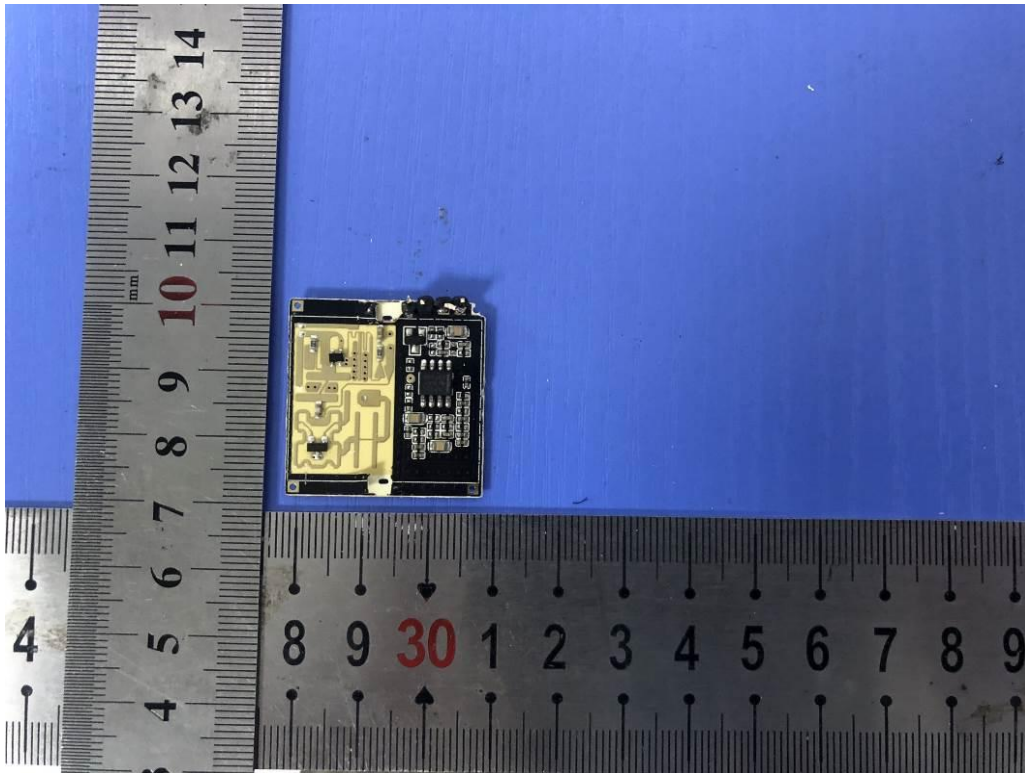


Fig. 5

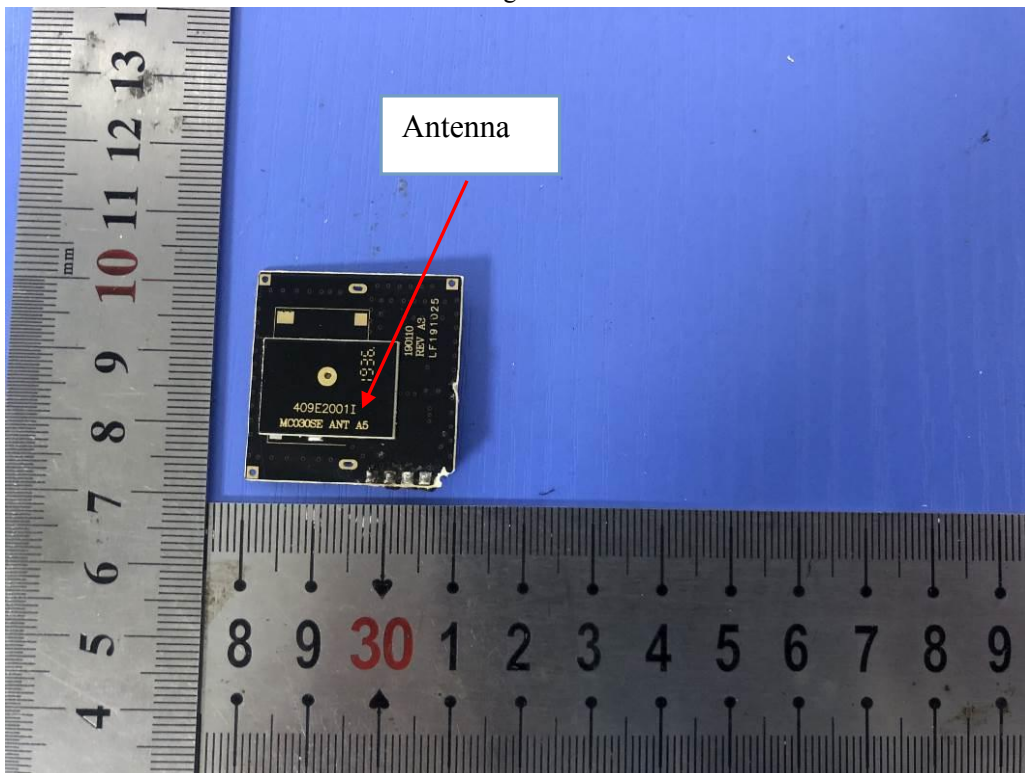


Fig. 6

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