



Report No.: E01A22020131F00101

1 of 43

**ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT
INTENTIONAL RADIATOR CERTIFICATION TO
FCC PART 15 SUBPART C REQUIREMENT**

OF

Smart door lock

Model No.: F01, F02, F03, K1, K2, B3, B4, B5, B6

FCC ID: 2A4KZ-F01

Trademark: N/A

Report No.: E01A22020131F00101

Issue Date: Feb. 23, 2022

Prepared for

**Zhongshan Kaisen Technology Co., Ltd
Room 301, No.30, Wansheng Road, Xiaolan Town, Zhongshan City,
China**

Prepared by

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Hi-tech Industrial Development Zone, Dongguan City, Guangdong Pr.,
China.**

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Dong Guan Anci Electronic Technology Co., Ltd.**



Report No.: E01A22020131F00101

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VERIFICATION OF COMPLIANCE

Applicant:	Zhongshan Kaisen Technology Co., Ltd Room 301, No.30, Wansheng Road, Xiaolan Town, Zhongshan City, China
Manufacturer:	Zhongshan Kaisen Technology Co., Ltd Room 301, No.30, Wansheng Road, Xiaolan Town, Zhongshan City, China
Product Description:	Smart door lock
Model Number:	F01, F02, F03, K1, K2, B3, B4, B5, B6 (All models have the same circuit principle and PCB, the difference is the color of external paint and the shape of mechanical structural parts, we choose model:F01 for all tests.)
Trademark:	N/A

We hereby certify that:

The above equipment was tested by Dong Guan Anci Electronic Technology Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10-2013 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.225(2021).

Date of Test :

Feb. 16, 2022 to Feb. 22, 2022

Prepared by :

Tomas Yang/Editor

Approved & Authorized Signer :

Alan He/Manager

Modified Information

Version	Summary	Revision Date	Report No.
Ver.1.0	Original Report	/	E01A22020131F00101



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APPENDIX (Photos of EUT) (5 pages)

1 General Information

1.1 Product Description

Characteristics	Description
EUT:	Smart door lock
Modulation:	ASK
Operating Frequency:	13.56MHz
Number of Channels:	1 channel
Antenna Type :	Internal Loop antenna
Input rating:	Battery 4*1.5V
Power supply:	Battery 4*1.5V
Antenna Gain	The antenna is permanently attached on PCB, no consideration of replacement. Please refer to internal Photos for details.

Note: for a more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

1.2 Related Submittal(s) / Grant(s)

This submittal(s) (test report) is intended for FCC ID: 2A4KZ-F01 filing to comply with Section 15.225 of the FCC Part 15, Subpart C Rules.

1.3 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10-2013. Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Special Accessories

There is a USB cable with two ferrite cores in this submission.

1.5 Equipment Modifications

Not available for this EUT intended for grant.

1.6 Test Facility

Site Description

EMC Lab. : Accredited by CNAS, 2017.06.26
The certificate is valid until 2022.10.28
The Laboratory has been assessed and proved to be in compliance with CNAS-CL01:2006 (identical to ISO/IEC 17025:2005)
The Certificate Registration Number is L6214.

Accredited by A2LA, 2018.03.15
The Certificate Number is 4422.01.

Name of Firm : Dong Guan Anci Electronic Technology Co., Ltd.
Site Location : 1-2 Floor, Building A, No.11, Headquarters 2 Road, Songshan, Lake Hi-tech Industrial Development Zone, Dongguan City, Guangdong Pr., China.

2 System Test Configuration

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 which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. The TX frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table 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 max. emission, the relative positions of this transmitter(EUT) was tested according to the requirements in Section 13.1.4.1 of ANSI C63.10-2013.

2.4 Configuration of Tested System

Fig. 2-1 Configuration of Tested System



Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
1	Smart door lock	N/A	F01	2A4KZ-F01	N/A	<i>EUT</i>

Note:

- (1) Unless otherwise denoted as EUT in 『Remark』 column, device(s) used in tested system is a support equipment.

3 Summary of Test Results

FCC Rules	Description Of Test	Result
§15.207	AC Power Conducted Emission	N/A(See note)
§15.225(a)(b)(c), (d), §15.209	Radiated Emission	Complied
§15.225(e)	Frequency Stability	Complied
§15.225(a)	20dB Bandwidth	Complied
§15.203	Antenna Application	Complied
Note: N/A. EUT powered by battery.		

For Radiated: The EUT's antenna was pre-tested under the following modes:

Test Mode	Description
Mode A	X-Y axis
Mode B	Y-Z axis
Mode C	X-Z axis

From the above modes, the worst case was found in Mode A. Therefore only the test data of the mode was recorded in this report.

4 TEST SYSTEM UNCERTAINTY

The following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
Maximum Peak Output Power Test	$\pm 1.0\text{dB}$
Conducted Emissions Test	$\pm 2.0\text{dB}$
Radiated Emission Test	$\pm 2.0\text{dB}$
Power Density	$\pm 2.0\text{dB}$
Occupied Bandwidth Test	$\pm 1.0\text{dB}$
Band Edge Test	$\pm 3\text{dB}$
All emission, radiated	$\pm 3\text{dB}$
Antenna Port Emission	$\pm 3\text{dB}$
Temperature	$\pm 0.5^{\circ}\text{C}$
Humidity	$\pm 3\%$

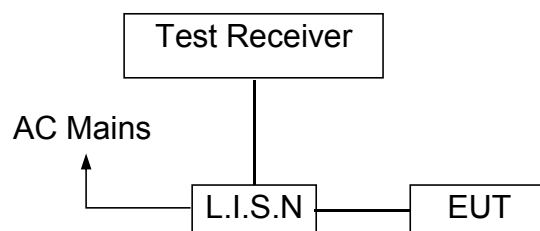
Remark: The coverage Factor ($k=2$), and measurement Uncertainty for a level of Confidence of 95%

5 Conducted Emissions Test

5.1 Measurement Procedure:

1. The EUT was placed on a table, which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured was complete.

5.2 Test SET-UP (Block Diagram of Configuration)



5.3 Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	Calibrated until
L.I.S.N	SCHWARZBECK	NSLK 8127	8127-669	2022-05-22
10 db attenuator	JFW	50FP-010-H4	4360846-427-1	2022-05-22
RF Cable	N/A	N/A	2#	2022-05-22
EMI Test Receiver	ROHDE&SCHWARZ	ESCI	101358	2022-05-22

5.4 Measurement Result:
N/A

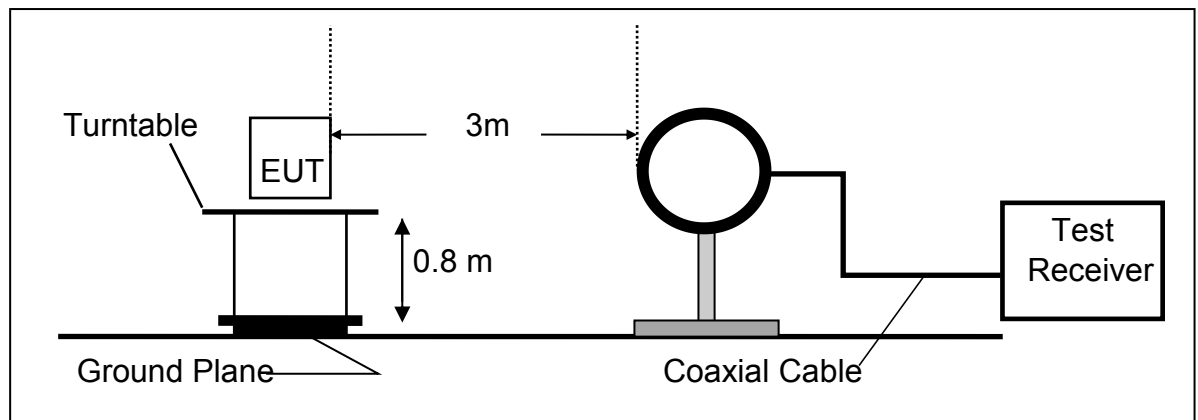
6 Radiated Emission Test

6.1 Measurement Procedure

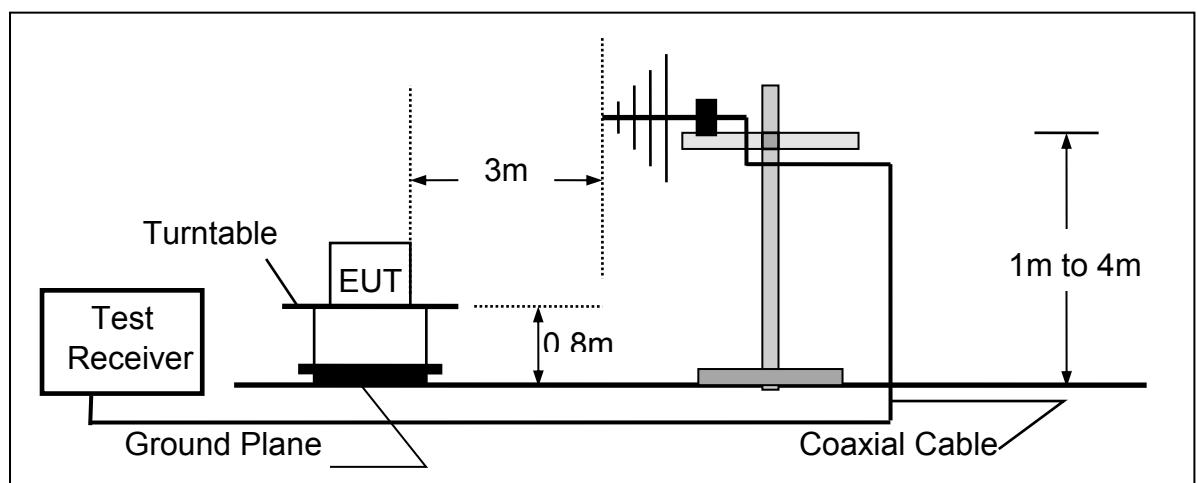
1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured were complete.

6.2 Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



6.3 Measurement Equipment Used

Item	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1.	EMI Test Receiver	Rohde & Schwarz	ESPI	100502	2022-11-12
2.	Pre-Amplifier	HP	8447D	2727A06172	2022-05-22
3.	Bilog Antenna	Schwarzbeck	VULB9163	VULB9163-588	2022-05-22
4.	Loop Antenna	Schwarzbeck	FMZB 1516	1516-141	2020-01-04
5.	Spectrum Analyzer	Rohde & Schwarz	FSV40	US40240623	2022-11-12
6.	Low noise Amplifiers	A-INFO	LA1018N4009	J101313052400 1	2022-05-22
7.	Horn antenna	A-INFO	LB-10180-SF	J203109061212 3	2022-05-22
8.	Broadband RF Power Amplifier	AEROFLEX	AEROFLEX10 0KHz-40GHz	J101313052400 1	2022-11-12
9.	DRG Horn Antenna	A.H.SYSTEMS	SAS-574	J203109061212 3	2022-11-12
10.	RF Cable	Gigalink Microwave	ZT40-2.92J-2. 92J-2m	N/A	2022-11-12
11.	RF Cable	Gigalink Microwave	ZT40-2.92J-2. 92J-0.3m	N/A	2022-11-12
12.	RF Cable	N/A	N/A	6#	2022-05-22
13.	RF Cable	N/A	N/A	1-1#	2022-05-22
14.	RF Cable	N/A	N/A	1-2#	2022-05-22
15.	RF Cable	N/A	N/A	7#	2022-05-22
16.	3m Semi-anechoic Chamber	chengyu	9m*6m*6m	N/A	2022-05-22
17.	Test Software	Farad	EZ-EMC Ver:ANCI-3A1	N/A	N/A

6.4 Radiated Emission Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table 15.209(a):

FCC Part 15.209				
Frequency (MHz)	Field Strength Limitation		Field Strength Limitation Frequency at 3m Measurement Distance	
	(uV/m)	Dist	(uV/m)	(dBuV/m)
0.009 – 0.490	$2400 / F(\text{KHz})$	300m	$10000 * 2400 / F(\text{KHz})$	$20\log 2400 / F(\text{KHz}) + 80$
0.490 – 1.705	$24000 / F(\text{KHz})$	30m	$100 * 24000 / F(\text{KHz})$	$20\log 24000 / F(\text{KHz}) + 40$
1.705 – 30.00	30	30m	$100 * 30$	$20\log 30 + 40$
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	$20\log 500$

FCC Part 15.225(a)/(b)/(c)				
Frequency (MHz)	Field Strength Limitation		Field Strength Limitation Frequency tion at 3m Measurement Dist	
	(uV/m)	Dist	(uV/m)	(dBuV/m)
13.110 – 13.410	106	30 m	106*100	80.5
13.410 – 13.553	334	30 m	334*100	90.5
13.553 – 13.567	15,848	30 m	15,848*100	124
13.567 – 13.710	334	30 m	334*100	90.5
13.710 – 14.010	106	30 m	106*100	80.5

15.205 Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

Remark 1. Emission level in dBuV/m=20 log (uV/m)

- :
- Measurement was performed at an antenna to the closed point of EUT distance of meters.
 - Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of § 15.205, and the emissions located in restricted bands also comply with 15.209 limit.

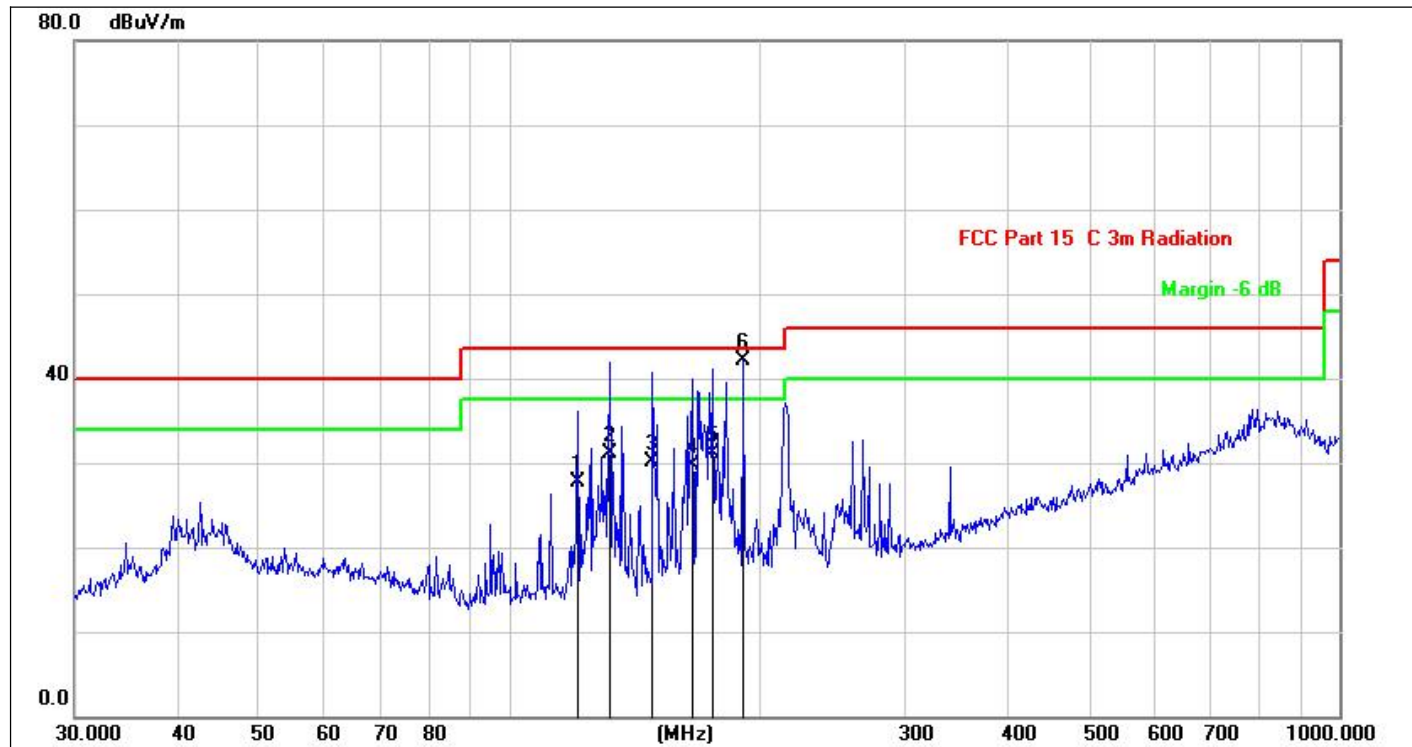
6.5 Measurement Result

Operation Mode:	TX Mode	Test Date :	Feb. 21, 2022
Frequency Range:	9kHz~30MHz	Temperature :	28°C
Test Result:	PASS	Humidity :	65 %
Measured Distance:	3m	Test By:	BEST

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)	Note
9.32	V	33.08	69.54	-36.46	QP
12.32	V	31.19	69.54	-38.35	QP
14.55	V	35.52	69.54	-34.02	QP
16.32	V	34.19	69.54	-35.35	QP
23.52	V	36.90	69.54	-32.64	QP
27.12	V	40.33	69.54	-19.29	QP
10.23	H	31.47	69.54	-38.07	QP
11.56	H	32.60	69.54	-36.94	QP
15.32	H	36.73	69.54	-32.81	QP
20.66	H	37.81	69.54	-31.73	QP
25.34	H	34.09	69.54	-35.45	QP
27.12	H	48.36	69.54	-21.18	QP

Operation Mode:	TX Mode	Test Date :	Feb. 21, 2022
Frequency Range:	30~1000MHz	Temperature :	28°C
Test Result:	PASS	Humidity :	65 %
Measured Distance:	3m	Test By:	BEST

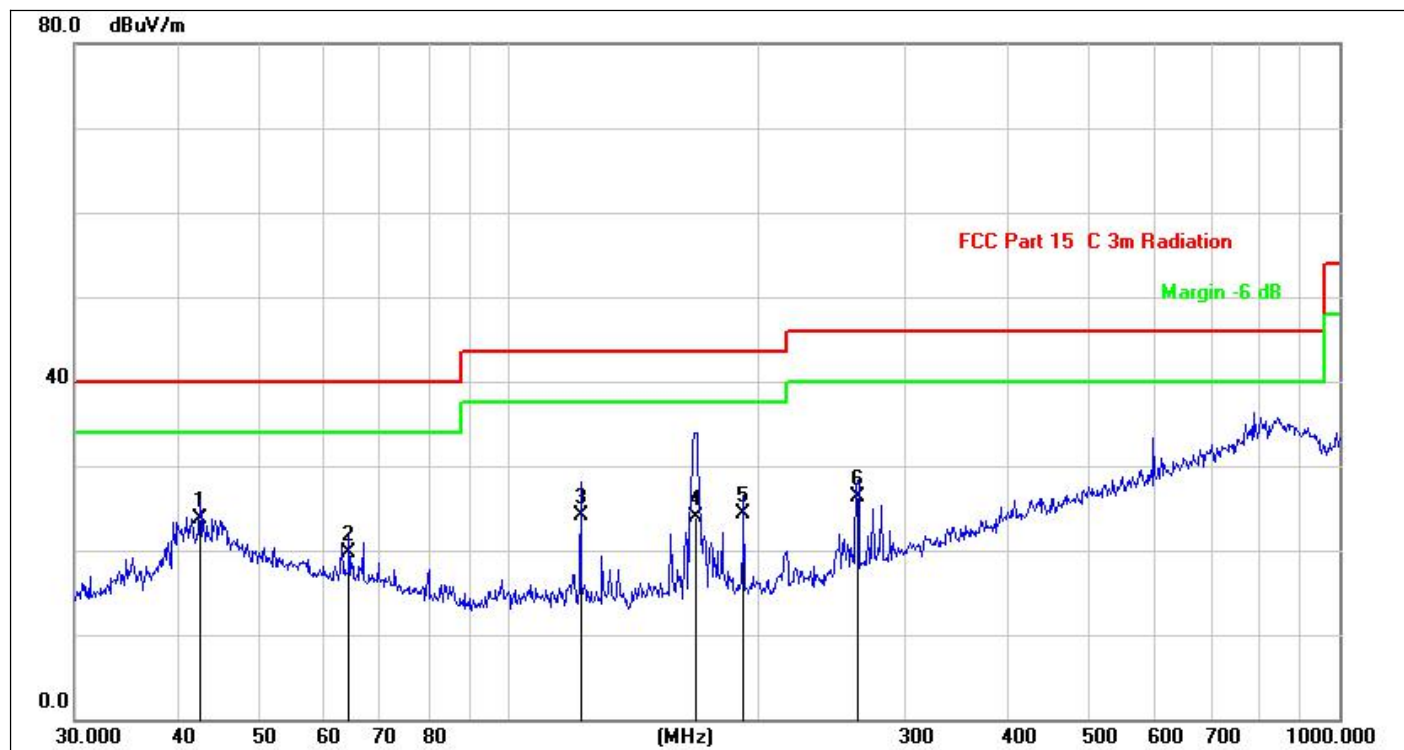
Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)	Note
42.4508	V	23.80	40.00	-16.20	QP
64.2074	V	19.70	40.00	-20.30	QP
121.9755	V	24.09	43.50	-19.41	QP
167.8243	V	23.95	43.50	-19.55	QP
191.7450	V	24.40	43.50	-19.10	QP
262.8955	V	26.22	46.00	-19.78	QP
121.1231	H	27.80	43.50	-15.70	QP
132.2206	H	31.20	43.50	-12.30	QP
148.9625	H	30.10	43.50	-13.40	QP
166.6514	H	29.80	43.50	-13.70	QP
175.6516	H	31.03	43.50	-12.47	QP
191.7450	H	40.10	43.50	-3.40	QP



Site:	LAB	Antenna::Horizontal	Temperature(C):26(C)
Limit:	FCC Part 15 C 3m Radiation		Humidity(%):60%
EUT:	Smart door lock	Test Time:	2022-02-19
M/N.:	F01	Power Rating:	DC 6V
Mode:	TX	Test Engineer:	Dyson
Note:			

No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Remark
1	121.1231	39.86	-12.06	27.80	43.50	-15.70	QP	
2	132.2206	43.39	-12.19	31.20	43.50	-12.30	QP	
3	148.9625	41.73	-11.63	30.10	43.50	-13.40	QP	
4	166.6514	41.72	-11.92	29.80	43.50	-13.70	QP	
5	175.6516	42.75	-11.72	31.03	43.50	-12.47	QP	
6 *	191.7450	51.44	-11.34	40.10	43.50	-3.40	QP	

Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor



Site: LAB
Limit: FCC Part 15 C 3m Radiation
EUT: Smart door lock
M/N.: F01
Mode: TX
Note:

Antenna:: Vertical
Temperature(C): 26(C)
Humidity(%): 60%
Test Time: 2022-02-19
Power Rating: DC 6V
Test Engineer: Dyson

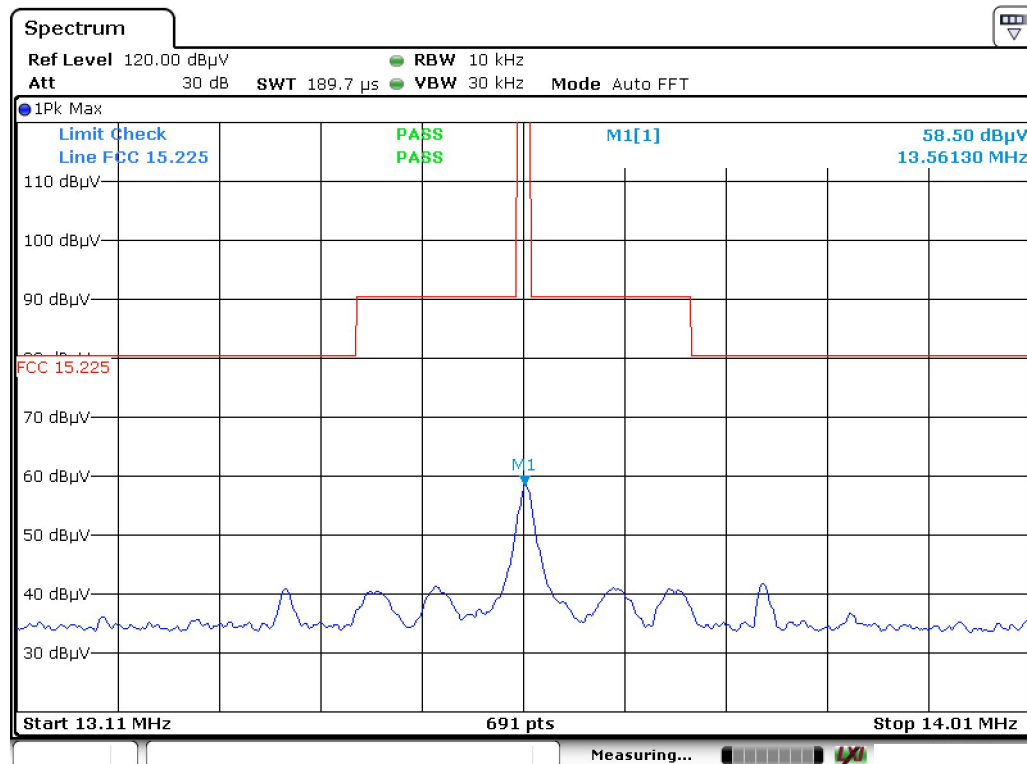
No.	Frequency (MHz)	Reading (dBuV)	Factor (dB/m)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Det.	Remark
1 *	42.4508	34.48	-10.68	23.80	40.00	-16.20	QP	
2	64.2074	29.52	-9.82	19.70	40.00	-20.30	QP	
3	121.9755	36.14	-12.05	24.09	43.50	-19.41	QP	
4	167.8243	35.83	-11.88	23.95	43.50	-19.55	QP	
5	191.7450	35.74	-11.34	24.40	43.50	-19.10	QP	
6	262.8955	35.25	-9.03	26.22	46.00	-19.78	QP	

Note: 1. Result Level = Read Level+ Antenna Factor+ Cable Loss- Amp. Factor

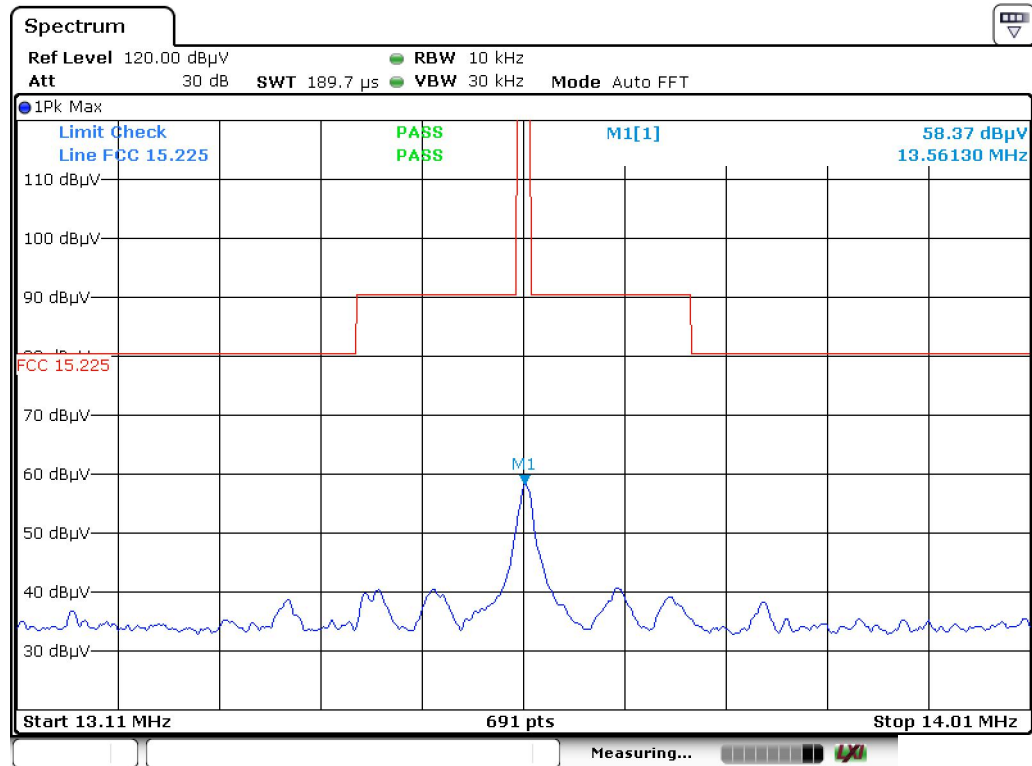
Operation Mode: TX Mode
 Frequency Range: 13.560 MHz
 Test Result: PASS
 Measured Distance: 3m

Test Date : Feb. 21, 2022
 Temperature : 28°C
 Humidity : 65 %
 Test By: BEST

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
13.56	V	58.50	124	-65.50
13.56	H	58.37	124	-65.63

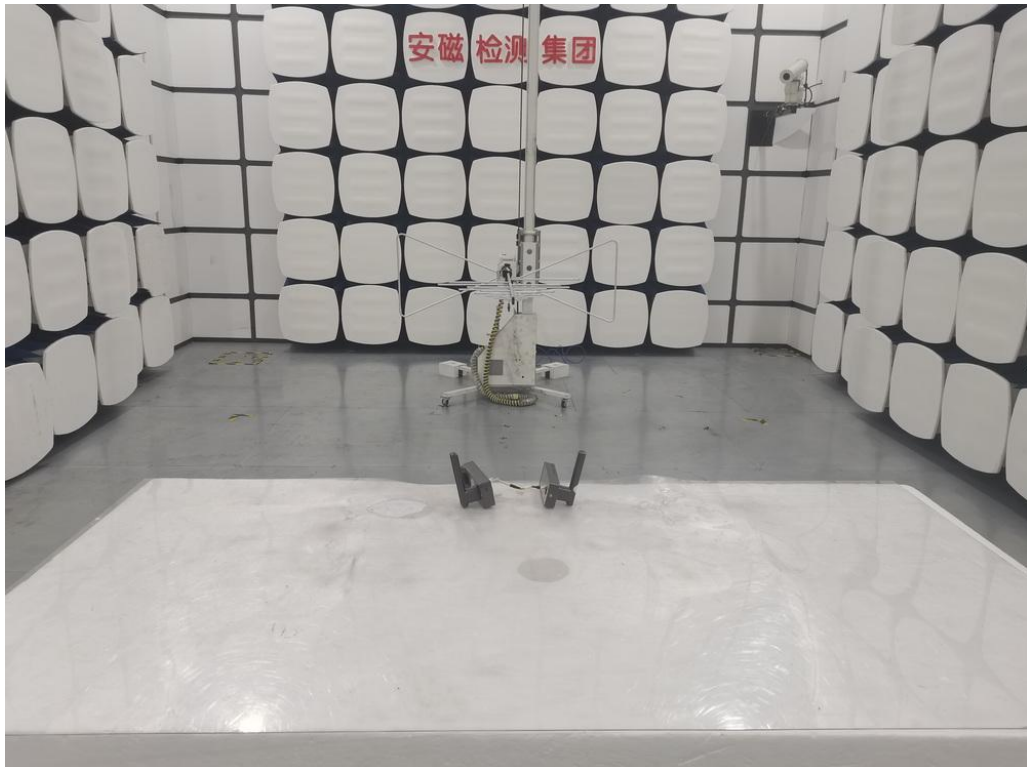
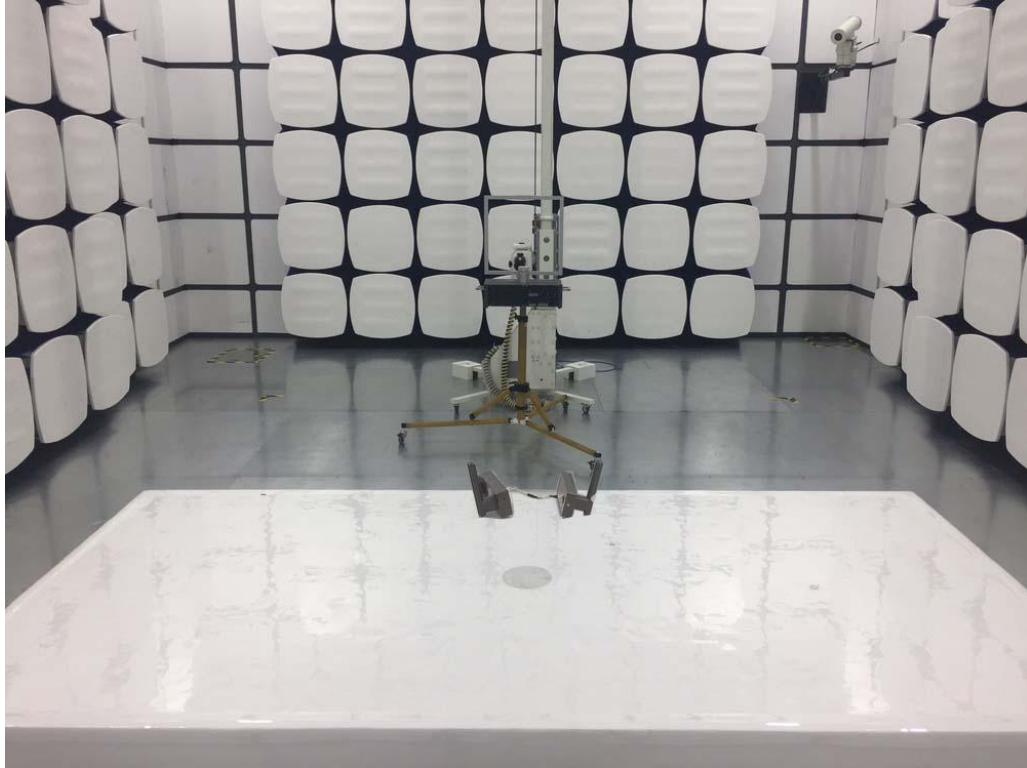


VERTICAL



HORIZONTAL

6.6 Radiated Measurement Photos:



7 FREQUENCY STABILITY MEASUREMENT

7.1 FREQUENCY STABILITY LIMITS

FCC Part 15.225(e)

the frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ of the operating frequency over a temperature variation of -20 degrees to $+ 50$ 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. For battery operated equipment, the equipment tests shall be performed using a new battery.

7.2 MEASUREMENT INSTRUMENTS LIST

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	CALIBRATED UNTIL
Spectrum Analyzer	Rohde & Schwarz	FSV40	US40240623	2022-11-12
Coaxial Cable	Gigalink Microwave	ZT40	19022092	2022-11-12
Antenna Connector	ARTHUR-YANG	2244-N1TG1	N/A	2022-11-12

Remark: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

7.3 TEST PROCEDURE

- The equipment under test was connected to an external AC power supply and the RF output was connected to a frequency counter via feed through attenuators. The EUT was placed inside the temperature chamber. After the temperature stabilized for approximately 20 minutes, the frequency of the output signal was recorded from the counter.
- At room temperature ($25 \pm 5^\circ\text{C}$), an external variable DC power supply was connected to the EUT. The frequency of the transmitter was measured for 115%, 100% and 85% of the nominal operating input voltage.
- For the actual test configuration, please refer to the related Item –EUT Test Photos.

7.4 EUT OPERATING CONDITIONS

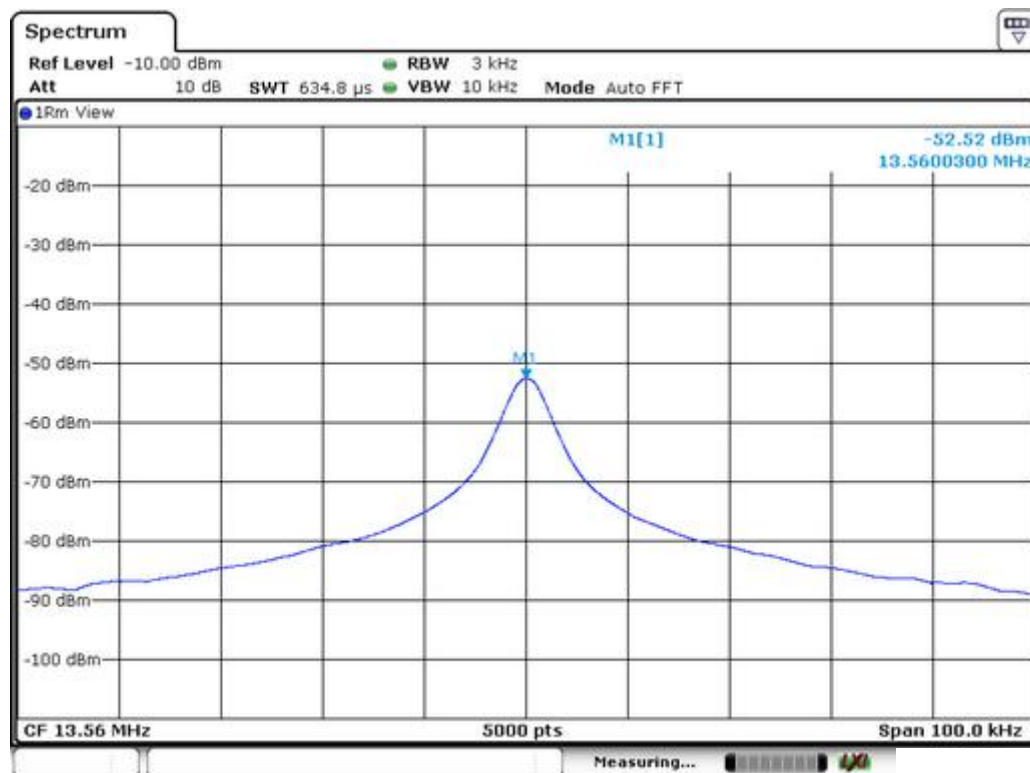
The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.

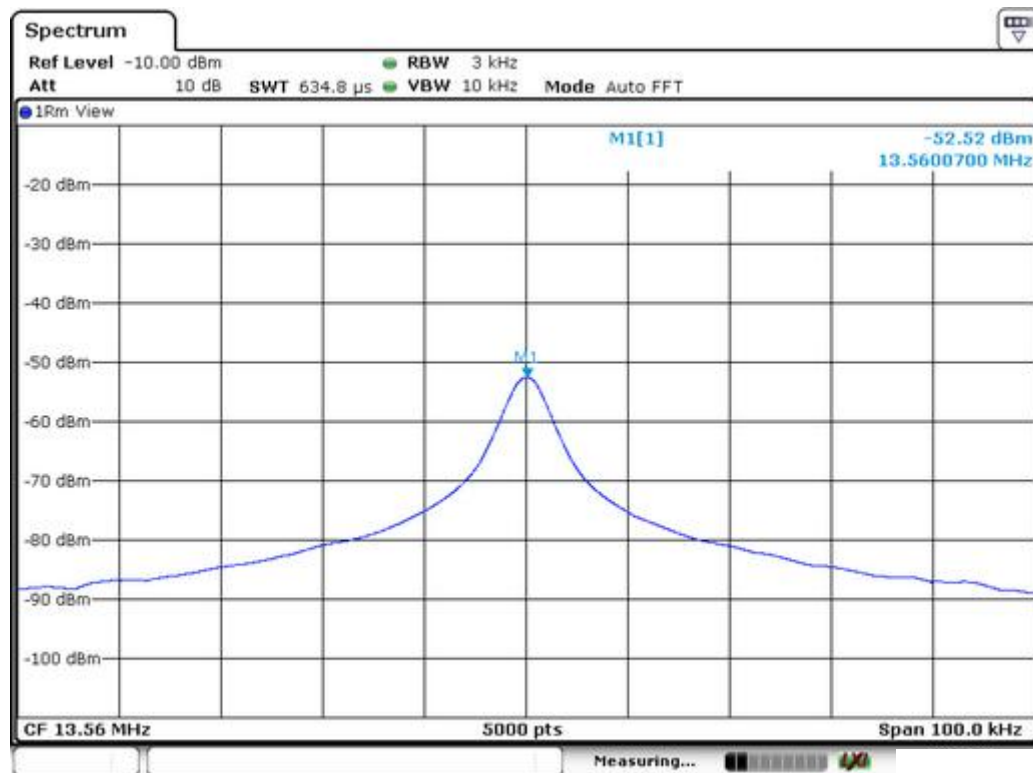
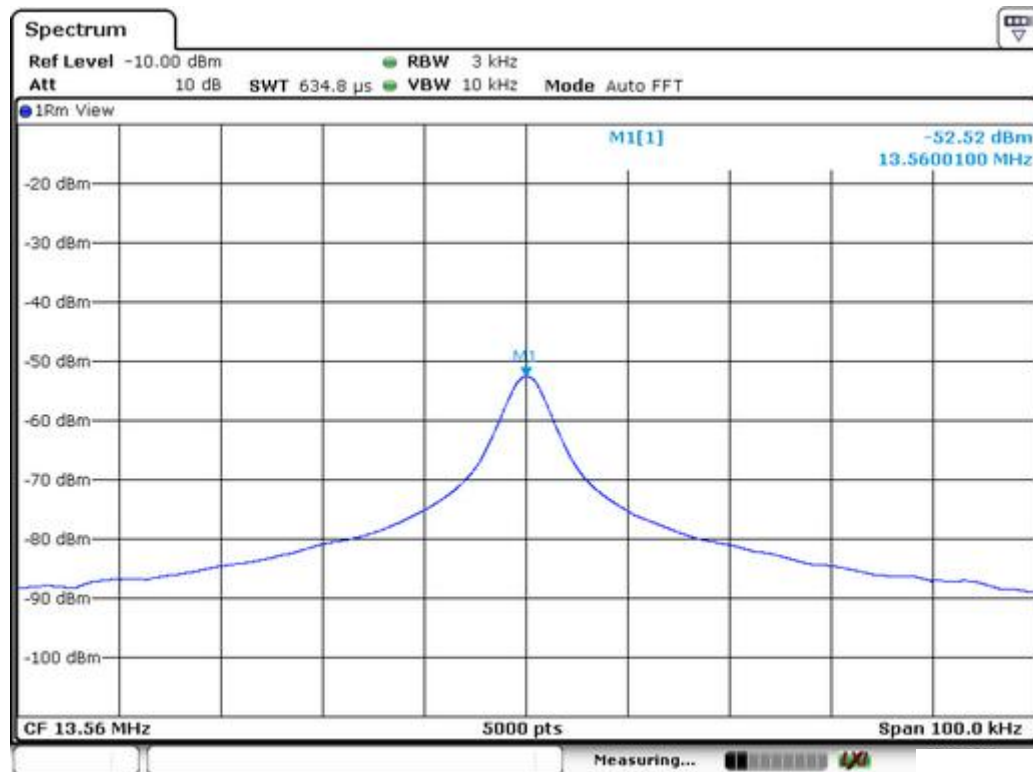
7.5 TEST RESULTS

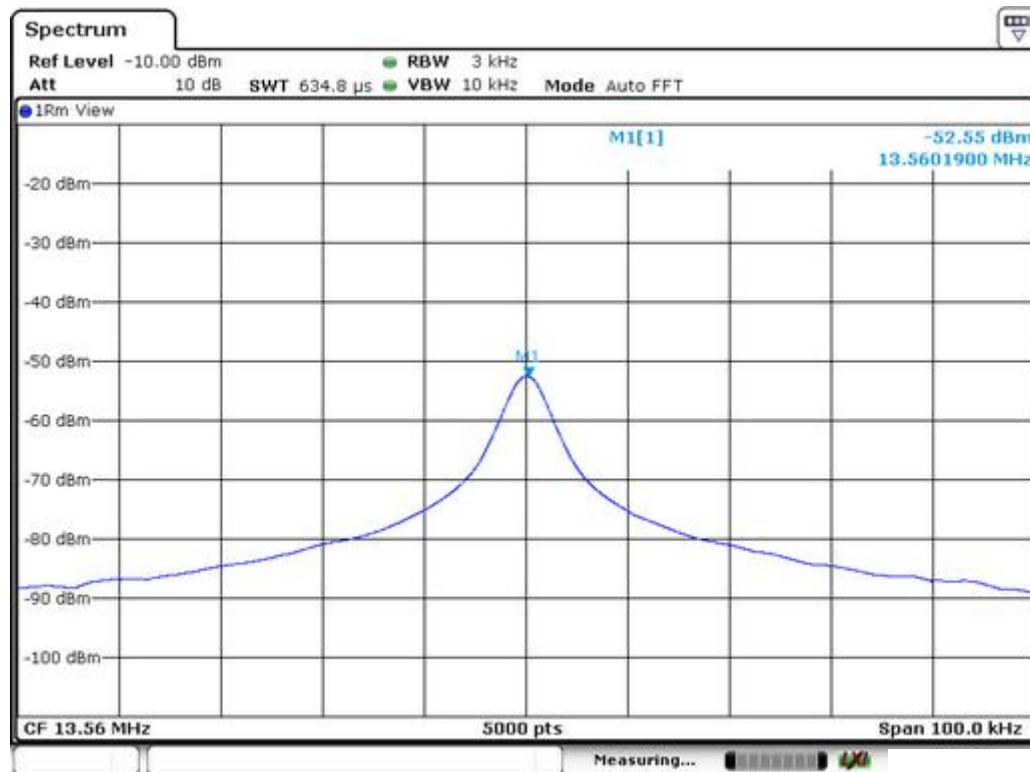
E.U.T :	Smart door lock	Test Mode :	TX Mode
Test Voltage :	DC 6V		

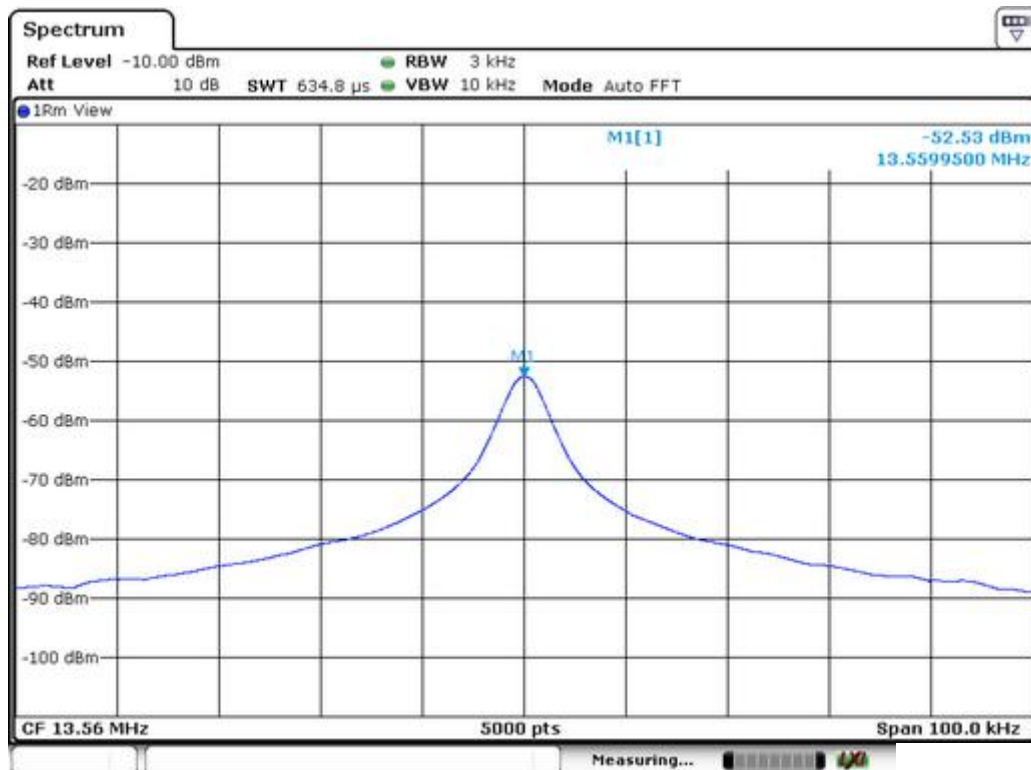
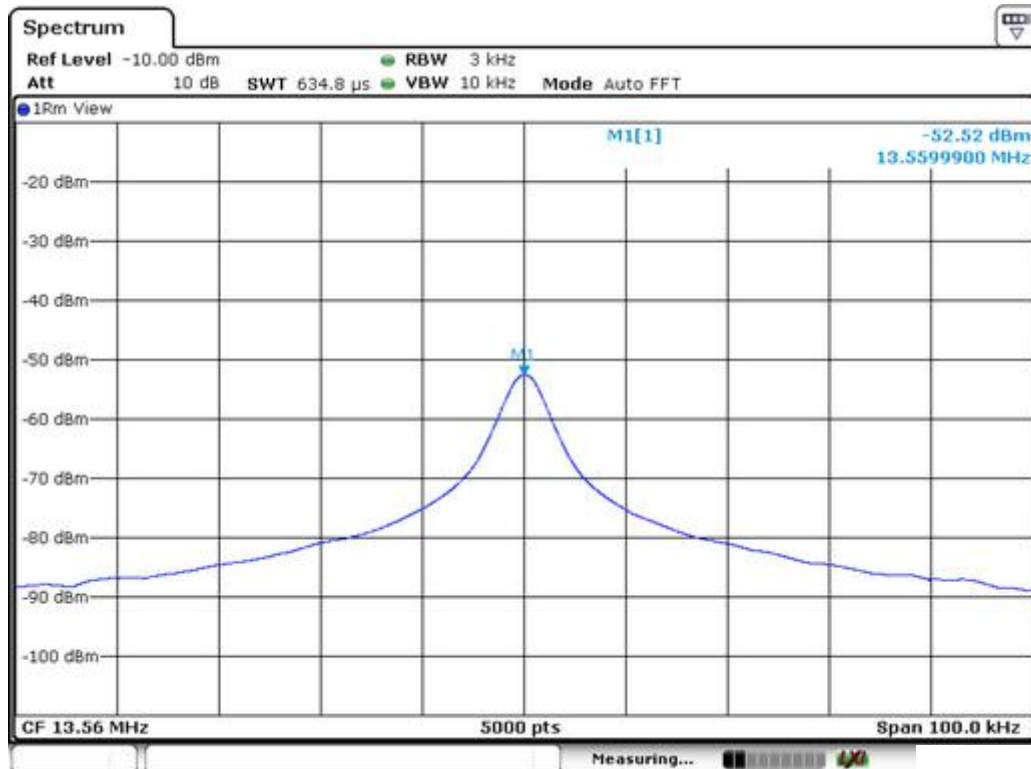
Frequency Stability Versus Environmental Temperature					
Temperature (°C)	Voltage (Vac)	Frequency (MHz)	Freq Error (ppm)	Limit (ppm)	Results
-20	DC 6V	13.5600300	2.21	100	PASS
-10	DC 6V	13.5600100	0.74	100	PASS
0	DC 6V	13.5600700	5.16	100	PASS
10	DC 6V	13.5601900	14.01	100	PASS
20	DC 6V	13.5601500	11.06	100	PASS
30	DC 6V	13.5599900	0.74	100	PASS
40	DC 6V	13.5599500	3.69	100	PASS
50	DC 6V	13.5603500	25.81	100	PASS

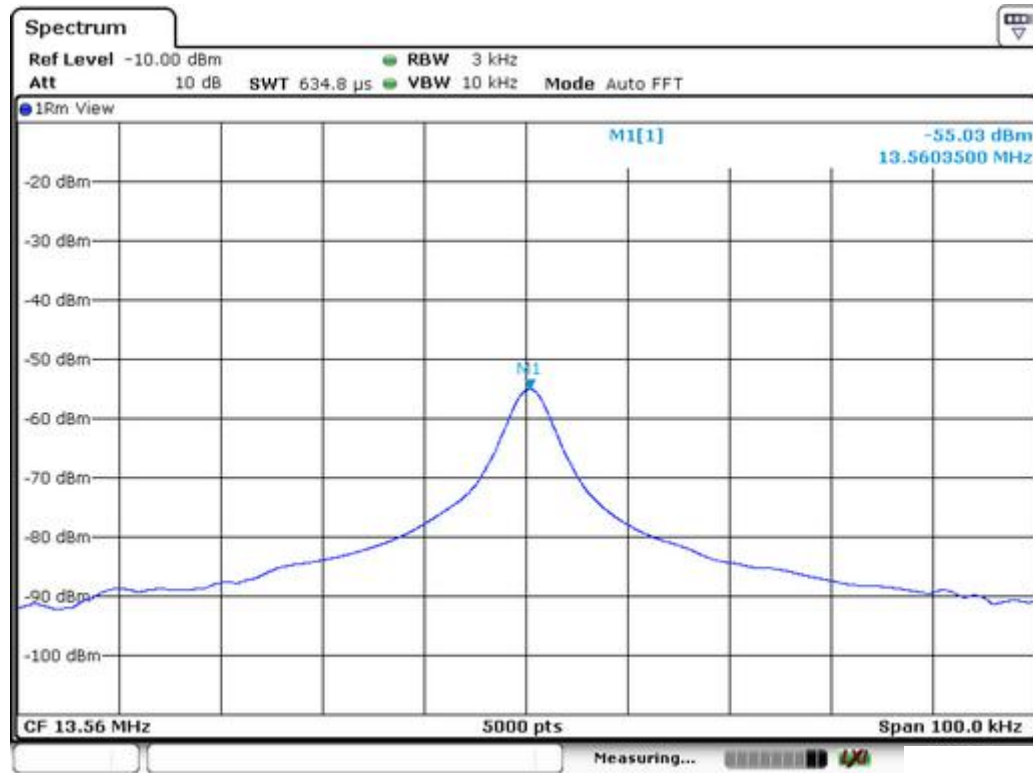
Frequency Stability Versus Environmental Temperature





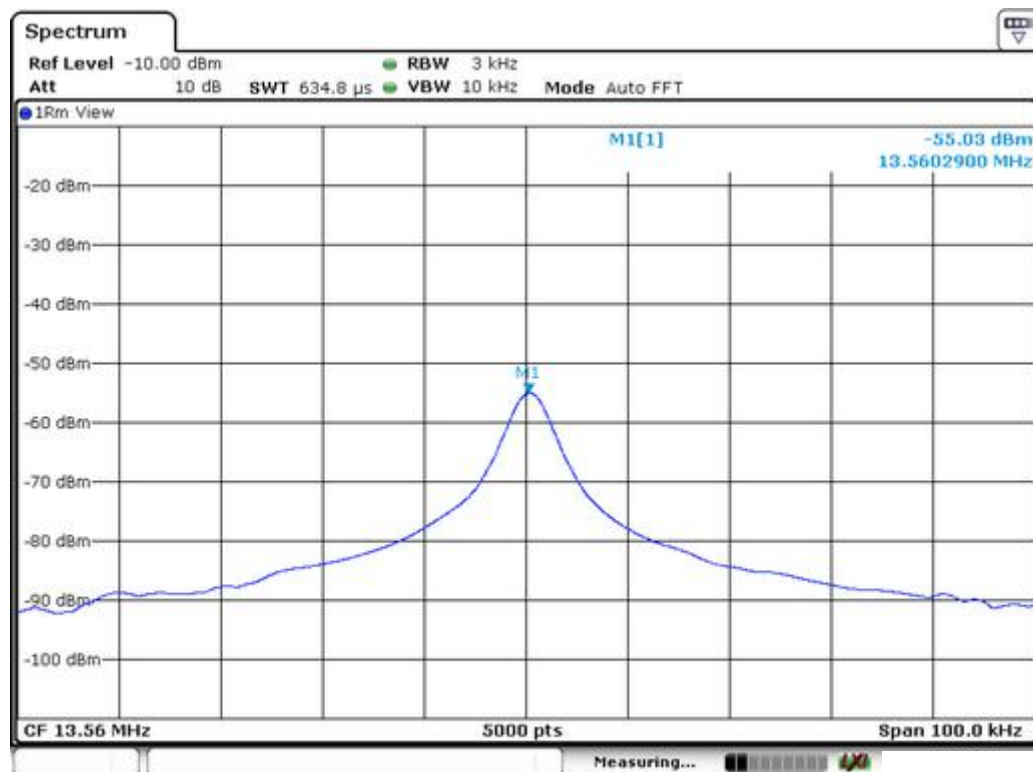


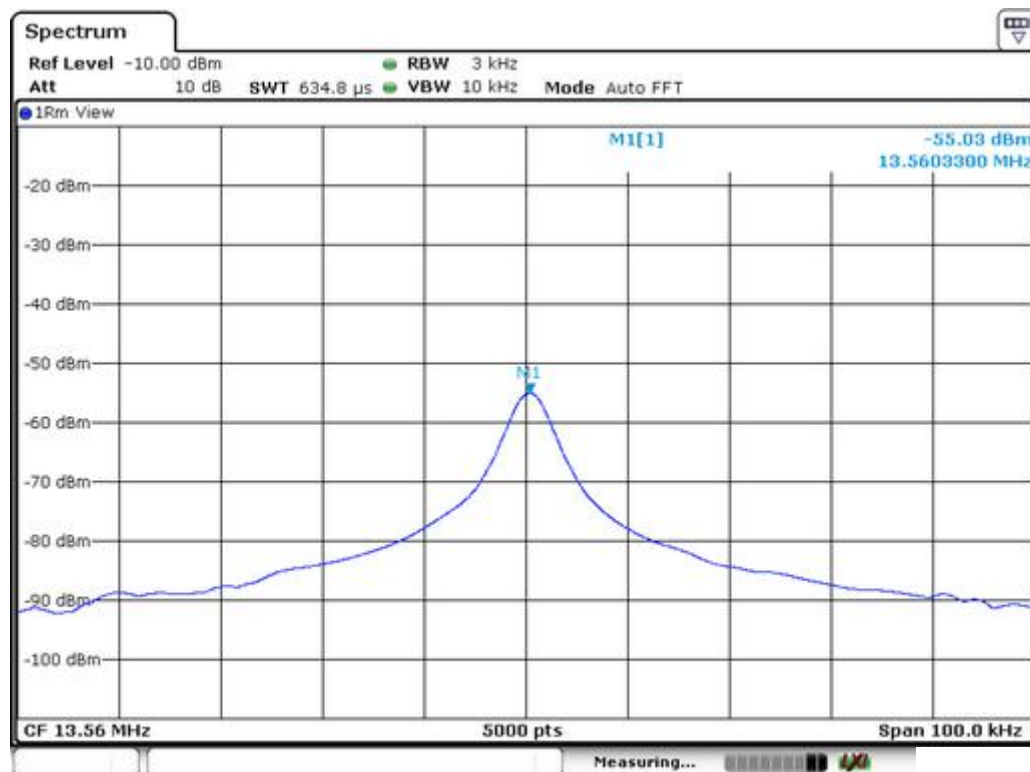
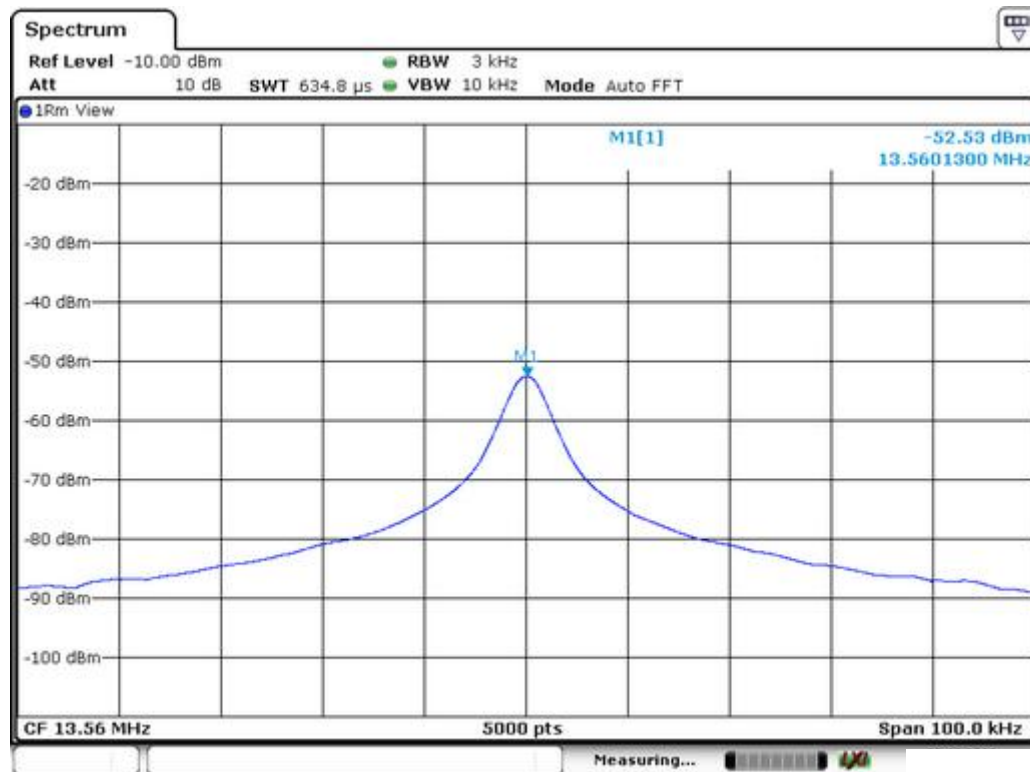




Frequency Stability Versus Input Voltage					
Temperature (°C)	Voltage (Vdc)	Frequency (MHz)	Freq Error (ppm)	Limit (ppm)	Results
25	5.1V	13.5602900	21.39	100	PASS
25	6V	13.5601300	9.59	100	PASS
25	6.9V	13.5603300	24.34	100	PASS

Frequency Stability Versus Input Voltage





8 EMISSION BANDWIDTH

8.1 Emission Bandwidth Limit

Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emissions in the specific band (13.553 – 13.567 MHz).

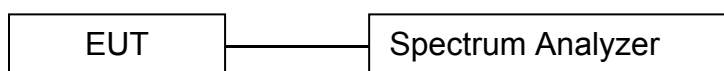
8.2 TEST INSTRUMENTS

Refer a test equipment and calibration data table in this test report.

8.3 TEST PROCEDURE

The bandwidth of the fundamental frequency was measured by spectrum analyzer with 3kHz RBW and 10kHz VBW. The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

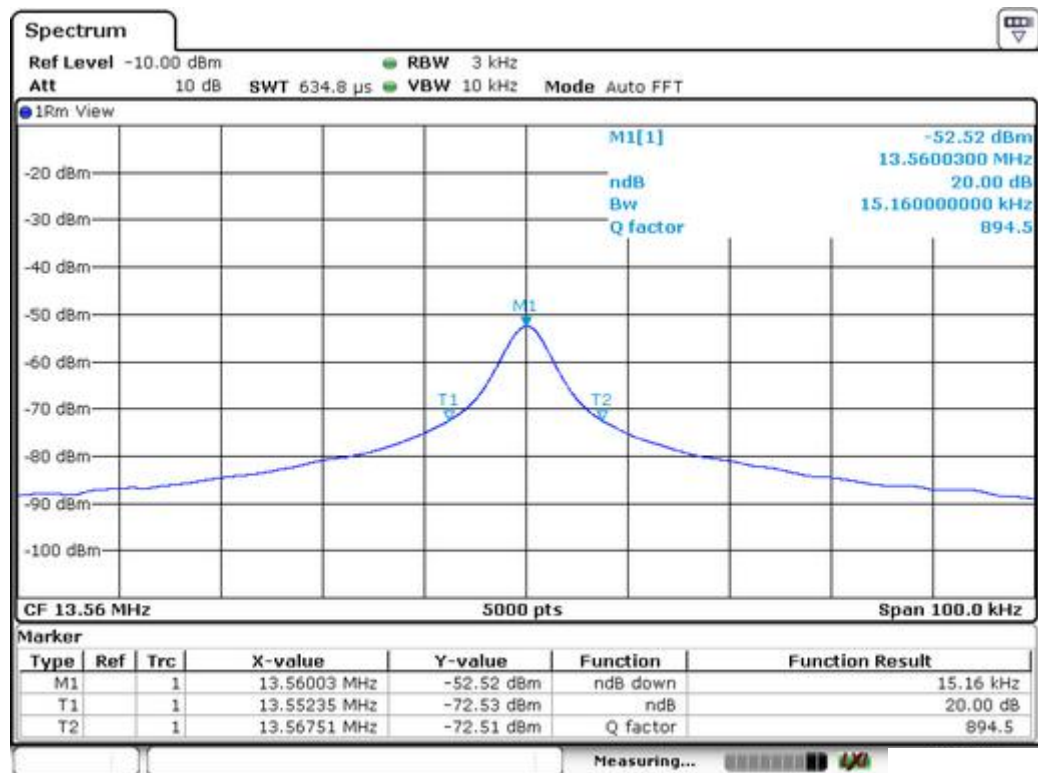
8.4 Test Setup



8.5 Test Result

Frequency (MHz)	20dB Bandwidth (kHz)	Results
13.56	15.16	PASS

BANDWIDTH TEST PLOT



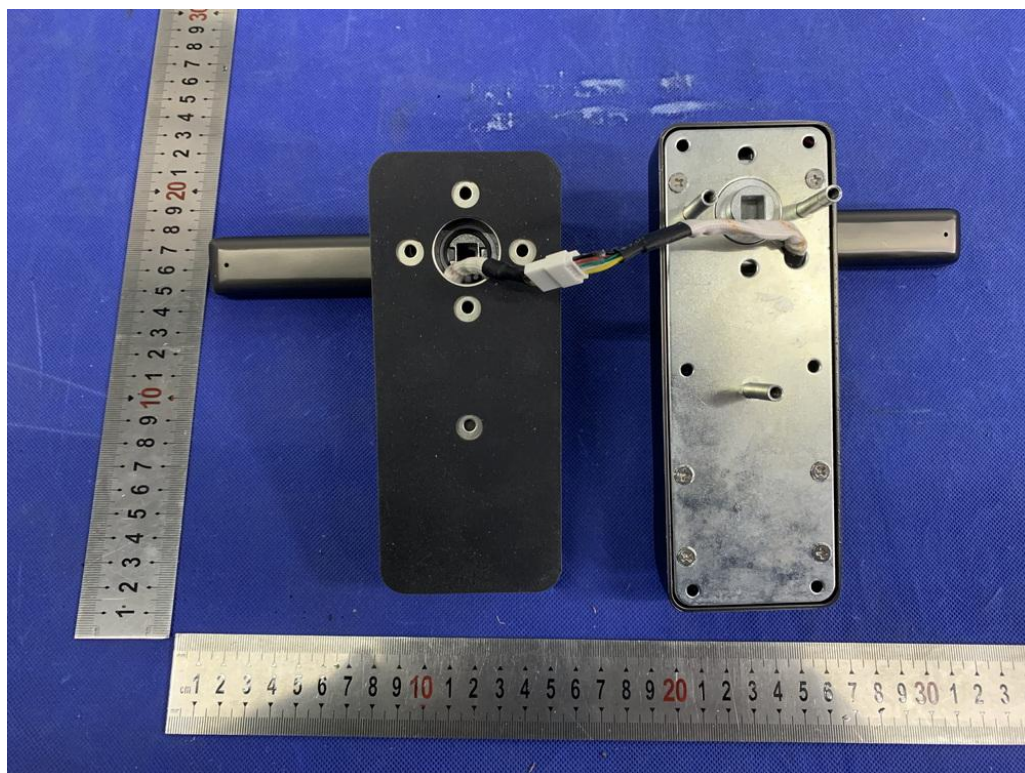
9 ANTENNA REQUIREMENT

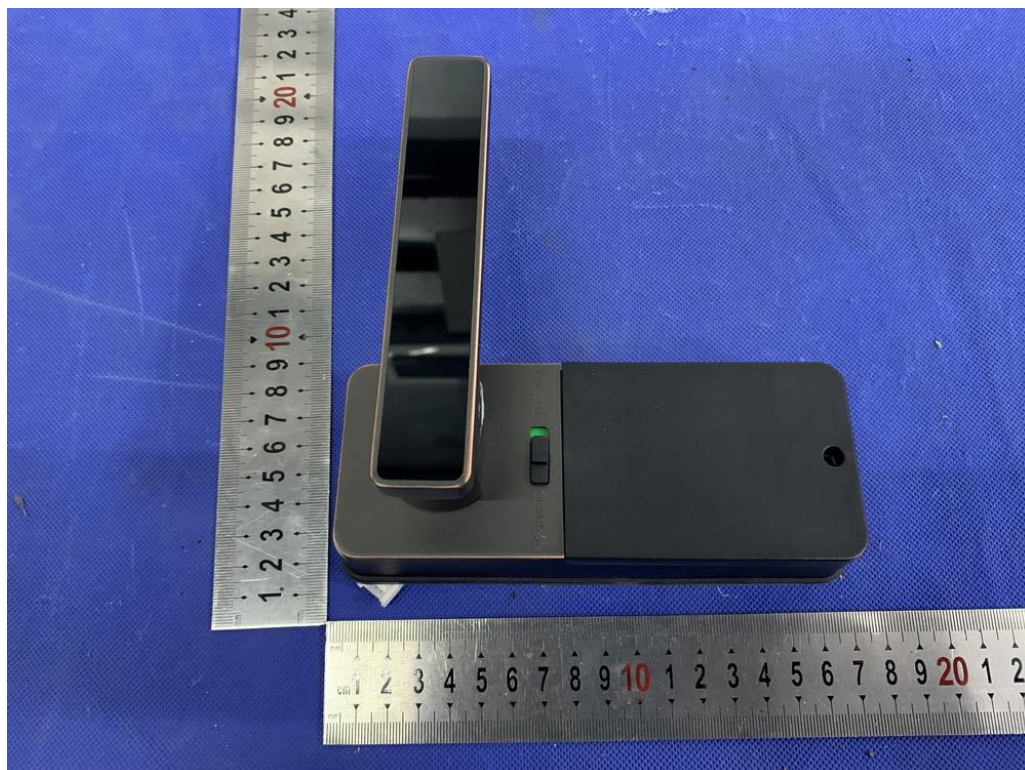
The EUT'S antenna is met the requirement of FCC part 15C section 15.203.

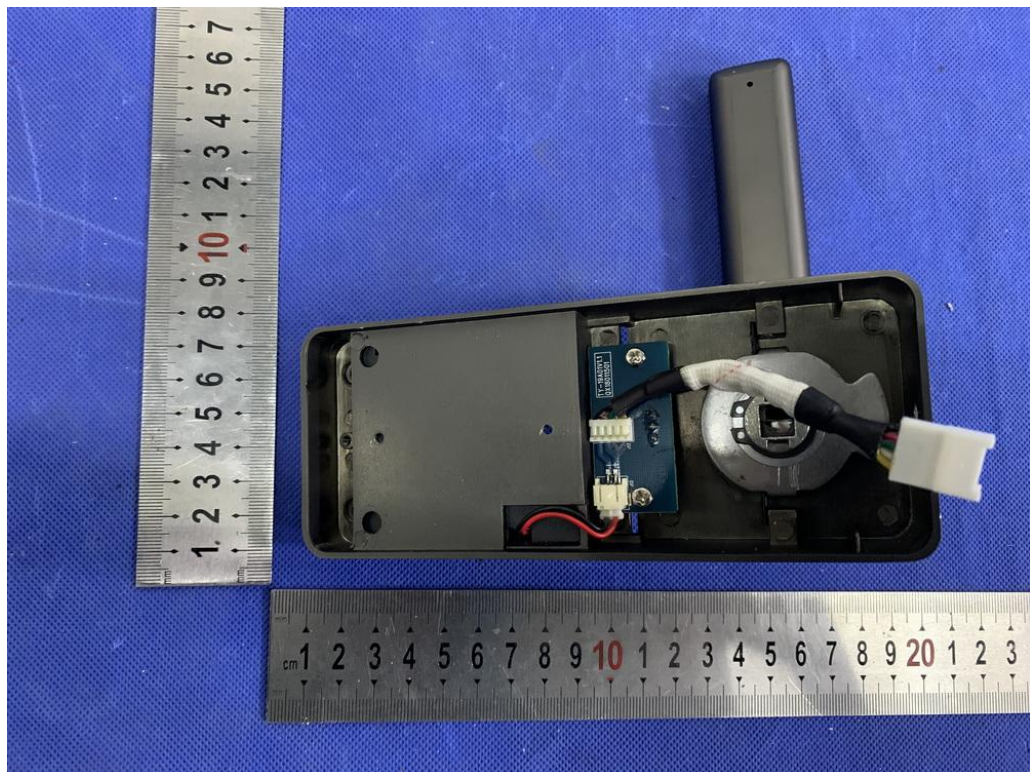
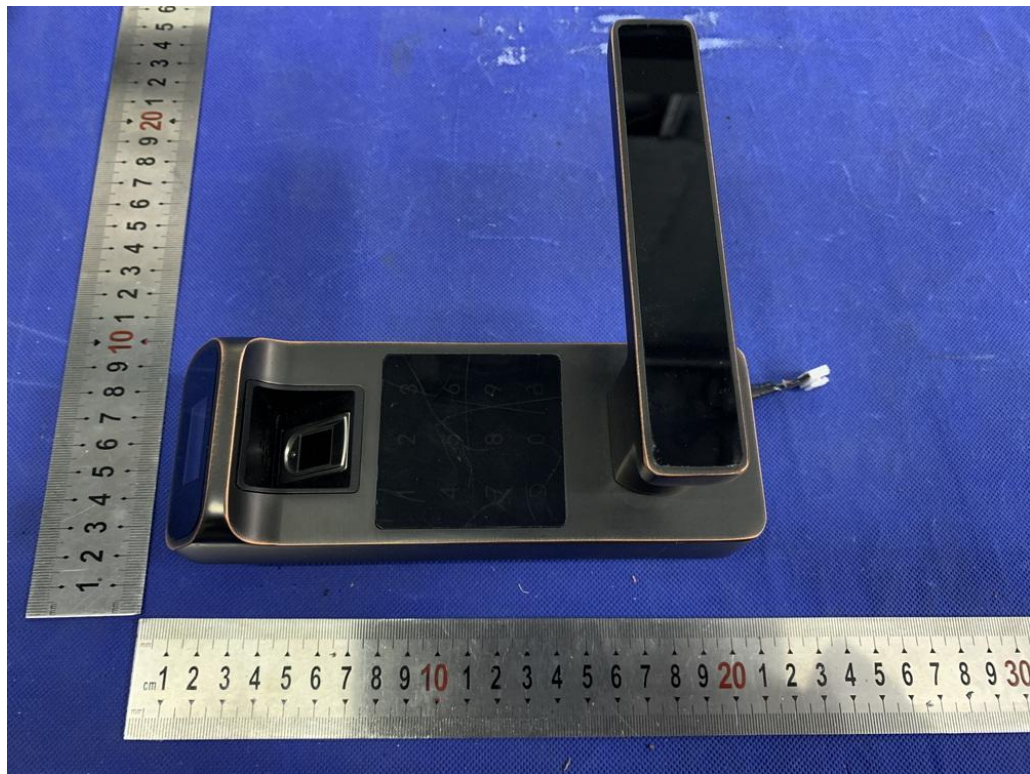
9.1 Result

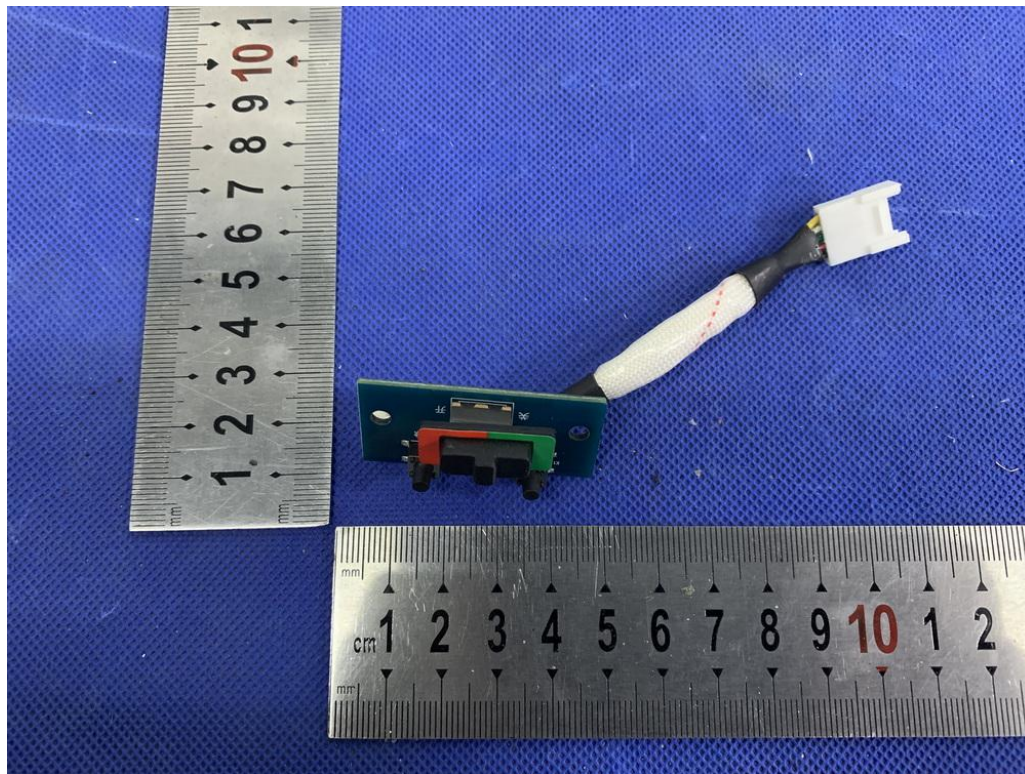
The EUT's antenna used an inter Loop Antenna and integral on the PCB. The antenna is permanently attached on PCB, no consideration of replacement. Please refer to internal Photos for details. So it meets the requirement.

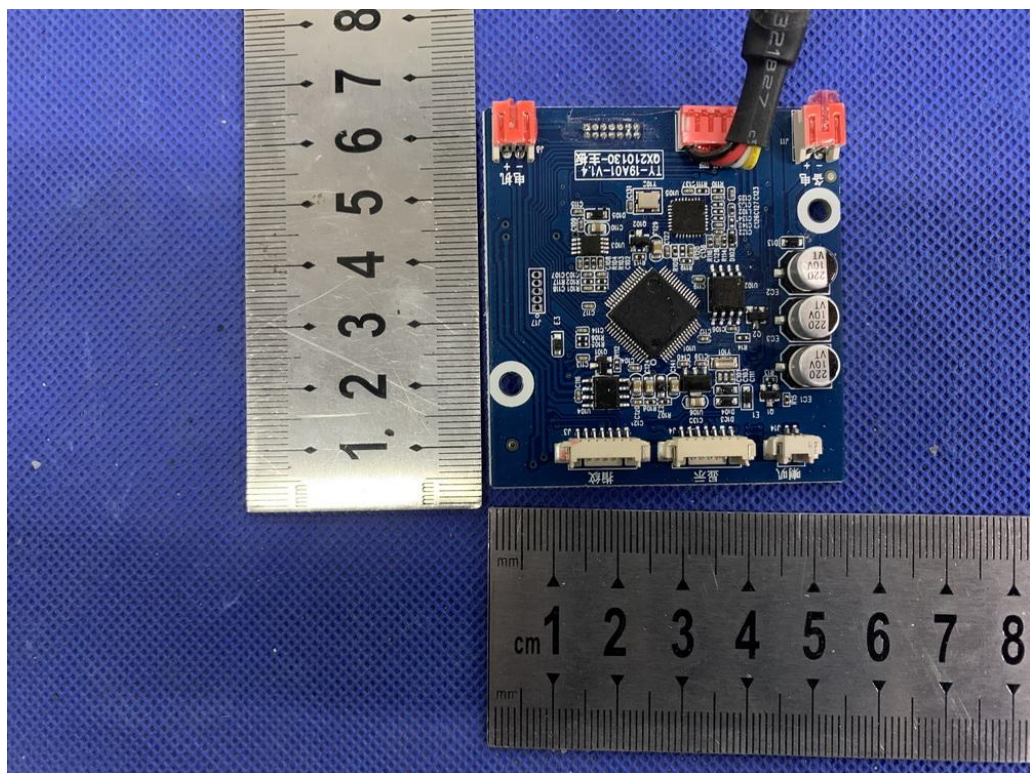
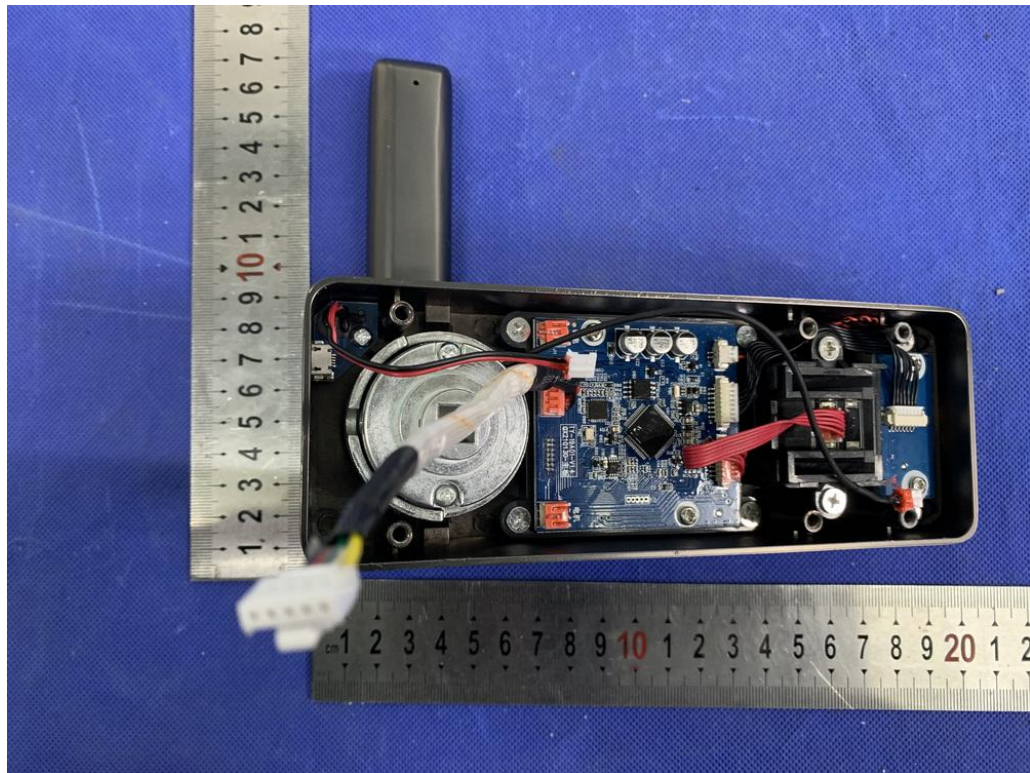
APPENDIX I (Photos of EUT)

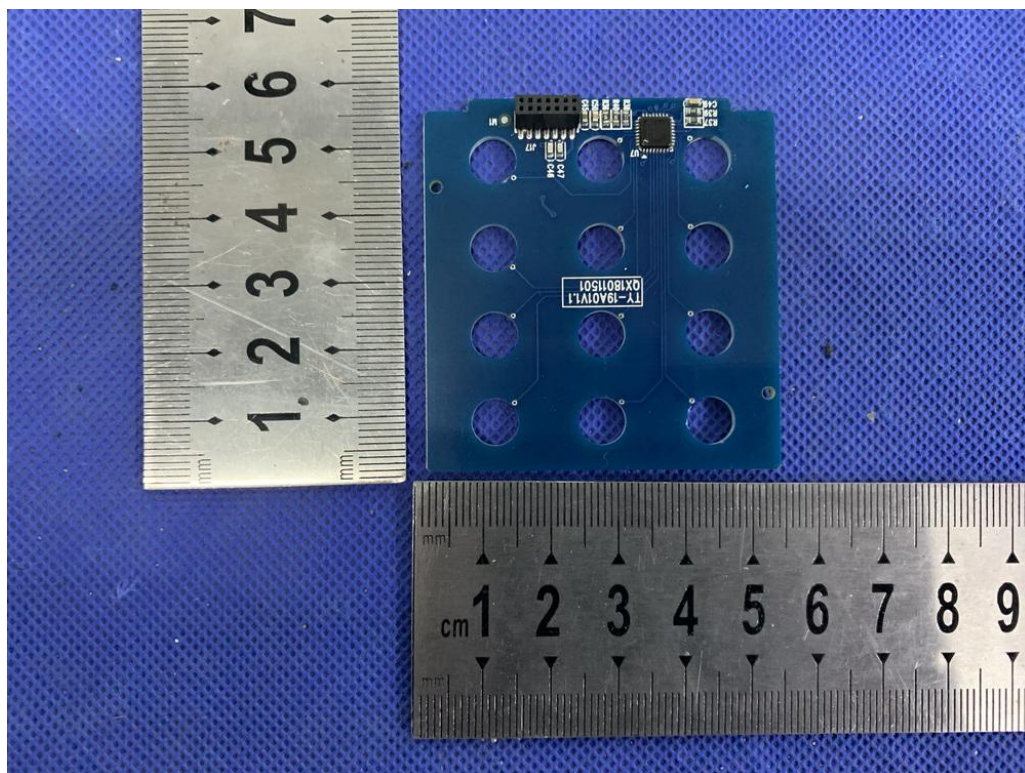
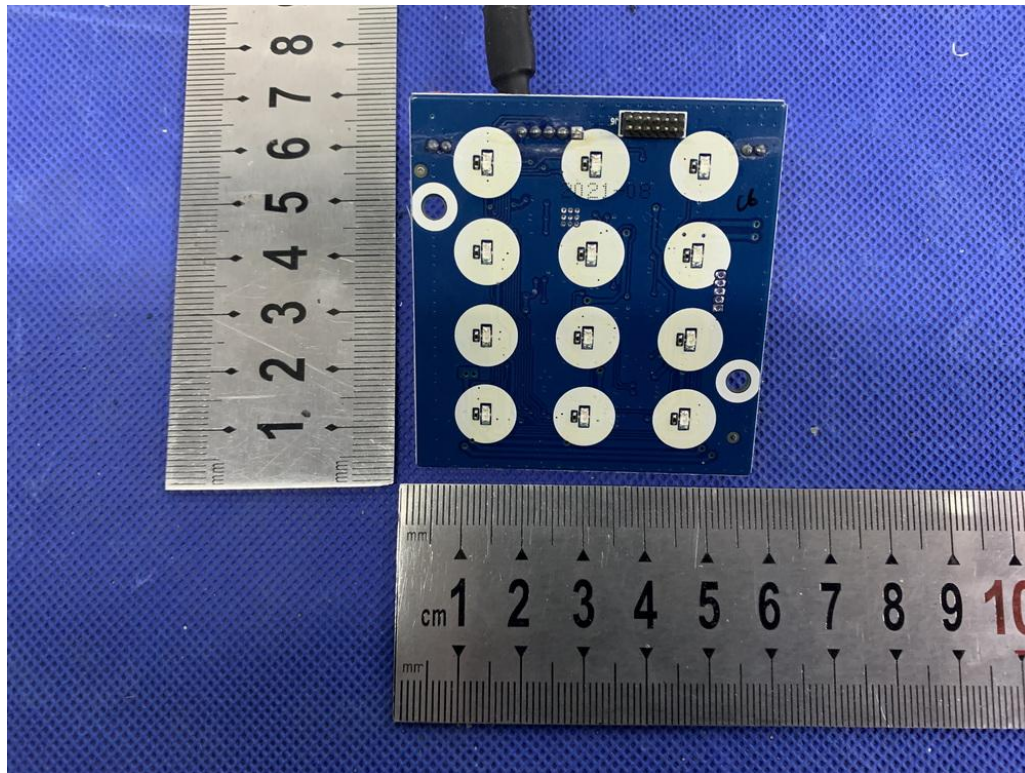


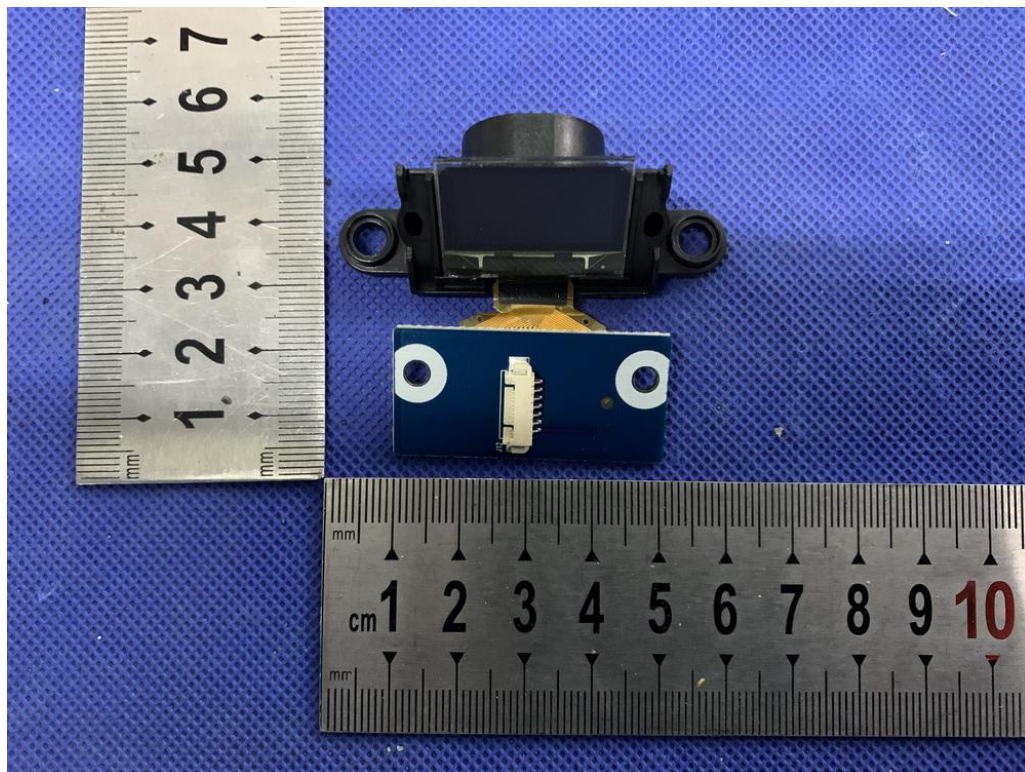
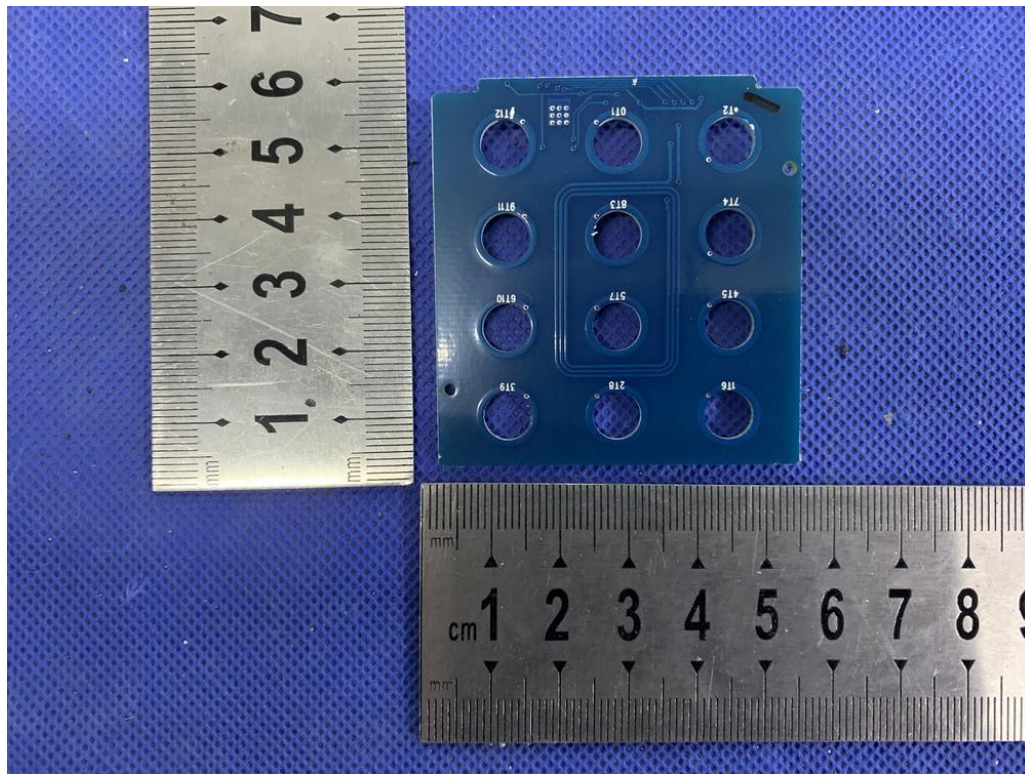


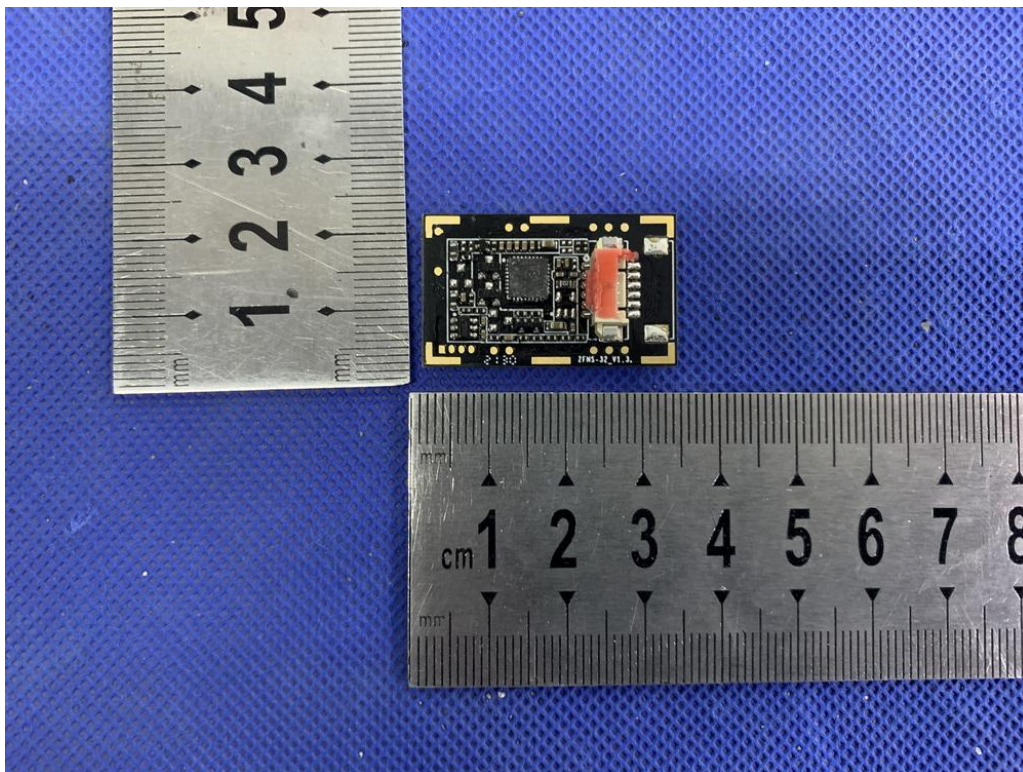
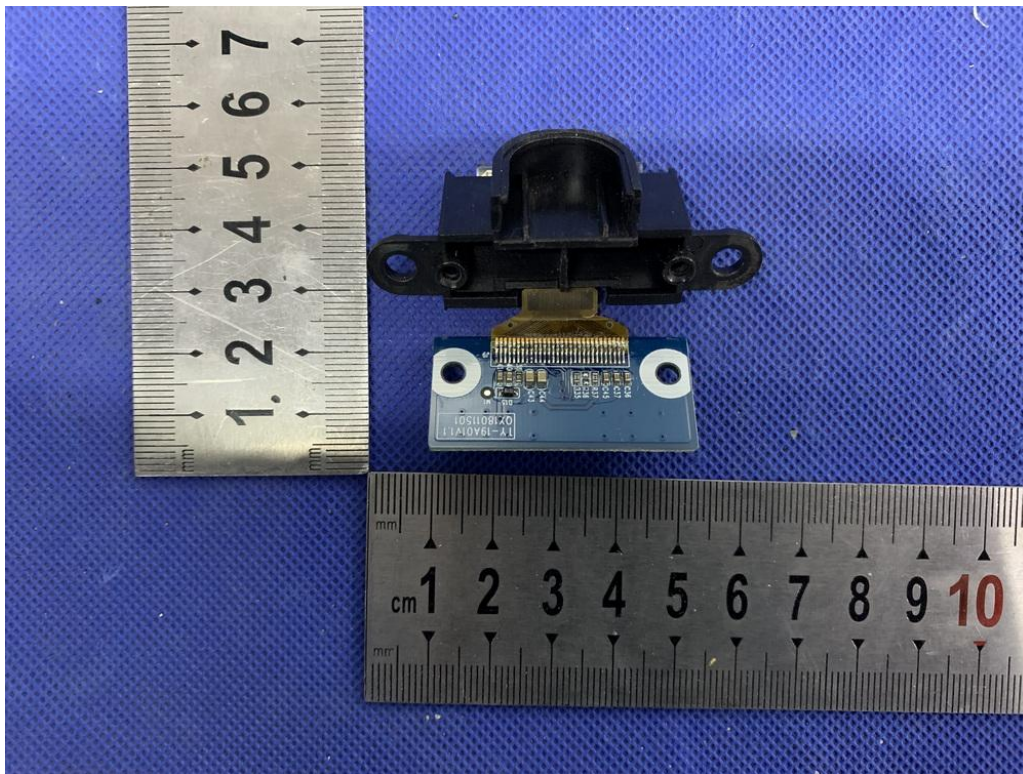


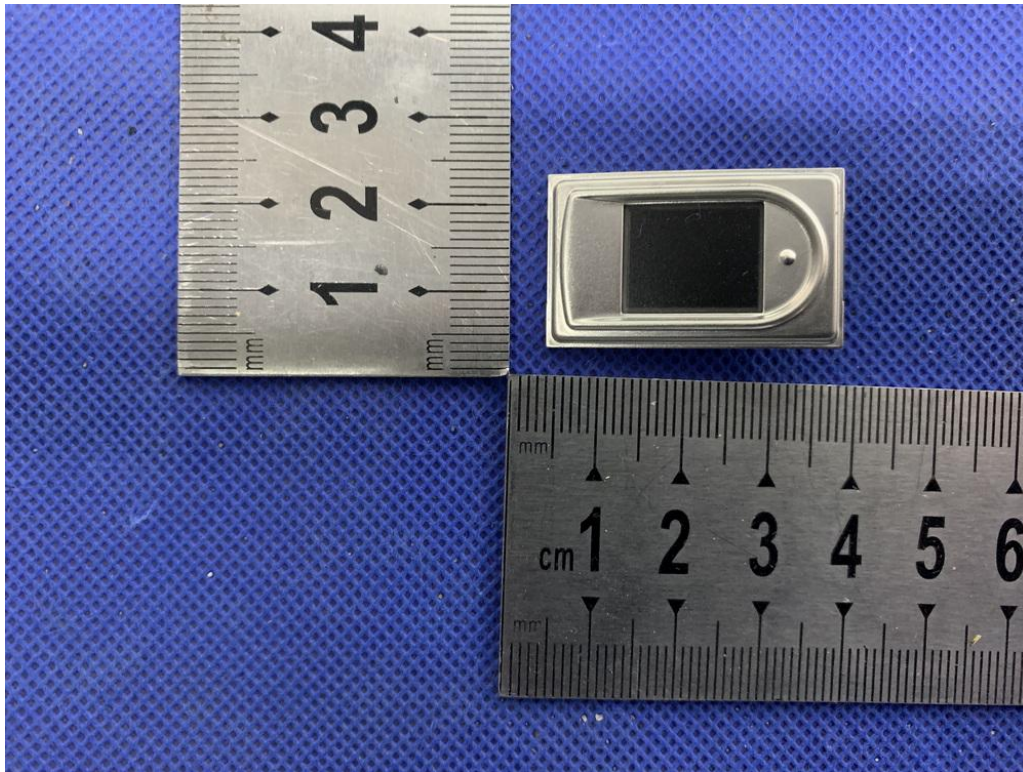












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