FCC PART 15 SUBPART C TEST REPORT

FCC PART 15 C (15.225)

Report Reference No.....:	**GTS20210708008-1-1**
FCC ID..... :	**2AVVS-UR5000CIS**
Compiled by (position+printed name+signature)..:	File administrators Yilia Zhong Yilia zhong
Supervised by (position+printed name+signature)..:	Test Engineer Jenny Zeng Jenny Zeng
Approved by (position+printed name+signature)..:	Manager Simon Hu Simon Hu
Date of issue.....:	Aug. 14, 2021
Representative Laboratory Name.:	**Shenzhen Global Test Service Co.,Ltd.**
Address.....:	No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong
Applicant's name.....:	**CIS GLOBAL L L C**
Address.....:	1791 W DAIRY PL SUITE 185, TUCSON, Arizona, 85705, United States
Test specification.....:	
Standard.....:	**FCC Part 15 C (15.225)**
TRF Originator.....:	Shenzhen Global Test Service Co.,Ltd.
Master TRF.....:	Dated 2014-12

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Test item description.....:	**U-level Assets Management Module**
Trade Mark.....:	N/A
Manufacturer.....:	ASIA PACIFIC CIS (WUXI) CO., LTD. SHUOFANG PLANT
Model/Type reference.....:	42U-UR5000CIS
List Model .....:	44U-UR5000CIS, 45U-UR5000CIS, 48U-UR5000CIS
Modulation Type.....:	ASK
Operation Frequency.....:	13.56 MHz
Hardware Version .....:	UR5000CIS-PM-6U-V1.0
Software Version.....:	Master_CIS_V1.1.bin
Rating.....:	DC 5V
Result.....:	**PASS**

TEST REPORT

Test Report No. :	GTS20210708008-1-1	Aug. 14, 2021 Date of issue

Equipment under Test	:	U-level Assets Management Module
Model /Type	:	42U-UR5000CIS
List Model	:	44U-UR5000CIS, 45U-UR5000CIS, 48U-UR5000CIS
Applicant	:	**CIS GLOBAL L L C**
Address	:	1791 W DAIRY PL SUITE 185, TUCSON, Arizona, 85705, United St ates
Manufacturer	:	**ASIA PACIFIC CIS (WUXI) CO., LTD. SHUOFANG PLANT**
Address	:	B1 BUILDING, NO. 5 FEIFENG ROAD, HIGH-TECH ZONE WUXI C ITY JIANGSU CHINA

Test Result:	**PASS**

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.

Contents

1. TEST STANDARDS 4
2. SUMMARY 5
2.1. General Remarks 5
2.2. Product Description 5
2.3. Equipment Under Test 6
2.4. Short description of the Equipment under Test (EUT) 6
2.5. Block Diagram of Test Setup 6
2.6. Related Submittal(s) / Grant (s) 6
2.7. EUT Exercise Software 6
2.8. Special Accessories 6
2.9. External I/O Cable 6
2.10. Modifications 6
3. TEST ENVIRONMENT 7
3.1. Address of the test laboratory 7
3.2. Test Facility 7
3.3. Environmental conditions 7
3.4. Statement of the measurement uncertainty 7
3.5. Summary of measurement results 8
3.6. Equipments Used during the Test 9
4. RADIATED MEASUREMENT 10
4.1. Standard Applicable 10
4.2. Measuring Instruments and Setting 10
4.3. Test Procedures 11
4.4. Test Setup Layout 13
4.5. Test Results 14
5. FIELD STRENGTH OF FUNDAMENTAL EMISSIONS AND MASK MEASUREMENT 16
5.1. Block Diagram of Test Setup 16
5.2. Field strength of fundamental emissions limit and Mask limit 16
5.3. Test Results 17
6. BANDWIDTH OF THE OPERATING FREQUENCY 18
6.1. Standard Applicable 18
6.2. Test Result 18
7. FREQUENCY STABILITY MEASUREMENT 19
7.1. Standard Applicable 19
7.2. Test Result 19
8. LINE CONDUCTED EMISSIONS 20
8.1. Standard Applicable 20
8.2. Block Diagram of Test Setup 20
8.3. Test Results 20
9. ANTENNA REQUIREMENTS 22
9.1. Standard Applicable 22
9.2. Antenna Connected Construction 22
9.2.1. Standard Applicable 22
9.2.2. Antenna Connector Construction 22
9.2.3. Results: Compliance 22
10. TEST SETUP PHOTOS OF THE EUT 23

11. EXTERNAL AND INTERNAL PHOTOS OF THE EUT.....25

1. TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.225: RADIO FREQUENCY DEVICES.
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices

2. SUMMARY

2.1. General Remarks

Date of receipt of test sample	:	Jul. 21, 2021
Testing commenced on	:	Jul. 21, 2021
Testing concluded on	:	Aug. 14, 2021

2.2. Product Description

Product Name	U-level Assets Management Module
Trade Mark	N/A
Model/Type reference	42U-UR5000CIS
List Models	44U-UR5000CIS, 45U-UR5000CIS, 48U-UR5000CIS
Model Declaration	PCB board, structure and internal of these model(s) are the same, Only the model name is different , So no additional models were tested.
Power supply:	DC 5V
Sample ID	GTS20210708008-1-1#
RFID(13.56MHz)	
Frequency Range	13.56MHz
Channel Number	1
Modulation Type	ASK
Antenna Description	Internal Antenna, 0dBi (Max.) Forty five identical Internal Antennas respectively.NFCdoes not support MIMO technology.

2.3. Equipment Under Test

Power supply system utilised

Power supply voltage	:	○	230V / 50 Hz	○	120V / 60Hz
		○	12 V DC	○	24 V DC
		●	Other (specified in blank below)		

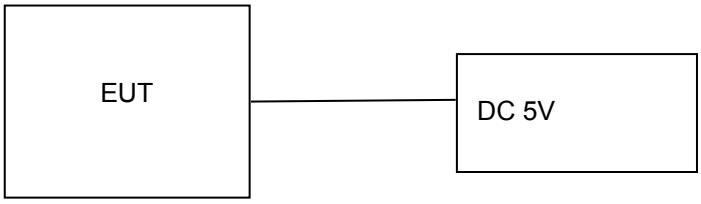
DC 5V

2.4. Short description of the Equipment under Test (EUT)

This is a U-level Assets Management Module

For more details, refer to the user's manual of the EUT.

2.5. Block Diagram of Test Setup



2.6. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AVVS-UR5000CIS** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.7. EUT Exercise Software

N/A

2.8. Special Accessories

Manufacturer	Description	Model	Serial Number	Certificate
ASIA PACIFIC CIS (WUXI) CO., LTD. SHUOFANG PLANT	Converter	UT-890A	UT037042641	--
Lenovo	Laptop	DESKTOP-G3FKNG9	--	--
Lenovo	Adapter	ADLX65CDGC2A	--	--

Remark: Converters, laptops and Adapters are only used for testing and are not shipped with the product.

2.9. External I/O Cable

I/O Port Description	Quantity	Cable
SATA 7P Port	1	--

2.10. Modifications

No modifications were implemented to meet testing criteria.

3. TEST ENVIRONMENT

3.1. Address of the test laboratory

Shenzhen Global Test Service Co.,Ltd.
No.7-101 and 8A-104, Building 7 and 8, DCC Cultural and Creative Garden, No.98, Pingxin North Road, Shangmugu Community, Pinghu Street, Longgang District, Shenzhen, Guangdong

3.2. Test Facility

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

CNAS (No. CNAS L8169)
Shenzhen Global Test Service Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2019 General Requirements) for the Competence of Testing and Calibration Laboratories.
A2LA (Certificate No. 4758.01)
Shenzhen Global Test Service Co., Ltd. has been assessed by the American Association for Laboratory Accreditation (A2LA). Certificate No. 4758.01.
Industry Canada Registration Number. is 24189.
FCC Designation Number is CN1234.
FCC Registered Test Site Number is165725.

3.3. Environmental conditions

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

Temperature:	15-35 ° C
Humidity:	30-60 %
Atmospheric pressure:	950-1050mbar

3.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen Global Test Service Co.,Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.
Hereafter the best measurement capability for Shenzhen GTS laboratory is reported:

Test	Range	Measurement Uncertainty	Notes
Radiated Emission	30~1000MHz	4.10 dB	(1)
Radiated Emission	1~18GHz	4.32 dB	(1)
Radiated Emission	18-40GHz	5.54 dB	(1)
Conducted Disturbance	0.15~30MHz	3.12 dB	(1)

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

3.5. Summary of measurement results

Applied Standard: FCC Part 15 Subpart C			
Test Items	**FCC Rules**	**Test Sample**	**Result**
Line Conducted Emissions	§15.207(a)	GTS20210708008-1-1 #	PASS
Field Strength of Fundamental Emissions	§15.225(a)(b)(c)	GTS20210708008-1-1 #	PASS
Radiated Emissions	§15.225(d) & §15.209	GTS20210708008-1-1 #	PASS
20dB Bandwidth	§ 15.215	GTS20210708008-1-1 #	PASS
Frequency Stability	§15.225(e)	GTS20210708008-1-1 #	PASS
Antenna Requirement	§15.203	GTS20210708008-1-1 #	PASS

Remark:
1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed
3. Note 1 – Test results inside test report;
4. Note 2 – Test results in other test report (SAR Report).
5. We tested all test mode and recorded worst case in report

3.6. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
LISN	CYBERTEK	EM5040A	E1850400105	2021/07/24	2022/07/23
LISN	R&S	ESH2-Z5	893606/008	2021/07/24	2022/07/23
EMI Test Receiver	R&S	ESPI3	101841-cd	2021/07/24	2022/07/23
EMI Test Receiver	R&S	ESCI7	101102	2020/09/20	2021/09/19
Spectrum Analyzer	Agilent	N9020A	MY48010425	2020/09/20	2021/09/19
Spectrum Analyzer	R&S	FSV40	100019	2021/07/24	2022/07/23
Vector Signal generator	Agilent	N5181A	MY49060502	2021/07/14	2022/07/13
Signal generator	Agilent	N5182A	3610AO1069	2020/09/20	2021/09/19
Climate Chamber	ESPEC	EL-10KA	A20120523	2020/09/20	2021/09/19
Controller	EM Electronics	Controller EM 1000	N/A	N/A	N/A
Horn Antenna	Schwarzbeck	BBHA 9120D	01622	2020/11/08	2021/11/07
Active Loop Antenna	Beijing Da Ze Technology Co.,Ltd.	ZN30900C	15006	2020/10/11	2021/10/10
Bilog Antenna	Schwarzbeck	VULB9163	000976	2021/07/26	2022/07/25
Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2020/11/08	2021/11/07
Amplifier	Schwarzbeck	BBV 9743	#202	2021/07/24	2022/07/23
Amplifier	Schwarzbeck	BBV9179	9719-025	2021/07/24	2022/07/23
Amplifier	EMCI	EMC051845B	980355	2021/07/24	2022/07/23
Temperature/Humidity Meter	Gangxing	CTH-608	02	2021/07/24	2022/07/23
High-Pass Filter	K&L	9SH10-2700/X12750-O/O	KL142031	2021/07/24	2022/07/23
High-Pass Filter	K&L	41H10-1375/U12750-O/O	KL142032	2021/07/24	2022/07/23
RF Cable(below 1GHz)	HUBER+SUHNER	RG214	RE01	2021/07/24	2022/07/23
RF Cable(above 1GHz)	HUBER+SUHNER	RG214	RE02	2021/07/24	2022/07/23
Data acquisition card	Agilent	U2531A	TW53323507	2021/07/24	2022/07/23
Power Sensor	Agilent	U2021XA	MY5365004	2021/07/24	2022/07/23
Test Control Unit	Tonscend	JS0806-1	178060067	2021/07/22	2022/07/21
Automated filter bank	Tonscend	JS0806-F	19F8060177	2021/07/24	2022/07/23
EMI Test Software	Tonscend	JS1120-1	Ver 2.6.8.0518	/	/
EMI Test Software	Tonscend	JS1120-3	Ver 2.5.77.0418	/	/
EMI Test Software	Tonscend	JS32-CE	Ver 2.5	/	/
EMI Test Software	Tonscend	JS32-RE	Ver 2.5.1.8	/	/

Note: The Cal.Interval was one year.

4. RADIATED MEASUREMENT

4.1. Standard Applicable

According to §15.209/ §15.205

15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

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\)
13.36-13.41			

\1\ Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

\2\ Above 38.6

According to §15.247 (d): 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) limit in the table below has to be followed.

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

4.2. Measuring Instruments and 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	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B kHz for Average
RB / VB (Emission in non-restricted band)	1MHz / 1MHz for Peak, 1 MHz / 1/B 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

4.3. Test Procedures

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 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 (± 45°) 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 (± 45°) 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:

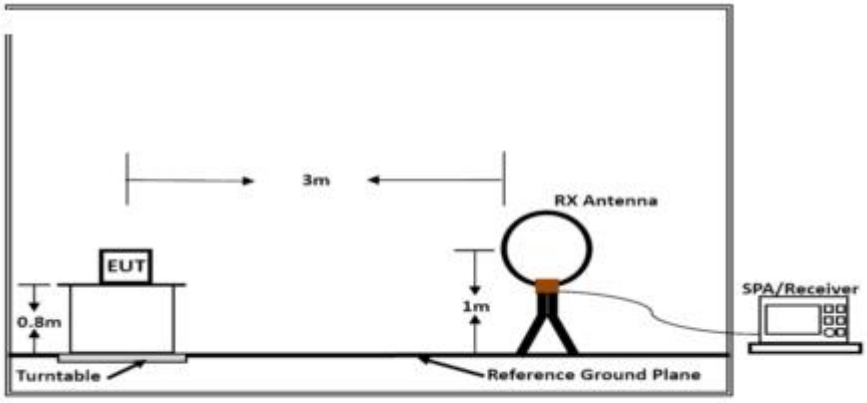
--- The antenna is moved spherical over the EUT in different polarizations of the antenna.

Final measurement:

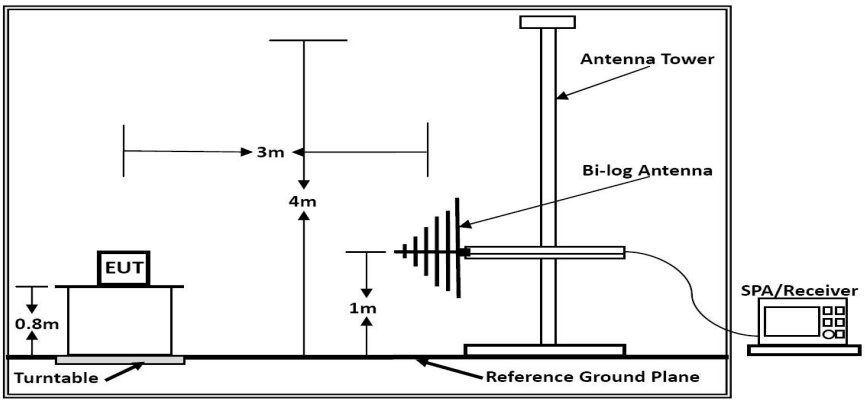
--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.

--- 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.

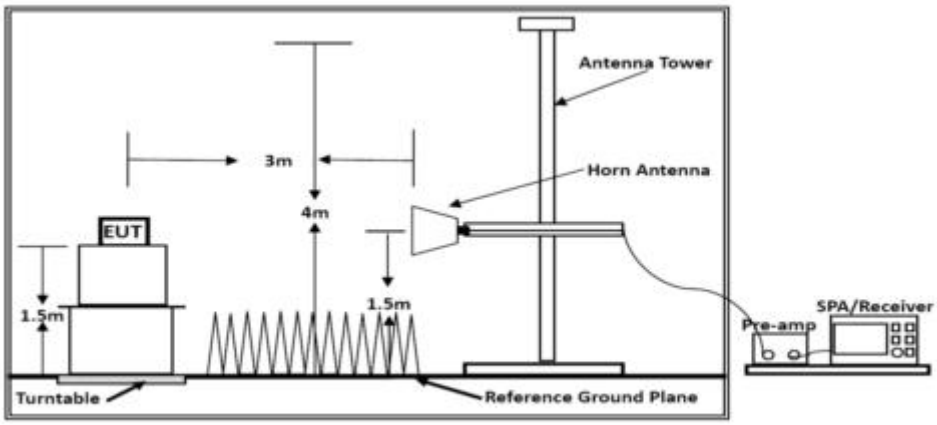
4.4. Test Setup Layout



Below 30MHz



Below 1GHz



Above 1GHz

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

Distance extrapolation factor = 20 log (specific distanc [3m] / test distance [1m]) (dB);
Limit line = specific limits (dBuV) + distance extrapolation factor [6 dB].

4.5. Test Results

Temperature	24.5℃	Humidity	53.7%
Test Engineer	Jenny Zeng	Configurations	NFC

PASS.

The test data please refer to following page:

9 KHz~30MHz

Freq. MHz	Reading dBuV	Factor dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark
0.099	--	--	--	107.69	--	--
0.970	--	--	--	67.87	--	--
5.409	30.51	20.30	50.81	69.54	-18.74	QP
9.480	31.82	20.32	52.14	69.54	-17.40	QP
10.048	37.98	20.18	58.16	69.54	-11.38	QP
17.830	30.46	20.12	50.58	69.54	-18.96	QP
21.930	31.20	19.94	51.14	69.54	-18.40	QP
25.090	32.08	19.95	52.03	69.54	-17.51	QP

*Note: Emission Level= Reading Level + Antenna Factor + Cable Loss

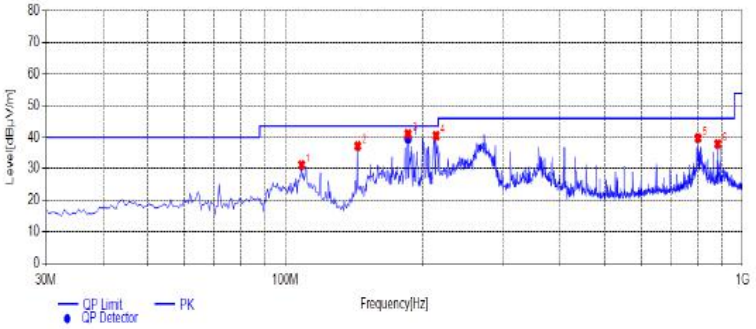
Margin = Emission Level Limit – Measured Values

"--" means noise floor.

30MHz ~ 1GHz

Horizontal

Test Graph



Suspected List											
NO.	Frequency [MHz]	Reading [dBμV/m]	Factor [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity	Remark
1	108.5700	39.36	-8.22	31.14	43.50	12.36	100	331	PK	Horizonta	PASS
2	143.9750	49.14	-11.88	37.26	43.50	6.24	100	48	PK	Horizonta	PASS
3	185.6850	51.58	-10.53	41.05	43.50	2.45	100	302	PK	Horizonta	PASS
4	213.8150	49.92	-9.43	40.49	43.50	3.01	100	321	PK	Horizonta	PASS
5	800.1800	38.55	1.22	39.77	46.00	6.23	100	89	PK	Horizonta	PASS
6	883.6000	35.77	2.13	37.90	46.00	8.10	100	128	PK	Horizonta	PASS

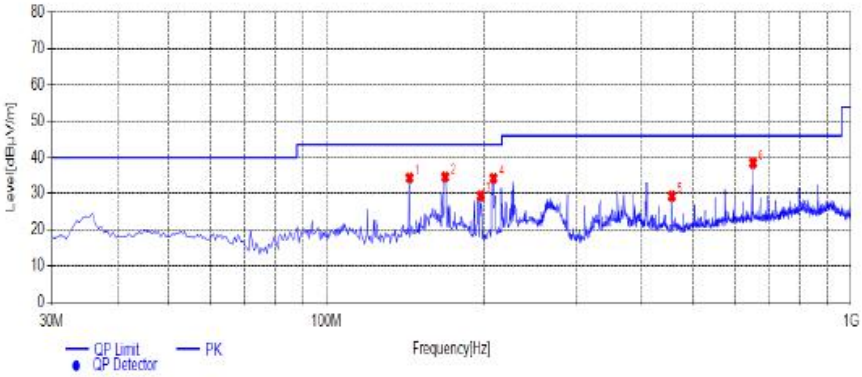
Quasi-peak Final Data List										
NO.	Frequency [MHz]	Reading [dBμV/m]	Factor [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Polarity	Remark
1	185.6850	50.23	-10.53	39.70	43.50	3.80	100	302	Horizontal	PASS

Note:1. Result (dBμV/m) = Reading(dBμV/m) + Factor (dB) .

2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

Vertical

Test Graph



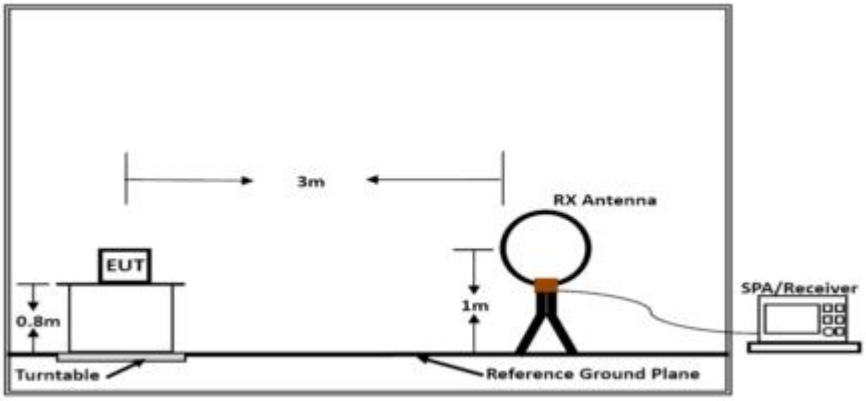
Suspected List											
NO.	Frequency [MHz]	Reading [dBμV/m]	Factor [dB]	Result [dBμV/m]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Angle [°]	Detector	Polarity	Remark
1	143.9750	46.25	-11.88	34.37	43.50	9.13	100	261	PK	Vertical	PASS
2	168.7100	46.11	-11.50	34.61	43.50	8.89	100	274	PK	Vertical	PASS
3	196.8400	38.69	-9.34	29.35	43.50	14.15	100	251	PK	Vertical	PASS
4	208.4800	43.38	-9.12	34.26	43.50	9.24	100	226	PK	Vertical	PASS
5	455.8300	33.95	-4.68	29.27	46.00	16.73	100	261	PK	Vertical	PASS
6	650.8000	39.41	-0.91	38.50	46.00	7.50	100	335	PK	Vertical	PASS

Note:1. Result (dBμV/m) = Reading(dBμV/m) + Factor (dB) .

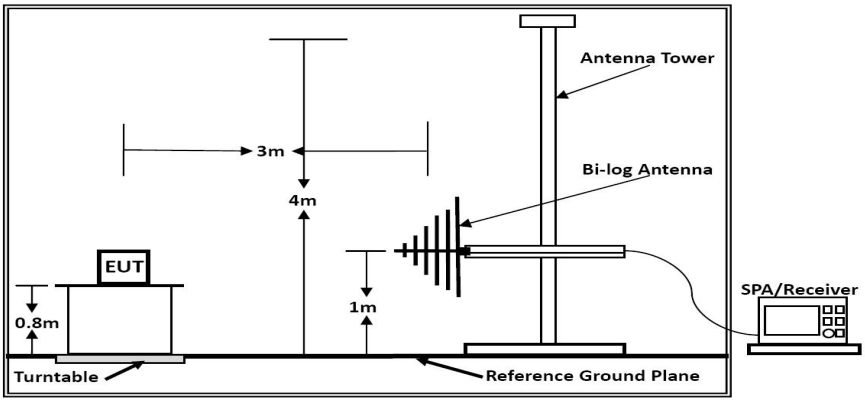
2. Factor (dB) = Antenna Factor (dB/m) + Cable loss (dB) - Pre Amplifier gain (dB).

5. FIELD STRENGTH OF FUNDAMENTAL EMISSIONS AND MASK MEASUREMENT

5.1. Block Diagram of Test Setup



Below 30MHz



Below 1GHz

5.2. Field strength of fundamental emissions limit and Mask limit

The field strength of fundamental emissions shall not exceed 15848 microvolts/meter at 30 meters. The emissions limit in this paragraph is based on measurement instrumentation employing a QP detector.

Frequencies (MHz)	Field Strength (microvolts/meter)	Field Strength (dBµV/m) at 10m	Field Strength (dBµV/m) at 3m
13.553 ~ 13.567MHz	15848 at 30m	103.08 (QP)	124 (QP)

Mask Limit:

Frequency (MHz)	Limit (dBuV/m)	Distance (m)
1.705-13.110	69.5	3
13.110-13.410	80.5	3
13.410-13.553	90.5	3
13.553-13.567	124.0	3
13.567-13.710	90.5	3
13.710-14.010	80.5	3
14.010-30.000	69.5	3

5.3. Test Results

Temperature	24.5℃	Humidity	53.7%
Test Engineer	Jenny Zeng	Configurations	NFC

PASS.

The test data please refer to following page:

	Freq.(MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Pol.	Remark
1	13.31	35.42	20.64	56.06	80.5	H	QP
2	13.85	14.47	20.64	35.11	80.5	H	QP
3	13.56	14.88	20.64	35.52	124.0	H	QP
4	13.1	14.86	20.64	35.50	69.5	H	QP
5	13.82	14.83	20.64	35.47	80.5	H	QP

*Note: Factor= Antenna Factor + Cable Loss

Emission level (dBμV/m) = 20 log Emission level (μV/m).

Measured distance is 3m.

All emissions emit from non-NFC function of digital unintentional emissions. All NFC's spurious emissions are below 20dB of limits.

6. BANDWIDTH OF THE OPERATING FREQUENCY

6.1. Standard Applicable

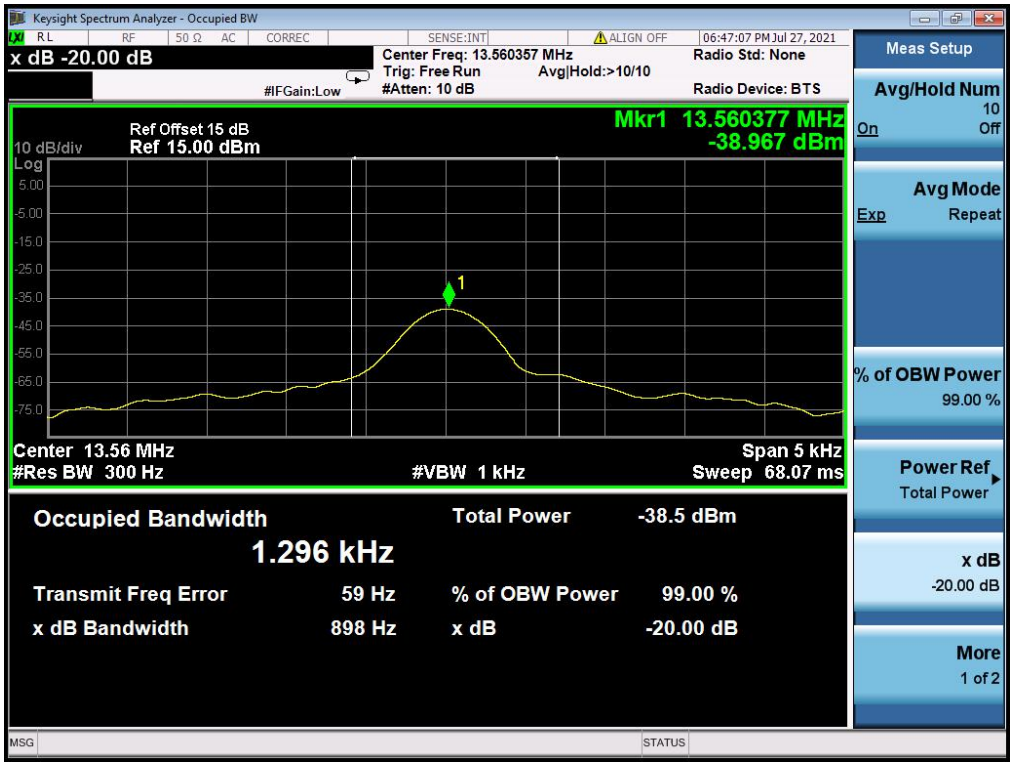
Intentional radiators must be designed to ensure that the 20 dB bandwidth of the emissions in the specific band (13.553 ~ 13.567MHz).

6.2. Test Result

Temperature	24.5℃	Humidity	53.7%
Test Engineer	Jenny Zeng	Configurations	NFC

Carrier Frequency (MHz)	20dB Bandwidth (KHz)	F_L (MHz)	F_H (MHz)
13.56	0.898	13.5579634	13.5608162

Please refer to the test plot:



7. FREQUENCY STABILITY MEASUREMENT

7.1. Standard Applicable

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% (100ppm) 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 full charged battery.

7.2. Test Result

Temperature	24.5℃	Humidity	53.7%
Test Engineer	Jenny Zeng	Configurations	NFC

Voltage vs. Frequency Stability

Voltage(V)	Measurement Frequency (MHz)	Deviation (KHz)	Deviation (ppm)	Limit (ppm)
DC 4.5V	13.560039	0.039	2.88	100
DC 5V	13.560044	0.044	3.24	100
DC 5.5V	13.560020	0.020	1.47	100

Temperature vs. Frequency Stability

Temperature (℃)	Measurement Frequency (MHz)	Deviation (KHz)	Deviation (ppm)	Limit (ppm)
-20	13.560021	0.021	1.55	100
-10	13.560071	0.071	5.24	100
0	13.560084	0.084	6.19	100
10	13.560030	0.030	2.21	100
20	13.560058	0.058	4.28	100
30	13.560098	0.098	7.23	100
40	13.560043	0.043	3.17	100
50	13.560097	0.097	7.15	100

8. LINE CONDUCTED EMISSIONS

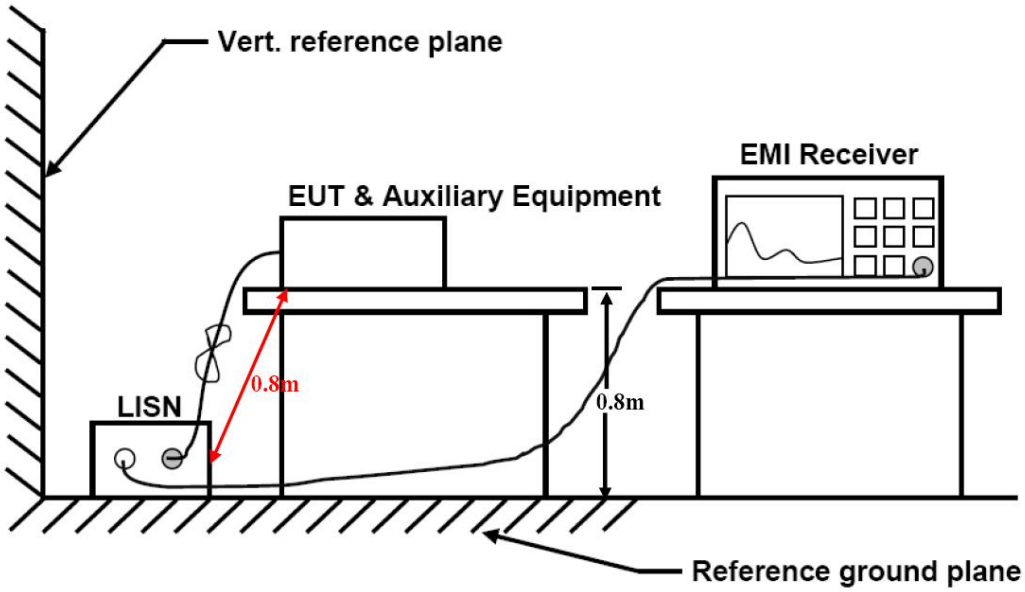
8.1. Standard Applicable

According to §15.207(a): For an intentional radiator which is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed 250 microvolts (The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz). The limits at specific frequency range are listed as follows:

Frequency Range (MHz)	Limits (dBμV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

* Decreasing linearly with the logarithm of the frequency

8.2. Block Diagram of Test Setup

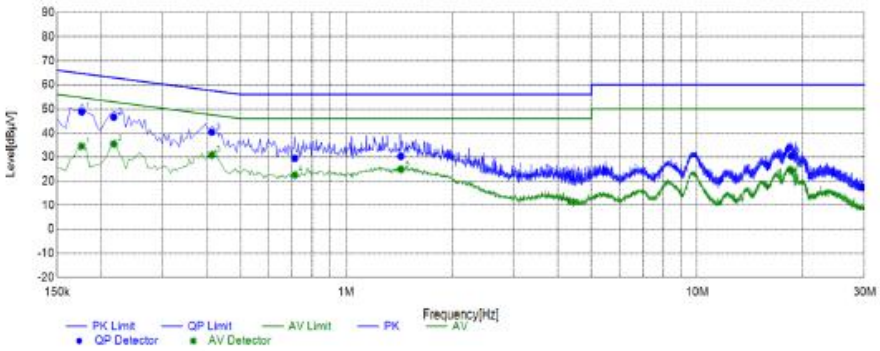


8.3. Test Results

Temperature	25℃	Humidity	60%
Test Engineer	Jenny Zeng	Configurations	BT

Power supply:	AC 120V/60Hz	Polarization	L

Test Graph



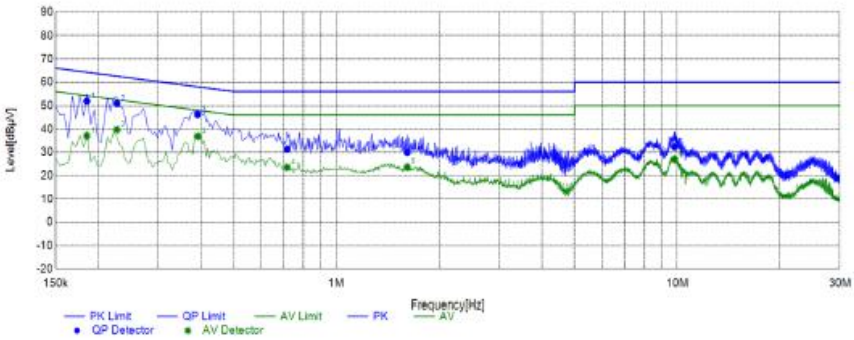
Final Data List

NO.	Frequency [MHz]	QP Reading [dBμV]	AVG. Reading [dBμV]	Factor [dB]	QP Result [dBμV]	AVG. Result [dBμV]	QP Limit [dBμV]	AVG. Limit [dBμV]	QP Margin [dB]	AVG. Margin [dB]	Line	Remark
1	0.1766	38.76	24.37	10.05	48.81	34.42	64.65	54.65	15.84	20.23	L1	PASS
2	0.2176	36.56	25.36	10.05	46.61	35.41	62.91	52.91	16.30	17.50	L1	PASS
3	0.4141	30.26	20.82	10.03	40.29	30.85	57.57	47.57	17.28	16.72	L1	PASS
4	0.7125	19.37	12.49	10.05	29.42	22.54	56.00	46.00	26.58	23.46	L1	PASS
5	1.4310	20.18	14.78	10.10	30.28	24.88	56.00	46.00	25.72	21.12	L1	PASS
6	18.5219	19.00	12.99	11.36	30.36	24.35	60.00	50.00	29.64	25.65	L1	PASS

Note:1. Result (dBμV) = Reading (dBμV) + Factor (dB).
2. Factor (dB) = Cable loss (dB) + LISN Factor (dB).

Power supply:	AC 120V/60Hz	Polarization	N

Test Graph



Final Data List

NO.	Frequency [MHz]	QP Reading [dBμV]	AVG. Reading [dBμV]	Factor [dB]	QP Result [dBμV]	AVG. Result [dBμV]	QP Limit [dBμV]	AVG. Limit [dBμV]	QP Margin [dB]	AVG. Margin [dB]	Line	Remark
1	0.1855	41.88	26.95	10.06	51.94	37.01	64.24	54.24	12.30	17.23	N	PASS
2	0.2269	40.88	29.64	10.04	50.92	39.68	62.56	52.56	11.64	12.88	N	PASS
3	0.3919	36.21	26.79	10.02	46.23	36.81	58.02	48.02	11.79	11.21	N	PASS
4	0.7169	21.31	13.47	10.05	31.36	23.52	56.00	46.00	24.64	22.48	N	PASS
5	1.6145	19.85	13.52	10.12	29.97	23.64	56.00	46.00	26.03	22.36	N	PASS
6	9.8208	21.62	16.25	10.68	32.30	26.93	60.00	50.00	27.70	23.07	N	PASS

Note:1. Result (dBμV) = Reading (dBμV) + Factor (dB).
2. Factor (dB) = Cable loss (dB) + LISN Factor (dB).

9. ANTENNA REQUIREMENTS

9.1. Standard Applicable

According to antenna requirement of §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be re-placed by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

9.2. Antenna Connected Construction

9.2.1. Standard Applicable

According to § 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.

9.2.2. Antenna Connector Construction

The gains of antenna used for transmitting is 0dBi, and the antenna is a Loop antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.

9.2.3. Results: Compliance.

10. TEST SETUP PHOTOS OF THE EUT

Photo of Radiated Emissions Measurement

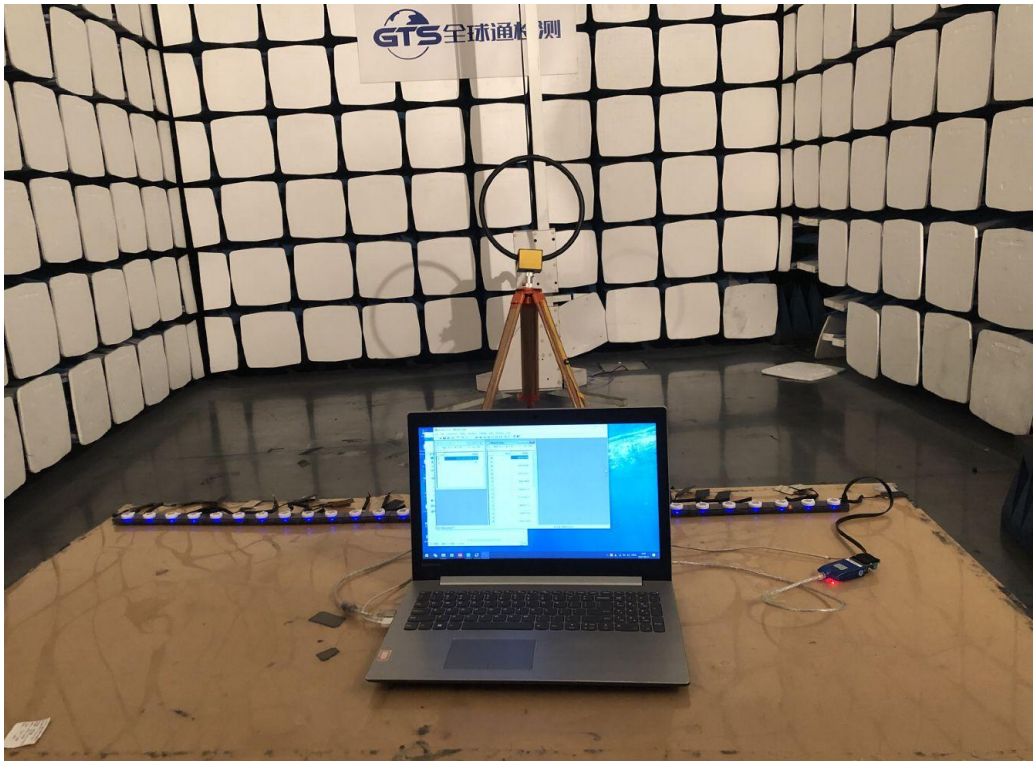


Fig. 1

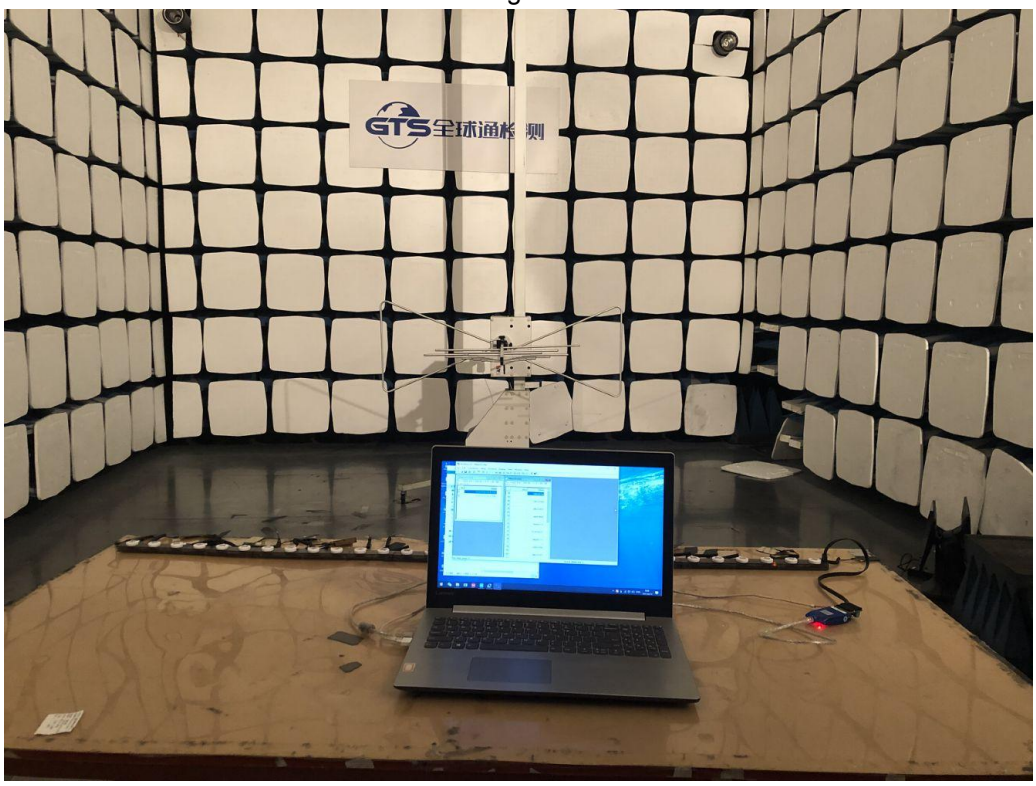


Fig. 2

Photo of Conducted Emission Measurement

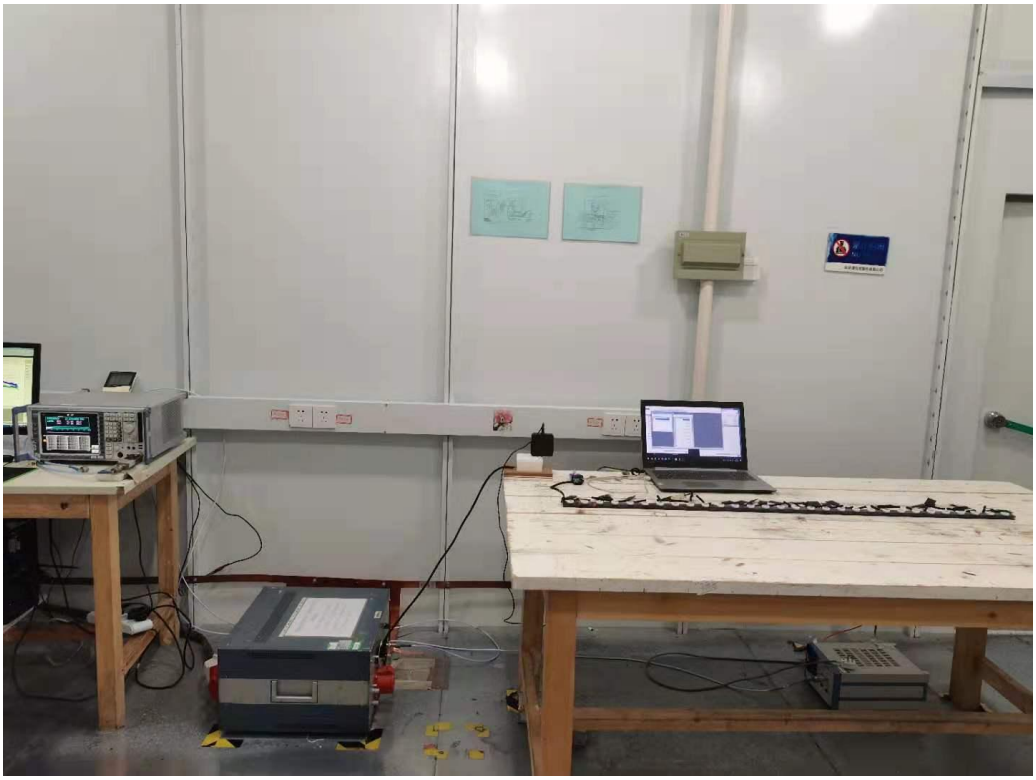


Fig. 3

11. EXTERNAL AND INTERNAL PHOTOS OF THE EUT

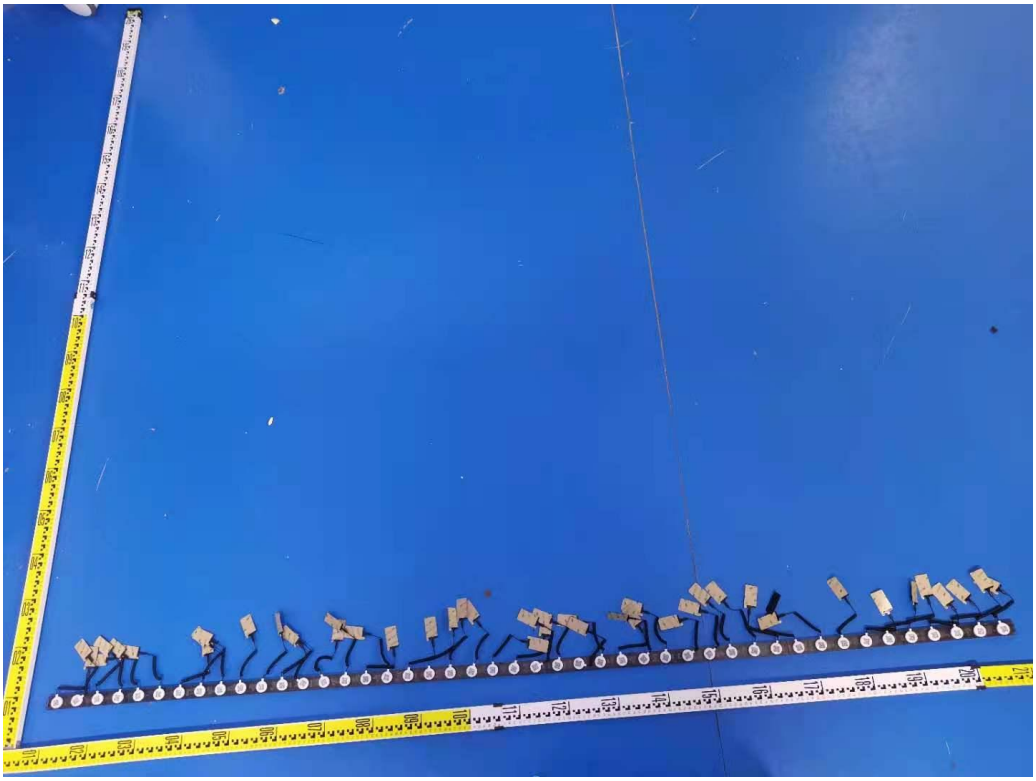


Fig. 1

Fig. 2

Fig. 3

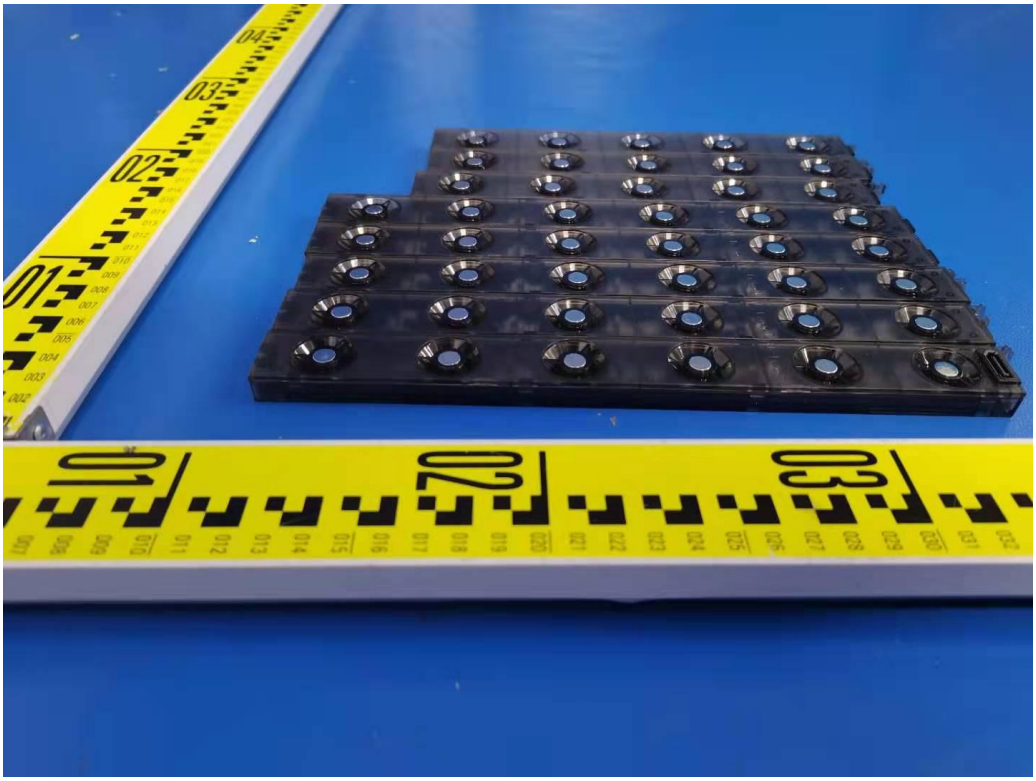


Fig. 4

Fig. 5

Fig. 6

Fig. 7

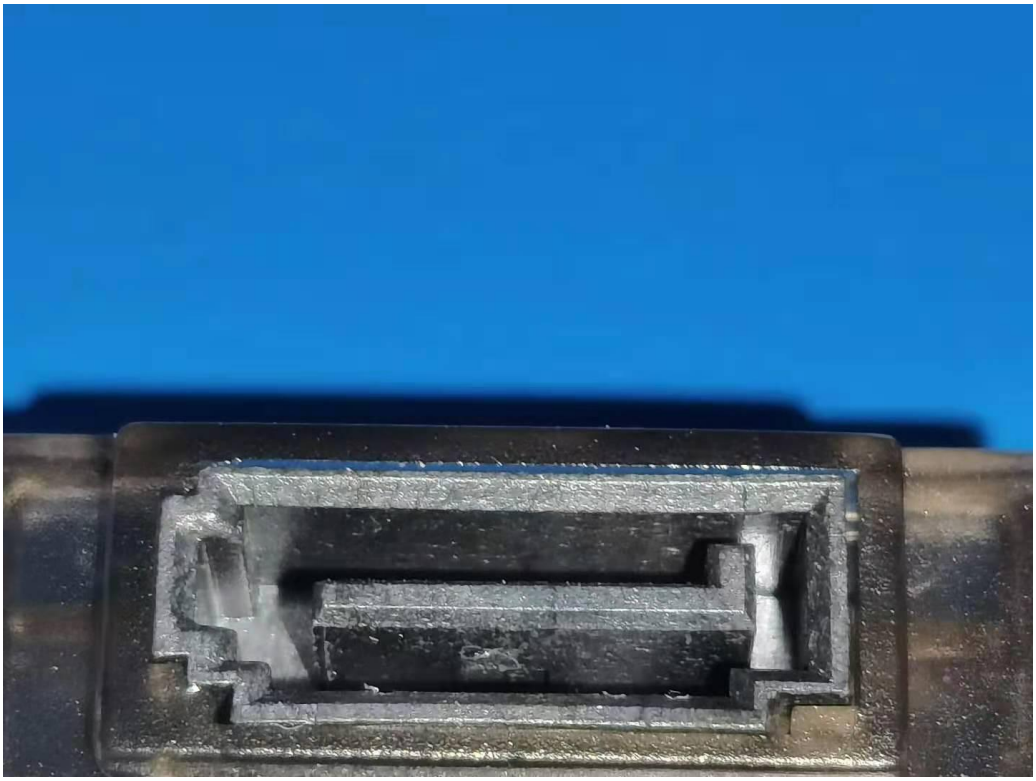


Fig. 8

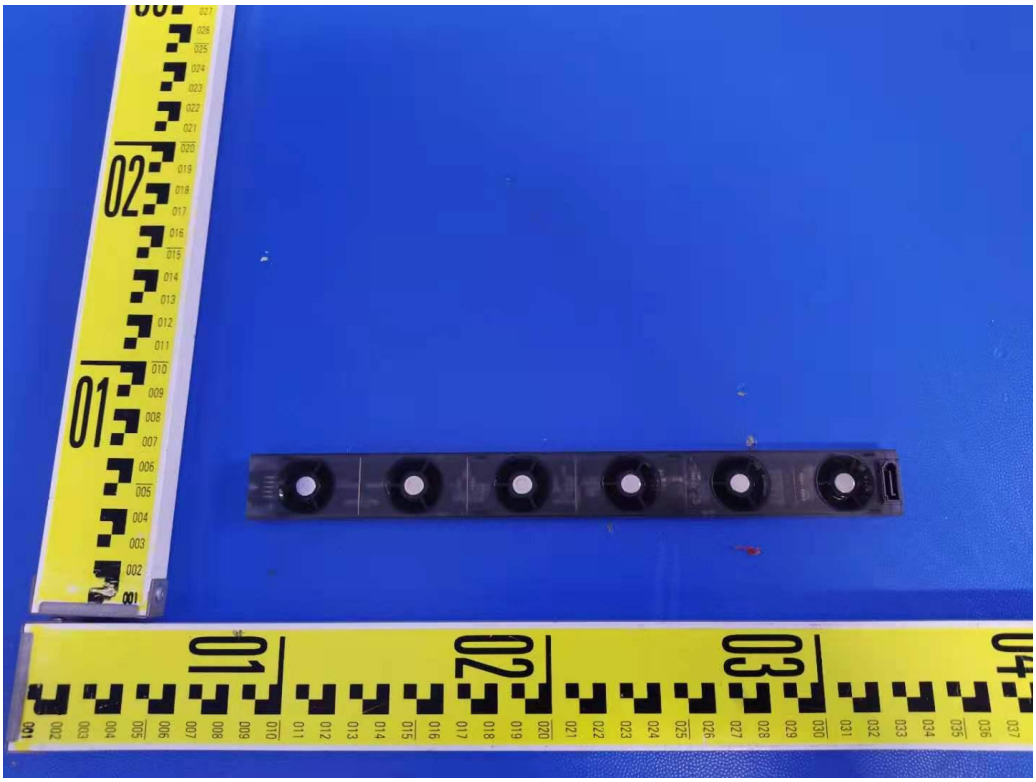


Fig. 9

Fig. 10

Fig. 11

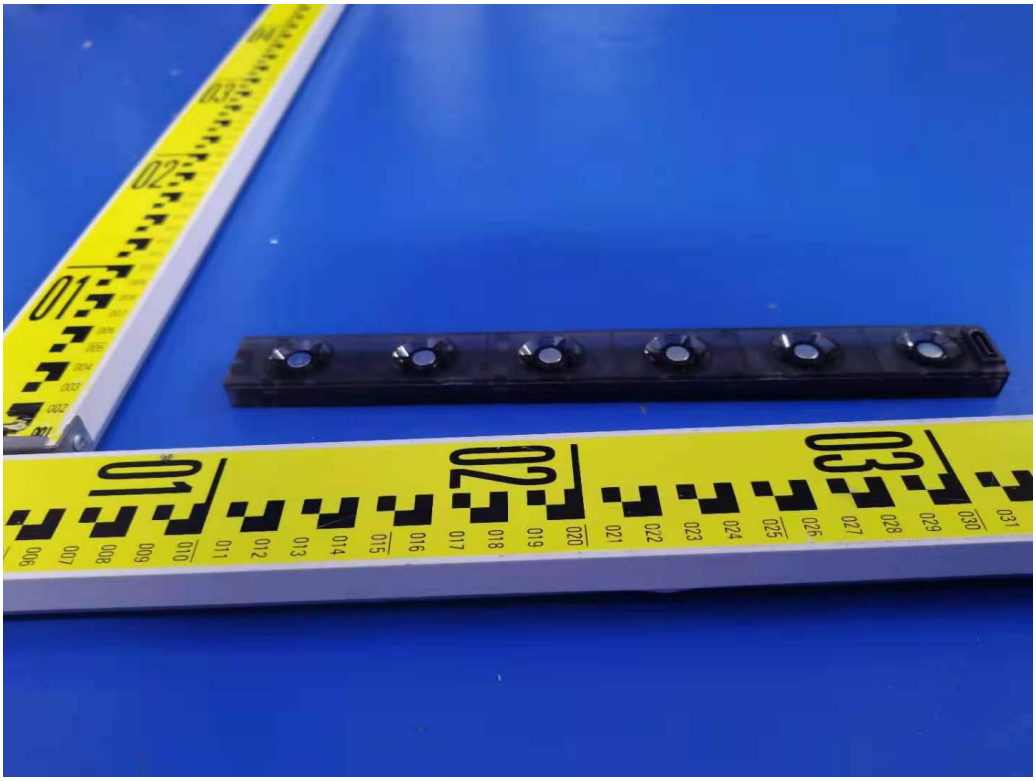


Fig. 12

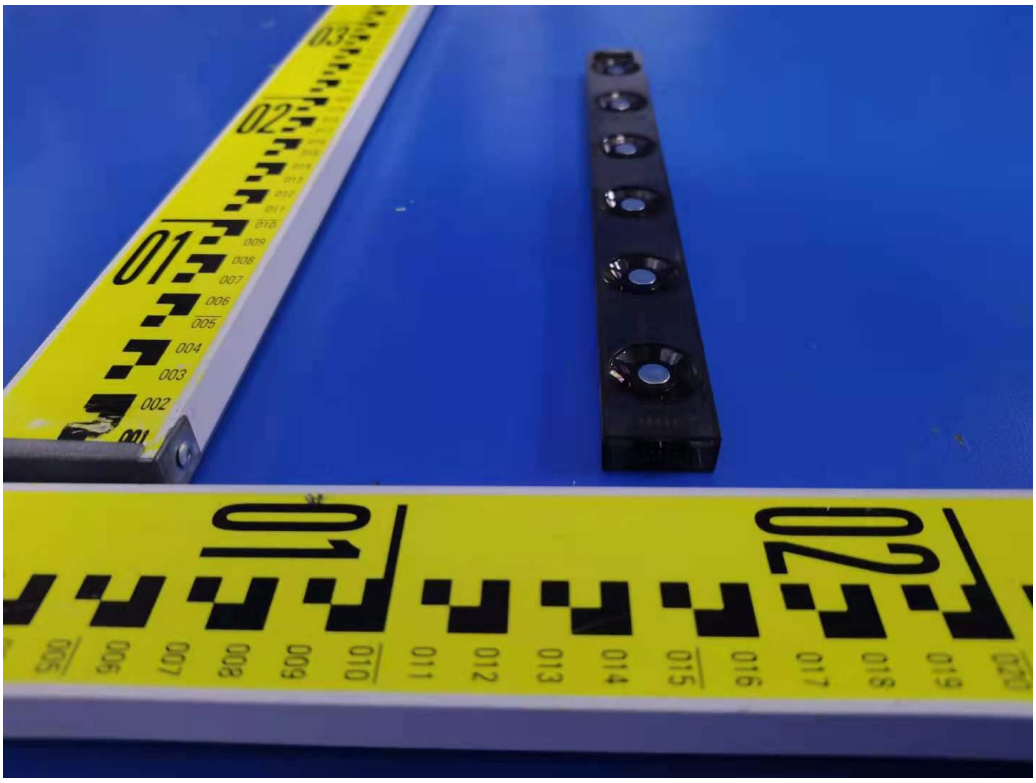


Fig. 13

Fig. 14

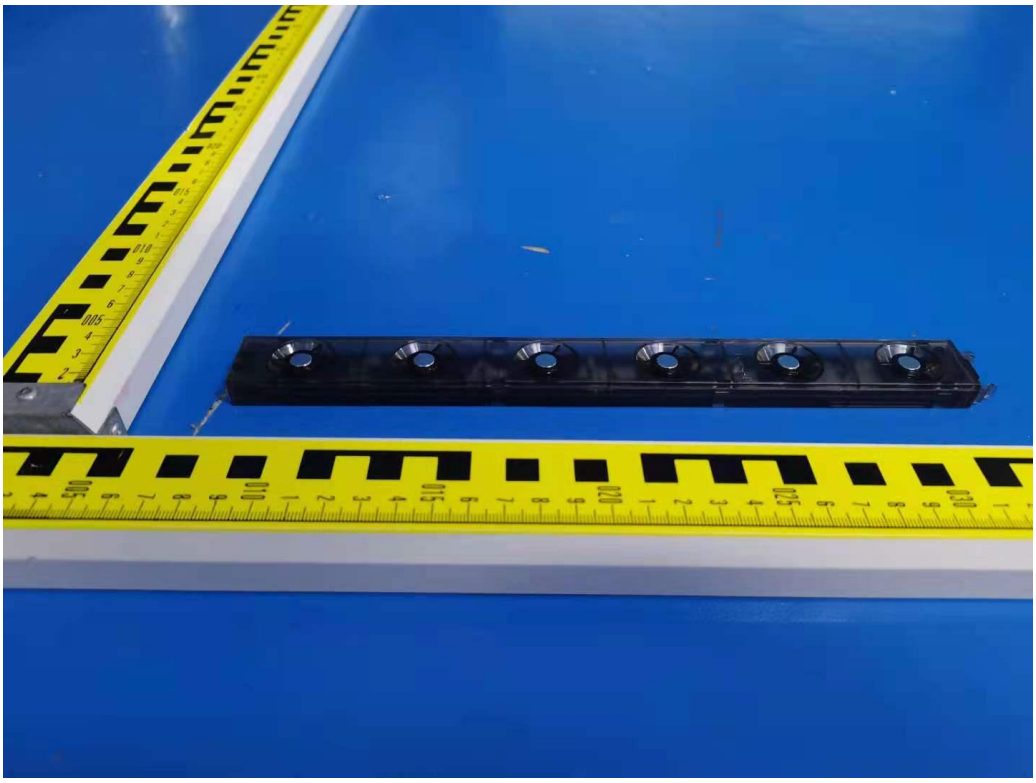


Fig. 15

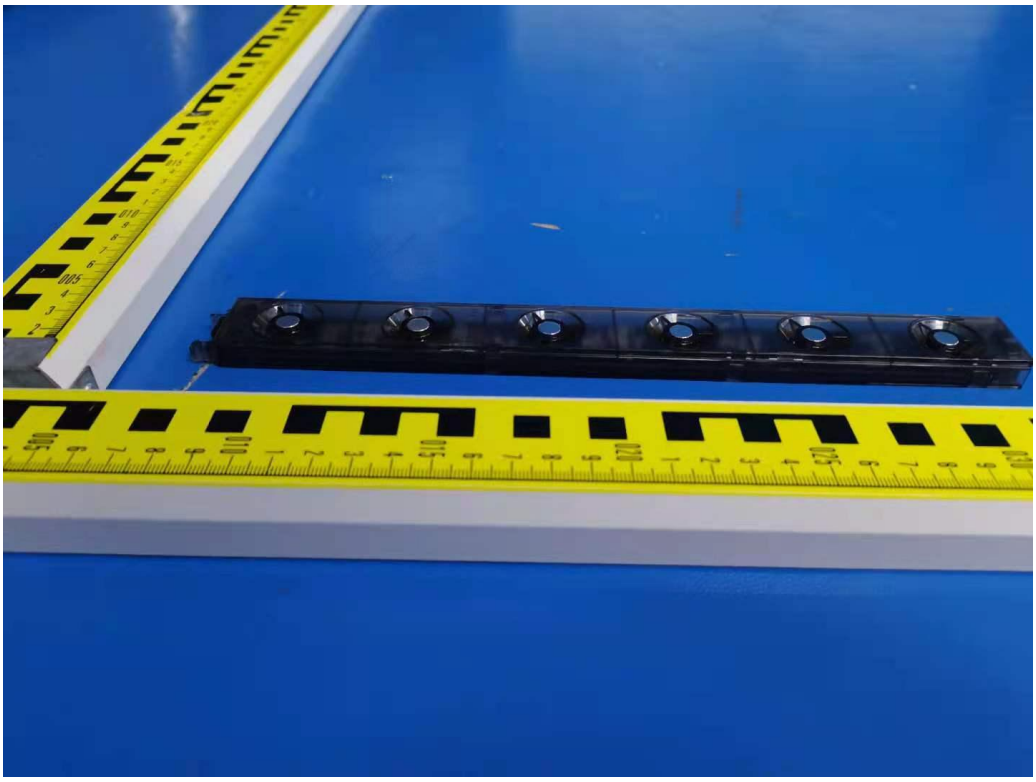


Fig. 16

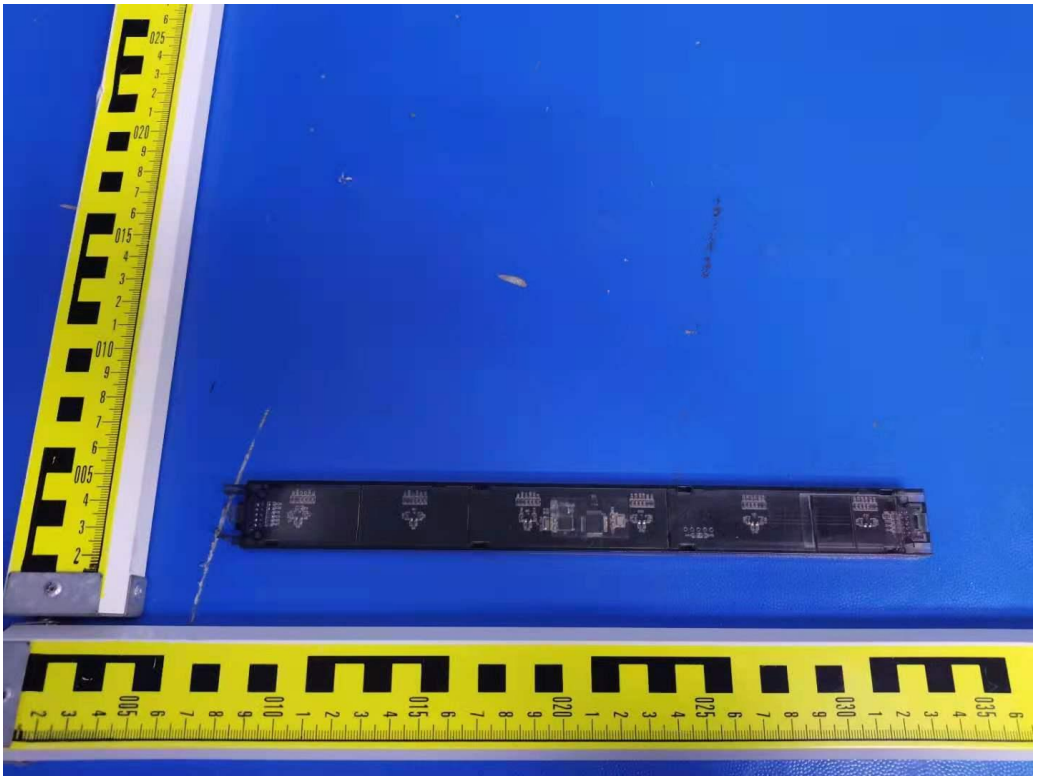


Fig. 17

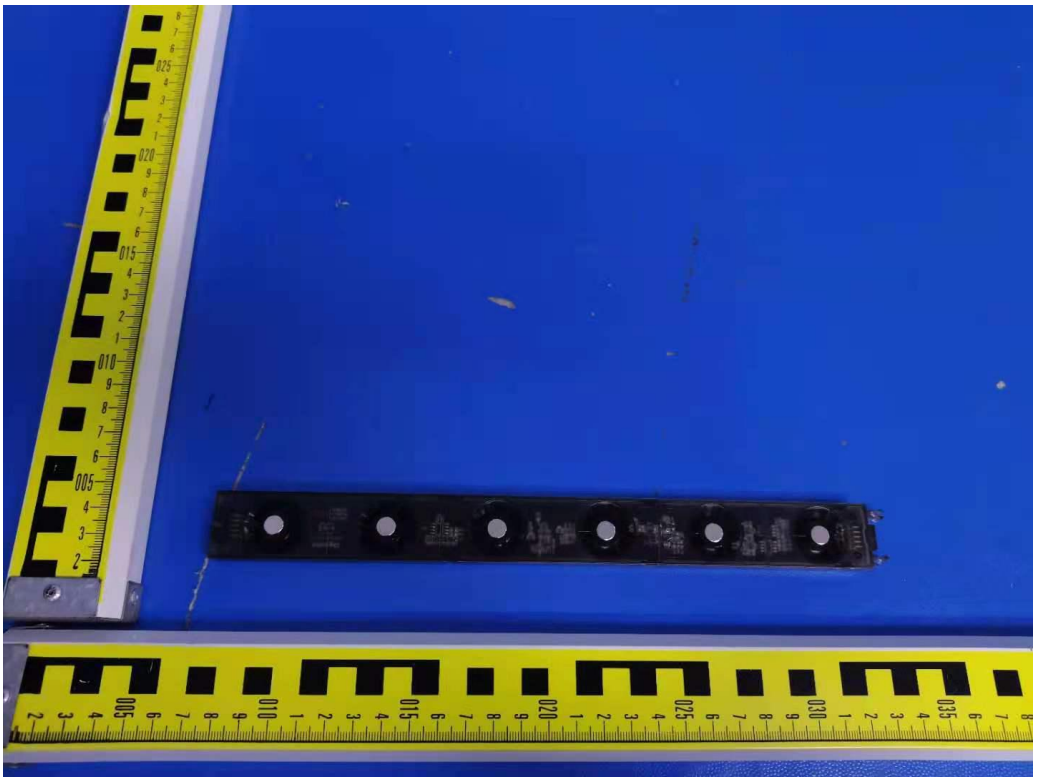


Fig. 18

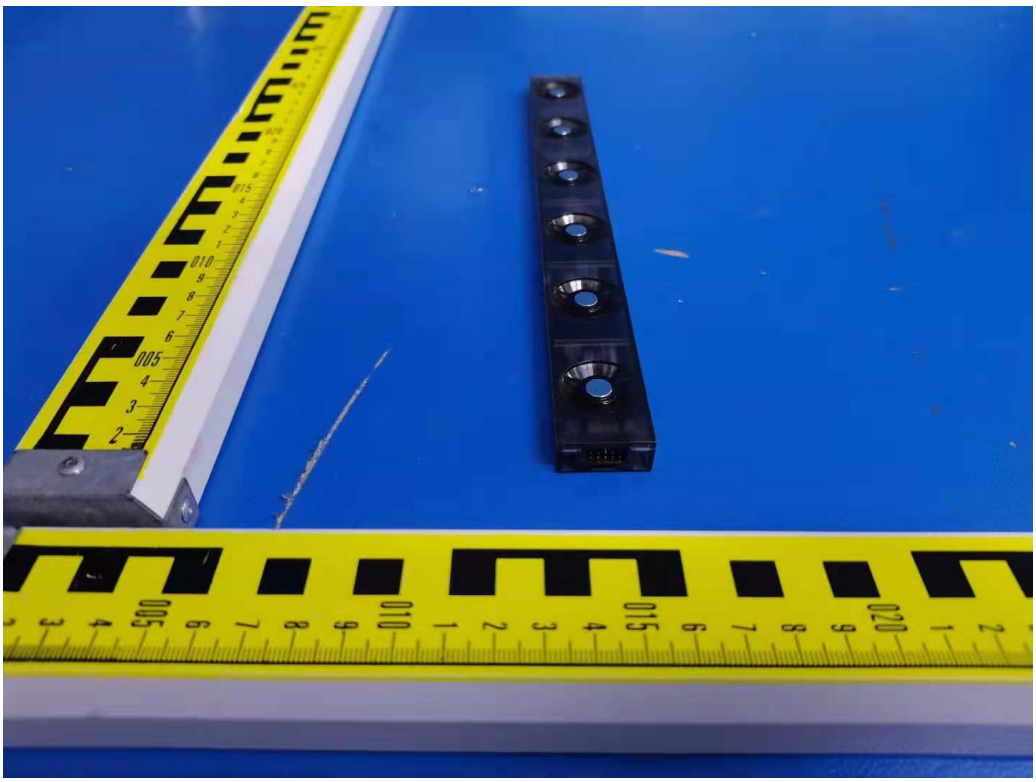


Fig. 19

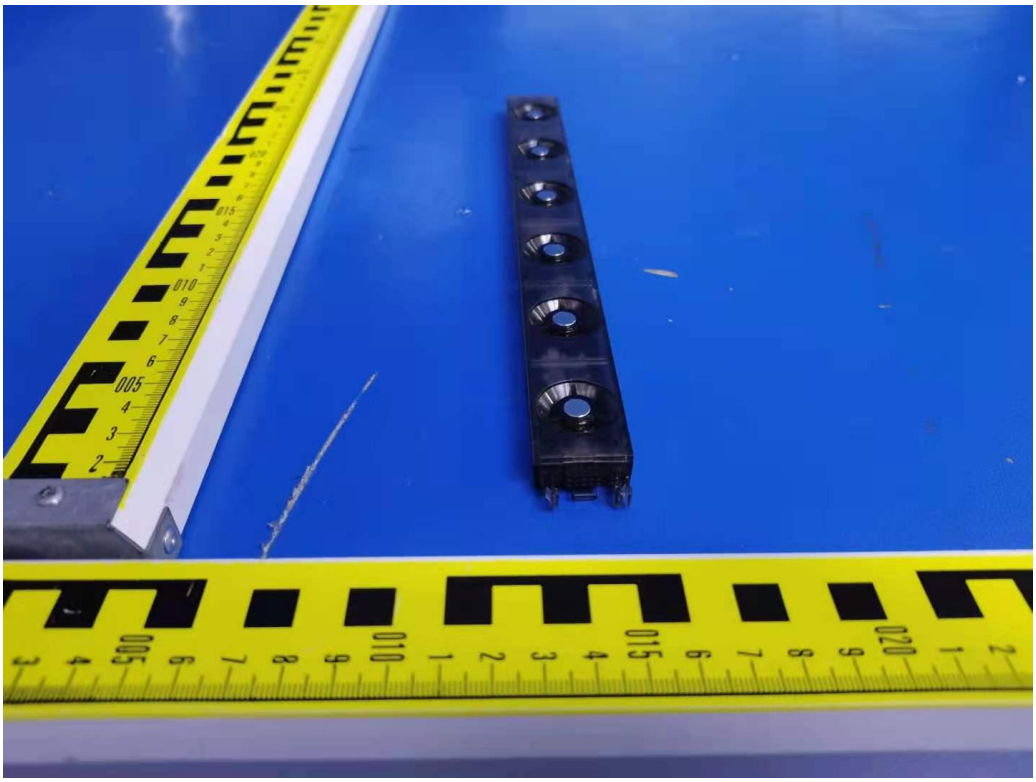


Fig. 20

Fig. 21

Fig. 22

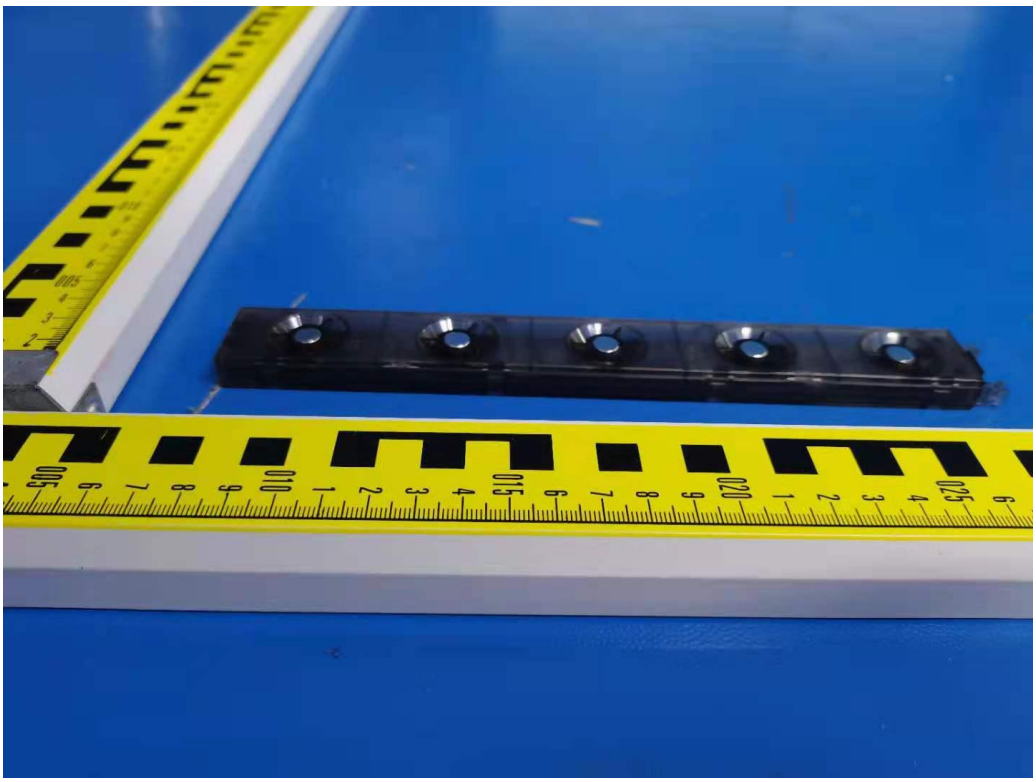


Fig. 23

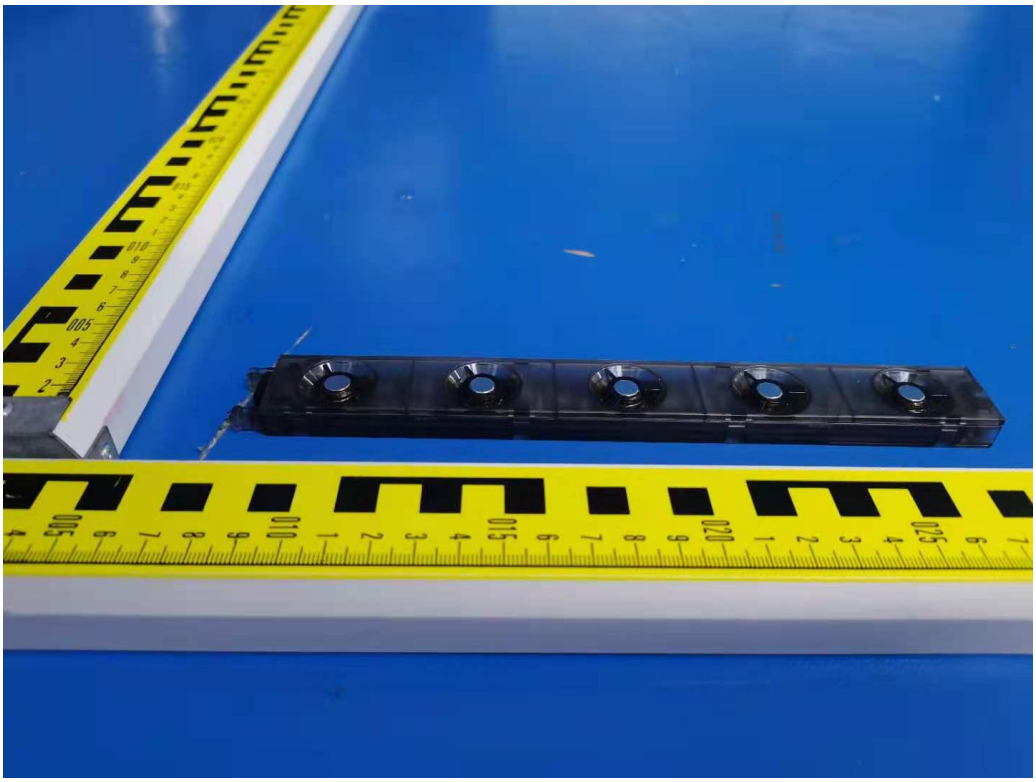


Fig. 24

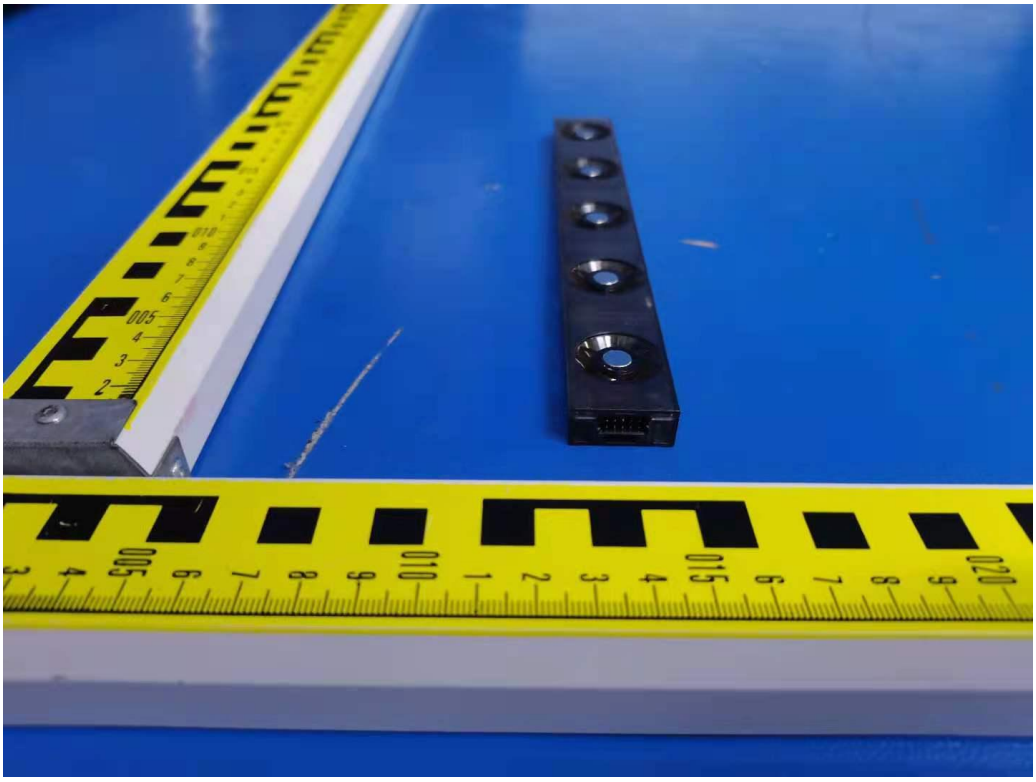


Fig. 25

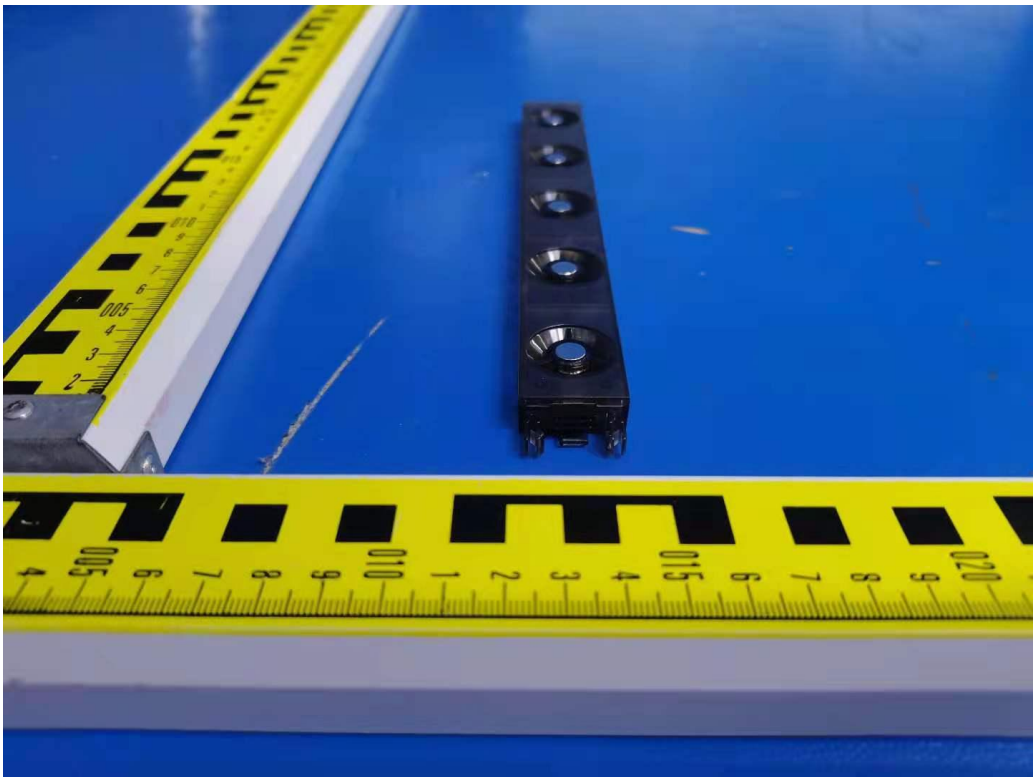


Fig. 26

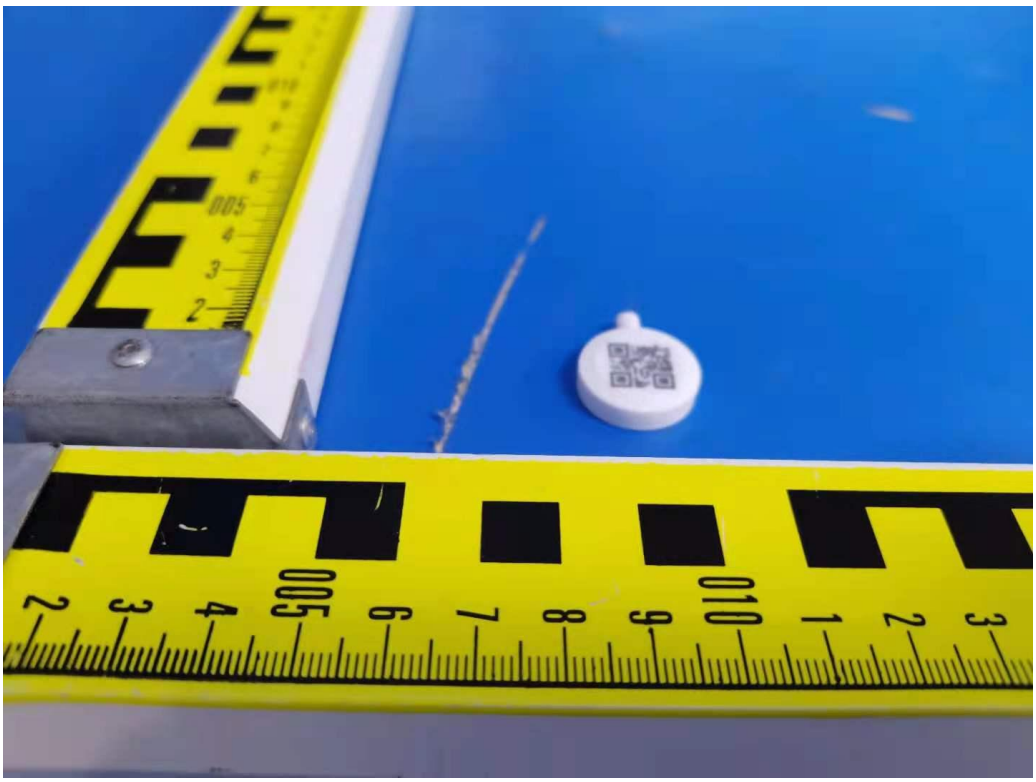


Fig. 27

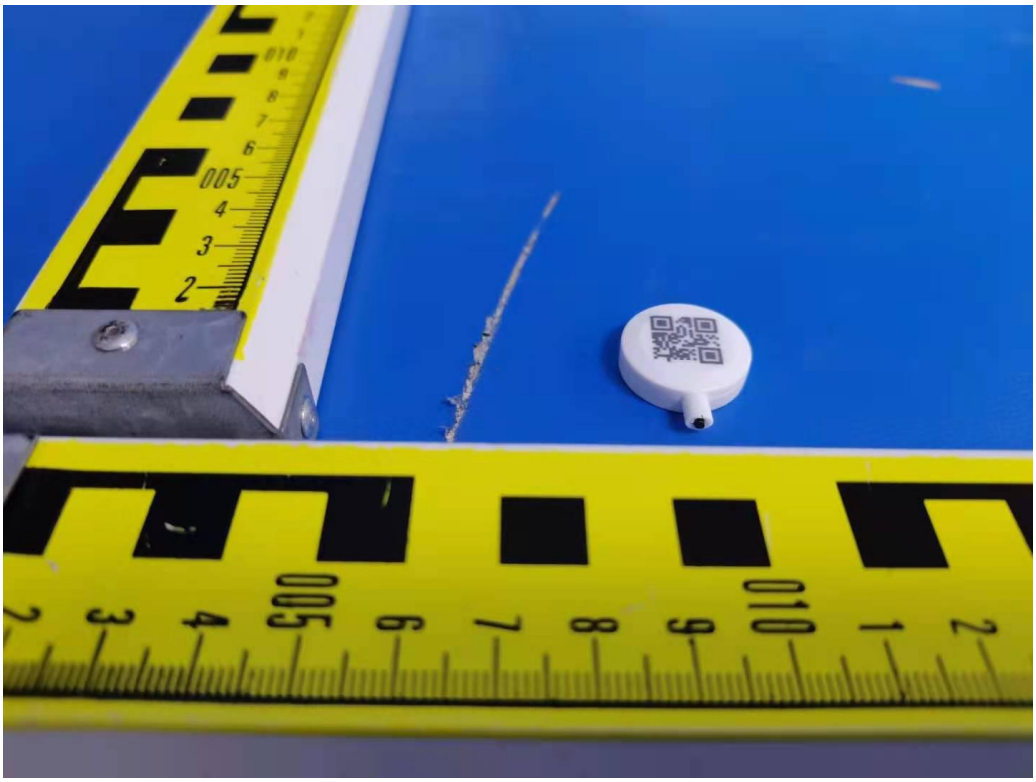


Fig. 28

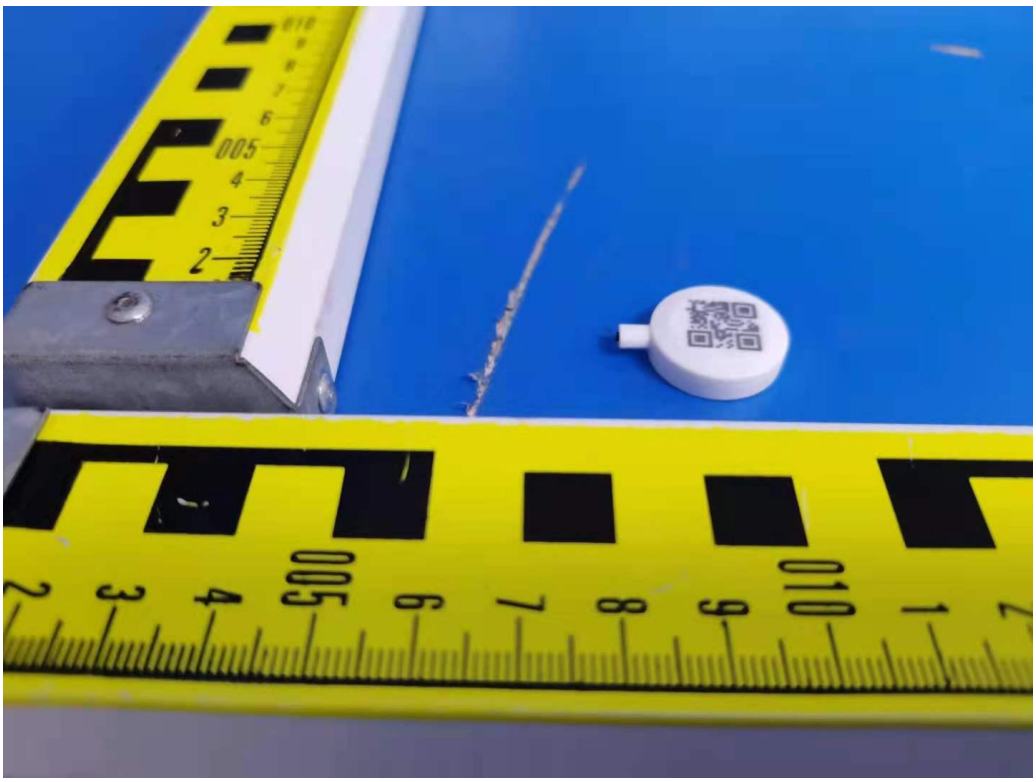


Fig. 29

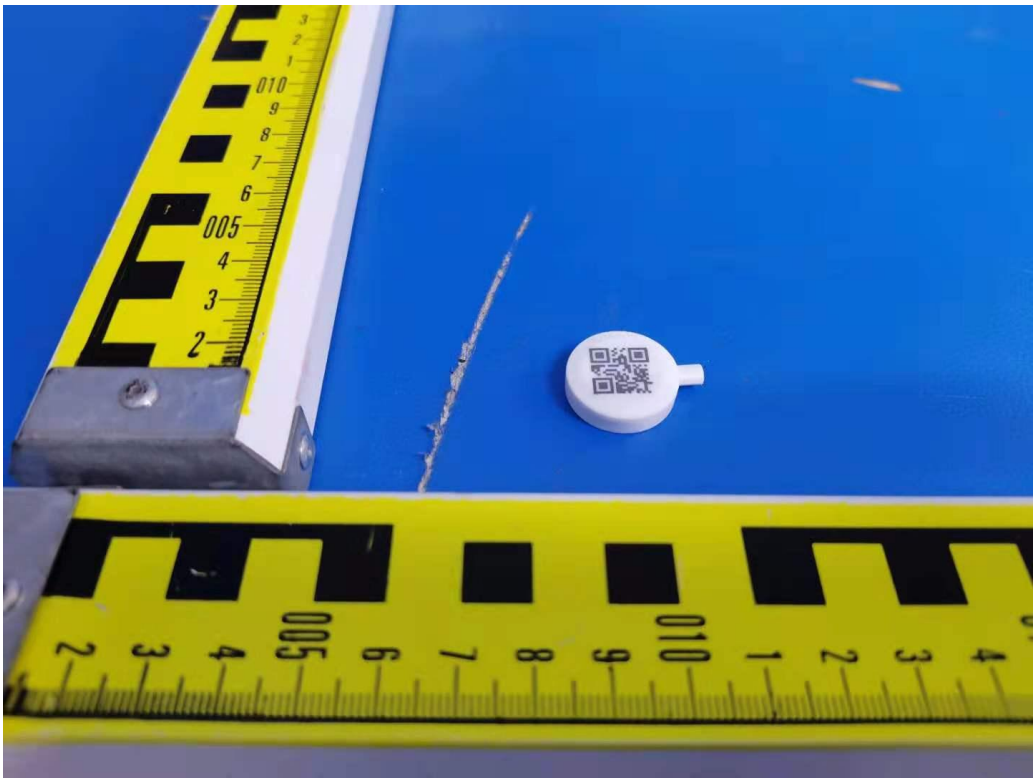


Fig. 30

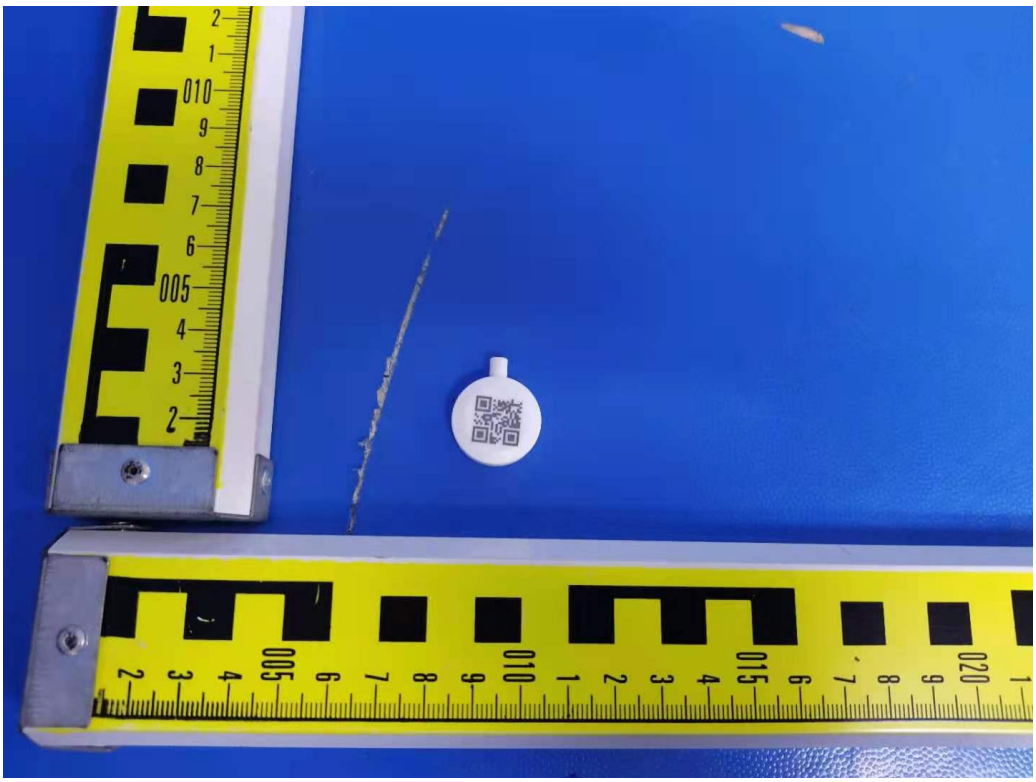


Fig. 31

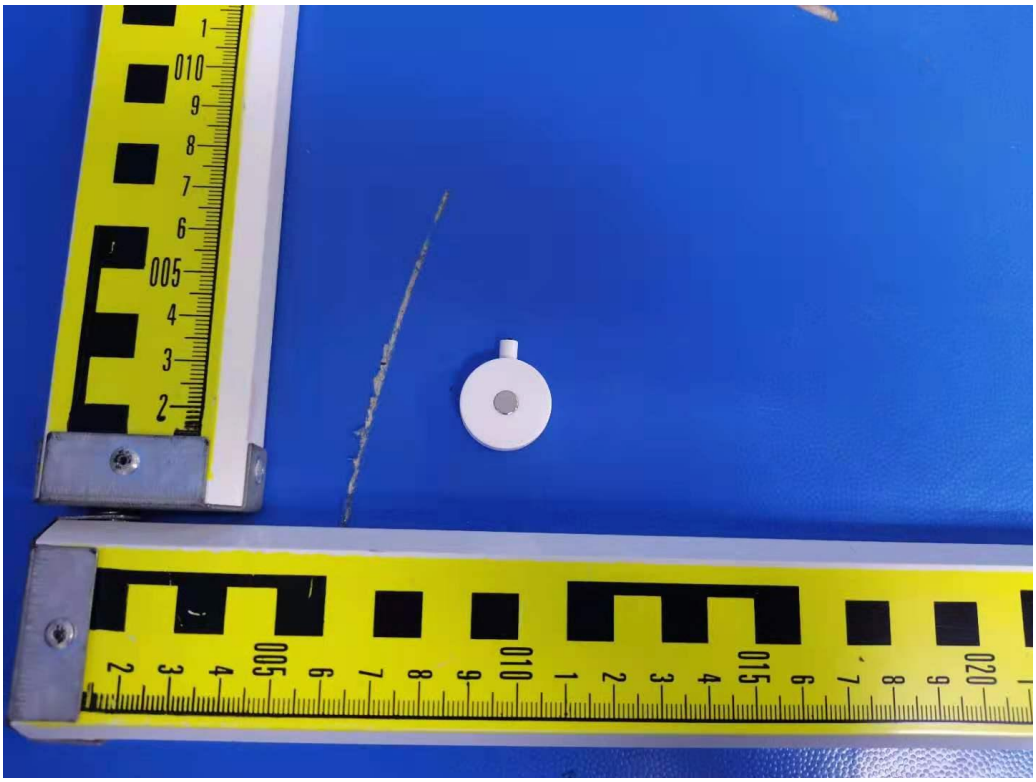


Fig. 32

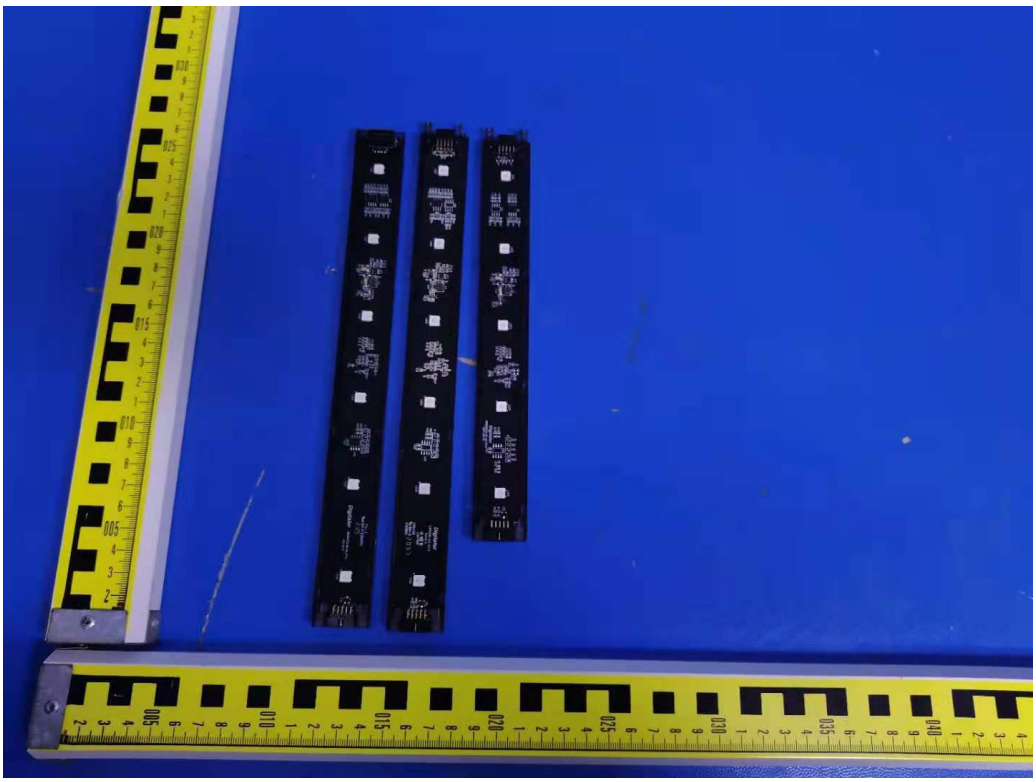


Fig. 33

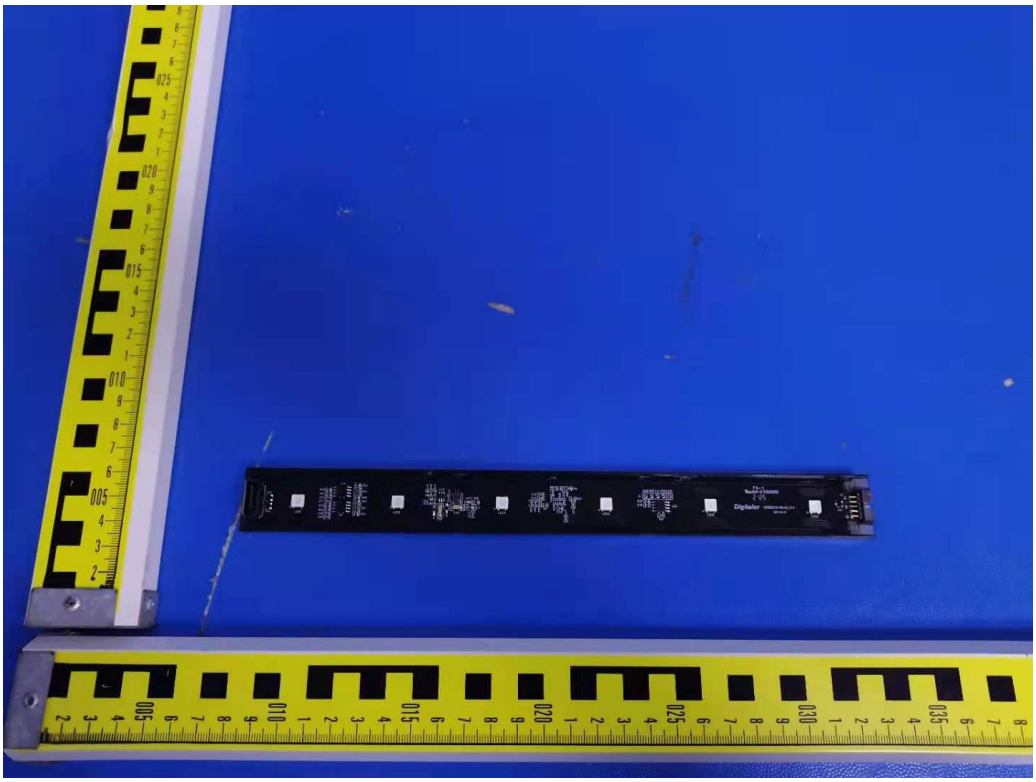


Fig. 34

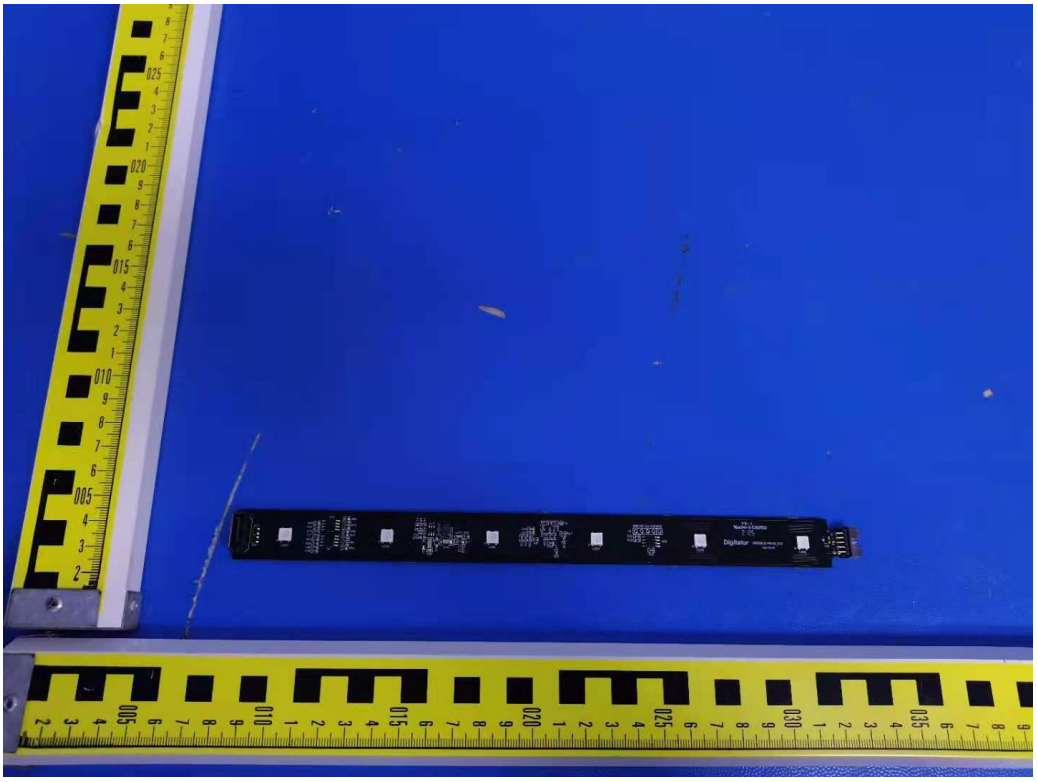


Fig. 35

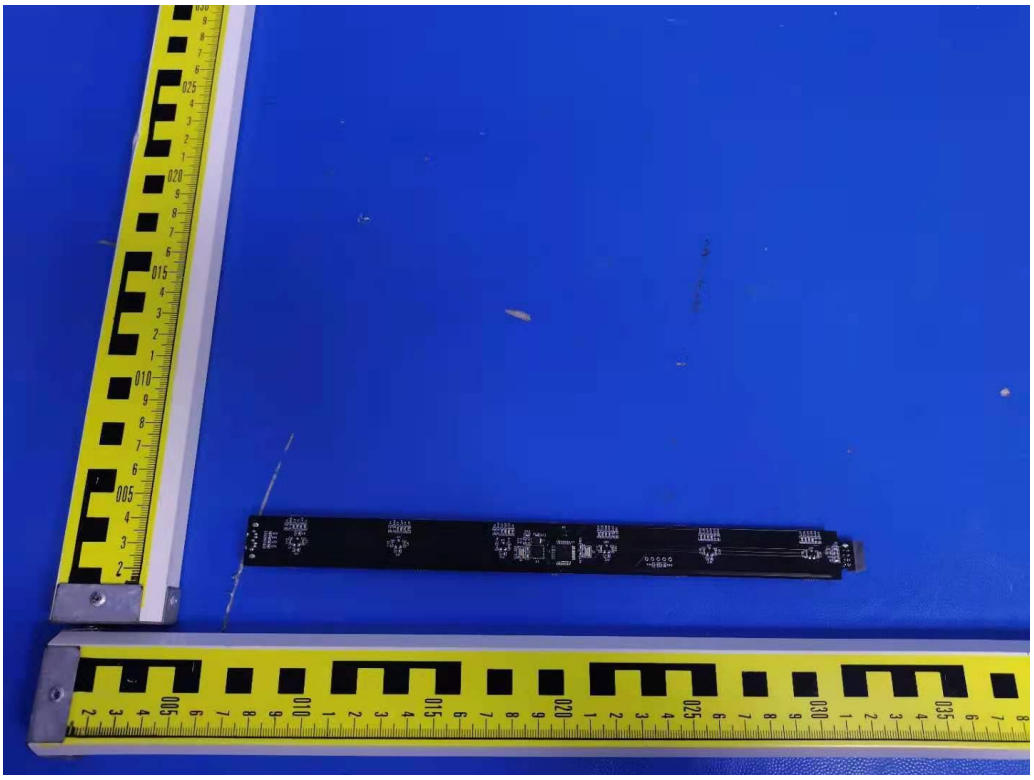


Fig. 36

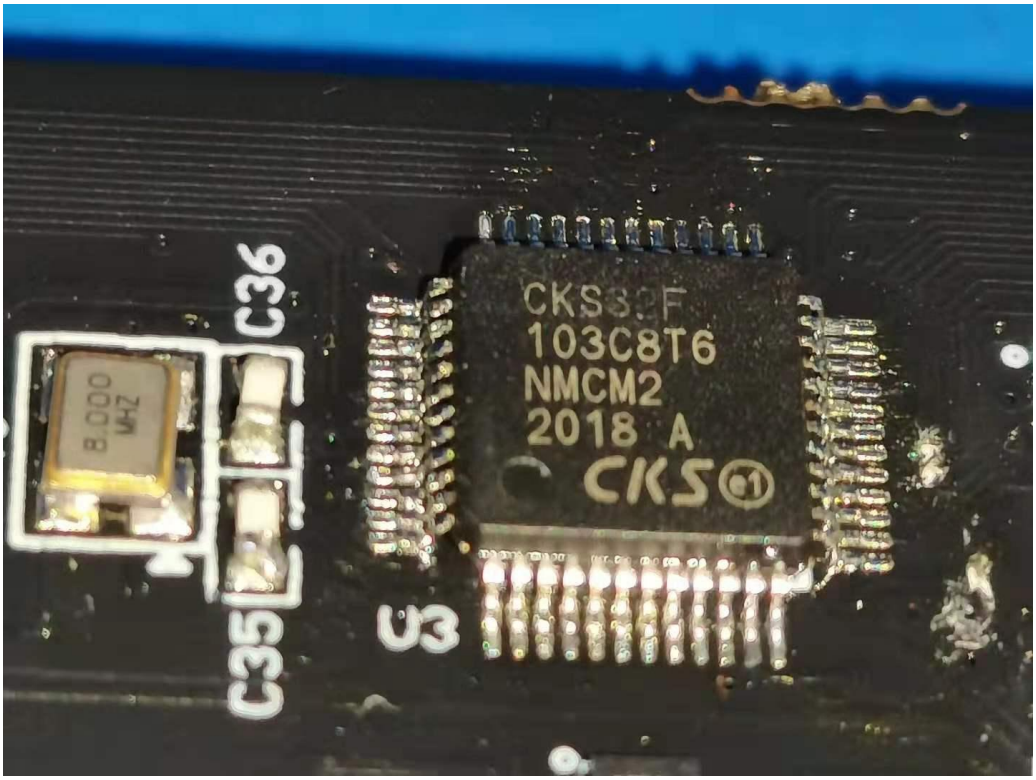

C36
C35
U3
103C8T6
NMCM2
2018 A
CKS

Fig. 37

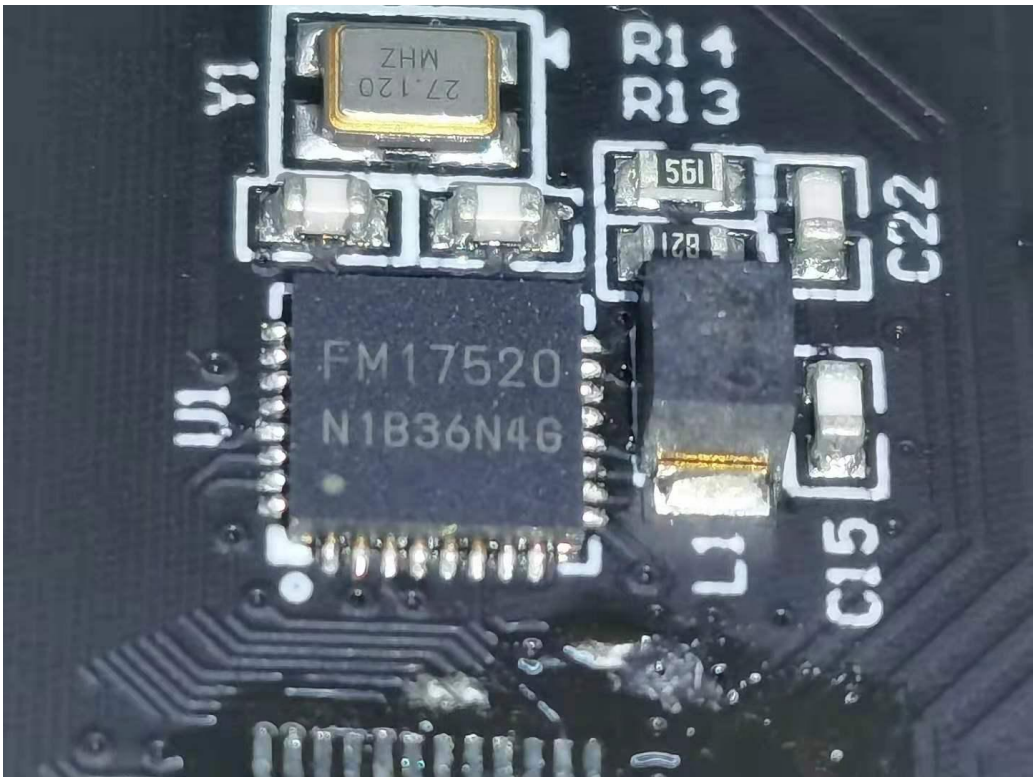

Y1
27.120
MHZ
R14
R13
C22
U1
FM17520
N1B36N4G
L1
C15

Fig. 38

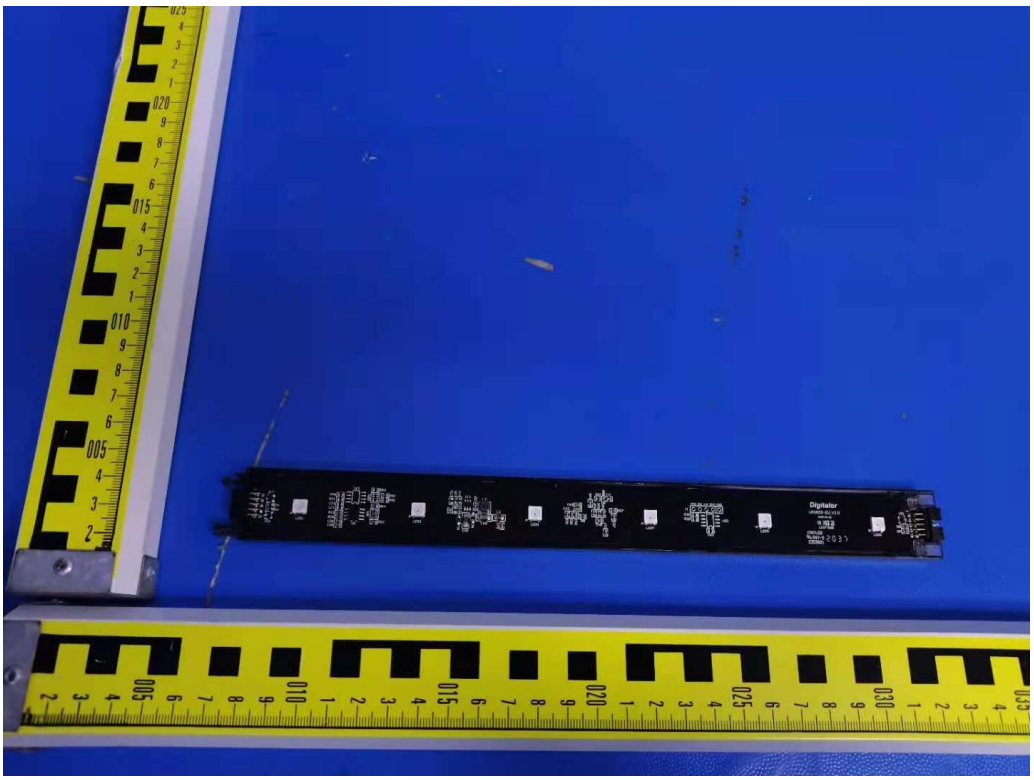


Fig. 39

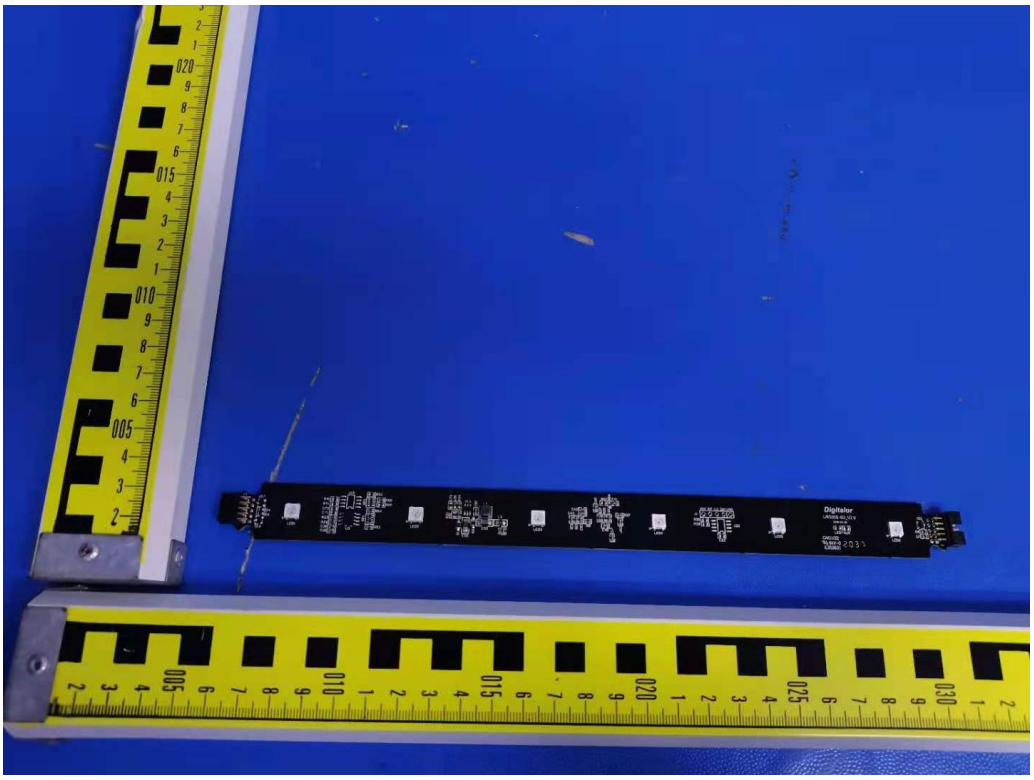


Fig. 40

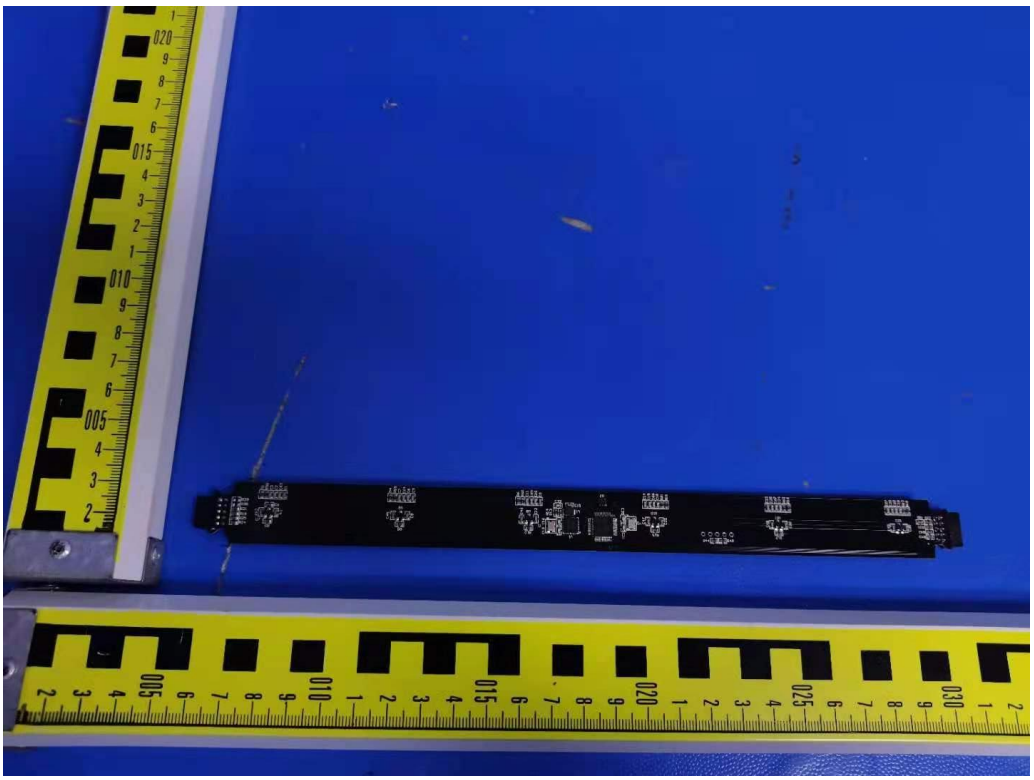


Fig. 41

Fig. 42

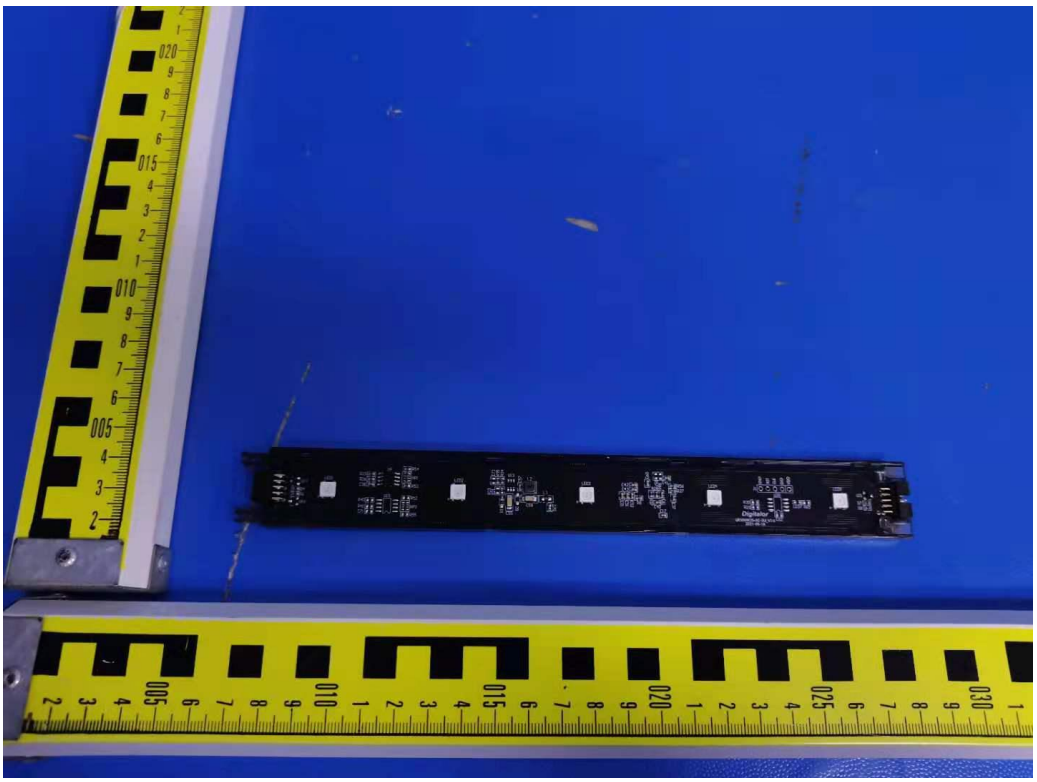


Fig. 43

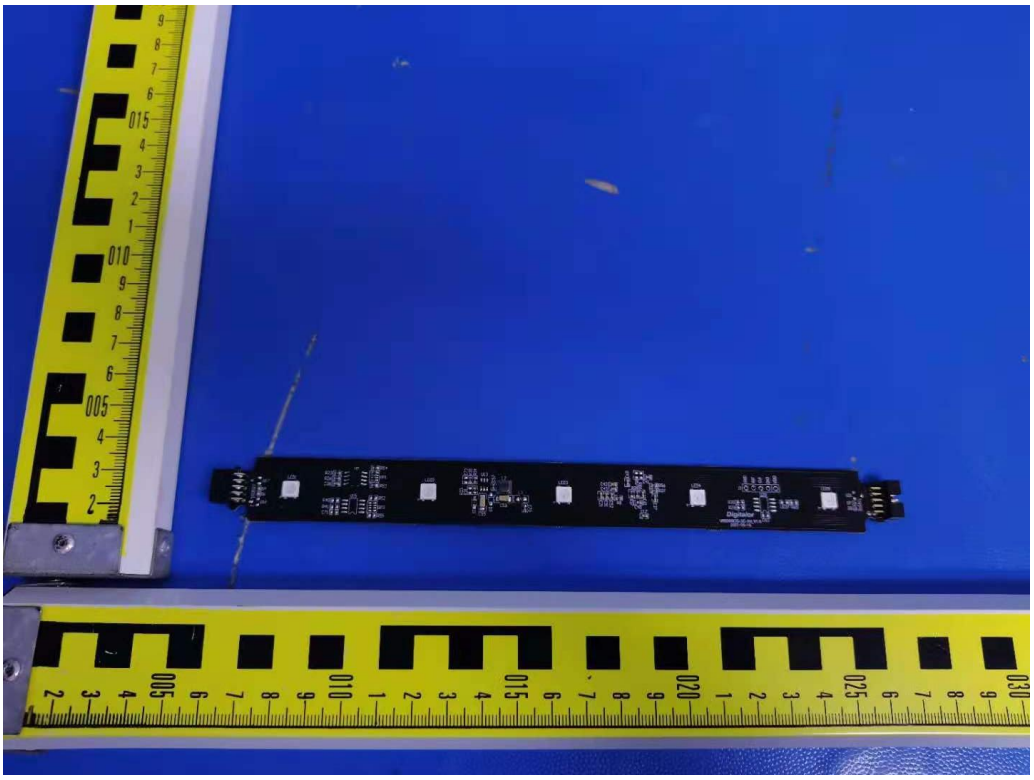


Fig. 44

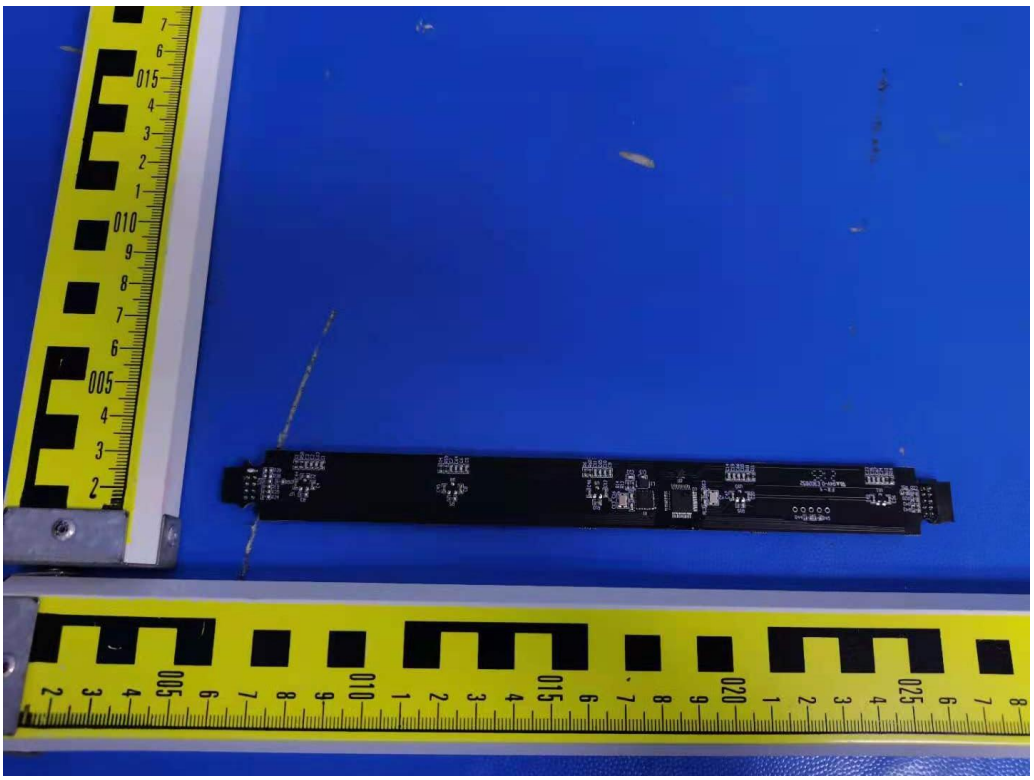


Fig. 45

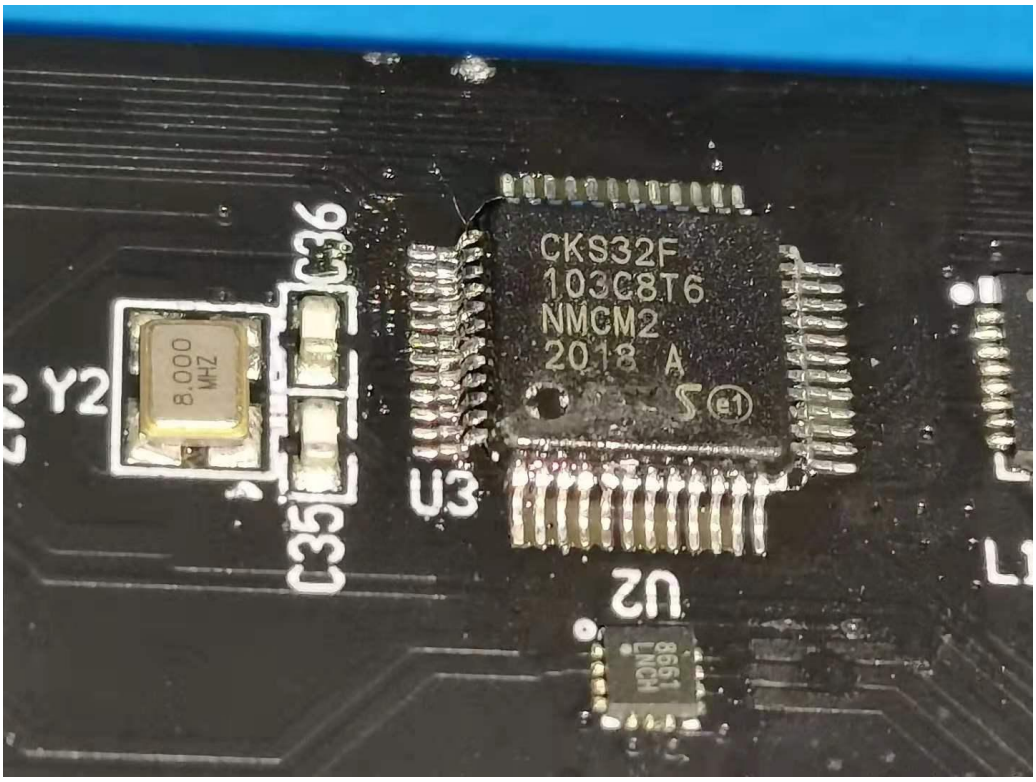

CKS32F
103C8T6
NMCM2
2018 A
Y2
8.000
MHZ
C36
C35
U3
U2
8661
LNCH

Fig. 46

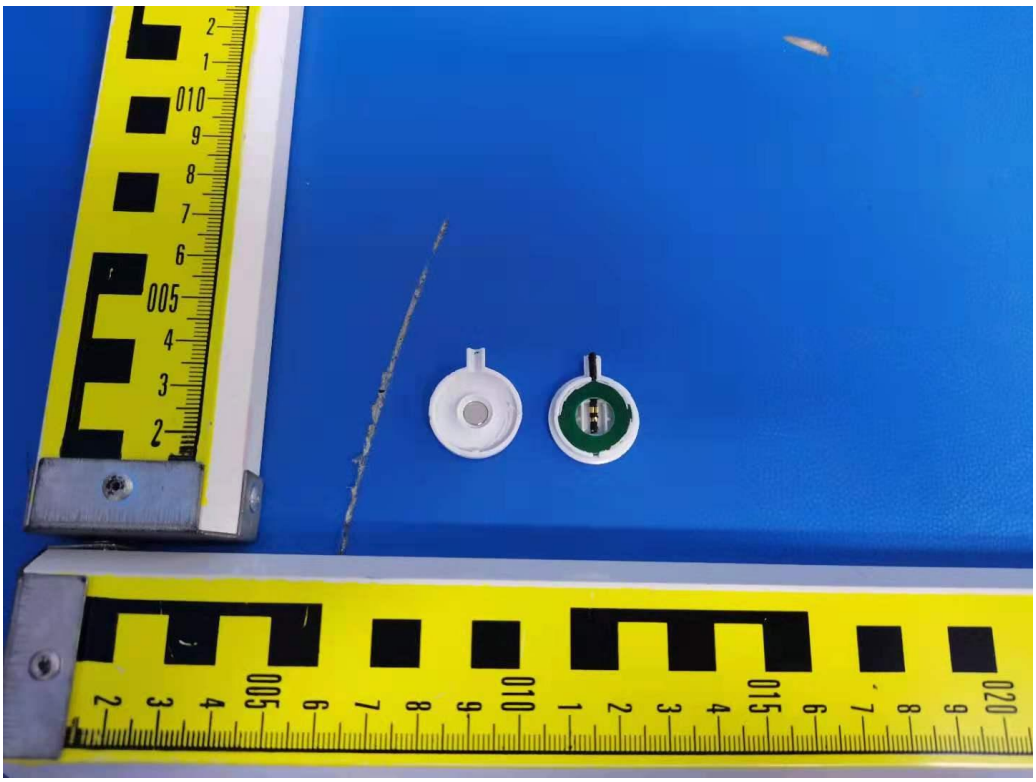


Fig. 47

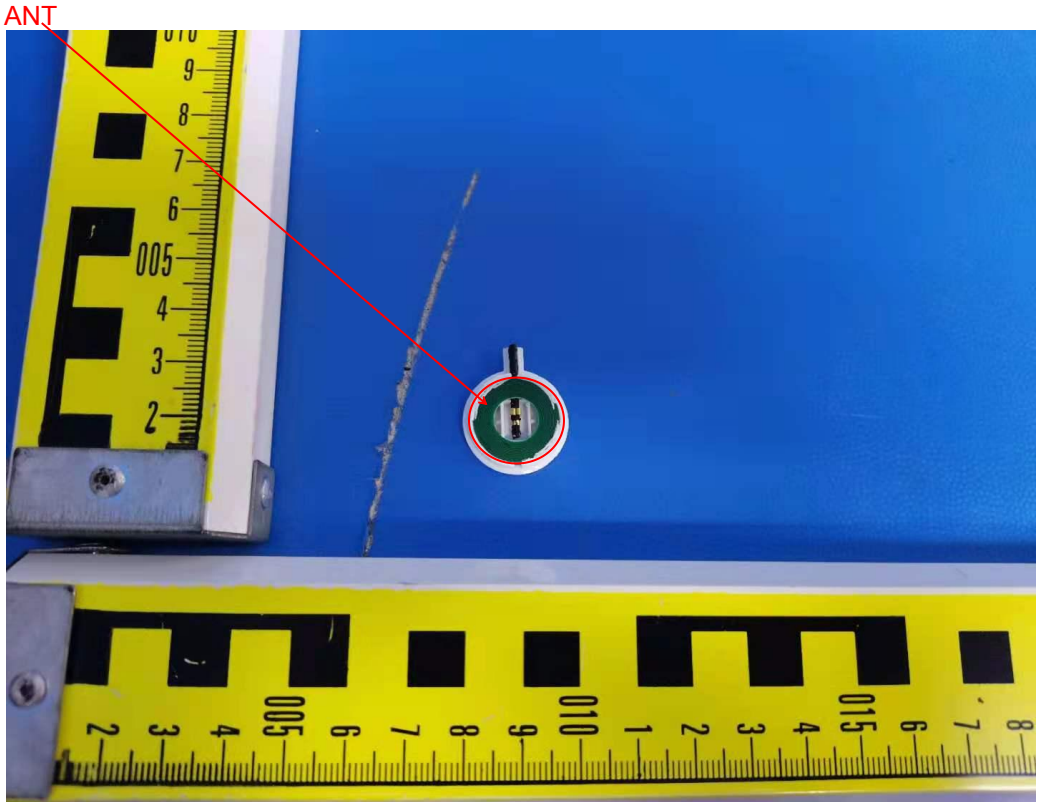


Fig. 48

.....End of Report.....