RF Test Report

For

Applicant Name:	**JinXian Ruizhi Electronic Tech Co.,Ltd**
Address:	No.288 Qingyang Road,Industrial Area Jinxian,Jiangxi
EUT Name:	RZ066 Remote Control
Brand Name:	N/A
Model Number:	RZ066
Series Model Number:	N/A

Issued By

Company Name:	**BTF Testing Lab (Shenzhen) Co., Ltd.**
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Report Number:	BTF230718R02701
Test Standards:	47 Part 15 Subpart C Section 15.231
FCC ID:	2A5EZ-RZ066
Test Conclusion:	Pass
Test Date:	2023-07-11 to 2023-07-25
Date of Issue:	2023-07-25
Prepared By:	Elma.Yang
	Elma.yang / Project Engineer
Date:	2023-07-25
Approved By:	Ryan.CJ
	Ryan.CJ / EMC Manager
Date:	2023-07-25

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Revision History		
Version	Issue Date	Revisions Content
R_V0	2023-07-25	Original
Note:	*Once the revision has been made, then previous versions reports are invalid.*	

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1. Introduction

1.1 Identification of Testing Laboratory

Company Name:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Phone Number:	+86-0755-23146130
Fax Number:	+86-0755-23146130

1.2 Identification of the Responsible Testing Location

Test Location:	BTF Testing Lab (Shenzhen) Co., Ltd.
Address:	F101, 201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
Description:	All measurement facilities used to collect the measurement data are located at F101,201 and 301, Building 1, Block 2, Tantou Industrial Park, Tantou Community, Songgang Street, Bao'an District, Shenzhen, China
FCC Registration Number:	518915
Designation Number:	CN1330

1.3 Laboratory Condition

Ambient Temperature:	20℃ to 25℃
Ambient Relative Humidity:	45% to 55%
Ambient Pressure:	100 kPa to 102 kPa

1.4 Announcement

(1) The test report reference to the report template version v0.

(2) The test report is invalid if not marked with the signatures of the persons responsible for preparing, reviewing and approving the test report.

(3) The test report is invalid if there is any evidence and/or falsification.

(4) This document may not be altered or revised in any way unless done so by BTF and all revisions are duly noted in the revisions section.

(5) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.

(6) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

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2. Product Information

2.1 Application Information

Company Name:	JinXian Ruizhi Electronic Tech Co.,Ltd
Address:	No.288 Qingyang Road,Industrial Area Jinxian,Jiangxi

2.2 Manufacturer Information

Company Name:	JinXian Ruizhi Electronic Tech Co.,Ltd
Address:	No.288 Qingyang Road,Industrial Area Jinxian,Jiangxi

2.3 Factory Information

Company Name:	JinXian Ruizhi Electronic Tech Co.,Ltd
Address:	No.288 Qingyang Road,Industrial Area Jinxian,Jiangxi

2.4 General Description of Equipment under Test (EUT)

EUT Name	RZ066 Remote Control
Under Test Model Name	RZ066
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	MP_0.1
Software and Firmware Version	PD2138CF_EX_A_3.6.11

2.5 Technical Information

Modulation Type	FSK
Operation Frequency	433.92MHz
Number of Channel	1 Channels
Antenna Type	PCB Antenna
Antenna Gain#	0.56dBi

Note:

#: The antenna gain provided by the applicant, and the laboratory will not be responsible for the accumulated calculation results which covers the information provided by the applicant.

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3. Summary of Test Results

3.1 Summary of Test Result

No.	Test Item	Standard Section	Test By	Result	Remark
1	Antenna Requirement	15.203		Pass	--
2	Conduction Emission	15.207		N/A	--
3	20 dB Bandwidth	15.231(c)		Pass	--
4	Transmission time	15.231(a)(1)		Pass	--
5	Duty cycle corrected factor	--		Pass*1	--
6	Field strength of the Fundamental signal	15.231(b)		Pass	--
7	Radiation Spurious Emission	15.231(b)/15.205/ 15.209		Pass	--

Note:
– The measurement uncertainty is not included in the test result.
– *1: No requirement on standard, only report these test data.

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3.2 Uncertainty of Test

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2 and TR100 028-1/-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Measurement	Value
Occupied Channel Bandwidth	69 KHz
RF output power, conducted	0.87 dB
Power Spectral Density, conducted	0.69 dB
Unwanted Emissions, conducted	0.94 dB
All emissions, radiated(<1GHz)	4.12 dB
All emissions, radiated(>1GHz)	4.16 dB
Temperature	0.82 °C
Humidity	4.1 %

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4. Test Configuration

4.1 Environment Condition

Environment Parameter	Selected Values During Tests			
	Temperature	Voltage	Relative Humidity	Ambient Pressure
Normal Temperature, Normal Voltage (NTNV)	20°C to 25°C	DC 3V from battery	30% to 60%	100 kPa to 102 kPa

4.2 Test Equipment List

Conducted Method Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
MXA Signal Analyzer	KEYSIGHT	N9020A	MY50410020	2022.11.24	2023.11.23	☒
WIDEBAND RADIO COMMNUNICATION TESTER	Rohde & Schwarz	CMW500	161997	2022.11.24	2023.11.23	☒
ESG VECTOR SIGNAL GENERATOR	Agilent	E4438C	MY45094854	2022.11.24	2023.11.23	☒
MXG Vector Signal Generator	Agilent	N5182A	MY46240163	2022.11.24	2023.11.23	☒
Adjustable Direct Current Regulated Power Supply	Dongguan Tongmen Electronic Technology Co., LTD	etm-6050c	20211026123	2022.11.25	2023.11.24	☒
Programmable constant temperature and humidity box	ZZCKONG	ZZ-K02A	20210928007	2022.11.24	2023.11.23	☒
RF Control Unit	TST	TST-Full	S01	/	/	☒
RF Test software	TST	V2.0	/	/	/	☒

Radiated Method Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
SIGNAL ANALYZER	ROHDE&SCHWARZ	FSQ40	100010	2022.11.24	2023.11.23	☒
EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCI7	101032	2022.11.24	2023.11.23	☒
Log periodic antenna	SCHWARZBECK	VULB 9168	01328	2021.11.28	2023.11.27	☒
Horn Antenna	SCHWARZBECK	BBHA9170	01157	2021.11.28	2023.11.27	☒
POSITIONAL CONTROLLER	SKET	PCI-GPIB	/	/	/	☒
RE Cable	REBES Talent	UF2-NMNM-10m	21101570	2022.11.24	2023.11.23	☒
RE Cable	REBES Talent	UF2-NMNM-2.5m	21101573	2022.11.24	2023.11.23	☒
RE Cable	REBES Talent	UF2-NMNM-1m	21101576	2022.11.24	2023.11.23	☒

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Coaxial cable Multiflex 141	Schwarzbeck	N/SMA 0.5m	517386	2023.3.24	2024.3.23	☒
RE Cable	Talent Microwave	A40-2.92M2.92 M-14M	22080539	2022.11.24	2023.11.23	☒
RE Cable	Talent Microwave	A81-SMAMNM-14M	22080538	2022.11.24	2023.11.23	☒
Preamplifier	SCHWARZBECK	BBV9744	00246	2022.11.24	2023.11.23	☒
Horn Antenna	Schwarzbeck	BBHA9120D	2597	2022.5.22	2024.5.21	☒
Broadband Preamplilifier	Schwarzbeck	BBV9718D	00008	2023.3.24	2024.3.23	☒

Conducted disturbance Test						
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due	Use
EMI Receiver	ROHDE&SCHWARZ	ESCI3	101422	2022.11.24	2023.11.23	☒
V-LISN	SCHWARZBECK	NSLK 8127	01073	2022.11.24	2023.11.23	☒
LISN	AFJ	LS16/110VAC	16010020076	2022.11.24	2023.11.23	☒
Coaxial Switcher	SCHWARZBECK	CX210	CX210	2022.11.24	2023.11.23	☒
Pulse Limiter	SCHWARZBECK	VTSD 9561-F	00953	2022.11.24	2023.11.23	☒
EZ_EMC	Frad	EMC-CON 3A1.1+	/	/	/	☒

4.3 Test Auxiliary Equipment

Description	Manufacturer	Model	Serial No.	Length	Description	Use
/	/	/	/	/	/	

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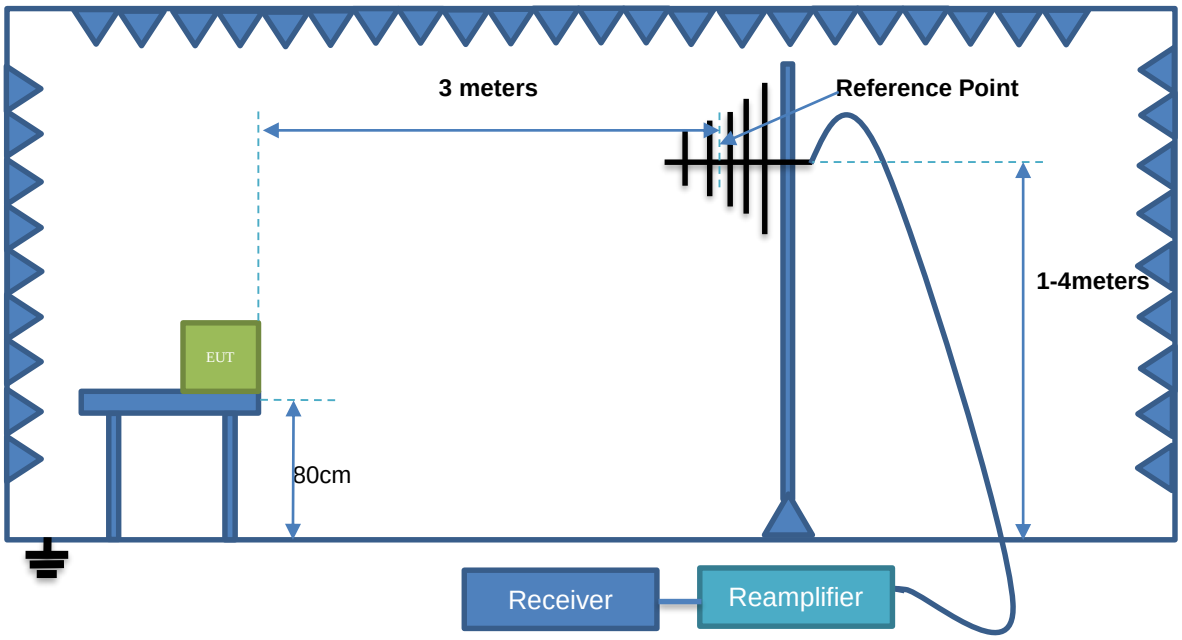
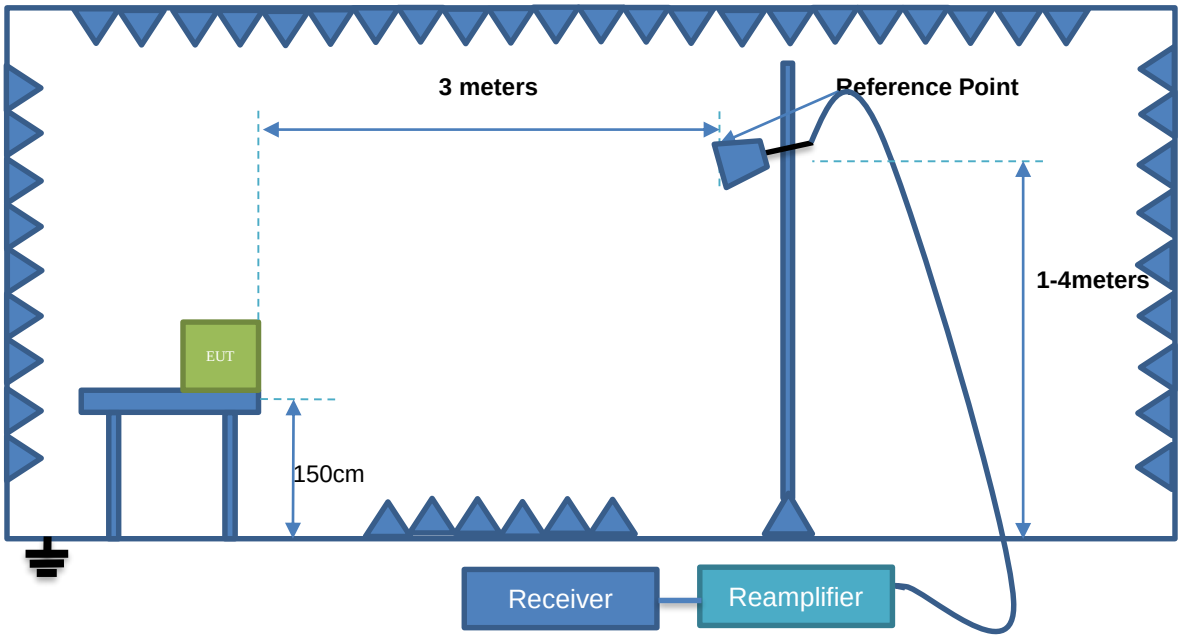
4.4 Test Setup

Test Setup 1



Radiation Test (30MHz – 1GHz)



Radiation Test (Above 1GHz)

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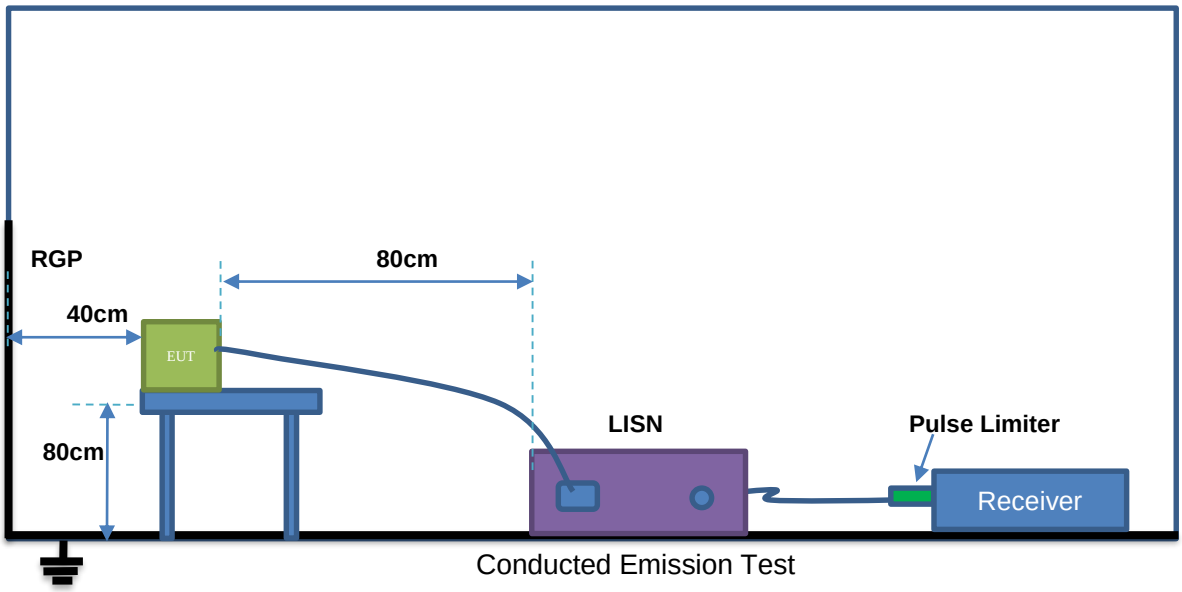
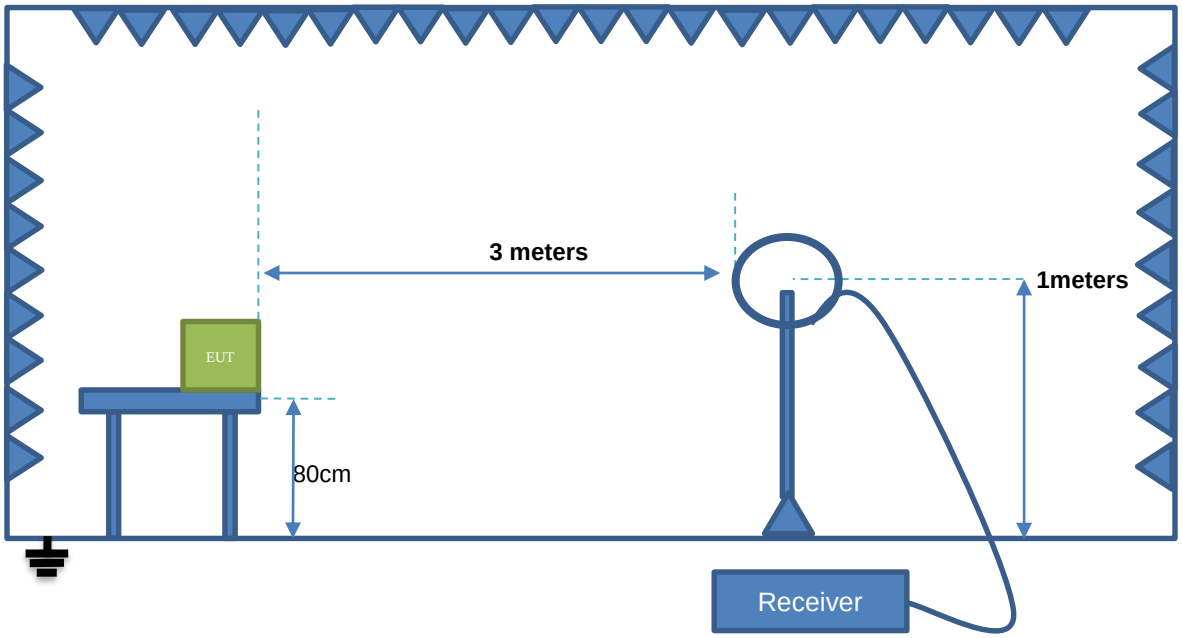
Test Setup 2



Conducted Emission Test

Test Setup 3



Radiation Test (9k - 30MHz)

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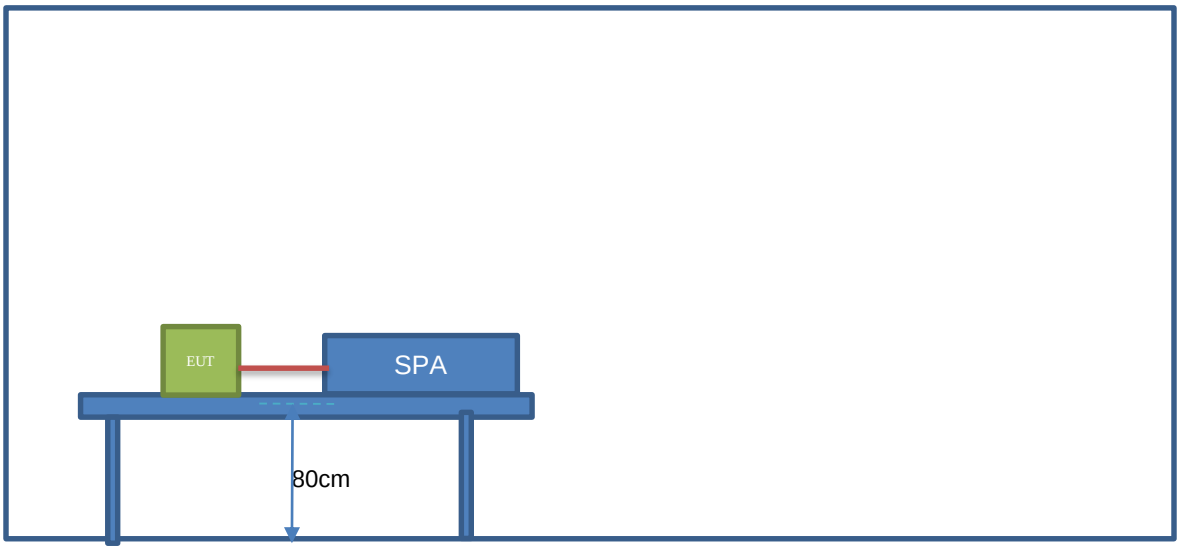
Test Setup 4



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5. Test Items

5.1 Antenna Requirements

5.1.1 Relevant Standards

FCC §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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

5.1.2 TEST RESULT

☒Passed ☐Not Applicable

The antenna type is a PCB antenna, the maximum gain of the antenna is 0.56dBi.

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5.2 Conduction Emission

5.2.1 Limit

FCC §15.207

For an intentional radiator that 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 within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

5.2.2 Test Setup

See section 4.4 for test setup description for setup 2. The photo of test setup please refer to ANNEX B

5.2.3 Test Procedure

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

Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

5.2.4 Test Result

The EUT is powered by DC, no requirements for this item.

NOTE:

1. Results (dBuV) = Reading (dBuV) + Factor (dB)
   The reading level is calculated by software which is not shown in the sheet
2. Factor = Insertion loss + Cable loss
3. Over limit = Results – Limit.

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5.3 20dB Bandwidth

5.3.1 Limit

FCC §15.231(c)

The bandwidth of the emission shall be no wider than 0.25% of the centre frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the centre frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

5.3.2 Test Setup

See section 4.4 for test setup description for antenna port. The photo of test setup please refer to ANNEX A

5.3.3 Test Procedure

1.keep the relative position between the artificial antenna and the EUT.

2. Set to the maximum power setting and enable the EUT transmit continuously.

3. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.

   Span = approximately 2 to 3 times the 20 dB

   bandwidth, centered on a hopping channel

   RBW⩾ 1% of the 20 dB bandwidth; VBW⩾RBW

   Sweep = auto

   Detector function = peak

   Trace = max hold.

4. Measure and record the results in the test report.

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5.3.4 Test Result

Frequency (MHz)	20dB Bandwidth (MHz)	Result
433.92	0.1642	Pass

FSK

5.4 Transmission time

5.4.1 Limit

FCC §15.231(a)(1)

A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

5.4.2 Test Setup

See section 4.4 for test setup description for antenna port. The photo of test setup please refer to ANNEX A

5.4.3 Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Frequency=Center carrier frequency
   RBW=100kHz, VBW=300kHz, Span= zero,
   Sweep time= 10second, Detector function = peak, Trace = single
4. Measure and record the results in the test report.

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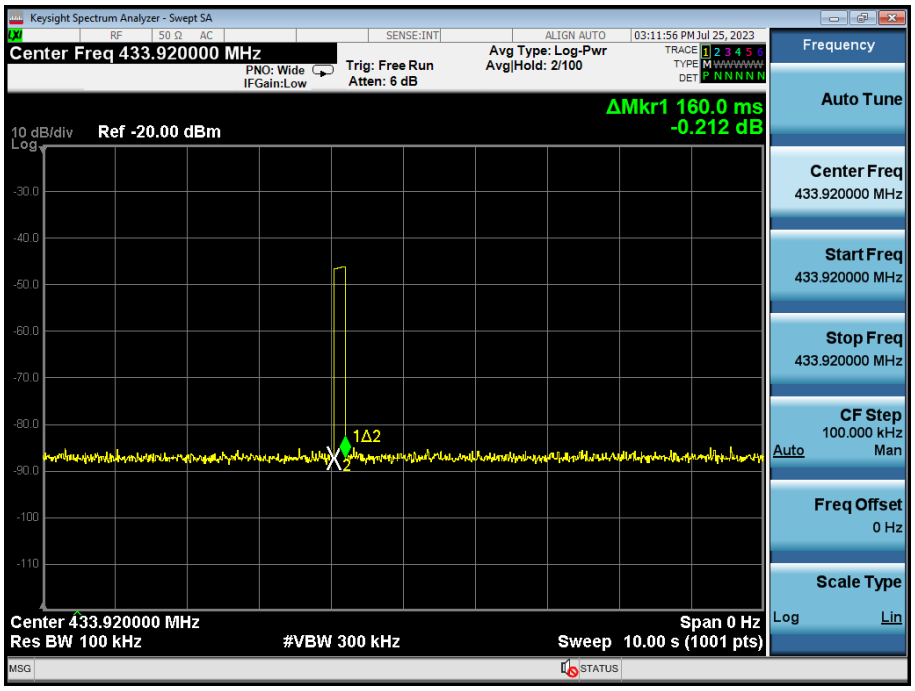
5.4.4 Test Result

	Transmission cease time (second)	Limit (second)	Result
Normal	0.160	<5s	Pass



5.5 Duty Cycle Corrected Factor

5.5.1 Limit

N/A

5.5.2 Test Setup

See section 4.4 for test setup description for the antenna port. The photo of test setup please refer to ANNEX A

5.5.3 Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator, the path loss was compensated to the results for each measurement.
2. Set to the maximum power setting and enable the EUT transmit continuously
3. Use the following spectrum analyzer settings:
   Span=zero span, Frequency=centered channel, RBW= 100kHz, VBW ≥ RBW
   Sweep time=as necessary to capture the entire dwell time,
   Detector function = peak, Trigger mode
4. Measure and record the duty cycle data

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5.5.4 Test Result

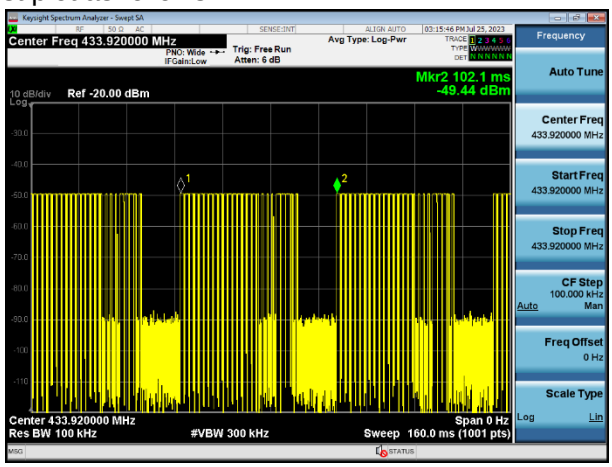
Duty Cycle= Effective time one cycle/ Total time one cycle

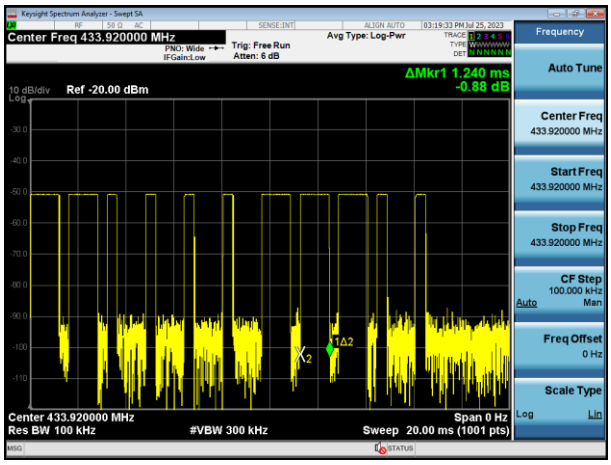
Averaging factor in dB =20log (duty cycle)

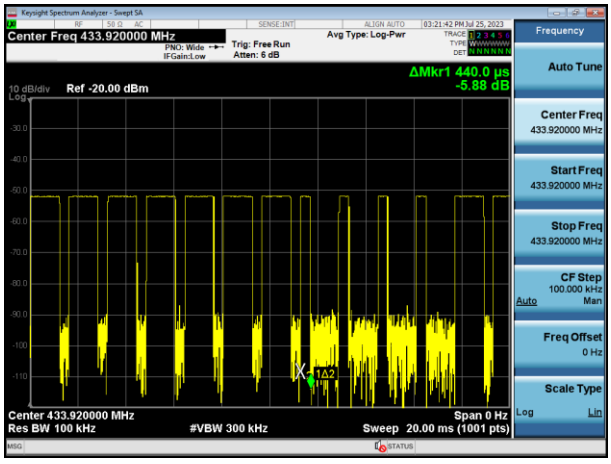
Duty Cycle = (1.24ms*19+0.44ms*6)/100

Therefore, the averaging factor is found by 20log0.26=-11.7dB

Test plot as follows:







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5.6 Field strength of the Fundamental signal

5.6.1 Limit

FCC §15.231(b)

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66 – 40.70	2,250	225
70 – 130	1,250	125
130 – 174	*1,250 to 3,750	*125 to 375
174 – 260	3,750	375
260 – 470	*3,750 to 12,500	*375 to 1,250
Above 470	12,500	1,250

*Linear interpolations

5.6.2 Test Setup

See section 4.4 for test setup description for the antenna port. The photo of test setup please refer to ANNEX A

5.6.3 Test Procedure

1. The EUT was setup and tested according to ANSI C63.10.
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1GHz, The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
   Span shall wide enough to fully capture the emission being measured;
   RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;
   If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

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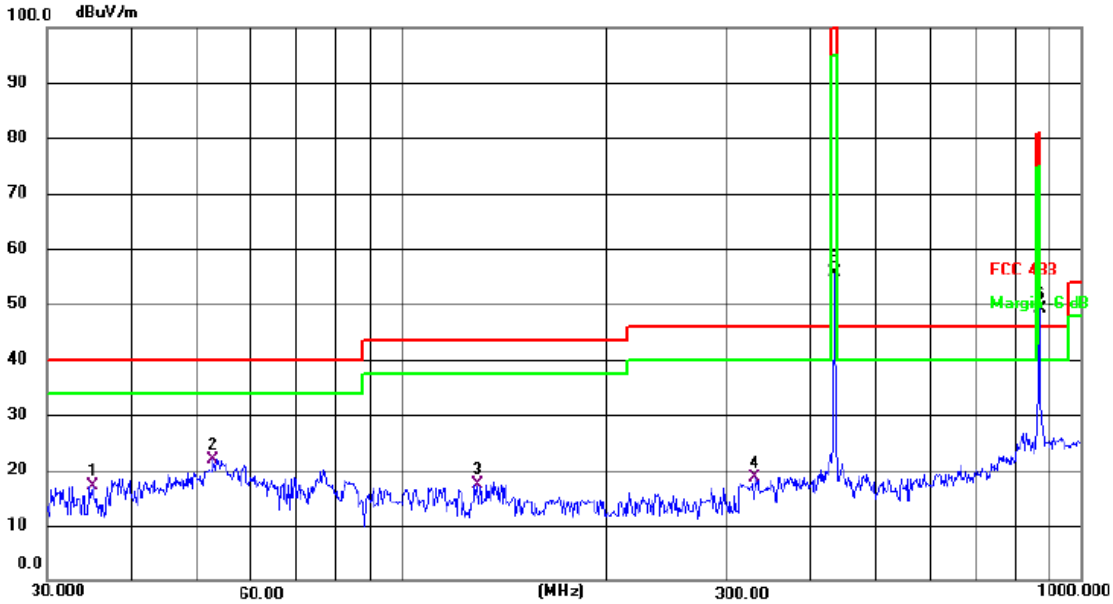
5.6.4 Test Result

Temperature:	24.5℃	Relative Humidity:	54%
Pressure:	1010 hPa	Polarization :	Horizontal
Test Voltage :	DC 3V		
Test Mode :	TX Mode		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		35.1276	32.08	-14.91	17.17	40.00	-22.83	QP
2	*	52.7600	35.03	-13.07	21.96	40.00	-18.04	QP
3		129.4677	34.36	-16.92	17.44	43.50	-26.06	QP
4		331.3546	29.48	-10.91	18.57	46.00	-27.43	QP
5		434.0857	64.57	-9.01	55.56	100.80	-45.24	peak
6		869.1956	50.06	-1.04	49.02	80.80	-31.78	peak

Remark:
Correct Factor = Cable loss + Antenna factor – Preamplifier;
Level = Reading Level + Correct Factor; Margin = Level - Limit;

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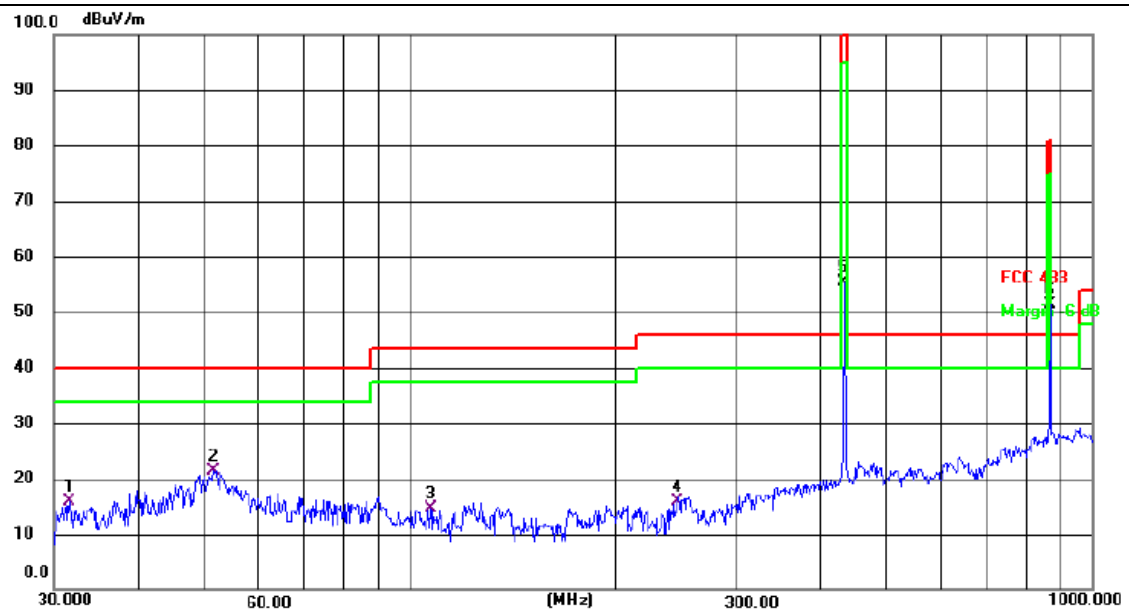
Temperature:	24.5℃	Relative Humidity:	54%
Pressure:	1010 hPa	Polarization :	Vertical
Test Voltage :	DC 3V		
Test Mode :	TX Mode		



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		31.6201	31.67	-15.69	15.98	40.00	-24.02	QP
2	*	51.4806	34.49	-13.14	21.35	40.00	-18.65	QP
3		107.1337	31.05	-16.54	14.51	43.50	-28.99	QP
4		245.9507	28.89	-12.89	16.00	46.00	-30.00	QP
5		434.0259	64.38	-9.02	55.36	100.80	-45.44	peak
6		869.0098	52.41	-1.04	51.37	80.80	-29.43	peak

Remark:
Correct Factor = Cable loss + Antenna factor – Preamplifier;
Level = Reading Level + Correct Factor; Margin = Level - Limit;

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For average Emission

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	AverageLevel dBuV/m	Polarization	Limit AV	Margin
434.0857	55.56	-11.7	43.86	Horizontal	80.8	-36.94
869.1956	49.02	-11.7	37.32	Horizontal	60.6	-23.28

Notes: 1. Average emission Level = Peak Level + Duty cycle factor
2.Duty cycle level please see clause 5.5.

Frequency MHz	Peak Level dBuV/m	Duty cycle factor	AverageLevel dBuV/m	Polarization	Limit AV	Margin
434.0259	55.36	-11.7	43.66	Vertical	80.8	-37.14
869.0098	51.37	-11.7	39.67	Vertical	60.6	-20.93

Notes: 1. Average emission Level = Peak Level + Duty cycle factor
2.Duty cycle level please see clause 5.5.

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5.7 Radiated Spurious Emission

5.7.1 Limit

FCC §15.231(b)

Fundamental frequency (MHz)	Field strength of fundamental (microvolts/meter)	Field strength of spurious emissions (microvolts/meter)
40.66 – 40.70	2,250	225
70 – 130	1,250	125
130 – 174	*1,250 to 3,750	*125 to 375
174 – 260	3,750	375
260 – 470	*3,750 to 12,500	*375 to 1,250
Above 470	12,500	1,250

*Linear interpolations

FCC §15.209

Frequency Range (MHz)	Distance (m)	Field strength (dB μ V/m)
0.009-0.490	3	20log 2400/F (kHz) + 80
0.490-1.705	3	20log 24000/F (kHz) + 40
1.705-30	3	20log 30 + 40
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

Note:

1. RF Voltage (dBuV) = 20 log RF Voltage (uV)
2. In the Above Table, the tighter limit applies at the band edges.
3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT
4. The radiated emissions should be tested under 3-axes position (Lying, Side, and Stand), After pre-test. It was found that the worse radiated emission was get at the lying position.
5. If measurement is made at 3m distance, then F.S Limitation at 3m distance is adjusted by using the formula Ld1 = Ld2 * (d2/d1)

5.7.2 Test Setup

See section 4.4 for test setup description for the antenna port. The photo of test setup please refer to ANNEX A

5.7.3 Test Procedure

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1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter camber in below 1GHz, 1.5m above the ground in above 1GHz. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

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5.7.4 Test Result

Polar (H/V)	Frequency (MHz)	Peak Reading Level (dBuV)	Correct Factor (dB)	Peak Level (dB)	Duty cycle factor (dB/m)	Average Level (dBuV/m)	Limits PK (dB)	Limits AV (dB)	Margin PK	Margin AV
operation frequency:433.92										
V	1301.76	43.69	-21.97	21.72	-11.7	10.02	74	54	-52.28	-43.98
V	1735.68	44.55	-21.97	22.58	-11.7	10.88	80.8	60.8	-58.22	-49.92
V	2169.6	46.77	-17.41	29.36	-11.7	17.66	80.8	60.8	-51.44	-43.14
V	2603.52	51.22	-17.41	33.81	-11.7	22.11	80.8	60.8	-46.99	-38.69
V	3037.44	43.37	-2.63	40.74	-11.7	29.04	80.8	60.8	-40.06	-31.76
V	3471.36	47.69	-2.63	45.06	-11.7	33.36	80.8	60.8	-35.74	-27.44
H	1301.76	54.25	-21.97	32.28	-11.7	20.58	74	54	-41.72	-33.42
H	1735.68	45.79	-21.97	23.82	-11.7	12.12	80.8	60.8	-56.98	-48.68
H	2169.6	51.24	-17.41	33.83	-11.7	22.13	80.8	60.8	-46.97	-38.67
H	2603.52	46.58	-17.41	29.17	-11.7	17.47	80.8	60.8	-51.63	-43.33
H	3037.44	44.23	-2.63	41.6	-11.7	29.9	80.8	60.8	-39.20	-30.90
H	3471.36	43.38	-2.63	40.75	-11.7	29.05	80.8	60.8	-40.05	-31.75

Remark:
1. PK Emission Level = Peak Reading Level + Correct Factor
2. Correct Factor= Antenna Factor + Cable Loss – Pre-amplifier,
   Margin= Emission Level - Limit

2. If peak below the average limit, the average emission was no test.
3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Notes: 1. Average emission Level = Peak Level + Duty cycle factor

2.Duty cycle level please see clause 5.5.

3. Pulse Desensitization Correction Factor

Pulse Width (PW) = 100ms

2/PW = 2/100ms = 0.02kHz

RBW (100 kHz) > 2/PW (0.02kHz)

Therefore PDCF is not needed

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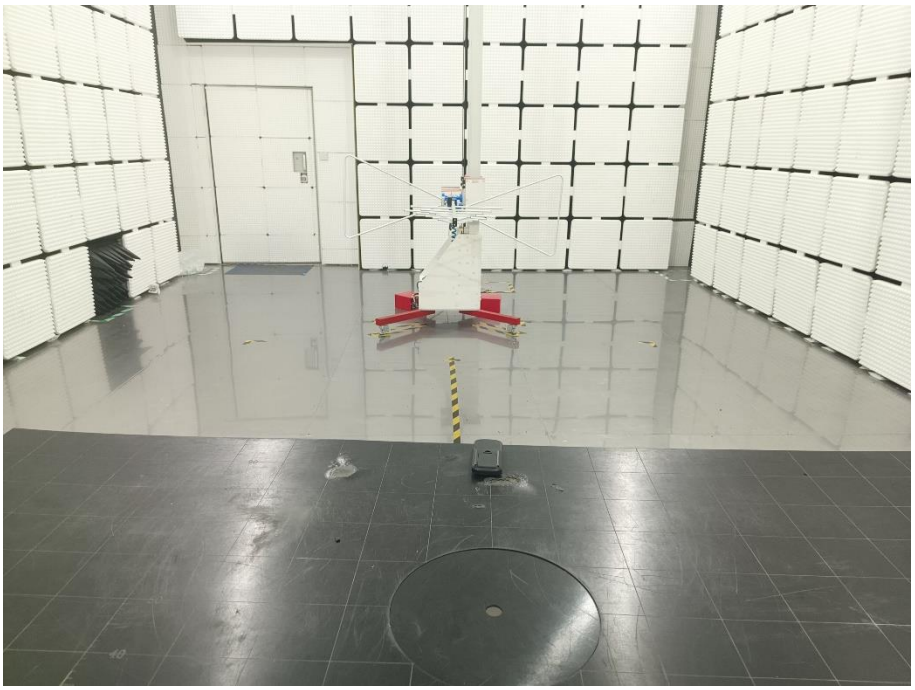
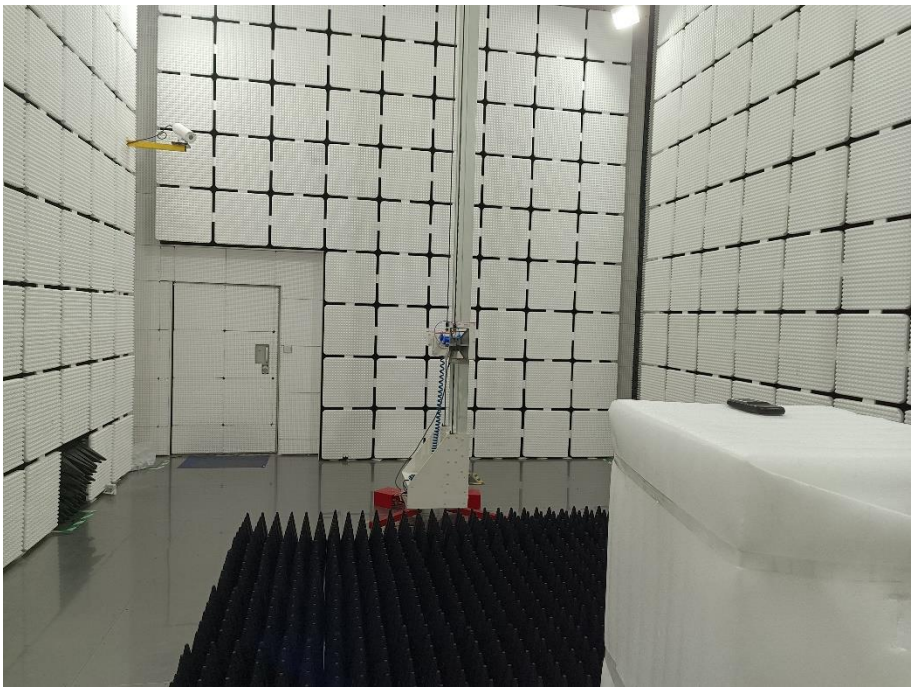
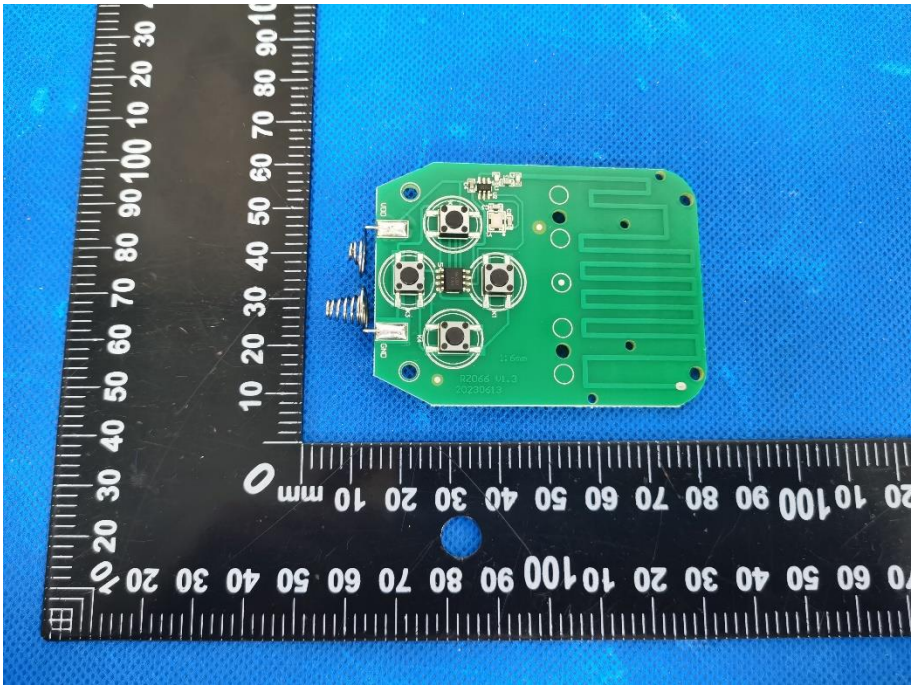
ANNEX A TEST SETUP PHOTOS

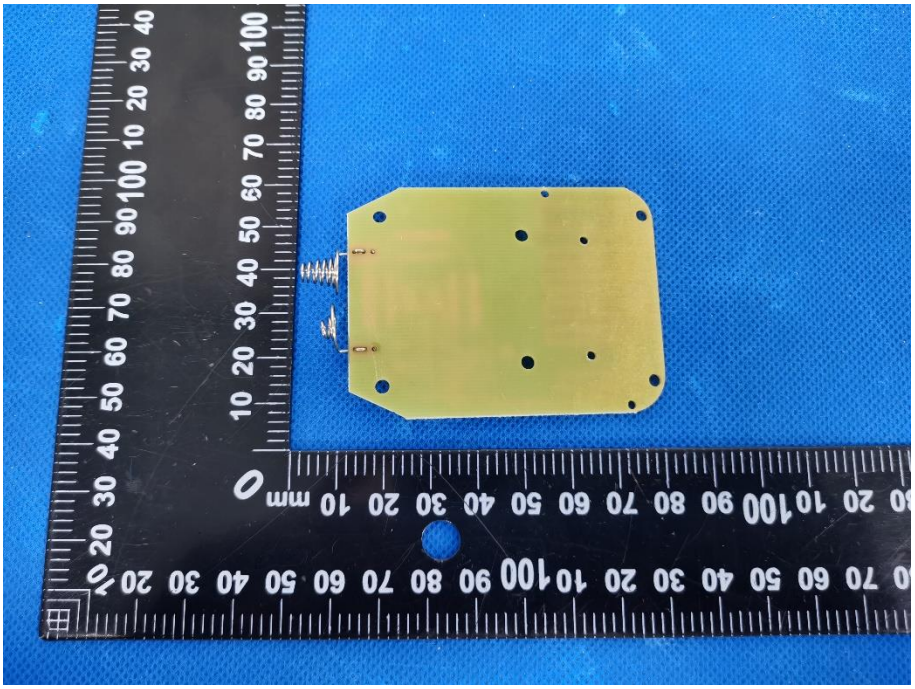


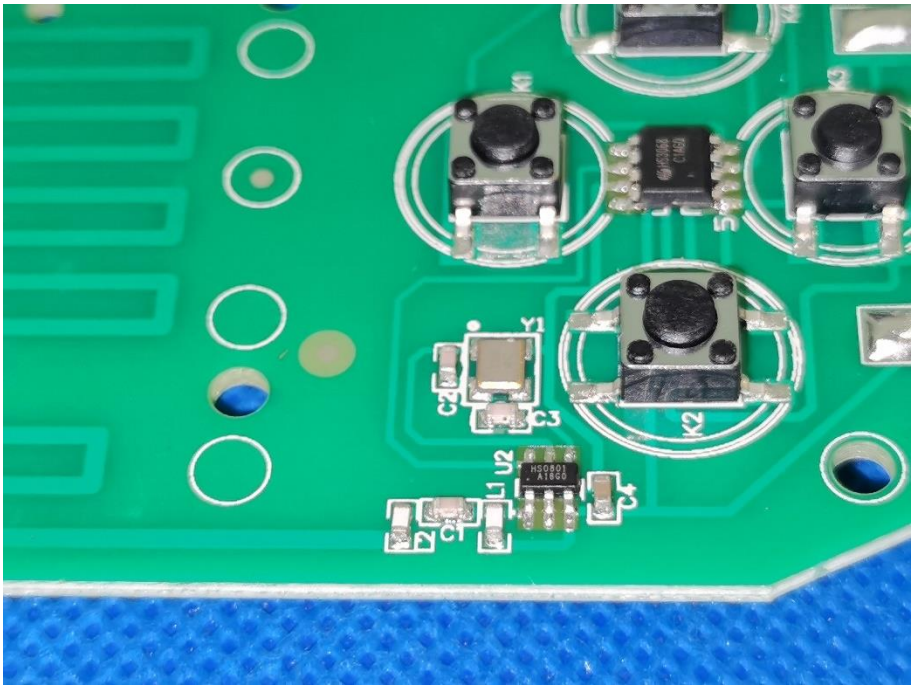


ANNEX B EUT EXTERNAL PHOTOS

ANNEX C EUT INTERNAL PHOTOS







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