FCC Test Report

Report No.: AGC07849161101FE03

FCC ID	:	2AKARRU101R
APPLICATION PURPOSE	:	Class II Permissive Change
PRODUCT DESIGNATION	:	UHF Reader
BRAND NAME	:	ZK RFID
MODEL NAME	:	UHF1-5F, UHF2-5F, RU100R-W-F-V1.0
CLIENT	:	Guangdong ZK Radio Electronic Tech Co., Ltd
DATE OF ISSUE	:	Nov. 30, 2016
STANDARD(S)	:	FCC Part 15 Rules
REPORT VERSION	:	V1.0

Attestation of ***G***lobal ***C***ompliance (Shenzhen) Co., Ltd

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Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Nov. 30, 2016	Valid	Original Report

Note: All the test items can refer to the report No. AGC078491002FE03 except the Radiated Emission.

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1. VERIFICATION OF CONFORMITY

Applicant	Guangdong ZK Radio Electronic Tech Co., Ltd
Address	1004 Room, 3 block B, Tian-an-Yun-Gu, Ban Tian Longgang, Shenzhen, China
Manufacturer	Guangdong ZK Radio Electronic Tech Co., Ltd
Address	1004 Room, 3 block B, Tian-an-Yun-Gu, Ban Tian Longgang, Shenzhen, China
Product Designation	UHF Reader
Brand Name	ZK RFID
Test Model	UHF1-5F
Series Model	UHF2-5F, RU100R-W-F-V1.0
Model Difference	RU100R-W-E-V1.0 and UHF2-5F are same as UHF1-5F except the antenna and encryption software.
Date of test	Nov. 29, 2016 to Nov. 30, 2016
Deviation	None
Condition of Test Sample	Normal
Test Result	Pass
Report Template	AGCRT-US-BR/RF (2013-03-01)

We hereby certify that:

The above equipment was tested by Dongguan Precise Testing Service 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 radiated emission limits of FCC Rules Part 15.247.

Tested by Max Zhang

Max Zhang(Zhang Yi) Nov. 30, 2016

Reviewed by Bart Xie

Bart Xie(Xie Xiaobin) Nov. 30, 2016

Approved by Solger Zhang

Solger Zhang(Zhang Hongyi)
Authorized Officer Nov. 30, 2016

Tel: +86-755 2908 1955 Fax: +86-755 2600 8484 E-mail: agc@agc-cert.com 400 089 2118
Add: 2F. , Building 2, No.1-4,Chaxi Sanwei Technical Industrial Park,Gushu, Xixiang, Baoan District, Shenzhen, Guangdong China

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is “RFID” designed as a “Communication Device”. It is designed by way of utilizing the FHSS technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	902.5 MHz to 927.5MHz
RF Output Power	16.317dBm(Max)
Modulation	GFSK
Number of channels	51
Hardware Version	MI610_V1.1
Software Version	UR011 20160820_V1.2
Antenna Designation	Integrated Antenna
Antenna Gain	8dBi
Power Supply	DC 12V

Note: The USB port is only for updating the configuration file.

2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
902~928MHZ	1	902.5 MHZ
	2	903.0 MHZ
	:	:
	50	927.0 MHZ
	51	927.5 MHZ

Note: The channel spacing is 0.5MHz.

2.3. RECEIVER INPUT BANDWIDTH

The input bandwidth of the receiver is 200kHz.

2.4. EXAMPLE OF A HOPPING SEQUENCY IN DATA MODE

Example of a 51 hopping sequence in data mode:
21,23,33,25,27,31,07,09,13,11,15,02,06,01,03,05,04,08,10,12,14,16,17,18,19,20,
24,26,27,28,29,30,32,34,35,36,37,38,40,41,42,43,45,44,47,46,48,49,50,51

2.5. EQUALLY AVERAGE USE OF FREQUENCIES AND BEHAVIOUR

The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter.

2.6. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AKARRU101R** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.7. 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.

2.8. SPECIAL ACCESSORIES

Refer to section 5.2.

2.9. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

3. MEASUREMENT UNCERTAINTY

Conducted measurement: +/- 3.18dB

Radiated measurement: +/- 3.91dB

4. DESCRIPTION OF TEST MODES

NO.	TEST MODE DESCRIPTION
1	Low channel TX
2	Middle channel TX
3	High channel TX

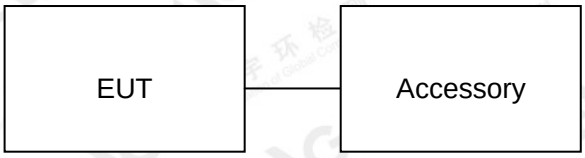
Note:

1. Only the result of the worst case was recorded in the report, if no other cases.
2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Configure 1:



5.2. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Mfr/Brand	Model/Type No.	Remark
1	UHF READER	ZK RFID	UHF1-5F	EUT
2	PC	Sony	E1412AYCW	A.E

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.209 & §15.247	Radiated Emission	Compliant

6. TEST FACILITY

Site	Dongguan Precise Testing Service Co., Ltd.
Location	Building D, Baoding Technology Park,Guangming Road2, Dongcheng District, Dongguan, Guangdong, China.
FCC Registration No.	371540
Description	The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2014.

ALL TEST EQUIPMENT LIST

Radiated Emission Test Site					
Name of Equipment	Manufacturer	Model Number	Serial Number	Last Calibration	Due Calibration
EMI Test Receiver	Rohde & Schwarz	ESCI	101417	July 3, 2016	July 2, 2017
Trilog Broadband Antenna (25M-1GHz)	SCHWARZBECK	VULB9160	9160-3355	July 3, 2016	July 2, 2017
Signal Amplifier	SCHWARZBECK	BBV 9475	9745-0013	July 3, 2016	July 2, 2017
RF Cable	SCHWARZBECK	AK9515E	96221	July 3, 2016	July 2, 2017
3m Anechoic Chamber	CHENGYU	966	PTS-001	June 3, 2016	June 2, 2017
MULTI-DEVICE Positioning Controller	Max-Full	MF-7802	MF780208339	N/A	N/A
Active loop antenna (9K-30MHz)	Schwarzbeck	FMZB1519	1519-038	June 3, 2016	June 2, 2017
Spectrum analyzer	Agilent	E4407B	MY46185649	June 3, 2016	June 2, 2017
Power Sensor	Agilent	U2021XA	MY55050474	June 3, 2016	June 2, 2017
Horn Antenna (1G-18GHz)	SCHWARZBECK	BBHA9120D	9120D-1246	June 3, 2016	June 2, 2017
Horn Ant (18G-40GHz)	Schwarzbeck	BBHA 9170	9170-181	June 3, 2016	June 2, 2017

7. RADIATED EMISSION

7.1. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

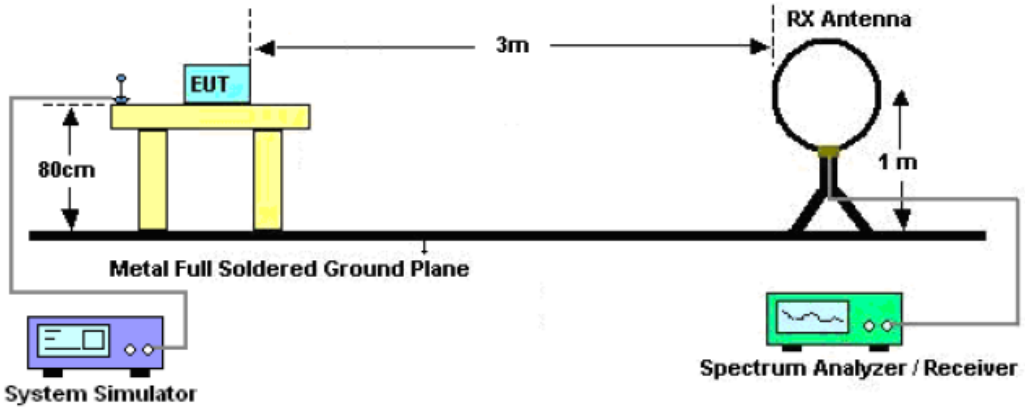
The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP
Start ~Stop Frequency	1GHz~26.5GHz 1MHz/1MHz for Peak, 1MHz/10Hz for Average

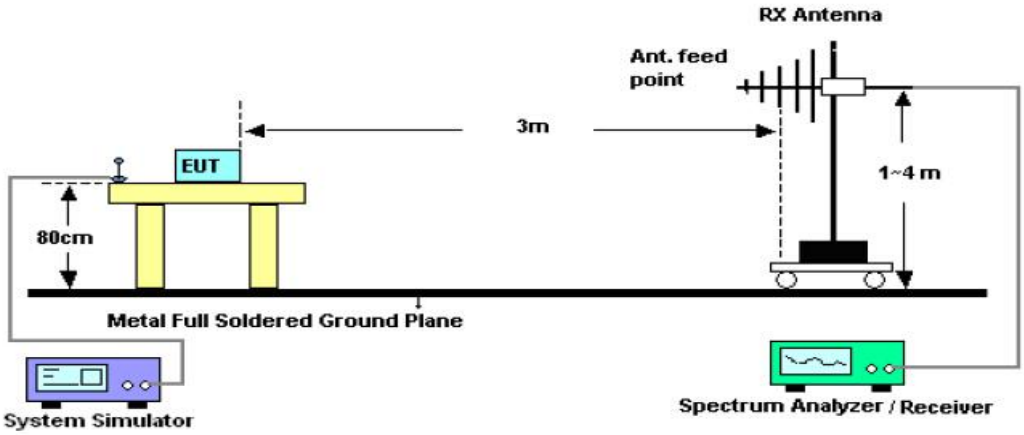
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

7.2. TEST SETUP

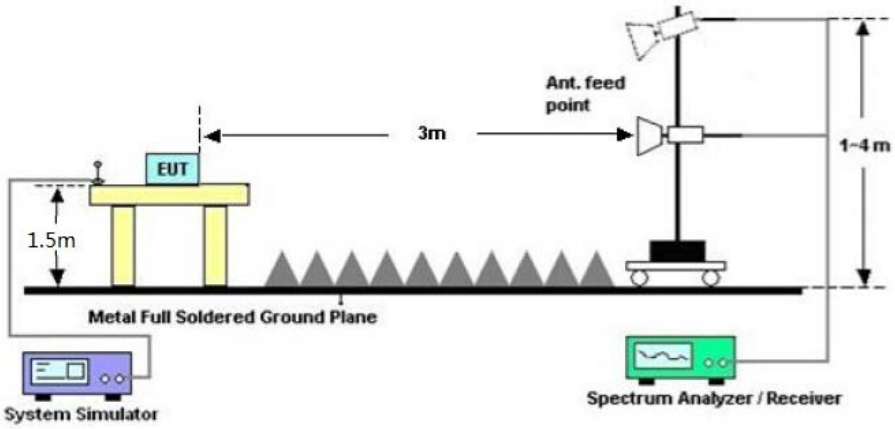
Radiated Emission Test-Setup Frequency Below 30MHz



RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



7.3. LIMITS AND MEASUREMENT RESULT

15.209(a) Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/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

Note: All modes were tested For restricted band radiated emission,
the test records reported below are the worst result compared to other modes.

7.4. TEST RESULT

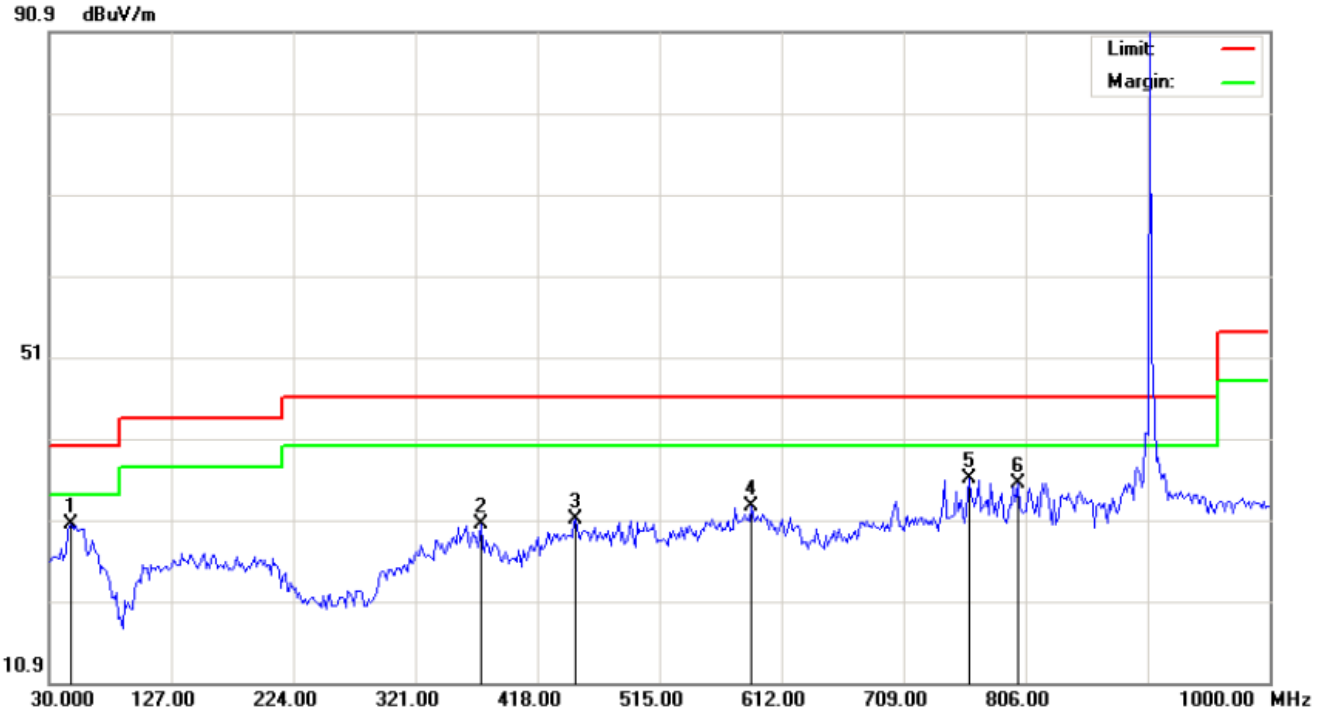
RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

Tel: +86-755 2908 1955 Fax: +86-755 2600 8484 E-mail: agc@agc-cert.com 400 089 2118
Add: 2F. , Building 2, No.1-4,Chaxi Sanwei Technical Industrial Park,Gushu, Xixiang, Baoan District, Shenzhen, Guangdong China

RADIATED EMISSION BELOW 1GHZ

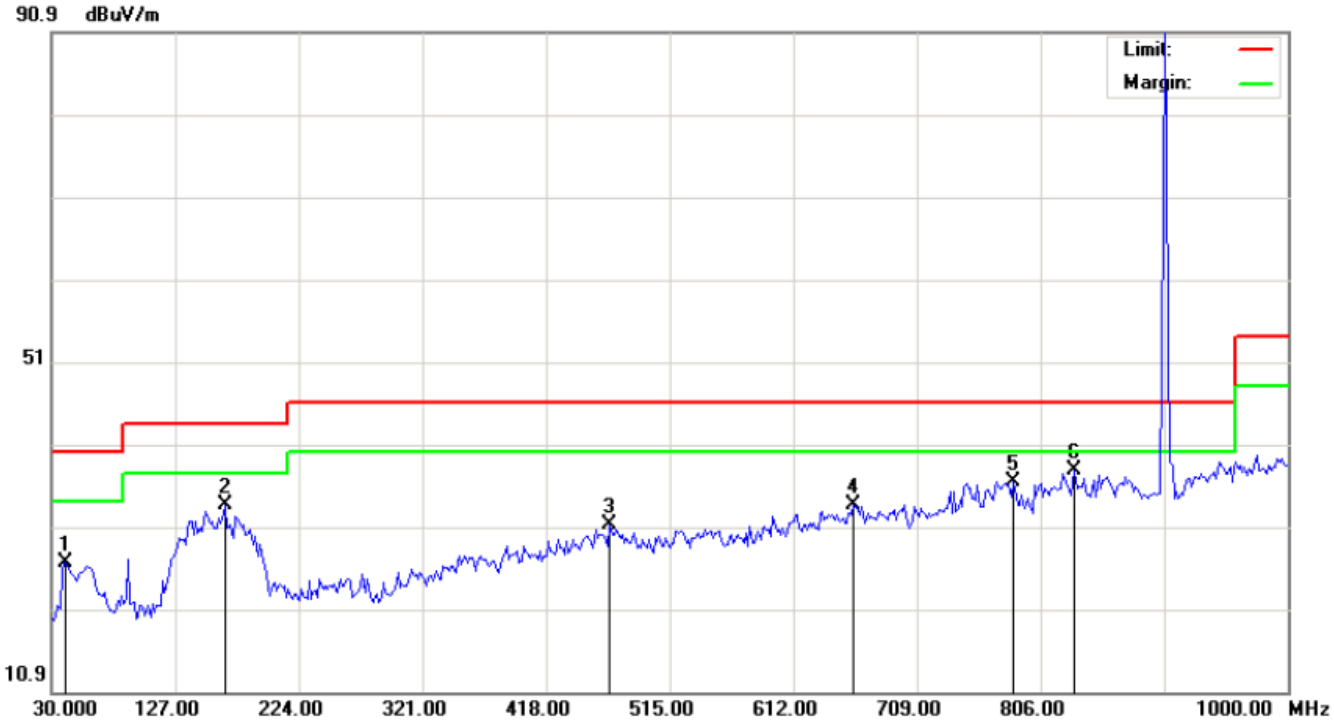
EUT	UHF READER	Model Name	UHF1-5F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	47.7832	18.96	11.39	30.35	40.00	-9.65	peak			
2		372.7333	11.61	18.89	30.50	46.00	-15.50	peak			
3		448.7167	10.50	20.55	31.05	46.00	-14.95	peak			
4		587.7500	9.11	23.42	32.53	46.00	-13.47	peak			
5		760.7333	9.27	26.78	36.05	46.00	-9.95	peak			
6		799.5333	8.18	27.31	35.49	46.00	-10.51	peak			

RESULT: PASS

EUT	UHF READER	Model Name	UHF1-5F
Temperature	25℃	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical



No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		41.3167	17.83	8.81	26.64	40.00	-13.36	peak			
2		165.8000	18.57	14.96	33.53	43.50	-9.97	peak			
3		468.1167	10.33	20.79	31.12	46.00	-14.88	peak			
4		658.8832	9.54	24.09	33.63	46.00	-12.37	peak			
5		784.9833	9.34	27.11	36.45	46.00	-9.55	peak			
6	*	831.8667	10.51	27.31	37.82	46.00	-8.18	peak			

RESULT: PASS

Note:

1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.
2. The “Factor” value can be calculated automatically by software of measurement system.
3. All test modes had been pre-tested. The mode 1 is the worst case and recorded in the report.

RADIATED EMISSION ABOVE 1GHZ

EUT	UHF READER	Model Name	UHF1-5F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
1805.014	69.42	-12.18	57.24	74	-16.76	peak
1805.014	60.08	-12.18	47.9	54	-6.1	AVG
2707.021	58.15	-6.74	51.41	74	-22.59	peak
2707.021	49.12	-6.74	42.38	54	-11.62	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	UHF READER	Model Name	UHF1-5F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 1	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
1805.014	67.55	-12.18	55.37	74	-18.63	peak
1805.014	58.47	-12.18	46.29	54	-7.71	AVG
2707.021	57.12	-6.74	50.38	74	-23.62	peak
2707.021	48.65	-6.74	41.91	54	-12.09	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

Tel: +86-755 2908 1955 Fax: +86-755 2600 8484 E-mail: agc@agc-cert.com 400 089 2118
Add: 2F. , Building 2, No.1-4,Chaxi Sanwei Technical Industrial Park,Gushu, Xixiang, Baoan District, Shenzhen, Guangdong China

EUT	UHF READER	Model Name	UHF1-5F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
1830.013	68.24	-12.04	56.2	74	-17.8	peak
1830.013	59.33	-12.04	47.29	54	-6.71	AVG
2745.018	58.28	-6.72	51.56	74	-22.44	peak
2745.018	49.36	-6.72	42.64	54	-11.36	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	UHF READER	Model Name	UHF1-5F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 2	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
1830.013	67.33	-12.04	55.29	74	-18.71	peak
1830.013	58.29	-12.04	46.25	54	-7.75	AVG
2745.018	56.37	-6.72	49.65	74	-24.35	peak
2745.018	47.55	-6.72	40.83	54	-13.17	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	UHF READER	Model Name	UHF1-5F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Horizontal

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
1855.012	69.85	-11.96	57.89	74	-16.11	peak
1855.012	60.35	-11.96	48.39	54	-5.61	AVG
2782.516	61.74	-6.68	55.06	74	-18.94	peak
2782.516	52.19	-6.68	45.51	54	-8.49	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

EUT	UHF READER	Model Name	UHF1-5F
Temperature	25°C	Relative Humidity	55.4%
Pressure	960hPa	Test Voltage	Normal Voltage
Test Mode	Mode 3	Antenna	Vertical

Frequency (MHz)	Meter Reading (dBμV)	Factor (dB)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Value Type
1855.012	67.58	-11.96	55.62	74	-18.38	peak
1855.012	58.17	-11.96	46.21	54	-7.79	AVG
2782.516	59.42	-6.68	52.74	74	-21.26	peak
2782.516	50.07	-6.68	43.39	54	-10.61	AVG
Remark:						
Factor = Antenna Factor + Cable Loss – Pre-amplifier.						

RESULT: PASS

Note:

Other emissions from 3G to 10 GHz are considered as ambient noise. No recording in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

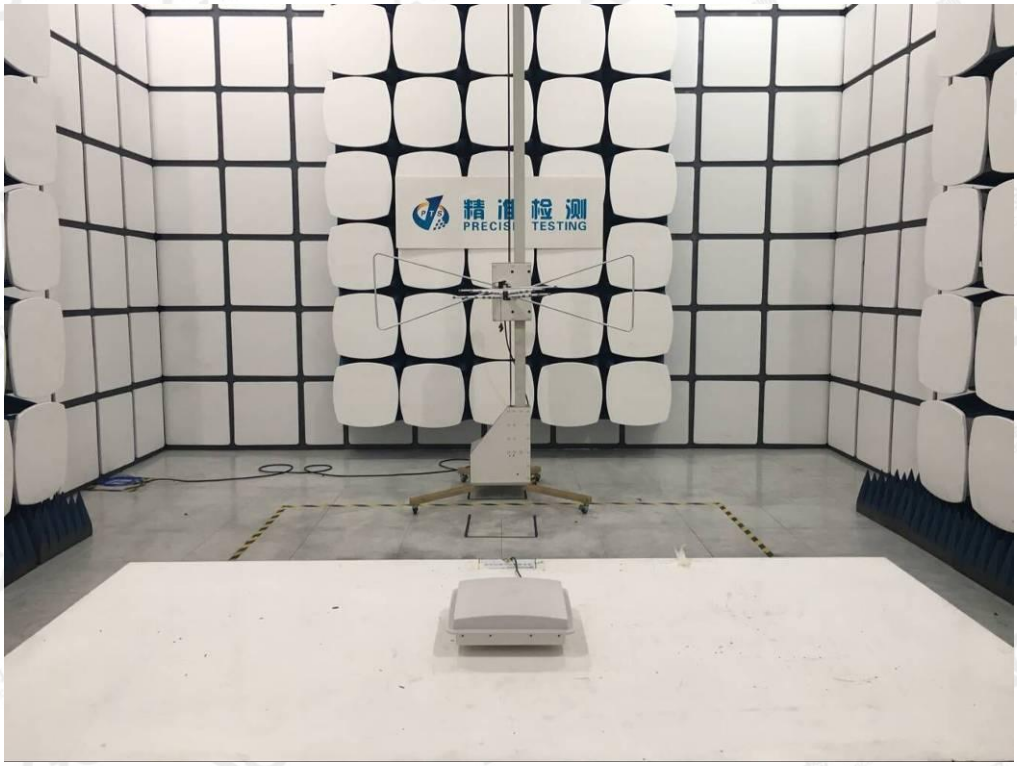
The “Factor” value can be calculated automatically by software of measurement system.

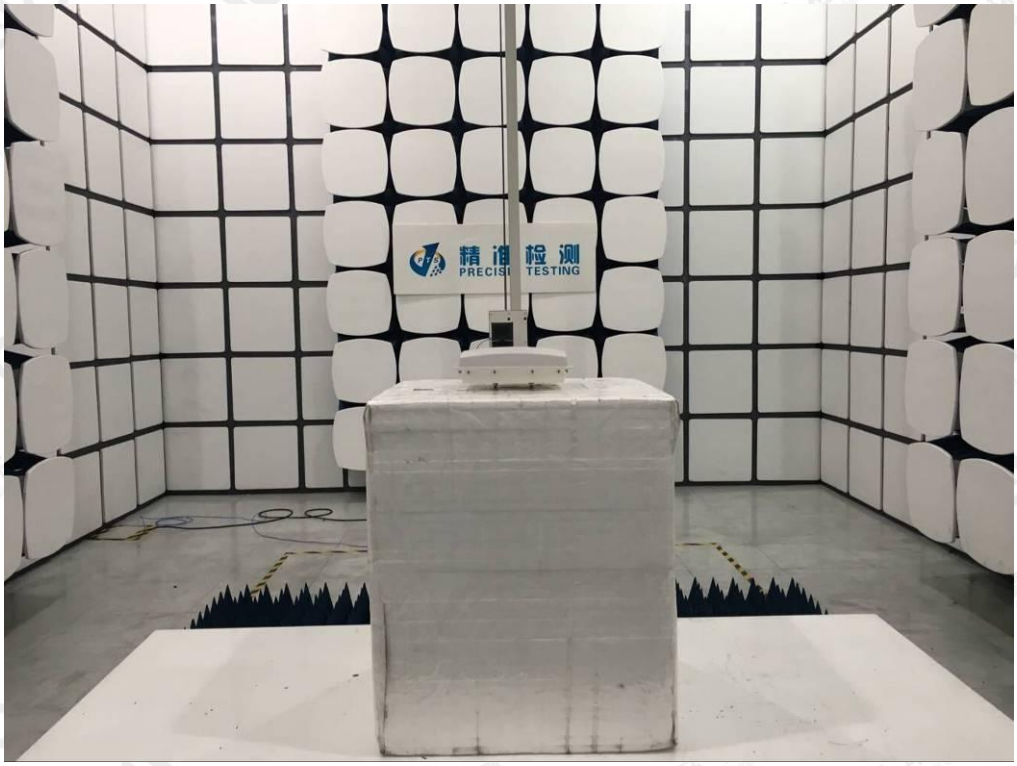
All test modes had been pre-tested. The GFSK modulation is the worst case and recorded in the report.

Tel: +86-755 2908 1955 Fax: +86-755 2600 8484 E-mail: agc@agc-cert.com 400 089 2118
Add: 2F. , Building 2, No.1-4,Chaxi Sanwei Technical Industrial Park,Gushu, Xixiang, Baoan District, Shenzhen, Guangdong China

APPENDIX A: PHOTOGRAPHS OF TEST SETUP

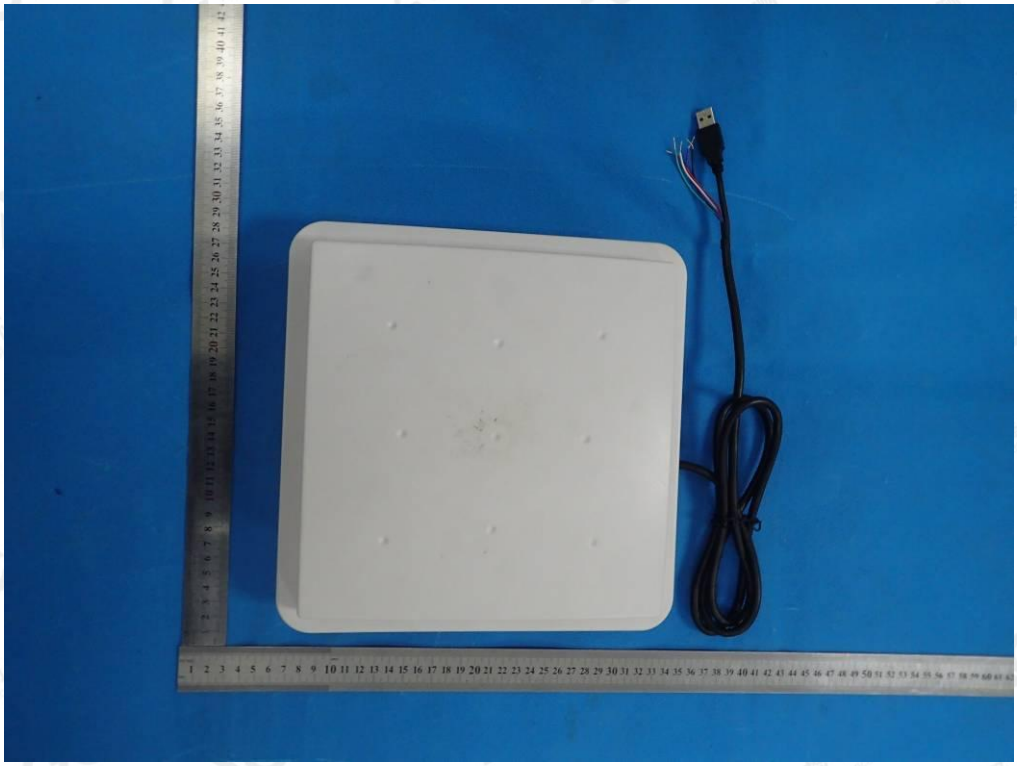
FCC RADIATED EMISSION TEST SETUP



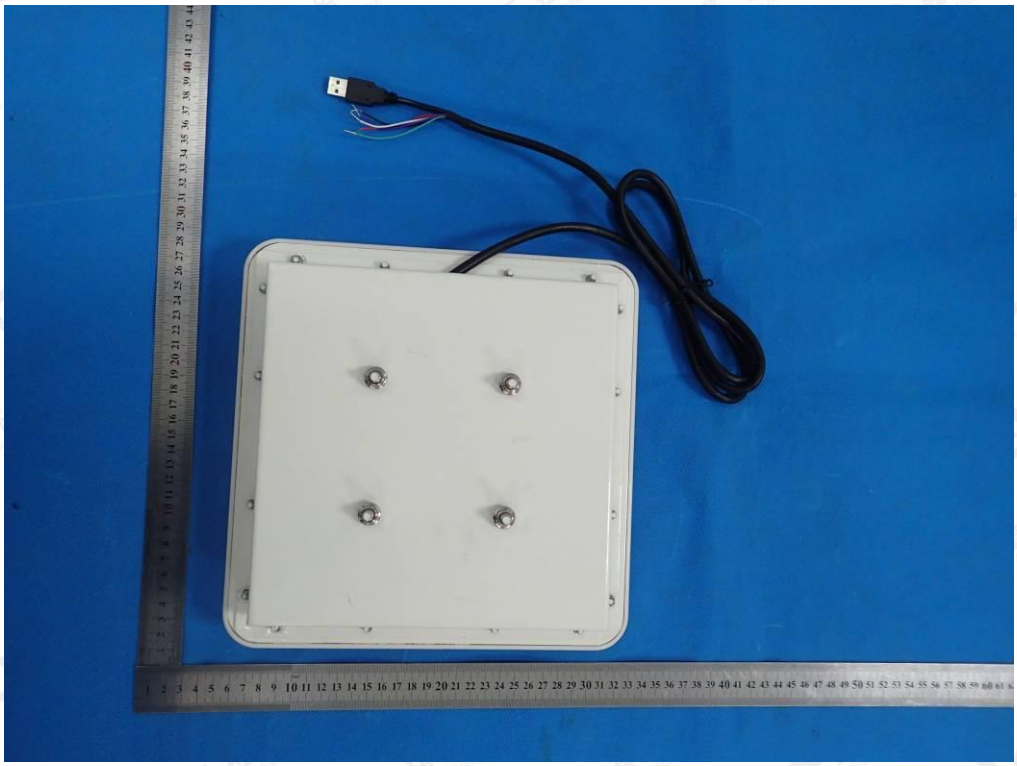


APPENDIX B: PHOTOGRAPHS OF EUT

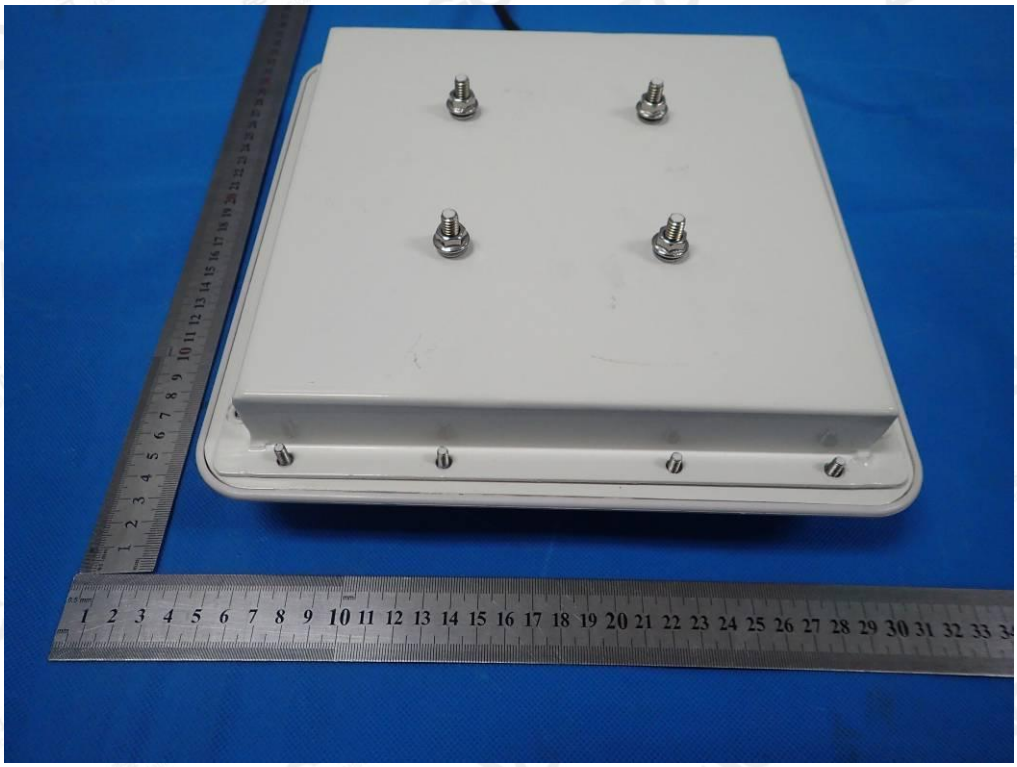
TOP VIEW OF EUT



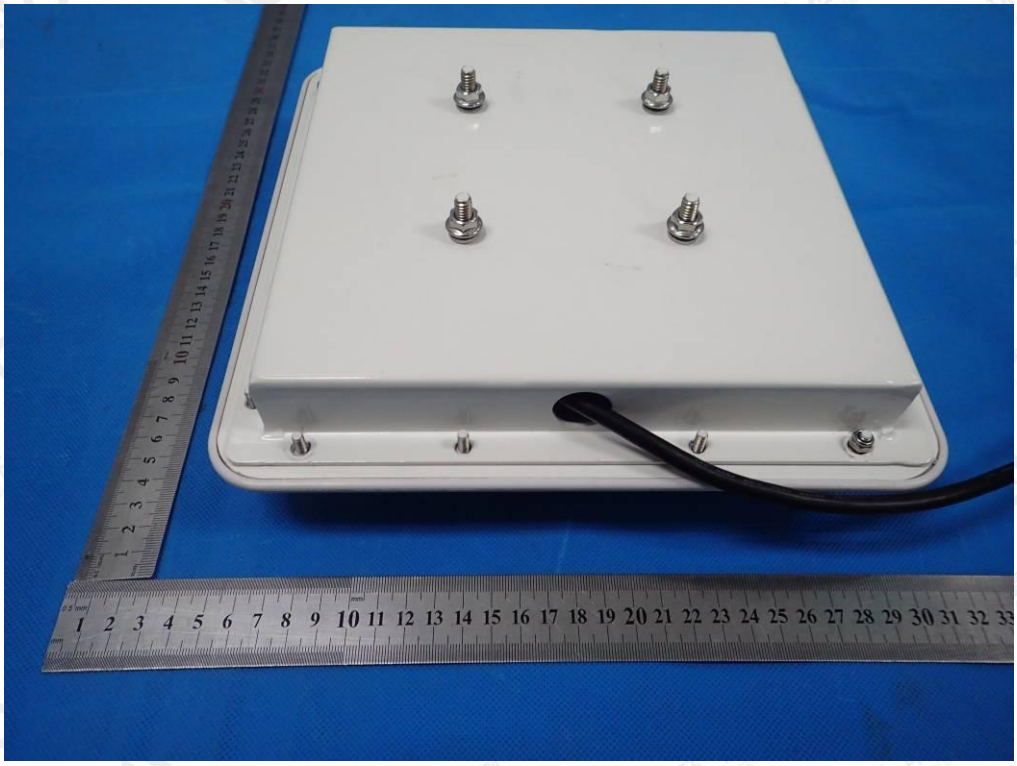
BOTTOM VIEW OF EUT



FRONT VIEW OF EUT



BACK VIEW OF EUT



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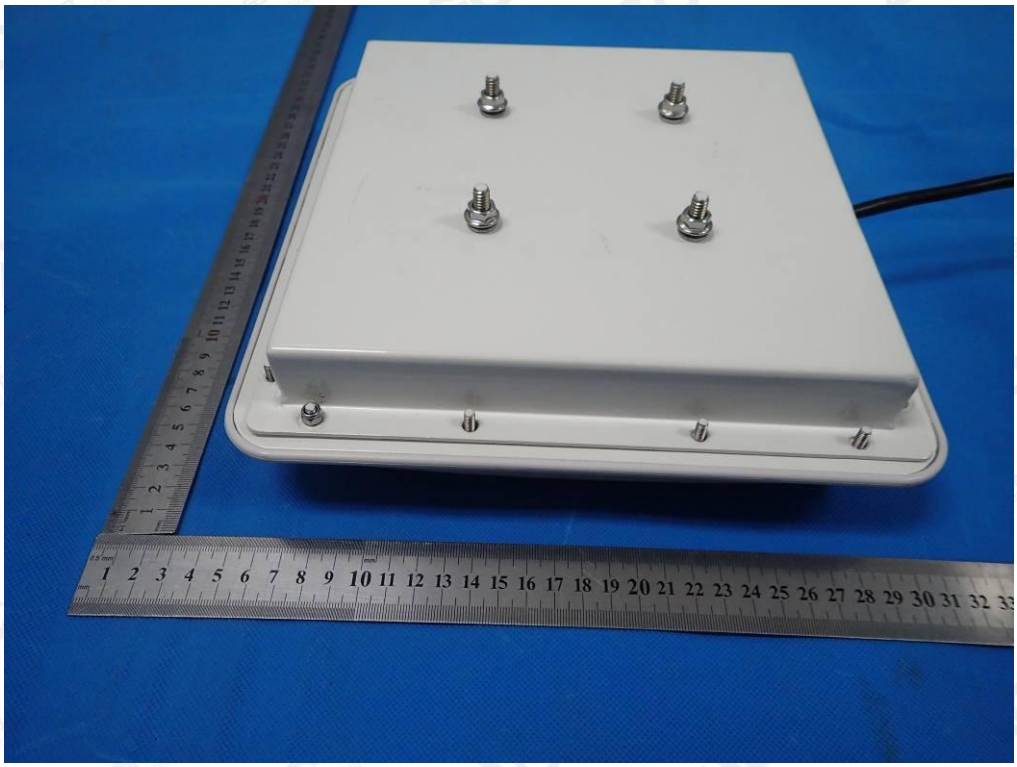
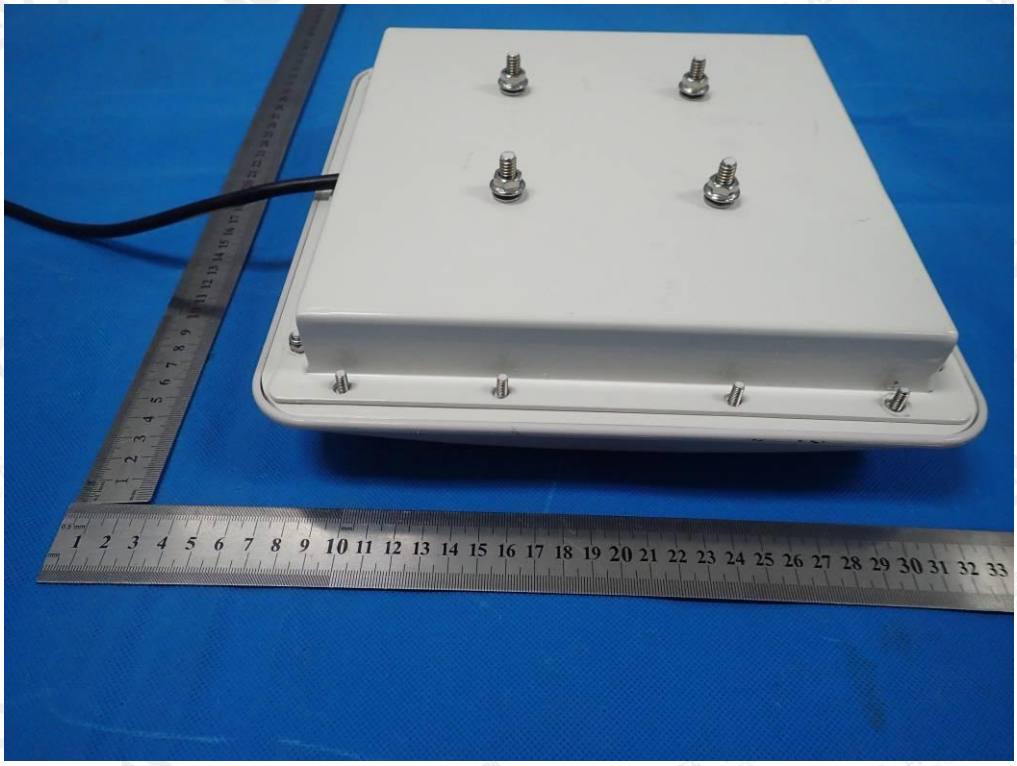
LEFT VIEW OF EUT



RIGHT VIEW OF EUT



Tel: +86-755 2908 1955 Fax: +86-755 2600 8484 E-mail: agc@agc-cert.com 400 089 2118
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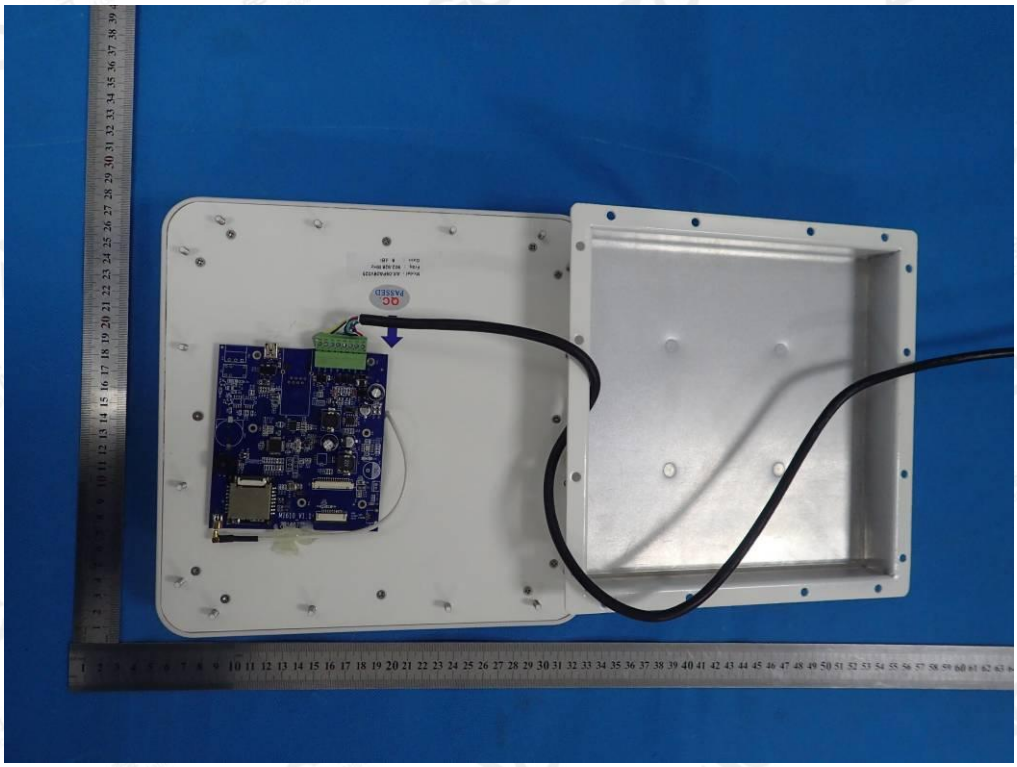
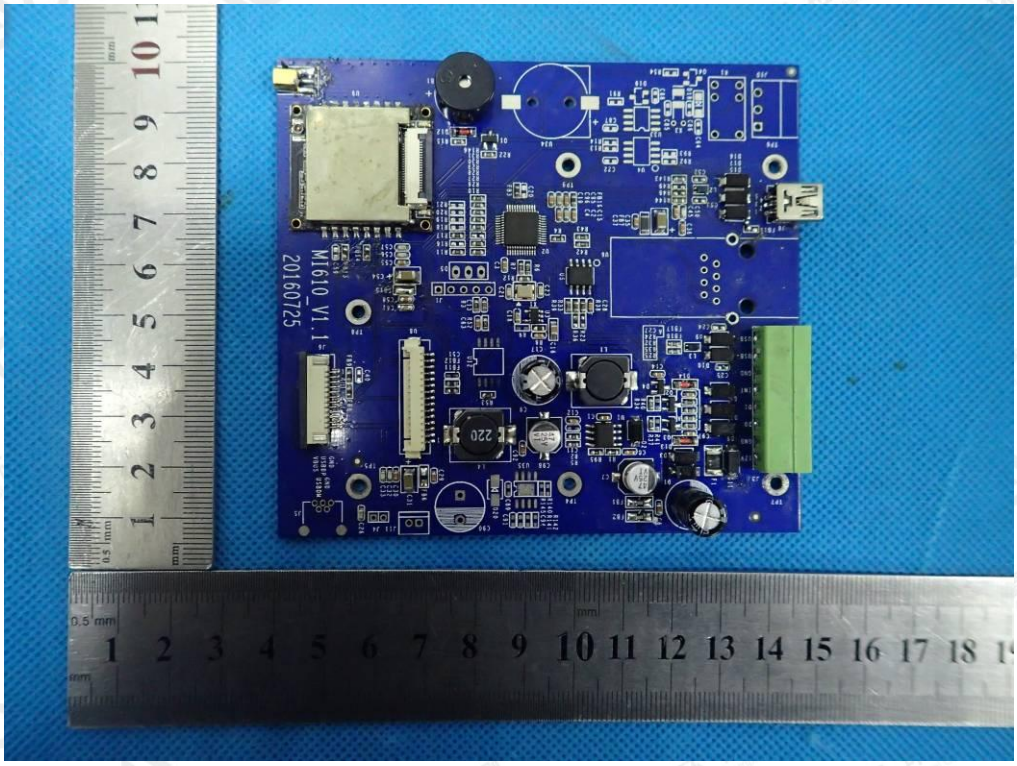
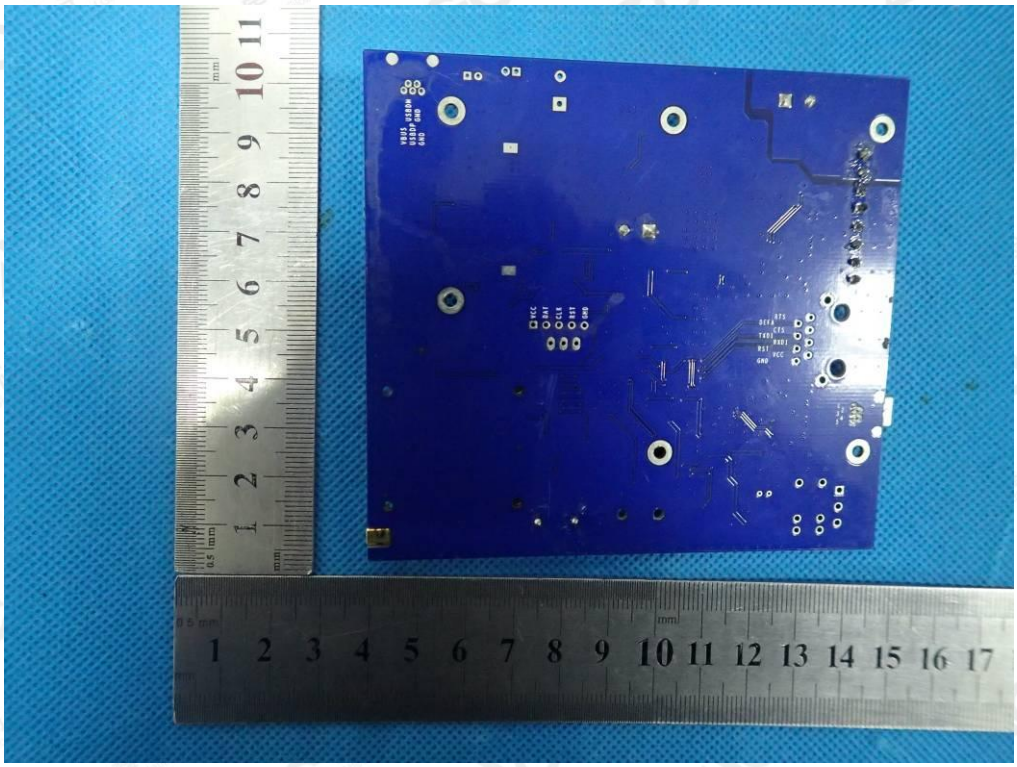
OPEN VIEW OF EUT



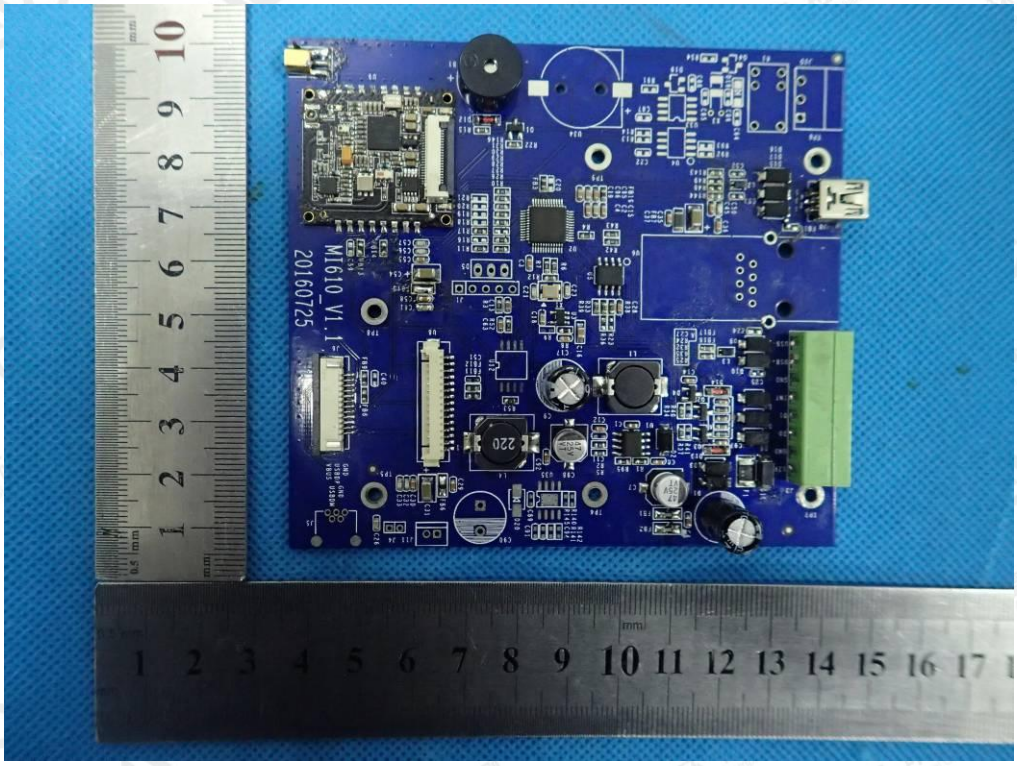
INTERNAL VIEW OF EUT-1



INTERNAL VIEW OF EUT-2



INTERNAL VIEW OF EUT-3



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