FCC Test Report

Report No.: AGC00927201105FE06

FCC ID	:	2AKAR-AMRFID
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	Module
BRAND NAME	:	ZKRADIO
MODEL NAME	:	AM-SMRTCP-RFID
APPLICANT	:	Guangdong ZK Radio Electronic Tech Co., Ltd
DATE OF ISSUE	:	Jan. 04, 2021
STANDARD(S)	:	FCC Rules and Regulations Part 15 Subpart C Section 15.225 ANSI C63.10: 2013
REPORT VERSION	:	V1.0

Attestation of Global Compliance (Shenzhen) Co., Ltd

REPORT REVISE RECORD

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jan. 04, 2021	Valid	Initial Release

TABLE OF CONTENTS

1. GENERAL INFORMATION

1.1. GENERAL DESCRIPTION OF EUT

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
Factory	Guangdong ZK Radio Electronic Tech Co., Ltd
Address	1004 Room, 3 block B, Tian-an-Yun-Gu, Ban Tian Longgang, Shenzhen, China
Product Designation	Module
Brand Name	ZKRADIO
Test Model	AM-SMRTCP-RFID
Date of test	Dec. 08, 2020 to Jan. 04, 2021
Operating Frequency(NFC)	13.56MHz
Max Output Power	62.79dBuV/m (Peak)
Modulation(NFC)	ASK
Auxiliary Antenna (NFC)	Coil antenna(Comply with requirements of the FCC part 15.203)
Auxiliary Antenna Gain(NFC)	0dBi
Hardware Version	V1.00
Software Version	V1.11
Power Supply:	DC 24V by adapter
Test Result	Pass

Prepared By	Sky Dong (Project Engineer)	Jan. 04, 2021
Reviewed By	Max Zhang (Reviewer)	Jan. 04, 2021
Approved By	Forrest Lei (Authorized Officer)	Jan. 04, 2021

1.2. ANTENNA REQUIREMENT

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

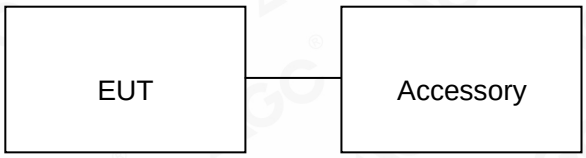
2. OPERATION OF EUT DURING TESTING

NO.	TEST MODE DESCRIPTION
1	Transmitting

Note:
1. All the test had been tested with full charging, 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.
3. EUT is a limited modular

2.1. DESCRIPTION OF TEST SETUP

Configure :



2.2. EQUIPMENT USED IN TESTED SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	Module	AM-SMRTCP-RFID	2AKAR-AMRFID	EUT
2	Reader	IP-SMRTCP/2P/RFID	The silicone/white	AE

2.3. SUMMARY OF TEST RESULTS

Item	Equipment	Model No.	ID or Specification	Remark
1	Module	AM-SMRTCP-RFID	2AKAR-AMRFID	EUT
2	Adapter	HJ-0502000W2-US	DC 24V	AE
3	USB Cable	N/A	N/A	AE

2.4. MEASUREMENT INSTRUMENTS LIST

NAME OF EQUIPMENT	MANUFACTURER	MODEL	S/N	Cal. Date	Cal. Due
TEST RECEIVER	R&S	ESCI	10096	May 15, 2020	May 14, 2022
Amplifier	Schwarzbeck	BBV 9718	9718-205	June 10,2020	June 09,2021
WIDEBAND REQUENCY ANTENNA	SCHWARZBECK	VULB9168	VULB9168-494	Jan. 09, 2019	Jan. 08, 2021
LOOP ANTENNA	A.H	SAS-562B	/	Feb.27, 2020	Feb.26, 2022

3. RADIATED EMISSION

3.1. TEST LIMIT

Within the 13.110MHz-14.010MHz band

Frequencies (MHz)	Field Strength at 30m (microvolts/meter)	Field Strength at 30m (dBuV/m)	Field Strength at 3m (dBuV/m)
13.553~13.567	15.848	84	124
13.410~13.553 13.567~13.710	334	50.5	90.5
13.110~13.410 13.710~14.010	106	40.5	80.5

According to 15.35, on any frequency or frequencies below or equal to 1000 MHz, the limits Shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test.

Outside of the 13.110MHz-14.010MHz band

Frequency (MHz)	Distance Meters	Field Strengths Limit	
		μV/m	dB(μV)/m
0.009 ~ 0.490	300	2400/F(kHz)	---
0.490 ~ 1.705	30	24000/F(kHz)	---
1.705 ~ 30	30	30	---
30 ~ 88	3	100	40.0
88 ~ 216	3	150	43.5
216 ~ 960	3	200	46.0
960 ~ 1000	3	500	54.0
Above 1000	3	Other:74.0 dB(μV)/m (Peak) 54.0 dB(μV)/m (Average)	

Remark: (1) Emission level dBμV = 20 log Emission level μV/m
(2) The smaller limit shall apply at the cross point between two frequency bands.
(3) Distance is the distance in meters between the measuring instrument, antenna and the closest point of any part of the device or system.

3.2. MEASUREMENT PROCEDURE

1. The EUT was placed on the top of the turntable 0.8 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.
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.

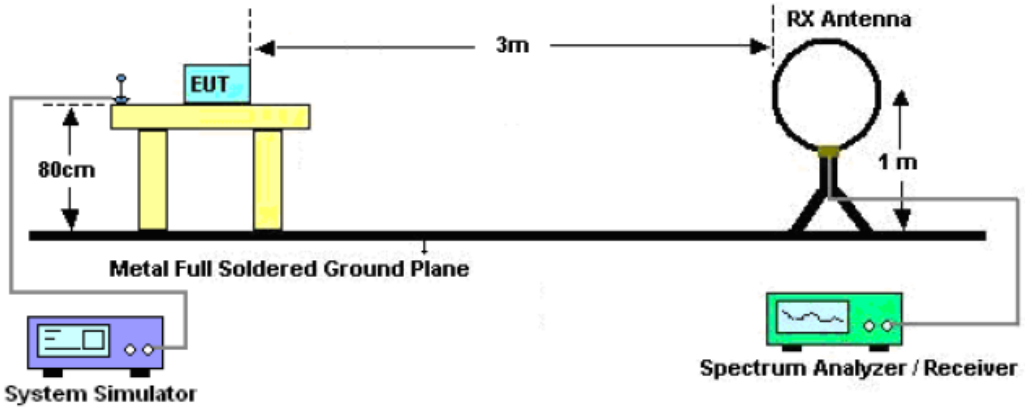
The following table is the setting of spectrum analyzer and receiver.

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

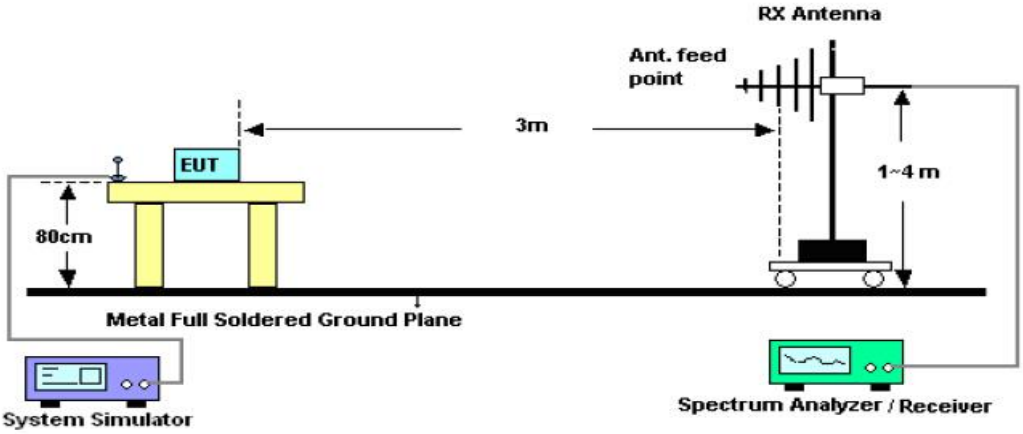
Receiver Parameter	Setting
Start ~Stop Frequency	9KHz~150KHz/RB 200Hz for QP
Start ~Stop Frequency	150KHz~30MHz/RB 9KHz for QP
Start ~Stop Frequency	30MHz~1000MHz/RB 120KHz for QP

3.3. TEST SETUP

Radiated Emission Test-Setup Frequency Below 30MHz



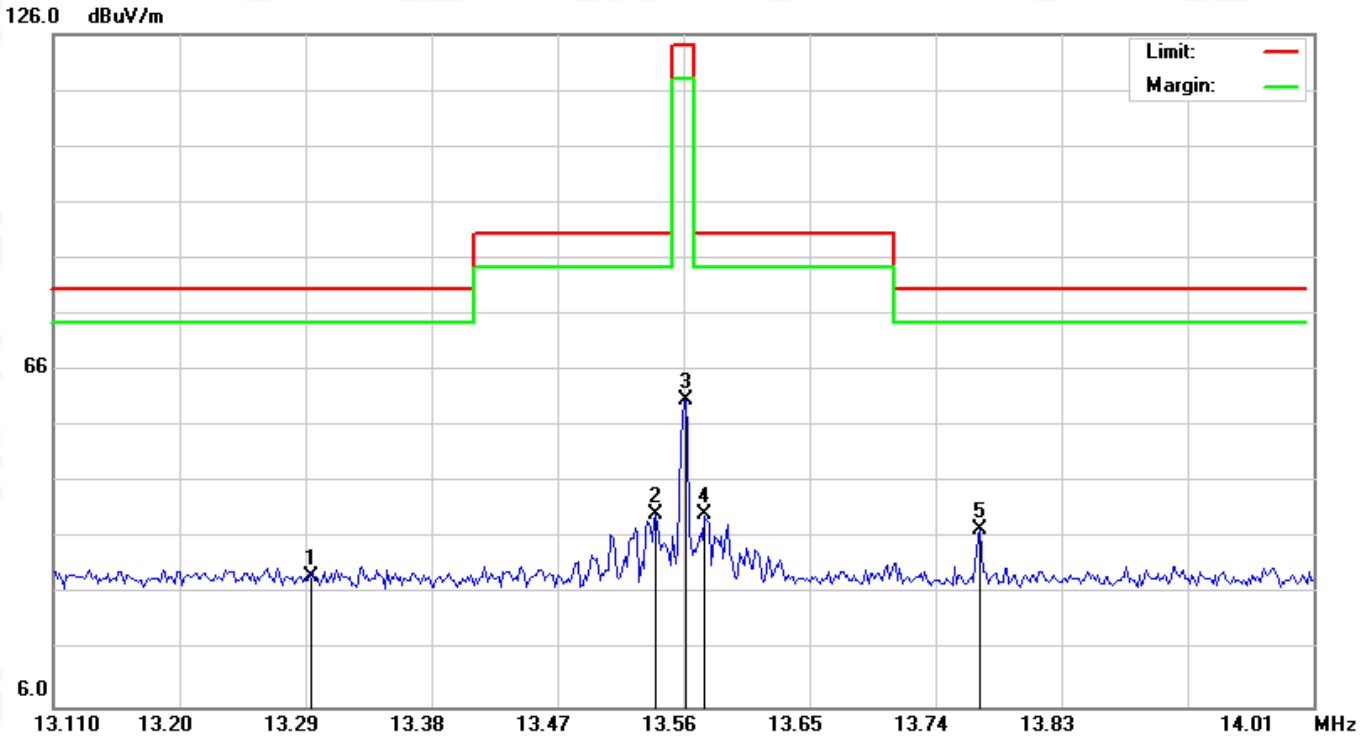
RADIATED EMISSION TEST SETUP 30MHz-1000MHz



3.4. TEST RESULT

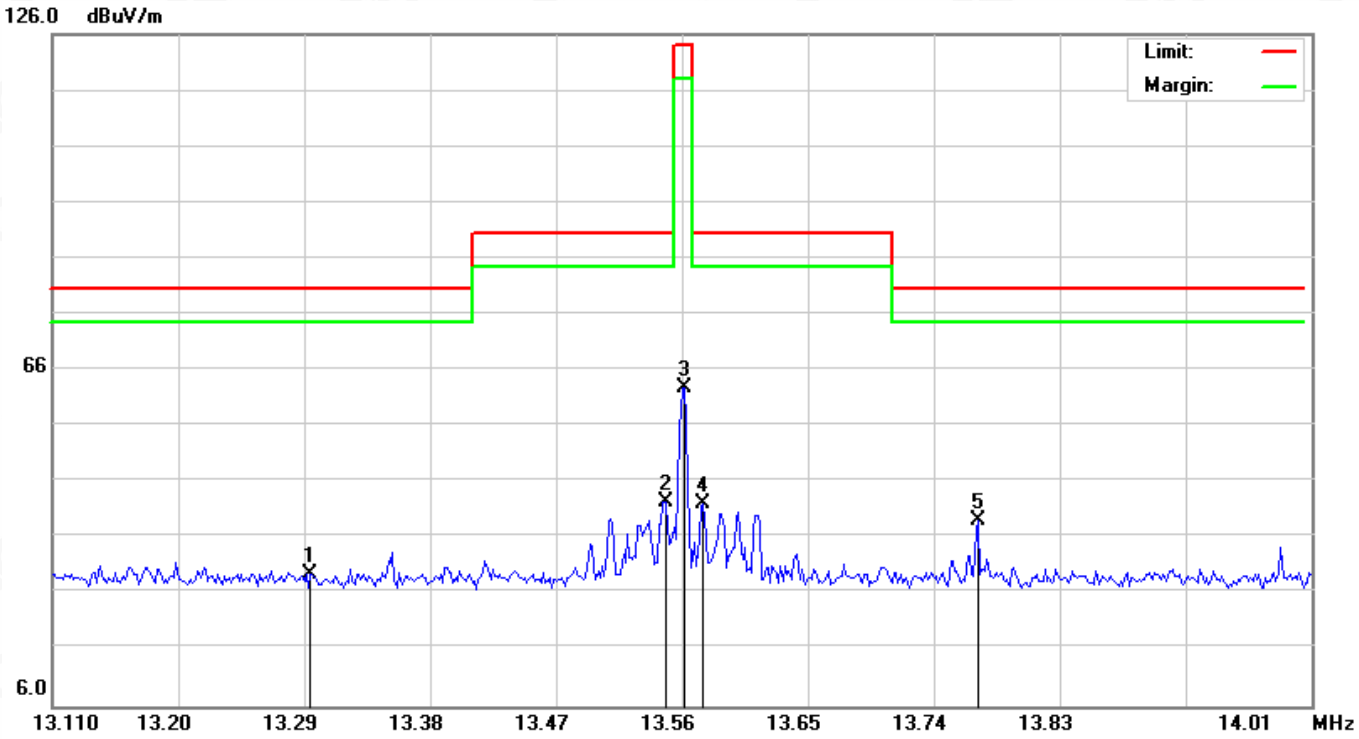
RADIATED EMISSION BELOW 30MHZ

EUT：	Module	Model Name	AM-SMRTCP-RFID
Temperature：	21.8 ℃	Relative Humidtity：	58%
Pressure：	1010hPa	Test Voltage ：	DC24V
Test Mode ：	Mode 1	Polarization：	Face



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		13.2958	4.52	24.62	29.14	80.50	-51.36	peak
2		13.5403	15.69	24.64	40.33	90.50	-50.17	peak
3		13.5615	36.01	24.64	60.65	124.0	-63.35	peak
4		13.5749	15.56	24.64	40.20	90.50	-50.30	peak
5	*	13.7713	12.87	24.66	37.53	80.50	-42.97	peak

EUT：	Module	Model Name	AM-SMRTCP-RFID
Temperature：	21.8 ℃	Relative Humidtity：	58%
Pressure：	1010 hPa	Test Voltage ：	DC24V
Test Mode ：	Mode 1	Polarization：	Side

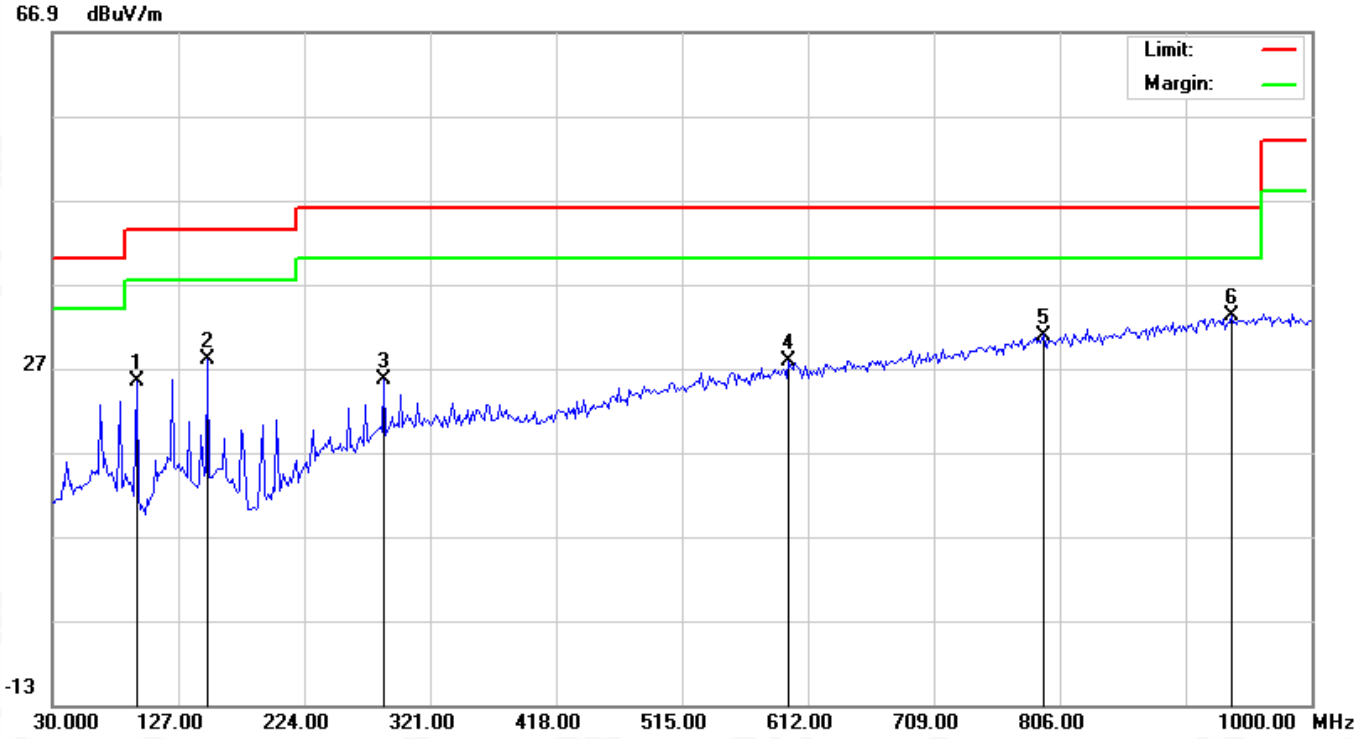


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		13.2944	5.00	24.62	29.62	80.50	-50.88	peak
2		13.5480	17.95	24.64	42.59	90.50	-47.91	peak
3		13.5615	38.15	24.64	62.79	124.0	-61.21	peak
4		13.5749	17.62	24.64	42.26	90.50	-48.24	peak
5	*	13.7713	14.54	24.66	39.20	80.50	-41.30	peak

Note: Other emissions from 9 kHz to 30 MHz are considered as ambient noise. No recording in the test report.

RADIATED EMISSION 30MHz- 1GHZ

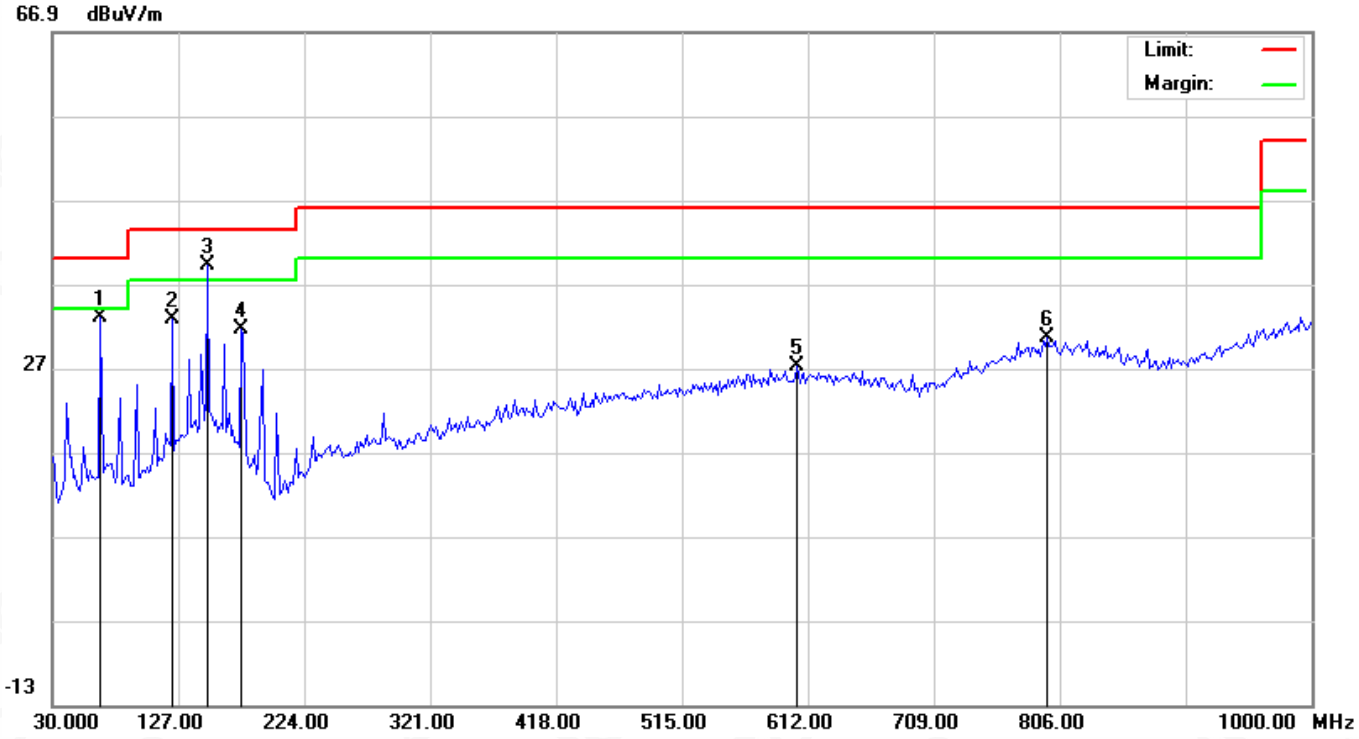
EUT：	Module	Model Name	AM-SMRTCP-RFID
Temperature：	21.8 ℃	Relative Humidtity：	58%
Pressure：	1010 hPa	Test Voltage ：	DC24V
Test Mode ：	Mode 1	Polarization :	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		94.6667	12.18	13.13	25.31	43.50	-18.19	peak
2		149.6332	12.80	15.17	27.97	43.50	-15.53	peak
3		285.4332	5.15	20.36	25.51	46.00	-20.49	peak
4		597.4500	0.99	26.90	27.89	46.00	-18.11	peak
5		793.0666	0.65	30.25	30.90	46.00	-15.10	peak
6	*	938.5666	1.21	32.03	33.24	46.00	-12.76	peak

RESULT: PASS

EUT：	Module	Model Name	AM-SMRTCP-RFID
Temperature：	21.8 ℃	Relative Humidtity：	58%
Pressure：	1010 hPa	Test Voltage ：	DC24V
Test Mode ：	Mode 1	Polarization :	Vertical



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		67.1833	16.33	16.76	33.09	40.00	-6.91	peak
2		122.1500	14.65	18.11	32.76	43.50	-10.74	peak
3	*	149.6333	19.96	19.21	39.17	43.50	-4.33	peak
4		175.5000	14.07	17.59	31.66	43.50	-11.84	peak
5		603.9167	0.29	26.88	27.17	46.00	-18.83	peak
6		796.3000	0.45	30.22	30.67	46.00	-15.33	peak

RESULT: PASS

Note:

Factor=Antenna Factor + Cable loss, Margin=Result- Limit.

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

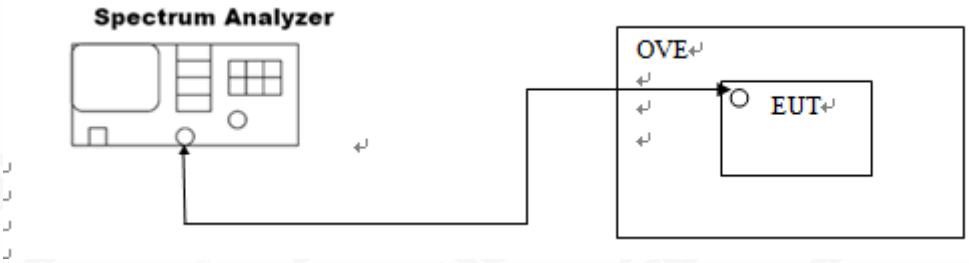
The mode 1 is the worst case, and only the data of the worst case recorded in this test report.

4. FREQUENCY STABILITY

4.1. MEASUREMENT PROCEDURE

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the operation frequency.
3. Set SPA Centre Frequency = Operation Frequency, RBW= 1 KHz, VBW≥3×RBW.
4. Set SPA Trace 1 Max hold, then View.
5. The test extreme voltage is to change the primary supply voltage from 85 to 115 percent of the nominal value
6. Extreme temperature rule is -20°C~40°C.

4.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



4.3. MEASUREMENT RESULTS

Operating frequency: 13.56MHz

Voltage vs. Frequency Stability (Test Temperature: 20℃)

Voltage(V)	Measurement Frequency (MHz)	Max. Deviation (MHz)	Limit(MHz)	Conclusion
24.0	13.56082	0.00087	0.001356	PASS
20.4	13.56084			
27.6	13.56087			

Temperature vs. Frequency Stability (Test Voltage: 24V)

Temperature	Measurement Frequency (MHz)	Max. Deviation (MHz)	Limit(MHz)	Conclusion
- 20℃	13.56081	0.00087	0.001356	PASS
-10℃	13.56084			
0℃	13.56083			
10℃	13.56085			
20℃	13.56087			
30℃	13.56083			
40℃	13.56082			

5. BANDWIDTH

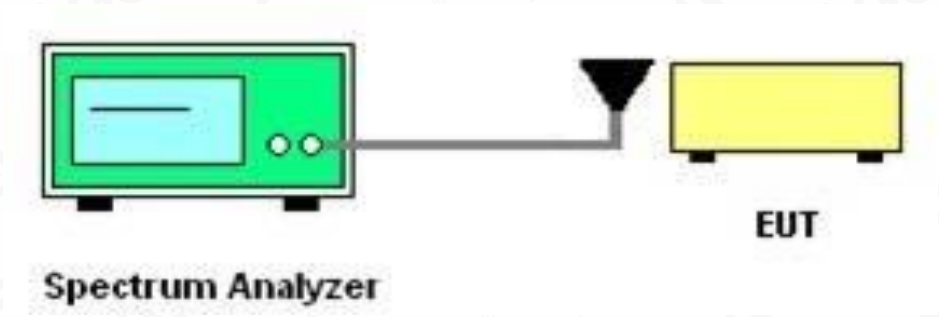
5.1. TEST LIMIT

Intentional radiators must be designed to ensure that the 20dB and 99% emission bandwidth in the specific band 13.553~13.567MHz

5.2. MEASUREMENT PROCEDURE

1. The spectrum analyzer connected via a receive antenna placed near the EUT in peak Max hold mode.
2. The resolution bandwidth of 1 kHz and the video bandwidth of 3 kHz were used.
3. Measured the spectrum width with power higher than 20dB below carrier.
4. Measured the 99% OBW.

9.3. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



5.3. MEASUREMENT RESULTS

TEST ITEM	BANDWIDTH
TEST MODE	Mode1

Test Data (kHz)		Criteria
Occupied Bandwidth	2.220	PASS
-20dB Bandwidth	2.590	PASS

6. LINE CONDUCTED EMISSION TEST

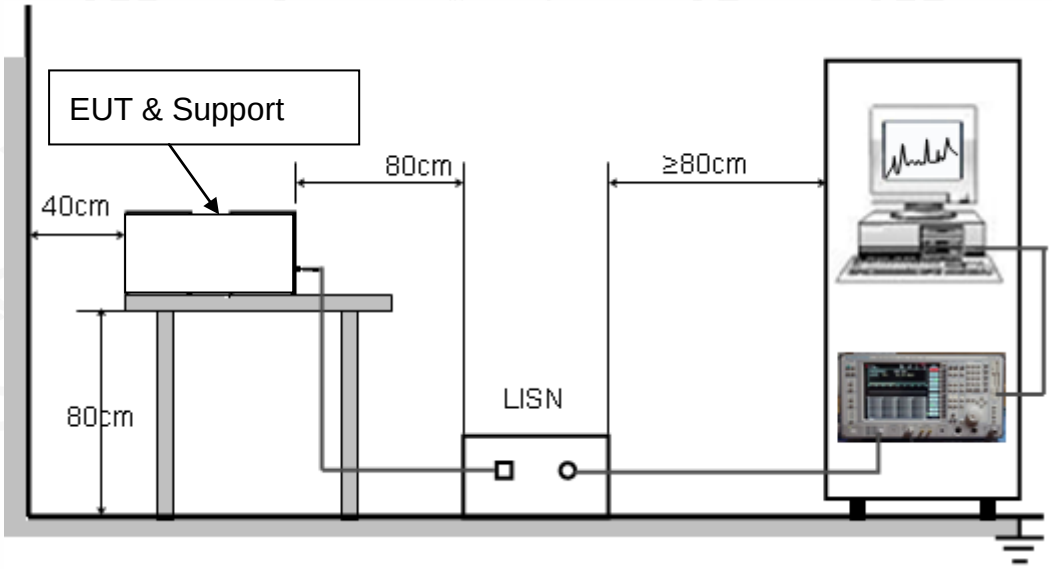
6.1. LIMITS OF LINE CONDUCTED EMISSION TEST

Frequency	Maximum RF Line Voltage	
	Q.P.(dBuV)	Average(dBuV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

6.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



6.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.10.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
4. All support equipments received AC120V/60Hz power from a LISN, if any.
5. The EUT received charging voltage by adapter which received 120V/60Hzpower by a LISN..
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

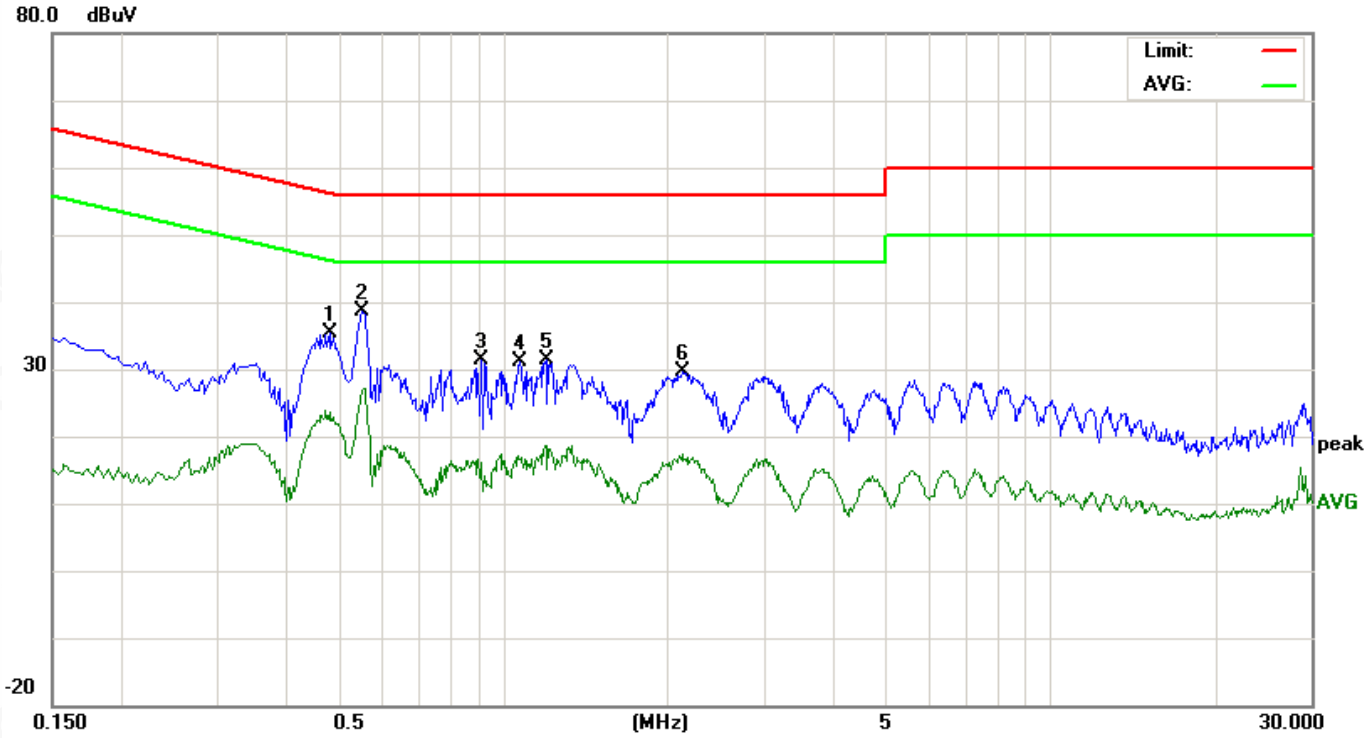
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

6.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

6.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST

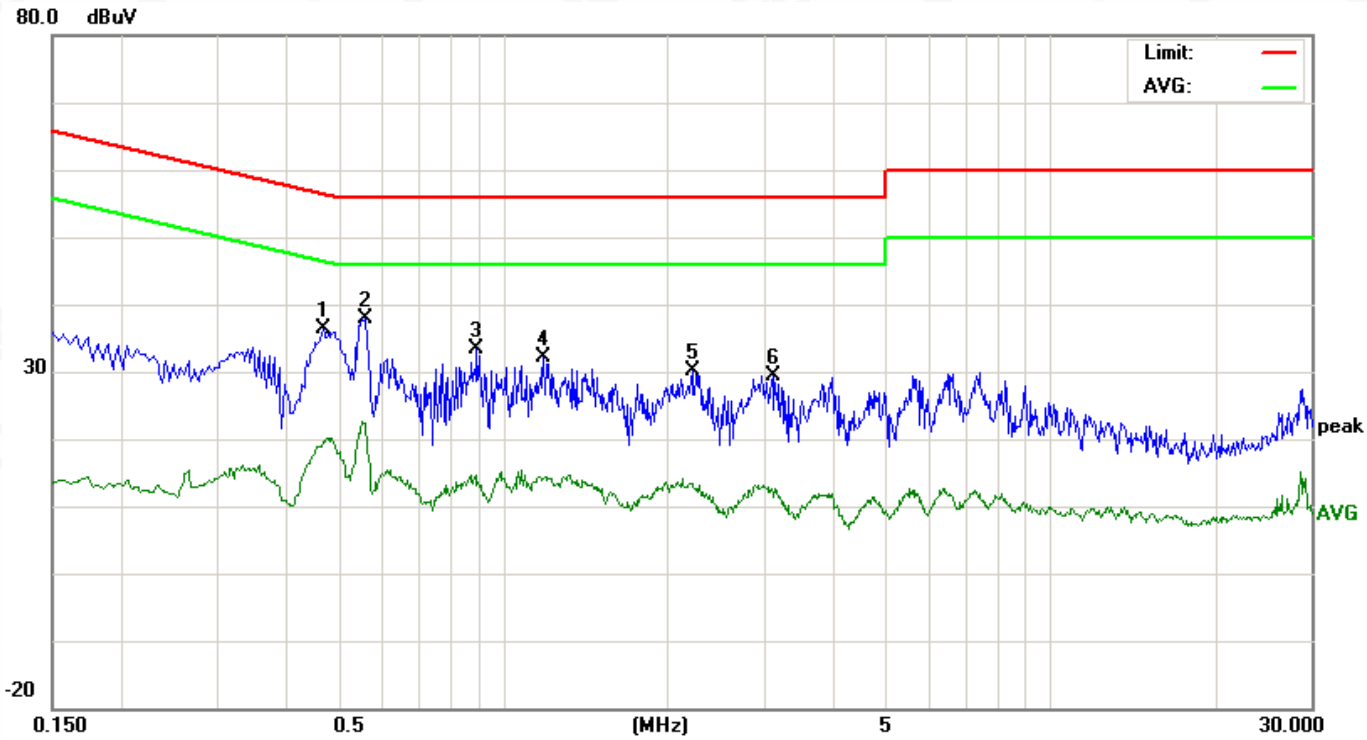
LINE CONDUCTED EMISSION TEST LINE 1-L



No.	Freq. (MHz)	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		P/F
		Peak	QP	AVG	dB	Peak	QP	AVG	QP	AVG	QP	AVG	
1	0.4820	21.79	N/A	9.99	13.70	35.49	N/A	23.69	56.30	46.30	-20.81	-22.61	P
2	0.5540	24.72	N/A	12.94	13.78	38.50	N/A	26.72	56.00	46.00	-17.50	-19.28	P
3	0.9180	17.57	N/A	1.36	13.83	31.40	N/A	15.19	56.00	46.00	-24.60	-30.81	P
4	1.0740	17.30	N/A	2.87	13.80	31.10	N/A	16.67	56.00	46.00	-24.90	-29.33	P
5	1.2020	17.46	N/A	4.78	13.79	31.25	N/A	18.57	56.00	46.00	-24.75	-27.43	P
6	2.1260	16.11	N/A	3.76	13.63	29.74	N/A	17.39	56.00	46.00	-26.26	-28.61	P

RESULT: PASS

Line Conducted Emission Test Line 2-N

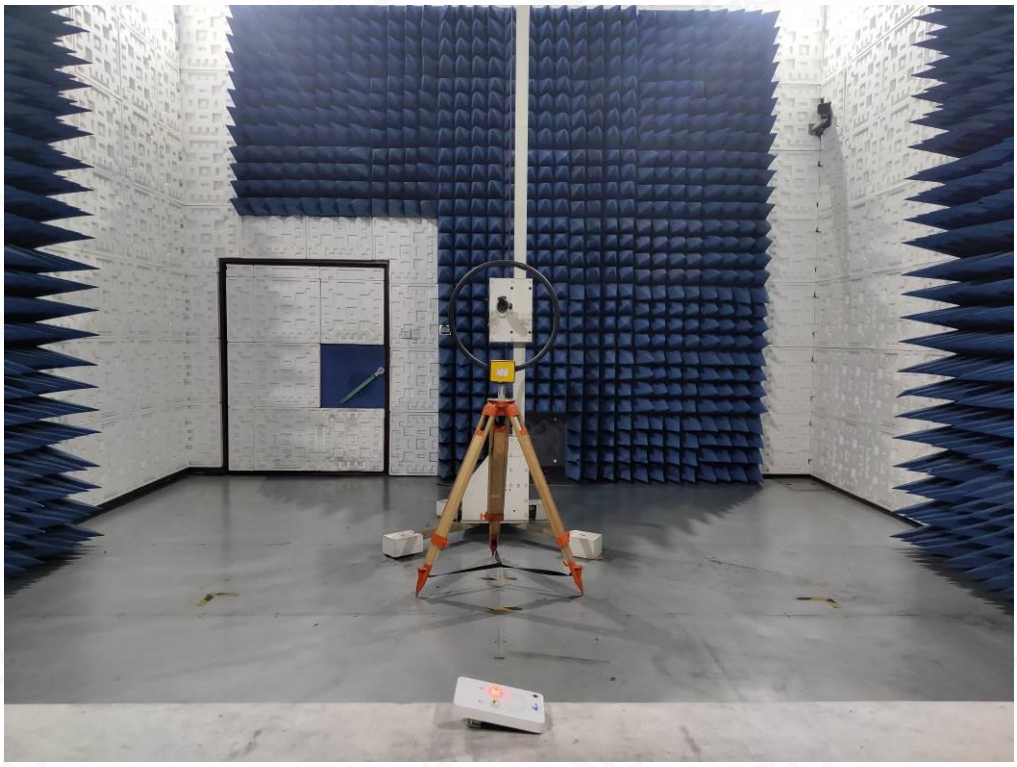


No.	Freq. (MHz)	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		P/F
		Peak	QP	AVG	dB	Peak	QP	AVG	QP	AVG	QP	AVG	
1	0.4700	22.65	N/A	5.84	13.67	36.32	N/A	19.51	56.51	46.51	-20.19	-27.00	P
2	0.5620	24.15	N/A	8.34	13.79	37.94	N/A	22.13	56.00	46.00	-18.06	-23.87	P
3	0.8980	19.49	N/A	-0.73	13.83	33.32	N/A	13.10	56.00	46.00	-22.68	-32.90	P
4	1.1900	18.30	N/A	0.32	13.79	32.09	N/A	14.11	56.00	46.00	-23.91	-31.89	P
5	2.2139	16.42	N/A	-0.11	13.60	30.02	N/A	13.49	56.00	46.00	-25.98	-32.51	P
6	3.1220	16.31	N/A	-1.42	13.18	29.49	N/A	11.76	56.00	46.00	-26.51	-34.24	P

RESULT: PASS

APPENDIX A: PHOTOGRAPHS OF TEST SETUP

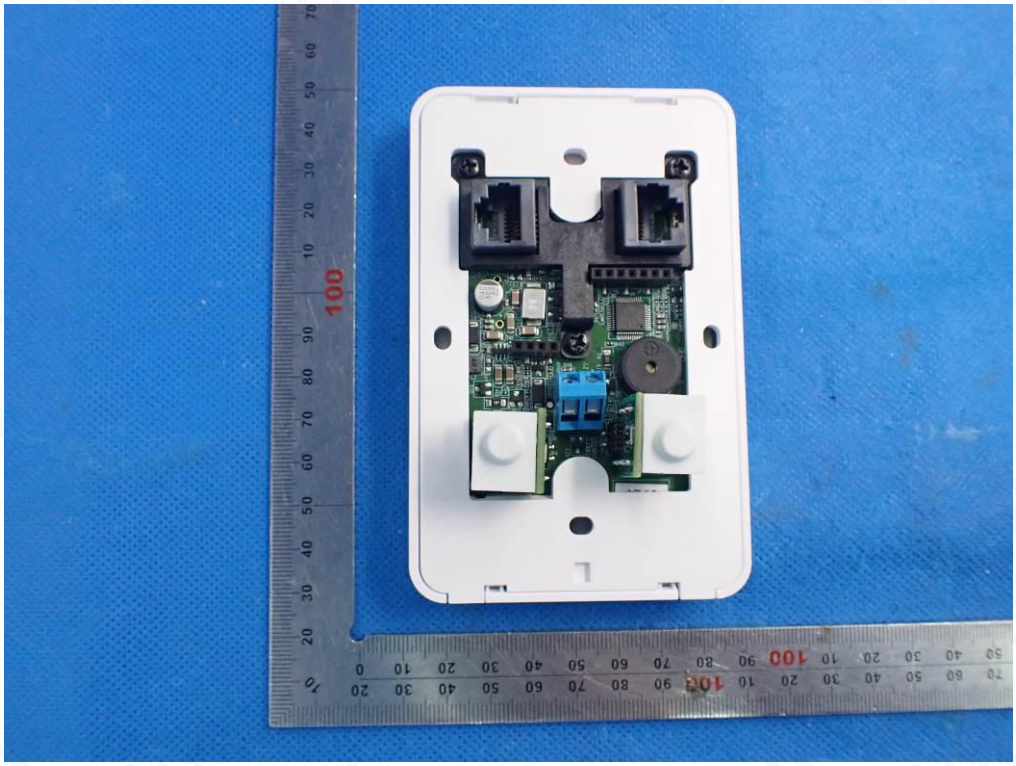
RADIATED EMISSION TEST SETUP BELOW 30MHz

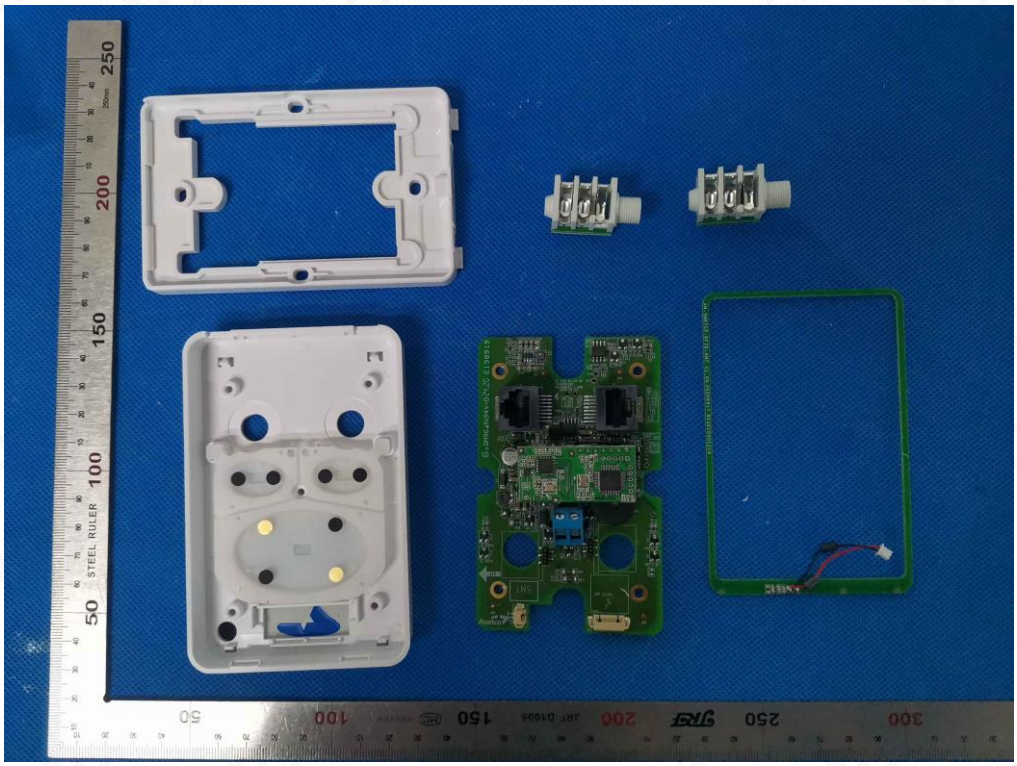


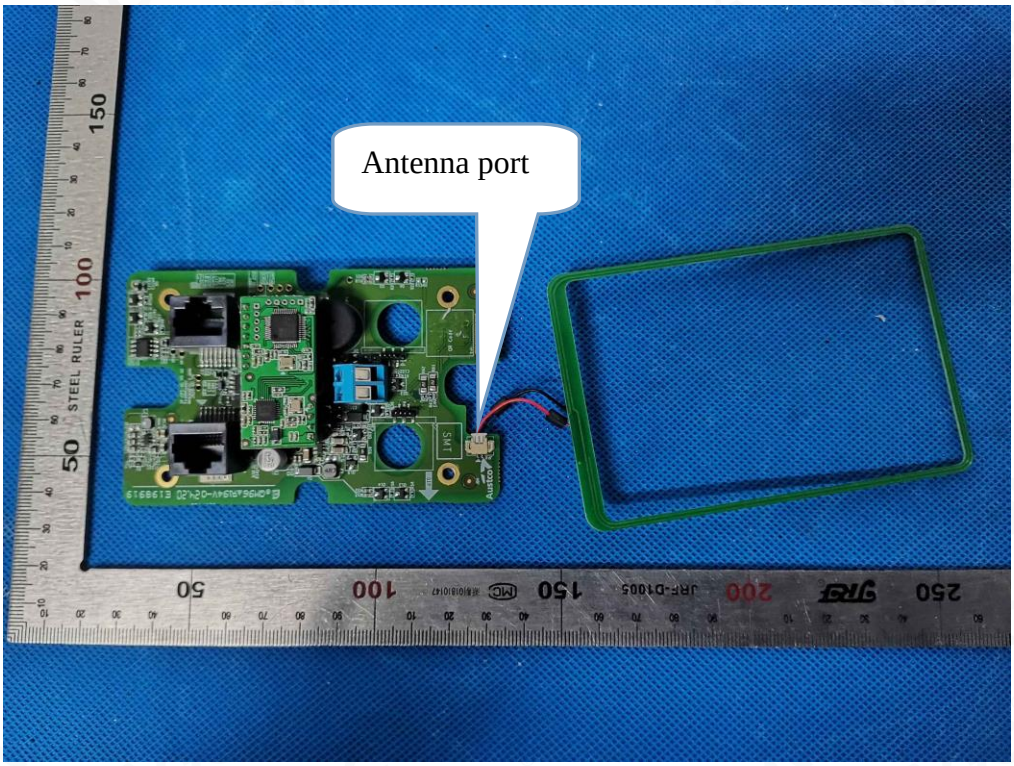
RADIATED EMISSION TEST SETUP BELOW 1GHz

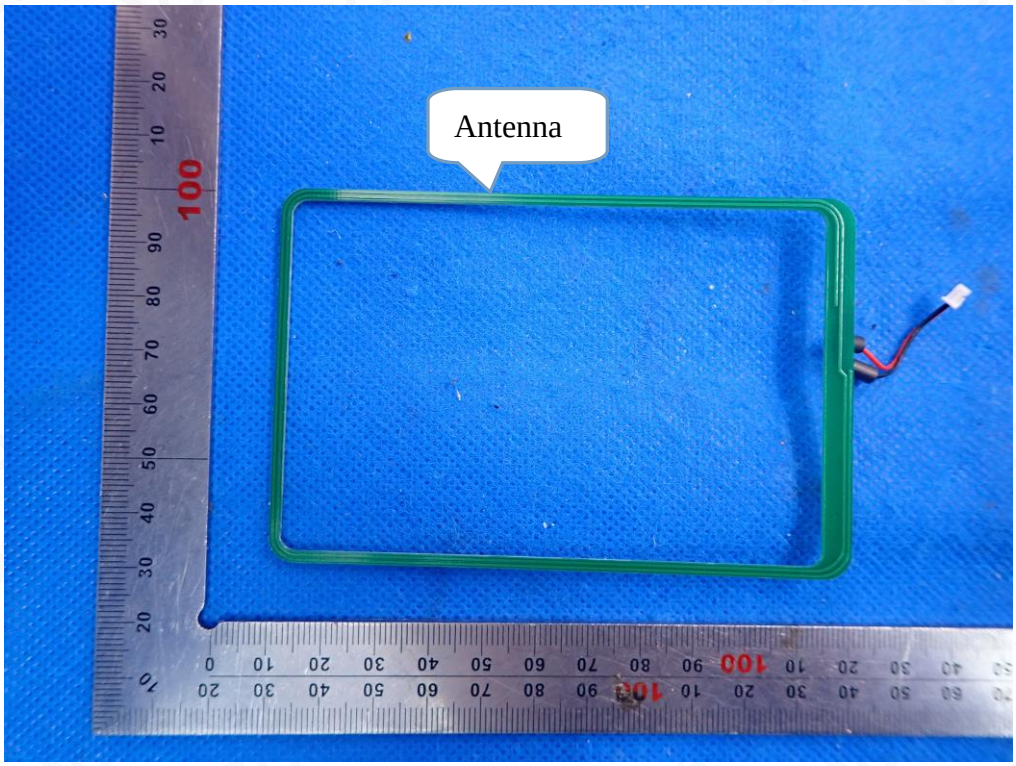
FCC LINE CONDUCTED EMISSION TEST SETUP

Test auxiliary host photos



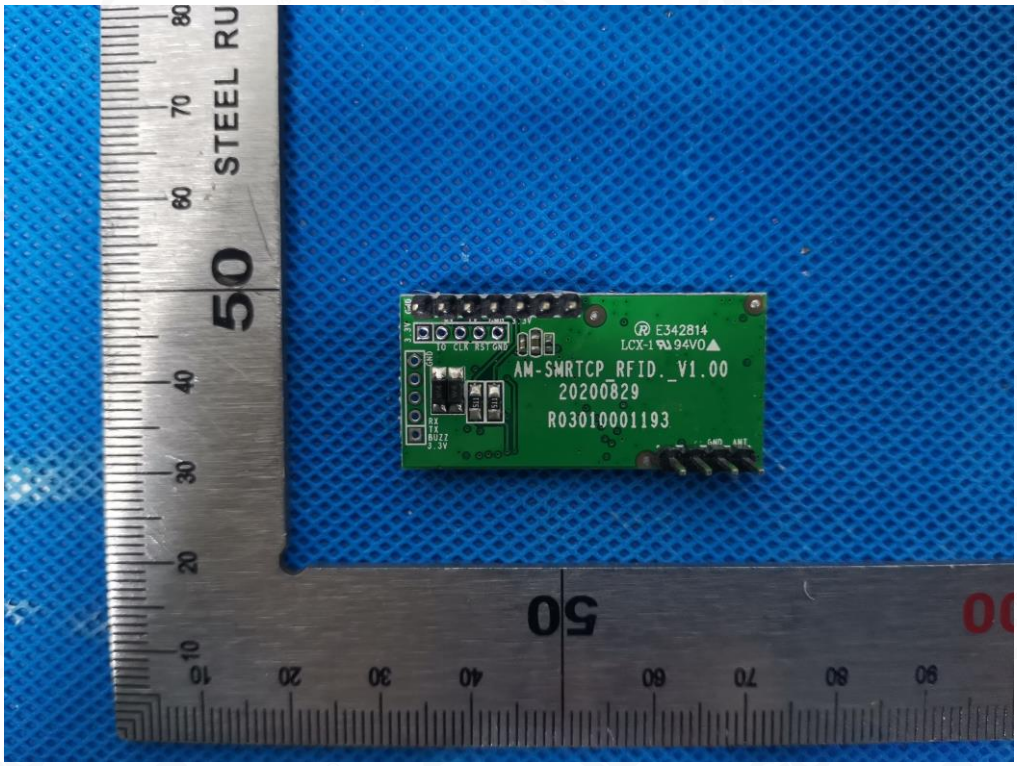




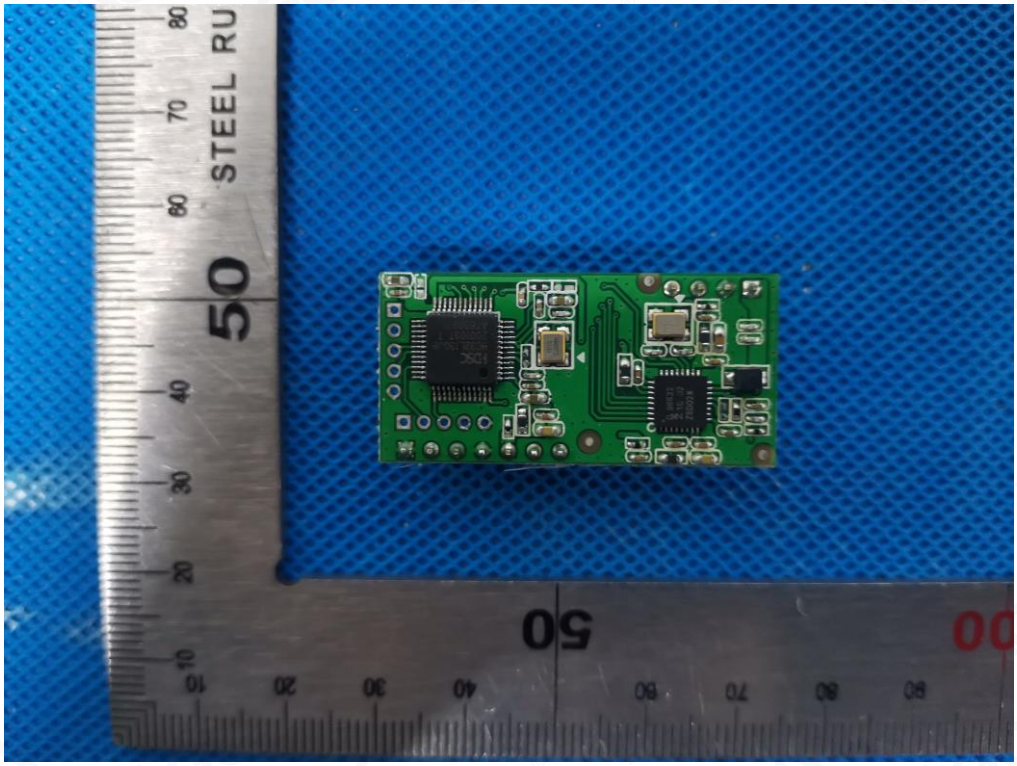


APPENDIX B: PHOTOGRAPHS OF EUT

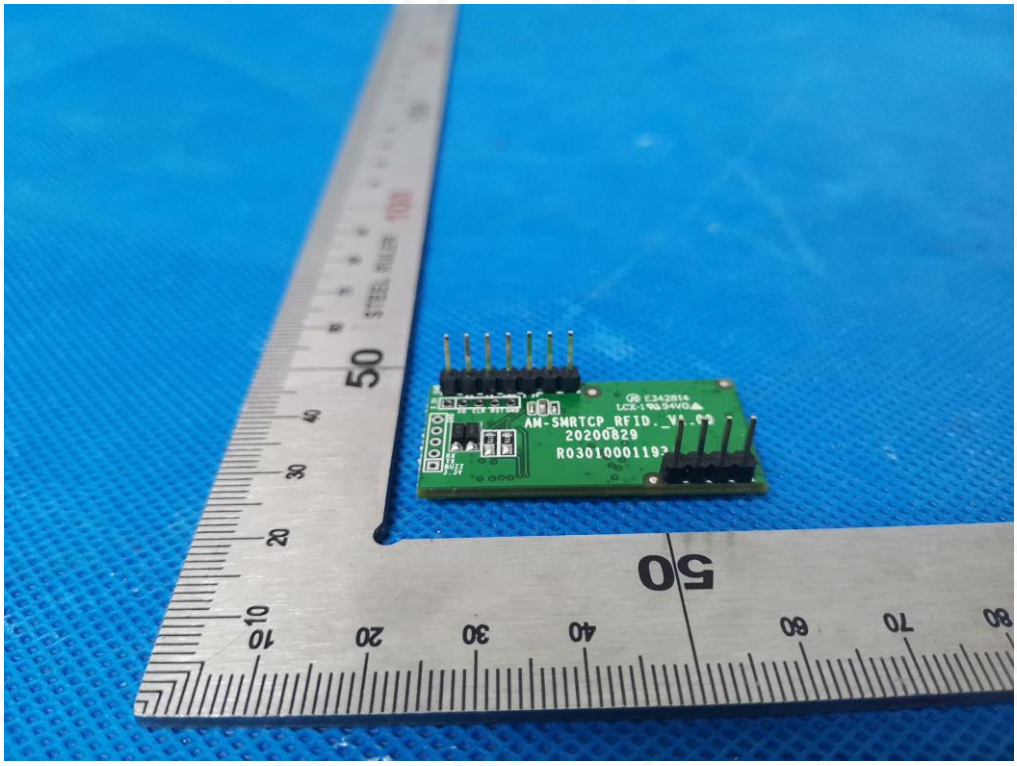
TOP VIEW OF EUT



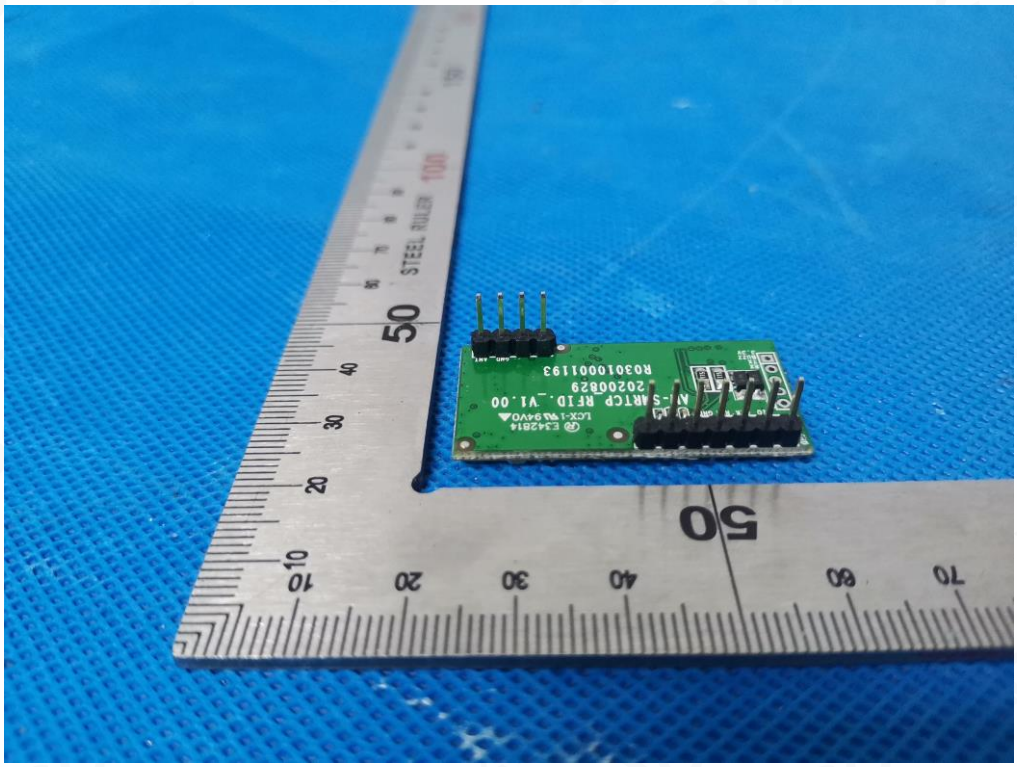
BOTTOM VIEW OF EUT



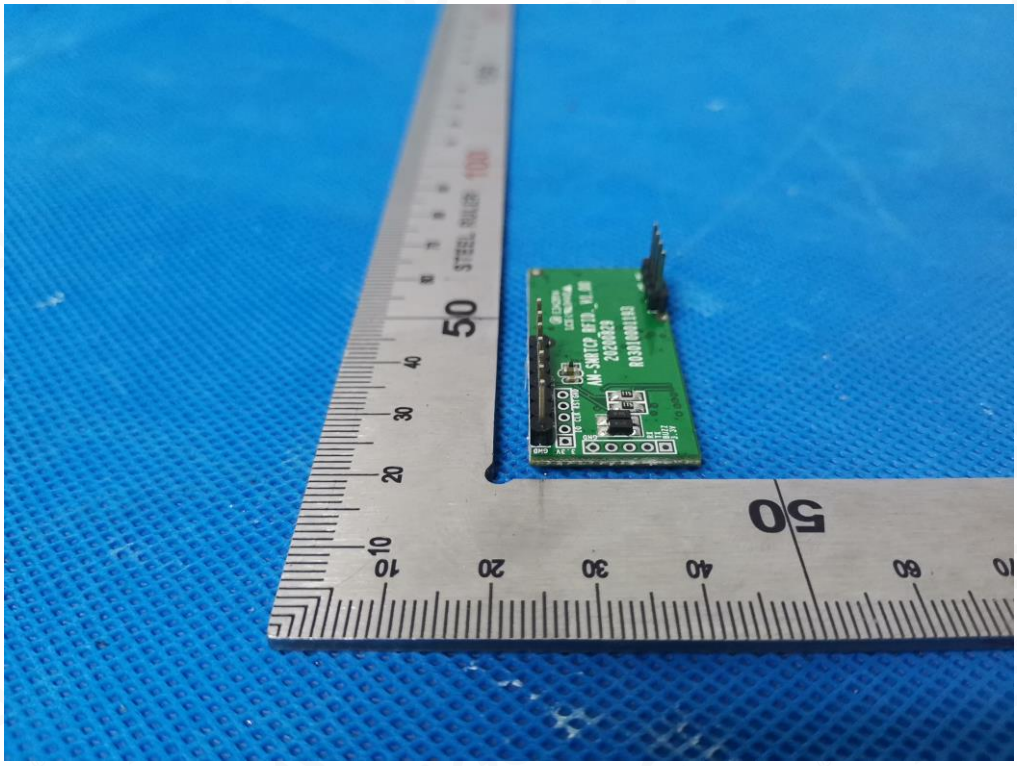
FRONT VIEW OF EUT



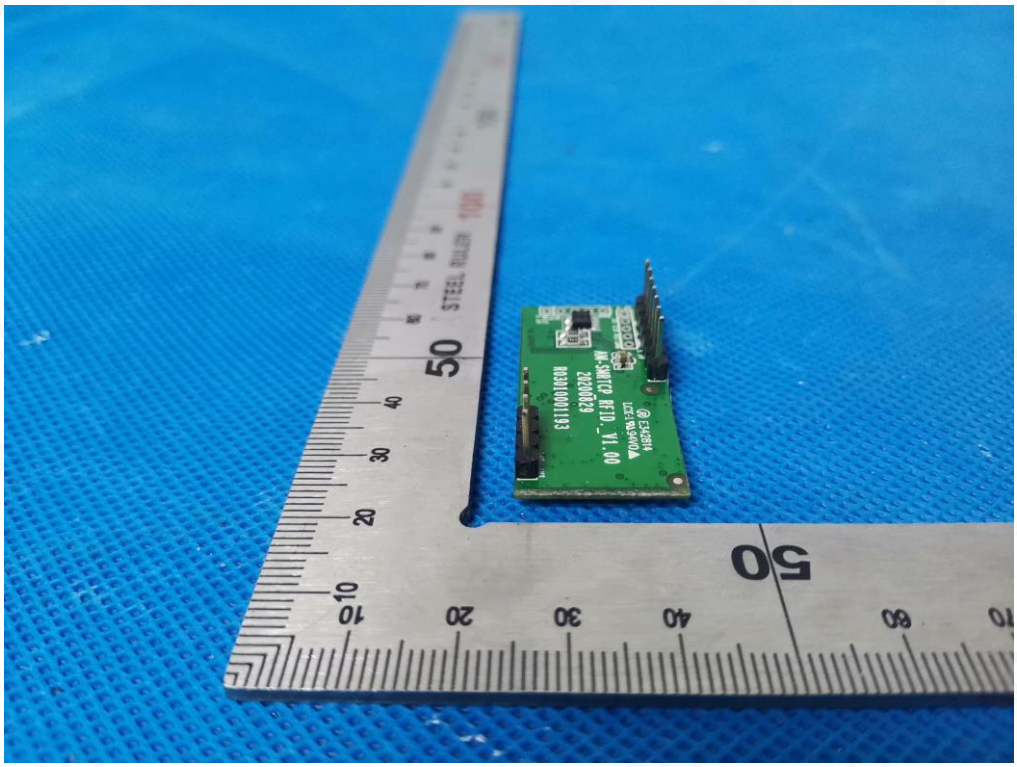
BACK VIEW OF EUT



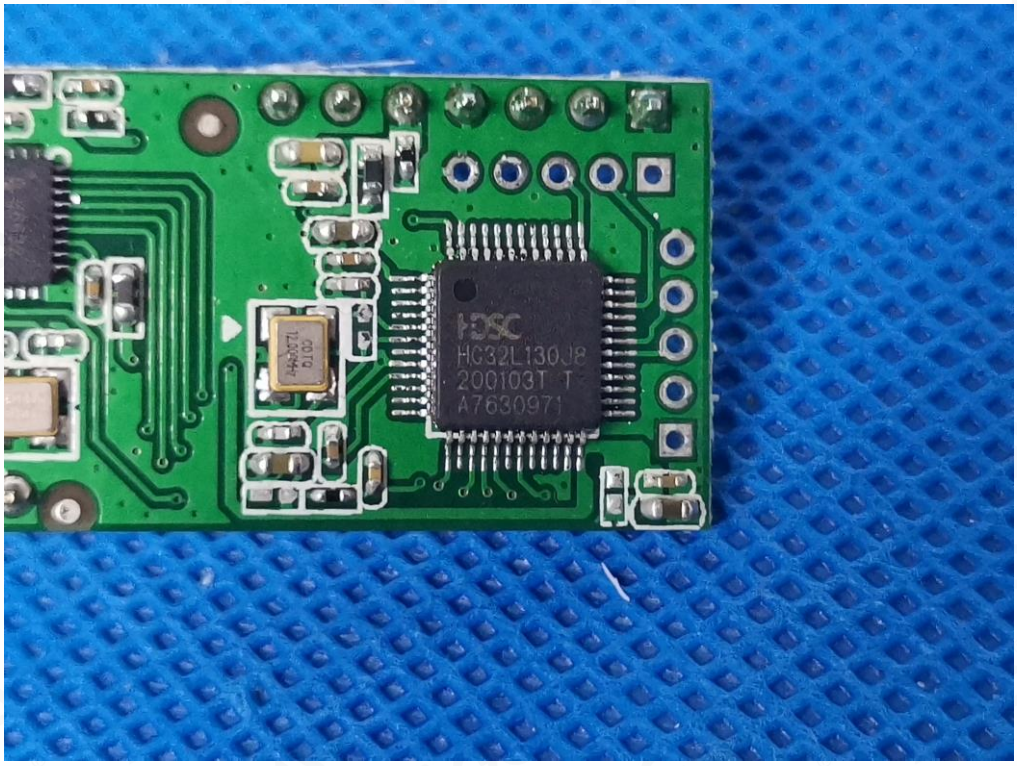
LEFT VIEW OF EUT



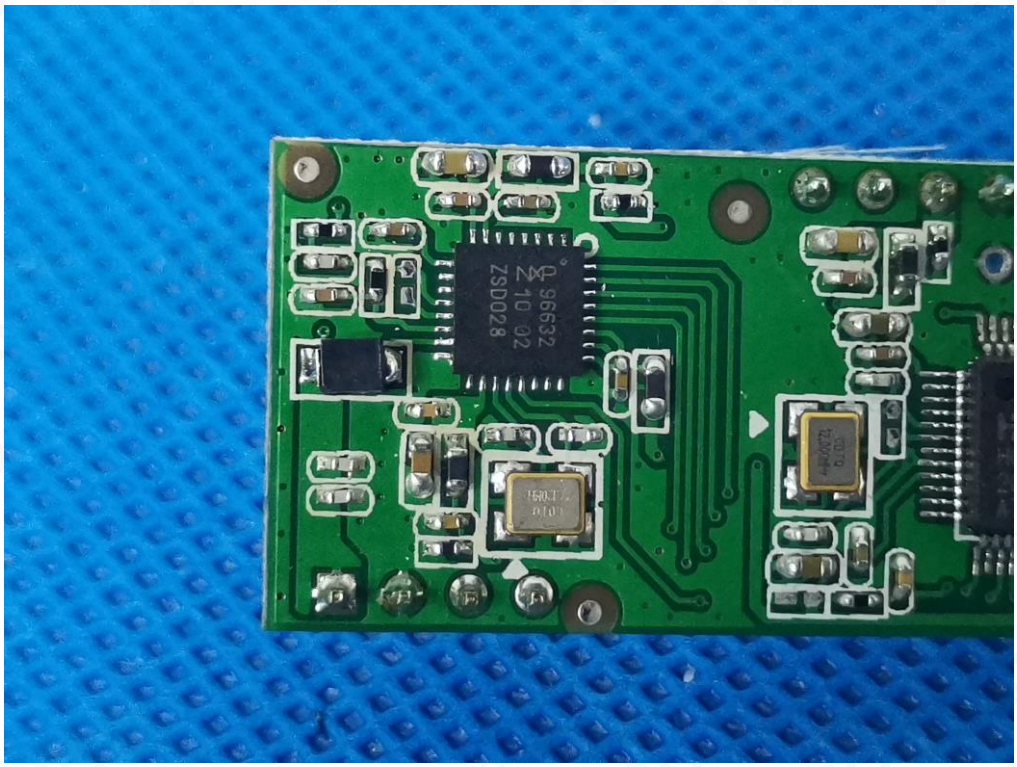
RIGHT VIEW OF EUT



INTERNAL VIEW OF EUT-1



INTERNAL VIEW OF EUT-2



----END OF REPORT----

Conditions of Issuance of Test Reports

1. All samples and goods are accepted by the Attestation of Global Compliance (Shenzhen) Co., Ltd (the "Company") solely for testing and reporting in accordance with the following terms and conditions. The company provides its services on the basis that such terms and conditions constitute express agreement between the company and any person, firm or company requesting its services (the "Clients").

2. Any report issued by Company as a result of this application for testing services (the "Report") shall be issued in confidence to the Clients and the Report will be strictly treated as such by the Company. It may not be reproduced either in its entirety or in part and it may not be used for advertising or other unauthorized purposes without the written consent of the Company. The Clients to whom the Report is issued may, however, show or send it, or a certified copy thereof prepared by the Company to its customer, supplier or other persons directly concerned. The Company will not, without the consent of the Clients, enter into any discussion or correspondence with any third party concerning the contents of the Report, unless required by the relevant governmental authorities, laws or court orders.

3.The Company shall not be called or be liable to be called to give evidence or testimony on the Report in a court of law without its prior written consent, unless required by the relevant governmental authorities, laws or court orders.

4. The non-CMA report issued by AGC is only permitted to be used by the client as internal reference use and shall not be used for public demonstration purpose.

5. In the event of the improper use of the report as determined by the Company, the Company reserves the right to withdraw it, and to adopt any other additional remedies which may be appropriate.

6. Samples submitted for testing are accepted on the understanding that the Report issued cannot form the basis of, or be the instrument for, any legal action against the Company.

7. The Company will not be liable for or accept responsibility for any loss or damage however arising from the use of information contained in any of its Reports or in any communication whatsoever about its said tests or investigations.

8.Clients wishing to use the Report in court proceedings or arbitration shall inform the Company to that effect prior to submitting the sample for testing.

9. The Company is not responsible for recalling the electronic version of the original report when any revision is made to them. The Client assumes the responsibility to providing the revised version to any interested party who uses them.

10. Subject to the variable length of retention time for test data and report stored hereinto as otherwise specifically required by individual accreditation authorities, the Company will only keep the supporting test data and information of the test report for a period of six years. The data and information will be disposed of after the aforementioned retention period has elapsed. Under no circumstances shall we provide any data and information which has been disposed of after retention period. Under no circumstances shall we be liable for damage of any kind, including (but not limited to) compensatory damages, lost profits, lost data, or any form of special, incidental, indirect, consequential or punitive damages of any kind, whether based on breach of contract of warranty, tort (including negligence), product liability or otherwise, even if we are informed in advance of the possibility of such damages.