EMC TEST REPORT

Report No.: 16020756-FCC-E
Supersede Report No.: N/A

Applicant	Shanghai Smarfid Security Equipment Co.,Ltd.
Product Name	Magic Series 13.56MHz&125KHz Reader
Main Model	LH322-8K
Serial Model	LH322-8N
Test Standard	FCC Part 15 Subpart C:2017, ANSI C63.10:2013
Test Date	October 25 to December 06, 2017
Issue Date	December 07, 2017
Test Result	☒ Pass ☐ Fail
Equipment complied with the specification	☒
Equipment did not comply with the specification	☐

Trety Lu	Deon Dai	
Trety Lu Test Engineer	Deon Dai Engineer Reviewer	

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Test result presented in this test report is applicable to the tested sample only

Issued by:
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Laboratories Introduction

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Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

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1. Report Revision History

Report No.	Report Version	Description	Issue Date
16020756-FCC-E	NONE	Original	December 07, 2017

2. Customer information

Applicant Name	Shanghai Smarfid Security Equipment Co.,Ltd.
Applicant Add	No. 88, Lane 600, XinLi Road, Minhang District, Shanghai, China
Manufacturer	Shanghai Smarfid Security Equipment Co.,Ltd.
Manufacturer Add	No. 88, Lane 600, XinLi Road, Minhang District, Shanghai, China

3. Test site information

Lab performing tests	SIEMIC (Nanjing-China) Laboratories
Lab Address	2-1 Longcang Avenue Yuhua Economic and Technology Development Park, Nanjing, China
FCC Test Site No.	694825
IC Test Site No.	4842B-1
Test Software	EZ_EMC

4. Equipment under Test (EUT) Information

Description of EUT:	Magic Series 13.56MHz&125KHz Reader
Main Model:	LH322-8K
Serial Model:	LH322-8N
Date EUT received:	October 23, 2017
Test Date(s):	October 25 to December 06, 2017
Operating Frequency :	125KHz&13.56MHz
Antenna Gain	125KHz: 6dBi 13.56MHz: 6dBi
Type of Modulation:	125KHz: ASK、FSK 13.56MHz: ASK
Number of Channels:	125KHz: 1CH 13.56MHz: 1CH
Trade Name :	N/A
FCC ID:	X3A-LH3228K

Note: the difference between these models please refer to ANNEX E. DECLARATION OF SIMILARITY.

5. Test Summary

The product was tested in accordance with the following specifications.
All testing has been performed according to below product classification:

FCC Rules	Description of Test	Result
§15.207; ANSI C63.10: 2013	AC Power Line Conducted Emissions	Compliance
§15.209; ANSI C63.10: 2013	Radiated Emissions	Compliance

Measurement Uncertainty

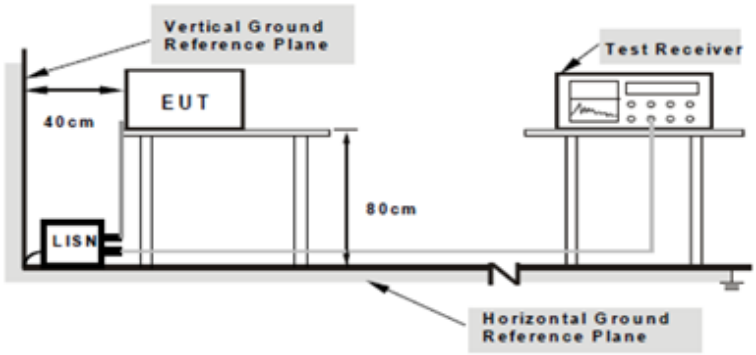
Emissions		
Test Item	Description	Uncertainty
Conducted Emissions & Radiated Emissions	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	1.634dB / 3.952dB

6. Measurements, Examination And Derived Results

6.1 AC Power Line Conducted Emissions

Temperature	24°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar
Test date :	October 25, 2017
Tested By :	Trety Lu

Requirement(s):

<table>
<tr><th>Spec</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>§15.207</td><td>For Low-power radio-frequency devices 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 or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 [mu]H/50 ohms line impedance stabilization network (LISN). The lower limit applies at the boundary between the frequencies ranges.
<table>
<tr><th rowspan="2">Frequency ranges (MHz)</th><th colspan="2">Limit (dBµV)</th></tr>
<tr><th>QP</th><th>Average</th></tr>
<tr><td>0.15 ~ 0.5</td><td>66 – 56</td><td>56 – 46</td></tr>
<tr><td>0.5 ~ 5</td><td>56</td><td>46</td></tr>
<tr><td>5 ~ 30</td><td>60</td><td>50</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td> 

Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.</td><td></td></tr>
<tr><td>Procedure</td><td>1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50W/50mH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another main supply.
5. The EUT was switched on and allowed to warm up to its normal operating condition.
6. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.
7. High peaks, relative to the limit line, were then selected, The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10kHz.
8. Steps 6-7 were repeated for the LIVE line (for AC mains) or DC line (for DC power).</td><td></td></tr>
<tr><td>Remark</td><td></td><td></td></tr>
<tr><td>Result</td><td>☒ Pass ☐ Fail</td><td></td></tr>
</table>

Test Data	☒Yes	☐N/A
Test Plot	☒Yes	☐N/A

Data sample

Data sample

No.	Frequency	Reading	Detector	Lisn/Isn	Ps_Lmt	Cab_L	Result	Limit	Margin
	(MHz)	(dBμV)		(dB}	(dB)	(dB)	(dBμV)	(dBμV)	(dB)

Frequency (MHz) = Emission frequency in MHz

Reading (dBμV) = Receiver Reading Value

Detector=Quasi Peak Detector or Average Detector

Lisn/ISN= Insertion loss of LISN

Ps_Lmt= Insertion loss of transient limiter (The transient limiter included 10dB attenuation)

Cab_L= cable loss

Result (dBμV) = Reading Value + Corrected Value

Limit (dBμV) = Limit stated in standard

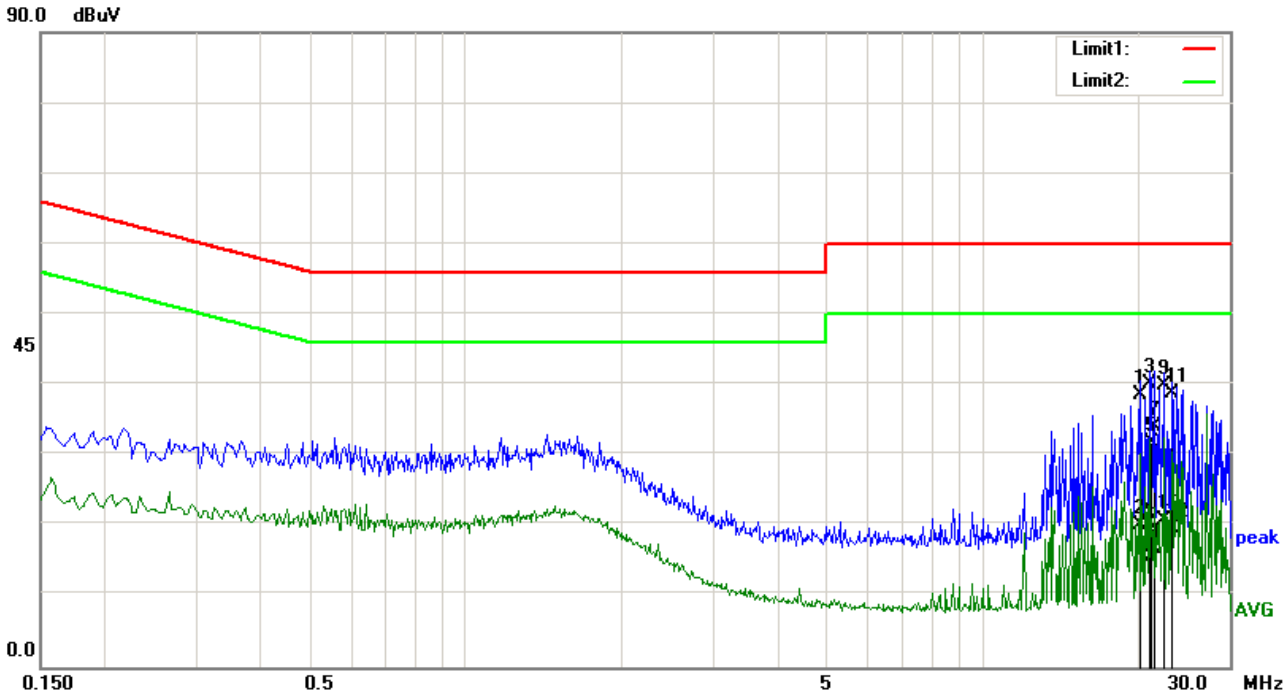
Calculation Formula:

Margin (dB) = Result (dBμV) – limit (dBμV)

Test Mode:

1	ASK Transmitting Mode	Worst Case
2	FSK Transmitting Mode	
Note: The worst case will be recorded in this report		

Test Mode:	ASK Transmitting Mode

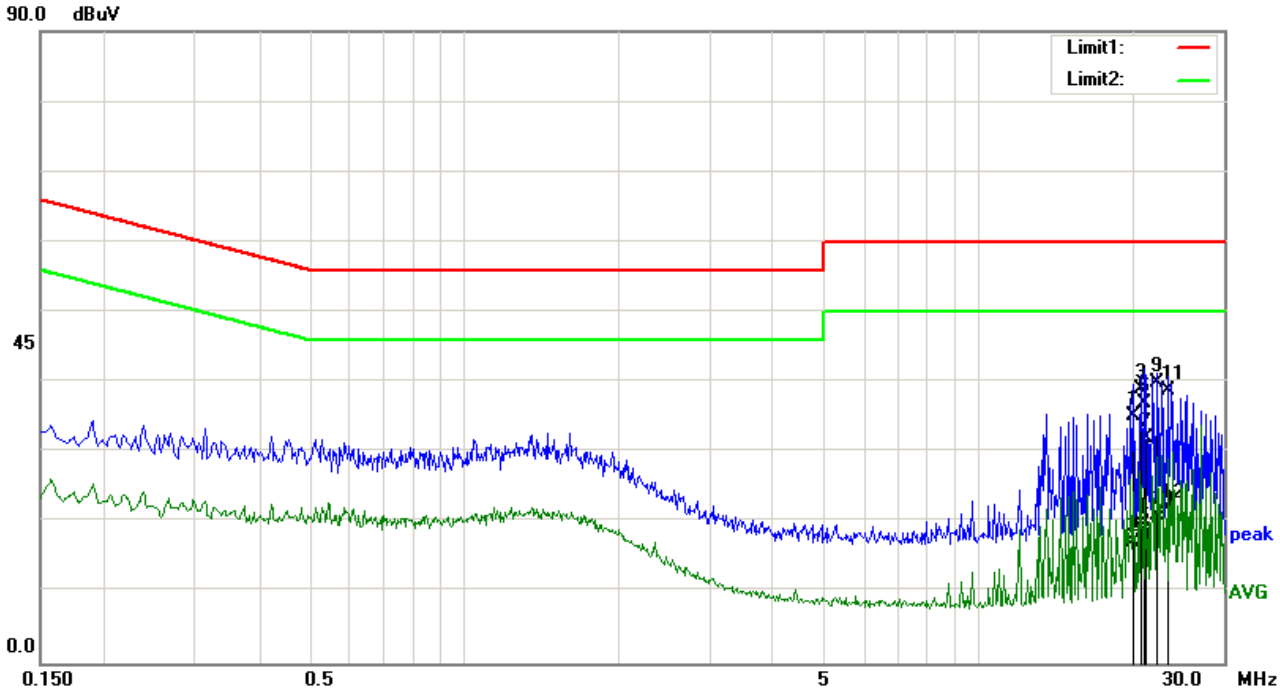


Test Data

Phase Line Plot at DC12V

No.	Frequency (MHz)	Reading (dBµV)	Detector	Lisn/Isn (dB}	Ps_Lmt (dB)	Cab_L (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	20.2500	26.79	QP	1.09	-10.00	0.63	38.51	60.00	-21.49
2	20.2500	8.53	AVG	1.09	-10.00	0.63	20.25	50.00	-29.75
3	21.0020	28.43	QP	1.12	-10.00	0.67	40.22	60.00	-19.78
4	21.0020	8.62	AVG	1.12	-10.00	0.67	20.41	50.00	-29.59
5	21.2460	20.16	QP	1.13	-10.00	0.66	31.95	60.00	-28.05
6	21.2460	3.87	AVG	1.13	-10.00	0.66	15.66	50.00	-34.34
7	21.5060	22.22	QP	1.14	-10.00	0.66	34.02	60.00	-25.98
8	21.5060	4.88	AVG	1.14	-10.00	0.66	16.68	50.00	-33.32
9	22.5020	28.12	QP	1.19	-10.00	0.66	39.97	60.00	-20.03
10	22.5020	8.95	AVG	1.19	-10.00	0.66	20.80	50.00	-29.20
11	23.2500	26.88	QP	1.22	-10.00	0.64	38.74	60.00	-21.26
12	23.2500	7.72	AVG	1.22	-10.00	0.64	19.58	50.00	-30.42

Test Mode:	ASK Transmitting Mode



Test Data

Phase Neutral Plot at DC12V

No.	Frequency (MHz)	Reading (dBµV)	Detector	Lisn/Isn (dB}	Ps_Lmt (dB)	Cab_L (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	19.9980	23.43	QP	1.20	-10.00	0.60	35.23	60.00	-24.77
2	19.9980	5.48	AVG	1.20	-10.00	0.60	17.28	50.00	-32.72
3	20.7500	27.24	QP	1.23	-10.00	0.66	39.13	60.00	-20.87
4	20.7500	8.11	AVG	1.23	-10.00	0.66	20.00	50.00	-30.00
5	20.9980	25.17	QP	1.24	-10.00	0.67	37.08	60.00	-22.92
6	20.9980	6.89	AVG	1.24	-10.00	0.67	18.80	50.00	-31.20
7	21.2460	20.17	QP	1.25	-10.00	0.66	32.08	60.00	-27.92
8	21.2460	3.66	AVG	1.25	-10.00	0.66	15.57	50.00	-34.43
9	22.2500	28.07	QP	1.30	-10.00	0.65	40.02	60.00	-19.98
10	22.2500	8.98	AVG	1.30	-10.00	0.65	20.93	50.00	-29.07
11	23.5020	26.73	QP	1.35	-10.00	0.67	38.75	60.00	-21.25
12	23.5020	9.96	AVG	1.35	-10.00	0.67	21.98	50.00	-28.02

6.2 Radiated Emissions

Temperature	22°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar
Test date :	October 25 to December 06, 2017
Tested By :	Trety Lu

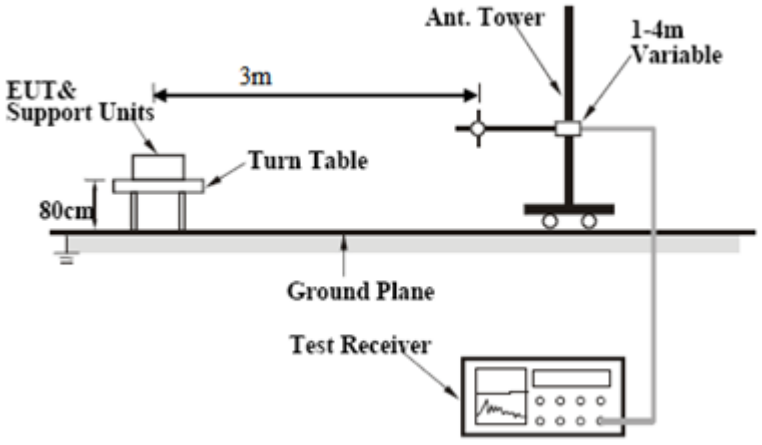
Requirement(s):

Spec	Requirement	Applicable
§15.209	Except higher limit as specified elsewhere in other section, the emissions from the low-power radio-frequency devices shall not exceed the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges	☒

Fundamental frequency (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
88-246	150**	3
216-960	200**	3
Above 960	500	3

Frequency range (MHz)	Field Strength (μV/m)
30 – 88	100
88 – 216	150
216 – 960	200
Above 960	500

Test Setup



Procedure

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. The test was carried out at the selected frequency points obtained from the EUT characterisation. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.

	3. For emission frequencies measured below and above 1GHz, set the spectrum analyzer on a 100kHz and 1MHz resolution bandwidth respectively for each frequency measured. 4. Steps 2 and 3 were repeated for the next frequency point, until all selected frequency points were measured.
Remark	
Result	☒ Pass ☐ Fail
Test Data	☒Yes ☐N/A
Test Plot	☒Yes ☐N/A

Data sample

No.	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
	(MHz)	(dBμV/m)		(dB/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(cm)	(°)

Frequency (MHz) = Emission frequency in MHz

Reading (dBμV/m) = Receiver Reading Value

Detector= Peak Detector or Quasi Peak Detector

Ant_F=Antenna Factor

PA_G=Pre-Amplifier Gain

Cab_L=Cable Loss

Result (dBμV/m) = Read ing Value + Corrected Value

Limit (dBμV/m) = Limit stated in standard

Height (cm) = Height of Receiver antenna

Degree = Turn table degree

Calculation Formula:

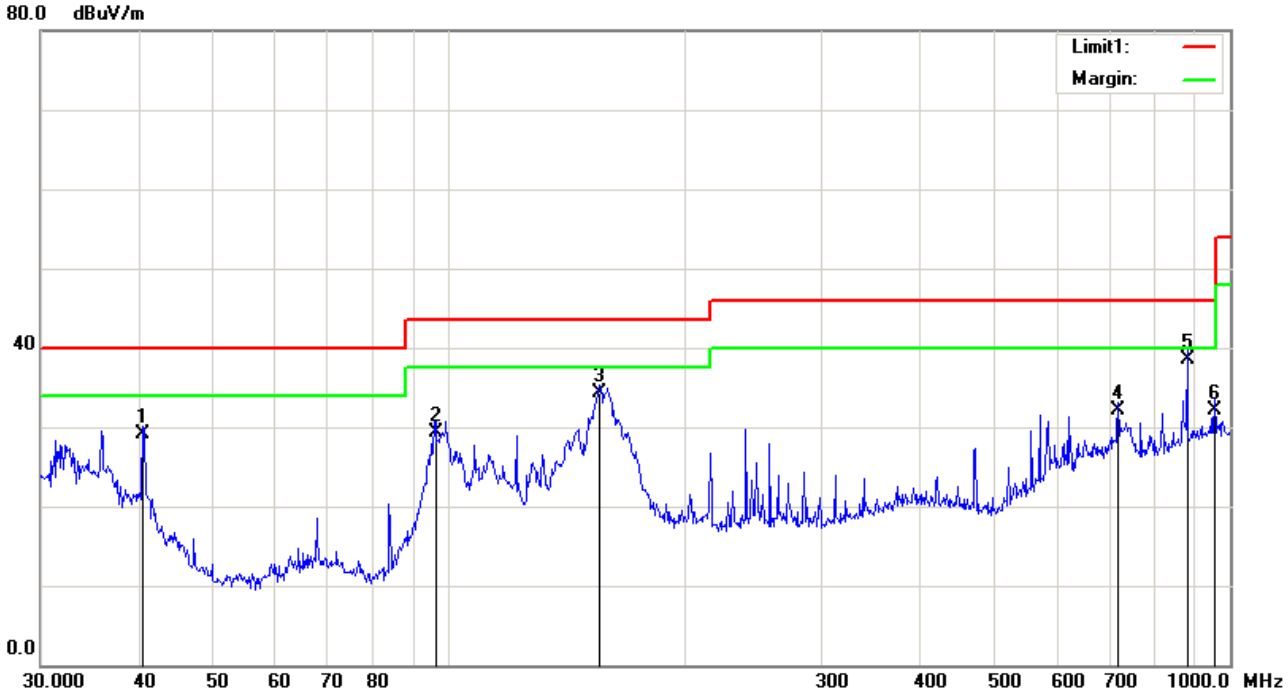
Margin (dB) = Result (dBμV/m) – limit (dBμV/m)

Test Mode:

1	ASK Transmitting Mode	Worst Case
2	FSK Transmitting Mode	
Note: The worst case will be recorded in this report		

Test Mode:	ASK Transmitting Mode

(30MHz - 1GHz)



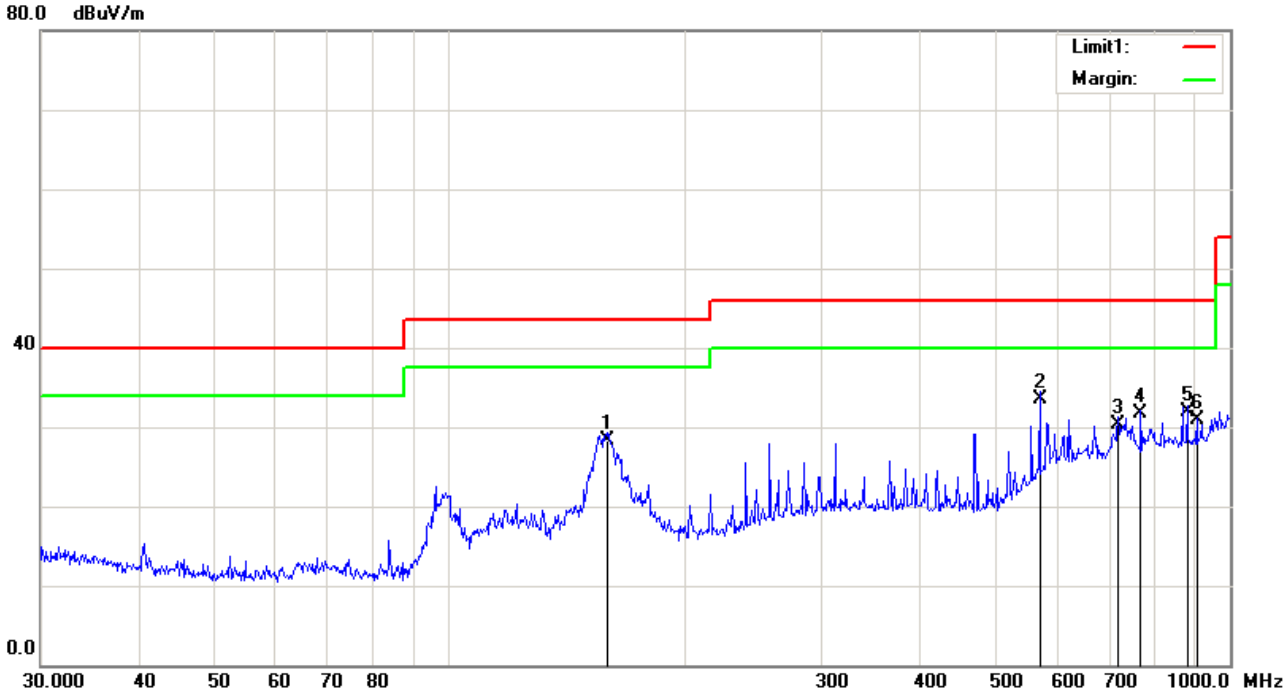
Test Data

Vertical Polarity Plot @3m

No.	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
	(MHz)	(dBμV/m)		(dB/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(cm)	(°)
1	40.5591	58.42	QP	15.40	45.73	1.06	29.15	40.00	-10.85	100	356
2	96.0986	64.14	QP	10.28	46.66	1.57	29.33	43.50	-14.17	100	250
3	155.9101	66.25	QP	13.60	47.57	2.08	34.36	43.50	-9.14	100	308
4	719.1995	51.22	QP	22.39	45.75	4.31	32.17	46.00	-13.83	200	7
5	881.4067	56.38	QP	23.28	45.95	4.80	38.51	46.00	-7.49	100	92
6	955.4381	49.74	QP	23.64	46.16	4.97	32.19	46.00	-13.81	100	108

Test Mode:	ASK Transmitting Mode

(30MHz - 1GHz)



Test Data

Horizontal Polarity Plot @3m

No.	Frequency (MHz)	Reading (dBμV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)
1	159.7844	61.01	QP	12.51	47.30	2.07	28.29	43.50	-15.21	300	233
2	570.6100	58.37	QP	19.71	48.43	3.82	33.47	46.00	-12.53	200	269
3	719.1995	49.20	QP	22.52	45.75	4.31	30.28	46.00	-15.72	300	102
4	768.7482	49.99	QP	22.81	45.46	4.45	31.79	46.00	-14.21	200	230
5	881.4067	50.27	QP	22.76	45.95	4.80	31.88	46.00	-14.12	300	23
6	906.4824	49.71	QP	22.86	46.63	4.87	30.81	46.00	-15.19	200	294

Test Mode:	ASK Transmitting Mode

0° 9 kHz -30MHz

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Ant. Factor (dB/m)	Cable Loss (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
0.099	30.65	QP	71.3	0.01	101.96	107.69	-5.73
0.103	31.98	QP	70.4	0.02	102.4	107.35	-4.95
1.25	13.61	QP	50.3	0.08	63.99	65.67	-1.68
14.5	18.39	QP	38.5	0.1	56.99	69.54	-12.55
25.7	14.24	QP	37.7	0.2	52.14	69.54	-17.4
27.3	14.27	QP	36.2	0.3	50.77	69.54	-18.77

90° 9 kHz -30MHz (ASK Modulation is worst)

Frequency (MHz)	S.A. Reading (dBμV)	Detector (PK/AV)	Ant. Factor (dB/m)	Cable Loss (dB)	Cord. Amp. (dBμV/m)	Limit (dBμV/m)	Margin (dB)
0.099	30.28	QP	71.3	0.01	101.59	107.69	-6.1
0.103	30.64	QP	70.4	0.02	101.06	107.35	-6.29
1.25	13.98	QP	50.3	0.08	64.36	65.67	-1.31
14.5	18.59	QP	38.5	0.1	57.19	69.54	-12.35
25.7	14.38	QP	37.7	0.2	52.28	69.54	-17.26
27.3	14.59	QP	36.2	0.3	51.09	69.54	-18.45

Note: The highest frequency of the internal sources of the EUT is less than 108MHz, so the measurement shall only be made up to 1GHz.

Annex A. TEST INSTRUMENT

Instrument	Model	Serial #	Cal Date	Cal Due	In use
AC Line Conducted Emissions					
R&S EMI Test Receiver	ESPI3	101216	05/03/2017	05/03/2017	☒
V-LISN	ESH3-Z5	838979/005	05/15/2017	05/15/2017	☒
Com-Power LISN	LI-115	241091	05/15/2017	05/15/2017	☒
SIEMIC EZ_EMC Conducted Emissions software	Ver.ICP-03A1	N/A	N/A	N/A	☒
Radiated Emissions					
Agilent Technologies Spectrum Analyzer	N9010A	MY47191130	05/03/2017	05/03/2017	☒
R&S EMI Receiver	ESPI3	101216	05/03/2017	05/03/2017	☒
Antenna (30MHz~6GHz)	JB6	A121411	10/31/2016	10/31/2017	☒
EMCO Passive Loop Antenna	6509	9909-1469	10/09/2017	10/08/2018	☒
Hp Agilent Pre-Amplifier	8447F	1937A01160	10/27/2016	10/26/2017	☒
SIEMIC EZ_EMC Radiated Emissions software	Ver.ICP-03A1	N/A	N/A	N/A	☒

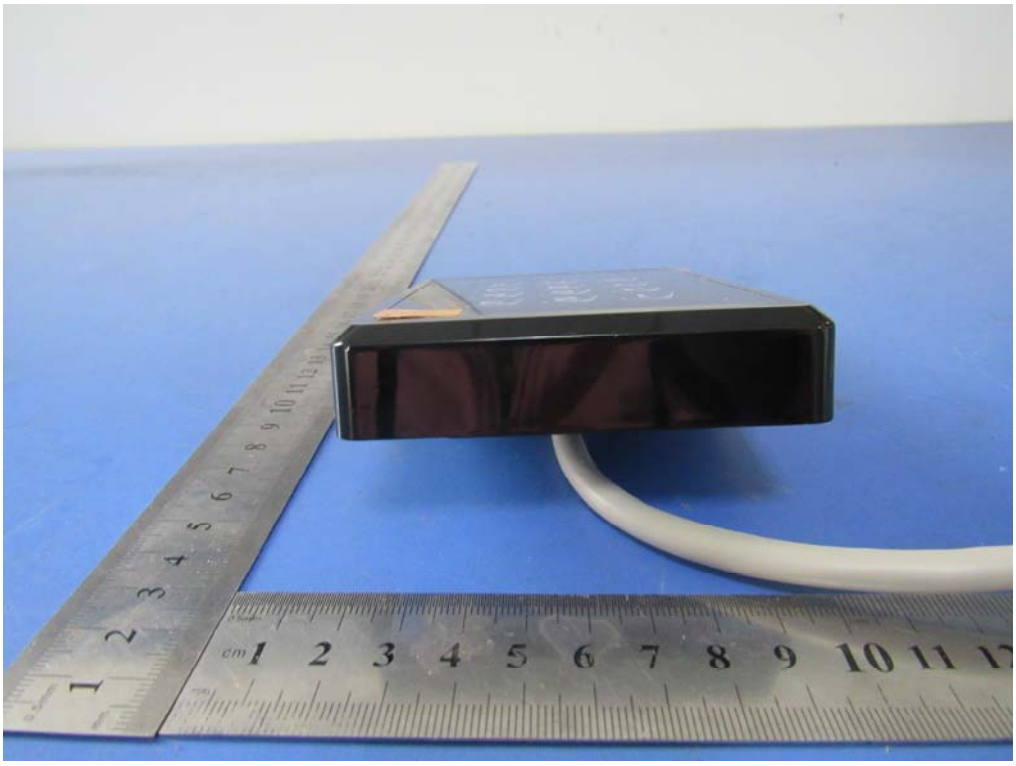
Annex B. EUT And Test Setup Photographs

Annex B.i. Photograph: EUT External Photo

EUT – Front View

EUT – Rear View

EUT – Top View



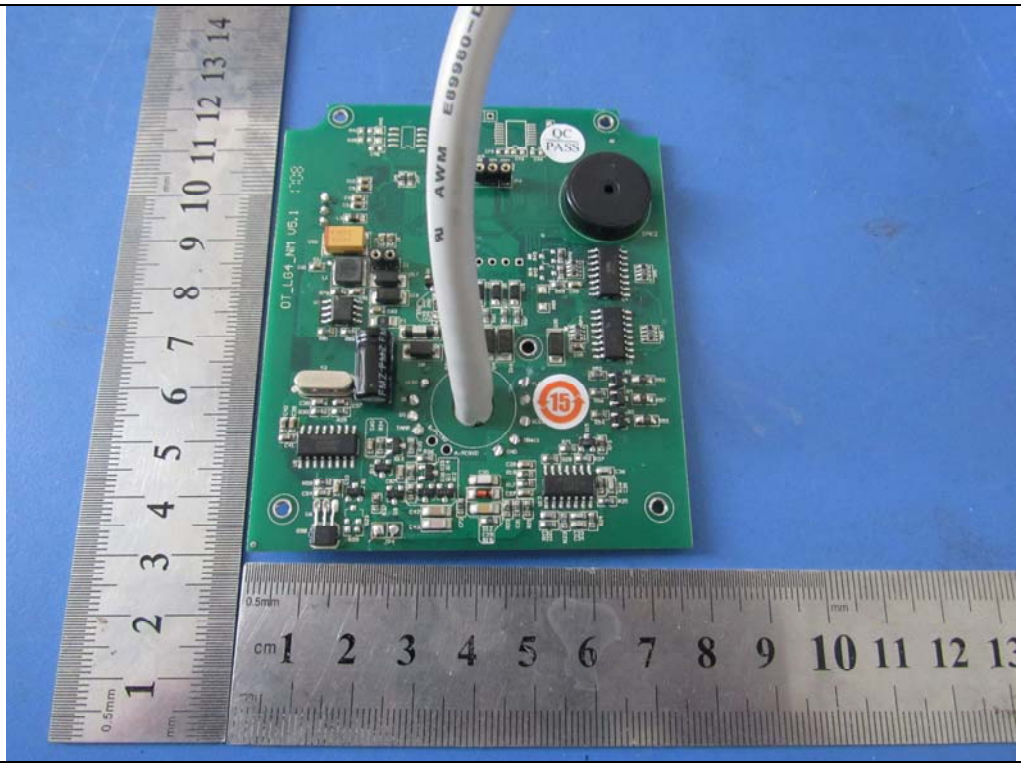
EUT – Bottom View

EUT – Left View

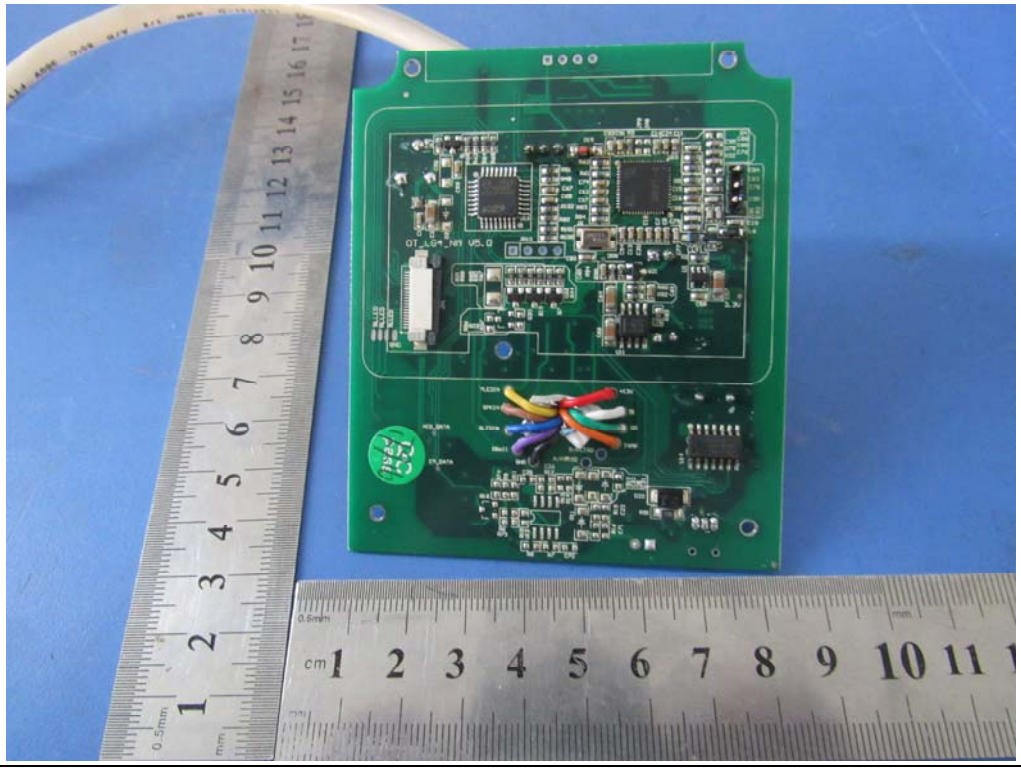
EUT – Right View

Annex B.ii. Photograph: EUT Internal Photo

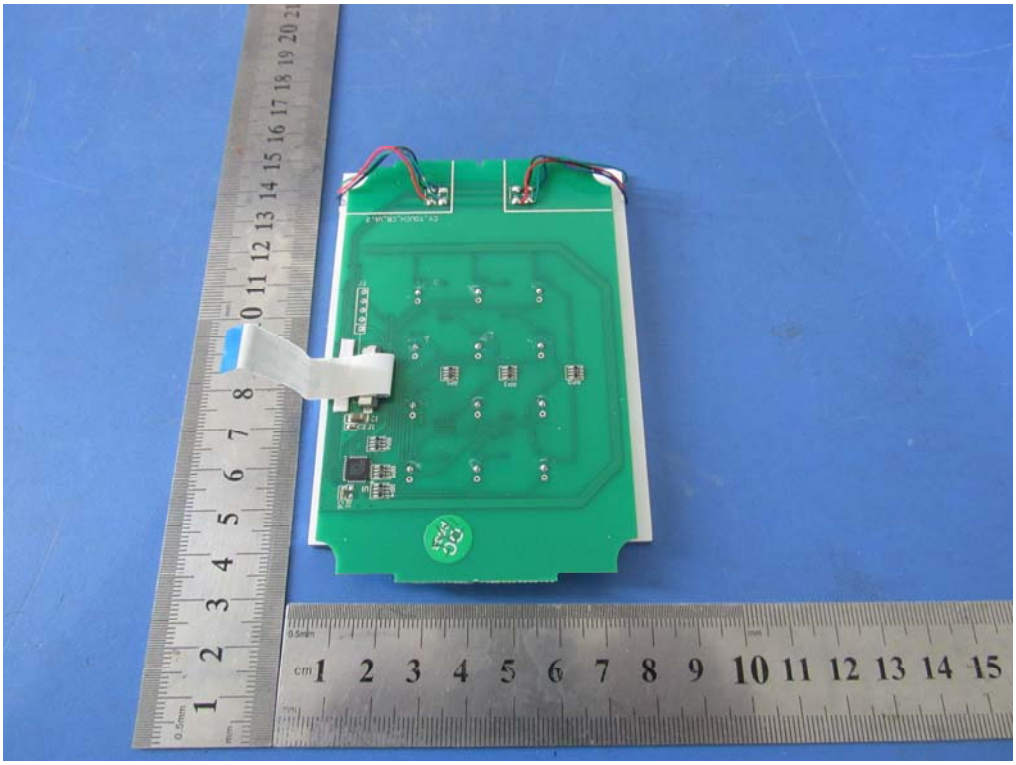
EUT – Uncover Front View 1



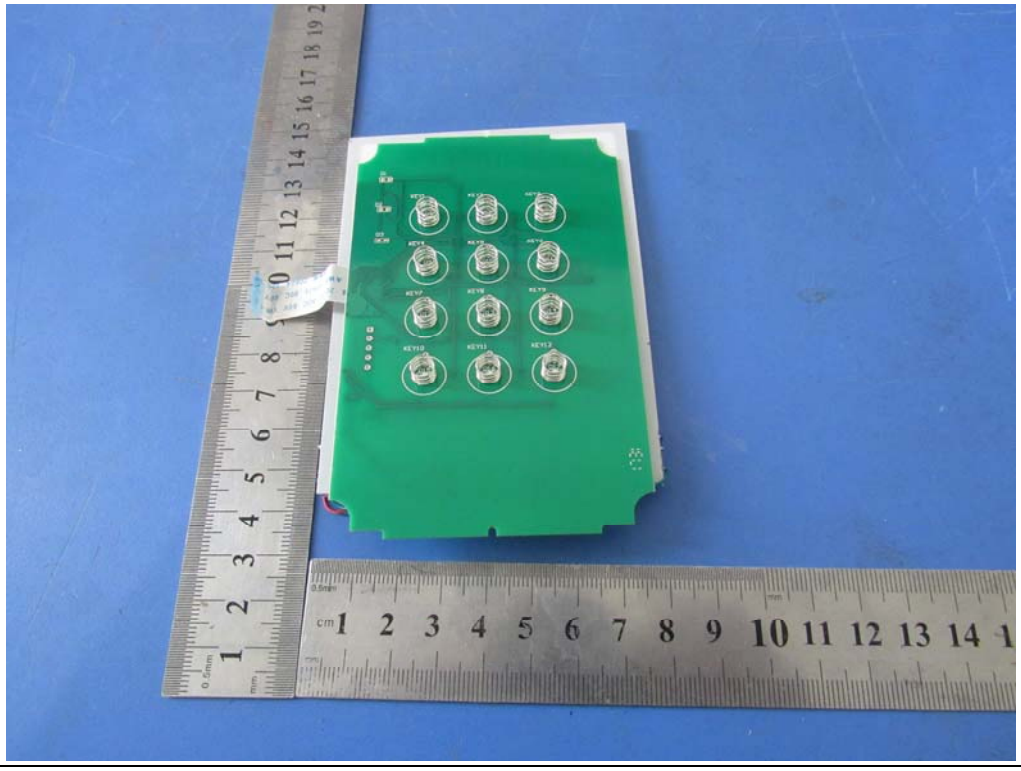
EUT – PCBA 1 Front View



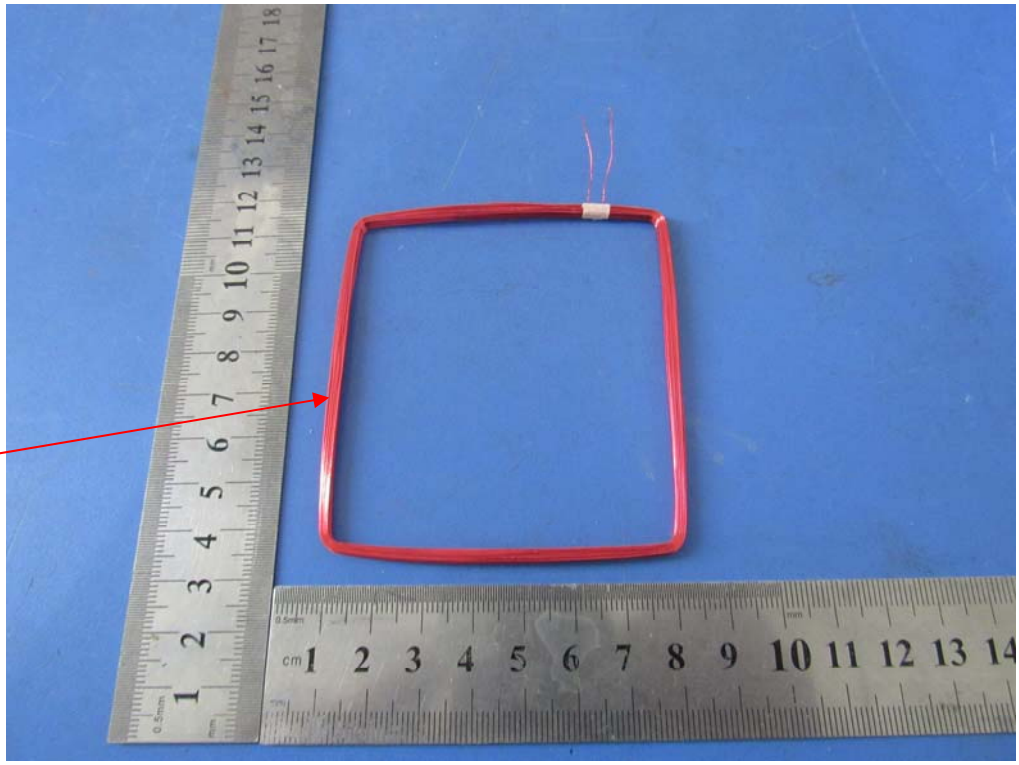
EUT – PCBA 1 Rear View



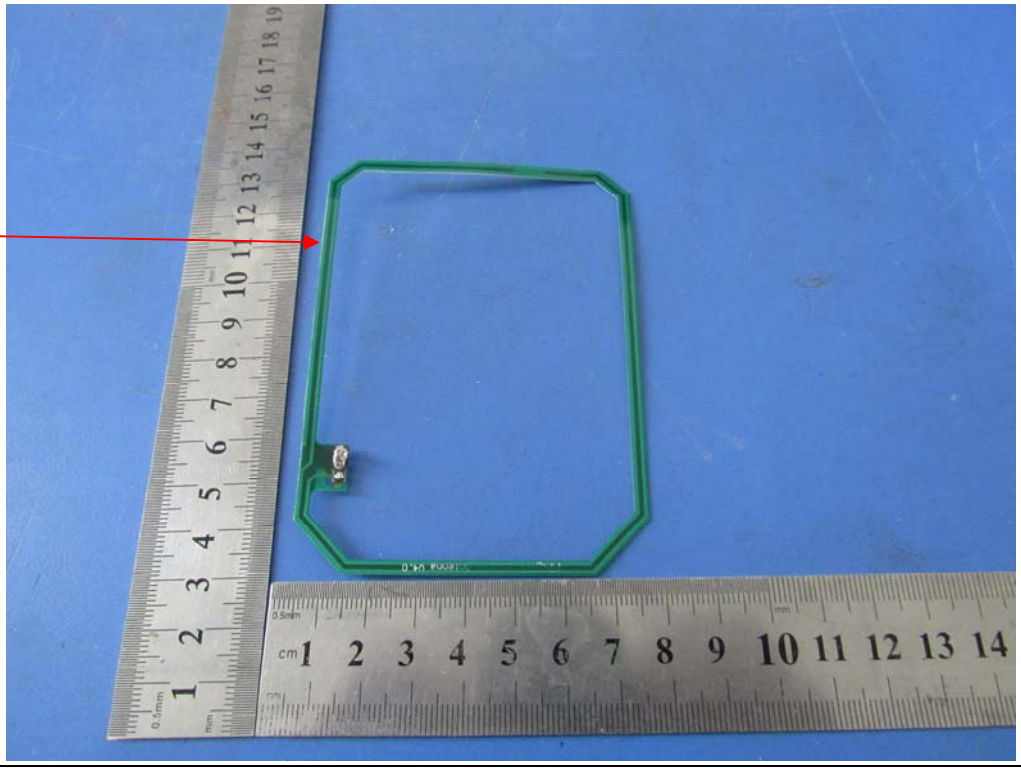
EUT – PCBA 2 Front View



EUT – PCBA 2 Rear View



EUT – Antenna Front View



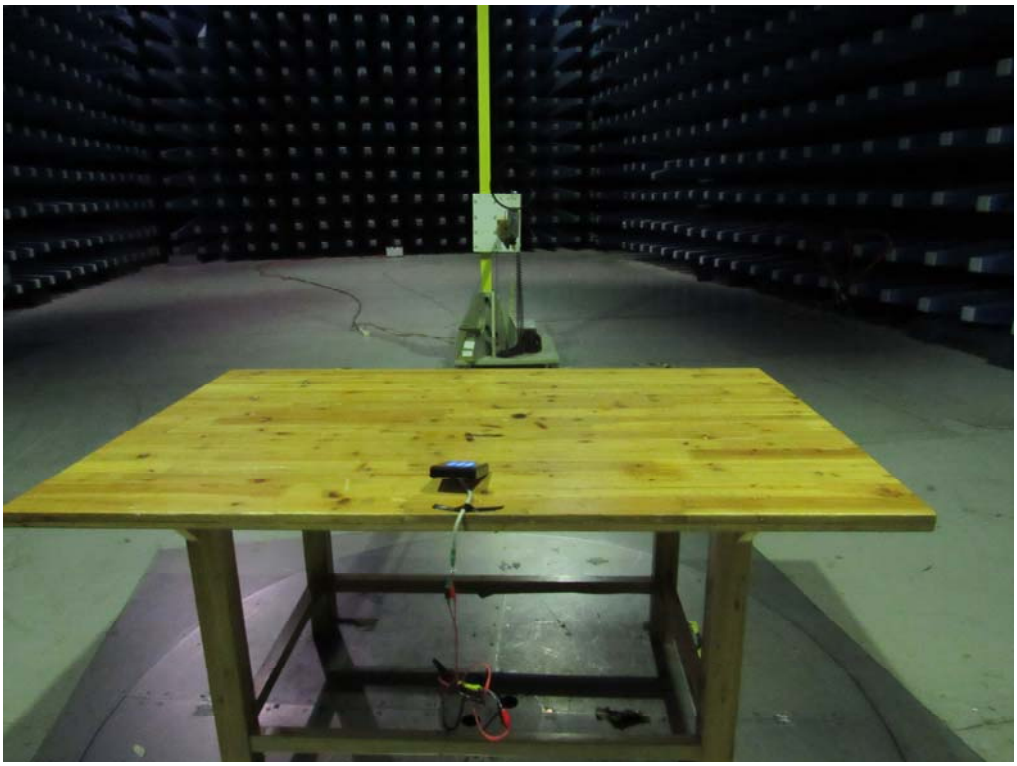
EUT – Antenna Front View

Annex B.iii. Photograph Test Setup Photo

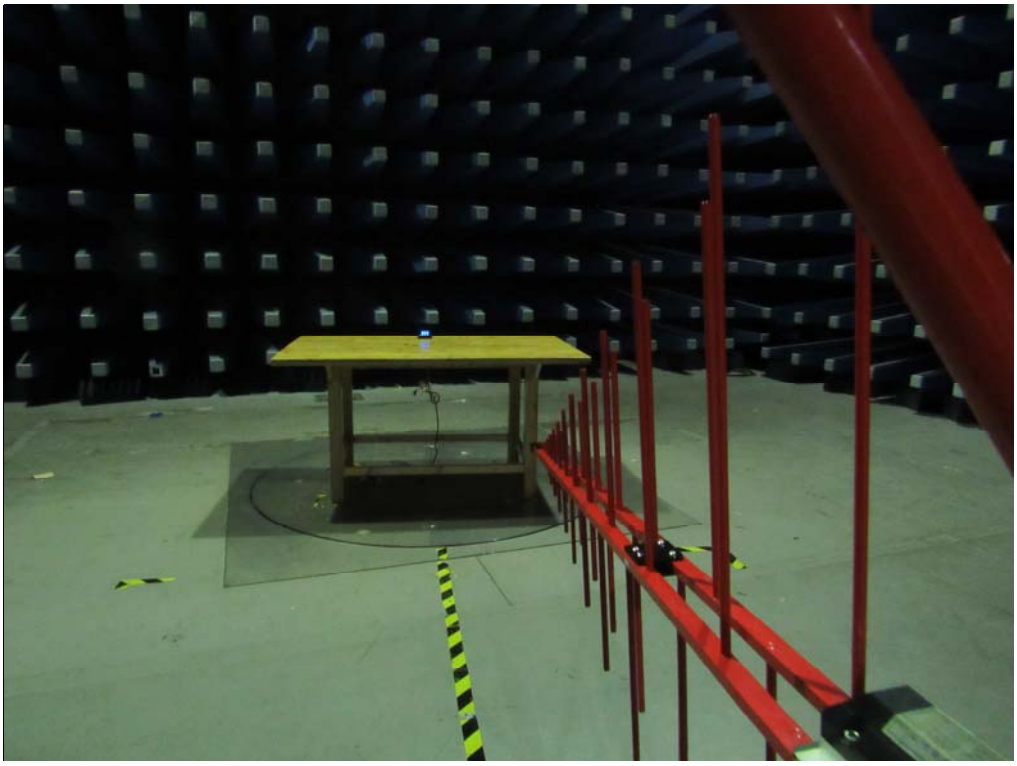
Conducted Emissions Setup Front View

Conducted Emissions Setup Side View

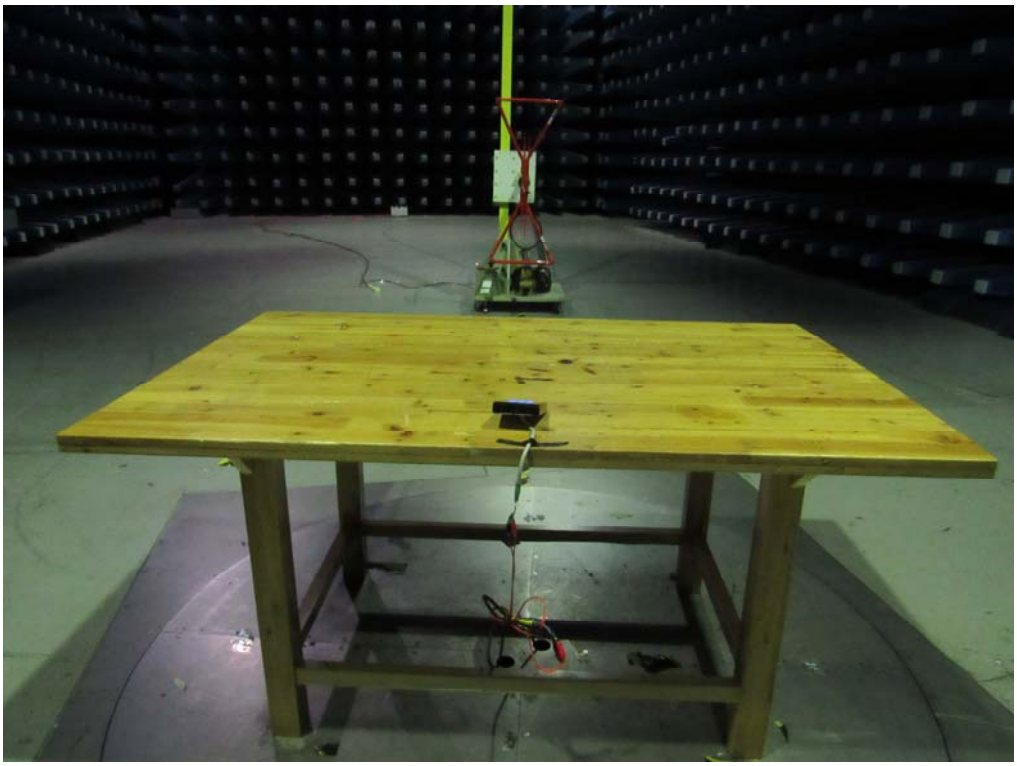
Front View of Radiated Emissions Test Setup below 30MHz



Rear View of Radiated Emissions Test Setup below 30MHz



Radiated Emissions Setup Below 1GHz Front View

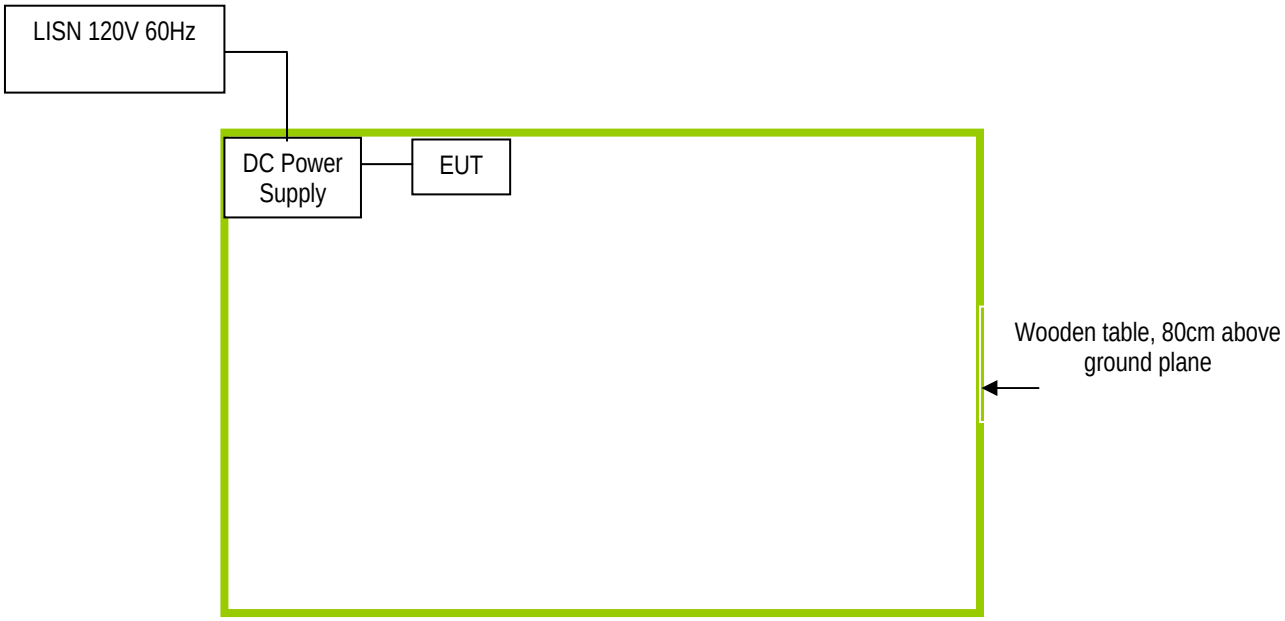


Radiated Emissions Setup Below 1GHz Rear View

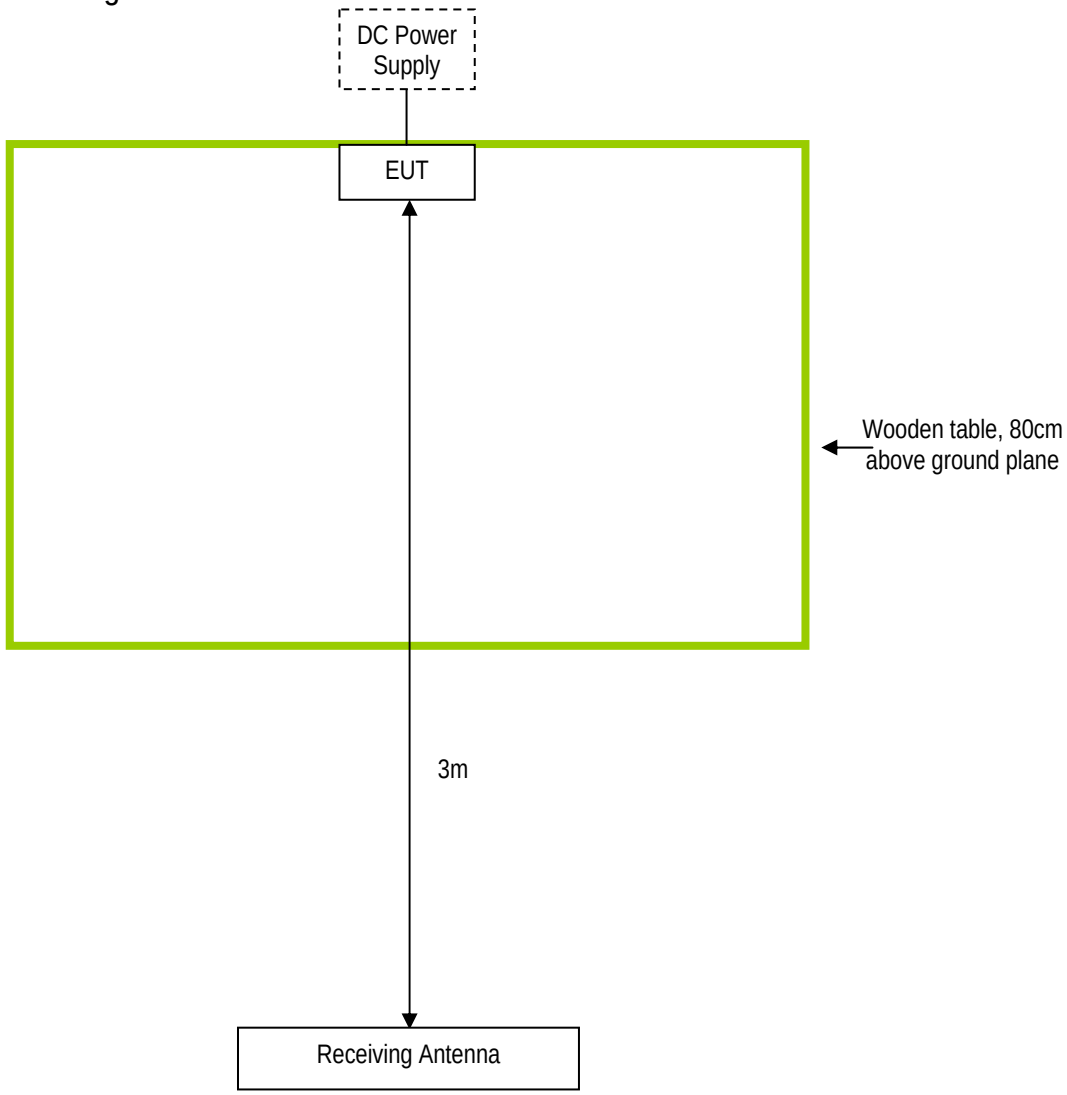
Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

Annex C.i. TEST SET UP BLOCK

Block Configuration Diagram for Conducted Emissions



Block Configuration Diagram for Radiated Emissions



Annex C. ii. SUPPORTING EQUIPMENT DESCRIPTION

The following is a description of supporting equipment and details of cables used with the EUT.

Manufacturer	Equipment Description	Model	Cal Date	Cal Due Date
BK PRECISION	DC Power Supply	1786B	N/A	N/A

Annex D. User Manual / Block Diagram / Schematics / Partlist

Please see Attachment

Annex E. DECLARATION OF SIMILARITY

SMARFID

Shanghai Smarfid Security Equipment Co., Ltd.
Add: No. 88, Lane 600, XinLi Road, Minhang District, Shanghai, 201199, China
Tel: （86-21) 54260103, 54260132 ext.215 Fax: (86-21) 54260132 ext.222

To:

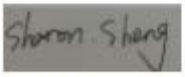
Declaration letter

Dear Sir/Madam:

For our business issue and marketing requirement, we would like to list different models numbers on the FCC ID certificates and reports, as following:
FCC ID：X3ALH3228K
Model No: LH322-8K、
LH322-8N
The two models have the same Circuits, components and color.

Apart from the different model name, the two models differ from each other by:
LH322-8K has the button function, but LH322-8N has no button function.

Thank you!

Signature: 

Printed name/title: Sharon Sheng