RF TEST REPORT

Report No.: 17020509-FCC-R1
Supersede Report No.: N/A

Applicant	chongqing lihua automatic technology Co.,Ltd.
Product Name	remote control
Main Model	1000i
Serial Model	2000i, 3000i, 4000i, 5000i, 7000i
Test Standard	FCC Part 15.231: 2016, ANSI C63.10: 2013
Test Date	May 04 to June 01, 2017
Issue Date	June 01, 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	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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Country/Region	Scope
USA	EMC , RF/Wireless , Telecom
Canada	EMC, RF/Wireless , Telecom
Taiwan	EMC, RF, Telecom , Safety
Hong Kong	RF/Wireless ,Telecom
Australia	EMC, RF, Telecom , Safety
Korea	EMI, EMS, RF , Telecom, Safety
Japan	EMI, RF/Wireless, Telecom
Singapore	EMC , RF , Telecom
Europe	EMC, RF, Telecom , Safety

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1. Report Revision History

Report No.	Report Version	Description	Issue Date
17020509-FCC-R1	NONE	Original	June 01, 2017

2. Customer information

Applicant Name	chongqing lihua automatic technology Co.,Ltd.
Applicant Add	NO.9,Yangliu North Road,Yubei District,Chongqing401121,China
Manufacturer Name	chongqing lihua automatic technology Co.,Ltd.
Manufacturer Add	NO.9,Yangliu North Road,Yubei District,Chongqing401121,China

3. Test site information

Lab performing tests	SIEMIC (Nanjing-China) Laboratories
Lab Add	2-1 Longcang Avenue Yuhua Economic and Technology Development Park, Nanjing, China
FCC Test Site No.	986914
IC Test Site No.	4842B-1
Test Software	EZ_EMC

4. Equipment Under Test (EUT) Information

Description of EUT:	remote control
Main Model:	1000i
Serial Model:	2000i, 3000i, 4000i, 5000i, 7000i
Date EUT received:	May 02, 2017
Test Date(s):	May 04 to June 01, 2017
Antenna Gain:	2dBi
Type of Modulation:	ASK
RF Operating Frequency (ies):	Tx:433.92MHz
Number of Channels:	1 CH
Port:	N/A
Power:	DC3V
Trade Name:	N/A
FCC ID:	2AL6E-4000I

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
§15.203	Antenna Requirement	Compliance
§15.207	Conducted Emissions Voltage	N/A*
§15.231(b)	Fundamental & Radiated Spurious Emission	Compliance
§15.231(c)	20dB Bandwidth	Compliance
§15.231(a)(1)	Deactivation	Compliance

Note: Preliminary radiated emission testing has been performed on X, Y, Z axis, only worst case test result is presented in this test report.

Measurement Uncertainty

Emissions		
Test Item	Description	Uncertainty
Radiated Spurious 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)	3.92dB

N/A*: EUT is Power Supply by Battery

6. Measurements, Examination And Derived Results

6.1 Antenna Requirement

Applicable Standard

Requirement(s): 47 CFR §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.

Antenna requirement must meet at least one of the following:

a) Antenna must be permanently attached to the device.

b) Antenna must use a unique type of connector to attach to the device.

c) Device must be professionally installed. Installer shall be responsible for ensuring that the correct antenna is employed with the device.

The antenna is permanently attached to the device which meets the requirement.

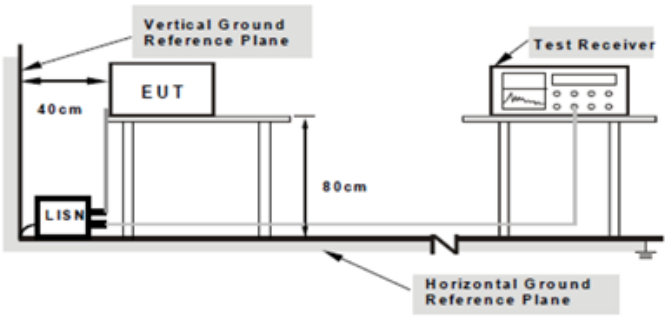
Result: Compliance.

6.2 AC Conducted Emissions Voltage

Temperature	-
Relative Humidity	-
Atmospheric Pressure	-
Test date :	-
Tested By :	-

Conducted Emission Limit

Frequency ranges (MHz)	Limit (dBμV)	
	QP	Average
0.15 ~ 0.5	66 – 56	56 – 46
0.5 ~ 5	56	46
5 ~ 30	60	50

Spec	Item	Requirement	Applicable
47CFR§15.207, RSS210 (A8.1)	a)	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 frequency ranges.	☐
Test Setup	 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.		
Procedure	- 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, as shown in Annex B. - The power supply for the EUT was fed through a 50W/50mH EUT LISN, connected to filtered mains. - The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable. - All other supporting equipment were powered separately from another main supply.		
Remark	EUT is Power Supply by Battery		
Result	☒N/A ☐ Fail		

6.3 20dB Occupied Bandwidth

Temperature	25°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar
Test date :	June 01, 2017
Tested By :	Trety Lu

Requirement(s):

Spec	Item	Requirement	Applicable
§15.231(c)	a)	The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz.	☒
	b)	For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency.	☐
Test Setup	Spectrum Analyzer — EUT		
Test Procedure	20dB Emission bandwidth measurement procedure - Set RBW = 30 kHz. - Set the video bandwidth (VBW) ≥3*RBW. - Detector = Peak. - Trace mode = max hold. - Sweep = auto couple. - Allow the trace to stabilize. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission.		
Remark			
Result	☒Pass ☐Fail		

Test Data ☒Yes ☐N/A

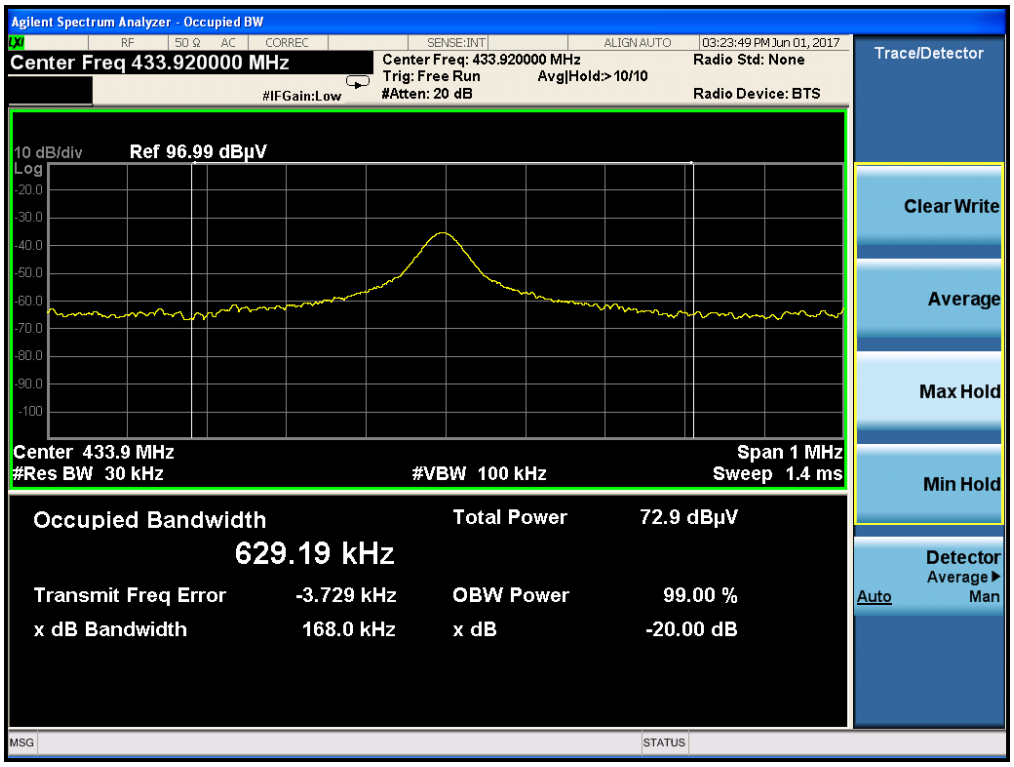
Test Plot ☒Yes ☐N/A

20dB Bandwidth measurement result

Type	Freq (MHz)	CH	Measured 20dB Bandwidth (kHz)	Limit (kHz)	Result
20dB BW	433.92	1 CH	168.0	1084.8	Pass

Test Plots

20dB Bandwidth measurement result

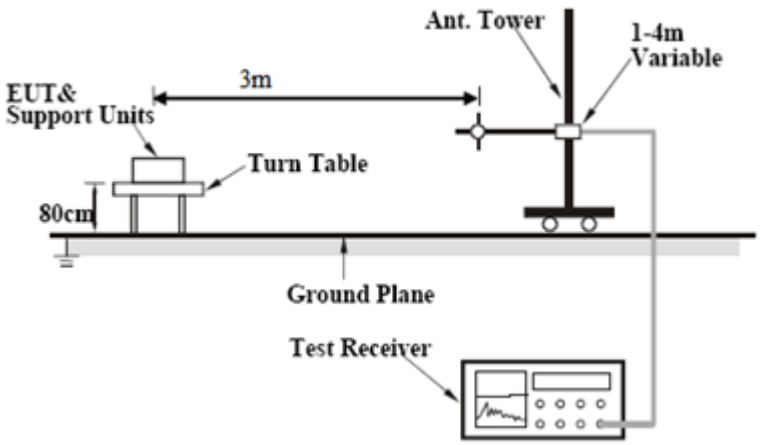


20dB Bandwidth

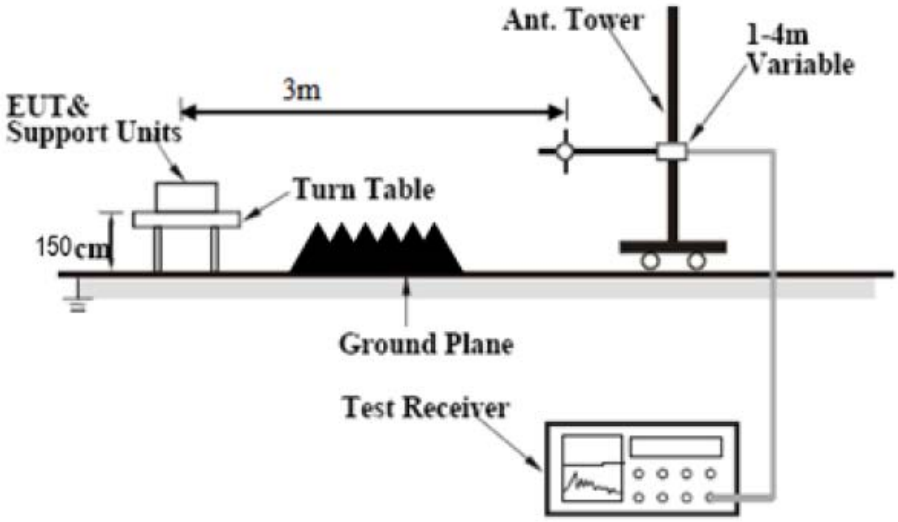
6.4 Radiated Fundamental and Spurious Emission

Temperature	25°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar
Test date :	May 04, 2017
Tested By :	Trety Lu

Requirement(s):

<table>
<tr><th>Spec</th><th>Item</th><th>Requirement</th><th>Applicable</th></tr>
<tr><td>§15.231(b)</td><td>a)</td><td>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
<table>
<tr><th>Fundamental frequency (MHz)</th><th>Field strength of fundamental (microvolts/meter)</th><th>Field strength of spurious emissions (microvolts/meter)</th></tr>
<tr><td>40.66-40.70</td><td>2250</td><td>225</td></tr>
<tr><td>70-130</td><td>1250</td><td>125</td></tr>
<tr><td>130-174</td><td>1250 to 3750</td><td>125 to 375</td></tr>
<tr><td>174-260</td><td>3750</td><td>375</td></tr>
<tr><td>260-470</td><td>3750-12500</td><td>375 to 1250</td></tr>
<tr><td>Above 470</td><td>12500</td><td>1250</td></tr>
<tr><td colspan="3">Note: All 3 axes have been investigated. Only worst case is presented in the test report.</td></tr>
</table></td><td>☒</td></tr>
<tr><td>Test Setup</td><td colspan="3">A: < 1GHz
 

B: >1GHz</td></tr>
</table>



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. A Quasi-peak measurement was then made for that frequency point. 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 (See below) ☐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

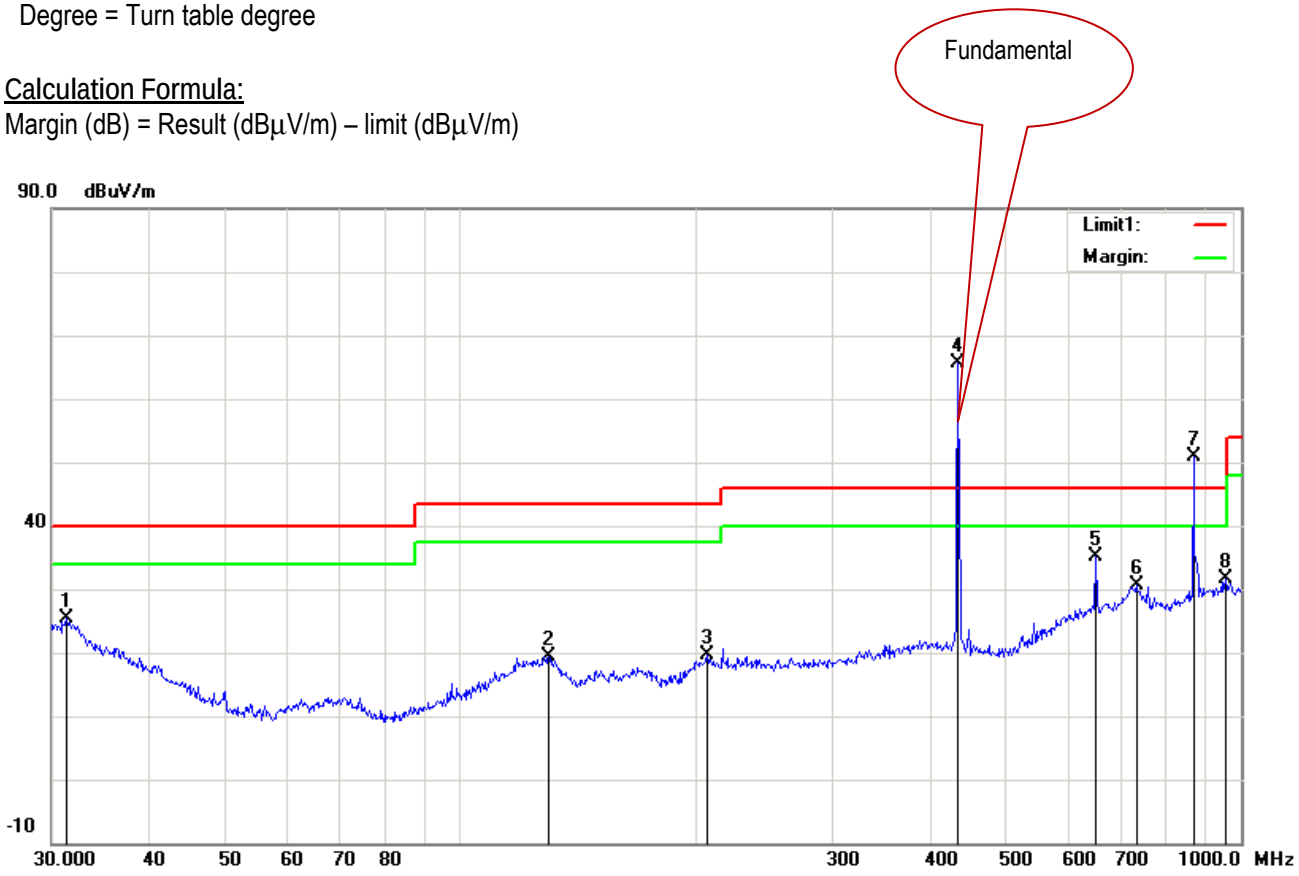
Limit (dBμV/m) = Limit stated in standard

Height (cm) = Height of Receiver antenna

Degree = Turn table degree

Calculation Formula:

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



Vertical Polarity Plot @3m

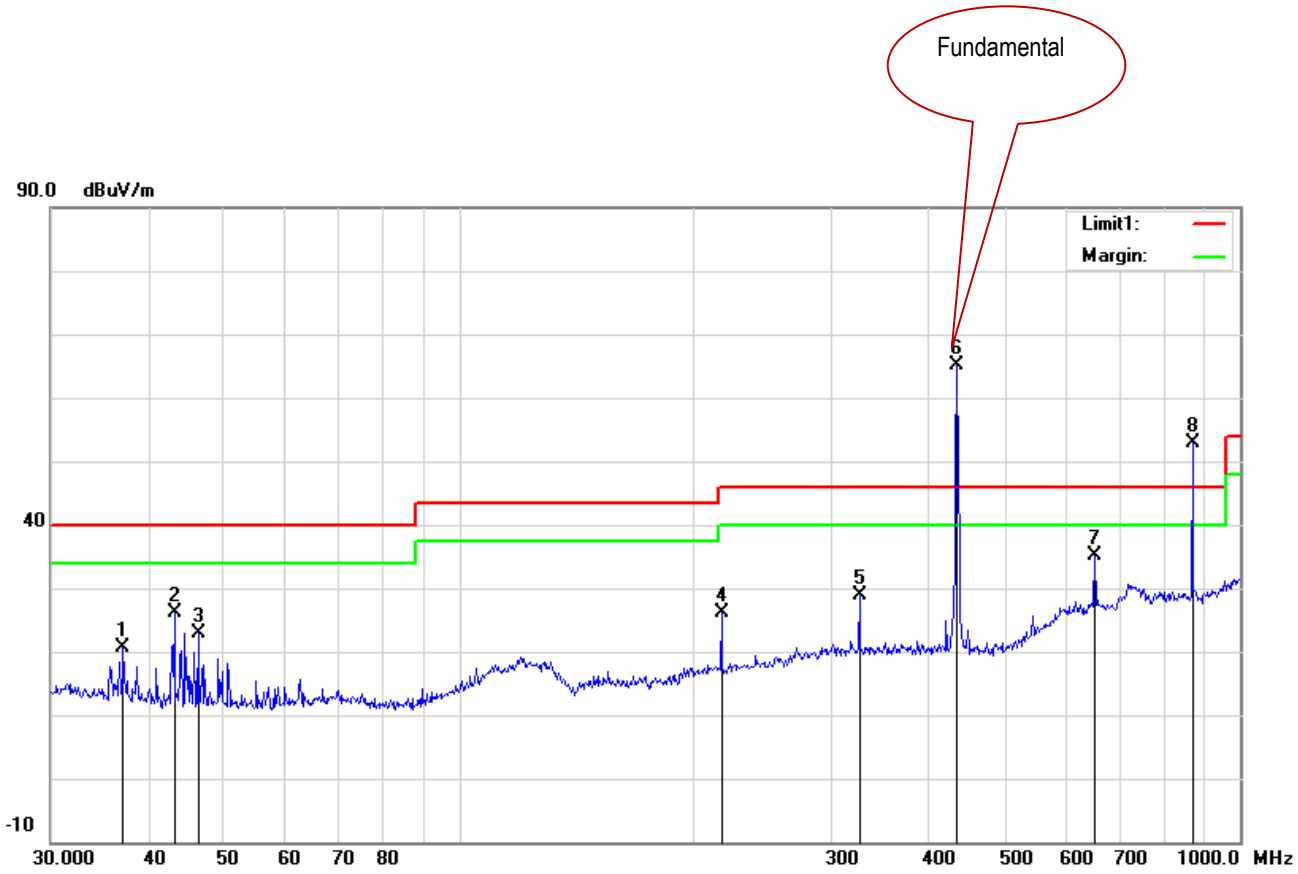
Field strength of fundamental Result

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 (°)
4	433.92	94.9	Pk	16.43	49.13	3.35	65.55	100.8	-35.25	100	291
4	433.92	-	Ave	-	-	-	56.58	80.8	-24.22	-	-

Field strength of spurious emissions Result

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 (°)
7	867.84	69.19	peak	23.02	46.12	4.76	50.85	80.8	-29.95	100	48
7	867.84	-	Ave	-	-	-	41.88	60.8	-18.92	-	-

Notes: Duty cycle is 35.6%, 20log (duty cycle) = -8.97dB correction was used to determine the average level from the peak reading.
Average = peak reading + 20log (duty cycle), Final Average= peak reading-8.97dB



Horizontal Polarity Plot @3m

Field strength of fundamental Result

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 (°)
6	433.92	94.97	Pk	16	49.13	3.35	65.19	100.8	-35.61	100	16
6	433.92	-	Ave	-	-	-	56.22	80.8	-24.58	-	-

Field strength of spurious emissions Result

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 (°)
8	867.84	71.42	peak	22.79	46.12	4.76	52.85	80.8	-27.95	100	242
8	867.84	-	Ave	-	-	-	43.88	60.8	-16.92	-	-

Notes: Duty cycle is 35.6%, 20log (duty cycle) = -8.97dB correction was used to determine the average level from the peak reading.
Average = peak reading + 20log (duty cycle), Final Average= peak reading-8.97dB

Spurious Emissions (< 1GHz) Measurement Result

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	31.2893	49.28	peak	20.85	45.67	0.89	25.35	40.00	-14.65	100	126
2	129.9226	48.53	peak	16.37	47.29	1.86	19.47	43.50	-24.03	200	235
3	207.1226	49.97	peak	14.86	47.51	2.29	19.61	43.50	-23.89	200	168
5	651.9417	57.81	peak	21.47	48.15	4.10	35.23	46.00	-10.77	100	223
6	734.4913	49.22	peak	22.23	45.29	4.35	30.51	46.00	-15.49	100	113
8	955.4381	49.18	peak	23.64	46.16	4.97	31.63	46.00	-14.37	100	106

Horizontal 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	37.1550	53.89	peak	11.46	45.66	1.00	20.69	40.00	-19.31	100	297
2	43.2017	60.29	peak	10.61	45.90	1.11	26.11	40.00	-13.89	100	282
3	46.3402	57.66	peak	10.28	46.13	1.18	22.99	40.00	-17.01	100	192
4	216.7828	57.65	peak	13.98	47.74	2.34	26.23	46.00	-19.77	100	56
5	325.5958	58.03	peak	16.67	48.74	2.89	28.85	46.00	-17.15	100	75
7	651.9417	57.24	peak	21.85	48.15	4.10	35.04	46.00	-10.96	133	360

Notes:

1. Duty cycle is 35.6%, 20log (duty cycle) = -8.97dB correction was used to determine the average level from the peak reading. Average = peak reading + 20log (duty cycle), Final Average= peak reading -8.97dB

2. All the data measurement of peak values.

3. FCC Limit for Average Measurement=41.67* (433.92MHz)-7083.3333=10998.1131μV/m=80.8dBμV/m

4. Average pulsed signal over one complete pulse train or 100 ms time frame if pulse train exceeds 100 ms

5. Maximum average in 100 ms

6. Calculate duty cycle for pulse train or 100 ms

7. Duty cycle = (t1 + t2 + t3+…tn)/T where tn = pulse width, T = pulse train length or 100 ms

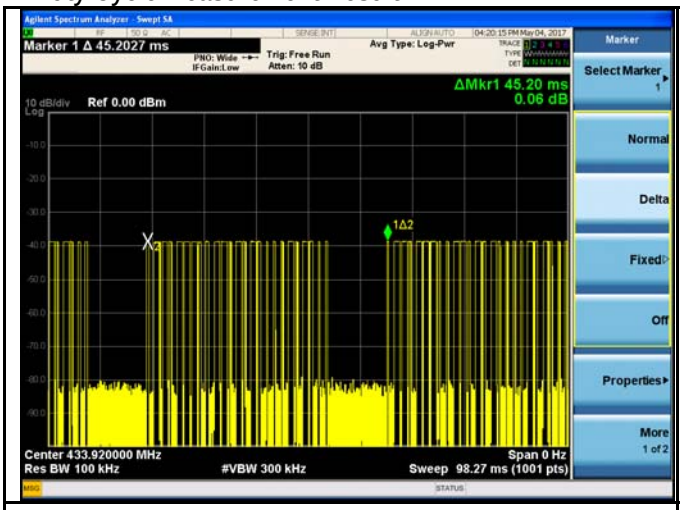
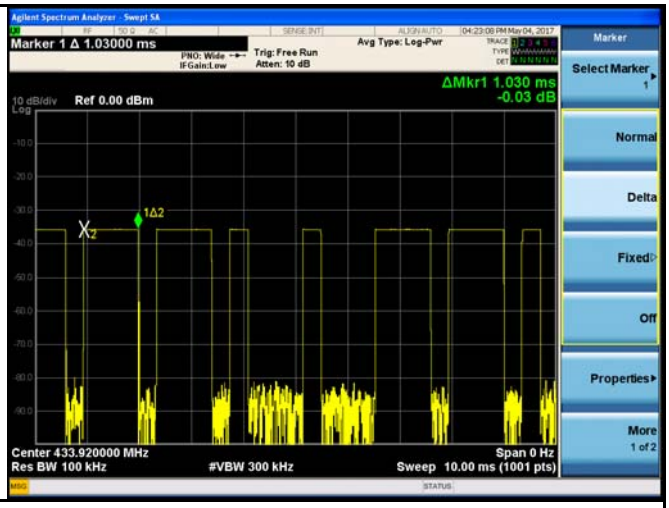
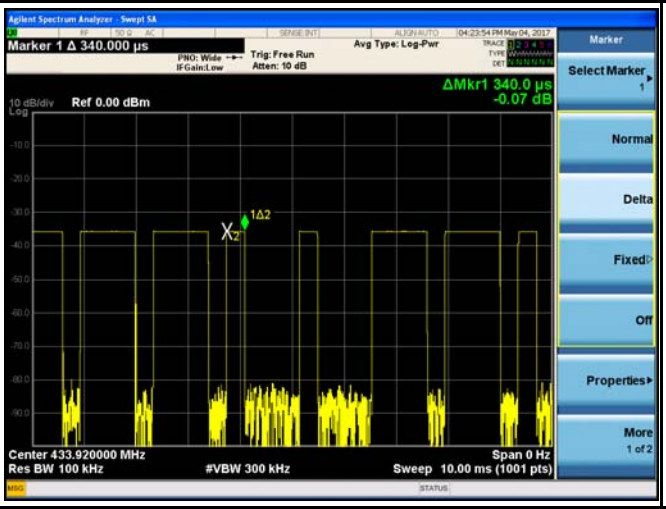
Spurious Emissions (> 1GHz) Measurement Result

Frequency GHz	Reading (dBμV/m)	Direction Degree	Height Meter	Polar H/V	Ant_F (dB/M)	PA_G (dB)	Cab_L (dB)	correct (dBμV/m)	FCC 15.231 Limit (dBμV/m)	Margin	Comments
1.3	66.43	50	2	H	24.64	51.58	2.84	42.33	74.0	-31.67	Peak
1.3	-	-	-	H	-	-	-	33.36	54.0	-20.64	Ave
1.735	65.45	94	1	H	25.99	50.98	3.99	44.45	80.8	-36.35	Peak
1.735	-	-	-	H	-	-	-	35.48	60.8	-25.32	Ave
2.145	61.17	233	1	H	27.74	52.36	4.14	40.69	80.8	-40.11	Peak
2.145	-	-	-	H			-	31.72	60.8	-29.08	Ave
2.455	82.3	0	2	H	29.1	52.6	4.04	62.84	80.8	-17.96	Peak
2.455	-	-	-	H			-	53.87	60.8	-6.93	Ave
3.2	59.02	187	1	H	30.34	52.84	4.76	41.28	80.8	-39.52	Peak
3.2	-	-	-	H			-	32.31	60.8	-28.49	Ave
4.19	58.44	360	1	H	32.26	52.6	6.1	44.2	74.0	-29.8	Peak
4.19	-	-	-	H			-	35.23	54.0	-18.77	Ave
1.3	74.02	360	2	V	24.64	51.58	2.84	49.92	74.0	-24.08	Peak
1.3	-	-	-	V			-	40.95	54.0	-13.05	Ave
1.89	67.53	88	2	V	26.64	51.72	3.98	46.43	80.8	-34.37	Peak
1.89	-	-	-	V			-	37.46	60.8	-23.34	Ave
2.17	62.55	123	2	V	27.85	52.38	4.17	42.19	80.8	-38.61	Peak
2.17	-	-	-	V			-	33.22	60.8	-27.58	Ave
2.455	82.23	315	2	V	29.1	52.6	4.04	62.77	80.8	-18.03	Peak
2.455	-	-	-	V			-	53.8	60.8	-7.00	Ave
2.68	61.51	349	2	V	29.23	52.7	4.18	42.22	80.8	-38.58	Peak
2.68	-	-	-	V			-	34.69	60.8	-26.11	Ave
3.815	58.77	271	2	V	32.26	52.94	5.15	43.24	74.0	-30.76	Peak
3.815		-	-	V			-	34.27	57.0	-22.73	Ave

Note: Duty cycle is 35.6%, 20log (duty cycle) = -8.97dB correction was used to determine the average level from the peak reading.
Average = peak reading + 20log (duty cycle), final Average= peak reading -8.97dB

Note:
Narrow Pulse: 0.34ms
2/NP = 2/0.34ms =5.88kHz
RBW > 2/NP (5.88kHz)
Therefore PDCF is not needed.

Duty Cycle Measurement Result

	
Duty Cycle 1#	Duty Cycle 2#
	
Duty Cycle 3#	
Wide Pulse: 1.03ms Narrow Pulse: 0.34ms Duty cycle= (1.03*11+0.34*14)/45.2 =35.60% Average Duty Factor: 20*log (Duty Cycle)= -8.97dB	
Pulse Duty Cycle	

6.5 Deactivation

Temperature	25°C
Relative Humidity	50%
Atmospheric Pressure	1019mbar
Test date :	May 04, 2017
Tested By :	Trety Lu

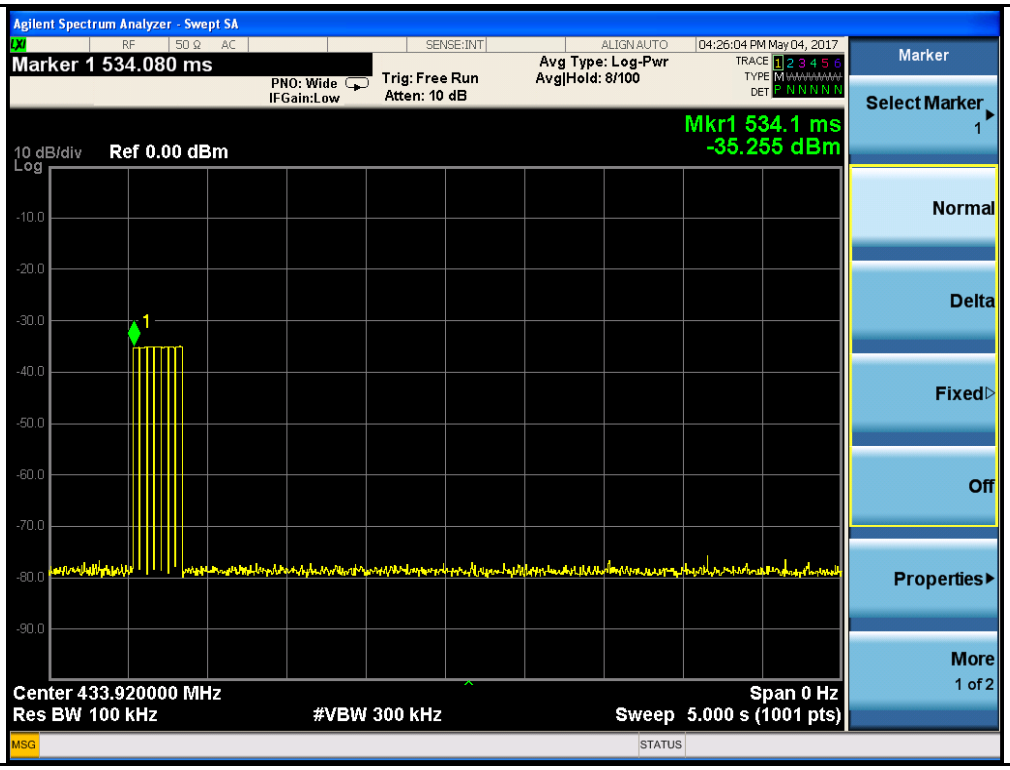
Requirement(s):

Spec	Item	Requirement	Applicable
§15.231 (a)(1)	a)	A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.	☒
Test Setup	Spectrum Analyzer — EUT		
Test Procedure	measurement procedure - Set analyzer center frequency to channel center frequency. - Set the span to 0Hz. - Set the RBW=100KHz - Set the VBW ≥ 3 ´ RBW. - Detector = peak. - Sweep time = auto couple. - Trace mode = max hold. - Allow trace to fully stabilize.		
Remark			
Result	☒ Pass ☐ Fail		

Test Data ☐Yes ☒N/A
Test Plot ☒Yes (See below) ☐N/A

Test Plots

Deactivation Measurement Result



< 5 seconds

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	05/02/2018	☐
V-LISN	ESH3-Z5	838979/005	03/31/2017	03/31/2018	☐
SIEMIC EZ_EMC software Conducted Emissions	Ver.ICP-03A1	N/A	N/A	N/A	☐
RF conducted test					
Agilent Technologies Spectrum Analyzer	N9010A	MY47191130	05/03/2017	05/02/2018	☒
Temperature/Humidity Chamber	1007H	N/A	01/07/2017	01/06/2018	☒
Radiated Emissions					
Agilent Technologies Spectrum Analyzer	N9010A	MY47191130	05/03/2017	05/02/2018	☒
R&S EMI Receiver	ESPI3	101216	05/03/2017	05/02/2018	☒
Antenna (30MHz~6GHz)	JB6	A121411	10/31/2016	10/31/2017	☒
EMCO Horn Antenna (1 ~18GHz)	3115	N/A	10/09/2016	10/08/2017	☒
Hp Agilent Pre-Amplifier	8447F	1937A01160	10/27/2016	10/26/2017	☒
Pre-Amplifier	8449B	3008A02224	10/30/2016	10/30/2017	☒
SIEMIC EZ_EMC software Radiated Emissions	Ver.ICP-03A1	N/A	N/A	N/A	☒

Annex B. EUT And Test Setup Photographs

Annex B.i. Photograph: EUT External Photos

Top View of EUT

Bottom View of EUT

Front View of EUT

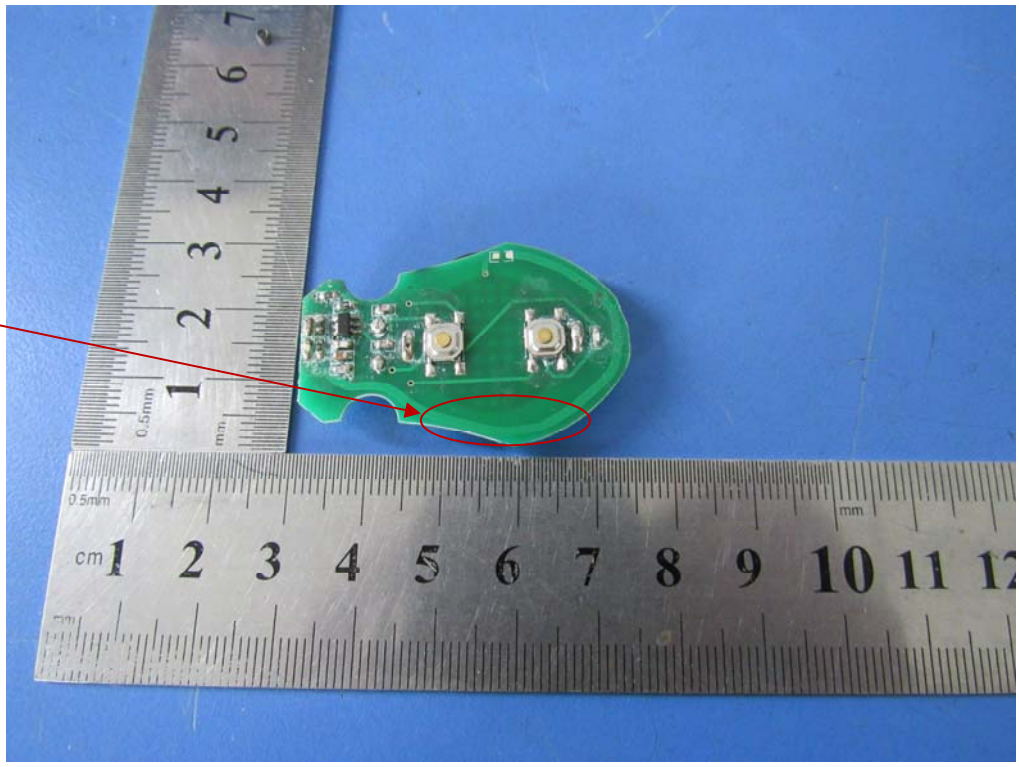
Rear View of EUT

Left View of EUT

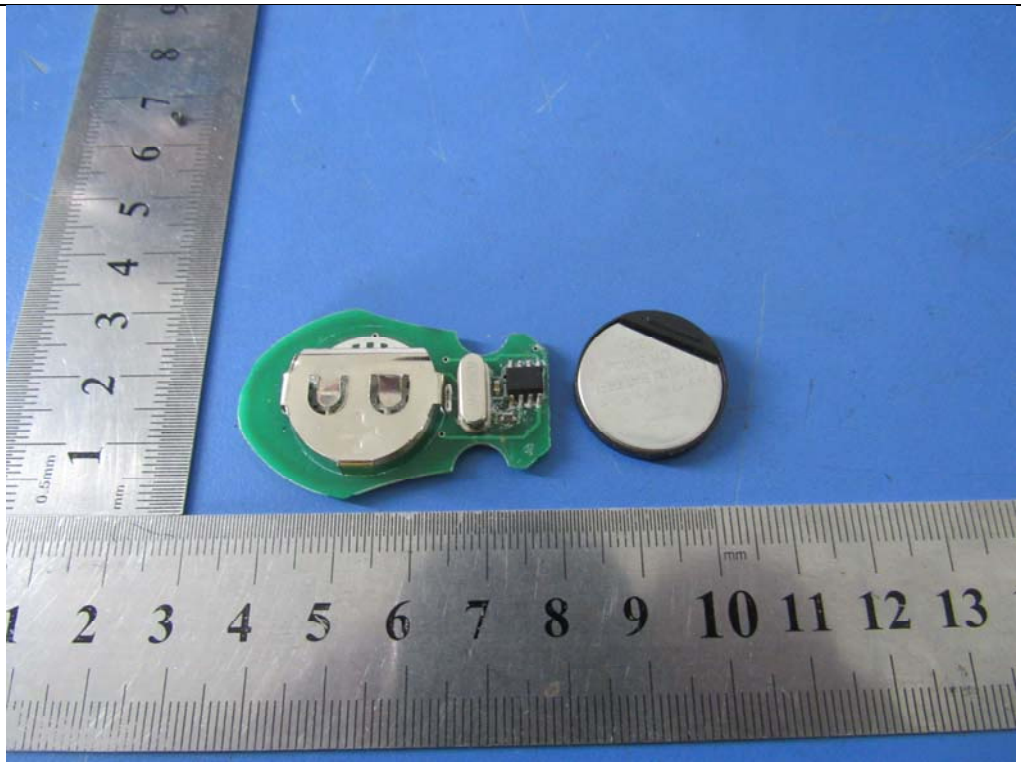
Right View of EUT

Annex B.ii. Photograph EUT Internal Photos

EUT Uncover– Front View

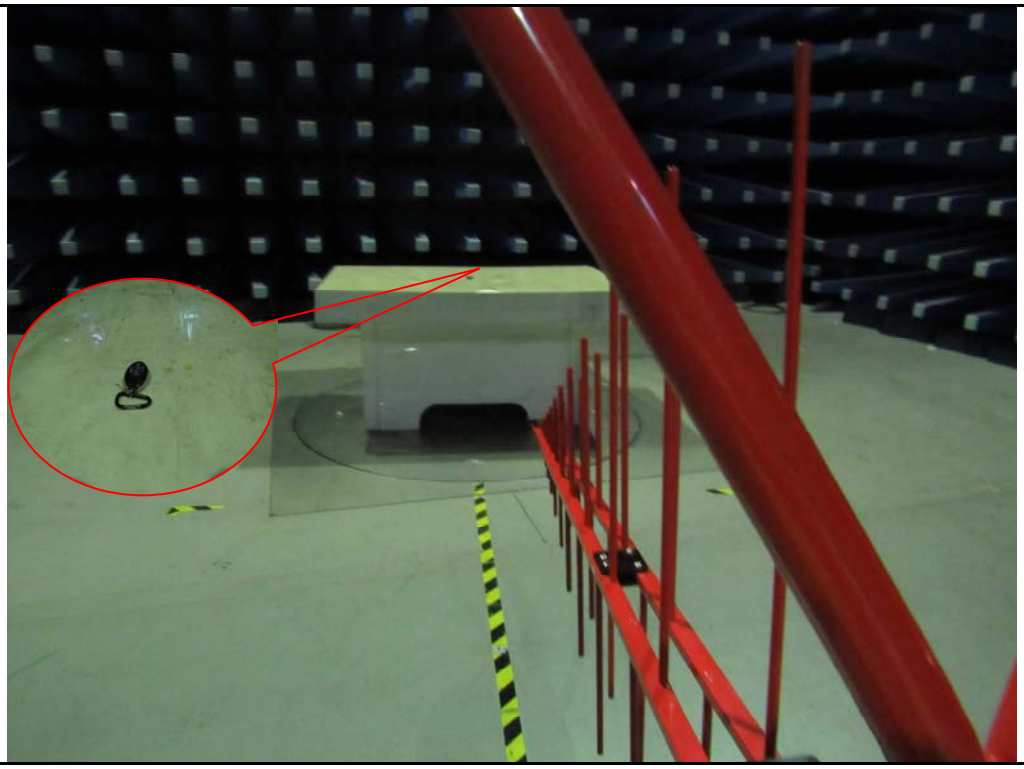


EUT PCBA – Front View

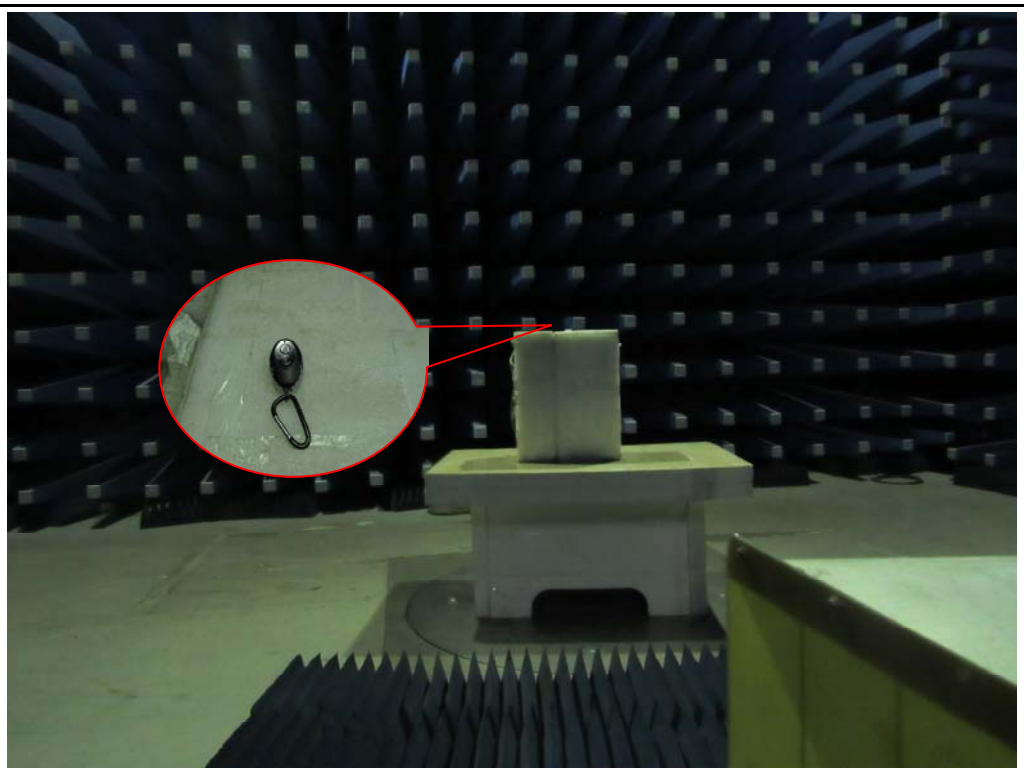


EUT PCBA 1 – Rear View

Annex B.iii. Photograph: Test Setup Photo



Radiated Spurious Emissions Test Setup Below 1GHz

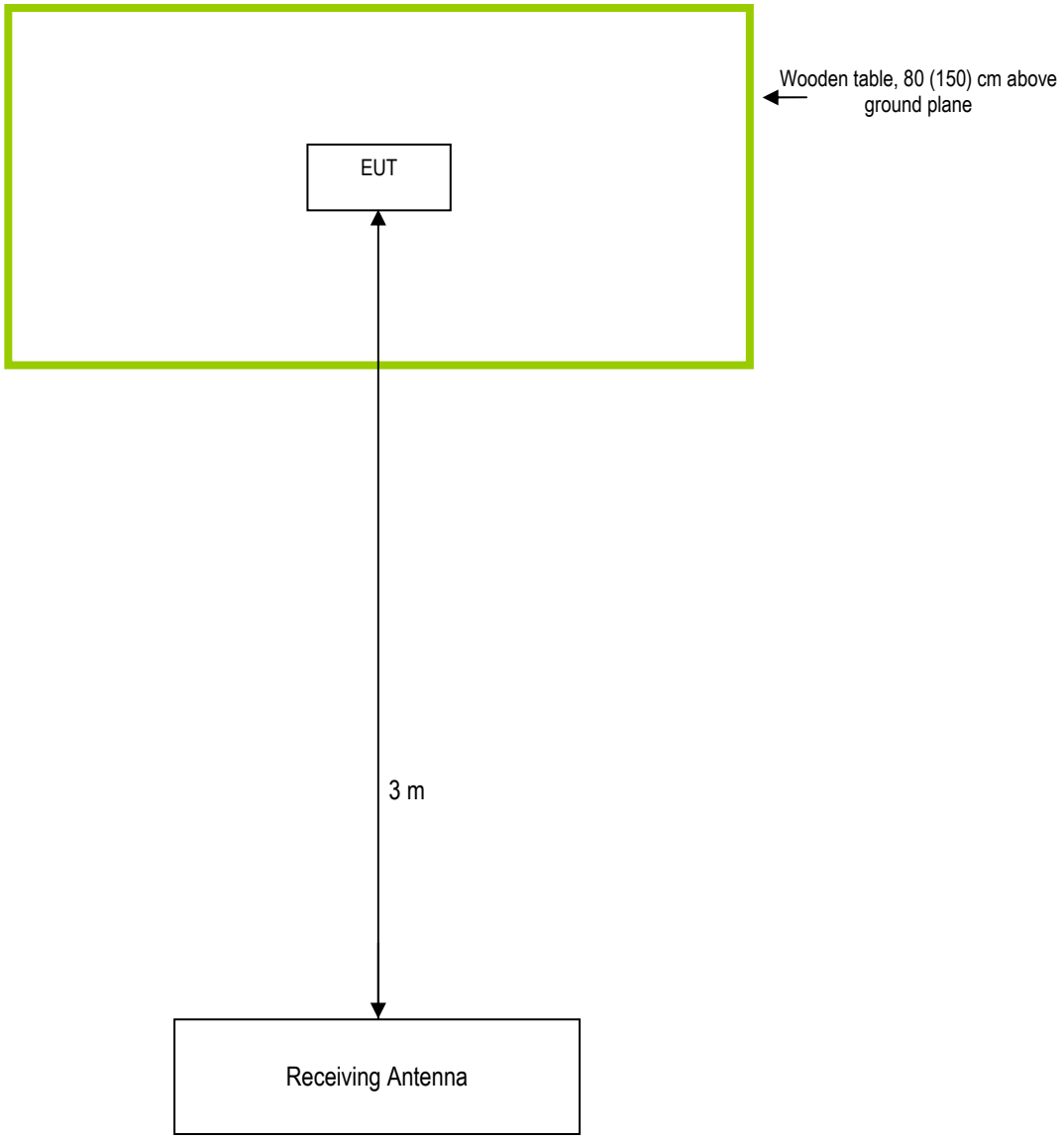


Radiated Spurious Emissions Test Setup Above 1GHz

Annex C. TEST SETUP AND SUPPORTING EQUIPMENT

Annex C.i. TEST SET UP BLOCK

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
N/A	N/A	N/A

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

Please see attachment

Annex E. DECLARATION OF SIMILARITY

Chongqing Lihua Automatic Technology Co.,Ltd.

To：SIEMIC INC.

Declaration letter

Dear Sir,

We hereby state that the remote controller are identical in interior PCB, This controller is mainly used in the 4000I generator, but the same applies to 1000I, 2000i, 3000i, 5000i, 7000i generator, method for controller for the same principle, control mode is the same, the difference is installed in different types of position.
FCC ID：2AL6E-4000I

Your assistance on this matter is highly appreciated.

Signature:
Printed name/title: yong dong qiu/ General manager
address: No.9 Yangliu north Road,Yubei district,Chongqing