FCC TEST REPORT

FCC ID	: SJ8-45242T
Applicant	: RDI Technology (Shenzhen) Co., Ltd.
Address	: Building C1 Xintang Industrial Park, East Baishixia, Fuyong, Baoan, Shenzhen, PRC
Manufacturer	: RDI Technology (Shenzhen) Co., Ltd.
Address	: Building C1 Xintang Industrial Park, East Baishixia, Fuyong, Baoan, Shenzhen, PRC
Equipment Under Test (EUT) :	
Product Name	: Tool box remote
Model No.	: 45242T
Rules	: FCC CFR47 Part 15 Section 15.231:2010
Date of Test	: Dec.04~06, 2012
Date of Issue	: Dec. 07, 2012
Test Result	**: PASS***

Remark:

* The sample described above has been tested to be in compliance with the requirements of the rules listed above.
The results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company.
The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

PERPARED BY:
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Compiled by:

Zero Zhou / Project Engineer

Approved by:

Philo Zhong / Manager

2 Content

3 Test Summary

Test	Test Requirement	Test Method	Result
Activation time	15.231(a)(2)	ANSI C63.4:2003	PASS
20 dB Bandwidth	15.231(c)	ANSI C63.4:2003	PASS
Antenna Requirement	15.203	15.203	PASS
Radiated Emission	15.205(a) 15.209 15.231(b)	ANSI C63.4:2003	PASS
Conducted Emission	15.207	ANSI C63.4:2003	N/A

4 General Information

4.1 General Description of E.U.T.

Product Name	: Tool box remote
Model No.	: 45242T
Model Description	: N/A
Type of Modulation	: ASK
Note	: N/A
Operation Frequency	: 433.92 MHz (Transmitter)
Oscillator	: 433.92MHz

4.2 Details of E.U.T.

Technical Data	: Battery 12V
Adapter manufacturer	: N/A
M/N	: N/A

4.3 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **IC – Registration No.:7760A**

Waltek Services(Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files.

Registration No.: 7760A, July 12, 2012.

- **FCC – Registration No.: 880581**

Waltek Services(Shenzhen) Co., Ltd. has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 880581, May 26, 2011

4.4 Test Location

All Emissions testswere performed at:-

Waltek Services(Shenzhen) Co., Ltd. at 1/F, Fukangtai Building,West Baima Rd., Songgang Street, Baoan District, Shenzhen 518105, China.

4.5 General condition

Ambient Condition: 25.5 ℃ 58 %RH

4.5.1 Environmental condition of test site

For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

The follow condition is not applicable

Test Voltage	Input voltage
Rated voltage-15%	
normal	
Rated voltage+15%	

The follow condition is applicable.

Test voltage	Test Voltage
Rated voltage	New Battery DC 12V

4.5.2 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test mode	Lower channel	Middle channel	Upper channel
Transmitting	N/AMHz	433.92MHz	N/AMHz
Receiving	N/AMHz	N/AMHz	N/AMHz

5 Equipment Used during Test

5.1 Equipments List

3m Semi-anechoic Chamber for Radiation Emissions						
Item	**Equipment**	**Manufacturer**	**Model No.**	**Serial No.**	**Last Calibration Date**	**Calibration Due Date**
1.	EMC Analyzer	Agilent	E7405A	MY45114943	Aug. 13,2012	Aug. 13,2013
2.	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Aug. 13,2012	Aug. 13,2013
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Aug. 13,2012	Aug. 13,2013
4.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Aug. 13,2012	Aug. 13,2013
5.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	399	Aug. 13,2012	Aug. 13,2013
6.	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Feb .23,2012	Feb .23,2013
7.	Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-148	Aug. 13,2012	Aug. 13,2013
8.	10m Coaxial Cable with N- plug	SCHWARZBECK	AK 9515 H	-	Aug. 13,2012	Aug. 13,2013
9.	10m 50 Ohm Coaxial Cable with N-plug	SCHWARZBECK	AK 9513	-	Aug. 13,2012	Aug. 13,2013

5.2 Measurement Uncertainty

Parameter	**Uncertainty**
Radio Frequency	± 1 x 10^{-6}
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 4.74 dB (Horn antenna 1000M~25000MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Conducted Emission Test

Test Requirement:	FCC CFR47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Frequency Range:	150kHz to 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit
Test Result:	N/A

Remark:This device is powered by battery,this item do not be required.

7 Radiation Emission Test

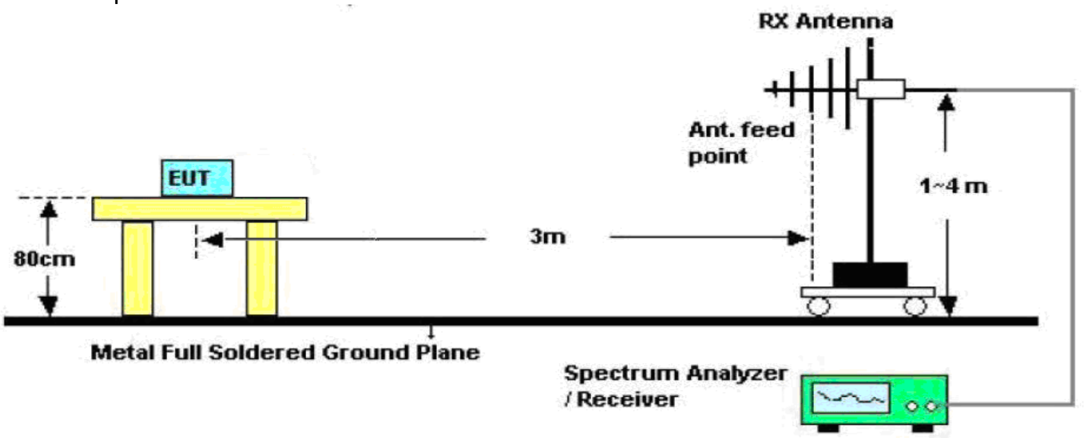
Test Requirement:	FCC CFR47 Part 15 Section 15.209 & Section 15.231
Test Method:	ANSI C63.4:2003
Frequency Range:	30MHz to 5GHz
Measurement Distance:	3m

7.1 Test Procedure

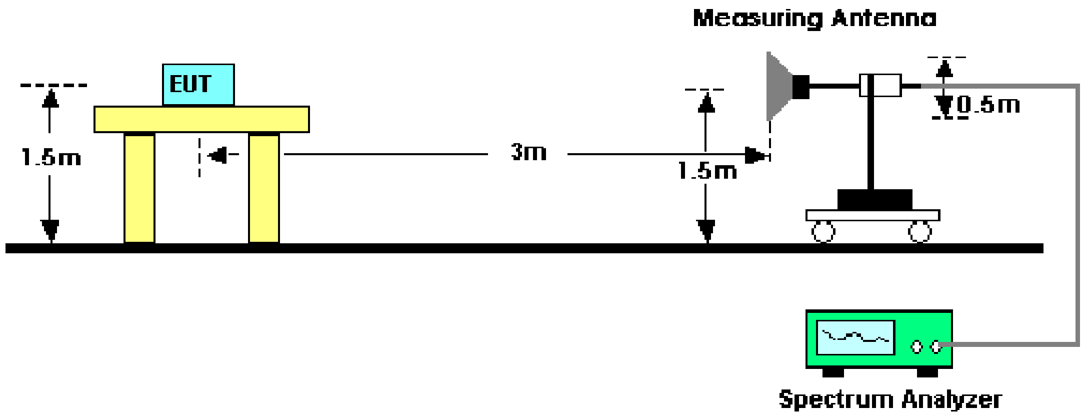
1. The radiation emission should be tested under 3-axes position(lying,side and stand), After pre-test, It was found that the worse radiation emission was get at the lying position.
2. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combinations.
3. All data was recorded in the peak and average detection mode.
4. The EUT was under working mode during the final qualification test and the configuration was used to represent the worst case results.
5. New battery was used during the testing.

7.2 Radiated Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4.
The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

According to FCC Part 15.209 and 15.231 Rules, the system was tested from 30MHz to 5000MHz.

30MHz ~ 1GHz

Sweep Speed ....Auto
IF Bandwidth...120 KHz
Video Bandwidth..100KHz
Quasi-Peak Adapter Bandwidth ....120 KHz
Quasi-Peak Adapter Mode ....Normal
Resolution Bandwidth..100KHz

Above 1GHz

Sweep Speed ....Auto
IF Bandwidth...120 KHz
Video Bandwidth..3MHz
Quasi-Peak Adapter Bandwidth ....120 KHz
Quasi-Peak Adapter Mode ....Normal
Resolution Bandwidth..1MHz

7.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor - Amplifier Gain

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the maximum limit for Class B. The equation for margin calculation is as follows:

Margin = Corr. Ampl. – Class B Limit

7.5 Limit

FCC Part 15.209 Limits

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	10000 * 2400/F(kHz)	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	100 * 30	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

FCC Part 15.231 Limits

Fundamental Frequency (MHz)	Field Strength of the Fundamental (Note 1) (uV/m)	Field Strength of Unwanted Emissions (Note 1) (uV/m)
70-130	1,250	125
130-174	1,250 to 3,750*	125 to 375
174-260 (Note 2)	3,750	375
260-470 (Note 2)	3,750 to 12,500*	375 to 1,250
Above 470	12,500	1,250

Note 1: Limits on the field strength of emissions, as shown in this table, are based on the average value of the measured emissions. As an alternative, compliance with the limits in this table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector.

* Linear interpolation with frequency F in MHz:

For 130-174 MHz: FS (uV/m) = (56.82 x F)-6136

For 260-470 MHz: FS (uV/m) = (41.77 x F)-7083

Sample calculation of limit @ 433.92MHz

41.6667 (433.50)- 7083.3333=10996.681uV/m

20log(10996.681)=80.82 dBuV/m(AV) limit @ 433.92MHz

And The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.

7.6 Test Result

Formula of conversion factors:the field strength at 3m was egtablished by adding the meter reading of the spectrum analyer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stared in terms of dB.The gain of the pressletor was accounted for in the spectrum analyser meter reading.

Example:

Freq(MHz) Meter Reading +ACF=FS

33 20dBuV+10.36dB=30.36dBuV/m @3m

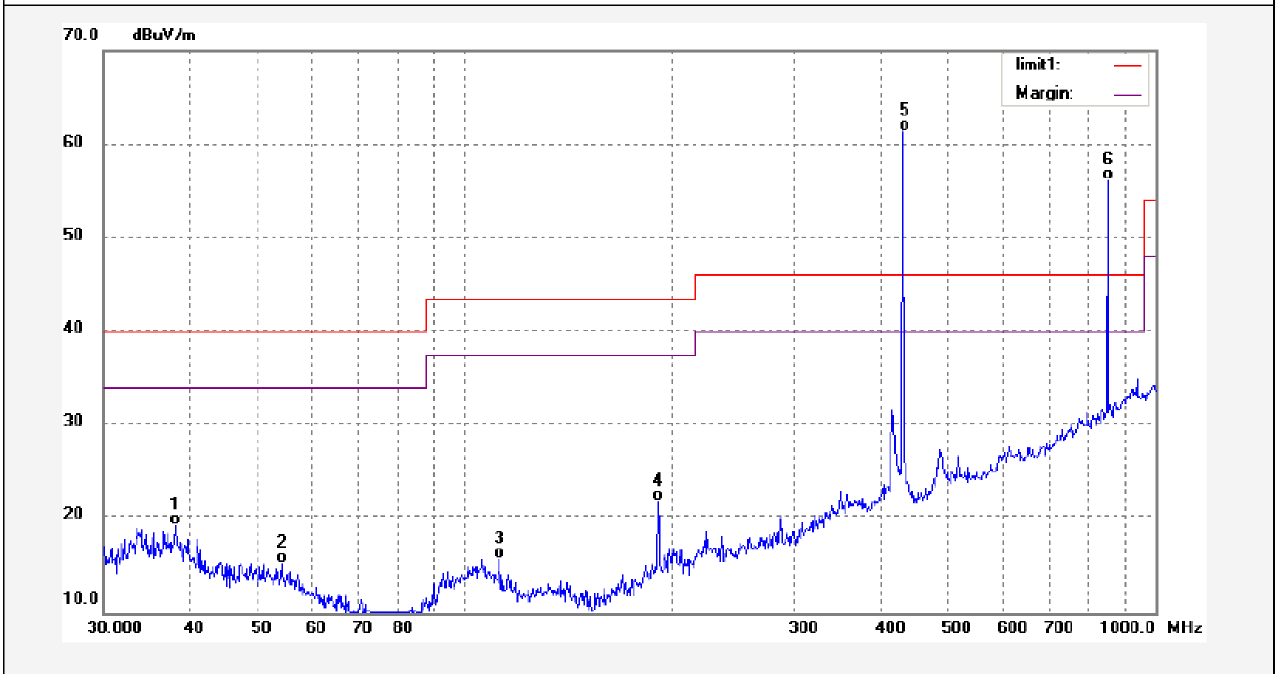
AV = Peak +20Log$_{10}$(duty cycle) =PK-17.67

See section 8 for duty cycle factor.

Test frequency 30MHz to 1GHz

Test Mode: Transmitter Mode

Antenna Porlarization: Vertical



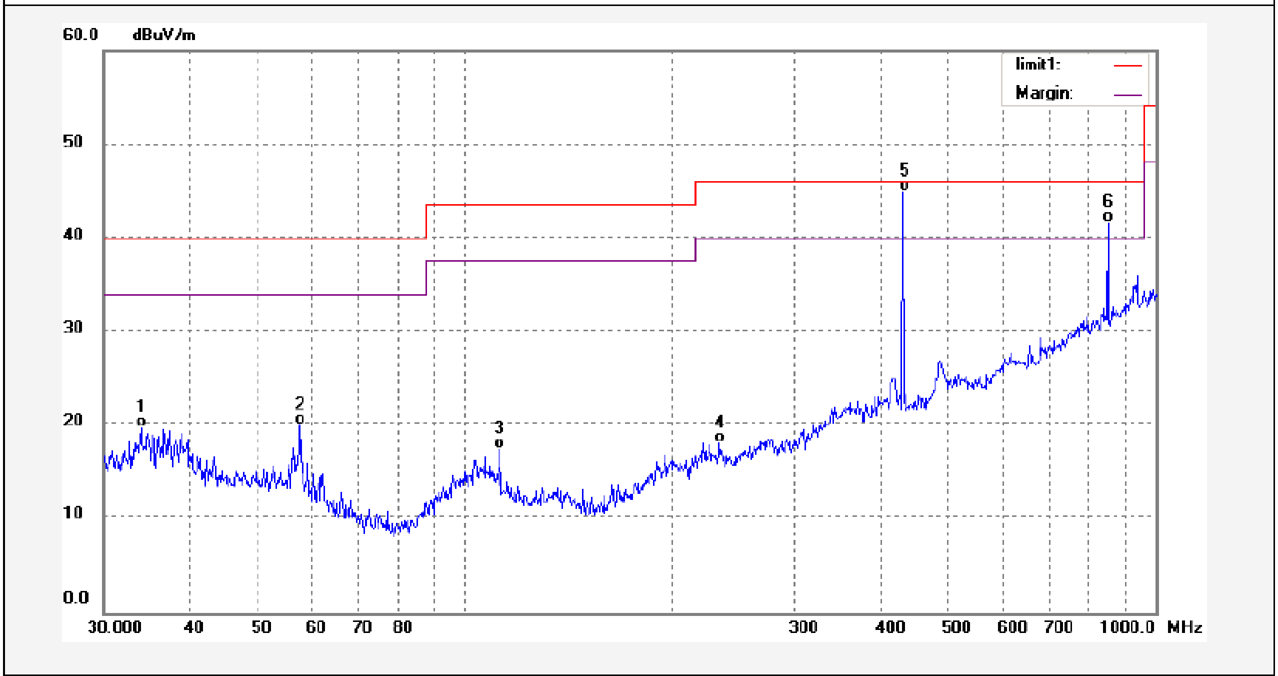
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	38.2305	2.81	16.63	19.44	40.00	-20.56	QP	
2	54.3255	1.38	13.94	15.32	40.00	-24.68	QP	
3	112.4271	2.61	13.19	15.80	43.50	-27.70	QP	
4	190.4411	7.81	14.08	21.89	43.50	-21.61	QP	
5	433.9200	41.09	20.26	61.35				*
6	867.8447	26.57	29.62	56.19				*

Remark:(1)Mark 5 is fundamental wave.

(2) Mark 6 is harmonics wave.

(3)"*" refer to the below table

Antenna Porlarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	34.0451	3.15	16.53	19.68	40.00	-20.32	QP	
2	57.6693	6.94	13.08	20.02	40.00	-19.98	QP	
3	112.4271	4.24	13.19	17.43	43.50	-26.07	QP	
4	233.4881	2.23	15.89	18.12	46.00	-27.88	QP	
5	433.9200	24.68	20.26	44.94				*
6	867.8447	12.05	29.62	41.67				*

Remark: (1) Mark 5 is fundamental wave.

(2) Mark 6 is harmonics wave.

(3)"*" refer to the below table

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
433.92	AV	Vertical	43.68	80.83	-37.15	1.1	138
867.84	AV	Vertical	38.52	60.83	-22.31	1.2	129
1301.76	AV	Vertical	22.17	54	-31.83	1.9	145
1735.68	AV	Vertical	18.16	54	-35.84	2.4	110
2169.6	AV	Vertical	16.91	54	-37.09	2	165
2603.52	AV	Vertical	21.36	54	-32.64	2	135
3037.44	AV	Vertical	19.69	54	-34.31	2.3	125
3471.36	AV	Vertical	-	54	< -20dB	-	-
3905.28	AV	Vertical	-	54	< -20dB	-	-
4339.2	AV	Vertical	-	54	< -20dB	-	-
433.92	AV	Horizontal	27.27	80.83	-53.56	1.1	133
867.84	AV	Horizontal	24.00	60.83	-36.83	1.2	121
1301.76	AV	Horizontal	20.23	54	-33.77	2	110
1735.68	AV	Horizontal	24.56	54	-29.44	1.9	140
2169.6	AV	Horizontal	19.96	54	-34.04	2	115
2603.52	AV	Horizonta	20.02	54	-33.98	1.9	160
3037.44	AV	Horizontal	23.12	54	-30.88	2	150
3471.36	AV	Horizontal	-	54	< -20dB	-	-
3905.28	AV	Horizontal	-	54	< -20dB	-	-
4339.2	AV	Horizontal	-	54	< -20dB	-	-
433.92	Peak	Vertical	61.35	100.83	-39.48	1.7	35
867.84	Peak	Vertical	56.19	80.83	-24.64	2.5	105
1301.76	Peak	Vertical	40.96	74	-33.04	2.1	135
1735.68	Peak	Vertical	45.39	74	-28.61	2.1	215
2169.6	Peak	Vertical	44.11	74	-29.89	1.6	115
2603.52	Peak	Vertical	46.21	74	-27.79	1.8	95
3037.44	Peak	Vertical	47.88	74	-26.12	1.8	180
3471.36	Peak	Vertical	-	74	< -20dB	-	-
3905.28	Peak	Vertical	-	74	< -20dB	-	-
4339.2	Peak	Vertical	-	74	< -20dB	-	-
433.92	Peak	Horizontal	44.94	100.83	-55.89	2.4	105
867.84	Peak	Horizontal	41.67	80.83	-39.16	3	145
1301.76	Peak	Horizontal	55.27	74	-18.73	2.4	115
1735.68	Peak	Horizontal	56.94	74	-17.06	2	45
2169.6	Peak	Horizontal	52.12	74	-21.88	1.8	195
2603.52	Peak	Horizontal	53.87	74	-20.13	2.3	45
3037.44	Peak	Horizontal	52.52	74	-21.48	2.4	225
3471.36	Peak	Horizontal	-	74	< -20dB	-	-
3905.28	Peak	Horizontal	-	74	< -20dB	-	-
4339.2	Peak	Horizontal	-	74	< -20dB	-	-

8 Activation time

Test Requirement: FCC Part 15.231 (a)(2)

Test Mothed: ANSI C63.4:2003

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

Test Status: Normal working mode.

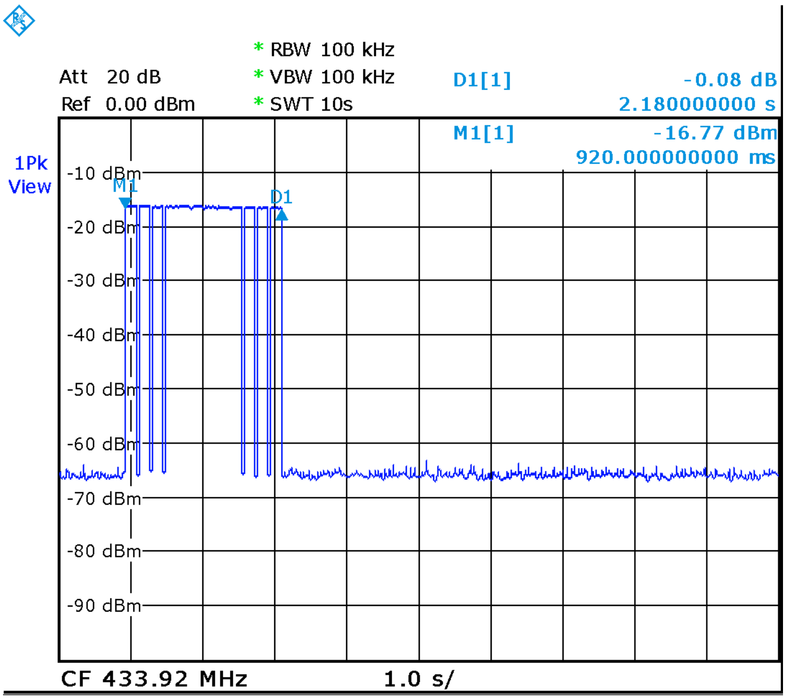
8.1 Test Procedure

1. The EUT was placed on a turntable which is 0.8m above ground plane
2. Set EUT as normal operation mode
3. Set SPA center frequency = fundamental frequency, RBW = 100kHz, VBW = 100kHz, Span = 0 Hz, Adjacent sweep time.

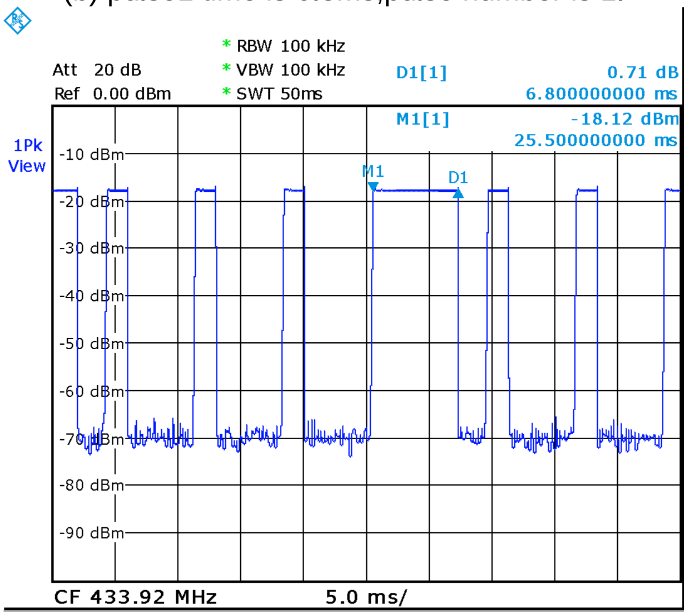
8.2 Test Result

Test result plot as follows:

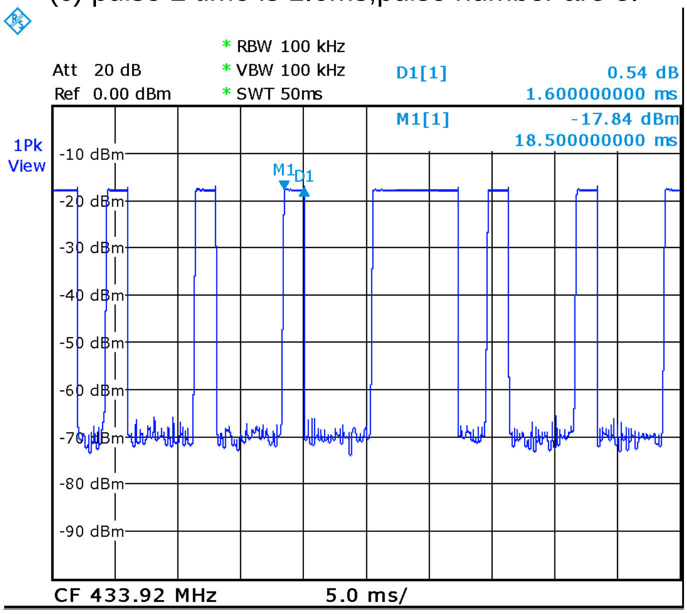
(a) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.



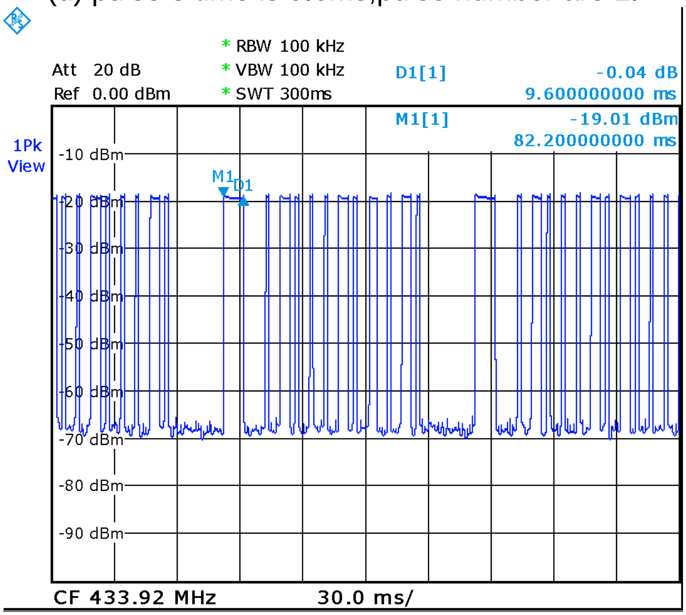
(b) pulse1 time is 6.8ms,pulse number is 1.



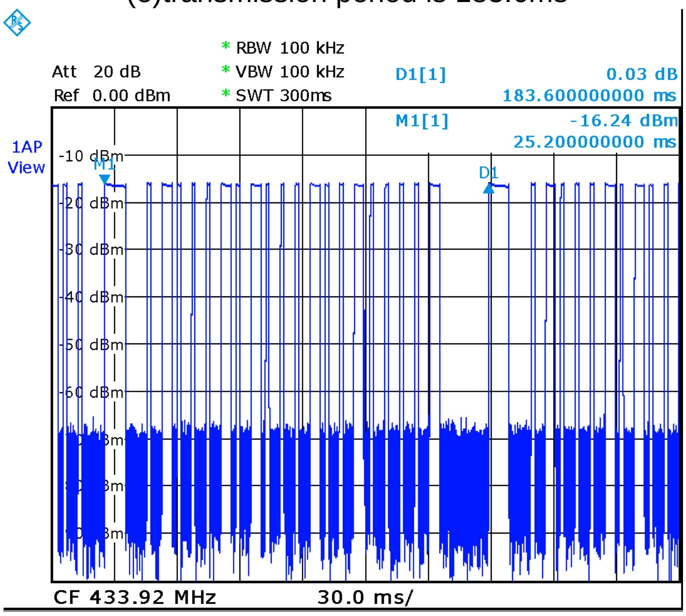
(c) pulse 2 time is 1.6ms,pulse number are 5.



(d) pulse 3 time is 9.6ms,pulse number are 2.



(e)transmission period is 183.6ms



The EUT is auto. operation for transmitter, it is declared by the manufacturer as a duty cycle ratio of less than 100%.

The EUT's work time : T_{on} =long pulse time*pulse number+ short pulse time*pulse number+middle pulse*pulse number =(6.8ms*1+1.6ms*5+9.6ms*2)ms=24ms

The EUT's work period :$T=T_{ON}+T_{OFF}$=183.6ms

The EUT's duty cycle : $D = T_{on} / T$ = 24/183.6*100% =13.07%

Duty Cycle Correction Factor(dB)=20 * Log_{10}(Duty Cycle)=20* Log_{10}(13.07%)

= -17.67dB

9 20 dB Bandwidth

Test Requirement: FCC Part 15.231 (c)

Test Method: ANSI C63.4:2003

Test mode: TX On

9.1 Test Procedure

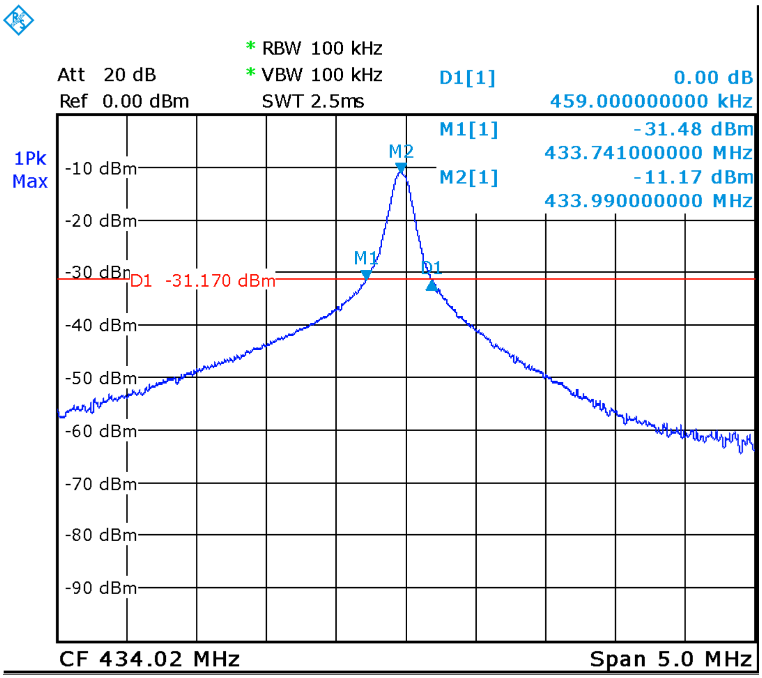
1. The transmitter output (antenna port) was connected to the spectrum analyzer.EUT and its simulators are placed on a table, let EUT working in test mode,then test it.
2. The bandwidth of the fundamental frequency was measure by spectrum analyser with 100kHz RBW and 100kHz VBW.

9.2 Limit

The bandwidth of the emission shall be no wider than 0.25% of the center frequency at the points 20 dB down from the modulated carrier. The bandwidth of the emission shall be no wider than 1083.75kHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.

9.3 Test Result

Frequency (MHz)	Bandwidth (KHz)	Limit (KHz)	Result
433.92	459	1083.75	Pass



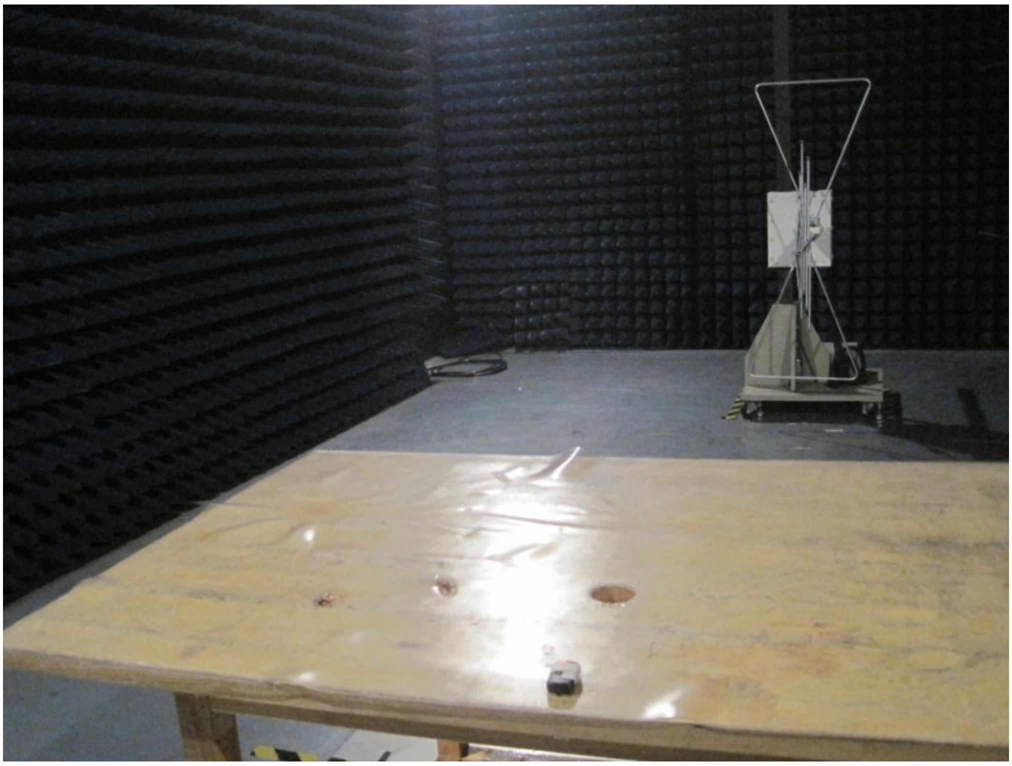
10 Antenna Requirement.

According to the FCC Part 15 Paragraph 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. This product has a PCB printed antenna, fulfill the requirement of this section.

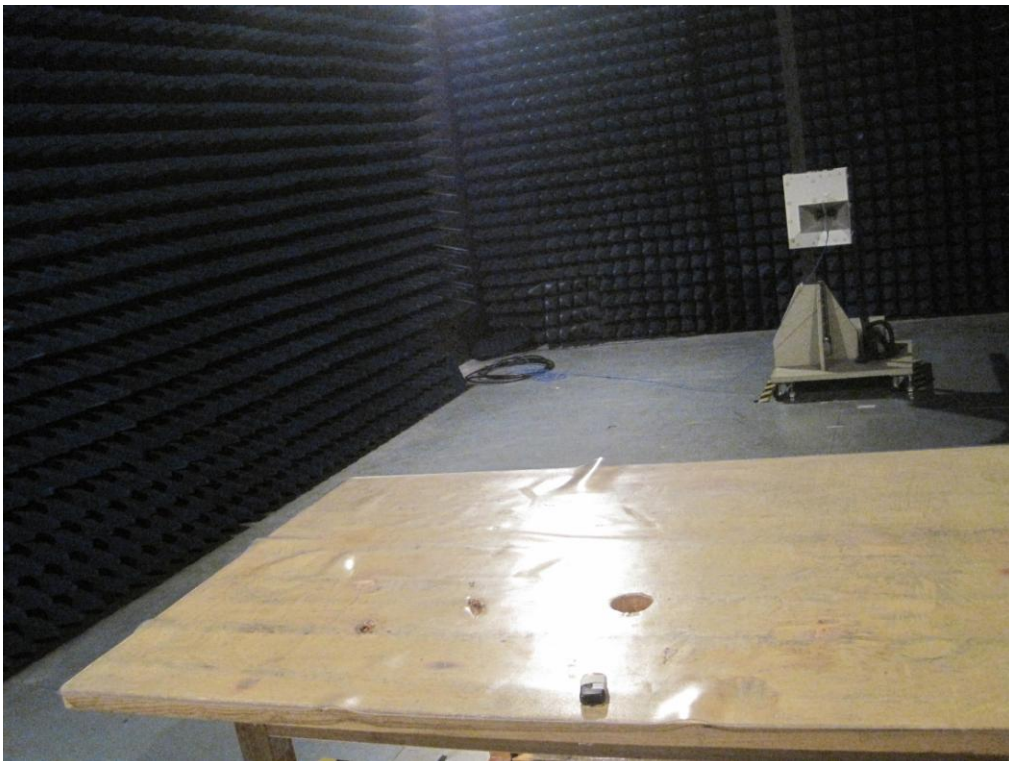
11 Photographs of Testing

11.1 Photographs –Radiated Emission Test Setup

TX From 30MHz to 1GHz

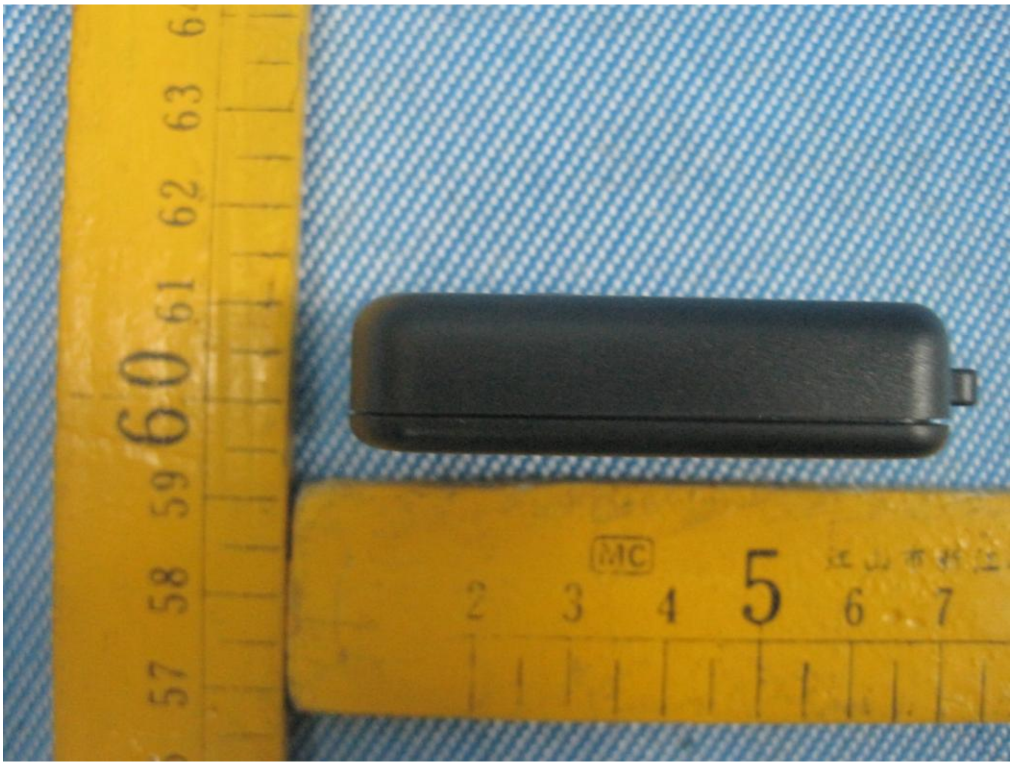


TX Above 1 GHz



12 Photographs - Constructional Details

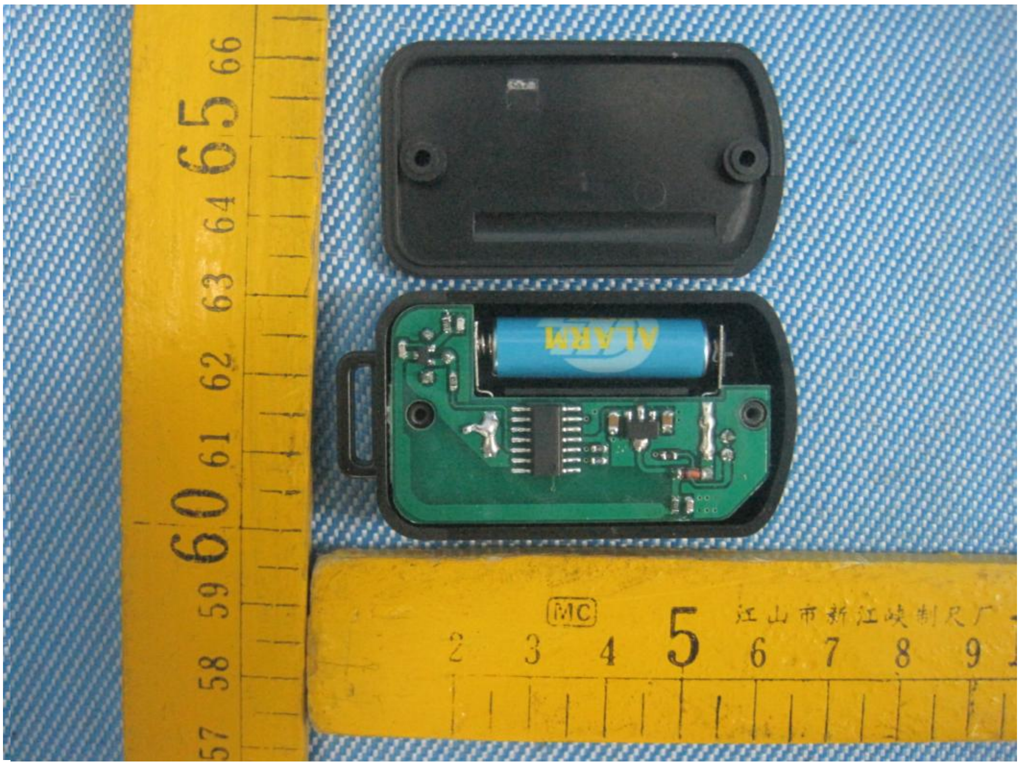
12.1 EUT –Appearance View


57 58 59 60 61 62 63
MC
2 3 4 5 6 7

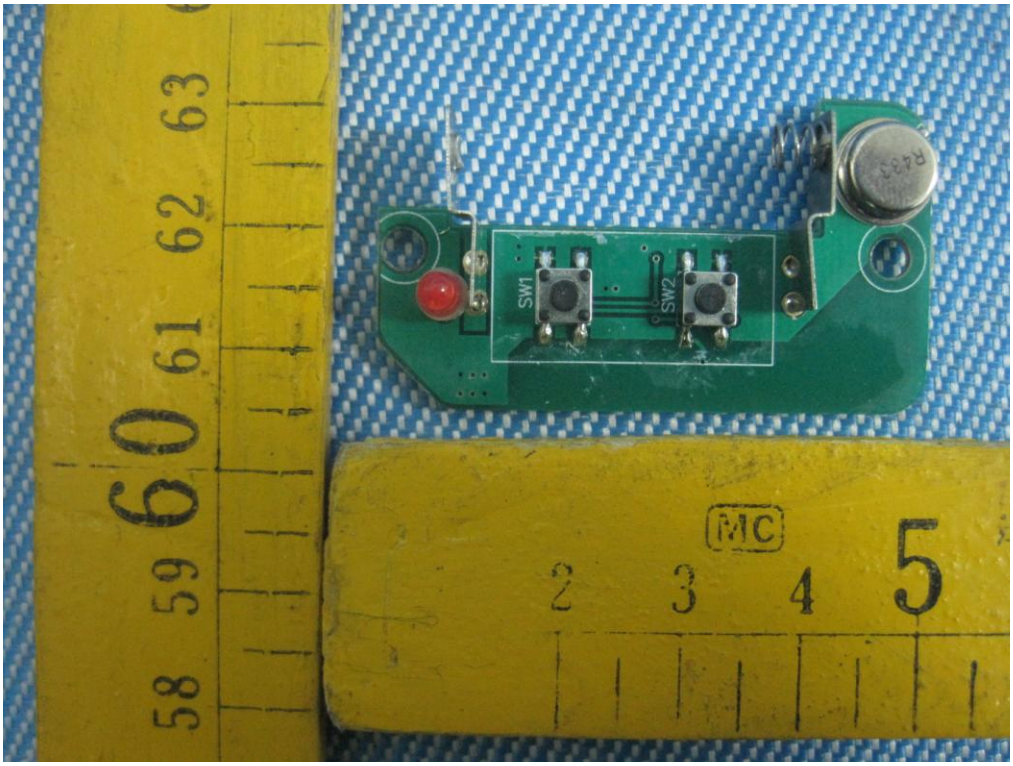

57 58 59 60 61 62 63 64
MC
2 3 4 5 6 7 8

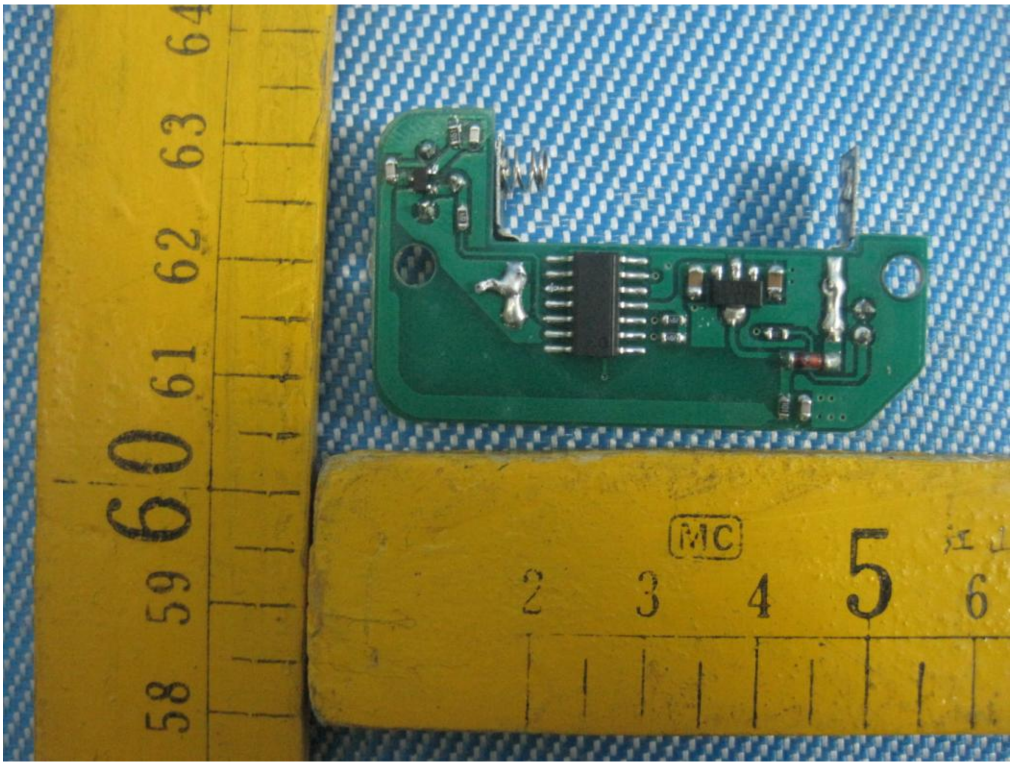

57 58 59 60 61 62 63 64 65
MC
2 3 4 5 6

12.2 EUT – Open View



12.3 EUT – PCB View





13 FCC Label

FCC ID: SJ8-45242T

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

The Label must not be a stick-on paper. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

=End of report=