

TEST REPORT

FCC ID : XRQELITEIR
Applicant : Efergy Technologies Limited
Address : Suit 1108-1109, Junction Building, 3820 Nanhuan Road, Binjiang district,
Hangzhou, Zhejiang, China
Manufacturer : DongGuan Protronic Electronics Ltd.
Address : Protronic Industrial Park, Xiangxi Village, Shipai Town, Dongguan, Guangdong
China

Equipment Under Test (EUT) :

Product Name : IR-Tx
Model No. : Elite IR-Tx, E2 IR-Tx, WPM120 Tx, WPM220 Tx
Rule : FCC CFR47 Part 15 Section 15.231:2010

Date of Test : August 18~24,2012

Date of Issue : August 24,2012

Test Result : **PASS***

Remark:

* The sample described above has been tested to be in compliance with the requirements of the rule listed above.

PERPARED BY:

Waltek Services (Shenzhen) Co., Ltd.

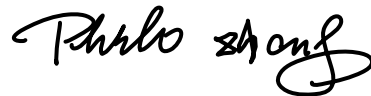
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3 Test Summary

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

Remark : the methods of measurement in all the test items were according to ANSI C63.4:2003.

4 General Information

4.1 General Description of E.U.T.

Product Name	: IR-Tx
Model No.	: Elite IR-Tx, E2 IR-Tx,WPM120 Tx, WPM220 Tx
Model Description	: N/A
Type of Modulation	: FSK
Note	: N/A
Frequency Range	: 433.5 MHz
Oscillator	:Crystal 32.768 KHz and 4 MHz for MCU(HT46RU232), 13.25 MHz for RF IC(A7302)

4.2 Details of E.U.T.

Technical Data	: Batteries 1.5V*3 size AA
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.:IC7760**

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 IC7760, July 10, 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.

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4.5 General condition

Ambient Condition: 25.5 °C 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 4.5V

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	433.5MHz	N/AMHz
Receiving	N/AMHz	N/AMHz	N/AMHz

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101178	Aug. 13,2012	Aug. 13,2013
2.	LISN	R&S	ENV216	101215	Aug. 13,2012	Aug. 13,2013
3.	Cable	HUBER+SUHNER	CBL2-NN-3M	2230300	Aug.14,2012	Aug. 14,2013
4.	Switch	---	RSU/M2	---	Aug.14,2012	Aug. 14,2013
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	SCHWARZBECK	BBV 9719	9719-254	Aug. 13,2012	Aug. 13,2013
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.14,2012	Aug. 14,2013
9.	10m 50 Ohm Coaxial Cable with N-plug	SCHWARZBECK	AK 9513	-	Aug.14,2012	Aug. 14,2013
10.	Positioning Controller	C&C LAB	CC-C-IF	-	Aug.14,2012	Aug. 14,2013
11.	Color Monitor	SUNSP0	SP-14C	-	Aug.14,2012	Aug. 14,2013
Harmonic/ Flicker						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Digital Power Analyzer	Em Test AG	ADP500	V0745103095	Aug.14,2012	Aug. 14,2013
2	Power Source	Em Test AG	ACS500	V0745103096	Aug.14,2012	Aug. 14,2013
Electrostatic Discharge						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	Electrostatic Discharge Simulator	Em Test	DITO	V0745103094	Aug.14,2012	Aug. 14,2013
Contucted Immunity						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	RF Generator	TESEQ	HSG4070	25781	Aug.14,2012	Aug. 14,2013

2	CDN M-Type	TESEQ	CDN M016	25112	Aug.14,2012	Aug. 14,2013
3	EM-Clamp	TESEQ	KEMZ 801	25453	Aug.14,2012	Aug. 14,2013
4	Attenuator 6dB	TESEQ	ATN6050	25365	Aug.14,2012	Aug. 14,2013
Surge, EFT, Voltage dips and Interruption						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	All Modules Generator	SCHAFFNER	6150	34579	Aug.14,2012	Aug. 14,2013
2	Capacitive Coupling Clamp	SCHAFFNER	CDN 8014	25311	Aug.14,2012	Aug. 14,2013
3	Signal and Data Line Coupling Network	SCHAFFNER	CDN 117	25627	Aug.14,2012	Aug. 14,2013
4	AC Power Supply	TONGYUN	DTDGC-4	-	Aug.14,2012	Aug. 14,2013

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
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)
Conducted Spurious Emissions test	± 2.46 dB (AC mains 150KHz~30MHz)

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.

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6 Conducted Emission Test

Test Requirement:	FCC CFR47 Part 15 Section 15.207
Test Method:	ANSI C63.4
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
Frequency Range:	9kHz to 5GHz
Measurement Distance:	3m

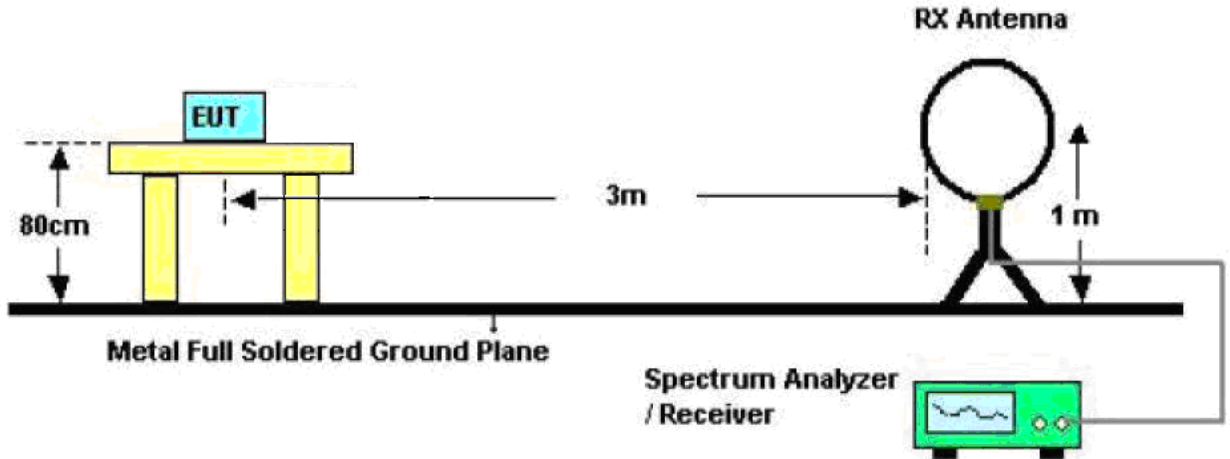
7.1 Test Procedure

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.

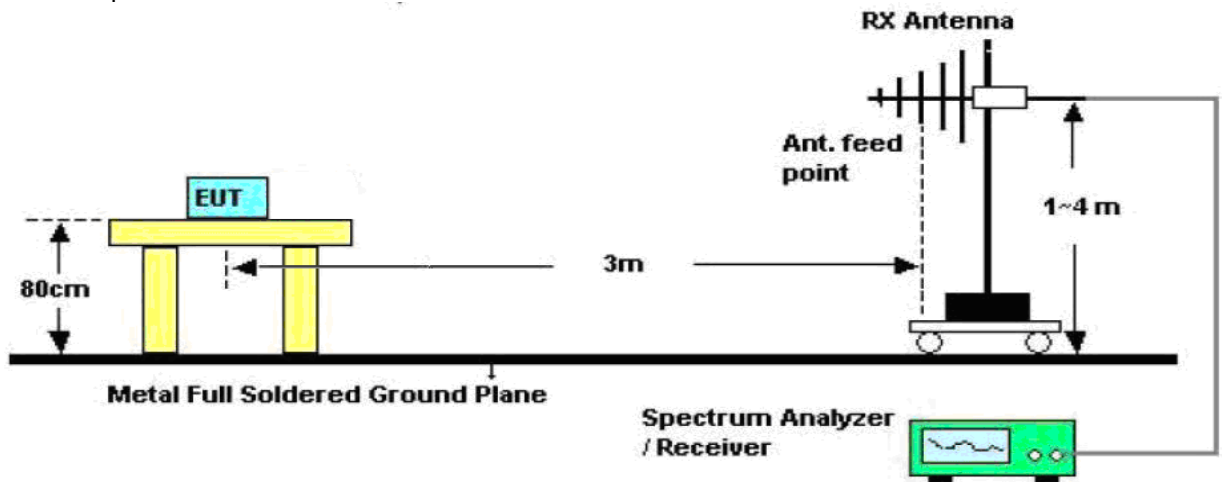
7.2 Radiated Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4.

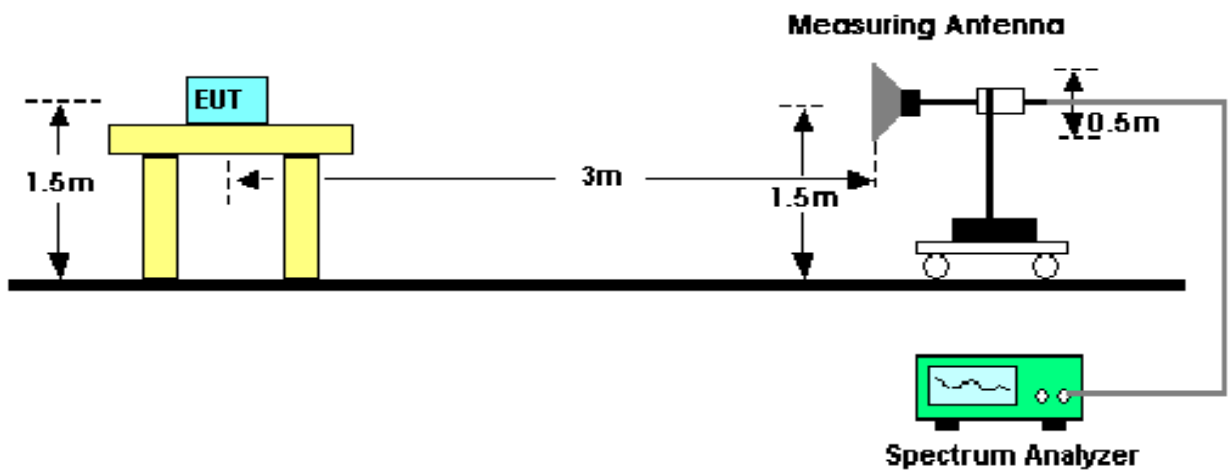
The test setup for emission measurement below 30MHz.



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 9kHz to 5000 MHz.

Below 30MHz

Sweep Speed Auto
 IF Bandwidth 10KHz
 Video Bandwidth..... 10KHz
 Resolution Bandwidth..... 10KHz

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:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain}$$

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:

$$\text{Margin} = \text{Corr. Ampl.} - \text{Class B Limit}$$

7.5 Radiated Emissions 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 @ 433.50MHz

41.6667 (433.50)- 7083.3333=10996.681uV/m

20log(10996.681)=80.82 dBuV/m(AV) limit @ 433.50MHz

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

7.6 Radiated Emissions Test Result

Formula of conversion factors:the field strength at 3m was established by adding the meter reading of the spectrum analyzer (which is set to read in units of dBuV) to the antenna correction factor supplied by the antenna manufacturer. The antenna correction factors are stated 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 +20Log₁₀(duty cycle) =PK-9.56

See section 8 for duty cycle factor.

Test Data

Since the emissions below 30MHz are more than 20dB below the limit, the data is not shown in the report.

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
433.5	Peak	Vertical	83.70	100.82	-17.12	1.1	45
867.0	Peak	Vertical	54.42	80.82	-26.40	1.3	120
1300.5	Peak	Vertical	43.40	74.00	-30.60	1.2	45
1734.0	Peak	Vertical	42.11	74.00	-31.89	1.2	90
2167.5	Peak	Vertical	36.44	74.00	-37.56	1.4	130
2601.0	Peak	Vertical	36.77	74.00	-37.23	1.3	40
3034.5	Peak	Vertical	37.62	74.00	-36.38	1.4	60
3468.0	Peak	Vertical	37.06	74.00	-36.94	1.4	60
3901.5	Peak	Vertical	38.04	74.00	-35.96	1.5	45
4335.0	Peak	Vertical	38.04	74.00	-35.96	1.5	70
433.5	Peak	Horizontal	73.39	100.82	-27.43	1.6	110
867.0	Peak	Horizontal	50.73	80.82	-30.09	1.1	45
1300.5	Peak	Horizontal	37.06	74.00	-36.94	1.1	110
1734.0	Peak	Horizontal	43.44	74.00	-30.56	1.4	90
2167.5	Peak	Horizontal	37.77	74.00	-36.23	1.1	130
2601.0	Peak	Horizontal	36.29	74.00	-37.71	1.1	40
3034.5	Peak	Horizontal	34.33	74.00	-39.67	1.5	60
3468.0	Peak	Horizontal	34.80	74.00	-39.20	1.3	110
3901.5	Peak	Horizontal	34.20	74.00	-39.80	1.3	140
4335.0	Peak	Horizontal	32.31	74.00	-41.69	1.4	90

8 Activation time

Test Requirement: FCC Part 15.231 (a)(2)
 Test Method: ANSI C63.4
 Limit: A transmitter activated automatically shall cease transmission within 5 seconds after activation.
 Test Status: Normal working mode.

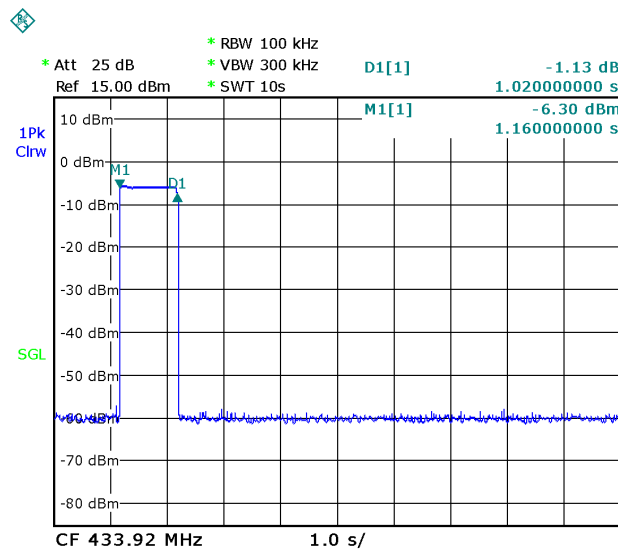
8.1 Test Procedure

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 = 300kHz, Span = 0 Hz, Adjacent sweep time.

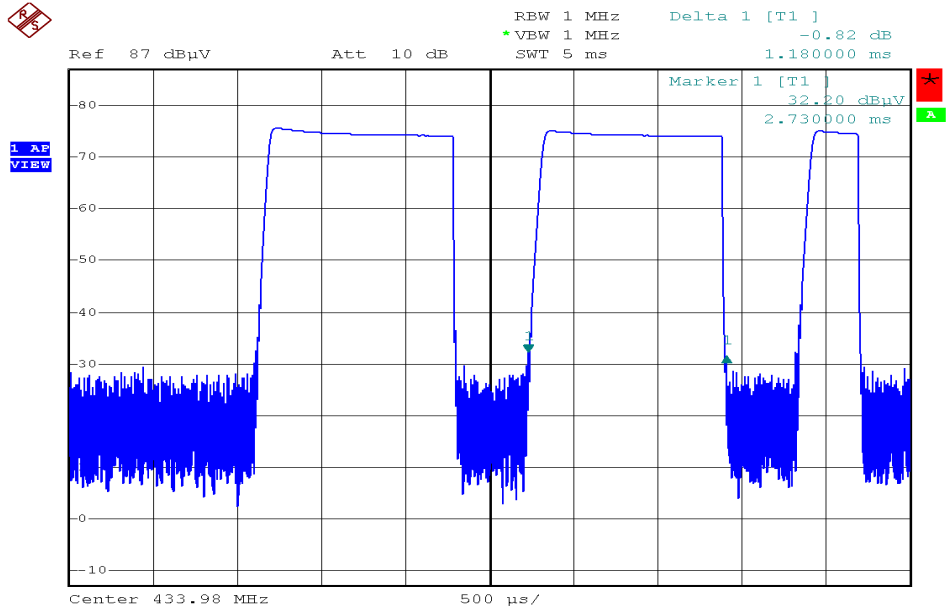
8.2 Test Result

Test result plot as follows:

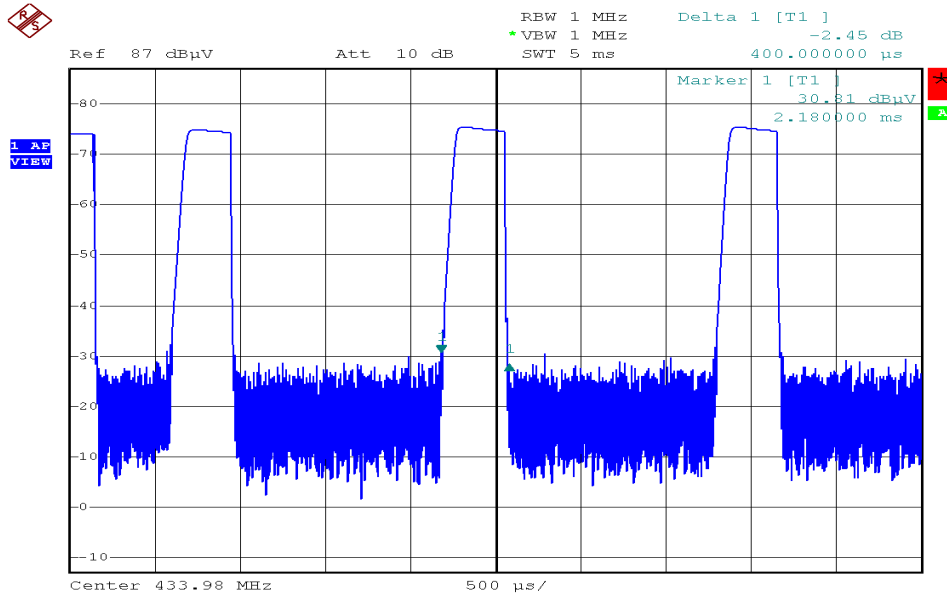
- (a) A transmitter activated automatically shall cease transmission within 5 seconds after activation.



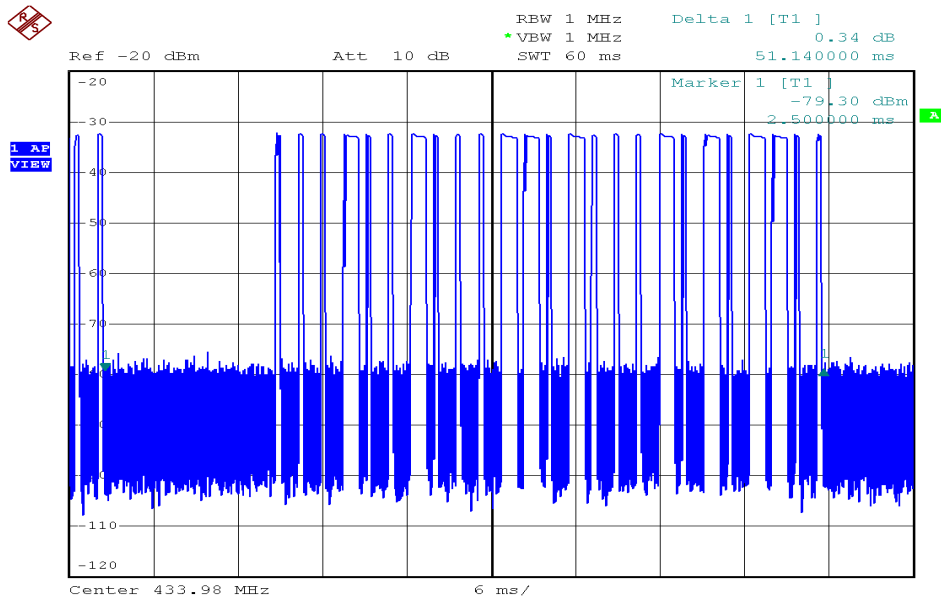
(b) long pulse time is 1.18ms,pulse number is 9.



(c) short pulse time is 0.4ms,pulse number are 16.



(d) pulse train is 51.14ms



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 : $T_{on} = \text{long pulse time} * \text{pulse number} + \text{short pulse time} * \text{pulse number} + \text{middle pulse} * \text{pulse number} = (1.18 * 9 + 0.4 * 16) \text{ms} = 17.02 \text{ms}$

The EUT's work period : $T = T_{ON} + T_{OFF} = 51.14 \text{ms}$

Remark: 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 value.

The EUT's duty cycle : $D = T_{on} / T = 17.02 / 51.14 * 100\% = 33.28\%$

Duty Cycle Correction Factor(dB) = $20 * \text{Log}_{10}(\text{Duty Cycle}) = 20 * \text{Log}_{10}(33.28\%) = -9.56 \text{dB}$

9 Bandwidth

Test Requirement: FCC Part 15.231 (c)
 Test Method: ANSI C63.4
 Test mode: TX On

9.1 Test Procedure

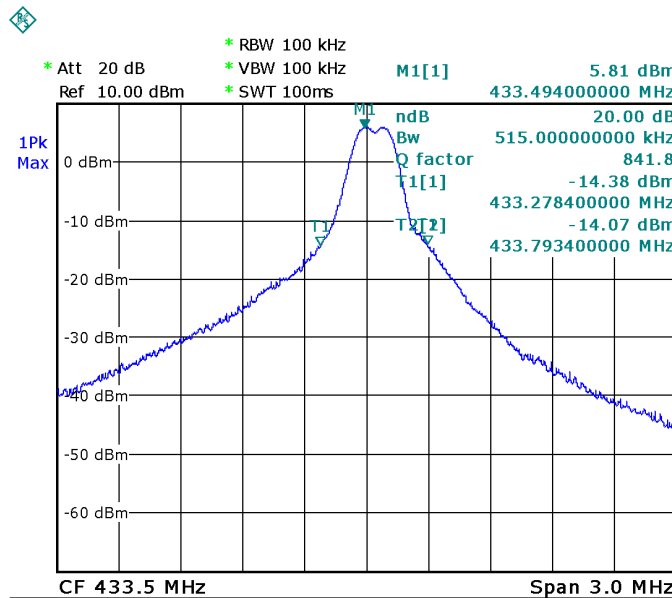
1. The transmitter output (antenna port) was connected to the spectrum analyzer. EUT and its simulators are placed on a table, let EUT working in test mode, then test it.
2. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 30kHz RBW and 100kHz VBW.

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
433.5	515	1083.75	Pass



10 Antenna Requirement.

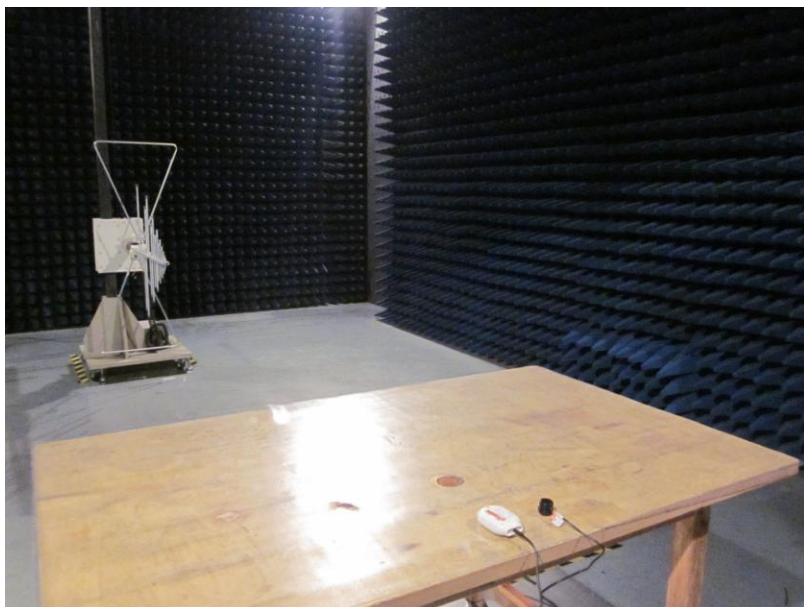
According to the FCC Part 15 Paragraph 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. This product has a integrated antenna, fulfill the requirement of this section.

11 Photographs of Testing

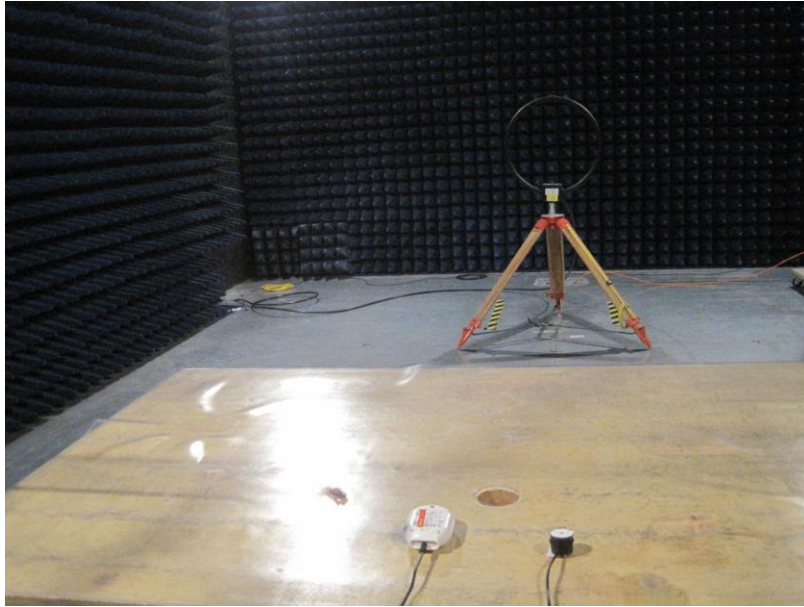
11.1 Photographs – Spurious Radiated Emission Test Setup TX Above 1 GHz



TX From 30MHz to 1GHz



TX Below 30 MHz



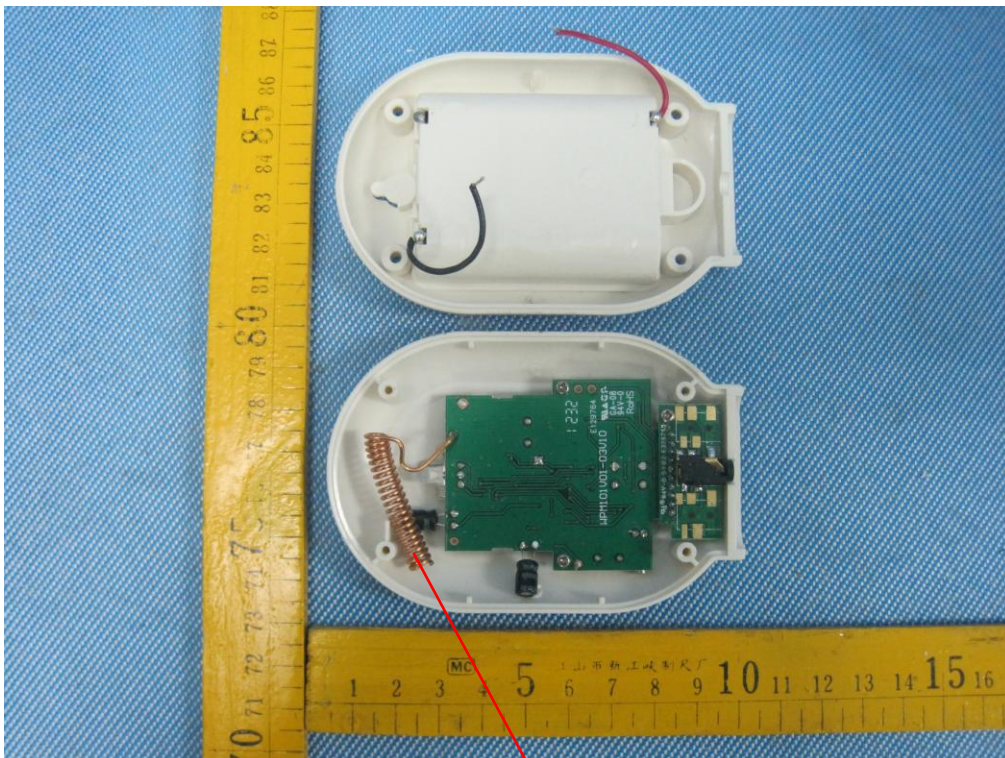
12 Photographs - Constructional Details

12.1 EUT –Appearance View



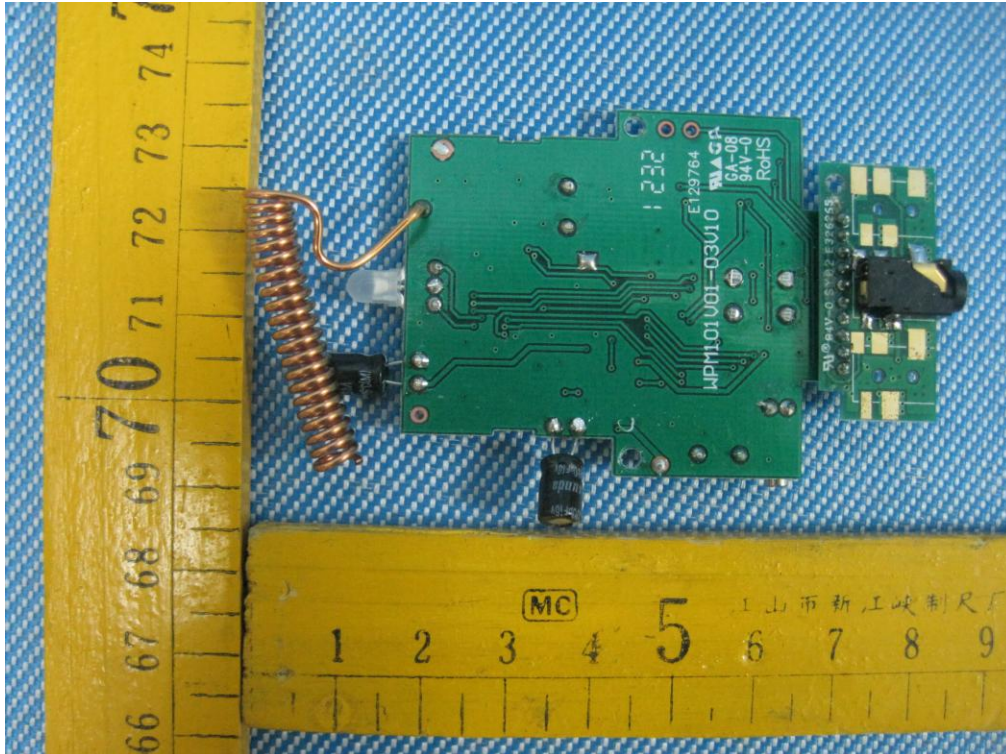
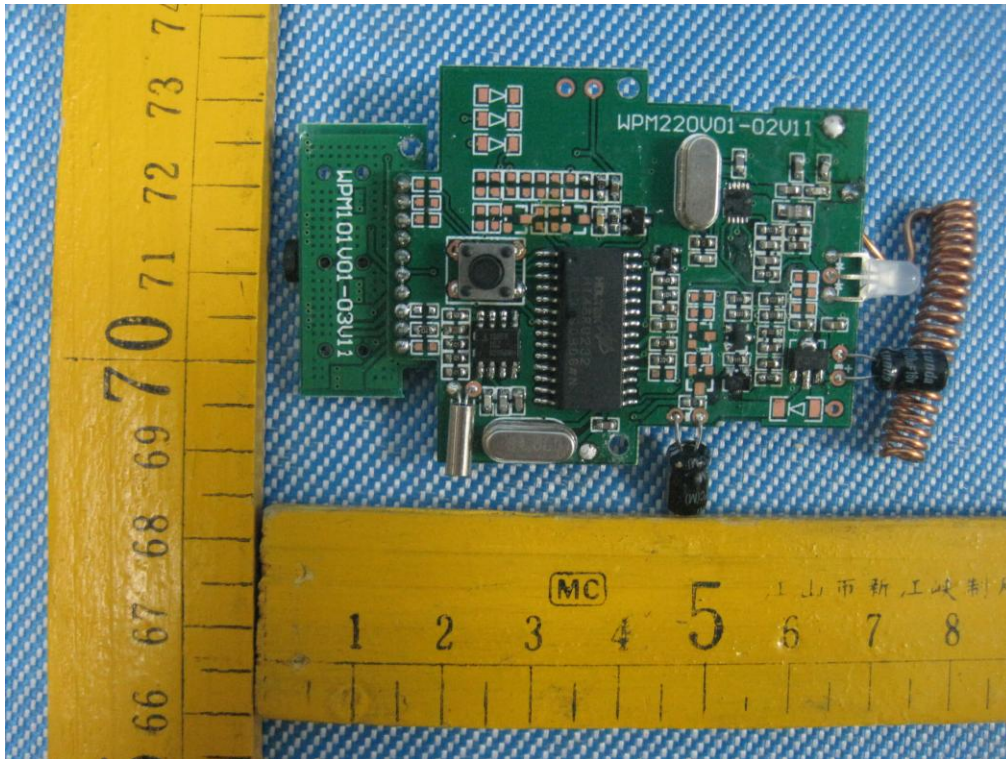


12.2 EUT – Open View

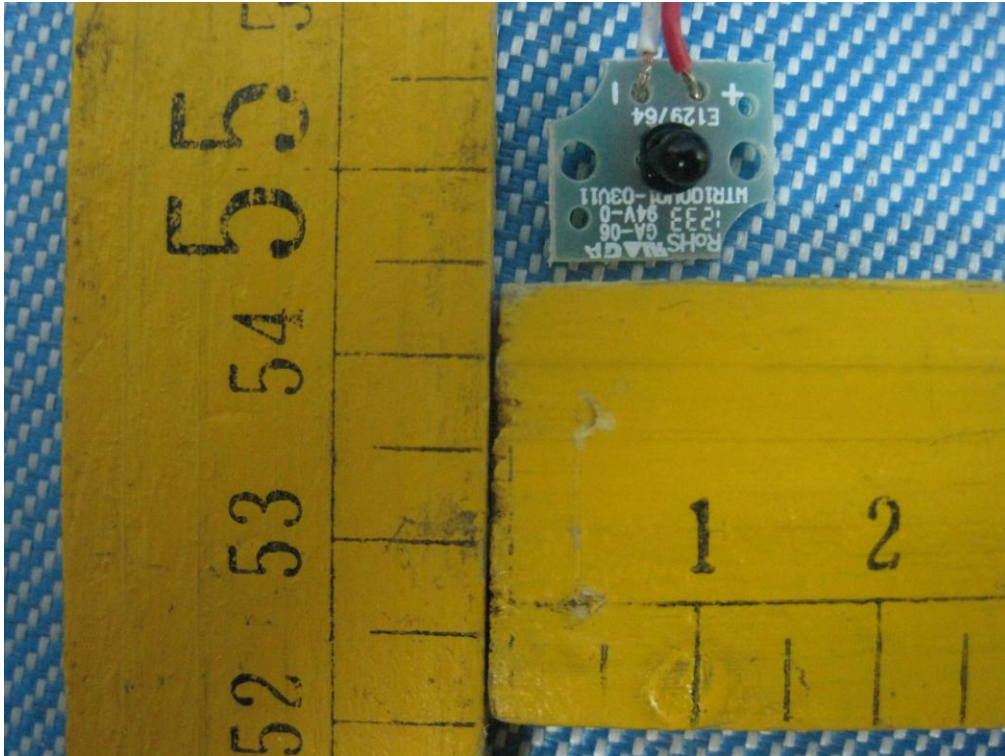
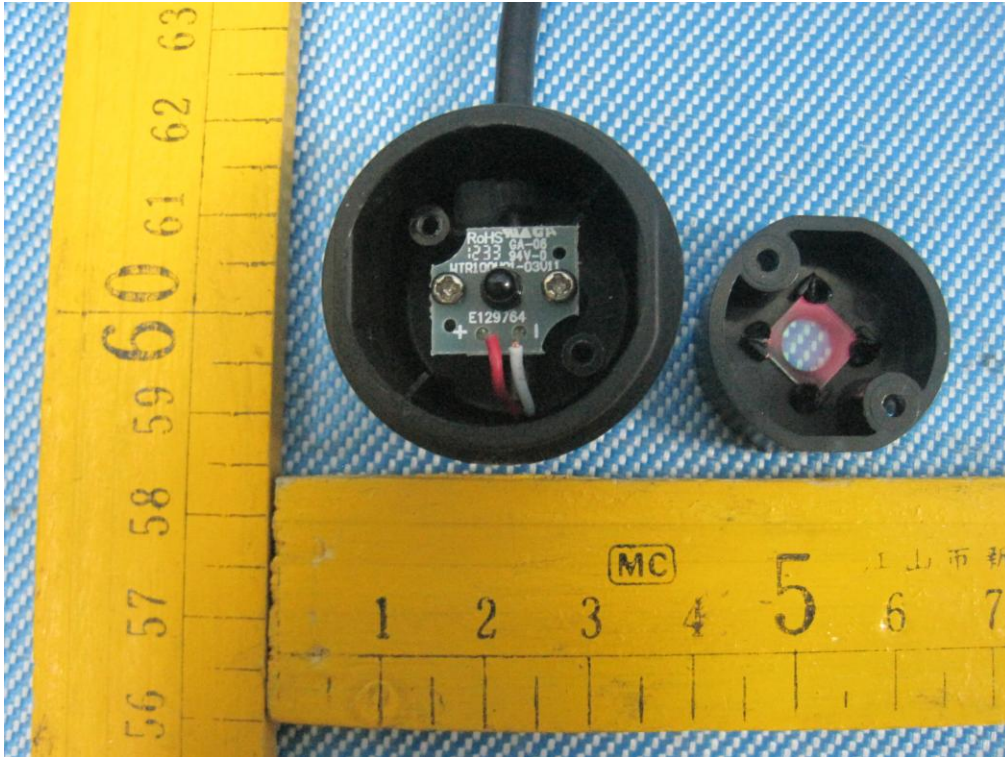


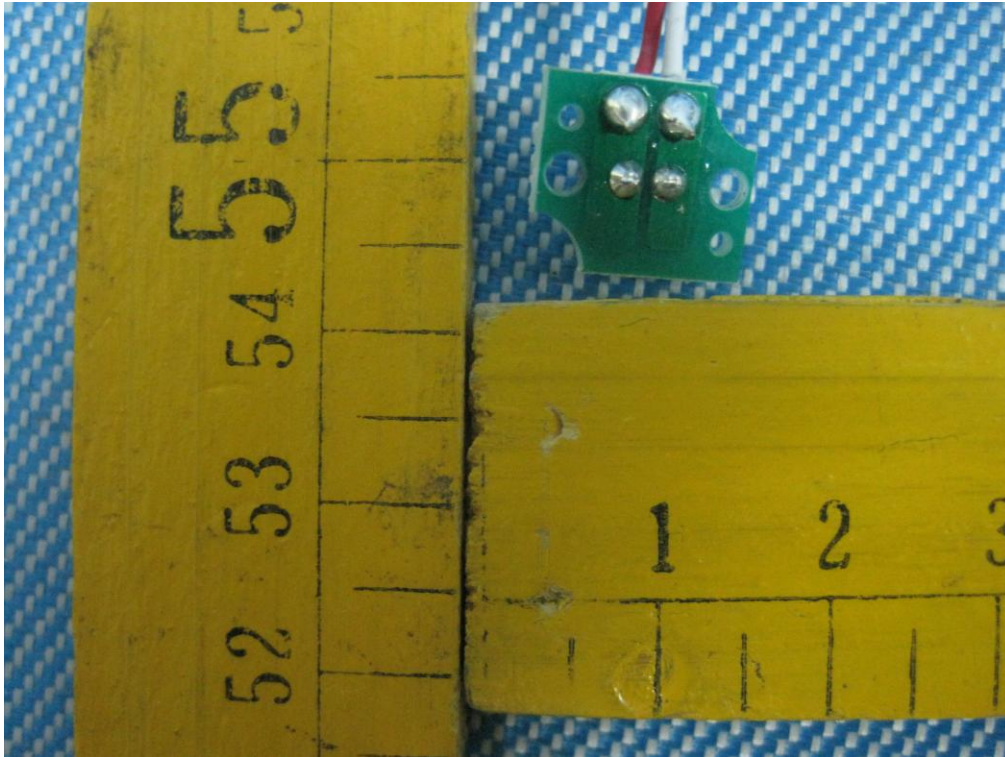
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12.3 EUT – PCB View



12.4 Sensor – PCB View





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13 FCC Label

FCC Label Sample for model: ELITE IR-Tx

FCC ID: XRQELITEIR

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.

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FCC Label Location for model: ELITE IR-Tx

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.

