



# FCC TEST REPORT

**FCC ID** : KE3-3001140  
**Applicant** : Radio Systems Corporation  
**Address** : 10427 Petsafe Way Knoxville, TN 37932 USA  
**Manufacturer** : Radio Systems Corporation  
**Address** : 10427 Petsafe Way Knoxville, TN 37932 USA  
**Equipment Under Test (EUT) :**  
Product Name : Basic Remote Trainer  
Model No. : RFA-487,RFA-489, RFA-506  
**Rules** : FCC CFR47 Part 15 Section 15.231:2010

**Date of Test** : Nov. 07, 2012

**Date of Issue** : Nov. 13, 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.

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### 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



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## 4 General Information

### 4.1 General Description of E.U.T.

<b>Product Name</b>	: Basic Remote Trainer
<b>Model No.</b>	: RFA-487,RFA-489, RFA-506
<b>Model Description</b>	: Circuit principle and PCB layout of above models are the same. Only the product colour is different.
<b>Type of Modulation</b>	: ASK
<b>Note</b>	: N/A
<b>Operation Frequency</b>	: 433.92 MHz (Transmitter)
<b>Oscillator</b>	: MCU crystal 12MHz ; RF crystal 13.56MHz

### 4.2 Details of E.U.T.

<b>Technical Data</b>	: Battery 6.0V
<b>Adapter manufacturer</b>	: N/A
<b>M/N</b>	: 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 tests were 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 °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 6.0V

#### 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

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## 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.	10m Coaxial Cable with N- plug	SCHWARZBECK	AK 9515 H	-	Aug.14,2012	Aug. 14,2013
8.	10m 50 Ohm Coaxial Cable with N-plug	SCHWARZBECK	AK 9513	-	Aug.14,2012	Aug. 14,2013

### 5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	$\pm 1.0$ dB
RF Power Density	$\pm 2.2$ dB
Radiated Spurious Emissions test	$\pm 5.03$ dB (Bilog antenna 30M~1000MHz)
	$\pm 4.74$ 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.



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## 7 Radiation Emission Test

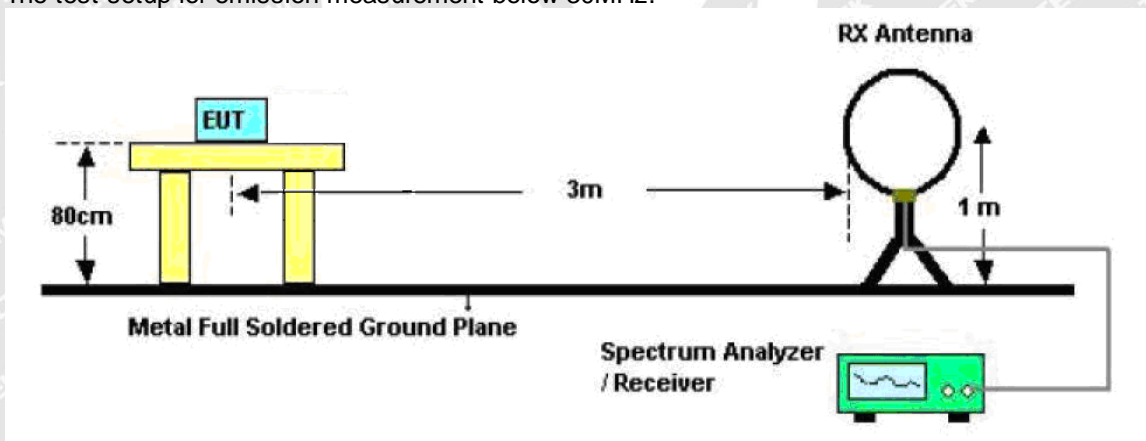
Test Requirement:	FCC CFR47 Part 15 Section 15.209 & Section 15.231
Test Method:	ANSI C63.4:2003
Frequency Range:	12MHz to 5GHz
Measurement Distance:	3m

### 7.1 Test Procedure

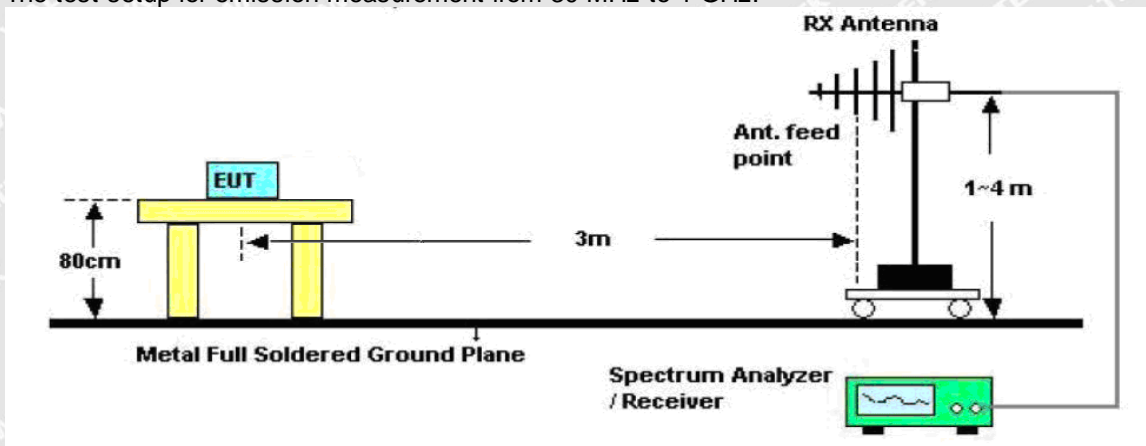
1. The radiation emission should be tested under 3-axes position(lying,side and stand), After pre-test, It was found that the worse radiation emission was get at the lying position.
2. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation 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.



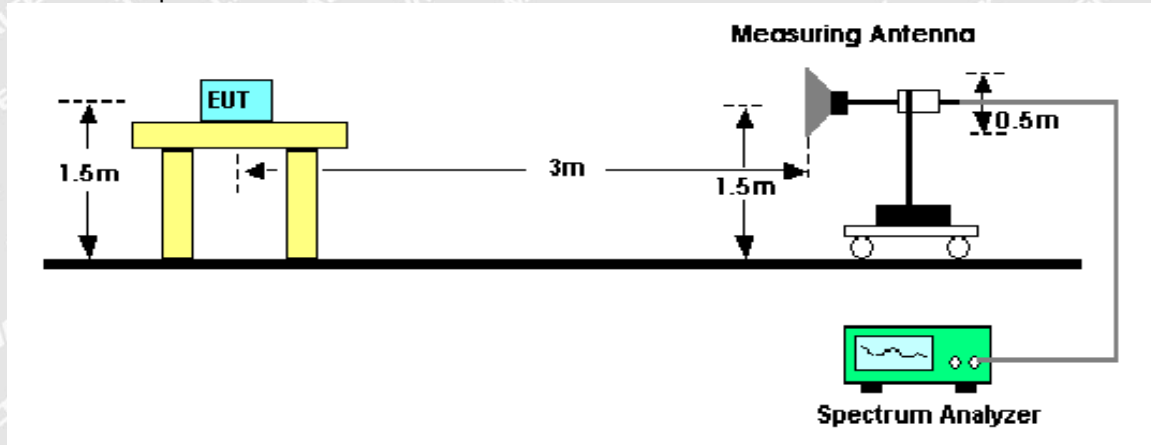
The test setup for emission measurement from 30 MHz to 1 GHz.







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 12MHz 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 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)	20log <sup>(2400/F(kHz))</sup> + 80
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	20log <sup>(24000/F(kHz))</sup> + 40
1.705 ~ 30	30	30	100 * 30	20log <sup>(30)</sup> + 40
30 ~ 88	100	3	100	20log <sup>(100)</sup>
88 ~ 216	150	3	150	20log <sup>(150)</sup>
216 ~ 960	200	3	200	20log <sup>(200)</sup>
Above 960	500	3	500	20log <sup>(500)</sup>

### FCC Part 15.231 Limits

Fundamental Frequency (MHz)	Field Strength of the Fundamental <sup>(Note 1)</sup> (uV/m)	Field Strength of Unwanted Emissions <sup>(Note 1)</sup> (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 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 stored in terms of dB.The gain of the pressletor was accounted for in the spectrum analyser meter reading.

Example:

$$\text{Freq(MHz)} \quad \text{Meter Reading} + \text{ACF} = \text{FS}$$

$$33 \quad 20\text{dBuV} + 10.36\text{dB} = 30.36\text{dBuV/m} @ 3\text{m}$$

$$\text{AV} = \text{Peak} + 20\text{Log}_{10}(\text{duty cycle}) = \text{PK} - 17.83$$

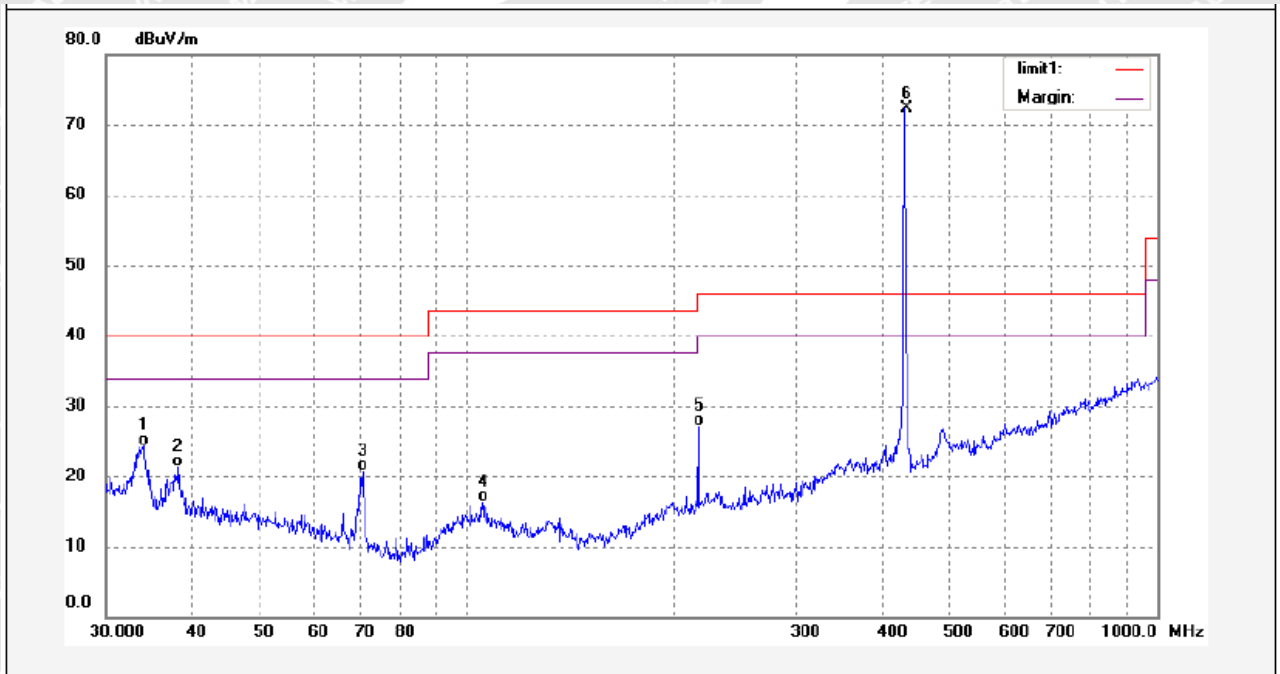
See section 8 for duty cycle factor.

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

Test frequency 30MHz to 1GHz

Test Mode:normal working

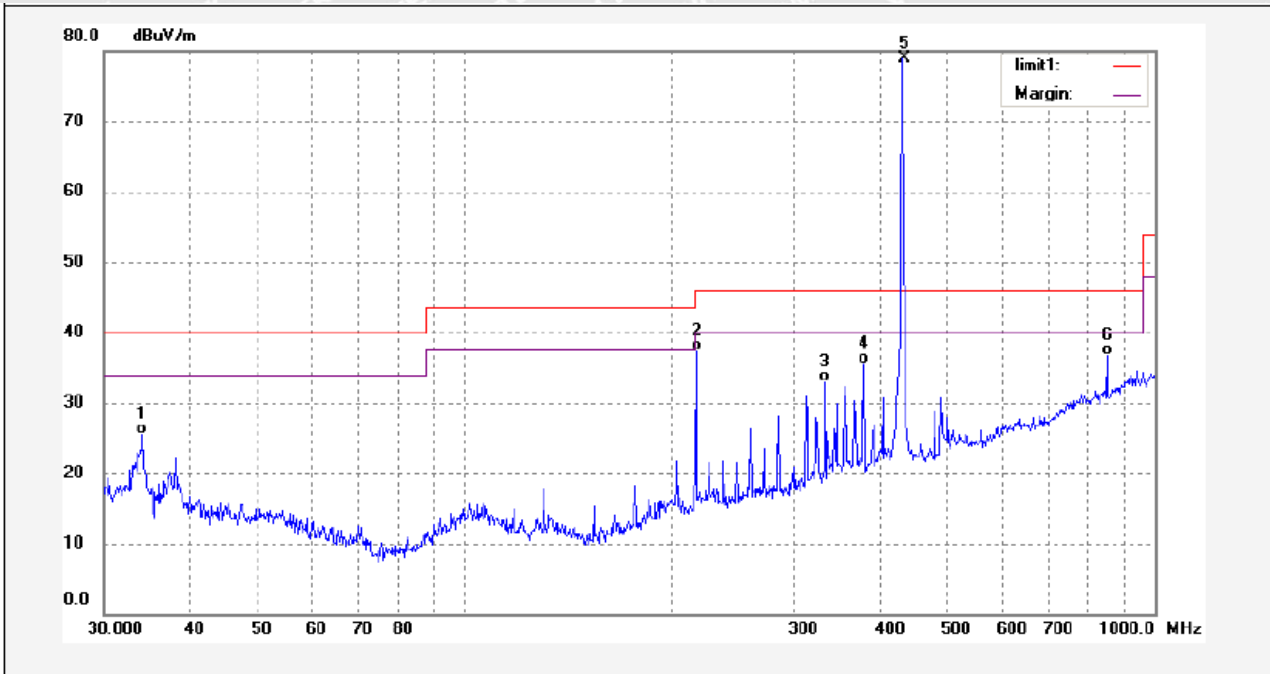
Antenna Polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	34.0451	7.68	16.53	24.21	40.00	-15.79	QP	
2	38.2305	4.58	16.63	21.21	40.00	-18.79	QP	
3	70.7047	10.87	9.81	20.68	40.00	-19.32	QP	
4	105.1668	2.03	14.24	16.27	43.50	-27.23	QP	
5	216.8803	11.52	15.50	27.02	46.00	-18.98	QP	
6	433.9150	52.08	20.26	72.34	46.00	26.34	QP	



Antenna Polarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	34.1649	9.07	16.52	25.59	40.00	-14.41	QP	
2	216.8803	21.89	15.50	37.39	46.00	-8.61	QP	
3	332.9536	13.46	19.47	32.93	46.00	-13.07	QP	
4	379.1780	15.47	20.05	35.52	46.00	-10.48	QP	
5	433.9150	58.59	20.26	78.85	46.00	32.85	QP	
6	853.7547	7.01	29.62	36.63	46.00	-9.37	QP	

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Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
433.92	QP	Vertical	72.34	100.82	-17.12	1.1	45
867.84	QP	Vertical	54.42	74.00	-26.40	1.3	120
1301.76	Peak	Vertical	43.40	74.00	-30.60	1.2	45
1735.68	Peak	Vertical	42.11	74.00	-31.89	1.2	90
2169.6	Peak	Vertical	36.44	74.00	-37.56	1.4	130
2603.52	Peak	Vertical	36.77	74.00	-37.23	1.3	40
3037.44	Peak	Vertical	37.62	74.00	-36.38	1.4	60
3471.36	Peak	Vertical	37.06	74.00	-36.94	1.4	60
3905.28	Peak	Vertical	38.04	74.00	-35.96	1.5	45
4339.2	Peak	Vertical	38.04	74.00	-35.96	1.5	70
433.92	QP	Horizontal	78.85	100.82	-27.43	1.6	110
867.84	QP	Horizontal	50.73	74.00	-30.09	1.1	45
1301.76	Peak	Horizontal	37.06	74.00	-36.94	1.1	110
1735.68	Peak	Horizontal	43.44	74.00	-30.56	1.4	90
2169.6	Peak	Horizontal	37.77	74.00	-36.23	1.1	130
2603.52	Peak	Horizontal	36.29	74.00	-37.71	1.1	40
3037.44	Peak	Horizontal	34.33	74.00	-39.67	1.5	60
3471.36	Peak	Horizontal	34.80	74.00	-39.20	1.3	110
3905.28	Peak	Horizontal	34.20	74.00	-39.80	1.3	140
4339.2	Peak	Horizontal	32.31	74.00	-41.69	1.4	90
433.92	-	Vertical	-	80.82	-	-	-
867.84	-	Vertical	-	54.00	-	-	-
1301.76	AV	Vertical	25.57	54.00	-28.43	1.2	45
1735.68	AV	Vertical	24.28	54.00	-29.72	1.2	90
2169.6	AV	Vertical	18.61	54.00	-35.39	1.4	130
2603.52	AV	Vertical	18.94	54.00	-35.06	1.3	40
3037.44	AV	Vertical	19.79	54.00	-34.21	1.4	60
3471.36	AV	Vertical	19.23	54.00	-34.77	1.4	60
3905.28	AV	Vertical	20.21	54.00	-33.79	1.5	45
4339.2	AV	Vertical	20.21	54.00	-33.79	1.5	70
433.92	-	Horizontal	-	80.82	-	-	-
867.84	-	Horizontal	-	54.00	-	-	-
1301.76	AV	Horizontal	19.23	54.00	-34.77	1.1	110
1735.68	AV	Horizontal	25.61	54.00	-28.39	1.4	90
2169.6	AV	Horizontal	19.94	54.00	-34.06	1.1	130
2603.52	AV	Horizontal	18.46	54.00	-35.54	1.1	40
3037.44	AV	Horizontal	16.5	54.00	-37.5	1.5	60
3471.36	AV	Horizontal	16.97	54.00	-37.03	1.3	110



3905.28	AV	Horizontal	16.37	54.00	-37.63	1.3	140
4339.2	AV	Horizontal	14.48	54.00	-39.52	1.4	90



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## 8 Activation time

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

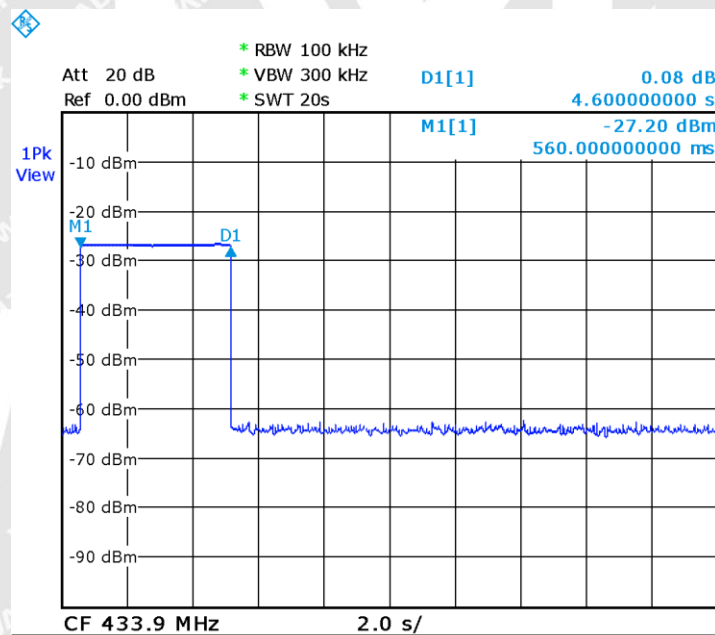
### 8.1 Test Procedure

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

### 8.2 Test Result

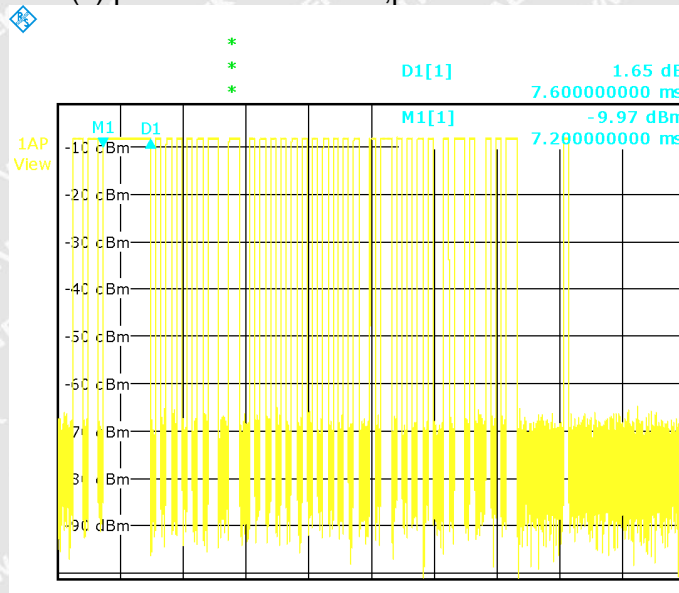
Test result plot as follows:

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

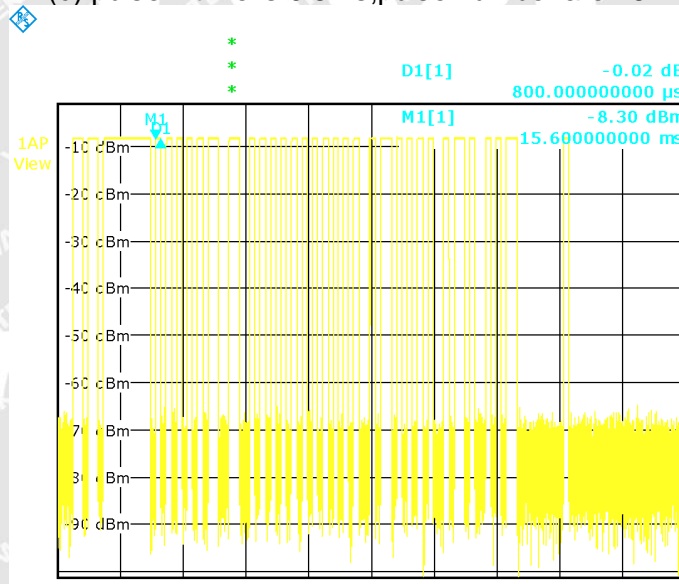




(b) pulse1 time is 7.6ms,pulse number is 1.



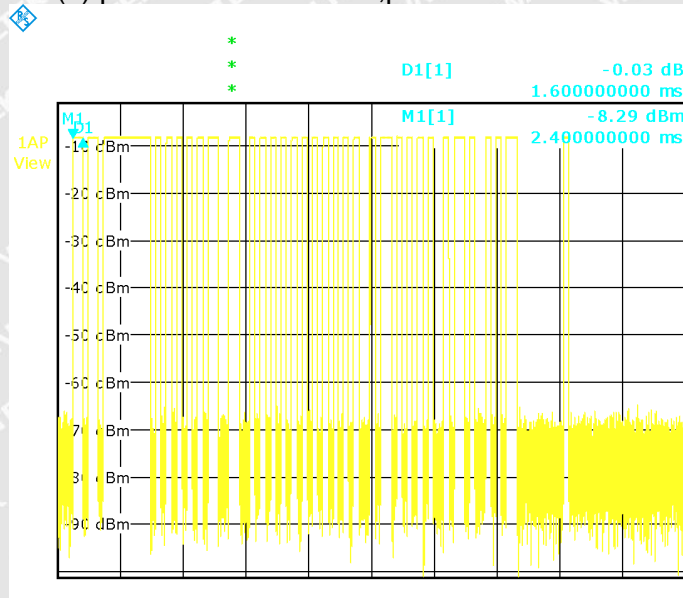
(c) pulse 2 time is 0.8ms,pulse number are 26.



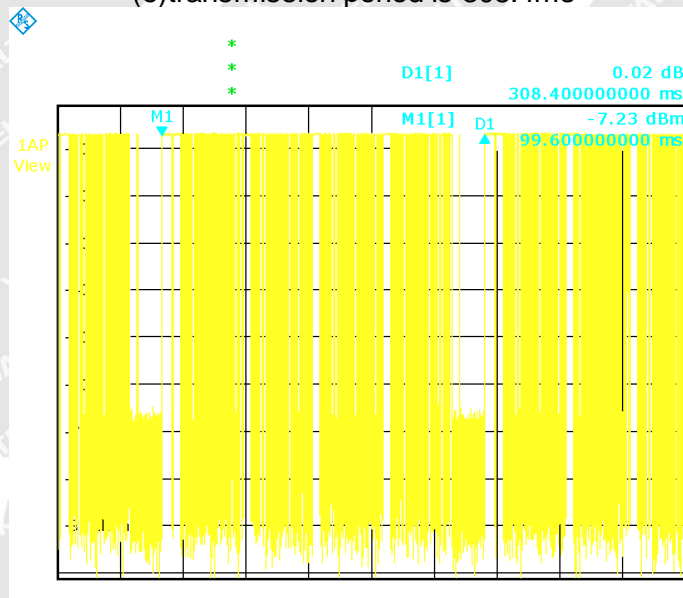




(d) pulse 3 time is 1.6ms,pulse number are 7.



(e) transmission period is 308.4ms



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 :  $T_{on} = \text{long pulse time} * \text{pulse number} + \text{short pulse time} * \text{pulse number} + \text{middle pulse} * \text{pulse number} = (7.6\text{ms} * 1 + 1.6\text{ms} * 7 + 0.8\text{ms} * 26)\text{ms} = 39.6\text{ms}$

The EUT's work period :  $T = T_{ON} + T_{OFF} = 308.4\text{ms}$

The EUT's duty cycle :  $D = T_{on} / T = 39.6 / 308.4 * 100\% = 12.8\%$

Duty Cycle Correction Factor(dB) =  $20 * \text{Log}_{10}(\text{Duty Cycle}) = 20 * \text{Log}_{10}(1.56\%) = -17.83\text{dB}$



### 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

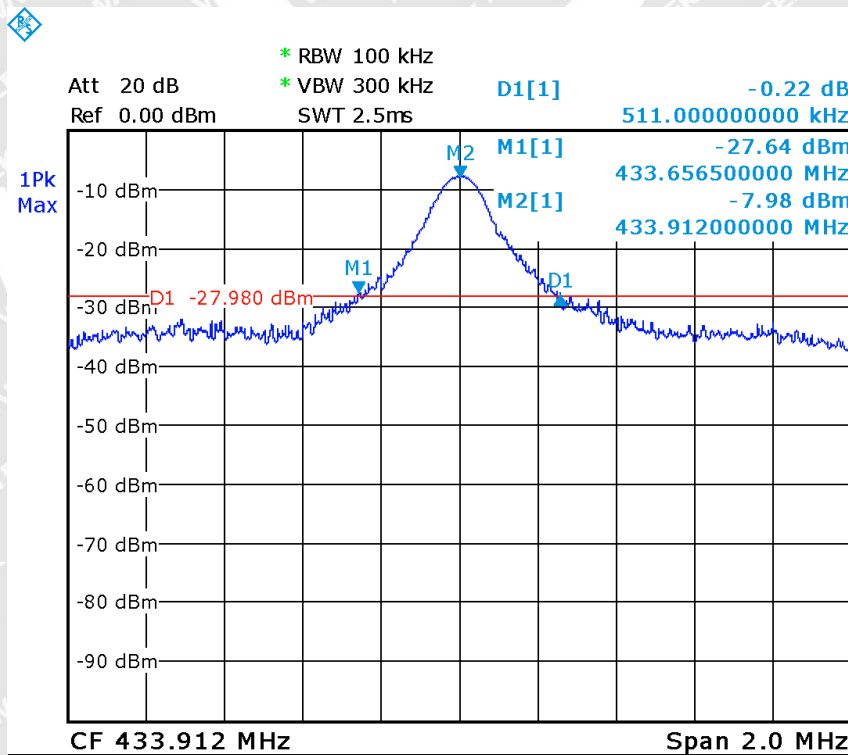
1. The transmitter output (antenna port) was connected to the spectrum analyzer. EUT and its simulators are placed on a table, let EUT working in test mode, then test it.
2. The bandwidth of the fundamental frequency was measured by spectrum analyzer with 100kHz RBW and 300kHz VBW.

#### 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	511	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.

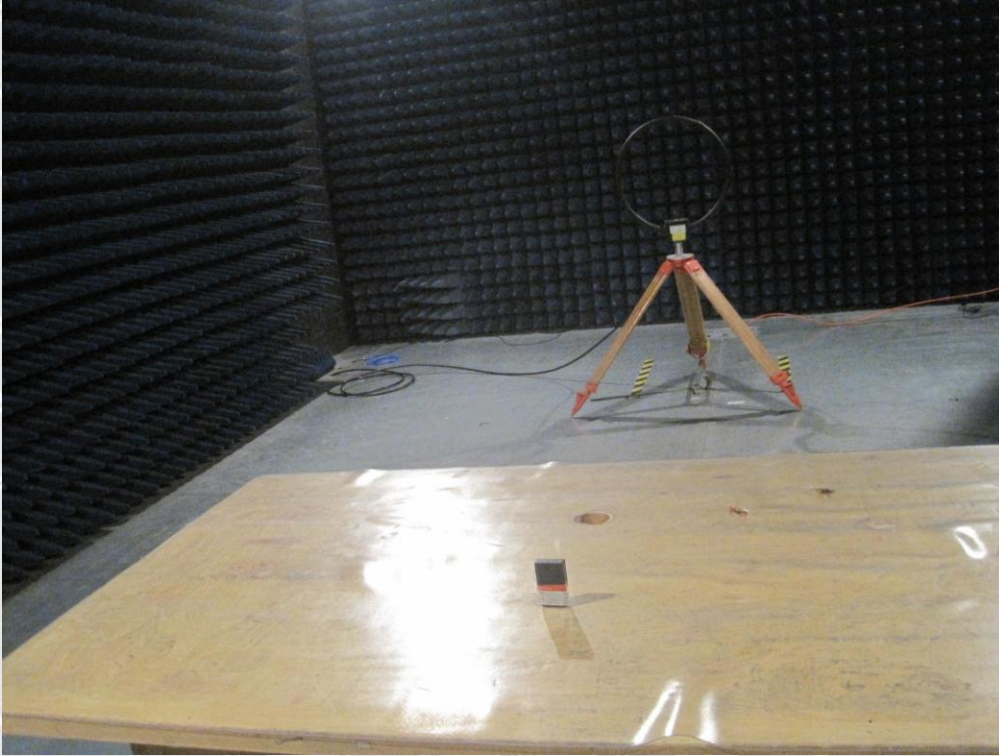


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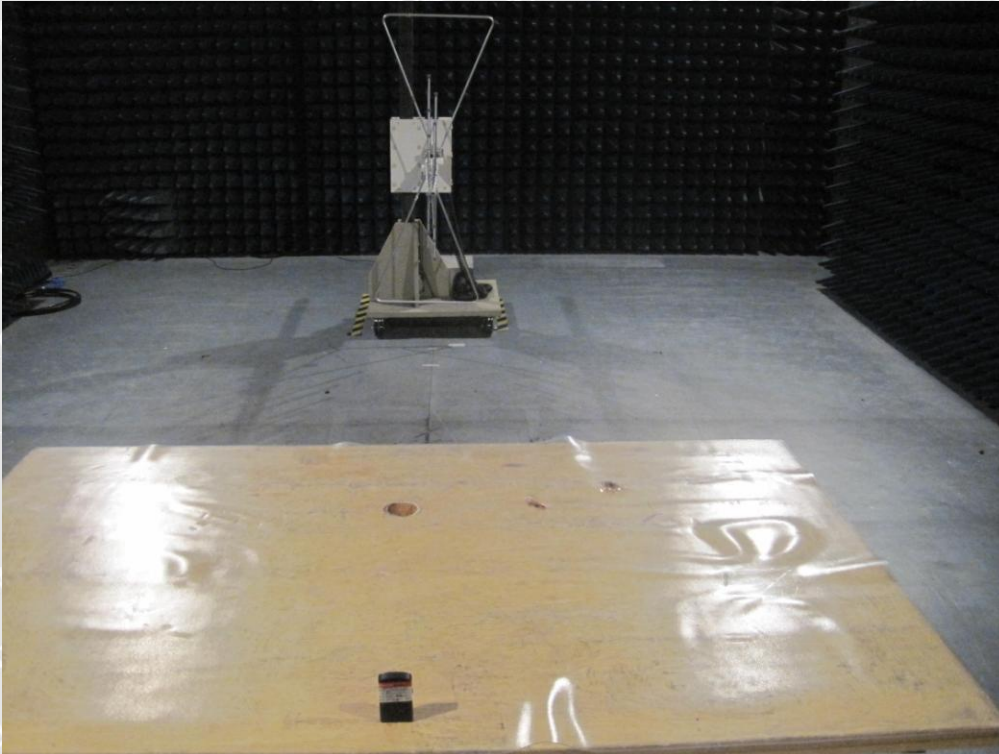


## 11 Photographs of Testing

### 11.1 Photographs –Radiated Emission Test Setup TX Below 30 MHz

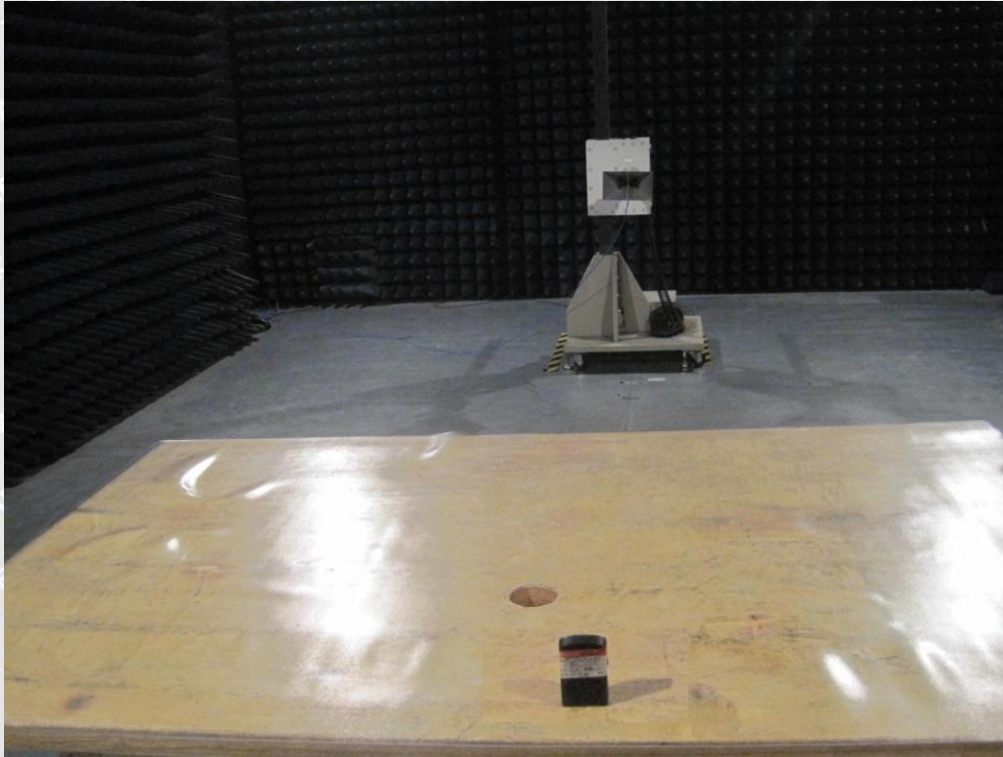


### TX From 30MHz to 1GHz





### TX Above 1 GHz



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## 12 Photographs - Constructional Details

### 12.1 EUT - Appearance View



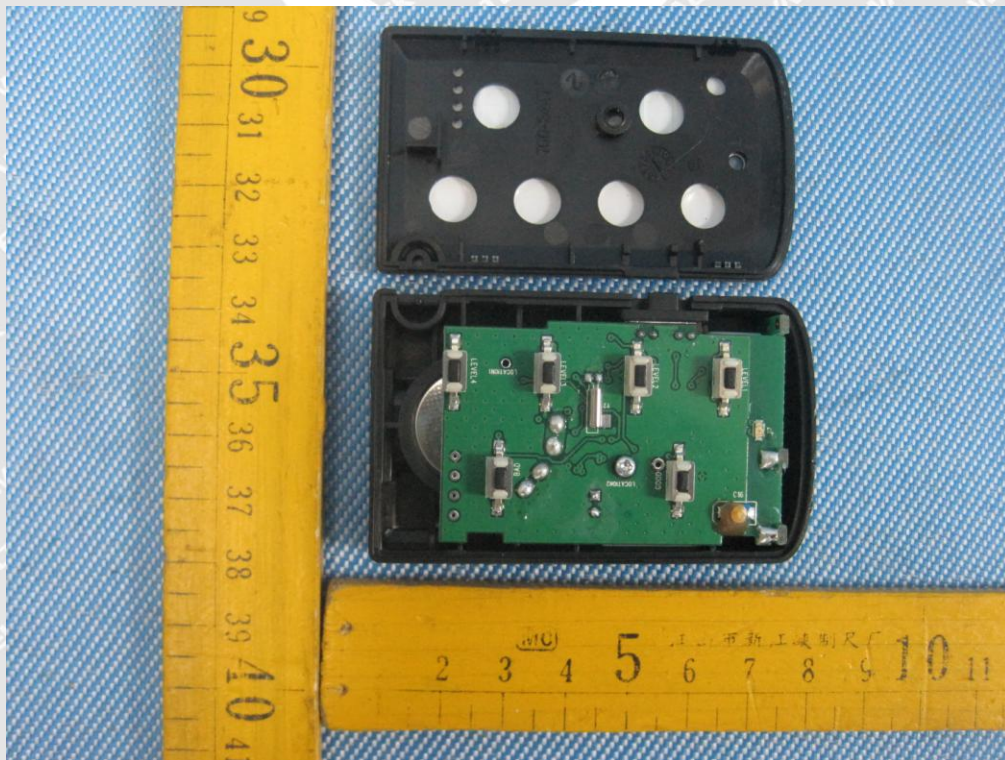






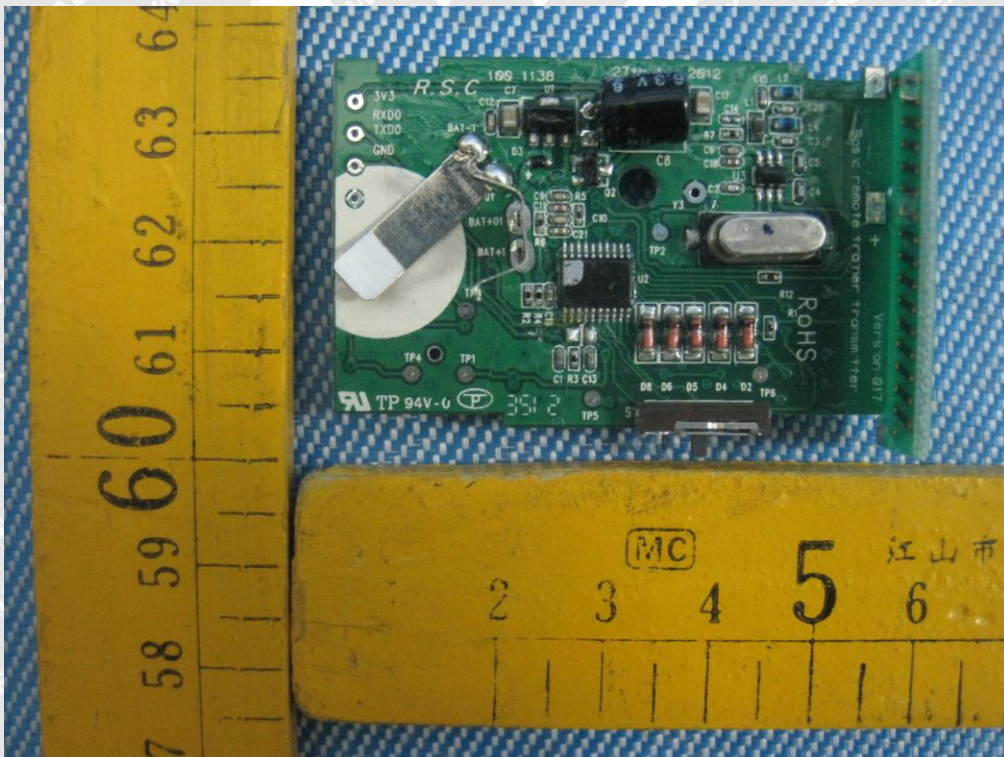
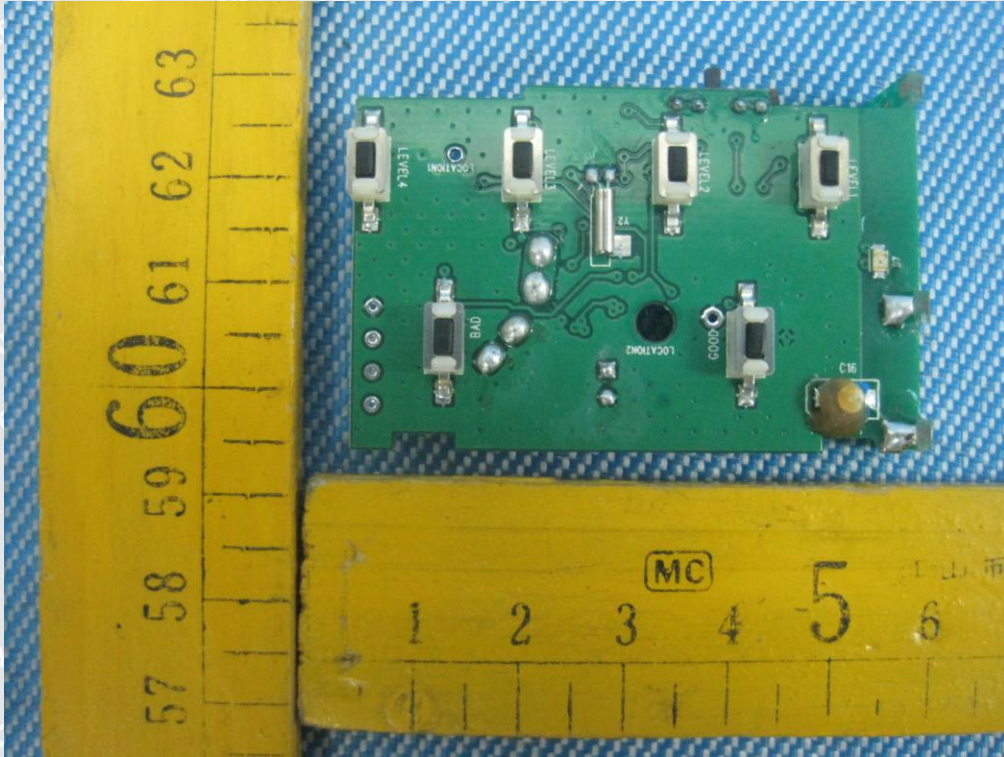


## 12.2 EUT – Open View





### 12.3 EUT – PCB View





### 13 FCC Label

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=



# WALTEK