

TEST REPORT

Reference No. : WTS13S1008699E
FCC ID : KE3-3002768
Applicant : Radio Systems Corporation
Address : 10427 Petsafe Way Knoxville, TN 37932 USA
Manufacturer : The same as above
Address : The same as above

Equipment Under Test (EUT) :

Product Name : INDOOR COMPUTER COLLAR
Model No. : RIG00-14107
Rules : FCC CFR47 Part 15 Section 15.231: 2012
Date of Test : Nov 06~11, 2013
Date of Issue : Nov 20, 2013

Test Result : **PASS***

Remark:

* The sample described above has been tested to be in compliance with the requirements of ANSI C63.4:2003. The test results have been reviewed and comply with the rules listed above and found to meet their essential requirements.

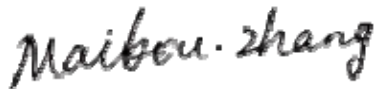
PERPARED BY:

Waltek Services (Shenzhen) Co., Ltd.

1/F, Fukangtai Building, West of Baima Road., Songgang Street, Bao'an District,
Shenzhen, China

Tel: +86-755-83551033 Fax: +86-755-83552400

Compiled by:



Maikou Zhang / Project Engineer

Approved by:



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Conducted Emissions	15.207	N/A
Radiated Spurious Emissions	15.205(a) 15.209 15.231(b)	PASS
Periodic Operation	15.231(a)	PASS
20dB Bandwidth	15.231(c)	PASS
Antenna Requirement	15.203	PASS

3 Contents

	Page
1 COVER PAGE	1
2 TEST SUMMARY	2
3 CONTENTS	3
4 GENERAL INFORMATION	4
4.1 GENERAL DESCRIPTION OF E.U.T.	4
4.2 DETAILS OF E.U.T.	4
4.3 TEST FACILITY	4
4.4 TEST LOCATION	4
4.5 GENERAL CONDITION	4
4.5.1 <i>Environmental condition of test site</i>	5
4.5.2 <i>Test Mode</i>	5
5 EQUIPMENT USED DURING TEST	6
5.1 EQUIPMENTS LIST	6
5.2 MEASUREMENT UNCERTAINTY	6
5.3 TEST EQUIPMENT CALIBRATION	6
6 CONDUCTED EMISSION TEST	7
7 RADIATION EMISSION TEST	8
7.1 TEST EQUIPMENT	8
7.2 MEASUREMENT UNCERTAINTY	8
7.3 TEST PROCEDURE	8
7.4 EUT OPERATION:	8
7.5 TEST SETUP	8
7.6 SPECTRUM ANALYZER SETUP	10
7.7 TEST PROCEDURE	10
7.8 CORRECTED AMPLITUDE & MARGIN CALCULATION	10
7.9 SUMMARY OF TEST RESULTS	11
8 PERIODIC OPERATION	12
9 20DB BANDWIDTH	16
9.1 TEST PROCEDURE	16
9.2 TEST RESULT	16
10 ANTENNA REQUIREMENT	17
11 PHOTOGRAPHS OF TESTING	18
11.1 RADIATION EMISSION TEST VIEW	18
12 PHOTOGRAPHS - CONSTRUCTIONAL DETAILS	19
12.1 EUT - APPEARANCE VIEW	19
12.2 EUT- INTERNAL VIEW	22
12.3 BATTERY VIEW	23

4 General Information

4.1 General Description of E.U.T.

Product Name	: INDOOR COMPUTER COLLAR
Model No.	: RIG00-14107
Type of Modulation	: FSK
Model Description	: N/A
Frequency Range	: 433.92 MHz
Oscillator	: 433.92MHz
Antenna installation	: PCB Printed Antenna

4.2 Details of E.U.T.

Technical Data	: DC 3V Powered by Battery
Adapter manufacturer	: FDK
M/N	: CR-1/3N

4.3 Test Facility

The test facility has a test site registered with 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 7760A, July 12, 2012.

- **FCC – Registration No.: 880581**

Waltek Services (Shenzhen) Co., Ltd. EMC Laboratory 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 55 %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 3V

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	MHz	433.92MHz	MHz

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. 13,2013	Aug. 12,2014
2.	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Aug. 13,2013	Aug. 12,2014
3.	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr. 20,2013	Apr. 19,2014
4.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr. 20,2013	Apr. 19,2014
5.	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	399	Aug. 13,2013	Aug. 12,2014
6.	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr.07,2013	Apr.06,2014
7.	Broadband Preamplifier	SCHWARZBECK	BBV 9718	9718-148	Aug. 13,2013	Aug. 12,2014
8.	Cable	Top	EWO2014-7	-	Apr. 20,2013	Apr. 19,2014
9.	Cable	Top	TYPE16(13M)	-	Aug. 13,2013	Aug. 12,2014

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 (30M~1000MHz)
	± 4.74 dB (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 CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Frequency Range:	150kHz to 30MHz
Class:	Class B
Limit:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 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 powered by battery, this test is not applicable.

7 Radiation Emission Test

Test Requirement:	FCC Part15 Paragraph 15.231
Test Method:	Based on FCC Part15 Paragraph 15.33
Frequency Range:	30MHz to 5GHz
Measurement Distance:	3m
Test Result:	PASS

7.1 Test Equipment

Please refer to Section 5 this report.

7.2 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on ANSI C63.4: 2003, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Waltek EMC Lab is +2.9 dB.

7.3 Test Procedure

1. New battery were installed in the equipment under test for radiated emissions test.
2. This is a handheld device, 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.
3. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combinations.
4. All data was recorded in the peak and average detection mode.
5. The EUT was under working mode during the final qualification test and the configuration was used to represent the worst case results.

7.4 EUT Operation:

Operating Environment:

Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	1010 mbar

Operation Mode:

The EUT was tested in Transmitting mode. The test data were shown as follow.

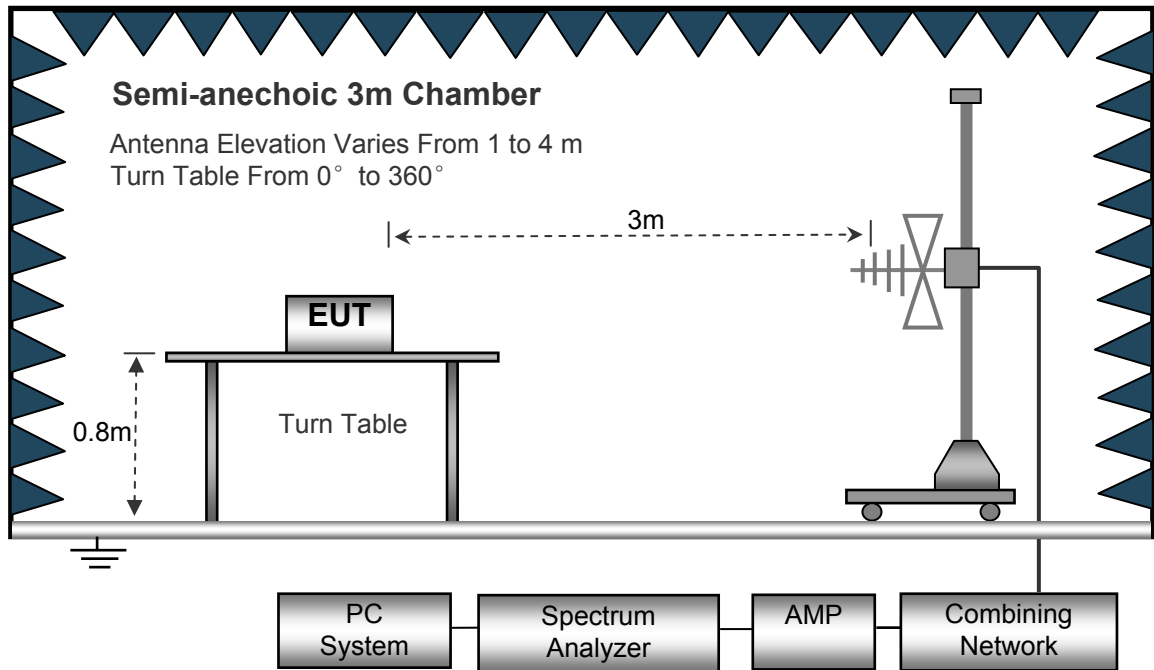
7.5 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

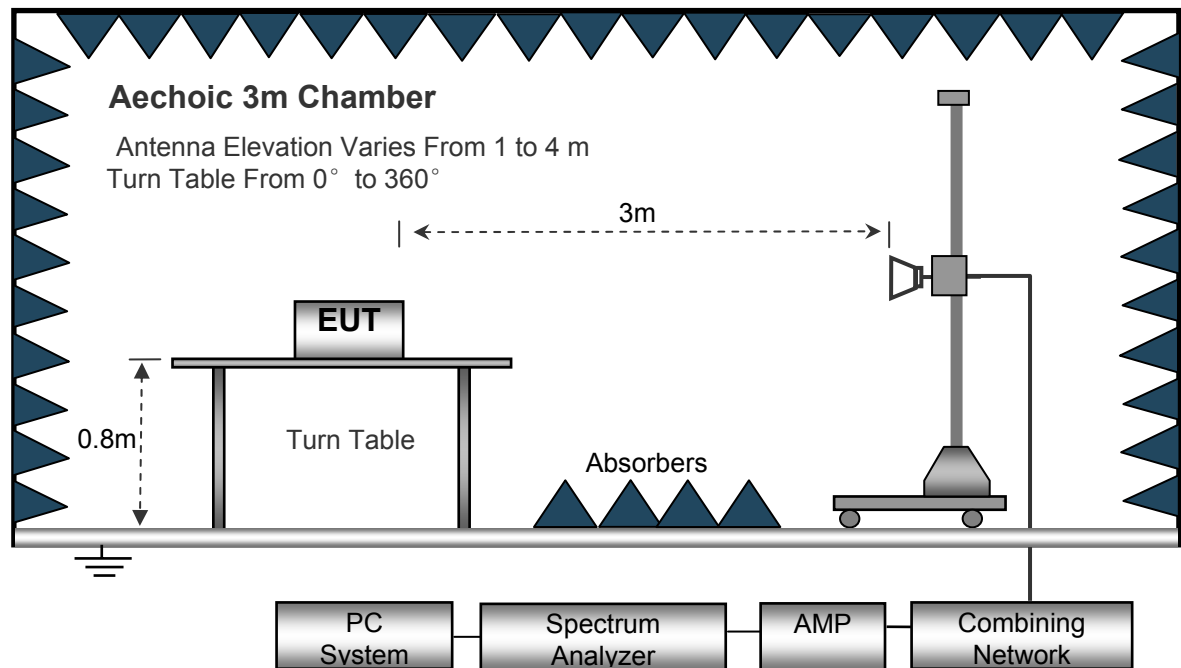
Waltek Services (Shenzhen) Co., Ltd.

<http://www.waltek.com.cn>

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



The test setup for emission measurement above 1 GHz.



7.6 Spectrum Analyzer Setup

According to FCC Part15 Rules, the system was tested from 30MHz to 5GHz.

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

7.7 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X, Y, Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand). After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

7.8 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:

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

7.9 Summary of Test Results

Test Frequency : 30MHz ~ 5GHz

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.231/15.209/205	
				Height	Polar			Limit	Margin
(MHz)	(dB μ V)	(PK/Q P/Ave)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
433.92	55.37	PK	114	2.0	H	19.68	75.05	100.82	-25.77
433.92	53.64	PK	113	1.6	V	19.68	73.32	100.82	-27.50
867.84	28.64	PK	341	1.6	H	29.71	58.35	80.82	-22.47
867.84	28.55	PK	265	1.5	V	29.71	58.26	80.82	-22.56
1816.80	52.33	PK	79	1.2	H	-16.38	35.95	74.00	-38.05
1816.80	50.89	PK	27	1.5	V	-16.38	34.51	74.00	-39.49
2725.20	51.39	PK	108	1.3	H	-14.87	36.52	74.00	-37.48
2725.20	51.27	PK	309	1.1	V	-14.87	36.40	74.00	-37.60

AV = Peak +20Log₁₀(duty cycle) =PK+(-16.99) [refer to section 8 for more detail]

Frequency	PK	Turn table Angle	RX Antenna		Duty cycle Factor	AV	FCC Part 15.231/209/205	
			Height	Polar			Limit	Margin
(MHz)	(dB μ V/m)	Degree	(m)	(H/V)	(dB)	(dB μ V/m)	(dB μ V/m)	(dB)
433.92	75.05	114	2.0	H	-16.99	58.06	80.82	-22.76
433.92	73.32	113	1.6	V	-16.99	56.33	80.82	-24.49
867.84	58.35	341	1.6	H	-16.99	41.36	60.82	-19.46
867.84	58.26	265	1.5	V	-16.99	41.27	60.82	-19.55
1816.80	35.95	79	1.2	H	-16.99	18.96	74.00	-35.04
1816.80	34.51	27	1.5	V	-16.99	17.52	74.00	-36.48
2725.20	36.52	108	1.3	H	-16.99	19.53	54.00	-34.47
2725.20	36.40	309	1.1	V	-16.99	19.41	54.00	-34.59

8 Periodic Operation

The duty cycle was determined by the following equation:

To calculate the actual field intensity, The duty cycle correction factor in decibel is needed for later use and can be obtained from following conversion

Duty Cycle(%)=

Total On interval in a complete pulse train/ Length of a complete pulse train * %

Duty Cycle Correction Factor(dB)=20 * Log₁₀(Duty Cycle(%))

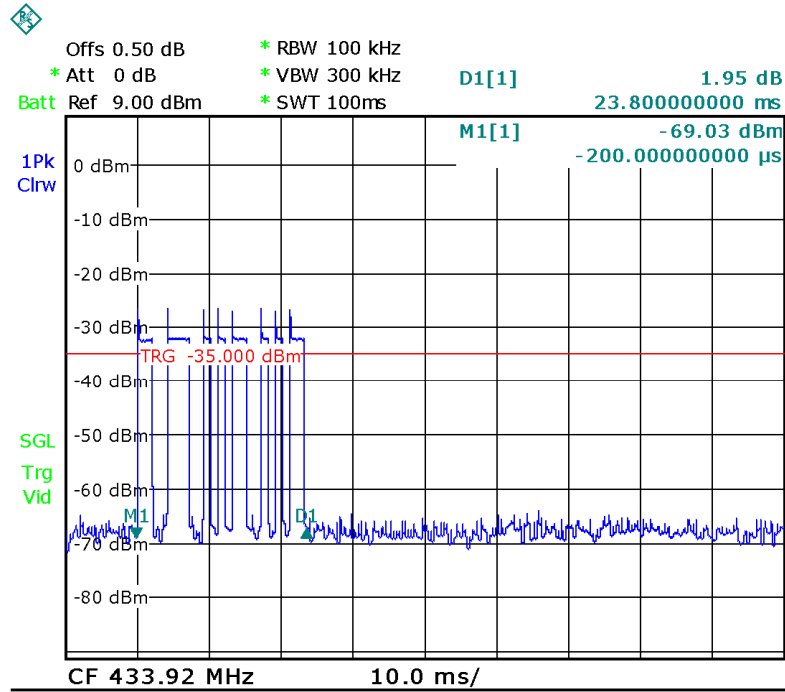
Pulse Train	Number of Pulse	T(ms)	Total Time(ms)
Pulse 1	3	2.17	6.51
Pulse 2	1	3.15	3.15
Pulse 3	4	1.12	4.48

Total On interval in a complete pulse train(ms)	14.14
Length of a complete pulse train(ms)	100.00
Duty Cycle(%)	14.14
Duty Cycle Correction Factor(dB)	-16.99

Refer to the duty cycle plot (as below), This device meets the FCC requirement.

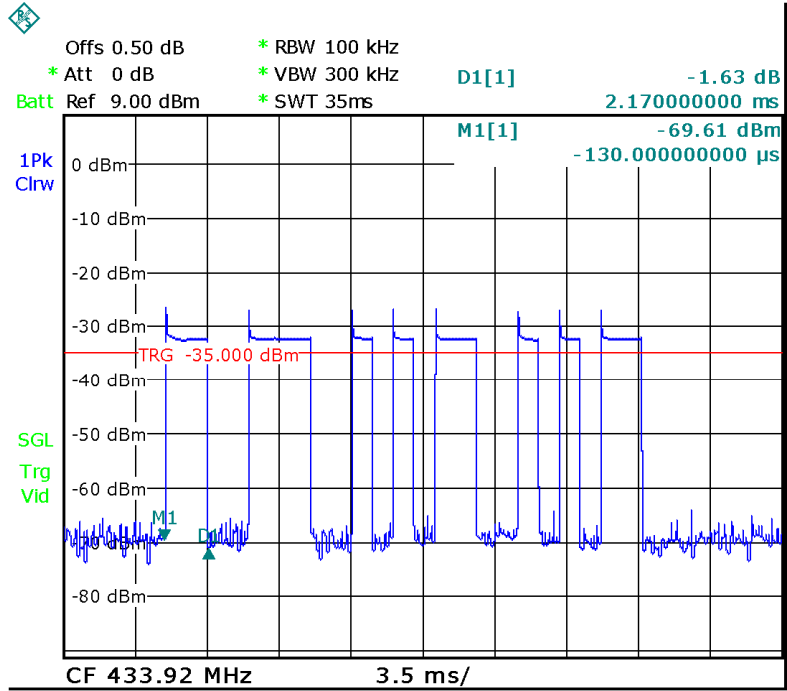
Length of a complete pulse train:

Remark: FCC part 15.35(c) required that a complete pulse train is more than 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.



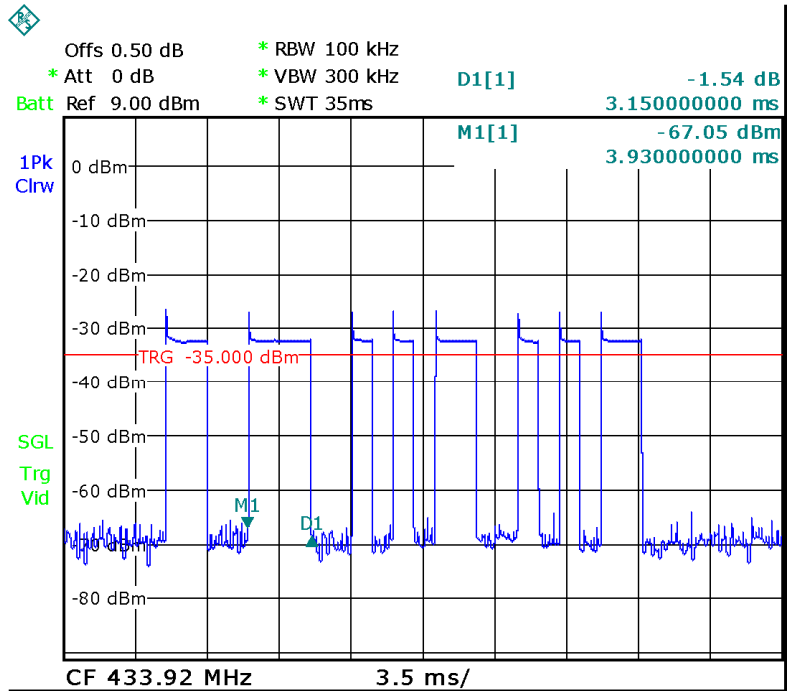
Date: 18.NOV.2013 13:44:13

Pulse 1

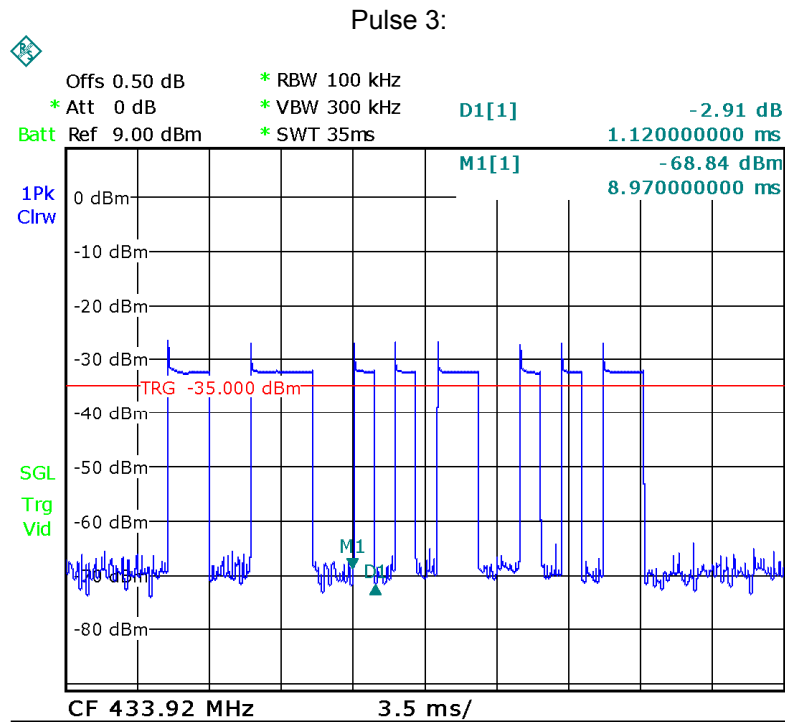


Date: 18.NOV.2013 13:46:57

Pulse 2:

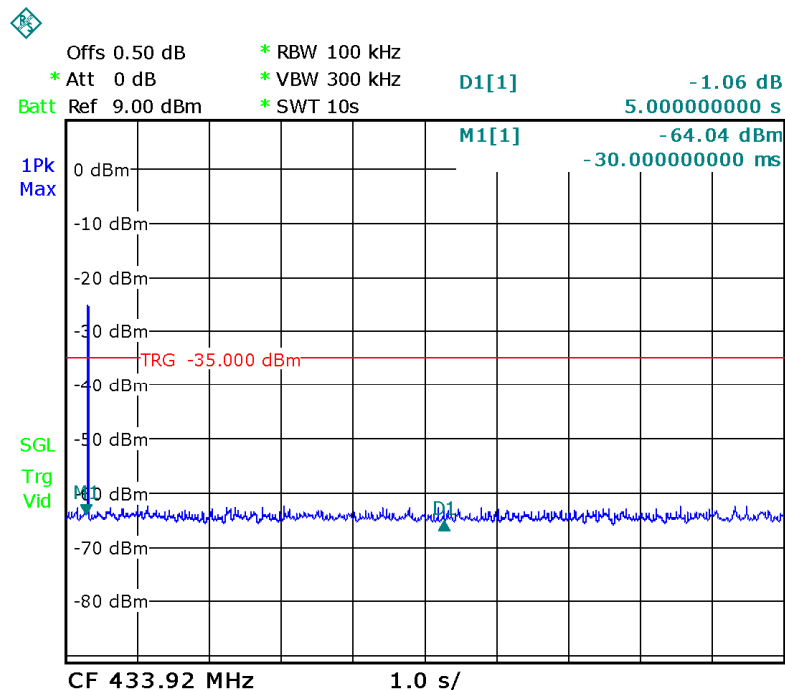


Date: 18.NOV.2013 13:47:34



Date: 18.NOV.2013 13:48:29

Refer to the plot (as below), We find a manually operated transmitter shall employ a switch that will automatically deactivate the transmitter immediately, within not more than 5 seconds of being released.



Date: 19.NOV.2013 08:41:51

9 20dB Bandwidth

Test Requirement: FCC Part15 C
 Test Method: FCC Part15 Paragraph 15.231(c)
 Limit: 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. For devices operating above 900 MHz, the emission shall be no wider than 0.5% of the center frequency.

9.1 Test Procedure

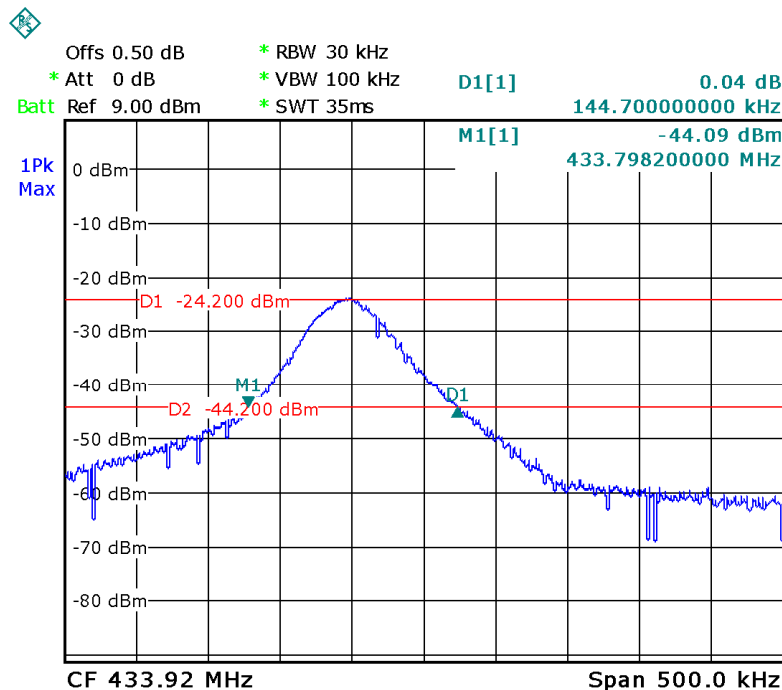
1. The transmitter output (antenna port) was connected to the spectrum analyzer.EUT and its simulators are placed on a table, let EUT working in test mode,then test it.
2. The bandwidth of the fundamental frequency was measure by spectrum analyser with 100KHz RBW and 100KHz VBW.The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power 20dB.

9.2 Test Result

Frequency (MHz)	Bandwidth Emission (KHz)	Limit (KHz)	Result
433.92	144.70	1084.8	Pass

Limit=Center Frequency*0.25%

Test Plot



Date: 18.NOV.2013 13:54:25

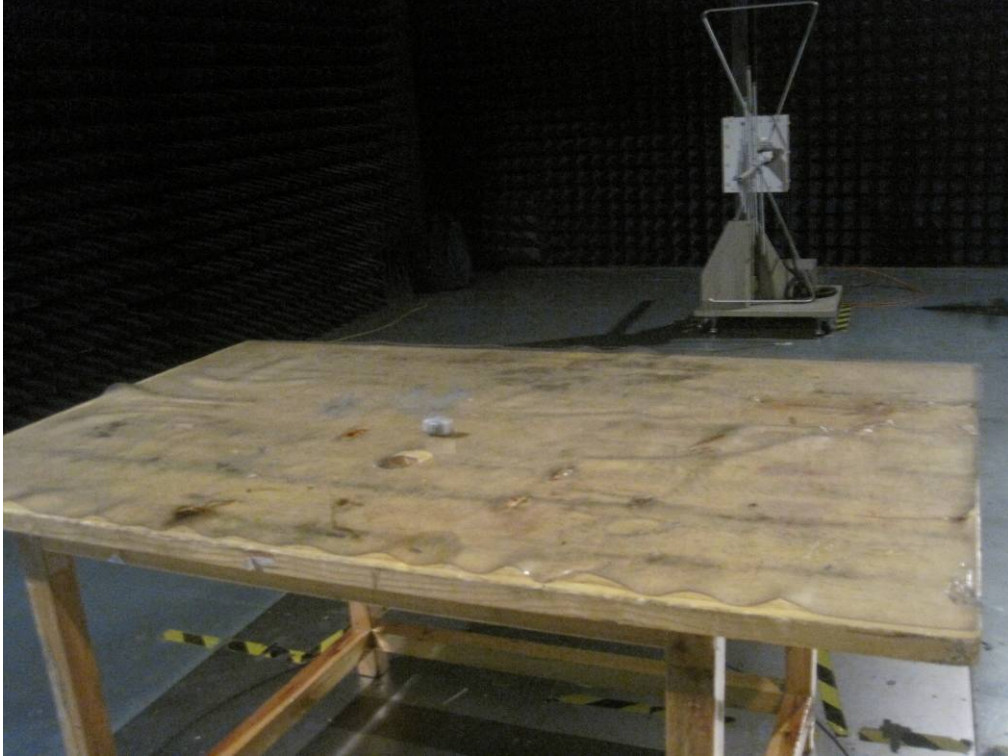
10 Antenna Requirement

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 to the intentional radiator shall be considered sufficient to comply with the provisions of this section. This product use a permanent PCB printed antenna, fulfill the requirement of this section

11 Photographs of Testing

11.1 Radiation Emission Test View

From 30MHz to 1GHz



Above 1GHz

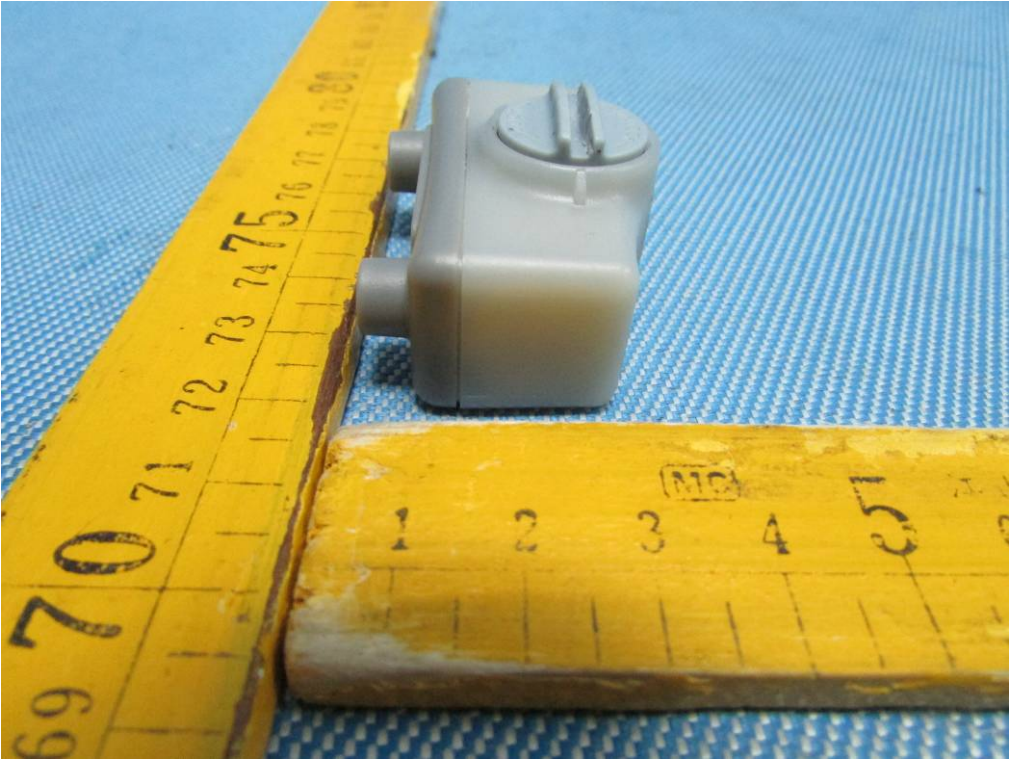


12 Photographs - Constructional Details

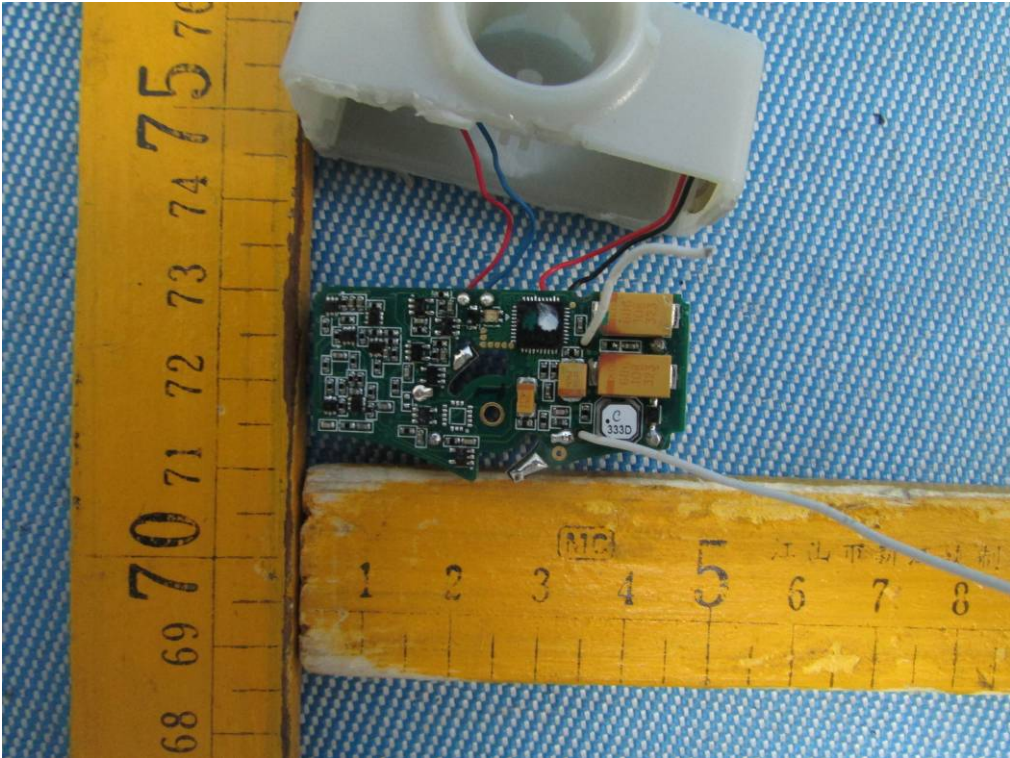
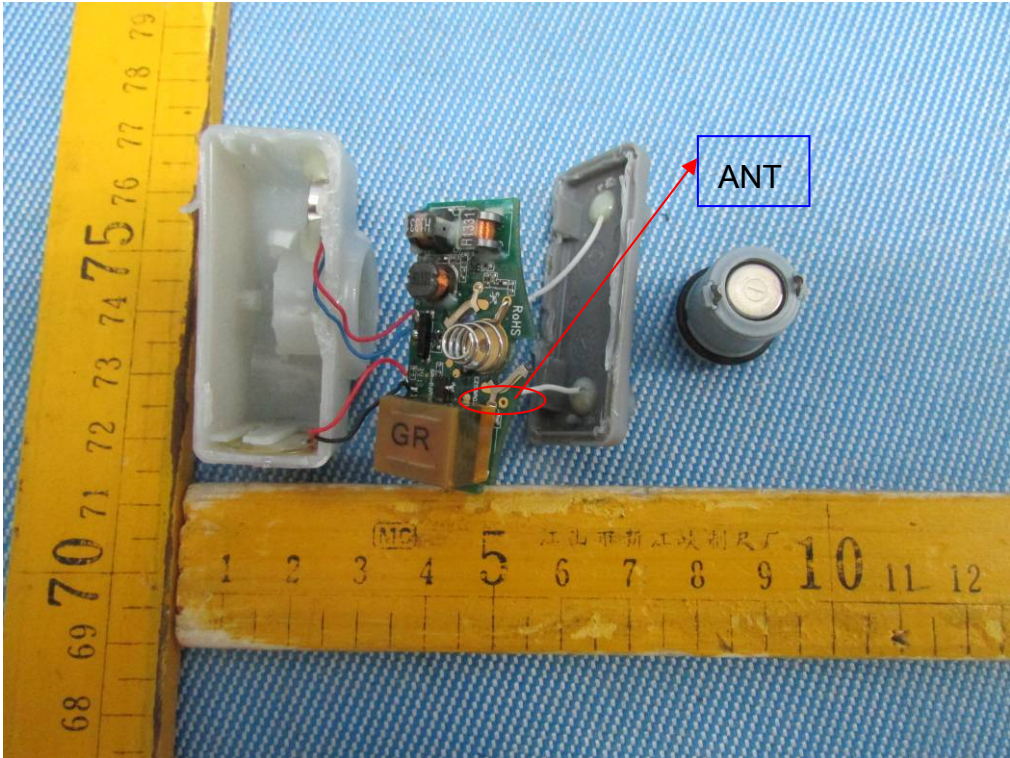
12.1 EUT - Appearance View

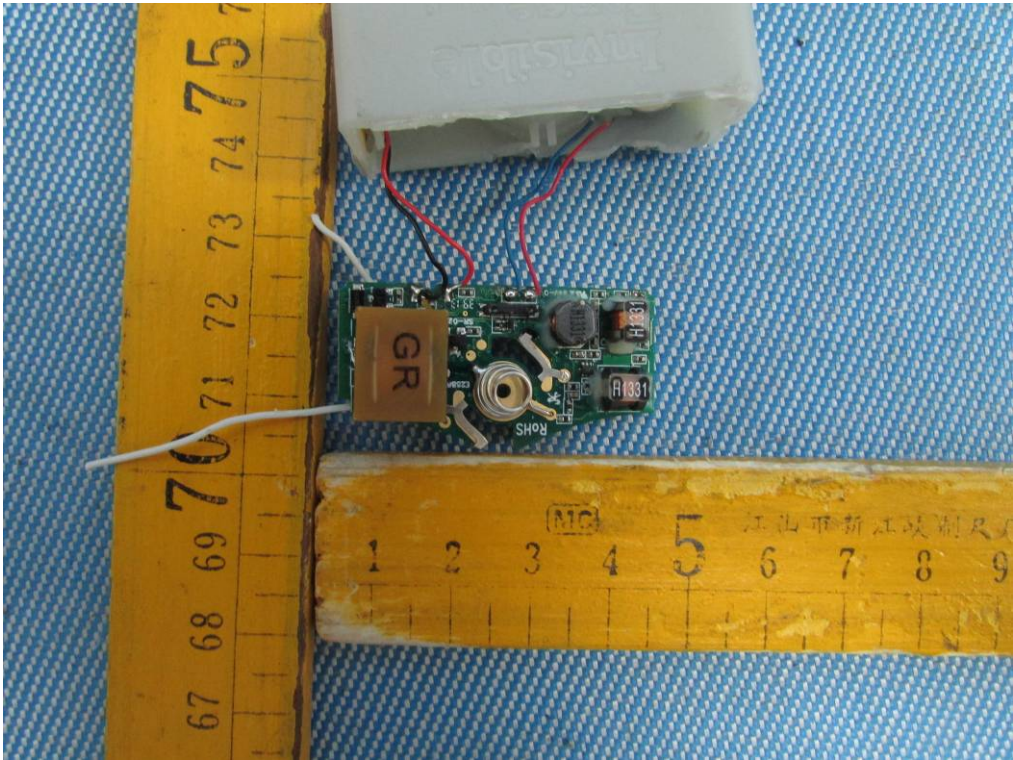






12.2 EUT- Internal View





12.3 Battery View



=End of test report=