

TEST REPORT

Reference No. : WTS13S1210015E
FCC ID : KE3-3002788
Applicant..... : Radio Systems Corporation
Address..... : 10427 Petsafe Way Knoxville,TN 37932 USA
Manufacturer : The same as above.
Address..... : The same as above.
Product Name..... : Auto Trainer E Collar
Model No. : RFA-518
Standards..... : FCC CFR47 Part 15 Section 15.231: 2012
Date of Receipt sample : Dec. 19, 2013
Date of Test..... : Dec. 20~23, 2013
Date of Issue..... : Dec.30, 2013
Test Result..... : **Pass ***

Remarks:

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.

Prepared By:

Waltek Services (Shenzhen) Co., Ltd.

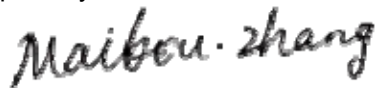
Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

Testing location: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

Tel :+86-755-83551033

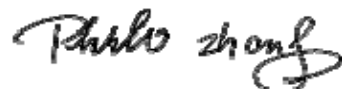
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Compiled by:



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

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4 General Information

4.1 General Description of E.U.T.

Product Name	: Auto Trainer E Collar
Model No.	: RFA-518
Type of Modulation	: FSK
Frequency Range	: 433.92 MHz
Oscillator	: 13.56MHz
Antenna installation	: PCB Printed Antenna

4.2 Details of E.U.T.

Technical Data	: DC 3V*2 Powered by Battery
Battery	: Manufacturer:Panasonic M/N:CR 2032

4.3 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A-1**

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-1, 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.

5 Equipment Used during Test

5.1 Equipments List

3m Semi-anechoic Chamber for Radiation						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.18,2013	Sep.17,2014
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.18,2013	Sep.17,2014
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.20,2013	Apr.19,2014
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.18,2013	Sep.17,2014
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.20,2013	Apr.19,2014
6	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Apr.07,2013	Apr.06,2014
7	Coaxial Cable (above 1GHz)	Top	25MHz-18GHz	EW02014-7	Apr.20,2013	Apr.19,2014

5.2 Measurement Uncertainty

Parameter	Uncertainty
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:	13.56MHz to 5GHz
Measurement Distance:	3m
Test Result:	PASS

7.1 EUT Operation:

Operating Environment:

Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	101.0 kPa

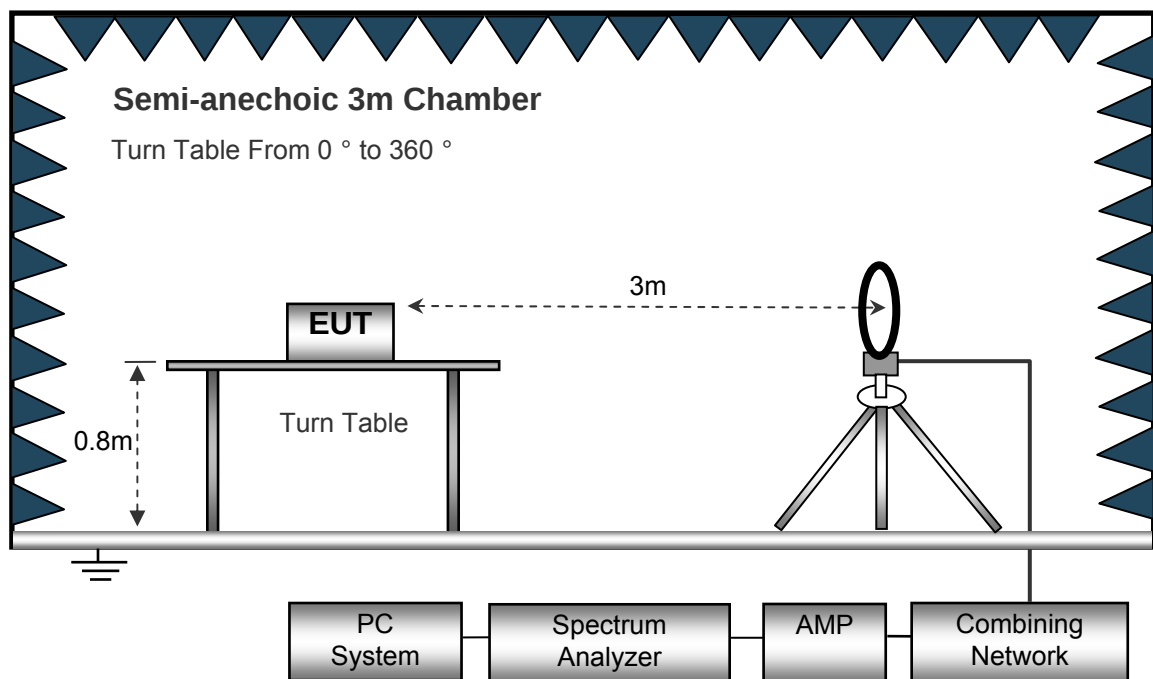
Operation Mode:

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

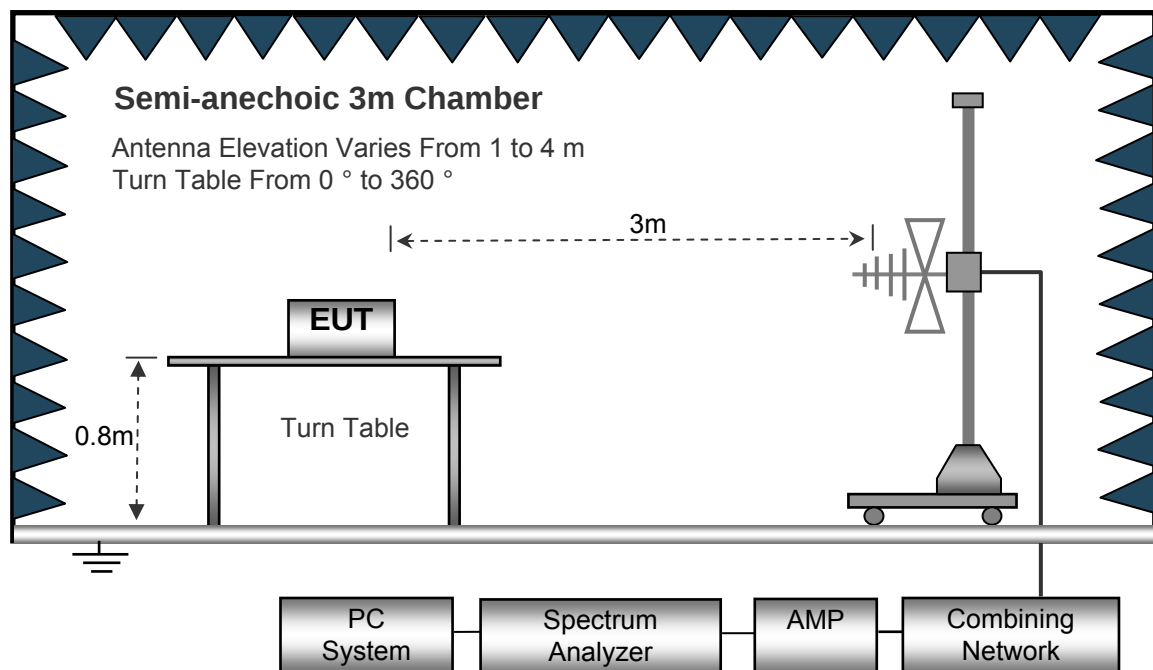
7.2 Test Setup

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

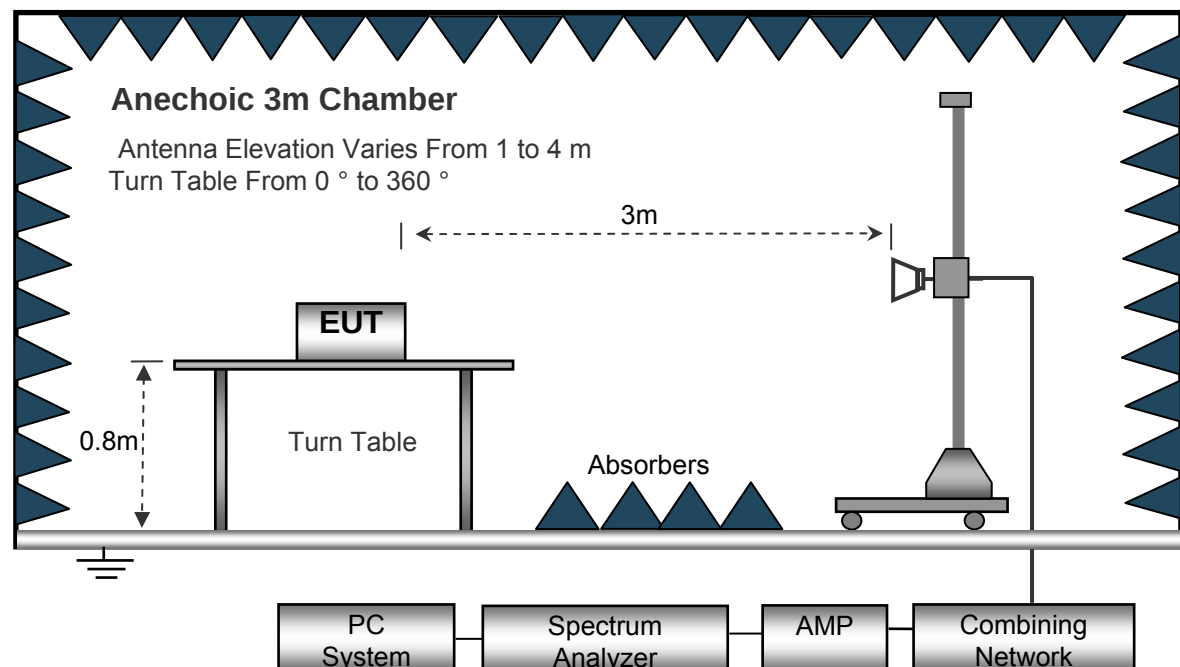
The diagram below shows the test setup that is utilized to make the measurements for emission from 13.56 MHz to 30 MHz Emissions.



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 Part15 Rules, the system was tested from 13.56MHz to 5GHz.

Below 30MHz

Sweep SpeedAuto
 IF Bandwidth.....10kHz
 Video Bandwidth.....10kHz
 Resolution Bandwidth.....10kHz

30MHz ~ 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth.....100kHz
 Video Bandwidth.....300kHz

Above 1GHz

Sweep SpeedAuto
 DetectorPK
 Resolution Bandwidth.....1MHz
 Video Bandwidth.....3MHz

7.4 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.

7.5 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:

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

7.6 Summary of Test Results

Test Frequency : Below 30MHz

The measurements were more than 20 dB below the limit and not reported.

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)	(dBμV)	(PK/QP/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
433.92	61.87	PK	319	2.0	H	19.68	81.55	100.82	19.27
433.92	65.32	PK	272	1.1	V	19.68	85.00	100.82	15.82
867.84	25.34	PK	112	1.6	H	29.71	55.05	80.82	25.77
867.84	24.26	PK	154	1.3	V	29.71	53.97	80.82	26.85
1301.76	53.24	PK	176	1.2	H	-15.75	37.49	74.00	36.51
1301.76	51.24	PK	68	1.6	V	-15.75	35.49	74.00	38.51
3204.12	50.98	PK	308	1.6	H	-9.89	41.09	74.00	32.91
3204.12	49.86	PK	58	1.1	V	-9.89	39.97	74.00	34.03

AV = Peak +20Log₁₀(duty cycle) =PK+(-6.26) [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)	(dBμV/m)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
433.92	81.55	319	2.0	H	-6.26	75.29	80.82	-5.53
433.92	85.00	272	1.1	V	-6.26	78.74	80.82	-2.08
867.84	55.05	112	1.6	H	-6.26	48.79	60.82	-12.03
867.84	53.97	154	1.3	V	-6.26	47.71	60.82	-13.11
1301.76	37.47	176	1.2	H	-6.26	31.21	54.00	-22.75
1301.76	35.49	68	1.6	V	-6.26	29.23	54.00	-24.77
3204.12	41.09	308	1.6	H	-6.26	34.83	54.00	-19.17
3204.12	39.97	58	1.1	V	-6.26	33.71	54.00	-20.29

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 * %

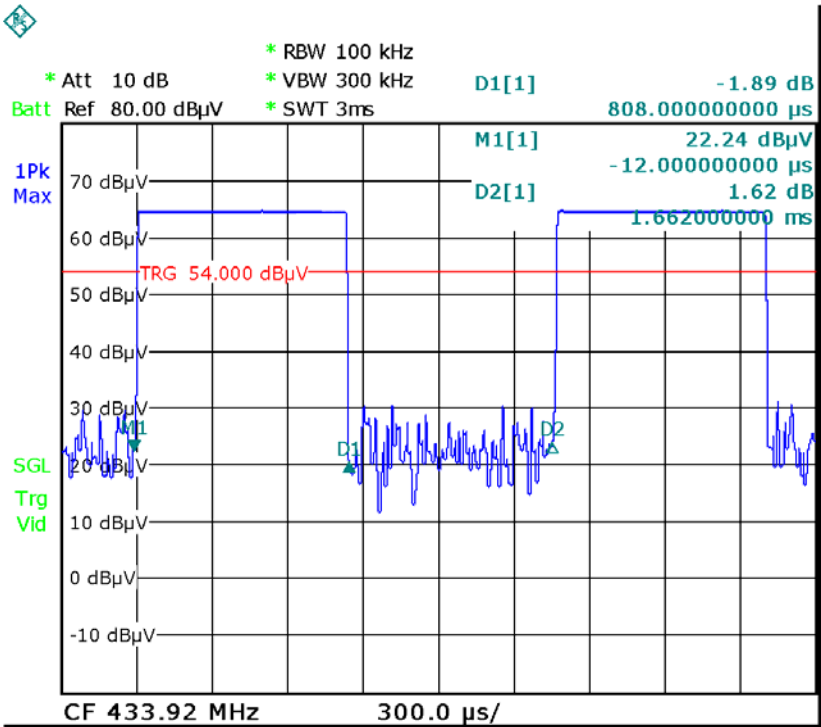
Duty Cycle Correction Factor(dB)=20 * Log₁₀(Duty Cycle(%))

Total On interval in a complete pulse train(ms)	0.808
Length of a complete pulse train(ms)	1.662
Duty Cycle(%)	48.62
Duty Cycle Correction Factor(dB)	-6.26

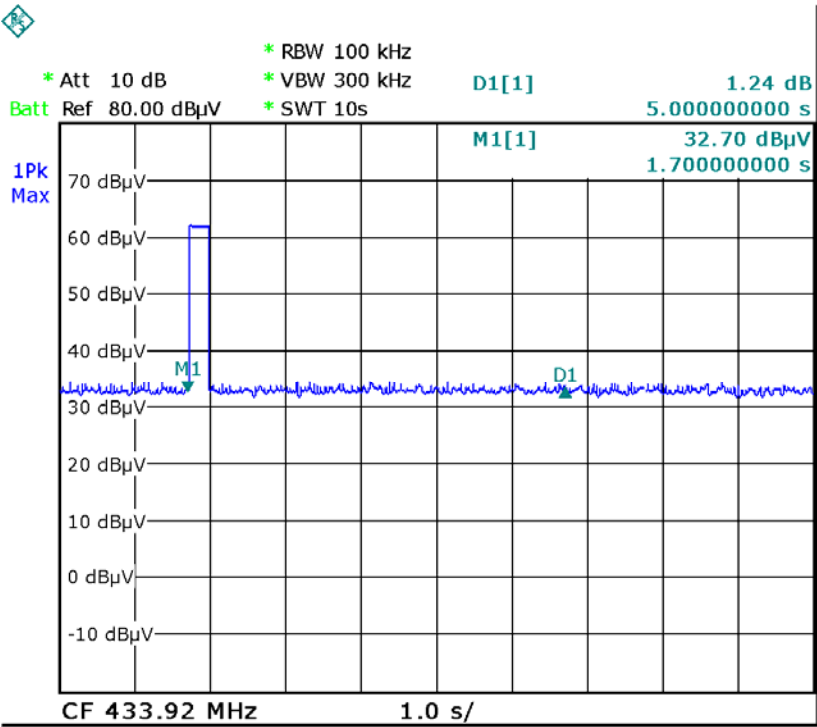
Refer to the duty cycle plot (as below), This device meets the FCC requirement.

Length of a complete pulse train:

Remark: FCC part15.35(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.



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.



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

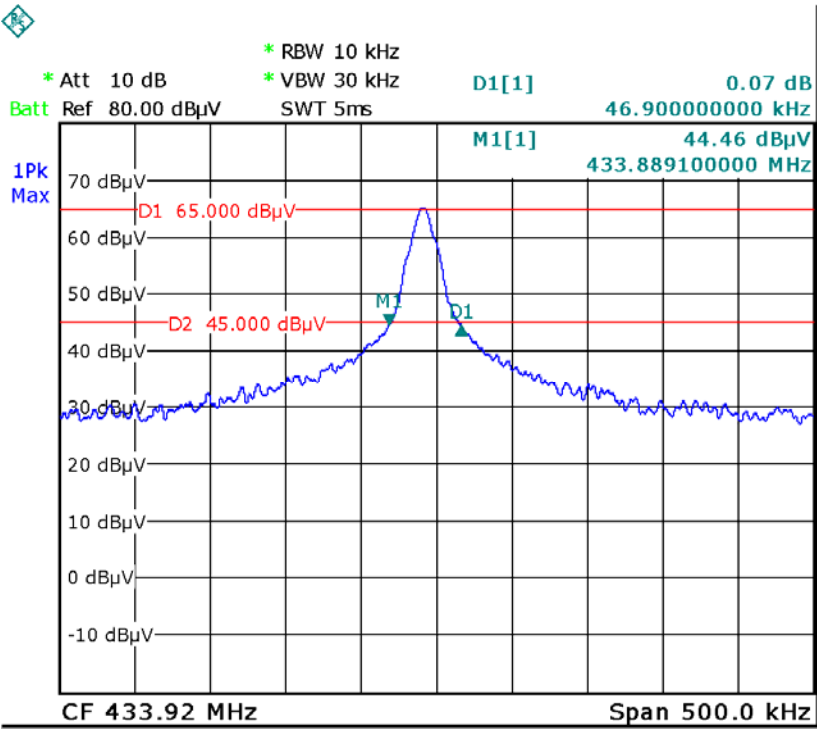
1. The transmitter output (antenna port) was connected to the spectrum analyzer.EUT and its simulators are placed on a table, let EUT working in test mode,then test it.
2. The bandwidth of the fundamental frequency was measure by spectrum analyser with 10kHz RBW and 30kHz VBW.The 20dB bandwidth is defined 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	46.90	1084.80	Pass

Limit=Center Frequency*0.25%

Test Plot



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

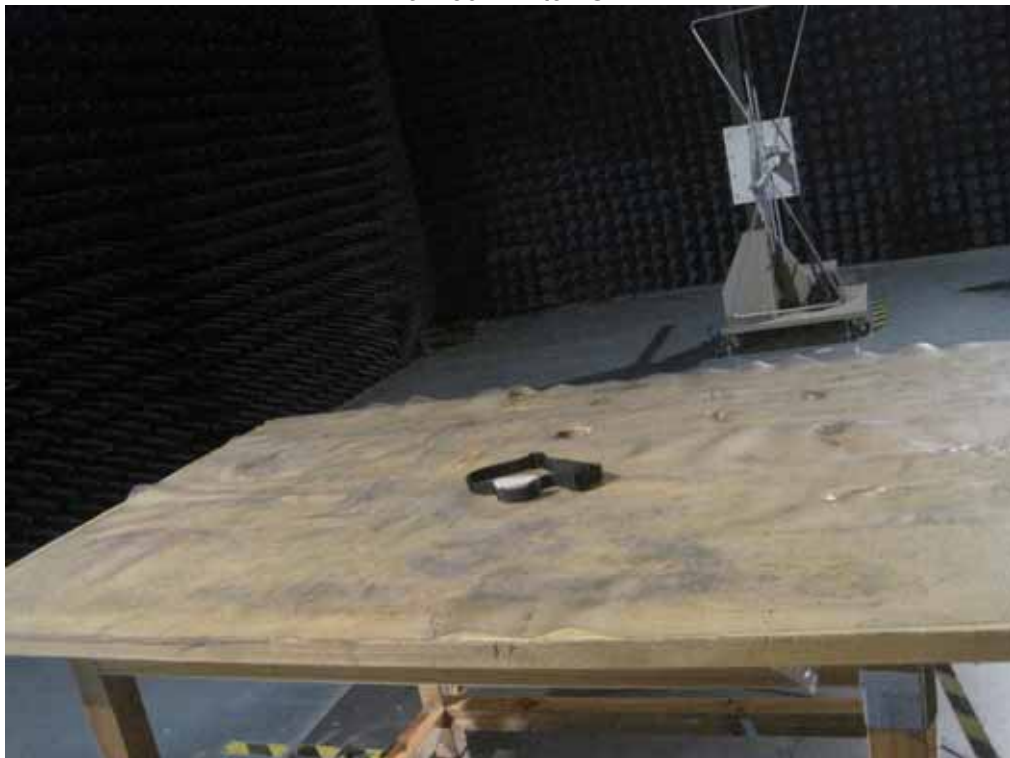
11 Photographs of Testing

11.1 Radiation Emission Test Setup

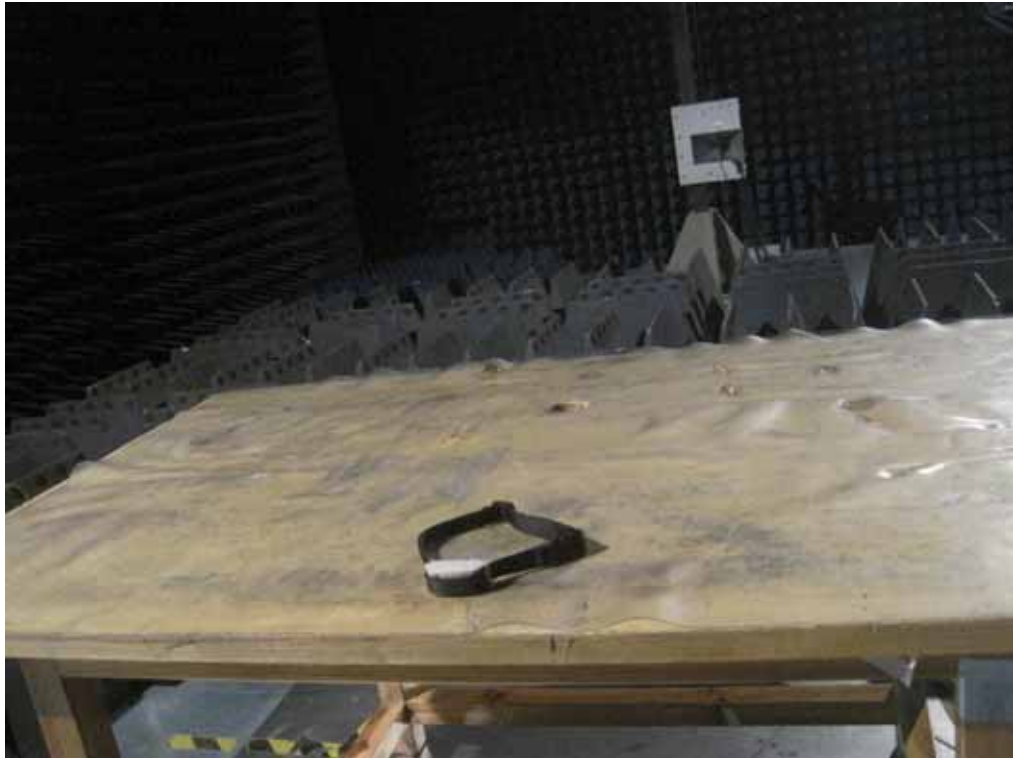
From 9kHz-30MHz



From 30MHz to 1GHz



Above 1GHz



12 Photographs - Constructional Details

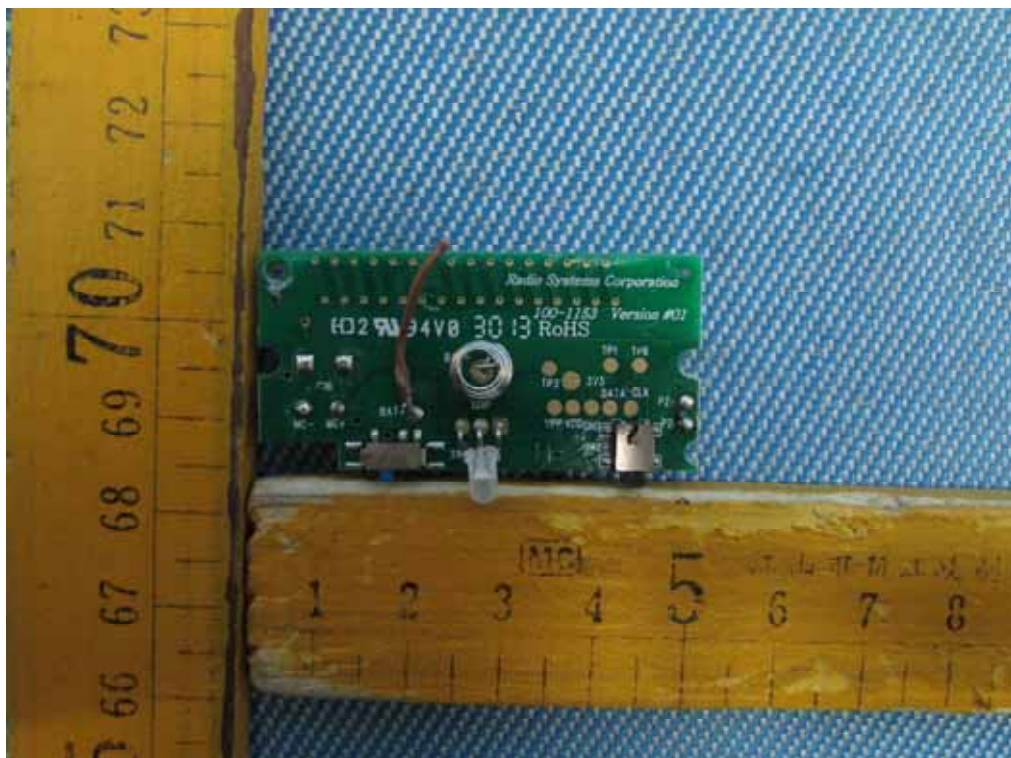
12.1 EUT - Appearance View

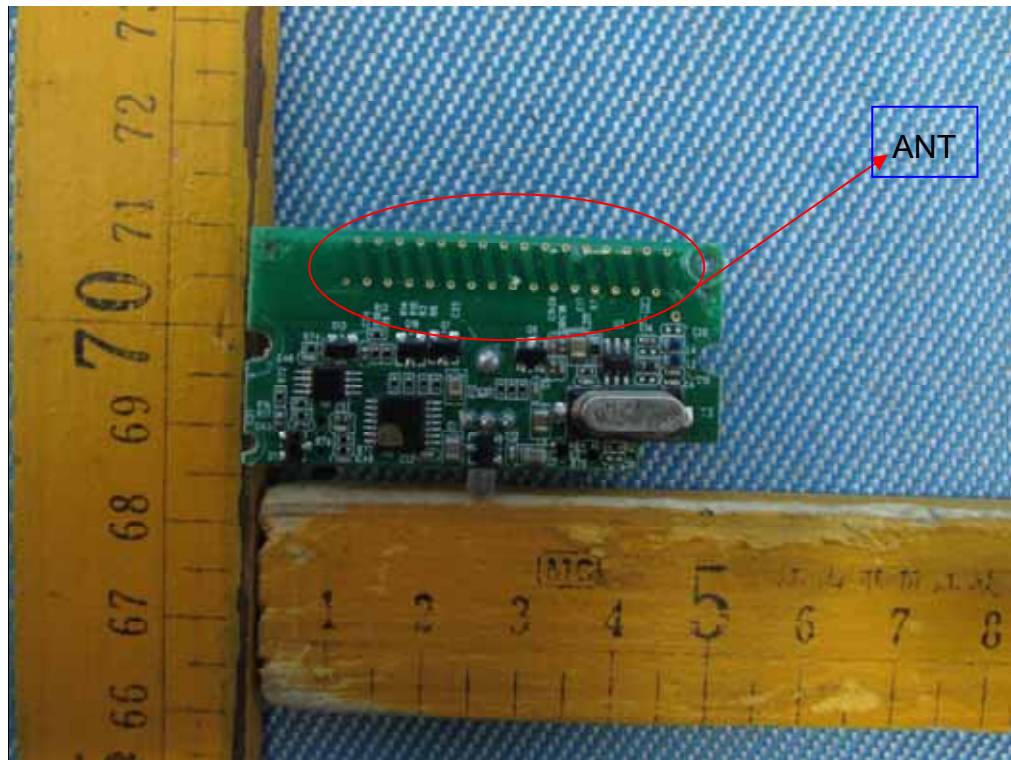






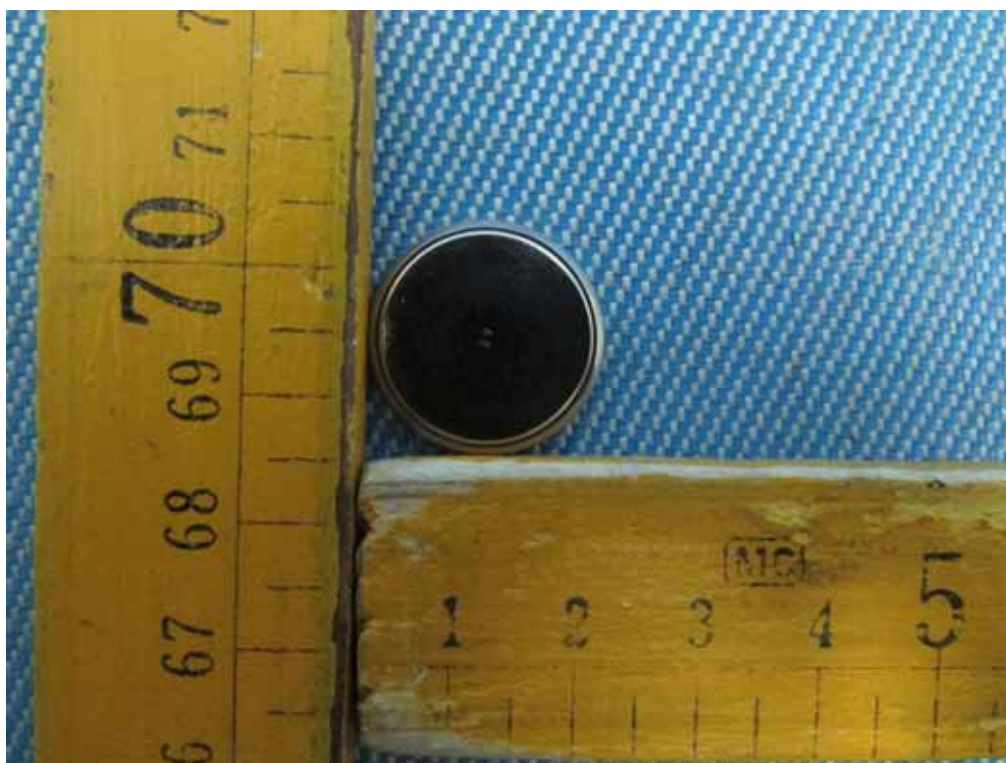
12.2 EUT- Internal View





12.3 Battery View





=====End of Test Report=====