

**FCC TEST REPORT**

**FCC ID** : KE3-3002563  
**Applicant** : Radio Systems Corporation  
**Address** : 10427 PetSafe Way, Knoxville, TN 37932, USA

**Equipment Under Test (EUT) :**

Product Name : Micro Shields  
 Model No. : RAC00-13547

**Standards** : FCC CFR47 Part 15 Section 15.209:2009

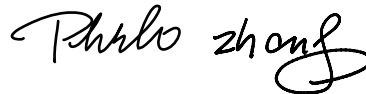
**Date of Test** : June 1 ~ 7, 2012

**Date of Issue** : June 7, 2012

**Tested By** : Zero Zhou / Engineer



**Reviewed By** : Philo zhong / Manager



<b>Test Result</b>	<b>: PASS</b>
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**Prepared By:****Waltek Services (Shenzhen) Co., Ltd.**

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- ✧ The sample detailed above has been tested to the requirements of Council Directives ANSI C63.4:2003. The test results have been reviewed against the Directives above and found to meet their essential requirements.

**2 Test Summary**

<b>Test Items</b>	<b>Test Requirement</b>	<b>Test Method</b>	<b>Result</b>
Radiated Emissions (9kHz ~ 1GHz)	Part 15.209	ANSI C63.4: 2003	PASS
Conducted Emissions (150kHz ~ 30MHz)	Part 15.207	ANSI C63.4:2003	PASS

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## 4 General Information

### 4.1 Client Information

**Applicant** : Radio Systems Corporation  
**Address of Applicant** : 10427 PetSafe Way,Knoxville, TN 37932, USA

**Manufacturer** : Radio Systems Corporation  
**Address of Manufacturer** : 10427 PetSafe Way,Knoxville, TN 37932, USA

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

**Product Name** : Micro Shields  
**Model No.** : RAC00-13547  
**Operation Frequency** : 7.5kHz & 10.5kHz

### 4.3 Details of E.U.T.

**Technical Data:** : DC 5.0V 0.5A or Lithium-ion battery DC3.7V,420mAh

### 4.4 Description of Support Units

The EUT has been tested as an independent unit.

### 4.5 Standards Applicable for Testing

The customer requested FCC tests for a Micro Shields. The rules used were FCC CFR47 Part 15 Section 15.207 and Section 15.209.

#### 4.6 Test Facility

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

- **IC – Registration No.: IC7760A**

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, August 3, 2010.

- **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.

#### 4.7 Test Location

All the tests were performed at:

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

#### 4.8 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)
Conducted Spurious Emissions test	$\pm 2.2$ dB

**5 Equipment Used during Test**

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Uncertainty
EMC Analyzer	Agilent/ E7405A	MY451149 43	W2008001	9k-26.5GHz	Aug. 2, 2011	Aug. 1, 2012	±1dB
Trilog Broadband Antenne	SCHWARZB ECK MESS- ELEKTROM / VULB9163	336	W2008002	30-3000 MHz	Aug. 2, 2011	Aug. 1, 2012	±1dB
Broad-band Horn Antenna	SCHWARZB ECK MESS- ELEKTROM / BBHA 9120D(1201)	667	W2008003	1-18GHz	Aug. 2, 2011	Aug. 1, 2012	f < 10 GHz : ±1dB 10GHz < f < 18 GHz : ±1.5dB
Broadband Preamplifier	SCHWARZB ECK MESS- ELEKTROM / BBV 9718	9718-148	W2008004	0.5-18GHz	Aug. 2, 2011	Aug. 1, 2012	±1.2dB
10m Coaxial Cable with N-male Connectors	SCHWARZB ECK MESS- ELEKTROM / AK 9515 H	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-
10m 50 Ohm Coaxial Cable	SCHWARZB ECK MESS- ELEKTROM / AK 9513	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-
Positioning Controller	C&C LAB/ CC-C-IF	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-
Color Monitor	SUNSP0/ SP-14C	-	-	-	Aug. 2, 2011	Aug. 1, 2012	-
Test Receiver	ROHDE&SC HWARZ/ ESPI	101155	W2005001	9k-3GHz	Aug. 2, 2011	Aug. 1, 2012	±1dB
Two-Line V-Network	ROHDE&SC HWARZ/ ENV216	100115	W2005002	50Ω/50μH	Aug. 2, 2011	Aug. 1, 2012	±10%
RF Generator	TESEQ GmbH/ NSG4070	25781	W2008008	Fraq-range : 9K-1GHz RF voltage : - 60 dBm- +10dBm	Aug. 2, 2011	Aug. 1, 2012	Power_freq distinguish0. 1Hz RFelectricity distinguish 0.1B
Active Loop Antenna	Beijing Dazhi / ZN30900A	-	-	-	Aug. 2, 2011	Aug. 1, 2012	±1dB

## 6 Conducted Emissions

Test Requirement:	FCC CFR47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Test Result:	PASS
Frequency Range:	150kHz to 30MHz
Limit:	66-56 dB $\mu$ V between 0.15MHz & 0.5MHz 56 dB $\mu$ V between 0.5MHz & 5MHz 60 dB $\mu$ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit

### 6.1 E.U.T. Operation

#### Operating Environment:

Temperature:	25.5 °C
Humidity:	51 % RH
Atmospheric Pressure:	1012 mbar

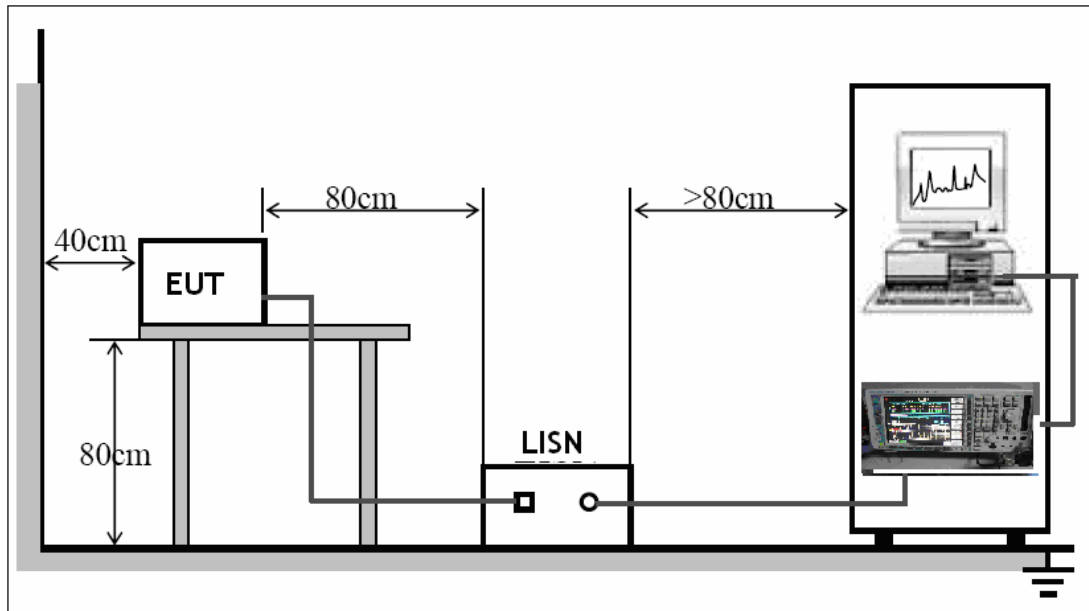
#### EUT Operation:

The EUT was tested according to ANSI C63.4:2003. The frequency spectrum from 150kHz to 30MHz was investigated.

The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

## 6.2 EUT Setup

The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003, The specification used in this report was the FCC Part15 Section 15.207 limits.



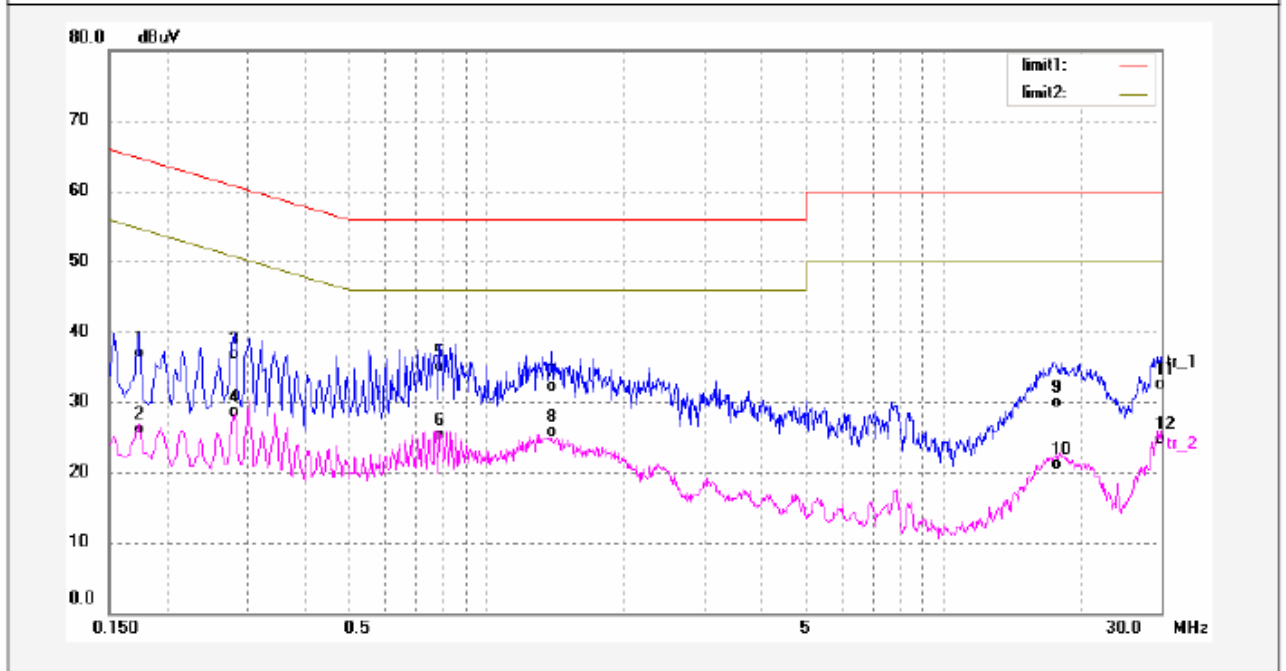
The EUT was placed on the test table in shielding room

## 6.3 Conducted Emission Test Result



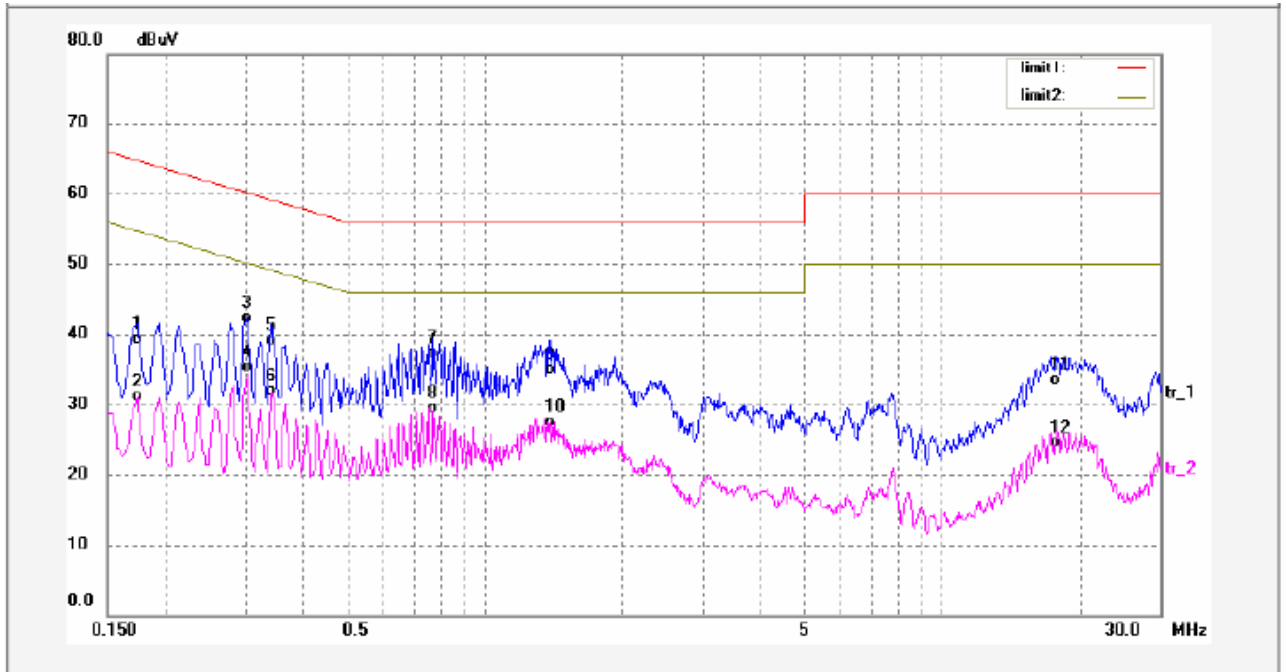
Mode:charging and normal working(the worst case)

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1740	25.76	10.28	36.04	64.76	-28.72	QP	
2	0.1740	15.02	10.28	25.30	54.76	-29.46	AVG	
3	0.2819	25.63	10.32	35.95	60.76	-24.81	QP	
4	0.2819	17.42	10.32	27.74	50.76	-23.02	AVG	
5	0.7940	23.58	10.45	34.03	56.00	-21.97	QP	
6	0.7940	14.10	10.45	24.55	46.00	-21.45	AVG	
7	1.3980	20.83	10.55	31.38	56.00	-24.62	QP	
8	1.3980	14.28	10.55	24.83	46.00	-21.17	AVG	
9	17.5620	17.90	11.14	29.04	60.00	-30.96	QP	
10	17.5620	9.13	11.14	20.27	50.00	-29.73	AVG	
11	29.4820	20.45	11.29	31.74	60.00	-28.26	QP	
12	29.4820	12.68	11.29	23.97	50.00	-26.03	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1740	28.27	10.28	38.55	64.76	-26.21	QP	
2	0.1740	19.97	10.28	30.25	54.76	-24.51	AVG	
3	0.3020	31.08	10.33	41.41	60.19	-18.78	QP	
4	0.3020	24.21	10.33	34.54	50.19	-15.65	AVG	
5	0.3420	28.05	10.34	38.39	59.15	-20.76	QP	
6	0.3420	20.68	10.34	31.02	49.15	-18.13	AVG	
7	0.7740	26.05	10.45	36.50	56.00	-19.50	QP	
8	0.7740	18.18	10.45	28.63	46.00	-17.37	AVG	
9	1.3820	23.65	10.55	34.20	56.00	-21.80	QP	
10	1.3820	16.17	10.55	26.72	46.00	-19.28	AVG	
11	17.8460	21.64	11.14	32.78	60.00	-27.22	QP	
12	17.8460	12.56	11.14	23.70	50.00	-26.30	AVG	

## 7 Radiated Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209  
 Test Method: ANSI C63.4:2003  
 Test Result: PASS  
 Frequency Range: 9kHz to 1GHz  
 Measurement Distance: 3m  
 Limit:

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)	$20\log^{(2400/F(\text{kHz}))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	100 * 24000/F(kHz)	$20\log^{(24000/F(\text{kHz}))} + 40$
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	$20\log^{(500)}$

Note:

- The tighter limit applies at the band edges.  
 For example: F.S limit at 88MHz is 100uV/m
- If measurement is made at 3m distance, then F.S Limit at 3m distance is adjusted by using the formula of  $L_{d1} = L_{d2} * (d2/d1)^2$ .  
 For example:  
 F.S Limit at 30m(d2) distance is 30uV/m( $L_{d2}$ ), then F.S Limit at 3m(d1) distance is  
 $L_{d1} = 30\text{uV/m} * (30/3)^2 = 100 * 30\text{uV/m}$

### EUT Operation :

#### Operating Environment:

Temperature: 25.5 °C  
 Humidity: 51 % RH  
 Atmospheric Pressure: 1012 mbar

### EUT Operation:

The EUT was tested in continuously transmit mode.

**7.1 Measurement Uncertainty**

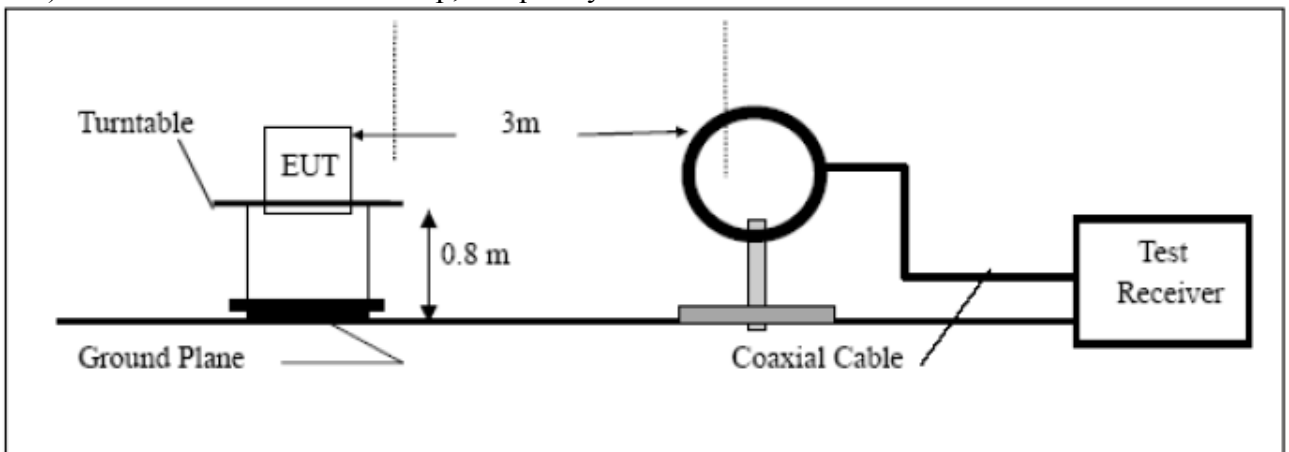
All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor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

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at Waltek EMC Lab is  $\pm 5.03\text{dB}$ .

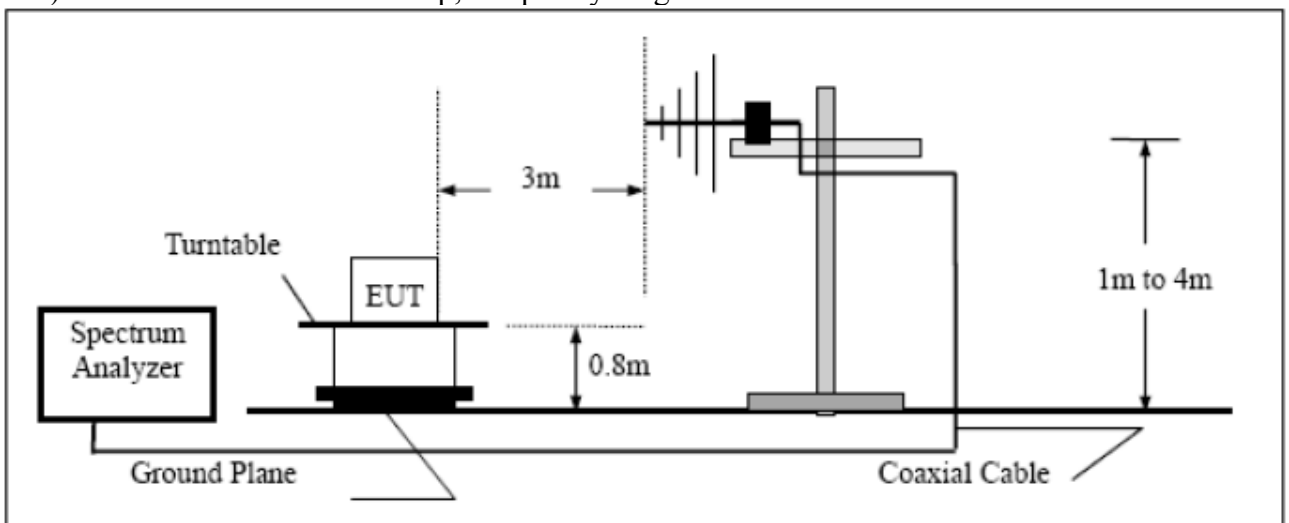
**7.2 EUT Setup**

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

a) Radiated Emission Test Setup, Frequency Below 30MHz



b) Radiated Emission Test Setup, Frequency range 30MHz ~ 1000MHz



### 7.3 Spectrum Analyzer Setup

According to FCC Part15 Rules, the system was tested 9kHz to 1000MHz.

#### Below 30MHz

Start Frequency ..... 9 kHz  
 Stop Frequency ..... 30MHz  
 Sweep Speed ..... Auto  
 IF Bandwidth ..... 10 KHz  
 Video Bandwidth ..... 10KHz  
 Resolution Bandwidth ..... 10KHz

#### Above 30MHz

Start Frequency ..... 30MHz  
 Stop Frequency ..... 1000MHz  
 Sweep Speed ..... Auto  
 IF Bandwidth ..... 120 KHz  
 Video Bandwidth ..... 100KHz  
 Quasi-Peak Adapter Bandwidth ..... 120 KHz  
 Quasi-Peak Adapter Mode ..... Normal  
 Resolution Bandwidth ..... 120kHz

### 7.4 Test Procedure

#### a) Test Procedure (below 30MHz)

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.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. Repeat above procedures until the measurements for all frequencies are complete.
- 6, New battery used during test.

b) Test Procedure (above 30MHz)

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 performed in X(normal uses) axis positioning.
8. New battery used during test.

And all the modes was tested in the report. Only the worst case is shown in the report.

**7.5 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/m) 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:

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

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

**7.6 Summary of Test Results**

According to the data in this section, the EUT complied with the FCC Part15 C rules.

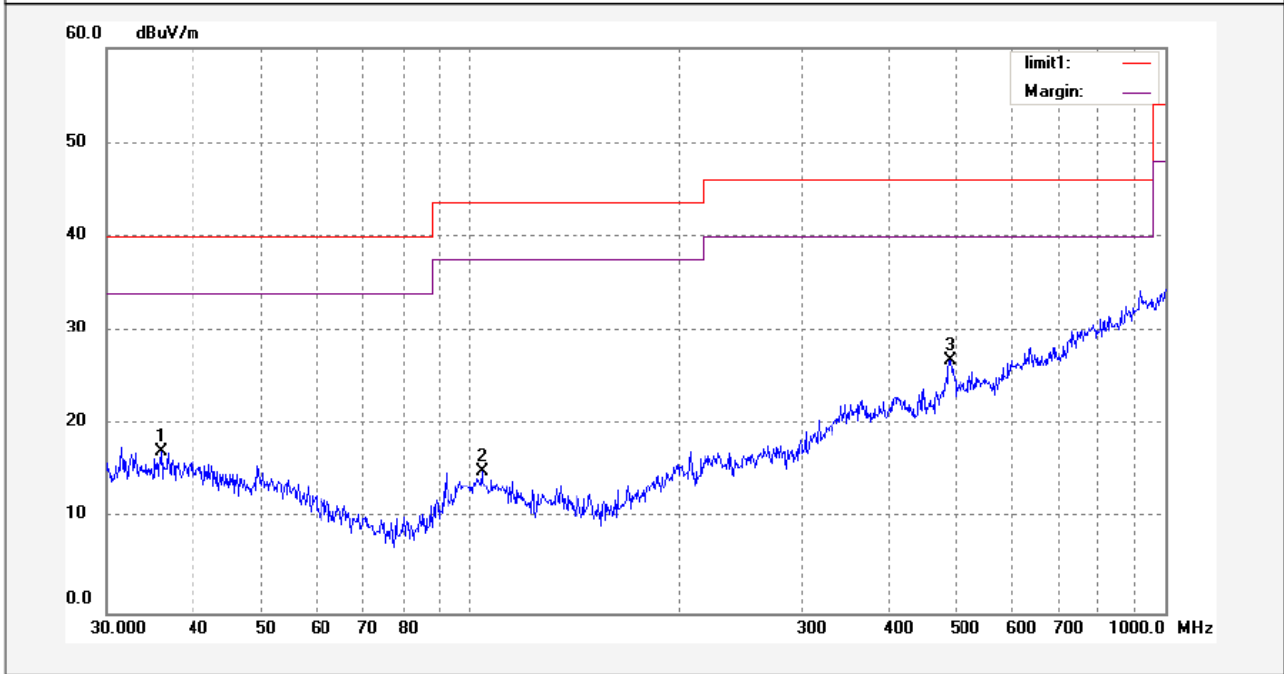
Test frequency below 30MHz

Frequency (kHz)	Detector	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Distance (m)
10.503	peak	96.22	127	-30.78	3
No suspicious signal found in other frequency that other emissions are more than 20dB below the limit,the data do not reprot .					

Mode: Battery power supply and normal working

Test frequency above 30MHz

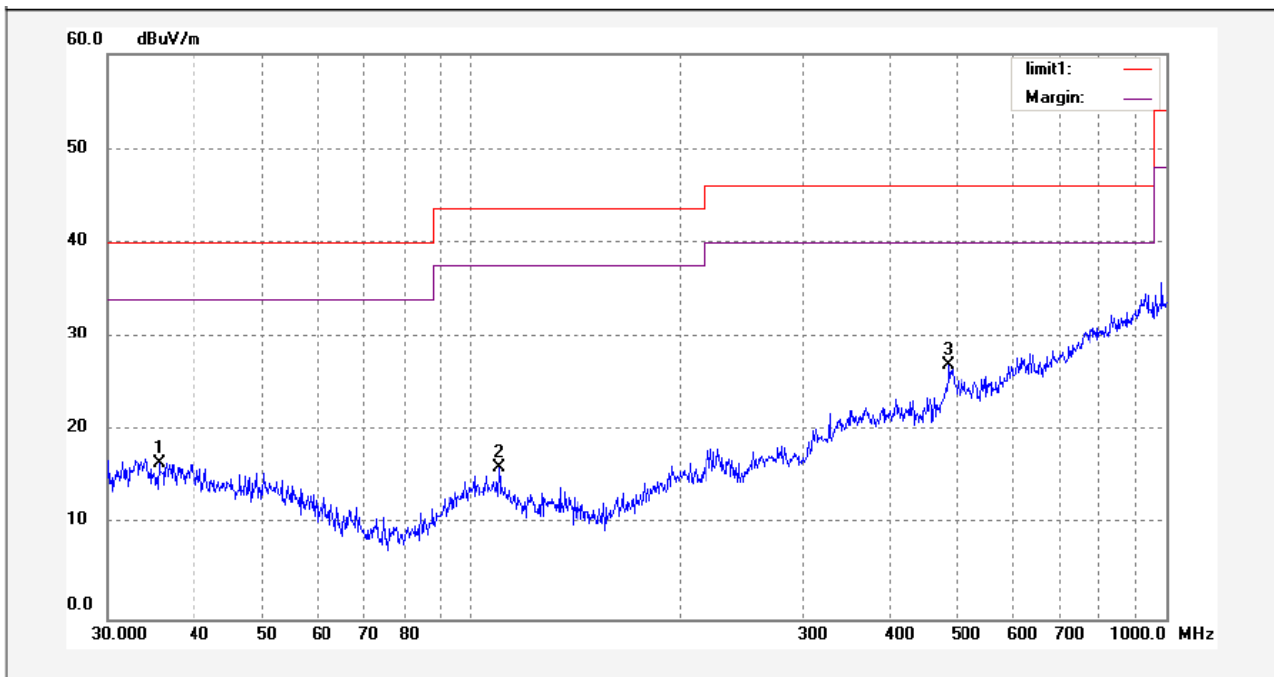
Antenna Polarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	35.8875	0.88	16.29	17.17	40.00	-22.83	peak	
2	104.0640	0.82	14.20	15.02	43.50	-28.48	peak	
3	490.0451	1.06	25.75	26.81	46.00	-19.19	peak	

Mode: Battery power supply and normal working

Antenna Polarization: Horizontal



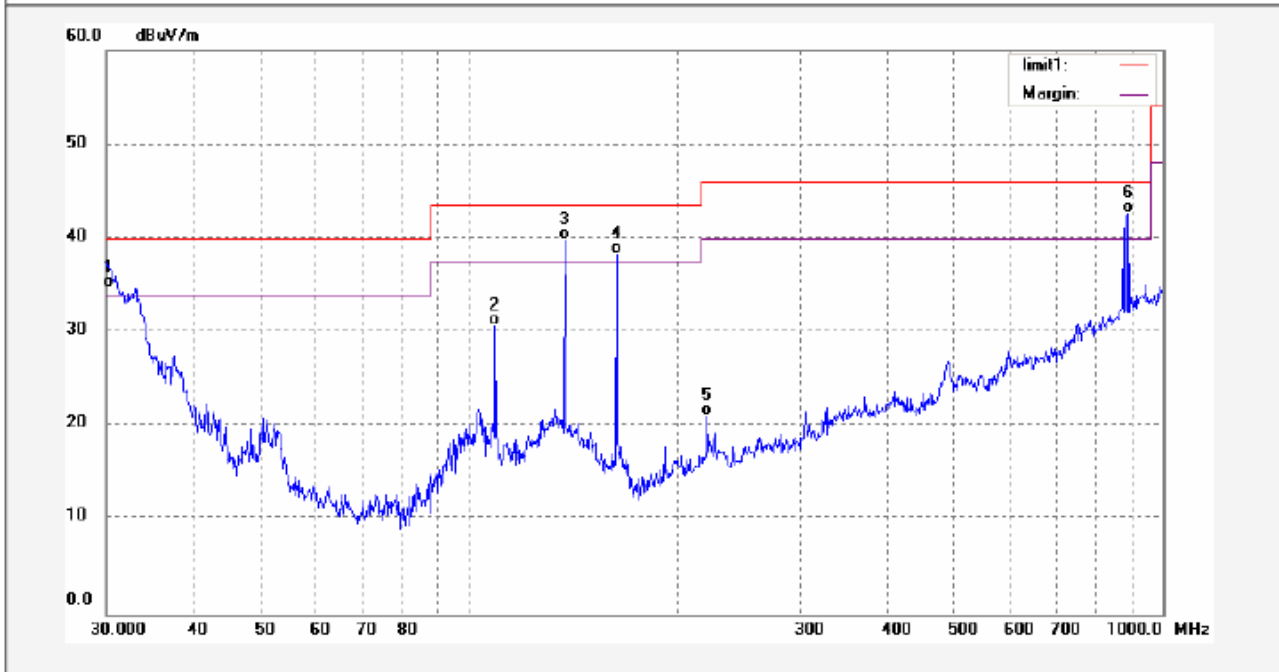
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	35.5112	0.29	16.34	16.63	40.00	-23.37	peak	
2	109.6957	2.29	13.78	16.07	43.50	-27.43	peak	
3	486.6136	2.26	24.72	26.98	46.00	-19.02	peak	



Mode:charging and normal working(the worst case)

Test frequency above 30MHz

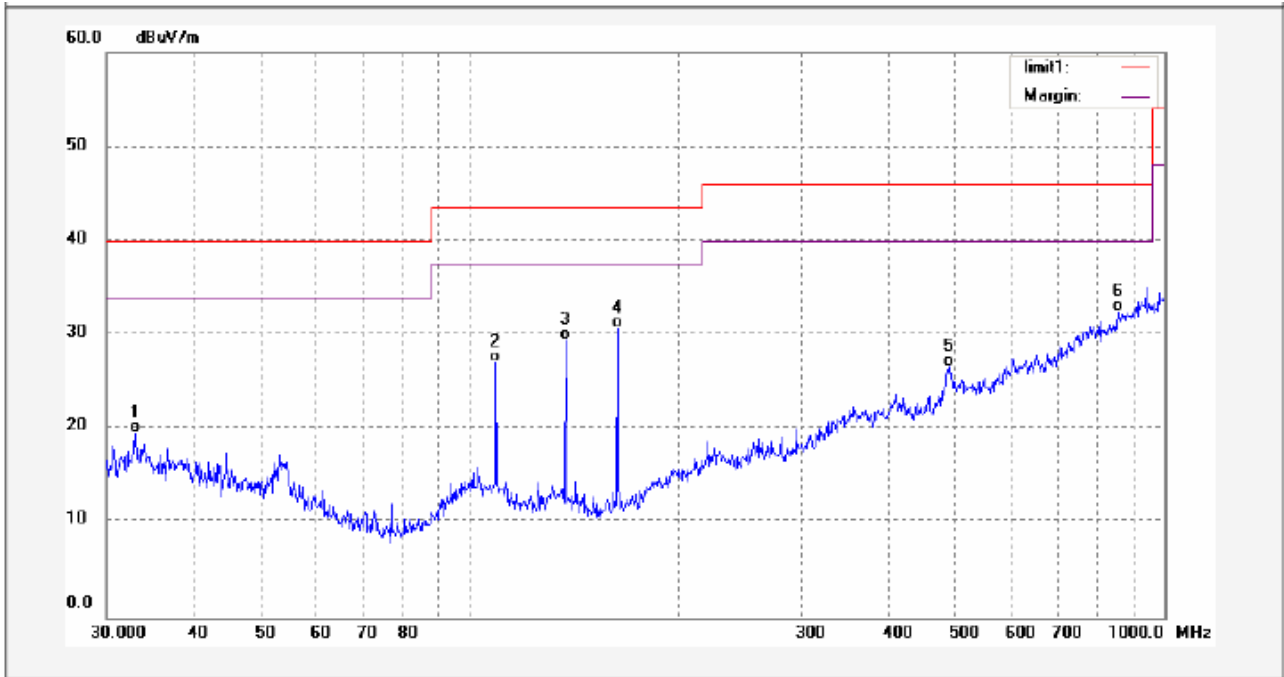
Antenna Porlarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	30.0000	18.55	16.15	34.70	40.00	-5.30	peak	
2	108.9276	16.77	13.85	30.62	43.50	-12.88	peak	
3	137.3565	27.95	11.90	39.85	43.50	-3.65	peak	
4	163.1623	26.65	11.71	38.36	43.50	-5.14	peak	
5	220.7241	4.94	16.17	21.11	46.00	-24.89	peak	
6	893.6557	11.96	30.78	42.74	46.00	-3.26	peak	

Mode:charging and normal working(the worst case)

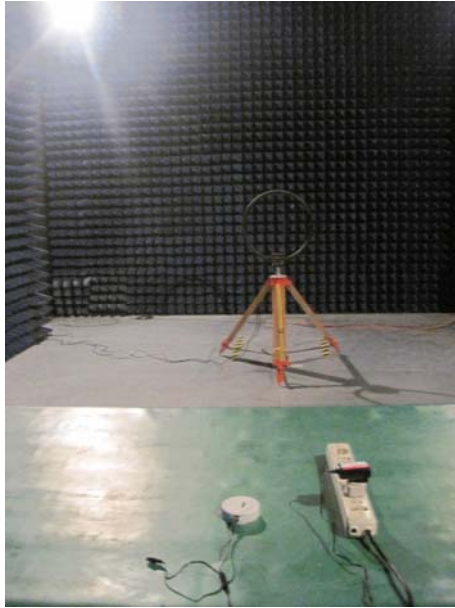
Antenna Polarization: Horizontal



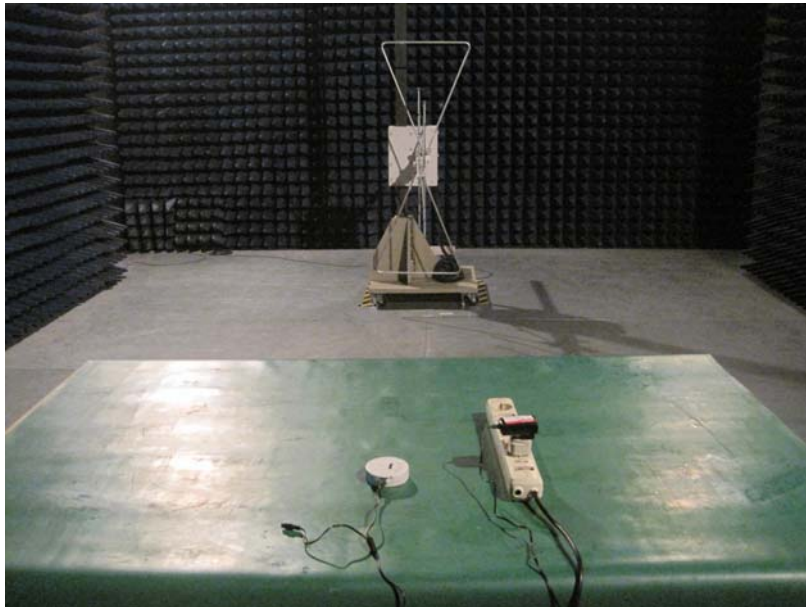
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	32.9854	2.96	16.57	19.53	40.00	-20.47	peak	
2	108.9276	13.20	13.85	27.05	43.50	-16.45	peak	
3	137.3565	17.57	11.90	29.47	43.50	-14.03	peak	
4	163.1623	18.92	11.71	30.63	43.50	-12.87	peak	
5	490.0451	0.90	25.75	26.65	46.00	-19.35	peak	
6	859.7753	2.77	29.65	32.42	46.00	-13.58	peak	

**7.7 Photograph – Radiation Emission Test Setup**

Below 30MHz



Above 30MHz



**7.8 Photograph – Conduction Emission Test Setup**



## 8 Photographs - Constructional Details

### 8.1 EUT – Appearance View

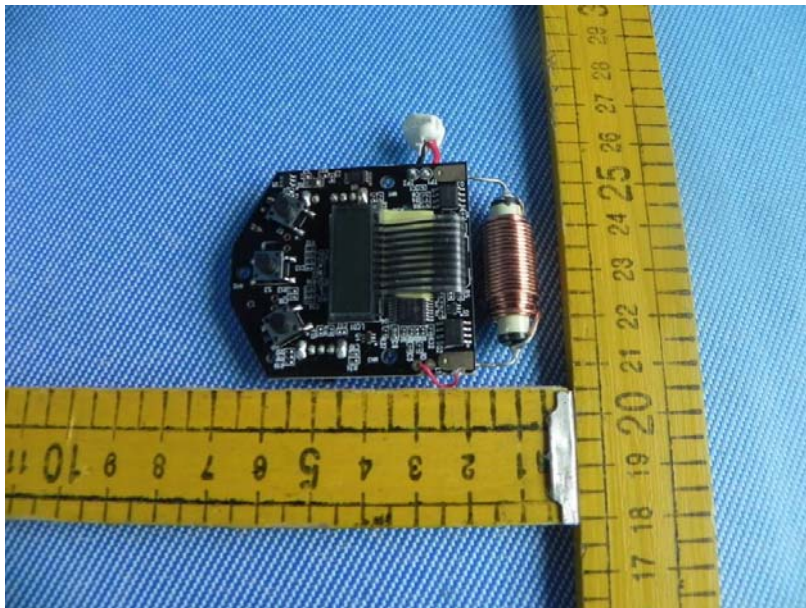
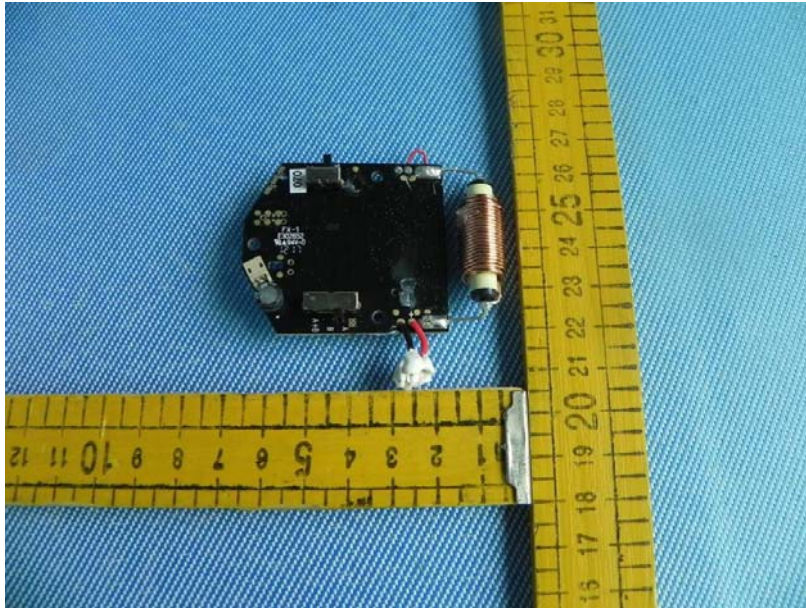


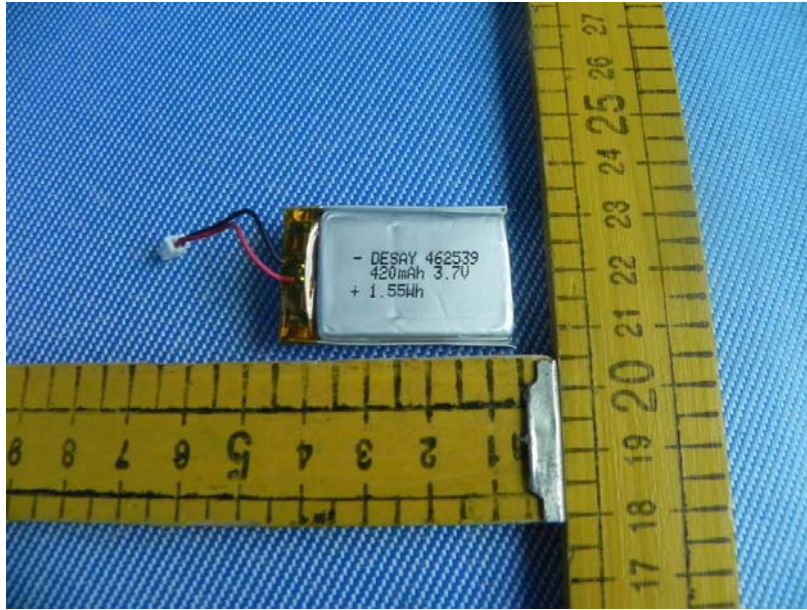


## 8.2 EUT – Open View



8.3 EUT – PCB View







## 9 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 harmful interference,and (2) this device must accept any interference received, including interference that may cause undesired operation

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.

Proposed Label Location on EUT  
EUT Back View/proposed FCC Mark Location

