FCC TEST REPORT

FCC ID	: KE3-3002587
Applicant	: Radio Systems Corporation
Address	: 10427 Electric Ave.Knoxville, TN 37932 USA
Manufacturer	: Radio Systems Corporation
Address	: 10427 Electric Ave.Knoxville, TN 37932 USA

Equipment Under Test (EUT) :

Product Name	: Boundary Plus® Single Loop Transmitter
Model No.	: RIG00-11350

Rule	: FCC CFR47 Part 15 Section 15.209:2010
Date of Test	: Oct. 22 ~ 23, 2012
Date of Issue	: Oct. 30, 2012
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:
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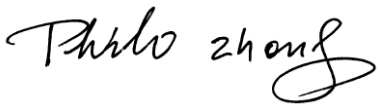
Compiled by: Approved by:



Zero Zhou / Project Engineer Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Test Method	Result
Conducted Emissions	Part 15.207	ANSI C63.4:2003	PASS
Radiated Emissions	Part 15.209	ANSI C63.4: 2003	PASS

Remark:

PASS	Test item meets the requirement
FAIL	Test item does not meet the requirement
N/A	Test case does not apply to the test object

3 Contents

4 General Information

4.1 General Description of E.U.T.

Product Name	: Boundary Plus® Single Loop Transmitter
Model No.	: RIG00-11350
Model Difference	: N/A
Operation Frequency	: 7.5kHz & 10.7kHz(transmitter)
Type of Modulation	:OOK

4.2 Details of E.U.T.

Technical Data:	: DC 19V , 1.0A powered by adapter (input: 100-240V~ 50/60Hz 0.6A)
Adapter model:	KSAS0241900100HU
Adapter manufacturer:	Radio Systems Corporation

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 number 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 the tests were performed at:
Waltek Services(Shenzhen) Co., Ltd. at 1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District, Shenzhen, China

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. 13,2012	Aug. 13,2013
9.	10m 50 Ohm Coaxial Cable with N-plug	SCHWARZBECK	AK 9513	-	Aug. 13,2012	Aug. 13,2013
10.	Positioning Controller	C&C LAB	CC-C-IF	-	Aug. 13,2012	Aug. 13,2013
11.	Color Monitor	SUNSPO	SP-14C	-	Aug. 13,2012	Aug. 13,2013

5.2 Measurement Uncertainty

Parameter	Uncertainty
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.

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 dBμV between 0.15MHz & 0.5MHz
	56 dBμV between 0.5MHz & 5MHz
	60 dBμV 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	: 26 °C
Humidity	: 60% RH
Atmospheric Pressure	: 1012 mbar

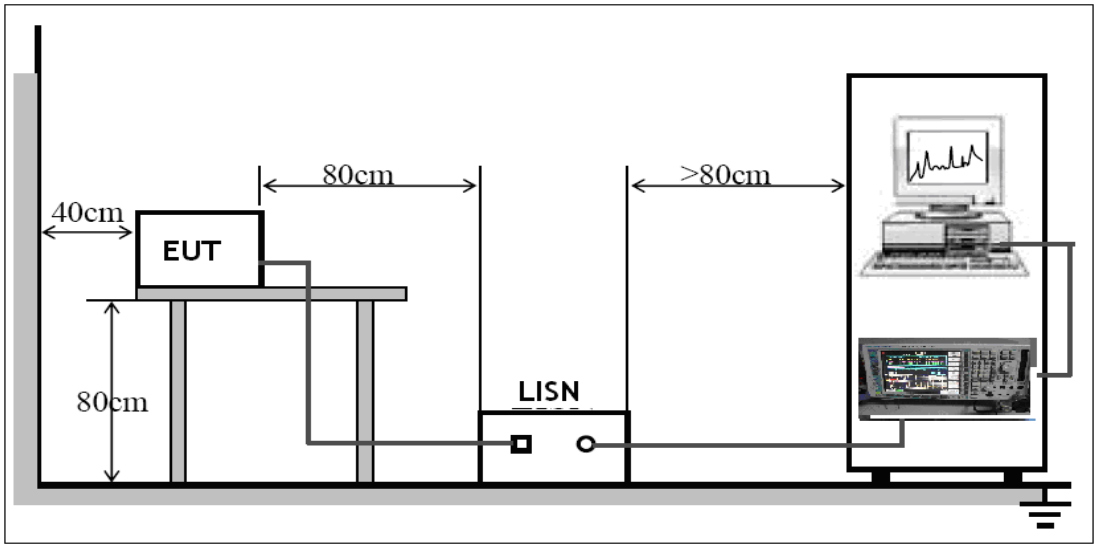
6.2 Test Procedure

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

(2) 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.

6.3 Test Setup

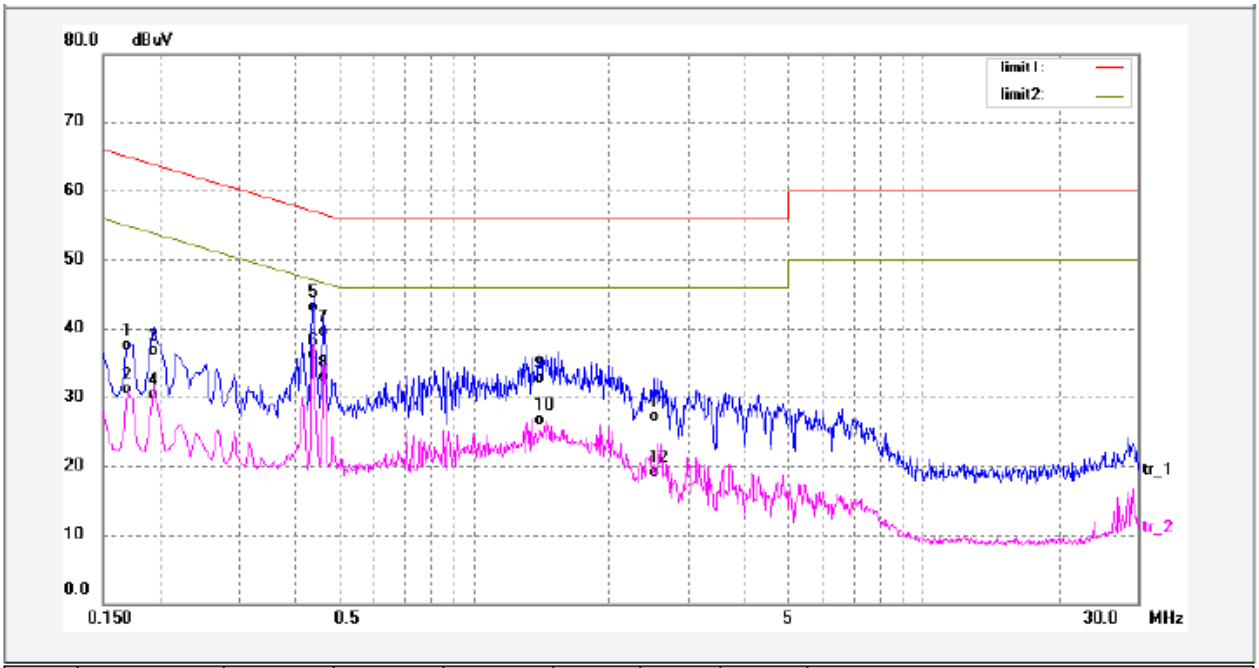
The EUT was placed on the test table in shielding room



6.4 Test Result

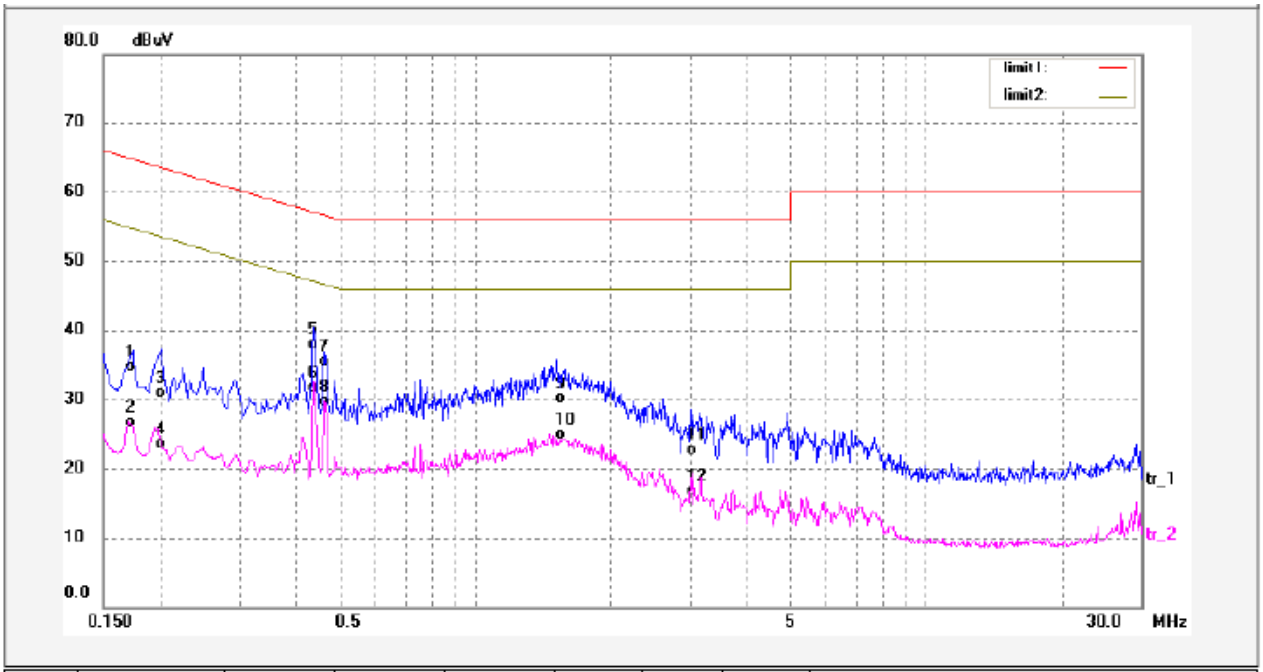
Test Mode:ON

Live line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1700	25.41	11.22	36.63	64.96	-28.33	QP	
2	0.1700	19.17	11.22	30.39	54.96	-24.57	AVG	
3	0.1940	24.57	11.28	35.85	63.86	-28.01	QP	
4	0.1940	18.29	11.28	29.57	53.86	-24.29	AVG	
5	0.4420	30.99	11.31	42.30	57.02	-14.72	QP	
6	0.4420	23.96	11.31	35.27	47.02	-11.75	AVG	
7	0.4660	27.48	11.31	38.79	56.58	-17.79	QP	
8	0.4660	20.75	11.31	32.06	46.58	-14.52	AVG	
9	1.3940	20.70	11.19	31.89	56.00	-24.11	QP	
10	1.3940	14.70	11.19	25.89	46.00	-20.11	AVG	
11	2.5140	15.05	11.21	26.26	56.00	-29.74	QP	
12	2.5140	7.05	11.21	18.26	46.00	-27.74	AVG	

Neutral line:



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1740	22.60	11.23	33.83	64.76	-30.93	QP	
2	0.1740	14.64	11.23	25.87	54.76	-28.89	AVG	
3	0.2020	18.74	11.30	30.04	63.52	-33.48	QP	
4	0.2020	11.44	11.30	22.74	53.52	-30.78	AVG	
5	0.4380	25.70	11.31	37.01	57.10	-20.09	QP	
6	0.4380	19.50	11.31	30.81	47.10	-16.29	AVG	
7	0.4660	23.31	11.31	34.62	56.58	-21.96	QP	
8	0.4660	17.61	11.31	28.92	46.58	-17.66	AVG	
9	1.5220	18.18	11.19	29.37	56.00	-26.63	QP	
10	1.5220	12.82	11.19	24.01	46.00	-21.99	AVG	
11	3.0100	10.70	11.21	21.91	56.00	-34.09	QP	
12	3.0100	4.68	11.21	15.89	46.00	-30.11	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)	$20\log^{(2400/F(kHz))} + 80$
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	$20\log^{(500)}$

Note:

a) The tighter limit applies at the band edges.
For example: F.S limit at 88MHz is 100uV/m

b) 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} = 30uV/m * $(30/3)^2$ = 100 * 30uV/m

7.1 EUT Operation

Operating Environment:

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

7.2 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) The radiation measurements are performed in X,Y,Z axes position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), the worst is X position.

(7) AC source used during test.

(8) A calculated substitution wire ring antenna 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,Y,Z axes position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), the worst is X position.

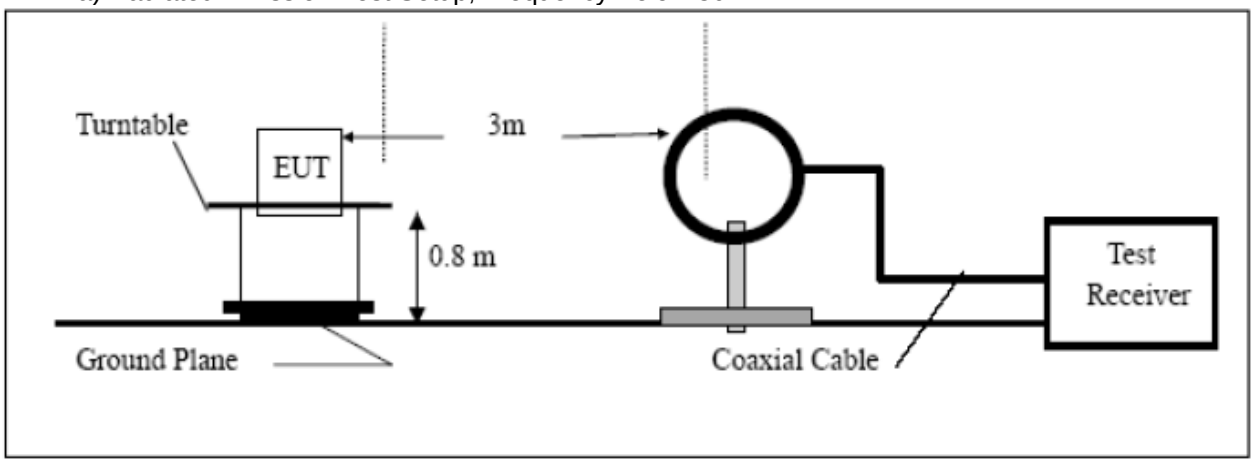
(8) AC source used during test.

(9) A calculated substitution wire ring antenna used during test.

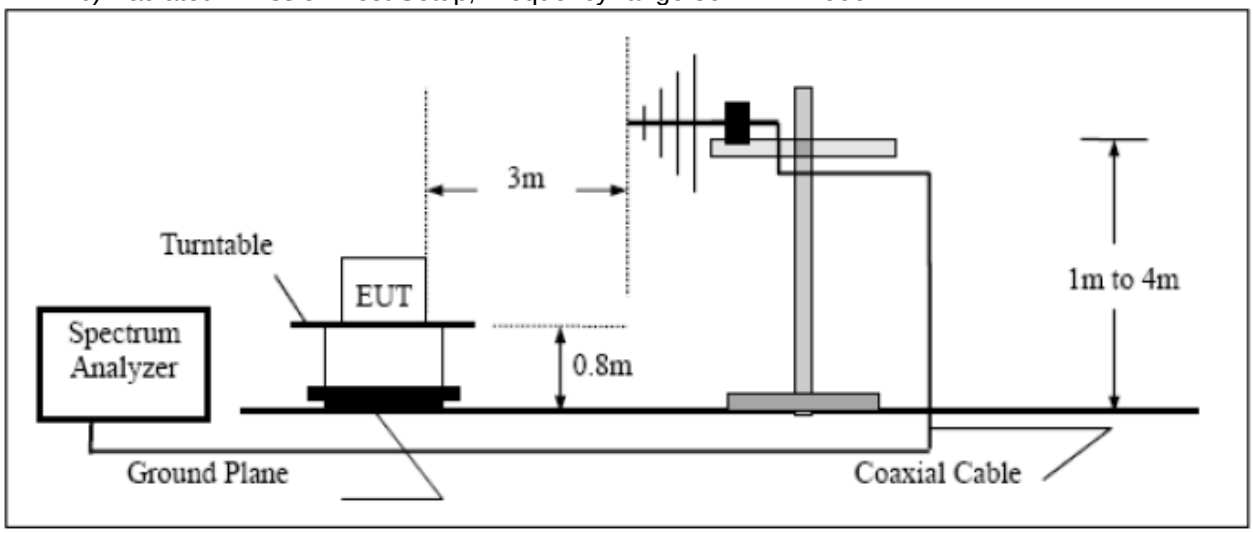
7.3 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site.

a) Radiated Emission Test Setup, Frequency Below 30MHz



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



7.4 Spectrum Analyzer Setup

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

Below 30MHz:

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

Above 30MHz:

Sweep Speed .....Auto
IF Bandwidth .....120 KHz
Video Bandwidth 100KHz
Quasi-Peak Adapter Bandwidth.....120 KHz
Quasi-Peak Adapter Mode.....Normal
Resolution Bandwidth 120kHz

7.5 Corrected Amplitude & Margin Calculation

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 stared 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

7.6 Test Results

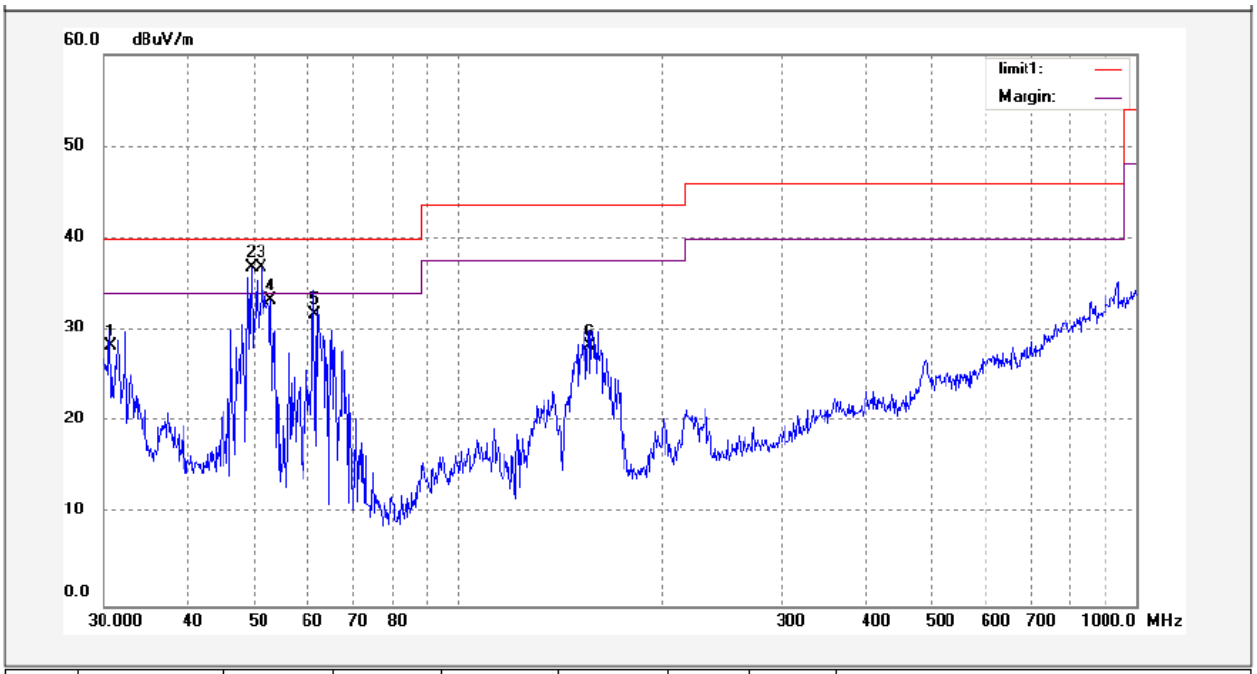
Test frequency below 30MHz:

Frequency (kHz)	Detector	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement Distance (m)
10.503	peak	92.22	127	-34.78	3
No suspicious signal found in other frequency that other emissions are more than 20dB below the limit,the data do not report .					

Test frequency above 30MHz

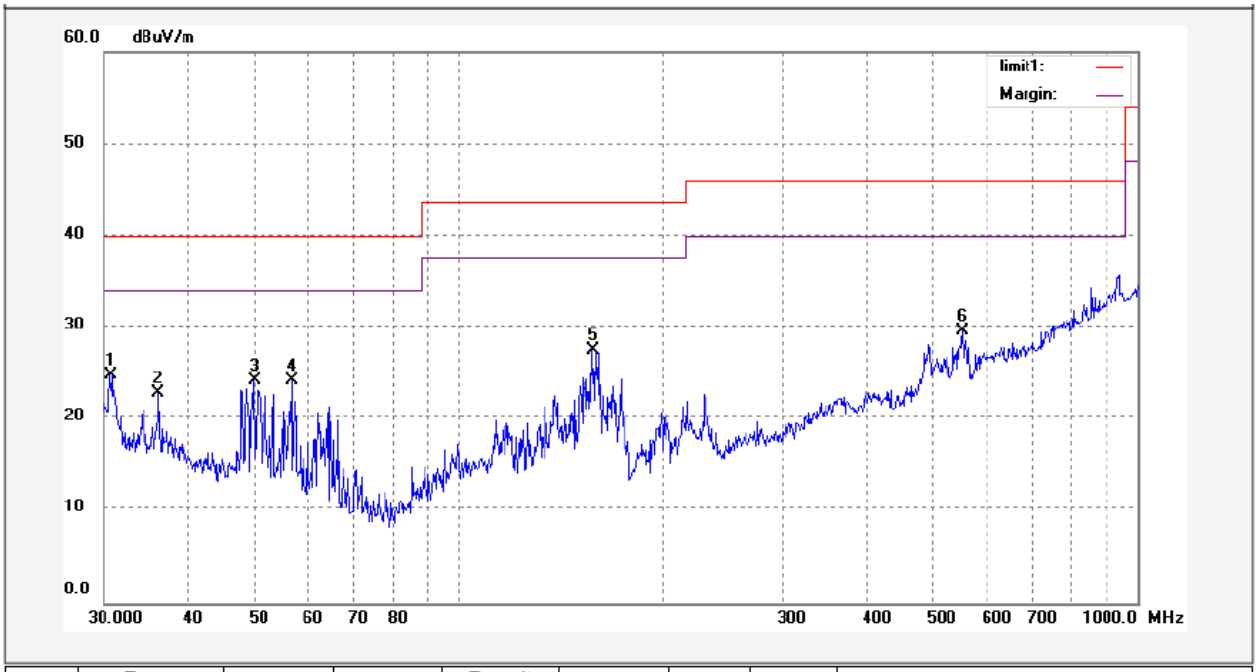
Test Mode:ON

Antenna Porlarization: Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	30.6392	12.01	16.29	28.30	40.00	-11.70	peak	
2	49.5825	22.18	14.59	36.77	40.00	-3.23	peak	
3	51.3556	22.32	14.52	36.84	40.00	-3.16	peak	
4	53.0056	18.93	14.26	33.19	40.00	-6.81	peak	
5	61.2189	19.60	12.16	31.76	40.00	-8.24	peak	
6	156.4259	17.30	10.96	28.26	43.50	-15.24	peak	

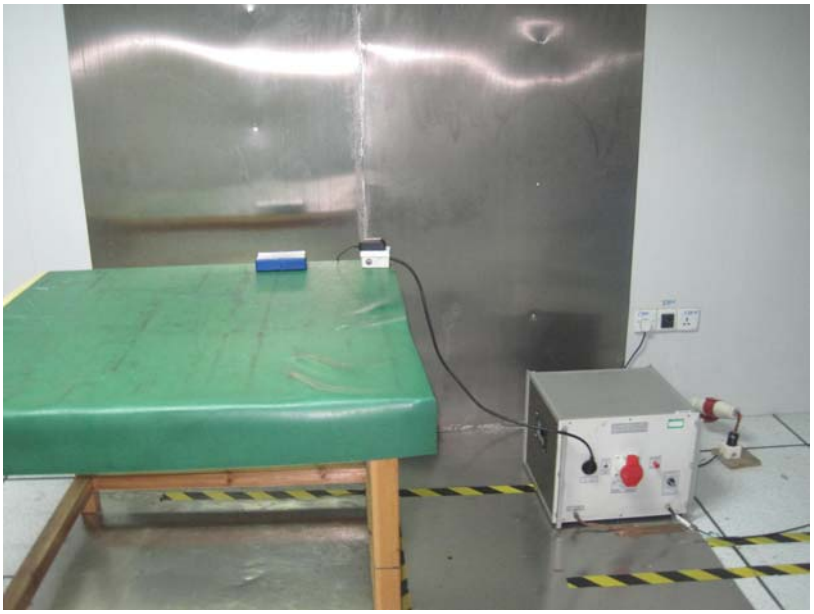
Antenna Porlarization: Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	30.6392	8.56	16.29	24.85	40.00	-15.15	peak	
2	36.1406	6.53	16.31	22.84	40.00	-17.16	peak	
3	49.9323	9.58	14.58	24.16	40.00	-15.84	peak	
4	56.6650	10.91	13.36	24.27	40.00	-15.73	peak	
5	157.5290	16.51	11.06	27.57	43.50	-15.93	peak	
6	554.1708	6.00	23.70	29.70	46.00	-16.30	peak	

8 Photographs

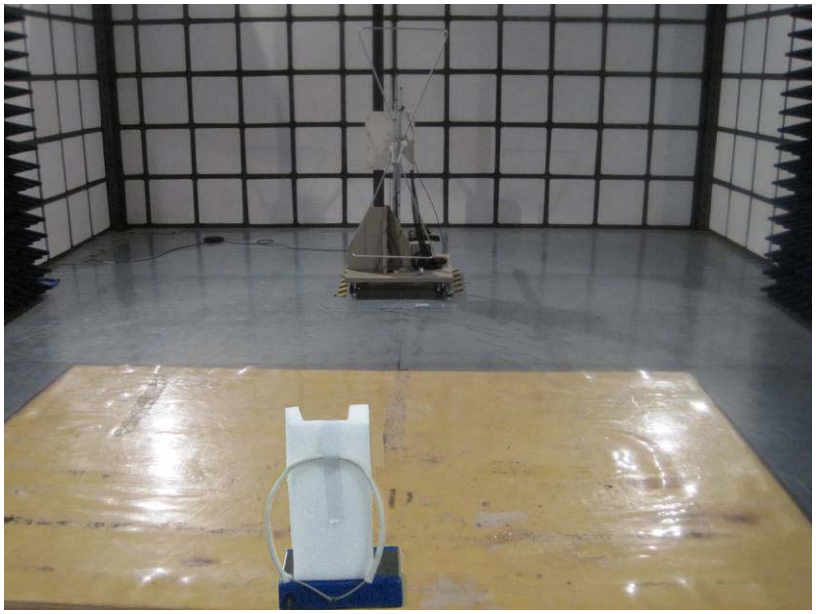
8.1 Photograph –Conducted Emissions Test Setup



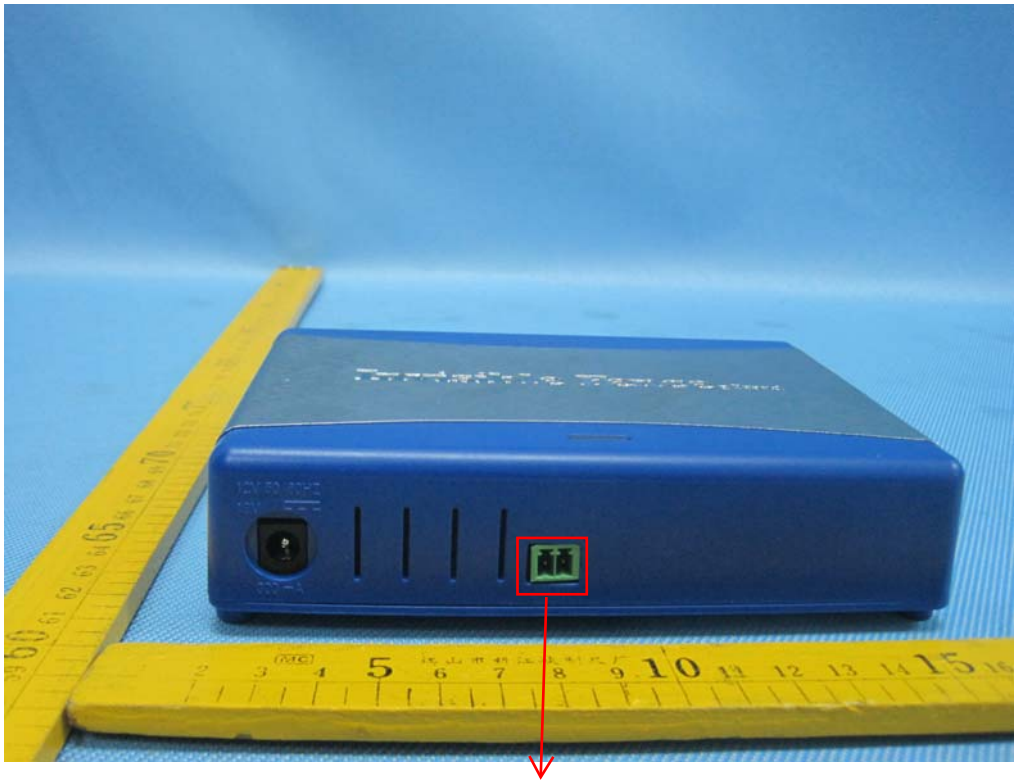
8.2 Photograph – Radiation Emissions Test Setup

Below 30MHz

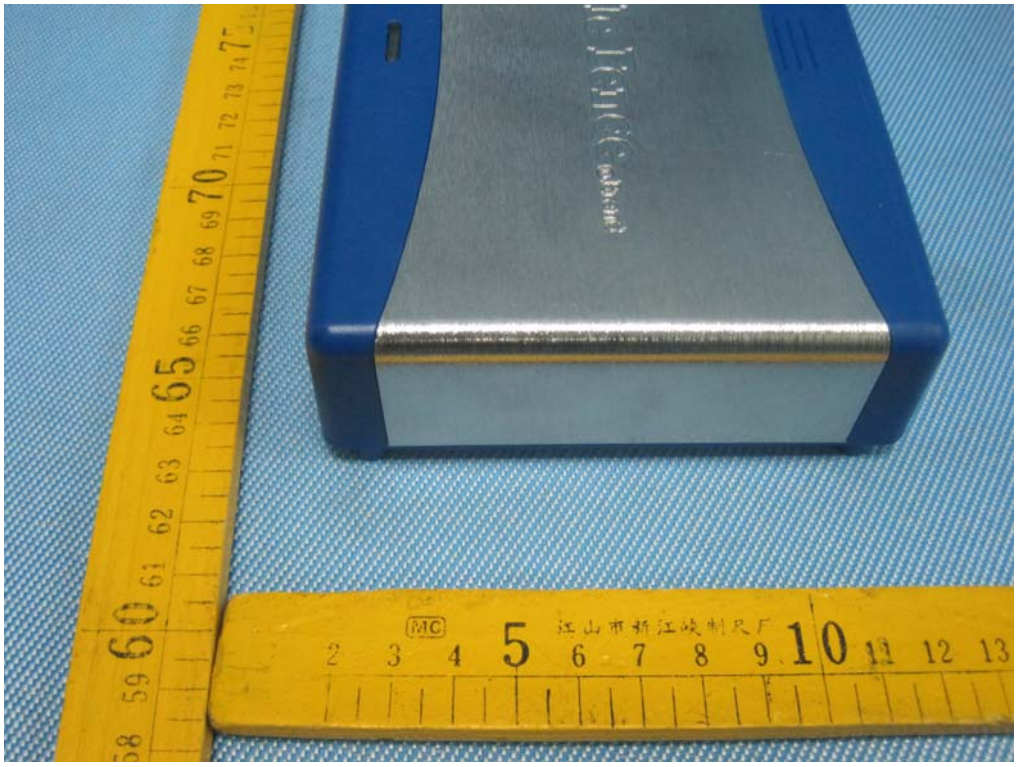
Above 30MHz

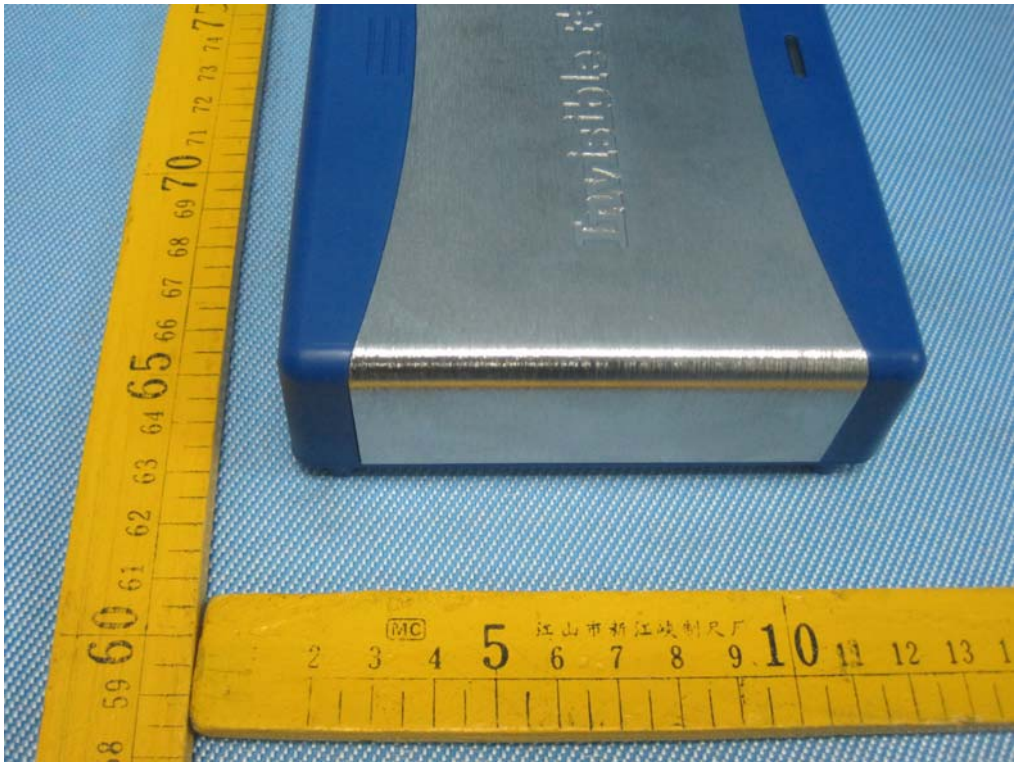


8.3 EUT – Appearance View

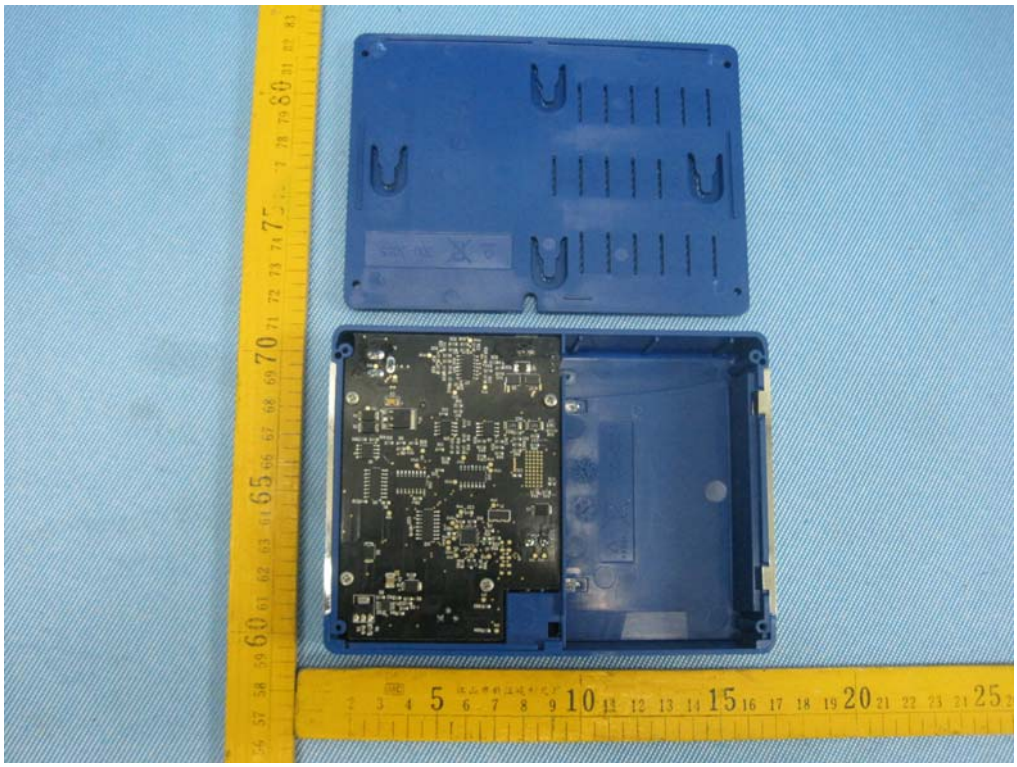


Antenna connector

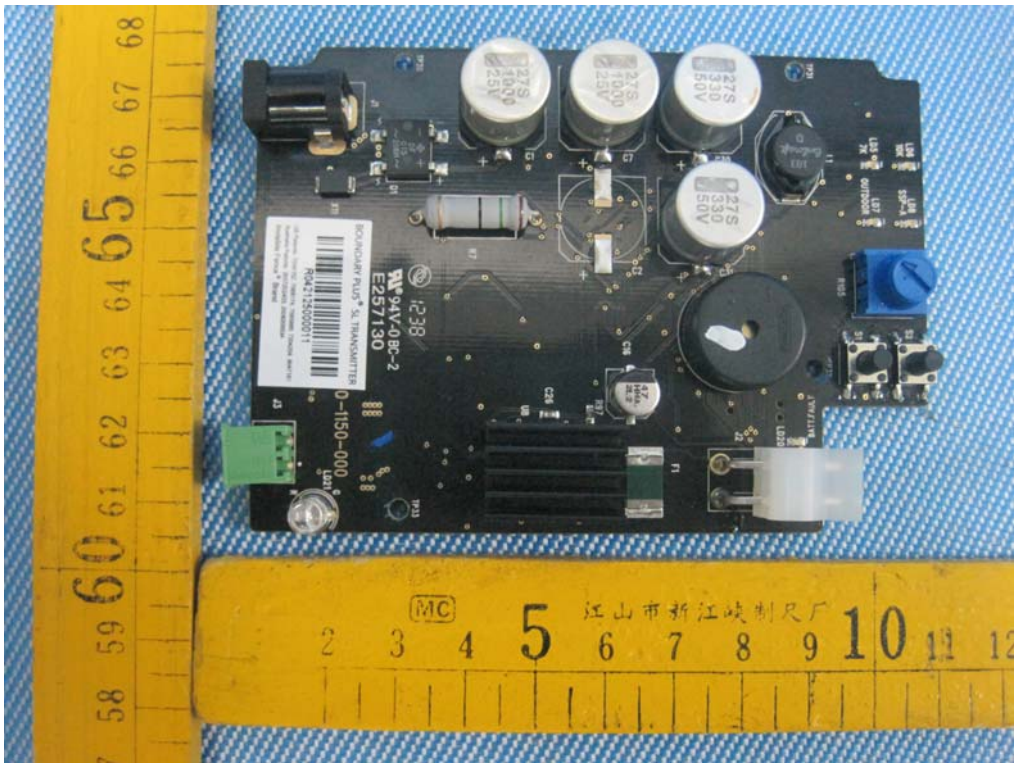


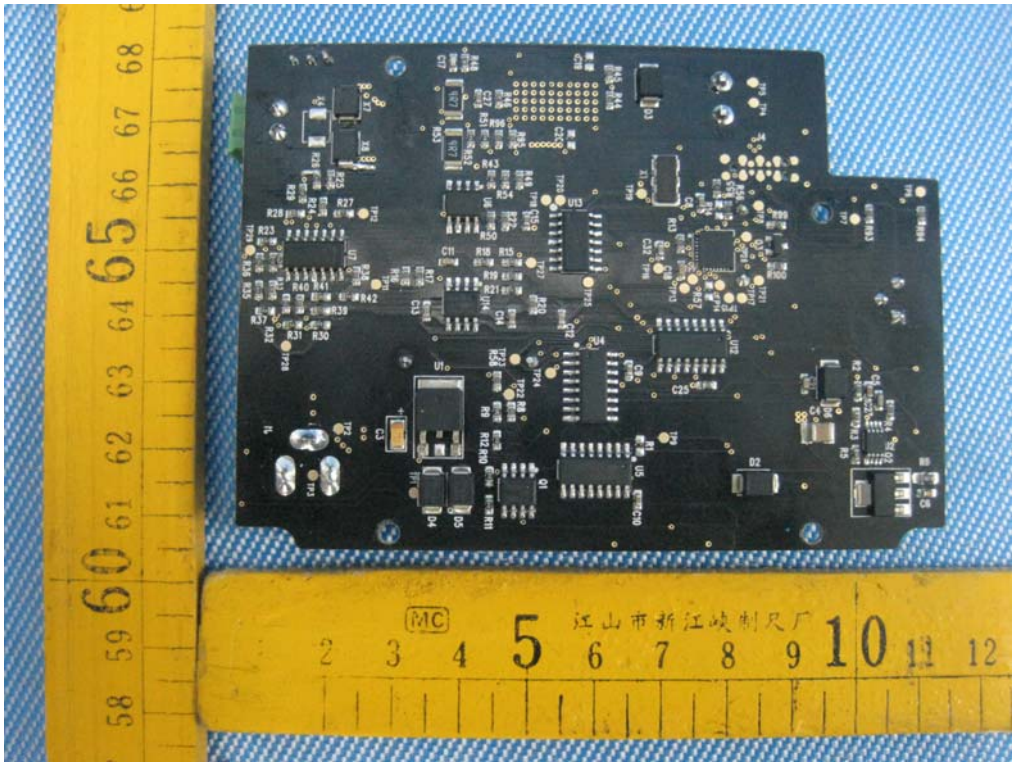


8.4 EUT – Open View



8.5 EUT – PCB View





8.6 Adapter – Appearance View


Radio Systems®
CORPORATION
AC ADAPTOR
P/N:650-231-1
MODEL:KSAS0241900100HU
INPUT:100-240V~ 50/60Hz 0.6A
OUTPUT:19V ⎓ 1.0A
115V
LPS
c UL us
LISTED
80ZN
E215890
I.T.E.POWER SUPPLY
Tested To Comply
With FCC Standards
FOR HOME OR OFFICE USE
MADE IN CHINA 80BH

9 FCC Label

9.1 Label sample

Label sample for model: RIG00-11350

FCC ID: KE3-3002587
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.

9.2 Label Location

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.