

## ***FCC TEST REPORT***

**FCC ID** : KE3-3001186  
**Applicant** : Radio Systems Corporation  
**Address** : 10427 Electric Ave. Knoxville, TN 37932, USA

**Equipment Under Test (EUT) :**

Product Name : Boundary Plus® Transmitter  
Model No. : RIG00-11334

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

**Date of Test** : August 22 ~ August 26

**Date of Issue** : September 5, 2011

**Test Engineer** : Hunk yan

*Hunk yan*

**Reviewed By** : Philo zhong

*Philo zhong*

|                    |               |
|--------------------|---------------|
| <b>Test Result</b> | <b>: PASS</b> |
|--------------------|---------------|

**Prepared By:**

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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

| Test Items                              | Test Requirement | Test Method      | Result |
|---|------------------|------------------|--------|
| Radiated Emissions<br>(9kHz ~ 1GHz)     | Part 15.209      | ANSI C63.4: 2003 | PASS   |
| Conducted Emissions<br>(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 Electric Ave. Knoxville, TN 37932, USA

**Manufacturer** : Radio Systems Corporation  
**Address of Manufacturer** : 10427 Electric Ave. Knoxville, TN 37932, USA

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

**Product Name** : Boundary Plus® Transmitter  
**Model No.** : RIG00-11334  
**Operation Frequency** : 7.5kHz & 10.7kHz

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

**Technical Data:** : DC 12V Battery  
Adapter Input: 100 ~ 240VAC, 50/60 Hz, 0.6A  
Adapter Output: 19VDC, 1.0A

### 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 Boundary Plus® Transmitter. The standards used were FCC CFR47 Part 15 Section 15.207:2009 and Section 15.209:2009.

#### 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

## 5 Equipment Used during Test

| Equipment Name                           | Manufacturer Model                            | Equipment No | Internal No | Specification                                      | Cal. Date    | Due Date     | Cert. No     | Uncertainty   |
|--|---|--------------|-------------|--|--------------|--------------|--------------|---|
| EMC Analyzer                             | Agilent/ E7405A                               | MY451149 43  | W2008001    | 9k-26.5GHz   | Aug. 2, 2011 | Aug. 1, 2012 | Wws20 081596 | ±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                            | SUNSPO/ SP-14C                                | -            | -           | -  | Aug. 2, 2011 | Aug. 1, 2012 | -            | -   |
| Test Receiver                            | ROHDE&SC HWARZ/ ESPI                          | 101155       | W2005001    | 9k-3GHz  | Aug. 2, 2011 | Aug. 1, 2012 | Wws20 080942 | ±1dB  |
| Two-Line V-Network                       | ROHDE&SC HWARZ/ ENV216                        | 100115       | W2005002    | 50Ω/50µH   | Aug. 2, 2011 | Aug. 1, 2012 | Wws20 080941 | ±10%  |
| RF Generator                             | TESEQ GmbH/ NSG4070                           | 25781        | W2008008    | Fraq-range: 9K-1GHz<br>RF voltage: -60 dBm- +10dBm | Aug. 2, 2011 | Aug. 1, 2012 | Wws20 081890 | Power_freq distinguish0. 1Hz RFeletricity distinguish 0.1 B |
| Active Loop Antenna 9kHz- 30MHz          | Beijing Dazhi / ZN30900A                      | -            | -           | 9kHz- 30MHz  | 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  |
| Class:            | Class B  |
| Limit:            | 66-56 dB $\mu$ V between 0.15MHz & 0.5MHz<br>56 dB $\mu$ V between 0.5MHz & 5MHz<br>60 dB $\mu$ V between 5MHz & 30MHz |
| Detector:         | Peak for pre-scan (9kHz Resolution Bandwidth)<br>Quasi-Peak & Average if maximised peak within 6dB of Average Limit    |

### 6.1 E.U.T. Operation

#### Operating Environment:

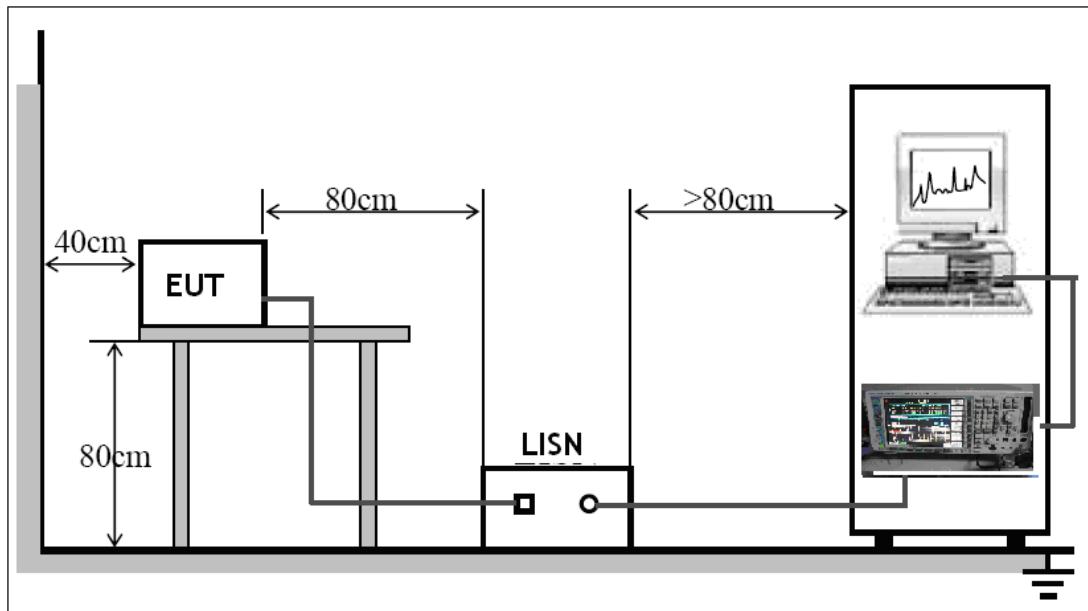
Temperature: 25.5 °C  
 Humidity: 51 % RH  
 Atmospheric Pressure: 1012 mbar

#### EUT Operation:

The EUT was test in working and powered by adapter mode.  
 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.

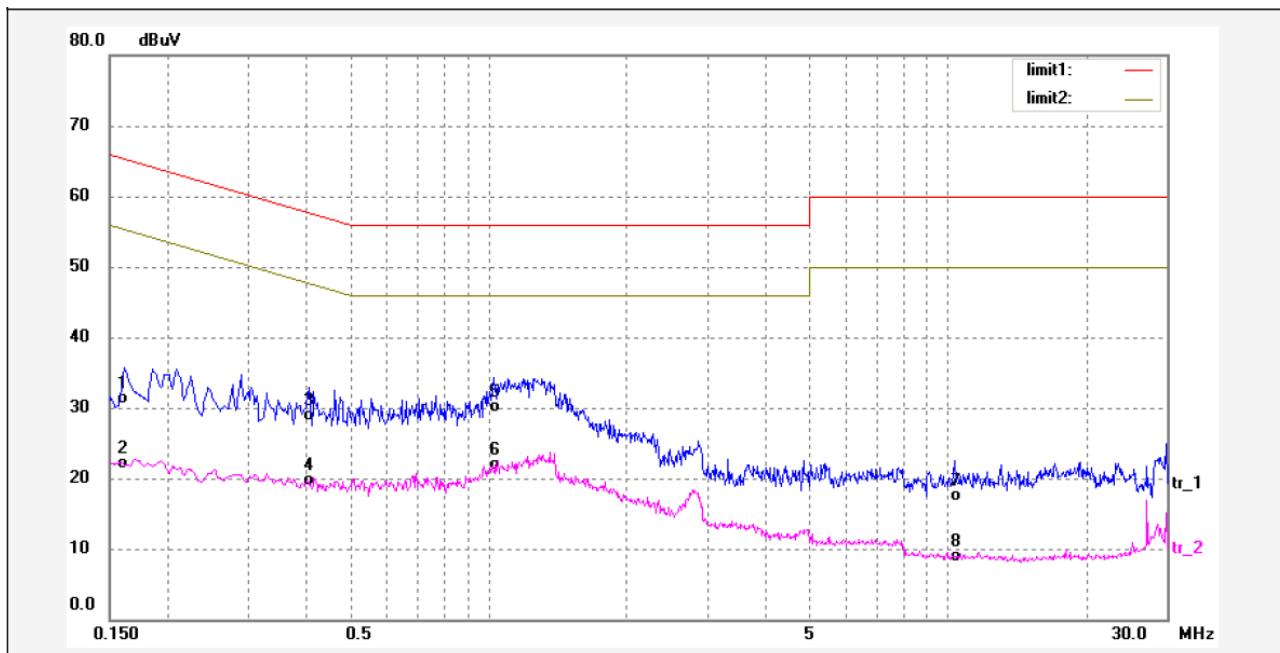


The EUT was placed on the test table in shielding room

### 6.3 Conducted Emission Test Result

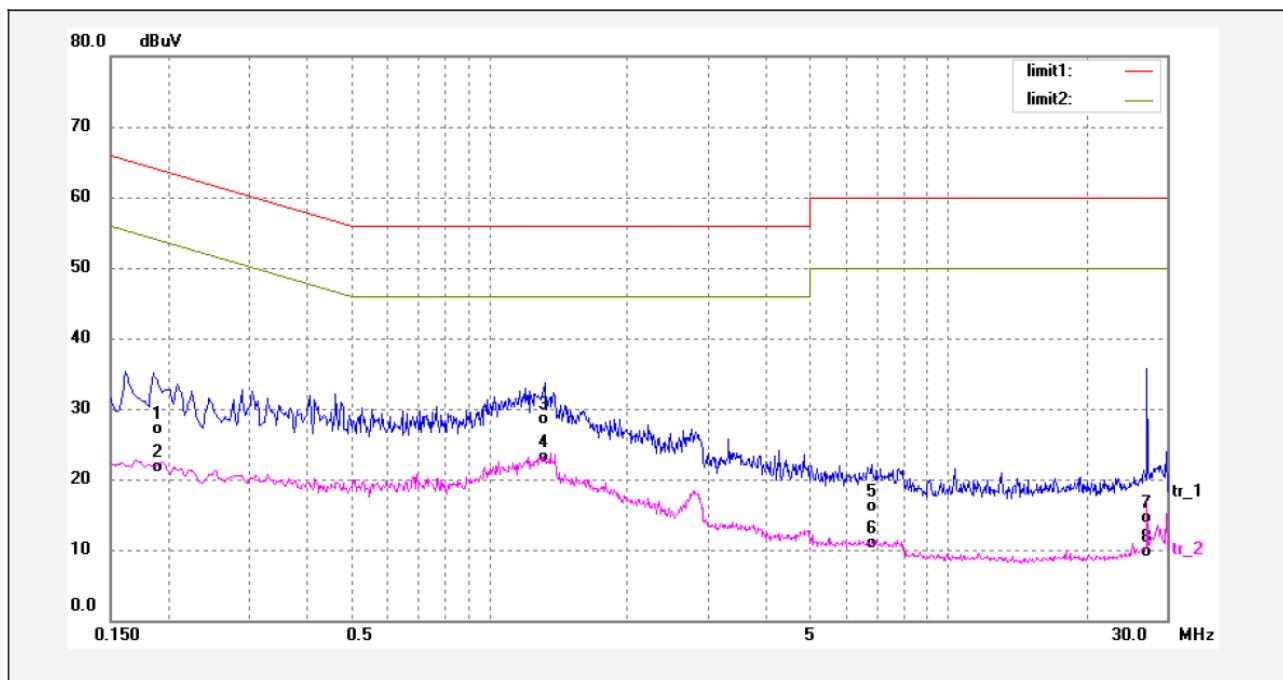
An initial pre-scan was performed on the live and neutral lines.

Live line:



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|------------|-------------|----------|--------|
| 1   | 0.1620      | 19.83          | 10.62       | 30.45         | 65.36      | -34.91      | QP       |        |
| 2   | 0.1620      | 10.77          | 10.62       | 21.39         | 55.36      | -33.97      | AVG      |        |
| 3   | 0.4100      | 17.34          | 10.70       | 28.04         | 57.65      | -29.61      | QP       |        |
| 4   | 0.4100      | 8.12           | 10.70       | 18.82         | 47.65      | -28.83      | AVG      |        |
| 5   | 1.0300      | 17.09          | 12.19       | 29.28         | 56.00      | -26.72      | QP       |        |
| 6   | 1.0300      | 8.89           | 12.19       | 21.08         | 46.00      | -24.92      | AVG      |        |
| 7   | 10.3860     | 4.64           | 12.08       | 16.72         | 60.00      | -43.28      | QP       |        |
| 8   | 10.3860     | -3.93          | 12.08       | 8.15          | 50.00      | -41.85      | AVG      |        |

Neutral line:



| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|-----|-------------|----------------|-------------|---------------|------------|-------------|----------|--------|
| 1   | 0.1874      | 15.69          | 10.66       | 26.35         | 64.15      | -37.80      | QP       |        |
| 2   | 0.1874      | 10.32          | 10.66       | 20.98         | 54.15      | -33.17      | AVG      |        |
| 3   | 1.3260      | 15.53          | 12.19       | 27.72         | 56.00      | -28.28      | QP       |        |
| 4   | 1.3260      | 10.21          | 12.19       | 22.40         | 46.00      | -23.60      | AVG      |        |
| 5   | 6.8140      | 3.43           | 11.86       | 15.29         | 60.00      | -44.71      | QP       |        |
| 6   | 6.8140      | -1.68          | 11.86       | 10.18         | 50.00      | -39.82      | AVG      |        |
| 7   | 27.2620     | 0.85           | 12.88       | 13.73         | 60.00      | -46.27      | QP       |        |
| 8   | 27.2620     | -3.88          | 12.88       | 9.00          | 50.00      | -41.00      | AVG      |        |

#### 6.4 Photograph – Radiation Emission Test Setup



## 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

Class: Class B

Limit:

| Frequency<br>(MHz) | Field Strength |                 | Field Strength Limit at 3m Measurement Dist |                                |
|--------------------|----------------|-----------------|---|--------------------------------|
|                    | uV/m           | Distance<br>(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.
- b) If measurement is made at 3m distance, then F.S Limit at 3m distance is adjusted by using the formula of  $L_{d1} = L_{d2} * (d2/d1)^2$ .

### 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

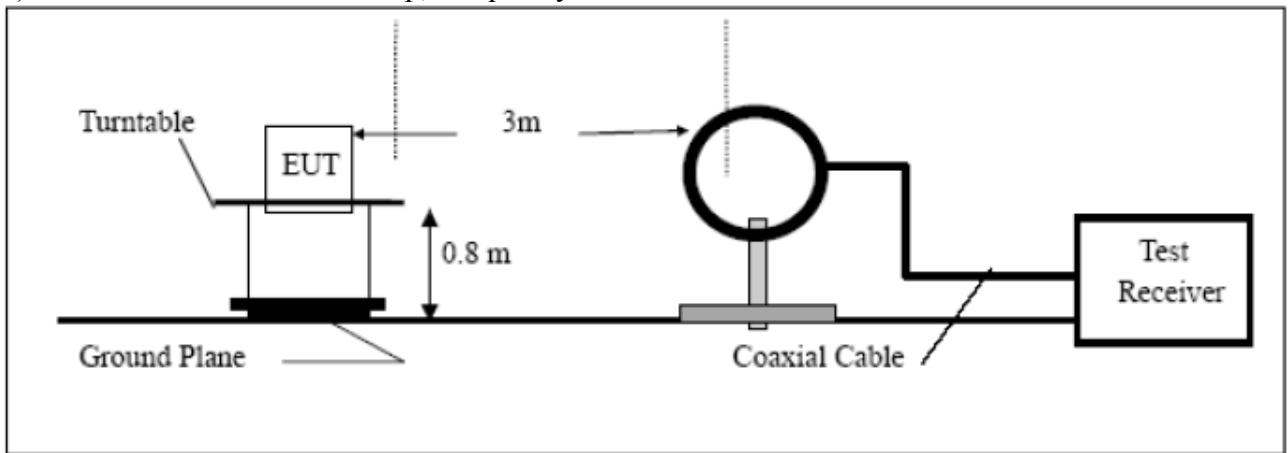
All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor 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  $\pm 5.03\text{dB}$ .

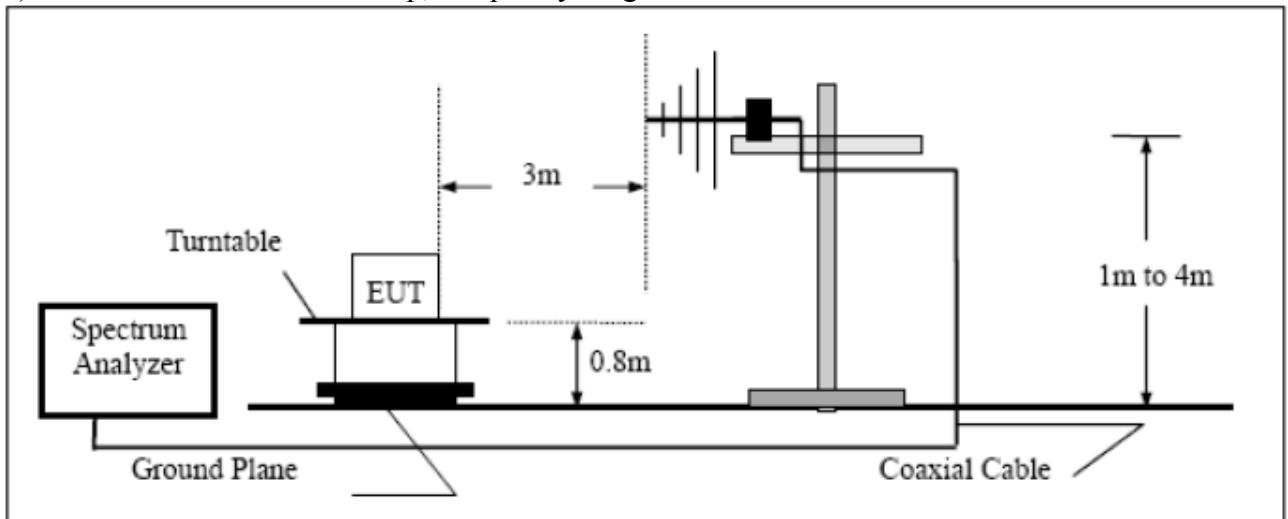
## 7.2 EUT Setup

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.

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

**7.5 Summary of Test Results**

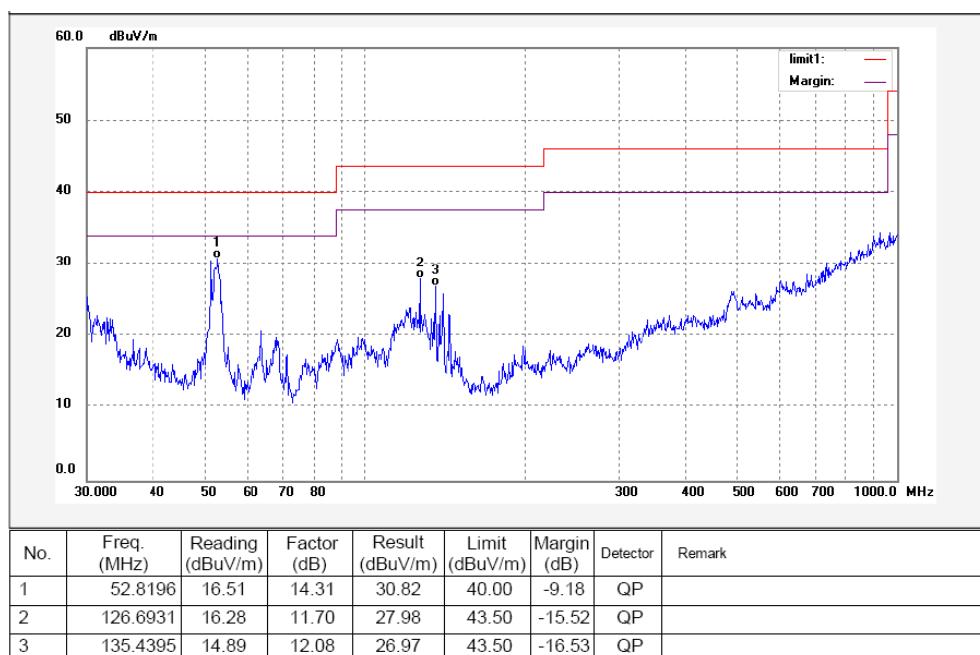
According to the data in this section, the EUT complied with the FCC Part15 C standards.

**Test Data below 30MHz**

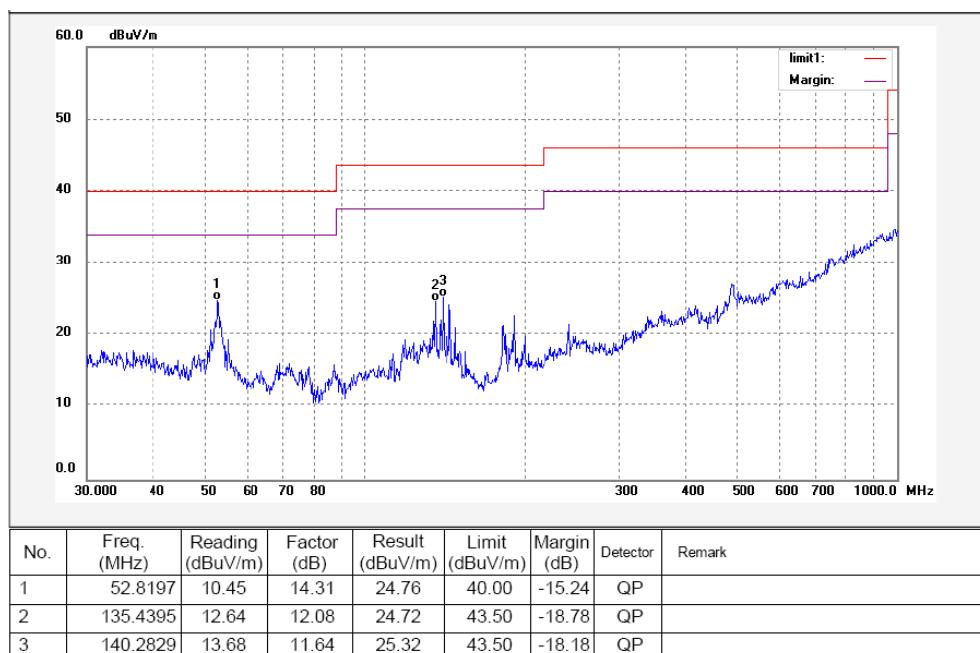
| Frequency<br>(KHz)                             | Detector | Level<br>(dBuV/m) | Limit<br>(dBuV/m) | Margin<br>(dB) | Measurement<br>Distance (m) |
|--|----------|-------------------|-------------------|----------------|-----------------------------|
| 10.734   | peak     | 85.74             | 127               | -41.26         | 3                           |
| No suspicious signal found in other frequency. |          |                   |                   |                |                             |

**Test Data above 30MHz**

Antenna Porlarization: Vertical



Antenna Porlarization: Horizontal

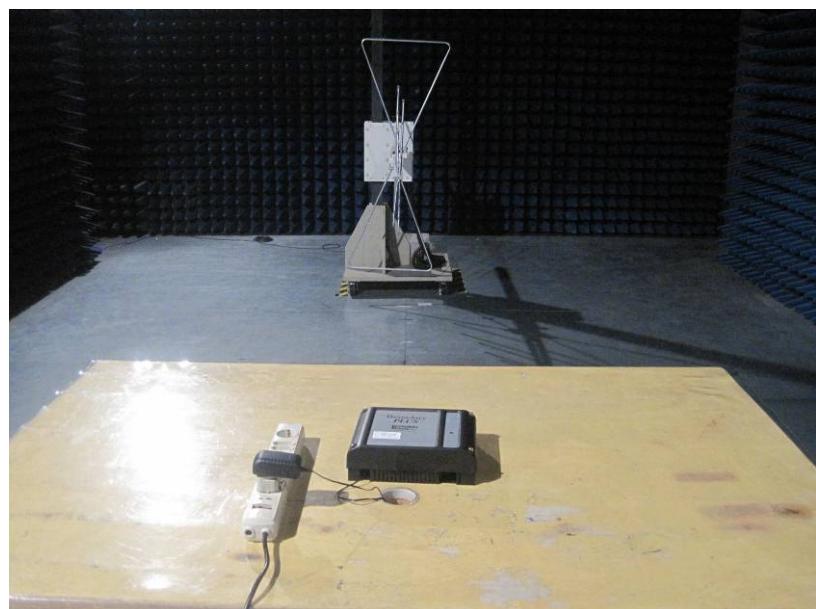


## 7.6 Photograph – Radiation Emission Test Setup

Below 30MHz

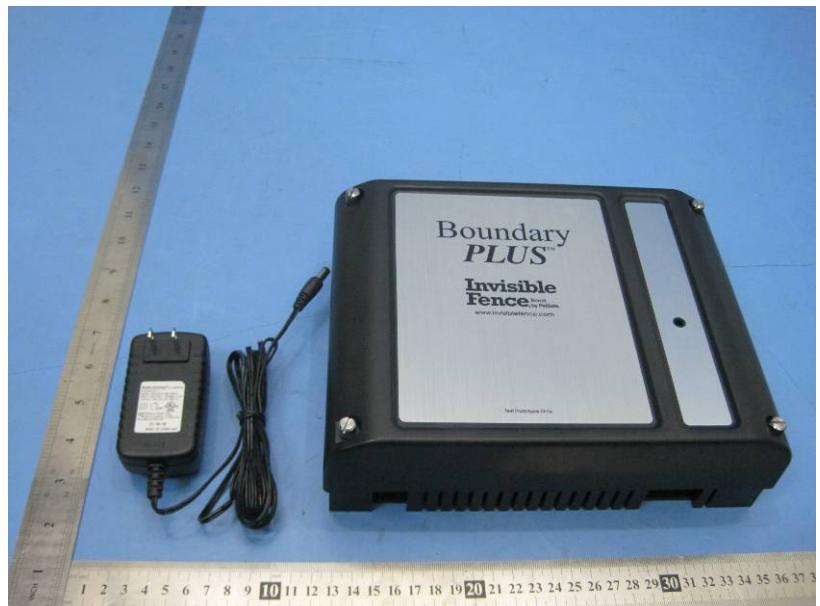


Above 30MHz



## 8 Photographs - Constructional Details

### 8.1 Product View

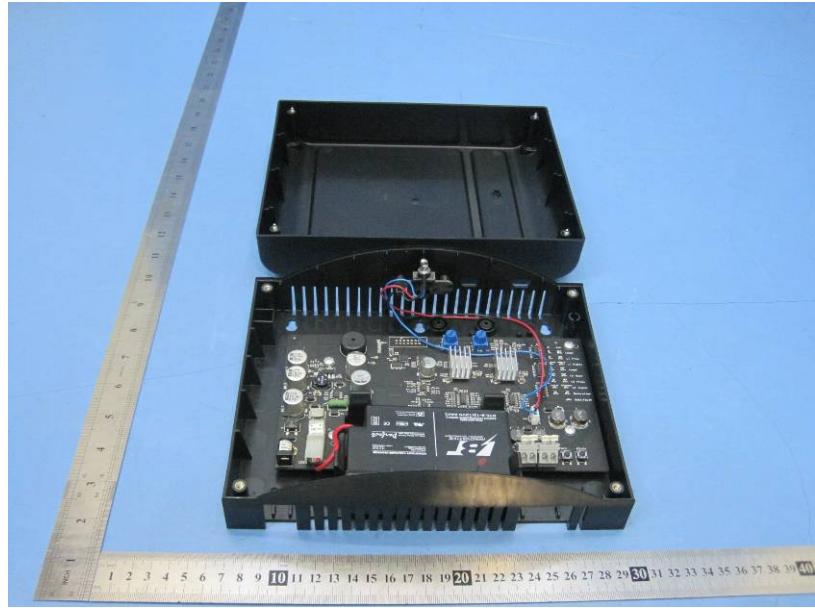


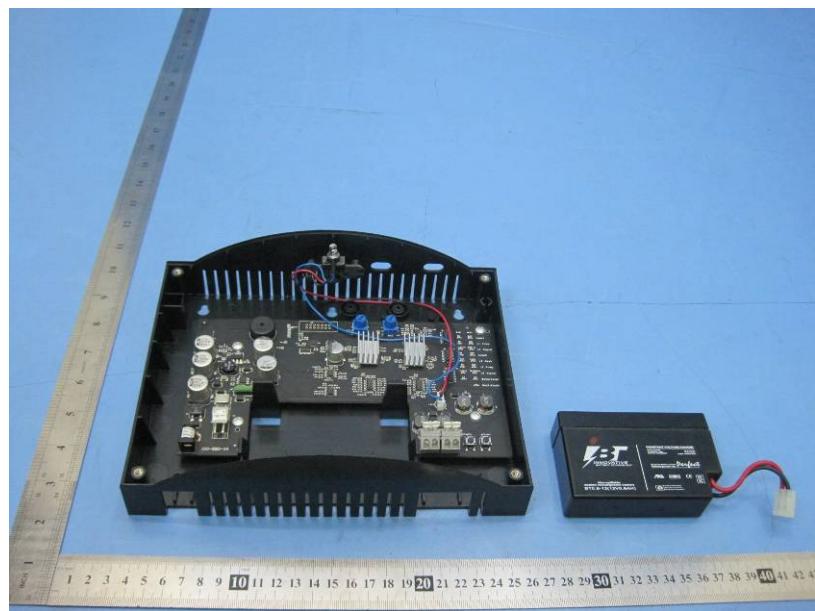
### 8.2 EUT – Appearance View



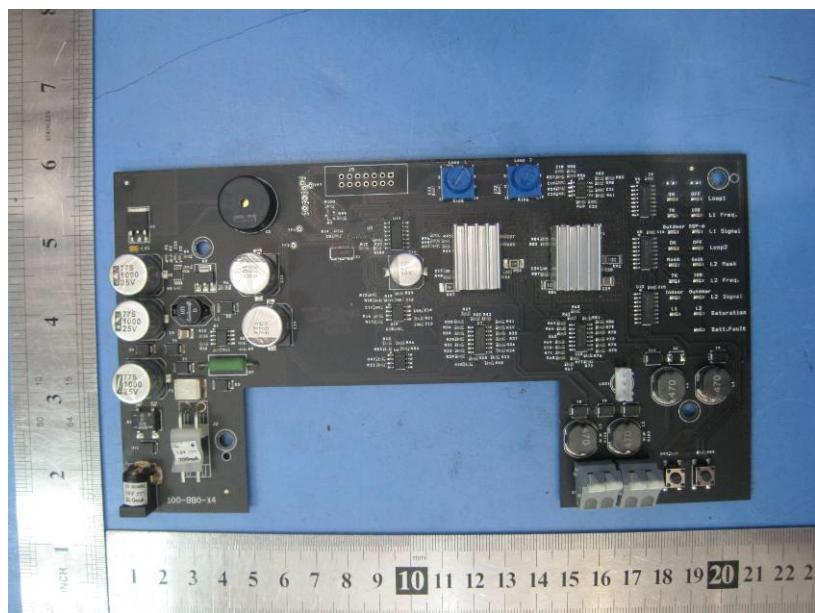


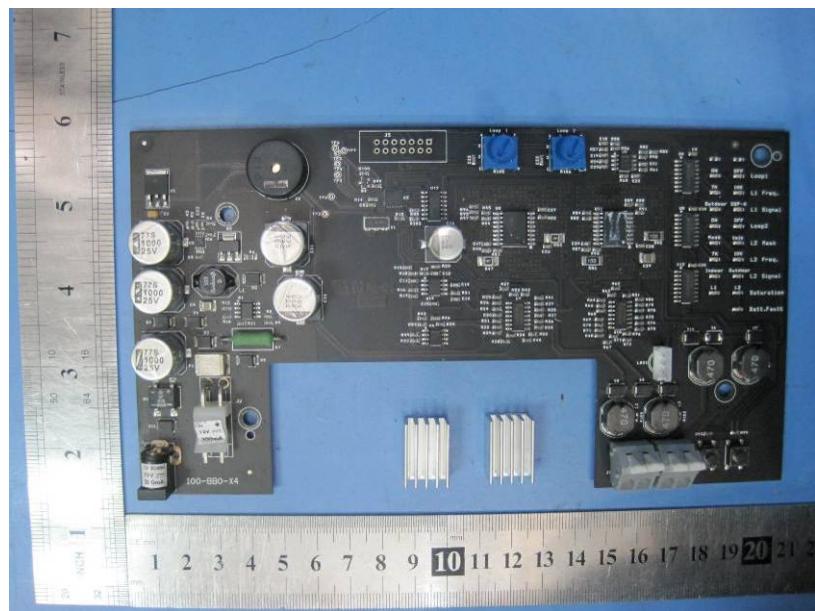
### 8.3 EUT – Open View



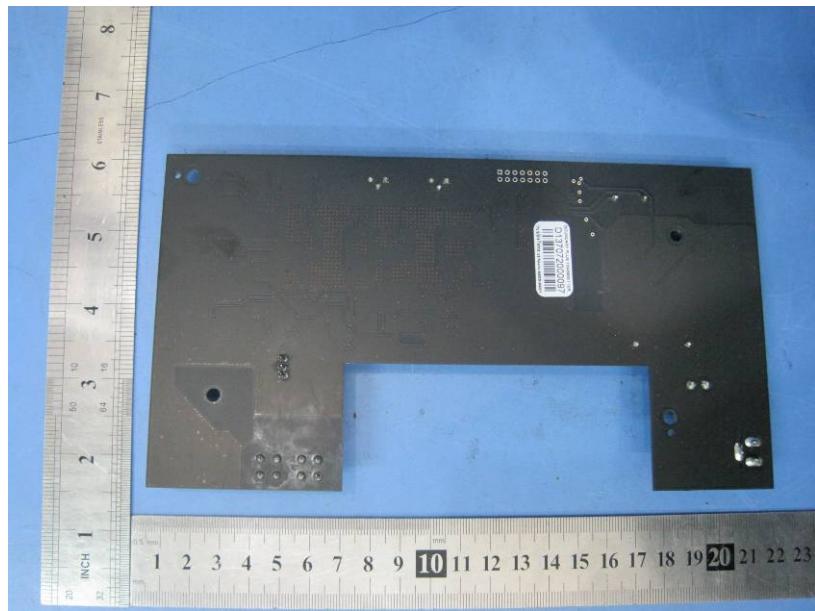


#### 8.4 PCB – Front View





### 8.5 PCB – Back 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.

