

FCC TEST REPORT

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


Equipment Under Test (EUT) :

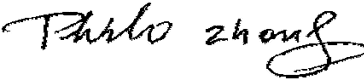
Product Name : Boundary Plus® Transmitter
Model No. : RIG00-11334

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 

Reviewed By : Philo zhong 

Test Result	: PASS
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Prepared By:

Waltek Services (Shenzhen) Co., Ltd.

1/F, Fukangtai Building, West Baima Rd., Songgang Street, Baoan District,
Shenzhen 518105, China

Tel :+86-755-27553488

Fax:+86-755-27553868

- ✧ 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.

WALTEK SERVICES

Reference No.: WT11084242-D-E-F

2 Test Summary

Test Items	Test Requirement	Test Method	Result
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 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	MY45114943	W2008001	9k-26.5GHz	Aug. 2, 2011	Aug. 1, 2012	Wws20081596	±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&SCHWARZ/ ESPI	101155	W2005001	9k-3GHz	Aug. 2, 2011	Aug. 1, 2012	Wws20080942	±1dB
Two-Line V-Network	ROHDE&SCHWARZ/ ENV216	100115	W2005002	50Ω/50μH	Aug. 2, 2011	Aug. 1, 2012	Wws20080941	±10%
RF Generator	TESEQ GmbH/ NSG4070	25781	W2008008	Fraq-range: 9K-1GHz RF voltage: -60 dBm-+10dBm	Aug. 2, 2011	Aug. 1, 2012	Wws20081890	Power_freq distinguish0.1Hz RFelectricity 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 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

6.1 E.U.T. Operation

Operating Environment:

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

EUT Operation:

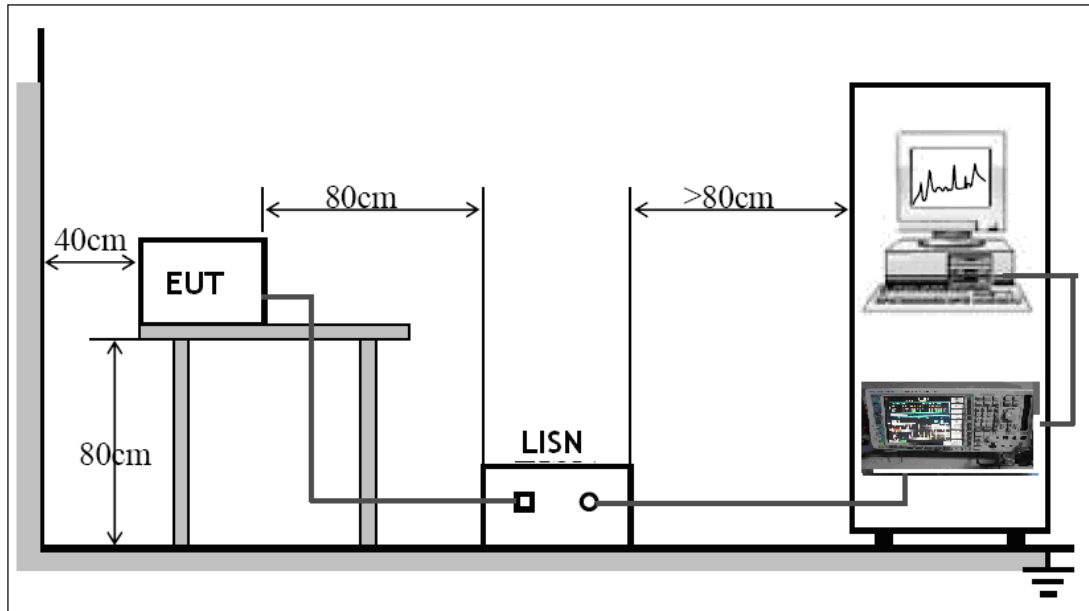
The EUT was test in working and powered by adapter mode.

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.

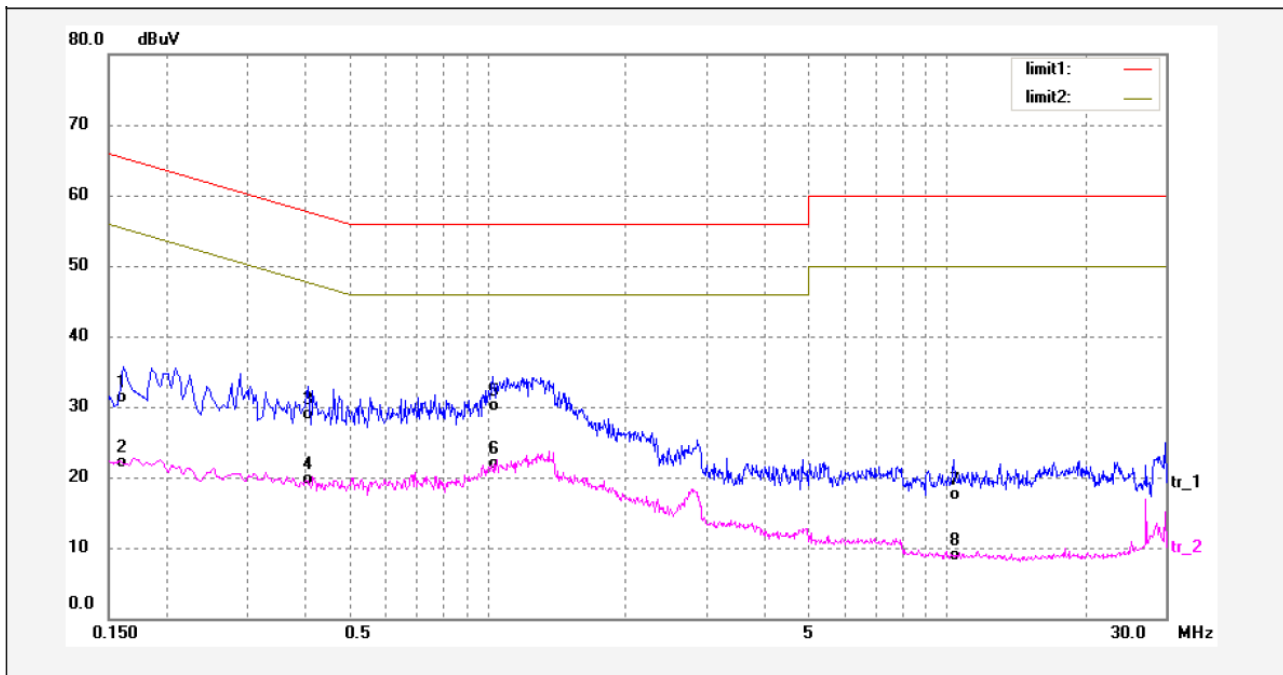


The EUT was placed on the test table in shielding room

6.3 Conducted Emission Test Result

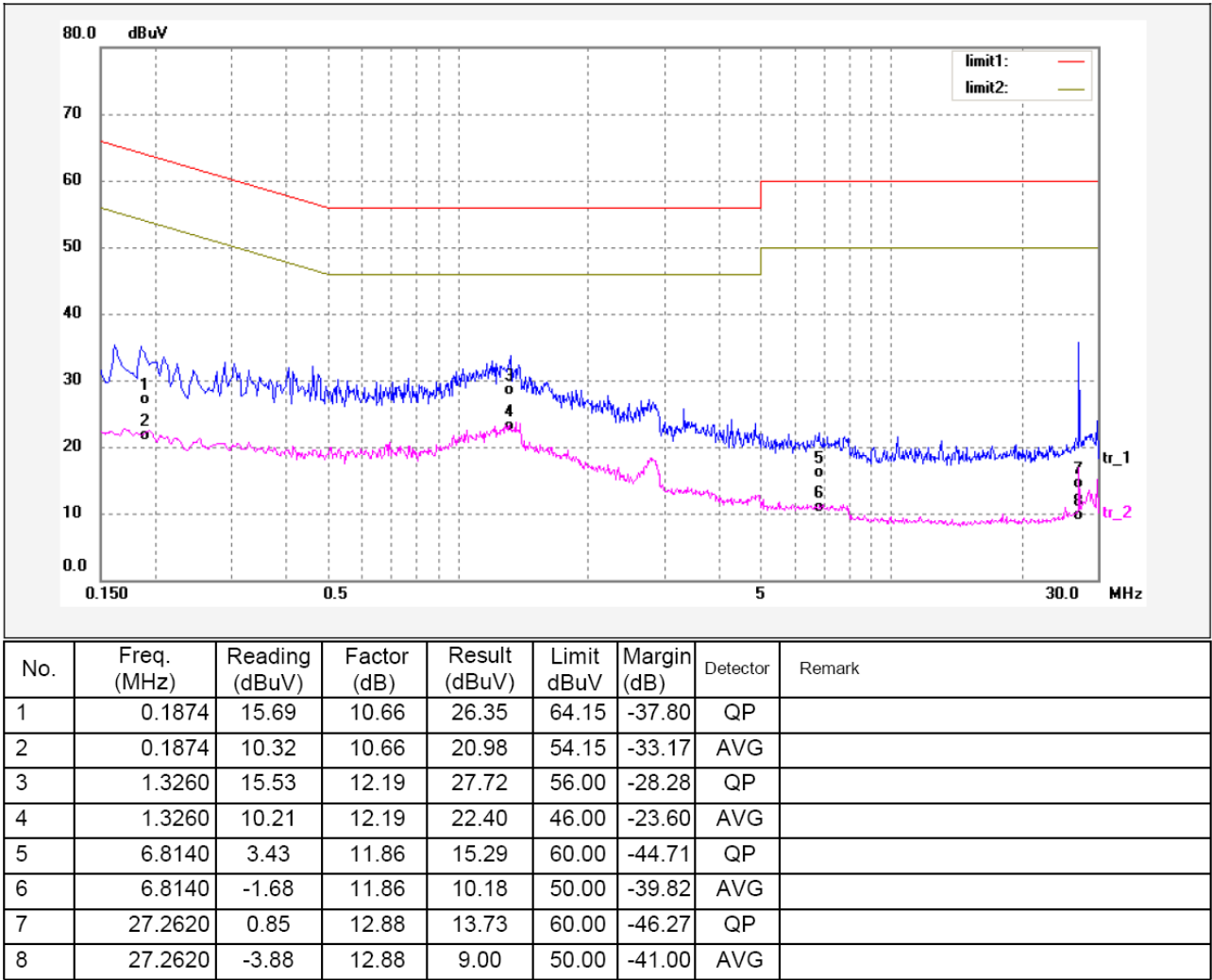
An initial pre-scan was performed on the live and neutral lines.

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:



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 (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:

- The tighter limit applies at the band edges.
- 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

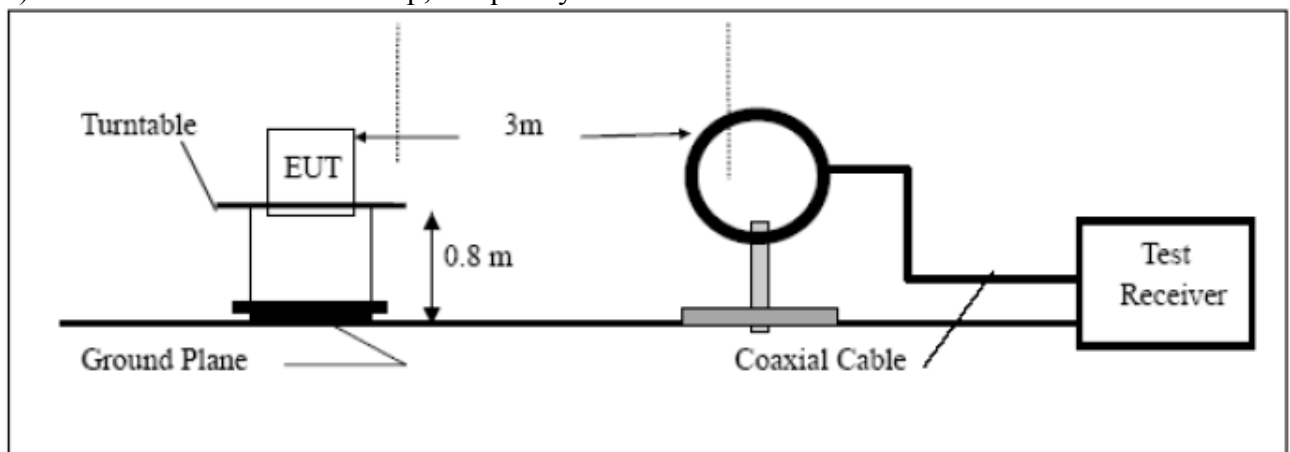
All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor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

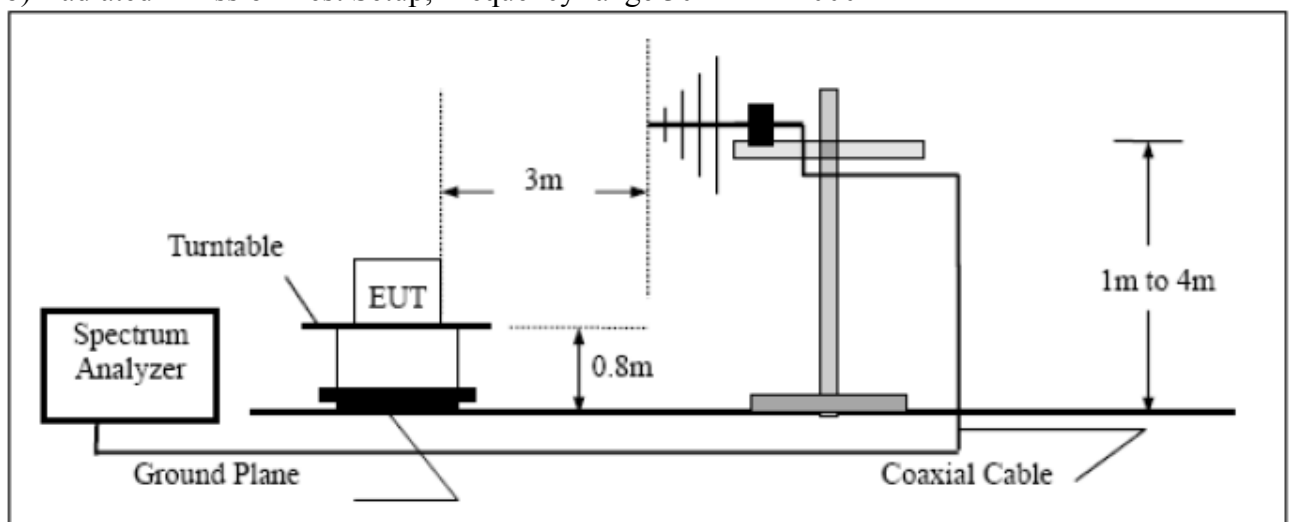
7.2 EUT Setup

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.

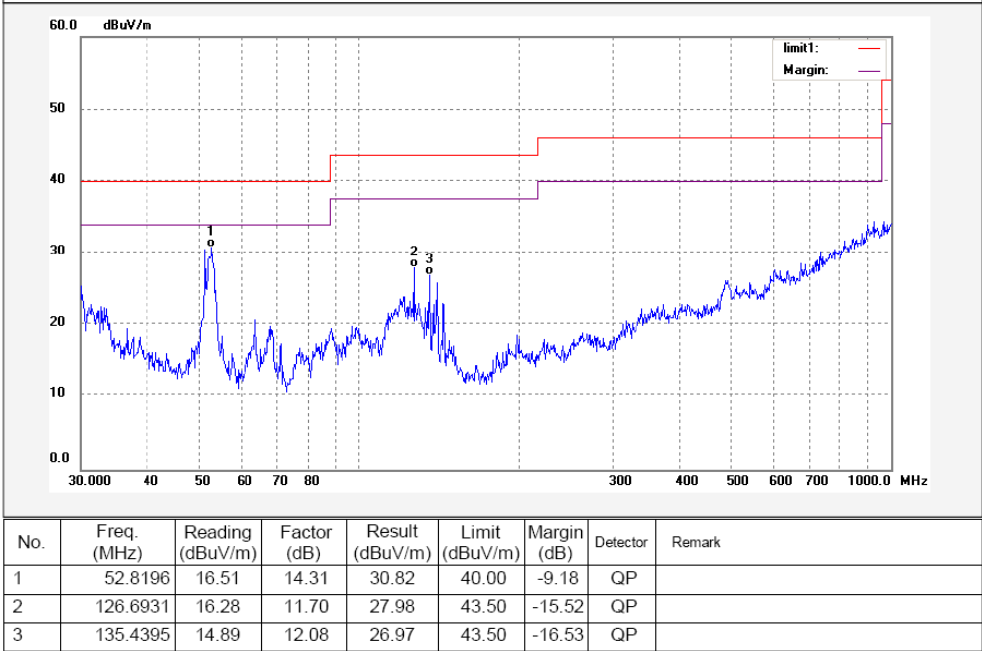
7.5 Summary of Test Results

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

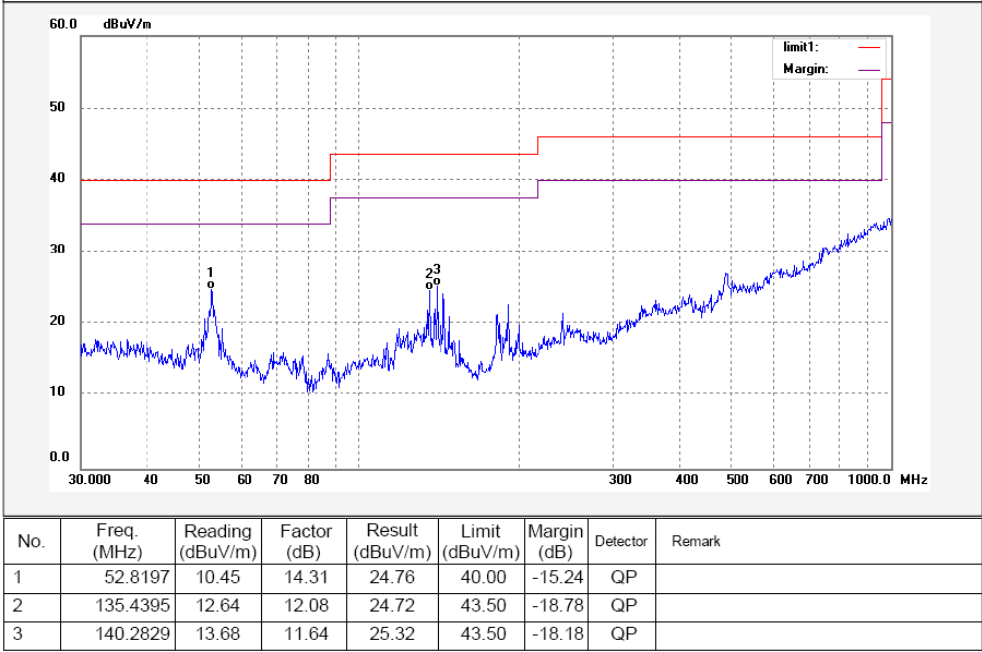
Test Data below 30MHz

Frequency (KHz)	Detector	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Measurement 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

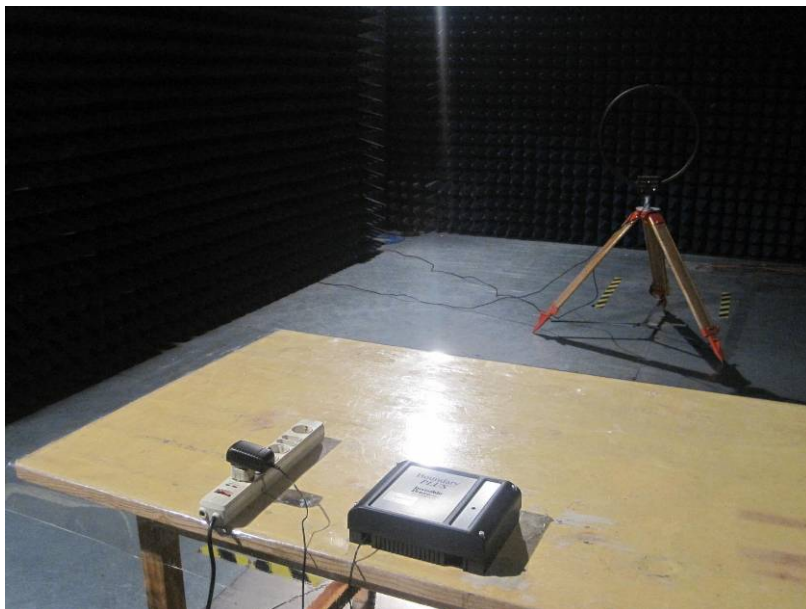


Antenna Porlarization: Horizontal

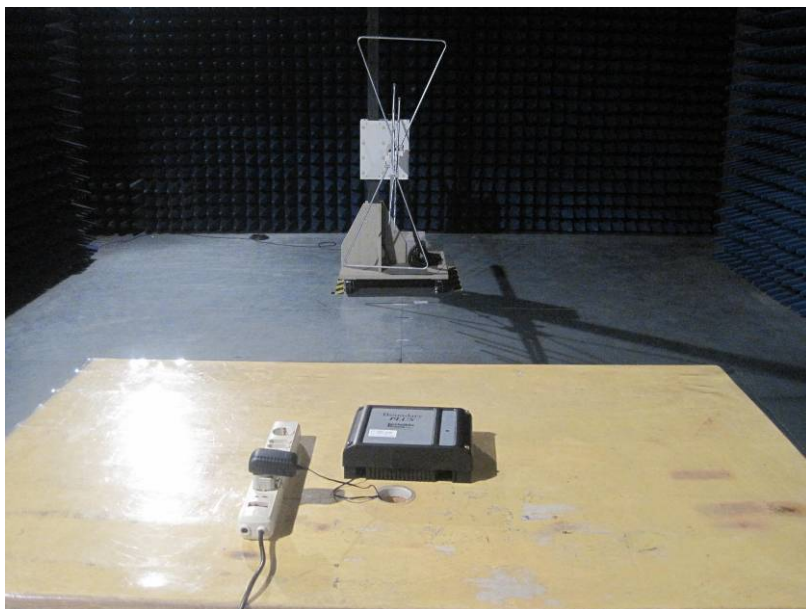


7.6 Photograph – Radiation Emission Test Setup

Below 30MHz

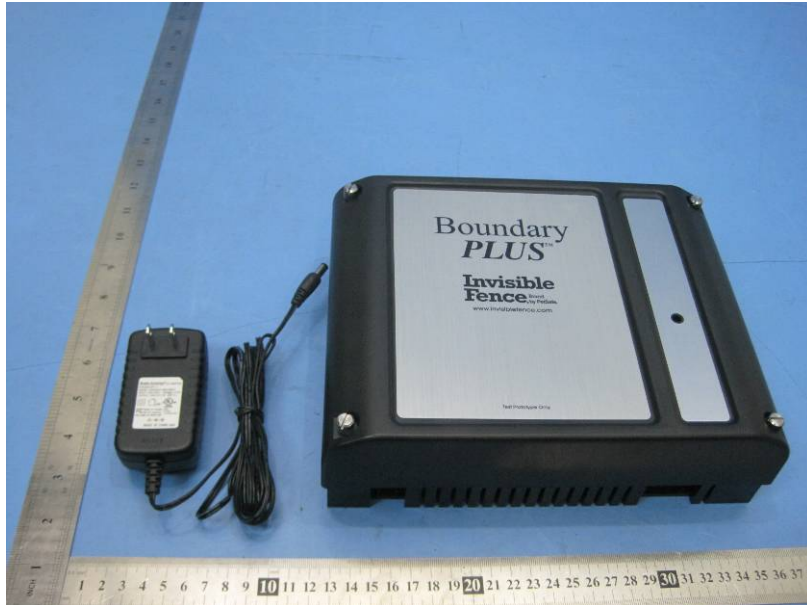


Above 30MHz



8 Photographs - Constructional Details

8.1 Product View



8.2 EUT – Appearance View

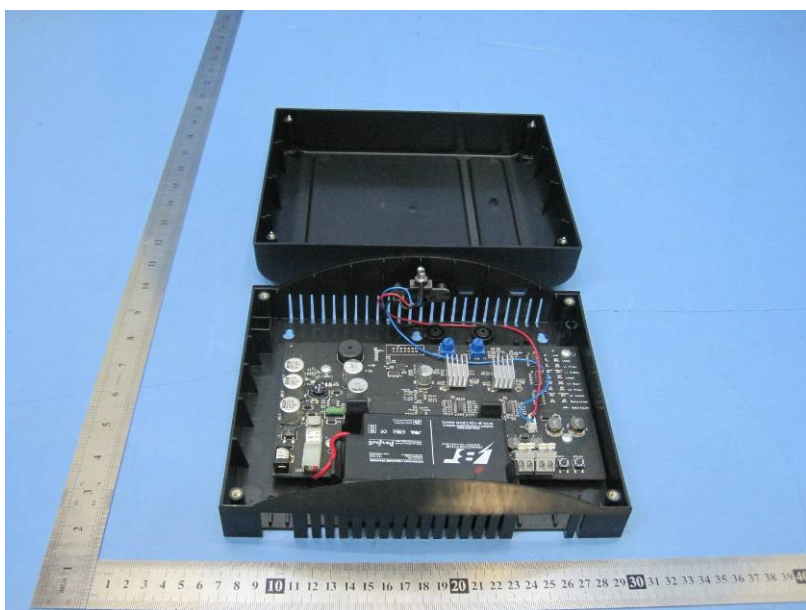


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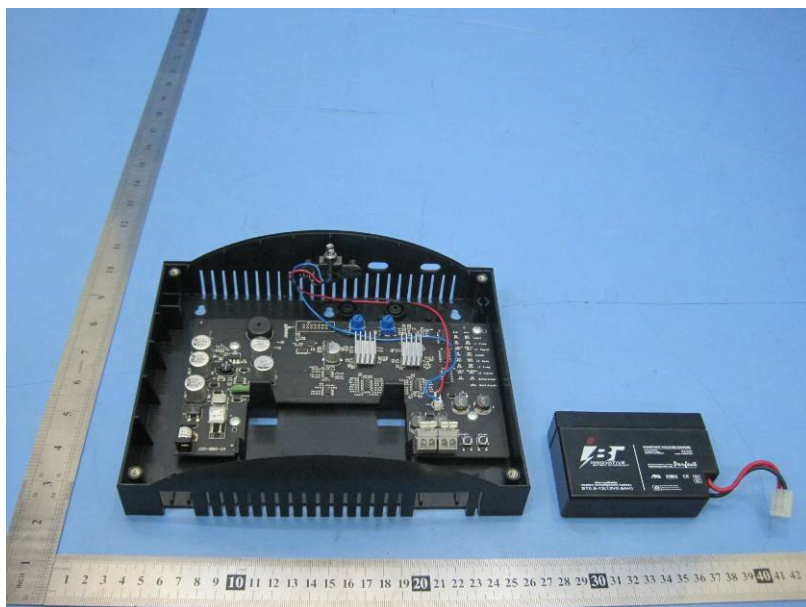


8.3 EUT – Open View

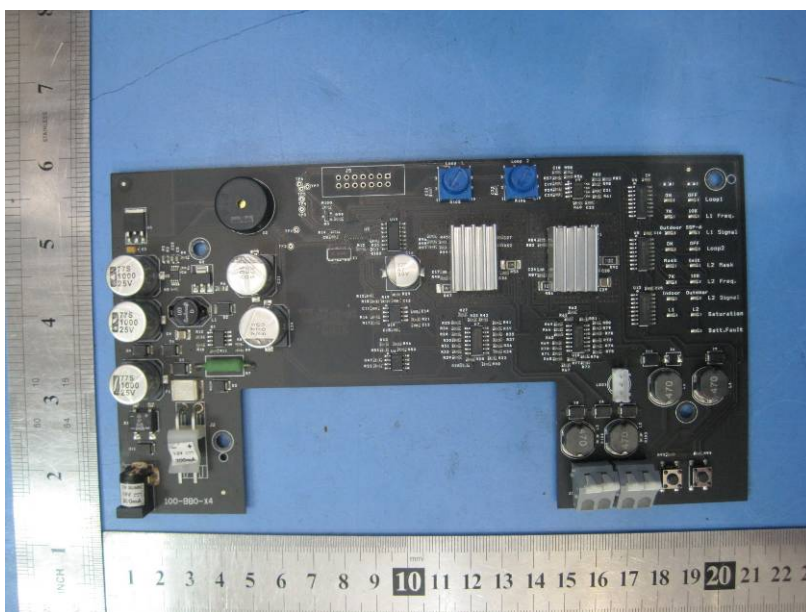


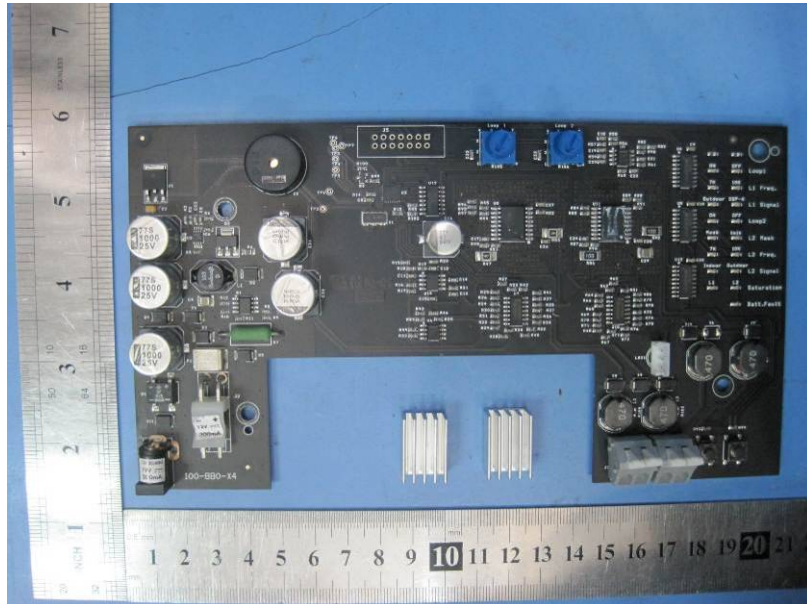
WALTEK SERVICES

Reference No.: WT11084242-D-E-F

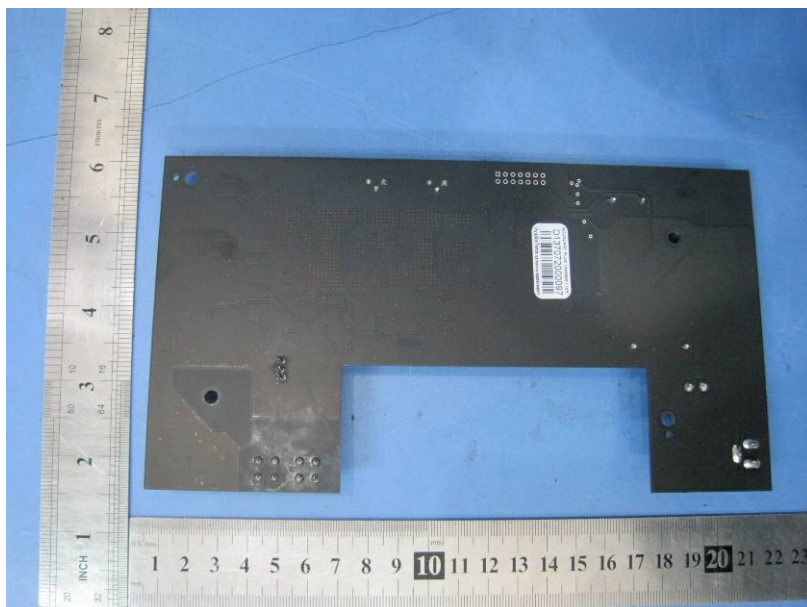


8.4 PCB – Front View





8.5 PCB – Back View



WALTEK SERVICES

Reference No.: WT11084242-D-E-F

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.

