COMMUNICATION CERTIFICATION LABORATORY

1940 West Alexander Street
Salt Lake City, UT 84119
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Test Report

Certification

Test of: tiwiPro

FCC ID Number: XB9TW1

Test Specifications:

47 CFR, Part 15, Subpart C

Test Report Serial No: 2157

Applicant:

inthinc, inc.
4225 West Lake Park Blvd., Suite 100
West Valley City, UT 84120
U.S.A.

Date of Test: April 21, 2009

Issue Date: April 30, 2009

Accredited Testing Laboratory By:

NVLAP

NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

This report has been prepared by Communication Certification Laboratory to document compliance of the device described below with the Federal Communications Commission (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction of this report may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

- Applicant: inthinc, inc.
- Manufacturer: inthinc, inc.
- Brand Name: inthinc
- Model Number: tiwiPro
- FCC ID Number: XB9TW1

On this 30th day of April 2009, I, individually, and for Communication Certification Laboratory, certify that the statements made in this engineering report are true, complete, and correct to the best of my knowledge, and are made in good faith.

Although NVLAP has accredited the Communication Certification Laboratory EMC testing facilities, this report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

COMMUNICATION CERTIFICATION LABORATORY

Tested by: Norman P. Hansen
EMC Technician

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SECTION 1.0 CLIENT INFORMATION

1.1 Applicant:

Company Name: inthinc, inc.
4225 West Lake Park Blvd., Suite 100
West Valley City, UT 84120
U.S.A.

Contact Name: Carleton Watkins
Title: VP of Engineering

1.2 Manufacturer:

Company Name: inthinc, inc.
4225 West Lake Park Blvd., Suite 100
West Valley City, UT 84120
U.S.A.

Contact Name: Carleton Watkins
Title: VP of Engineering

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	inthinc
Model Number:	tiwiPro
Serial Number:	None
Options Fitted:	N/A
Country of Manufacture:	U.S.A.

2.2 Description of EUT:

The tiwiPro is a device for monitoring driving behavior, driving style, and driving incidents. Sensors in the tiwiPro monitor the vehicle for things such as turns, braking, acceleration, seat belts, and speed. Data is sent to a collection center using an FCC certified Wavecom WMP100 cell phone module. An eRide Opus III ezRide GPS module operating at 1.575 GHz is used for location monitoring and in monitoring algorithms. A 13.56 MHz RFID module is included in the tiwiPro to assign a driver using a passive RFID tag. The tiwiPro is powered by the vehicle battery over the OBD II cable. Driving alerts and notifications are reported to the driver over an internal speaker using recorded audio with predefined messages.

This report covers the RFID transmitter circuitry subject to FCC Part 15, Subpart C. The other circuitry of this device that is subject to FCC Part 15, Subpart B is covered in a separate report.

2.3 EUT and Support Equipment:

The FCC ID numbers for all the EUT and support equipment used during the test are listed below:

Brand Name Model Number	FCC ID Number	Description	Name of Interface Ports / Interface Cables
BN: inthinc MN: tiwiPro SN: None	Cell phone module: O9EWMP100 RFID: XB9TW1	Vehicle driver monitor	See Section 2.4

2.4 Interface Ports on EUT:

Name of Ports	No. of Ports Fitted to EUT	Cable Descriptions/Length
OBD II	1	Permanently attached 16 conductor cable/9 feet
Micro SD slot	1	Direct connection to 2 GB SD card
Configuration	0	Not cabled – test and configuration port only
Development	0	No cable to mini USB port used for loading software
Custom Port	0	Not supported or defined at this time

2.5 Modification Incorporated/Special Accessories on EUT:

There were no modifications or special accessories required to comply with the specification.

Signature: _____

Typed Name: Carleton Watkins

Title: VP of Engineering

SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES

3.1 Test Specification:

Title: FCC PART 15, Subpart C (47 CFR 15).
Section 15.203, 15.207, 15.225

Antenna requirements
Operation within the band 13.110 – 14.010 MHz

Purpose of Test: The tests were performed to demonstrate initial compliance.

3.2 Methods & Procedures:

3.2.1 §15.203 Antenna Requirement

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 or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

3.2.2 §15.225

(a) The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters.

(b) Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

(e) The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of –20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For battery operated equipment, the equipment tests shall be performed using a new battery.

(f) In the case of radio frequency powered tags designed to operate with a device authorized under this section, the tag may be approved with the device or be considered as a separate device subject to its own authorization. Powered tags approved with a device under a single application shall be labeled with the same identification number as the device.

3.2.3 Test Procedure

The line conducted and radiated emissions testing was performed according to the procedures in ANSI C63.4 (2003). Testing was performed at CCL's Wanship open area test site #2, located at 29145 Old Lincoln Highway, Wanship, UT. This site has been fully described in a report submitted to the FCC, and was accepted in a letter dated June 6, 2006 (90504).

CCL participates in the National Voluntary Laboratory Accreditation Program (NVLAP) and has been accepted under NVLAP Lab Code: 100272-0, which is effective until September 30, 2009.

For radiated emission testing at 30 MHz or above that is performed at distances closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance. A factor of 40 dB per decade is used for frequencies from 9 kHz to 30 MHz.

SECTION 4.0 OPERATION OF EUT DURING TESTING

4.1 Operating Environment:

Power Supply: 12.0 VDC

4.2 Operating Modes:

The tiwiPro was in a constant transmit state for testing.

4.3 EUT Exercise Software:

Internal firmware was used to exercise the EUT.

SECTION 5.0 SUMMARY OF TEST RESULTS

5.1 FCC Part 15, Subpart C

5.1.1 Summary of Tests:

Section	Test Performed	Frequency Range (MHz)	Result
15.203	Antenna Requirements	Structural requirement	Complied
15.225 (a)	Radiated Emissions	13.553 – 13.567	Complied
15.225 (b)	Radiated Emissions	13.410 – 13.553 and 13.567 – 13.710	Complied
15.225(c)	Radiated Emissions	13.110 – 13.410 and 13.710 – 14.010	Complied
15.225 (d)	Radiated Emissions	0.009 – 1000 excluding the frequency bands of paragraphs (a) through (c)	Complied
15.225 (e)	Frequency Stability	13.56	Complied
15.225(f)	Powered RFID Tag Requirements	13.56	Not Applicable (Note 1)
Note 1: The EUT uses passive RFID tags so this paragraph is not applicable.			

5.2 Result

In the configuration tested, the EUT complied with the requirements of the specification.

SECTION 6.0 MEASUREMENTS, EXAMINATIONS AND DERIVED RESULTS

6.1 General Comments:

This section contains the test results only. Details of the test methods used and a list of the test equipment used during the measurements can be found in Appendix 1 of this report.

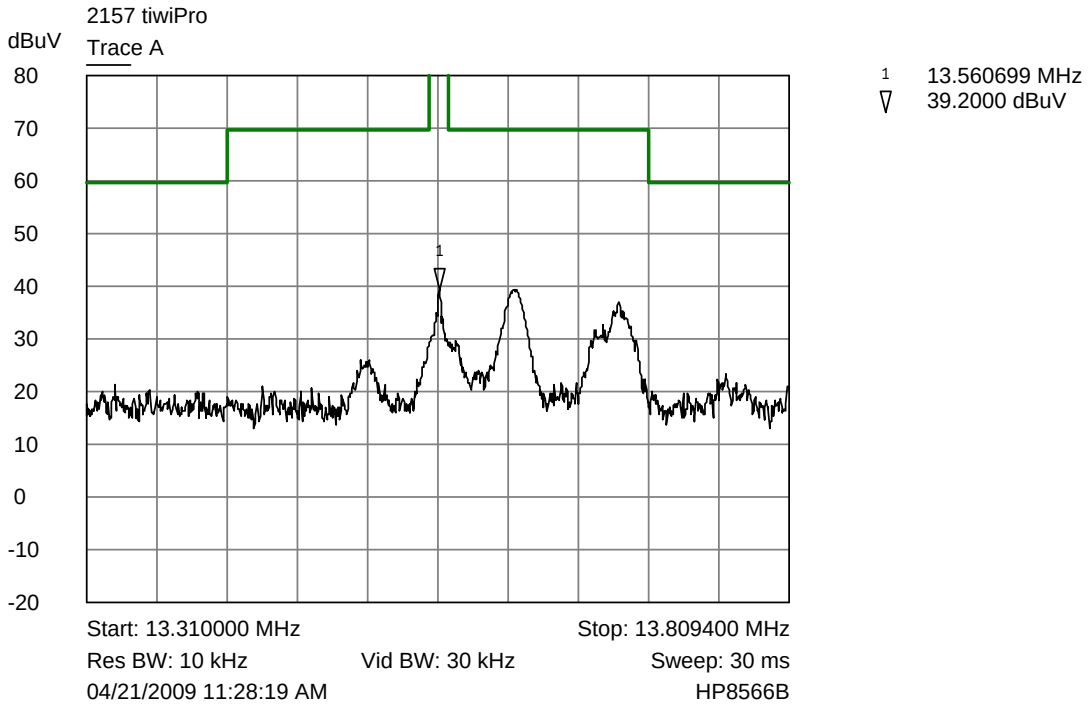
6.2 Test Results:

6.2.1 §15.203 Antenna Requirements

The antenna is etched on the PCB and is not replaceable so the requirements of this section are met.

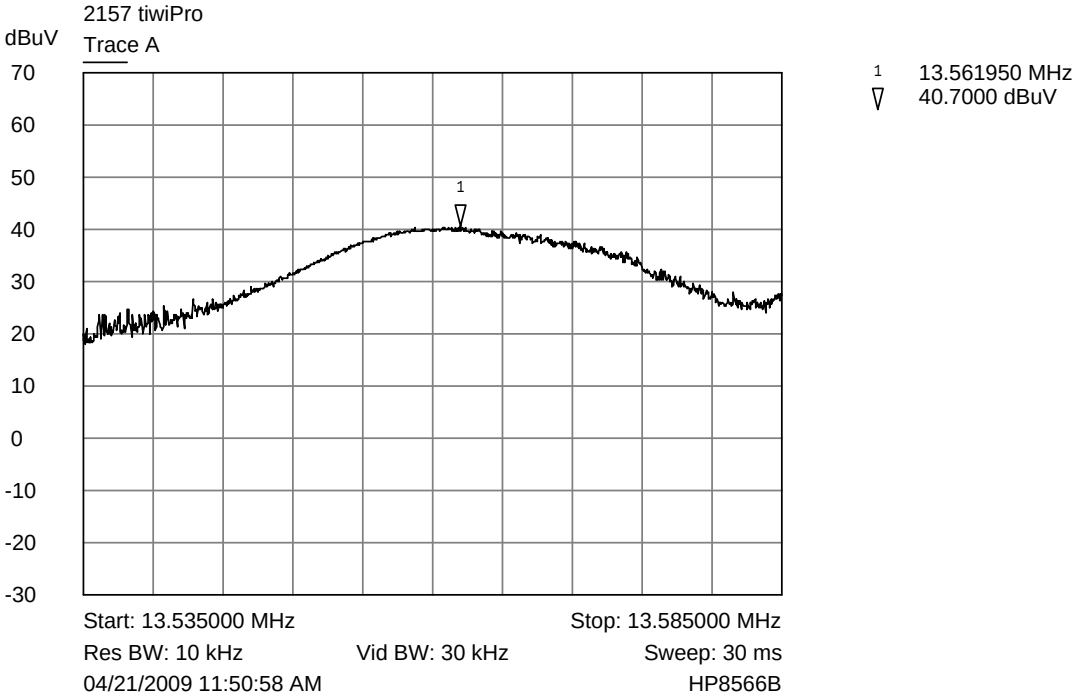
6.2.2 §15.225(a) – (d) Operation in the Band 13.110 – 14.010 MHz

The emissions from the tiwiPro must meet the emission mask specified in §15.225. The plots of the fundamental frequency and operating band of the transmitter are shown below. The data for the fundamental, harmonics, and spurious emissions is shown in tabular format after the plots.



10 meter measurement distance - normal operation - carrier noted with marker 1 - other signals are ambient of OA

Trace A Peak Detection Band of Operation - Corrected Trace - Antenna and Cable CF of 11.1 dB



10 meter measurement distance - 1 MHz span

Trace A Peak Detection Band of Operation - Corrected Trace - Antenna and Cable CF of 11.1 dB

Frequency (MHz)	Detector (Note 1)	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	Limit (dBμV/m) (Note 3)	Margin (dB)
13.56	Peak	(Note 2)	29.6	11.1	40.7	103.1	-62.4
27.12	Peak	(Note 2)	17.8	11.0	28.8	48.6	-19.8
40.68	Peak	Vertical	15.2	13.2	28.4	40.0	-11.6
40.68	Peak	Horizontal	4.3	13.2	17.5	40.0	-22.5
54.24	Peak	Vertical	17.4	9.1	26.5	40.0	-13.5
54.24	Peak	Horizontal	7.4	9.1	16.5	40.0	-23.5
67.8	Peak	Vertical	16.2	7.8	24.0	40.0	-16.0
67.8	Peak	Horizontal	10.5	7.8	18.3	40.0	-21.7
81.36	Peak	Vertical	7.8	7.7	15.5	40.0	-24.5
81.36	Peak	Horizontal	4.3	7.7	12.0	40.0	-28.0
94.92	Peak	Vertical	18.4	9.5	27.9	43.5	-15.6
94.92	Peak	Horizontal	9.2	9.5	18.7	43.5	-24.8
108.48	Peak	Vertical	6.2	9.7	15.9	43.5	-27.6

Frequency (MHz)	Detector (Note 1)	Antenna Polarity	Receiver Reading (dBμV)	Correction Factor (dB/m)	Field Strength (dBμV/m)	Limit (dBμV/m) (Note 3)	Margin (dB)
108.48	Peak	Horizontal	5.6	9.7	15.3	43.5	-28.2
122.04	Peak	Vertical	8.7	8.7	17.4	43.5	-26.1
122.04	Peak	Horizontal	6.3	8.7	15.0	43.5	-28.5
135.60	Peak	Vertical	6.7	8.8	15.5	43.5	-28.0
135.60	Peak	Horizontal	4.2	8.8	13.0	43.5	-30.5

Note 1: The reference detector used for the measurements was peak and the data was compared to the quasi-peak limit.

Note 2: Active loop antenna was used for these measurements.

Note 3: At frequencies below 30 MHz, the measurement distance was 10 meters and the limit adjusted accordingly using an inverse proportionality factor of 40 dB per decade. At frequencies above 30 MHz, the measurement distance was 3 meters.

Sample Field Strength Calculation:

The field strength is calculated by adding the Correction Factor (Antenna Factor + Cable Factor) and the Average Factor to the measured level of the receiver. The receiver amplitude reading is compensated for any amplifier gain.

The basic equation with a sample calculation is shown below:

FS = RA + CF + AV Where

FS = Field Strength
RA = Receiver Amplitude Reading
CF = Correction Factor (Antenna Factor + Cable Factor)
AV = Averaging Factor

Assume a receiver reading of 44.2 dBμV is obtained from the receiver, with an average factor of –8.6 dB and a correction factor of 17.5 dB. The field strength is calculated by adding the correction factor and the average factor, giving a field strength of 53.1 dBμV/m, FS = 44.2 + 17.5 + (-8.6) = 53.1 dBμV/m

RESULT

In the configuration tested, the EUT complied with the requirements of §15.225 (a) – (d) with a nearest margin to the limit of 11.6 dB.

6.2.3 §15.225 (e) Frequency Stability Over Temperature and Voltage Fluctuations

The frequency tolerance of the carrier signal shall be maintained within +/-0.01% of the operating frequency over a temperature variation of –20° to +50°C at normal voltage, and to allow for a variance in the vehicle battery voltage, at voltages of 10.8 to 15.6 VDC at a temperature of 20°C.

The operating frequency of the tiwiPro is 13.56 MHz; therefore, the frequency must be maintained between 13.558644 MHz and 13.561,356 MHz.

13.56 MHz x 0.0001 = 1.356 kHz

Lower edge of range = 13.56 MHz – 1.356 kHz = 13.558644 MHz
Upper edge of range = 13.56 MHz + 1.356 kHz = 13.561356 MHz

Time of Measurement	12.0 VDC +20°C	12.0 VDC +50°C	12.0 VDC -20°C	10.8 VDC +20°C	15.6 VDC +20°C
Start up	13559778	13559278	13560028	13559778	13559778
2 minutes	13559778	13559528	13560028	13559778	13559778
5 minutes	13559778	13559678	13559978	13559778	13559778
10 minutes	13559778	13559768	13559928	13559778	13559778

RESULT

The maximum deviation from the fundamental frequency of 13.56 MHz was 722 Hz or 0.005%; therefore, the EUT meets the requirement of §15.225 (e).

APPENDIX 1 TEST PROCEDURES AND TEST EQUIPMENT

A1.1 Radiated Disturbance:

The radiated disturbance from the EUT was measured using a spectrum analyzer with a quasi-peak adapter for peak and quasi-peak readings. A preamplifier with a fixed gain of 26 dB and a power amplifier with a fixed gain of 22 dB were used to increase the sensitivity of the measuring instrumentation. The quasi-peak adapter uses a bandwidth of 120 kHz, with the spectrum analyzer's resolution bandwidth set at 1 MHz, for readings in the 30 to 1000 MHz frequency ranges.

An active loop antenna was used to measure frequencies below 30 MHz at a distance of 10 meters from the EUT. A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz, at a distance of 10 meters from the EUT. The readings obtained by these antennas are correlated to the levels obtained with a tuned dipole antenna by adding antenna factors.

The configuration of the EUT was varied to find the maximum radiated emission. The EUT was connected to the peripherals listed in Section 2.3 via the interconnecting cables listed in Section 2.4. A technician manually manipulated these interconnecting cables to obtain worst-case radiated disturbance. The EUT was rotated 360 degrees, and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. Where there was multiple interface ports all of the same type, cables are either placed on all of the ports or cables added to these ports until the emissions do not increase by more than 2 dB.

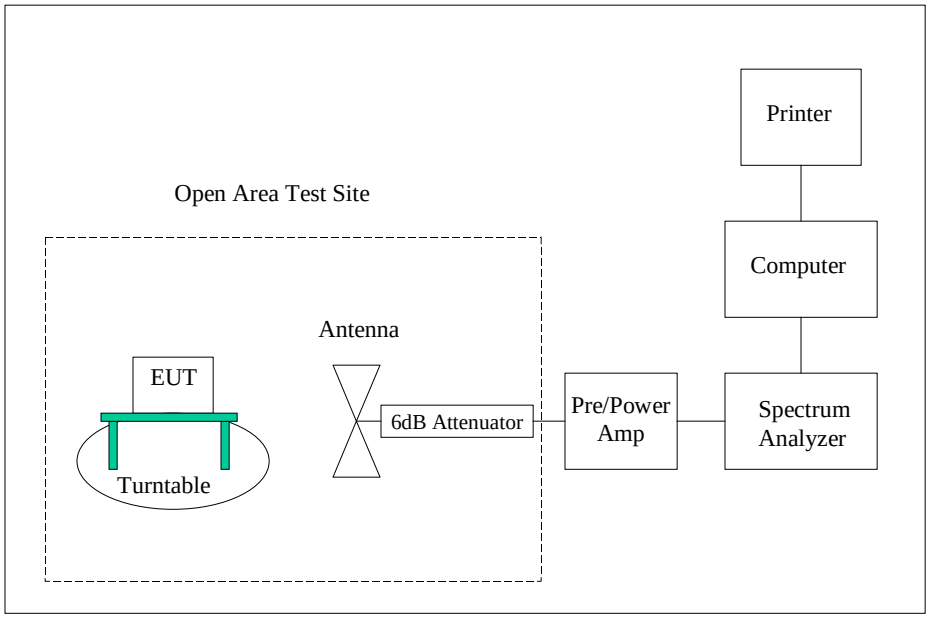
Desktop EUT are measured on a non-conducting table 0.8 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	CCL	N/A	N/A	10/08/2008
Test Software	CCL	Radiated Emissions	Revision 1.3	N/A
Spectrum Analyzer/Receiver	Rhode & Schwarz	1302.6005.40	100064	06/23/2008
Spectrum Analyzer	Hewlett Packard	8566B	2230A01711	10/31/2008

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00137	11/05/2008
Biconilog Antenna	EMCO	3142	9601-1008	9/26/2008
3 Meter Radiated Emissions Cable Wanship Site #2	CCL	Cable K	N/A	12/31/2008
10 Meter Radiated Emissions Cable Wanship Site #2	CCL	Cable L	N/A	12/31/2008
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	08/28/2008
Active Loop Antenna	EMCO	6502	9111-2675	03/12/2009
6 dB Attenuator	Hewlett Packard	8491A	32835	12/31/2008

An independent calibration laboratory or CCL personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting documentation relative to tractability is on file and is available for examination upon request.

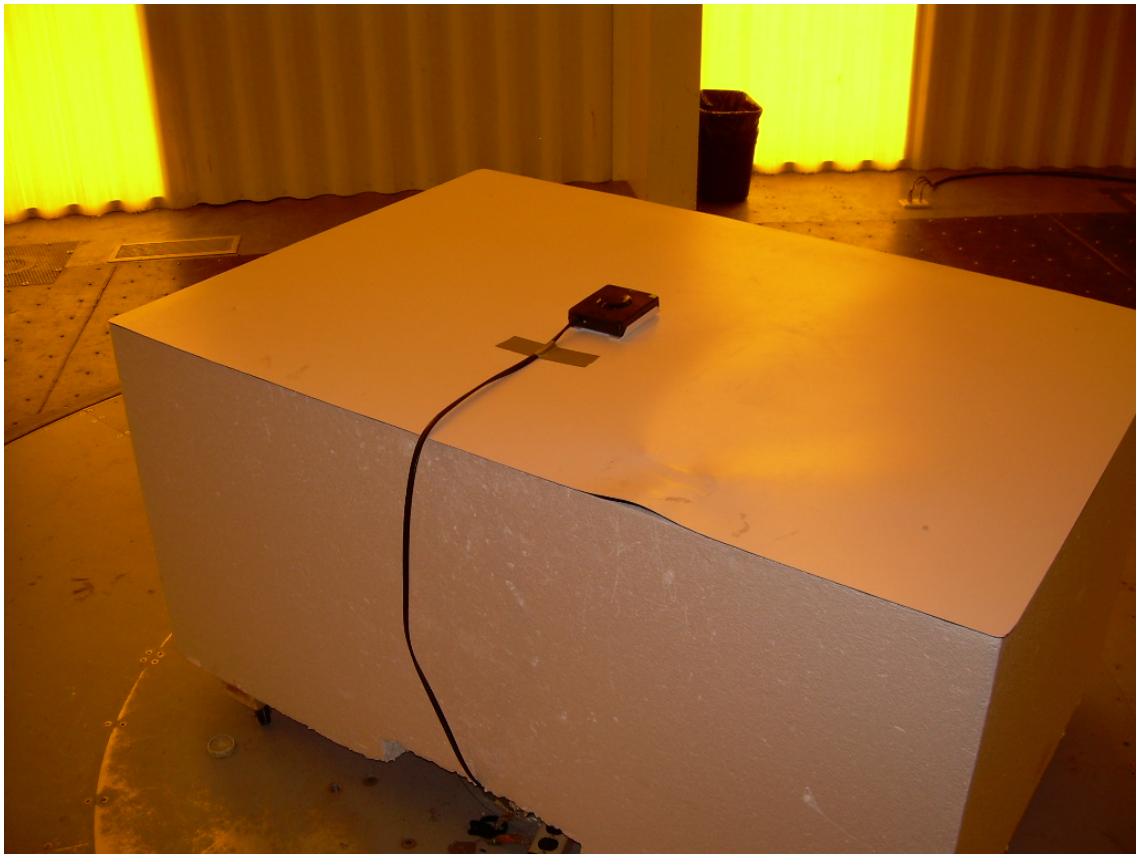
Radiated Emissions Test Setup



APPENDIX 2 PHOTOGRAPHS

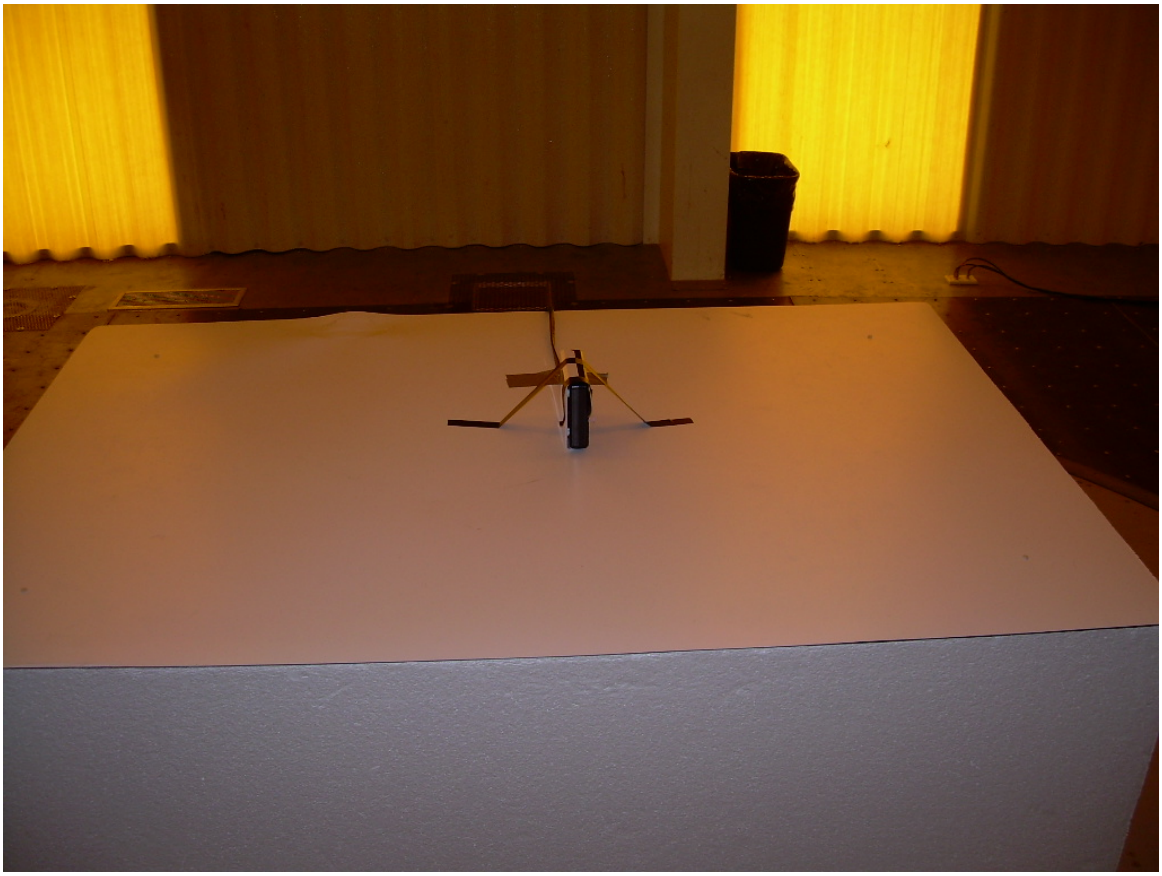
Photograph 1 – Front View Radiated Disturbance Worst Case Configuration – Horizontal Placement

Photograph 2 – Back View Radiated Disturbance Worst Case Configuration – Horizontal Placement



Photograph 3 – Vertical EUT Placement

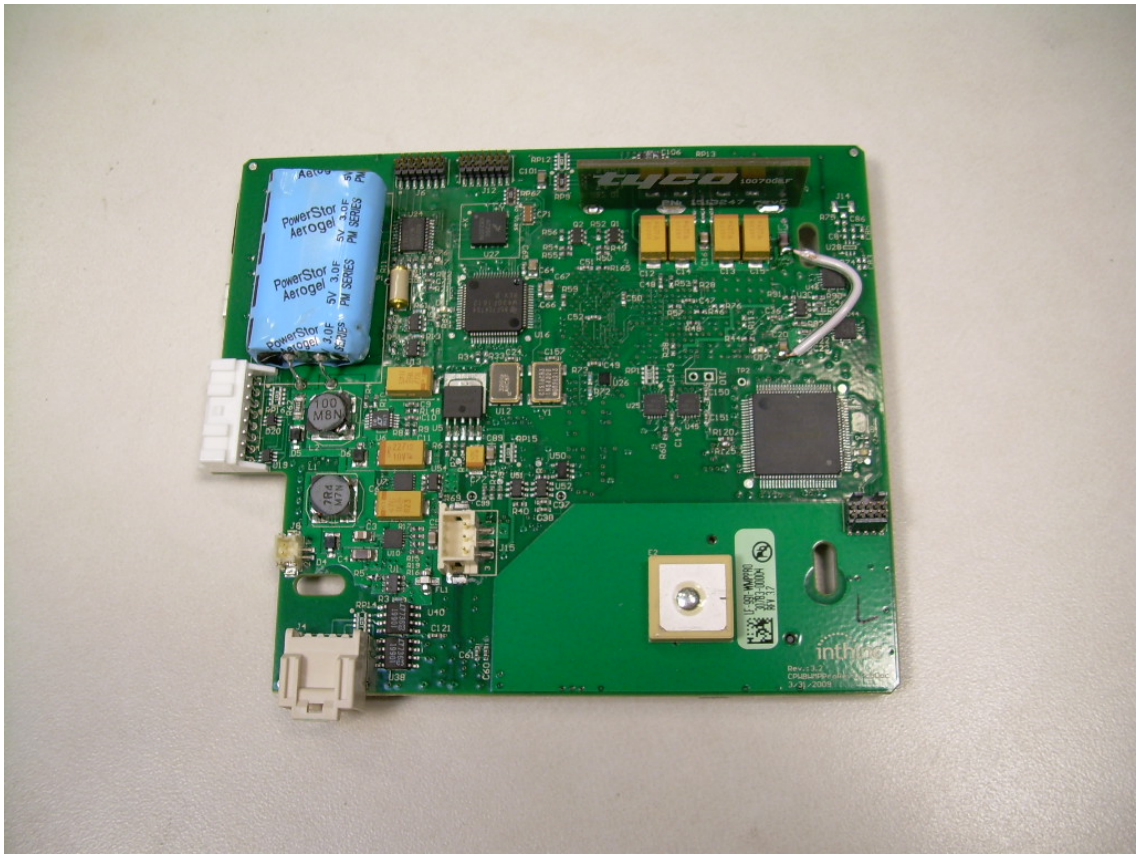
Photograph 4 – On Edge EUT Placement



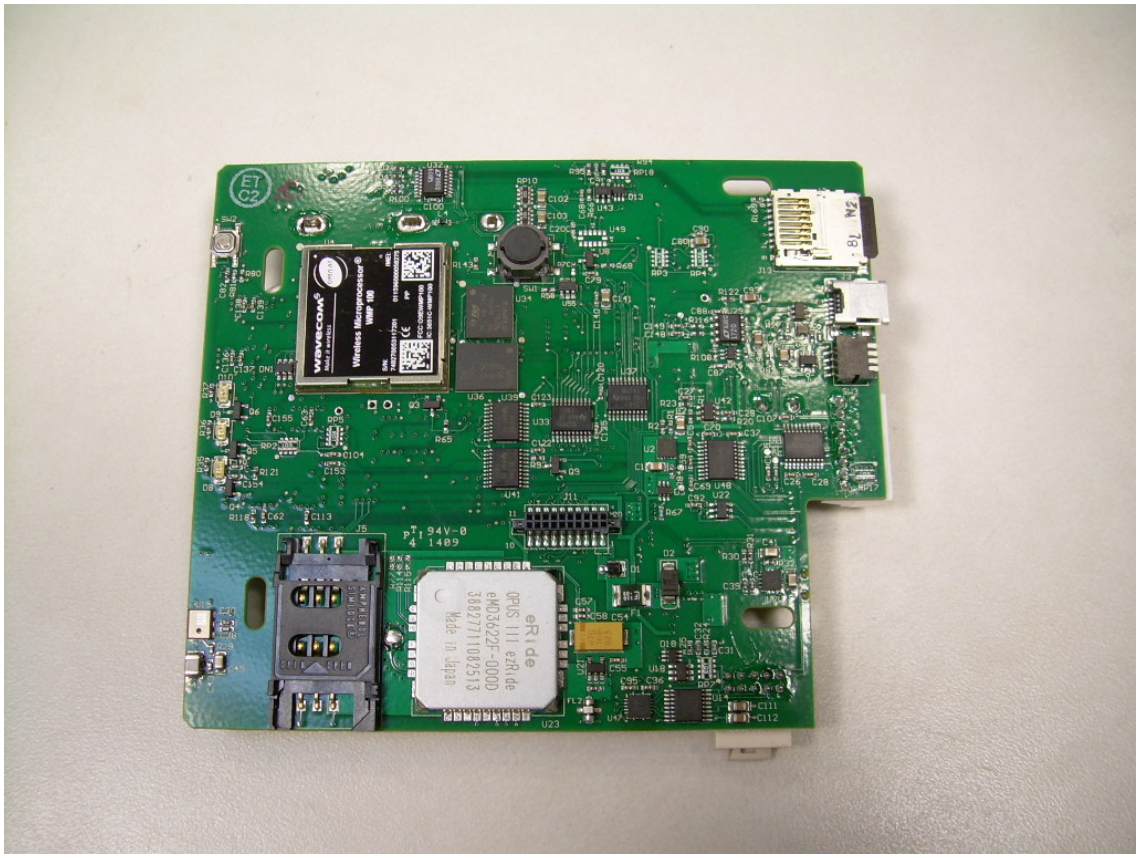
Photograph 5 – Front/Top View of the EUT

Photograph 6 – Back/Bottom View of the EUT

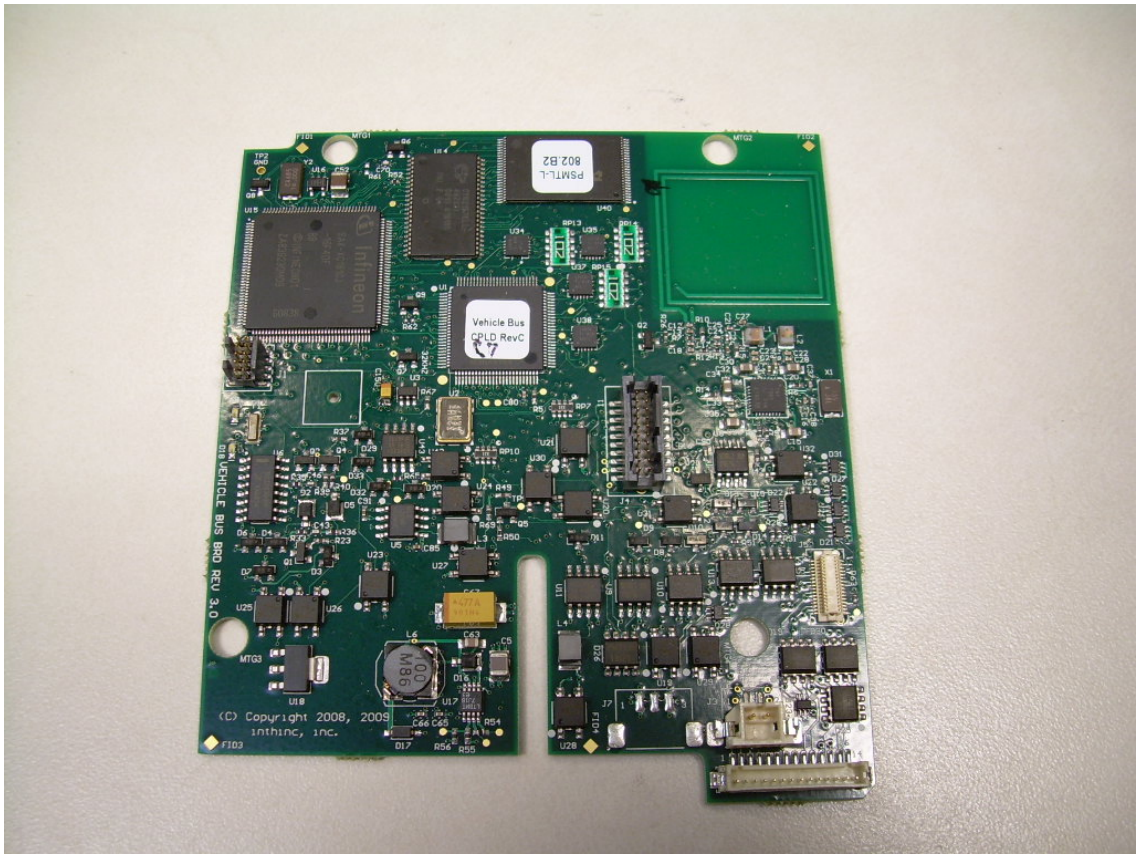
Photograph 7 – Side A of the Cell Phone/GPS PCB



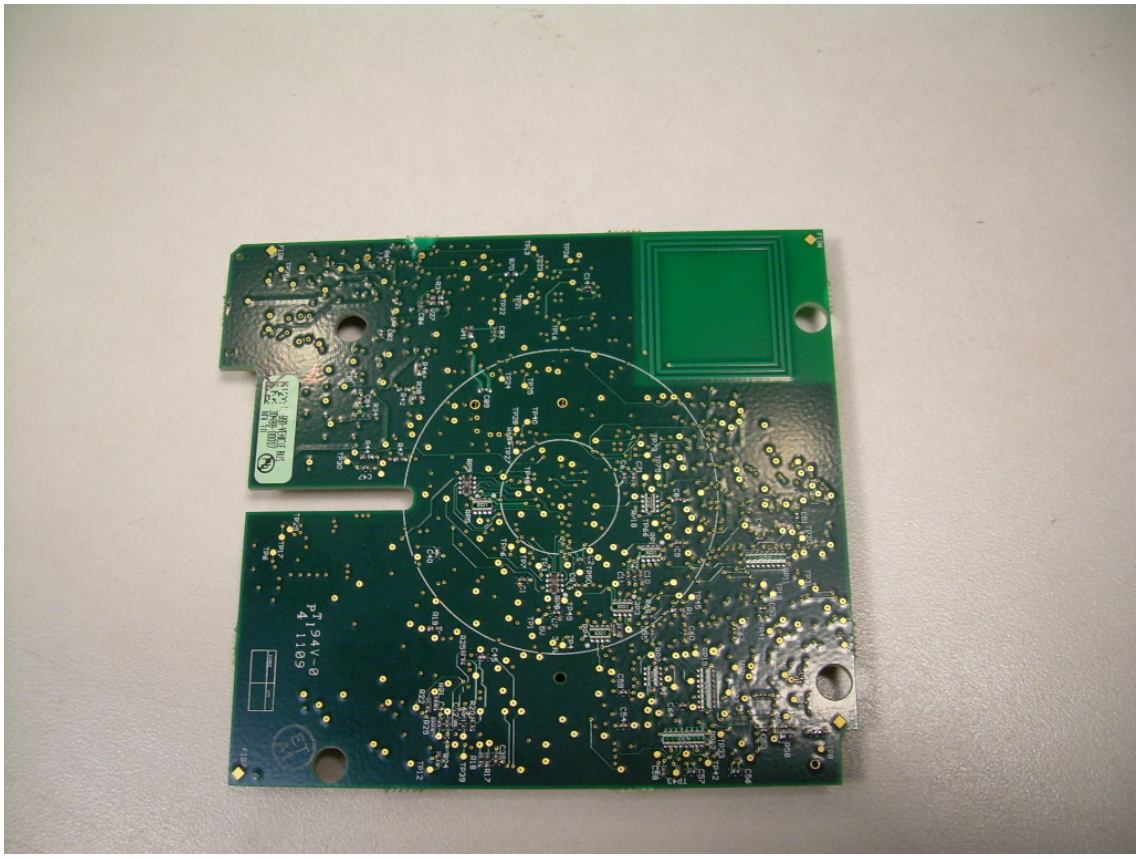
Photograph 8 – Side B of the Cell Phone/GPS PCB



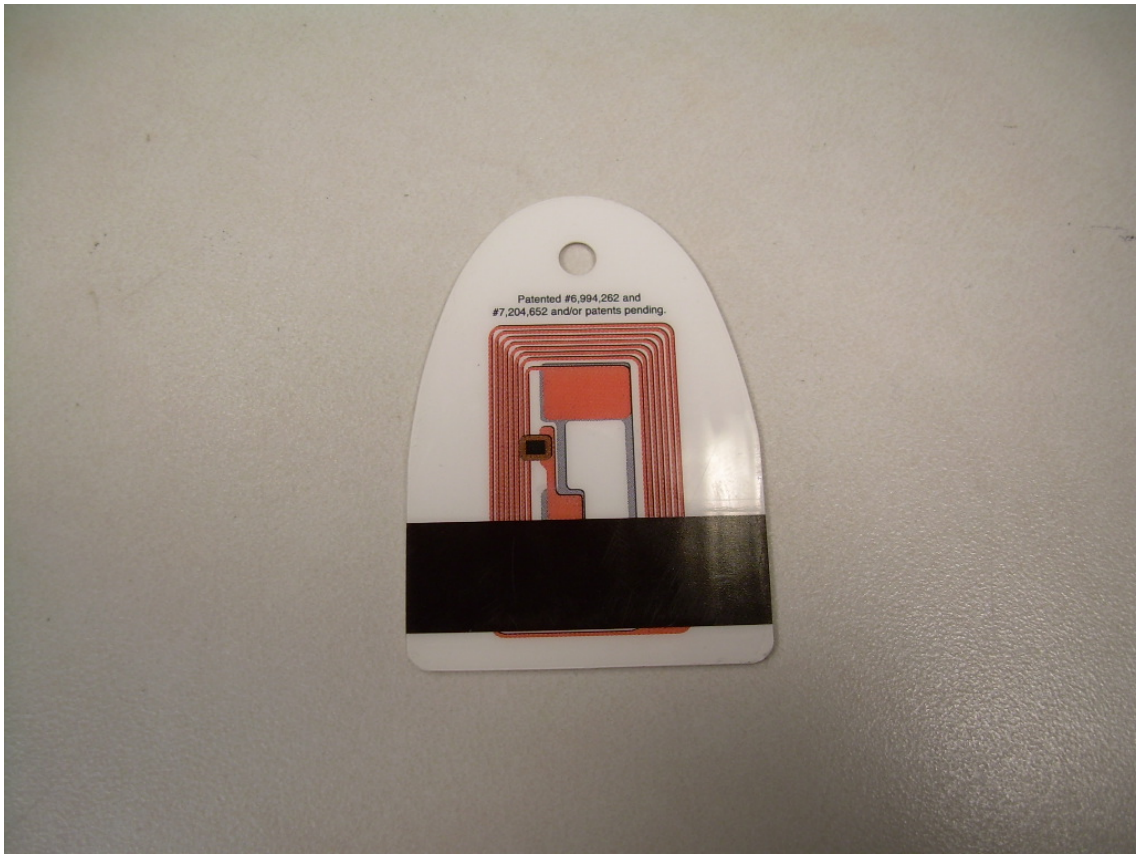
Photograph 9 – Component Side of the RFID PCB



Photograph 10 – Trace Side of the RFID PCB



Photograph 11 – Antenna Side of the RFID Tag



Photograph 12 – Top Side of the RFID Tag