

# COMMUNICATION CERTIFICATION LABORATORY

1940 West Alexander Street  
Salt Lake City, UT 84119  
801-972-6146

## Test Report

Certification

Test Of: PC7

FCC ID#: WCS-PC7

Test Specification:

FCC PART 15, Subpart C

Test Report Serial No: 2404

Applicant:

SRM Service Center, Inc.  
720 West Monument Street  
Colorado Springs, CO 80904

Date of Test: October 7, 2009

Issue Date: October 8, 2009

Accredited Testing Laboratory By:



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 requirements of Federal Communications Commission (FCC) Part 15, Subpart C. This report may be reproduced in full. Partial reproduction may only be made with the written consent of the laboratory. The results in this report apply only to the sample tested.

- Applicant: SRM Service Center, Inc.
- Manufacturer: SRM Service Center, Inc.
- Brand Name: SRM
- Model Number: PC7
- FCC ID Number: WCS-PC7

On this 8<sup>th</sup> day of October 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: SRM Service Center, Inc.  
720 West Monument Street  
Colorado Springs, CO 80904

Contact Name: Ulrich Schoberer  
Title: Owner

**1.2 Manufacturer:**

Company Name: SRM Service Center, Inc.  
720 West Monument Street  
Colorado Springs, CO 80904

Contact Name: Ulrich Schoberer  
Title: Owner

**SECTION 2.0 EQUIPMENT UNDER TEST (EUT)****2.1 Identification of EUT:**

Brand Name:	SRM
Model Number:	PC7
Serial Number:	None
Country of Manufacture:	Germany

**2.2 Description of EUT:**

The PC7 interfaces a PowerMeter6 via a 2.457 GHz transceiver to create a system for monitoring and measuring the torque applied to a bicycle crank. The PC7 is the display portion of the system. The 2.457 GHZ transceiver uses ANT + Sport protocol for communication. The PC7 is powered by a 3.6 Vdc NiMH battery that may be charged over a USB port using a SRM UE05WCP-050100SPA, 5.0 Vdc at 1.0 amp, power supply. The PC7 does not transmit while connection is made to the USB port.

This report covers the transceiver circuitry of the device subject to FCC Part 15, Subpart C. The circuitry, subject to FCC Part 15, Subpart B is to be tested and the results shown in a separate report. See CCL report #2403.

**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 Serial No.	FCC ID Number	Description	Name of Interface Ports / Interface Cables
BN: SRM MN: PC7	WCS-PC7	Control Assembly	See Section 2.4

Note: (1) EUT

**2.4 Interface Ports on EUT:**

Name of Port	No. of Ports Fitted to EUT	Cable Descriptions/Length
USB	1	USB cable/1 meter

**2.5 Modification Incorporated/Special Accessories on EUT:**

The following modifications were made to the PC7 by the Client during testing to comply with the specification. These modifications will be implemented during manufacturing.

1. The software was changed to set the transmitter power the -10 setting.

Signature: \_\_\_\_\_

Typed Name: Ulrich Schoberer

Title: Owner

**SECTION 3.0 TEST SPECIFICATION, METHODS & PROCEDURES****3.1 Test Specification:**

Title: FCC PART 15, Subpart C (47 CFR 15)  
15.203 and 15.249

Limits and methods of measurement of radio interference characteristics of radio frequency devices.

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 §15.249 Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, 5725 - 5875 MHz, and 24.0 - 24.25 GHz**

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (Microvolts/meter)
902 - 928 MHz	50	500
2400 - 2483.5 MHz	50	500
5725 - 5875 MHz	50	500
24.0 - 24.25 GHz	250	2500

(b) Fixed, point-to-point operation as referred to in this paragraph shall be limited to systems employing a fixed transmitter transmitting to a fixed remote location. Point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information are not allowed. Fixed, point-to-point operation is permitted in the 24.05-24.25 GHz band subject to the following conditions:

(1) The field strength of emissions in this band shall not exceed 2500 millivolts/meter.

(2) The frequency tolerance of the carrier signal shall be maintained within + 0.001% 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.

(3) Antenna gain must be at least 33 dBi. Alternatively, the main lobe beamwidth must not exceed 3.5 degrees. The beamwidth limit shall apply to both the azimuth and elevation planes. At antenna gains over 33 dBi or beamwidths narrower than 3.5 degrees, power must be reduced to ensure that the field strength does not exceed 2500 millivolts/meter.

(c) Field strength limits are specified at a distance of 3 meters.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation.

(e) As shown in Section 15.35(b), for frequencies above 1000 MHz, the above field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any

condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

(f) Parties considering the manufacture, importation, marketing or operation of equipment under this section should also note the requirement in Section 15.37(d).

### **3.3 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 March 11, 2009 (90504).

CCL is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2010.

For radiated emissions 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.

**SECTION 4.0 OPERATION OF EUT DURING TESTING**

**4.1 Operating Environment:**

Power Supply: 3.6 VDC NiMH battery

**4.2 Operating Modes:**

The EUT was tested on three orthogonal axes while in a constant transmit mode.

**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:**

Paragraph	Requirements	Frequency Range (MHz)	Result
15.203	Antenna Requirements	N/A	Complied
15.249	Radiated Field Strengths	30 to 24570	Complied

**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 EUT uses a trace on the PCB for an antenna.

**RESULT**

The EUT complied with the specification.

**6.2.2 §15.249 Radiated Field Strength (Vertical Polarity)**

Frequency (MHz)	Detector	Receiver Reading (dB $\mu$ V)	Correction Factor (dB/m)	Field Strength (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
2457.25	Peak	41.4	31.6	73.0	114.0	-41.0
2475.25	Average	40.5	31.6	72.1	94.0	-21.9
4914.50	Peak	16.1	37.7	53.8	74.0	-20.2
4914.50	Average	14.1	37.7	51.8	54.0	-2.2
7371.75	Peak	3.2	41.8	45.0	74.0	-29.0
7173.75	Average	-7.1	41.8	34.7	54.0	-19.3
9829.00	Peak	5.3	44.3	49.6	74.0	-24.4
9829.00	Average	-5.4	44.3	38.9	54.0	-15.1
12286.25	Peak	5.6	45.5	51.1	74.0	-22.9
12286.25	Average	-5.4	45.5	40.1	54.0	-13.9
14743.50	Peak	4.3	49.0	53.3	74.0	-20.7
14743.50	Average	-5.8	49.0	43.2	54.0	-10.8
17200.75	Peak	5.6	49.8	55.4	74.0	-18.6
17200.75	Average	-4.4	49.8	45.4	54.0	-8.6
19658.00	Peak	15.8	50.1	65.9	74.0	-8.1
19658.00	Average	-2.6	50.1	47.5	54.0	-6.5
22115.25	Peak	16.3	50.6	66.9	74.0	-7.1
22115.25	Average	-2.2	50.6	48.4	54.0	-5.6

Frequency (MHz)	Detector	Receiver Reading (dB $\mu$ V)	Correction Factor (dB/m)	Field Strength (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
24572.50	Peak	17.0	51.0	68.0	74.0	-6.0
24572.50	Average	-1.9	51.0	49.1	54.0	-4.9

RESULT

The EUT complied with the specification limit by a margin of 2.2 dB.

**6.2.3 §15.249 Radiated Disturbance Data (Horizontal Polarity)**

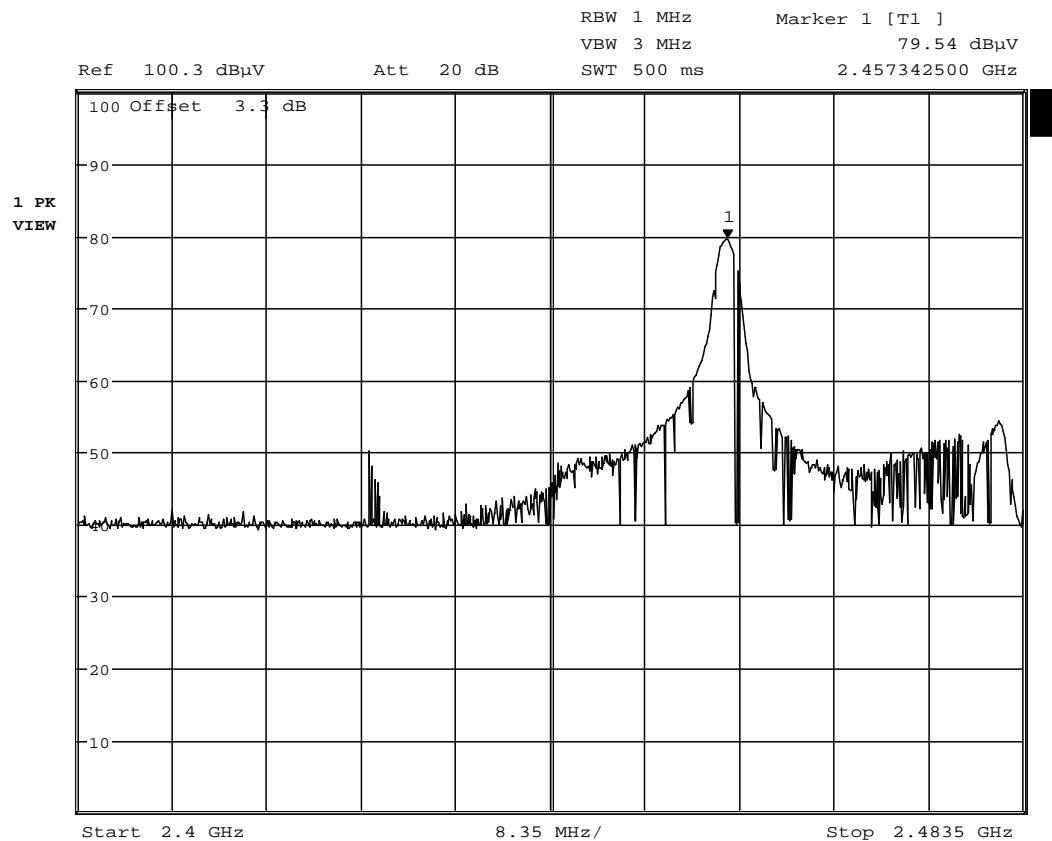
Frequency (MHz)	Detector	Receiver Reading (dB $\mu$ V)	Correction Factor (dB/m)	Field Strength (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
2457.25	Peak	48.8	31.6	80.4	114.0	-33.6
2475.25	Average	48.2	31.6	79.8	94.0	-14.2
4914.50	Peak	14.4	37.7	52.1	74.0	-21.9
4914.50	Average	12.4	37.7	50.1	54.0	-3.9
7371.75	Peak	3.8	41.8	45.6	74.0	-28.4
7173.75	Average	-6.9	41.8	34.9	54.0	-19.1
9829.00	Peak	5.1	44.3	49.4	74.0	-24.6
9829.00	Average	-5.9	44.3	38.4	54.0	-15.6
12286.25	Peak	5.3	45.5	50.8	74.0	-23.2
12286.25	Average	-5.4	45.5	40.1	54.0	-13.9
14743.50	Peak	4.9	49.0	53.9	74.0	-20.1
14743.50	Average	-5.8	49.0	43.2	54.0	-10.8
17200.75	Peak	6.4	49.8	56.2	74.0	-17.8
17200.75	Average	-4.4	49.8	45.4	54.0	-8.6
19658.00	Peak	15.8	50.1	65.9	74.0	-8.1
19658.00	Average	-2.6	50.1	47.5	54.0	-6.5
22115.25	Peak	16.3	50.6	66.9	74.0	-7.1
22115.25	Average	-2.2	50.6	48.4	54.0	-5.6
24572.50	Peak	17.0	51.0	68.0	74.0	-6.0
24572.50	Average	-1.9	51.0	49.1	54.0	-4.9

RESULT

The EUT complied with the specification limit by a margin of 3.9 dB.

6.2.4 §15.249 Operating Band

A plot is shown below showing the fundamental frequency is totally within the operating band of 2400 - 2483.5 MHz.



**6.3 Sample Field Strength Calculation:**

The field strength is calculated by adding the Correction Factor (Antenna Factor + Cable Factor), to the measured level from 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 Where

FS = Field Strength

RA = Receiver Amplitude Reading (Receiver Reading -  
Amplifier Gain)

CF = Correction Factor (Antenna Factor + Cable Factor)

Assume a receiver reading of 42.5 dB $\mu$ V is obtained from the receiver, an amplifier gain of 26.5 dB and a correction factor of 8.5 dB/m. The field strength is calculated by subtracting the amplifier gain and adding the correction factor, giving a field strength of 24.5 dB $\mu$ V/m, FS = (42.5 - 26.5) + 8.5 = 24.5 dB $\mu$ V/m.

**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 was 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.

A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz, at a distance of 3 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. A double ridged guide antenna was used for measurements from 1 to 18 GHz at a distance of 3 or 1 meter from the EUT. A standard gain horn antenna was used for measurements from 18 to 25 GHz at a distance of 1 meter from the EUT.

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.

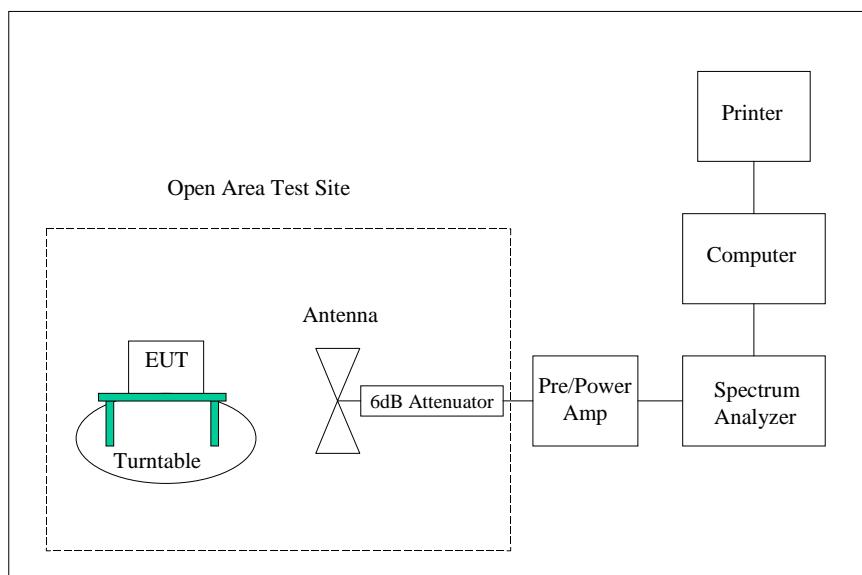
Desktop EUT are measured on a non-conducting table 0.8 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

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	Rohde & Schwarz	1302.6005.40	100064	07/08/2009
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	09/26/2008
Double Ridged Guide Antenna	EMCO	3115	9409-4355	03/11/2009
High Frequency Amplifier	Miteq	AFS4-01001800-43-10P-4	1096455	06/04/2009
20' High Frequency Cable	Utiflex	UFA210A-1-2400-30050U	1175	03/05/2009
3 Meter Radiated Emissions Cable Wanship Site #2	CCL	Cable K	N/A	12/31/2008
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	08/24/2009
6 dB Attenuator	Hewlett Packard	8491A	32835	12/31/2008

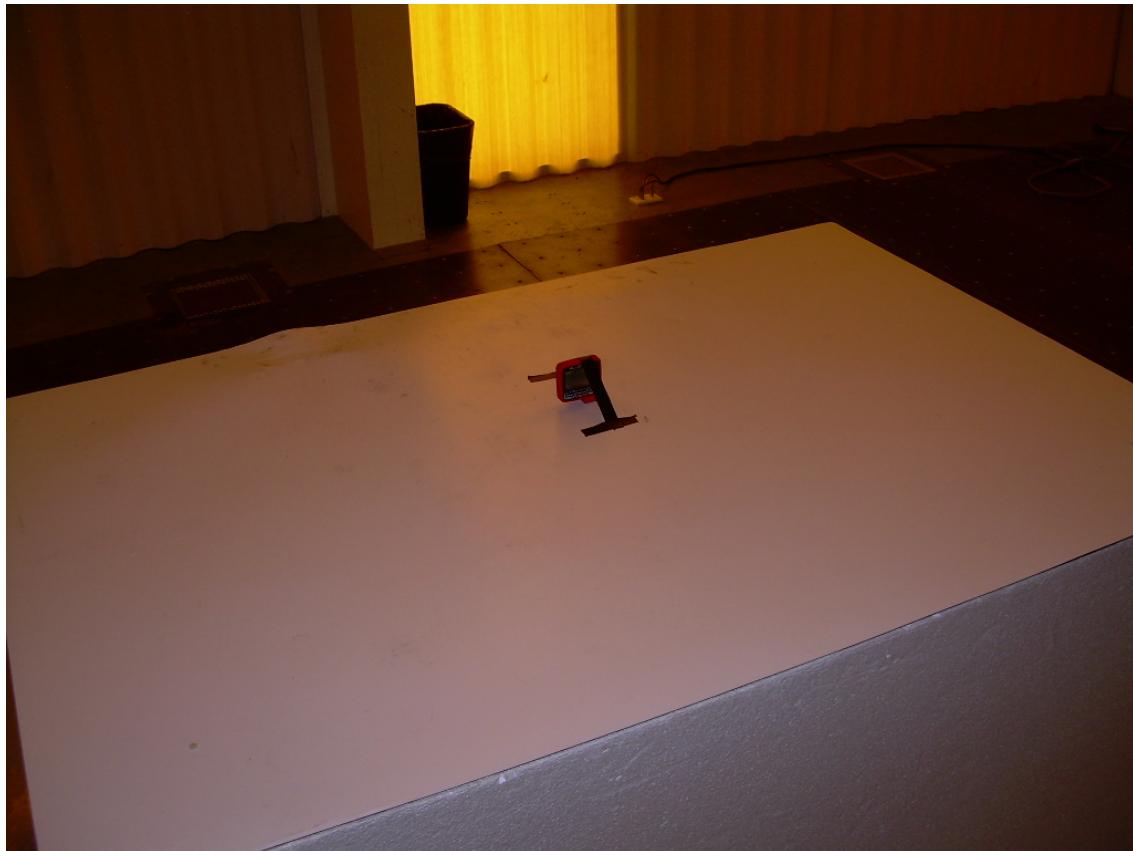
An independent calibration laboratory or CCL personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST). Supporting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

#### Radiated Emissions Test Setup

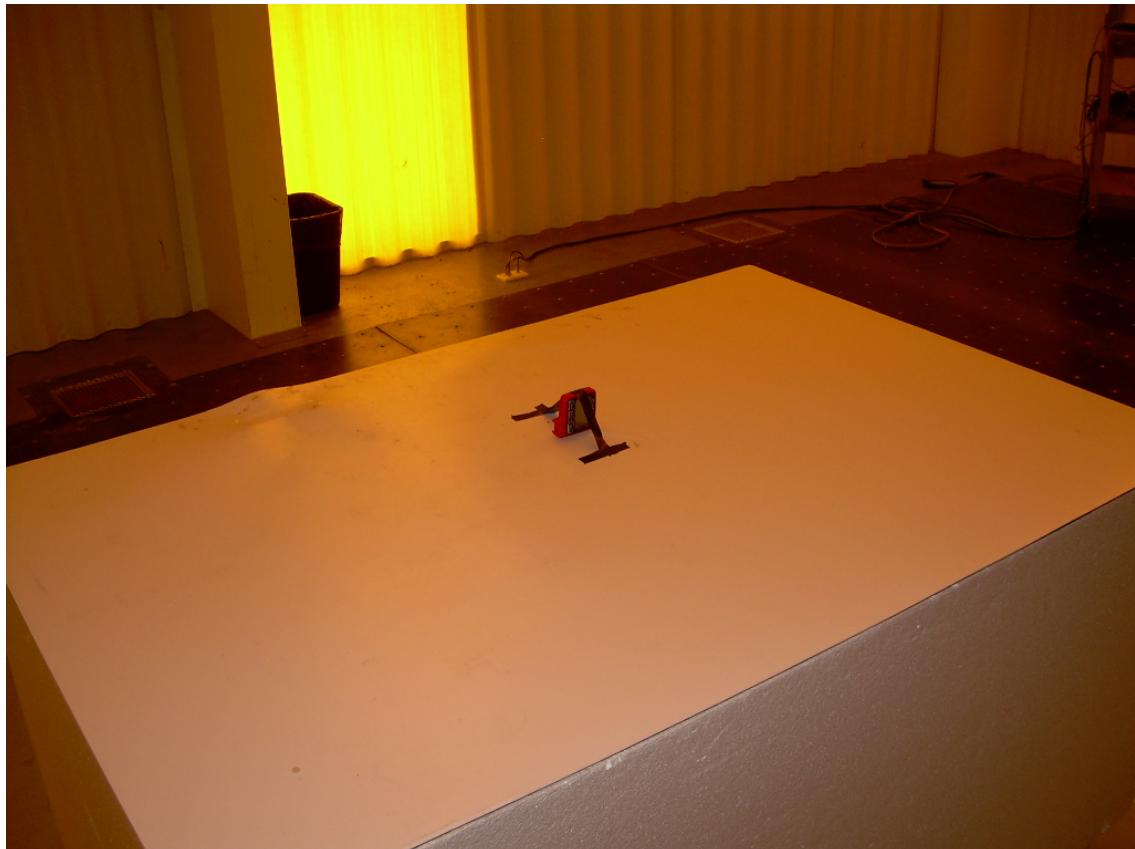


**APPENDIX 2 PHOTOGRAPHS**

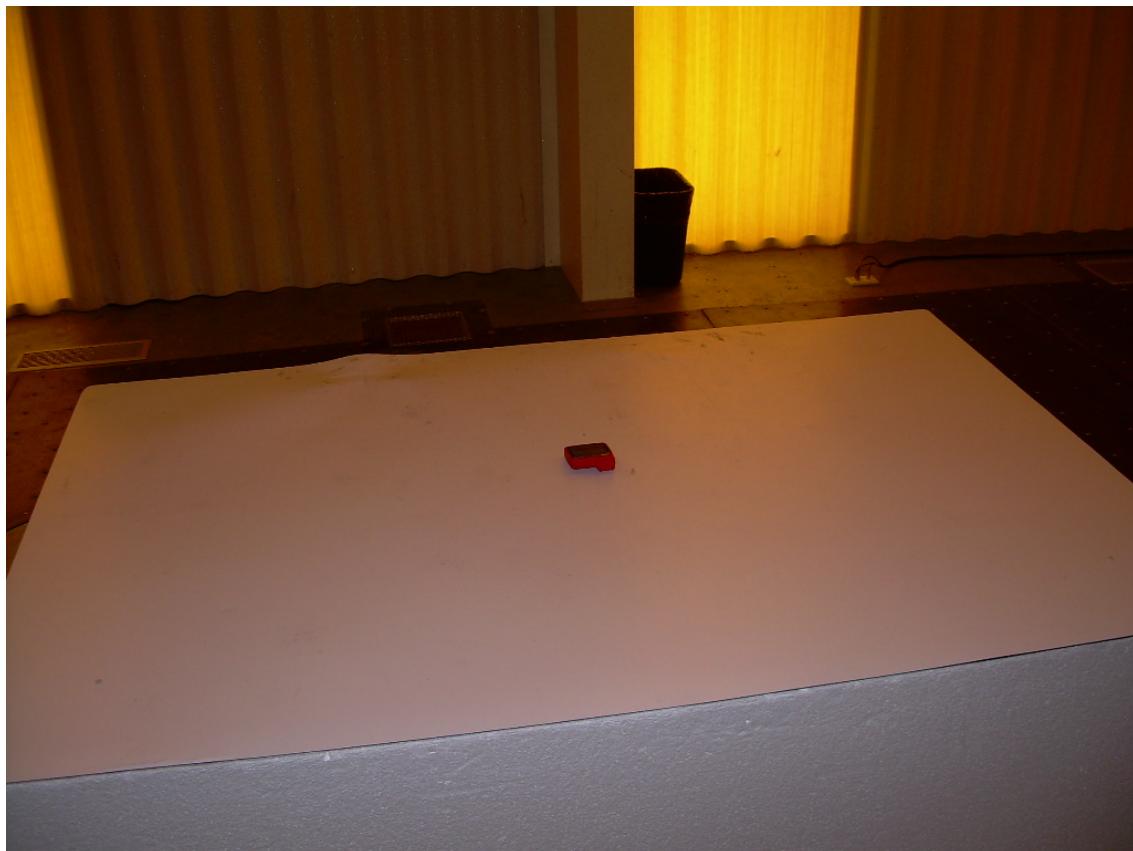
Photograph 1 – Radiated Set-Up – Vertical Configuration



Photograph 2 - Radiated Set-Up - On-Edge Configuration



Photograph 3 - Radiated Set-Up - Horizontal Configuration



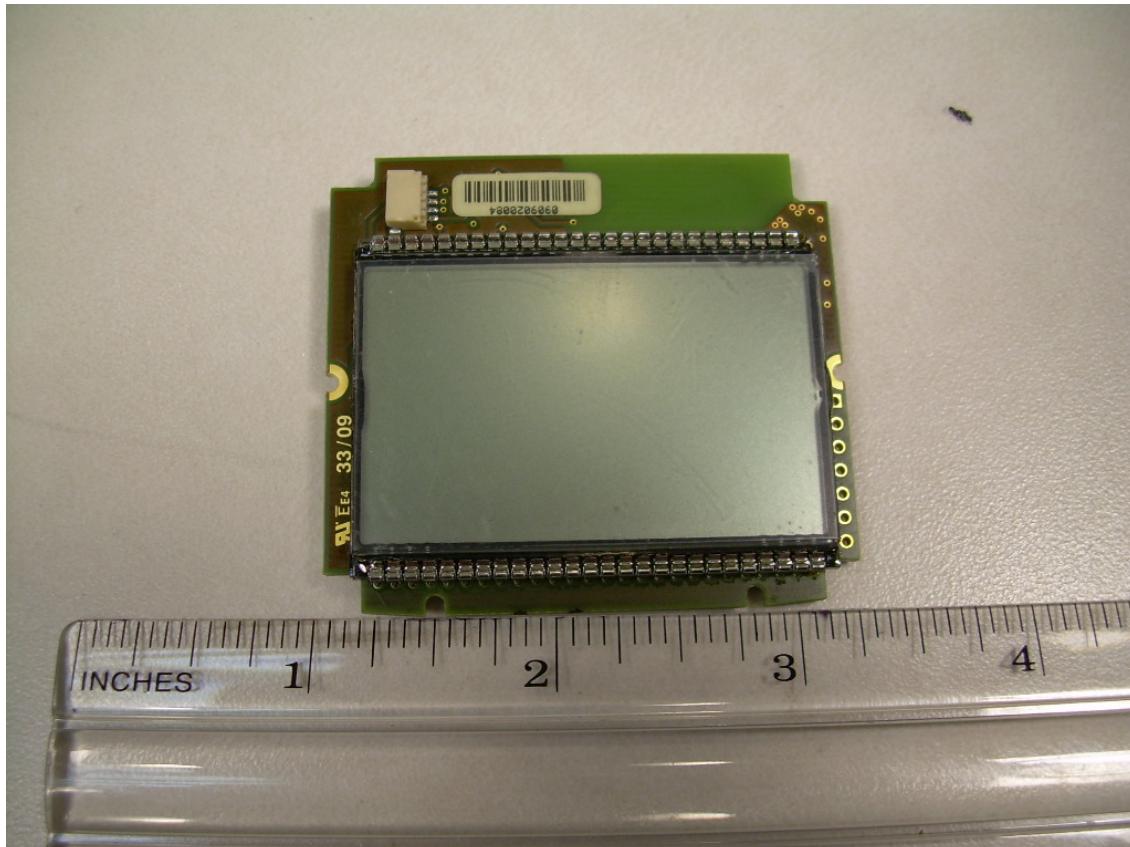
Photograph 4 - Front View of the EUT



Photograph 5 - Back View of the EUT



Photograph 6 - View of the Display Side of the PCB



Photograph 7 - View of the Component Side of the PCB

