Nemko-CCL, Inc.

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

Test Report

Certification

Test Of:

PowerMeter 7

FCC ID#: WCS-PM7

Test Specification:

FCC PART 15, Subpart C

Test Report Serial No: 162447-4.1

Applicant:

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

Date of Test: November 30, 2010

Issue Date: December 1, 2010

Accredited Testing Laboratory By:

NVLAP

NVLAP Lab Code 100272-0

CERTIFICATION OF ENGINEERING REPORT

This report has been prepared by Nemko-CCL, Inc. 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: PowerMeter 7
- FCC ID Number: WCS-PM7

On this 1st day of December 2010, I, individually, and for Nemko-CCL, Inc., 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 Nemko-CCL, Inc. 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.

Nemko-CCL, Inc.

Norman P Hansen

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: Peter Rosenland
Title: Engineer

1.2 Manufacturer:

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

Contact Name: Peter Rosenland
Title: Engineer

SECTION 2.0 EQUIPMENT UNDER TEST (EUT)

2.1 Identification of EUT:

Brand Name:	SRM
Model Number:	PowerMeter 7
Serial Number:	None
Country of Manufacture:	U.S.A.

2.2 Description of EUT:

The PowerMeter 7 is a module to measure the torque applied to a bicycle pedal and transmit the data to a control module. The PowerMeter 7 uses a 2.457 GHz transceiver using ANT + Sport protocol to send the data to the control module. The PowerMeter 7 is powered by 2 lithium 3.6 volt batteries.

This report covers the circuitry of the device subject to FCC Part 15, Subpart C. Compliance of the device to FCC Part 15, Subpart B is shown in Nemko-CCL report # 162447-3.1.

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: PowerMeter 7 SN: None	WCS-PM7	Power Meter	See Section 2.4

2.4 Interface Ports on EUT:

There are not interface ports on the EUT.

2.5 Modification Incorporated/Special Accessories on EUT:

There were no modifications or special accessories required to comply with the specification. This report is not complete without an accompanying signed attestation, included as Appendix 3, that the product will have all of the documented modifications incorporated into the product when manufactured and placed on the market.

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).

3.2.2 Test Procedure

The testing was performed according to the procedures in ANSI C63.4 (2003). Testing was performed at the Nemko-CCL, Inc. 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).

Nemko-CCL, Inc. is accredited by National Voluntary Laboratory Accreditation Program (NVLAP); NVLAP Lab Code: 100272-0, which is effective until September 30, 2011.

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 from 2 Lithium batteries

4.2 Operating Modes:

The PowerMeter 7 was tested on 3 orthogonal axes while in a constant modulated transmit state at 2.457 GHz.

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	Requirement	Frequency Range (MHz)	Result
15.203	Antenna Requirements	N/A	Complied
15.249	Radiated Field Strengths	30 - 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 2.45 dBi Yageo CAN4311851042453K chip antenna that is soldered to the PCB and is not user replaceable.

RESULT

The EUT complies with the specification.

6.2.2 Average Factor Calculations

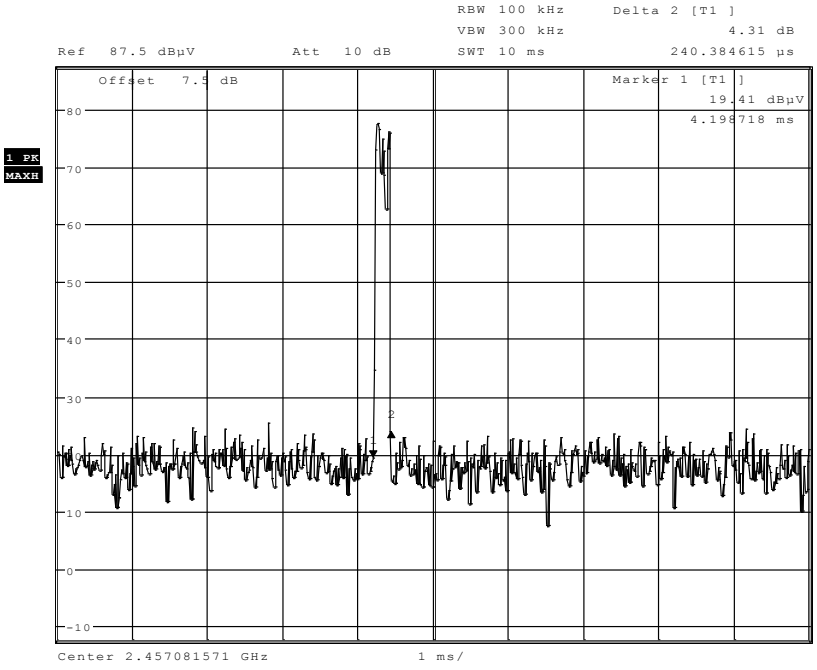
The EUT is a pulsed operation transmitter using ANT + Sport protocol that transmits for 240 μs every 250 ms. An Averaging Factor was calculated as allowed in FCC §15.35(c) using the equation:

AvF = 20 log (Pon/Pon + Poff) (Pon+ Poff = 100 ms maximum for calculations)

From the plots shown below:

AvF = 20 log (0.24 / 100) = -52.4 dB
(-20 dB is maximum factor allowed by FCC §15.35(c))

The emissions are measured using peak detection, corrected for amplifier gain, antenna factors and cable loss, and then the Averaging Factor is added. This field strength is compared to the average limits found in FCC §15.249.



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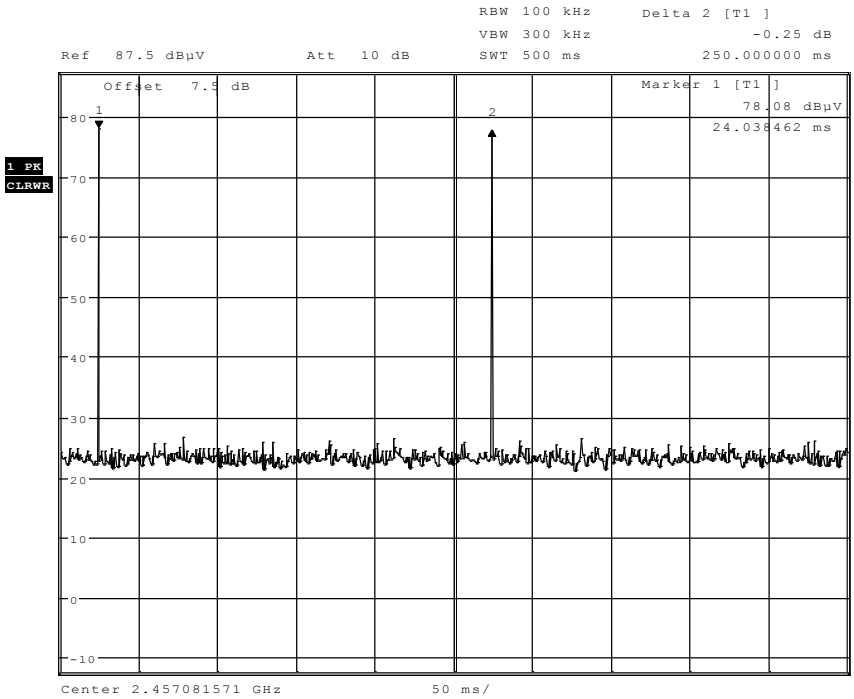

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6.2.3 §15.249 Radiated Field Strength (Vertical Polarity)

Frequency (MHz)	Receiver Reading (dBμV)	Correction Factor (dB/m)	Averaging Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2457.0	43.3	31.5	-20.0	54.8	94.0	-39.2
4914.0	19.6	37.7	-20.0	37.3	54.0	-16.7
7371.0	-0.2	41.8	-20.0	21.6	54.0	-32.4
9828.0	-0.6	44.3	-20.0	23.7	54.0	-30.3
12285.0	-0.9	45.6	-20.0	24.7	54.0	-29.3
14742.0	-0.8	48.9	-20.0	28.1	54.0	-25.9
17199.0	-9.5	49.8	-20.0	20.3	54.0	-33.7
19656.0	-11.3	48.2	-20.0	16.9	54.0	-37.1
22113.0	-10.4	48.6	-20.0	18.2	54.0	-35.8
24570.0	-8.6	50.1	-20.0	21.5	54.0	-32.5

RESULT

The EUT complied with the specification limit by a margin of 16.7 dB.

6.2.4 §15.249 Radiated Field Strength (Horizontal Polarity)

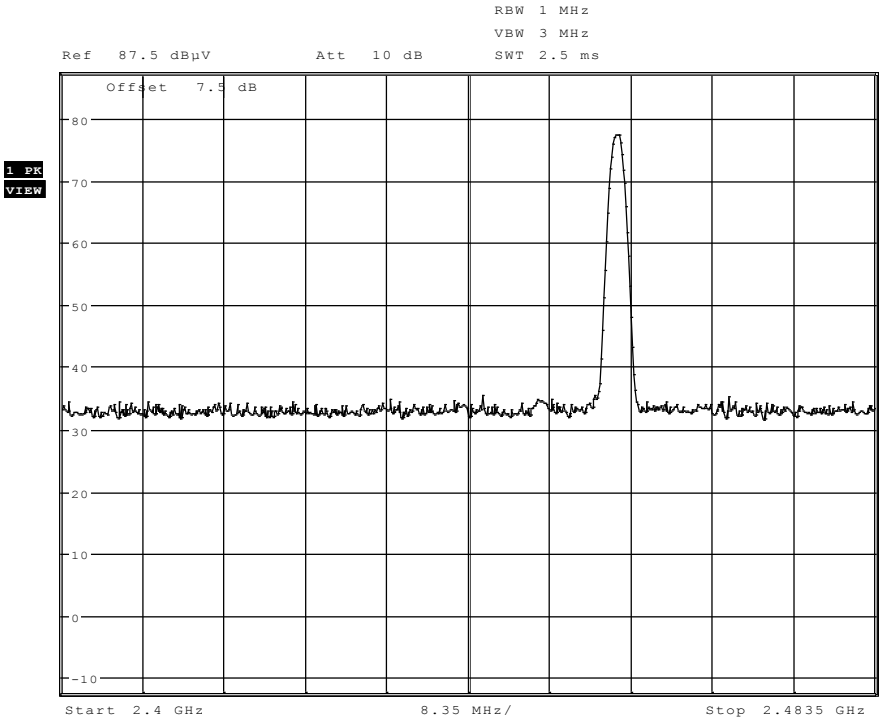
Frequency (MHz)	Receiver Reading (dBμV)	Correction Factor (dB/m)	Averaging Factor (dB)	Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2457.0	45.8	31.5	-20.0	57.3	94.0	-36.7
4914.0	21.9	37.7	-20.0	39.6	54.0	-14.4
7371.0	0.9	41.8	-20.0	22.7	54.0	-31.3
9828.0	0.3	44.3	-20.0	24.6	54.0	-29.4
12285.0	-0.9	45.6	-20.0	24.7	54.0	-29.3
14742.0	-0.7	48.9	-20.0	28.2	54.0	-25.8
17199.0	-10.4	49.8	-20.0	19.4	54.0	-34.6
19656.0	-11.1	48.2	-20.0	17.1	54.0	-36.9
22113.0	-10.3	48.6	-20.0	18.3	54.0	-35.7
24570.0	-8.3	50.1	-20.0	21.8	54.0	-32.2

RESULT

The EUT complied with the specification limit by a margin of 14.4 dB.

6.2.5 Operation in the Band 2400 MHz – 2483.5 MHz

The plot below shows the fundamental emission residing totally with in the 2400 to 2483.5 MHz band.



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6.3 Sample Field Strength Calculation:

The field strength is calculated by adding the Correction Factor (Antenna Factor + Cable Factor) and Averaging 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 + AvF Where

FS = Field Strength
RA = Receiver Amplitude Reading (Receiver Reading - Amplifier Gain)
CF = Correction Factor (Antenna Factor + Cable Factor)
AvF = Averaging Factor (calculation from timing plots)

Assume a receiver reading of 42.5 dBμV is obtained from the receiver, an amplifier gain of 26.5 dB, a correction factor of 8.5 dB/m, and an averaging factor of -10.0 dB. The field strength is calculated by subtracting the amplifier gain and adding the correction factor, giving a field strength of 24.5 dBμV/m, FS = (42.5 - 26.5) + 8.5 + (-10.0) = 14.5 dBμV/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 1 MHz RBW was used at frequencies above 1000 MHz.

A biconilog antenna was used to measure the frequency range of 30 to 1000 MHz, at a distance of 3 or 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. A double-ridged guide antenna and standard gain horn antenna were used to measure the emissions at frequencies above 1000 MHz at a distance of 3 and/or 1 meter from the EUT.

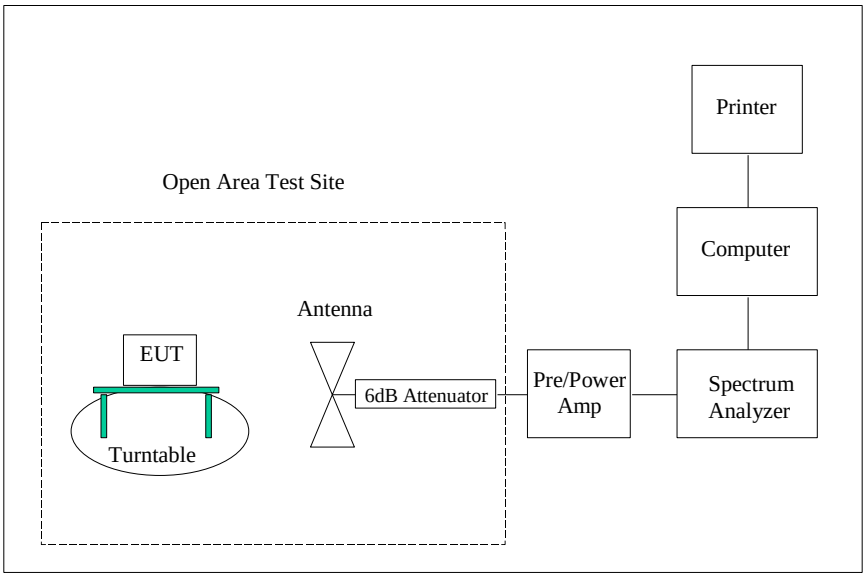
The EUT was tested on 3 orthogonal axes. The EUT was measured on a non-conducting table 0.8 meters above the ground plane. The table is placed on a turntable, which is level with the ground plane. For equipment normally placed on floors, the equipment shall be placed directly on the turntable.

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
Wanship Open Area Test Site #2	Nemko-CCL, Inc.	N/A	N/A	11/15/2010
Test Software	Nemko-CCL, Inc.	Radiated Emissions	Revision 1.3	N/A
Spectrum Analyzer/Receiver	Rhode & Schwarz	1302.6005.40	100064	07/30/2010
Spectrum Analyzer	Hewlett Packard	8566B	2232A02726	01/12/2010
Quasi-Peak Detector	Hewlett Packard	85650A	2043A00287	01/12/2010
Biconilog Antenna	EMCO	3142	9601-1009	08/21/2009
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	03/04/2010

Type of Equipment	Manufacturer	Model Number	Serial Number	Date of Last Calibration
3 Meter Radiated Emissions Cable Wanship Site #2	Nemko-CCL, Inc.	Cable K	N/A	12/31/2009
Pre/Power-Amplifier	Hewlett Packard	8447F	3113A05161	08/25/2010
6 dB Attenuator	Hewlett Packard	8491A	32835	12/31/2009

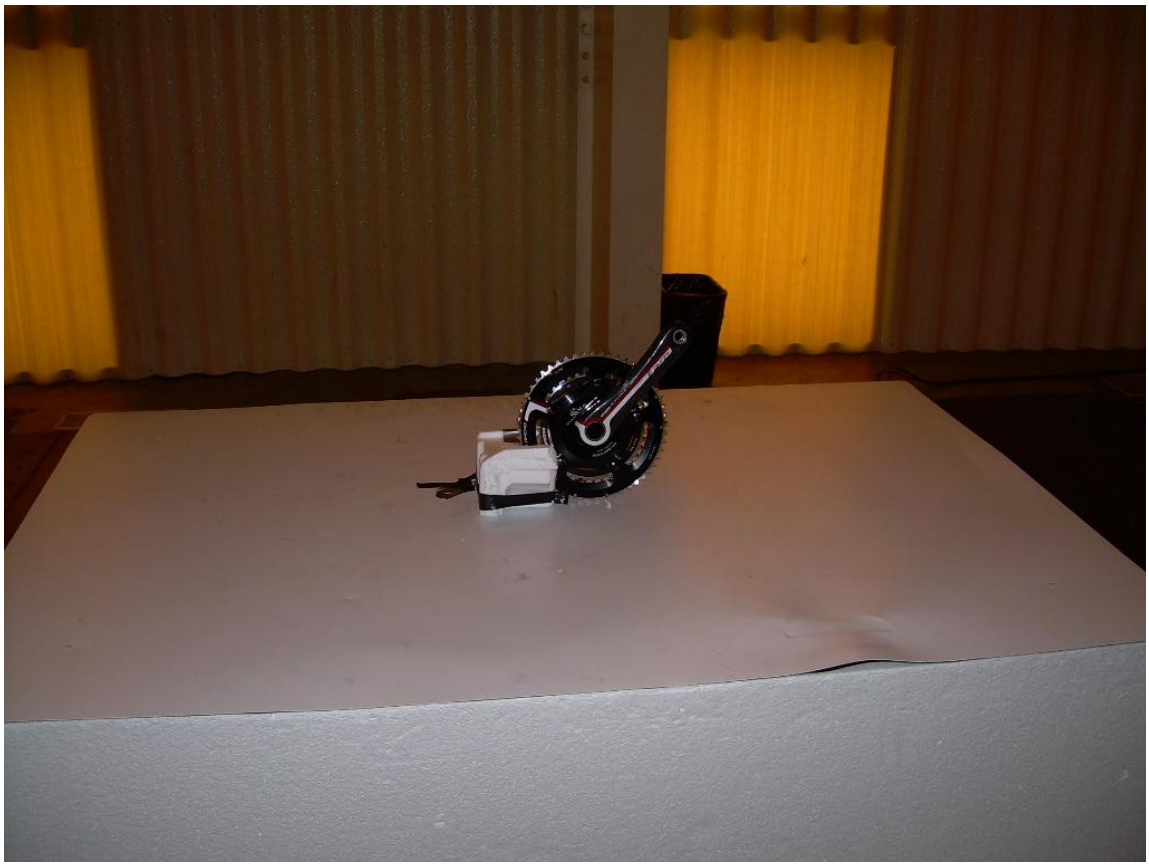
An independent calibration laboratory or Nemko-CCL, Inc. personnel calibrates all the equipment listed above at intervals defined in ANSI C63.4:2003 Section 4.4 following outlined calibration procedures. All measurement instrumentation is traceable to the National Institute of Standards and Technology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

Radiated Emissions Test Setup

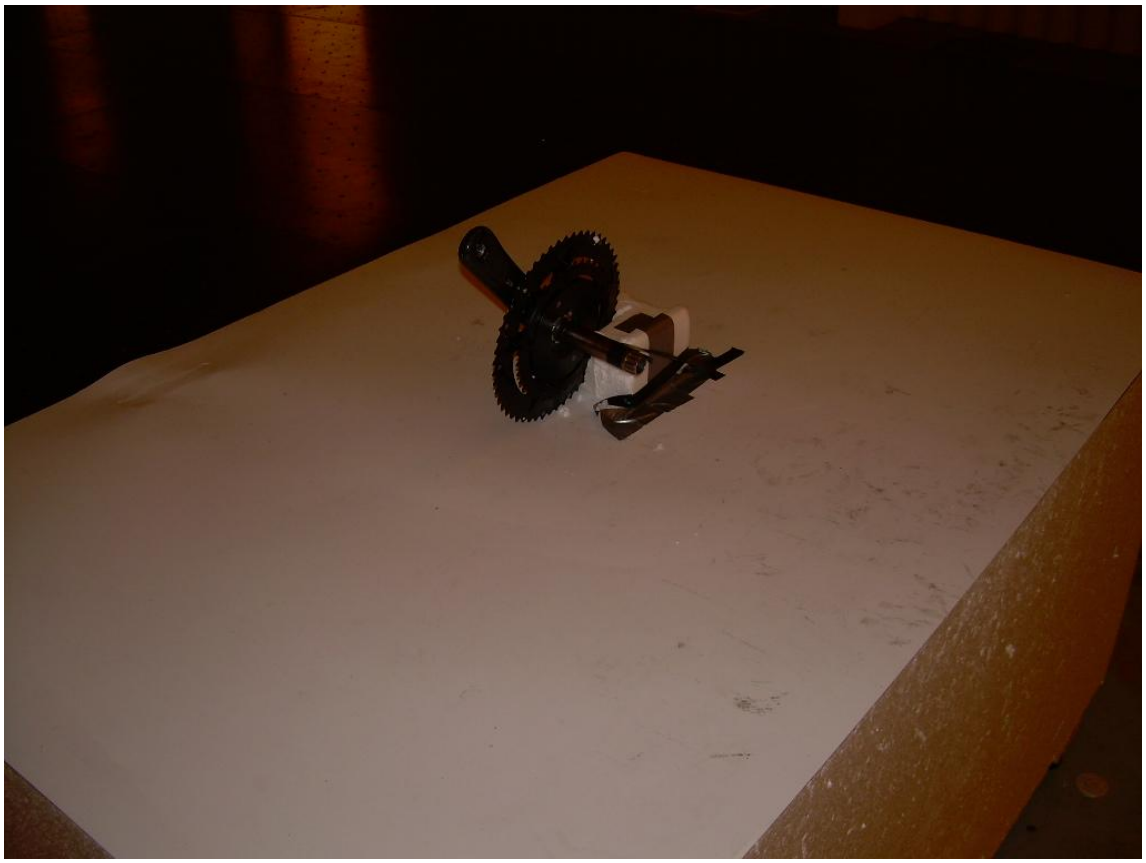


APPENDIX 2 PHOTOGRAPHS

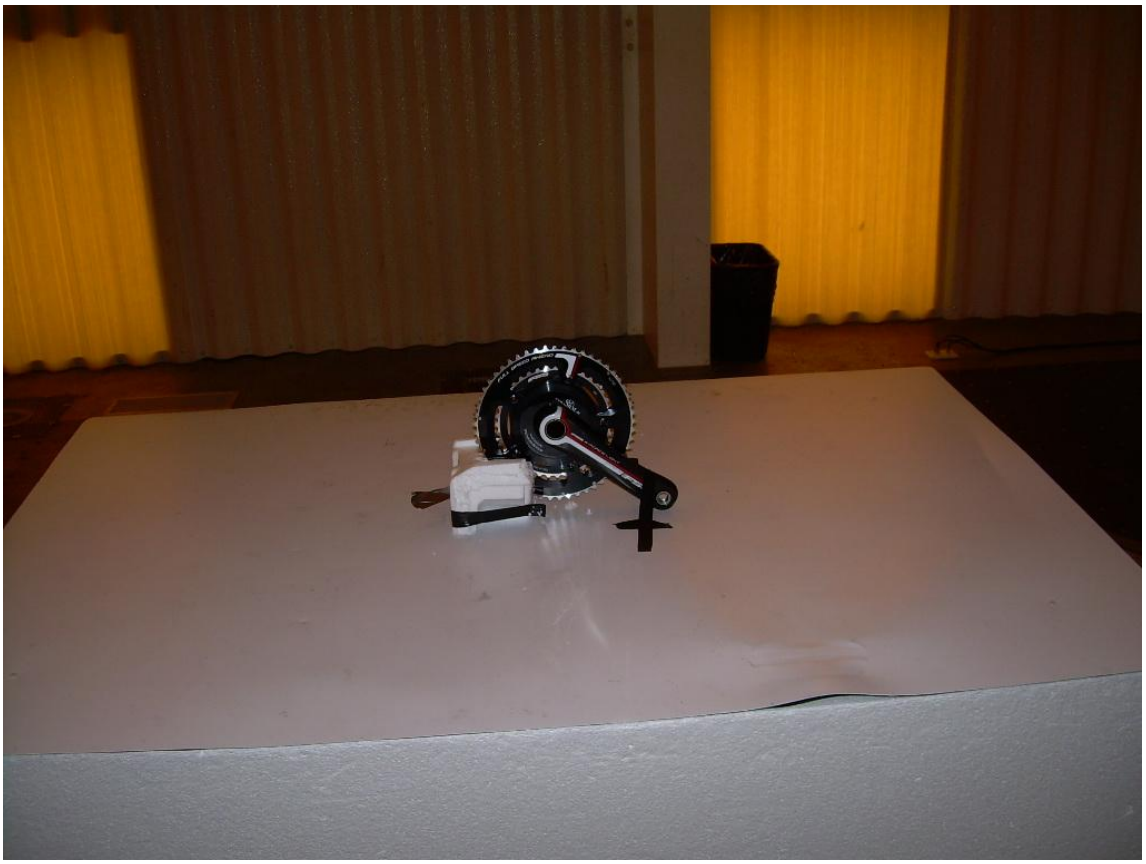
Photograph 1 – Front View Radiated Disturbance – Configuration #1



Photograph 2 – Back View Radiated Disturbance – Configuration #1



Photograph 3 – Front View Radiated Disturbance – Configuration #2

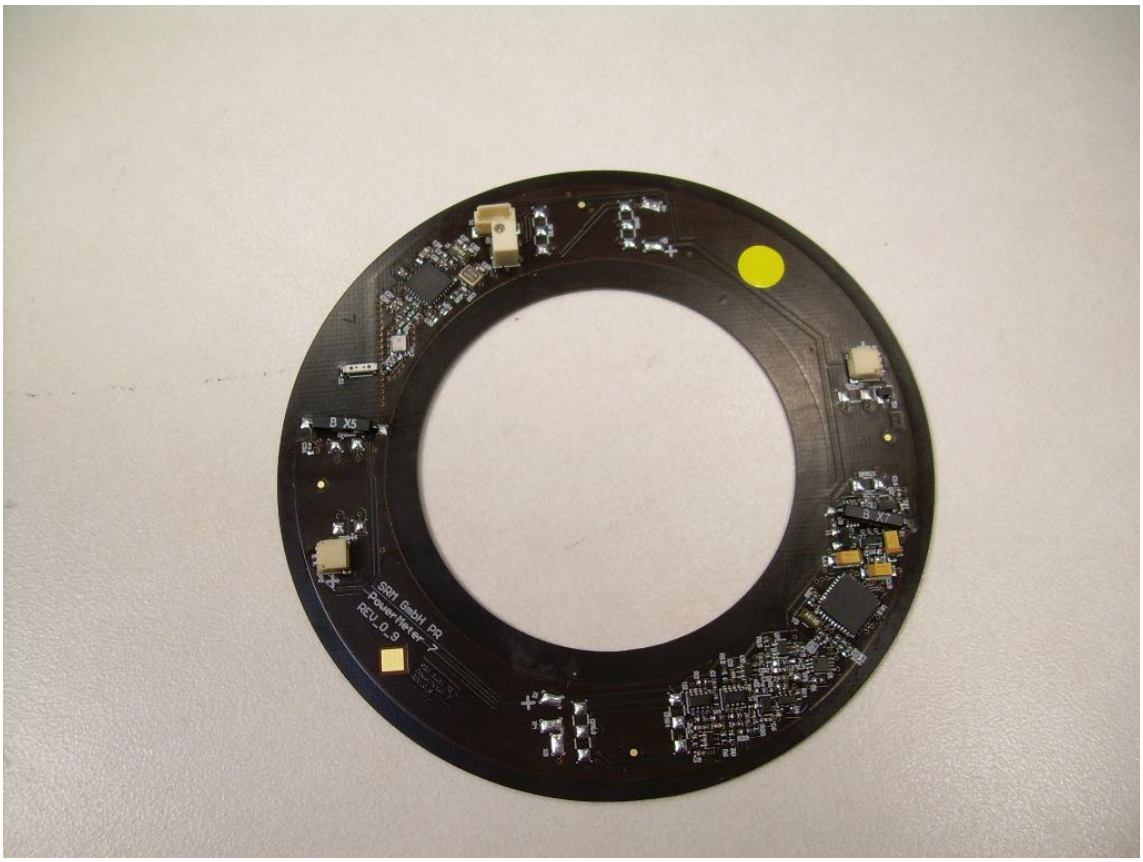


Photograph 4 – Front View Radiated Disturbance – Configuration #3

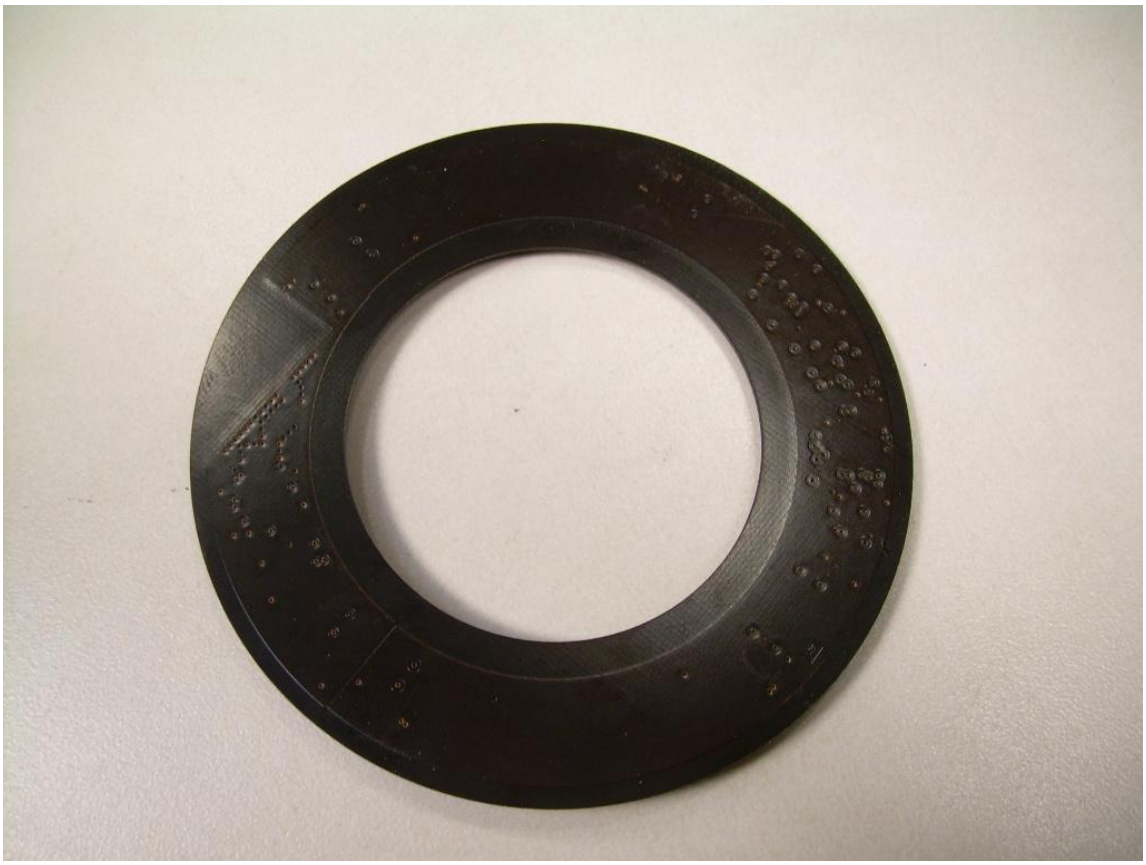
Photograph 5 – Front View of the EUT

Photograph 6 – Back View of the EUT

Photograph 7 – View of the Component Side of the PCB



Photograph 8 – View of the Trace Side of the PCB



APPENDIX 3 MANUFACTURER'S STATEMENT/ATTESTATION

The manufacturer or responsible party for the equipment tested hereby affirms:

a) That he/she has reviewed and concurs that the tests shown in this report are reflective of the operational characteristics of the device for which certification is sought;
b) That the device in this test report will be representative of production units;
c) That the product will have all of the documented modifications incorporated into the product when manufactured and placed on the market;
d) That all changes in hardware and software/firmware to the subject device will be reviewed.
e) That any changes impacting the attributes, functionality or operational characteristics documented in this report will be communicated to the body responsible for approving or certifying the subject equipment.

Printed name of official	Signature of official	Date

NOTE—This affirmation must be signed by the responsible party before it is submitted to a regulatory body for approval.

APPENDIX 4 FCC PART 15/ICES-003 COMPLIANCE INFORMATION

A4.1 LABEL AND COMPLIANCE STATEMENT

The label of the SRM Service Center, Inc. PowerMeter 7 is shown in documents filed for certification with the FCC and Industry Canada.

A4.2 BLOCK DIAGRAM

A block diagram showing the clock frequencies and signal paths of the SRM Service Center, Inc. PowerMeter 7 is shown in documents filed for certification with the FCC and Industry Canada.

A4.3 USER'S MANUAL

A copy of the User's manual containing the FCC warning statement is shown in documents filed for certification with the FCC and Industry Canada.