1250 Peterson Dr., Wheeling, IL 60090

Company: Saris Cycling Group Inc
Model Tested: SL2.4
Report Number: 14635

FCC Rules and Regulations / Intentional Radiators

Operational in the 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz Bands

Part 15, Subpart C, Section 15.249

THE FOLLOWING **MEETS** THE ABOVE TEST SPECIFICATION

Formal Name:	PowerTap SL2.4
Kind of Equipment:	RF Module in 2 host units
Frequency Range:	2453 MHz & 2457 MHz
Test Configuration:	two parts system; bicycle hub and user display (CPU)
Model Number(s):	SL2.4
Model(s) Tested:	SL2.4
Serial Number(s):	51739
Date of Tests:	August 1, 4, 14, 20, & 21, 2008
Test Conducted For:	Saris Cycling Group Inc 5253 Verona Road Madison, Wisconsin 53711

NOTICE: "This report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government". Please see the "Additional Description of Equipment Under Test" page listed inside of this report.

SIGNATURE PAGE

Report By:

Arnom C. Rowe
Test Engineer
EMC-001375-NE

Reviewed By:

William Stumpf
OATS Manager

Approved By:

Brian Mattson
General Manager

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United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 100276-0

D.L.S. Electronic Systems, Inc.
Wheeling, IL

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated 18 June 2005).

2007-10-01 through 2008-09-30
Effective dates

Sally S. Bruce
For the National Institute of Standards and Technology

NVLAP-01C (REV. 2006-09-13)

1.0 SUMMARY OF TEST REPORT

It was found that the PowerTap SL2.4, Model Number(s) SL2.4 **meets** the radio interference radiated emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Section 15.249 for operational in the 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz Bands. The AC Power Line conducted emissions test was not required because the PowerTap SL2.4 is powered from a D.C. power source. It does not have a line cord to plug into the A.C. power line.

2.0 INTRODUCTION

On August 1, 4, 14, 20, & 21, 2008, a series of radio frequency interference measurements was performed on PowerTap SL2.4, Model Number(s) SL2.4, Serial Number: 51739. The tests were performed according to the procedures of the FCC as stated in the "Methods of Measurement of Radio-Noise Emissions for Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz" found in the American National Standards Institute, ANSI C63.4-2003. Tests were performed by personnel of D.L.S. Electronic Systems, Inc. who are responsible to Donald L. Sweeney, Senior EMC Engineer.

D.L.S. Electronic Systems, Inc. is a full service EMC/Safety Testing Laboratory accredited to ISO 17025. NVLAP Certificate and Scope can be viewed at http://www.dlsemc.com/certificate. Our facilities are registered with the FCC, Industry Canada, and VCCI.

Main Test Facility:
D.L.S. Electronic Systems, Inc.
1250 Peterson Drive
Wheeling, Illinois 60090

O.A.T.S. Test Facility:
D.L.S. Electronic Systems, Inc.
166 S. Carter Street
Genoa City, Wisconsin 53128

3.0 OBJECT

The purpose of this series of tests was to determine if the test sample could meet the radio frequency interference emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Sections 15.35(b), 15.37(d), 15.209 & 15.249 for Intentional Radiators operating in the Bands 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24-24.25 GHz.

4.0 TEST SET-UP

All emission tests were performed at D.L.S. Electronic Systems, Inc. and set up according to the ANSI C63.4-2003, Annex H. The conducted tests were performed with the test item placed on a non-conductive table (table top equipment), located in the test room. Equipment normally operated on the floor was tested by placing it on the metal ground plane. The ground plane has an electrical isolation layer over its surface approximately 7mm thick. The power line supplied was connected to a dual line impedance stabilization network electrically bonded to the ground plane, located on the floor. The networks were constructed per the requirements of the ANSI C63.4-2003, Annex H.

All radiated emissions tests were performed with the test item placed on a 80 cm high rotating non-conductive table, located in the test room. Equipment normally operated on the floor was placed on a metal covered turntable which is flush with the surrounding conducting ground plane. The ground plane has an electrical isolation layer over its surface approximately 7 mm thick. The EUT is separated from the turntable ground plane by a non-conductive layer. The equipment under test was set up according to ANSI C63.4-2003, Sections 6 and 8.

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5.0 TEST EQUIPMENT (Bandwidths and Detector Function)

All preliminary data below 1000 MHz was automatically plotted using the ESI 26/40 Fixed Tuned Receiver. The data was taken using Peak, Quasi-Peak or the Average Detector Functions as required. This information was then used to determine the frequencies of maximum emissions. Above 1000 MHz, final data was taken using the Average Detector.

Below 1000 MHz, final data was taken using the ESI 26/40 Fixed Tuned Receiver. These plots were made using the Peak or Quasi-Peak Detector functions, with manual measurements performed on the questionable frequencies using the Quasi-Peak or the Average Detector Function of the ESI 26/40 Fixed Tuned Receiver as required. Above 1000 MHz, final data was taken using the Average Detector on the Spectrum Analyzer.

The bandwidths shown below are specified by ANSI C63.4-2003, Section 4.2.

Frequency Range	Bandwidth (-6 dB)
10 to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
30 MHz to 1 GHz	120 kHz
Above 1 GHz	1 MHz

A list of the equipment used can be found in Table 1. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.

6.0 AMBIENT MEASUREMENTS

For emissions measurements, broadband antennas and an EMI Test Receiver with a panoramic spectrum display are used. First the frequency range is scanned and displayed on the test receiver display. Next the scanned frequency range is divided into smaller ranges, and then it is manually tuned through to determine the emissions from the EUT. A headset or loudspeaker is connected to the test receiver's AM/FM demodulated output as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT. If there is any doubt as to the source of the emission, it is further investigated by rotating the EUT, or by disconnecting the power from the EUT.

The EUT is set up in its typical configuration and operated in its various modes. For tabletop systems, cables are manipulated within the range of likely configurations. For floor-standing equipment, the cables are located in the same manner as the user would install them and no further manipulation is made. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to produce the maximum level of emissions. For each mode of operation, the frequency spectrum is monitored. Variations in antenna height, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) are explored to produce the emissions that have the highest amplitude relative to the limit. These methods are performed to the specifications in ANSI C63.4-2003.

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7.0 DESCRIPTION OF TEST SAMPLE: (See also Paragraph 8.0)

7.1 Description:

The PowerTap SL2.4 system is installed in any bicycle; the rear hub (or wheel) of the bicycle is replaced with the SL2.4 hub and the CPU mounts on the handle bars.

The hub measures parameters of the rear wheel; torque, wheel speed, rider cadence. The hub calculates power in watts and transmits the information at a predetermined periodic rate. The CPU receives the hub transmission and displays the information to the user real time.

The CPU calculates some parameters from the hub transmission; speed in MPH, distance, ride time etc.

7.2 PHYSICAL DIMENSIONS OF EQUIPMENT UNDER TEST

SL2.4 length = 141mm x 70mm flange diameter

7.3 LINE FILTER USED:

none - batteries only

7.4 INTERNAL CLOCK FREQUENCIES:

Switching Power Supply Frequencies:

N/A

Clock Frequencies:

0.03125, 0.032768, 1.000, 4.000, 16.000 MHz

7.5 DESCRIPTION OF ALL CIRCUIT BOARDS:

1. SL2.4 electronics; main circuit board PN: 16748 revision E
2. SL2.4 electronics; RF circuit board PN: 16776 revision 1

8.0 ADDITIONAL DESCRIPTION OF TEST SAMPLE:
(See also Paragraph 7.0)

1: There were no additional descriptions noted at the time of test.

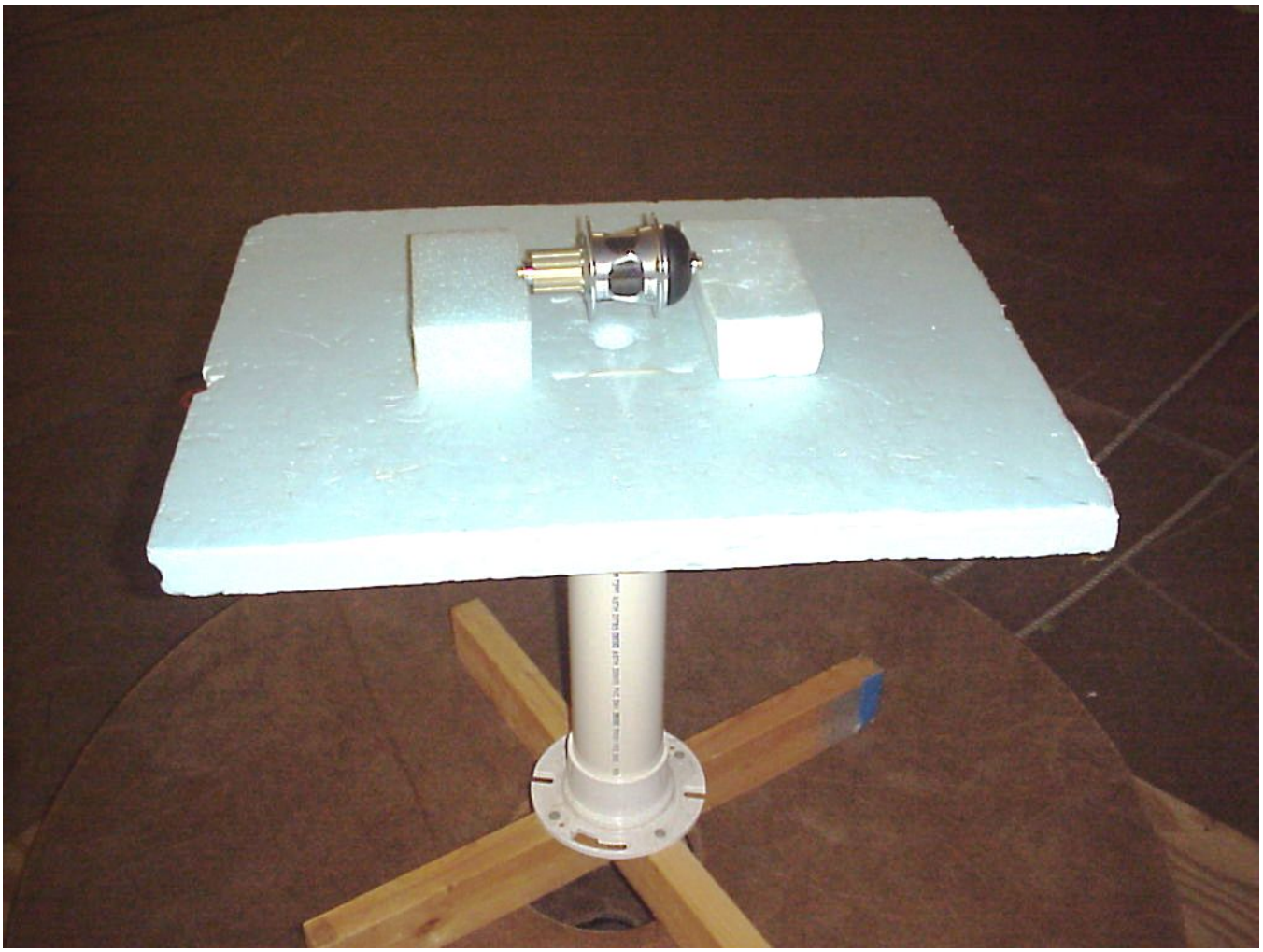
NOTE:

Continuous Transmit.
Continuous Receive.

9.0 PHOTO INFORMATION AND TEST SET-UP

Item 0 PowerTap SL2.4
Model Number: SL2.4; Serial Number: 51739

10.0 RADIATED PHOTOS TAKEN DURING TESTING



HUB SETUP

11.0 RESULTS OF TESTS

The radio interference emission charts can be seen on the pages at the end of this report. Data sheets indicating the test measurements taken during testing can also be found at the end of this report.

12.0 CONCLUSION

It was found that the PowerTap SL2.4, Model Number(s) SL2.4 **meets** the radio interference radiated emission requirements of the FCC "Rules and Regulations", Part 15, Subpart C, Section 15.249 for operational in the 902-928 MHz, 2400-2483.5 MHz, 5725-5875 MHz, and 24.0-24.25 GHz Bands. The conducted emissions test was not required because the PowerTap SL2.4 is powered from a D.C. power source. It does not have a line cord to plug into the A.C. power line.

TABLE 1 – EQUIPMENT LIST

Test Equipment	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Due Dates
Receiver, RF, Tuned	Rohde & Schwarz	ESI 40	837808/006	20Hz-40GHz	3/24/2009
Preamp, RF	Miteq	AMF-6D-100200-50	313936	1-10GHz	5/8/2009
Preamp, RF	Miteq	AMF-6D-010100-50	213976	10-18GHz	5/8/2009
Preamp	Miteq	AMF-8B-180265-40-10P-H/S	NA	18-26GHz	9/18/2008
Preamp, RF	Rohde & Schwarz	TS-PR10	032001/005		3/10/2009
RF 20dB Fixed Attenuator	Aeroflex/weinschel	75A-20-12	1071		7/28/2009
Biconical Antenna	EMCO	3104C	9701-4785	20-220MHz	4/21/2009
Log Periodic Antenna,	EMCO	3146	9702-4895	200MHz-1GHz	4/21/2009
Horn Antenna	EMCO	3115	9903-5731	1-18GHz	6/12/2009
Horn Antenna	EMCO	3116	2549	18-40GHz	6/12/2009
High Pass Filter	Q Microwave, Inc.	100462	1		5/8/2009

All primary equipment is calibrated against known reference standards with a verified traceable path to NIST.

APPENDIX A

DUTY CYCLE CORRECTION FACTOR

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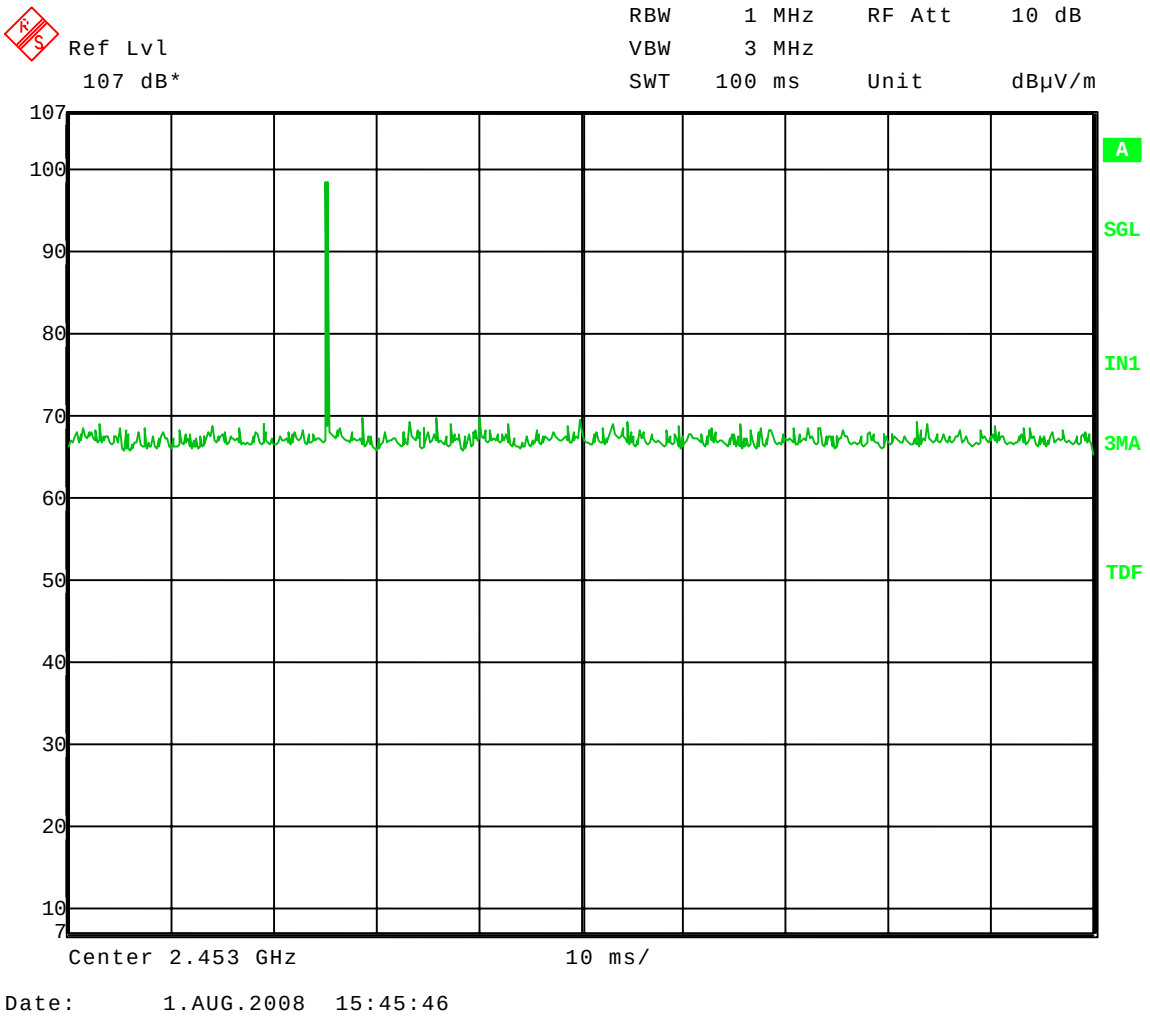
Company: Saris Cycling Group Inc
Model Tested: SL2.4
Report Number: 14635

Test Date: 08-01-2008
Company: Saris Cycling Group
EUT: SL2.4 module
Test: Duty Cycle (FCC Part 15.35)
Operator: Craig B
Comment: Total ON Time during 100 ms = 0.20441 ms
20 log (0.20441 /100) = -53.8
Duty cycle correction factor = 53.8 dB

100 ms sweep:



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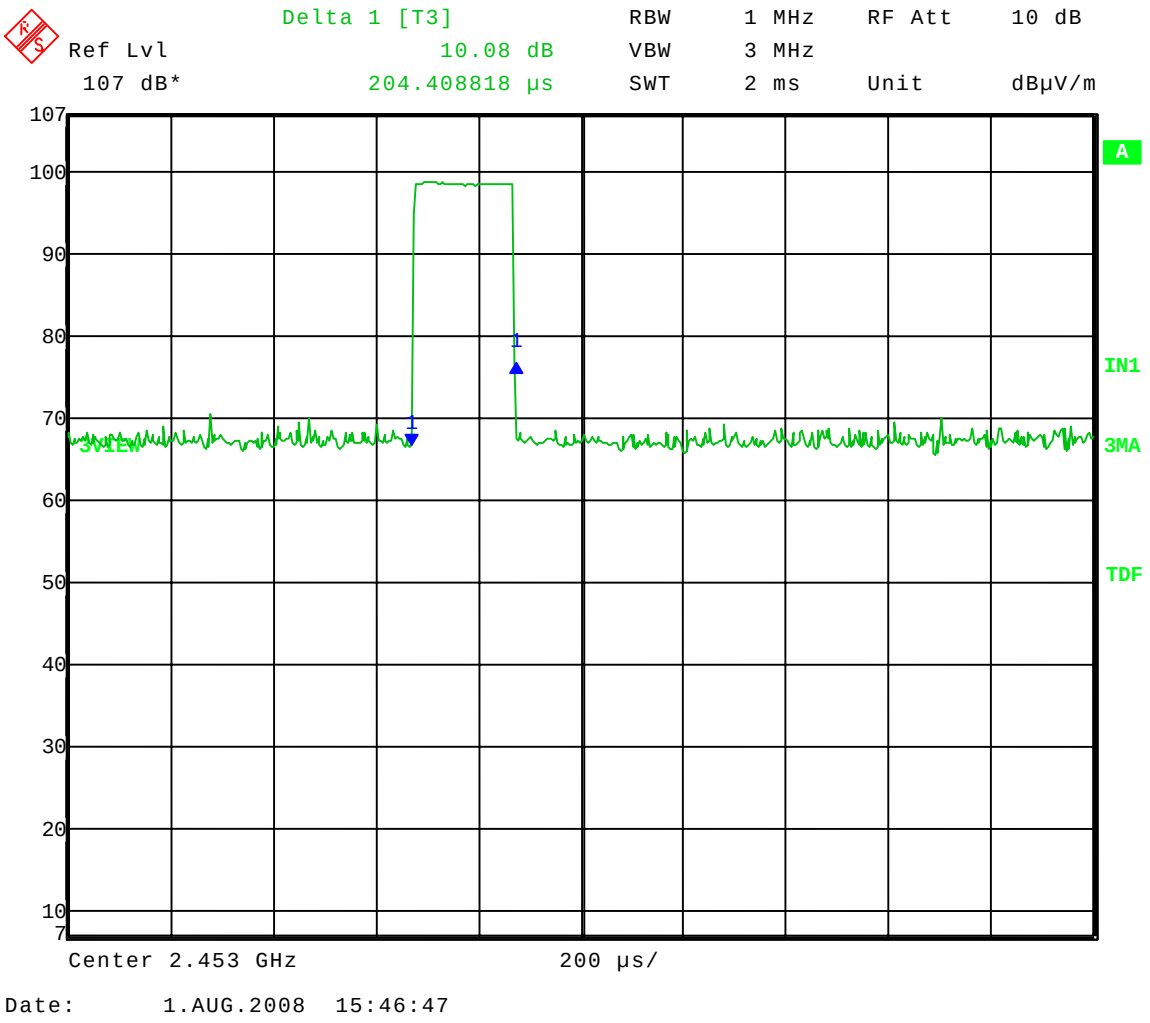
Company: Saris Cycling Group Inc
Model Tested: SL2.4
Report Number: 14635

Test Date: 08-01-2008
Company: Saris Cycling Group
EUT: SL2.4 module
Test: Duty Cycle (FCC Part 15.35)
Operator: Craig B
Comment:

Duration of one pulse:



APPENDIX B

RADIATED DATA

AND

CHARTS TAKEN DURING TESTING

1250 Peterson Dr., Wheeling, IL 60090

Company: Saris Cycling Group Inc
Model Tested: SL2.4
Report Number: 14635

Radiated Fundamental and Spurious Emissions – 30 MHz to 25 GHz

Tested at a 3 Meter Distance (30 MHz to 10 GHz)

Tested at a 1 Meter Distance (10 GHz to 25 GHz)

EUT: SL2.4 (Hub) with SL2.4 module
Manufacturer: Saris Cycling Group
Operating Condition: 73 deg F; 63% R.H.
Test Site: Site 3
Operator: Craig B
Test Specification: FCC Part 15.249, Part 15.205 and Part 15.209
Comment: Continuous Transmit
Channel: **2.453** GHz
Date: 08/04/2008

Notes: **(1)** The EUT was measured in 3 orthogonal axis and placed in the worst case axis for the following measurements.
(2) All other emissions at least 20 dB under the FCC Part 15.209 limits
(3) No emissions where found at the upper and lower band-edges

Frequency (MHz)	Measurement Type	Ant. Pol.	Level (dBuV)	Antenna Factor (dB/m)	System Loss (dB)	Total Level (dBuV/m)	Duty Cycle Correction (dB)	Final Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Ant. Height (m)	EUT Angle (deg)	Comment
2453	Max Peak	Vert	52.99	28.60	3.8	85.4	---	85.4	114	28.6	1.0	270	Fundamental
2453	Average	Vert	52.99	28.60	3.8	85.4	-53.8	31.6	94	62.4	1.0	270	Fundamental
2453	Max Peak	Horz	57.75	28.60	3.8	90.2	---	90.2	114	23.9	1.2	300	Fundamental
2453	Average	Horz	57.75	28.60	3.8	90.2	-53.8	36.4	94	57.7	1.2	300	Fundamental
4906	Max Peak	Vert	64.11	33.01	-32.4	64.7	---	64.7	74	9.3	1.0	270	Res. Band
4906	Average	Vert	64.11	33.01	-32.4	64.7	-53.8	10.9	54	43.1	1.0	270	Res. Band
4906	Max Peak	Horz	64.37	33.01	-32.4	65.0	---	65.0	74	9.0	1.7	315	Res. Band
4906	Average	Horz	64.37	33.01	-32.4	65.0	-53.8	11.2	54	42.8	1.7	315	Res. Band
7359	Max Peak	Vert	Noise Floor										Res. Band
7359	Average	Vert	Noise Floor										Res. Band
7359	Max Peak	Horz	Noise Floor										Res. Band
7359	Average	Horz	Noise Floor										Res. Band