



166 South Carter, Genoa City, WI 53128

Company: Saris Cycling Group  
Model Tested: Powertap 3 RF Module  
Report Number: 17049  
DLS Project: 4062

## Code of Federal Regulations 47 Part 15 – Radio Frequency Devices

Subpart C – Intentional Radiators

Section 15.249

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

Subpart B – Unintentional Radiators

Section 15.109

Radiated Emissions  
Class B Digital Device

THE FOLLOWING **MEETS** THE ABOVE TEST SPECIFICATION

Formal Name: Powertap 3 RF Module  
Kind of Equipment: Wireless Communication Device  
Frequency Range: 2405 MHz to 2480 MHz  
Test Configuration: Stand-alone for single modular approval  
Model Number(s): Powertap 3  
Model(s) Tested: Powertap 3  
Serial Number(s): 0x7445 8C46 1A00 0A00 F8FE 1110 FF7F FEFF 6008 CA09 5006 6107  
0105 DA05 1206 B17F 4480 0261 088A 0C68 0E1A 122E 2296 0020  
0023 0009 00  
Date of Tests: June 20 through June 22, 2011  
Test Conducted For: Saris Cycling Group  
5253 Verona Road  
Madison, WI 53711

**NOTICE:** “This test report relates only to the items tested and must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government”. Please see the "Description of Test Sample" page listed inside of this report.

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Saris Cycling Group  
Powertap 3 RF Module  
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SIGNATURE PAGE

Report By:

A handwritten signature in black ink that reads "Craig Brandt". The signature is written in a cursive style with a long horizontal stroke at the end.

Craig Brandt  
Test Engineer

Reviewed By:

A handwritten signature in black ink that reads "William Stumpf". The signature is written in a cursive style with a long horizontal stroke at the end.

William Stumpf  
OATS Manager

Approved By:

A handwritten signature in black ink that reads "Brian J. Mattson". The signature is written in a cursive style with a long horizontal stroke at the end.

Brian Mattson  
General Manager



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United States Department of Commerce  
National Institute of Standards and Technology



# 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 Communiqué dated January 2009).*



2010-10-01 through 2011-09-30

*Effective dates*

*Dolly S. Buces*  
For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)



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Company: Saris Cycling Group  
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## 1.0 Summary of Test Report

It was determined that the Powertap 3 RF Module, complies with the requirements of CFR 47 Part 15 Subpart C Section 15.249, and Subpart B Section 15.109.

### Subpart C Section 15.249, and Subpart B Section 15.109 Applicable Technical Requirements Tested:

Section	Description	Procedure	Note	Compliant?
15.249(a)	Field Strength of Fundamental Frequency	ANSI C63.4-2009 & ANSI C63.10-2009	1	Yes
15.249(a)	Field Strength of Harmonics	ANSI C63.4-2009 & ANSI C63.10-2009	1, 2	Yes
15.205	Restricted Bands of Operation (Band-Edge)	ANSI C63.4-2009 & ANSI C63.10-2009	1	Yes
15.215(c)	20 dB Emission Bandwidth	ANSI C63.4-2009 & ANSI C63.10-2009	3	NA
15.35(c)	Duty Cycle Correction	ANSI C63.4-2009 & ANSI C63.10-2009	3	NA
2.1093	RF Exposure	ANSI C63.4-2009 & ANSI C63.10-2009	1,3	Yes
15.109(a)	Receiver Radiated Emissions	ANSI C63.4-2009	1, 2, 3	Yes

Note 1: EUT tested at a distance of 3 meters in three orthogonal planes.

Note 2: EUT tested at a distance of 1 meter in three orthogonal planes.

Note 3: Informative.

NA: Not Applicable.

## 2.0 Introduction

On June 20 through June 22, 2011, the Powertap 3 RF Module, as provided by Saris Cycling Group was tested to the requirements of CFR 47 Part 15 Subpart C Section 15.249, and Subpart B Section 15.109. To meet these requirements, the procedures contained within this report were performed by personnel of D.L.S Electronic Systems, Inc.



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### 3.0 Facilities

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.

#### Wisconsin Test Facility:

D.L.S. Electronic Systems, Inc.  
166 S. Carter Street  
Genoa City, Wisconsin 53128

#### Wheeling Test Facility:

D.L.S. Electronic Systems, Inc.  
1250 Peterson Drive  
Wheeling, IL 60090

### 4.0 Description of Test Sample

#### Description:

This is an RF module for measuring various metrics in cycling or other sporting equipment. This is a 2.4GHz transceiver that communicates with an external device, typically a portable bicycle computer. An application dependant host board is connected to the module. The host board collects the metrics, and the module communicates the data to the receiver.

#### Type of Equipment / Frequency Range:

RF Module for Bicycle Power Meter / 2405 MHz to 2480 MHz

#### Physical Dimensions of Equipment Under Test:

Length: 2 in. x Width: 2 in. x Height: 0.8 in.

#### Power Source:

Single battery; 3 VDC

#### Internal Frequencies:

16 MHz, 0.032768 MHz

#### Transmit / Receive Frequencies Used For Test Purpose:

2405 MHz, 2440 MHz, 2480 MHz



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#### 4.0 Description of Test Sample (continued)

##### Type of Modulation(s) / Antenna Type:

GFSK / Integrated PCB Trace Antenna

##### Description of Circuit Board(s) / Part Number:

EASSM,T-ANTENNA AT3, BARE PCB	19669 Rev A
-------------------------------	-------------

#### 5.0 Test Equipment

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

##### D.L.S. Wisconsin – Site 3 - Test Equipment:

Description	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Due Dates
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	7/11
Preamplifier	Rohde & Schwarz	TS-PR10	032001/005	9 kHz – 1 GHz	1/12
Antenna	EMCO	3104C	97014785	20 MHz – 200 MHz	9/12
Antenna	EMCO	3146	97024895	200 MHz – 1 GHz	9/12
Horn Antenna	EMCO	3115	9502-4451	1-18GHz	4/12
Filter- High-Pass	Q-Microwave	100462	1	4.2GHz-18GHz	5/12
Preamp	Ciao	CA118-4010	101	1GHz-18GHz	1/12
Preamp	Miteq	AMF-8B-180265-40-10P-H/S	438727	18GHz-26GHz	8/11
Horn Antenna	A.H. Systems	SAS-574	221	18 – 40GHz	5/12
High Pass Filter	Planar	CL22500-9000-CD-SS	PF1229/0728	15-40 GHz	8/11



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## 6.0 Test Arrangements

### Radiated Arrangement:

All emission tests were performed at D.L.S. Electronic Systems, Inc. and set up according to ANSI C63.4-2009 and ANSI C63.10-2009 unless otherwise noted. Description of procedures and measurements can be found in Appendix B – Measurement Data. See Appendix A for additional photos of the test set up.

Unless otherwise noted, the bandwidth of the measuring receiver / analyzer used during testing is shown below.

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

## 7.0 Test Conditions

### Temperature and Humidity:

73°F at 66% RH

### Battery Voltage:

3.1 VDC

## 8.0 Modifications Made To EUT For Compliance

None noted at time of test.

## 9.0 Additional Descriptions

Test Software used to control transmit and receive. User can select low, mid, or high channel, modulated or unmodulated, transmit or receive. Test Software: individual HID driver batch files for each operation.





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## 10.0 Results

Measurements were performed in accordance with ANSI C63.4-2009 and ANSI C63.10-2009. Graphical and tabular data can be found in Annex B at the end of this report.

## 11.0 Conclusion

The Powertap 3 RF Module as provided by Saris Cycling Group, tested on June 20 through June 22, 2011 **meets** the requirements of CFR 47 Part 15 Subpart C Section 15.249, and Subpart B Section 15.109 Class B.



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DLS Project:

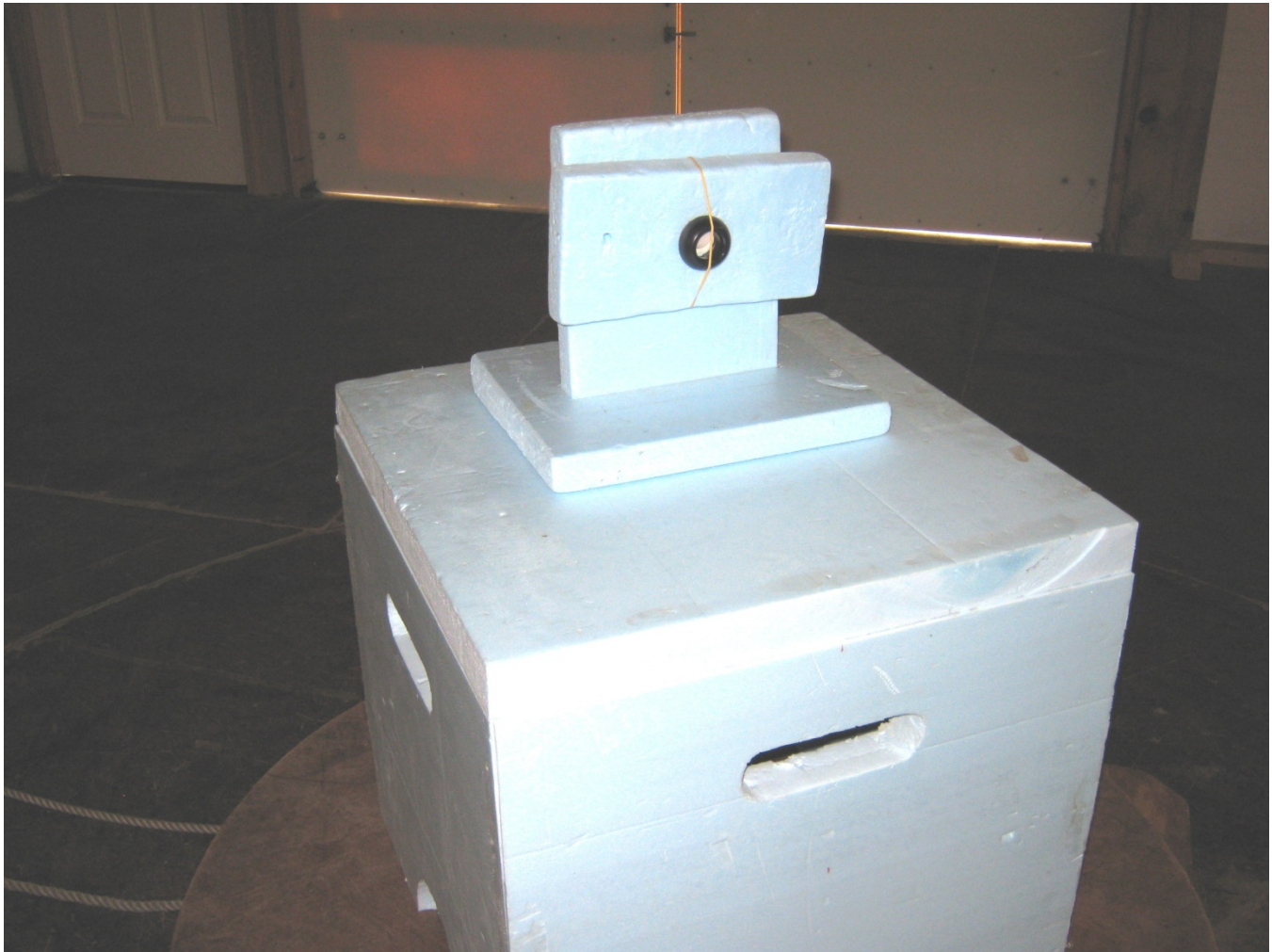
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## Appendix A – Test Photos

### Photo Information and Test Setup:

Item: EUT – Powertap 3

#### Radiated X Position





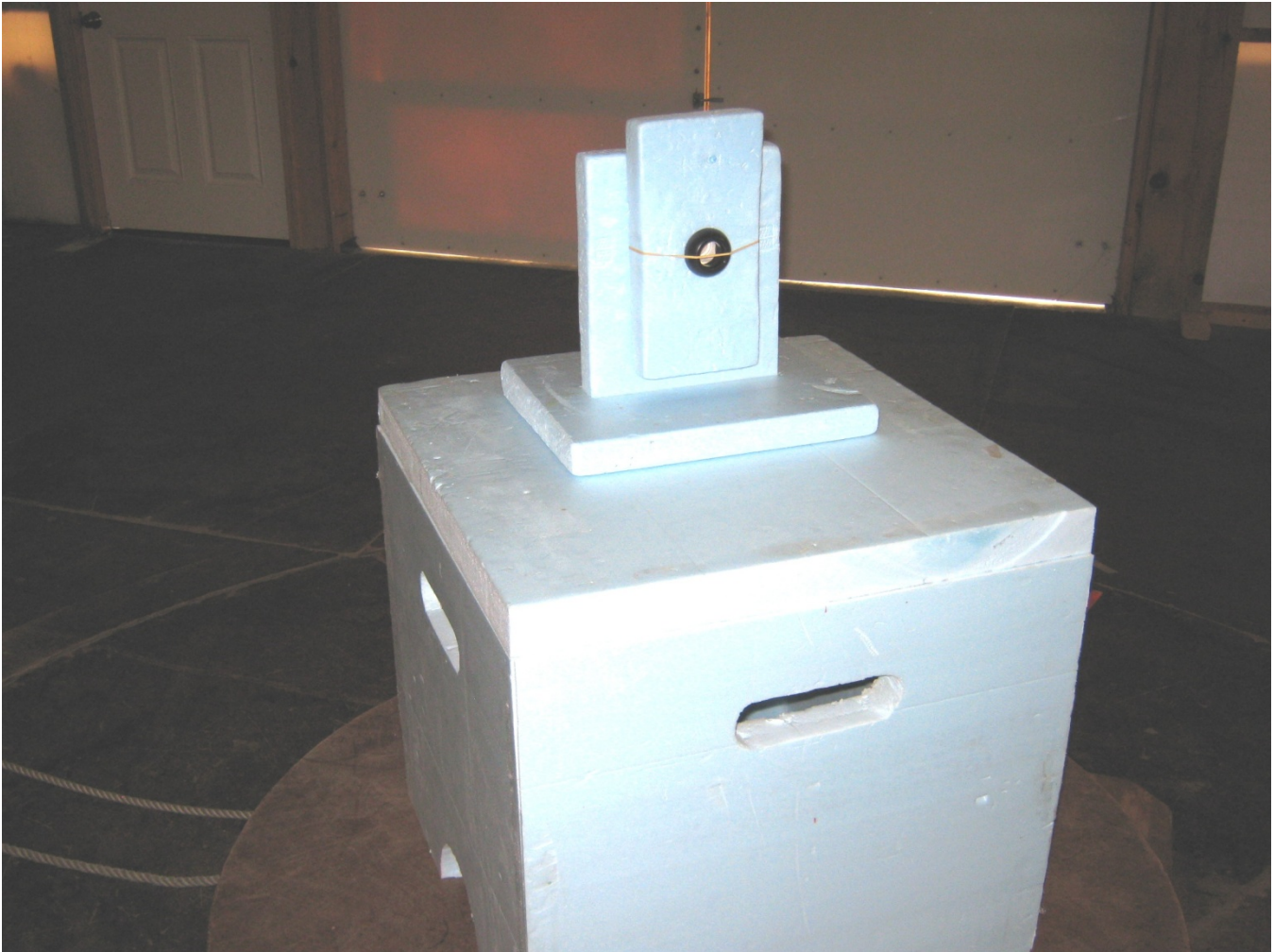
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## Appendix A

### Radiated Y Position



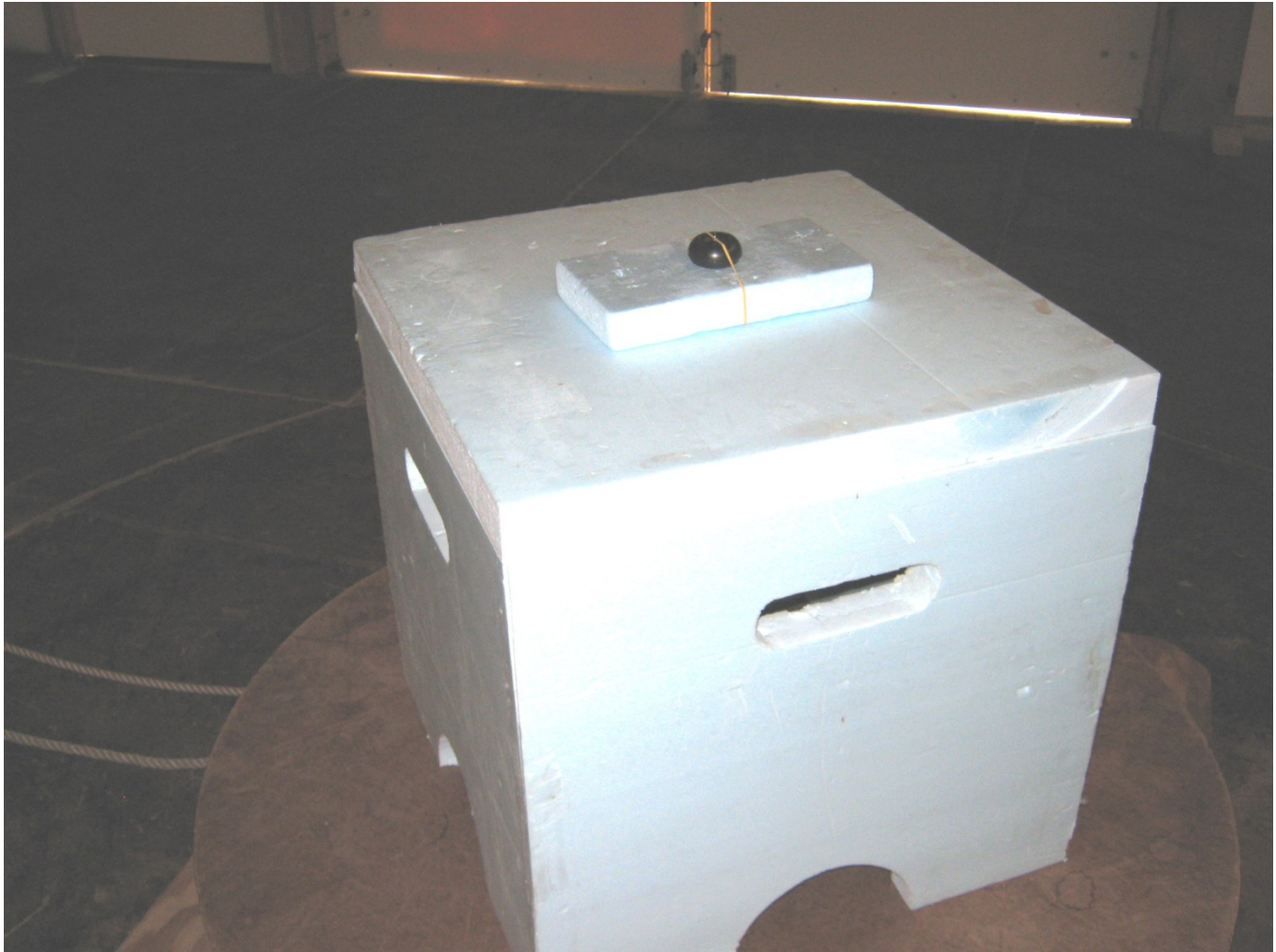


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## Appendix A

### Radiated Z Position





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## Appendix A

### Radiated above 1 GHz





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## Appendix B – Measurement Data

### 1.0 Field Strength of Fundamental and Spurious emissions

**Rule Part:** Section 15.249(a) including 15.209(a)

**Test Procedure:** ANSI C63.4-2009

**Limits:**

Fundamental Frequency	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
2400 – 2483.5 MHz	50	500

**Results:** Compliant

**Sample Equations:**

Total Level = Level + System Loss + Antenna Factor  
Final Corrected = Total Level - Duty Cycle Correction  
Margin = Limit - Final Corrected

**Notes:**

Tested at a 3 meter distance 30 MHz to 10 GHz  
Tested at a 1 meter distance 10 GHz to 26 GHz  
All other emissions at least 20 dB below the limit  
Since the EUT was not able to transmit continuously while modulated, compliance is shown by measurement of an unmodulated signal with a peak detector and applying a duty cycle corrected value to the average limit (see above equations).

# Radiated Fundamental and Spurious Emissions – 30 MHz to 26 GHz

30 MHz – 10 GHz Tested at a 3 Meter Distance

10 – 26 GHz Tested at a 1 Meter Distance

**EUT:** Powertap 3  
**Manufacturer:** Saris Cycling Group Inc.  
**Operating Condition:** 73 deg F; 66% R.H.  
**Test Site:** Site 3  
**Operator:** Craig B  
**Test Specification:** FCC Part 15.249, Part 15.205 and Part 15.209  
**Comment:** Low channel: 2405 MHz  
**Date:** 06-21-2011

**Notes:** EUT set to continuous transmit, unmodulated.  
 Peak detector. (Average = Peak detector measurement – duty cycle correction factor).  
 All other emissions at least 20 dB under the limit.

Frequency (GHz)	Measurement Type	Ant. Pol.	Level (dBuV)	Antenna Factor (dBuV/m)	System Loss (dB)	Total Level (dBuV/m)	Duty Cycle Correction (dB)	Final Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comment
2.405	Max Peak	Vert	59.17	28.64	1.7	89.5	---	89.5	114	24.5	Fundamental
2.405	Average	Vert	59.17	28.64	1.7	89.5	54.3	35.2	94	58.8	Fundamental
2.405	Max Peak	Horz	60.47	28.64	1.7	90.8	---	90.8	114	23.2	Fundamental
2.405	Average	Horz	60.47	28.64	1.7	90.8	54.3	36.5	94	57.5	Fundamental
4.810	Max Peak	Vert	55.59	33.04	-38.9	49.7	---	49.7	74	24.3	Restricted Band
4.810	Average	Vert	55.59	33.04	-38.9	49.7	54.3	-4.6	54	58.6	Restricted Band
4.810	Max Peak	Horz	56.49	33.04	-38.9	50.6	---	50.6	74	23.4	Restricted Band
4.810	Average	Horz	56.49	33.04	-38.9	50.6	54.3	-3.7	54	57.7	Restricted Band
7.215	Max Peak	Vert	50.76	36.11	-33.3	53.6	---	53.6	74	20.4	Restricted Band
7.215	Average	Vert	50.76	36.11	-33.3	53.6	54.3	-0.7	54	54.7	Restricted Band
7.215	Max Peak	Horz	52.36	36.11	-33.3	55.2	---	55.2	74	18.8	Restricted Band
7.215	Average	Horz	52.36	36.11	-33.3	55.2	54.3	0.9	54	53.1	Restricted Band

## Radiated Fundamental and Spurious Emissions – 30 MHz to 26 GHz

30 MHz – 10 GHz Tested at a 3 Meter Distance

10 – 26 GHz Tested at a 1 Meter Distance

**EUT:** Powertap 3  
**Manufacturer:** Saris Cycling Group Inc.  
**Operating Condition:** 73 deg F; 66% R.H.  
**Test Site:** Site 3  
**Operator:** Craig B  
**Test Specification:** FCC Part 15.249, Part 15.205 and Part 15.209  
**Comment:** Mid channel: 2440 MHz  
**Date:** 06-21-2011

**Notes:** EUT set to continuous transmit, unmodulated.  
 Peak detector. (Average = Peak detector measurement – duty cycle correction factor).  
 All other emissions at least 20 dB under the limit.

Frequency (GHz)	Measurement Type	Ant. Pol.	Level (dBuV)	Antenna Factor (dBuV/m)	System Loss (dB)	Total Level (dBuV/m)	Duty Cycle Correction (dB)	Final Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comment
2.440	Max Peak	Vert	60.03	28.67	1.7	90.4	---	90.4	114	23.6	Fundamental
2.440	Average	Vert	60.03	28.67	1.7	90.4	54.3	36.1	94	57.9	Fundamental
2.440	Max Peak	Horz	63.08	28.67	1.7	93.5	---	93.5	114	20.6	Fundamental
2.440	Average	Horz	63.08	28.67	1.7	93.5	54.3	39.2	94	54.9	Fundamental
4.880	Max Peak	Vert	57.05	33.11	-39.5	50.7	---	50.7	74	23.3	Restricted Band
4.880	Average	Vert	57.05	33.11	-39.5	50.7	54.3	-3.6	54	57.6	Restricted Band
4.880	Max Peak	Horz	58.07	33.11	-39.5	51.7	---	51.7	74	22.3	Restricted Band
4.880	Average	Horz	58.07	33.11	-39.5	51.7	54.3	-2.6	54	56.6	Restricted Band
7.320	Max Peak	Vert	50.19	36.60	-33.0	53.8	---	53.8	74	20.2	Restricted Band
7.320	Average	Vert	50.19	36.60	-33.0	53.8	54.3	-0.5	54	54.5	Restricted Band
7.320	Max Peak	Horz	50.32	36.60	-33.0	53.9	---	53.9	74	20.1	Restricted Band
7.320	Average	Horz	50.32	36.60	-33.0	53.9	54.3	-0.4	54	54.4	Restricted Band



# Radiated Fundamental and Spurious Emissions – 30 MHz to 26 GHz

30 MHz – 10 GHz Tested at a 3 Meter Distance

10 – 26 GHz Tested at a 1 Meter Distance

**EUT:** Powertap 3  
**Manufacturer:** Saris Cycling Group Inc.  
**Operating Condition:** 73 deg F; 66% R.H.  
**Test Site:** Site 3  
**Operator:** Craig B  
**Test Specification:** FCC Part 15.249, Part 15.205 and Part 15.209  
**Comment:** High channel: 2480 MHz  
**Date:** 06-21-2011

**Notes:** EUT set to continuous transmit, unmodulated.  
 Peak detector. (Average = Peak detector measurement – duty cycle correction factor).  
 All other emissions at least 20 dB under the limit.

Frequency (GHz)	Measurement Type	Ant. Pol.	Level (dBuV)	Antenna Factor (dBuV/m)	System Loss (dB)	Total Level (dBuV/m)	Duty Cycle Correction (dB)	Final Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comment
2.480	Max Peak	Vert	64.09	28.69	1.8	94.6	---	94.6	114	19.4	Fundamental
2.480	Average	Vert	64.09	28.69	1.8	94.6	54.3	40.3	94	53.7	Fundamental
2.480	Max Peak	Horz	65.01	28.69	1.8	95.5	---	95.5	114	18.5	Fundamental
2.480	Average	Horz	65.01	28.69	1.8	95.5	54.3	41.2	94	52.8	Fundamental
4.960	Max Peak	Vert	58.10	33.25	-39.1	52.3	---	52.3	74	21.8	Restricted Band
4.960	Average	Vert	58.10	33.25	-39.1	52.3	54.3	-2.1	54	56.1	Restricted Band
4.960	Max Peak	Horz	58.36	33.25	-39.1	52.5	---	52.5	74	21.5	Restricted Band
4.960	Average	Horz	58.36	33.25	-39.1	52.5	54.3	-1.8	54	55.8	Restricted Band
7.440	Max Peak	Vert	49.47	36.65	-33.8	52.3	---	52.3	74	21.7	Restricted Band
7.440	Average	Vert	49.47	36.65	-33.8	52.3	54.3	-2.0	54	56.0	Restricted Band
7.440	Max Peak	Horz	49.98	36.65	-33.8	52.8	---	52.8	74	21.2	Restricted Band
7.440	Average	Horz	49.98	36.65	-33.8	52.8	54.3	-1.5	54	55.5	Restricted Band



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**Appendix B**

**2.0 Restricted Bands of Operation (Radiated Band Edge measurement)**

**Rule Part:** Section 15.249 including 15.205, 15.209, and 15.35

**Test Procedure:** ANSI C63.4-2009

**Limits:**

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
Above 960	500	3

**Results:** Compliant

**Sample Equations:**

Average Band-Edge Field Strength = Peak Field Strength – Duty Cycle Correction\*

\*Used to compare to the average limit. Peak detector used, then a correction applied.

**Notes:**

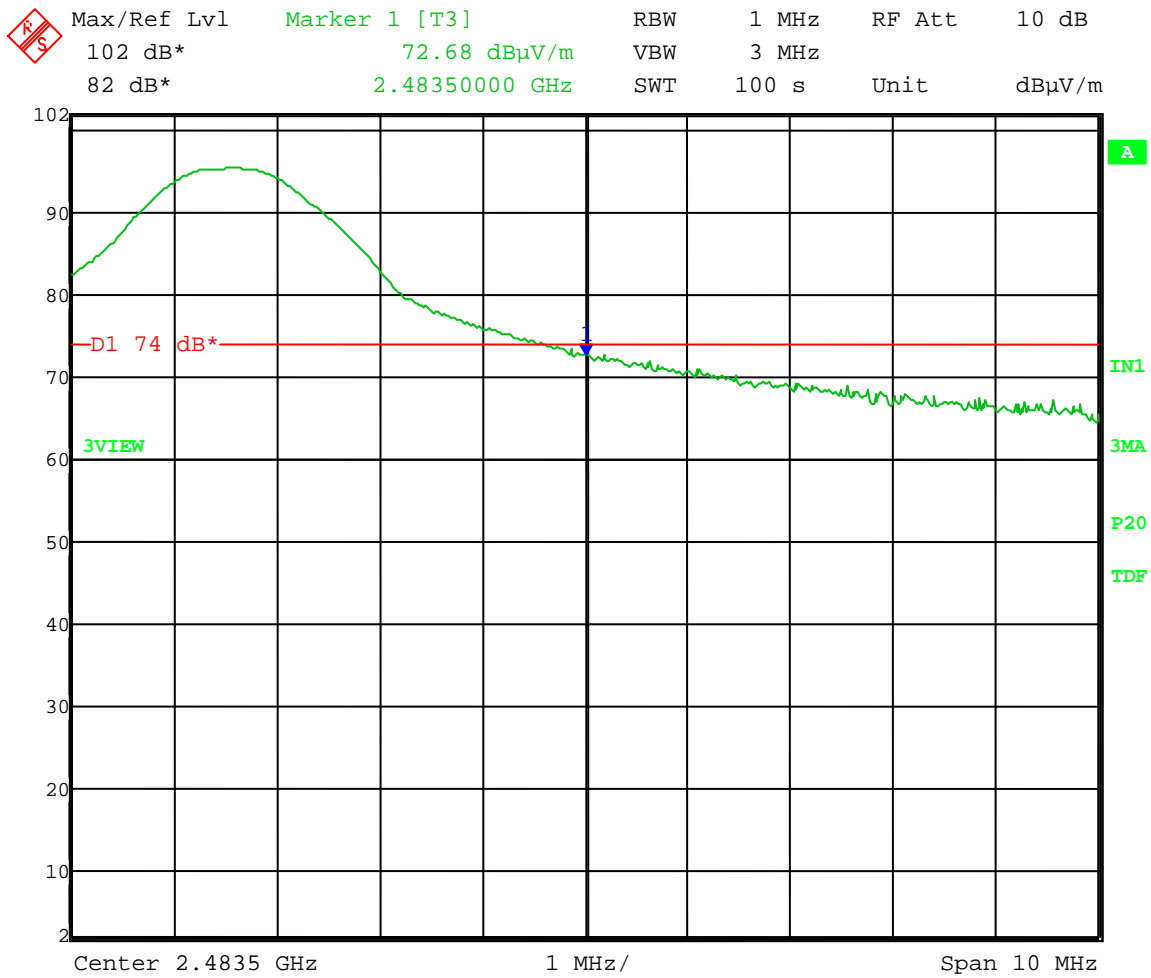
Because the upper band edge coincides with a restricted band, band edge compliance for the upper band edge was determined using a radiated measurement of the highest channel transmitting its normal modulation. The radiated field strength of the fundamental emission at the band edge was measured with a peak detector. Then the duty cycle correction factor was applied to show compliance to the Average limit at the band edge.

Test Date: 06-21-2011  
 Company: Saris Cycling Group  
 EUT: Powertap 3  
 Test: Band edge 2.4835 GHz (FCC Pt. 15.249, FCC Pt. 15.205, FCC Pt. 15.209)  
 Operator: Craig B

Comment: **2.480 GHz Transmit Frequency**  
 Modulation ON  
 Horizontal (worst-case)  
 Peak Detector  
 Peak Limit: 74 dB $\mu$ V/m at 3 meters  
 Average Limit: 54 dB $\mu$ V/m at 3 meters

**Peak field strength: 72.68 dB $\mu$ V/m at 3 meters: Margin = 1.32 dB**

**Average field strength: 72.68 – 54.3 dB (duty cycle correction) = 18.38 dB $\mu$ V/m at 3 meters: Margin = 35.62 dB**



Date: 21.JUN.2011 11:31:58



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## Appendix B

### 3.0 20 dB Emission Bandwidth

**Rule Part:** Section 15.215(c)

**Test Procedure:** ANSI C63.4-2009, Section 13.7

**Limits:** Not Applicable

**Results:** 20 dB Bandwidth = 1.11 MHz

**Sample Equations:**

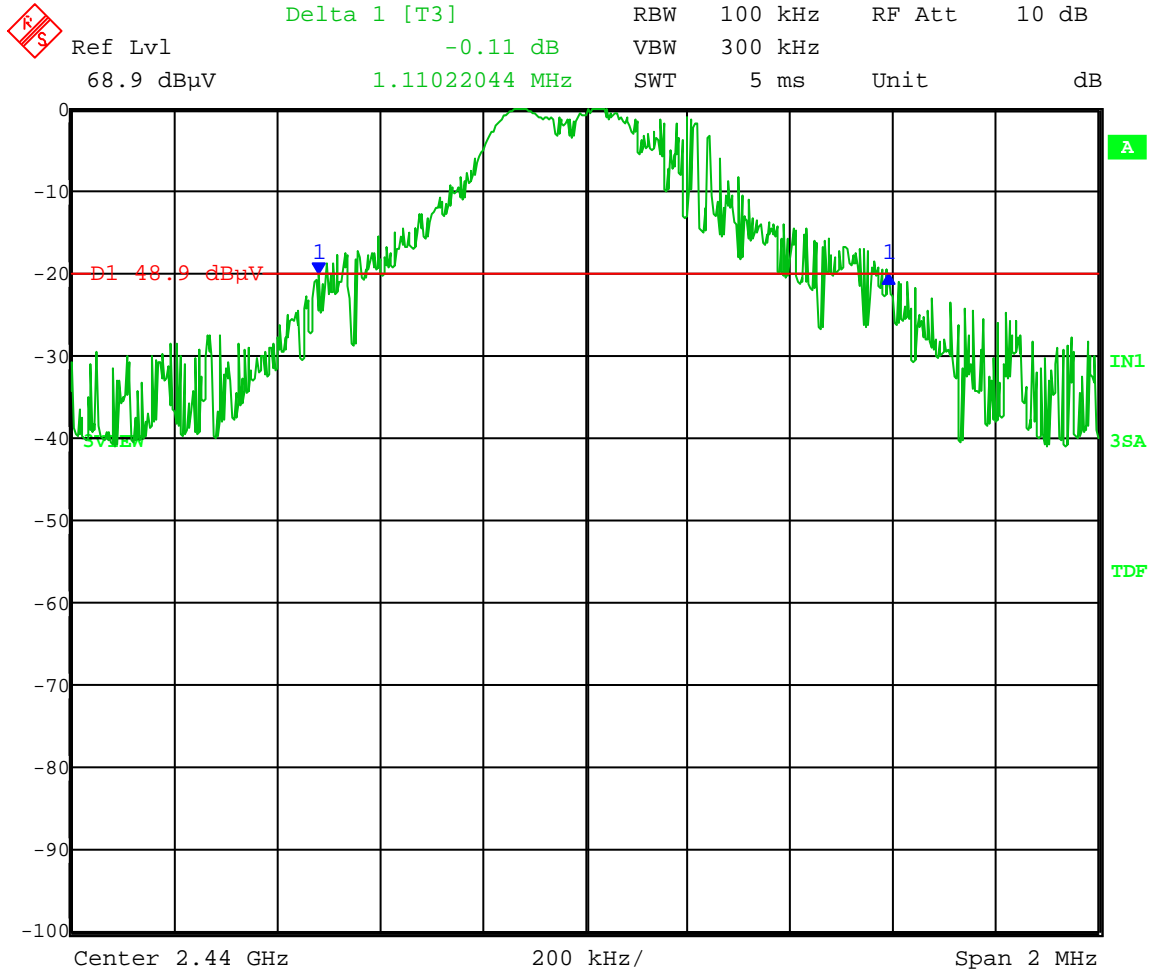
None

**Notes:**

None

Test Date: 06-20-2011  
 Company: Saris Cycling Group  
 EUT: Powertap 3  
 Test: 20 dB Bandwidth (FCC Part 15.249)  
 Operator: Craig B  
 Comment: Frequency – 2.440 GHz

**20 dB Bandwidth = 1.11 MHz**



Date: 20.JUN.2011 15:18:53



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## Appendix B

### 4.0 Duty Cycle Correction

**Rule Part:** Section 15.35(c)

**Test Procedure:** ANSI C63.4-2009

**Limits:** Not Applicable

**Results:** Duty Cycle Correction Factor: 54.37 dB

#### Sample Equations:

One pulse at 0.1912 ms  
One pulse during 100 ms sweep

Total on Time = 0.1912 ms during 100 ms Sweep  
 $20 \log (0.1912 / 100) = -54.370$   
Duty Cycle Correction Factor = 54.37 dB

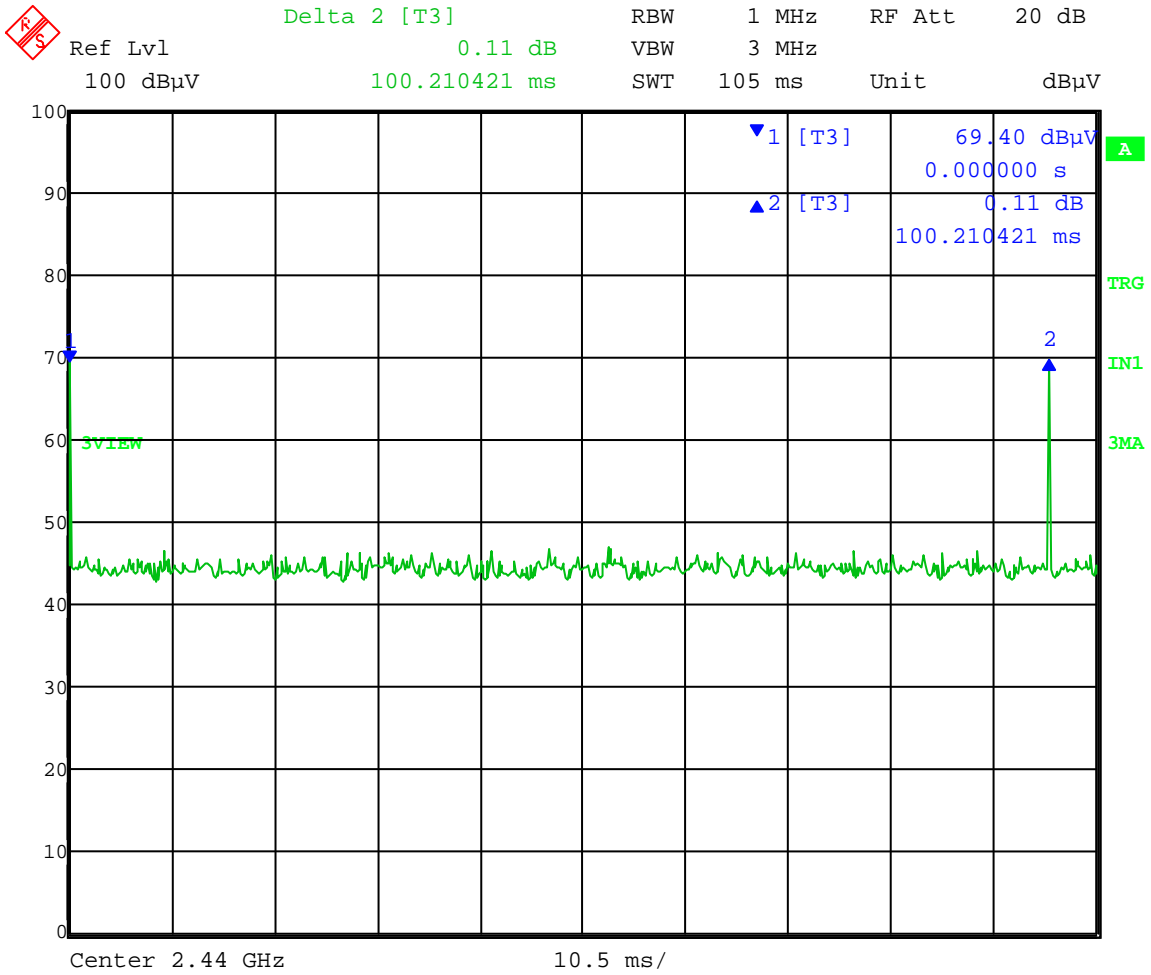
#### Notes:

None

Test Date: 06-20-2011  
 Company: Saris Cycling Group  
 EUT: Powertap 3  
 Test: Duty Cycle (FCC Part 15.249)  
 Operator: Craig B

Comment: Duty Cycle Correction:  $20\log(0.1912/100) = -54.37$   
 Duty Cycle Correction factor: 54.3 dB

105 ms sweep: Only 1 pulse during 100 ms

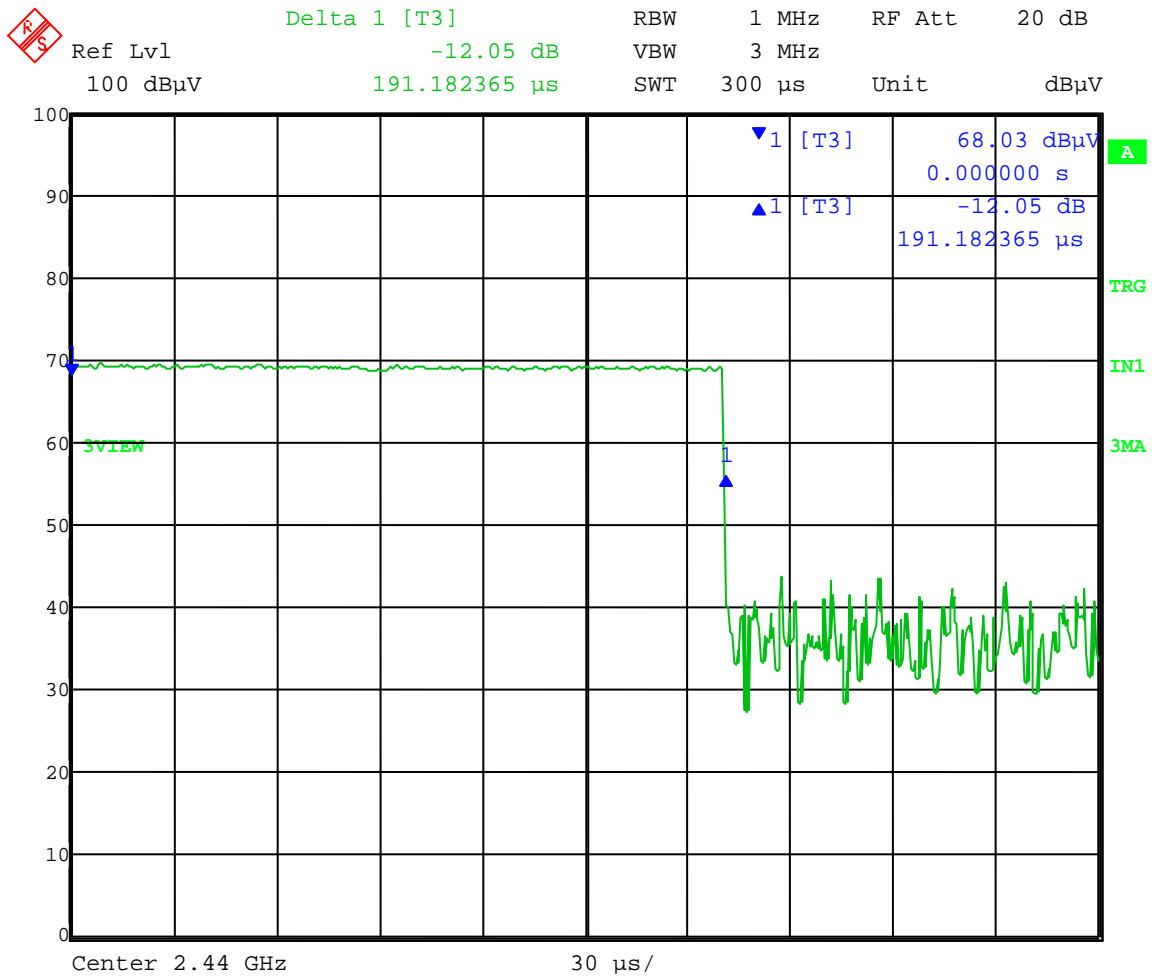


Date: 20.JUN.2011 15:33:48

Test Date: 06-20-2011  
 Company: Saris Cycling Group  
 EUT: Powertap 3  
 Test: Duty Cycle (FCC Part 15.249)  
 Operator: Craig B

Comment: Duty Cycle Correction:  $20\log(0.1912/100) = -54.37$   
 Duty Cycle Correction factor: 54.3 dB

Duration of one pulse:  $191.2 \mu\text{s} = 0.1912 \text{ ms}$



Date: 20.JUN.2011 15:37:05



## Appendix B

### 5.0 RF Exposure Compliance

<b>Rule Part:</b>	CFR 47 Part 1.1307(b) CFR 47 Part 2.1093
<b>Test Procedure:</b>	Exemption from SAR measurements based on output power lower than FCC threshold.
<b>Limits:</b>	FCC threshold for SAR measurements is $60/f(\text{GHz})$ mW. ( $d < 2.5$ cm general population category). Highest power was measured on the High channel (2480 MHz). $60/f \text{ GHz} = 60/2.480 = 24 \text{ mW}$ <b>Threshold for SAR measurements is = 24 mW.</b>
<b>Results:</b>	This is a portable device and the maximum peak output power measured -1.15 dBm e.i.r.p. (using substitution method). This is equivalent to -3.30 dBm e.r.p. <sub>(ref. to <math>\frac{1}{2}\lambda</math> dipole)</sub> -3.30 dBm = 0.47 mW. <b>The measured output power of 0.47 mW is less than the 24 mW threshold.</b> SAR measurement is not necessary.



166 South Carter, Genoa City, WI 53128

Company: Saris Cycling Group  
 Model Tested: Powertap 3 RF Module  
 Report Number: 17049  
 DLS Project: 4062

**Appendix B**

**5.1 EIRP – Low Channel**

DLS Electronic Systems, Inc.

Company: Saris Cycling Group  
 Operator: Craig B  
 Date of test: 06-21-2011  
 Temperature: 70 deg. F  
 Humidity: 71% R.H.  
 Test Specifications: FCC Pt. 2.1093

EIRP - Substitution Method

Model: <b>Powertap 3</b>								
Channel: Low: <b>2405 MHz</b>								
Frequency and Polarization (MHz)	Max. Field Strength of EUT @ 3 meters (dBuV/m)	Output of Signal Generator when field strength equals that of EUT (dBm)	Correction factor for cable between Signal Gen. and subst. antenna (dB)	Gain of subst. antenna (dBi)	Strength of emission [EIRP] (dBm)	Limit (dBm)	Margin (dB)	Strength of emission [EIRP] (mW)
2405 vertical	89.51	-14.67	1.88	9.53	-7.02	NA	NA	0.20
2405 horizontal	90.81	-13.64	1.88	9.53	-5.99	NA	NA	0.25

EIRP = Signal generator output - cable loss + antenna gain

ERP<sub>(ref. to ½λ dipole)</sub> = Signal generator output - cable loss + antenna gain - 2.15



166 South Carter, Genoa City, WI 53128

Company: Saris Cycling Group  
 Model Tested: Powertap 3 RF Module  
 Report Number: 17049  
 DLS Project: 4062

**Appendix B**

**5.2 EIRP – Middle Channel**

DLS Electronic Systems, Inc.

Company: Saris Cycling Group  
 Operator: Craig B  
 Date of test: 06-21-2011  
 Temperature: 70 deg. F  
 Humidity: 71% R.H.  
 Test Specifications: FCC Pt. 2.1093

EIRP - Substitution Method

Model: <b>Powertap 3</b>								
Channel: Middle: <b>2440 MHz</b>								
Frequency and Polarization (MHz)	Max. Field Strength of EUT @ 3 meters (dBuV/m)	Output of Signal Generator when field strength equals that of EUT (dBm)	Correction factor for cable between Signal Gen. and subst. antenna (dB)	Gain of subst. antenna (dBi)	Strength of emission [EIRP] (dBm)	Limit (dBm)	Margin (dB)	Strength of emission [EIRP] (mW)
2440 vertical	90.40	-13.72	1.92	9.39	-6.25	NA	NA	0.24
2440 horizontal	93.45	-10.80	1.92	9.39	-3.33	NA	NA	0.46

EIRP = Signal generator output - cable loss + antenna gain

ERP<sub>(ref. to ½λ dipole)</sub> = Signal generator output - cable loss + antenna gain - 2.15



166 South Carter, Genoa City, WI 53128

Company: Saris Cycling Group  
 Model Tested: Powertap 3 RF Module  
 Report Number: 17049  
 DLS Project: 4062

**Appendix B**

**5.3 EIRP – High Channel**

DLS Electronic Systems, Inc.

Company: Saris Cycling Group  
 Operator: Craig B  
 Date of test: 06-21-2011  
 Temperature: 70 deg. F  
 Humidity: 71% R.H.  
 Test Specifications: FCC Pt. 2.1093

EIRP - Substitution Method

Model: <b>Powertap 3</b>								
Channel: High: <b>2480 MHz</b>								
Frequency and Polarization (MHz)	Max. Field Strength of EUT @ 3 meters (dBuV/m)	Output of Signal Generator when field strength equals that of EUT (dBm)	Correction factor for cable between Signal Gen. and subst. antenna (dB)	Gain of subst. antenna (dBi)	Strength of emission [EIRP] (dBm)	Limit (dBm)	Margin (dB)	Strength of emission [EIRP] (mW)
2480 vertical	94.58	-9.20	1.97	9.24	-1.93	NA	NA	0.64
2480 horizontal	95.50	-8.42	1.97	9.24	-1.15	NA	NA	0.77

EIRP = Signal generator output - cable loss + antenna gain

ERP<sub>(ref. to ½λ dipole)</sub> = Signal generator output - cable loss + antenna gain - 2.15

**FCC Part 15.109 Class B**

**Electric Field Strength**

EUT: Powertap G3  
Manufacturer: Saris Cycling Group  
Operating Condition: 72 deg. F; 64% R.H.  
Test Site: DLS O.F. Site 3  
Operator: Craig B  
Test Specification: Receiver radiated emissions  
Comment: Continuous receive; Low, Mid, and High channels  
Date: 06-22-2011

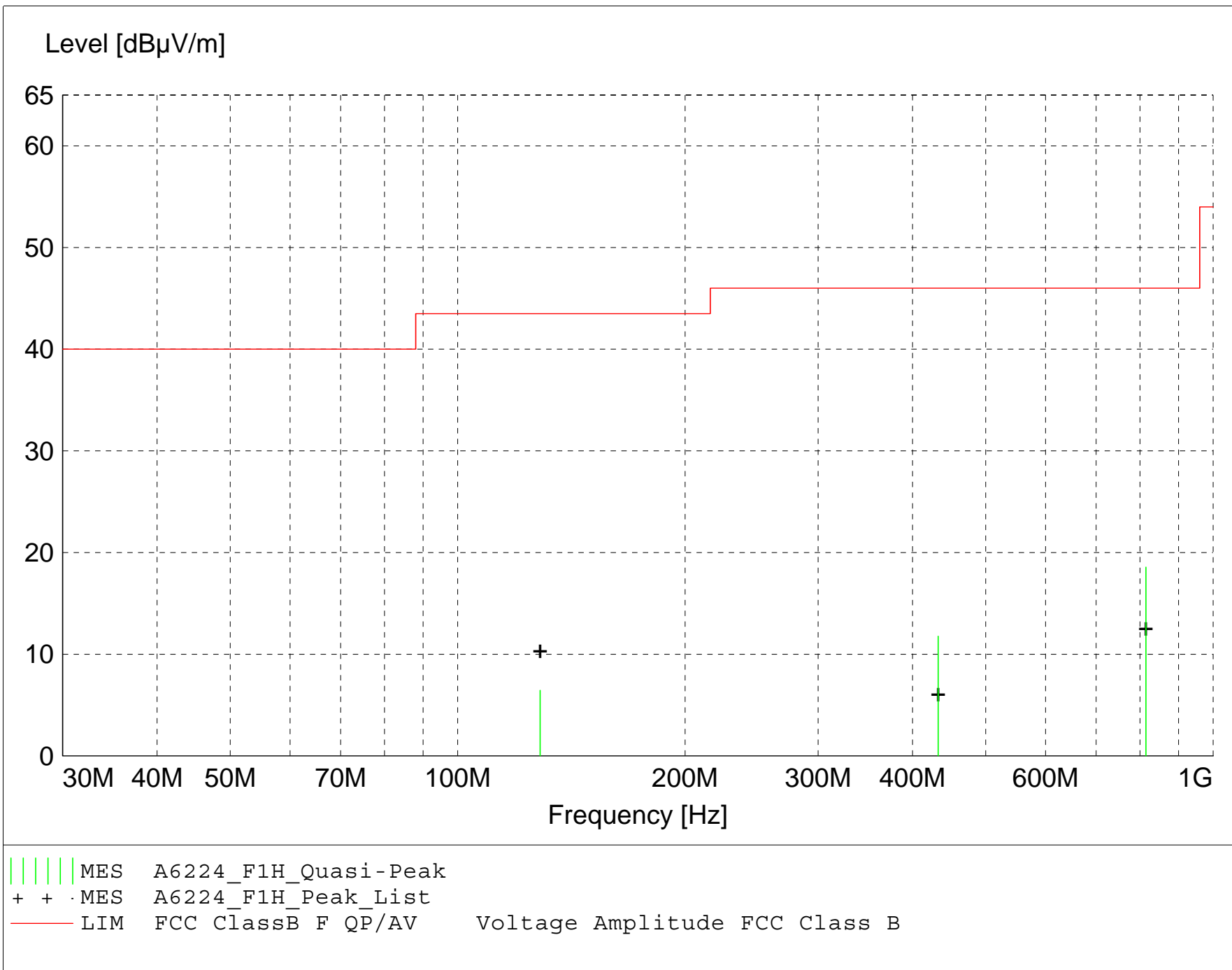
**TEXT: "Horz 3 meters"**

Short Description: Test Set-up

Test Set-up: EUT Measured at 3 Meters with HORIZONTAL Antenna Polarization

Equations: 
$$\text{Total Level (dB}\mu\text{V/m)} = \text{Level (dB}\mu\text{V)} + \text{System Loss (dB)} + \text{Antenna Factor (dB}\mu\text{V/m)}$$
$$\text{Margin (dB)} = \text{Limit (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

Graph Markers: + Frequency marker (Level of marker not related to final level)  
| Final maximized level using Quasi-Peak detector  
X Final maximized level using Average detector  
# Final maximized level using Peak detector



**MEASUREMENT RESULT: "A6224\_F1H\_Final"**

6/22/2011 1:03PM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dB $\mu$ V	Factor	Loss	Level	dB $\mu$ V/m	dB	Ant.	Angle	Detector	
		dB $\mu$ V/m	dB	dB $\mu$ V/m	dB $\mu$ V/m		m	deg		
814.930000	15.82	22.00	-19.2	18.6	46.0	27.4	2.00	45	QUASI-PEAK	noise floor
432.600000	16.21	16.70	-21.1	11.8	46.0	34.2	2.00	0	QUASI-PEAK	noise floor
128.580000	16.90	12.74	-23.2	6.4	43.5	37.1	2.50	90	QUASI-PEAK	noise floor

**FCC Part 15.109 Class B**

**Electric Field Strength**

EUT: Powertap G3  
Manufacturer: Saris Cycling Group  
Operating Condition: 72 deg. F; 64% R.H.  
Test Site: DLS O.F. Site 3  
Operator: Craig B  
Test Specification: Receiver radiated emissions  
Comment: Continuous receive; Low, Mid, and High channels  
Date: 06-22-2011

**TEXT: "Vert 3 meters"**

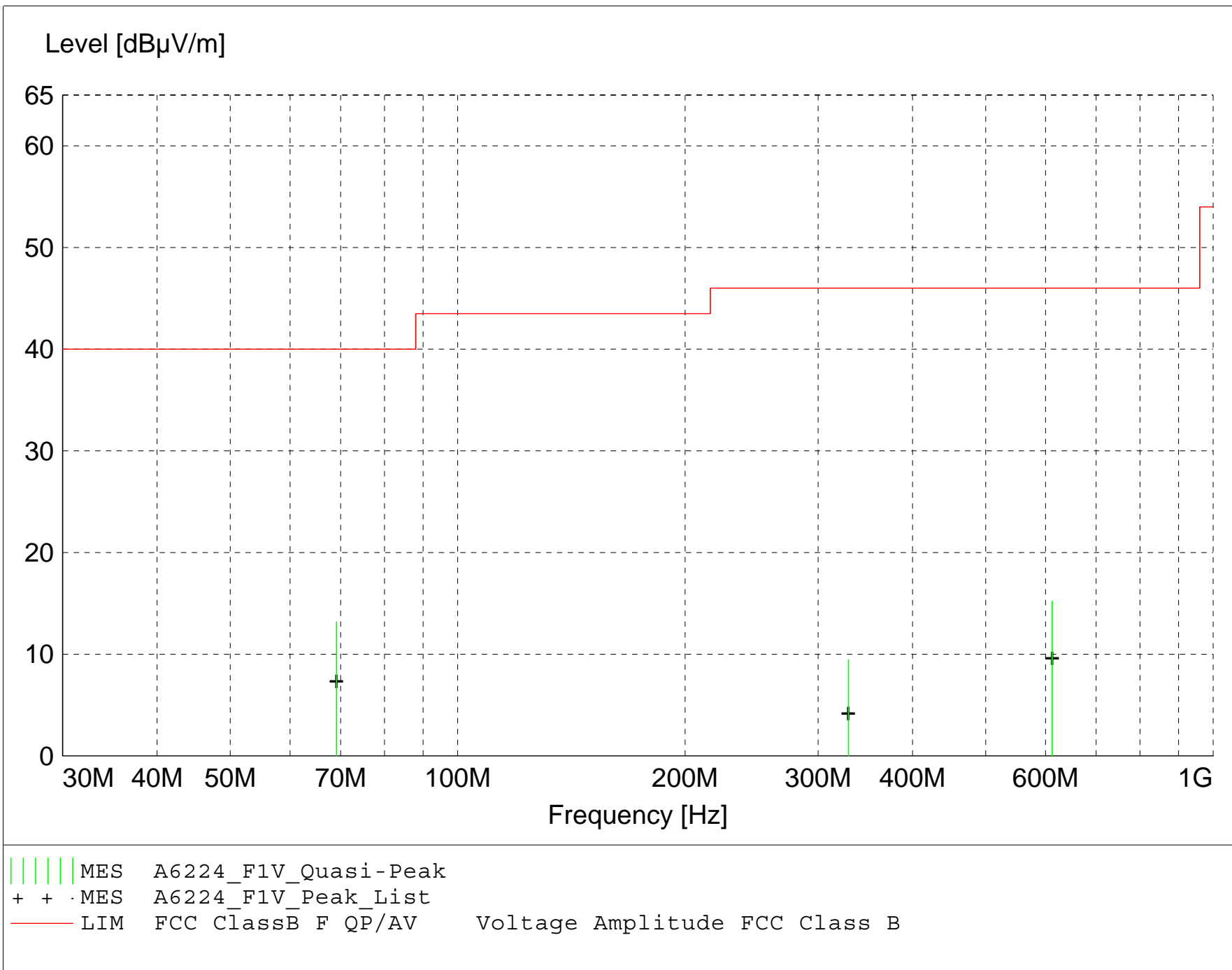
Short Description: Test Set-up

Test Set-up: EUT Measured at 3 Meters with VERTICAL Antenna Polarization

Equations: 
$$\text{Total Level (dB}\mu\text{V/m)} = \text{Level (dB}\mu\text{V)} + \text{System Loss (dB)} + \text{Antenna Factor (dB}\mu\text{V/m)}$$
$$\text{Margin (dB)} = \text{Limit (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

Graph Markers: + Frequency marker (Level of marker not related to final level)  
| Final maximized level using Quasi-Peak detector  
X Final maximized level using Average detector  
# Final maximized level using Peak detector





**MEASUREMENT RESULT: "A6224\_F1V\_Final"**

6/22/2011 12:54PM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dB $\mu$ V	Factor	Loss	Level	dB $\mu$ V/m	dB	Ant.	Angle	Detector	
		dB $\mu$ V/m	dB	dB $\mu$ V/m	dB $\mu$ V/m		m	deg		
69.120000	29.71	7.56	-24.1	13.2	40.0	26.8	1.00	0	QUASI-PEAK	noise floor
612.190000	16.03	19.54	-20.4	15.2	46.0	30.8	1.00	0	QUASI-PEAK	noise floor
328.940000	16.69	14.70	-21.9	9.5	46.0	36.5	1.00	0	QUASI-PEAK	noise floor

**FCC Part 15.109 Class B**

**Electric Field Strength**

EUT: Powertap G3  
Manufacturer: Saris Cycling Group  
Operating Condition: 72 deg. F; 71% R.H.  
Test Site: DLS O.F. Site 3  
Operator: Craig B  
Test Specification: Receiver radiated emissions  
Comment: Continuous receive; Low, Mid, and High channels  
Date: 06-22-2011

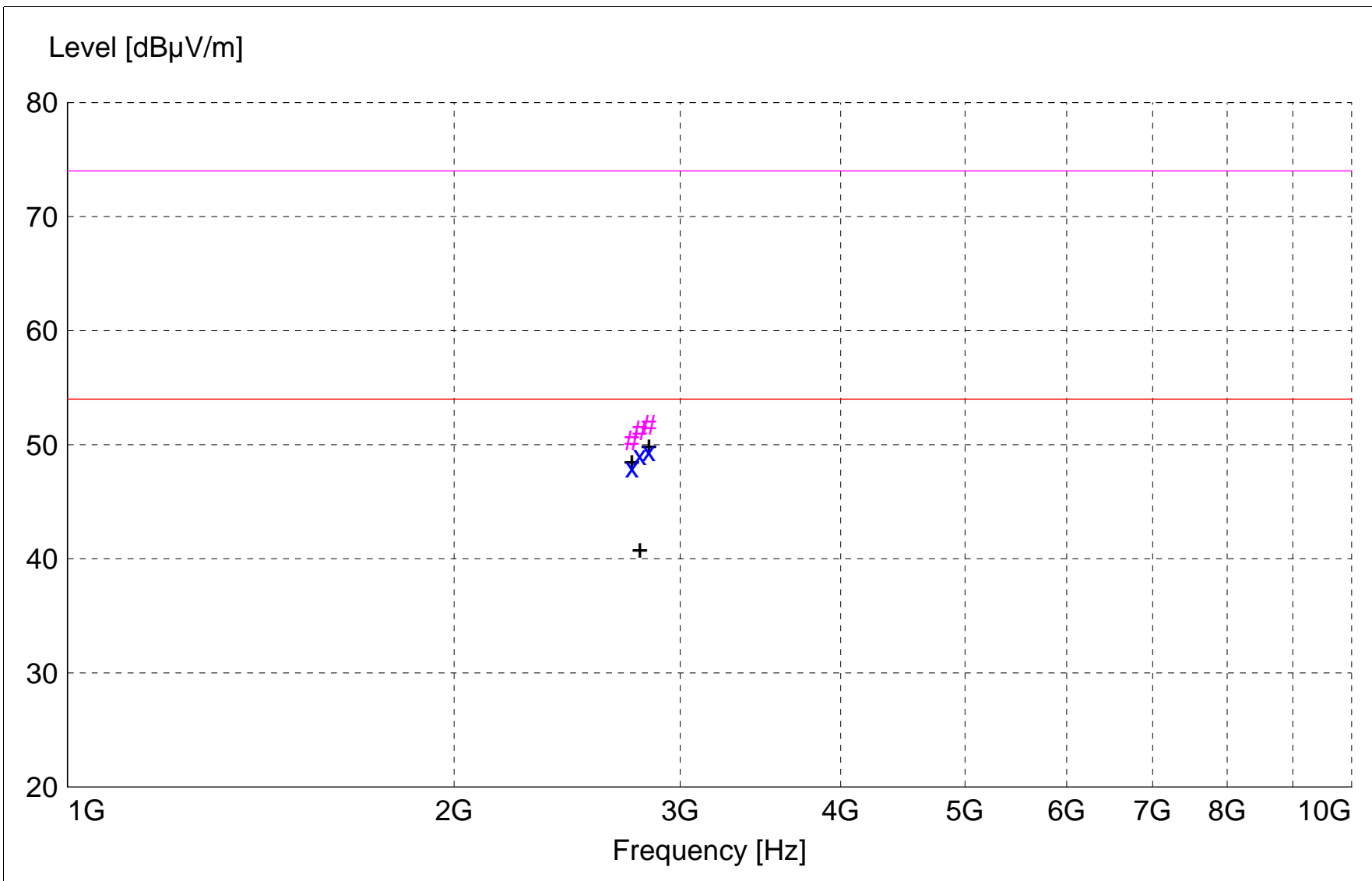
**TEXT: "Horz 3 meters"**

Short Description: Test Set-up

Test Set-up: EUT Measured at 3 Meters with HORIZONTAL Antenna Polarization

Equations: 
$$\text{Total Level (dB}\mu\text{V/m)} = \text{Level (dB}\mu\text{V)} + \text{System Loss (dB)} + \text{Antenna Factor (dB}\mu\text{V/m)}$$
$$\text{Margin (dB)} = \text{Limit (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

Graph Markers: + Frequency marker (Level of marker not related to final level)  
| Final maximized level using Quasi-Peak detector  
X Final maximized level using Average detector  
# Final maximized level using Peak detector



x x :MES A6213\_sh\_Average  
 # # :MES A6213\_sh\_Peak  
 + + :MES A6213\_sh\_Peak\_List  
 — LIM FCC Class B F 3m AVG Field Strength AVG Limit 3m  
 — LIM FCC Class B F 3m PK Field Strength PEAK Limit 3m

**MEASUREMENT RESULT: "A6213\_sh\_Final"**

6/22/2011 8:58AM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBµV	Factor	Loss	Level	dBµV/m	dB	Ant.	Angle	Detector	
		dBµV/m	dB	dBµV/m	dBµV/m		m	deg		
2836.600000	58.29	29.11	-38.0	49.4	54.0	4.6	1.00	110	AVERAGE	High channel
2790.900000	58.52	28.94	-38.4	49.1	54.0	4.9	1.00	110	AVERAGE	Mid channel
2750.900000	57.46	28.90	-38.4	48.0	54.0	6.0	1.00	270	AVERAGE	Low channel
2836.600000	60.62	29.11	-38.0	51.7	74.0	22.3	1.00	110	MAX PEAK	High channel
2790.900000	60.75	28.94	-38.4	51.3	74.0	22.7	1.00	110	MAX PEAK	Mid channel
2750.900000	59.80	28.90	-38.4	50.3	74.0	23.7	1.00	270	MAX PEAK	Low channel

**FCC Part 15.109 Class B**

**Electric Field Strength**

EUT: Powertap G3  
Manufacturer: Saris Cycling Group  
Operating Condition: 72 deg. F; 71% R.H.  
Test Site: DLS O.F. Site 3  
Operator: Craig B  
Test Specification: Receiver radiated emissions  
Comment: Continuous receive; Low, Mid, and High channels  
Date: 06-22-2011

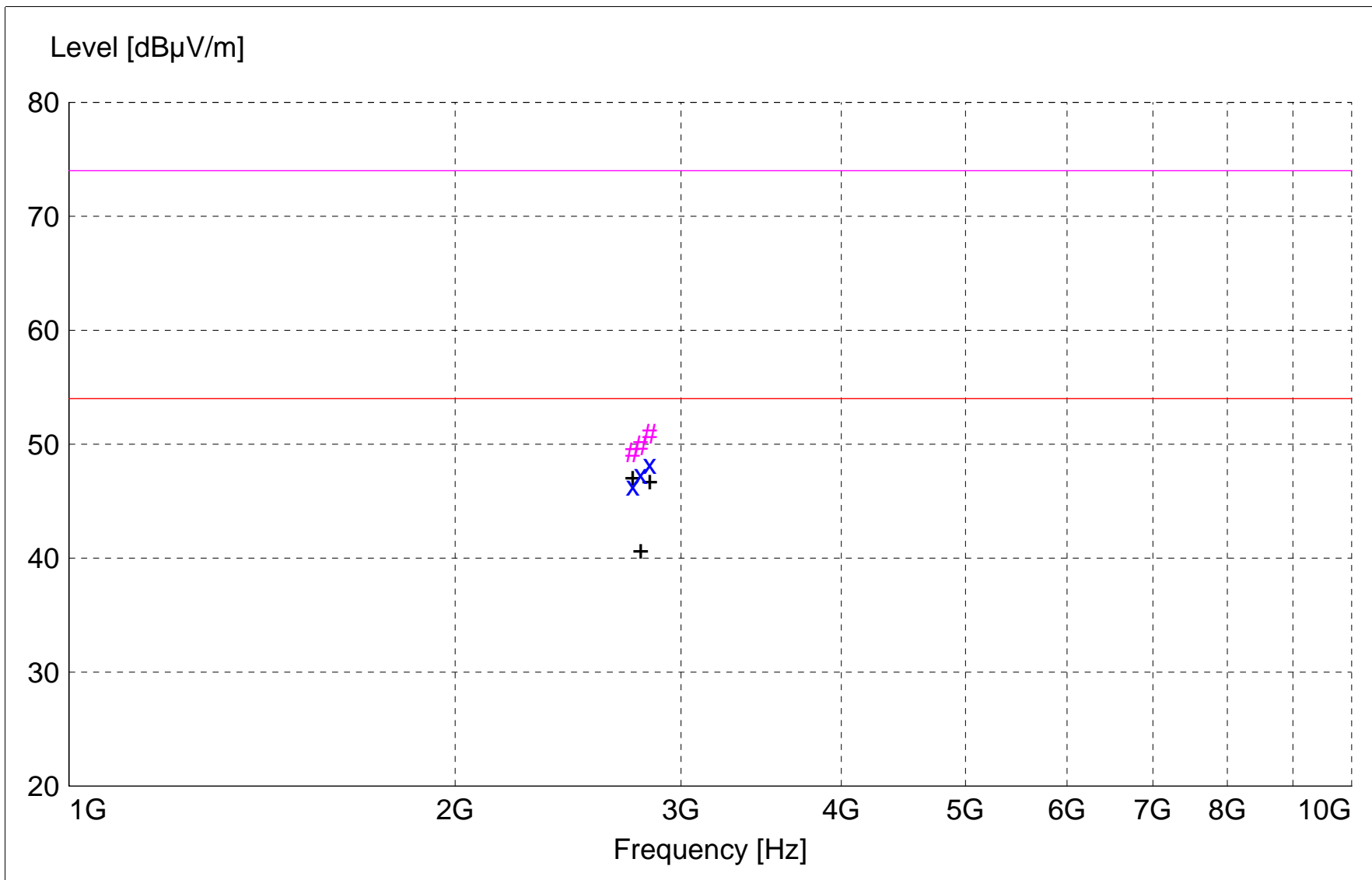
**TEXT: "Vert 3 meters"**

Short Description: Test Set-up

Test Set-up: EUT Measured at 3 Meters with VERTICAL Antenna Polarization

Equations:  $Total\ Level\ (dB\mu V/m) = Level\ (dB\mu V) + System\ Loss\ (dB) + Antenna\ Factor\ (dB\mu V/m)$   
 $Margin\ (dB) = Limit\ (dB\mu V/m) - Total\ Level\ (dB\mu V/m)$

Graph Markers: + Frequency marker (Level of marker not related to final level)  
| Final maximized level using Quasi-Peak detector  
X Final maximized level using Average detector  
# Final maximized level using Peak detector



```

x x :MES A6213_sv_Average
# # :MES A6213_sv_Peak
+ + :MES A6213_sv_Peak_List
— LIM FCC Class B F 3m AVG Field Strength AVG Limit 3m
— LIM FCC Class B F 3m PK Field Strength PEAK Limit 3m

```

**MEASUREMENT RESULT: "A6213\_sv\_Final"**

6/22/2011 8:58AM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBµV	Factor	Loss	Level	dBµV/m	dB	Ant.	Angle	Detector	
		dBµV/m	dB	dBµV/m	dBµV/m		m	deg		
2836.600000	57.16	29.11	-38.0	48.3	54.0	5.7	1.00	225	AVERAGE	High channel
2790.900000	56.83	28.94	-38.4	47.4	54.0	6.6	1.00	200	AVERAGE	Mid channel
2750.900000	55.81	28.90	-38.4	46.3	54.0	7.7	1.00	225	AVERAGE	Low channel
2836.600000	59.84	29.11	-38.0	51.0	74.0	23.0	1.00	225	MAX PEAK	High channel
2790.900000	59.36	28.94	-38.4	49.9	74.0	24.1	1.00	200	MAX PEAK	Mid channel
2750.900000	58.74	28.90	-38.4	49.3	74.0	24.7	1.00	225	MAX PEAK	Low channel



**FCC Part 15.109 Class B**

**Electric Field Strength**

EUT: Powertap G3  
Manufacturer: Saris Cycling Group  
Operating Condition: 72 deg. F; 67% R.H.  
Test Site: DLS O.F. Site 3  
Operator: Craig B  
Test Specification: Receiver radiated emissions  
Comment: Continuous receive; Low, Mid, and High channels  
Date: 06-22-2011

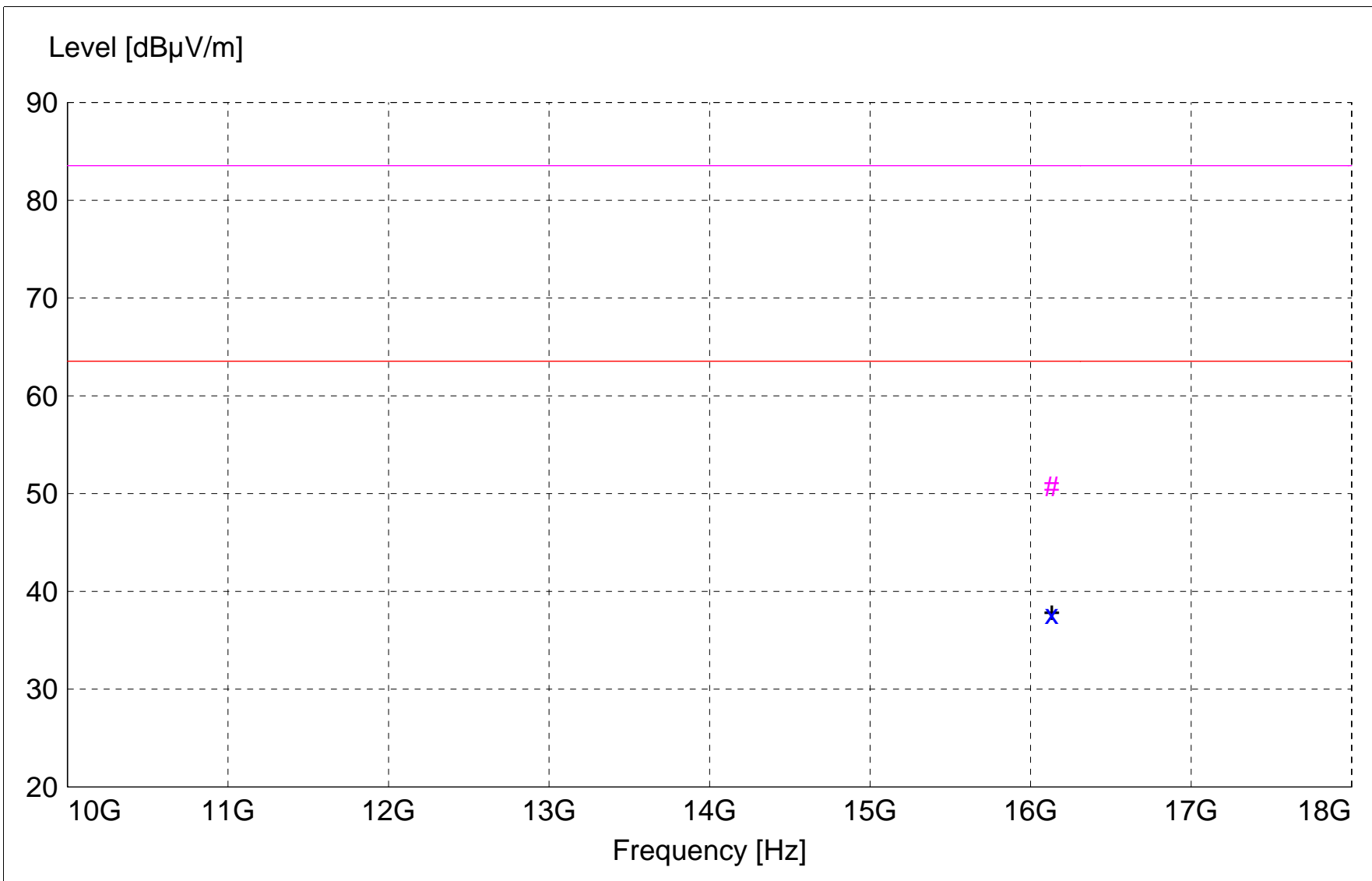
**TEXT: "Horz 1 meters"**

Short Description: Test Set-up

Test Set-up: EUT Measured at 1 Meters with HORIZONTAL Antenna Polarization

Equations:  $\text{Total Level (dB}\mu\text{V/m)} = \text{Level (dB}\mu\text{V)} + \text{System Loss (dB)} + \text{Antenna Factor (dB}\mu\text{V/m)}$   
 $\text{Margin (dB)} = \text{Limit (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$

Graph Markers: + Frequency marker (Level of marker not related to final level)  
| Final maximized level using Quasi-Peak detector  
X Final maximized level using Average detector  
# Final maximized level using Peak detector



```

x x :MES A6222_sh_Average
# # :MES A6222_sh_Peak
+ + :MES A6222_sh_Peak_List
— LIM FCC Class B F 1m AVG Field Strength AVG Limit 1m
— LIM FCC Class B F 1m PK Field Strength Peak Limit 1m

```

**MEASUREMENT RESULT: "A6222\_sh\_Final"**

6/22/2011 9:51AM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dB $\mu$ V	Factor	Loss	Level	dB $\mu$ V/m	dB	Ant.	Angle	Detector	
		dB $\mu$ V/m	dB	dB $\mu$ V/m	dB $\mu$ V/m		m	deg		
16131.400000	37.54	38.27	-38.1	37.7	63.5	25.9	1.00	0	AVERAGE	noise floor
16131.400000	50.63	38.27	-38.1	50.8	83.5	32.8	1.00	0	MAX PEAK	noise floor

**FCC Part 15.109 Class B**

**Electric Field Strength**

EUT: Powertap G3  
Manufacturer: Saris Cycling Group  
Operating Condition: 72 deg. F; 67% R.H.  
Test Site: DLS O.F. Site 3  
Operator: Craig B  
Test Specification: Receiver radiated emissions  
Comment: Continuous receive; Low, Mid, and High channels  
Date: 06-22-2011

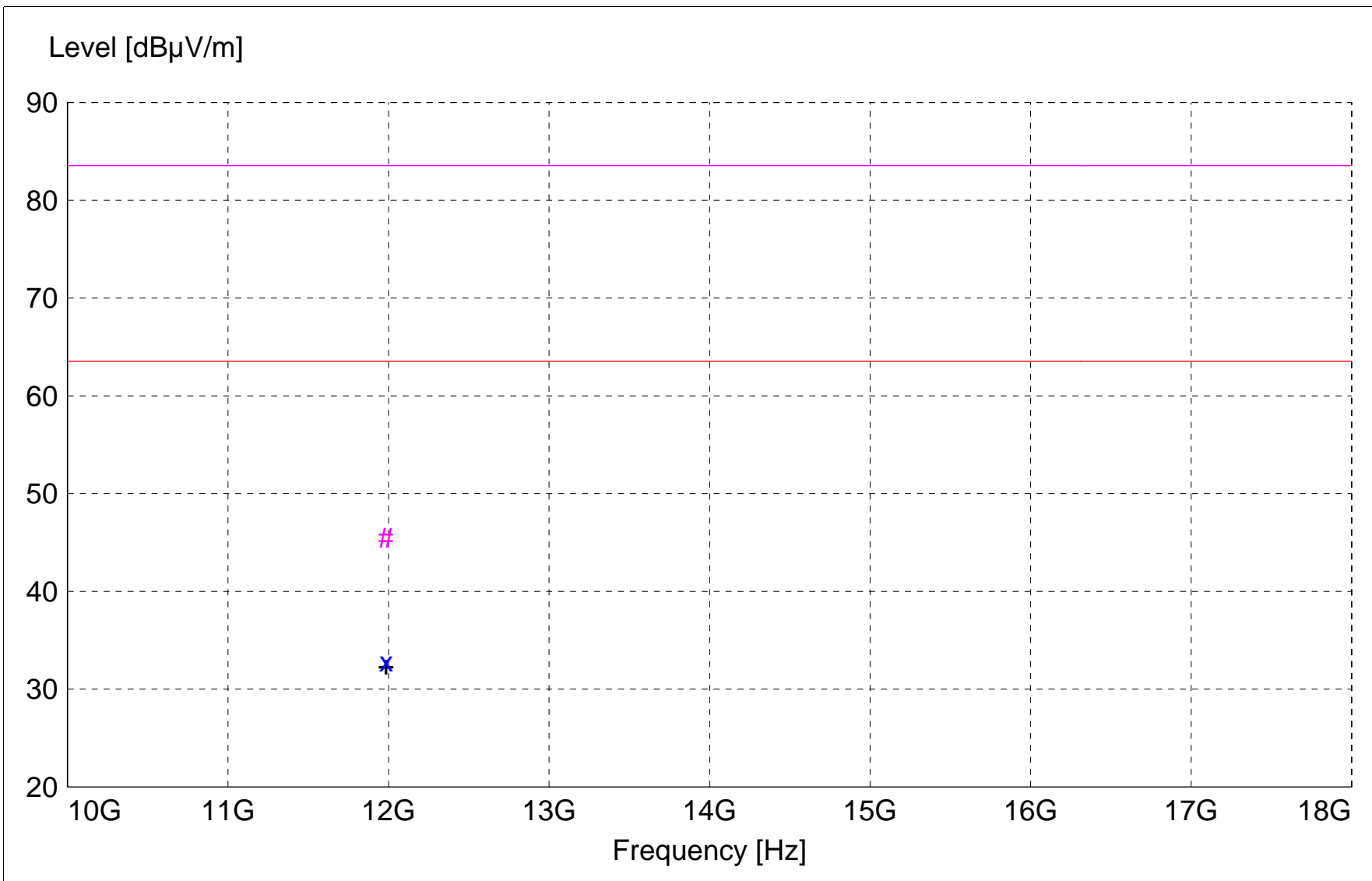
**TEXT: "Vert 1 meters"**

Short Description: Test Set-up

Test Set-up: EUT Measured at 1 Meters with VERTICAL Antenna Polarization

Equations:  $\text{Total Level (dB}\mu\text{V/m)} = \text{Level (dB}\mu\text{V)} + \text{System Loss (dB)} + \text{Antenna Factor (dB}\mu\text{V/m)}$   
 $\text{Margin (dB)} = \text{Limit (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$

Graph Markers: + Frequency marker (Level of marker not related to final level)  
| Final maximized level using Quasi-Peak detector  
X Final maximized level using Average detector  
# Final maximized level using Peak detector



```

x x :MES  A6222_sv_Average
# # :MES  A6222_sv_Peak
+ + :MES  A6222_sv_Peak_List
— — :LIM  FCC Class B F 1m AVG  Field Strength AVG Limit 1m
— — :LIM  FCC Class B F 1m PK   Field Strength Peak Limit 1m

```

**MEASUREMENT RESULT: "A6222\_sv\_Final"**

6/22/2011 9:54AM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBµV	Factor	Loss	Level	dBµV/m	dB	Ant.	Angle	Detector	
		dBµV/m	dB	dBµV/m	dBµV/m		m	deg		
11984.400000	34.94	39.13	-41.3	32.8	63.5	30.7	1.00	0	AVERAGE	noise floor
11984.400000	47.64	39.13	-41.3	45.5	83.5	38.0	1.00	0	MAX PEAK	noise floor



166 South Carter, Genoa City, WI 53128

Company: Saris Cycling Group  
Model Tested: Powertap 3 RF Module  
Report Number: 17049  
DLS Project: 4062

## END OF REPORT

Revision #	Date	Comments	By
1.0	06-29-2011	Preliminary Release	CB
1.1	07-21-2011	Part A updates & data added	JS
1.2	08-02-2011	Page 25 updated	JS