



Date(s) of Evaluation
Nov 14, 15 & 17, 2013

Test Report Issue Date
January 17, 2014

Test Report Serial No.
102813IPH-1260

Description of Test(s)
Specific Absorption Rate

Test Report Revision No.
Rev. 1.2 (2nd Release)

RF Exposure Category
Gen. Pop. / Uncontrolled



DECLARATION OF COMPLIANCE	SAR RF EXPOSURE EVALUATION	FCC & IC
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Test Lab Information	CELLTECH LABS INC. 21-364 Loughheed Road, Kelowna, BC. V1X 7R8 Canada				
Test Lab Accreditation	A2LA - ISO/IEC 17025:2005 (A2LA TEST LAB CERTIFICATE NO. 2470.01)				
Applicant Information	GARMIN INTERNATIONAL INC. 1200, East 151 st Street, Olathe, KS, 66062 USA				
Application Type(s)	FCC	TCB Certification	IC	CB Certification	
Standard(s) Applied	FCC	47 CFR §2.1093	IC	Health Canada Safety Code 6	
Procedure(s) Applied	FCC	KDB 447498 D01v05r01 - General RF Exposure Procedures			
	FCC	KDB 248227 D01v01r02 - SAR Measurement Procedures for 802.11a/b/g Transmitters			
	IC	RSS-102 Issue 4			
	IEEE	1528-2013	IEC	62209-2:2010	
Device RF Exposure Category	FCC/IC	General Population / Uncontrolled Environment			
Device Classification(s)	FCC	DTS - Digital Transmission System (Part 15 Subpart C)			
	IC	Low Power License-Exempt Radio-communication Device (RSS-210)			
Device Identifier(s)	FCC ID:	IPH-02276	IC:	1792A-02276	
Device Model No(s).	F4ACGQ00		O4AHGQ00		
	Transmitter circuitry and operating characteristics are identical between the two models				
Test Sample Serial No.	n/a (Identical Prototype)				
Test Sample Hardware Rev. No.	v5		Test Sample Firmware Rev. No.	1.21 or later	
Measurement Date(s)	November 14, 15 & 17, 2013		Date of Sample Receipt	October 28, 2013	
Device Description	Body-worn GPS Device				
Internal Transmitter(s) Type	802.11b/g		802.15		
Transmitter Type Tested	802.11b/g				
Transmitter Specifications	Frequency Range - 2412 - 2462 MHz				
	802.11b - Modulations [DSSS, CCK] - Data Rates [1, 2, 5.5, 11]				
	802.11g - Modulations [OFDM] - Data Rates [6, 9, 12, 24, 36, 48, 54]				
	Maximum Rated Conducted Output Power = 16dBm				
	Duty Cycle = 100%				
Co-located Transmitter(s)	RFCOMM	2402 - 2480 MHz	4 dBm	No simultaneous tx	
Antenna Type(s) Tested	Internal (2.4 GHz)				
Battery Type(s) Tested	Internal Lithium-ion			P/N:	
Max. SAR Level(s) Evaluated	FCC	Body-Worn	0.790 W/kg	1g average	General Population / Uncontrolled
	IC	Body-Worn	0.815 W/kg	1g average	General Population / Uncontrolled
FCC/IC Spatial Peak SAR Limit	FCC/IC	Body-Worn	1.6 W/kg	1g average	General Population / Uncontrolled
Celltech Labs Inc. declares under its sole responsibility that this wireless portable device was compliant with the Specific Absorption Rate (SAR) RF exposure requirements specified in FCC 47 CFR §2.1093 and Health Canada's Safety Code 6 for the General Population / Uncontrolled Exposure environment. The device was tested in accordance with the measurement procedures specified FCC KDB 447498 and KDB 248227, Industry Canada RSS-102 Issue 4, IEEE Standard 1528-2013 and IEC International Standard 62209-2:2010. All measurements were performed in accordance with the SAR system manufacturer recommendations.					
I attest to the accuracy of data. All measurements were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.					
The results and statements contained in this report pertain only to the device evaluated.					
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Test Report Approved By		Art Voss	Senior Engineer	Celltech Labs Inc.	

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQ00	DUT Type:	Body-worn GPS Device			
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TABLE OF CONTENTS	
1.0 INTRODUCTION	4
2.0 SAR MEASUREMENT SYSTEM	4
3.0 CONDUCTED OUTPUT POWER MEASUREMENTS	5
4.0 FLUID DIELECTRIC PARAMETERS	6
5.0 SAR MEASUREMENT SUMMARY	8
6.0 SAR SCALING FOR TUNE-UP TOLERANCE	9
7.0 SIMULTANEOUS TRANSMISSION ASSESSMENT	9
8.0 DETAILS OF SAR EVALUATION	10
9.0 SAR EVALUATION PROCEDURES	10
10.0 SYSTEM VERIFICATION	11
11.0 SIMULATED EQUIVALENT TISSUES	12
12.0 SAR LIMITS	12
13.0 ROBOT SYSTEM SPECIFICATIONS	13
14.0 PROBE SPECIFICATION (EX3DV4)	14
15.0 SAM TWIN PHANTOM V4.0C	14
16.0 DEVICE HOLDER	14
17.0 TEST EQUIPMENT LIST	15
18.0 MEASUREMENT UNCERTAINTY (IEC 62209-2)	16
19.0 REFERENCES	17
APPENDIX A - SAR MEASUREMENT PLOTS	18
APPENDIX B - SYSTEM PERFORMANCE CHECK PLOTS	29
APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS	34
APPENDIX D - SAR TEST SETUP & DUT PHOTOGRAPHS	37
APPENDIX E - DIPOLE CALIBRATION	42
APPENDIX F - PROBE CALIBRATION	43
APPENDIX G - SAM PHANTOM CERTIFICATE OF CONFORMITY	44

	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

REVISION HISTORY			
REVISION NO.	DESCRIPTION	IMPLEMENTED BY	RELEASE DATE
1.2	Corrections and Attachments	Art Voss	January 17, 2014

TEST REPORT SIGN-OFF			
DEVICE TESTED BY	REPORT PREPARED BY	QA REVIEW BY	REPORT APPROVED BY
Art Voss	Cheri Frangiadakis	Glen Westwell	Art Voss

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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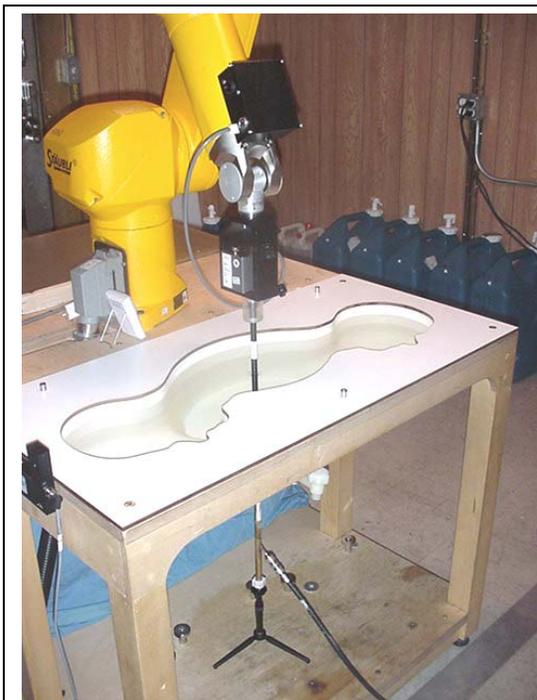
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1.0 INTRODUCTION

This measurement report demonstrates that the Garmin International Inc. Model(s): F4ACGQ00 / O4AHCGQ00 Body-worn GPS Device complies with the SAR (Specific Absorption Rate) RF exposure requirements specified in FCC 47 CFR §2.1093 (see reference [1]) and Health Canada's Safety Code 6 (see reference [2]) for the General Population / Uncontrolled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 (see reference [3]), IC RSS-102 Issue 4 (see reference [4]), IEEE Standard 1528-2013 (see reference [5]) and IEC International Standard 62209-2:2010 (see reference [7]) were employed. A description of the product, operating configuration, detailed summary of the test results, methodology and procedures used in the evaluation, equipment used, and the various provisions of the rules are included within this test report.

2.0 SAR MEASUREMENT SYSTEM

Celltech Labs Inc. SAR measurement facility utilizes the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY4 measurement system is comprised of the measurement server, robot controller, computer, near-field probe, probe alignment sensor, specific anthropomorphic mannequin (SAM) phantom, and various planar phantoms for Head and/or Body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the DASY4 measurement server. The DAE4 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the DASY4 measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot utilizes a controller with built in VME-bus computer.



DASY4 System with SAM Twin Phantom V4.0C



DASY4 Measurement Server

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQ00	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
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3.0 CONDUCTED OUTPUT POWER MEASUREMENTS

Freq. (MHz)	Channel	Peak Conducted Output Power (dBm)
802.11b Mode		1 Mbps
2412	1	14.2
2437	6	14.1
2462	11	14
Notes		
1. According to the manufacturer the conducted power levels of all higher data rates are <1/4 dB higher than the lowest data rates.		
2. The peak conducted power levels were provided by the EMC lab.		
3. The manufacturer confirmed that the SAR test sample met the output power specifications.		

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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4.0 FLUID DIELECTRIC PARAMETERS

FLUID DIELECTRIC PARAMETERS						
Date: 11/14&15/2013		Frequency: 2450 MHz			Tissue: Body	
Freq	Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity
2.350	51.63	1.76	52.7	1.95	-2.03%	-9.74%
2.360	51.12	1.79	52.7	1.95	-3.00%	-8.21%
2.370	51.13	1.81	52.7	1.95	-2.98%	-7.18%
2.380	51.33	1.79	52.7	1.95	-2.60%	-8.21%
2.390	51.51	1.82	52.7	1.95	-2.26%	-6.67%
2.400	51.61	1.88	52.7	1.95	-2.07%	-3.59%
2.410	51.77	1.88	52.7	1.95	-1.76%	-3.59%
2.412*	51.7	1.88	52.7	1.95	-1.90%	-3.59%
2.420	51.66	1.87	52.7	1.95	-1.97%	-4.10%
2.430	51.8	1.9	52.7	1.95	-1.71%	-2.56%
2.437*	51.6	1.89	52.7	1.95	-2.09%	-3.08%
2.440	51.54	1.89	52.7	1.95	-2.20%	-3.08%
2.450	51.4	1.9	52.7	1.95	-2.47%	-2.56%
2.460	51.29	1.9	52.7	1.95	-2.68%	-2.56%
2.462*	51.3	1.9	52.7	1.95	-2.66%	-2.56%
2.470	51.19	1.91	52.7	1.95	-2.87%	-2.05%
2.480	51.04	1.92	52.7	1.95	-3.15%	-1.54%
2.490	51.04	1.94	52.7	1.95	-3.15%	-0.51%
2.500	51.06	1.96	52.7	1.95	-3.11%	0.51%
2.510	51.06	1.99	52.7	1.95	-3.11%	2.05%
2.520	51.32	2	52.7	1.95	-2.62%	2.56%
2.530	51.35	2.02	52.7	1.95	-2.56%	3.59%
2.540	51.27	2.01	52.7	1.95	-2.71%	3.08%
2.550	51.32	2.04	52.7	1.95	-2.62%	4.62%

**interpolated using DASY4 software*

Test Date	Fluid Type	Ambient Temperature	Fluid Temperature	Fluid Depth	Atmospheric Pressure	Relative Humidity	ρ (Kg/m ³)
Nov 14	2450 Body	26°C	24.1 °C	≥ 15 cm	101.9 kPa	23%	1000
Nov 15	2450 Body	25°C	23.6 °C	≥ 15 cm	100.6 kPa	22%	1000

FLUID DIELECTRIC PARAMETERS						
Date: 11/17/2013		Frequency: 2450 MHz			Tissue: Body	
Freq	Test e	Test s	Target e	Target s	Deviation Permittivity	Deviation Conductivity
2.350	51.13	1.78	52.7	1.95	-2.98%	-8.72%
2.360	50.98	1.8	52.7	1.95	-3.26%	-7.69%
2.370	50.9	1.8	52.7	1.95	-3.42%	-7.69%
2.380	50.91	1.82	52.7	1.95	-3.40%	-6.67%
2.390	50.75	1.84	52.7	1.95	-3.70%	-5.64%
2.400	50.85	1.86	52.7	1.95	-3.51%	-4.62%
2.410	50.87	1.89	52.7	1.95	-3.47%	-3.08%
2.420	50.7	1.87	52.7	1.95	-3.80%	-4.10%
2.430	50.7	1.89	52.7	1.95	-3.80%	-3.08%
2.440	50.56	1.9	52.7	1.95	-4.06%	-2.56%
2.450	50.57	1.93	52.7	1.95	-4.04%	-1.03%
2.460	50.68	1.94	52.7	1.95	-3.83%	-0.51%
2.470	50.53	1.97	52.7	1.95	-4.12%	1.03%
2.472*	50.5	1.97	52.7	1.95	-4.17%	1.03%
2.480	50.39	1.97	52.7	1.95	-4.38%	1.03%
2.490	50.45	1.97	52.7	1.95	-4.27%	1.03%
2.500	50.24	2	52.7	1.95	-4.67%	2.56%
2.510	50.33	1.99	52.7	1.95	-4.50%	2.05%
2.520	50.13	2.02	52.7	1.95	-4.88%	3.59%
2.530	50.38	2.02	52.7	1.95	-4.40%	3.59%
2.540	50.29	2.02	52.7	1.95	-4.57%	3.59%
2.550	50.16	2.03	52.7	1.95	-4.82%	4.10%

*interpolated using DASY4 software

Test Date	Fluid Type	Ambient Temperature	Fluid Temperature	Fluid Depth	Atmospheric Pressure	Relative Humidity	ρ (Kg/m ³)
Nov 17	2450 Body	24°C	23.8 °C	≥ 15 cm	100.6 kPa	22%	1000

	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	
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5.0 SAR MEASUREMENT SUMMARY

BODY-WORN SAR EVALUATION RESULTS

Plot #	WLAN Mode	Test Mode	Test Freq.	Test Chan.	Data Rate	Battery	DUT Position (Side facing phantom)	DUT Distance to Phantom	Conducted Power Before Test	Measured SAR (1g)	SAR Drift During Test	Scaled SAR (1g) with Drift
			MHz		Mbps				dBm	W/kg	dB	W/kg
DUT Tested: F4ACGQ00												
1	802.11b	DSSS	2412	1	1	Li-ion	Back Touch	0mm	14.2	0.522	-0.137	0.539
2	802.11b	DSSS	2412	1	1	Li-ion	Front Touch	0mm	14.2	0.101	-1.07	0.129
3	802.11b	DSSS	2412	1	1	Li-ion	Top Touch	0mm	14.2	0.031	-1.56	0.044
4	802.11b	DSSS	2412	1	1	Li-ion	Side Touch	0mm	14.2	0.245	-0.741	0.291
5	802.11b	DSSS	2437	6	1	Li-ion	Back Touch	0mm	14.1	0.439	-0.538	0.497
6	802.11b	DSSS	2462	11	1	Li-ion	Back Touch	0mm	14	0.401	-0.222	0.422

DUT Tested: O4AHCGQ00												
7	802.11b	DSSS	2472	13	1	Li-ion	Back Touch	0mm	14	0.088	-0.611	0.102

SAR SAFETY LIMIT(S)						BODY	SPATIAL PEAK	RF EXPOSURE CATEGORY			
FCC 47 CFR 2.1093			Health Canada Safety Code 6			1.6 W/kg	1g average	General Population / Uncontrolled			

Test Date(s): Jun. 20, 2013

Notes	
1.	Detailed measurement data and plots showing the maximum SAR location of the DUT are reported in Appendix A.
2.	The DUT was not required to be evaluated in 802.11g mode or higher data rates because the highest output power channel was < 1/4 dB higher than the corresponding 802.11b channel on the lowest data rate, in accordance with the procedures of FCC KDB 248227 (see reference [9]).
3.	The SAR drift of the DUT was measured by the DASY4 system for the duration of the SAR evaluation.
4.	The DUT battery was fully charged prior to each SAR evaluation.
5.	The O4AHCGQ00 was tested in the worst-case configuration for the F4ACGQ00. The worst-case configuration for the F4ACGQ00 was tested at 2472 MHz.
6.	The fluid temperature remained within +/-2°C from the dielectric parameter measurement to the completion of the SAR test.
7.	The dielectric parameters of the simulated tissue mixture were measured prior to the SAR evaluations using a Dielectric Probe Kit and a Network Analyzer.

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6.0 SAR SCALING FOR TUNE-UP TOLERANCE

SCALED SAR								
Cert.	Plot #	DUT Model	Freq.	DUT Position	Measured Cond. Power	SAR Level 1 g (Note 4)	Scaling up to Manuf. Upper Tol. Power Spec. (16 dBm)	Scaled SAR 1g (W/kg)
					dBm	W/kg		
FCC	1	F4ACGQ00	2412	Back Touch	14.2	0.522	+1.8 dB	0.790
IC	1	F4ACGQ00	2412	Back Touch	14.2	0.539*	+1.8 dB	0.815

Notes:

1. Only the highest SAR values for body-worn are scaled.
2. The resulting value is the reported SAR.
3. The scaled SAR levels are below the FCC/IC SAR Limit of 1.6 W/kg.
4. * SAR Values indicated are scaled for drift and power per IC requirements.

7.0 SIMULTANEOUS TRANSMISSION ASSESSMENT

802.11b/g + 802.15

These transmitters are not capable of simultaneous transmission. The 802.15 is rated at 4 dBm and is below the threshold for standalone SAR evaluation.

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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8.0 DETAILS OF SAR EVALUATION

1. The DUT was evaluated for body-worn SAR in accordance with the test positions required by FCC KDB 447498 D01v05 (see reference [8]).
2. The DUT was supplied with test mode software that was able to transmit at any selected channel / data-rate required for SAR testing.
3. The DUT was tested with a modulated DSSS signal in 802.11b mode.
4. The battery was fully charged before each SAR evaluation.

9.0 SAR EVALUATION PROCEDURES

- (i) The evaluation was performed in the applicable area of the phantom depending on the type of device being tested. For devices held to the ear during normal operation, both the left and right ear positions were evaluated using the SAM phantom.
- (ii) For body-worn and face-held devices a planar phantom was used.
- The SAR was determined by a pre-defined procedure within the DASY4 software. Upon completion of a reference and optical surface check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 10mm x 10mm.
An area scan was determined as follows:
- Based on the defined area scan grid, a more detailed grid is created to increase the points by a factor of 10. The interpolation function then evaluates all field values between corresponding measurement points.
- A linear search is applied to find all the candidate maxima. Subsequently, all maxima are removed that are >2 dB from the global maximum. The remaining maxima are then used to position the cube scans.
A 1g and 10g spatial peak SAR was determined as follows:
- Extrapolation is used to determine the values between the dipole center of the probe and the surface of the phantom. This data cannot be measured because the center of the dipole sensors is 1.0 mm away from the probe tip and the distance between the probe and the boundary must be larger than 25% of the probe diameter. The probe diameter is 2.4 mm. In the DASY4 software, the distance between the sensor center and phantom surface is set to 2.0 mm. This provides a distance of 1.0 mm between the probe tip and the surface. The extrapolation of the values between the dipole center and the surface of the phantom was based on trivariate quadratics computed from the previously calculated 3D interpolated points nearest the phantom surface.
- Interpolated data is used to calculate the average SAR over 1g and 10g cubes by spatially discretizing the entire measured cube. The volume used to determine the averaged SAR is a 1mm grid (42875 interpolated points).
- A zoom scan volume of 30 mm x 30 mm x 30 mm (5x5x7 points) centered at the peak SAR location determined from the area scan is used for all zoom scans for devices with a transmit frequency < 800 MHz. Zoom scans for frequencies ≥ 800 MHz are determined with a scan volume of 30 mm x 30 mm x 30 mm (7x7x7 points) to ensure complete capture of the peak spatial-average SAR. When the area scan estimated SAR is < 1.4W/kg, less points can be used for higher frequency zoom scans.

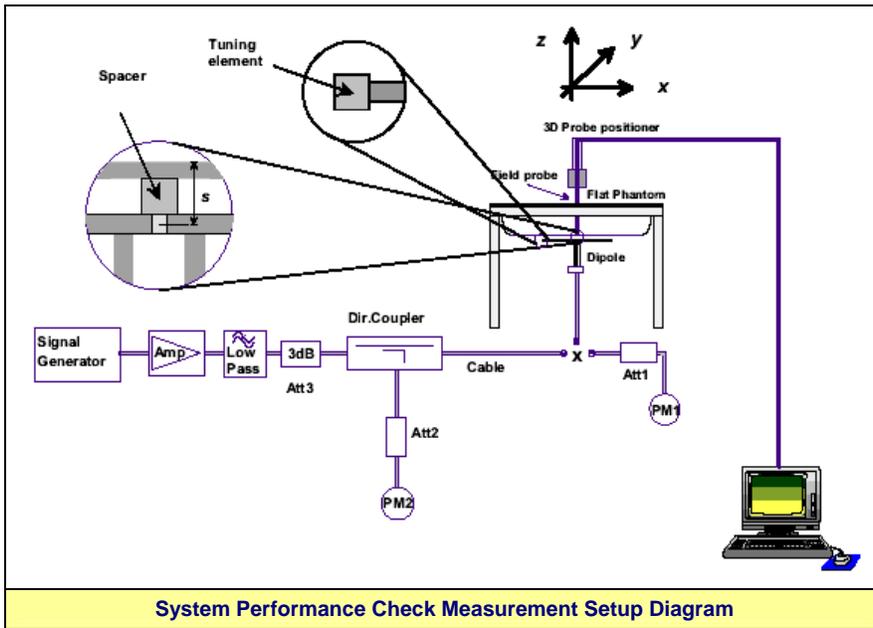
Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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10.0 SYSTEM VERIFICATION

Prior to the SAR evaluations, a system check was performed at the planar section of the SAM phantom with a 2450MHz SPEAG validation dipole (see Appendix B) in accordance with the procedures described in IEEE Standard 1528-2013 (see reference [5]) and IEC 62209-2:2010 (see reference [7]). A forward power of 250 mW was applied to the dipole and the system was verified to a tolerance of $\pm 10\%$ from the system manufacturer's dipole calibration target SAR value (see Appendix E).

SYSTEM PERFORMANCE CHECK EVALUATION																
Test Date	Equiv. Tissue	SAR 1g (W/kg)			Dielectric Constant ϵ_r			Conductivity σ (mho/m)			ρ (Kg/m ³)	Amb. Temp. (°C)	Fluid Temp. (°C)	Fluid Depth (cm)	Humid. (%)	Barom. Press. (kPa)
		Freq. (MHz)	Target	Meas.	Dev.	Target	Meas.	Dev.	Target	Meas.						
Nov 14	BODY 2450	12.7 $\pm 10\%$	13.6	+7.1%	52.7 $\pm 5\%$	51.4	-2.5%	1.95 $\pm 5\%$	1.90	-2.6%	1000	26	24.1	≥ 15	23	101.9
Nov 17	BODY 2450	12.7 $\pm 10\%$	12.5	-1.6%	52.7 $\pm 5\%$	50.6	-4.0%	1.95 $\pm 5\%$	1.93	-1.0%	1000	24	23.8	≥ 15	22	100.6
Notes	1. The target SAR value is the measured value from the dipole calibration performed by the system manufacturer (see Appendix E).															
	2. The target dielectric parameters are the nominal values from the dipole calibration performed by SPEAG (see Appendix E) and specified in IC RSS-102 Issue 4 (see reference [4]).															
	3. The fluid temperature remained within $\pm 2^\circ\text{C}$ from the dielectric parameter measurement to the completion of the system performance check evaluation.															
	4. The dielectric parameters of the simulated tissue mixture were measured prior to the system performance check using a Dielectric Probe Kit and a Network Analyzer (see Appendix C).															



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

11.0 SIMULATED EQUIVALENT TISSUES

The simulated equivalent tissue recipe listed in the table below is derived from the SAR system manufacturer's suggested recipe in the DASY4 manual (see reference [11]). The ingredient percentage may have been adjusted minimally in order to achieve the appropriate target dielectric parameters within the specified tolerance.

2450 MHz SIMULATED TISSUE MIXTURES	
INGREDIENT	2450 MHz Body
Water	69%
Glycol Monobutyl	31%

12.0 SAR LIMITS

SAR RF EXPOSURE LIMITS			
FCC 47 CFR 2.1093	Health Canada Safety Code 6	(General Population / Uncontrolled Exposure)	(Occupational / Controlled Exposure)
Spatial Average (averaged over the whole body)		0.08 W/kg	0.4 W/kg
Spatial Peak (averaged over any 1 g of tissue)		1.6 W/kg	8.0 W/kg
Spatial Peak (hands/wrists/feet/ankles averaged over 10 g)		4.0 W/kg	20.0 W/kg
The Spatial Average value of the SAR averaged over the whole body.			
The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.			
The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.			
Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.			
Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.			

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

13.0 ROBOT SYSTEM SPECIFICATIONS

<u>Specifications</u>	
Positioner	Stäubli Unimation Corp. Robot Model: RX60L
Repeatability	0.02 mm
No. of axis	6
<u>Data Acquisition Electronic (DAE) System</u>	
<u>Cell Controller</u>	
Processor	AMD Athlon XP 2400+
Clock Speed	2.0 GHz
Operating System	Windows XP Professional
<u>Data Converter</u>	
Features	Signal Amplifier, multiplexer, A/D converter, and control logic
Software	Measurement Software: DASYS4, V4.7 Build 80
	Postprocessing Software: SEMCAD, V1.8 Build 186
Connecting Lines	Optical downlink for data and status info.; Optical uplink for commands and clock
<u>DASY4 Measurement Server</u>	
Function	Real-time data evaluation for field measurements and surface detection
Hardware	PC/104 166MHz Pentium CPU; 32 MB chipdisk; 64 MB RAM
Connections	COM1, COM2, DAE, Robot, Ethernet, Service Interface
<u>E-Field Probe</u>	
Model	EX3DV4
Serial No.	3600
Construction	Symmetrical design with triangular core
Frequency	10 MHz to 6 GHz
Linearity	±0.2 dB (30 MHz to 3 GHz)
<u>Phantom(s)</u>	
Type	SAM V4.0C
Shell Material	Fiberglass
Thickness	2.0 ±0.1 mm
Volume	Approx. 25 liters

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

14.0 PROBE SPECIFICATION (EX3DV4)

Construction: Symmetrical design with triangular core
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g. DGBE)

Calibration: Basic Broadband Calibration in air: 10-3000 MHz
Conversion Factors (CF) for HSL 900 and HSL 1750

Frequency: 10 MHz to >6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)

Directivity: ± 0.3 dB in HSL (rotation around probe axis)
 ± 0.5 dB in tissue material (rotation normal to probe axis)

Dynamic Range: 10 μ W/g to >100 mW/g; Linearity: ± 0.2 dB
(noise: typically < 1 μ W/g)

Dimensions: Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 2.5 mm (Body: 12 mm)
Typical distance from probe tip to dipole centers: 1.0 mm

Application: High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better than 30%.



EX3DV4 E-Field Probe

15.0 SAM TWIN PHANTOM V4.0C

The SAM Twin Phantom V4.0C is a fiberglass shell phantom with a 2.0 mm (+/-0.2 mm) shell thickness for left and right head and flat planar area integrated in a wooden table. The shape of the fiberglass shell corresponds to the phantom defined by SCC34-SC2. The device holder positions are adjusted to the standard measurement positions in the three sections (see Appendix G for specifications of the SAM Twin Phantom V4.0C).



SAM Twin Phantom V4.0C

16.0 DEVICE HOLDER

The DASY4 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. For evaluations of larger devices a Plexiglas platform is attached to the device holder.



Device Holder

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

17.0 TEST EQUIPMENT LIST

TEST EQUIPMENT DESCRIPTION	ASSET NO.	SERIAL NO.	DATE CALIBRATED	CALIBRATION INTERVAL
Schmid & Partner DASY4 System	-	-	-	-
-DASY4 Measurement Server	00158	1078	CNR	CNR
-Robot	00046	599396-01	CNR	CNR
-DAE4	00019	353	19-Apr-12	Biennial
-EX3DV4 E-Field Probe	00213	3600	27-Apr-13	Annual
-D2450V2 Validation Dipole	00219	825	25-Apr-12	Triennial
-SAM Twin Phantom V4.0C	00154	1033	CNR	CNR
HP 85070C Dielectric Probe Kit	00033	None	CNR	CNR
Gigatronics 8652A Power Meter	00007	1835272	03-May-12	Biennial
Gigatronics 80701A Power Sensor	00014	1833542	03-May-12	Biennial
Gigatronics 80334A Power Sensor	-	1837001	03-May-12	Biennial
HP 8753ET Network Analyzer	00134	US39170292	26-Apr-12	Biennial
Rohde & Schwarz SMR20 Signal Generator	00006	100104	02-May-12	Biennial
Amplifier Research 5S1G4 Power Amplifier	00106	26235	CNR	CNR
CNR = Calibration Not Required				

	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

18.0 MEASUREMENT UNCERTAINTY (IEC 62209-2)

UNCERTAINTY BUDGET FOR DEVICE EVALUATION (IEC 62209-2:2010)

Source of Uncertainty	IEC 62209-2 Section	Tolerance / Uncertainty $\pm\%$	Probability Distribution	Divisor	ci 1g	ci 10g	Standard Uncertainty $\pm\%$ (1g)	Standard Uncertainty $\pm\%$ (10g)	V_i or V_{eff}
Measurement System									
Probe Calibration (2450 MHz)	7.2.2.1	6.0	Normal	1	1	1	6.0	6.0	∞
Isotropy	7.2.2.2	4.7	Rectangular	1.732050808	1	1	2.7	2.7	∞
Boundary Effect	7.2.2.6	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Linearity	7.2.2.3	4.7	Rectangular	1.732050808	1	1	2.7	2.7	∞
Detection Limits	7.2.2.5	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Readout Electronics	7.2.2.7	0.3	Normal	1	1	1	0.3	0.3	∞
Response Time	7.2.2.8	0.8	Rectangular	1.732050808	1	1	0.5	0.5	∞
Integration Time	7.2.2.9	2.6	Rectangular	1.732050808	1	1	1.5	1.5	∞
RF Ambient Conditions	7.2.4.5	3	Rectangular	1.732050808	1	1	1.7	1.7	∞
Probe Positioner Mechanical Restrictions	7.2.3.1	0.4	Rectangular	1.732050808	1	1	0.2	0.2	∞
Probe Positioning wrt Phantom Shell	7.2.3.3	2.9	Rectangular	1.732050808	1	1	1.7	1.7	∞
Post-processing	7.2.5	1	Rectangular	1.732050808	1	1	0.6	0.6	∞
Test Sample Related									
Test Sample Positioning	7.2.3.4.3	2.9	Normal	1	1	1	2.9	2.9	12
Device Holder Uncertainty	7.2.3.4.2	3.6	Normal	1	1	1	3.6	3.6	8
Drift of Output Power (meas. SAR drift)	7.2.2.10	0	Rectangular	1.732050808	1	1	0.0	0.0	∞
Phantom and Tissue Parameters									
Phantom Uncertainty	7.2.3.2	4	Rectangular	1.732050808	1	1	2.3	2.3	∞
SAR Correction Algorithm for deviations in permittivity and conductivity	7.2.4.3	1.2	Normal	1	1	0.81	1.2	0.97	∞
Liquid Conductivity (measured)	7.2.4.3	3.59	Normal	1	0.78	0.71	2.8	2.5	∞
Liquid Permittivity (measured)	7.2.4.3	4.17	Normal	1	0.23	0.26	1.0	1.1	∞
Liquid Permittivity - temp. uncertainty	7.2.4.4	1.23	Rectangular	1.732050808	0.78	0.71	0.6	0.5	∞
Liquid Conductivity - temp. uncertainty	7.2.4.4	0.93	Rectangular	1.732050808	0.23	0.26	0.1	0.1	∞
Combined Standard Uncertainty	7.3.1		RSS				9.87	9.78	
Expanded Uncertainty (95% Confidence Interval)	7.3.2		k=2				19.73	19.57	

Measurement Uncertainty Table in accordance with International Standard IEC 62209-2:2010

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2

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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

19.0 REFERENCES

- [1] Federal Communications Commission - "Radiofrequency radiation exposure evaluation: portable devices", Rule Part 47 CFR §2.1093.
- [2] Health Canada - "Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz", Safety Code 6: 1999.
- [3] Federal Communications Commission - "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65, Supplement C (Edition 01-01), FCC, Washington, D.C.: June 2001.
- [4] Industry Canada - "Radio Frequency Exposure Compliance of Radio Communication Apparatus (All Frequency Bands)", Radio Standards Specification RSS-102 Issue 4: March 2010.
- [5] IEEE Standard 1528-2013 - "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques": June 2013.
- [6] International Standard IEC 62209-1:2005 - "Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures."
- [7] International Standard IEC 62209-2 Edition 1.0 2010-03 - "Human exposure to radio frequency fields from hand-held & body-mounted wireless communication devices - Part 2: Procedure to determine the specific absorption rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)".
- [8] Federal Communications Commission, Office of Engineering and Technology - "Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies"; KDB 447498 D01v05r01: May 2013.
- [9] Federal Communications Commission, Office of Engineering and Technology - "SAR Measurement Procedures for 802.11a/b/g Transmitters"; KDB 248227 D01 v01r02: May 2007.
- [10] Federal Communications Commission, Office of Engineering and Technology - "SAR Measurement Requirements for 100MHz to 6GHz"; KDB 865664 D01v01r01: May 2013.
- [11] Schmid & Partner Engineering AG - DASY4 Manual V4.6, Chapter 17 Application Note, Body Tissue Recipe: Sept. 2005.
- [12] International Standard ISO/IEC 17025:2005 - "General requirements for the competence of testing and calibration laboratories".
- [13] Federal Communications Commission - "Measurements Required: RF Power Output"; Rule Part 47 CFR §2.1046.
- [14] Industry Canada - "General Requirements and Information for the Certification of Radiocommunication Equipment", Radio Standards Specification RSS-Gen Issue 2: June 2007.

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

APPENDIX A - SAR MEASUREMENT PLOTS

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Plot 1

Date Tested: 11/14/2013

DUT: Garmin F4ACGQ00; Type: GPS; Serial: n/a (identical prototype)

Program Notes: Ambient Temp: 26C; Fluid Temp: 24.1C; Barometric Pressure: 101.9 kPa; Humidity: 23%

Procedure Notes:

Communication System: 802.11

Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2412 \text{ MHz}$; $\sigma = 1.88 \text{ mho/m}$; $\epsilon_r = 51.7$; $\rho = 1000 \text{ kg/m}^3$

- Probe: EX3DV4 - SN3600; ConvF(6.61, 6.61, 6.61); Calibrated: 26/04/2013
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 19/04/2012
- Phantom: SAM 4.0; Type: Fiberglass; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back Touch, Ch-1 2/Area Scan (9x15x1): Measurement grid: dx=10mm, dy=10mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.746 mW/g

Back Touch, Ch-1 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

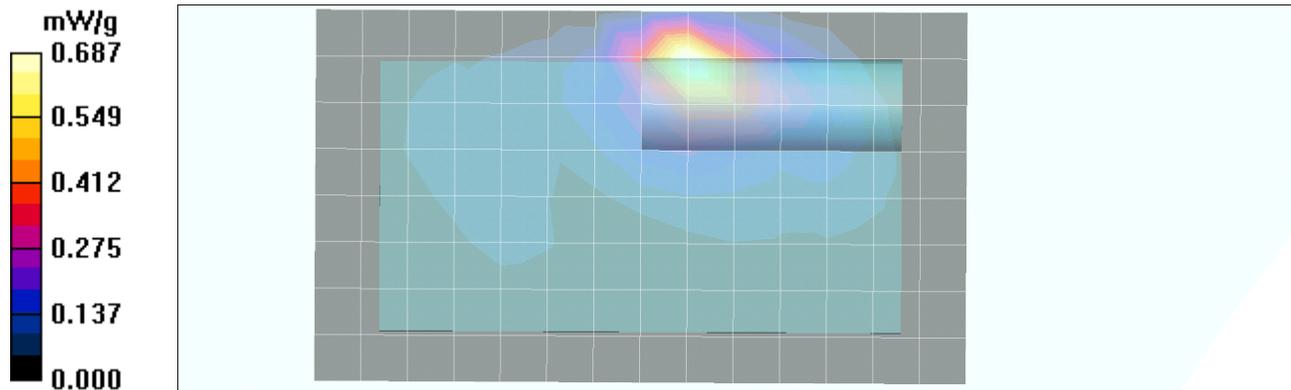
Reference Value = 5.82 V/m; Power Drift = -0.137 dB

Peak SAR (extrapolated) = 1.32 W/kg

SAR(1 g) = 0.522 mW/g; SAR(10 g) = 0.215 mW/g

[Info: Interpolated medium parameters used for SAR evaluation.](#)

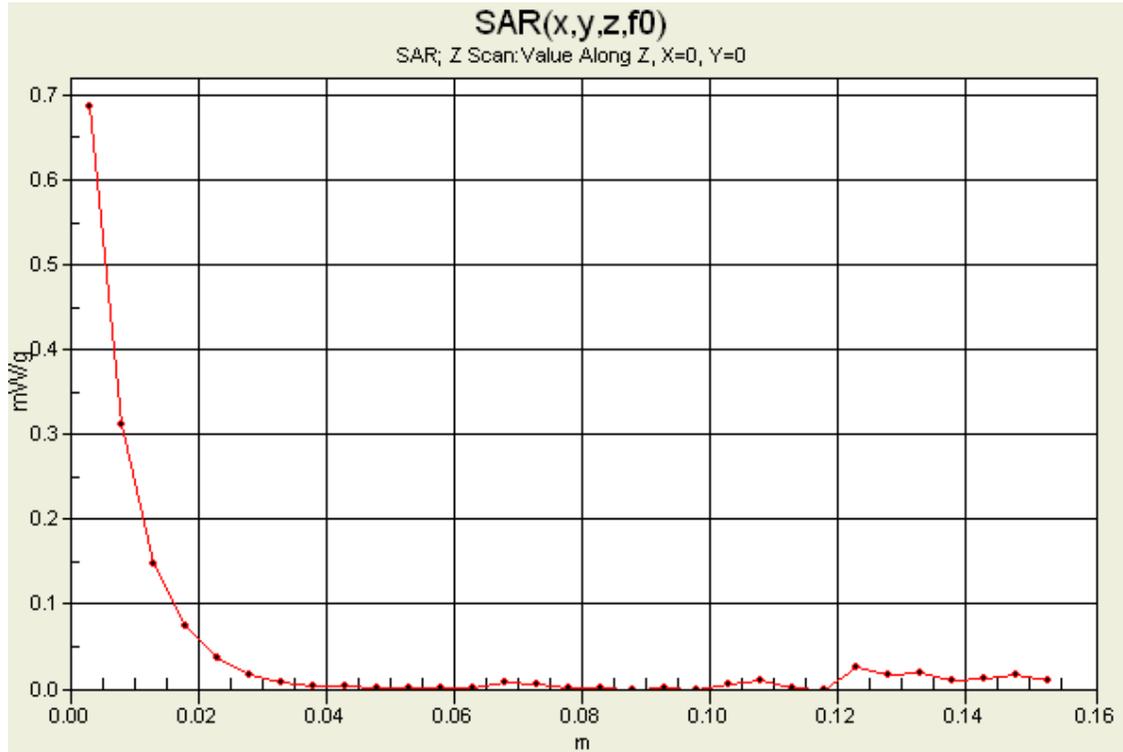
Maximum value of SAR (measured) = 0.735 mW/g



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Z-Axis Scan



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Plot 2

Date Tested: 11/15/2013

DUT: Garmin F4ACGQ00; Type: GPS; Serial: n/a (identical prototype)

Program Notes: Ambient Temp: 25C; Fluid Temp: 23.6C; Barometric Pressure: 100.6 kPa; Humidity: 22%

Procedure Notes:

Communication System: 802.11

Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2412 \text{ MHz}$; $\sigma = 1.88 \text{ mho/m}$; $\epsilon_r = 51.7$; $\rho = 1000 \text{ kg/m}^3$

- Probe: EX3DV4 - SN3600; ConvF(6.61, 6.61, 6.61); Calibrated: 26/04/2013
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 19/04/2012
- Phantom: SAM 4.0; Type: Fiberglass; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Front Touch, Ch-1 2/Area Scan (9x15x1): Measurement grid: dx=10mm, dy=10mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.134 mW/g

Front Touch, Ch-1 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.73 V/m; Power Drift = -1.07 dB

Peak SAR (extrapolated) = 0.236 W/kg

SAR(1 g) = 0.101 mW/g; SAR(10 g) = 0.046 mW/g

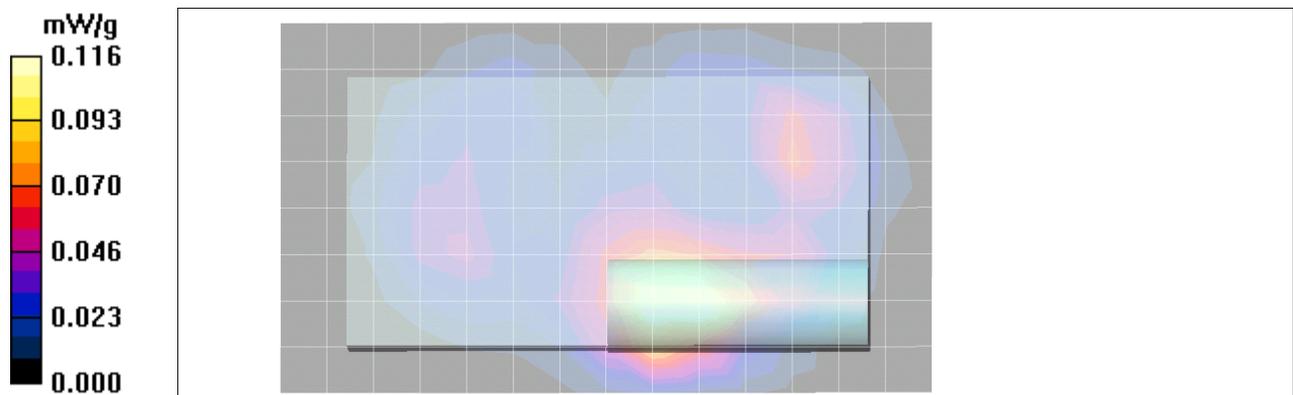
Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.137 mW/g

Front Touch, Ch-1 2/Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.116 mW/g



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Plot 3

Date Tested: 11/15/2013

DUT: Garmin F4ACGQ00; Type: GPS; Serial: n/a (identical prototype)

Program Notes: Ambient Temp: 25C; Fluid Temp: 23.6C; Barometric Pressure: 100.6 kPa; Humidity: 22%

Procedure Notes:

Communication System: 802.11
 Frequency: 2412 MHz; Duty Cycle: 1:1
 Medium: M2450 Medium parameters used (interpolated): $f = 2412 \text{ MHz}$; $\sigma = 1.88 \text{ mho/m}$; $\epsilon_r = 51.7$; $\rho = 1000 \text{ kg/m}^3$

- Probe: EX3DV4 - SN3600; ConvF(6.61, 6.61, 6.61); Calibrated: 26/04/2013
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 19/04/2012
- Phantom: SAM 4.0; Type: Fiberglass; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top Touch, Ch-1/Area Scan 2 (10x6x1): Measurement grid: dx=10mm, dy=10mm

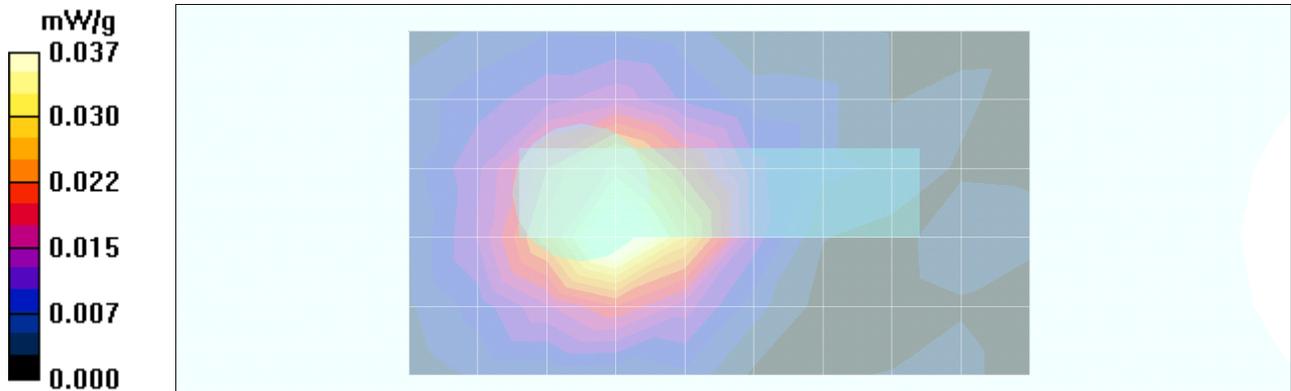
Info: [Interpolated medium parameters used for SAR evaluation.](#)
 Maximum value of SAR (measured) = 0.042 mW/g

Top Touch, Ch-1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
 Reference Value = 3.69 V/m; Power Drift = -1.56 dB
 Peak SAR (extrapolated) = 0.061 W/kg
SAR(1 g) = 0.031 mW/g; SAR(10 g) = 0.015 mW/g

Info: [Interpolated medium parameters used for SAR evaluation.](#)
 Maximum value of SAR (measured) = 0.040 mW/g

Top Touch, Ch-1/Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)
 Maximum value of SAR (measured) = 0.037 mW/g



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Plot 4

Date Tested: 11/15/2013

DUT: Garmin F4ACGQ00; Type: GPS; Serial: n/a (identical prototype)

Program Notes: Ambient Temp: 25C; Fluid Temp: 23.6C; Barometric Pressure: 100.6 kPa; Humidity: 22%

Procedure Notes:

Communication System: 802.11

Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2412 \text{ MHz}$; $\sigma = 1.88 \text{ mho/m}$; $\epsilon_r = 51.7$; $\rho = 1000 \text{ kg/m}^3$

- Probe: EX3DV4 - SN3600; ConvF(6.61, 6.61, 6.61); Calibrated: 26/04/2013
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 19/04/2012
- Phantom: SAM 4.0; Type: Fiberglass; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Side Touch, Ch-1/Area Scan 3 (6x15x1): Measurement grid: dx=10mm, dy=10mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.375 mW/g

Side Touch, Ch-1/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 13.0 V/m; Power Drift = -0.741 dB

Peak SAR (extrapolated) = 0.605 W/kg

SAR(1 g) = 0.245 mW/g; SAR(10 g) = 0.108 mW/g

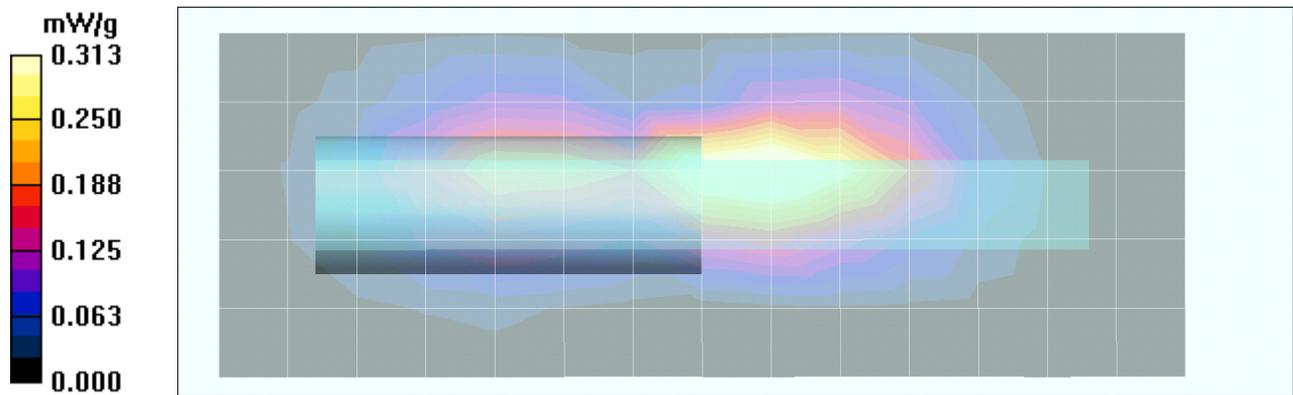
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.348 mW/g

Side Touch, Ch-1/Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.313 mW/g



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Plot 5

Date Tested: 11/15/2013

DUT: Garmin F4ACGQ00; Type: GPS; Serial: n/a (identical prototype)

Program Notes: Ambient Temp: 25C; Fluid Temp: 23.6C; Barometric Pressure: 100.6kPa; Humidity: 22%

Procedure Notes:

Communication System: 802.11

Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2437 \text{ MHz}$; $\sigma = 1.89 \text{ mho/m}$; $\epsilon_r = 51.6$; $\rho = 1000 \text{ kg/m}^3$

- Probe: EX3DV4 - SN3600; ConvF(6.61, 6.61, 6.61); Calibrated: 26/04/2013
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 19/04/2012
- Phantom: SAM 4.0; Type: Fiberglass; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back Touch, Ch-6/Area Scan (10x15x1): Measurement grid: dx=10mm, dy=10mm

Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.545 mW/g

Back Touch, Ch-6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.48 V/m; Power Drift = -0.538 dB

Peak SAR (extrapolated) = 1.12 W/kg

SAR(1 g) = 0.439 mW/g; SAR(10 g) = 0.183 mW/g

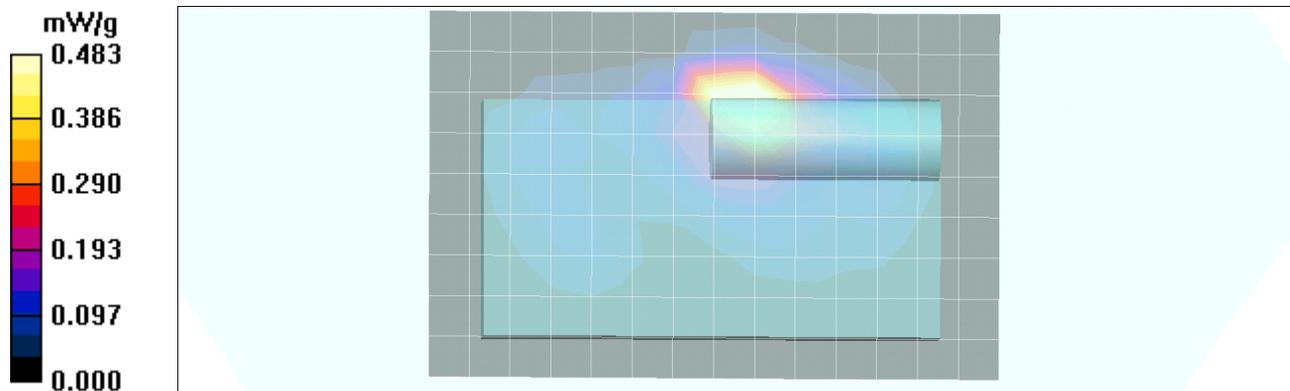
Info: Interpolated medium parameters used for SAR evaluation.

Maximum value of SAR (measured) = 0.610 mW/g

Back Touch, Ch-6/Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: Interpolated medium parameters used for SAR evaluation.

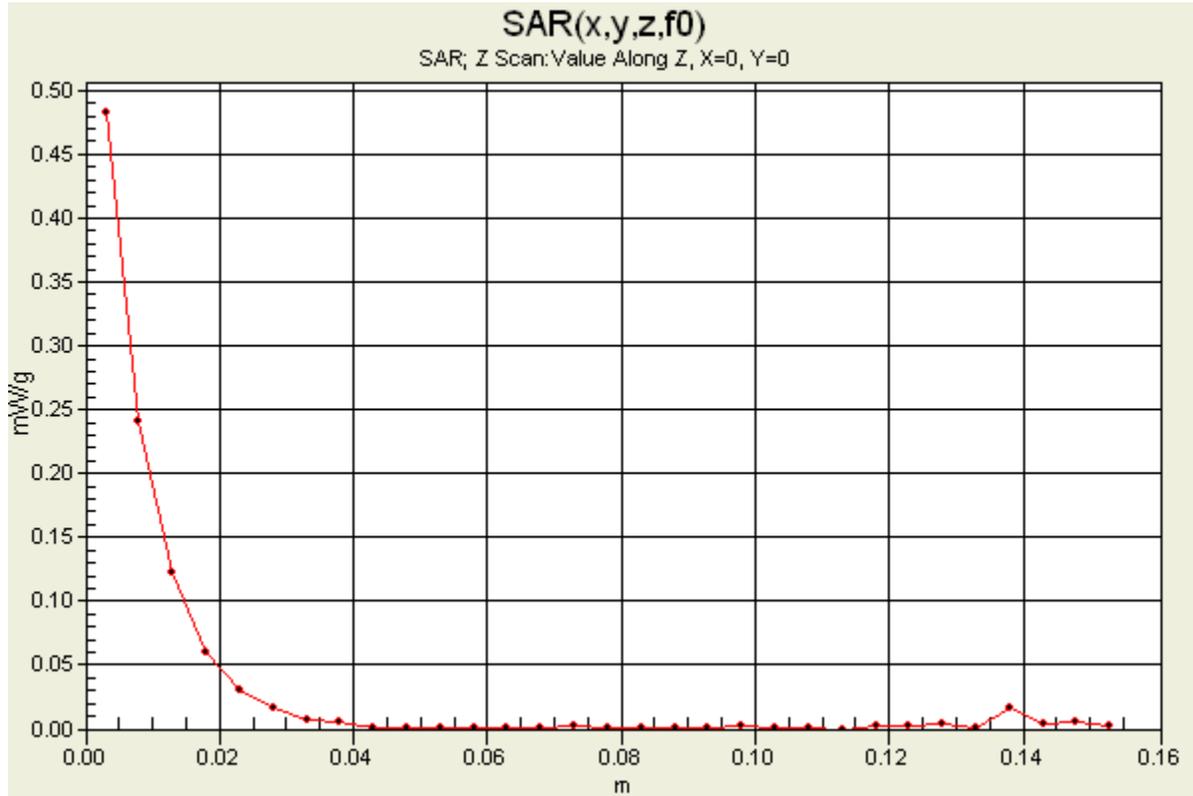
Maximum value of SAR (measured) = 0.483 mW/g



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Z-Axis Scan



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Plot 6

Date Tested: 11/15/2013

DUT: Garmin F4ACGQ00; Type: GPS; Serial: n/a (identical prototype)

Program Notes: Ambient Temp: 25C; Fluid Temp: 23.6C; Barometric Pressure: 100.6kPa; Humidity: 22%

Procedure Notes:

Communication System: 802.11
 Frequency: 2462 MHz; Duty Cycle: 1:1
 Medium: M2450 Medium parameters used (interpolated): $f = 2462 \text{ MHz}$; $\sigma = 1.9 \text{ mho/m}$; $\epsilon_r = 51.3$; $\rho = 1000 \text{ kg/m}^3$

- Probe: EX3DV4 - SN3600; ConvF(6.61, 6.61, 6.61); Calibrated: 26/04/2013
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Electronics: DAE4 Sn353; Calibrated: 19/04/2012
- Phantom: SAM 4.0; Type: Fiberglass; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back Touch, Ch-11/Area Scan (10x15x1): Measurement grid: dx=10mm, dy=10mm

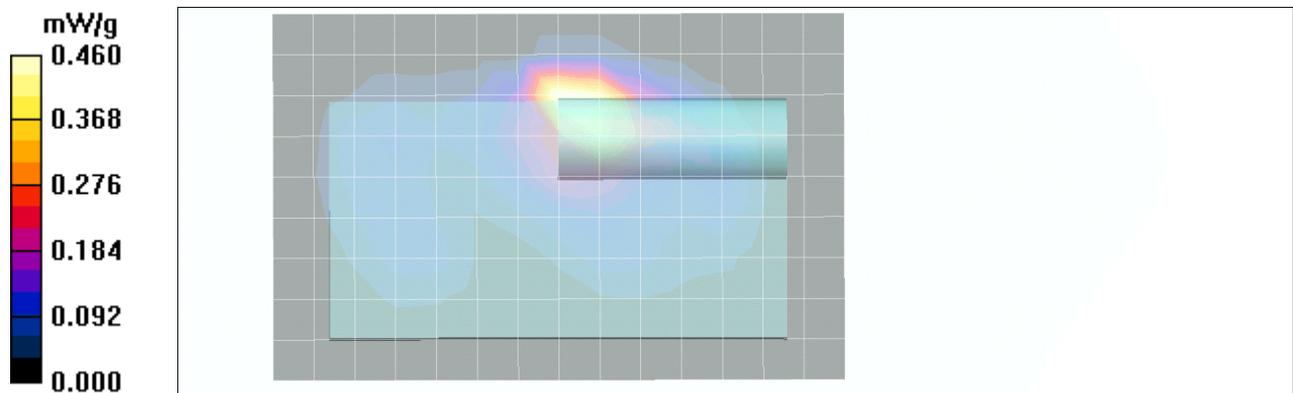
Info: [Interpolated medium parameters used for SAR evaluation.](#)
 Maximum value of SAR (measured) = 0.480 mW/g

Back Touch, Ch-11/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
 Reference Value = 7.05 V/m; Power Drift = -0.222 dB
 Peak SAR (extrapolated) = 1.00 W/kg
SAR(1 g) = 0.401 mW/g; SAR(10 g) = 0.168 mW/g

Info: [Interpolated medium parameters used for SAR evaluation.](#)
 Maximum value of SAR (measured) = 0.571 mW/g

Back Touch, Ch-11/Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm

Info: [Interpolated medium parameters used for SAR evaluation.](#)
 Maximum value of SAR (measured) = 0.460 mW/g



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Plot 7

Date Tested: 11/17/2013

DUT: Garmin O4AHGQ00; Type: GPS; Serial: n/a (identical prototype)

Program Notes: Ambient Temp: 24C; Fluid Temp: 23.8C; Barometric Pressure: 100.6 kPa; Humidity: 22%

Procedure Notes:

Communication System: 802.11

Frequency: 2472 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used (interpolated): $f = 2472 \text{ MHz}$; $\sigma = 1.97 \text{ mho/m}$; $\epsilon_r = 50.5$; $\rho = 1000 \text{ kg/m}^3$

- Probe: EX3DV4 - SN3600; ConvF(6.61, 6.61, 6.61); Calibrated: 26/04/2013
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 19/04/2012
- Phantom: SAM 4.0; Type: Fiberglass; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back Touch, Ch-13/Area Scan (10x15x1): Measurement grid: dx=10mm, dy=10mm

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.111 mW/g

Back Touch, Ch-13/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.62 V/m; Power Drift = -0.611 dB

Peak SAR (extrapolated) = 0.195 W/kg

SAR(1 g) = 0.088 mW/g; SAR(10 g) = 0.041 mW/g

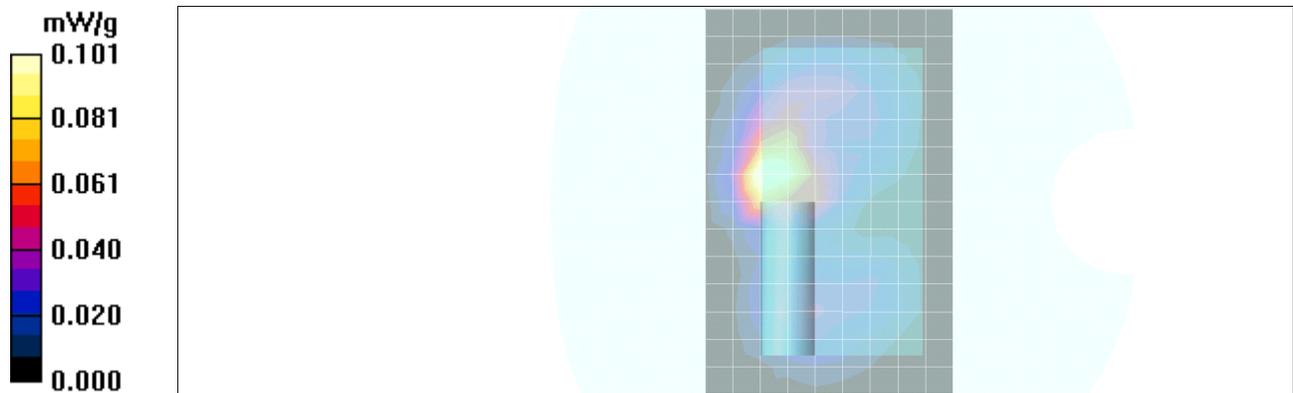
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.116 mW/g

Back Touch, Ch-13/Z Scan (1x1x31): Measurement grid: dx=20mm, dy=20mm, dz=5mm

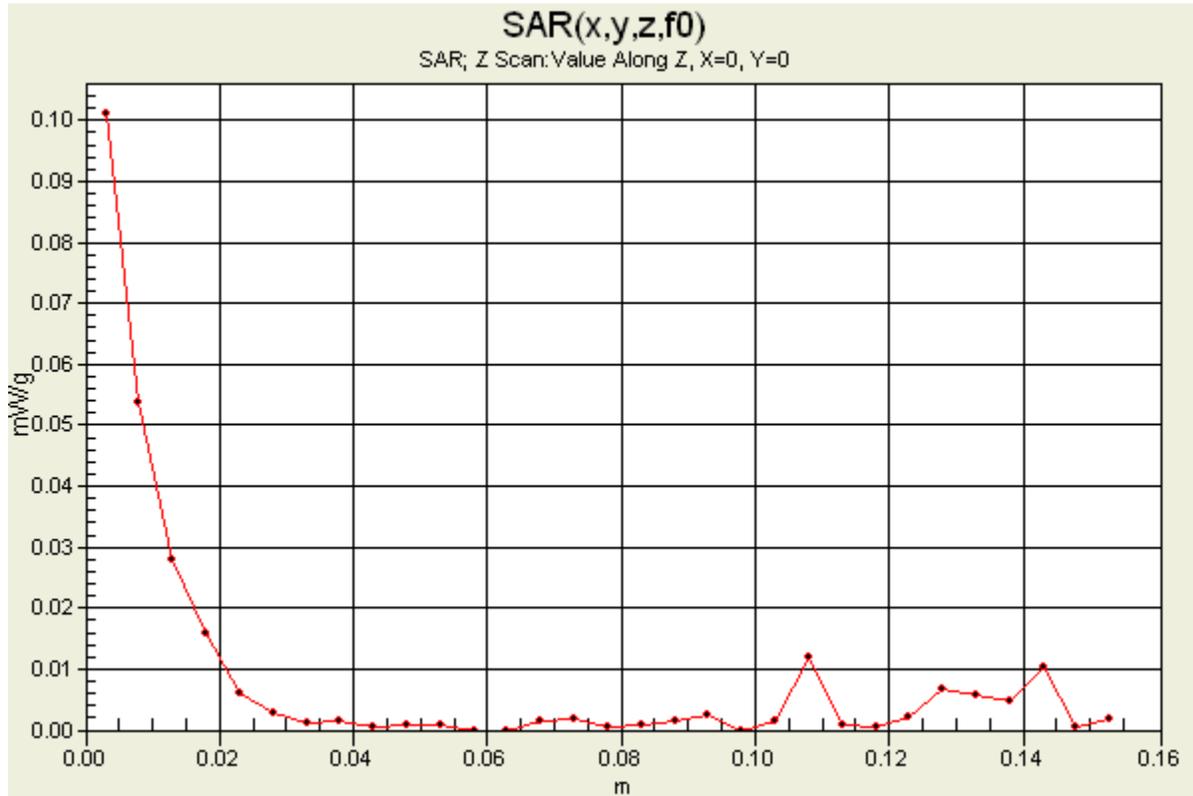
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.101 mW/g



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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Z-Axis Scan



	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

APPENDIX B - SYSTEM PERFORMANCE CHECK PLOTS

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Date Tested: 11/14/2013

System Performance Check - 2450 MHz Dipole - Body

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 825; Calibrated: 25/04/2012

Program Notes: Ambient Temp: 26C; Fluid Temp: 24.1C; Barometric Pressure: 101.9 kPa; Humidity: 23%

Procedure Notes:

Communication System: CW

Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used: $f = 2450 \text{ MHz}$; $\sigma = 1.9 \text{ mho/m}$; $\epsilon_r = 51.4$; $\rho = 1000 \text{ kg/m}^3$

- Probe: EX3DV4 - SN3600; ConvF(6.61, 6.61, 6.61); Calibrated: 26/04/2013
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 19/04/2012
- Phantom: SAM 4.0; Type: Fiberglass; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

2450 MHz Dipole d=10mm P=250mW/Area Scan (6x10x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 16.7 mW/g

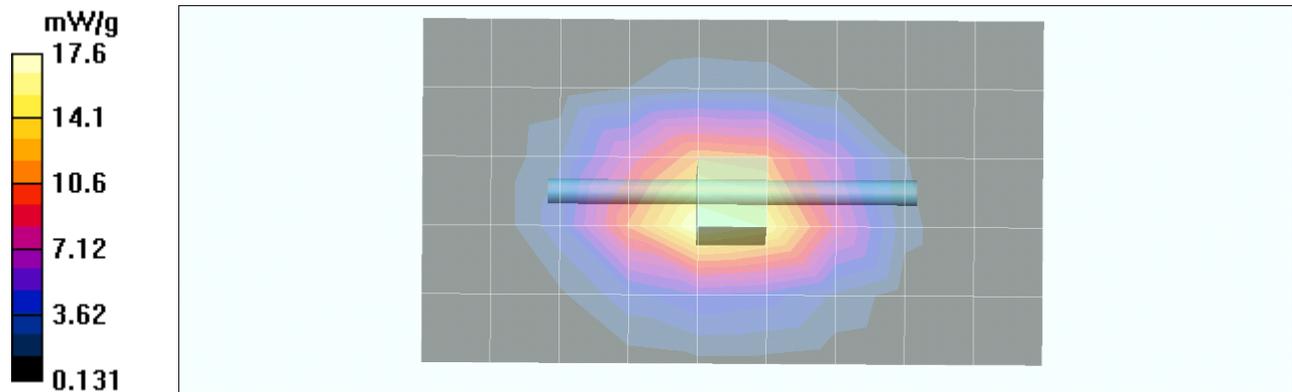
2450 MHz Dipole d=10mm P=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.4 V/m; Power Drift = -0.043 dB

Peak SAR (extrapolated) = 26.9 W/kg

SAR(1 g) = 13.6 mW/g; SAR(10 g) = 6.42 mW/g

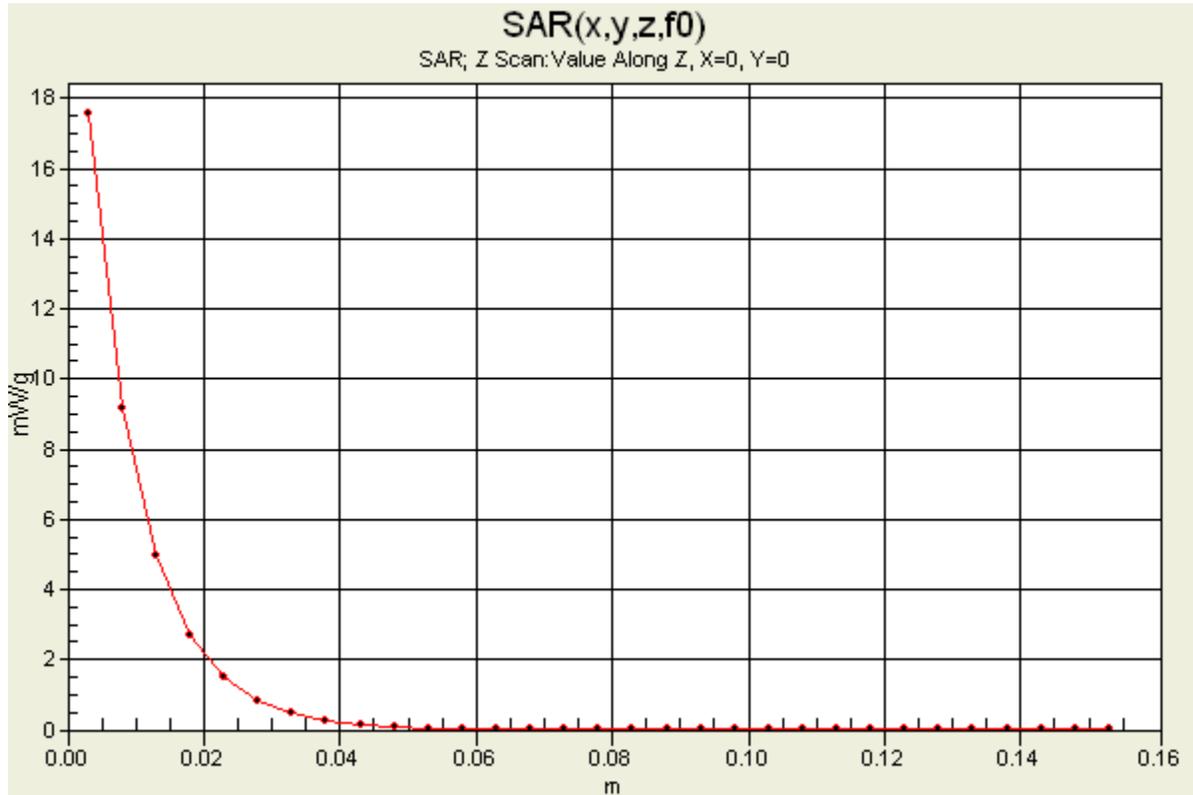
Maximum value of SAR (measured) = 17.6 mW/g



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Z-Axis Scan



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Date Tested: 11/17/2013

System Performance Check - 2450 MHz Dipole - Body

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 825; Calibrated: 25/04/2012

Program Notes: Ambient Temp: 24C; Fluid Temp: 23.8C; Barometric Pressure: 100.6 kPa; Humidity: 22%

Procedure Notes:

Communication System: CW

Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: M2450 Medium parameters used: $f = 2450 \text{ MHz}$; $\sigma = 1.93 \text{ mho/m}$; $\epsilon_r = 50.6$; $\rho = 1000 \text{ kg/m}^3$

- Probe: EX3DV4 - SN3600; ConvF(6.61, 6.61, 6.61); Calibrated: 26/04/2013
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353; Calibrated: 19/04/2012
- Phantom: SAM 4.0; Type: Fiberglass; Serial: 1033
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

2450 MHz Dipole d=10mm P=250mW/Area Scan (6x10x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 14.9 mW/g

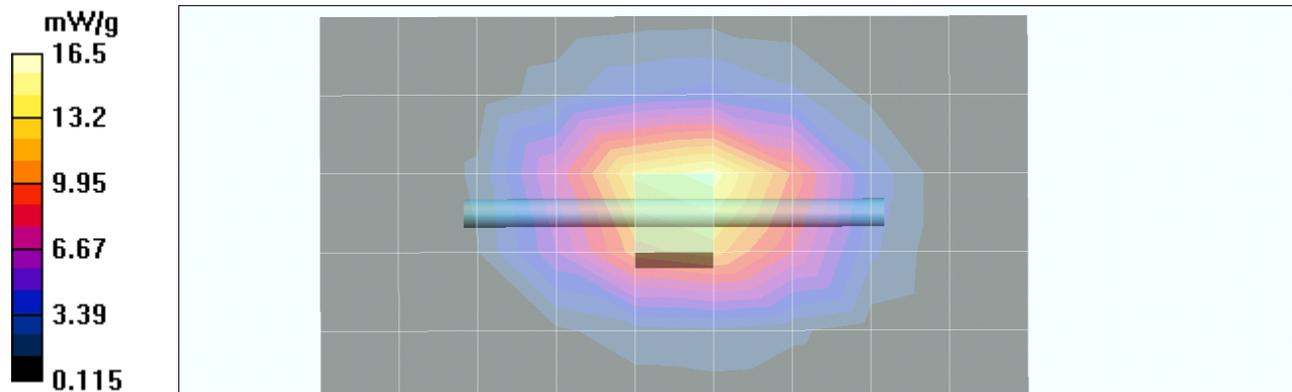
2450 MHz Dipole d=10mm P=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.1 V/m; Power Drift = -0.006 dB

Peak SAR (extrapolated) = 25.2 W/kg

SAR(1 g) = 12.5 mW/g; SAR(10 g) = 5.86 mW/g

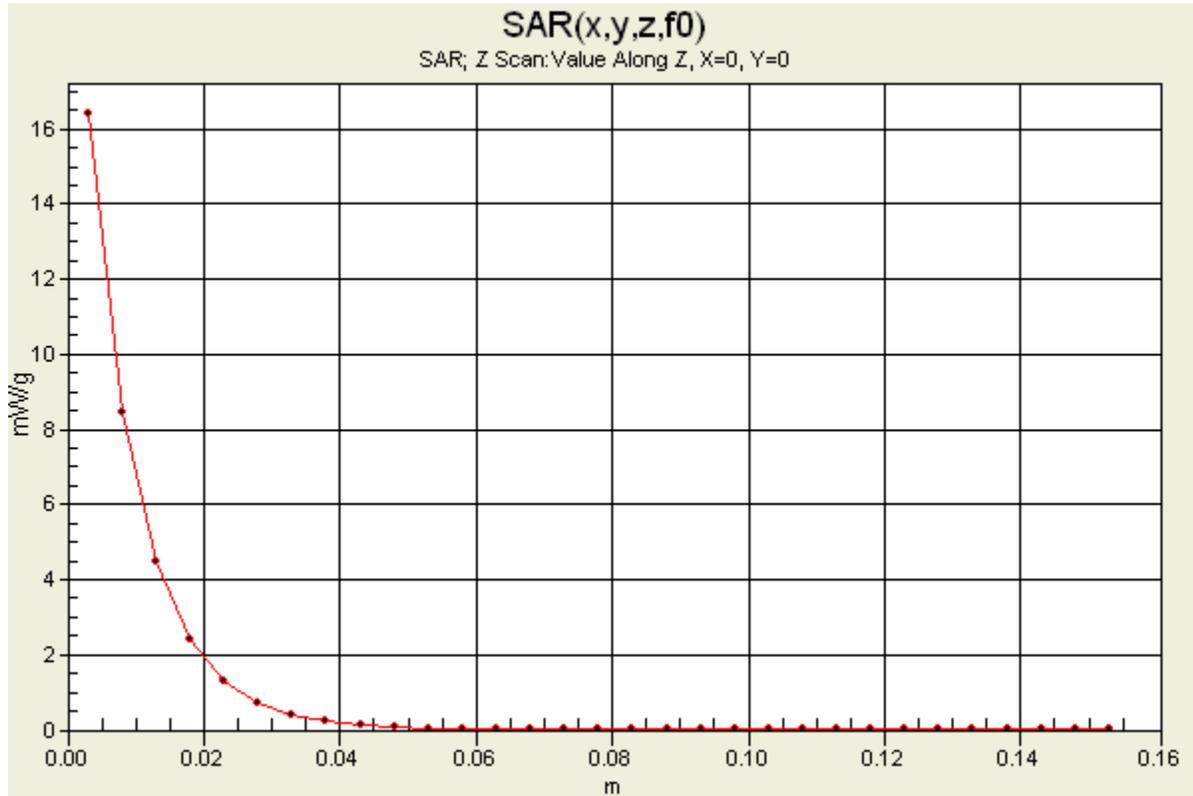
Maximum value of SAR (measured) = 16.5 mW/g



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

Z-Axis Scan



Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

APPENDIX C - MEASURED FLUID DIELECTRIC PARAMETERS

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

2450 MHz Body

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
14/Nov/2013
Frequency(GHz)
FCC_eHFCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sHFCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

Freq	FCC_eB	FCC_sB	Test_e	Test_s
2.3500	52.83	1.85	51.63	1.76
2.3600	52.82	1.86	51.12	1.79
2.3700	52.81	1.87	51.13	1.81
2.3800	52.79	1.88	51.33	1.79
2.3900	52.78	1.89	51.51	1.82
2.4000	52.77	1.90	51.61	1.88
2.4100	52.75	1.91	51.77	1.88
2.4200	52.74	1.92	51.66	1.87
2.4300	52.73	1.93	51.80	1.90
2.4400	52.71	1.94	51.54	1.89
2.4500	52.70	1.95	51.40	1.90
2.4600	52.69	1.96	51.29	1.90
2.4700	52.67	1.98	51.19	1.91
2.4800	52.66	1.99	51.04	1.92
2.4900	52.65	2.01	51.04	1.94
2.5000	52.64	2.02	51.06	1.96
2.5100	52.62	2.04	51.06	1.99
2.5200	52.61	2.05	51.32	2.00
2.5300	52.60	2.06	51.35	2.02
2.5400	52.59	2.08	51.27	2.01
2.5500	52.57	2.09	51.32	2.04

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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	<u>Date(s) of Evaluation</u> Nov 14, 15 & 17, 2013	<u>Test Report Serial No.</u> 102813IPH-1260	<u>Test Report Revision No.</u> Rev. 1.2 (2nd Release)	 Test Lab Certificate No. 2470.01
	<u>Test Report Issue Date</u> January 17, 2014	<u>Description of Test(s)</u> Specific Absorption Rate	<u>RF Exposure Category</u> Gen. Pop. / Uncontrolled	

2450 MHz Body

Celltech Labs Inc.
Test Result for UIM Dielectric Parameter
17/Nov/2013
Frequency(GHz)
FCC_eHFCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sHFCC Bulletin 65 Supplement C (June 2001) Limits for Head Sigma
FCC_eB FCC Limits for Body Epsilon
FCC_sB FCC Limits for Body Sigma
Test_e Epsilon of UIM
Test_s Sigma of UIM

Freq	FCC_eB	FCC_sB	Test_e	Test_s
2.3500	52.83	1.85	51.13	1.78
2.3600	52.82	1.86	50.98	1.80
2.3700	52.81	1.87	50.90	1.80
2.3800	52.79	1.88	50.91	1.82
2.3900	52.78	1.89	50.75	1.84
2.4000	52.77	1.90	50.85	1.86
2.4100	52.75	1.91	50.87	1.89
2.4200	52.74	1.92	50.70	1.87
2.4300	52.73	1.93	50.70	1.89
2.4400	52.71	1.94	50.56	1.90
2.4500	52.70	1.95	50.57	1.93
2.4600	52.69	1.96	50.68	1.94
2.4700	52.67	1.98	50.53	1.97
2.4800	52.66	1.99	50.39	1.97
2.4900	52.65	2.01	50.45	1.97
2.5000	52.64	2.02	50.24	2.00
2.5100	52.62	2.04	50.33	1.99
2.5200	52.61	2.05	50.13	2.02
2.5300	52.60	2.06	50.38	2.02
2.5400	52.59	2.08	50.29	2.02
2.5500	52.57	2.09	50.16	2.03

Applicant:	Garmin International Inc.	FCC ID:	IPH-02276	IC:	1792A-02276	
Model:	F4ACGQ00/O4AHGQOO	DUT Type:	Body-worn GPS Device			
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