Test Report Serial Number:	45461362-R1.4
Test Report Date:	9 December 2016
Project Number:	1358

SAR Test Report - New Certification

Applicant:

Garmin International Inc.
1200 East 151 St.
Olathe, KS, 66062
USA

Maximum Reported 1g SAR			
FCC	Hand	0.72	W/kg
IC	Hand	0.75	
General Pop. Limit:		4.00	

FCC ID: **IPH-03097**

IC Registration Number: **1792A-03097**

Product Model Number / HVIN: **A03097**

Product Name / PMN: **A03097**

In Accordance With:

FCC 47 CFR §2.1093
Radiofrequency Radiation Exposure Evaluation: Portable Devices

IC RSS-102 Issue 5
Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

Approved By:

Ben Hewson, President
Celltech Labs Inc.
21-364 Lougheed Rd.
Kelowna, BC, V1X 7R8
Canada

Test Lab Certificate: 2470.01 | **IC Registration 3874A-1** | **FCC Registration: 714830**

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1.0 DOCUMENT CONTROL

Tested By:	**Art Voss**
Prepared By:	**Art Voss**
Reviewed By:	**Ben Hewson**

Issue Number	Description	By	Issue Date
1.0	Initial Release	Art Voss	10 October 2016
1.1	Correction to Cover Page	Art Voss	13 October 2016
1.2	Correction to Model Numbers	Art Voss	22 November 2016
1.3	Correction Per TCB	Art Voss	8 December 2016
1.4	Correction Per TCB	Art Voss	9 December 2016

2.0 NORMATIVE REFERENCES

Normative References*	
ANSI / ISO 17025:2005	General Requirements for competence of testing and calibration laboratories
FCC CFR Title 47 Part 2 Title 47: Part 2.1093:	Code of Federal Regulations Telecommunication Radiofrequency Radiation Exposure Evaluation: Portable Devices
Health Canada Safety Code 6 (2015)	Limits of Human Exposure to Radiofrequency Electromagnetic Energy in the Frequency Range from 3kHz to 300GHz
Industry Canada Spectrum Management & Telecommunications Policy RSS-102 Issue 5:	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
IEEE International Committee on Electromagnetic Safety IEEE 1528-2013:	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
IEC International Standard IEC 62209-2 2010	Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Part 2
FCC KDB KDB 865664 D01v01r04	SAR Measurement Requirements for 100MHz to 6GHz
FCC KDB KDB 865664 D02v01r02	RF Exposure Compliance Reporting and Documentation Considerations
FCC KDB KDB 447498 D01v06	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies
FCC KDB KDB 248227 D01v02r02	SAR Test Guidane for IEEE 802.11 (WiFI) Transmitters
* When the issue number or issue date is omitted, the latest version is assumed.	

3.0 CLIENT AND DEVICE INFORMATION

Client Information	
Applicant Name	Garmin International Inc.
Applicant Address	1200 East 151 St
	Olathe, KS, 66062
	USA
DUT Information	
Device Identifier(s):	**FCC ID:** IPH-03097
	IC: 1792A-03097
Type of Equipment:	Mobile GPS
Device Model(s) / HVIN:	A03097
Device Marketing Name / PMN:	A03097
Test Sample Serial No.:	T/A Sample - Identical Prototype
Transmit Frequency Range:	BLE: 2448MHz
	WiFi: 2412-2462 MHz
Number of Channels:	n/a
Manuf. Max. Rated Output Power:	BLE: 4dBm, WiFi: 20dBm
Modulation:	DSSS, OFDM, MCS0-7, CW
Duty Cycle:	100%
DUT Power Source:	5VDC Li-Ion
Deviation(s) from standard/procedure:	None
Modification of DUT:	None

4.0 STATEMENT OF COMPLIANCE

This measurement report demonstrates that the:

Applicant:	Model / HVIN:
Garmin International Inc.	**A03097**

complies with the SAR (Specific Absorption Rate) RF exposure requirements and limits specified in the following:

Standard(s):	Measurement Procedure(s):
FCC 47 CFR §2.1093	**FCC KDB 865664 D01v01r04, FCC KDB 447498 D01v06, FCC KDB 248227 D01v02r02**
Health Canada's Safety Code 6	**Industry Canada RSS-102 Issue 5**
	IEEE Standard 1528-2013, IEC 62209-2 2010

Use Group:

☐ **Occupational / Controlled** ☒ **General Population / Uncontrolled**

Reason for Issue:

New Certification

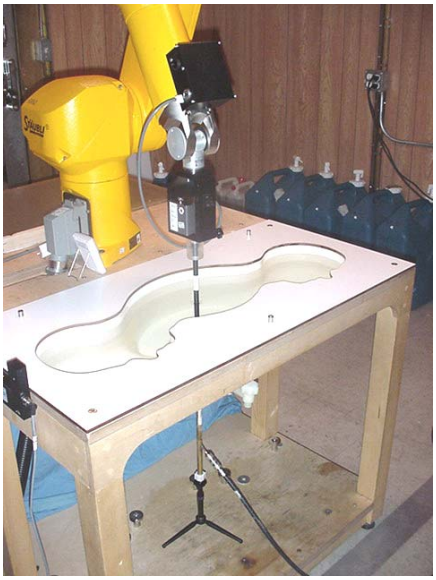
A description of the device, operating configuration, detailed summary of the test results, methodology and procedures used during this evaluation, equipment used and the various provisions of the rules are included within this test report.

Note: This device is intended to be installed as a Mobile GPS device. However in some cases, this device could be hand-held during certain WiFi and/or BlueTooth operations. The manufacturer chose to have this device evaluated for Extremity SAR.

5.0 SAR MEASUREMENT SYSTEM

SAR Measurement System

Celltech Labs Inc. SAR measurement facility employs a Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY4 measurement system is comprised of the measurement server, a robot controller, a computer, a near-field probe, a probe alignment sensor, an Elliptical Planar Phantom (ELI) phantom and a specific anthropomorphic mannequin (SAM) phantom 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 and a teach pendant (Joystick) to control the robot's servo 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 form the DAE to digital electronic signal 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, a command decoder and a 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.



DASY 4 SAR System with SAM Phantom

DASY 4 Measurement Controller

6.0 RF CONDUCTED POWER MEASUREMENT

Table 6.0

Conducted Power Measurements

Channel	Frequency (MHz)	Measured Power (dBm)	Rated Power (dBm)	Rated Power (W)	Delta (dBm)	SAR Test Channel (Y/N)
1	2412	19.70	20.00	0.10	-0.30	**Y**
6	2437	19.70	20.00	0.10	-0.30	**Y**
11	2462	19.70	20.00	0.10	-0.30	**Y**

Notes:

The Conducted Power of the DUT was measured at the antenna port, while plugged into a USB charger and transmitting at 100% duty cycle.

7.0 NUMBER OF TEST CHANNELS (N_C)

As per FCC KDB 248277 D01v02r02, the required 802.11 test channels are Ch1, Ch6 and Ch 11

8.0 ACCESSORIES EVALUATED

There are no handheld accessories.

9.0 SAR MEASUREMENT SUMMARY

Table 9.0

Measured SAR Results (10g) - BODY Configuration (FCC/ISEDC)

Date	Plot ID	DUT		Test Frequency (*MHz*)	Modulation	Accessories				DUT Spacing		Conducted Power (*dBm*)	Measured SAR (10g)		SAR Drift** (*dB*)
		M/N	Type			Antenna ID	Battery ID	Body ID	Audio ID	DUT (*mm*)	Antenna (*mm*)		100% DC (*W/kg*)	50% DC (*W/kg*)	
28 Sep 2016	B1	**DS51**	**n/a**	2437	**CW**	n/a	n/a	n/a	n/a	**0**	**0**	**19.7**	0.408		-0.200
28 Sep 2016	B2	**DS51**	**n/a**	2412	**CW**	n/a	n/a	n/a	n/a	**0**	**0**	**19.7**	0.356		-0.200
28 Sep 2016	B3	**DS51**	**n/a**	2462	**CW**	n/a	n/a	n/a	n/a	**0**	**0**	**19.7**	0.561		-0.200
30 Sep 2016	B10*	**DS51**	**n/a**	2462	**CW**	n/a	n/a	n/a	n/a	**0**	**0**	**19.7**	0.102		-0.200
SAR Limit							**Spatial Peak**			**Head/Body**		**RF Exposure Category**			
FCC 47 CFR 2.1093				**Health Canada Safety Code 6**			**10 Gram Average**			**4.0 W/kg**		**General Population/User Unaware**			

* This configuration was tested on the edge of the DUT

** The manufacturer states that this device will be plugged into a USB charger or USB computer port while being used in a hand-held configuration.
This device was tested while plugged into a USB charger as a result, the SAR Drift could not be accurately ascertained.
A drift assesment was made by measuring the conducted power over a period of time equal to the overall SAR test time as it was determind the SAR Drift was less than -0.2dB. A SAR Drift factor of -0.2dB is used for the purposes of SAR scaling.

10.0 SCALING OF MAXIMUM MEASURE SAR

Table 10.0

Scaling of Maximum Measured SAR (1)

Plot ID	Configuration	Freq (MHz)	Measured Fluid Deviation Permittivity	Measured Fluid Deviation Conductivity	Measured Conducted Power (dBm)	Measured Drift (dB)	Measured SAR (10g) (W/kg)
B4	Body	2472	-4.74%	4.14%	19.5	-0.200	0.602

Step 1 — Fluid Sensitivity Adjustment

Plot ID	Scale Factor (%)		Measured SAR (W/kg)		Step 1 Adjusted SAR (10g) (W/kg)
	1.000%	x		=	0.000
B4	1.000%	x	0.602	=	0.602

Step 2 — Manufacturer's Tune-Up Tolerance

Plot ID	Measured Conducted Power (dBm)	Rated Power (dBm)	Delta (dB)		Step 1 Adjusted SAR (W/kg)		Step 2 Adjusted SAR (10g) (W/kg)
				+	0.000	=	0.000
B4	19.5	20.0	-0.5	+	0.602	=	0.675

Step 3 — Simultaneous Transmission - Bluetooth and/or WiFi

Plot ID	Rated Output Power (Pmax) (mW)	Freq (MHz)	Separation Distance (mm)	Estimated SAR (W/kg)		Step 2 Adjusted SAR (W/kg)		Step 3 Adjusted SAR (10g) (W/kg)
				0.000	+	0.000	=	0.000
B4	2.5	2448	5	0.042	+	0.675	=	0.717

Step 4 — Drift Adjustment

Plot ID	Measured Drift (dB)		Step 3 Adjusted SAR (W/kg)		Step 4 Adjusted SAR (10g) (W/kg)
		+	0.000	=	0.000
B4	-0.200	+	0.717	=	0.750

Step 5 — Reported SAR

Plot ID	FCC From Steps 1 through 3 10g SAR (W/kg)	IC From Steps 1 through 4 10g SAR (W/kg)
	0.00	0.00
B4	0.72	0.75

NOTES to Table 10.0
(1) Scaling of the Maximum Measured SAR is based on the highest, 100% duty cycle, Face, Body and/or Head SAR measured of ALL test channels, configurations and accessories used during THIS evaluation. The Measured Fluid Deviation parameters apply only to deviation of the tissue equivalent fluids used at the frequencies which produced the highest measured SAR. The Measured Conducted Power applies to the Conducted Power measured at the frequencies producing the highest Face and Body SAR. The Measured Drift is the SAR drift associated with that specific SAR measurement. The Reported SAR is the accumulation of all SAR Adjustments from the applicable Steps 1 through 4. The Plot ID is for indentification of the SAR Measurement Plots in Annex A of this report. NOTE: Some of the scaling factors in Steps 1 through 4 may not apply and are identified by light gray text.
Step 1
Per IEC-62209-1 and FCC KDB 865664. Scaling required only when Measured Fluid Deviation is greater than 5%. If the Measured Fluid Deviation is greater than 5%, Table 10.1 will be shown and will indicate the SAR scaling factor in percent (%). SAR is MULTIPLIED by this scaling factor only when the scaling factor is positive (+).
Step 2
Per KDB 447498. Scaling required only when the difference (Delta) between the Measured Conducted Power and the Manufacturer's Rated Conducted Power is (-) Negative. The absolute value of Delta is ADDED to the SAR.
Step 3
Per KDB 447498 4.3.2. The SAR, either measured or calculated, of ANY and ALL simultaneous transmitters must be added together and includes all contributors.
Step 4
Per IEC 62209-1. Scaling required only when Measured Drift is (-) Negative. The absolute value of Measured Drift is added to Reported or Simultaneous Reported SAR.
Step 5
The Reported SAR is the Maximum Final Adjusted Cumulative SAR from the applicable Steps 1 through 4 and are reported on Page 1 of this report.

I attest that the data reported herein is true and accurate within the tolerance of the Measurement Instrument Uncertainty; that all tests and measurements were performed in accordance with accepted practices or procedures; and that all tests and measurements were performed by me or by trained personnel under my direct supervision. The results of this investigation are based solely on the test sample(s) provided by the client which were not adjusted, modified or altered in any manner whatsoever, except as required to carry out specific tests or measurements. This test report has been completed in accordance with ISO/IEC 17025.	Art Voss, P.Eng. Technical Manager Celltech Labs Inc. 10 October 2016 Date

11.0 SAR EXPOSURE LIMITS

Table 11.0

SAR RF EXPOSURE LIMITS			
FCC 47 CFR§2.1093	Health Canada Safety Code 6	General Population / Uncontrolled Exposure(4)	Occupational / Controlled Exposure(5)
Spatial Average(1) (averaged over the whole body)		0.08 W/kg	0.4 W/kg
Spatial Peak(2) (Head and Trunk averaged over any 1 g of tissue)		1.6 W/kg	**8.0 W/kg**
Spatial Peak(3) (Hands/Wrists/Feet/Ankles averaged over 10 g)		4.0 W/kg	20.0 W/kg
(1) The Spatial Average value of the SAR averaged over the whole body.			
(2) 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.			
(3) 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.			
(4) Uncontrolled environments are defined as locations where there is potential exposure to individuals who have no knowledge or control of their potential exposure.			
(5) Controlled environments are defined as locations where there is potential exposure to individuals who have knowledge of their potential exposure and can exercise control over their exposure.			

12.0 DETAILS OF SAR EVALUATION

EVALUATION DETAILS	
1	The DUT was evaluated for SAR in accordance with the procedures described in IEEE 1528, FCC KDB 865646 and RSS-102.
2	The DUT was evaluated for SAR at the maximum conducted output power level, preset by the manufacturer. The device was capable of transmitting in Continuous Wave (CW) and was testing in an unmodulated continuous transmit mode at 100% duty cycle.
3	Each SAR evaluations were performed while plugged into a USB Charger
4	The fluid temperature remained within +/-2°C from the time of the fluid dielectric parameter measurement to the completion of the SAR evaluation.
5	The fluid temperature remained within +/-0.5°C throughout the test day.

SCAN PROCEDURE	
Maximum distance from the closest measurement point to phantom surface.	4 ± 1mm
Maximum probe angle normal to phantom surface.	5^{o} ± 1^{o}
Area Scan Spatial Resolution ΔX, ΔY	12mm
Zoom Scan Spatial Resolution ΔX, ΔY	5mm
Zoom Scan Spatial Resolution ΔZ	5mm
Zoom Scan Volume X, Y, Z	30mm x 30mm x 30mm
Phantom	SAM
Fluid Depth	150mm
An Area Scan with an area extending beyond the device was used to locate the candidate maximas within 2dB of the global maxima.	
A Zoom Scan centered over the peak SAR location(s) determined by the Area Scan was used to determine the 1 gram and 10 gram peak spatial-averge SAR	

13.0 MEASUREMENT UNCERTAINTIES

Table 13.0

UNCERTAINTY BUDGET FOR DEVICE EVALUATION (IEEE 1528-2013 Table 9)

Uncertainty Component	IEEE 1528 Section	Uncertainty Value ±%	Probability Distribution	Divisor	ci 1g	ci 10g	Uncertainty Value ±% (1g)	Uncertainty Value ±% (10g)	V_i or V_{eff}
Measurement System									
Probe Calibration*	E.2.1	6.6	Normal	1	1	1	6.60	6.60	∞
Axial Isotropy*	E.2.2	4.7	Rectangular	1.732050808	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy*	E.2.2	9.6	Rectangular	1.732050808	0.7	0.7	3.9	3.9	∞
Boundary Effect*	E.2.3	8.3	Rectangular	1.732050808	1	1	4.8	4.8	∞
Linearity*	E.2.4	4.7	Rectangular	1.732050808	1	1	2.7	2.7	∞
System Detection Limits*	E.2.4	1.0	Rectangular	1.732050808	1	1	0.6	0.6	∞
Modulation Response	E.2.5	4.0	Rectangular	1.732050808	1	1	2.3	2.3	∞
Readout Electronics*	E.2.6	1.0	Normal	1	1	1	1.0	1.0	∞
Response Time*	E.2.7	0.8	Rectangular	1.732050808	1	1	0.5	0.5	∞
Integration Time*	E.2.8	1.4	Rectangular	1.732050808	1	1	0.8	0.8	∞
RF Ambient Conditions - Noise	E.6.1	0.0	Rectangular	1.732050808	1	1	0.0	0.0	∞
RF Ambient Conditions - Reflection	E.6.1	0.0	Rectangular	1.732050808	1	1	0.0	0.0	∞
Probe Positioner Mechanical Tolerance*	E.6.2	0.4	Rectangular	1.732050808	1	1	0.2	0.2	∞
Probe Positioning wrt Phantom Shell*	E.6.3	2.9	Rectangular	1.732050808	1	1	1.7	1.7	∞
Extrapolation, interpolation & integration algorithms for max. SAR evaluation*	E.5	3.9	Rectangular	1.732050808	1	1	2.3	2.3	∞
Test Sample Related									
Test Sample Positioning	E.4.2	0.3	Normal	1	1	1	0.3	0.3	5
Device Holder Uncertainty*	E.4.1	3.6	Normal	1	1	1	3.6	3.6	∞
SAR Drift Measurement**	E.2.9	0.0	Rectangular	1.732050808	1	1	0.0	0.0	∞
SAR Scaling***	E.6.5	2.0	Rectangular	1.732050808	1	1	1.2	1.2	∞
Phantom and Tissue Parameters									
Phantom Uncertainty*	E.3.1	4.0	Rectangular	1.732050808	1	1	2.3	2.3	∞
SAR Correction Uncertainty	E.3.2	1.2	Normal	1	1	0.84	1.2	1.0	∞
Liquid Conductivity (measurement)	E.3.3	6.8	Normal	1	0.78	0.71	5.3	4.8	10
Liquid Permittivity (measurement)	E.3.3	5.3	Normal	1	0.23	0.26	1.2	1.4	10
Liquid Conductivity (Temperature)	E.3.2	0.1	Rectangular	1.732050808	0.78	0.71	0.1	0.0	∞
Liquid Permittivity Temperature)	E.3.2	0.0	Rectangular	1.732050808	0.23	0.26	0.0	0.0	∞
Effective Degrees of Freedom(1)								**V_{eff} =**	**873.2**
Combined Standard Uncertainty			**RSS**				**12.59**	**12.40**	
Expanded Uncertainty (95% Confidence Interval)			**k=2**				**25.18**	**24.80**	
Measurement Uncertainty Table in accordance with IEEE Standard 1528-2003									

(1) The Effective Degrees of Freedom is > 30 therefore a coverage factor of k=2 represents an approximate confidence level of 95%.

* Provided by SPEAG

Table 13.1

Calculation of the Degrees and Effective Degrees of Freedom	
$v_i = n - 1$	$v_{eff} = \dfrac{u_c^4}{\dfrac{m}{\sum_{i=1} \dfrac{c_i^4 u_i^4}{v_i}}}$

14.0 FLUID DIELECTRIC PARAMETERS

****

Aprel Laboratory
Test Result for UIM Dielectric Parameter
Mon 26/Sep/2016 12:14:50
Freq Frequency(GHz)
FCC_eH FCC Bulletin 65 Supplement C (June 2001) Limits for Head Epsilon
FCC_sH FCC 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	50.48	1.89
2.3600	52.82	1.86	50.46	1.90
2.3700	52.81	1.87	50.43	1.92
2.3800	52.79	1.88	50.40	1.93
2.3900	52.78	1.89	50.38	1.95
2.4000	52.77	1.90	50.35	1.96
2.4100	52.75	1.91	50.33	1.98
2.4200	52.74	1.92	50.30	1.99
2.4300	52.73	1.93	50.28	2.00
2.4400	52.71	1.94	50.25	2.02
2.4500	52.70	1.95	50.23	2.03
2.4600	52.69	1.96	50.20	2.05
2.4700	52.67	1.98	50.18	2.06
2.4800	52.66	1.99	50.15	2.08
2.4900	52.65	2.01	50.13	2.09
2.5000	52.64	2.02	50.10	2.11
2.5100	52.62	2.04	50.08	2.12
2.5200	52.61	2.05	50.05	2.13
2.5300	52.60	2.06	50.02	2.15
2.5400	52.59	2.08	50.00	2.16
2.5500	52.57	2.09	49.97	2.18

Table 14.0

FLUID DIELECTRIC PARAMETERS

Date:	26 Sep 2016	Fluid Temp:	22.2	Frequency:	2450MHz	Tissue:	Body

Freq (MHz)		Test_e	Test_s	Target_e	Target_s	Deviation Permittivity	Deviation Conductivity
2350.0000		50.4800	1.8900	52.8300	1.85	-4.45%	2.16%
2360.0000		50.4600	1.9000	52.8200	1.86	-4.47%	2.15%
2370.0000		50.4300	1.9200	52.8100	1.87	-4.51%	2.67%
2380.0000		50.4000	1.9300	52.7900	1.88	-4.53%	2.66%
2390.0000		50.3800	1.9500	52.7800	1.89	-4.55%	3.17%
2400.0000		50.3500	1.9600	52.7700	1.90	-4.59%	3.16%
2410.0000		50.3300	1.9800	52.7500	1.91	-4.59%	3.66%
2412.0000	*	50.3240	1.9820	52.7480	1.91	-4.60%	3.66%
2420.0000		50.3000	1.9900	52.7400	1.92	-4.63%	3.65%
2430.0000		50.2800	2.0000	52.7300	1.93	-4.65%	3.63%
2437.0000	*	50.2590	2.0140	52.7160	1.94	-4.66%	3.98%
2440.0000		50.2500	2.0200	52.7100	1.94	-4.67%	4.12%
2450.0000		50.2300	2.0300	52.7000	1.95	-4.69%	4.10%
2460.0000		50.2000	2.0500	52.6900	1.96	-4.73%	4.59%
2462.0000	*	50.1960	2.0520	52.6860	1.96	-4.73%	4.48%
2470.0000		50.1800	2.0600	52.6700	1.98	-4.73%	4.04%
2472.0000	*	50.1740	2.0640	52.6680	1.98	-4.74%	4.14%
2480.0000		50.1500	2.0800	52.6600	1.99	-4.77%	4.52%
2490.0000		50.1300	2.0900	52.6500	2.01	-4.79%	3.98%
2500.0000		50.1000	2.1100	52.6400	2.02	-4.83%	4.46%
2510.0000		50.0800	2.1200	52.6200	2.04	-4.83%	3.92%
2520.0000		50.0500	2.1300	52.6100	2.05	-4.87%	3.90%
2530.0000		50.0200	2.1500	52.6000	2.06	-4.90%	4.37%
2540.0000		50.0000	2.1600	52.5900	2.08	-4.92%	3.85%
2550.0000		49.9700	2.1800	52.5700	2.09	-4.95%	4.31%

*Channel Frequency Tested

15.0 SYSTEM VERIFICATION TEST RESULTS

System Verification Test Results

Date		Frequency (MHz)	Validation Source		
			P/N		S/N
26 Sep 2016		2450	D2450V2		825
Fluid Type	Fluid Temp °C	Ambient Temp °C	Ambient Humidity (%)	Forward Power (mW)	Source Spacing (mm)
Body	22.2	22	24%	250	10

Fluid Parameters					
Permittivity			Conductivity		
Measured	Target	Deviation	Measured	Target	Deviation
50.23	52.70	-4.69%	2.03	1.95	4.10%

Measured SAR					
1 gram			10 gram		
Measured	Target	Deviation	Measured	Target	Deviation
13.80	13.00	6.15%	6.23	6.05	2.98%

Measured SAR Normalized to 1.0W					
1 gram			10 gram		
Normalized	Target	Deviation	Normalized	Target	Deviation
55.20	50.70	8.88%	24.92	23.80	4.71%

Prior to the SAR evaluations, system checks were performed on the planar section of the phantom and a SPEAG validation dipole in accordance with the procedures described in IEEE 1528-2013, FCC KDB 846224 and IEC 62209-1.

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.

The forward power was applied to the dipole and the system was verified to a tolerance of +10% from the system manufacturer's dipole calibration target SAR value.

The forward power applied was same forward power applied by the calibration lab during the calibration of this validation source.

16.0 MEASUREMENT SYSTEM SPECIFICATIONS

Table 16.0

Measurement System Specification	
Specifications	
Positioner	Stäubli Unimation Corp. Robot Model: RX60L
Repeatability	0.02 mm
No. of axis	6
Data Acquisition Electronic (DAE) System	
Cell Controller	
Processor	AMD Athlon XP 2400+
Clock Speed	2.0 GHz
Operating System	Windows XP Professional
Data Converter	
Features	Signal Amplifier, multiplexer, A/D converter, and control logic
Software	Measurement Software: DASY4, 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
DASY4 Measurement Server	
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
E-Field Probe	
Model	EX3DV4
Serial No.	3600
Construction	Triangular core fiber optic detection system
Frequency	10 MHz to 6 GHz
Linearity	±0.2 dB (30 MHz to 3 GHz)
Phantom	
Type	SAM
Shell Material	Fiberglass
Thickness	2mm +/- .2mm
Volume	> 30 Liter

Table 16.1

Measurement System Specification (Continued)

Probe Specification

Construction:	Symmetrical design with triangular core; Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, glycol)
Calibration:	In air from 10 MHz to 2.5 GHz In head simulating tissue at frequencies of 900 MHz and 1.8 GHz (accuracy ± 8%)
Frequency:	10 MHz to > 6 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity:	± 0.2 dB in head tissue (rotation around probe axis) ± 0.4 dB in head tissue (rotation normal to probe axis)
Dynamic Range:	5 μW/g to > 100 mW/g; Linearity: ± 0.2 dB
Surface Detect:	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surface
Dimensions:	Overall length: 330 mm; Tip length: 16 mm; Body diameter: 12 mm; Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetry up to 3 GHz; Compliance tests of mobile phone

EX3DV4 E-Field Probe

Phantom Specification

The SAM V5.0 phantom is an elliptical planar fiberglass shell phantom with a shell thickness of 2.0mm +/- .2mm at the planar area. This phantom conforms to OET Bulletin 65, Supplement C, IEEE 1528-2013, IEC 62209-1 and IEC 62209-2.

SAM Phantom

Device Positioner Specification

The DASY4 device positioner 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^{O}. 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.

Device Positioner

17.0 TEST EQUIPMENT LIST

Table 17.0

Test Equipment List

DESCRIPTION	ASSET NO.	SERIAL NO.	DATE CALIBRATED	CALIBRATION INTERVAL
Schmid & Partner DASY4 System	-	-	-	-
-DASY4 Measurement Server	158	1078	CNR	CNR
-Robot	46	599396-01	CNR	CNR
-DAE4	19	353	20-Apr-16	Annual
-DAE3	18	370	22-Apr-16	Annual
-EX3DV6 E-Field Probe	213	3600	27-Apr-16	Annual
-CLA150 Validation Source	251	4007	24-Jan-16	Triennial
-D835V2 Validation Dipole	217	4D075	23-Apr-15	Triennial
-D450V3 Validation Dipole	221	1068	21-Apr-15	Triennial
SAM Phantom	154	-	CNR	CNR
HP 85070C Dielectric Probe Kit	33	none	CNR	CNR
Gigatronics 8652A Power Meter	110	1835801	29-Feb-16	Triennial
Sensor	248	1833687	29-Feb-16	Triennial
HP 8753ET Network Analyzer	134	US39170292	22-Oct-14	Triennial
Generator	6	100104	08-May-14	Triennial
Amplifier	106	26235	CNR	CNR

CNR = Calibration Not Required

18.0 FLUID COMPOSITION

Table 18.0			2450MHz Body	
Tissue Simulating Liquid (TSL) Composition				
Component by Percent Weight				
Water	Glycol	Salt(1)	HEC(2)	Bacteriacide(3)
69.98	30.0	0.02	0.0	0.0

(1) Non-Iodinized
(2) **H**ydroxy**E**thyl-**C**ellulose: Sigma-Aldrich P/N 54290-500g
(3) Dow Chemical Dowicil 75 Antimicrobial Perservative

APPENDIX A – SYSTEM VERIFICATION PLOTS

Date/Time: 26/09/2016 12:41:50 PMDate/Time: 26/09/2016 12:45:01 PM

Test Laboratory: Celltech Labs

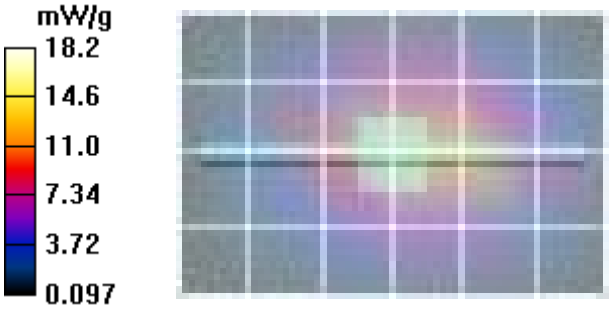
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 825; Calibrated: 25/04/2012
Program Name: 2450MHz Body SPC

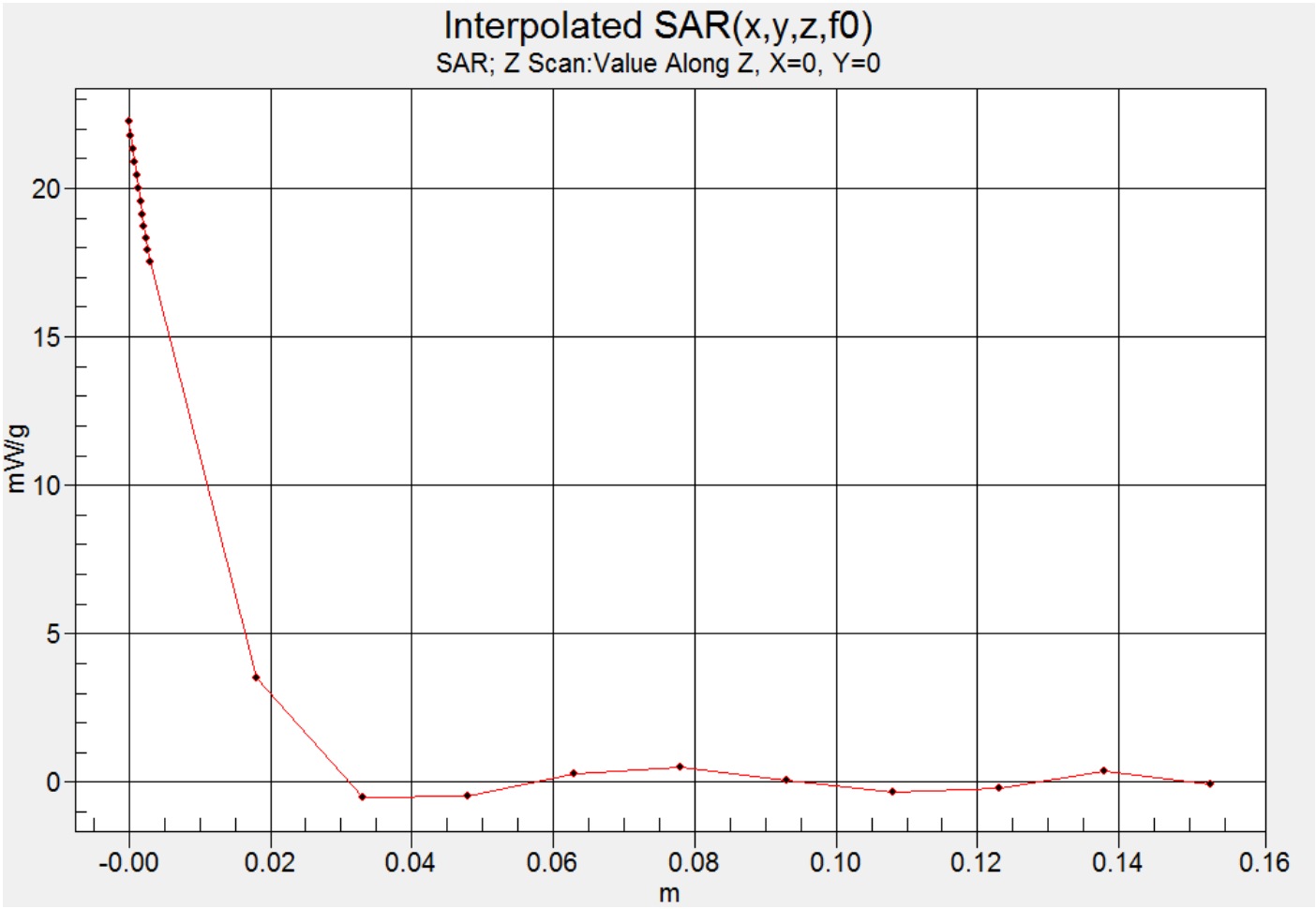
Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 2.03 mho/m; ε_r = 50.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 5mm (Mechanical Surface Detection)Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: SAM with CRP; Type: SAM; Serial: Not Specified
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

2450MHz Body Dipole d=10mm P=250mW TS=[11.7][13.0][14.3]/Area Scan (5x7x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 13.1 mW/g

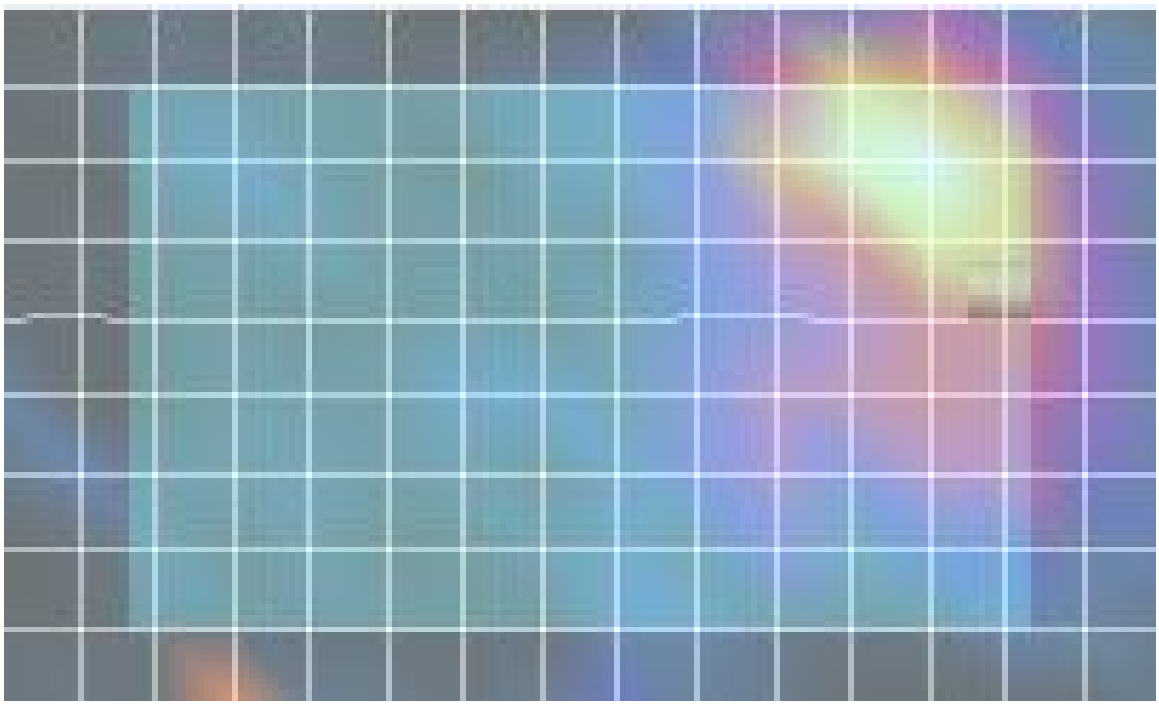
2450MHz Body Dipole d=10mm P=250mW TS=[11.7][13.0][14.3]/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.5 V/m; Power Drift = -0.097 dB
Peak SAR (extrapolated) = 29.5 W/kg
SAR(1 g) = 13.8 mW/g; SAR(10 g) = 6.23 mW/g
Maximum value of SAR (measured) = 18.2 mW/g





APPENDIX B – MEASUREMENT PLOTS OF MAXIMUMUM MEASURED SAT

Antenna Search



Plot B1

Date/Time: 29/09/2016 9:16:47 AMDate/Time: 29/09/2016 9:22:48 AM

Test Laboratory: Celltech Labs

DUT: Garmin; Type: Dash Mount GPS; Serial: Not Specified
Program Name: 2450 MHz Body

Communication System: CW; Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.98 mho/m; ε_r = 50.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

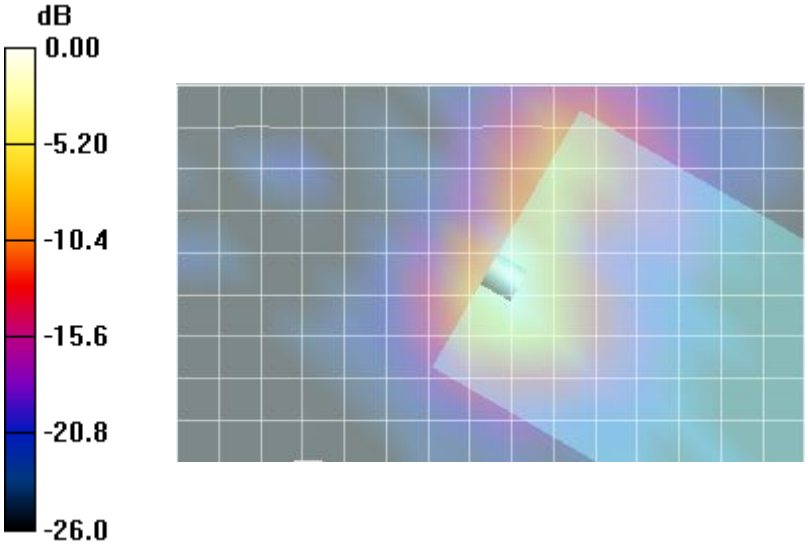
DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: SAM with CRP; Type: SAM;
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

B1b* Body Back A03097, 2412MHz Tilt/Area Scan (10x16x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 1.48 mW/g

B1b* Body Back A03097, 2412MHz Tilt/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 18.4 V/m; Power Drift = -0.352 dB
Peak SAR (extrapolated) = 2.76 W/kg
SAR(1 g) = 0.985 mW/g; SAR(10 g) = 0.356 mW/g

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 1.56 mW/g



Plot B2

Date/Time: 29/09/2016 8:58:07 AMDate/Time: 29/09/2016 9:04:04 AM

Test Laboratory: Celltech Labs

DUT: Garmin; Type: Dash Mount GPS; Serial: Not Specified
Program Name: 2450 MHz Body

Communication System: CW; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 2.01 mho/m; ε_r = 50.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

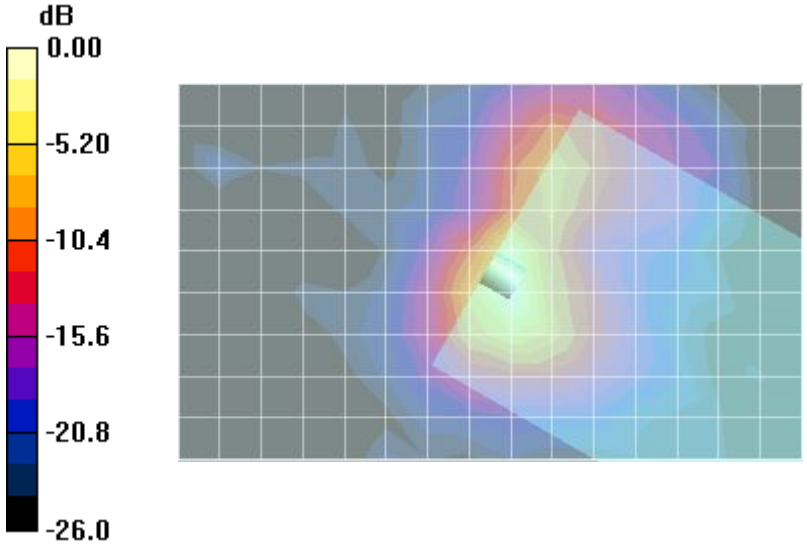
DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: SAM with CRP; Type: SAM;
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

B2b* Body Back A03097, 2437MHz Tilt/Area Scan (10x16x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 1.76 mW/g

B2b* Body Back A03097, 2437MHz Tilt/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 19.4 V/m; Power Drift = -0.448 dB
Peak SAR (extrapolated) = 3.31 W/kg
SAR(1 g) = 1.14 mW/g; SAR(10 g) = 0.408 mW/g

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 1.70 mW/g



Plot B3

Date/Time: 29/09/2016 8:35:54 AMDate/Time: 29/09/2016 8:41:52 AM

Test Laboratory: Celltech Labs

DUT: Garmin; Type: Dash Mount GPS; Serial: Not Specified
Program Name: 2450 MHz Body

Communication System: CW; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 2.05 mho/m; ε_r = 50.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

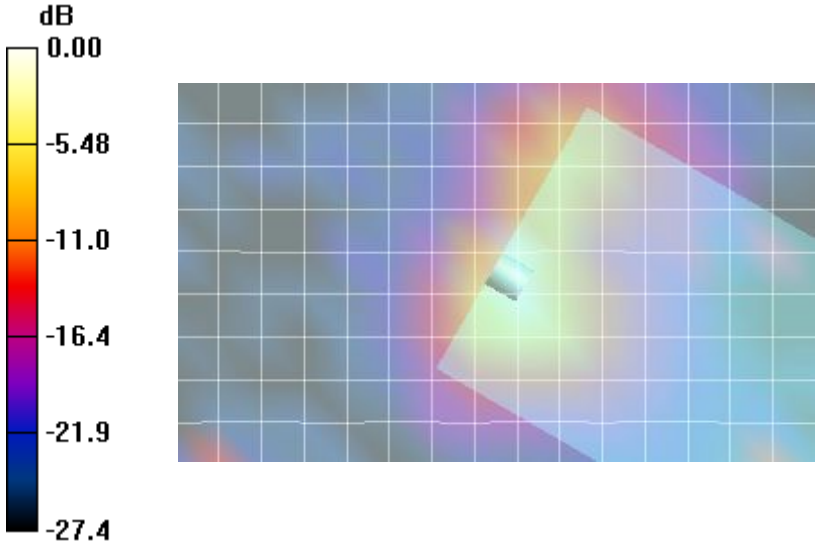
DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: SAM with CRP; Type: SAM;
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

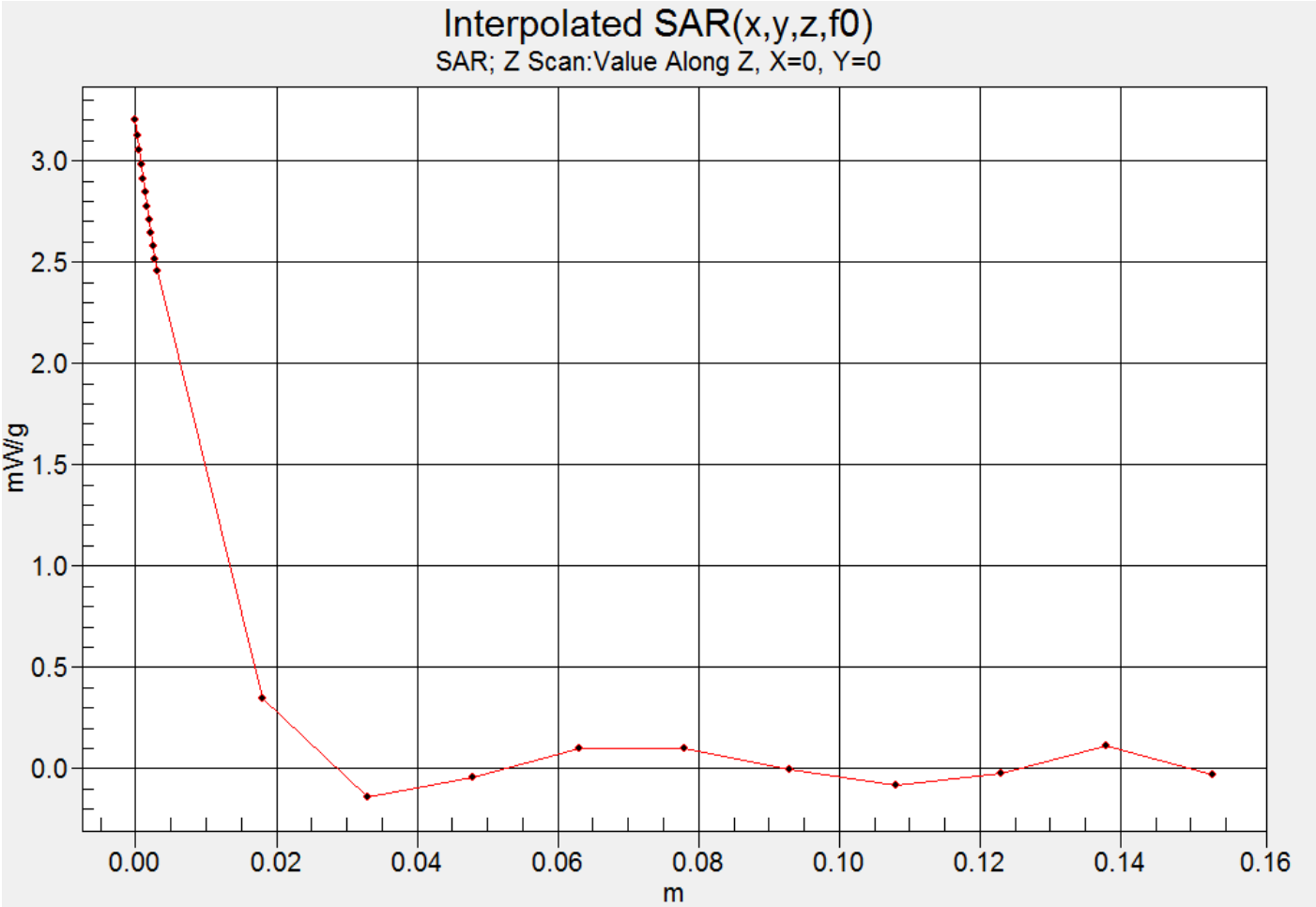
B3* Body Back A03097, 2462MHz Tilt/Area Scan (10x16x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 2.49 mW/g

B3* Body Back A03097, 2462MHz Tilt/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 23.4 V/m; Power Drift = -0.665 dB
Peak SAR (extrapolated) = 4.37 W/kg
SAR(1 g) = 1.52 mW/g; SAR(10 g) = 0.561 mW/g

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 2.37 mW/g





Plot B10

Date/Time: 30/09/2016 9:28:22 AMDate/Time: 30/09/2016 9:34:39 AM

Test Laboratory: Celltech Labs

DUT: Garmin; Type: Dash Mount GPS; Serial: Not Specified
Program Name: 2450 MHz Body

Communication System: CW; Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 2.05 mho/m; ε_r = 50.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

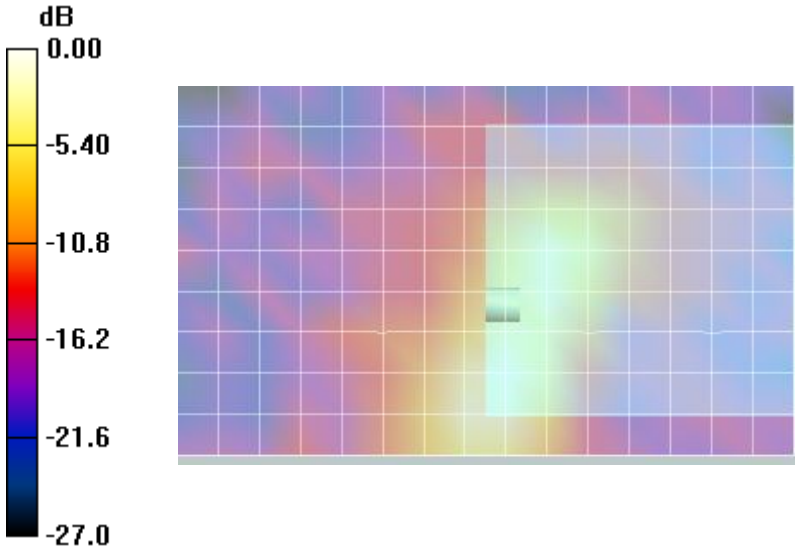
DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: SAM with CRP; Type: SAM;
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

B10* Body Edge A03097, 2462MHz Tilt/Area Scan (10x16x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 0.290 mW/g

B10* Body Edge A03097, 2462MHz Tilt/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 4.15 V/m; Power Drift = -0.250 dB
Peak SAR (extrapolated) = 0.494 W/kg
SAR(1 g) = 0.223 mW/g; SAR(10 g) = 0.102 mW/g

Info: Interpolated medium parameters used for SAR evaluation!



Plot B4 EU

Date/Time: 29/09/2016 9:36:21 AMDate/Time: 29/09/2016 9:42:32 AM

Test Laboratory: Celltech Labs

DUT: Garmin; Type: Dash Mount GPS; Serial: Not Specified
Program Name: 2450 MHz Body

Communication System: CW; Frequency: 2472 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2472 MHz; σ = 2.06 mho/m; ε_r = 50.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3600 2016; ConvF(6.55, 6.55, 6.55); Calibrated: 27/04/2016
- Sensor-Surface: 3mm (Mechanical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn353 2016; Calibrated: 20/04/2016
- Phantom: SAM with CRP; Type: SAM;
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

B4* Body Back A03097, 2472MHz Tilt/Area Scan (10x16x1): Measurement grid: dx=12mm, dy=12mm

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 2.56 mW/g

B4* Body Back A03097, 2472MHz Tilt/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 22.1 V/m; Power Drift = 1.19 dB
Peak SAR (extrapolated) = 4.33 W/kg
SAR(1 g) = 1.62 mW/g; SAR(10 g) = 0.602 mW/g

Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (measured) = 2.54 mW/g