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SAR Test Report

Report Number: M100102

Test Sample: Satellite Positioning Personal Transmitter

Model Number: SAT-232

Tested For: TRaC EMC & SAFETY LTD

Date of Issue: 13th January 2009

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CONTENTS

CONTENTS **2**
1.0 GENERAL INFORMATION **3**
2.0 DESCRIPTION OF DEVICE **4**
2.1 Description of Test Sample 4
2.2 Test sample Accessories 4
2.2.1 Battery Types 4
2.3 Test Signal, Frequency and Output Power 4
2.4 Conducted Power Measurements 4
2.5 Battery Status 5
2.5 Details of Test Laboratory 5
2.5.1 Location 5
2.5.2 Accreditations 5
2.5.3 Environmental Factors 5
3.0 DESCRIPTION OF SAR MEASUREMENT SYSTEM **6**
3.1 Probe Positioning System 6
3.2 E-Field Probe Type and Performance 6
3.3 Data Acquisition Electronics 6
3.4 Calibration and Validation Procedures and Data 6
3.4.1 Validation Results (1640 MHz) 7
3.4.2 Deviation from reference validation values 7
3.4.3 Liquid Depth 15cm 7
3.5 Phantom Properties (Size, Shape, Shell Thickness) 8
3.6 Tissue Material Properties 8
3.6.1 Liquid Temperature and Humidity 8
3.7 Simulated Tissue Composition Used for SAR Test 8
3.8 Device Holder for DASY4 9
4.0 SAR MEASUREMENT PROCEDURE USING DASY4 ..... **9**
5.0 MEASUREMENT UNCERTAINTY **10**
7.0 SAR TEST METHOD **13**
7.1 Description of the Test Positions 13
7.1.1 “Body Worn Position” 13
7.2 List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes) 13
7.3 FCC RF Exposure Limits for Occupational/ Controlled Exposure 13
7.4 FCC RF Exposure Limits for Un-controlled/Non–occupational 13
8.0 SAR MEASUREMENT RESULTS **14**
9.0 COMPLIANCE STATEMENT **15**
APPENDIX A1 Test Sample Photographs **16**
Appendix A2 Test Setup Photographs **17**
Appendix A3 Test Setup Photographs **18**
Appendix A4 Test Setup Photographs **19**
Appendix A5 Test Setup Photographs **20**
APPENDIX B PLOTS OF THE SAR MEASUREMENTS **21**
APPENDIX C CALIBRATION DOCUMENTS **36**

SAR EVALUATION

Satellite Positioning Personal Transmitter, **Model:** SAT-232 **Report Number:** M100102

1.0 GENERAL INFORMATION

Test Sample:	Satellite Positioning Personal Transmitter
Model Number:	SAT-232
Serial Number:	B4TRF
Manufacturer:	Satamatics Ltd
Device Category:	Portable Transmitter
Test Device:	Production Unit / Prototype Sample
RF exposure Category:	General Public/Unaware user
Tested for:	TRaC EMC & SAFETY LTD
Address:	100 Frobisher Business Park, Leigh Sinton Road, Malvern, WR14 1BX
Contact:	Rob Hillyard
Phone:	+44 (0) 1684 571 700
Fax:	+44 (0) 1684 571 701
Email:	rob.hillyard@tracglobal.com
Test Standard/s:	Evaluating Compliance with FCC Guidelines For Human Exposure to Radiofrequency Electromagnetic Fields Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01) Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands) RSS-102 Issue 2 November 2005
Statement Of Compliance:	The Satellite Positioning Personal Transmitter, model SAT-232. Complied with the FCC General public/uncontrolled RF exposure limits of 1.6mW/g per requirements of 47CFR2.1093(d).
Test Dates:	11th January 2010
Test Officer:	 Peter Jakubiec
Authorised Signature:	 Peter Jakubiec

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2.0 DESCRIPTION OF DEVICE

2.1 Description of Test Sample

The device tested was a Satellite Positioning Personal Transmitter, Model: SAT-232 operating in 1626.5025 MHz to 1660.4975 MHz frequency band. The test device was tested in the Body Worn Position.

Table: DUT Parameters

Operating Mode during Testing	: See Clouse 2.3
Operating Mode production sample	: Standard GSM and Globalstar Satellite
Modulation:	: Standard TDMA and Qualcomm Digital CDMA
Device Power Rating for test sample and identical production unit	: 30.0 dBm (Peak)
Device Dimensions (LxWxH)	: 180mm x 90mm x 50mm
Antenna type	: Helical
Applicable Head Configurations	: None
Applicable Body Worn-Configurations	: Body Worn
Battery Options	: One Battery Type

2.2 Test sample Accessories

2.2.1 Battery Types

A 3.7V 4400 mAh Lithium ion Battery Pack is used to power the DUT. The maximum rated power is 30 dBm (Peak). SAR measurements were performed with a standard 3.6 V battery.

2.3 Test Signal, Frequency and Output Power

The test was performed on DUT, for this evaluation. The test sample operates in the 1626.5025 MHz to 1660.4975 MHz frequency band. In normal use the maximum transmission rate is one 8-second burst every 2 minutes and one 2-second burst every one minute. To enable SAR testing the test sample was configured into a test mode of 40ms bursts every 400ms and was put into maximum continuous transmit mode for the duration of each SAR scan. The channels utilised in the measurements were the traffic channels shown in the table below.

Table: Test Frequencies

Frequency Range	Traffic Channels	Band Power Class	Nominal Power (dBm)
1626.5025 MHz to 1660.4975 MHz	6000, 12800, and 19600	N/A	30.0 (Peak)

2.4 Conducted Power Measurements

The conducted power of the DUT was measured in the 1626.5025 MHz to 1660.4975 MHz frequency range with a calibrated Power Meter. The results of this measurement are listed in table below.

Table: Frequency and Output Power

Channel	Channel Frequency MHz	Maximum Conducted Output Power dBm (average)
6000	1626.5025	26.87
12800	1643.5	28.40
19600	1660.4975	28.16

Note: The loss's due to cabling and attenuation has been taken into account.

2.5 Battery Status

The device battery was fully charged prior to commencement of measurement. Each SAR test was completed within 30 minutes. The battery condition was monitored by measuring the RF power at a defined position inside the phantom before the commencement of each test and again after the completion of the test.

Table: Battery Details

Battery:	Li-ion 3.7V 4.4 Ah
Manufacturer:	Varta
Model No.:	700698

2.5 Details of Test Laboratory

2.5.1 Location

EMC Technologies Pty Ltd
176 Harrick Road
Keilor Park, (Melbourne) Victoria
Australia 3042

Telephone: +61 3 9365 1000
Facsimile: +61 3 9331 7455
email: melb@emctech.com.au
website: www.emctech.com.au

2.5.2 Accreditations

EMC Technologies Pty. Ltd. is accredited by the National Association of Testing Authorities, Australia (NATA). **NATA Accredited Laboratory Number: 5292**

EMC Technologies Pty Ltd is NATA accredited for the following standards:

ARPANSA Standard AS/NZS 2772.2:	RF and microwave radiation hazard measurement
ACA:	Radio communications (Electromagnetic Radiation - Human Exposure) Standard 2003
FCC:	Guidelines for Human Exposure to RF Electromagnetic Field OET65C 01/01
CENELEC:	ES59005: 1998
EN 50360: 2001	Product standard to demonstrate the compliance of mobile phones with the basic restrictions related to human exposure to electromagnetic fields (300 MHz – 3 GHz)
EN 62209-1:2006	Human exposure to radio frequency fields from hand-held and body-mounted devices-Human models, instrumentation and procedures. **Part 1:** Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range 300 MHz to 3 GHz)
IEEE 1528: 2003	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head Due to Wireless Communications Devices: Measurement Techniques.

Refer to NATA website www.nata.asn.au for the full scope of accreditation.

2.5.3 Environmental Factors

The measurements were performed in a shielded room with no background network signals. The temperature in the laboratory was controlled to within 20 ± 1 °C, the humidity was 63 %. The liquid parameters were measured prior to the commencement of the tests. Tests were performed to check that reflections within the environment did not influence the SAR measurements. The noise floor of the DASY4 SAR measurement system using the SN1377 probe is less than 5μV in both air and liquid mediums.

3.0 DESCRIPTION OF SAR MEASUREMENT SYSTEM

3.1 Probe Positioning System

The measurements were performed with the state of the art automated near-field scanning system **DASY4 Version V4.7 Build 53** from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision 6-axis robot (working range greater that 1.1m), which positions the SAR measurement probes with a positional repeatability of better than ±0.02 mm. The DASY4 fully complies with the OET65 C (01-01), IEEE 1528 and EN50361SAR measurement requirements.

3.2 E-Field Probe Type and Performance

The SAR measurements were conducted with the dosimetric probe ET3DV6 Serial: 1377 (manufactured by SPEAG) designed in the classical triangular configuration and optimised for dosimetric evaluation. The probe has been calibrated and found to be accurate to better than ±0.25 dB. The probe is suitable for measurements close to material discontinuity at the surface of the phantom. The sensors of the probe are directly loaded with Schottky diodes and connected via highly resistive lines (length = 300 mm) to the data acquisition unit.

3.3 Data Acquisition Electronics

The data acquisition electronics (DAE3) consists of 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. The input impedance of the DAE3 box is 200 MΩ; the inputs are symmetrical and floating. Common mode rejection is above 80dB.Transmission to the PC-card is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The mechanical probe-mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

3.4 Calibration and Validation Procedures and Data

Prior to the SAR assessment, the system validation kit was used to verify that the DASY4 was operating within its specifications. The validation was performed at 1640 MHz with the SPEAG D1640V2 calibrated dipole.

The validation dipoles are highly symmetric and matched at the centre frequency for the specified liquid and distance to the phantom. The accurate distance between the liquid surface and the dipole centre is achieved with a distance holder that snaps onto the dipole.

System validation is performed by feeding a known power level into a reference dipole, set at a know distance from the phantom. The measured SAR is compared to the theoretically derived level.

3.4.1 Validation Results (1640 MHz)

The following table lists the dielectric properties of the tissue simulating liquid measured prior to each SAR validation. The results of the validation for each day are listed in columns 5 and 6. The forward power into the reference dipole for each SAR validation was adjusted to 250 mW.

Table: Validation Results (SPEAG calibrated dipoles)

1 Validation Date	2 Frequency (MHz)	3 ϵr (measured)	4 σ (mho/m) (measured)	5 Measured SAR 1g	6 Measured SAR 10g
11th January 2010	1640	40.3	1.32	8.69	4.53

3.4.2 Deviation from reference validation values

The SPEAG calibration reference SAR value is the SAR validation result obtained in a specific dielectric liquid using the validation dipole (DV1640V2) during calibration. The measured one-gram SAR should be within 10% of the expected target reference values shown in table below.

Table: Deviation from reference validation values

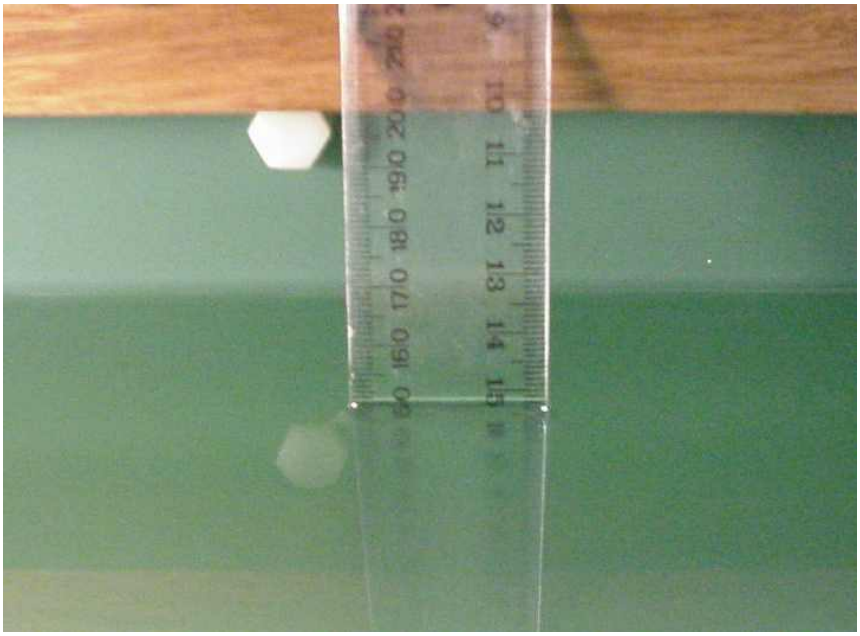
Validation Frequency	Measured SAR 1g (input power = 250mW)	Measured SAR 1g (Normalized to 1W)	SPEAG Calibration Reference SAR Value 1g (mW/g)	Deviation From SPEAG 1g (%)
1640 MHz	8.69	34.76	33	5.33

Note: All reference validation values are referenced to 1W input power.

3.4.3 Liquid Depth 15cm

During the SAR measurement process the liquid level was maintained to a level of 15cm with a tolerance of ±0.5cm. The following photo shows the depth of the liquid maintained during the testing.

Photo of liquid Depth in Flat Phantom



3.5 Phantom Properties (Size, Shape, Shell Thickness)

The phantom used during the SAR testing in Touch, Tilted positions and the validation was the "SAM" phantom from SPEAG. The phantom thickness is 2.0mm+/-0.2 mm and was filled with the required tissue simulating liquid.

3.6 Tissue Material Properties

The dielectric parameters of the tissue simulating liquid were measured prior to SAR assessment using the HP85070A dielectric probe kit and HP8714B Network Analyser. The actual dielectric parameters are shown in the following table.

Table: Measured Body Simulating Liquid Dielectric Values

Frequency Band	∈r (measured range)	∈r (target)	σ (mho/m) (measured range)	σ (target)	ρ kg/m^3
1626.5 MHz Body	51.6	53.8 ±5% (51.1 to 56.5)	1.43	1.40 ±5% (1.33 to 1.47)	1000
1643.5 MHz Body	51.6	53.8 ±5% (51.1 to 56.5)	1.44	1.40 ±5% (1.33 to 1.47)	1000
1660.5 MHz Body	51.5	53.8 ±5% (51.1 to 56.5)	1.45	1.40 ±5% (1.33 to 1.47)	1000

Note: The body and muscle liquid parameters were within the required tolerances of ±5%.

3.6.1 Liquid Temperature and Humidity

The humidity and dielectric/ambient temperatures are recorded during the assessment of the tissue material dielectric parameters. The difference between the ambient temperature of the liquid during the dielectric measurement and the temperature during tests was less than |2|°C.

Table: Temperature and Humidity recorded for each day

Date	Ambient Temperature (°C)	Liquid Temperature (°C)	Humidity (%)
11th January 2010	20.0	19.8	63.0

3.7 Simulated Tissue Composition Used for SAR Test

The tissue simulating liquids are created prior to the SAR evaluation and often require slight modification each day to obtain the correct dielectric parameters.

Table: Tissue Type: Brain @ 1600MHz

Volume of Liquid: 30 Litres

Approximate Composition	% By Weight
Distilled Water	61.17
Salt	0.31
Bactericide	0.29
Triton X-100	38.23

*Refer "OET Bulletin 65 97/01 P38"

3.8 Device Holder for DASY4

The DASY4 device holder supplied by SPEAG is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The rotation centres for both scales is the ear opening. Thus the device needs no repositioning when changing the angles.

The DASY4 device holder is made of low-loss material having the following dielectric parameters: relative permittivity ε=3 and loss tangent δ=0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, to reduce the influence on the clamp on the test results.

Refer to Appendix A for photographs of device positioning

4.0 SAR MEASUREMENT PROCEDURE USING DASY4

The SAR evaluation was performed with the SPEAG DASY4 System (**VERSION V4.7 BUILD 53**). A summary of the procedure follows:

a) A measurement of the conducted power value at the antenna port is used as a reference value for assessing the power drop of the DUT. Also a measurement of the SAR value at a fixed location is used. The power is measured at the start of the test and then again at the end of the test.

b) The SAR distribution at the exposed side of the head or the flat section of the flat phantom is measured at a distance of 3.9 mm from the inner surface of the shell. The area covers the entire dimension of the head and the horizontal grid spacing is 15 mm x 15 mm. The actual Area Scan has dimensions of 120 mm x 240 mm, surrounding the test device. Based on this data, the area of the maximum absorption is determined by Spline interpolation.

c) Around this point, a volume of 30 mm x 30 mm x 30 mm is assessed by measuring 7 x 7 x 7 points. On the basis of this data set, the spatial peak SAR value is evaluated with the following procedure:

   (i) The data at the surface are extrapolated, since the centre of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation is based on a least square algorithm. A polynomial of the fourth order is calculated through the points in z-axes. This polynomial is then used to evaluate the points between the surface and the probe tip.

   (ii) The maximum interpolated value is searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g and 10 g) are computed using the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot”- condition (in x, y and z-direction). The volume is integrated with the trapezoidal – algorithm. One thousand points (10 x 10 x 10) are interpolated to calculate the averages.

   (iii) All neighbouring volumes are evaluated until no neighbouring volume with a higher average value is found.

   (iv) The SAR value at the same location as in Step (a) is again measured

5.0 MEASUREMENT UNCERTAINTY

The uncertainty analysis is based on the template listed in the IEEE Std 1528-2003 for both Handset SAR tests and Validation uncertainty. The measurement uncertainty of a specific device is evaluated independently and the total uncertainty for both evaluations (95% confidence level) must be less than 30%.

Table: Uncertainty Budget for DASY4 Version V4.7 Build 53 – DUT SAR test

Uncertainty Component	Tol. (6%)	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g u_i (6%)	10g u_i (6%)	v_i
Measurement System								
Probe Calibration	7	N	1	1	1	7.0	7.0	∞
Axial Isotropy	4.7	R	1.73	0.707	0.707	1.9	1.9	∞
Hemispherical Isotropy	9.6	R	1.73	0.707	0.707	3.9	3.9	∞
Boundary Effects	1	R	1.73	1	1	0.6	0.6	∞
Linearity	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	0.3	N	1	1	1	0.3	0.3	∞
Response Time	0.8	R	1.73	1	1	0.5	0.5	∞
Integration Time	2.6	R	1.73	1	1	1.5	1.5	∞
RF Ambient Noise	3	R	1.73	1	1	1.7	1.7	∞
RF Ambient Reflections	3	R	1.73	1	1	1.7	1.7	∞
Probe Positioner	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning	2.9	R	1.73	1	1	1.7	1.7	∞
Max. SAR Eval.	1	R	1.73	1	1	0.6	0.6	∞
Test Sample Related								
Test Sample Positioning	1.61	N	1	1	1	1.6	1.6	11
Device Holder Uncertainty	3.6	N	1	1	1	3.6	3.6	7
Output Power Variation – SAR Drift Measurement	11.94	R	1.73	1	1	6.9	6.9	∞
Phantom and Setup								
Phantom Uncertainty	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	5	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity – Measurement uncertainty	2.5	N	1.00	0.64	0.43	1.6	1.1	5
Liquid Permittivity – Deviation from target values	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	2.5	N	1.00	0.6	0.49	1.5	1.2	5
Combined standard Uncertainty		RSS				12.9	12.7	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)		k=2				25.7	25.37	

Estimated total measurement uncertainty for the DASY4 measurement system was ±12.9%. The extended uncertainty (K = 2) was assessed to be ±25.7% based on 95% confidence level. The uncertainty is not added to the measurement result.

Table: Uncertainty Budget for DASY4 Version V4.7 Build 53 - Validation

Uncertainty Component	Tol. (6%)	Prob. Dist.	Div.	C_i (1g)	C_i (10g)	1g u_i (6%)	10g u_i (6%)	v_i
Measurement System								
Probe Calibration	7	N	1	1	1	7.0	7.0	∞
Axial Isotropy	4.7	R	1.73	1	1	2.7	2.7	∞
Hemispherical Isotropy	9.6	R	1.73	0	0	0.0	0.0	∞
Boundary Effects	1	R	1.73	1	1	0.6	0.6	∞
Linearity	4.7	R	1.73	1	1	2.7	2.7	∞
System Detection Limits	1	R	1.73	1	1	0.6	0.6	∞
Readout Electronics	0.3	N	1	1	1	0.3	0.3	∞
Response Time	0	R	1.73	1	1	0.0	0.0	∞
Integration Time	0	R	1.73	1	1	0.0	0.0	∞
RF Ambient Noise	3	R	1.73	1	1	1.7	1.7	∞
RF Ambient Reflections	3	R	1.73	1	1	1.7	1.7	∞
Probe Positioner	0.4	R	1.73	1	1	0.2	0.2	∞
Probe Positioning	2.9	R	1.73	1	1	1.7	1.7	∞
Max. SAR Eval.	1	R	1.73	1	1	0.6	0.6	∞
Dipole								
Dipole Axis to Liquid Distance	2	N	1.73	1	1	1.2	1.2	11
Input Power and SAR drift meas.	4.7	R	1.73	1	1	2.7	2.7	∞
Phantom and Tissue Param.								
Phantom Uncertainty	4	R	1.73	1	1	2.3	2.3	∞
Liquid Conductivity – Deviation from target values	5	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Conductivity – Measurement uncertainty	2.5	N	1.00	0.64	0.43	1.6	1.1	5
Liquid Permittivity – Deviation from target values	5	R	1.73	0.6	0.49	1.7	1.4	∞
Liquid Permittivity – Measurement uncertainty	2.5	N	1.00	0.6	0.49	1.5	1.2	5
Combined standard Uncertainty		RSS				9.9	9.7	154
Expanded Uncertainty (95% CONFIDENCE LEVEL)		k=2				19.9	19.38	

Estimated total measurement uncertainty for the DASY4 measurement system was ±9.90%. The extended uncertainty (K = 2) was assessed to be ±19.9% based on 95% confidence level. The uncertainty is not added to the Validation measurement result.

6.0 Equipment List and Calibration Details

Table: SPEAG DASY4 Version V4.7 Build 53

Equipment Type	Manufacturer	Model Number	Serial Number	Calibration Due	Used For this Test?
Robot - Six Axes	Staubli	RX90BL	N/A	Not applicable	✓
Robot Remote Control	SPEAG	CS7MB	RX90B	Not applicable	✓
SAM Phantom	SPEAG	N/A	1260	Not applicable	✓
SAM Phantom	SPEAG	N/A	1060	Not applicable	
Flat Phantom	AndreT	10.1	P 10.1	Not Applicable	✓
Flat Phantom	AndreT	9.1	P 9.1	Not Applicable	
Flat Phantom	SPEAG	PO1A 6mm	1003	Not Applicable	
Data Acquisition Electronics	SPEAG	DAE3 V1	359	08-July-2010	
Data Acquisition Electronics	SPEAG	DAE3 V1	442	08-Dec-2010	✓
Probe E-Field - Dummy	SPEAG	DP1	N/A	Not applicable	
Probe E-Field	SPEAG	ET3DV6	1380	11-Dec-2010	
Probe E-Field	SPEAG	ET3DV6	1377	14-July-2010	✓
Probe E-Field	SPEAG	ES3DV6	3029	Not Used	
Probe E-Field	SPEAG	EX3DV4	3563	16-July-2010	
Probe E-Field	SPEAG	EX3DV4	3557	16-Dec-2010	
Antenna Dipole 300 MHz	SPEAG	D300V2	1005	15-Dec-2011	
Antenna Dipole 450 MHz	SPEAG	D450V2	1009	17-Dec-2010	
Antenna Dipole 900 MHz	SPEAG	D900V2	047	7-July-2010	
Antenna Dipole 1640 MHz	SPEAG	D1640V2	314	16-July-2010	✓
Antenna Dipole 1800 MHz	SPEAG	D1800V2	242	8-July-2010	
Antenna Dipole 1950 MHz	SPEAG	D1950V3	1113	12-Dec -2010	
Antenna Dipole 3500 MHz	SPEAG	D3500V2	1002	17-July-2010	
Antenna Dipole 2450 MHz	SPEAG	D2450V2	724	10-Dec-2010	
Antenna Dipole 5600 MHz	SPEAG	D5GHzV2	1008	16-Dec-2011	
RF Amplifier	EIN	603L	N/A	*In test	
RF Amplifier	Mini-Circuits	ZHL-42	N/A	*In test	✓
RF Amplifier	Mini-Circuits	ZVE-8G	N/A	*In test	
Synthesized signal generator	Hewlett Packard	ESG-D3000A	GB37420238	*In test	✓
RF Power Meter Dual	Hewlett Packard	437B	3125012786	29-June-2010	✓
RF Power Sensor 0.01 - 18 GHz	Hewlett Packard	8481H	1545A01634	01-July-2010	✓
RF Power Meter Dual	Gigatronics	8542B	1830125	26-Mar-2010	
RF Power Sensor	Gigatronics	80301A	1828805	26-Mar-2010	
RF Power Meter Dual	Hewlett Packard	435A	1733A05847	*In test	✓
RF Power Sensor	Hewlett Packard	8482A	2349A10114	*In test	✓
Network Analyser	Hewlett Packard	8714B	GB3510035	30-Sept-2010	✓
Network Analyser	Hewlett Packard	8753ES	JP39240130	24-Nov-2010	
Dual Directional Coupler	Hewlett Packard	778D	1144 04700	*In test	
Dual Directional Coupler	NARDA	3022	75453	*In test	✓

* Calibrated during the test for the relevant parameters. Reference power meter only.

7.0 SAR TEST METHOD

7.1 Description of the Test Positions

The SAR measurements are performed at the Front and Back sides of the Device in the Body Worn position using the centre frequency of each operating band. The configuration giving the maximum mass-averaged SAR is used to test the low-end and high-end frequencies of the transmitting band.
See Appendix A for photos of test positions.

7.1.1 "Body Worn Position"

The body-worn operating configuration was tested with the device positioned against a flat phantom in normal use configuration. The position chosen for testing was the "Body Worn Position", this position simulated the DUT placed against the body of a user. Spacing used between the Mobile Phone and the flat phantom was 0mm. Additionally the tests were conducted with the device placed in the Holster that contained metal parts and provided with 7mm of spacing.

7.2 List of All Test Cases (Antenna In/Out, Test Frequencies, User Modes)

The SAR was measured at three test channels for with the test sample operating as maximum power, as specified in section 2.2.

7.3 FCC RF Exposure Limits for Occupational/ Controlled Exposure

SPATIAL PEAK SAR LIMITS FOR:	
Partial-Body:	8.0 mW/g (averaged over any 1g cube of tissue)
Hands, Wrists, Feet and Ankles:	20.0 mW/g (averaged over 10g cube of tissue)

7.4 FCC RF Exposure Limits for Un-controlled/Non–occupational

SPATIAL PEAK SAR LIMITS FOR:	
Partial-Body:	1.6 mW/g (averaged over any 1g cube of tissue)
Hands, Wrists, Feet and Ankles:	4.0 mW/g (averaged over 10g cube of tissue)

8.0 SAR MEASUREMENT RESULTS

The SAR values averaged over 1 g tissue masses were determined for the sample device for the Body Worn Front and Body Worn Back configurations of the phantom. The results are given in table below.

The plots with the corresponding SAR distributions, which reveal information about the location of the maximum SAR with respect to the devices, are contained in Appendix B of this report.

Table: SAR Measurement Results

Test Position	Plot Number	Test Channel	Test Freq. (MHz)	SAR Level for (1g) mW/g	DASY4 Measured Drift (dB)
Body Worn Back	1	12800	1643.5	0.281	-0.240
Body Worn Back with Holster	2	12800	1643.5	0.103	-0.340
Body Worn Front with Holster	3	12800	1643.5	0.424	0.050
Body Worn Front	4	6000	1626.5025	0.756	-0.060
	5	12800	1643.5	0.905	-0.169
	6	19600	1660.4975	0.749	-0.490

Note: The uncertainty of the system (± 25.7 %) has not been added to the results.

The maximum measured SAR level in the 1600 MHz band was 0.905 mW/g for a 1 gram cube this value was measured in the Body Worn Front position at a frequency of 1643.5 MHz (Channel 12800).

The FCC SAR limit for Non-occupational exposure is 1.6 m W/g measurement in a 1g cube of tissue.

9.0 COMPLIANCE STATEMENT

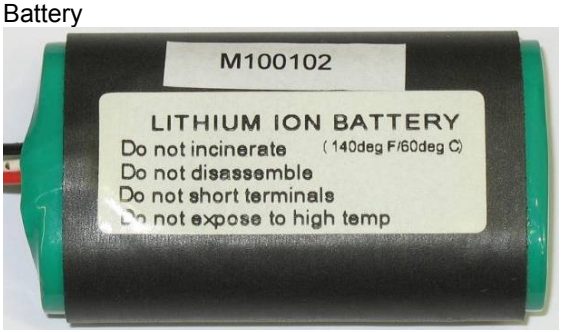
The Satellite Positioning Personal Transmitter, Model SAT-232 was tested on behalf of TRaC EMC & SAFETY LTD. It complied with the FCC SAR requirements.

The highest SAR level recorded for the 1600 MHz Satellite band was 0.905 mW/g, which is below the uncontrolled limit of 1.6 mW/g, even taking into account the measurement uncertainty of 25.7 %.

This document is issued in accordance with NATA's accreditation requirements. The results of tests, calibration and/or measurements included in this document are traceable to Australian/national standards. NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing and calibration reports.

APPENDIX A1 Test Sample Photographs

Battery



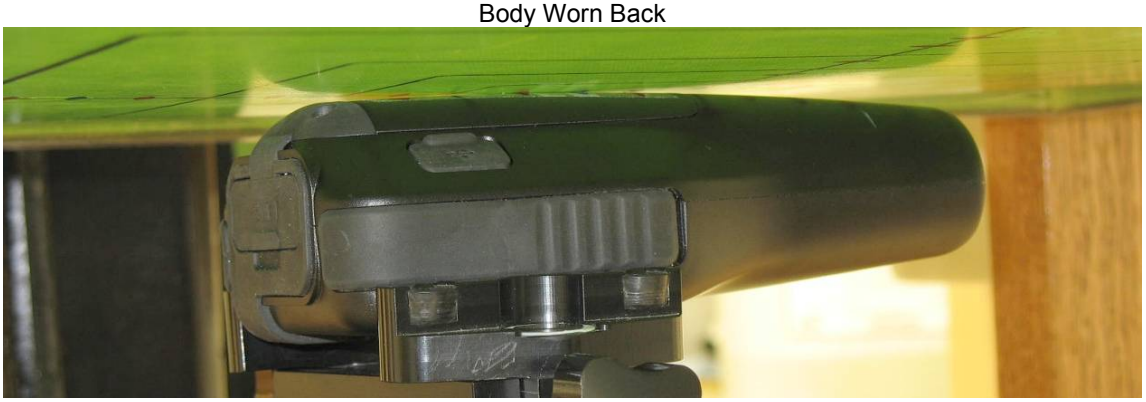
Battery

DUT

DUT

Appendix A2 Test Setup Photographs

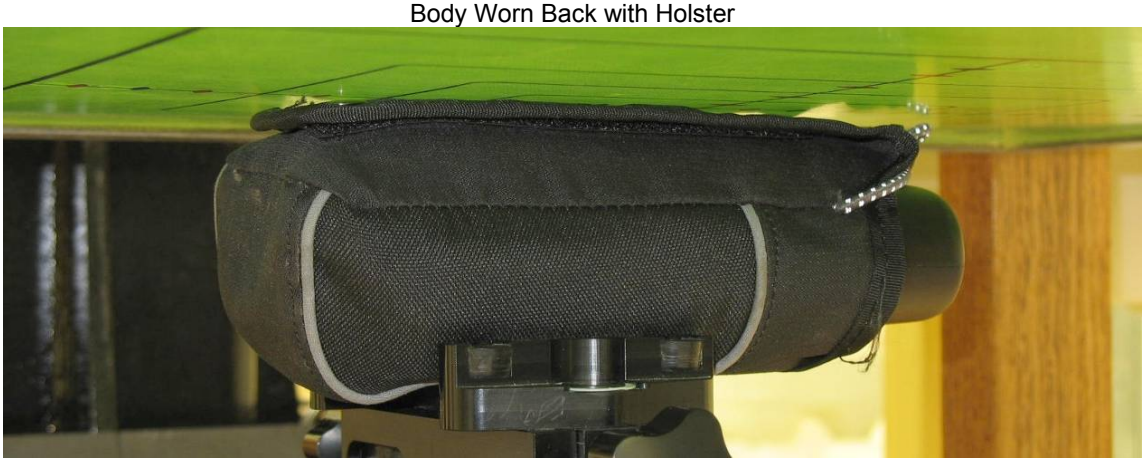
Body Worn Back



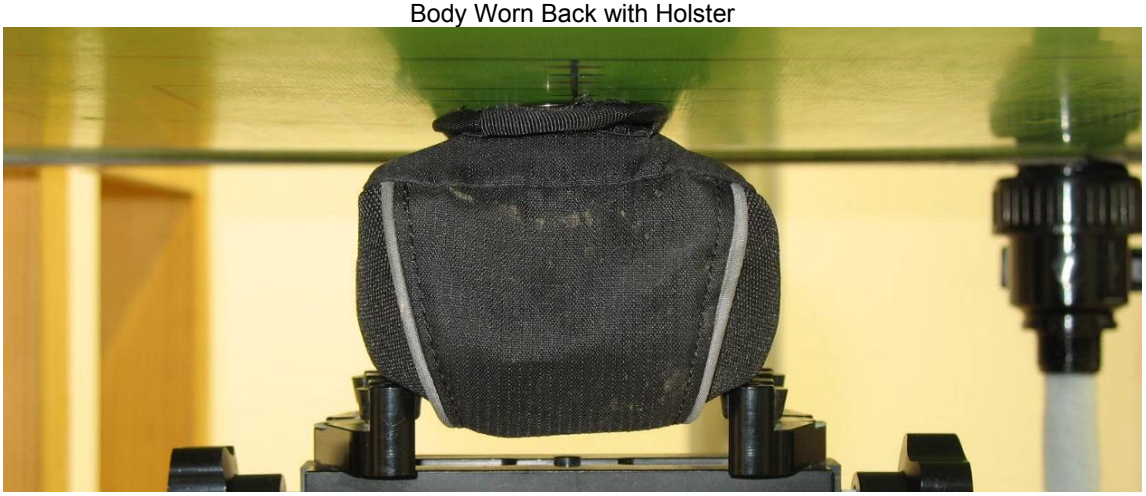
Body Worn Back

Appendix A3 Test Setup Photographs

Body Worn Back with Holster

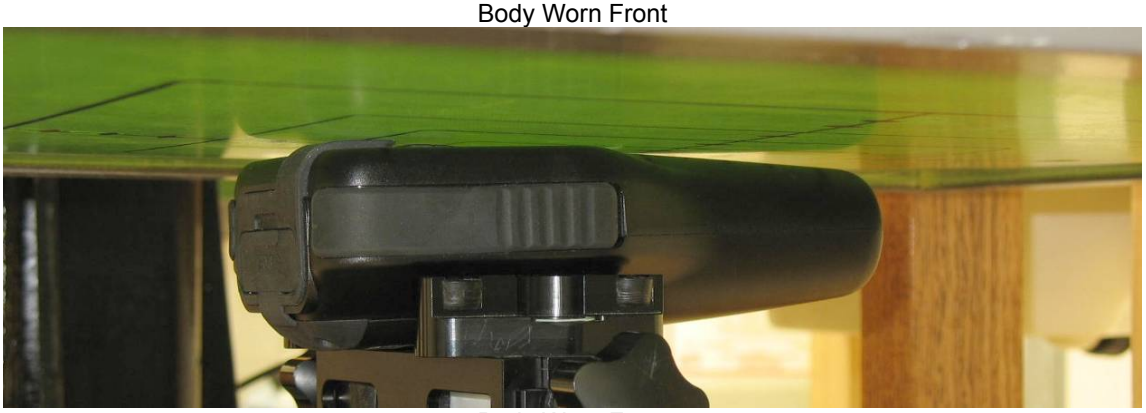


Body Worn Back with Holster



Appendix A4 Test Setup Photographs

Body Worn Front

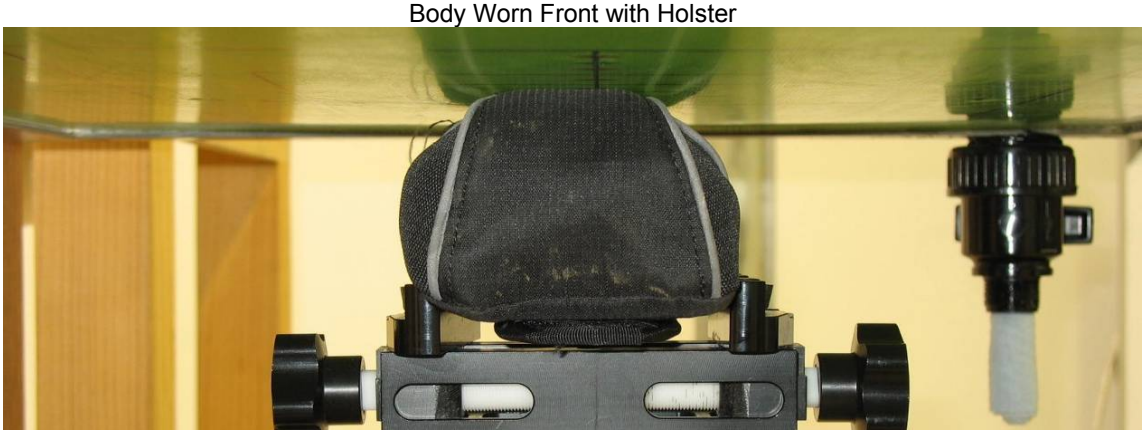


Body Worn Front

Appendix A5 Test Setup Photographs

Body Worn Front with Holster

Body Worn Front with Holster



APPENDIX B PLOTS OF THE SAR MEASUREMENTS

Plots of the measured SAR distributions inside the phantom are given in this Appendix for all tested configurations. The spatial peak SAR values were assessed with the procedure described in this report.

Table: 1600 MHz SAR Plots

Test Position	Plot Number	Test Channel
Body Worn Back	1	12800
Body Worn Back with Holster	2	12800
Body Worn Front with Holster	3	12800
Body Worn Front	4	6000
	5	12800
	6	19600

Table: SAR Validation Plots

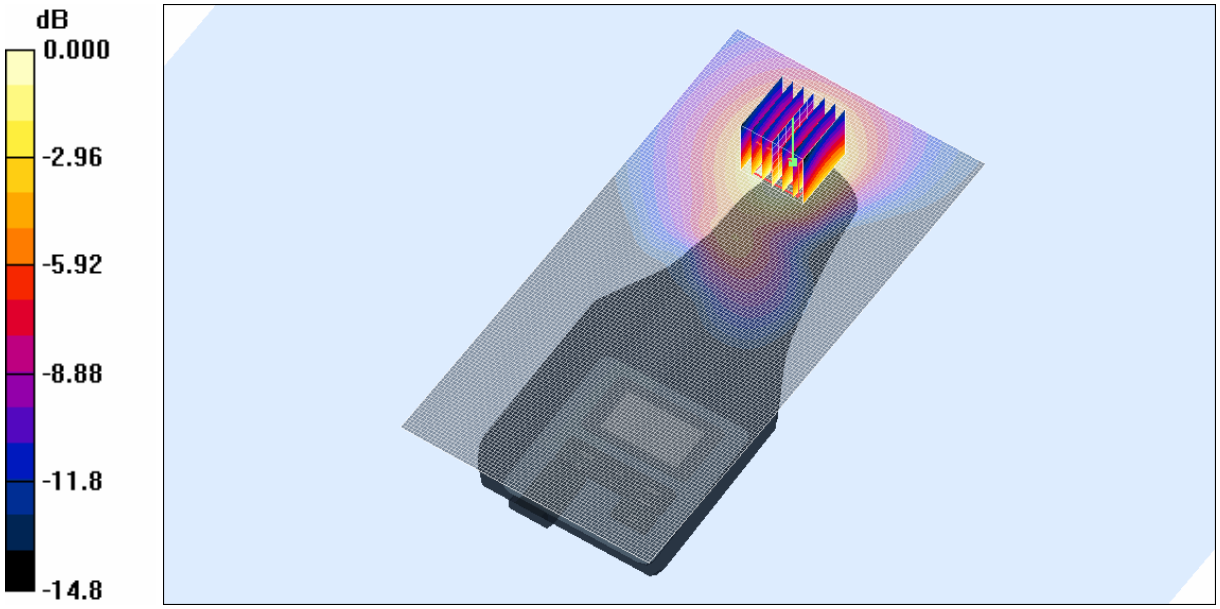
Date	Plot Number	Frequency
11th January 2010	7	1640 MHz

Test Date: 11 January 2010
File Name: M100102 Body Worn Back 1600 MHz (DAE442 Probe1377) 11-01-10.da4
DUT: Satamatics Personal Satelite Tracker; Type: SAT-232; Serial: B4TRF

* Communication System: 1600 MHz Satelite; Frequency: 1643.5 MHz; Duty Cycle: 1:10
* Medium parameters used: f = 1644 MHz; σ = 1.44 mho/m; ε_r = 51.6; ρ = 1000 kg/m^3
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(5.1, 5.1, 5.1)
- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 12800 Test/Area Scan (161x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.304 mW/g

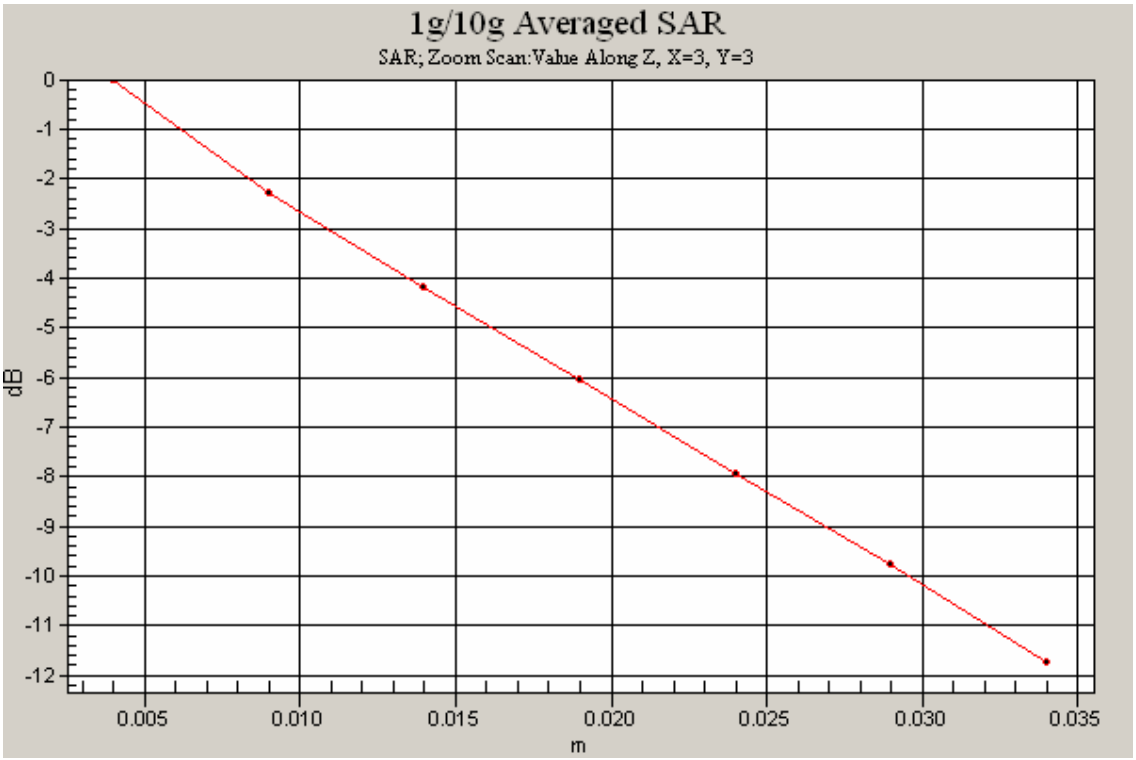
Channel 12800 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.94 V/m; Power Drift = -0.229 dB
Peak SAR (extrapolated) = 0.515 W/kg
SAR(1 g) = 0.281 mW/g; SAR(10 g) = 0.166 mW/g
Maximum value of SAR (measured) = 0.300 mW/g



0 dB = 0.300mW/g

SAR MEASUREMENT PLOT 1

Ambient Temperature	**20.0 Degrees Celsius**
Liquid Temperature	**19.8 Degrees Celsius**
Humidity	**63.0 %**

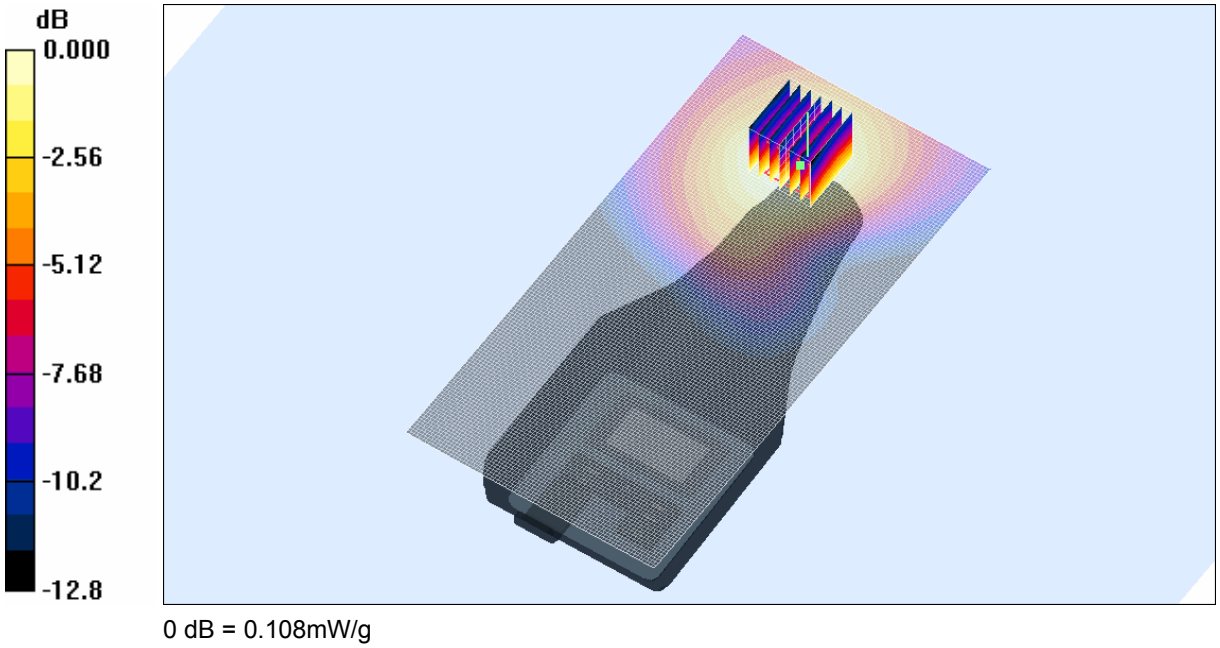


Test Date: 11 January 2010
File Name: M100102 Body Worn Back Holster 1600 MHz (DAE442 Probe1377) 11-01-10.da4
DUT: Satamatics Personal Satelite Tracker; Type: SAT-232; Serial: B4TRF

* Communication System: 1600 MHz Satelite; Frequency: 1643.5 MHz; Duty Cycle: 1:10
* Medium parameters used: f = 1644 MHz; σ = 1.44 mho/m; ε_r = 51.6; ρ = 1000 kg/m^3
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(5.1, 5.1, 5.1)
- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 12800 Test/Area Scan (161x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.110 mW/g

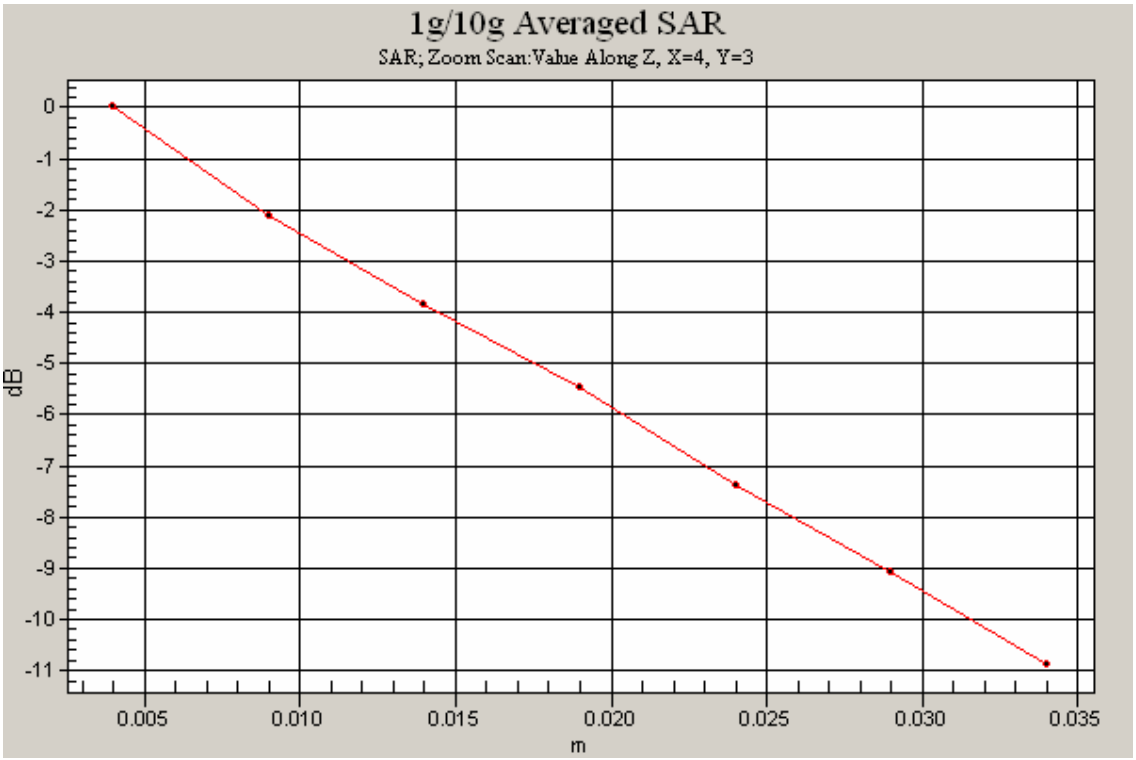
Channel 12800 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.88 V/m; Power Drift = -0.114 dB
Peak SAR (extrapolated) = 0.179 W/kg
SAR(1 g) = 0.103 mW/g; SAR(10 g) = 0.065 mW/g
Maximum value of SAR (measured) = 0.108 mW/g



0 dB = 0.108mW/g

SAR MEASUREMENT PLOT 2

Ambient Temperature	**20.0 Degrees Celsius**
Liquid Temperature	**19.8 Degrees Celsius**
Humidity	**63.0 %**

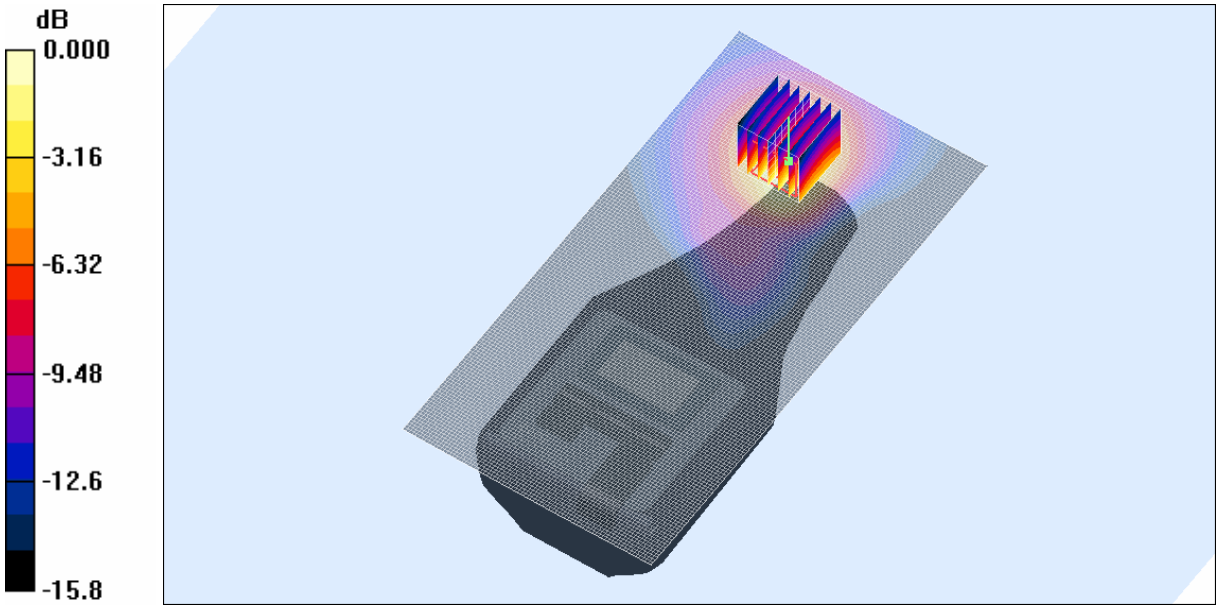


Test Date: 11 January 2010
File Name: M100102 Body Worn Front Holster 1600 MHz (DAE442 Probe1377) 11-01-10.da4
DUT: Satamatics Personal Satelite Tracker; Type: SAT-232; Serial: B4TRF

* Communication System: 1600 MHz Satelite; Frequency: 1643.5 MHz; Duty Cycle: 1:10
* Medium parameters used: f = 1644 MHz; σ = 1.44 mho/m; ε_r = 51.6; ρ = 1000 kg/m^3
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(5.1, 5.1, 5.1)
- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 12800 Test/Area Scan (161x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.467 mW/g

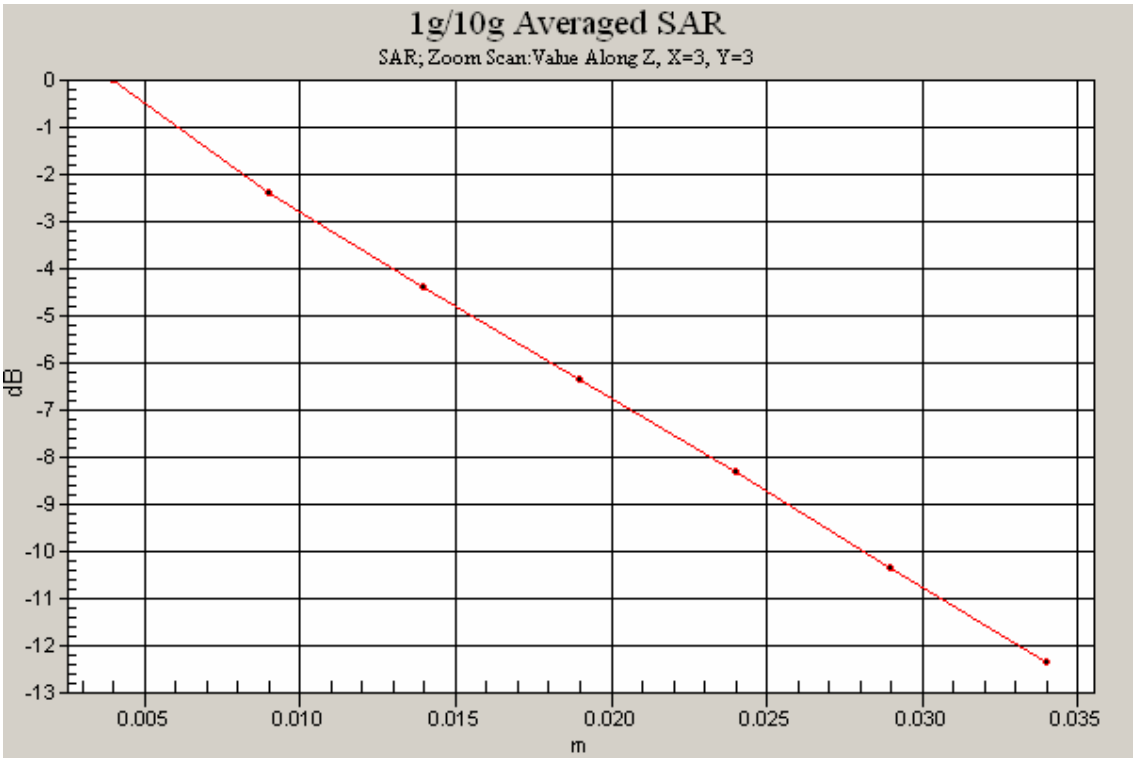
Channel 12800 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.54 V/m; Power Drift = 0.384 dB
Peak SAR (extrapolated) = 0.821 W/kg
SAR(1 g) = 0.424 mW/g; SAR(10 g) = 0.236 mW/g
Maximum value of SAR (measured) = 0.461 mW/g



0 dB = 0.461mW/g

SAR MEASUREMENT PLOT 3

Ambient Temperature	**20.0 Degrees Celsius**
Liquid Temperature	**19.8 Degrees Celsius**
Humidity	**63.0 %**

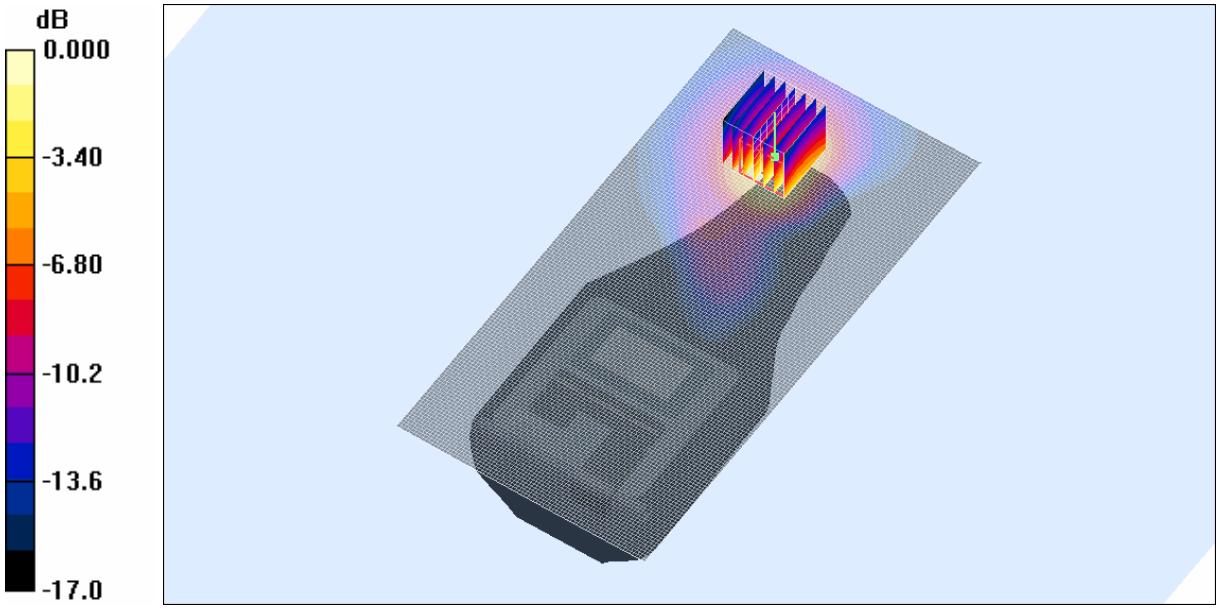


Test Date: 11 January 2010
File Name: M100102 Body Worn Front 1600 MHz (DAE442 Probe1377) 11-01-10.da4
DUT: Satamatics Personal Satelite Tracker; Type: SAT-232; Serial: B4TRF

* Communication System: 1600 MHz Satelite; Frequency: 1626.5025 MHz; Duty Cycle: 1:10
* Medium parameters used: f = 1626 MHz; σ = 1.43 mho/m; ε_r = 51.6; ρ = 1000 kg/m^3
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(5.1, 5.1, 5.1)
- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 6000 Test/Area Scan (161x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.823 mW/g

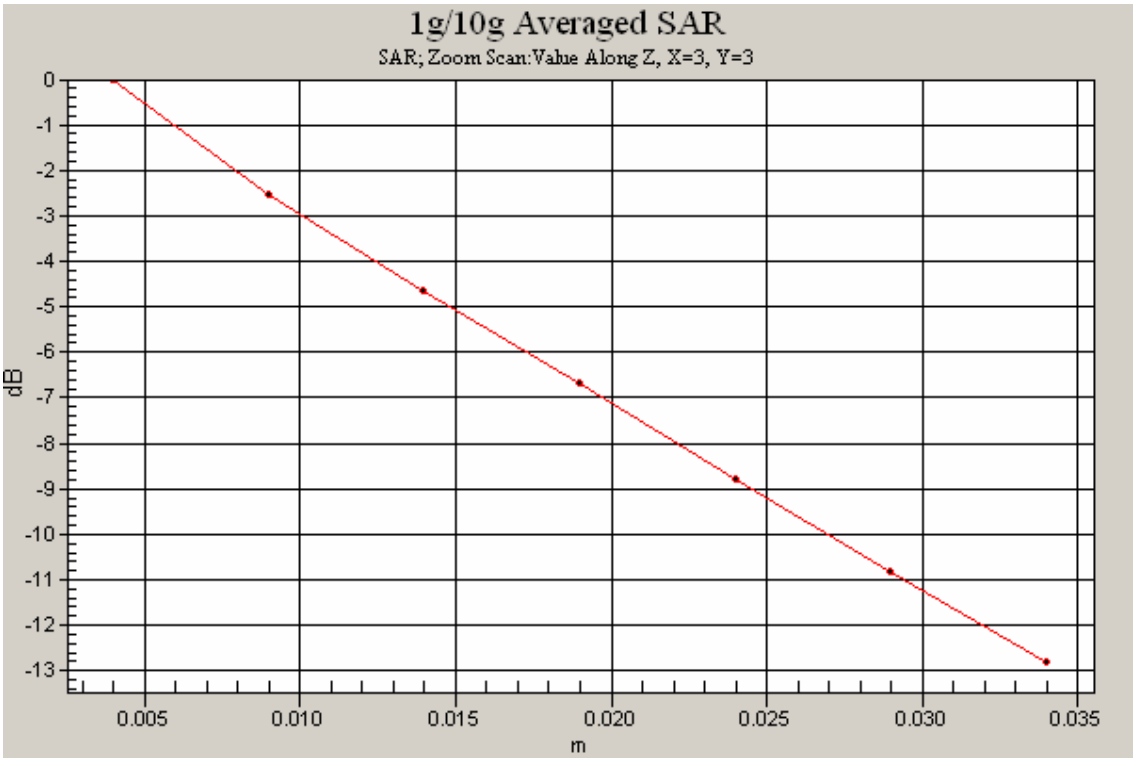
Channel 6000 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.92 V/m; Power Drift = 0.017 dB
Peak SAR (extrapolated) = 1.52 W/kg
SAR(1 g) = 0.756 mW/g; SAR(10 g) = 0.397 mW/g
Maximum value of SAR (measured) = 0.828 mW/g



0 dB = 0.828mW/g

SAR MEASUREMENT PLOT 4

Ambient Temperature	**20.0 Degrees Celsius**
Liquid Temperature	**19.8 Degrees Celsius**
Humidity	**63.0 %**

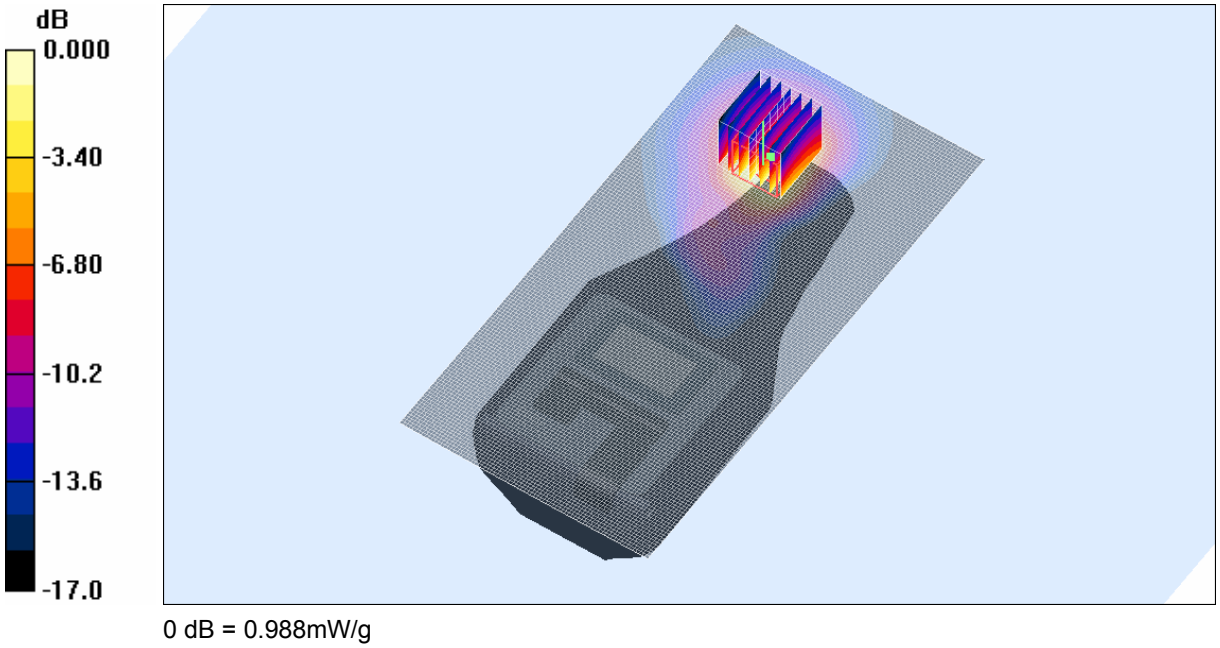


Test Date: 11 January 2010
File Name: M100102 Body Worn Front 1600 MHz (DAE442 Probe1377) 11-01-10.da4
DUT: Satamatics Personal Satelite Tracker; Type: SAT-232; Serial: B4TRF

* Communication System: 1600 MHz Satelite; Frequency: 1643.5 MHz; Duty Cycle: 1:10
* Medium parameters used: f = 1644 MHz; σ = 1.44 mho/m; ε_r = 51.6; ρ = 1000 kg/m^3
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(5.1, 5.1, 5.1)
- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 12800 Test 2/Area Scan (161x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.979 mW/g

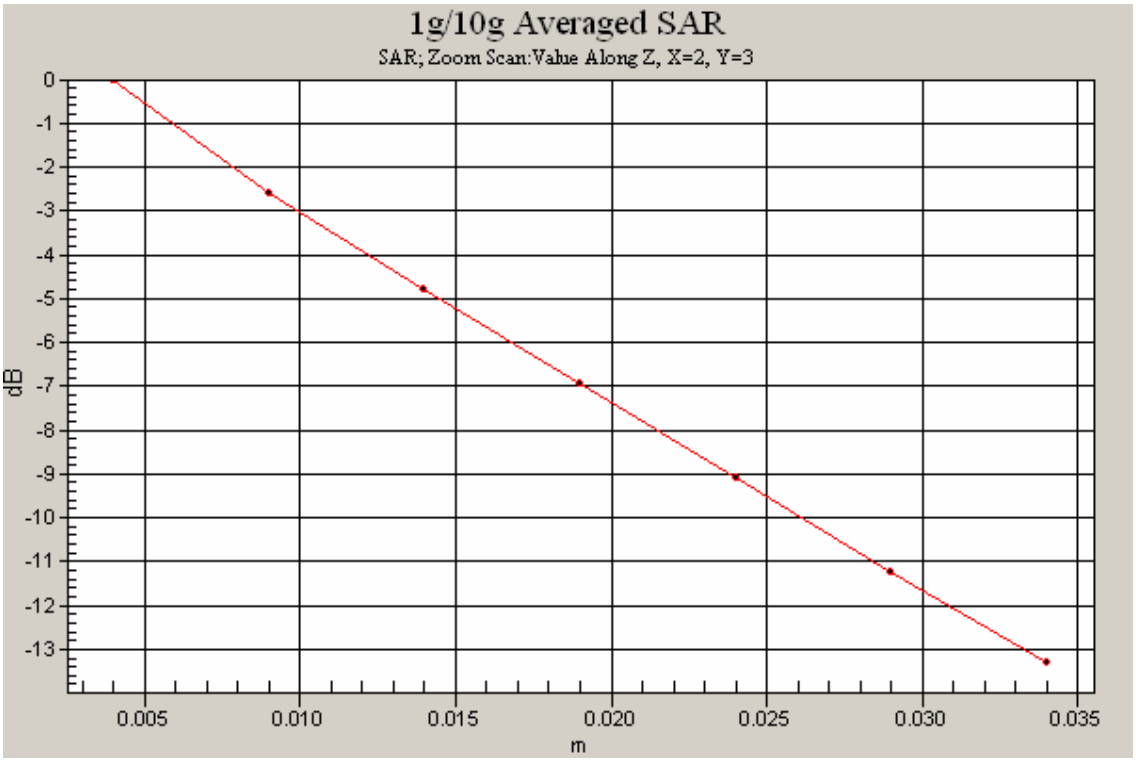
Channel 12800 Test 2/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.9 V/m; Power Drift = -0.169 dB
Peak SAR (extrapolated) = 1.87 W/kg
SAR(1 g) = 0.905 mW/g; SAR(10 g) = 0.466 mW/g
Maximum value of SAR (measured) = 0.988 mW/g



0 dB = 0.988mW/g

SAR MEASUREMENT PLOT 5

Ambient Temperature	**20.0 Degrees Celsius**
Liquid Temperature	**19.8 Degrees Celsius**
Humidity	**63.0 %**

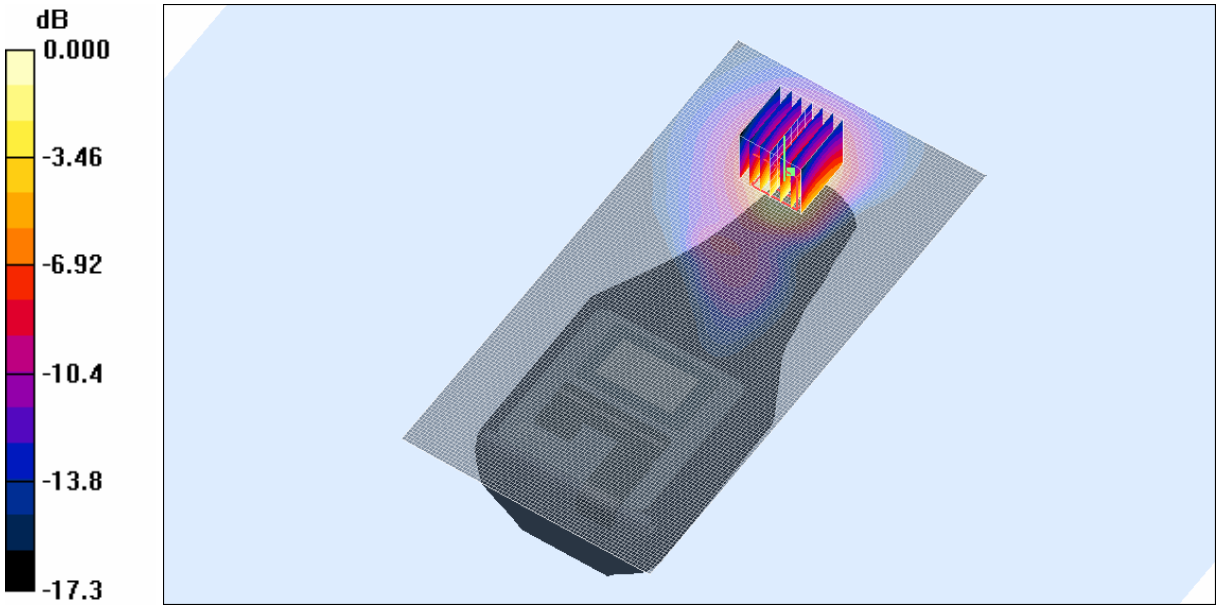


Test Date: 11 January 2010
File Name: M100102 Body Worn Front 1600 MHz (DAE442 Probe1377) 11-01-10.da4
DUT: Satamatics Personal Satelite Tracker; Type: SAT-232; Serial: B4TRF

* Communication System: 1600 MHz Satelite; Frequency: 1660.4975 MHz; Duty Cycle: 1:10
* Medium parameters used: f = 1660 MHz; σ = 1.45 mho/m; ε_r = 51.5; ρ = 1000 kg/m^3
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(5.1, 5.1, 5.1)
- Phantom: Flat Phantom 10.1; Serial: P 10.1; Phantom section: Flat 2.2 Section

Channel 19600 Test/Area Scan (161x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.805 mW/g

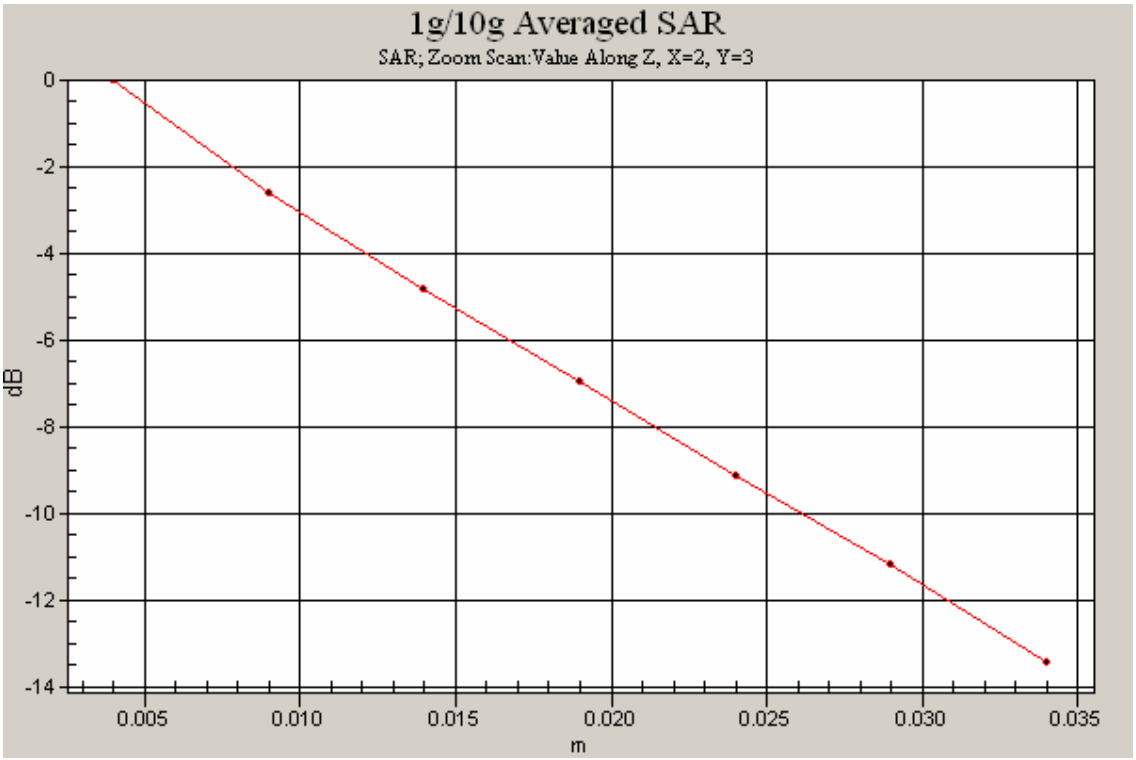
Channel 19600 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.77 V/m; Power Drift = -0.446 dB
Peak SAR (extrapolated) = 1.55 W/kg
SAR(1 g) = 0.749 mW/g; SAR(10 g) = 0.384 mW/g
Maximum value of SAR (measured) = 0.816 mW/g



0 dB = 0.816mW/g

SAR MEASUREMENT PLOT 6

Ambient Temperature	**20.0 Degrees Celsius**
Liquid Temperature	**19.8 Degrees Celsius**
Humidity	**63.0 %**

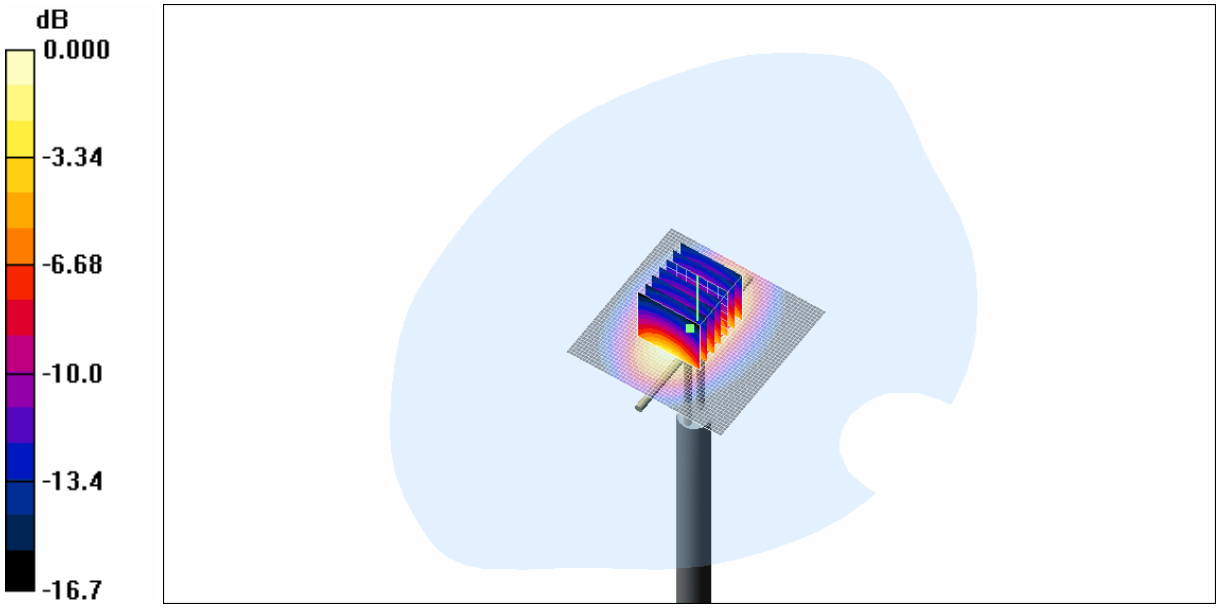


Test Date: 11 January 2010
File Name: Validation 1640 MHz (DAE442 Probe1377) 11-01-10.da4
DUT: Dipole 1640 MHz; Type: DV1640V2; Serial: 314

* Communication System: CW 1640 MHz; Frequency: 1640 MHz; Duty Cycle: 1:1
* Medium parameters used: f = 1640 MHz; σ = 1.32 mho/m; ε_r = 40.3; ρ = 1000 kg/m^3
- Electronics: DAE3 Sn442; Probe: ET3DV6 - SN1377; ConvF(5.5, 5.5, 5.5)
- Phantom: SAM 22; Serial: 1260; Phantom section: Flat Section

Channel 1 Test/Area Scan (51x51x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 10.4 mW/g

Channel 1 Test/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 84.9 V/m; Power Drift = 0.043 dB
Peak SAR (extrapolated) = 18.0 W/kg
SAR(1 g) = 8.69 mW/g; SAR(10 g) = 4.53 mW/g
Maximum value of SAR (measured) = 9.55 mW/g



0 dB = 9.55mW/g

SAR MEASUREMENT PLOT 7

Ambient Temperature	**20.0 Degrees Celsius**
Liquid Temperature	**19.8 Degrees Celsius**
Humidity	**63.0 %**