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Dosimetric Assessment
Test Report

For the

Guard Trax 2.0

Tested and Evaluated In Accordance With
FCC OET 65 Supplement C: 01-01

Prepared for

Guardtrax LLC
11 Commerce Drive
Cranford, NJ 07016

Engineering Statement: The measurements shown in this report were made in accordance with the procedures specified in Supplement C to OET Bulletin 65 of the Federal Communications Commission (FCC) Guidelines [FCC 2001] for uncontrolled exposure. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment evaluated is capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-1992.

SAR Evaluation

Applicant Name and Address: **Guardtrax LLC**
11 Commerce Drive
Cranford, NJ 07016

Test Location: **MET Laboratories, Inc.**
3162 Belick Street
Santa Clara, CA 95054
USA

<table>
<tr><th>EUT:</th><td colspan="4">Guard Trax 2.0</td></tr>
<tr><th>Date of Receipt:</th><td colspan="4">April 20, 2011</td></tr>
<tr><th>Device Category:</th><td colspan="4">Portable</td></tr>
<tr><th>RF exposure environment:</th><td colspan="4">General Population / Uncontrolled Exposure</td></tr>
<tr><th>RF exposure category:</th><td colspan="4">Portable</td></tr>
<tr><th>Production/prototype:</th><td colspan="4">Production</td></tr>
<tr><th>Antenna:</th><td colspan="4">Internal</td></tr>
<tr><th>Modulations Tested:</th><td colspan="4">GSM / GPRS</td></tr>
<tr><th>Duty Cycle:</th><td colspan="4">1:8.3 / 1:4</td></tr>
<tr><th>TX Range:</th><td colspan="2">824.2 – 848.8 MHz</td><td colspan="2">1850.2 – 1909.8 MHz</td></tr>
<tr><th rowspan="5">Frequencies Tested:</th><td></td><td>Frequency</td><td>Channel</td><td>SAR 1g (mW/g)</td></tr>
<tr><td>Head</td><td>836.4 MHz</td><td>190</td><td>0.314</td></tr>
<tr><td>Body</td><td>836.4 MHz</td><td>190</td><td>0.182</td></tr>
<tr><td>Head</td><td>1880.0 MHz</td><td>661</td><td>0.389</td></tr>
<tr><td>Body</td><td>1880.0 MHz</td><td>661</td><td>0.191</td></tr>
</table>

Shawn McMillen
SAR Compliance Manager

Report Status Sheet

Revision	Report Date	Reason for Revision
∅	February 18, 2011	Initial Issue.
1	March 30, 2011	Revised to reflect new company name.
2	April 14, 2011	Revised to reflect engineer corrections.
3	April 20, 2011	Revised to reflect engineer corrections.

Table of Contents

1 INTRODUCTION

The intent of this measurement report is to demonstrate that the Intergis Guard Trax 2.0 described within this report complies with the Specific Absorption Rate (SAR) RF exposure requirements specified in ANSI/IEEE Std. C95.1-1992 and FCC 47 CFR §2.1093 for the General Population/ Uncontrolled Exposure environment when used with a holster for body worn configuration. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 were employed.

A description of the device under test, device operating configuration and test conditions, measurement and site description, methodology and procedures used in the evaluation, equipment used, detailed summary of the test results and the various provisions of the rules are included in this dosimetric assessment test report.

2 SAR DEFINITION

Specific Absorption Rate (SAR) is defined as the time derivative (rate) of the incremental energy (*dU*) absorbed by (dissipated in) an incremental mass (*dm*) contained in a volume element (*dV*) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Fig. 1.1).

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho dv}\right)$$

Figure 1.1
SAR Mathematical Equation

SAR is expressed in units of Watts per Kilogram (W/kg).

$$\text{SAR} = \sigma E^2 / \rho$$

where:

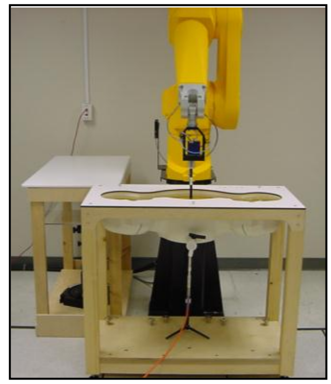
σ - conductivity of the tissue - simulant material (S/m)
ρ - mass density of the tissue - simulant material (kg/m3)
E - Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relations to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.

3 DESCRIPTION OF TEST PLATFORMS

Applicant:	Guardtrax LLC
Description of EUT:	The Guard Trax 2.0 is a hand held tracking device designed for the security industry. The Guard Trax 2.0 incorporates GPS/ GSM/ RFID technology.
Model Number:	GT-900100
Serial Number:	358281007063385
Battery Type(s) Tested:	Intergis Li-ion Pro Cell 3.7V 2000 mAh
Device Class:	Class C
Antenna Type(s) Tested:	Internal
Body Worn Accessories:	Holster
Tested Modes and Bands of Operation:	GSM 850/1900, GPRS 850/1900
Maximum Duty Cycle Tested:	1:8.3 , 1:4
Tested Frequency:	836.4 MHz, 1880 MHz
Application Type:	Certification
Exposure Category:	General Population / Uncontrolled Exposure
FCC Rule Part(s):	FCC 47 CFR §2.1093,
Standards:	IEEE Std. 1528-2003, FCC OET Bulletin 65, Supplement C, Edition 01-01

SAR MEASUREMENT SYSTEM



MET Laboratories, Inc SAR measurement facility utilizes the DASY4 Professional Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland for performing SAR compliance tests. 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 brain 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). The Cell controller system contain 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 uses its own controller with a built in VME-bus computer.

4 MEASUREMENT SUMMARY

Guard Trax 2.0 BODY-WORN SAR MEASUREMENT RESULTS (850MHz) Band									
Freq (MHz)	**Chan**	**Mode Test ed**	**Battery Type**	**Body-Worn Accessories**	**Antenna Position**	**EUT Test Position**	**Phantom Section**	**Host Sep. Dist. (cm)**	**Measured SAR 1g (W/kg)**
836.4	Mid	GPRS	Li-Ion	Silicon Boot w/ Holster	Internal	Front Phone Towards Body	Planar	1.2	0.182
836.4	Mid	GPRS	Li-Ion	Silicon Boot w/ Holster	Internal	Front Phone Away Body	Planar	1.2	0.150
ANSI/IEEE C95.1 1992 – SAFETY LIMIT: 1.6 W/kg (averaged over 1 gram) Spatial Peak – General Population / Uncontrolled Exposure									

Measured Mixture Type	835 MHz Body		**Date Tested**	January 21, 2011
Dielectric Constant εr	**IEEE Target**	**Measured**	**Duty Cycle**	1:4
	55.2	54.99	**Ambient Temperature (C)**	24.0
Conductivity σ (mho/m)	**IEEE Target**	**Measured**	**Fluid Temperature (C)**	22.3
	0.97	0.974	**Fluid Depth**	≥15cm

Guard Trax 2.0 BODY-WORN SAR MEASUREMENT RESULTS (1900MHz) Band									
Freq (MHz)	**Chan**	**Mode Test ed**	**Battery Type**	**Body-Worn Accessories**	**Antenna Position**	**EUT Test Position**	**Phantom Section**	**Host Sep. Dist. (cm)**	**Measured SAR 1g (W/kg)**
1880.0	Mid	GPRS	Li-Ion	Silicon Boot w/ Holster	Internal	Front Phone Towards Body	Planar	1.2	0.191
1880.0	Mid	GPRS	Li-Ion	Silicon Boot w/ Holster	Internal	Front Phone Away Body	Planar	1.2	0.156
ANSI/IEEE C95.1 1992 – SAFETY LIMIT: 1.6 W/kg (averaged over 1 gram) Spatial Peak – General Population / Uncontrolled Exposure									

Measured Mixture Type	1900 MHz Body		**Date Tested**	January 21, 2011
Dielectric Constant εr	**IEEE Target**	**Measured**	**Duty Cycle**	1:4
	53.3	51.0	**Ambient Temperature (C)**	24.0
Conductivity σ (mho/m)	**IEEE Target**	**Measured**	**Fluid Temperature (C)**	22.3
	1.52	1.57	**Fluid Depth**	≥15cm

Guard Trax 2.0 HEAD SAR MEASUREMENT RESULTS (850MHz) Band								
Freq (MHz)	**Chan**	**Mode Test ed**	**Battery Type**	**Accessories**	**Antenna Position**	**EUT Test Position**	**Phantom Section**	**Measured SAR 1g (W/kg)**
836.4	Mid	GSM	Li-Ion	Silicon Boot	Internal	Touch	Left Head	0.314
836.4	Mid	GSM	Li-Ion	Silicon Boot	Internal	Tilt	Left Head	0.187
836.4	Mid	GSM	Li-Ion	Silicon Boot	Internal	Touch	Right Head	0.271
836.4	Mid	GSM	Li-Ion	Silicon Boot	Internal	Tilt	Right Head	0.200
ANSI/IEEE C95.1 1992 – SAFETY LIMIT: 1.6 W/kg (averaged over 1 gram) Spatial Peak – General Population / Uncontrolled Exposure								

Measured Mixture Type	835 MHz Head		**Date Tested**	January 21, 2011
Dielectric Constant εr	**IEEE Target**	**Measured**	**Duty Cycle**	1:8.3
	41.5	39.89	**Ambient Temperature (C)**	24.0
Conductivity σ (mho/m)	**IEEE Target**	**Measured**	**Fluid Temperature (C)**	22.3
	0.90	0.923	**Fluid Depth**	≥15cm

Guard Trax 2.0 HEAD SAR MEASUREMENT RESULTS (1900MHz) Band								
Freq (MHz)	**Chan**	**Mode Test ed**	**Battery Type**	**Accessories**	**Antenna Position**	**EUT Test Position**	**Phantom Section**	**Measured SAR 1g (W/kg)**
1880.0	Mid	GSM	Li-Ion	Silicon Boot	Internal	Touch	Left Head	0.389
1880.0	Mid	GSM	Li-Ion	Silicon Boot	Internal	Tilt	Left Head	0.086
1880.0	Mid	GSM	Li-Ion	Silicon Boot	Internal	Touch	Right Head	0.315
1880.0	Mid	GSM	Li-Ion	Silicon Boot	Internal	Tilt	Right Head	0.104
ANSI/IEEE C95.1 1992 – SAFETY LIMIT: 1.6 W/kg (averaged over 1 gram) Spatial Peak – General Population / Uncontrolled Exposure								

Measured Mixture Type	1900 MHz Head		**Date Tested**	January 21, 2011
Dielectric Constant εr	**IEEE Target**	**Measured**	**Duty Cycle**	1:8.3
	40.0	39.85	**Ambient Temperature (C)**	24.0
Conductivity σ (mho/m)	**IEEE Target**	**Measured**	**Fluid Temperature (C)**	22.3
	1.40	1.45	**Fluid Depth**	≥15cm

DETAILS OF SAR EVALUATION

The Intergis Guard Trax 2.0 was determined to be compliant for localized Specific Absorption Rate based on the test provisions and conditions described below. Detailed test setup photographs are shown in the Appendix.

1. The sole purpose of this SAR evaluation was to determine if the Intergis Guard Trax 2.0 is compliant within the specified limits. The Guard Trax 2.0 was evaluated with a silicon boot and a holster (for body evaluation) as prescribed by the Guard Trax 2.0 installation manual.

2. The EUT was tested for both head and body SAR. For the head SAR, both touch and tilt positions were measured on the left and right side of the SAM phantom. The EUT was tested for body warn configuration with a leather holster. Note, a silicon boot was used for all testing.

3. The EUT was placed into test mode using a Rohde & Schwarz base station simulator. The power level control was set to maximum.

4. The SAR evaluations were performed with a fully charged battery.

5. The ambient and fluid temperatures were measured prior to each the SAR evaluation.

6. The dielectric parameters of the simulated body and head fluids were measured prior to the evaluation using an 85070D Dielectric Probe Kit and an 8722D Network Analyzer.

7. The output power of the Intergis Guard Trax 2.0 was not available for measurement. With a fully charged battery, it is assumed that the output power is set to maximum during the evaluation. For power measurements, please refer to the Intergis Guard Trax 2.0 FCC report for EIRP measurements.

8. The output power of the Intergis Guard Trax 2.0 was not available for measurement. An EIRP measurement was performed prior to SAR testing with a fully charged battery; it is assumed that the output power is set to maximum during the evaluation. For power measurements, please refer to the Intergis Guard Trax 2.0 FCC report for EIRP measurements.

5 EVALUATION PROCEDURES

The evaluation was performed in the applicable area of the phantom depending on the type of device being tested.

(i) 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 check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 15mm x 15mm.

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:

Based on the area scan, a 32mm x 32mm x 34mm (7x7x7 data points) zoom scan was assessed at the position where the greatest V/m was detected. The data at the surface was extrapolated since the distance from the probes sensors to the surface is 3.9cm. A least squares fourth-order polynomial was used to generate points between the probe detector and the inner surface of the phantom.

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).

Z-Scan was determined as follows:

The Z-scan measures points along a vertical straight line. The line runs along a line normal to the inner surface of the phantom surface.

6 DATA EVALUATION PROCEDURES

The DASY4 post processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe Parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion Factor	$ConvF_i$
	- Dipole Compression Point	dcp_i
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used. The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC - transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}$$

with V_i = Compensated signal of channel i (i = x, y, z)
U_i = Input signal of channel i (i = x, y, z)
cf = Crest factor of exciting field (DASY parameter)
dcp_i = Diode compression point (DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

$$\mathrm{E-fieldprobes:} \qquad E_i = \sqrt{\frac{V_1}{Norm_i \cdot ConvF}}$$

$$\mathrm{H-fieldprobes:} \qquad H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$$

with V_i = Compensated signal of channel i (i = x, y, z)
$Norm_i$ = Sensor sensitivity of channel i (i = x, y, z)
$\mu V/(V/m)^2$ for E-field probes
$ConvF$ = Sensitivity enhancement in solution
a_{ij} = Sensor sensitivity factors for H-field probes
f = Carrier frequency (GHz)
E_i = Electric field strength of channel i in V/m
H_i = Magnetic field strength of channel i in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

with SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in [mho/m] or [Siemens/m]
ρ = equivalent tissue density in g/cm3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

The power flow density is calculated assuming the excitation field as a free space field.

$$P_{pwe} = \frac{E_{tot}^2}{3770} \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with P_{pwe} = Equivalent power density of a plane wave in mW/cm2
E_{tot} = total electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

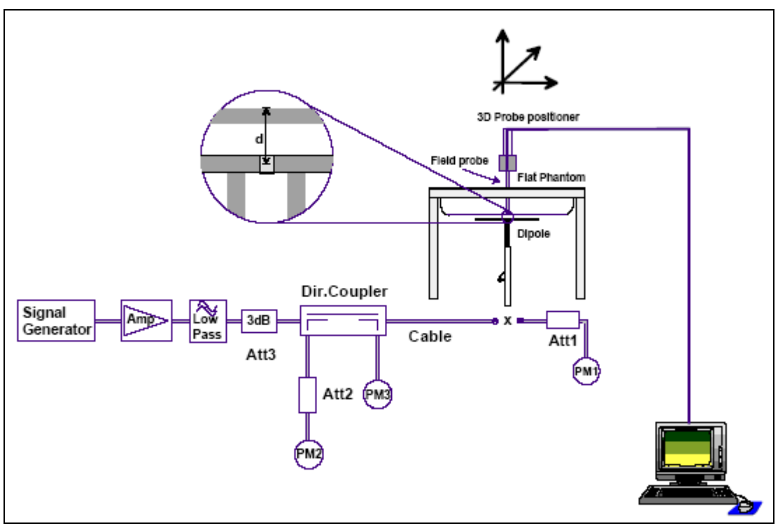
7 SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed in the planar section of the SAM phantom with an 835MHz dipole. The dielectric parameters of the simulated body fluids were measured prior to the system performance check using an 85070D Dielectric Probe Kit and an 8722D Network Analyzer. A forward power of 250mW was applied to the dipole and the system was verified to a tolerance of ±5%.

Test Date	835MHz Equivalent Tissue	SAR 1g (W/kg)		Permittivity Constant εr		Conductivity σ (mho/m)		Ambient Temp. (C)	Fluid Temp. (C)	Fluid Depth (cm)
		Calibrated Target	Measured	IEEE Target	Measured	IEEE Target	Measured			
1/21/2011	Body	2.53±5%	2.49	55.2 ±5%	54.99	0.97± 5%	0.973	24.0	22.3	≥15
1/21/2011	Head	2.42±5%	2.37	41.5 ±5%	39.89	0.90 ± 5%	0.923	24.0	22.3	≥15

Test Date	1800MHz Equivalent Tissue	SAR 1g (W/kg)		Permittivity Constant εr		Conductivity σ (mho/m)		Ambient Temp. (C)	Fluid Temp. (C)	Fluid Depth (cm)
		Calibrated Target	Measured	IEEE Target	Measured	IEEE Target	Measured			
1/21/2011	Body	9.51±5%	9.51	53.3 ±5%	51.0	1.52 ±5%	1.57	24.0	22.3	≥15
1/21/2011	Head	9.44±5%	8.98	40.0 ±5%	39.85	1.40 ±5%	1.45	24.0	22.3	≥15

Note: The ambient and fluid temperatures were measured prior to the fluid parameter check and the system performance check. The temperatures listed in the table above were consistent for all measurement periods.



8 SIMULATED EQUIVALENT TISSUES

Simulated Tissue Mixture				
Ingredient	**835MHz Head**	**835MHz Body**	**1900MHz Head**	**1900MHz Body**
Water	40.9%	53.1%	52.6%	68.8%
DGMBE	N/A	N/A	47.0%	30.8%
Salt	1.45%	0.9%	0.40%	0.4%
HEC	1%	1%	N/A	N/A
Sugar	56.4%	44.9%	N/A	N/A
Dowicil 75	0.25%	0.1%	N/A	N/A

9 SAR SAFETY LIMITS

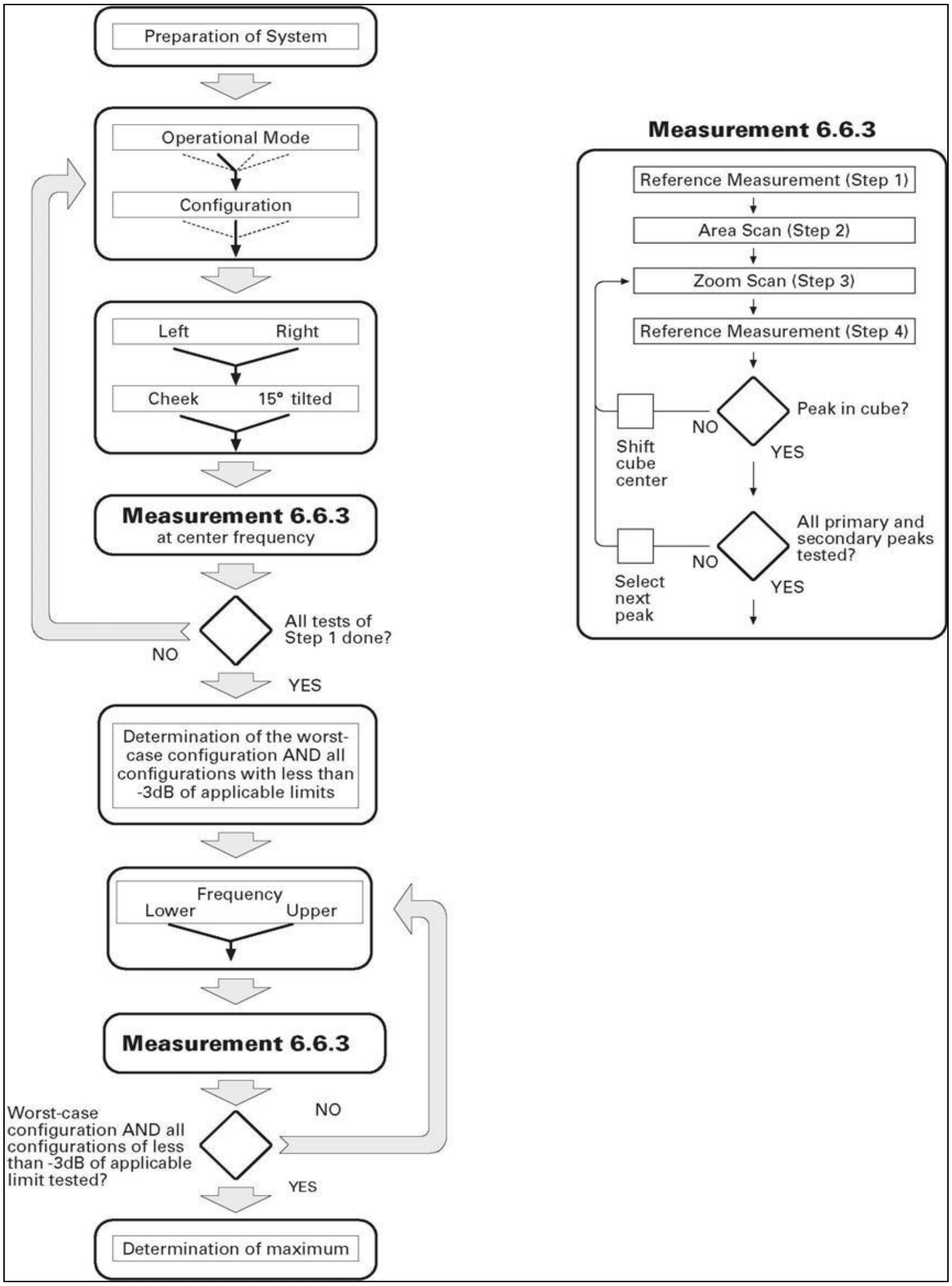
EXPOSURE LIMITS	SAR (W/kg)	
	(General Population / Uncontrolled Exposure Environment)	(Occupational / Controlled Exposure Environment)
Spatial Average (averaged over the whole body)	0.08	0.4
Spatial Peak (averaged over any 1g of tissue)	1.60	8.0
Spatial Peak (hands/wrists/feet/ankles averaged over 10g)	4.0	20.0

Notes:

1. Uncontrolled exposure environments are locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.

2. Controlled exposure environments are locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

10 FLOW CHART OF THE RECOMMENDED PRACTICES AND PROCEDURES



11 DEFINITION OF REFERENCE POINTS

11.1. EAR REFERENCE POINT

Figure 12.1 shows the front, back and side views of the SAM Twin Phantom. The point M is the reference point for the center of the mouth, LE is the left ear reference point (ERP), and RE is the right ERP. The ERPs are 15mm posterior to the entrance to the ear canal (EEC) along the B-M line (Back-Mouth), as shown in Figure 12.2. The plane passing through the two ear canals and M is defined as the Reference Plane. The line N-F (Neck-Front) is perpendicular to the reference plane and passing through the RE (or LE) is called the Reference Pivoting. Line B-M is perpendicular to the N-F line. Both N-F and B-M lines are marked on the external phantom shell to facilitate handset positioning.

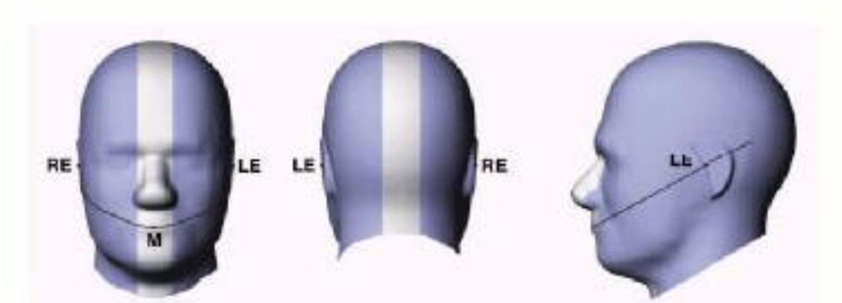


Figure 12.1
Front, back and side view of SAM Twin Phantom

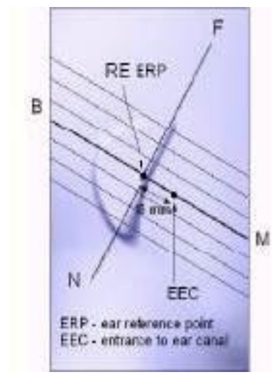


Figure 12.2
Side view of ERPs

11.2. HANDSET REFERENCE POINTS

Two imaginary lines on the handset were established: the vertical centerline and the horizontal line. The test device was placed in a normal operating position with the test device reference point located along the vertical centerline on the front of the device aligned to the ear reference point (See Fig. 12.3). The test device reference point was than located at the same level as the center of the ear reference point. The test device was positioned so that the vertical centerline was bisecting the front surface of the handset at it s top and bottom edges, positioning the ear reference point on the outer surface of the both the left and right head phantoms on the ear reference point.

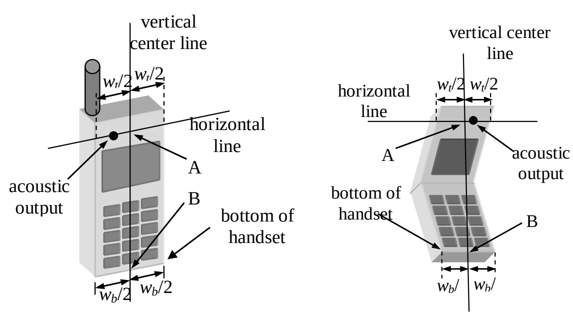


Figure 12.3
Handset Vertical Center & Horizontal Line Reference Points

11.3. POSITIONING FOR CHEEK/TOUCH

1. The test device was positioned with the handset close to the surface of the phantom such that point A is on the (virtual) extension of the line passing through points RE and LE on the phantom (see Figure 12.4), such that the plane defined by the vertical center line and the horizontal line of the phone is approximately parallel to the sagittal plane of the phantom.

2. The handset was translated towards the phantom along the line passing through RE & LE until the handset touches the ear.

3. While maintaining the handset in this plane, the handset was rotated around the LE-RE line until the vertical centerline was in the plane normal to MB-NF including the line MB (reference plane).

4. The phone was hen rotated around the vertical centerline until the phone (horizontal line) was symmetrical was respect to the line NF.

5. While maintaining the vertical centerline in the reference plane, keeping point A on the line passing through RE and LE, and maintaining the phone contact with the ear, the handset was rotated about the line NF until any point on the handset made contact with a phantom point below the ear (cheek). See Figure 12.5)

Figure 12.4
Front, Side and Top View of Cheek/Touch Position

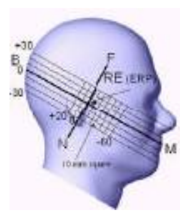


Figure 12.5
Side view with relevant markings

11.4. POSITIONING FOR EAR/15 DEGREE TILE

With the test device aligned in the Cheek/Touch Position:

1. While maintaining the orientation of the phone, the phone was retracted parallel to the reference plane far enough to enable a rotation of the phone by 15 degree.

2. The phone was then rotated around the horizontal line by 15 degree.

3. While maintaining the orientation of the phone, the phone was moved parallel to the reference plane until any part of the phone touches the head. (In this position, point A was located on the line RE-LE). The tilted position is obtained when the contact is on the pinna. If the contact was at any location other than the pinna, the angle of the phone would then be reduced. The tilted position was obtained when any part of the phone was in contact of the ear as well as a second part of the phone was in contact with the head (see Figure 12.6).

Figure 12.6
Front, Side and Top View of Ear/15 Tilt Position

12 ROBOT SYSTEM SPECIFICATIONS

12.1. SPECIFICATION

Positioner:

Robot:	Staubli Unimation Corp. Robot Model: RX90
Repeatability:	0.02 mm
No. of axis:	6

12.2. DATA ACQUISITION ELECTRONIC (DAE) SYSTEM:

Cell Controller

Processor:	Compaq Evo Clock Speed:2.4 GHz Operating System: Windows XP Professional

Data Converter

Features:	Signal Amplifier, multiplexer, A/D converter, and control logic
Software:	DASY4 software
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:	ET3DV6
Serial No.:	1793
Construction:	Triangular core fiber optic detection system
Frequency:	10 MHz to 6 GHz
Linearity:	± 0.2 dB (30 MHz to 3 GHz)

EX-Probe

Model:	EX3DV3
Serial No.	3511
Construction:	Triangular core
Frequency:	10 MHz to > 6 GHz
Linearity:	± 0.2 dB (30 MHz to 3 GHz)

12.3. PHANTOM(S):

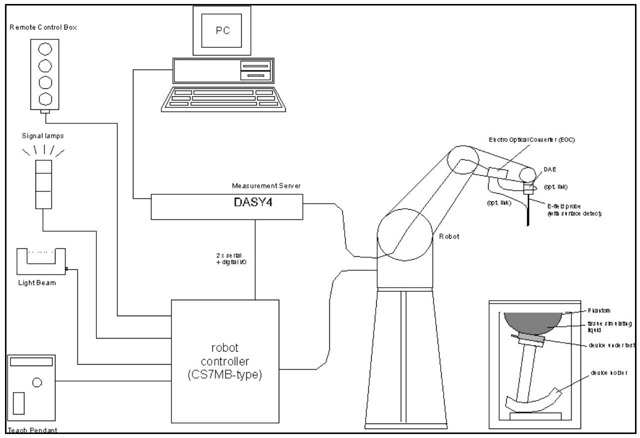
Validation & Evaluation Phantom

Type:	SAM V4.0C
Shell Material:	Fiberglass
Thickness:	2.0 ±0.1 mm
Volume:	Approx. 20 liters

12.4. ROBOT SPECIFICATIONS (ET3DV6)

Construction:	Symmetrical design with triangular core Built-in optical fiber for surface detection system Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g. glycolether)
Calibration:	Basic Broadband calibration in air from 10 MHz to 3 GHz
Frequency:	10 MHz to 3 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity:	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)
Dynamic Range:	5 µ W/g to > 100 mW/g; Linearity: ± 0.2 dB
Surface Detection:	± 0.2 mm repeatability in air and clear liquid over diffuse reflecting surfaces
Dimensions:	Overall length: 330 mm (Tip: 16 mm) Tip diameter (including protective cover): 6.8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.7 mm
Application:	General dosimetric measurements up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

13 SAR MEASUREMENT SYSTEM



Measurement System Diagram

13.1. RX90BL ROBOT

The Stäubli RX90BL Robot is a standard high precision 6-axis robot with an arm extension for accommodating the data acquisition electronics (DAE).

13.2. ROBOT CONTROLLER

The CS7MB Robot Controller system drives the robot motors. The system consists of a power supply, robot controller, and remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.

13.3. LIGHT BEAM SWITCH

The Light Beam Switch (Probe alignment tool) allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured as well as the probe length and the horizontal probe offset. The software then corrects all movements, so that the robot coordinates are valid for the probe tip. The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

13.4. DATA ACQUISITION ELECTRONICS

The Data Acquisition Electronics consists of a highly sensitive electrometer grade preamplifier with auto-zeroing, a channel and gain switching multiplexer, a fast 16-bit A/D converter and a command decoder and control logic unit. Some of the task the DAE performs is signal amplification, signal multiplexing, A/D conversion, and offset measurements. The DAE also contains the mechanical probe-mounting device, which contains two different sensor systems for frontal and sideways probe contacts used for probe collision detection and mechanical surface detection for controlling the distance between the probe and the inner surface of the phantom shell. Transmission from the DAE to the measurement server, via the EOC, is through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

13.5. ELECTRO-OPTICAL CONVERTER (EOC)

The Electro-Optical Converter performs the conversion between the optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC connects to, and transfers data to, the DASY4 measurement server. The EOC also contains the fiber optical surface detection system for controlling the distance between the probe and the inner surface of the phantom shell.

13.6. MEASUREMENT SERVER

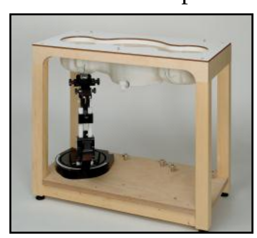
The Measurement Server performs time critical tasks such as signal filtering, all real-time data evaluation for field measurements and surface detection, controls robot movements, and handles safety operation. The PC-operating system cannot interfere with these time critical processes. A watchdog supervises all connections, and disconnection of any of the cables to the measurement server will automatically disarm the robot and disable all program-controlled robot movements.

13.7. DOSIMETRIC PROBE

Dosimetric Probe is a symmetrical design with triangular core that incorporates three 3 mm long dipoles arranged so that the overall response is close to isotropic. The probe sensors are covered by an outer protective shell, which is resistant to organic solvents i.e. glycol. The probe is equipped with an optical multi-fiber line, ending at the front of the probe tip, for optical surface detection. This line connects to the EOC box on the robot arm and provides automatic detection of the phantom surface. The optical surface detection works in transparent liquids and on diffuse reflecting surfaces with a repeatability of better than ±0.1mm.

13.8. SAM PHANTOM

The SAM (Specific Anthropomorphic Mannequin) twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm) integrated into a wooden table. The shape of the shell corresponds to the phantom defined by SCC34-SC2. It enables the dosimetric evaluation of left hand, right hand phone usage as well as body mounted usage at the flat phantom region. The flat section is also used for system validation and the length and width of the flat section are at least 0.75 λO and 0.6 λO respectively at frequencies of 824 MHz and above (λO = wavelength in air).



Reference markings on the phantom top allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. A white cover is provided to cover the phantom during off-periods preventing water evaporation and changes in the liquid parameters. Free space scans of devices on the cover are possible. The phantom is filled with a tissue simulating liquid to a depth of at least 15 cm at each ear reference point. The bottom plate of the wooden table contains three pair of bolts for locking the device holder.

13.9. PLANAR PHANTOM

The planar phantom is constructed of Plexiglas material with a 2.0 mm shell thickness for face-held and body-worn SAR evaluations of handheld radio transceivers. The planar phantom is mounted on the wooden table of the DASY4 system.

13.10. VALIDATION PLANAR PHANTOM

The validation planar phantom is constructed of Plexiglas material with a 6.0 mm shell thickness for system validations at 450MHz and below. The validation planar phantom is mounted on the wooden table of the DASY4 system.

13.11. DEVICE HOLDER

The device holder is designed to cope with the different measurement positions in the three sections of the SAM phantom given in the standard. It has two scales, one for device rotation (with respect to the body axis) and one for device inclination (with respect to the line between the ear openings). The rotation center for both scales is the ear opening, thus the device needs no repositioning when changing the angles. The plane between the ear openings and the mouth tip has a rotation angle of 65°.

The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity $\varepsilon = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

The dielectric properties of the liquid conform to all the tabulated values [2-5]. Liquids are prepared according to Annex A and dielectric properties are measured according to Annex B.

13.12. SYSTEM VALIDATION KITS

Power Capability: > 100 W (f < 1GHz); > 40 W (f > 1GHz)

Construction: Symmetrical dipole with l/4 balun Enables measurement of feed point impedance with NWA Matched for use near flat phantoms filled with brain simulating solutions Includes distance holder and tripod adaptor.

Frequency: 300, 450, 835, 1900, 2450 MHz

Return loss: >20 dB at specified validation position

Dimensions: 300 MHz Dipole: Length: 396mm; Overall Height:430 mm; Diameter: 6 mm
450 MHz Dipole: Length: 270 mm; Overall Height: 347 mm; Diameter: 6 mm
835 MHz Dipole: Length: 161 mm; Overall Height: 270 mm; Diameter: 3.6 mm
1900 MHz Dipole: Length: 68 mm; Overall Height: 219 mm; Diameter: 3.6 mm
2450 MHz Dipole: Length: 51.5 mm; Overall Height: 300 mm; Diameter: 3.6 mm

TEST EQUIPMENT LIST

Test Equipment	Serial Number	Calibration Date
DASY4 System Robot ET3DV6 DAE3 835MHz Dipole SAM Phantom V4.0C EUT Planar Phantom Validation Phantom 1900MHz Dipole	FO3/SX19A1/A/01 1793 584 4d110 N/A N/A N/A 1S2572	N/A April 2010 April 2010 November 2010 N/A N/A N/A November 2010
85070D Dielectric Probe Kt	N/A	N/A
Gigatronics 6061A Signal Generator	5130568	November 2010
HP E4418B Power Meter	GB40205140	October 2010
HP 8482A Power Sensor	2607A11286	May 2010
HP 8722D Vector Network Analyzer	3S36140188	July 2010
Anritsu ML2488A Power Meter	6K00001832	July 2010
Anritsu Power Sensor	030864	July 2010
Mini-Circuits Power Amplifier	D111903#8	N/A
Rohde & Schwarz CMU200	837727/070	Functional

MEASUREMENT UNCERTAINTIES

UNCERTAINTY ASSESSMENT FOR EUT

Error Description	Uncertainty Value ±%	Probability Distributio n	Divisor	c_i 1g	Standard Uncertain ty ±% (1g)	v_i or v_{eff}
Measurement System						
Probe calibration	± 4.8	Normal	1	1	± 4.8	∞
Axial isotropy of the probe	± 4.6	Rectangular	√3	(1-cp)1/2	± 1.9	∞
Spherical isotropy of the probe	± 9.7	Rectangular	√3	(cp)1/2	± 3.9	∞
Boundary effects	± 8.5	Rectangular	√3	1	± 4.8	∞
Probe linearity	± 4.5	Rectangular	√3	1	± 2.7	∞
Detection limit	± 0.9	Rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	Normal	1	1	± 1.0	∞
Response time	± 0.9	Rectangular	√3	1	± 0.5	∞
Integration time	± 1.2	Rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 0.54	Rectangular	√3	1	± 0.43	∞
Mech. constraints of robot	± 0.5	Rectangular	√3	1	± 0.2	∞
Probe positioning	± 2.7	Rectangular	√3	1	± 1.7	∞
Extrapolation & integration	± 4.0	Rectangular	√3	1	± 2.3	∞
Test Sample Related						
Device positioning	± 2.2	Normal	1	1	± 2.23	11
Device holder uncertainty	± 5.0	Normal	1	1	± 5.0	7
Power drift	± 5.0	Rectangular	√3		± 2.9	∞
Phantom and Setup						
Phantom uncertainty	± 4.0	Rectangular	√3	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid conductivity (measured)	± 5.0	Rectangular	√3	0.6	± 3.5./1.7	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					± 12.14/11.76	
Coverage Factor for 95%		Kp=2				
Expanded Uncertainty (k=2)					± 24.29/23.51	

Worst-case uncertainty for DASY4 assessed according to IEEE P1528.
The budget is valid for the frequency range 300MHz to 6GHz and represents a worst-case analysis.

UNCERTAINTY ASSESSMENT FOR SYSTEM VALIDATION

Error Description	Uncertainty Value ±%	Probability Distribution	Divisor	c_i 1g	Standard Uncertainty ±% (1g)	v_i or v_{eff}
Measurement System						
Probe calibration	± 4.8	Normal	1	1	± 4.8	∞
Axial isotropy of the probe	± 4.7	Rectangular	√3	(1-cp)1/2	± 2.7	∞
Spherical isotropy of the probe	± 9.6	Rectangular	√3	(cp)1/2	± 3.8	∞
Boundary effects	± 1.0	Rectangular	√3	1	± 0.0	∞
Probe linearity	± 4.7	Rectangular	√3	1	± 3.2	∞
Detection limit	± 1.0	Rectangular	√3	1	± 0.6	∞
Readout electronics	± 1.0	Normal	1	1	± 1.0	∞
Response time	± 0.8	Rectangular	√3	1	± 0.5	∞
Integration time	± 1.3	Rectangular	√3	1	± 0.8	∞
RF ambient conditions	± 3.0	Rectangular	√3	1	± 1.7	∞
Mech. constraints of robot	± 0.4	Rectangular	√3	1	± 0.2	∞
Probe positioning	± 1.4	Rectangular	√3	1	± 1.7	∞
Extrapolation & integration	± 4.0	Rectangular	√3	1	± 2.3	∞
Dipole						
Dipole Axis to liquid distance	± 2.0	Normal	1	1	± 1.2	11
Input Power	± 5.0	Normal	1	1	± 2.7	7
Phantom and Setup						
Phantom uncertainty	± 4.0	Rectangular	√3	1	± 2.3	∞
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid conductivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Liquid permittivity (measured)	± 5.0	Rectangular	√3	0.6	± 1.7	∞
Combined Standard Uncertainty					± 9.8	
Coverage Factor for 95%		Kp=2				
Expanded Uncertainty (k=2)					± 19.7	

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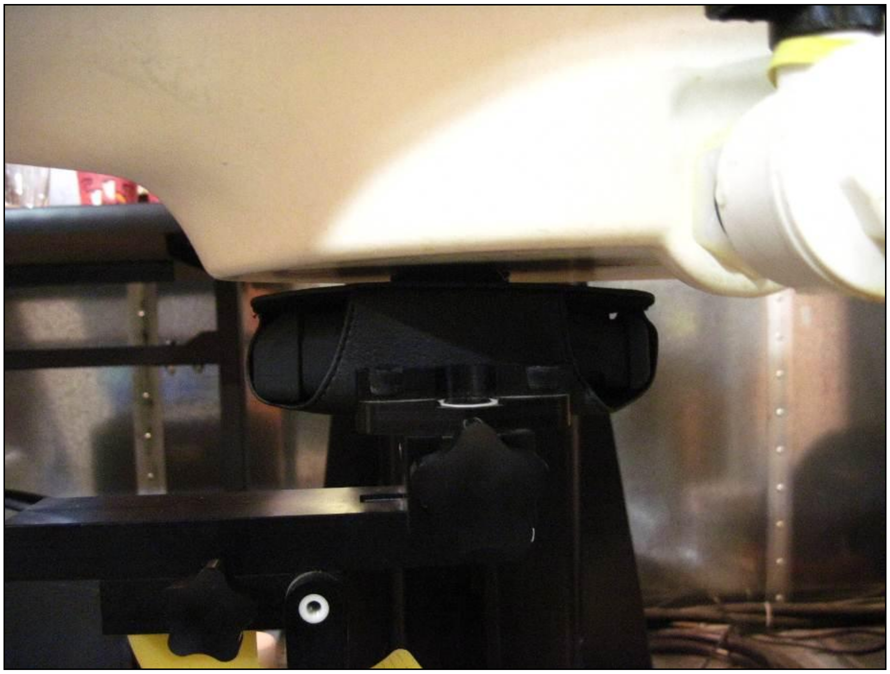
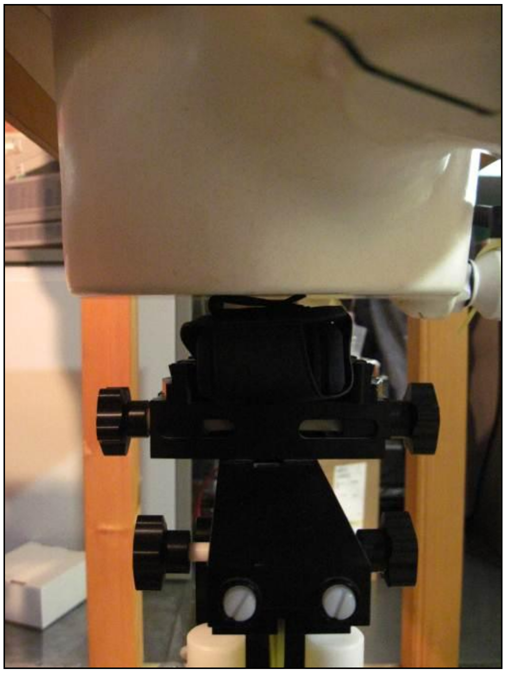
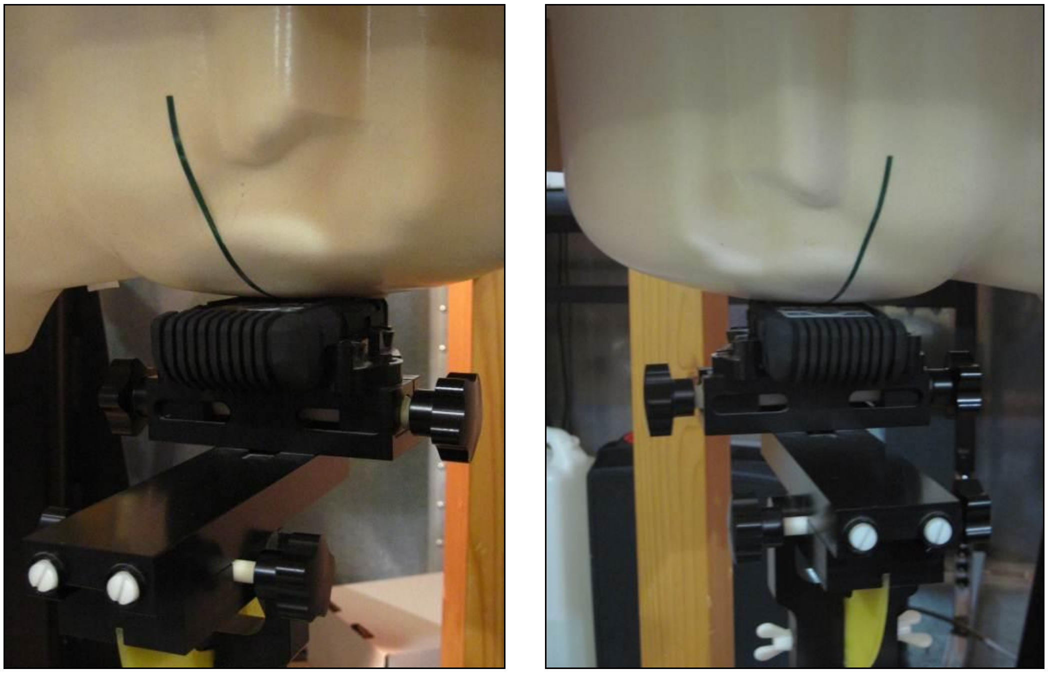
TEST SETUP



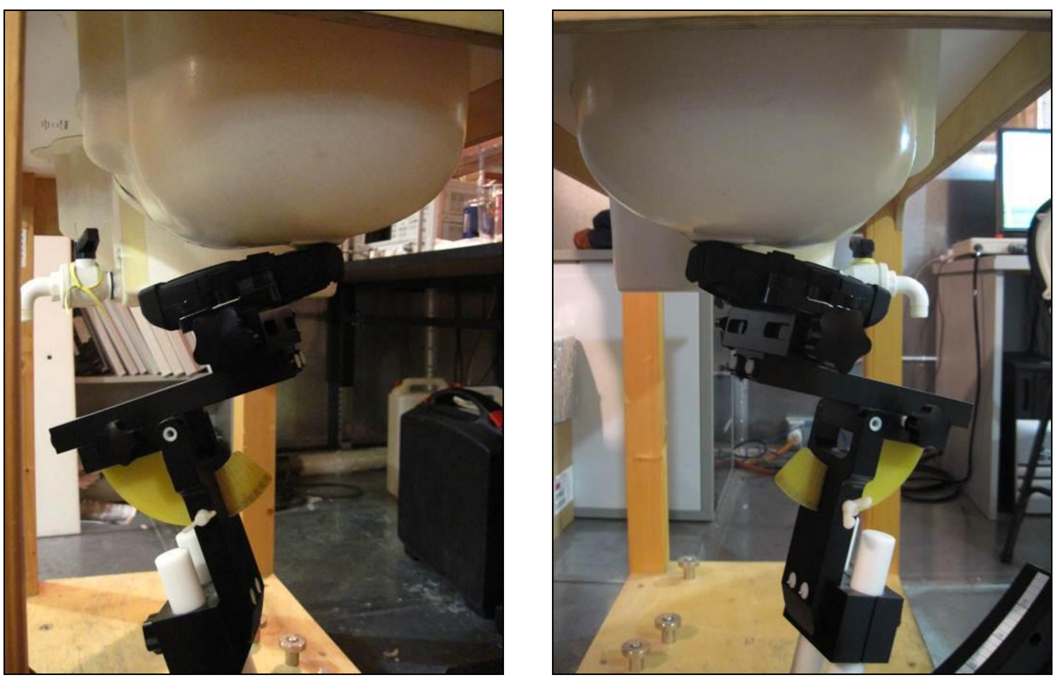
Photograph 1. Guard Trax 2.0, Away Body



Photograph 2. Guard Trax 2.0, Toward Body



Photograph 3. Guard Trax 2.0, Head Touch



Photograph 4. Guard Trax 2.0, Head Tilt

EUT Pictures


Intergis Li-ion Po Cell
Part Number: NT-951010
Rating: 3.7V 2000 mAh (7.4Wh)
Batch Code: 12-2009
Only use specified charger
Do not short circuit
Do not disassemble
Do not expose to high temperatures
Do not incinerate
Dispose of properly

APPENDIX A – SAR MEASUREMENT DATA

836.4 MHz, Mid Channel 190, Body GSM/GPRS (Front Face Towards Body)

Date/Time: 1/21/2011 8:30:22 AM

DUT: Intergis, LLC.; Type: Guard Trax

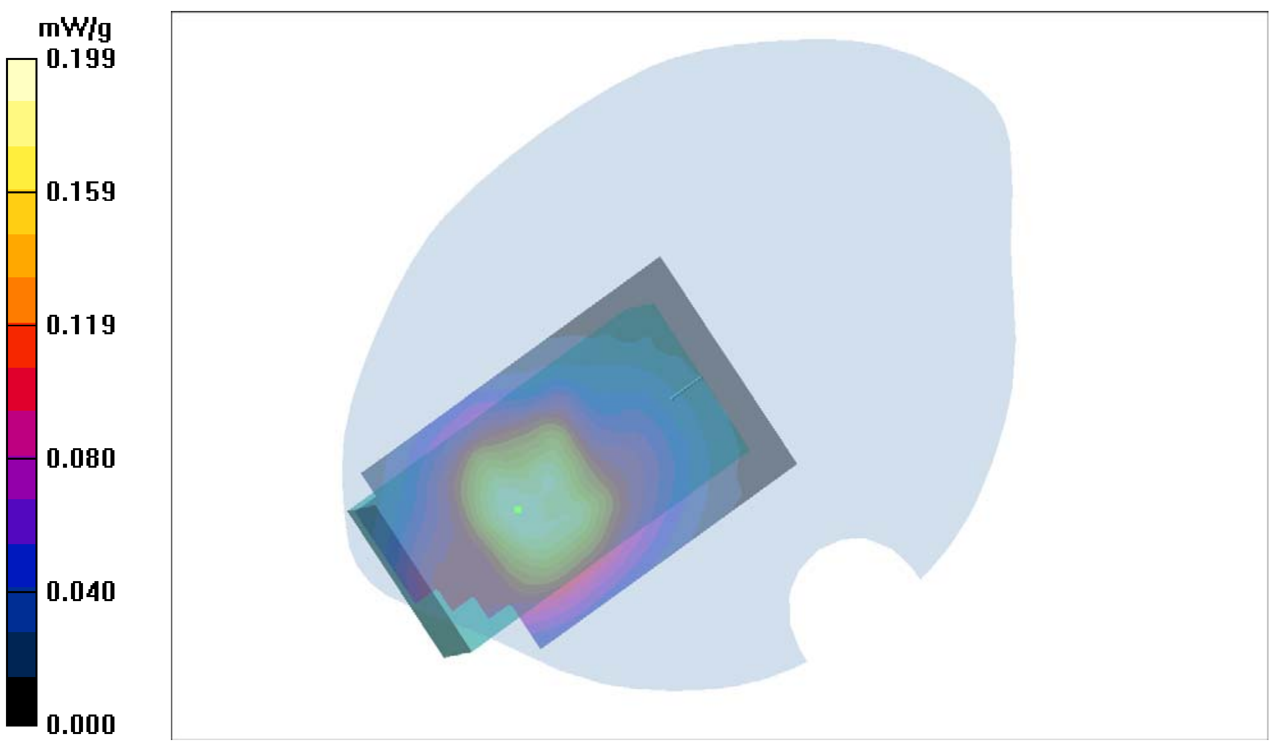
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: GSM/GPRS 850; ; Frequency: 836.4 MHz;Duty Cycle: 1:4
Medium: M850 Medium parameters used: f = 836.4 MHz; σ = 0.974 mho/m; ε_r = 55; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: ET3DV6 - SN1793; ConvF(6.06, 6.06, 6.06); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.199 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.59 V/m; Power Drift = -0.183 dB
Peak SAR (extrapolated) = 0.265 W/kg
SAR(1 g) = 0.182 mW/g; SAR(10 g) = 0.137 mW/g
Maximum value of SAR (measured) = 0.193 mW/g



836.4 MHz, Mid Channel 190, Body GSM/GPRS (Front Face Away Body)

Date/Time: 1/21/2011 8:50:53 AM

DUT: Intergis, LLC.; Type: Guard Trax

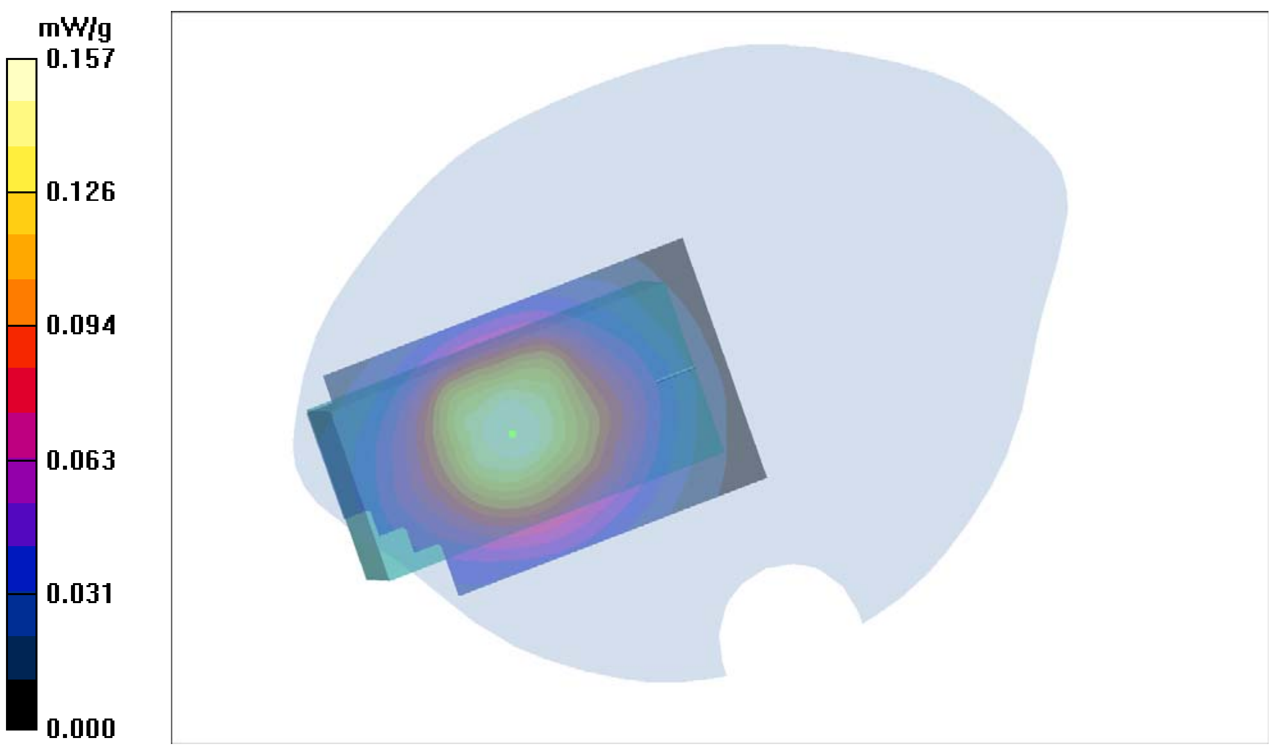
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: GSM/GPRS 850; ; Frequency: 836.4 MHz;Duty Cycle: 1:4
Medium: M850 Medium parameters used: f = 836.4 MHz; $\sigma = 0.974$ mho/m; $\varepsilon_r = 55$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

- Probe: ET3DV6 - SN1793; ConvF(6.06, 6.06, 6.06); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.157 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.32 V/m; Power Drift = -0.100 dB
Peak SAR (extrapolated) = 0.186 W/kg
SAR(1 g) = 0.150 mW/g; SAR(10 g) = 0.113 mW/g
Maximum value of SAR (measured) = 0.160 mW/g



1880 MHz, Mid Channel 661, Body GSM/GPRS (Front Face Towards Body)

Date/Time: 1/21/2011 9:34:56 AM

DUT: Intergis, LLC.; Type: Guard Trax

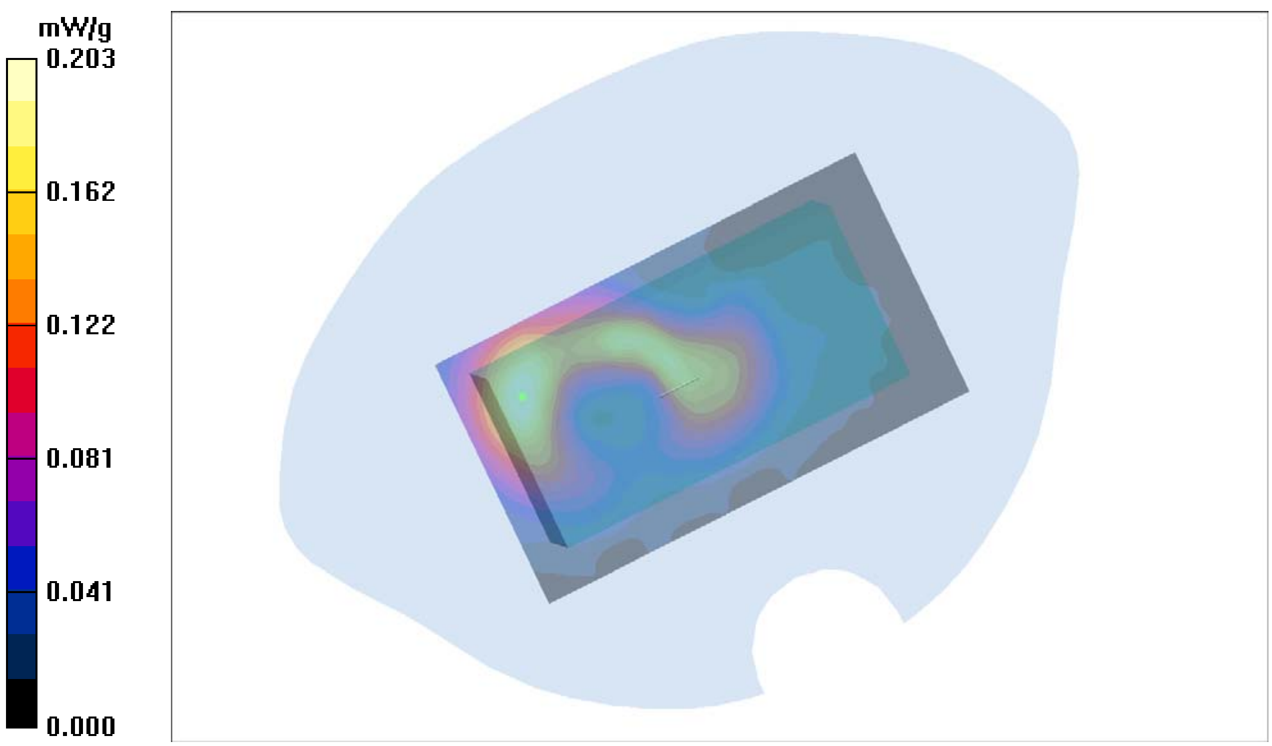
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: GSM/GPRS 1900; ; Frequency: 1880 MHz;Duty Cycle: 1:4
Medium: M1900 Medium parameters used: f = 1880 MHz; $\sigma = 1.57$ mho/m; $\varepsilon_r = 51$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

- Probe: ET3DV6 - SN1793; ConvF(4.59, 4.59, 4.59); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (91x161x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.206 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.7 V/m; Power Drift = -0.056 dB
Peak SAR (extrapolated) = 0.282 W/kg
SAR(1 g) = 0.191 mW/g; SAR(10 g) = 0.115 mW/g
Maximum value of SAR (measured) = 0.211 mW/g



1880 MHz, Mid Channel 661, Body GSM/GPRS (Front Face Away Body)

Date/Time: 1/21/2011 10:05:53 AM

DUT: Intergis, LLC.; Type: Guard Trax

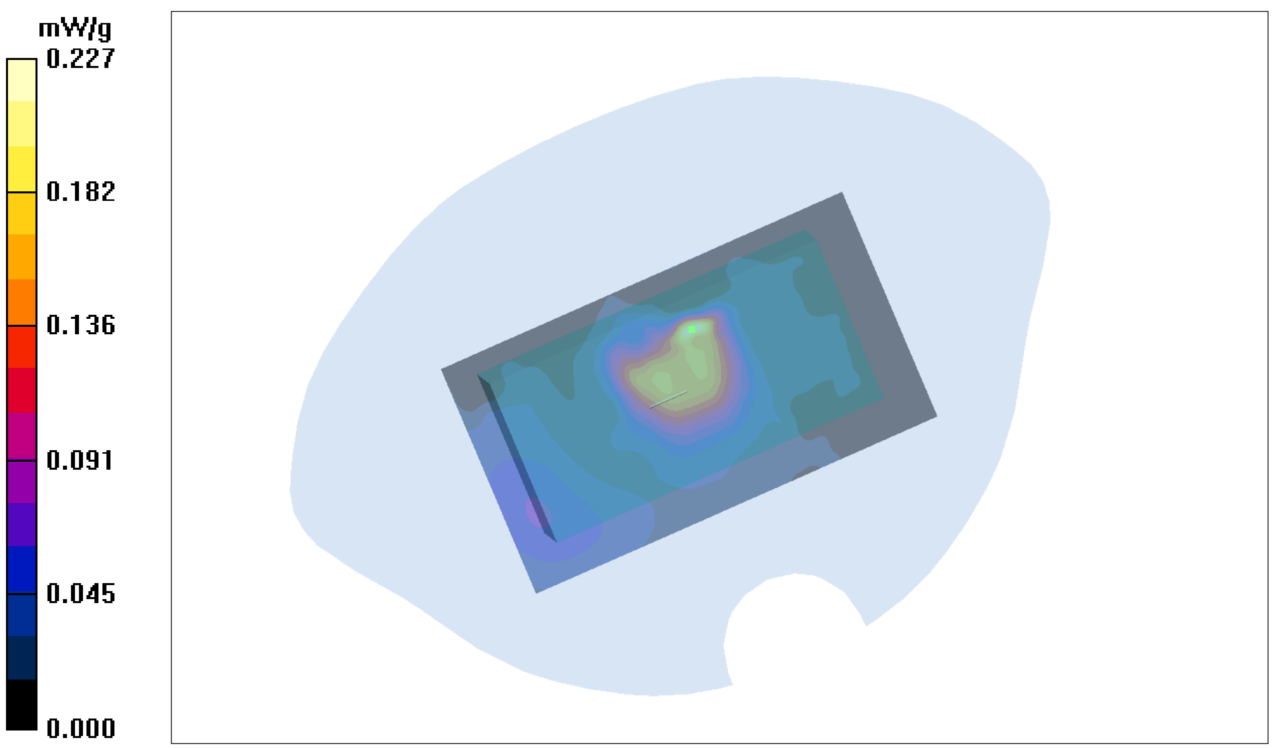
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: GSM/GPRS 1900; ; Frequency: 1880 MHz;Duty Cycle: 1:4
Medium: M1900 Medium parameters used: f = 1880 MHz; $\sigma = 1.57$ mho/m; $\varepsilon_r = 51$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

- Probe: ET3DV6 - SN1793; ConvF(4.59, 4.59, 4.59); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (91x161x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.230 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 10.9 V/m; Power Drift = -0.117 dB
Peak SAR (extrapolated) = 0.218 W/kg
SAR(1 g) = 0.156 mW/g; SAR(10 g) = 0.094 mW/g
Maximum value of SAR (measured) = 0.176 mW/g



836.4 MHz, Mid Channel 190, Head GSM (Left Head Touch)

Date/Time: 1/21/2011 10:57:04 AM

DUT: Intergis, LLC.; Type: Guard Trax

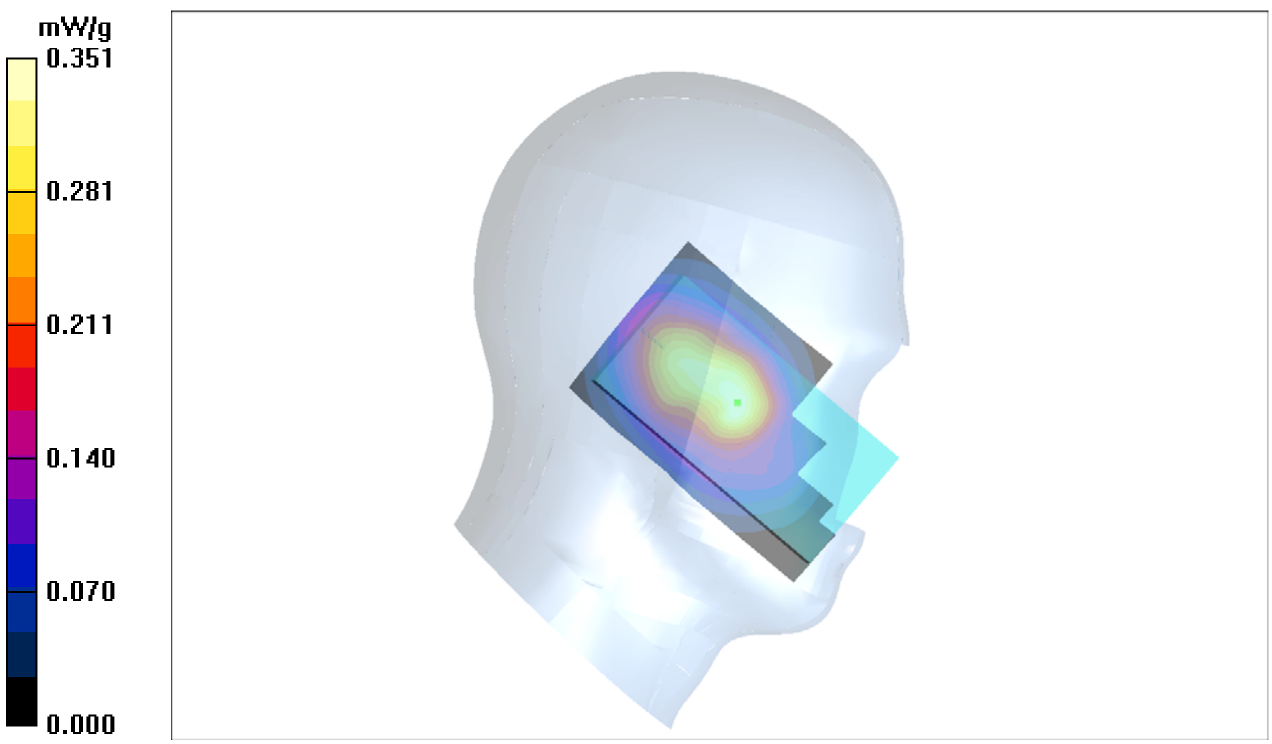
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: GSM 850; ; Frequency: 836.4 MHz;Duty Cycle: 1:8.3
Medium: HSL835 Medium parameters used: f = 836.41 MHz; $\sigma = 0.923$ mho/m; $\varepsilon_r = 39.9$; $\rho = 1000$ kg/m^3
Phantom section: Left Section

- Probe: ET3DV6 - SN1793; ConvF(6.1, 6.1, 6.1); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.351 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.0 V/m; Power Drift = -0.154 dB
Peak SAR (extrapolated) = 0.469 W/kg
SAR(1 g) = 0.314 mW/g; SAR(10 g) = 0.221 mW/g
Maximum value of SAR (measured) = 0.335 mW/g



836.4 MHz, Mid Channel 190, Head GSM (Left Head Tilt)

Date/Time: 1/21/2011 11:24:43 AM

DUT: Intergis, LLC.; Type: Guard Trax

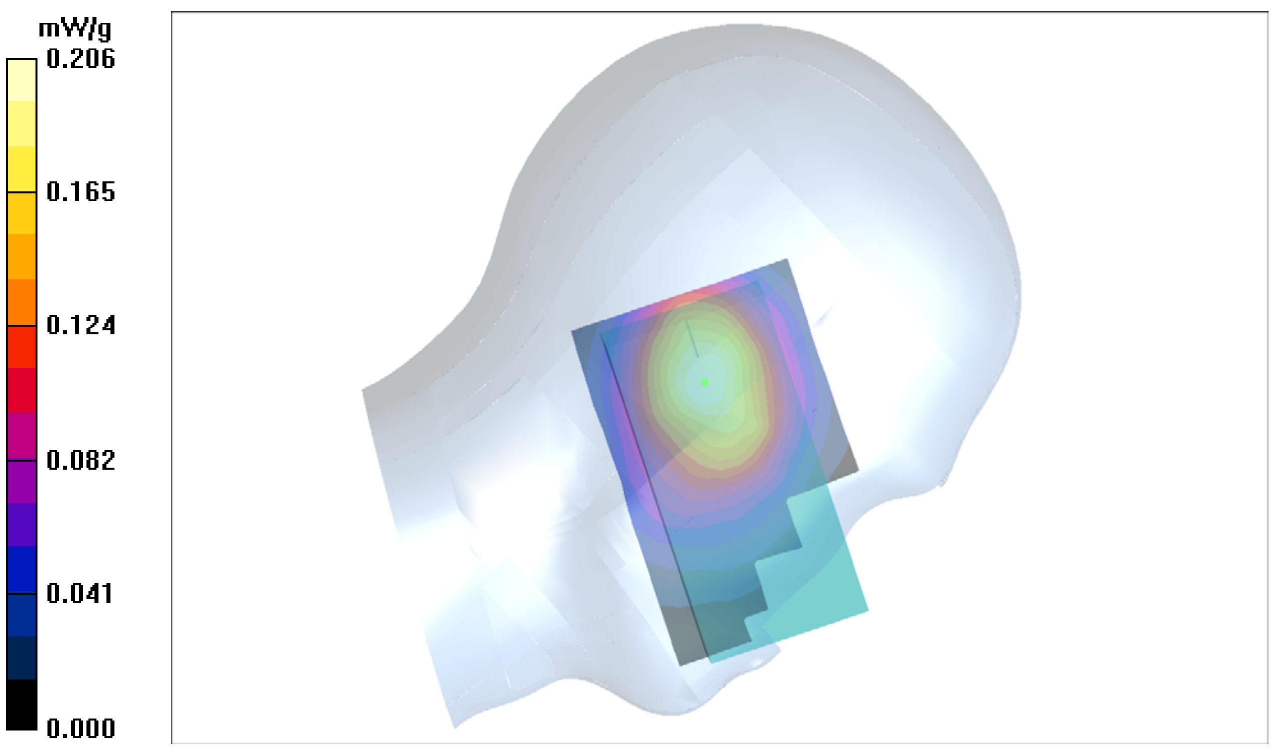
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: GSM 850; ; Frequency: 836.4 MHz;Duty Cycle: 1:8.3
Medium: HSL835 Medium parameters used: f = 836.41 MHz; σ = 0.923 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Left Section

- Probe: ET3DV6 - SN1793; ConvF(6.1, 6.1, 6.1); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.206 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.2 V/m; Power Drift = -0.079 dB
Peak SAR (extrapolated) = 0.241 W/kg
SAR(1 g) = 0.187 mW/g; SAR(10 g) = 0.135 mW/g
Maximum value of SAR (measured) = 0.201 mW/g



836.4 MHz, Mid Channel 190, Head GSM (Right Head Touch)

Date/Time: 1/21/2011 11:56:05 AM

DUT: Intergis, LLC.; Type: Guard Trax

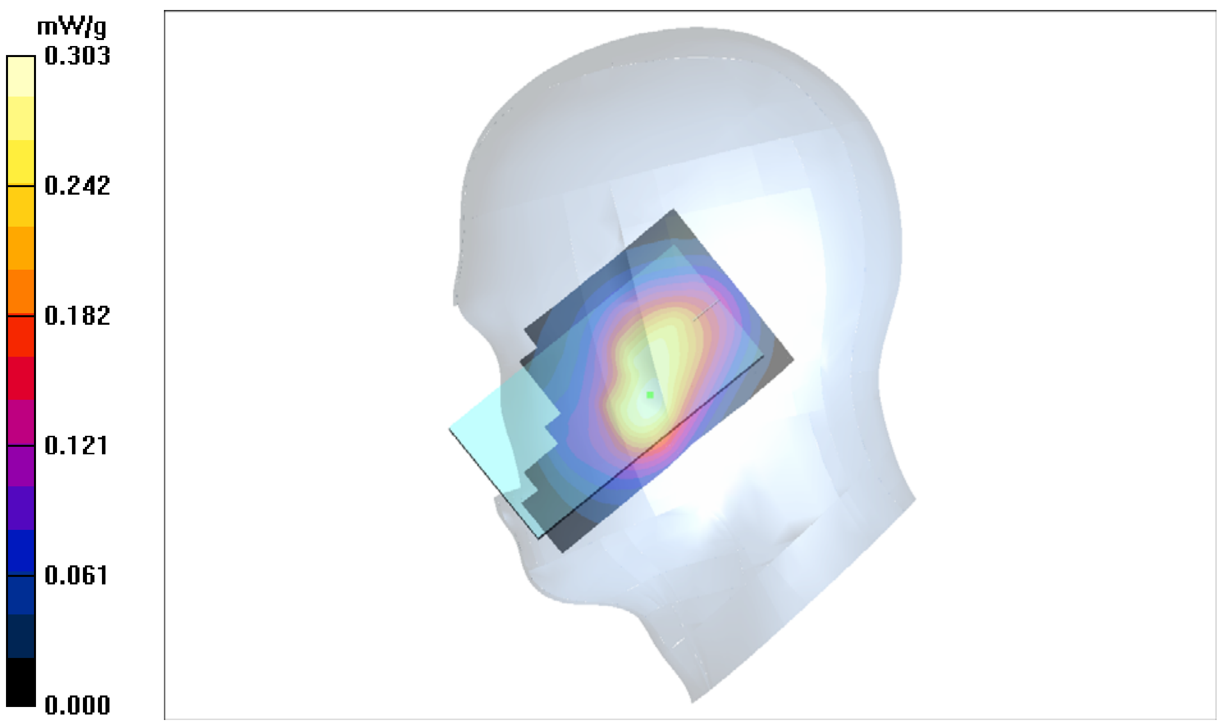
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: GSM 850; ; Frequency: 836.4 MHz;Duty Cycle: 1:8.3
Medium: HSL835 Medium parameters used: f = 836.41 MHz; σ = 0.923 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Right Section

- Probe: ET3DV6 - SN1793; ConvF(6.1, 6.1, 6.1); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Unnamed procedure/Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.303 mW/g

Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.6 V/m; Power Drift = -0.071 dB
Peak SAR (extrapolated) = 0.354 W/kg
SAR(1 g) = 0.271 mW/g; SAR(10 g) = 0.196 mW/g
Maximum value of SAR (measured) = 0.292 mW/g



836.4 MHz, Mid Channel 190, Head GSM (Right Head Tilt)

Date/Time: 1/21/2011 1:02:59 PM

DUT: Intergis, LLC.; Type: Guard Trax

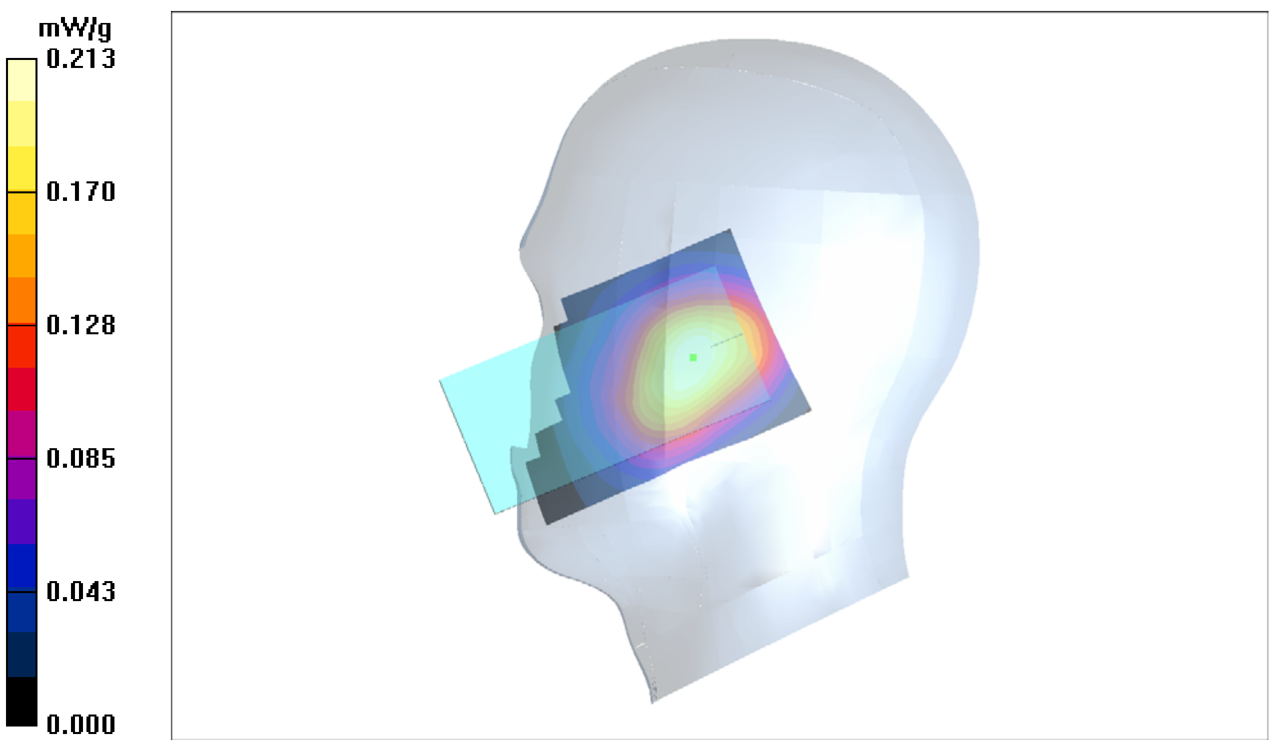
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: GSM 850; ; Frequency: 836.4 MHz;Duty Cycle: 1:8.3
Medium: HSL835 Medium parameters used: f = 836.41 MHz; σ = 0.923 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Right Section

- Probe: ET3DV6 - SN1793; ConvF(6.1, 6.1, 6.1); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.213 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.2 V/m; Power Drift = -0.276 dB
Peak SAR (extrapolated) = 0.269 W/kg
SAR(1 g) = 0.200 mW/g; SAR(10 g) = 0.143 mW/g
Maximum value of SAR (measured) = 0.218 mW/g



1880 MHz, Mid Channel 661, Head GSM (Left Head Touch)

Date/Time: 1/21/2011 2:03:30 PM

DUT: Intergis, LLC.; Type: Guard Trax

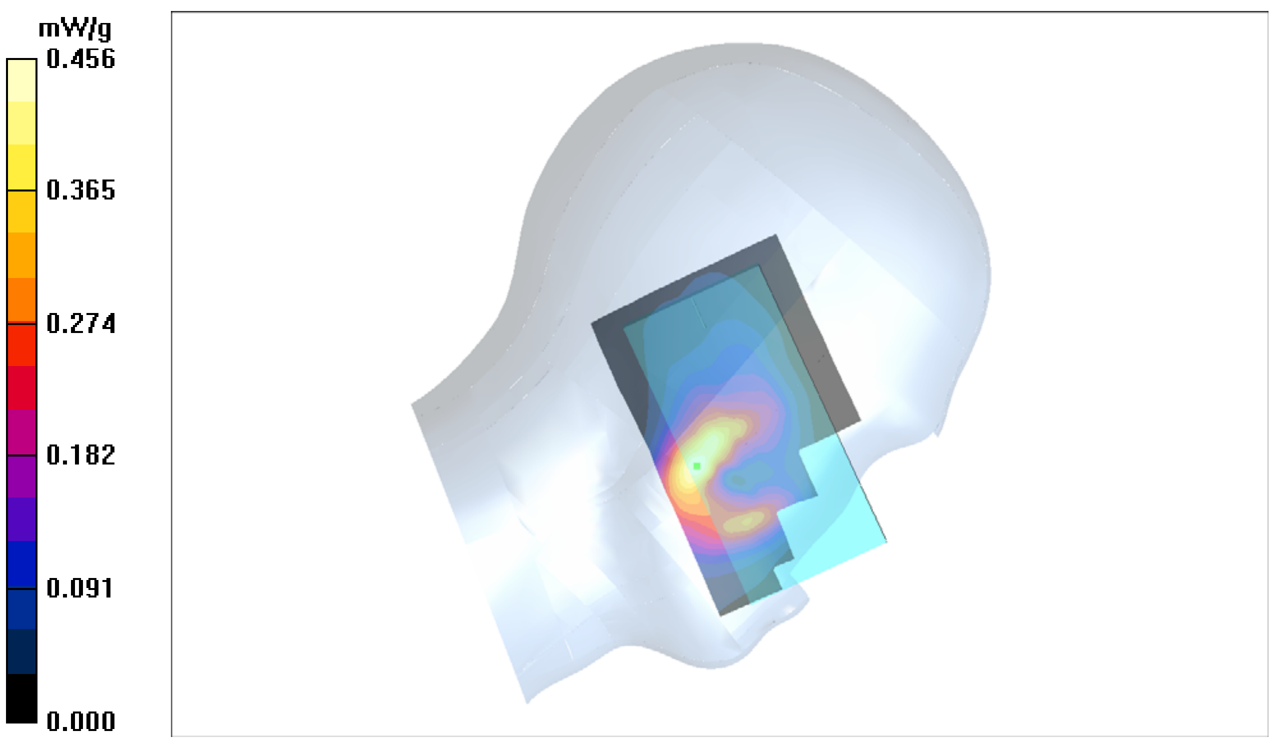
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: GSM 1900; ; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: HSL1800 Medium parameters used: f = 1880 MHz; $\sigma = 1.45$ mho/m; $\varepsilon_r = 39.9$; $\rho = 1000$ kg/m^3
Phantom section: Left Section

- Probe: ET3DV6 - SN1793; ConvF(5.17, 5.17, 5.17); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.456 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.70 V/m; Power Drift = 0.031 dB
Peak SAR (extrapolated) = 0.653 W/kg
SAR(1 g) = 0.389 mW/g; SAR(10 g) = 0.218 mW/g
Maximum value of SAR (measured) = 0.434 mW/g



1880 MHz, Mid Channel 661, Head GSM (Left Head Tilt)

Date/Time: 1/21/2011 2:36:36 PM

DUT: Intergis, LLC.; Type: Guard Trax

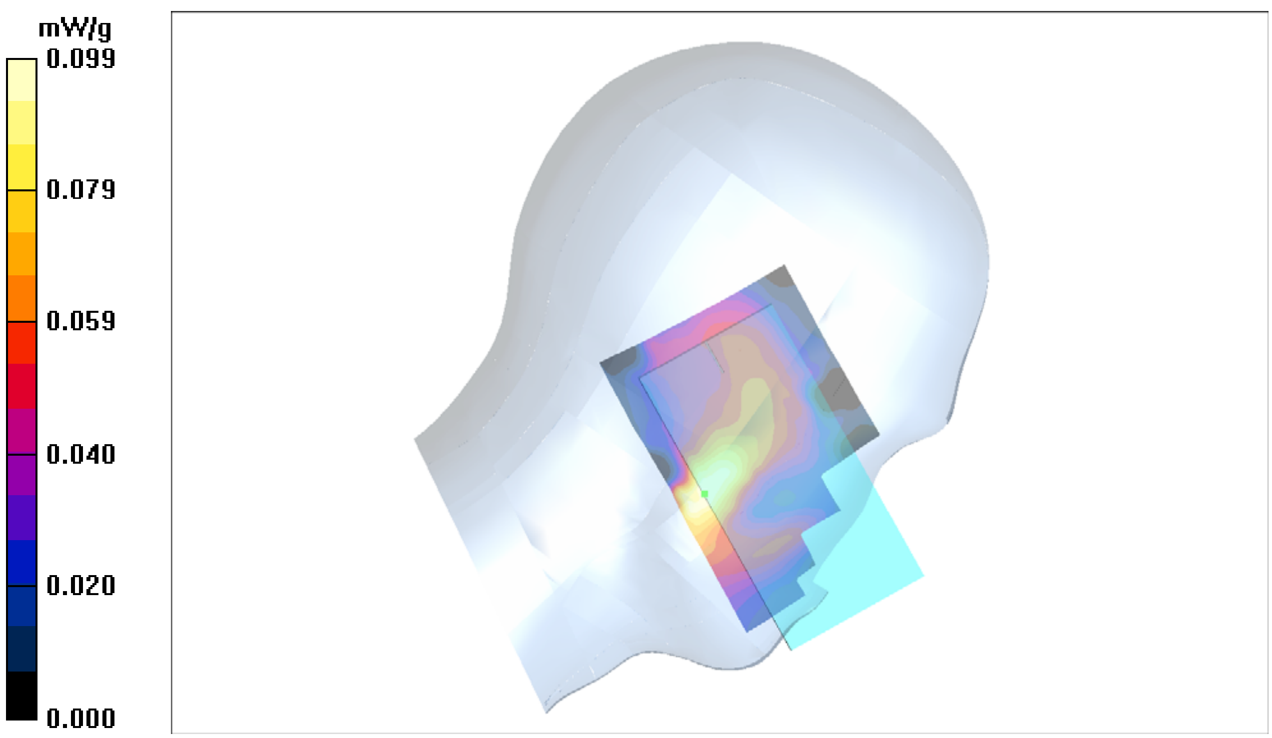
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: GSM 1900; ; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: HSL1800 Medium parameters used: f = 1880 MHz; σ = 1.45 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Left Section

- Probe: ET3DV6 - SN1793; ConvF(5.17, 5.17, 5.17); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.099 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.62 V/m; Power Drift = 0.357 dB
Peak SAR (extrapolated) = 0.130 W/kg
SAR(1 g) = 0.086 mW/g; SAR(10 g) = 0.049 mW/g
Maximum value of SAR (measured) = 0.094 mW/g



1880 MHz, Mid Channel 661, Head GSM (Right Head Touch)

Date/Time: 1/21/2011 2:56:12 PM

DUT: Intergis, LLC.; Type: Guard Trax

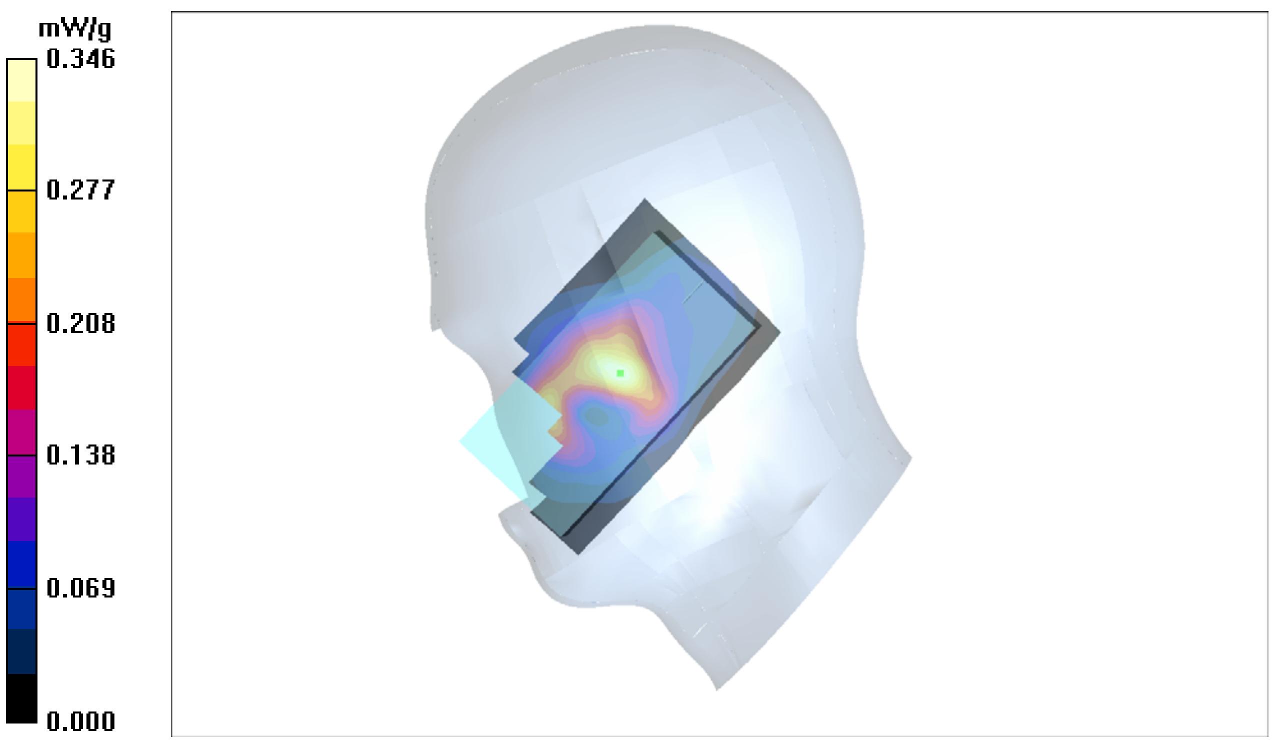
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: GSM 1900; ; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: HSL1800 Medium parameters used: f = 1880 MHz; σ = 1.45 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Right Section

- Probe: ET3DV6 - SN1793; ConvF(5.17, 5.17, 5.17); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.346 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 6.55 V/m; Power Drift = 0.500 dB
Peak SAR (extrapolated) = 0.520 W/kg
SAR(1 g) = 0.315 mW/g; SAR(10 g) = 0.179 mW/g
Maximum value of SAR (measured) = 0.351 mW/g



1880 MHz, Mid Channel 661, Head GSM (Right Head Tilt)

Date/Time: 1/21/2011 3:34:30 PM

DUT: Intergis, LLC.; Type: Guard Trax

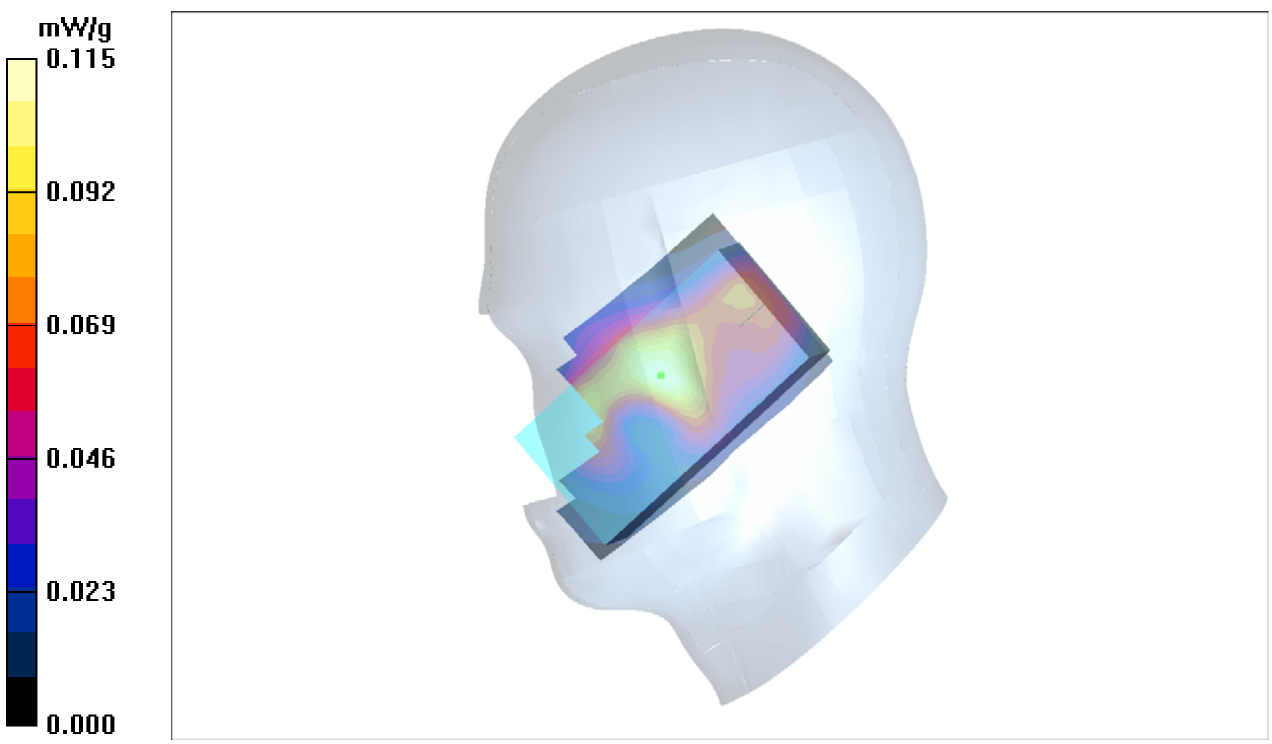
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: GSM 1900; ; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: HSL1800 Medium parameters used: f = 1880 MHz; σ = 1.45 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Right Section

- Probe: ET3DV6 - SN1793; ConvF(5.17, 5.17, 5.17); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (91x151x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.115 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.18 V/m; Power Drift = -0.380 dB
Peak SAR (extrapolated) = 0.154 W/kg
SAR(1 g) = 0.104 mW/g; SAR(10 g) = 0.065 mW/g
Maximum value of SAR (measured) = 0.113 mW/g



APPENDIX B – SYSTEM PERFORMANCE CHECK

835MHz Body System Check 01-21-2011

Date/Time: 1/21/2011 8:12:45 AM

DUT: Dipole 835 MHz; Type: D835V2

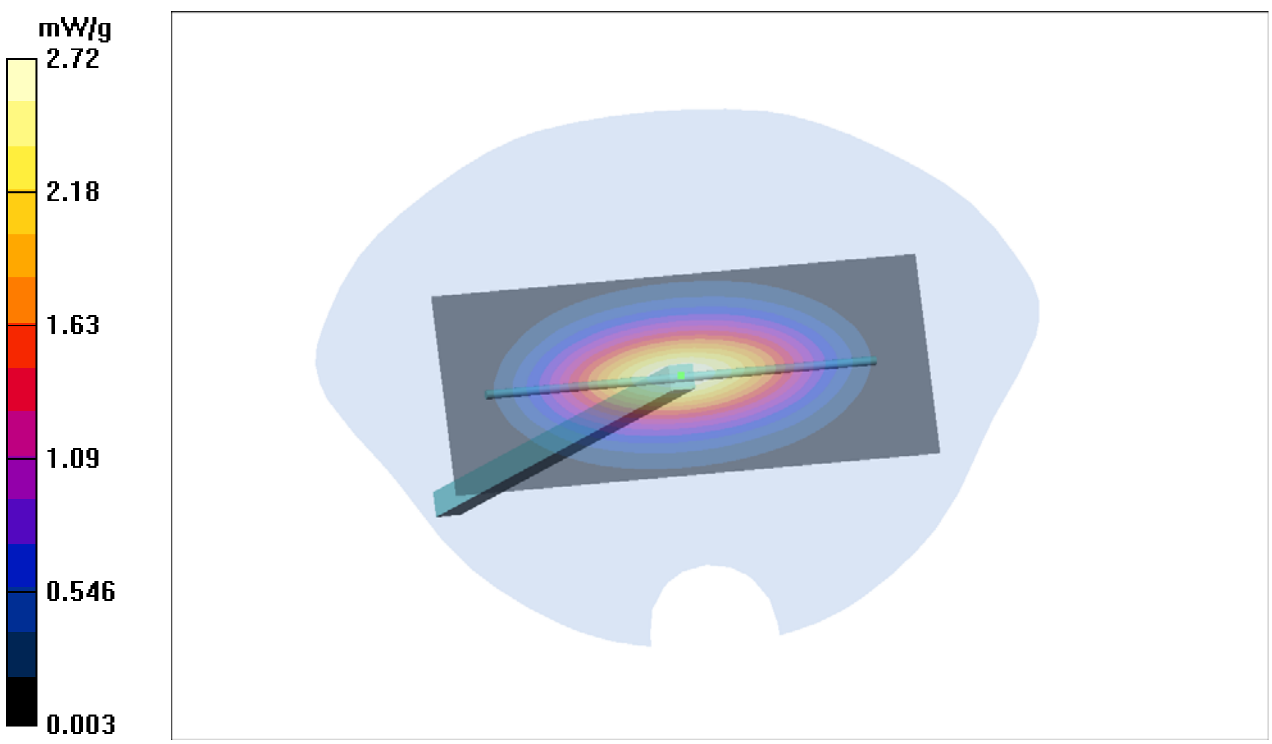
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: CW; ; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: M850 Medium parameters used (interpolated): f = 835 MHz; σ = 0.972 mho/m; ε_r = 54.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: ET3DV6 - SN1793; ConvF(6.06, 6.06, 6.06); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (81x201x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 2.72 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.1 V/m; Power Drift = 0.029 dB
Peak SAR (extrapolated) = 3.53 W/kg
SAR(1 g) = 2.49 mW/g; SAR(10 g) = 1.65 mW/g
Maximum value of SAR (measured) = 2.72 mW/g



Title

SubTitle

January 21, 2011 8:05 AM

Frequency	e'	e''
815.000000 MH	55.1461	20.9986
817.000000 MH	55.1188	20.9805
819.000000 MH	55.1284	20.9975
821.000000 MH	55.1227	20.9681
823.000000 MH	55.0753	20.9790
825.000000 MH	55.0812	20.9707
827.000000 MH	55.0550	20.9791
829.000000 MH	55.0729	20.9917
831.000000 MH	55.0428	20.9487
833.000000 MH	55.0069	20.9448
835.000000 MH	54.9929	20.9561
837.000000 MH	54.9542	20.9628
839.000000 MH	54.9665	20.9556
841.000000 MH	54.9373	20.9128
843.000000 MH	54.9410	20.9232
845.000000 MH	54.9064	20.9016
847.000000 MH	54.8890	20.8969
849.000000 MH	54.8868	20.8934
851.000000 MH	54.8601	20.8942
853.000000 MH	54.8133	20.8661
855.000000 MH	54.8161	20.8553
857.000000 MH	54.7961	20.8349
859.000000 MH	54.7562	20.8343
861.000000 MH	54.7385	20.8173
863.000000 MH	54.6958	20.8186
865.000000 MH	54.6829	20.7859
867.000000 MH	54.6641	20.7741
869.000000 MH	54.6701	20.7749
871.000000 MH	54.6413	20.7601
873.000000 MH	54.6023	20.7423
875.000000 MH	54.6241	20.7081
877.000000 MH	54.5790	20.7111
879.000000 MH	54.5685	20.6955
881.000000 MH	54.5474	20.6464
883.000000 MH	54.5504	20.6707

885.000000 MH	54.5257	20.6455
887.000000 MH	54.5311	20.6121
889.000000 MH	54.5019	20.6243
891.000000 MH	54.5009	20.5946
893.000000 MH	54.4712	20.5899
895.000000 MH	54.4853	20.5861
897.000000 MH	54.4644	20.6110
899.000000 MH	54.4509	20.5886
901.000000 MH	54.4423	20.5892
903.000000 MH	54.4112	20.5728
905.000000 MH	54.3995	20.5453
907.000000 MH	54.4039	20.5600
909.000000 MH	54.3697	20.5669
911.000000 MH	54.3632	20.5622
913.000000 MH	54.3458	20.5383
915.000000 MH	54.3213	20.5313

1800MHz Body System Check 01-21-2011

Date/Time: 1/21/2011 9:21:59 AM

DUT: Dipole 1800 MHz; Type: IndexSAR - SN: 1S2572

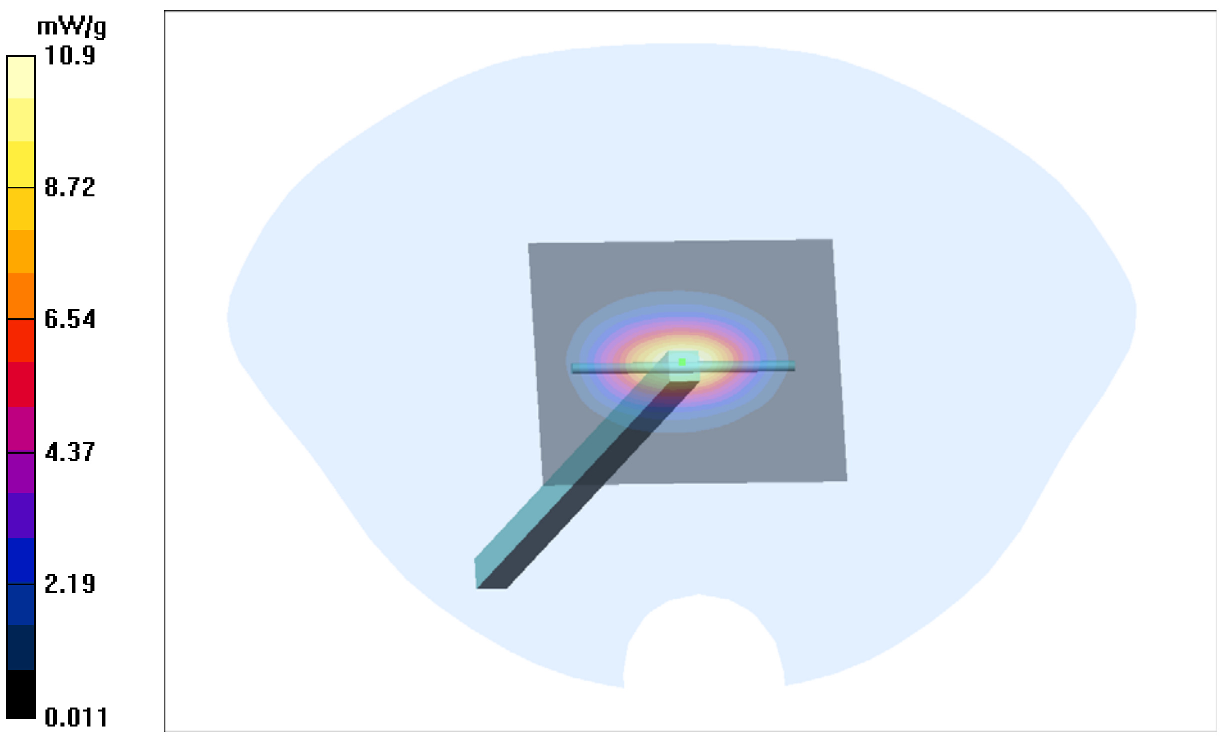
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: CW; ; Frequency: 1800 MHz;Duty Cycle: 1:1
Medium: M1800 Medium parameters used: f = 1800 MHz; σ = 1.57 mho/m; ε_r = 51; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: ET3DV6 - SN1793; ConvF(4.59, 4.59, 4.59); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Unnamed procedure/Area Scan (81x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 10.9 mW/g

Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.3 V/m; Power Drift = 0.083 dB
Peak SAR (extrapolated) = 15.1 W/kg
SAR(1 g) = 9.51 mW/g; SAR(10 g) = 5.11 mW/g
Maximum value of SAR (measured) = 10.9 mW/g



Title

SubTitle

January 21, 2011 9:16 AM

Frequency	e'	e''
1.820000000 GI	51.318	14.6726
1.822000000 GI	51.303	14.6791
1.824000000 GI	51.288	14.6710
1.826000000 GI	51.283	14.6679
1.828000000 GI	51.264	14.6620
1.830000000 GI	51.261	14.6602
1.832000000 GI	51.239	14.6694
1.834000000 GI	51.233	14.6680
1.836000000 GI	51.236	14.6784
1.838000000 GI	51.212	14.6862
1.840000000 GI	51.206	14.7075
1.842000000 GI	51.194	14.6842
1.844000000 GI	51.203	14.6872
1.846000000 GI	51.186	14.6939
1.848000000 GI	51.194	14.6968
1.850000000 GI	51.195	14.6943
1.852000000 GI	51.173	14.6856
1.854000000 GI	51.179	14.6757
1.856000000 GI	51.164	14.6950
1.858000000 GI	51.176	14.7003
1.860000000 GI	51.172	14.7050
1.862000000 GI	51.167	14.7145
1.864000000 GI	51.166	14.7349
1.866000000 GI	51.158	14.7449
1.868000000 GI	51.142	14.7545
1.870000000 GI	51.145	14.7836
1.872000000 GI	51.134	14.7877
1.874000000 GI	51.116	14.8040
1.876000000 GI	51.117	14.8010
1.878000000 GI	51.112	14.7927
1.880000000 GI	51.121	14.8062
1.882000000 GI	51.108	14.8057
1.884000000 GI	51.095	14.8308
1.886000000 GI	51.089	14.8274
1.888000000 GI	51.090	14.8323

1.890000000 GH	51.0779	14.8461
1.892000000 GH	51.0662	14.8467
1.894000000 GH	51.0668	14.8727
1.896000000 GH	51.0512	14.8788
1.898000000 GH	51.0651	14.8671
1.900000000 GH	51.0481	14.8831
1.902000000 GH	51.0615	14.8875
1.904000000 GH	51.0494	14.9123
1.906000000 GH	51.0822	14.8973
1.908000000 GH	51.0578	14.9628
1.910000000 GH	50.9591	15.0085
1.912000000 GH	50.9622	14.9500
1.914000000 GH	51.0069	14.9651
1.916000000 GH	50.9858	14.9721
1.918000000 GH	50.9861	14.9720
1.920000000 GH	50.9625	14.9825

835MHz Head System Check 01-21-2011

Date/Time: 1/21/2011 10:40:45 AM

DUT: Dipole 835 MHz; Type: D835V2

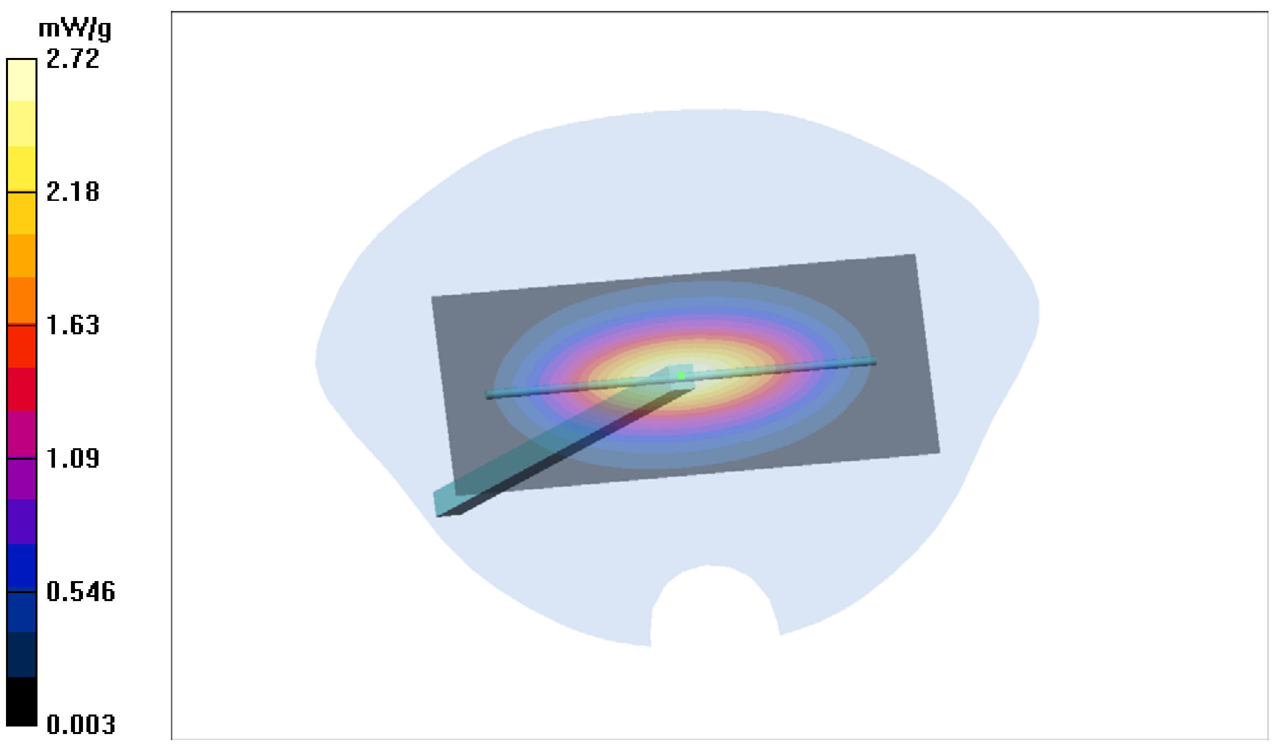
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: CW; ; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL835 Medium parameters used (interpolated): f = 835 MHz; σ = 0.923 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: ET3DV6 - SN1793; ConvF(6.06, 6.06, 6.06); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Area Scan (81x201x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 2.72 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.3 V/m; Power Drift = 0.018 dB
Peak SAR (extrapolated) = 3.41 W/kg
SAR(1 g) = 2.37 mW/g; SAR(10 g) = 1.58 mW/g
Maximum value of SAR (measured) = 2.68 mW/g



Title

SubTitle

January 21, 2011 10:36 AM

Frequency	e'	e''
815.000000 MI	40.194	19.9796
817.000000 MI	40.165	19.9623
819.000000 MI	40.116	19.9359
821.000000 MI	40.085	19.9653
823.000000 MI	40.061	19.9503
825.000000 MI	40.005	19.9439
827.000000 MI	40.011	19.9303
829.000000 MI	39.985	19.9289
831.000000 MI	39.941	19.9427
833.000000 MI	39.934	19.9054
835.000000 MI	39.895	19.9094
837.000000 MI	39.865	19.9058
839.000000 MI	39.841	19.8959
841.000000 MI	39.808	19.8852
843.000000 MI	39.798	19.8580
845.000000 MI	39.742	19.8687
847.000000 MI	39.726	19.8562
849.000000 MI	39.690	19.8435
851.000000 MI	39.667	19.8337
853.000000 MI	39.640	19.8253
855.000000 MI	39.638	19.8076
857.000000 MI	39.586	19.8135
859.000000 MI	39.570	19.8011
861.000000 MI	39.556	19.8005
863.000000 MI	39.516	19.7858
865.000000 MI	39.513	19.7730
867.000000 MI	39.477	19.7687
869.000000 MI	39.472	19.7606
871.000000 MI	39.444	19.7537
873.000000 MI	39.450	19.7334
875.000000 MI	39.424	19.7334
877.000000 MI	39.388	19.7061
879.000000 MI	39.388	19.7001
881.000000 MI	39.363	19.7082
883.000000 MI	39.334	19.6980

885.000000 MH	39.3222	19.6696
887.000000 MH	39.3099	19.6804
889.000000 MH	39.2803	19.6669
891.000000 MH	39.2522	19.6373
893.000000 MH	39.2250	19.6306
895.000000 MH	39.1911	19.6426
897.000000 MH	39.1875	19.5959
899.000000 MH	39.1641	19.5959
901.000000 MH	39.1221	19.5879
903.000000 MH	39.1401	19.5945
905.000000 MH	39.1183	19.5786
907.000000 MH	39.0848	19.5713
909.000000 MH	39.0522	19.5753
911.000000 MH	39.0270	19.5686
913.000000 MH	39.0110	19.5390
915.000000 MH	39.0103	19.5152

1800MHz Head System Check 01-21-2011

Date/Time: 1/21/2011 1:42:45 PM

DUT: Dipole 1800 MHz; Type: IndexSAR - SN: 1S2572

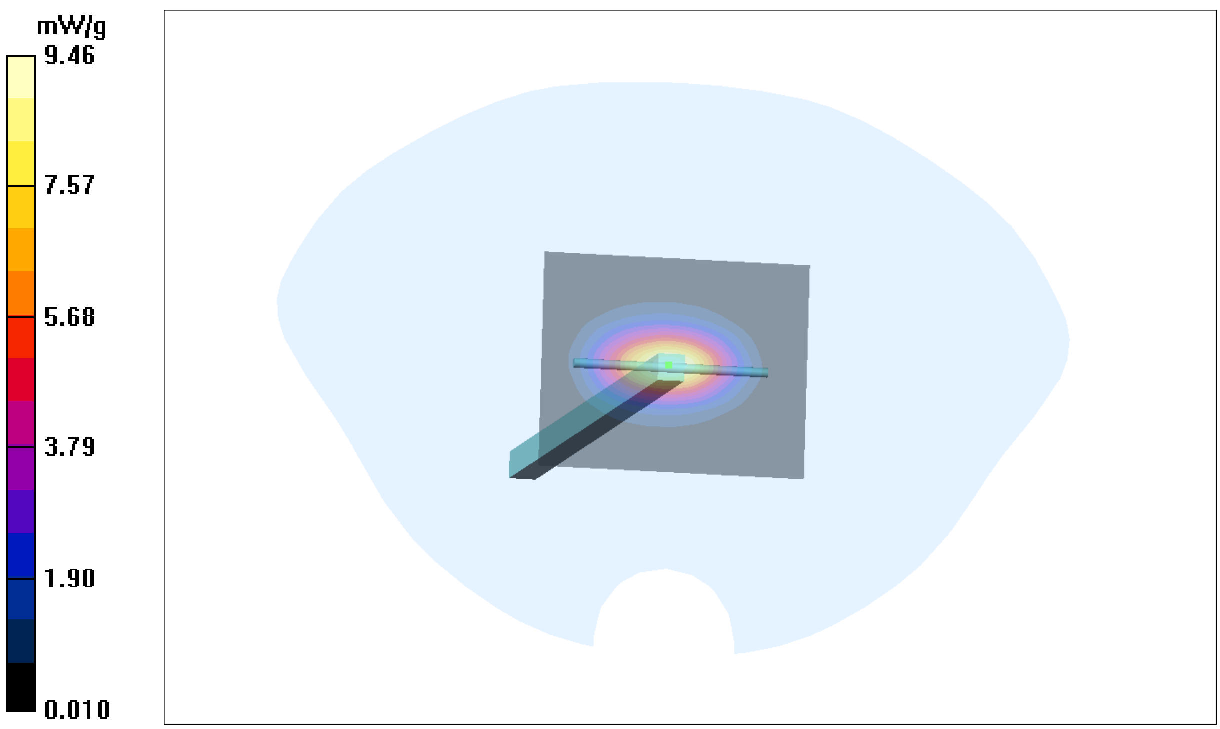
Medium Notes: Ambient Temp: 24.0 deg C, Fluid Temp: 22.3 deg C

Communication System: CW; ; Frequency: 1800 MHz;Duty Cycle: 1:1
Medium: HSL1800 Medium parameters used: f = 1800 MHz; σ = 1.45 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: ET3DV6 - SN1793; ConvF(5.17, 5.17, 5.17); Calibrated: 4/27/2010
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 4/26/2010
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Unnamed procedure/Area Scan (81x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 9.46 mW/g

Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 85.6 V/m; Power Drift = -0.034 dB
Peak SAR (extrapolated) = 14.4 W/kg
SAR(1 g) = 8.98 mW/g; SAR(10 g) = 4.75 mW/g
Maximum value of SAR (measured) = 9.32 mW/g



Title

SubTitle

January 21, 2011 1:30 PM

Frequency	e'	e''
1.820000000 GI	40.133	13.5699
1.822000000 GI	40.120	13.5763
1.824000000 GI	40.111	13.5814
1.826000000 GI	40.094	13.5978
1.828000000 GI	40.083	13.5998
1.830000000 GI	40.071	13.6105
1.832000000 GI	40.064	13.6008
1.834000000 GI	40.045	13.6069
1.836000000 GI	40.056	13.6256
1.838000000 GI	40.049	13.6262
1.840000000 GI	40.045	13.6357
1.842000000 GI	40.039	13.6479
1.844000000 GI	40.029	13.6454
1.846000000 GI	40.014	13.6543
1.848000000 GI	40.022	13.6640
1.850000000 GI	40.019	13.6616
1.852000000 GI	40.013	13.6679
1.854000000 GI	40.012	13.6801
1.856000000 GI	39.991	13.6830
1.858000000 GI	39.997	13.6954
1.860000000 GI	40.000	13.7091
1.862000000 GI	39.975	13.7133
1.864000000 GI	39.975	13.7225
1.866000000 GI	39.981	13.7289
1.868000000 GI	39.969	13.7290
1.870000000 GI	39.969	13.7526
1.872000000 GI	39.953	13.7424
1.874000000 GI	39.940	13.7439
1.876000000 GI	39.953	13.7518
1.878000000 GI	39.940	13.7416
1.880000000 GI	39.948	13.7435
1.882000000 GI	39.955	13.7628
1.884000000 GI	39.932	13.7538
1.886000000 GI	39.935	13.7686
1.888000000 GI	39.912	13.7596

1.890000000 GI	39.907!	13.7567
1.892000000 GI	39.896:	13.7625
1.894000000 GI	39.893!	13.7683
1.896000000 GI	39.904!	13.7614
1.898000000 GI	39.890!	13.7699
1.900000000 GI	39.853	13.7607
1.902000000 GI	39.884:	13.7771
1.904000000 GI	39.851!	13.7723
1.906000000 GI	39.863!	13.7840
1.908000000 GI	39.842:	13.8341
1.910000000 GI	39.761!	13.7739
1.912000000 GI	39.722:	13.8020
1.914000000 GI	39.744(	13.7922
1.916000000 GI	39.759!	13.8039
1.918000000 GI	39.754!	13.8152
1.920000000 GI	39.744!	13.7978

APPENDIX C – PROBE CALIBRATION CERTIFICATE

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **MET Laboratories**

Certificate No: ET3-1793_Apr10

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1793
Calibration procedure(s)	QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	April 27, 2010

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	29-Sep-09 (No. DAE4-660_Sep09)	Sep-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 27, 2010

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,y,z*: *A, B, C* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ET3DV6

SN:1793

Manufactured:	May 28, 2005
Last calibrated:	April 23, 2009
Recalibrated:	April 27, 2010

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1793

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.70	1.74	1.86	± 10.1%
DCP (mV)[B]	94.3	90.8	90.5	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300.0	± 1.5%
			Y	0.00	0.00	1.00	300.0	
			Z	0.00	0.00	1.00	300.0	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).

[B] Numerical linearization parameter: uncertainty not required.

[E] Uncertainty is determined using the maximum deviation from linear response applying recatangular distribution and is expressed for the square of the field value.

DASY - Parameters of Probe: ET3DV6 SN:1793

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	6.10	6.10	6.10	0.47	2.23	± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.17	5.17	5.17	0.61	2.36	± 11.0%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

DASY - Parameters of Probe: ET3DV6 SN:1793

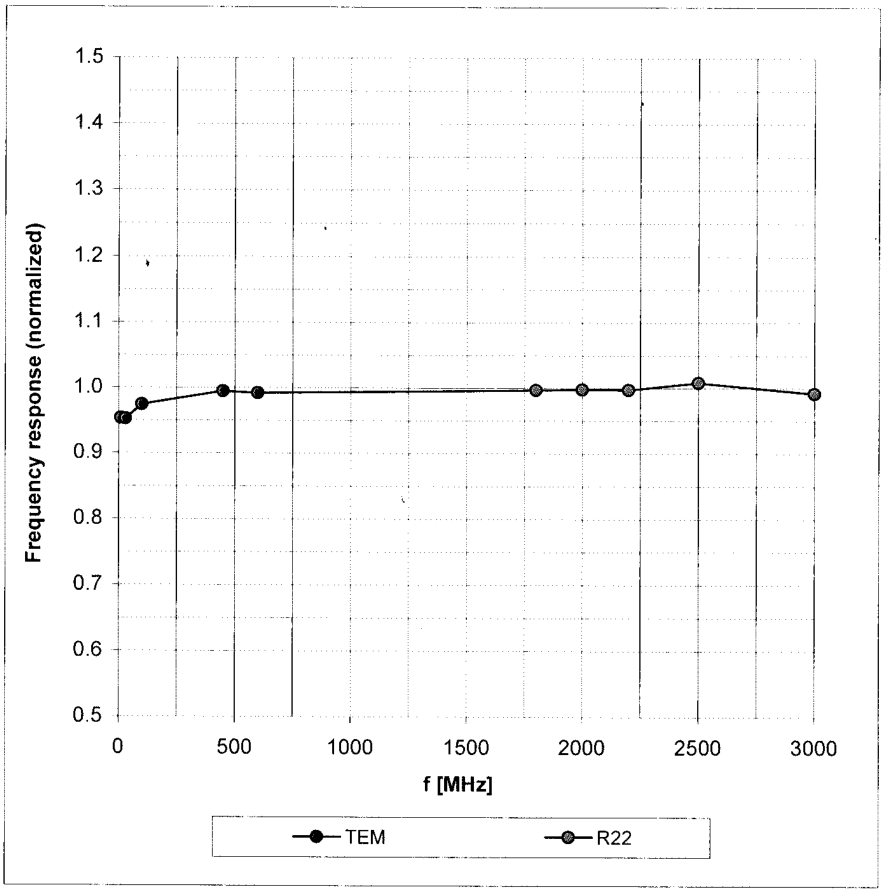
Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][C]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth	Unc (k=2)
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	6.06	6.06	6.06	0.44	2.36	± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.59	4.59	4.59	0.75	2.62	± 11.0%

[C] The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

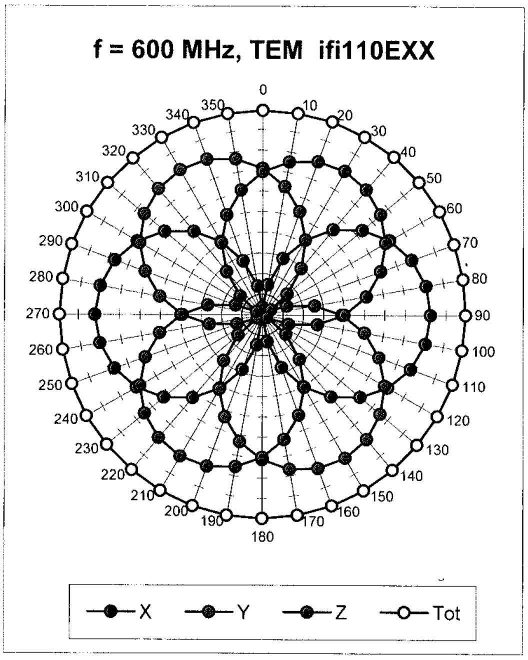
Frequency Response of E-Field

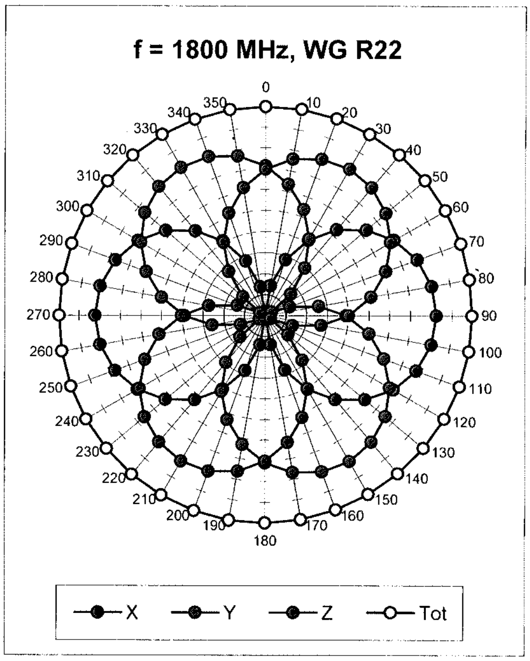
(TEM-Cell:ifi110 EXX, Waveguide: R22)

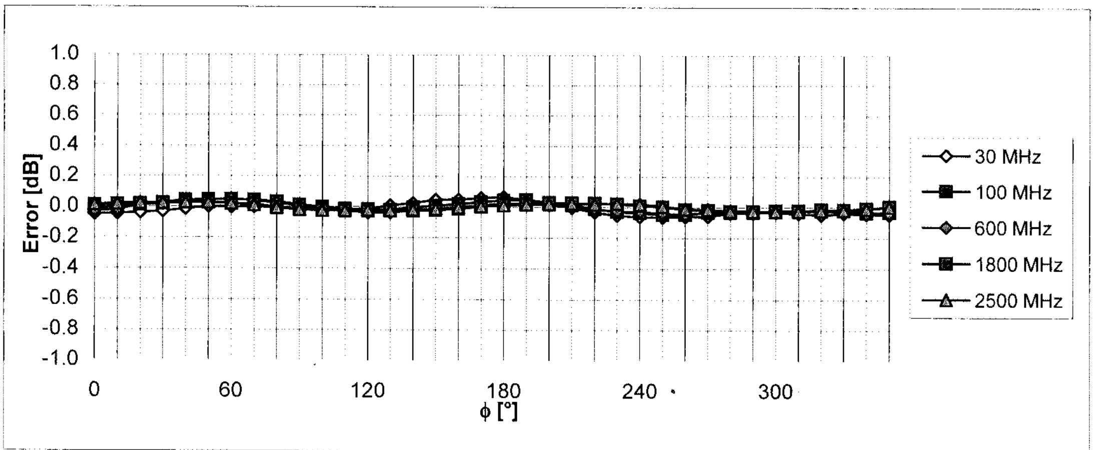


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



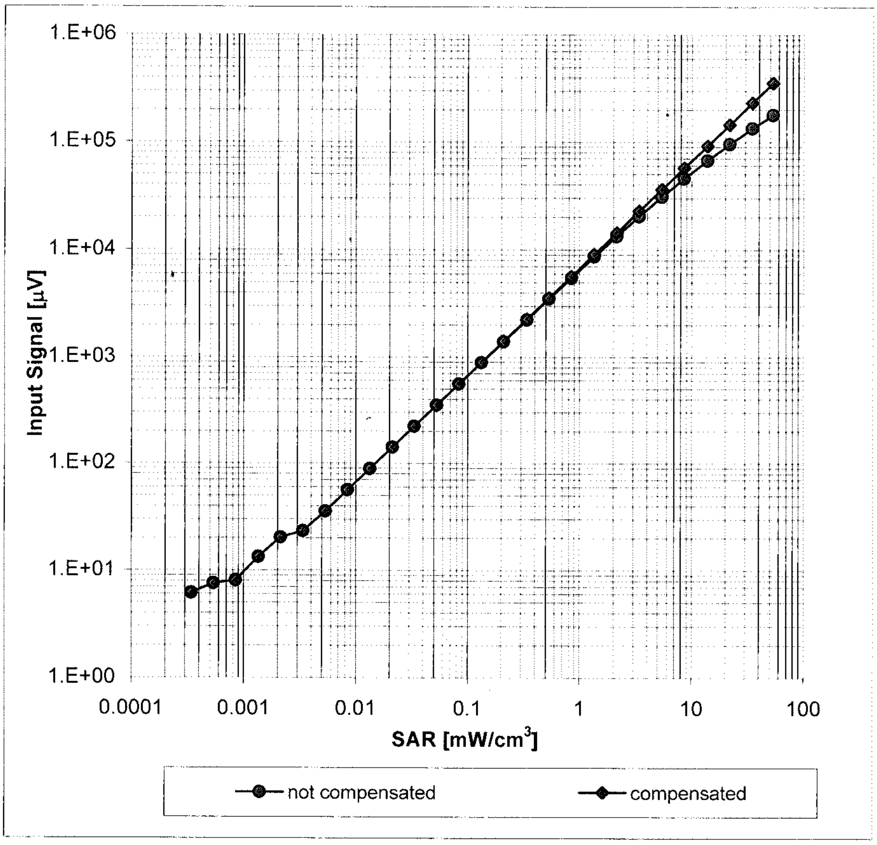


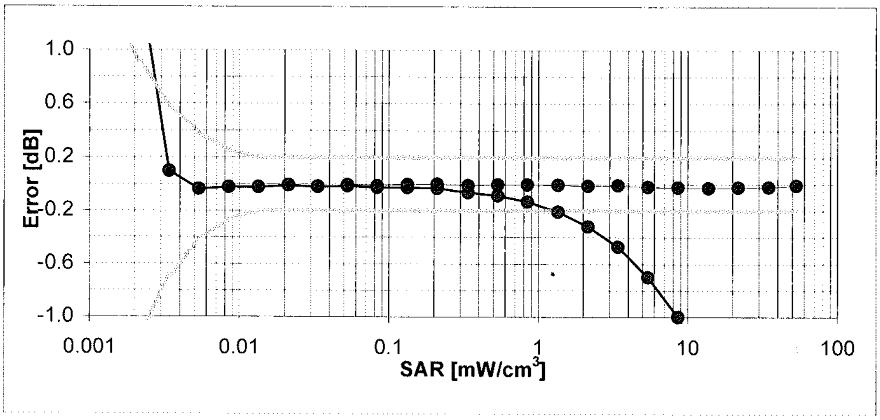


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

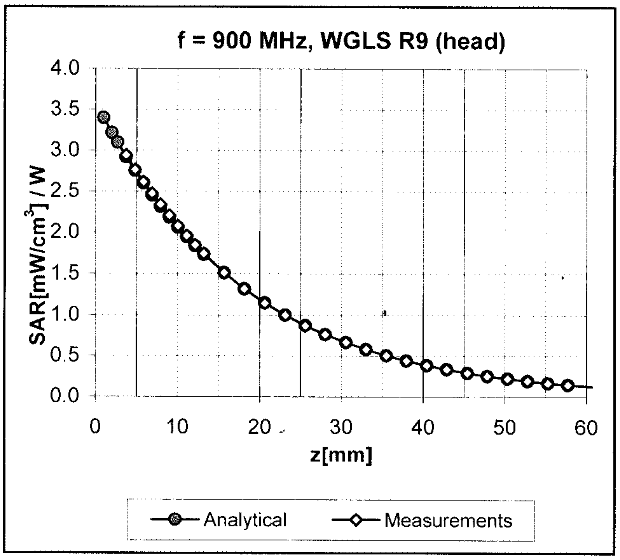
(Waveguide R22, f = 1800 MHz)

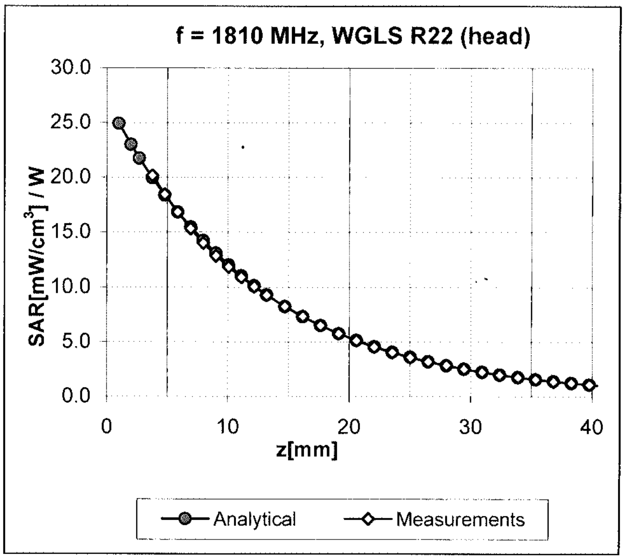




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

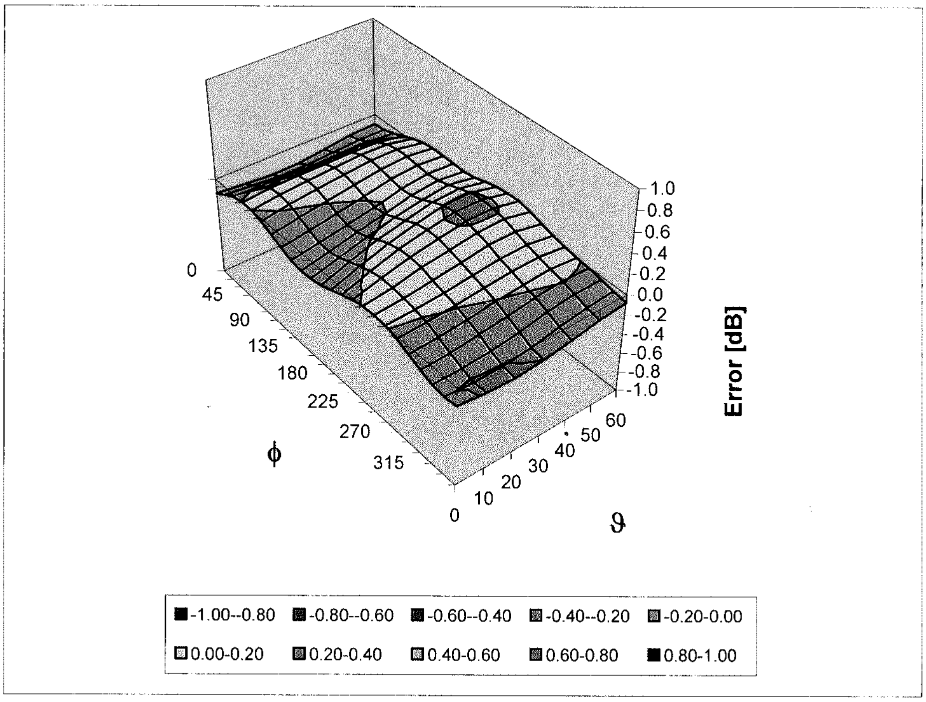
Conversion Factor Assessment





Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

APPENDIX D – DIPOLE CALIBRATION CERTIFICATE

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **MET Laboratories**

Certificate No: **D835V2-4d110_Nov10**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d110
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date:	November 22, 2010

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	D. Iliev
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 23, 2010

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.5 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.42 mW / g
SAR normalized	normalized to 1W	9.68 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.76 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.57 mW / g
SAR normalized	normalized to 1W	6.28 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.32 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.2 ± 6 %	0.99 mho/m ± 6 %
Body TSL temperature during test	(22.3 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.53 mW / g
SAR normalized	normalized to 1W	10.1 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.93 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.66 mW / g
SAR normalized	normalized to 1W	6.64 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.55 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.9 Ω - 2.9 jΩ
Return Loss	- 29.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.1 Ω - 4.5 jΩ
Return Loss	- 26.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.401 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	May 26, 2010

DASY5 Validation Report for Head TSL

Date/Time: 22.11.2010 11:06:48

Test Laboratory: SPEAG, Zurich, Switzerland

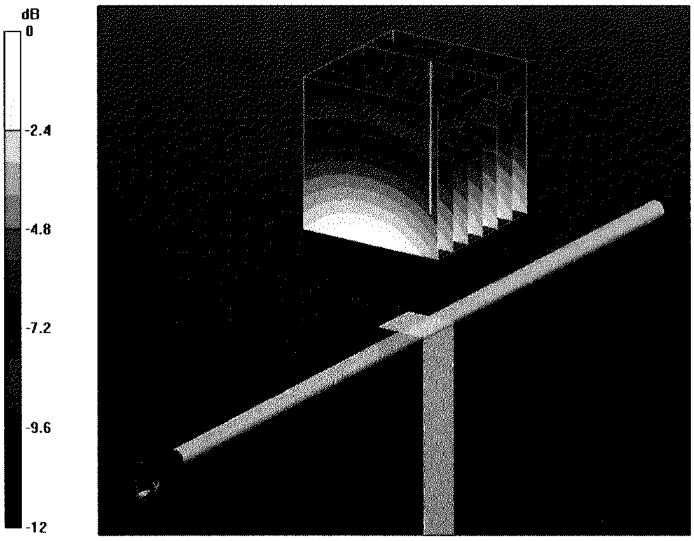
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d110

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: HSL900
Medium parameters used: f = 835 MHz; σ = 0.89 mho/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

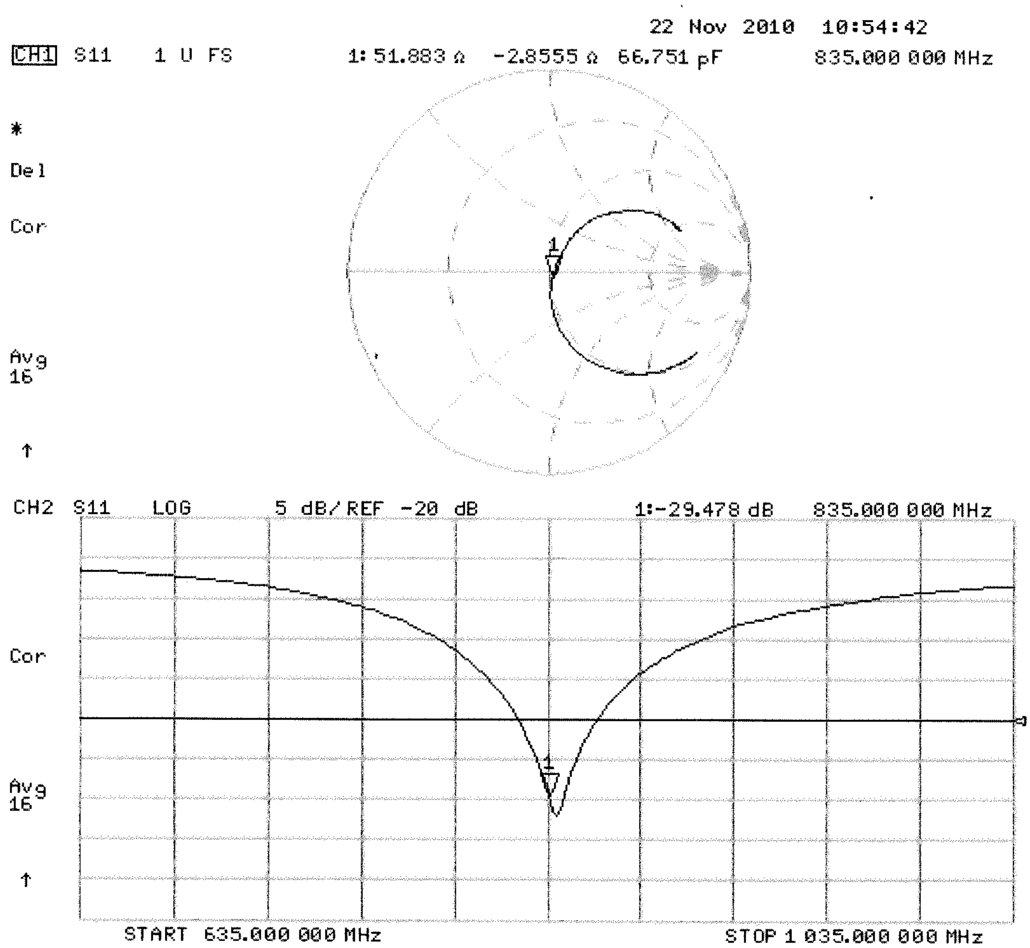
- Probe: ES3DV3 - SN3205; ConvF(6.03, 6.03, 6.03); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.5 V/m; Power Drift = 0.013 dB
Peak SAR (extrapolated) = 3.64 W/kg
SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.57 mW/g
Maximum value of SAR (measured) = 2.81 mW/g



0 dB = 2.81mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body

Date/Time: 22.11.2010 16:04:12

Test Laboratory: SPEAG, Zurich, Switzerland

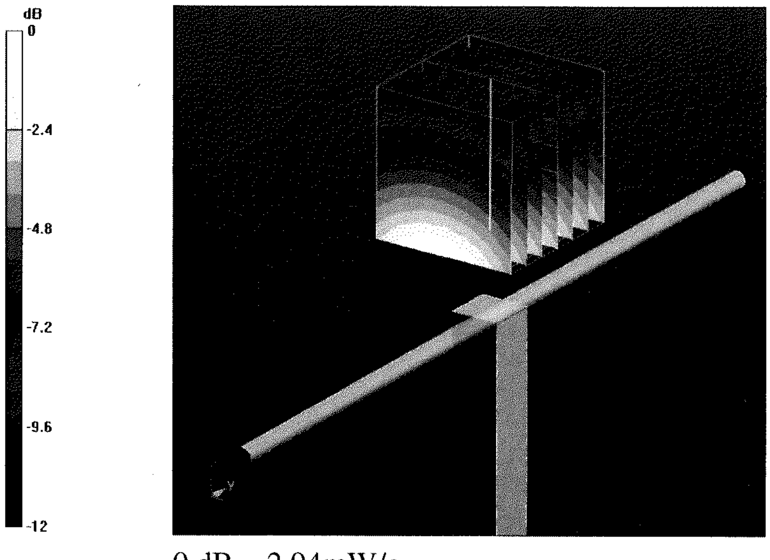
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d110

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: MSL900
Medium parameters used: f = 835 MHz; σ = 0.99 mho/m; ε_r = 54.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

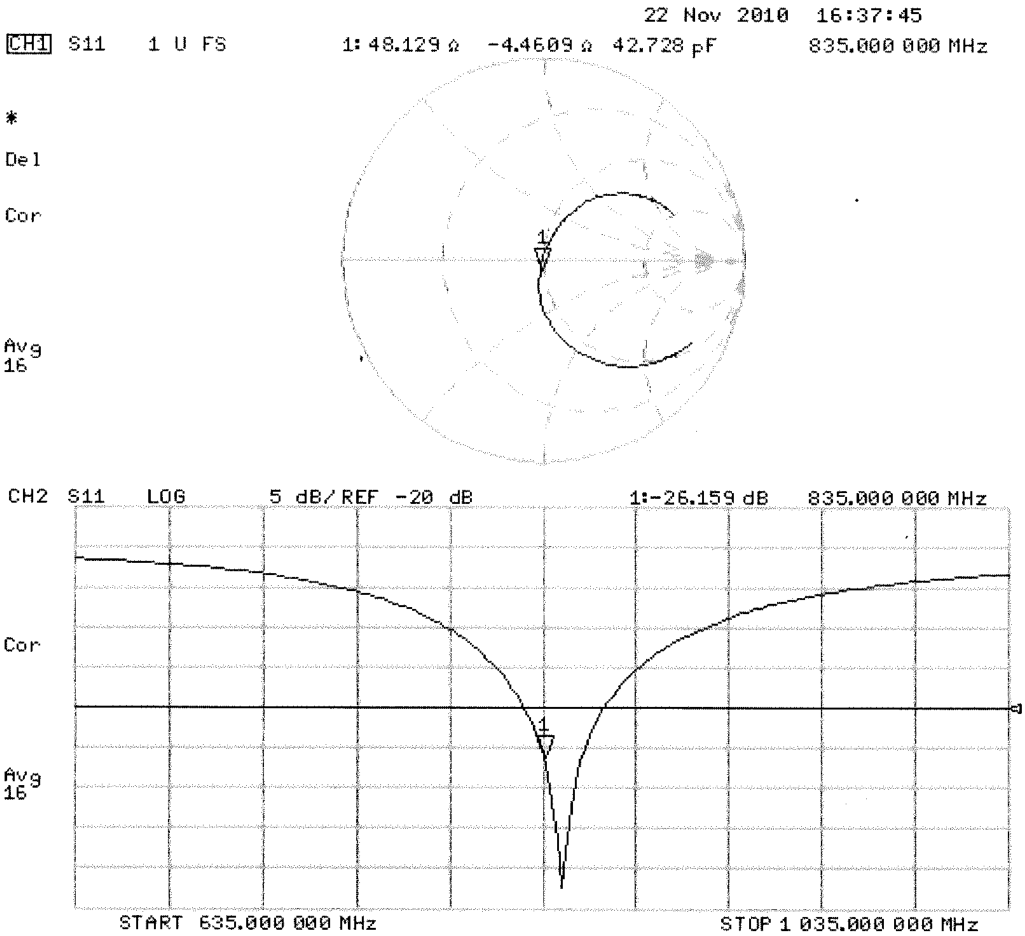
- Probe: ES3DV3 - SN3205; ConvF(5.86, 5.86, 5.86); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m; Power Drift = 0.026 dB
Peak SAR (extrapolated) = 3.75 W/kg
SAR(1 g) = 2.53 mW/g; SAR(10 g) = 1.66 mW/g
Maximum value of SAR (measured) = 2.94 mW/g



0 dB = 2.94mW/g

Impedance Measurement Plot for Body TSL



Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **MET Laboratories**

Certificate No: **IndexSAR-1S2572_Nov10**

CALIBRATION CERTIFICATE

Object	IndexSAR - SN: 1S2572
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits
Calibration date:	November 25, 2010

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 27, 2010

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1800 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.4 ± 6 %	1.35 mho/m ± 6 %
Head TSL temperature during test	(21.5 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.44 mW / g
SAR normalized	normalized to 1W	37.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**38.5 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.97 mW / g
SAR normalized	normalized to 1W	19.9 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**20.1 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	1.45 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.51 mW / g
SAR normalized	normalized to 1W	38.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**39.1 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.06 mW / g
SAR normalized	normalized to 1W	20.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**20.5 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.2 Ω - 2.2 jΩ
Return Loss	- 33.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.6 Ω - 3.2 jΩ
Return Loss	- 24.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.377 ns

Dipole designed and manufactured by IndexSAR. Please see details on http://www.indexsar.com/balanced.htm

Additional EUT Data

Manufactured by	IndexSAR
Manufactured on	unknown

DASY5 Validation Report for Head TSL

Date/Time: 25.11.2010 11:52:26

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: IndexSAR; Serial: IndexSAR - SN:1S2572

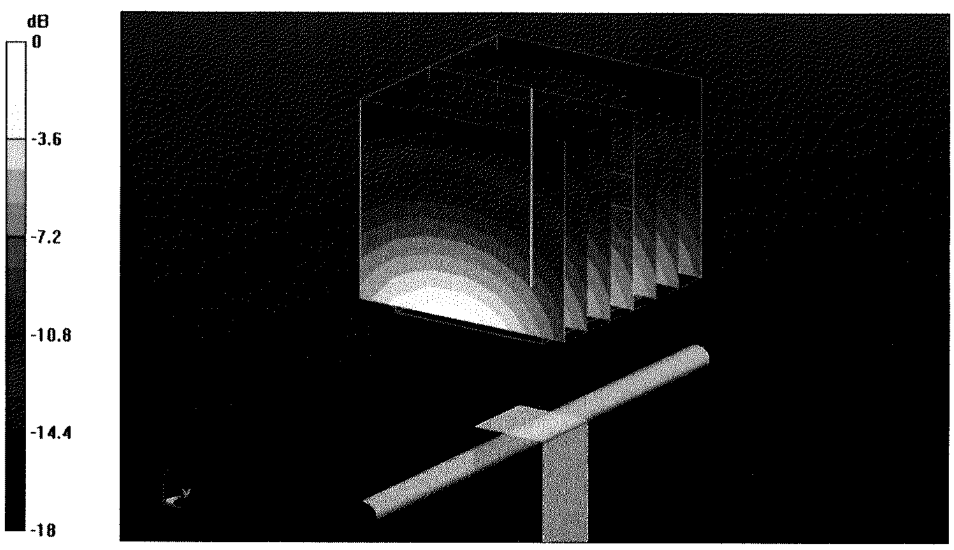
Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: HSL U12 BB
Medium parameters used: f = 1800 MHz; $\sigma = 1.35$ mho/m; $\varepsilon_r = 39.5$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.05, 5.05, 5.05); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

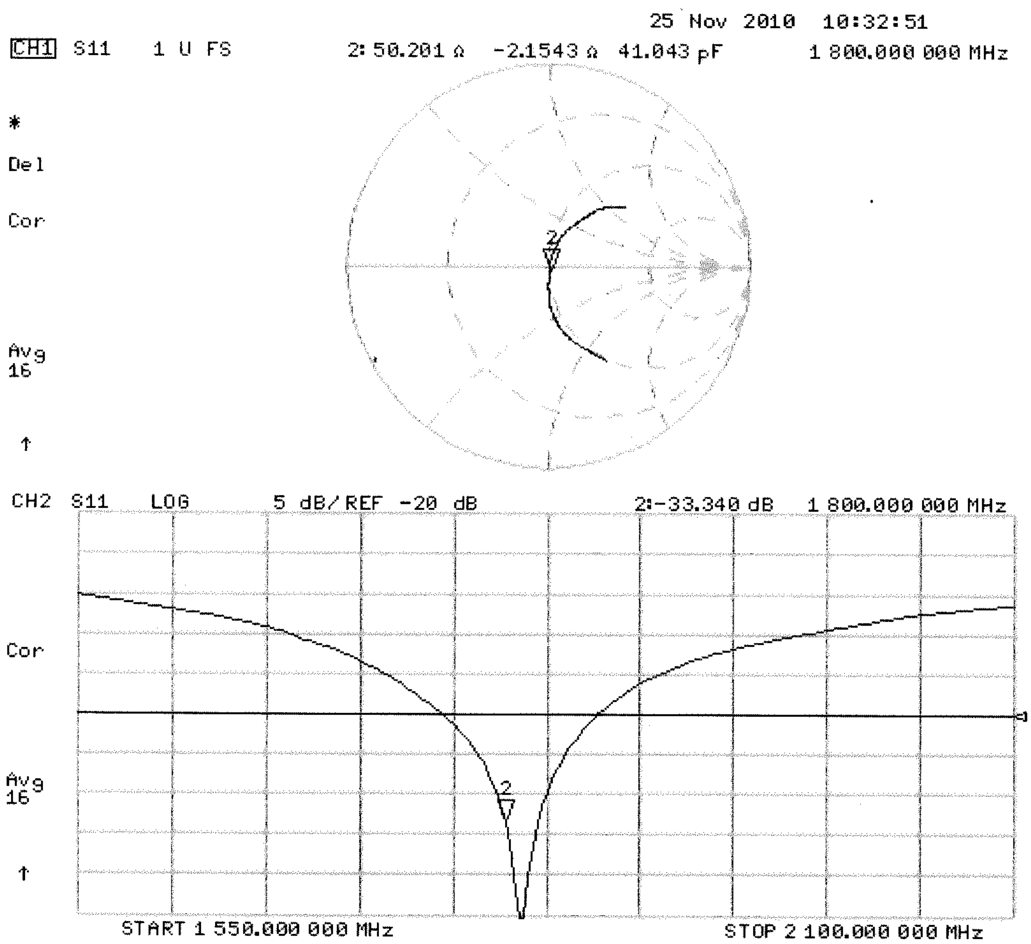
Head/d=10mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.4 V/m; Power Drift = 0.048 dB
Peak SAR (extrapolated) = 17.1 W/kg
SAR(1 g) = 9.44 mW/g; SAR(10 g) = 4.97 mW/g
Maximum value of SAR (measured) = 11.7 mW/g



0 dB = 11.7mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date/Time: 24.11.2010 15:55:08

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: IndexSAR; Serial: IndexSAR - SN:1S2572

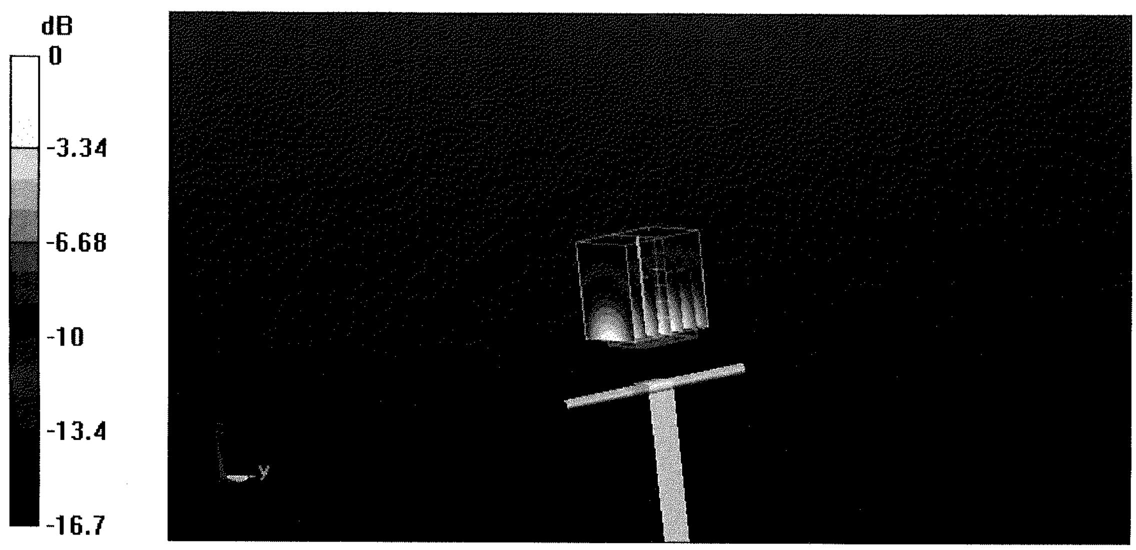
Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: MSL U12 BB
Medium parameters used: f = 1800 MHz; σ = 1.45 mho/m; ε_r = 52.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.74, 4.74, 4.74); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY52, V52.2 Build 0, Version 52.2.0 (163)
- Postprocessing SW: SEMCAD X, V14.2 Build 2, Version 14.2.2 (1685)

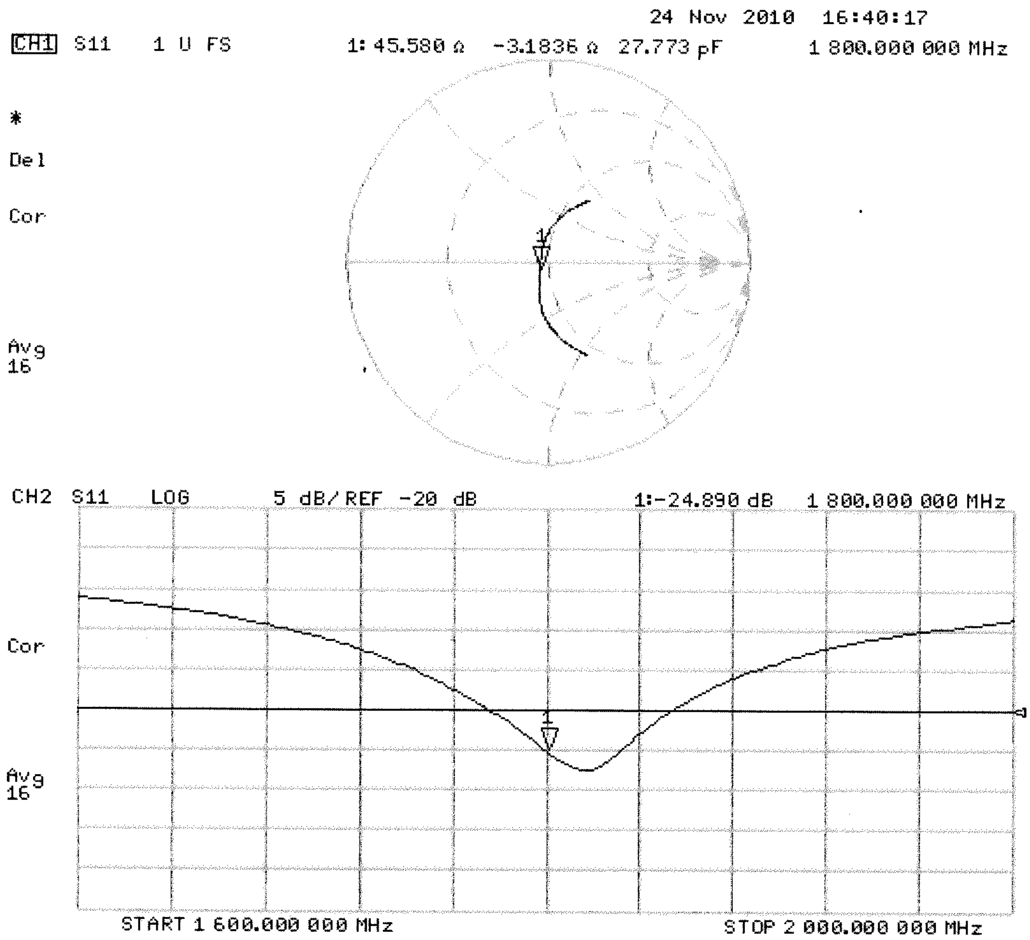
Body/d=10mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 97.5 V/m; Power Drift = -0.00118 dB
Peak SAR (extrapolated) = 16.3 W/kg
SAR(1 g) = 9.51 mW/g; SAR(10 g) = 5.06 mW/g
Maximum value of SAR (measured) = 12 mW/g



0 dB = 12mW/g

Impedance Measurement Plot for Body TSL



APPENDIX E – MEASURED FLUID DIELECTRIC PARAMETERS

Title

SubTitle

January 21, 2011 **08:05** AM

Frequency	e'	e''
815.000000 MH	55.146:	20.9986
817.000000 MH	55.118:	20.9805
819.000000 MH	55.128:	20.9975
821.000000 MH	55.122:	20.9681
823.000000 MH	55.075:	20.9790
825.000000 MH	55.081:	20.9707
827.000000 MH	55.055(	20.9791
829.000000 MH	55.072:	20.9917
831.000000 MH	55.042:	20.9487
833.000000 MH	55.006:	20.9448
835.000000 MH	54.992:	20.9561
837.000000 MH	54.954:	20.9628
839.000000 MH	54.966:	20.9556
841.000000 MH	54.937:	20.9128
843.000000 MH	54.941(	20.9232
845.000000 MH	54.906:	20.9016
847.000000 MH	54.889(	20.8969
849.000000 MH	54.886:	20.8934
851.000000 MH	54.860:	20.8942
853.000000 MH	54.813:	20.8661
855.000000 MH	54.816:	20.8553
857.000000 MH	54.796:	20.8349
859.000000 MH	54.756:	20.8343
861.000000 MH	54.738:	20.8173
863.000000 MH	54.695:	20.8186
865.000000 MH	54.682:	20.7859
867.000000 MH	54.664:	20.7741
869.000000 MH	54.670:	20.7749
871.000000 MH	54.641:	20.7601
873.000000 MH	54.602:	20.7423
875.000000 MH	54.624:	20.7081
877.000000 MH	54.579(	20.7111
879.000000 MH	54.568:	20.6955
881.000000 MH	54.547:	20.6464
883.000000 MH	54.550:	20.6707

885.000000 MH	54.5257	20.6455
887.000000 MH	54.5311	20.6121
889.000000 MH	54.5019	20.6243
891.000000 MH	54.5009	20.5946
893.000000 MH	54.4712	20.5899
895.000000 MH	54.4853	20.5861
897.000000 MH	54.4644	20.6110
899.000000 MH	54.4509	20.5886
901.000000 MH	54.4423	20.5892
903.000000 MH	54.4112	20.5728
905.000000 MH	54.3995	20.5453
907.000000 MH	54.4039	20.5600
909.000000 MH	54.3697	20.5669
911.000000 MH	54.3632	20.5622
913.000000 MH	54.3458	20.5383
915.000000 MH	54.3213	20.5313

Title

SubTitle

January 21, 2011 09:16 AM

Frequency	e'	e''
1.820000000 GH	51.318	14.6726
1.822000000 GH	51.303	14.6791
1.824000000 GH	51.288	14.6710
1.826000000 GH	51.283	14.6679
1.828000000 GH	51.264	14.6620
1.830000000 GH	51.261	14.6602
1.832000000 GH	51.239	14.6694
1.834000000 GH	51.233	14.6680
1.836000000 GH	51.236	14.6784
1.838000000 GH	51.212	14.6862
1.840000000 GH	51.206	14.7075
1.842000000 GH	51.194	14.6842
1.844000000 GH	51.203	14.6872
1.846000000 GH	51.186	14.6939
1.848000000 GH	51.194	14.6968
1.850000000 GH	51.195	14.6943
1.852000000 GH	51.173	14.6856
1.854000000 GH	51.179	14.6757
1.856000000 GH	51.164	14.6950
1.858000000 GH	51.176	14.7003
1.860000000 GH	51.172	14.7050
1.862000000 GH	51.167	14.7145
1.864000000 GH	51.166	14.7349
1.866000000 GH	51.158	14.7449
1.868000000 GH	51.142	14.7545
1.870000000 GH	51.145	14.7836
1.872000000 GH	51.134	14.7877
1.874000000 GH	51.116	14.8040
1.876000000 GH	51.117	14.8010
1.878000000 GH	51.112	14.7927
1.880000000 GH	51.121	14.8062
1.882000000 GH	51.108	14.8057
1.884000000 GH	51.095	14.8308
1.886000000 GH	51.089	14.8274
1.888000000 GH	51.090	14.8323

1.890000000 GH	51.0779	14.8461
1.892000000 GH	51.0662	14.8467
1.894000000 GH	51.0668	14.8727
1.896000000 GH	51.0512	14.8788
1.898000000 GH	51.0651	14.8671
1.900000000 GH	51.0481	14.8831
1.902000000 GH	51.0615	14.8875
1.904000000 GH	51.0494	14.9123
1.906000000 GH	51.0822	14.8973
1.908000000 GH	51.0578	14.9628
1.910000000 GH	50.9591	15.0085
1.912000000 GH	50.9622	14.9500
1.914000000 GH	51.0069	14.9651
1.916000000 GH	50.9858	14.9721
1.918000000 GH	50.9861	14.9720
1.920000000 GH	50.9625	14.9825

Title

SubTitle

January 21, 2011 10:36 AM

Frequency	e'	e''
815.000000 MI	40.194	19.9796
817.000000 MI	40.165	19.9623
819.000000 MI	40.116	19.9359
821.000000 MI	40.085	19.9653
823.000000 MI	40.061	19.9503
825.000000 MI	40.005	19.9439
827.000000 MI	40.011	19.9303
829.000000 MI	39.985	19.9289
831.000000 MI	39.941	19.9427
833.000000 MI	39.934	19.9054
835.000000 MI	39.895	19.9094
837.000000 MI	39.865	19.9058
839.000000 MI	39.841	19.8959
841.000000 MI	39.808	19.8852
843.000000 MI	39.798	19.8580
845.000000 MI	39.742	19.8687
847.000000 MI	39.726	19.8562
849.000000 MI	39.690	19.8435
851.000000 MI	39.667	19.8337
853.000000 MI	39.640	19.8253
855.000000 MI	39.638	19.8076
857.000000 MI	39.586	19.8135
859.000000 MI	39.570	19.8011
861.000000 MI	39.556	19.8005
863.000000 MI	39.516	19.7858
865.000000 MI	39.513	19.7730
867.000000 MI	39.477	19.7687
869.000000 MI	39.472	19.7606
871.000000 MI	39.444	19.7537
873.000000 MI	39.450	19.7334
875.000000 MI	39.424	19.7334
877.000000 MI	39.388	19.7061
879.000000 MI	39.388	19.7001
881.000000 MI	39.363	19.7082
883.000000 MI	39.334	19.6980

885.000000 MI	39.322	19.6696
887.000000 MI	39.309	19.6804
889.000000 MI	39.280	19.6669
891.000000 MI	39.252	19.6373
893.000000 MI	39.225	19.6306
895.000000 MI	39.191	19.6426
897.000000 MI	39.187	19.5959
899.000000 MI	39.164	19.5959
901.000000 MI	39.122	19.5879
903.000000 MI	39.140	19.5945
905.000000 MI	39.118	19.5786
907.000000 MI	39.084	19.5713
909.000000 MI	39.052	19.5753
911.000000 MI	39.027	19.5686
913.000000 MI	39.011	19.5390
915.000000 MI	39.010	19.5152

Title

SubTitle

January 21, 2011 **01:30** PM

Frequency	e'	e''
1.820000000 GI	40.133	13.5699
1.822000000 GI	40.120	13.5763
1.824000000 GI	40.111	13.5814
1.826000000 GI	40.094	13.5978
1.828000000 GI	40.083	13.5998
1.830000000 GI	40.071	13.6105
1.832000000 GI	40.064	13.6008
1.834000000 GI	40.045	13.6069
1.836000000 GI	40.056	13.6256
1.838000000 GI	40.049	13.6262
1.840000000 GI	40.045	13.6357
1.842000000 GI	40.039	13.6479
1.844000000 GI	40.029	13.6454
1.846000000 GI	40.014	13.6543
1.848000000 GI	40.022	13.6640
1.850000000 GI	40.019	13.6616
1.852000000 GI	40.013	13.6679
1.854000000 GI	40.012	13.6801
1.856000000 GI	39.991	13.6830
1.858000000 GI	39.997	13.6954
1.860000000 GI	40.000	13.7091
1.862000000 GI	39.975	13.7133
1.864000000 GI	39.975	13.7225
1.866000000 GI	39.981	13.7289
1.868000000 GI	39.969	13.7290
1.870000000 GI	39.969	13.7526
1.872000000 GI	39.953	13.7424
1.874000000 GI	39.940	13.7439
1.876000000 GI	39.953	13.7518
1.878000000 GI	39.940	13.7416
1.880000000 GI	39.948	13.7435
1.882000000 GI	39.955	13.7628
1.884000000 GI	39.932	13.7538
1.886000000 GI	39.935	13.7686
1.888000000 GI	39.912	13.7596

1.890000000 GI	39.907!	13.7567
1.892000000 GI	39.896:	13.7625
1.894000000 GI	39.893!	13.7683
1.896000000 GI	39.904!	13.7614
1.898000000 GI	39.890!	13.7699
1.900000000 GI	39.853	13.7607
1.902000000 GI	39.884:	13.7771
1.904000000 GI	39.851!	13.7723
1.906000000 GI	39.863!	13.7840
1.908000000 GI	39.842:	13.8341
1.910000000 GI	39.761!	13.7739
1.912000000 GI	39.722:	13.8020
1.914000000 GI	39.744(	13.7922
1.916000000 GI	39.759!	13.8039
1.918000000 GI	39.754!	13.8152
1.920000000 GI	39.744!	13.7978

APPENDIX F – PHANTOM CERTIFICATE OF CONFORMITY

Schmid & Partner Engineering AG

s p e a g

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Certificate of conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 C
Series No	TP-1150 and higher
Manufacturer / Origin	Untersee Composites Hauptstr. 69 CH-8559 Fruthwilen Switzerland

Tests

The series production process used allows the limitation to test of first articles.
Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas; 6mm +/- 0.2mm at ERP	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz – 3 GHz Relative permittivity < 5 Loss tangent < 0.05.	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions	DEGMBE based simulating liquids	Pre-series, First article, Samples

Standards

[1] CENELEC EN 50361
[2] IEEE Std 1528-200x Draft CD 1.1 (Dec 02)
[3] IEC 62209/CD (Nov 02)
(*) The IT'IS CAD file is derived from [2] and is also within the tolerance requirements of the shapes of [1] and [3].

Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

Date 7.8.2003

Signature / Stamp

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