SAR EVALUATION REPORT

Report No. : 24EE0050-HO-2

Applicant	:	**SHARP CORPORATION**
Type of Equipment	:	**GSM Mobile Phone**
Model No.	:	**TM100**
FCC ID	:	**APYNAR0055**
Test standard	:	**FCC47CFR 2.1093** **FCC OET Bulletin 65, Supplement C**
Test Result	:	**Complied**
Max SAR Measured	:	**Head 0.135 W/kg(1850.2 MHz)** **Body 0.392 W/kg(1880.0 MHz)**

1. This test report shall not be reproduced except full or partial, without the written approval of UL Apex Co., Ltd.
2. The results in this report apply only to the sample tested.
3. This equipment is in compliance with above regulation. We hereby certify that the data contain a true representation of the SAR profile.
4. The test results in this test report are traceable to the national or international standards.

Date of test : December 26, 2003 and January 11, 2004

Tested by : M. Ikuta

Miyo Ikuta
Head Office EMC Lab.

Approved by : T. Maeno

Tetsuo Maeno
Site Manager of Head Office EMC Lab.

CONTENTS

PAGE

SECTION 1 : Client information

Company Name	:	SHARP CORPORATION
Brand Name	:	SHARP
Address	:	2-13-1 Iida Hachihonmatsu Higashihiroshima-city Hirosima, 739-0192 , Japan
Telephone Number	:	+81-824-20-1863
Facsimile Number	:	+81-824-20-1864
Contact Person	:	Hiroyuki Uwatoko

SECTION 2 : Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Applicant	:	SHARP CORPORATION
Type of Equipment	:	GSM Mobile Phone
Model No.	:	TM100
Serial No.	:	187
Country of Manufacture	:	JAPAN
Receipt Date of Sample	:	December 25, 2003
Condition of EUT	:	Engineering prototype
Battery option	:	Only one model with EUT (M/N:OSH20056, 3.7V / 700mA.h.)
Accessories	:	Earphone
Category Identified	:	Portable device

2.2 Product Description

Tx Frequency	:	1850.2 - 1909.8 MHz for PCS1900
Modulation	:	GMSK
Rating	:	DC 2.7-3.0V
Max.Output Power Tested	:	27.5 dBm Peak Conducted
Antenna Type	:	Internal antenna
Size of EUT	:	49.4*100*19.1 (W*L*H)
Position of Antenna	:	See photograph of following

SECTION 3 : Requirements for compliance testing defined by the FCC

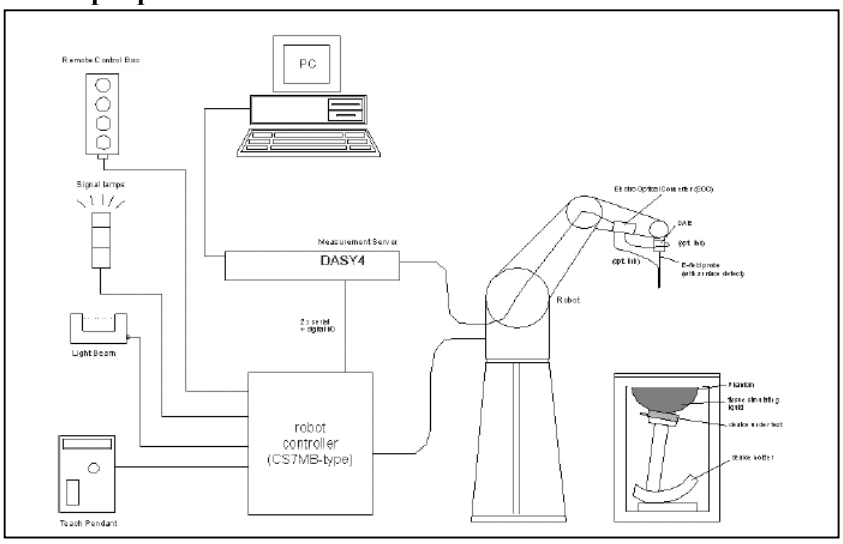
The US Federal Communications Commission has released the report and order “Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable telephones. For consumer products, the applicable limit is 1.6 mW/g for an uncontrolled environment and 8.0 mW/g for an occupational/controlled environment as recommended by the ANSI/IEEE standard C95.1-1992. According to the Supplement C of OET Bulletin 65 “Evaluating Compliance with FCC Guide-lines for Human Exposure to Radio frequency Electromagnetic Fields", released on Jun 29, 2001 by the FCC, the device should be evaluated at maximum output power (radiated from the antenna) under “worst-case” conditions for normal or intended use, incorporating normal antenna operating positions, device peak performance frequencies and positions for maximum RF energy coupling.

1 Specific Absorption Rate (SAR) is a measure of the rate of energy absorption due to exposure to an RF transmitting source (wireless portable device).
2 IEEE/ANSI Std. C95.1-1992 limits are used to determine compliance with FCC ET Docket 93-62.

SECTION 4 : Dosimetry assessment setup

These measurements were performed with the automated near-field scanning system DASY4 from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision robot (working range greater than 0.9 m), which positions the probes with a positional repeatability of better than +/- 0.02 mm. Special E- and H-field probes have been developed for measurements close to material discontinuity, the sensors of which are directly loaded with a Schottky diode and connected via highly resistive lines to the data acquisition unit. The SAR measurements were conducted with the dosimetry probe ET3DV6, SN: 1685 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation. The probe has been calibrated according to the procedure described in [2] with accuracy of better than +/-10%. The spherical isotropy was evaluated with the procedure described in [3] and found to be better than +/-0.25 dB. The phantom used was the SAM Twin Phantom as described in FCC supplement C, IEE P1528 and CENELEC EN50361.

4.1 Configuration and peripherals



The DASY4 system for performing compliance tests consist of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
   An arm extension for accommodating the data acquisition electronics (DAE).

2. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

3. A data acquisition electronic (DAE), which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

4. The Electro-optical converter (EOC) performs the conversion between 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 is connected to the measurement server.

5. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.

6. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.

7. A computer operating Windows 2000.

8. DASY4 software.

9. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.

10. The SAM twin phantom enabling testing left-hand and right-hand usage.

11. The device holder for handheld mobile phones.

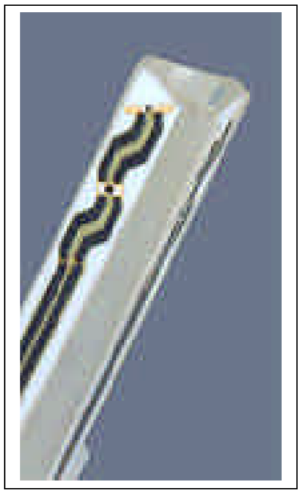
12. Tissue simulating liquid mixed according to the given recipes.

13. Validation dipole kits allowing to validate the proper functioning of the system.

4.2 System components

4.2.1 ET3DV6 Probe Specification

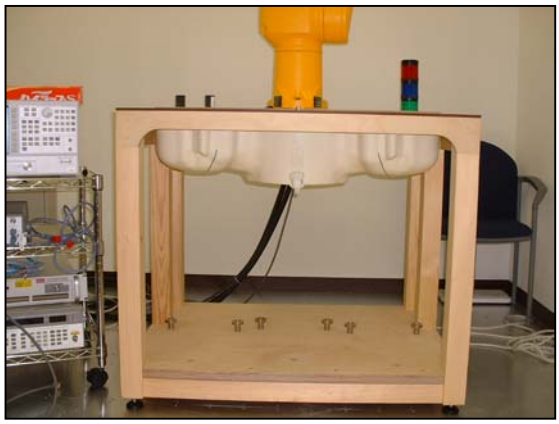
Construction:
Symmetrical design with triangular core
Built-in optical fiber for surface detection System
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., glycol ether)
Calibration:
Basic Broad Band calibration in air from 10 MHz to 2.5 GHz
In brain and muscle simulating tissue at
Frequencies of 450 MHz, 900 MHz, 1.8 GHz and 2.45GHz (accuracy +/-8%)
Frequency:
10 MHz to 3GHz; Linearity: +/-0.2 dB
(30 MHz to 3 GHz)
Directivity:
+/-0.2 dB in brain tissue (rotation around probe axis)
+/-0.4 dB in brain tissue (rotation normal probe axis)
Dynamic Range:
5 mW/g to > 100 mW/g;Linearity: +/-0.2 dB
Optical Surface Detection:
+/-0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces.
Dimensions:
Overall length: 330 mm (Tip: 16 mm)
Tip length: 16 mm
Body diameter: 12 mm (Body: 12 mm)
Tip diameter: 6.8 mm
Distance from probe tip to dipole centers: 2.7 mm
Application:
General dosimetric up to 3 GHz
Compliance tests of mobile phones
Fast automatic scanning in arbitrary phantoms



Inside view of ET3DV6 E-field Probe

4.2.2 SAM Phantom

Construction:
The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528-200X, CENELEC 50361 and IEC 62209.
It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points with the robot.
Shell Thickness:
2 +/-0.2 mm
Filling Volume:
Approx. 25 liters
Dimensions:
(H x L x W): 810 x 1000 x 500 mm



SAM Phantom

4.2.3 Device Holder for Transmitters

In combination with the SAM Twin Phantom V4.0, the Mounting Device enables the rotation of the mounted transmitter
in spherical coordinates whereby the rotation points is the ear opening. The devices can be easily, accurately, and repeatedly positioned according to the FCC and CENELEC specifications. The device holder can be locked at different phantom locations (left head, right head,flat phantom).
* Note: A simulating human hand is not used due to the complex anatomical and geometrical structure of the hand that may produced infinite number of configurations.
To produce the worst-case condition (the hand absorbs antenna output power), the hand is omitted during the tests.

Device Holder

SECTION 5 : Test system specifications

Robot RX60L

Number of Axes	:	6
Payload	:	1.6 kg
Reach	:	800mm
Repeatability	:	+/-0.025mm
Control Unit	:	CS7M
Programming Language	:	V+
Manuafacture	:	Stäubli Unimation Corp. Robot Model: RX60

DASY4 Measurement sever

Features	:	166MHz low power Pentium MMX 32MB chipdisk and 64MB RAM Serial link to DAE (with watchdog supervision) 16 Bit A/D converter for surface detection system Two serial links to robot (one for real-time communication which is supervised by watchdog) Ethernet link to PC (with watchdog supervision) Emergency stop relay for robot safety chainTwo expansion slots for future applications
Manufacture	:	Schimid & Partner Engineering AG

Data Acquisition Electronic (DAE)

Features	:	Signal amplifier, multiplexer, A/D converter and control logic Serial optical link for communication with DASY4 embedded system (fully remote controlled) 2 step probe touch detector for mechanical surface detection and emergency robot stop (not in -R version)
Measurement Range	:	1 µV to > 200 mV (16 bit resolution and two range settings: 4mV, 400mV)
Input Offset voltage	:	< 1 µV (with auto zero)
Input Resistance	:	200 MΩ
Battery Power	:	> 10 h of operation (with two 9 V accus)
Dimension	:	60 x 60 x 68 mm
Manufacture	:	Schimid & Partner Engineering AG

Software

Item	:	Dosimetric Assesment System DASY4
Type No.	:	SD 000 401A, SD 000 402A
Software version No.	:	4.1
Manufacture / Origin	:	Schimid & Partner Engineering AG

E-Field Probe

Model	:	ET3DV6
Serial No.	:	1685
Construction	:	Triangular core fiber optic detection system
Frequency	:	10 MHz to 6 GHz
Linearity	:	+/-0.2 dB (30 MHz to 3 GHz)
Manufacture	:	Schimid & Partner Engineering AG

Phantom

Type	:	SAM Twin Phantom V4.0
Shell Material	:	Fiberglass
Thickness	:	2.0 +/-0.2 mm
Volume	:	Approx. 20 liters
Manufacture	:	Schimid & Partner Engineering AG

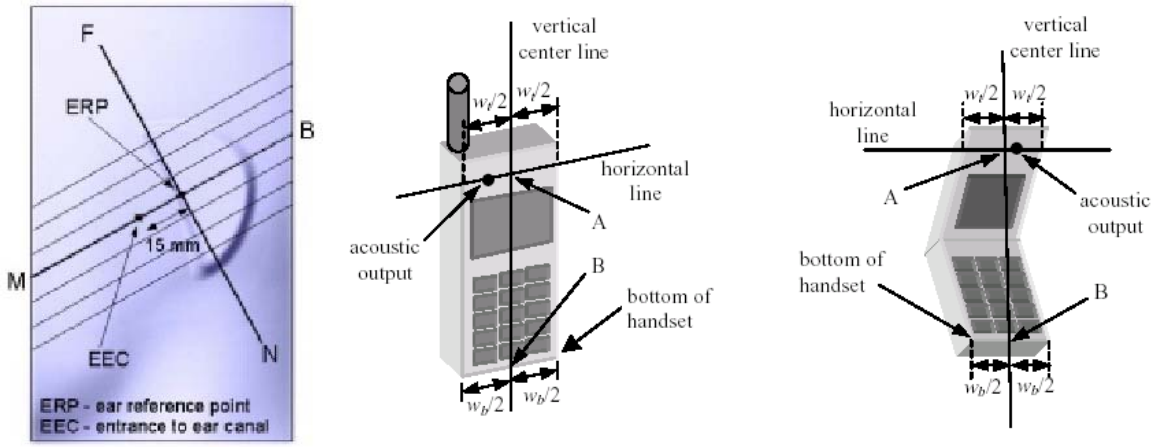
SECTION 6 : Test setup of EUT

6.1 Description of the head test setup

According to the OET 65 and IEEE1528, this EUT was tested on the left and right side of the head phantom in the "Cheek/Touch" and "Ear/Tilt" positions.
Antenna is built in the EUT and is fixed.

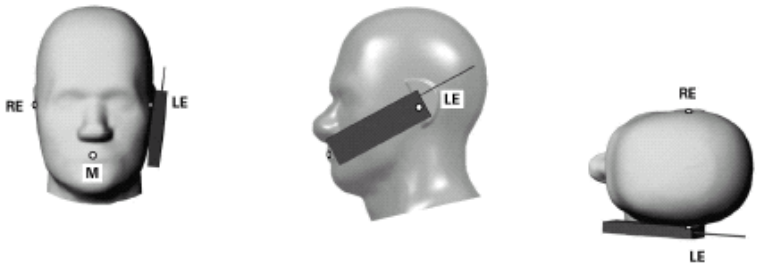
6.1.1 Initial ear position

A handset should be initially positioned with the earpiece region pressed against the ear spacerof a head phantom. The device should be positioned parallel to the "N-F" line defined along the base of the ear spacer that contains the "ear reference point". The "test device reference point" is aligned to the "ear reference point" on the head phantom and the "vertical centerline" is aligned to the "phantom reference plane".



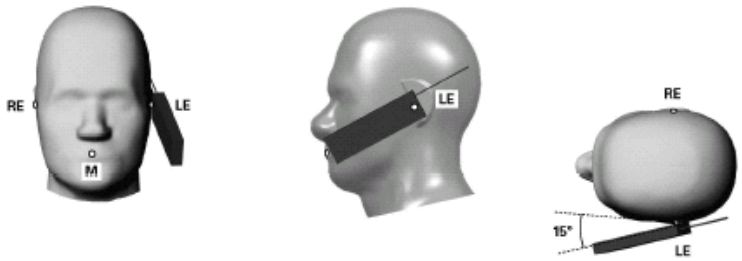
6.1.2 Cheek position

The device is brought toward the mouth of the head phantom by pivoting against the "ear reference point" or along the "N-F" line.
This test position is established:
i) When any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom.
ii) (or) When any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.



6.1.2 Tilt position

If the earpiece of the handset is not in full contact with the phantom's ear spacer and the peak SAR location for the "Cheek/Touch" position is located at the ear spacer region or corresponds to the earpiece region of the handset, the device should be returned to the "initial ear position" by rotating it away from the mouth until the earpiece is in full contact with the ear spacer.Otherwise the handset should be moved away from the cheek perpendicular to the line passes through both "ear reference points" for approximate 2-3 cm. While it is in this position, the handset is tilted away from the mouth with respect to the "test device reference point" by 15°. After the tilt, it is then moved back toward the head perpendicular to the line passes through both "ear reference points" until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process should be repeated with a tilt angle less than 15° so that the device and its antenna would touch the phantom simultaneously.



6.2 Description of the Body-worn test setup

Body-worn measurements were performed in GSM modeand GPRSmode.
The measurements in GSM mode were performed in the EUT with the earphone.
And test set-up is the following positions.

6.2.1 Face position

The test was performed in distanced 15mm with face of EUT to the flat phantom.

6.2.2 Bottom position

The test was performed in distanced 15mm with bottom of EUT to the flat phantom.

Face position

Bottom position

6.3 EUT Tune-up procedure

We used the basic-station simulator and determined the following conditions.

Since the modulation of this EUT is GSM .
Crest Factor = 8.3
Frequency conditions tested at low, middle and high channel (1850.2MHz, 1880.0MHz , 1909.8MHz).

Since the modulation of this EUT is GPRS.
Crest Factor = 4.2
Frequency conditions tested at low, middle and high channel (1850.2MHz, 1880.0MHz , 1909.8MHz).

*Detail of base-station simulator
Item : Universal Radio Cimmunication Tester
Model Number : CMU200
Serial Number : 130900897
Manufacture : Rohde & Schwarz

SECTION 7 : Measurement uncertainty

The uncertainty budget has been determined for the DASY4 measurement system according to the NIS81 [13] and the NIST1297 [6] documents and is given in the following Table.

Error Description	Uncertainty value ± %	Probability distribution	divisor	(ci)1 1g	Standard Uncertainty (1g)	vi or veff
Measurement System						
Probe calibration	±4.8	Normal	1	1	±4.8	∞
Axial isotropy of the probe	±4.7	Rectangular	√3	$(1-c_p)^{1/2}$	±1.9	∞
Spherical isotropy of the probe	±9.6	Rectangular	√3	$(c_p)^{1/2}$	±3.9	∞
Boundary effects	±1.0	Rectangular	√3	1	±0.6	∞
Probe linearity	±4.7	Rectangular	√3	1	±2.7	∞
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	±2.6	Rectangular	√3	1	±1.5	∞
RF ambient conditions	±3.0	Rectangular	√3	1	±1.7	∞
Mech. constraints of robot	±0.4	Rectangular	√3	1	±0.2	∞
Probe positioning	±2.9	Rectangular	√3	1	±1.7	∞
Extrap. and integration	±1.0	Rectangular	√3	1	±0.6	∞
Test Sample Related						
Device positioning	±2.9	Rectangular	√3	1	±2.9	14
Device holder uncertainty	±3.6	Rectangular	√3	1	±3.6	7
Power drift	±5.0	Rectangular	√3	1	±2.9	∞
Phantom and Setup						
Phantom uncertainty	±4.0	Rectangular	√3	1	±2.3	∞
Liquid conductivity (deviation from target values)	±5.0	Rectangular	√3	0.64	±1.8	∞
Liquid conductivity (measurement uncertainty)	±5.0	Rectangular	√3	0.64	±1.8	∞
Liquid permittivity (deviation from target values)	±5.0	Rectangular	√3	0.6	±1.7	∞
Liquid permittivity (measurement uncertainty)	±5.0	Rectangular	√3	0.6	±1.7	∞
Combined Standard Uncertainty					**±10.37**	
Expanded Uncertainty (k=2)					**±20.7**	

SECTION 8 : Simulated tissue liquid parameter

8.1 Simulated Tissue Liquid Parameter confirmation

The dielectric parameters were checked prior to assessment using the HP85070D dielectric probe kit.
The dielectric parameters measurement are reported in each correspondent section.

8.1.1 Head 1800MHz

Type of liquid : **Head 1800 MHz**
Ambient temperature (deg.c.) : **24.0(December 26), 24.5(January 11)**
Relative Humidity (%) : **32(December 26), 32(January 11)**

Measured By : Miyo Ikuta

DIELECTRIC PARAMETERS MEASUREMENT RESULTS								
Date	Frequency	Liquid Temp [deg.c]		Parameters	Target Value	Measured	Deviation [%]	Limit [%]
		Before	After					
December 26	1800	22.2	22.2	Relative Permittivity εr	40.0	40.1	0.3	+/-5
				Coductivity σ [mho/m]	1.40	1.37	-2.1	+/-5
January 11	1800	23.1	23.1	Relative Permittivity εr	40.0	40.0	0.0	+/-5
				Coductivity σ [mho/m]	1.40	1.35	-3.6	+/-5
December 26	1880	23.1	23.1	Relative Permittivity εr	40.0	40.1	0.3	+/-5
				Coductivity σ [mho/m]	1.40	1.35	-3.6	+/-5

8.1.2 Muscle 1800MHz

Type of liquid : **Muscle 1800 MHz**
Ambient temperature (deg.c.) : **24.5**
Relative Humidity (%) : **32**

Date : January 11, 2004
Measured By : Miyo Ikuta

DIELECTRIC PARAMETERS MEASUREMENT RESULTS								
Date	Frequency	Liquid Temp [deg.c]		Parameters	Target Value	Measured	Deviation [%]	Limit [%]
		Before	After					
January 11	1880	23.4	23.4	Relative Permittivity	53.3	51.6	-3.2	+/-5
				Coductivity σ [mho/m]	1.52	1.47	-3.3	+/-5

8.2 Simulated Tissues

Ingredient	MiXTURE(%)	
	Head 1800MHz	Muscle 1800MHz
Water	55.2	71.6
DGMBE	44.4	30.0
Salt	0.3	0.4

Note:DGMBE(Diethylenglycol-monobuthyl ether)

SECTION 9 : System validation data

Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of +/-10%. The validation results are tabulated below. Please refer to APPENDIX 3.

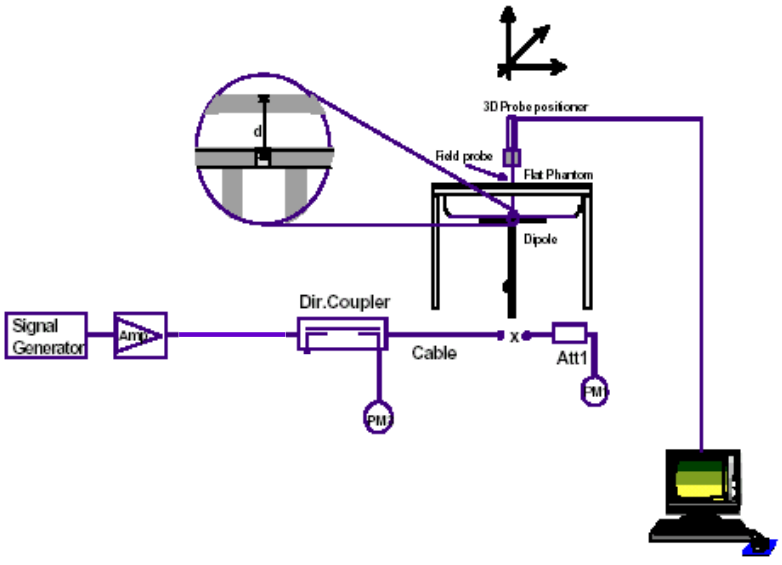
Type of liquid	:	**HEAD 1800MHz**
Frequency	:	**1800MHz**
Liquid depth (cm)	:	**15.5**
Ambient temperature (deg.c.)	:	**24.0(December 26), 24.5(January 11)**
Relative Humidity (%)	:	**32(December 26), 32(January 11)**
Dipole	:	**D1800V2 SN:2d040**
Power	:	**250mW**

Measured By : Miyo Ikuta

SYSTEM PERFORMANCE CHECK

Date	Liquid (HEAD 1800MHz)						System dipole validation target & measured			
	Liquid Temp [deg.c.]		Relative Permittivity εr		Conductivity σ [mho/m]		SAR 1g [W/kg]		Deviation [%]	Limit [%]
	Before	After	Target	Measured	Target	Measured	Target	Measured		
December 26	22.6	22.6	40.0	40.1	1.40	1.37	9.525	9.38	-1.5	+/-10
January 11	22.8	22.8	40.0	40.0	1.40	1.35	9.525	9.13	-4.1	+/-10

Note: Please refer to Attachment for the result representation in plot format



Test system for the system performance check setup diagram

1800MHz System performance check setup

SECTION 10 : Evaluation procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the E-filed at a fixed location above the ear point or central position of flat phantom was used as a reference value for assessing the power drop of Step 4

Step 2: The SAR distribution at the exposed side of head or body position was measured at a distance of each device from the inner surface of the shell. The area covered the entire dimension of the EUT and the horizontal grid spacing was 20 mm x 20 mm. Based on these data, the area of the maximum absorption was determined by spline interpolation.

Step 3: Around this point found in the Step 2 (area scan) , a volume of 30 mm x 30 mm x 30 mm was assessed by measuring 7 x 7 x 7 points. And for any secondary peaks found in the Step2 which are within 2dB of maximum peak and not with this Step3 (Zoom scan) is repeated. On the basis of this data set, the spatial peak SAR value was evaluated under the following procedure:

1. The data at the surface were extrapolated, since the center of the dipoles is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.3 mm. The extrapolation was based on a least square algorithm [4]. A polynomial of the fourth order was calculated through the points in z-axes.
This polynomial was then used to evaluate the points between the surface and the probe tip.

2. The maximum interpolated value was searched with a straightforward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed by the 3D-Spline interpolation algorithm. The 3D-Spline is composed of three one-dimensional splines with the “Not a knot"-condition (in x, y and z-directions) [4], [5]. The volume was integrated with the trapezoidal-algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.

3. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.

Step 4: Re-measurement of the E-field at the same location as in Step 1. It is measured power drift. (the difference between the E-field measured in Step 4 and Step 1)

SECTION 11 : Exposure limit

(A) Limits for Occupational/Controlled Exposure (W/kg)

Spatial Average (averaged over the whole body)	Spatial Peak (averaged over any 1g of tissue)	Spatial Peak (hands/wrists/feet/ankles averaged over 10g)
0.4	8.0	20.0

(B) Limits for General population/Uncontrolled Exposure (W/kg)

Spatial Average (averaged over the whole body	Spatial Peak (averaged over any 1g of tissue)	Spatial Peak (hands/wrists/feet/ankles averaged over 10g)
0.08	1.6	4.0

Occupational/Controlled Environments: are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

General Population/Uncontrolled Environments: are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

NOTE:GENERAL POPULATION/UNCONTROLLED EXPOSURE
SPATIAL PEAK(averaged over any 1g of tissue) LIMIT
1.6 W/kg

SECTION 12 : SAR Measurement results

12.1 Head 1800MHz SAR

12.1.1 Conducted power measurement results

Date : December 26, 2003
Measured By : Miyo Ikuta

CONDUCTED POWER MEASUREMENT RESULTS												
	Before					After						
Frequency [MHz]	Reading [dBm]	Att. [dB]	Cable loss [dB]	Result [dBm]	Convert [mW]	Reading [dBm]	Att. [dB]	Cable loss [dB]	Result [dBm]	Convert [mW]	Deviation [%]	Limit [%]
1850.2	-2.7	30	0.2	27.5	562.3	-2.7	30	0.2	27.5	562.3	0.0	+/-5
1880.0	-2.7	30	0.2	27.5	562.3	-2.8	30	0.2	27.4	549.5	-2.3	+/-5
1909.8	-3.0	30	0.2	27.2	524.8	-3.0	30	0.2	27.2	524.8	0.0	+/-5

12.2 Head 1800MHz SAR

Liquid Depth (cm)	:	**15.3**	Model	:	**TM100**
Parameters	:	ε_r =**40.1**, σ =**1.35**	Serial No.	:	**187**
Ambient Temperature[deg.c.]	:	**24.5**	Operating mode	:	**GSM**
Relative Humidity (%)	:	**32**	Crest factor	:	**8.3**

Date : December 26, 2003
Measured By : Miyo Ikuta

HEAD SAR MEASUREMENT RESULTS							
Frequency		Phantom Section	EUT Set-up Conditions		Liquid Temp.[deg.c]		SAR(1g) [W/kg]
Channel	[MHz]		Antenna	Position	Before	After	Maximum value of multi-peak)
Mid	1880.0	Left	Fixed	Cheek	22.7	22.7	**0.0818**
Mid	1880.0	Left	Fixed	Tilt	22.7	22.7	**0.0948**
Mid	1880.0	Right	Fixed	Cheek	22.9	22.9	**0.119**
Mid	1880.0	Right	Fixed	Tilt	22.9	23.0	**0.0976**
Low	1850.2	Right	Fixed	Cheek	23.0	23.1	**0.135**
High	1909.8	Right	Fixed	Cheek	23.1	23.1	**0.117**
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General					**Body SAR: 1.6 W/kg (averaged over 1 gram)**		

12.2 Body 1800MHz SAR
12.2.1 Conducted power measurement results

Date : January 11,2004
Measured By : Miyo Ikuta

CONDUCTED POWER MEASUREMENT RESULTS

Frequency [MHz]	Before					After					Deviation [%]	Limit [%]
	Reading [dBm]	Att. [dB]	Cable loss [dB]	Result [dBm]	Convert [mW]	Reading [dBm]	Att. [dB]	Cable loss [dB]	Result [dBm]	Convert [mW]		
1850.2	-2.8	30	0.2	27.4	549.5	-2.8	30	0.2	27.4	549.5	0.0	+/-5
1880.0	-2.8	30	0.2	27.4	549.5	-2.8	30	0.2	27.4	549.5	0.0	+/-5
1909.8	-2.9	30	0.2	27.3	537.0	-3.0	30	0.2	27.2	524.8	-2.3	+/-5

12.2 Body 1800MHz SAR

Liquid Depth (cm)	:	**15.9**	Model	:	**TM100**
Parameters	:	ε_r =**51.6**, σ =**1.47**	Serial No.	:	**187**
Ambient Temperature[deg.c.]	:	**24.5**	Operating mode	:	**GSM,GPRS**
Relative Humidity (%)	:	**32**	Crest factor	:	**8.3(GSM),4.2(GPRS)**

Date : January 11, 2004
Measured By : Miyo Ikuta

BODY SAR MEASUREMENT RESULTS

Mode	Frequency		Phantom Section	EUT Set-up Conditions			Liquid Temp.[deg.c]		SAR(1g) [W/kg]
	Channel	[MHz]		Antenna	Position	Separation [mm]	Before	After	Maximum value of multi-peak)
GSM	Mid	1880.0	Flat	Fixed	Face	15	23.0	23.0	**0.0713**
	Mid	1880.0	Flat	Fixed	Bottom	15	22.7	22.7	**0.176**
	Low	1850.2	Flat	Fixed	Bottom	15	22.8	22.9	**0.22**
	High	1909.8	Flat	Fixed	Bottom	15	22.9	22.9	**0.19**
GPRS	Mid	1880.0	Flat	Fixed	Face	15	23.0	23.1	**0.118**
	Mid	1880.0	Flat	Fixed	Bottom	15	23.2	23.2	**0.392**
	Low	1850.2	Flat	Fixed	Bottom	15	23.1	23.0	**0.349**
	High	1909.8	Flat	Fixed	Bottom	15	23.0	23.0	**0.304**
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population							**Body SAR: 1.6 W/kg (averaged over 1 gram)**		

SECTION 13 : Equipment & calibration information

Name of Equipment	Manufacture	Model number	Serial number	Calibration	
				Last Cal	due date
Power Meter	Agilent	E4417A	GB41290639	2003/11/12	2004/11/11
Power Sensor	Agilent	E9300B	US40010300	2003/11/17	2004/11/16
Power Sensor	Agilent	E9327A	US40440576	2003/11/13	2004/11/12
S-Parameter Network Analyzer	Agilent	E8358A	US41080381	2003/08/13	2004/08/12
Signal Generator	Rohde&Schwarz	SML03	100331	2003/09/11	2004/09/10
RF Amplifier	OPHIR	5056F	1005	2003/02/06	2004/02/05
Dosimetric E-Field Probe	Schmid&Partner Engineering AG	ET3DV6	1685	2003/10/10	2004/10/09
Data Acquisition Electronics	Schmid&Partner Engineering AG	DAE3 V1	509	2003/04/10	2004/04/09
Robot,SAM Phantom	Schmid&Partner Engineering AG	DASY4	I021834	N/A	N/A
Attenuator	HIROSE ELECTRIC CO.,LTD.	AT-120	901247	2003/02/03	2004/02/02
Attenuator	Orient Microwave	BX10-0476-00	-	2003/03/31	2004/03/30
Attenuator	Agilent	US40010300	08498-60012	2003/12/16	2004/12/15
1800MHz System Validation Dipole	Schmid&Partner Engineering AG	D1800V2	2d040	2002/11/14	2004/11/13
Dual Directional Coupler	N/A	Narda	03702	N/A	N/A
Head 1800MHz	N/A	N/A	N/A	N/A	N/A
Body 1800MHz	N/A	N/A	N/A	N/A	N/A

SECTION 14 : References

[1]ANSI, ANSI/IEEE C95.1-1992: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz, The Institute of Electrical and Electronics Engineers, Inc., New York, NY 10017, 1992.

[2] Katja Pokovic, Thomas Schmid, and Niels Kuster, "Robust setup for precise calibration of E-field probes in tissue simulating liquids at mobile communications frequencies", in ICECOM '97, Dubrovnik, October 15-17, 1997, pp. 120-124.

[3] Katja Pokovic, Thomas Schmid, and Niels Kuster, "E-_field probe with improved isotropy in brain simulating liquids", in Proceedings of the ELMAR, Zadar, Croatia, 23-25 June, 1996, pp.172-175.

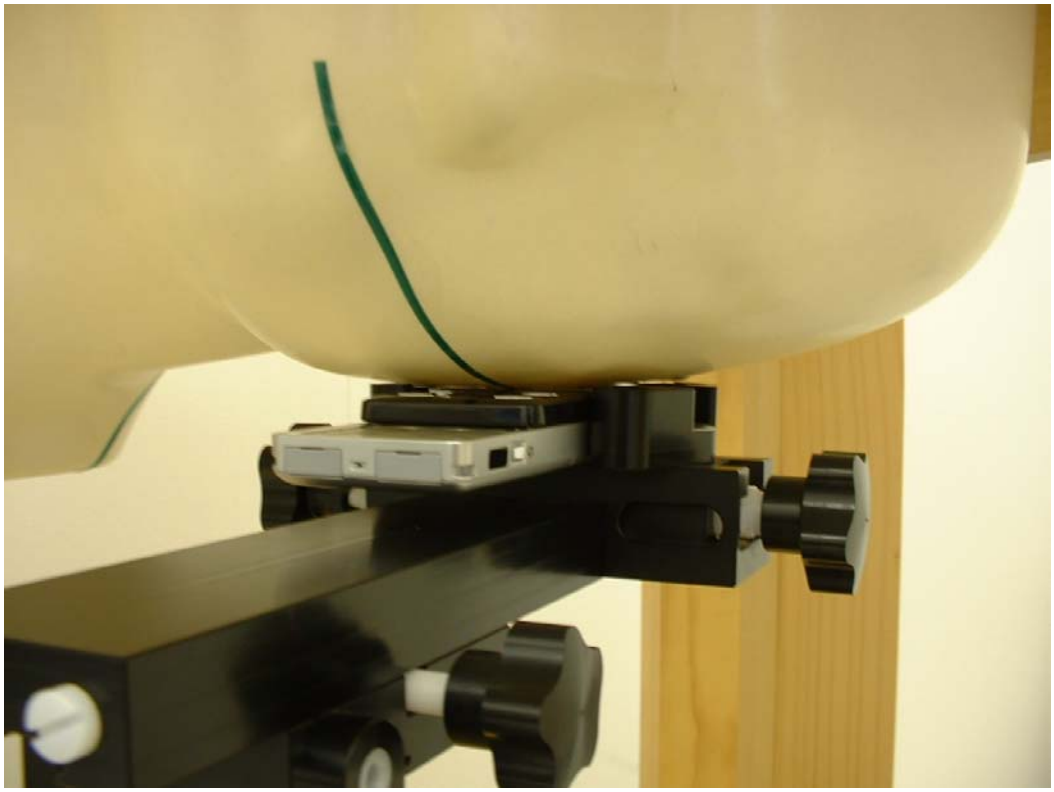
[4] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.

[5] W. H. Press, S. A. Teukolsky,W. T. Vetterling, and B. P. Flannery, Numerical Recepies in C, The Art of Scientific Computing, Second Edition, Cambridge University Press, 1992.

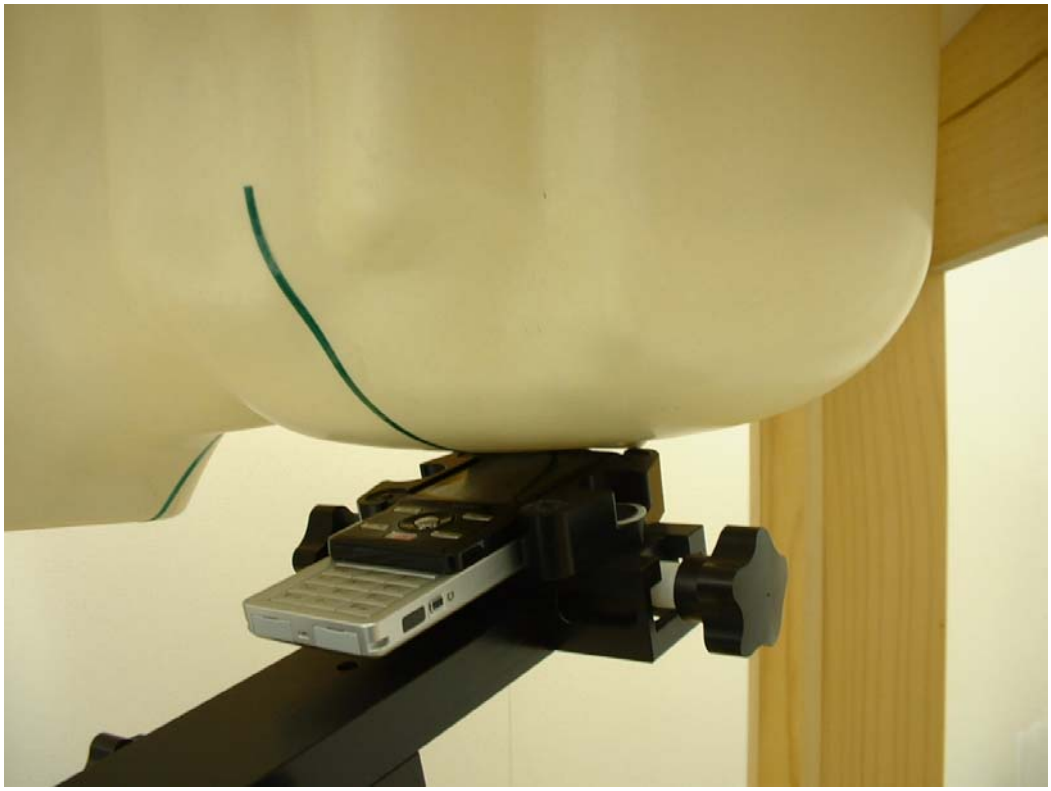
[6] Barry N. Taylor and Christ E. Kuyatt, "Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology,1994.

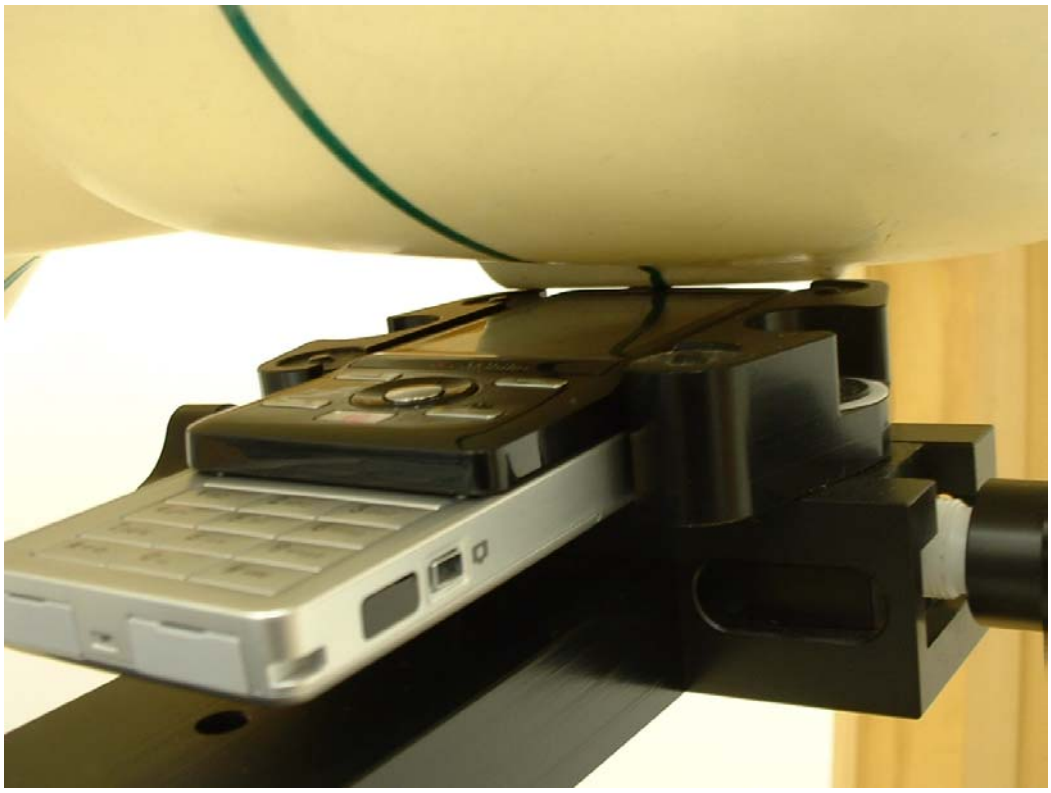
APPENDIX 1 : Photographs of test setup

Left head / Cheek

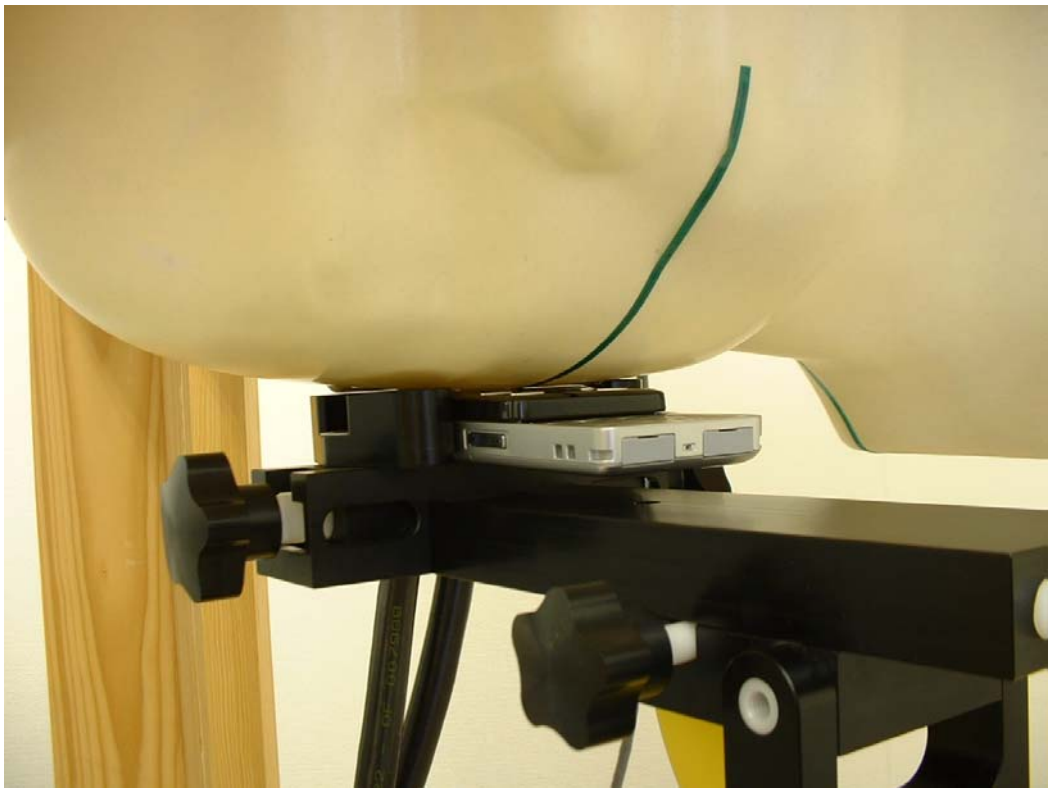


Left head / Tilt

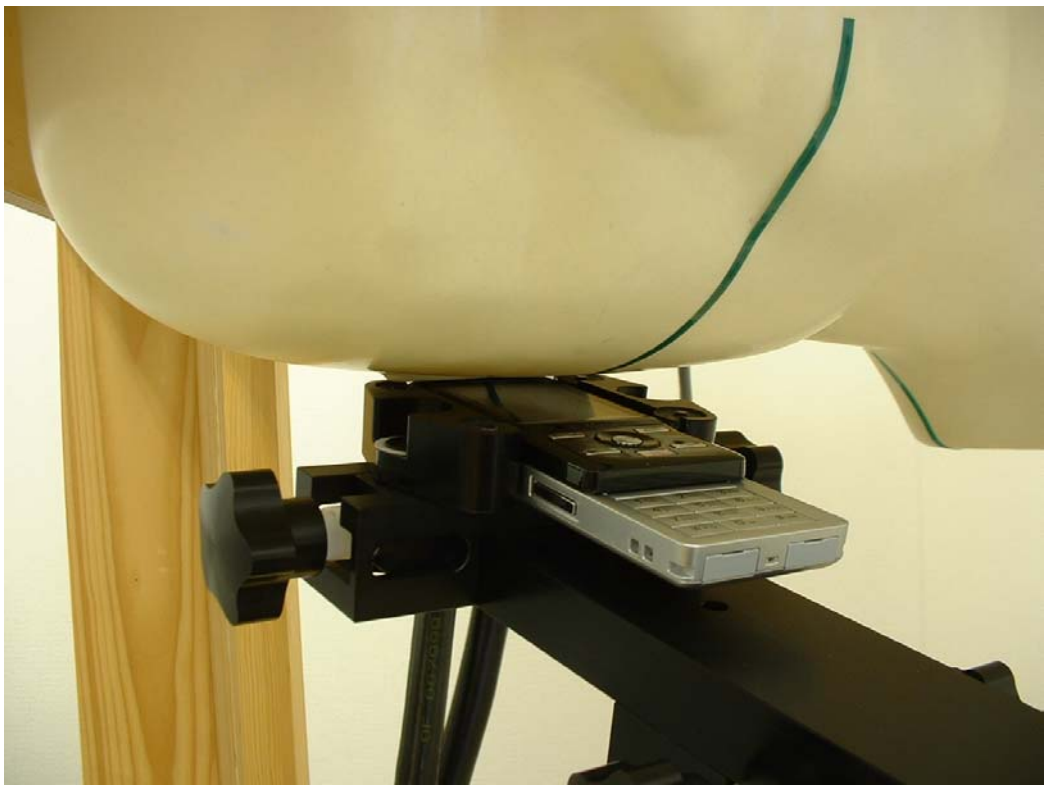




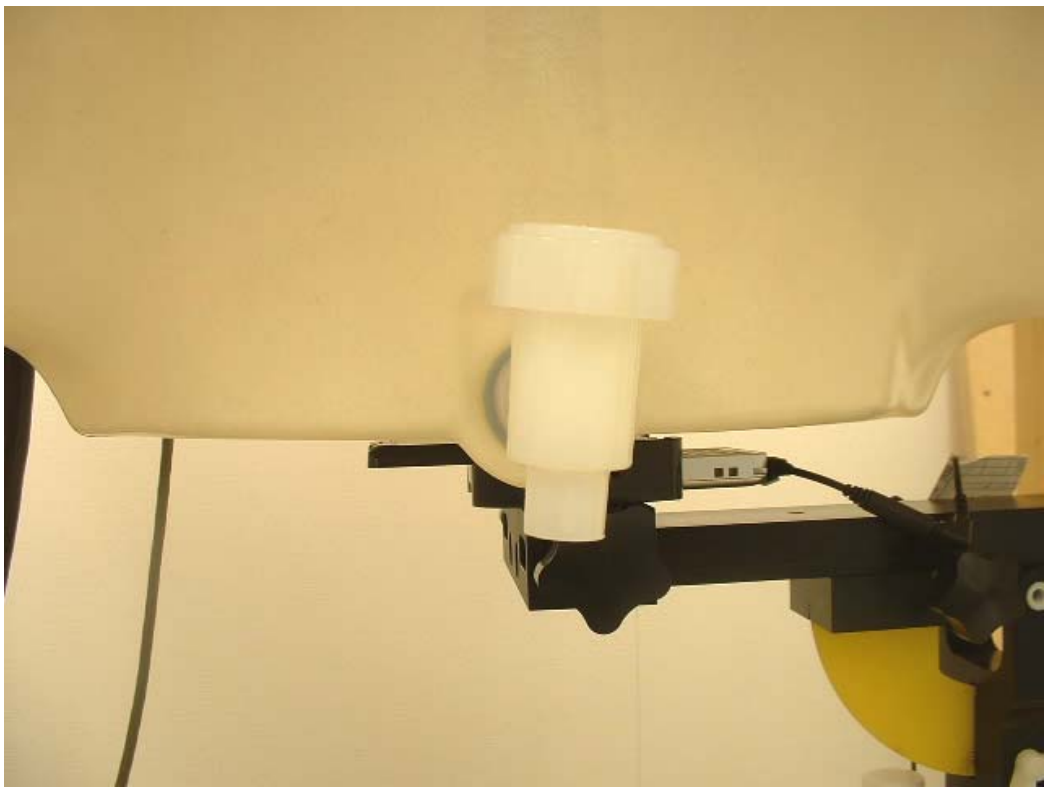
Right head / Cheek

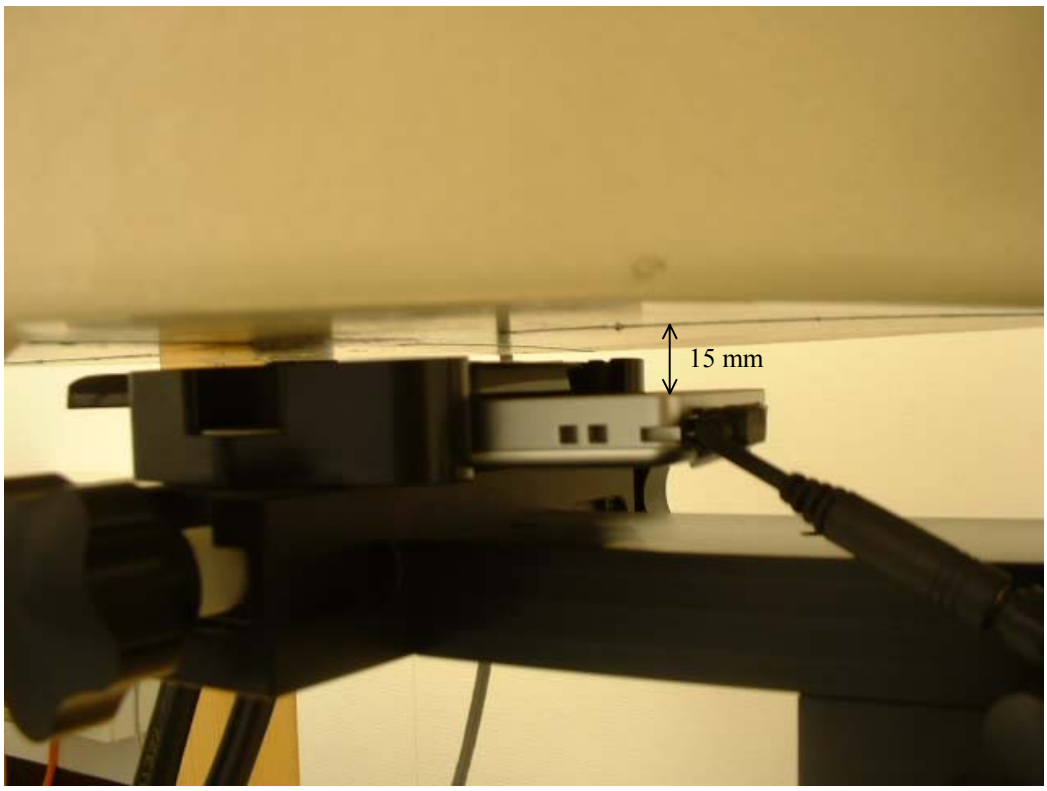


Right head / Tilt

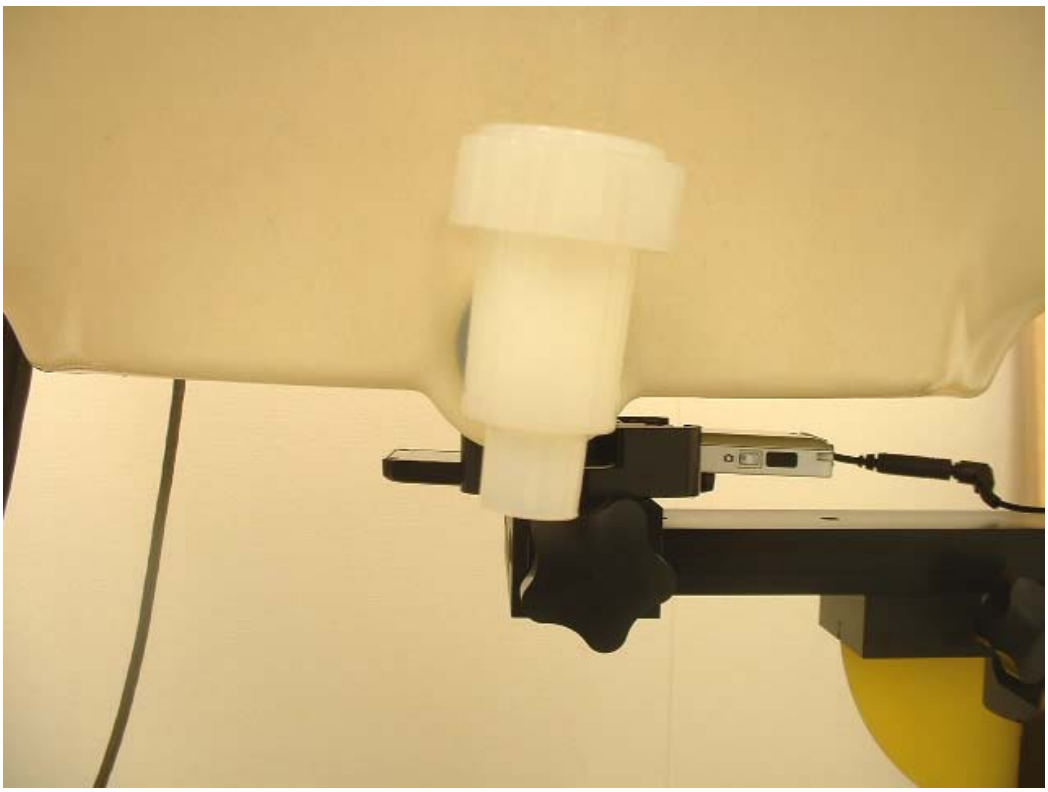


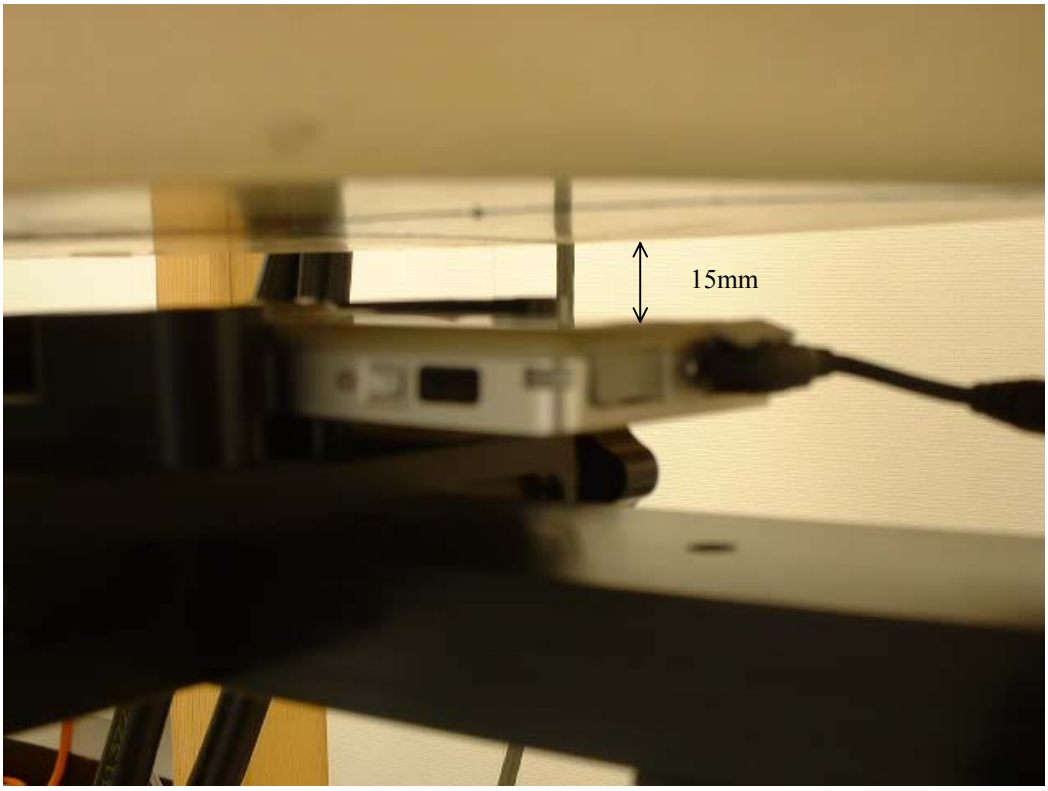
Body / Face (GSM)



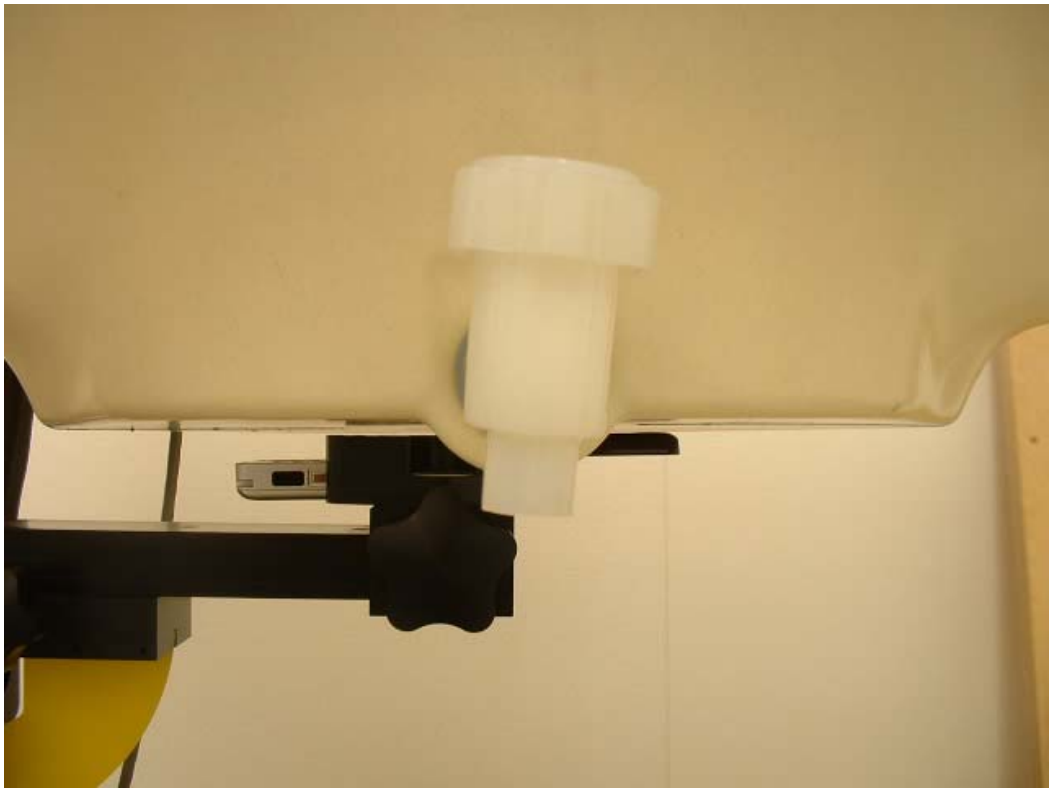


Body / Bottom (GSM)

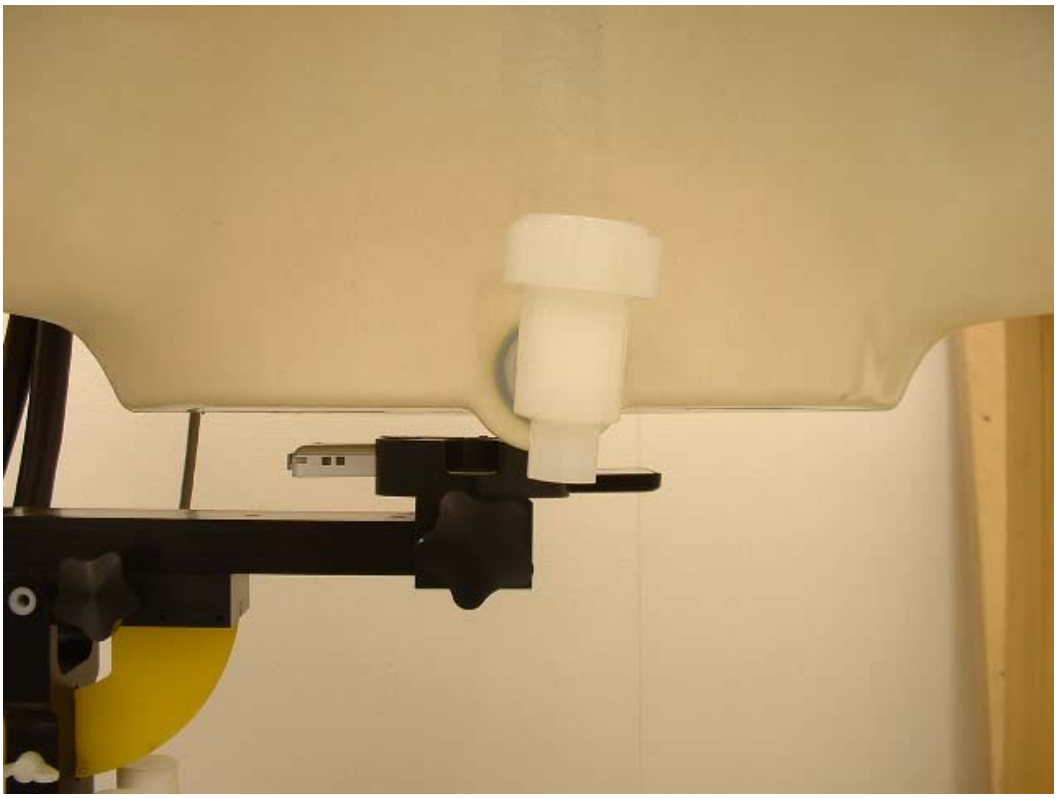


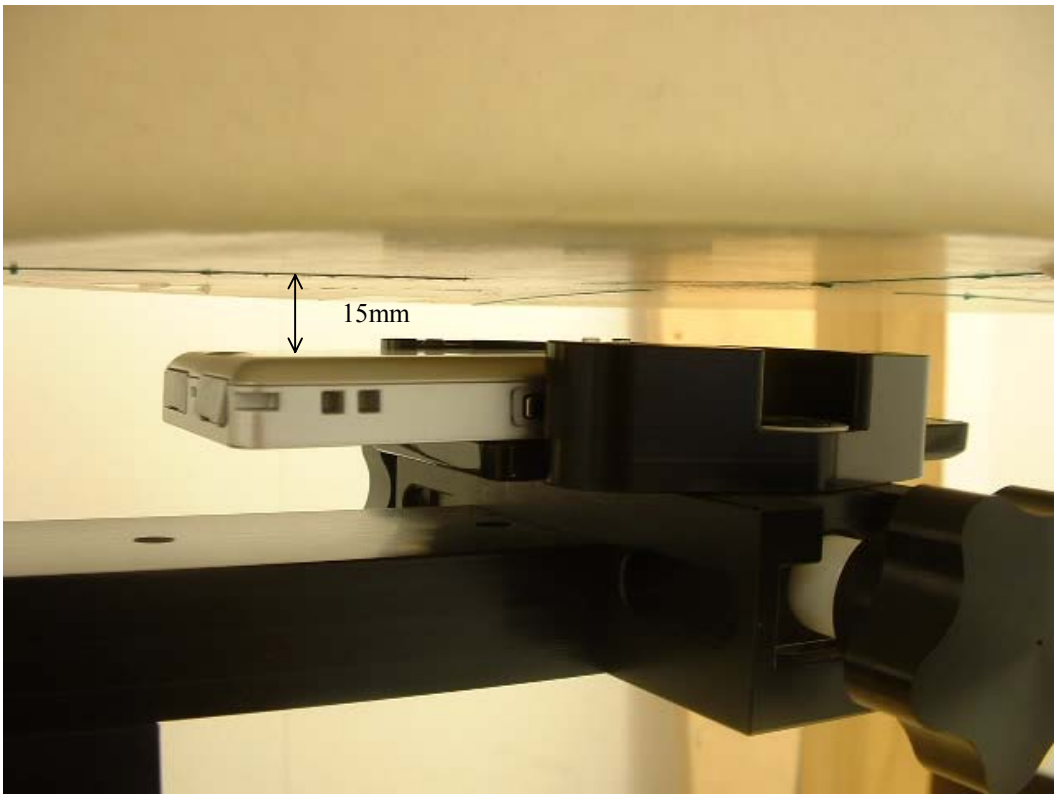


Body / Face (GPRS)



Body / Bottom (GPRS)





APPENDIX 2 : SAR Measurement data

TM100 / Left Head / Cheek / 1880.0 MHz

Crest factor: 8.3
Medium: HSL1800 (σ = 1.35 mho/m, ε_r = 40.1, ρ = 1000 kg/m^3)
Phantom section: Left Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(5.2, 5.2, 5.2); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

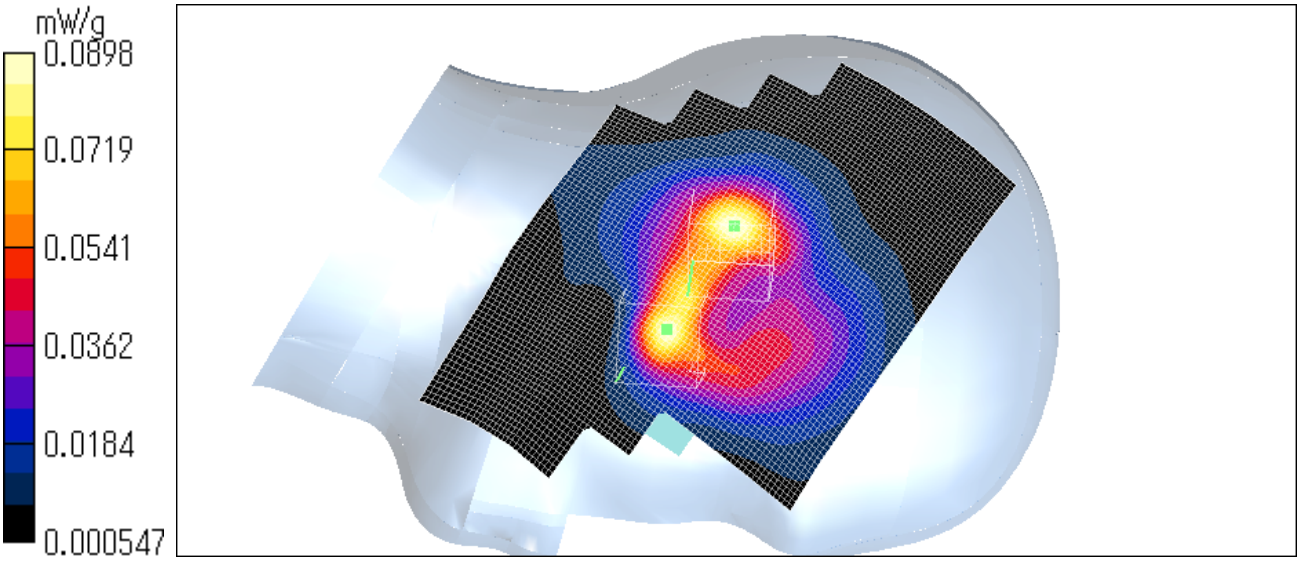
Area Scan (71x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.0912 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.12 W/kg
SAR(1 g) = 0.0805 mW/g; SAR(10 g) = 0.0492 mW/g
Maximum value of SAR = 0.0874 mW/g

Zoom Scan (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.115 W/kg
SAR(1 g) = 0.0818 mW/g; SAR(10 g) = 0.0496 mW/g
Maximum value of SAR = 0.0898 mW/g

Test date = 12 / 26 / 03
Reference Value = 8.07 V/m
Power Drift = -0.1 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 22.7 degree.C , After 22.7 degree.C



TM100 / Left Head / Tilt / 1880.0 MHz

Crest factor: 8.3
Medium: HSL1800 (σ = 1.35 mho/m, ε_r = 40.1, ρ = 1000 kg/m^3)
Phantom section: Left Section

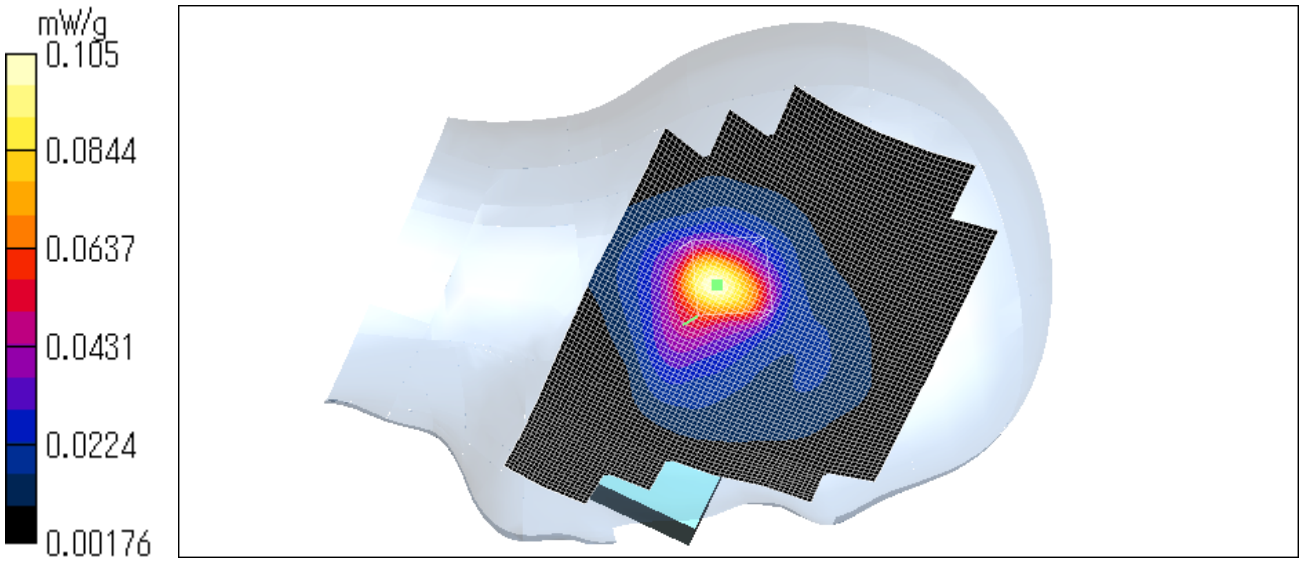
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(5.2, 5.2, 5.2); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (71x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.104 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.142 W/kg
SAR(1 g) = 0.0948 mW/g; SAR(10 g) = 0.0552 mW/g
Maximum value of SAR = 0.105 mW/g

Test date = 12 / 26 / 03
Reference Value = 9.18 V/m
Power Drift = -0.1 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 22.7 degree.C , After 22.7 degree.C



TM100 / Right Head / Cheek / 1880.0 MHz

Crest factor: 8.3
Medium: HSL1800 (σ = 1.35 mho/m, ε_r = 40.1, ρ = 1000 kg/m^3)
Phantom section: Right Section

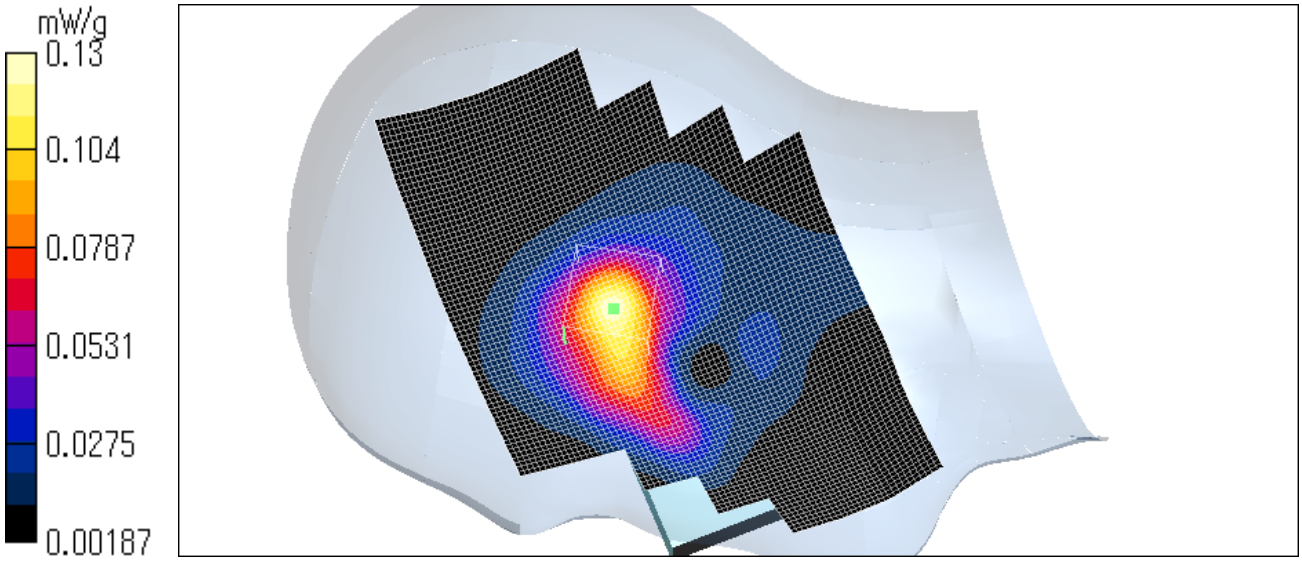
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(5.2, 5.2, 5.2); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (71x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.128 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.177 W/kg
SAR(1 g) = 0.119 mW/g; SAR(10 g) = 0.0706 mW/g
Maximum value of SAR = 0.13 mW/g

Test date = 12 / 26 / 03
Reference Value = 7.76 V/m
Power Drift = 0.03 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 22.9 degree.C , After 22.9 degree.C



TM100 / Right Head / Tilt / 1880.0 MHz

Crest factor: 8.3
Medium: HSL1800 (σ = 1.35 mho/m, ε_r = 40.1, ρ = 1000 kg/m^3)
Phantom section: Right Section

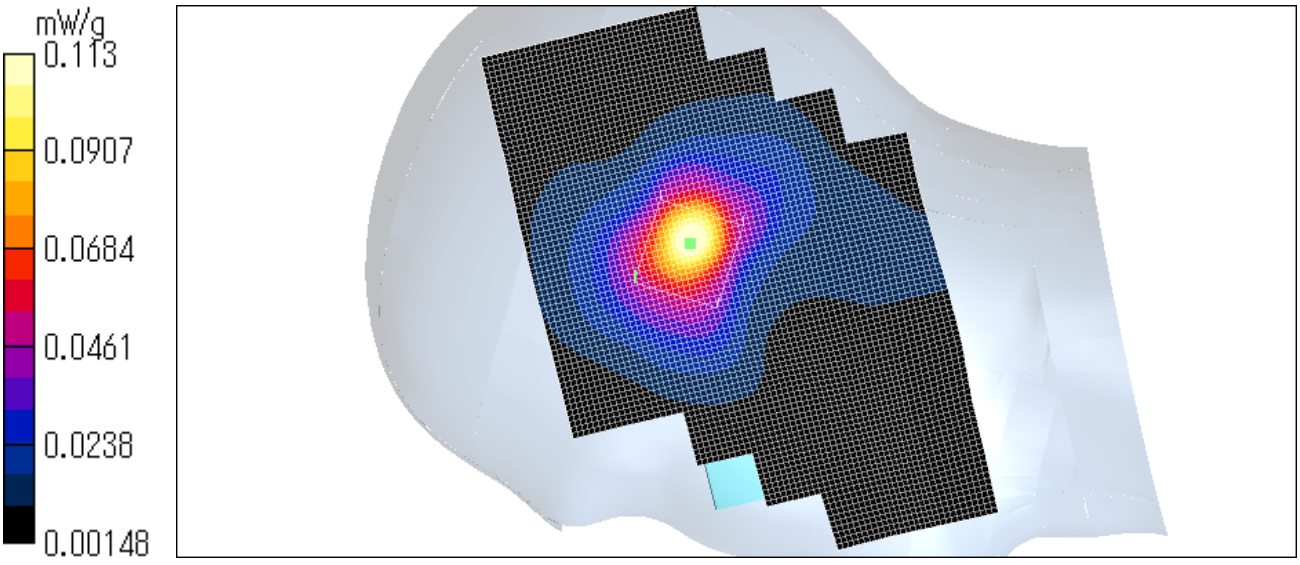
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(5.2, 5.2, 5.2); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (71x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.117 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.158 W/kg
SAR(1 g) = 0.0976 mW/g; SAR(10 g) = 0.0561 mW/g
Maximum value of SAR = 0.113 mW/g

Test date = 12 / 26 / 03
Reference Value = 8.41 V/m
Power Drift = -0.1 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 22.9 degree.C , After 23.0 degree.C



TM100 / Right Head / Cheek / 1850.2 MHz

Crest factor: 8.3
Medium: HSL1800 (σ = 1.35 mho/m, ε_r = 40.1, ρ = 1000 kg/m^3)
Phantom section: Right Section

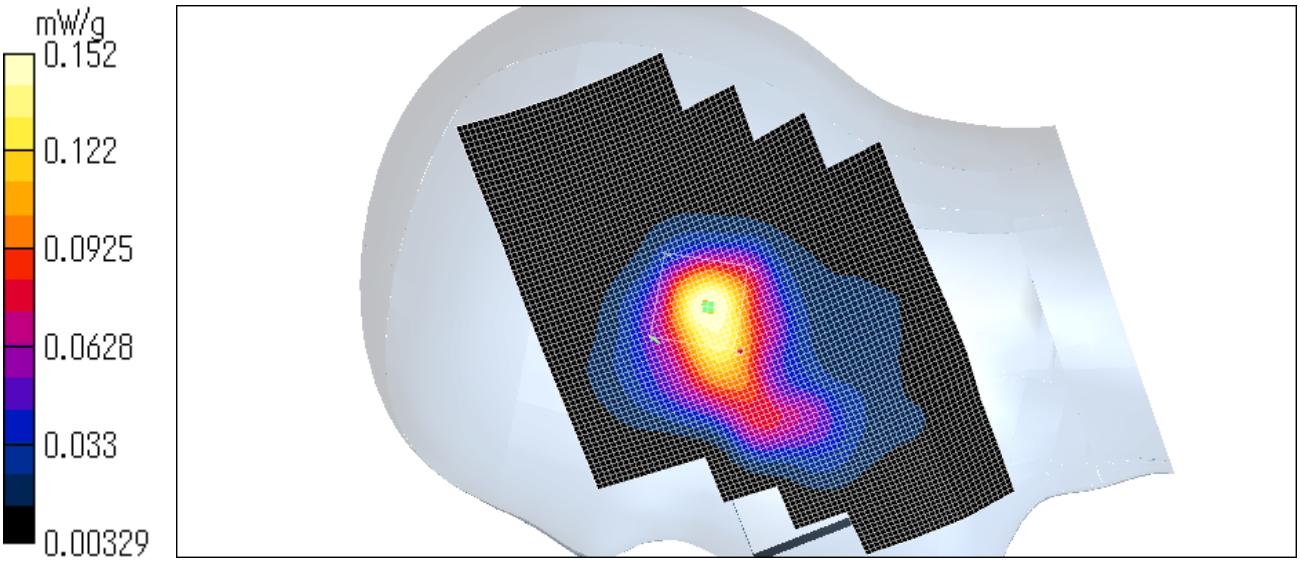
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(5.2, 5.2, 5.2); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (71x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.161 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.199 W/kg
SAR(1 g) = 0.135 mW/g; SAR(10 g) = 0.0849 mW/g
Maximum value of SAR = 0.152 mW/g

Test date = 12 / 26 / 03
Reference Value = 9.7 V/m
Power Drift = 0.001 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 23.0degree.C , After 23.0 degree.C



TM100 / Right Head / Cheek / 1909.8 MHz

Crest factor: 8.3
Medium: HSL1800 (σ = 1.35 mho/m, ε_r = 40.1, ρ = 1000 kg/m^3)
Phantom section: Right Section

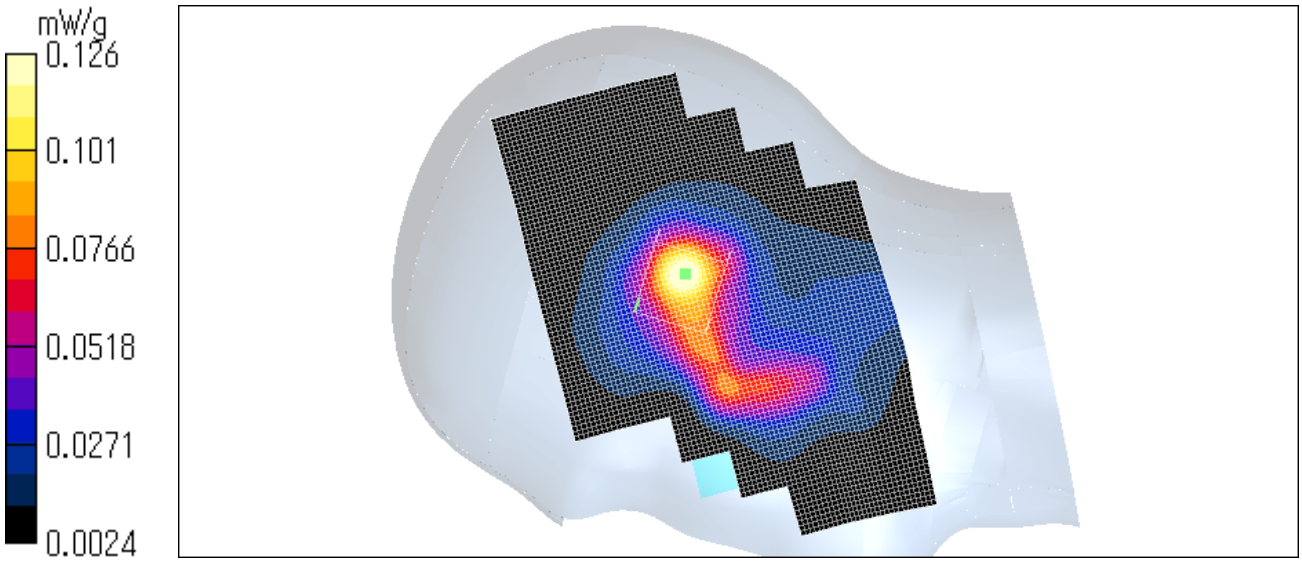
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(5.2, 5.2, 5.2); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (71x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.136 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.179 W/kg
SAR(1 g) = 0.117 mW/g; SAR(10 g) = 0.0693 mW/g
Maximum value of SAR = 0.126 mW/g

Test date = 12 / 26 / 03
Reference Value = 9.27 V/m
Power Drift = 0.07 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 23.1 degree.C , After 23.1 degree.C



TM100 / Body / Face (GSM) / 1880.0 MHz

Crest factor: 8.3
Medium: M1800 (σ = 1.47 mho/m, ε_r = 51.6, ρ = 1000 kg/m^3)
Phantom section: Flat Section

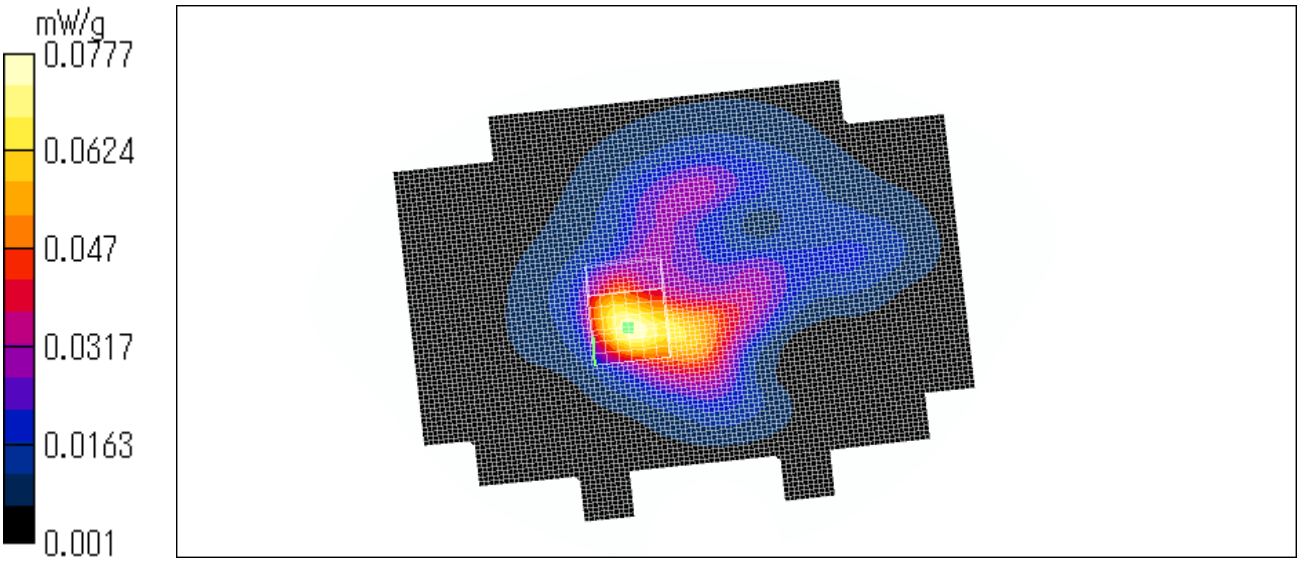
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.7, 4.7, 4.7); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (91x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.0842 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.107 W/kg
SAR(1 g) = 0.0713 mW/g; SAR(10 g) = 0.0433 mW/g
Maximum value of SAR = 0.0777 mW/g

Test date = 01 / 11 / 04
Reference Value = 5.99 V/m
Power Drift = 0.005 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 23.0 degree.C , After 23.0 degree.C



TM100 / Body / Bottom (GSM) / 1880.0 MHz

Crest factor: 8.3
Medium: M1800 (σ = 1.47 mho/m, ε_r = 51.6, ρ = 1000 kg/m^3)
Phantom section: Flat Section

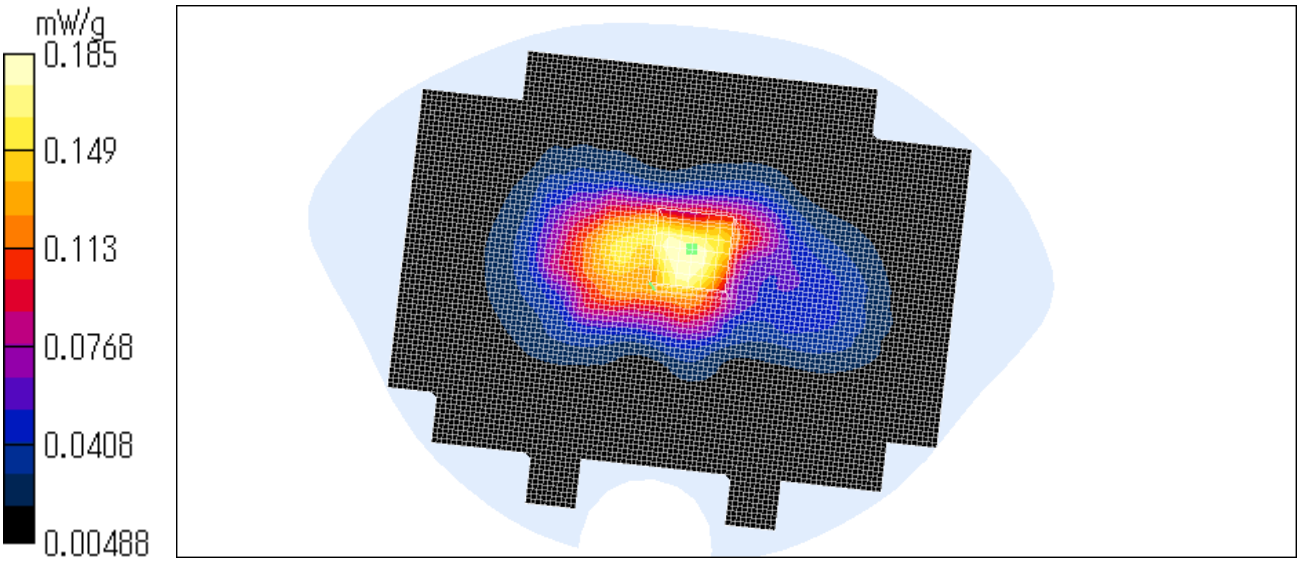
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.7, 4.7, 4.7); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (91x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.18 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.295 W/kg
SAR(1 g) = 0.176 mW/g; SAR(10 g) = 0.107 mW/g
Maximum value of SAR = 0.185 mW/g

Test date = 01 / 11 / 04
Reference Value = 11.2 V/m
Power Drift = -0.09 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 22.7 degree.C , After 22.7 degree.C



TM100 / Body / Bottom (GSM) / 1850.2 MHz

Crest factor: 8.3
Medium: M1800 (σ = 1.47 mho/m, ε_r = 51.6, ρ = 1000 kg/m^3)
Phantom section: Flat Section

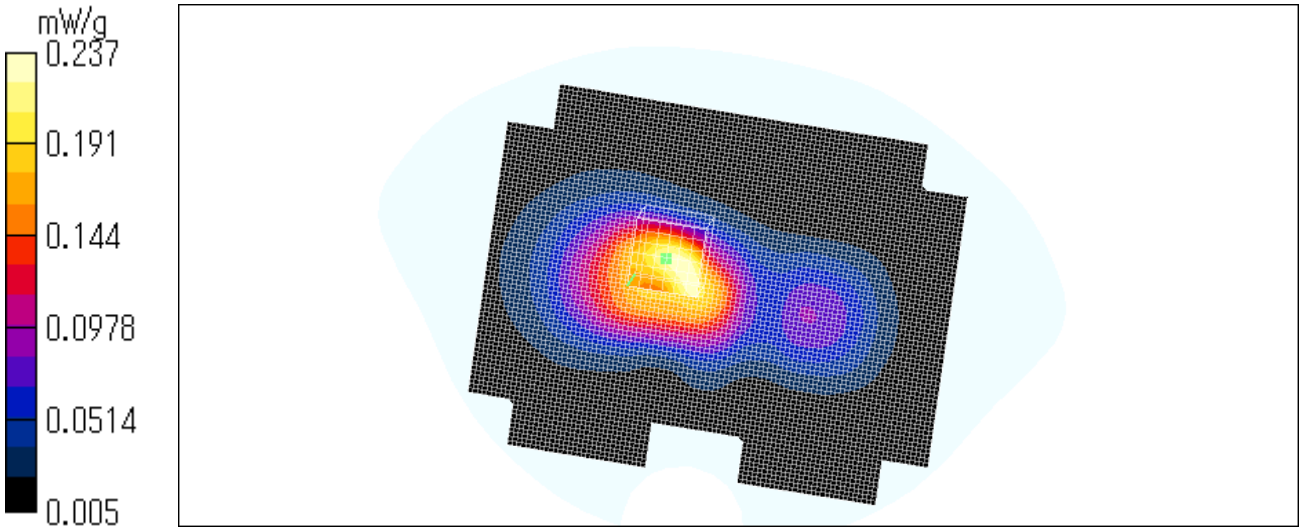
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.7, 4.7, 4.7); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.22 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.357 W/kg
SAR(1 g) = 0.22 mW/g; SAR(10 g) = 0.134 mW/g
Maximum value of SAR = 0.237 mW/g

Test date = 01 / 11 / 04
Reference Value = 11.5 V/m
Power Drift = -0.02 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 22.8 degree.C , After 22.9 degree.C



TM100 / Body / Bottom (GSM) / 1909.80 MHz

Crest factor: 8.3
Medium: M1800 (σ = 1.47 mho/m, ε_r = 51.6, ρ = 1000 kg/m^3)
Phantom section: Flat Section

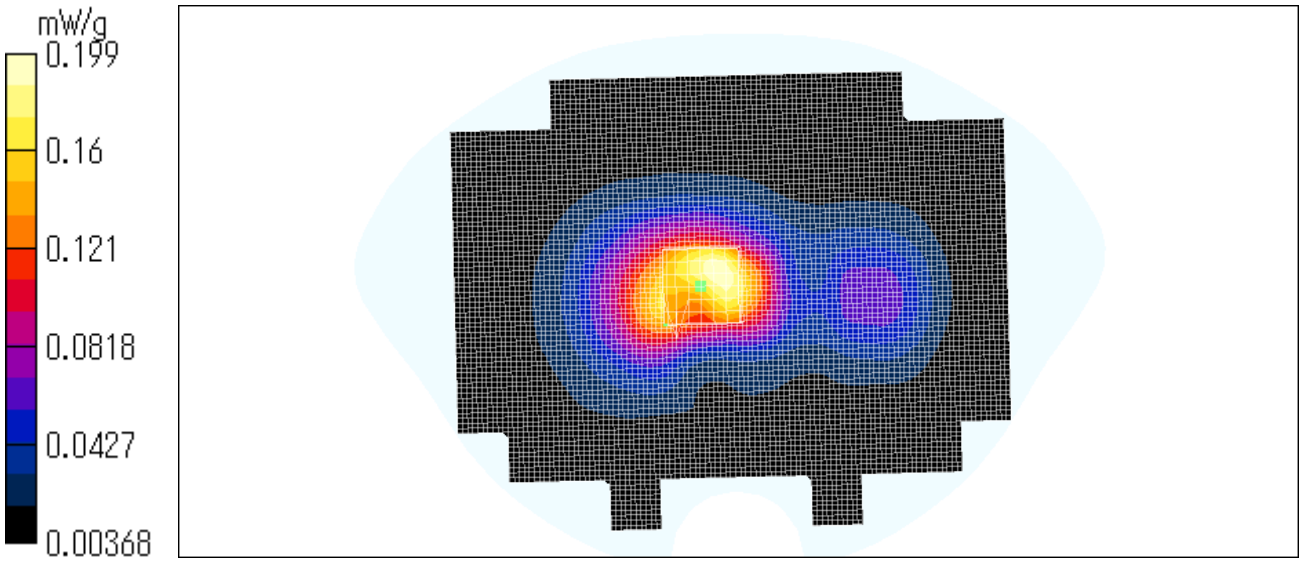
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.7, 4.7, 4.7); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (91x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.191 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.332 W/kg
SAR(1 g) = 0.19 mW/g; SAR(10 g) = 0.109 mW/g
Maximum value of SAR = 0.199 mW/g

Test date = 01 / 11 / 04
Reference Value = 11.9 V/m
Power Drift = 0.03 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 22.9 degree.C , After 22.9 degree.C



TM100 / Body / Face (GPRS) / 1880.0 MHz

Crest factor: 4.2
Medium: M1800 (σ = 1.47 mho/m, ε_r = 51.6, ρ = 1000 kg/m^3)
Phantom section: Flat Section

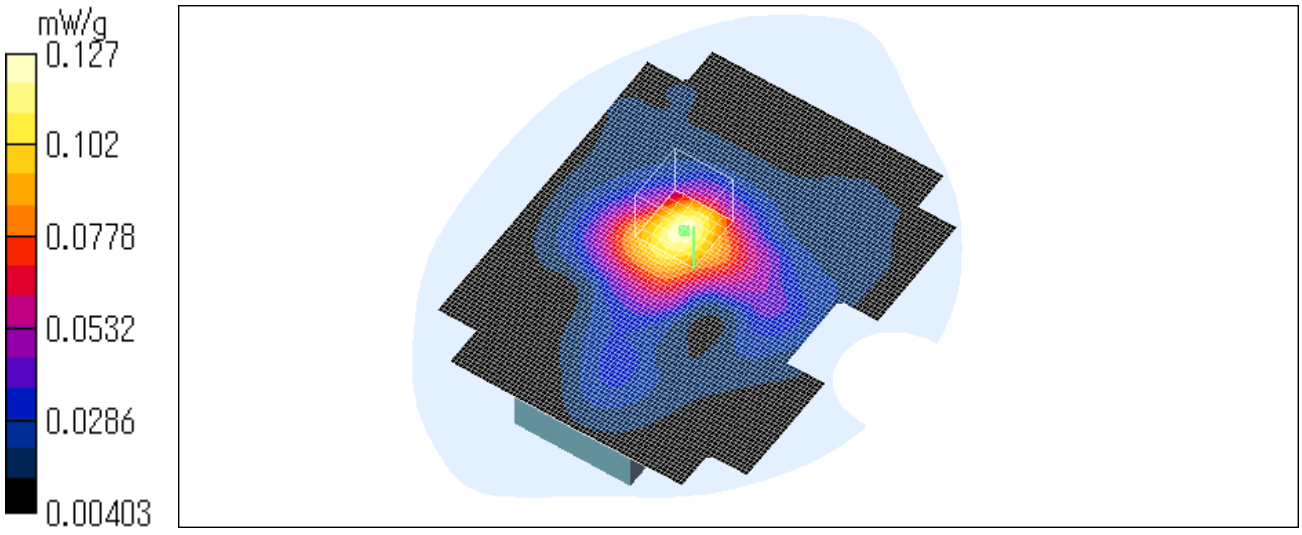
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.7, 4.7, 4.7); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.128 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.174 W/kg
SAR(1 g) = 0.118 mW/g; SAR(10 g) = 0.0739 mW/g
Maximum value of SAR = 0.127 mW/g

Test date = 01 / 11 / 04
Reference Value = 7.09 V/m
Power Drift = 0.2 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 23.0 degree.C , After 23.1 degree.C



TM100 / Body / Bottom (GPRS) / 1880.0 MHz

Crest factor: 4.2
Medium: M1800 (σ = 1.47 mho/m, ε_r = 51.6, ρ = 1000 kg/m^3)
Phantom section: Flat Section

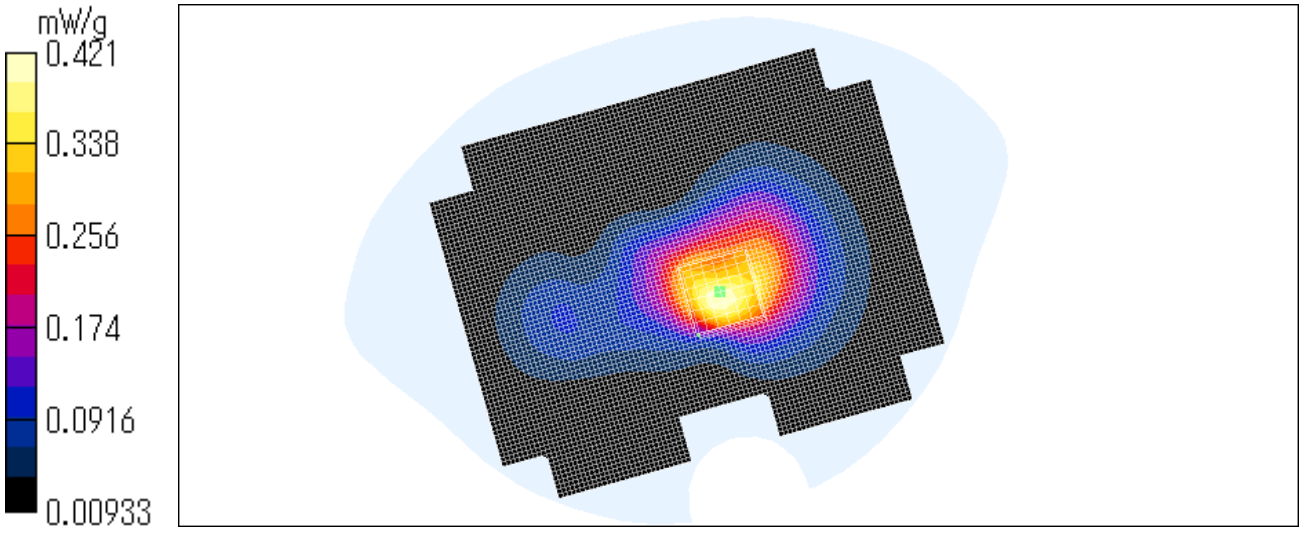
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.7, 4.7, 4.7); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.425 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.624 W/kg
SAR(1 g) = 0.392 mW/g; SAR(10 g) = 0.238 mW/g
Maximum value of SAR = 0.421 mW/g

Test date = 01 / 11 / 04
Reference Value = 15.9 V/m
Power Drift = -0.2 dB

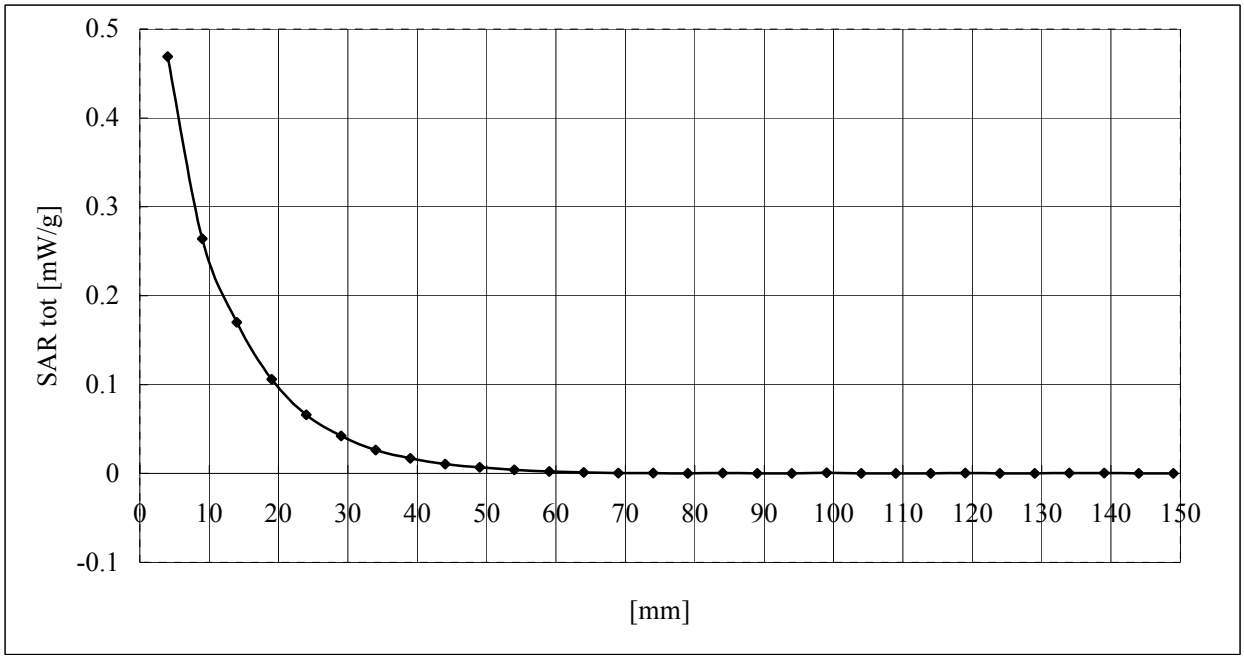
Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 23.2 degree.C , After 23.2 degree.C



Z-axis scan at max SARlocation

TM100 / Body / Bottom (GPRS) / 1880.0 MHz
Crest factor: 4.2
Medium: M1800 (σ = 1.47 mho/m, ε_r = 51.6, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.7, 4.7, 4.7); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115



TM100 / Body / Bottom (GPRS) / 1850.2 MHz

Crest factor: 4.2
Medium: M1800 (σ = 1.47 mho/m, ε_r = 51.6, ρ = 1000 kg/m^3)
Phantom section: Flat Section

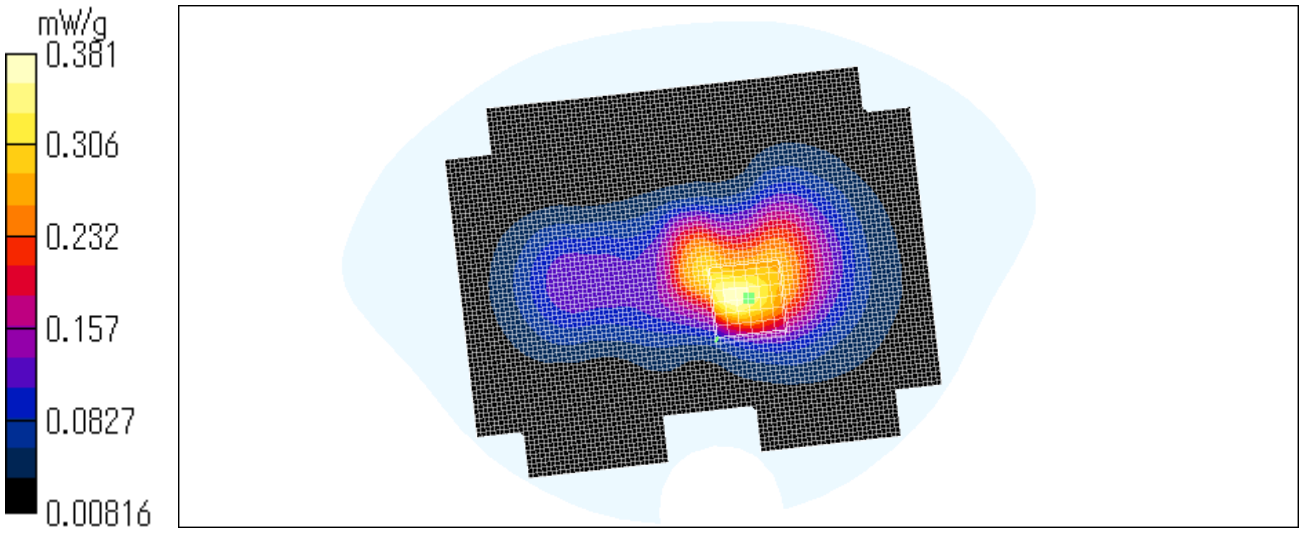
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.7, 4.7, 4.7); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.391 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.545 W/kg
SAR(1 g) = 0.349 mW/g; SAR(10 g) = 0.214 mW/g
Maximum value of SAR = 0.381 mW/g

Test date = 01 / 11 / 04
Reference Value = 14.8 V/m
Power Drift = -0.07 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 23.1 degree.C , After 23.0 degree.C



TM100 / Body / Bottom (GPRS) / 1909.8 MHz

Crest factor: 4.2
Medium: M1800 (σ = 1.47 mho/m, ε_r = 51.6, ρ = 1000 kg/m^3)
Phantom section: Flat Section

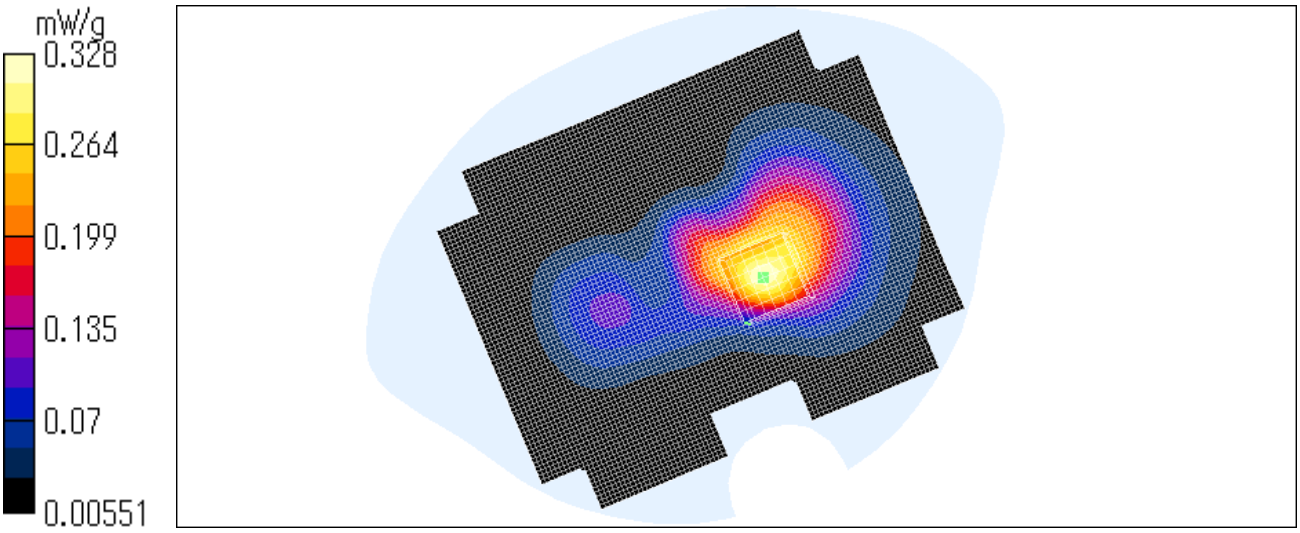
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.7, 4.7, 4.7); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x101x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.366 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 0.497 W/kg
SAR(1 g) = 0.304 mW/g; SAR(10 g) = 0.184 mW/g
Maximum value of SAR = 0.328 mW/g

Test date = 01 / 11 / 04
Reference Value = 12.4 V/m
Power Drift = 0.04 dB

Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 23.0 degree.C , After 23.0 degree.C



APPENDIX 3 : Validation Measurement data

System Validation / Dipole 1800 MHz / Forward Conducted Power : 250mW

Crest factor: 1
Medium: HSL1800 (σ = 1.37 mho/m, ε_r = 40.1, ρ = 1000 kg/m^3)
Phantom section: Flat Section

Dipole 1800 MHz;
- Type: D1800V2; Serial: SN:2d040

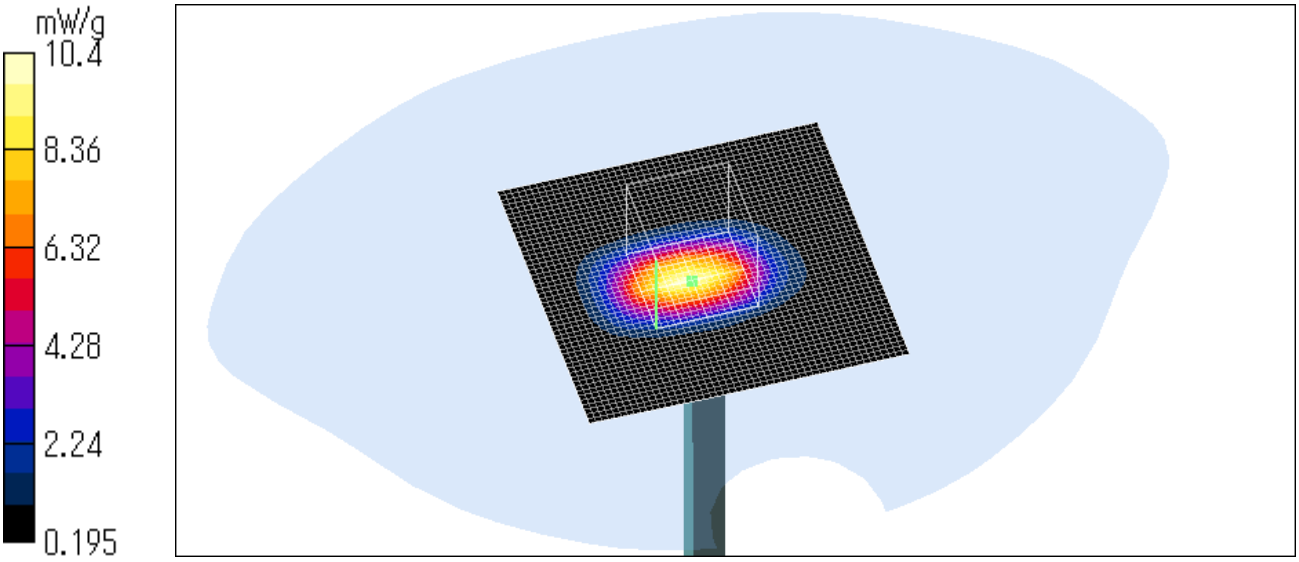
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(5.2, 5.2, 5.2); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 10.7 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 9.38 mW/g; SAR(10 g) = 4.93 mW/g
Maximum value of SAR = 10.4 mW/g

Test date = 12 / 26 / 03
Reference Value = 89.6 V/m
Power Drift = -0.0003 dB

Ambient Temperature = 24.0 degree.c
Liquid Temperature = Before 22.6 degree.C , After 22.6 degree.C



System Validation / Dipole 1800 MHz / Forward Conducted Power : 250mW

Crest factor: 1
Medium: HSL1800 (σ = 1.35 mho/m, ε_r = 40, ρ = 1000 kg/m^3)
Phantom section: Flat Section

Dipole 1800 MHz;
- Type: D1800V2; Serial: SN:2d040

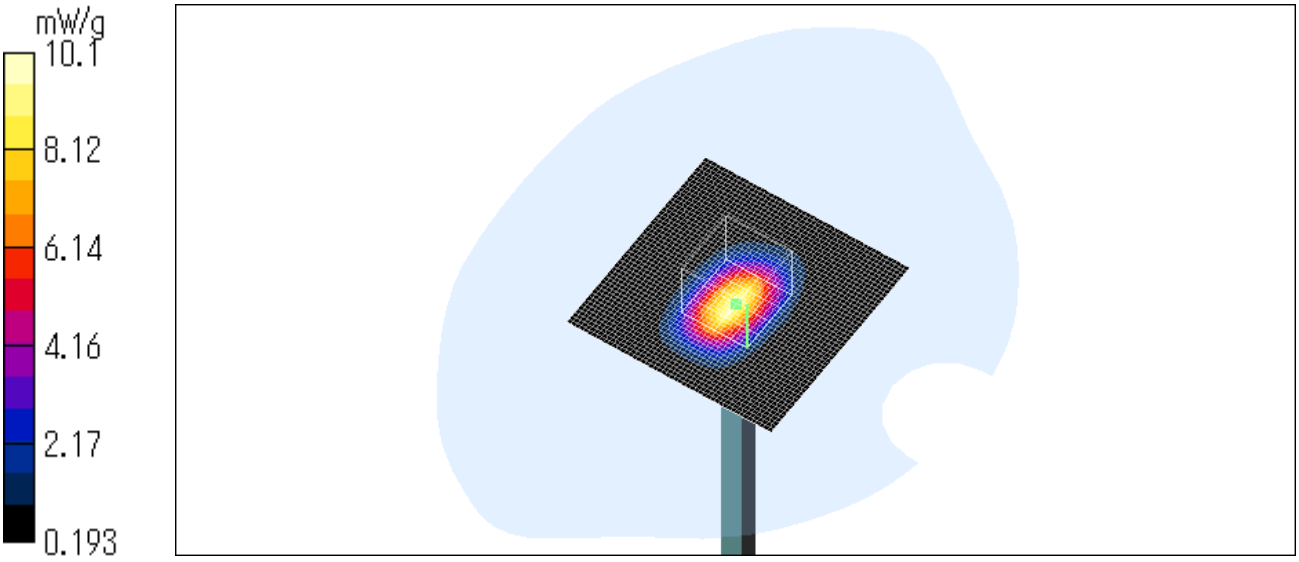
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(5.2, 5.2, 5.2); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 10.6 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 15.7 W/kg
SAR(1 g) = 9.13 mW/g; SAR(10 g) = 4.8 mW/g
Maximum value of SAR = 10.1 mW/g

Test date = 01 / 11 / 04
Reference Value = 89.1 V/m
Power Drift = -0.04 dB

Ambient Temperature = 24.5 degree.c
Liquid Temperature = Before 22.8 degree.C , After 22.8 degree.C



APPENDIX 4 : System Validation Dipole (D1800V2,S/N: 2d040)

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

Calibration Certificate

1800 MHz System Validation Dipole

Type:	D1800V2
Serial Number:	2d040
Place of Calibration:	Zurich
Date of Calibration:	November 14, 2002
Calibration Interval:	24 months

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:	
Approved by:	

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

DASY

Dipole Validation Kit

Type: D1800V2

Serial: 2d040

Manufactured: March 27, 2002
Calibrated: November 14, 2002

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with head simulating glycol solution of the following electrical parameters at 1800 MHz:

Relative Dielectricity	**40.2**	± 5%
Conductivity	**1.35 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.3 at 1800 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**37.8 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**19.7 mW/g**

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.204 ns**	(one direction)
Transmission factor:	**0.999**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 1800 MHz:	Re{Z} = **48.5 Ω**
	Im {Z} = **-1.8 Ω**
Return Loss at 1800 MHz	**-32.5 dB**

4. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with body simulating glycol solution of the following electrical parameters at 1800 MHz:

Relative Dielectricity	**52.5**	± 5%
Conductivity	**1.46 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.1 at 1800 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

5. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 4. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**37.8 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**19.8 mW/g**

6. Dipole Impedance and Return Loss

The dipole was positioned at the flat phantom sections according to section 4 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 1800 MHz:	Re{Z} = **44.5 Ω**
	Im {Z} = **-2.7 Ω**
Return Loss at 1800 MHz	**-23.8 dB**

7. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

8. Design

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.

9. Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

Date/Time: 11/14/02 13:33:35

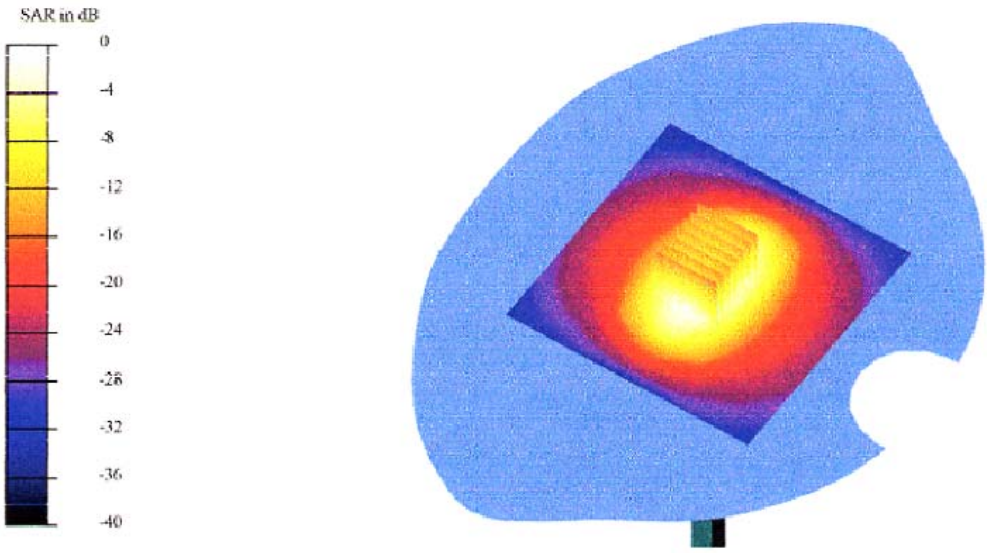
Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN2d040_SN1507_HSL1800_141102.da4

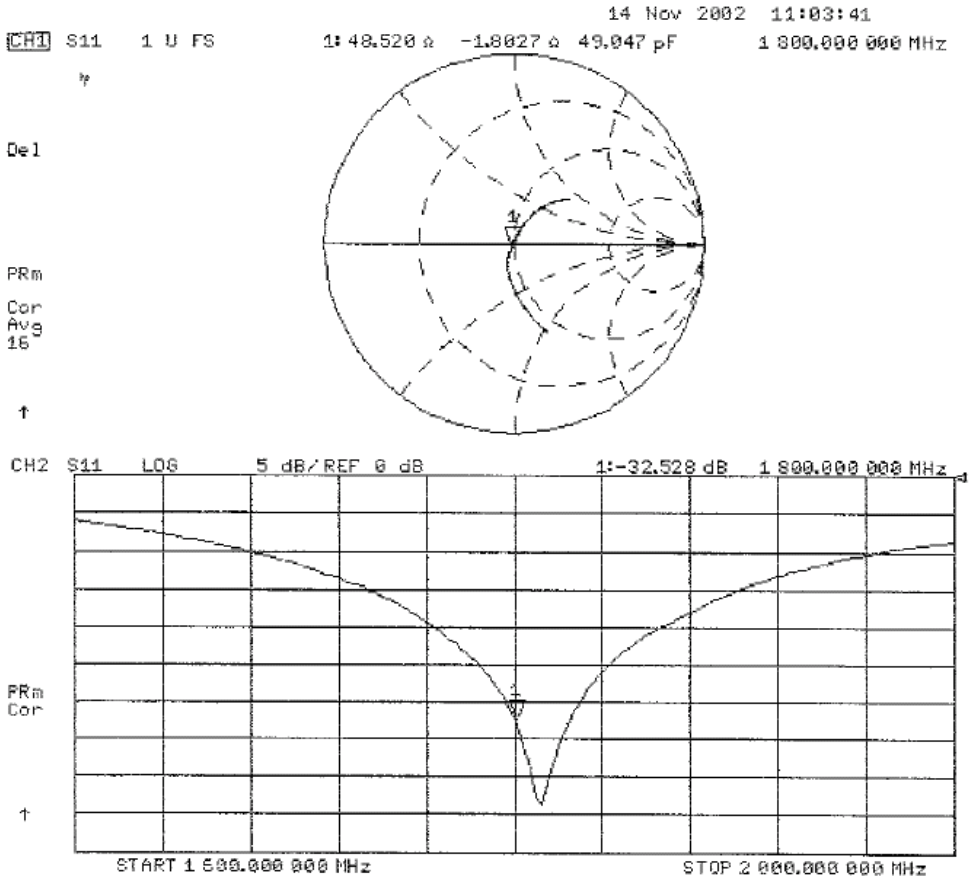
DUT: Dipole 1800 MHz Type & Serial Number: D1800V2 - SN2d040
Program: Dipole Calibration; Pin = 250 mW; d = 10 mm

Communication System: CW-1800; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: HSL 1800 MHz (σ = 1.35 mho/m, ε = 40.17, ρ = 1000 kg/m3)
Phantom section: FlatSection

DASY4 Configuration:
- Probe: ET3DV6 - SN1507; ConvF(5.3, 5.3, 5.3); Calibrated: 1/24/2002
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN410; Calibrated: 7/18/2002
- Phantom: SAM 4.0 - TP:1006
- Software: DASY4, V4.0 Build 35

Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm
Reference Value = 93.1 V/m
Peak SAR = 16.8 mW/g
SAR(1 g) = 9.45 mW/g; SAR(10 g) = 4.92 mW/g
Power Drift = 0.005 dB




14 Nov 2002 11:03:41
CH1 S11 1 U FS
1: 48.520 Ω -1.8027 Ω 49.047 pF
1 800.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG
5 dB/ REF 0 dB
1:-32.528 dB 1 800.000 000 MHz
PRm
Cor
START 1 500.000 000 MHz
STOP 2 000.000 000 MHz

Date/Time: 11/14/02 20:15:12

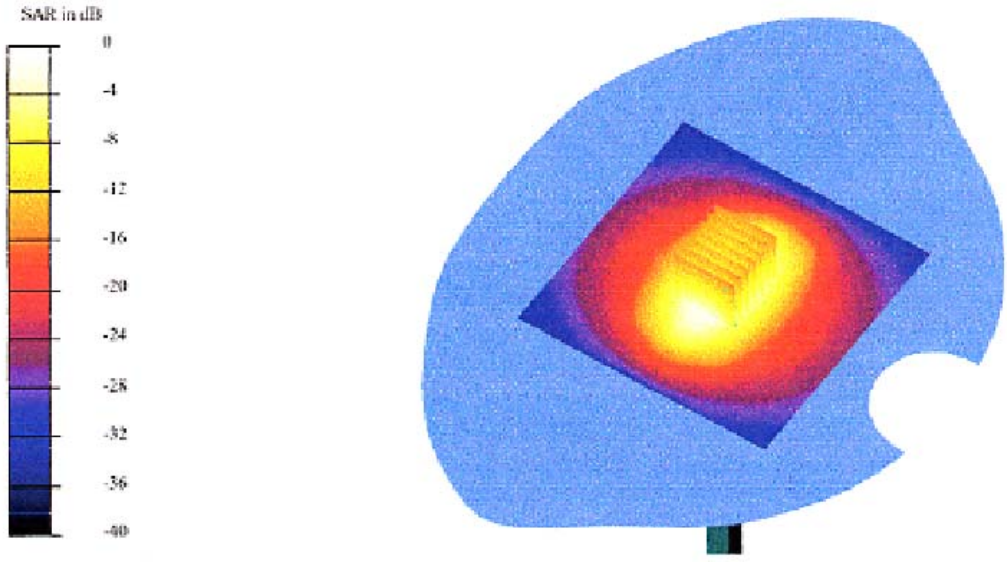
Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN2d040_SN1507_M1800_141102.da4

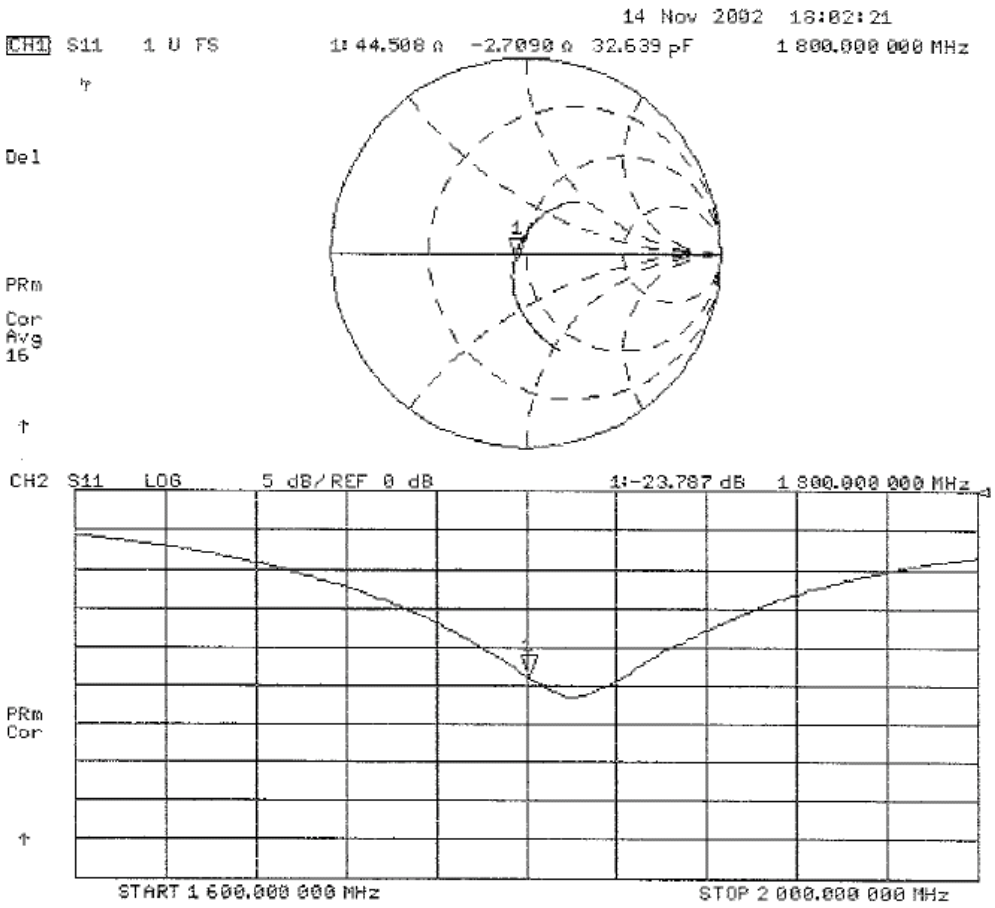
DUT: Dipole 1800 MHz Type & Serial Number: D1800V2 - SN2d040
Program: Dipole Calibration; Pin = 250 mW; d = 10 mm

Communication System: CW-1800; Frequency: 1800 MHz; Duty Cycle: 1:1
Medium: Muscle1800 MHz (σ = 1.46 mho/m, ε = 52.49, ρ = 1000 kg/m3)
Phantom section: FlatSection

DASY4 Configuration:
- Probe: ET3DV6 - SN1507; ConvF(5.1, 5.1, 5.1); Calibrated: 1/24/2002
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN410; Calibrated: 7/18/2002
- Phantom: SAM 4.0 - TP:1006
- Software: DASY4, V4.0 Build 35

Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm
Reference Value = 89.4 V/m
Peak SAR = 16.7 mW/g
SAR(1 g) = 9.45 mW/g; SAR(10 g) = 4.96 mW/g
Power Drift = -0.03 dB




14 Nov 2002 18:02:21
CH1 S11 1 U FS
1: 44.508 Ω -2.7090 Ω 32.639 pF
1 800.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG 5 dB/ REF 0 dB
1:-23.787 dB 1 800.000 000 MHz
PRm
Cor
START 1 600.000 000 MHz
STOP 2 000.000 000 MHz

APPENDIX 5 : Dosimetric E-Field Probe Calibration (ET3DV6,S/N: 1685)

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

IMPORTANT NOTICE

USAGE OF PROBES IN ORGANIC SOLVENTS

Diethylene Gycol Monobuthy Ether (the basis for liquids above 1 GHz), as many other organic solvents, is a very effective softener for synthetic materials. These solvents can cause irreparable damage to certain SPEAG products, except those which are explicitly declared as compliant with organic solvents.

Compatible Probes:
- ET3DV6
- ET3DV6R
- ES3DV2
- ER3DV6
- H3DV6

Important Note for ET3DV6 Probes:
The ET3DV6 probes shall not be exposed to solvents longer than necessary for the measurements and shall be cleaned daily after use with warm water and stored dry.

s p e a g

Schmid & Partner Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Schmid & Partner Engineering AG

Technical Note 01.06.15-1 June 2002

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

Client UL Apex (MTT)

CALIBRATION CERTIFICATE

Object(s) ET3DV6 - SN:1685

Calibration procedure(s) QA CAL-01 v2
Calibration procedure for dosimetric E-field probes

Calibration date: October 10, 2003

Condition of the calibrated item In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Reference 20 dB Attenuator	SN: 5086 (20b)	3-Apr-03 (METAS No. 251-0340	Apr-04
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (Agilent, No. 20020918)	In house check: Oct 03
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: October 23, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 international Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

880-KP0301061-A Page 1 (1)

Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Probe ET3DV6

SN:1685

Manufactured: April 3, 2002
Last calibration: May 10, 2002
Recalibrated: October 10, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

Head Office EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone: +81 596 24 8116
Facsimile: +81 596 24 8124

ET3DV6 SN:1685 October 10, 2003

DASY - Parameters of Probe: ET3DV6 SN:1685

Sensitivity in Free Space

Diode Compression

NormX	**1.60** μV/(V/m)^2	DCP X	**95**	mV
NormY	**1.65** μV/(V/m)^2	DCP Y	**95**	mV
NormZ	**1.56** μV/(V/m)^2	DCP Z	**95**	mV

Sensitivity in Tissue Simulating Liquid

Head 900 MHz ε_r = 41.5 ± 5% σ = 0.97 ± 5% mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**6.6** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.6** ± 9.5% (k=2)	Alpha	**0.26**
ConvF Z	**6.6** ± 9.5% (k=2)	Depth	**3.07**

Head 1800 MHz ε_r = 40.0 ± 5% σ = 1.40 ± 5% mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**5.2** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**5.2** ± 9.5% (k=2)	Alpha	**0.41**
ConvF Z	**5.2** ± 9.5% (k=2)	Depth	**2.77**

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	8.9	5.4
SAR_{be} [%]	With Correction Algorithm	0.4	0.5

Head 1800 MHz Typical SAR gradient: 10 % per mm

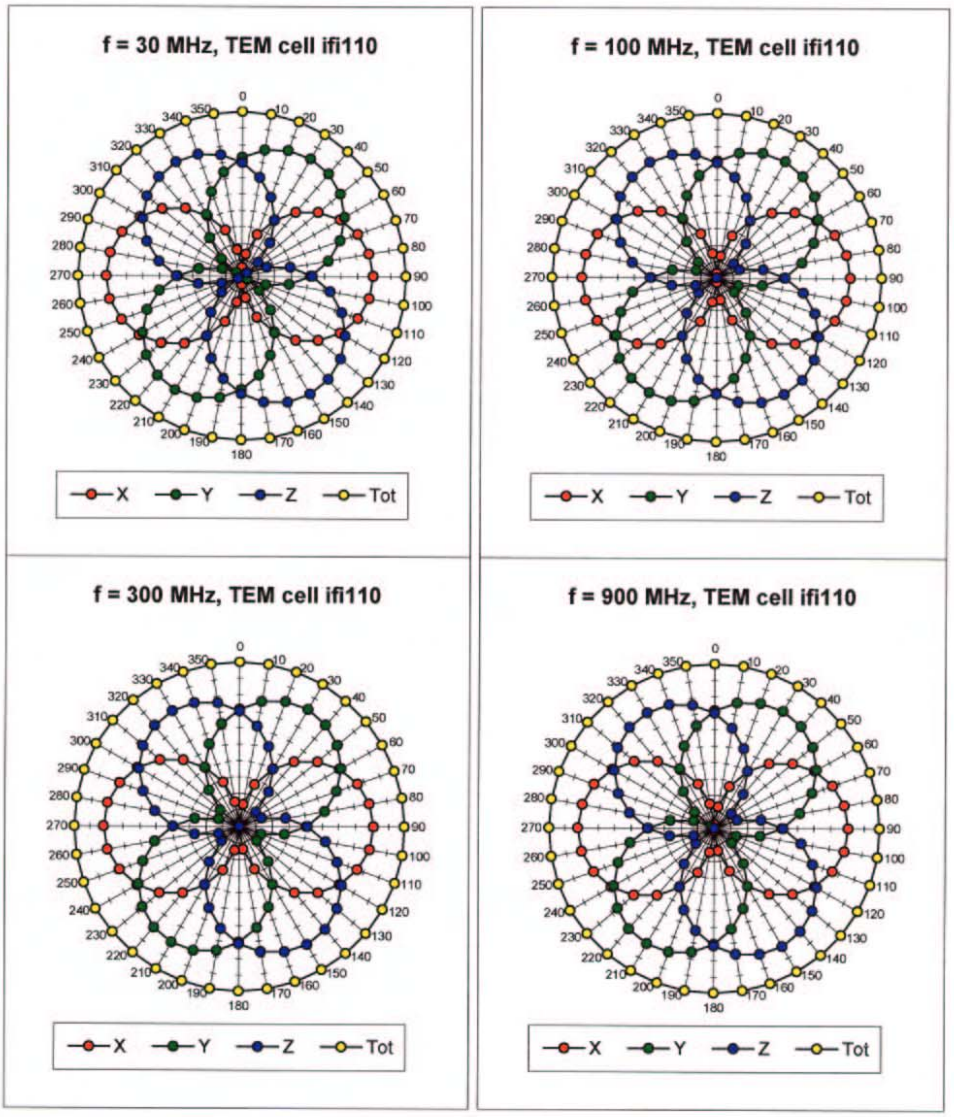
Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	11.8	8.4
SAR_{be} [%]	With Correction Algorithm	0.4	0.2

Sensor Offset

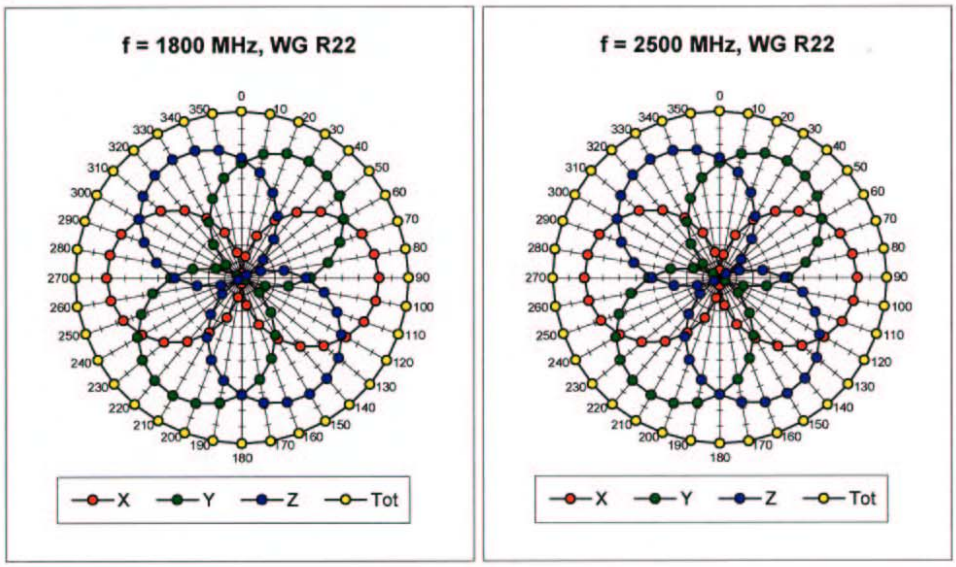
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.6 ± 0.2**	mm

ET3DV6 SN:1685 October 10, 2003

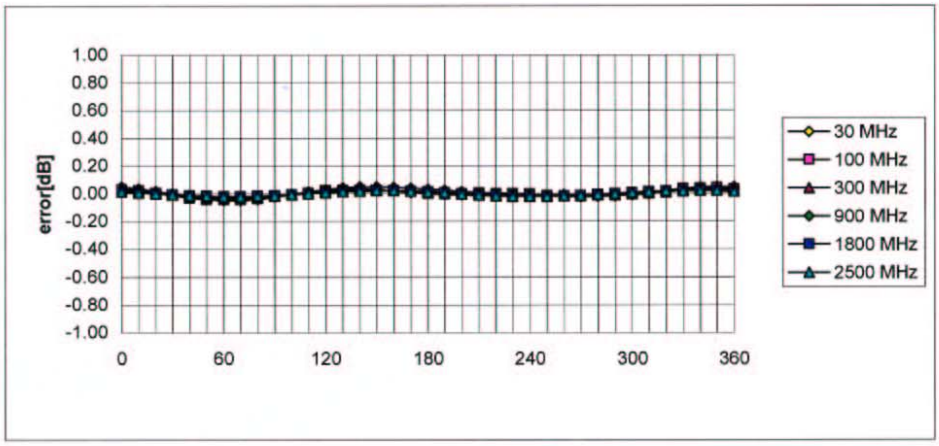
Receiving Pattern (ϕ , θ = 0°



ET3DV6 SN:1685 October 10, 2003



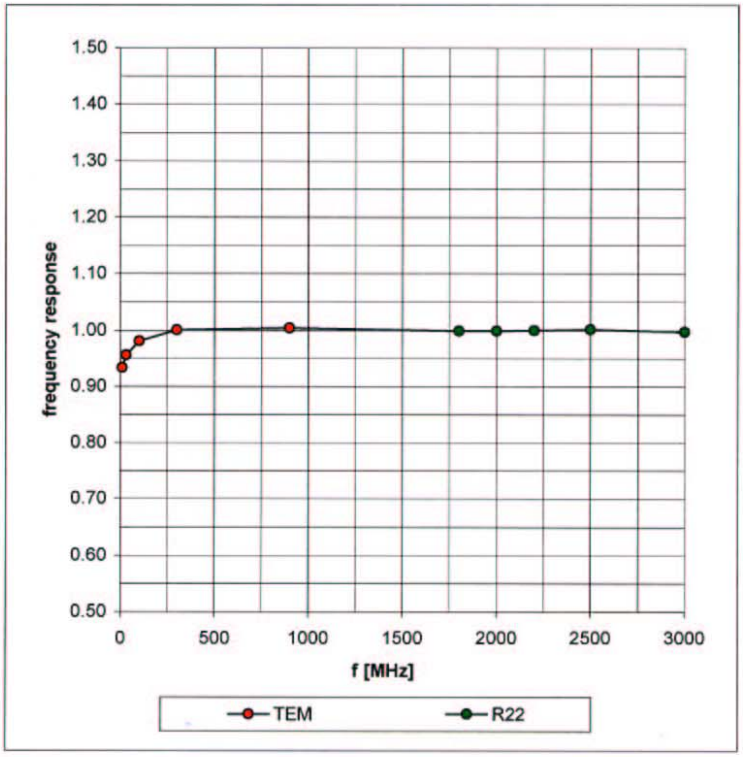
Isotropy Error (ϕ), θ = 0°



ET3DV6 SN:1685 October 10, 2003

Frequency Response of E-Field

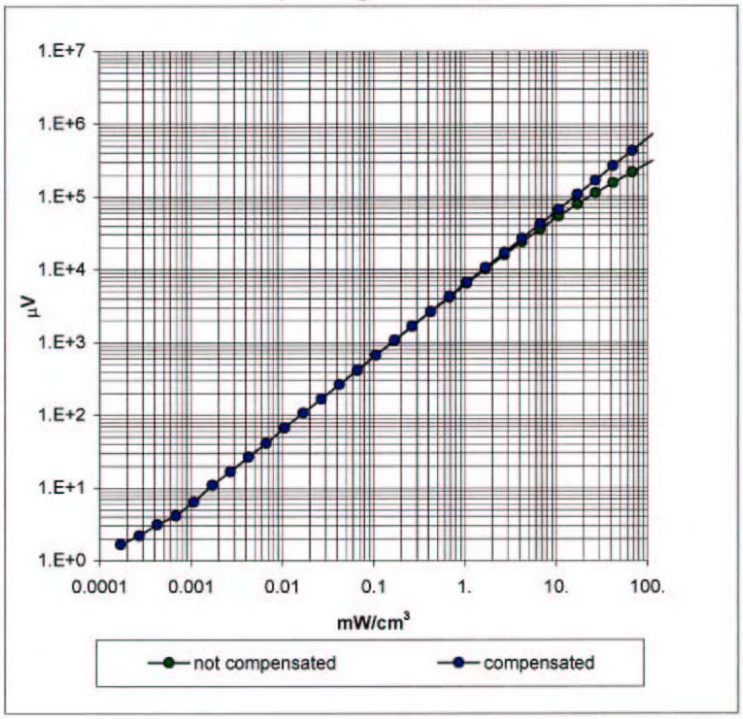
(TEM-Cell:ifi110, Waveguide R22)

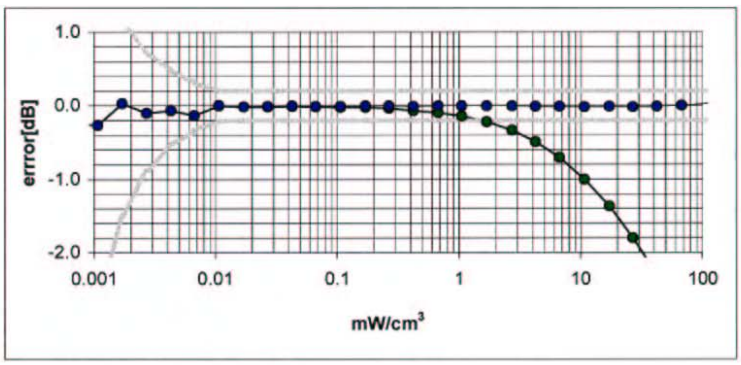


ET3DV6 SN:1685 October 10, 2003

Dynamic Range f(SAR_{brain})

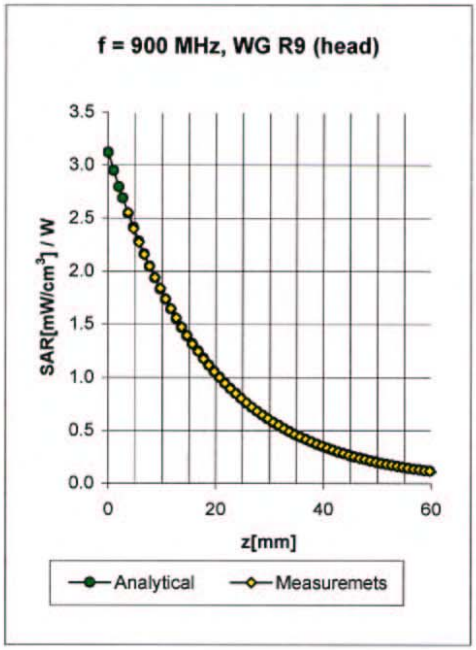
(Waveguide R22)

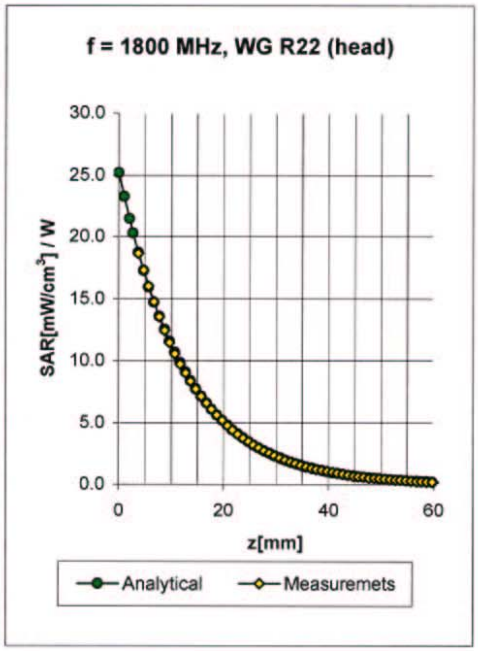




ET3DV6 SN:1685 October 10, 2003

Conversion Factor Assessment





Head **900 MHz** ε_r = 41.5 ± 5% σ = 0.97 ± 5% mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**6.6** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.6** ± 9.5% (k=2)	Alpha	**0.26**
ConvF Z	**6.6** ± 9.5% (k=2)	Depth	**3.07**

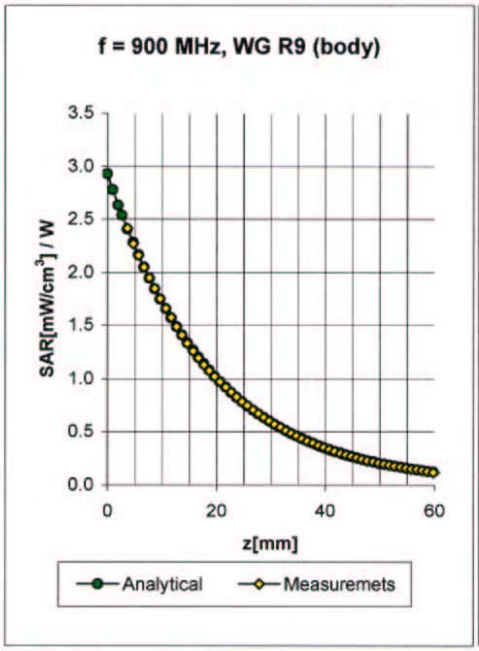
Head **1800 MHz** ε_r = 40.0 ± 5% σ = 1.40 ± 5% mho/m

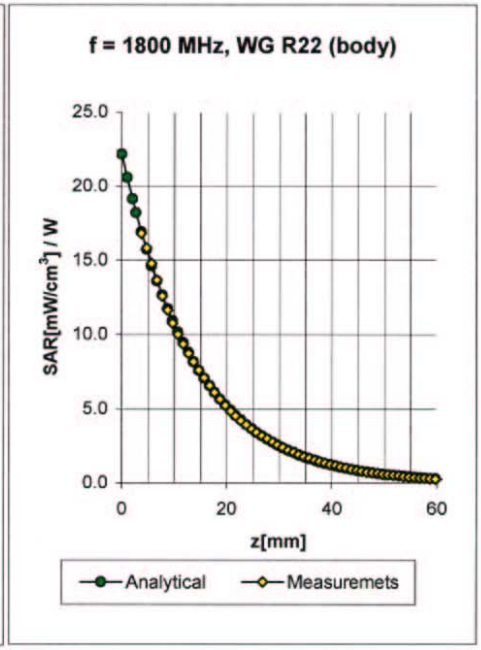
Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**5.2** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**5.2** ± 9.5% (k=2)	Alpha	**0.41**
ConvF Z	**5.2** ± 9.5% (k=2)	Depth	**2.77**

ET3DV6 SN:1685 October 10, 2003

Conversion Factor Assessment





Body **900 MHz** ε_r = 55.0 ± 5% σ = 1.05 ± 5% mho/m

Valid for f=800-1000 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**6.4** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.4** ± 9.5% (k=2)	Alpha	**0.27**
ConvF Z	**6.4** ± 9.5% (k=2)	Depth	**3.22**

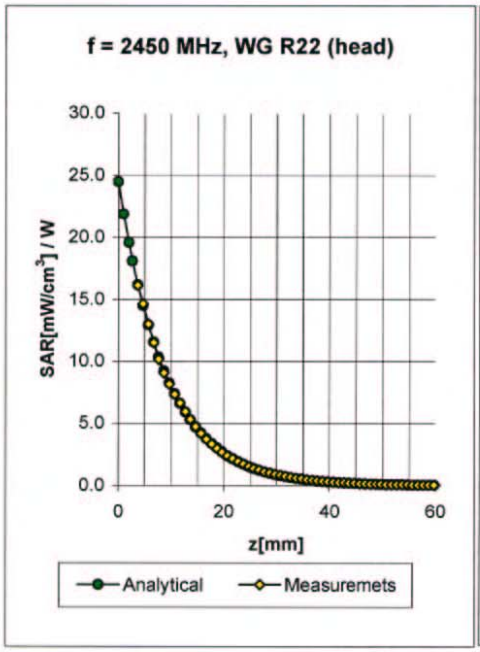
Body **1800 MHz** ε_r = 53.3 ± 5% σ = 1.52 ± 5% mho/m

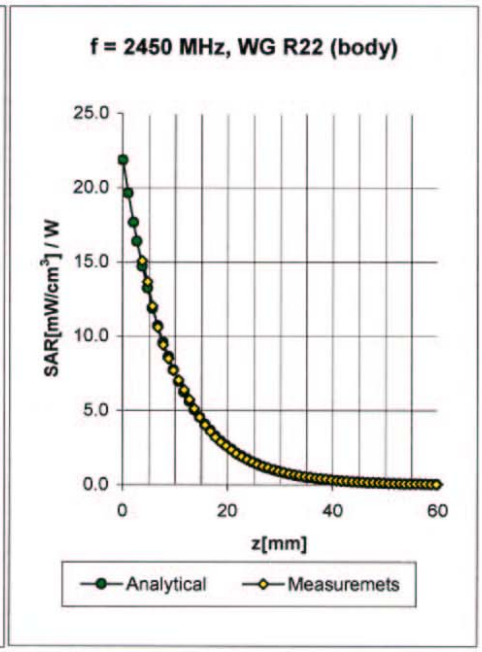
Valid for f=1710-1910 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**4.7** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.7** ± 9.5% (k=2)	Alpha	**0.48**
ConvF Z	**4.7** ± 9.5% (k=2)	Depth	**2.94**

ET3DV6 SN:1685 October 10, 2003

Conversion Factor Assessment





Head **2450 MHz** ε_r = 39.2 ± 5% σ = 1.80 ± 5% mho/m

Valid for f=2400-2500 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**4.7** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.7** ± 9.5% (k=2)	Alpha	**0.78**
ConvF Z	**4.7** ± 9.5% (k=2)	Depth	**2.04**

Body **2450 MHz** ε_r = 52.7 ± 5% σ = 1.95 ± 5% mho/m

Valid for f=2400-2500 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**4.3** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**4.3** ± 9.5% (k=2)	Alpha	**0.80**
ConvF Z	**4.3** ± 9.5% (k=2)	Depth	**1.89**

ET3DV6 SN:1685 October 10, 2003

Deviation from Isotropy in HSL

Error (θϕ), f = 900 MHz