SAR EVALUATION REPORT

Report No. : 24AE0054-HO

Applicant	:	**Welcat Inc.**
Type of Equipment	:	**Wireless Hand-held Terminal**
Model No.	:	**CTR-800-11W**
FCC ID	:	**Q98CTR80011W**
Test standard	:	**FCC47CFR 2.1093** **FCC OET Bulletin 65, Supplement C**
Test Result	:	**Complied**
Max SAR Measured	:	**1.02W/kg(Body, 2412MHz and 2437MHz)**

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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: August 28 , 2003

Tested by:

Miyo Ikuta
Head Office EMC Lab.

Approved by:

Tetsuo Maeno
Site Manager of Head Office EMC Lab.

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SECTION 1 : Client information

Company Name	:	Welcat Inc.
Brand Name	:	-
Address	:	1-17-12 Shin-Yokohama Kouhoku-ku Yokohama Kanagawa-ken 222-0033,Japan
Telephone Number	:	+81-45-474-9806
Facsimile Number	:	+81-45-474-9816
Contact Person	:	Kaoru Nayuki

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

2.1 Identification of E.U.T.

APPLICANT	:	Welcat Inc.
Type of Equipment	:	Wireless Hand-held Terminal
Model No.	:	CTR-800-11W
Serial No.	:	WAP0300014
Rating	:	DC 3.6 V
Country of Manufacture	:	Japan
Receipt Date of Sample	:	August 26,2003
Condition of EUT	:	Production prototype
Tx Frequency	:	2412MHz~2462MHz
Modulation	:	DSSS
Max.Output Power Tested	:	15.0 dBm Peak Conducted
Antenna Type	:	λ/2-dipole antenna
Position of Antenna	:	See Photograph of right
Battery option	:	Only one model with EUT
Category Identified	:	Portable device

SECTION 3 : Requirements for compliance testing defined by the FCC

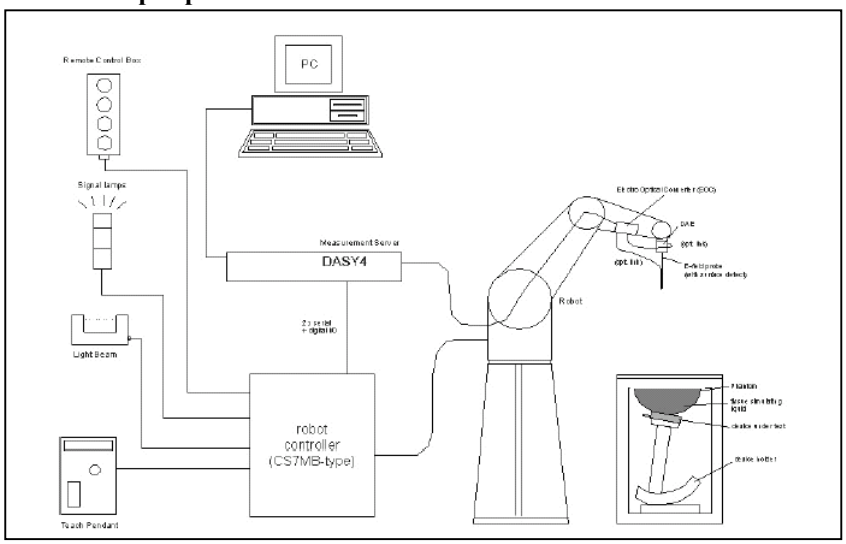
The US Federal Communications Commission has released the report and order “Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable 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: 1684 (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.

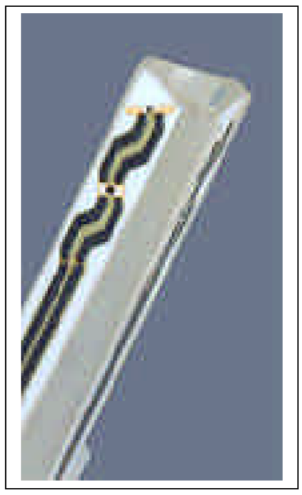
12. Tissue simulating liquid mixed according to the given recipes.

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

4.2 System components

4.2.1 ET3DV6 Probe Specification

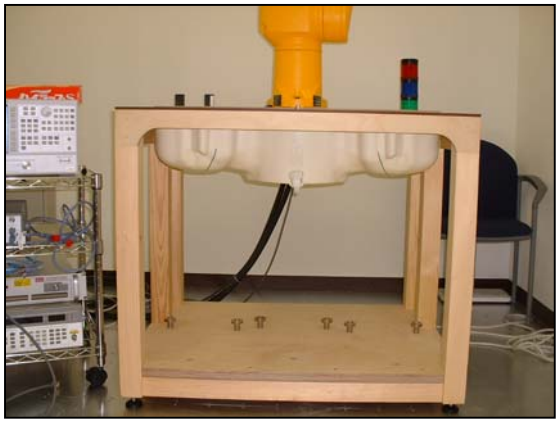
Construction:
Symmetrical design with triangular core
Built-in optical fiber for surface detection System
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., glycol ether)
Calibration:
Basic Broad Band calibration in air from 10 MHz to 2.5 GHz
In brain 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 couldn't be used at this SAR measurement.

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.	:	1684
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

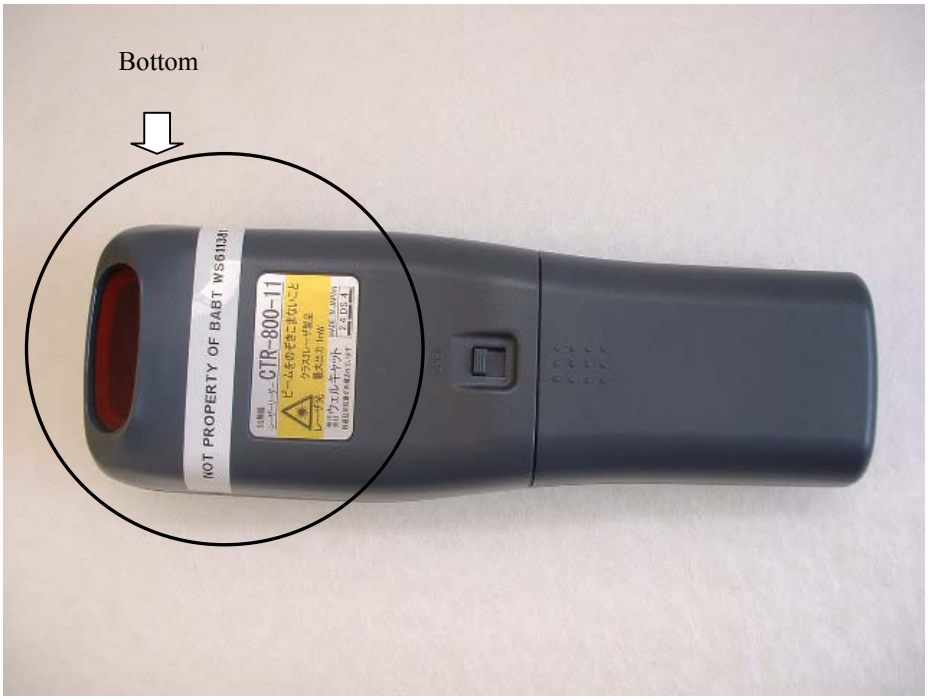
Type	:	SAM Twin Phantom V4.0
Shell Material	:	Fiberglass
Thickness	:	2.0 +/-0.2 mm
Volume	:	Approx. 20 liters
Manufacture	:	Schimid & Partner Engineering AG

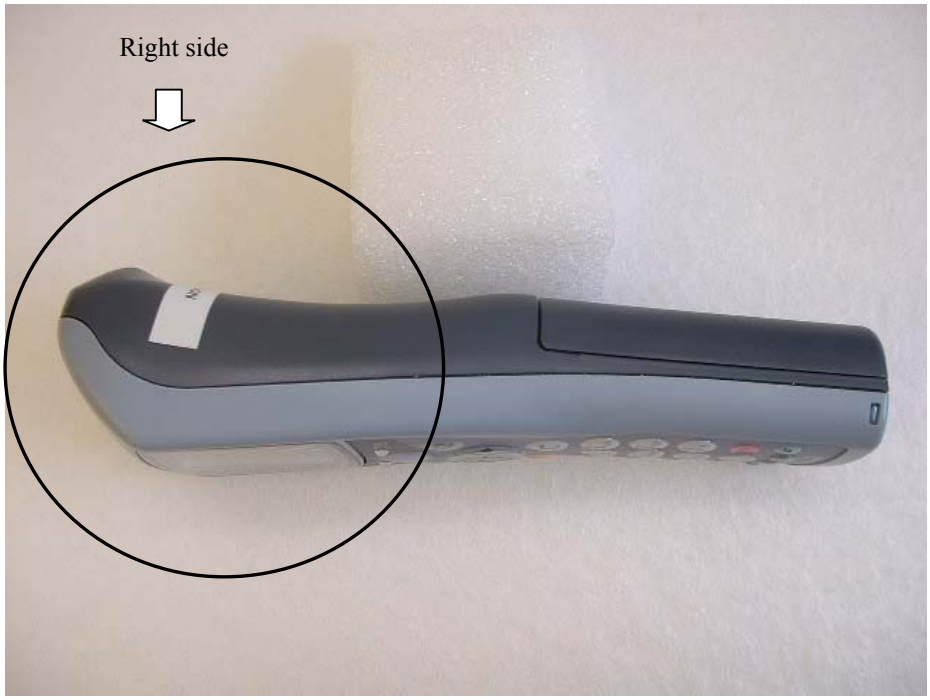
SECTION 6 : Test setup of EUT

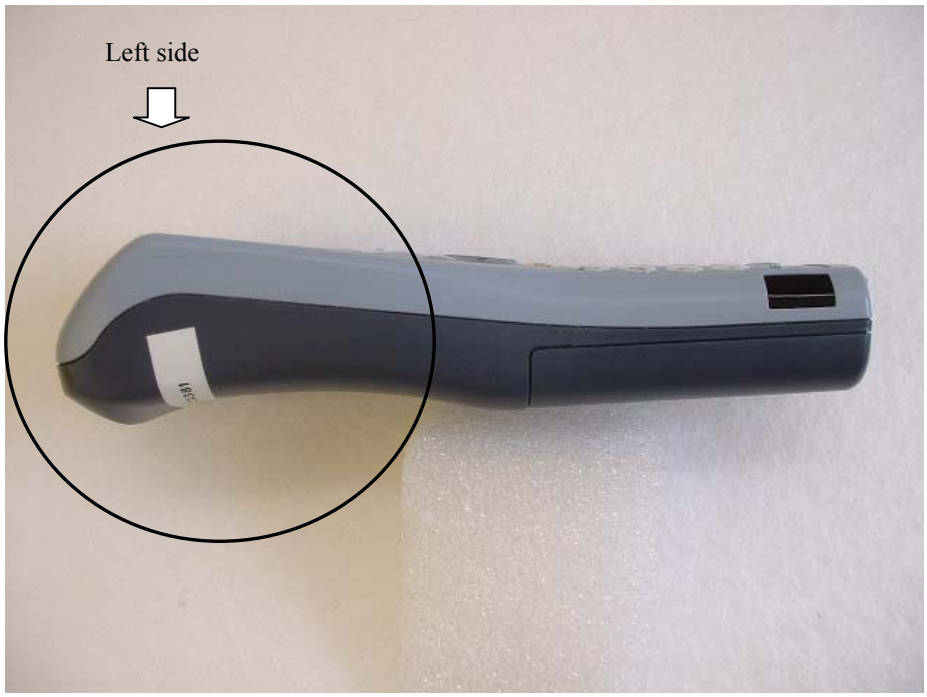
6.1 Photographs of test setup

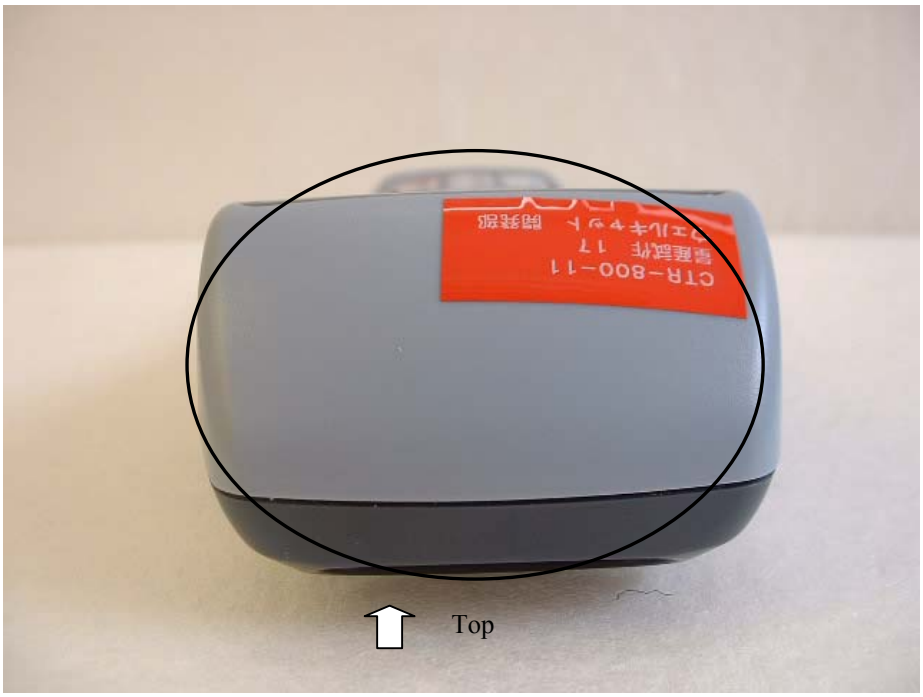
When users operate or carry this EUT, it could be considered to touch or get close to their bodies. In order to assume this situation, we performed the test at the following positions. Please refer to "APPENDIX 1" for more details.

1. Face	: We performed the test with face of EUT touching to the flat phantom.
2. Bottom	: We performed the test with bottom of EUT touching to the flat phantom.
4.Right side	: We performed the test with right side of EUT touching to the flat phantom.
6.Left side	: We performed the test with left side of EUT touching to the flat phantom.
7.Top	: We performed the test with top of EUT touching to the flat phantom.


Bottom
NOT PROPERTY OF BABT WS6113
CTR-800-11


Right side





6.2 EUT Tune-up procedure

We determined following conditions ;

Transmitter was continuous mode.
Crest Factor = 1
Frequency channel were low , middle and high (2412MHz ,2437MHz and 2462MHz)

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	6
Device holder uncertainty	±3.6	Rectangular	√3	1	±3.6	4
Power drift	±5.0	Rectangular	√3	1	±2.9	∞
Phantom and Setup						
Phantom uncertainty	±4.0	Rectangular	√3	1	±2.3	∞
Liquid conductivity (target)	±5.0	Rectangular	√3	0.64	±1.8	∞
Liquid conductivity (meas.)	±10.0	Rectangular	√3	0.64	±3.7	∞
Liquid permittivity (target)	±10.0	Rectangular	√3	0.6	±3.5	∞
Liquid permittivity (meas.)	±5.0	Rectangular	√3	0.6	±1.7	∞
Combined Standard Uncertainty					**±11.26**	
Expanded Uncertainty (k=2)					**±22.5**	

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 2450MHz

Type of liquid : **Head 2450 MHz**
Ambient temperature (deg.c.) : **24.5**
Relative Humidity (%) : **67**
Lquid depth (cm) : **15.9**

Date : August 28,2003
Measured By : Miyo Ikuta

DIELECTRIC PARAMETERS MEASUREMENT RESULTS						
Liquid Temp [deg.c]		Parameters	Target Value	Measured	Deviation [%]	Limit [%]
Before	After					
24.5	24.5	Relative Permittivity εr	39.2	36.8	-6.1	+/-10
		Coductivity σ [mho/m]	1.80	1.86	+3.3	+/-5

8.1.2 Muscle 2450MHz

Type of liquid : **Muscle 2450 MHz**
Ambient temperature (deg.c.) : **23.5**
Relative Humidity (%) : **65**
Liquid depth (cm) : **15.1**

Date : August 28,2003
Measured By : Miyo Ikuta

DIELECTRIC PARAMETERS MEASUREMENT RESULTS						
Liquid Temp [deg.c]		Parameters	Target Value	Measured	Deviation [%]	Limit [%]
Before	After					
23.4	23.4	Relative Permittivity εr	52.7	49.0	-7.0	+/-10
		Conductivity σ [mho/m]	1.95	1.94	-0.5	+/-5

8.2 Simulated Tissues

Ingredient	MiXTURE(%)	
	Head 2450MHz	Muscle 2450MHz
Water	45.0	69.83
DGMBE	55.0	30.17

Note:DGMBE(Diethylenglycol-monobuthyl ether)

SECTION 9 : System validation data

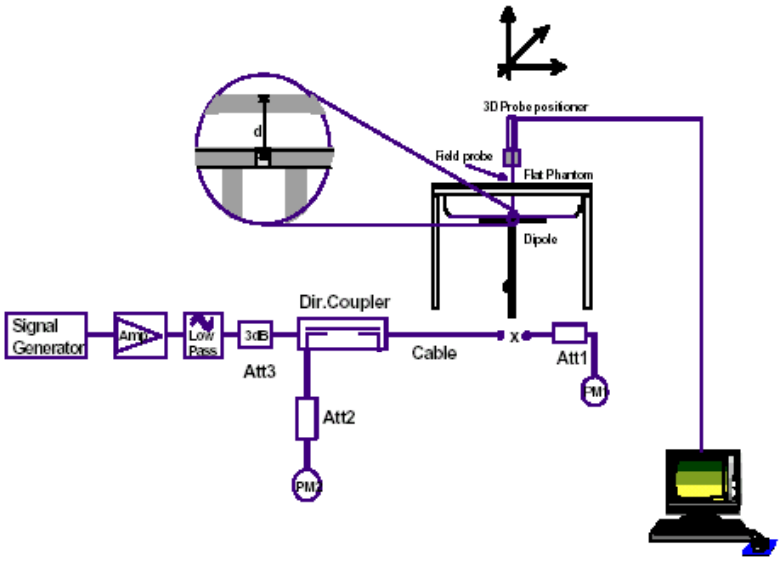
Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of +/-10%. The validation results are tabulated below. Please refer to APPENDIX 3.

Type of liquid	:	**HEAD 2450MHz**
Frequency	:	**2450MHz**
Liquid depth (cm)	:	**15.9**
Ambient temperature (deg.c.)	:	**24.5**
Relative Humidity (%)	:	**67**
Dipole	:	**D2450V2 SN:713**
Power	:	**250mW**

Date : August 28,2003
Measured By : Miyo Ikuta

SYSTEM PERFORMANCE CHECK									
Liquid (HEAD 2450MHz)						System dipole validation target & measured			
temperature (deg.c.)		Relative Permittivity εr		Conductivity σ [mho/m]		SAR 1g [W/kg]		Deviation [%]	Limit [%]
Before	Afterx	Target	Measured	Target	Measured	Target	Measured		
23.4	23.4	39.2	36.8	1.80	1.86	13.1	13.6	+3.8	+/-10

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



2450MHz System performance check setup

Test system for the system performance check setup diagram

SECTION 10 : Evaluation procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the SAR value 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.

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(180 x 260) 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 32 mm x 32 mm x 30 mm was assessed by measuring 5 x5 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 SAR value at the same location as in Step 1. It is measured SAR-drift(the difference between the SAR 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 Conducted power measurement results

Date : August 28,2003
Measured By : Miyo Ikuta

CONDUCTED POWER MEASUREMENT RESULTS										
Frequency [MHz]	Before				After				Deviation [%]	Limit [%]
	Reading [dBm]	Att. [dB]	Result [dBm]	Convert [mW]	Reading [dBm]	Att. [dB]	Result [dBm]	Convert [mW]		
2412	4.9	10	14.9	30.90	4.9	10	14.9	30.90	0.0	+/-5
2437	5.0	10	15.0	31.62	4.9	10	14.9	30.90	-2.3	+/-5
2462	4.4	10	14.4	27.54	4.4	10	14.4	27.54	0.0	+/-5

12.2 Body 2450MHz SAR

Liquid Depth (cm)	:	**15.1**	Model	:	**CTR-800-11W**
Parameters	:	**ε_r =49.0, σ =1.94**	Serial No.	:	**WAP0300014**
Ambient Temperature[deg.c.]	:	**24.5**	Modulation	:	**DSSS**
Relative Humidity (%)	:	**65**	Crest factor	:	**1**

Date : August 28,2003
Measured By : Miyo Ikuta

BODY SAR MEASUREMENT RESULTS								
Frequency		Phantom Section	EUT Set-up Conditions			Liquid Temp.[deg.c]		SAR(1g) [w/kg] (Maximum value of multi-peak)
Channel	MHz		Antenna	Position	Separation [mm]	Before	After	
Mid	2437	Flat	Fixed	Face	0	23.4	23.4	**0.584**
Mid	2437	Flat	Fixed	Bottom	0	23.2	23.0	**0.0758**
Mid	2437	Flat	Fixed	Right side	0	23.0	22.9	**0.0541**
Mid	2437	Flat	Fixed	Left side	0	23.0	23.0	**0.0301**
Mid	2437	Flat	Fixed	Top	0	23.4	23.4	**1.02**
Low	2412	Flat	Fixed	Top	0	23.5	23.5	**1.02**
High	2462	Flat	Fixed	Top	0	23.6	23.5	**0.978**
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	2002/11/08	2003/11/07
Power Sensor	Agilent	E9300B	US40010300	2002/11/14	2003/11/13
Power Sensor	Agilent	E9327A	US40440576	2003/04/14	2004/04/13
S-Parameter Network Analyzer	Agilent	8753ES	US39174808	2000/10/05	2003/10/04
Signal Generator	Rohde&Schwarz	SML03	100332	2003/06/24	2004/06/23
RF Amplifier	OPHIR	5056F	1005	2003/02/06	2004/02/05
Dosimetric E-Field Probe	Schmid&Partner Engineering AG	ET3DV6	1684	2002/11/20	2003/11/19
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	Agilent.	US40010300	08498-60012	2002/12/24	2003/12/23
Attenuator	HIROSE ELECTRIC Co.,LTD	AT-110	-	2003/02/04	2004/02/03
2450MHz System Validation Dipole	Schmid&Partner Engineering AG	D2450V2	713	2002/11/15	2004/11/14
Dual Directional Coupler	N/A	Narda	03702	N/A	N/A
Head 2450MHz	N/A	N/A	N/A	N/A	N/A
Body 2450MHz	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.

SECTION 15 : APPENDIX

APPENDIX 1	**:**	**Photographs of test setup**	**19-23**
APPENDIX 2	**:**	**SAR Measurement data**	**24-31**
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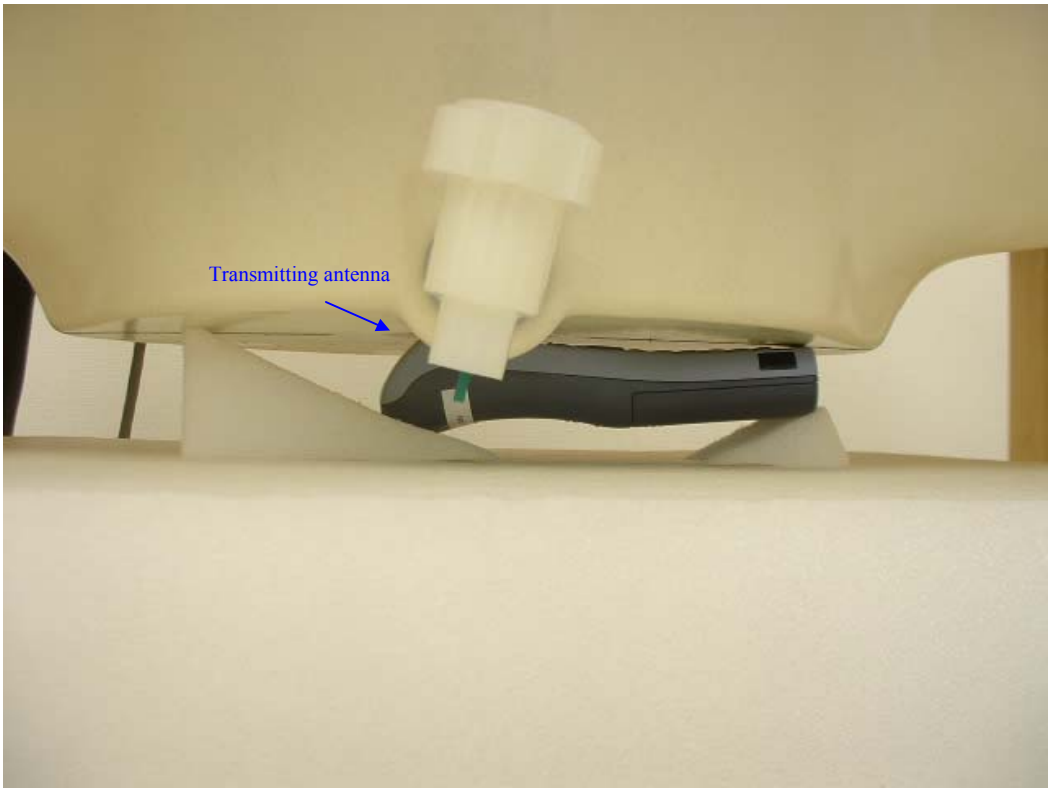
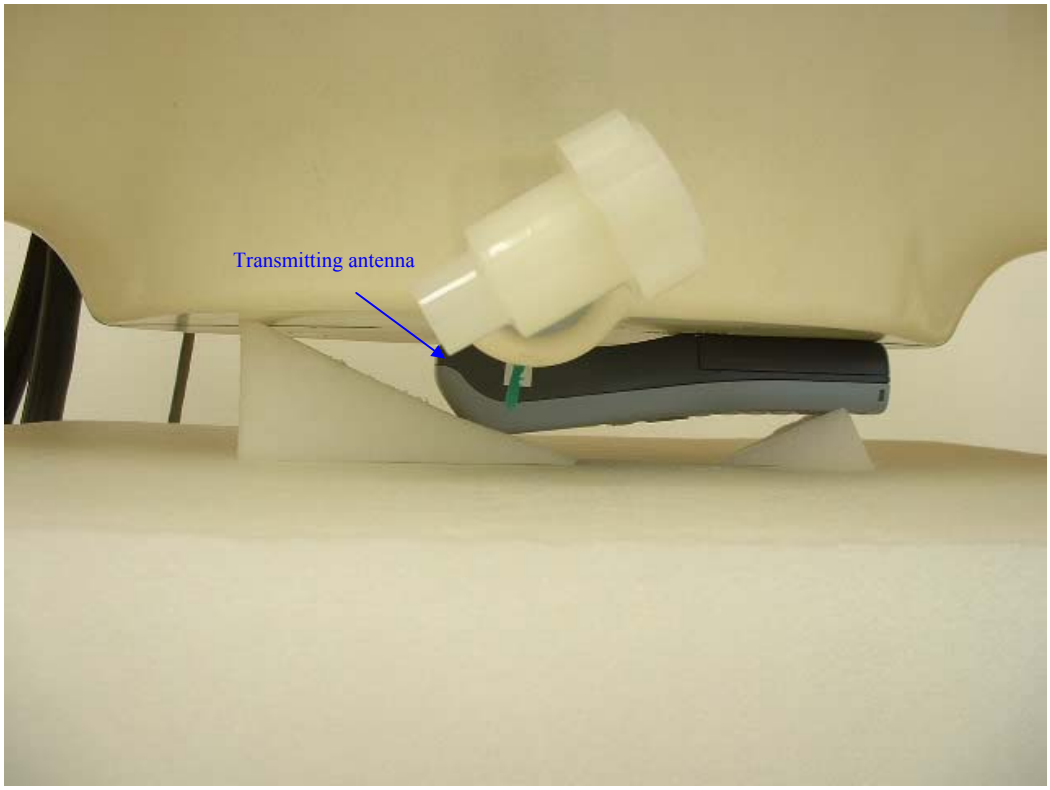
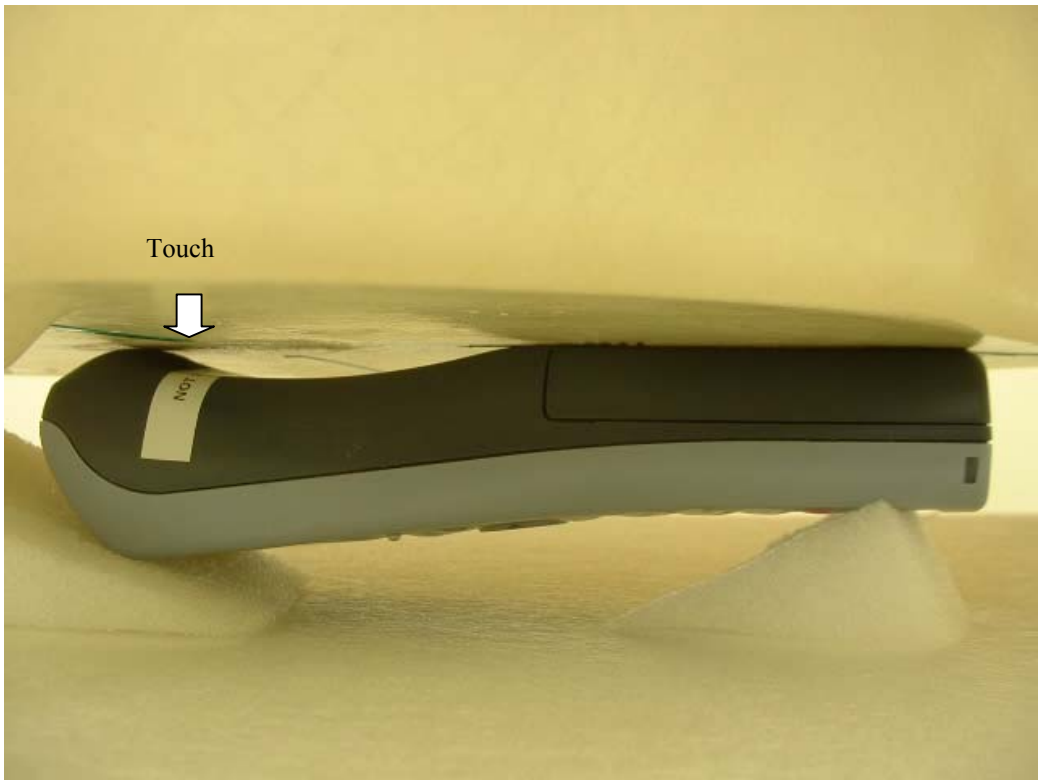
APPENDIX 1 : Photographs of test setup

Face



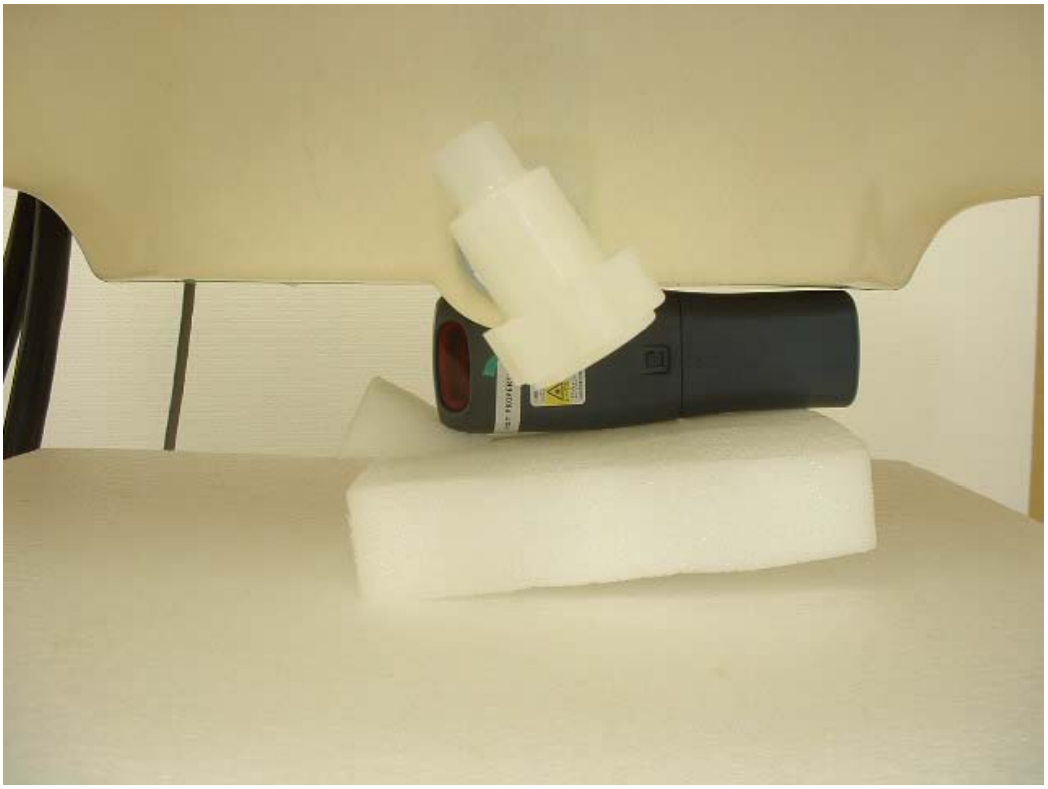
Bottom





Right side

Left side



Top

APPENDIX 2 : SAR Measurement data

CTR-800-11W / Body / Face / 2437 MHz

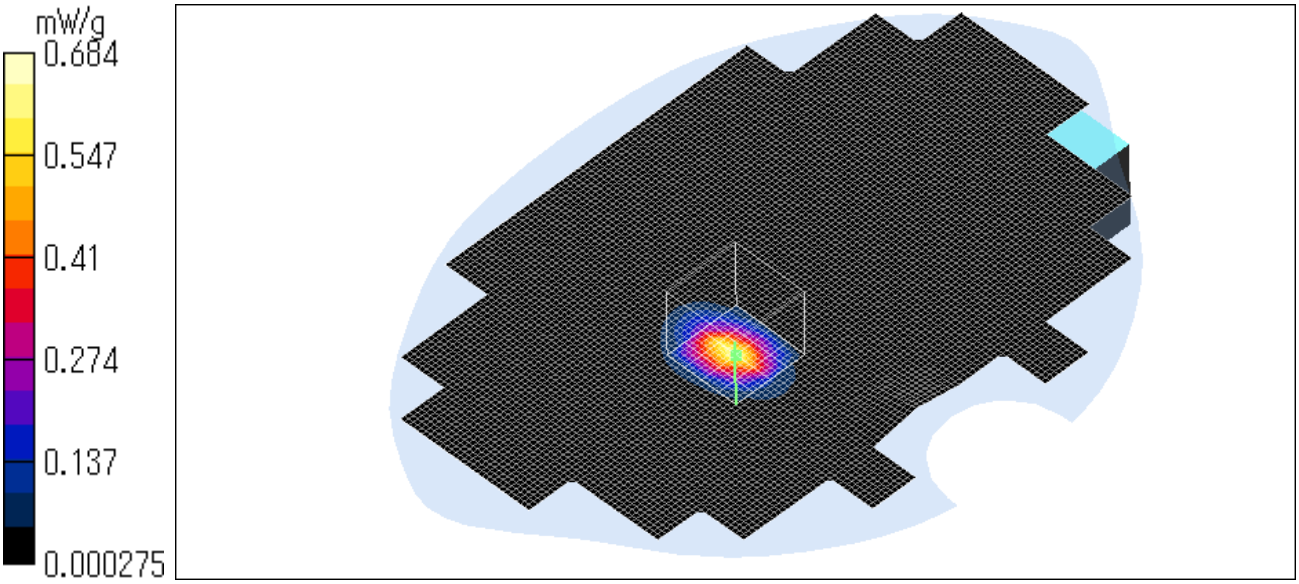
Crest factor : 1
Medium: M2450 (σ = 1.94 mho/m, ε_r = 49, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1684; ConvF(4.4, 4.4, 4.4); Calibrated: 2002/11/20
- 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 (91x131x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.685 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 1.25 W/kg
SAR(1 g) = 0.584 mW/g; SAR(10 g) = 0.242 mW/g
Maximum value of SAR = 0.684 mW/g

Test date = 08 /28/ 03
Reference Value = 1.15 V/m
Power Drift = 0.2 dB
Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 23.4 degree.C , After 23.4 degree.C



CTR-800-11W / Body / Bottom / 2437MHz

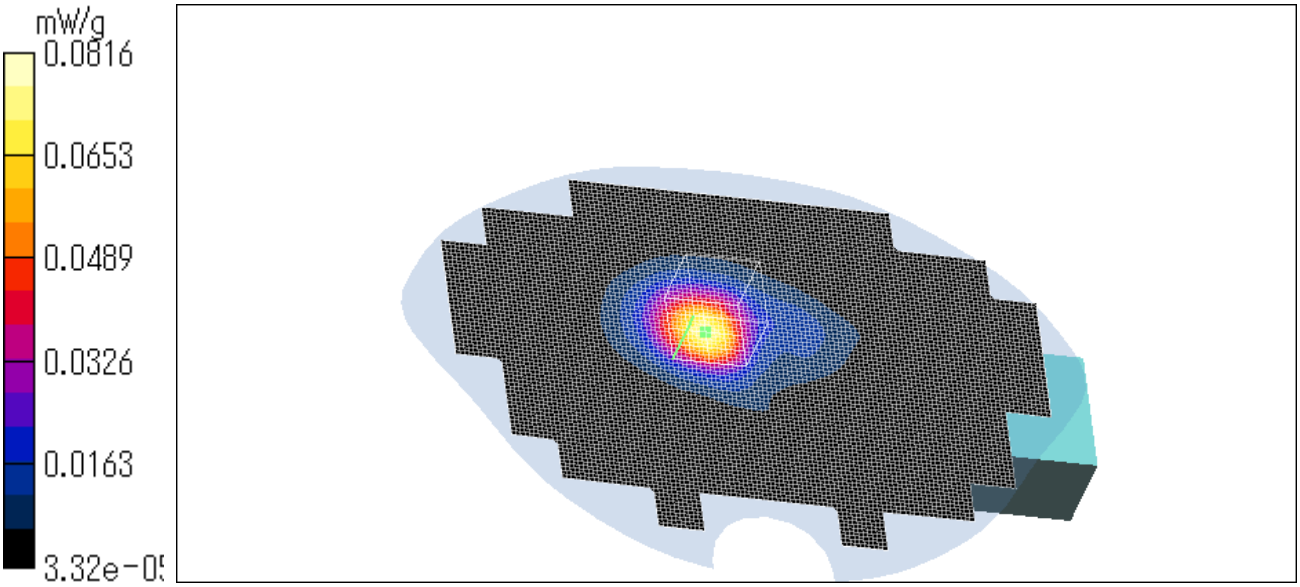
Crest factor : 1
Medium: M2450 (σ = 1.94 mho/m, ε_r = 49, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1684; ConvF(4.4, 4.4, 4.4); Calibrated: 2002/11/20
- 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 (91x131x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.0798 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 0.142 W/kg
SAR(1 g) = 0.0758 mW/g; SAR(10 g) = 0.0397 mW/g
Maximum value of SAR = 0.0816 mW/g

Test date = 08 / 28 / 03
Reference Value = 3.25 V/m
Power Drift = -0.07 dB
Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 23.2 degree.C , After 23.0degree.C



CTR-800-11W / Body / Right side / 2437MHz

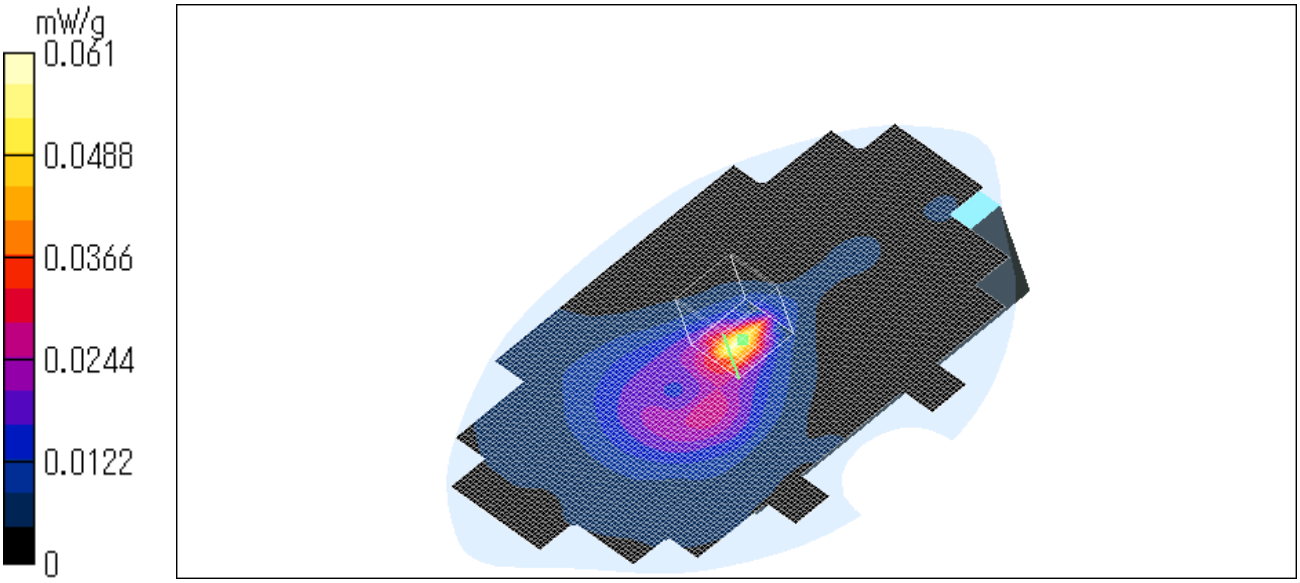
Crest factor : 1
Medium: M2450 (σ = 1.94 mho/m, ε_r = 49, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1684; ConvF(4.4, 4.4, 4.4); Calibrated: 2002/11/20
- 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 (91x131x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.0583 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 0.131 W/kg
SAR(1 g) = 0.0541 mW/g; SAR(10 g) = 0.0226 mW/g
Maximum value of SAR = 0.061 mW/g

Test date = 08 / 28/ 03
Reference Value = 4.43 V/m
Power Drift = -0.07 dB
Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 23.0 degree.C , After 22.9degree.C



CTR-800-11W / Body / Left side / 2437MHz

Crest factor : 1
Medium: M2450 (σ = 1.94 mho/m, ε_r = 49, ρ = 1000 kg/m^3)
Phantom section: Flat Section

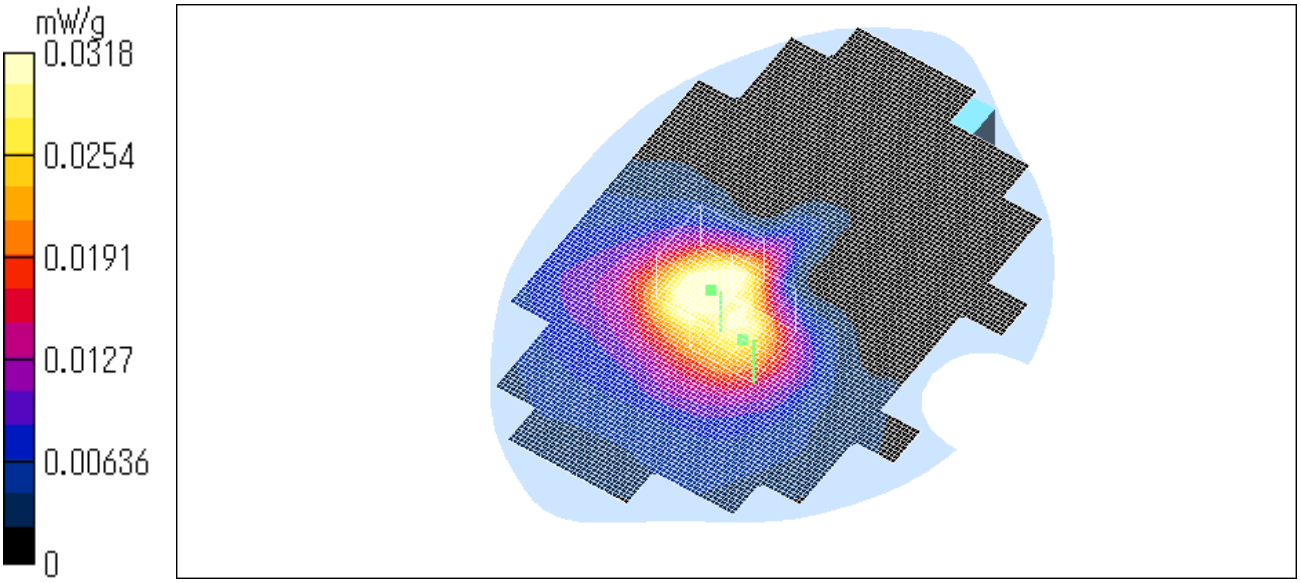
DASY4 Configuration:
- Probe: ET3DV6 - SN1684; ConvF(4.4, 4.4, 4.4); Calibrated: 2002/11/20
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (91x131x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.0363 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 0.0706 W/kg
SAR(1 g) = 0.0352 mW/g; SAR(10 g) = 0.0189 mW/g
Maximum value of SAR = 0.0378 mW/g

Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 0.0659 W/kg
SAR(1 g) = 0.0301 mW/g; SAR(10 g) = 0.0161 mW/g
Maximum value of SAR = 0.0318 mW/g

Test date = 08 / 28/ 03
Reference Value = 2.52 V/m
Power Drift = 0.2 dB
Ambient Temperature : 24.5 degree.c
Liquid Temperature : Before 23.0 degree.C , After 23.0 degree.C



CTR-800-11W / Body / Top / 2437 MHz

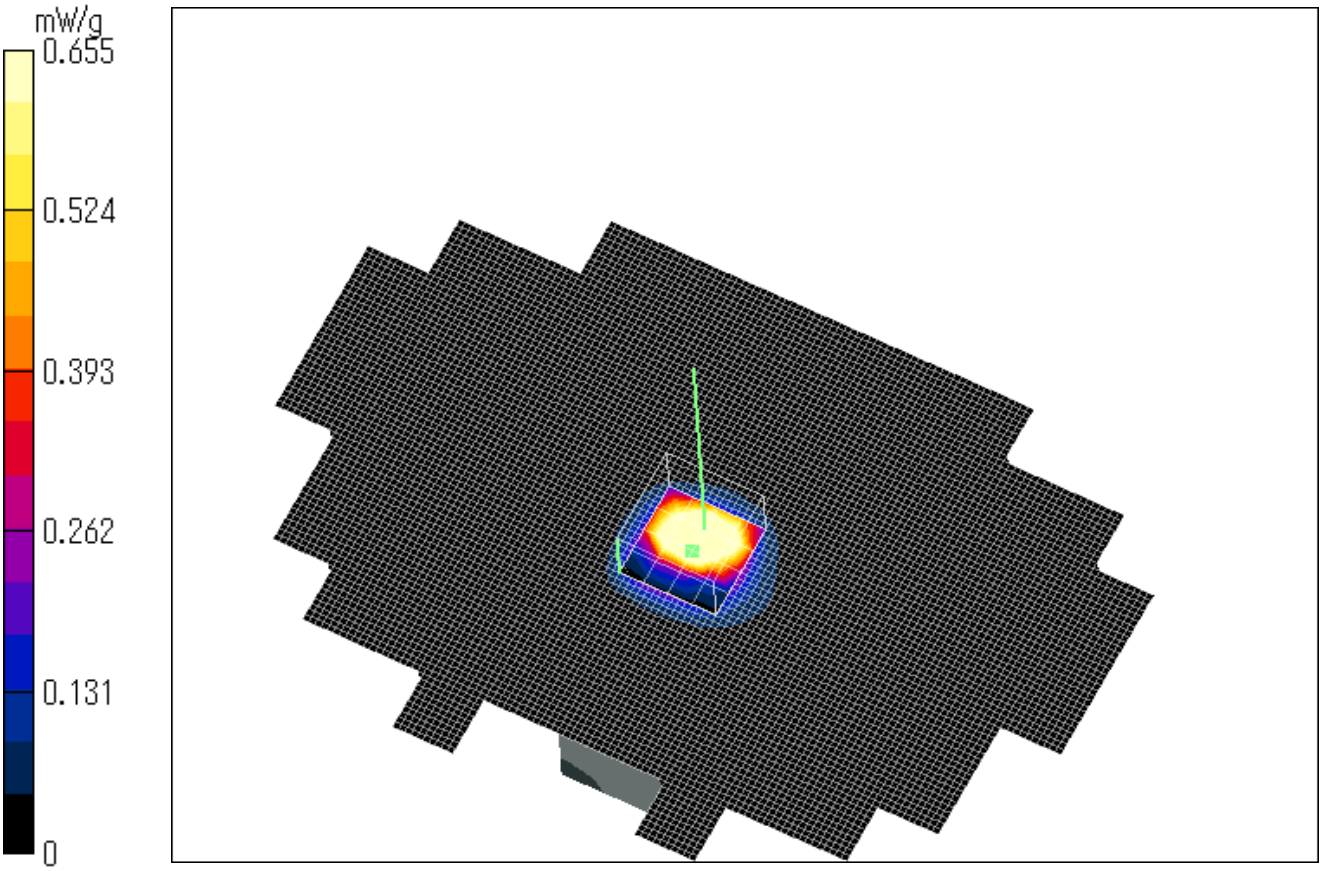
Crest factor : 1
Medium: M2450 (σ = 1.94 mho/m, ε_r = 49, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1684; ConvF(4.4, 4.4, 4.4); Calibrated: 2002/11/20
- 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 (91x131x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 1.02 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 2.02 W/kg
SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.436 mW/g
Maximum value of SAR = 1.06 mW/g

Test date = 08 / 28 / 03
Reference Value = 22.7 V/m
Power Drift = -0.2 dB
Ambient Temperature = 24.5 degree . C
Liquid Temperature = Before 23.4degree.C , After 23.4 degree.C

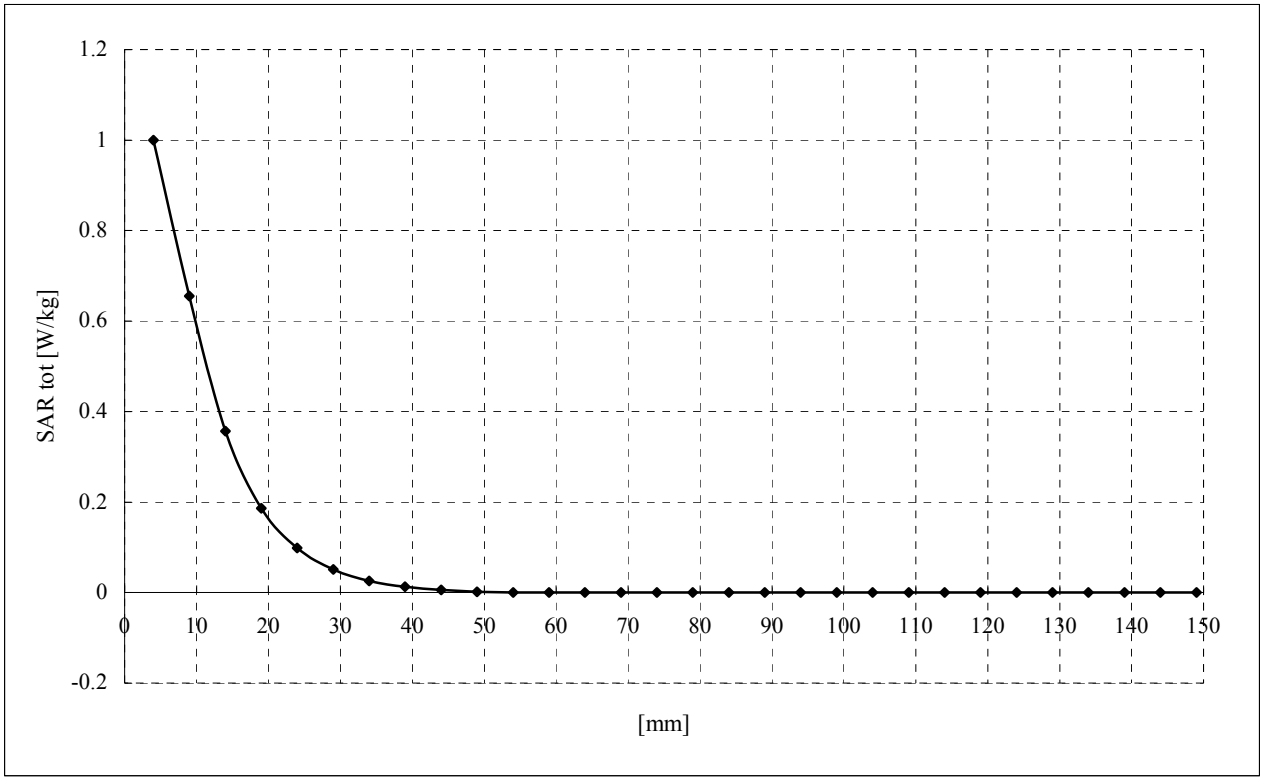


Z-axis scan at max SAR location

CTR-800-11W / Body / Top / 2437 MHz

Crest factor : 1
Medium: M2450 (σ = 1.94 mho/m, ε_r = 49, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1684; ConvF(4.4, 4.4, 4.4); Calibrated: 2002/11/20
- 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



CTR-800-11W / Body / Top / 2412 MHz

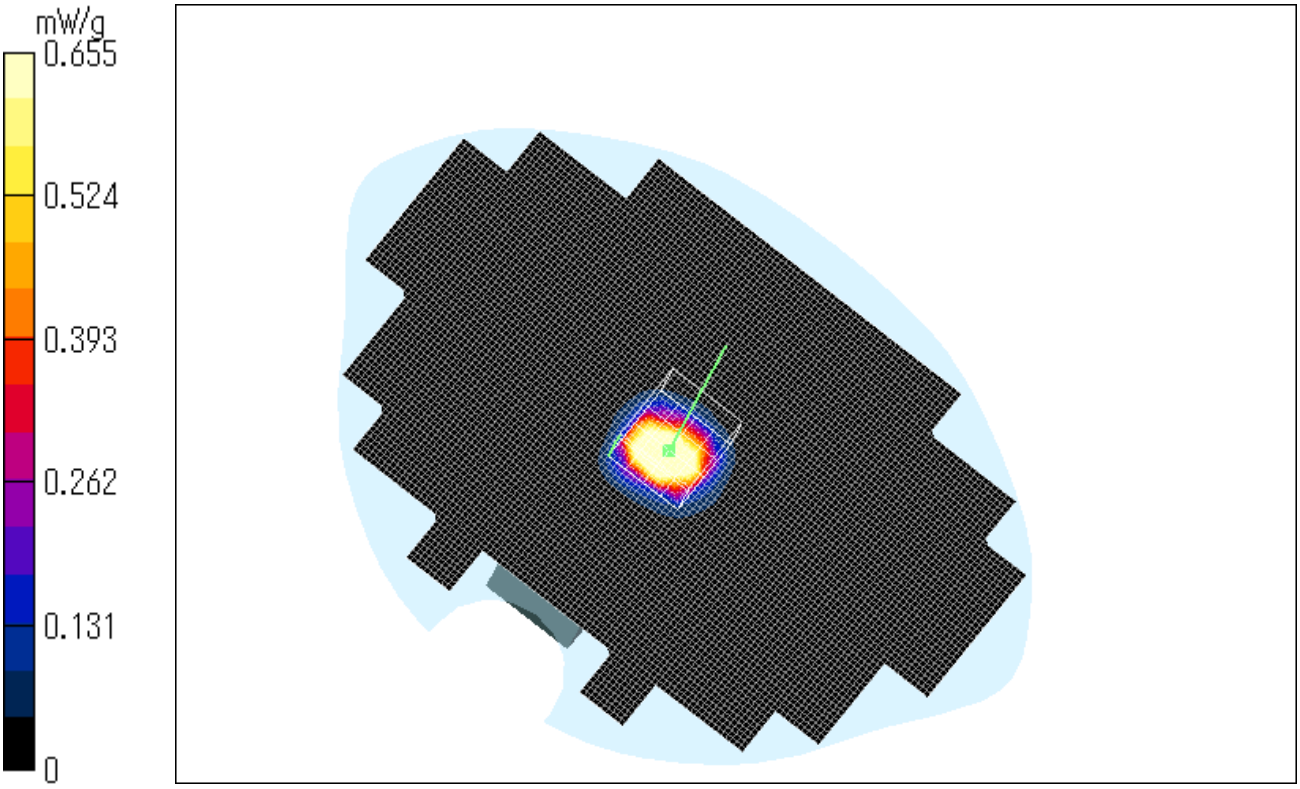
Crest factor : 1
Medium: M2450 (σ = 1.94 mho/m, ε_r = 49, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1684; ConvF(4.4, 4.4, 4.4); Calibrated: 2002/11/20
- 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 (91x131x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.938 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 2.09 W/kg
SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.433 mW/g
Maximum value of SAR = 1.11 mW/g

Test date = 08 / 28 / 03
Reference Value = 27.4 V/m
Power Drift = -0.4 dB
Ambient Temperature = 24.5 degree. C
Liquid Temperature : Before 23.5 degree.C , After 23.5 degree.C

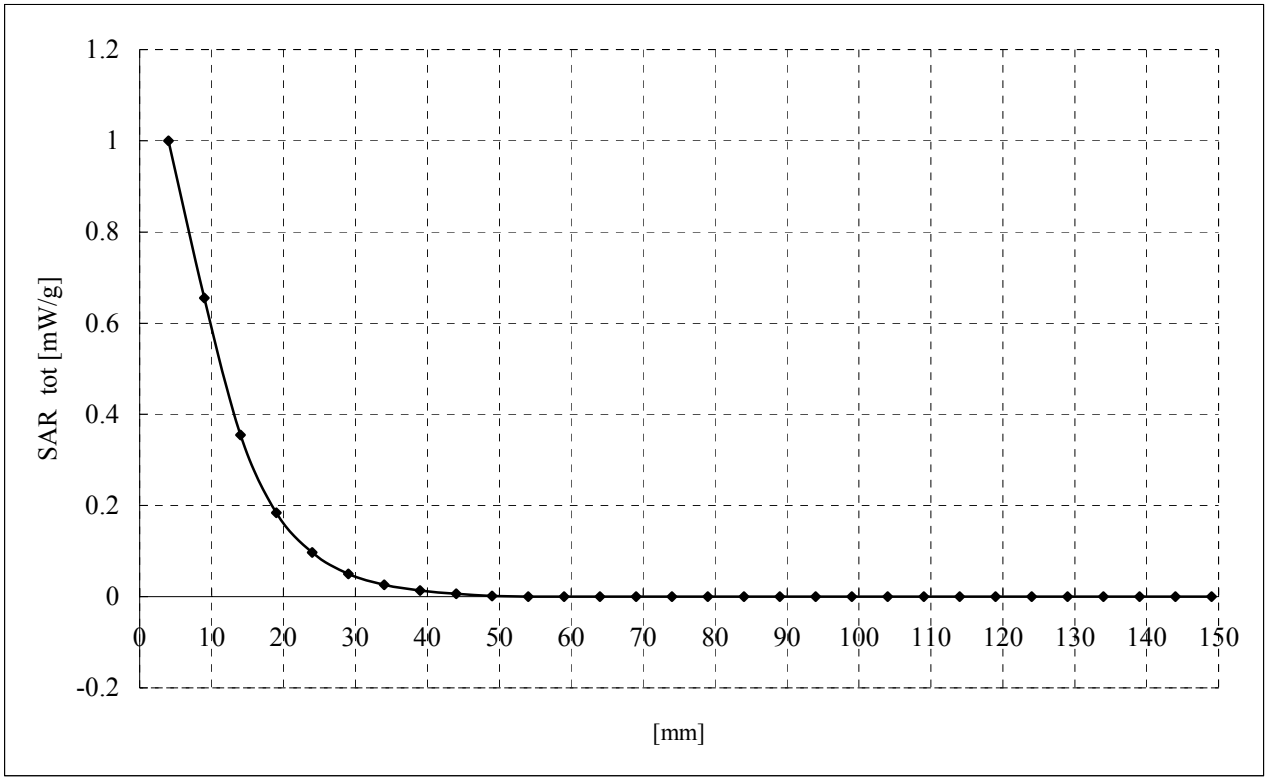


Z-axis scan at max SAR location

CTR-800-11W / Body / Top / 2412 MHz

Crest factor : 1
Medium: M2450 (σ = 1.94 mho/m, ε_r = 49, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1684; ConvF(4.4, 4.4, 4.4); Calibrated: 2002/11/20
- 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



CTR-800-11W / Body / Top / 2462MHz

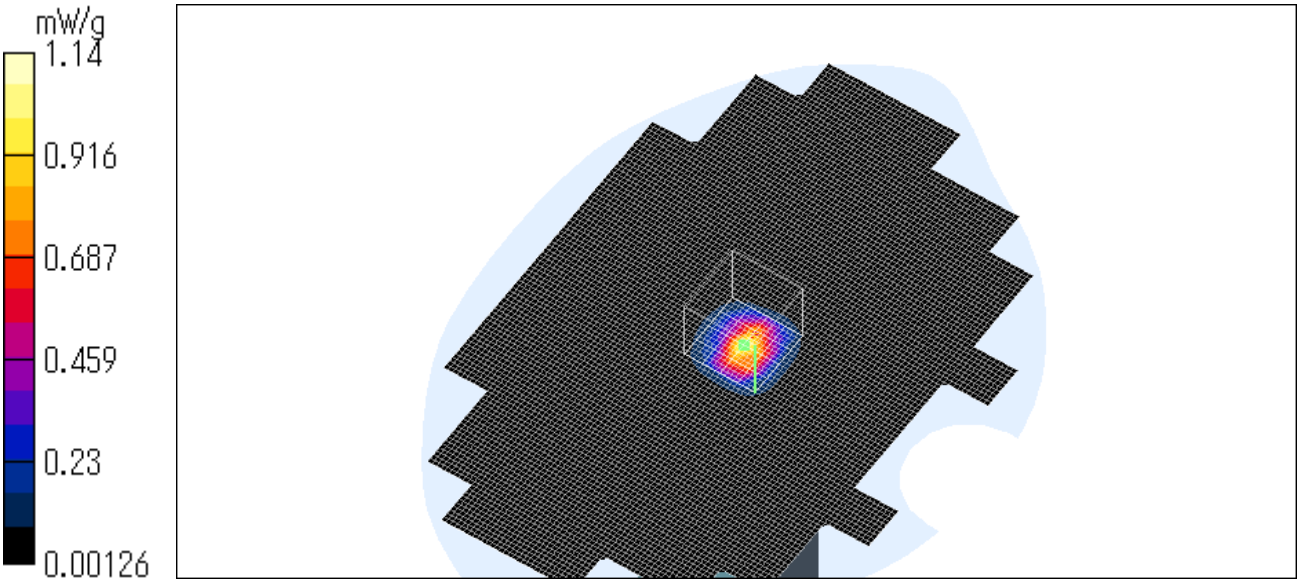
Crest factor : 1
Medium: M2450 (σ = 1.94 mho/m, ε_r = 49, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1684; ConvF(4.4, 4.4, 4.4); Calibrated: 2002/11/20
- 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 (91x131x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.838 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 2.09 W/kg
SAR(1 g) = 0.978 mW/g; SAR(10 g) = 0.392 mW/g
Maximum value of SAR = 1.14 mW/g

Test date = 08 / 28 / 03
Reference Value = 28.2 V/m
Power Drift = -0.5 dB
Ambient Temperature : 24.5 degree. C
Liquid Temperature : Before 23.6 degree.C , After 23.5 degree.C



APPENDIX 3 : Validation Measurement data

System Validation / Dipole 2450 MHz / Forward Conducted Power : 250mW

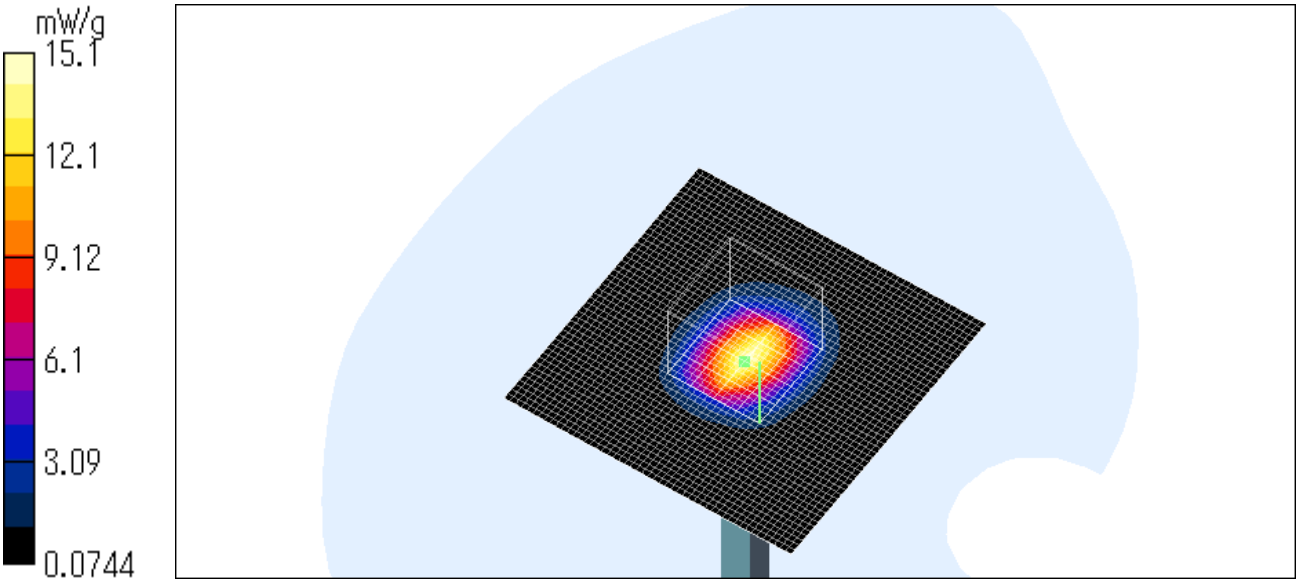
Crest factor : 1
Medium: HSL2450 (σ = 1.86 mho/m, ε_r = 36.8, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1684; ConvF(4.9, 4.9, 4.9); Calibrated: 2002/11/20
- 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 = 16.8 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 27.2 W/kg
SAR(1 g) = 13.6 mW/g; SAR(10 g) = 6.32 mW/g
Maximum value of SAR = 15.1 mW/g

Test date = 08 / 28 / 03
Reference Value = 97.2 V/m
Power Drift = -0.008 dB
Ambient Temperature = 24.5 degree.C
Liquid Temperature = Before 23.4 degree.C , After 23.4degree.C



APPENDIX 4 : System Validation Dipole (D2450V2,S/N: 713)

Schmid & Partner
Engineering AG

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

Calibration Certificate

2450 MHz System Validation Dipole

Type:	D2450V2
Serial Number:	713
Place of Calibration:	Zurich
Date of Calibration:	November 15, 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:	D. Velleu
Approved by:	[illegible]

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: D2450V2

Serial: 713

Manufactured: July 5, 2002
Calibrated: November 15, 2002

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with head simulating solution of the following electrical parameters at 2450 MHz:

Relative permitivity	**38.0**	± 5%
Conductivity	**1.87 mho/m**	± 10%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, conversion factor 5.0 at 2450 MHz) was used for the measurements.

The dipole feedpoint was positioned below the center marking and 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:	**54.4 mW/g**
averaged over 10 cm^3 (10 g) of tissue:	**24.2 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:	**1.158 ns**	(one direction)
Transmission factor:	**0.997**	(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 2450 MHz:	Re{Z} = **51.3 Ω**
	Im {Z} = **2.4 Ω**
Return Loss at 2450 MHz	**- 31.4 dB**

4. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with body simulating solution of the following electrical parameters at 2450 MHz:

Relative permitivity	**51.2**	± 5%
Conductivity	**1.96 mho/m**	± 10%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, conversion factor 4.5 at 2450 MHz) was used for the measurements.

The dipole feedpoint was positioned below the center marking and 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.

Date/Time: 11/13/02 21:52:22

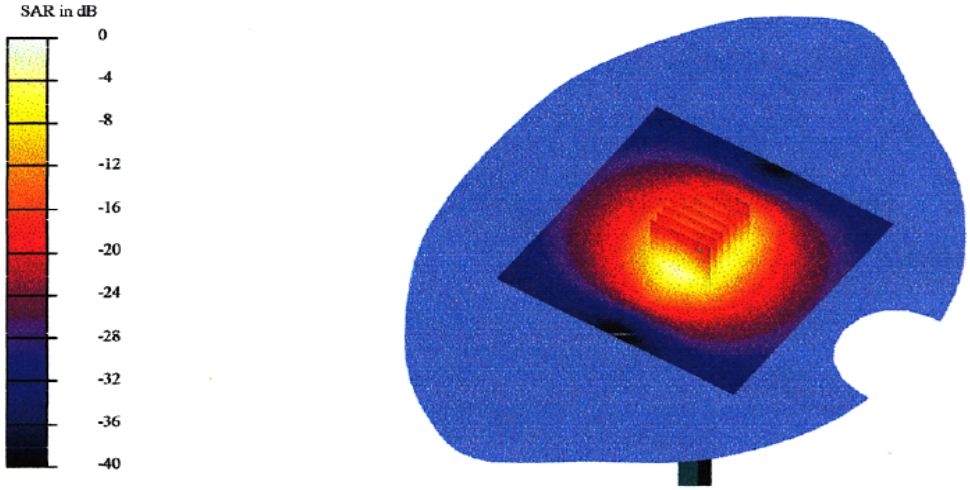
Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN713_SN1507_HSL2450_131102.da4

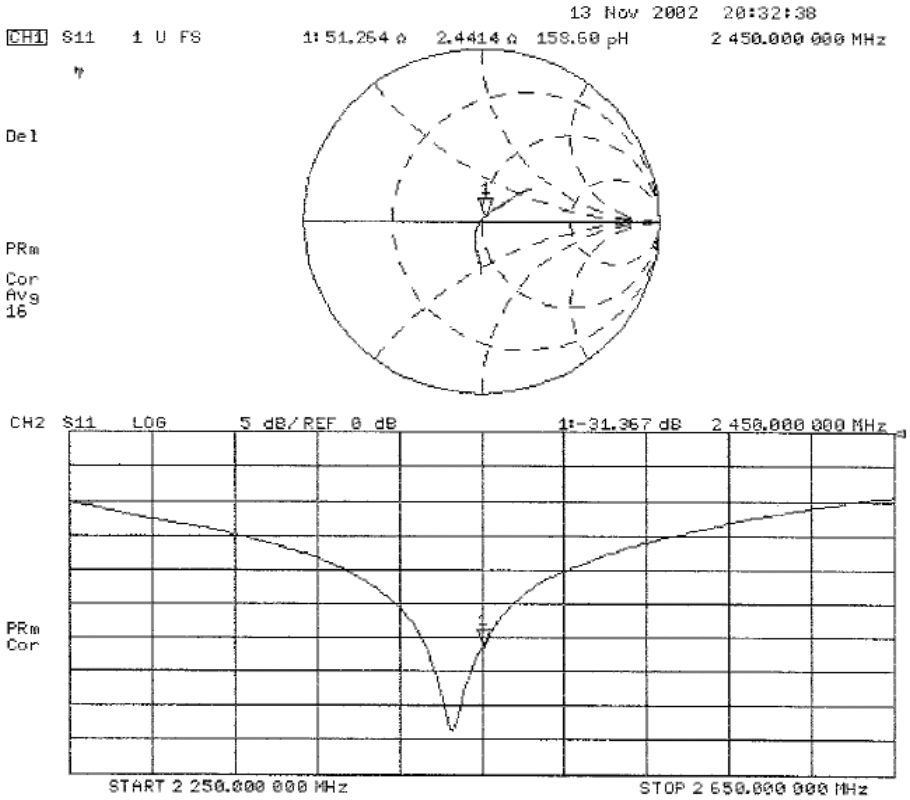
DUT: Dipole 2450 MHz Type & Serial Number: D2450V2 - SN713
Program: Dipole Calibration; Pin = 250 mW; d = 10 mm

Communication System: CW-2450; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: HSL 2450 MHz (σ = 1.87 mho/m, ε = 38.03, ρ = 1000 kg/m3)
Phantom section: FlatSection

DASY4 Configuration:
- Probe: ET3DV6 - SN1507; ConvF(5, 5, 5); 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 = 94.4 V/m
Peak SAR = 29.6 mW/g
SAR(1 g) = 13.6 mW/g; SAR(10 g) = 6.04 mW/g
Power Drift = 0.01 dB




13 Nov 2002 20:32:38
CH1 S11 1 U FS
1: 51.264 Ω 2.4414 Ω 158.60 pH 2 450.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG 5 dB/ REF 0 dB
1:-31.367 dB 2 450.000 000 MHz
PRm
Cor
START 2 250.000 000 MHz
STOP 2 650.000 000 MHz

Date/Time: 11/15/02 14:25:17

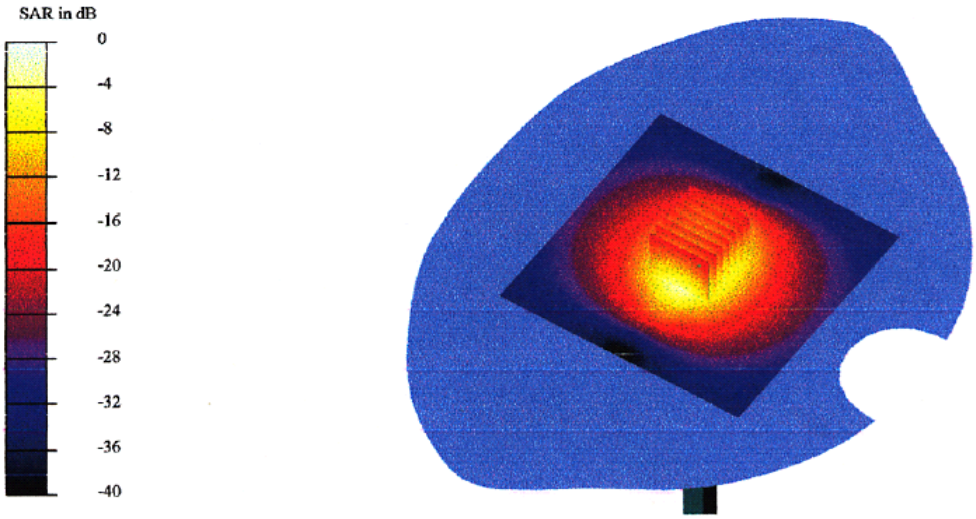
Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN713_SN1507_M2450_141102.da4

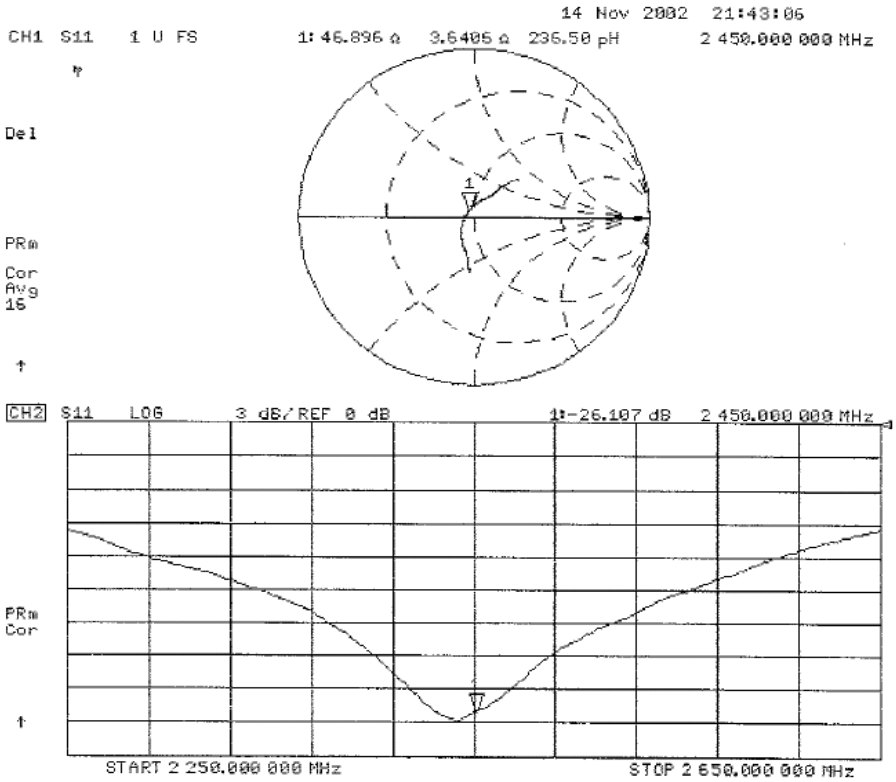
DUT: Dipole 2450 MHz Type & Serial Number: D2450V2 - SN713
Program: Dipole Calibration; Pin = 250 mW; d = 10 mm

Communication System: CW-2450; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium: Muscle 2450 MHz (σ = 1.96 mho/m, ε = 51.15, ρ = 1000 kg/m3)
Phantom section: FlatSection

DASY4 Configuration:
- Probe: ET3DV6 - SN1507; ConvF(4.5, 4.5, 4.5); 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 = 95.2 V/m
Peak SAR = 25 mW/g
SAR(1 g) = 12.9 mW/g; SAR(10 g) = 5.99 mW/g
Power Drift = 0.02 dB




14 Nov 2002 21:43:06
CH1 S11 1 U FS
1: 46.896 Ω 3.6405 Ω 236.50 pH 2 450.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG 3 dB/ REF 0 dB 1:-26.107 dB 2 450.000 000 MHz
PRm
Cor
START 2 250.000 000 MHz
STOP 2 650.000 000 MHz

APPENDIX 5 : Dosimetric E-Field Probe Calibration (ET3DV6,S/N: 1684)

Schmid & Partner
Engineering AG

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

IMPORTANT NOTICE

USAGE OF PROBES IN ORGANIC SOLVENTS

Diethylene Gycol Monobuthy Ether (the basis for HSL1800 and M1800 liquids), 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.

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Schmid & Partner Engineering AG

Technical Note 01.06.15-1 June 2002

Schmid & Partner
Engineering AG

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

Calibration Certificate

Dosimetric E-Field Probe

Type:	ET3DV6
Serial Number:	1684
Place of Calibration:	Zurich
Date of Calibration:	November 20, 2002
Calibration Interval:	12 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:	D. Vellen
Approved by:	

Schmid & Partner
Engineering AG

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

Probe ET3DV6

SN:1684

Manufactured:	April 3, 2002
Last calibration:	May 10, 2002
Recalibrated:	November 20, 2002

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

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ET3DV6 SN:1684 **November 20, 2002**

DASY - Parameters of Probe: ET3DV6 SN:1684

Sensitivity in Free Space

NormX	**1.55**	$\mu V/(V/m)^2$
NormY	**1.54**	$\mu V/(V/m)^2$
NormZ	**1.58**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**96**	mV
DCP Y	**96**	mV
DCP Z	**96**	mV

Sensitivity in Tissue Simulating Liquid

Head **900 MHz** ε_r **= 41.5 ± 5%** σ **= 0.97 ± 5% mho/m**
Head **835 MHz** ε_r **= 41.5 ± 5%** σ **= 0.90 ± 5% mho/m**

ConvF X	**6.8**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.8**	± 9.5% (k=2)	Alpha	**0.31**
ConvF Z	**6.8**	± 9.5% (k=2)	Depth	**2.51**

Head **1800 MHz** ε_r **= 40.0 ± 5%** σ **= 1.40 ± 5% mho/m**
Head **1900 MHz** ε_r **= 40.0 ± 5%** σ **= 1.40 ± 5% mho/m**

ConvF X	**5.5**	± 9.5% (k=2)	Boundary effect:	
ConvF Y	**5.5**	± 9.5% (k=2)	Alpha	**0.40**
ConvF Z	**5.5**	± 9.5% (k=2)	Depth	**2.61**

Boundary Effect

Head **900 MHz** **Typical SAR gradient: 5 % per mm**

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	7.8	4.5
SAR_{be} [%]	With Correction Algorithm	0.2	0.4

Head **1800 MHz** **Typical SAR gradient: 10 % per mm**

Probe Tip to Boundary		**1 mm**	**2 mm**
SAR_{be} [%]	Without Correction Algorithm	10.6	7.4
SAR_{be} [%]	With Correction Algorithm	0.2	0.2

Sensor Offset

Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.5 ± 0.2**	mm

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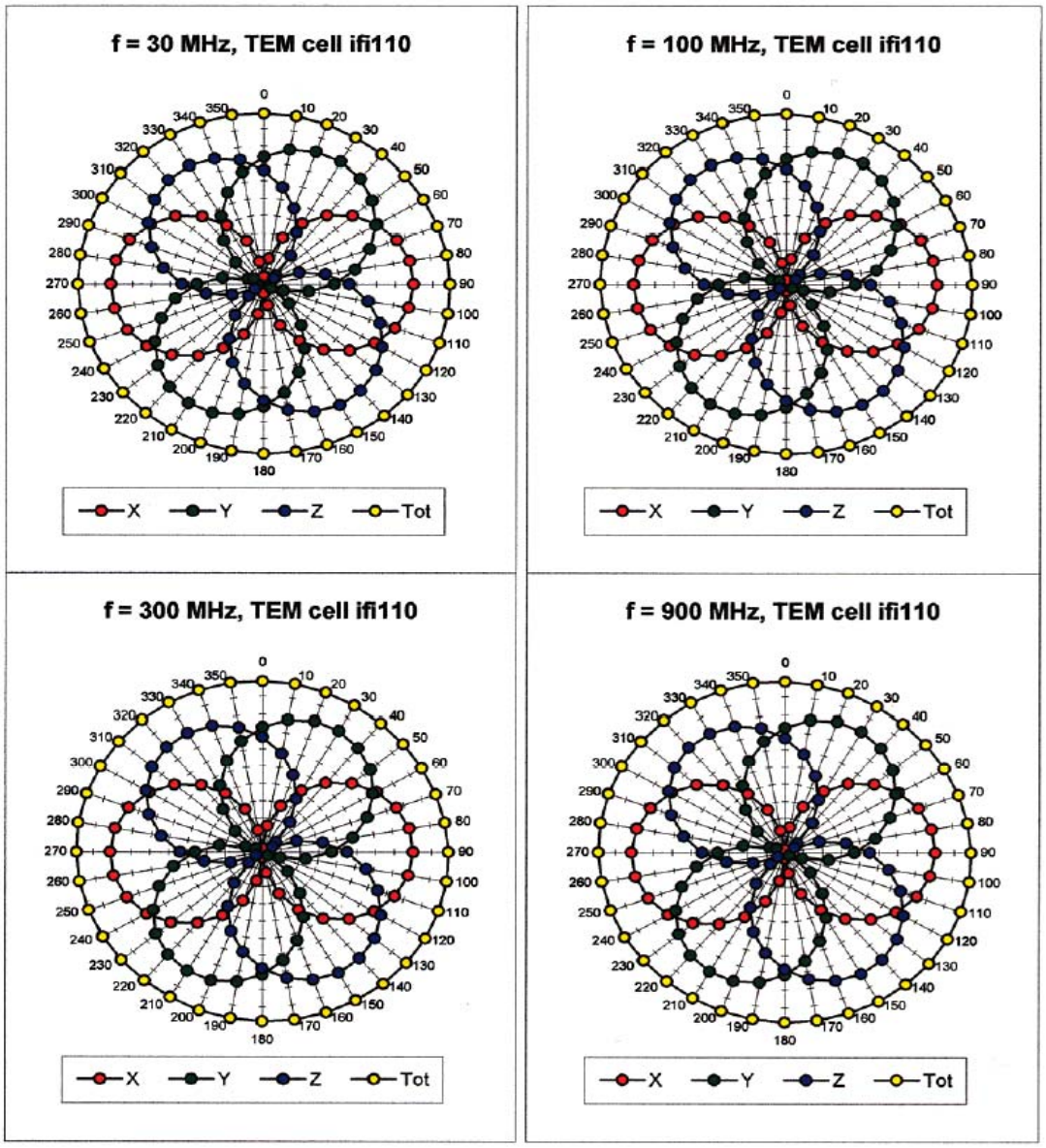
Receiving Pattern (ϕ), θ = 0°



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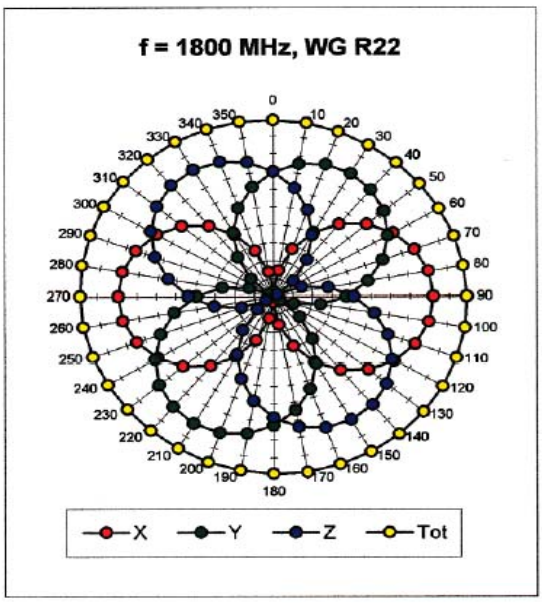
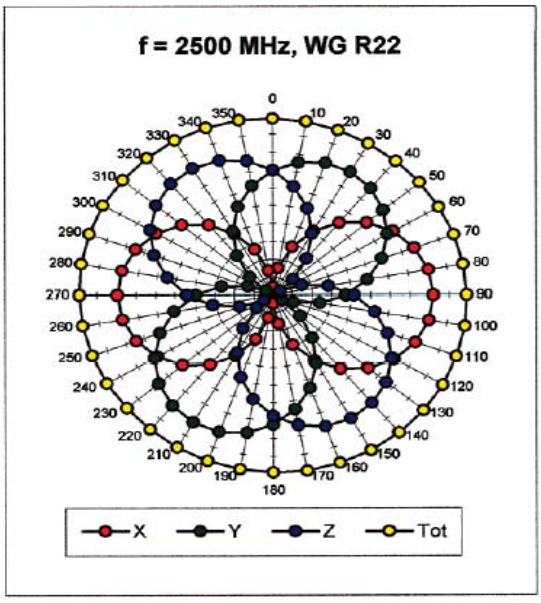
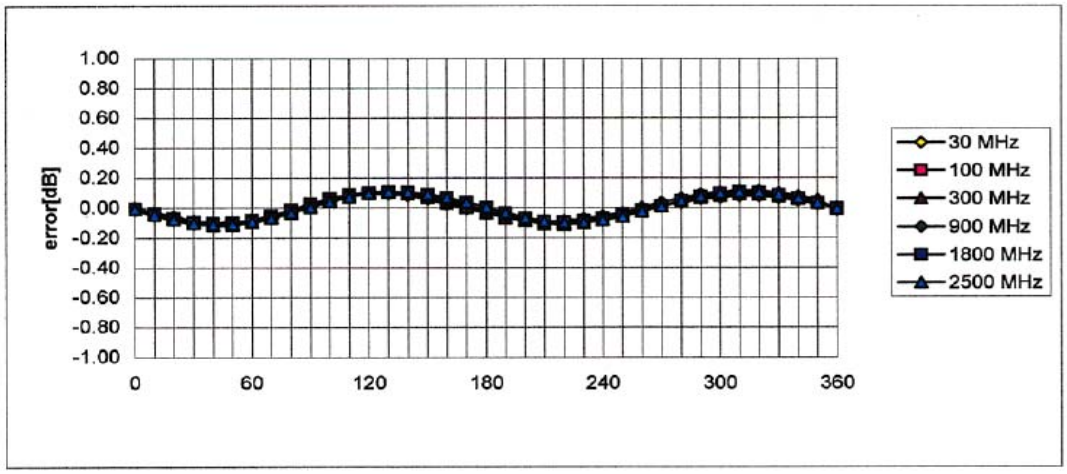




Isotropy Error (ϕ), θ = 0°



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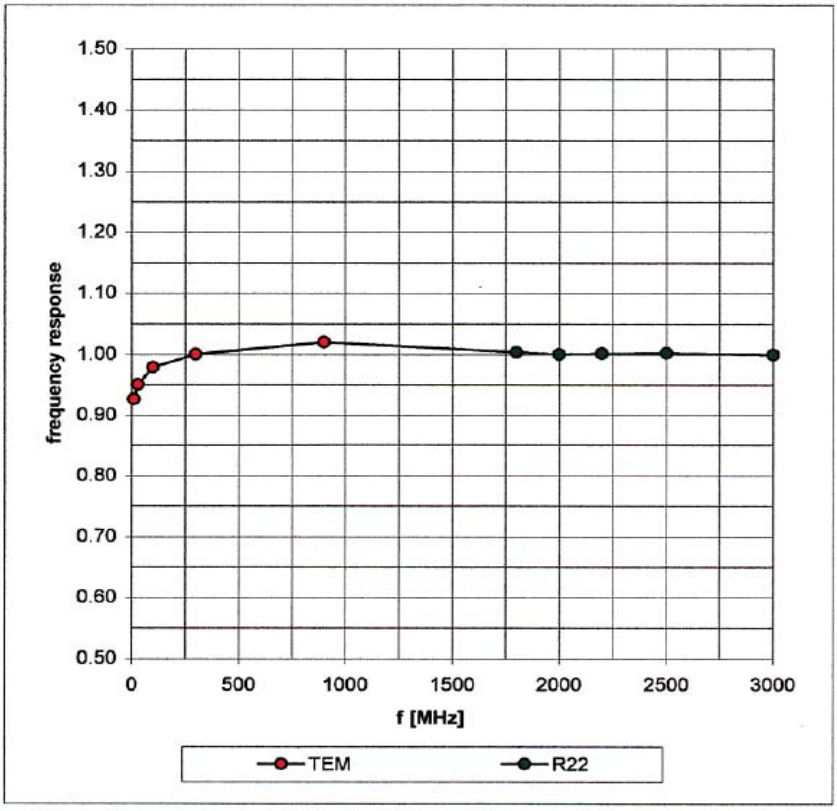
Frequency Response of E-Field

(TEM-Cell:ifi110, Waveguide R22)



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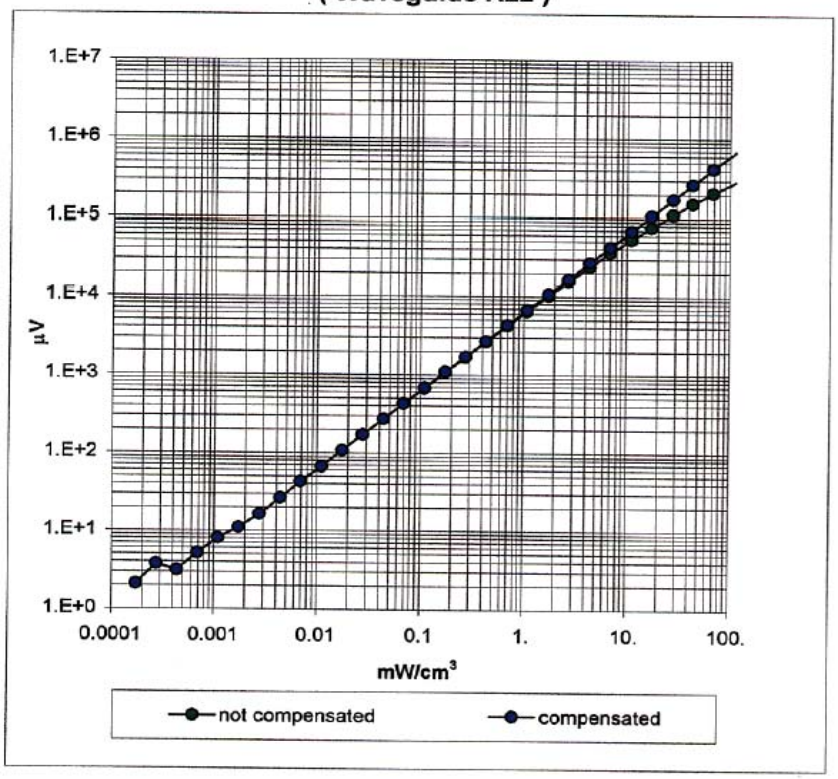
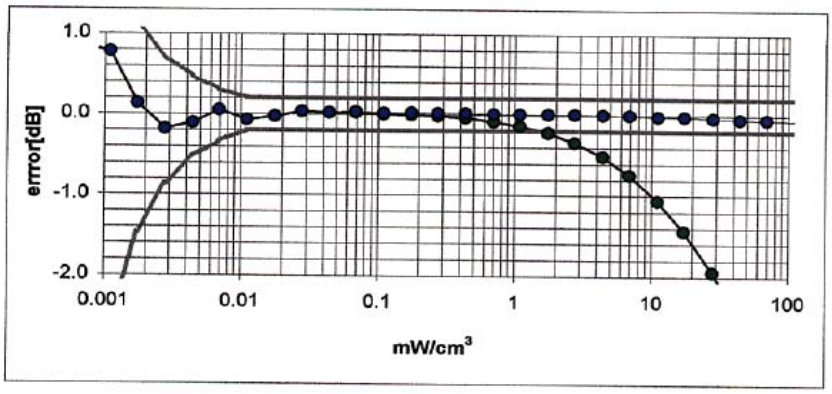
Dynamic Range f(SAR_{brain})

(Waveguide R22)





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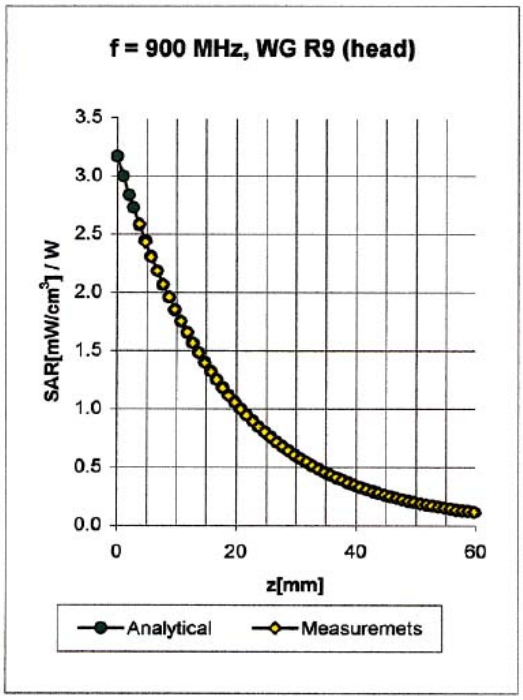
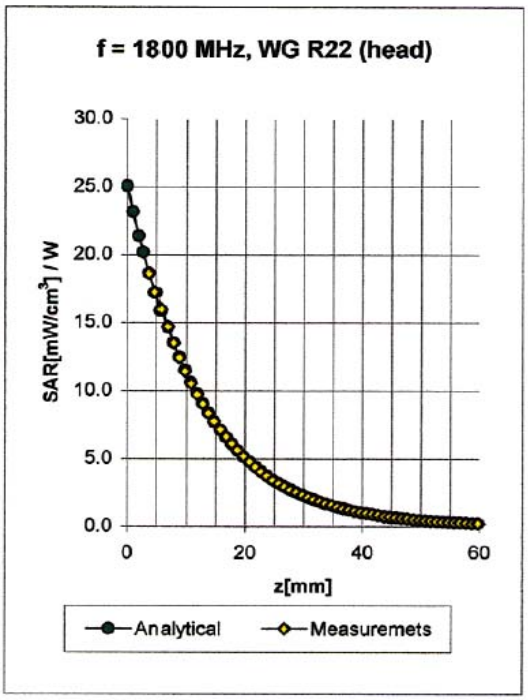
Conversion Factor Assessment





Head	**900 MHz**		ε_r = **41.5 ± 5%**	σ = **0.97 ± 5% mho/m**	
Head	**835 MHz**		ε_r = **41.5 ± 5%**	σ = **0.90 ± 5% mho/m**	
	ConvF X	**6.8**	± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**6.8**	± 9.5% (k=2)	Alpha	**0.31**
	ConvF Z	**6.8**	± 9.5% (k=2)	Depth	**2.51**

Head	**1800 MHz**		ε_r = **40.0 ± 5%**	σ = **1.40 ± 5% mho/m**	
Head	**1900 MHz**		ε_r = **40.0 ± 5%**	σ = **1.40 ± 5% mho/m**	
	ConvF X	**5.5**	± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**5.5**	± 9.5% (k=2)	Alpha	**0.40**
	ConvF Z	**5.5**	± 9.5% (k=2)	Depth	**2.61**

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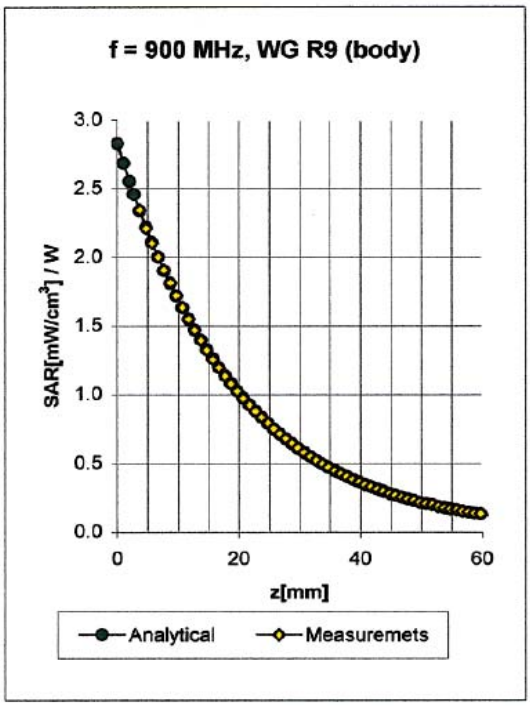
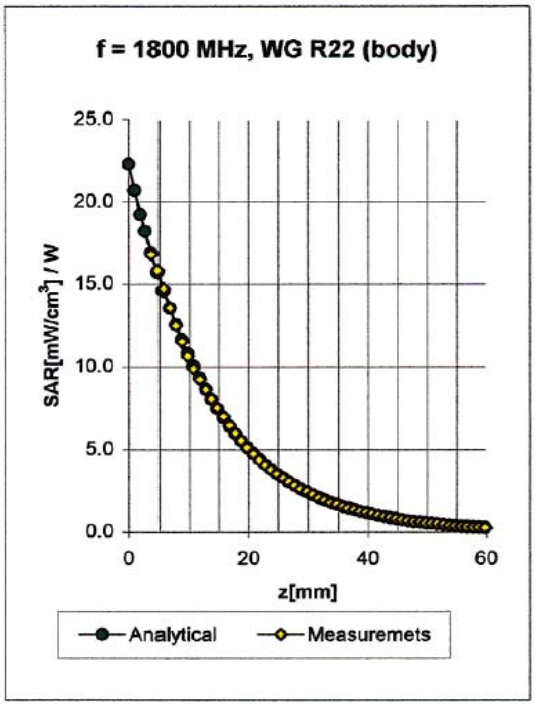
Conversion Factor Assessment





Body	**900 MHz**	ε_r = **55.0 ± 5%**	σ = **1.05 ± 5% mho/m**	
Body	**835 MHz**	ε_r = **55.2 ± 5%**	σ = **0.97 ± 5% mho/m**	
	ConvF X	**6.5** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**6.5** ± 9.5% (k=2)	Alpha	**0.26**
	ConvF Z	**6.5** ± 9.5% (k=2)	Depth	**3.22**

Body	**1800 MHz**	ε_r = **53.3 ± 5%**	σ = **1.52 ± 5% mho/m**	
Body	**1900 MHz**	ε_r = **53.3 ± 5%**	σ = **1.52 ± 5% mho/m**	
	ConvF X	**5.1** ± 9.5% (k=2)	Boundary effect:	
	ConvF Y	**5.1** ± 9.5% (k=2)	Alpha	**0.50**
	ConvF Z	**5.1** ± 9.5% (k=2)	Depth	**2.57**

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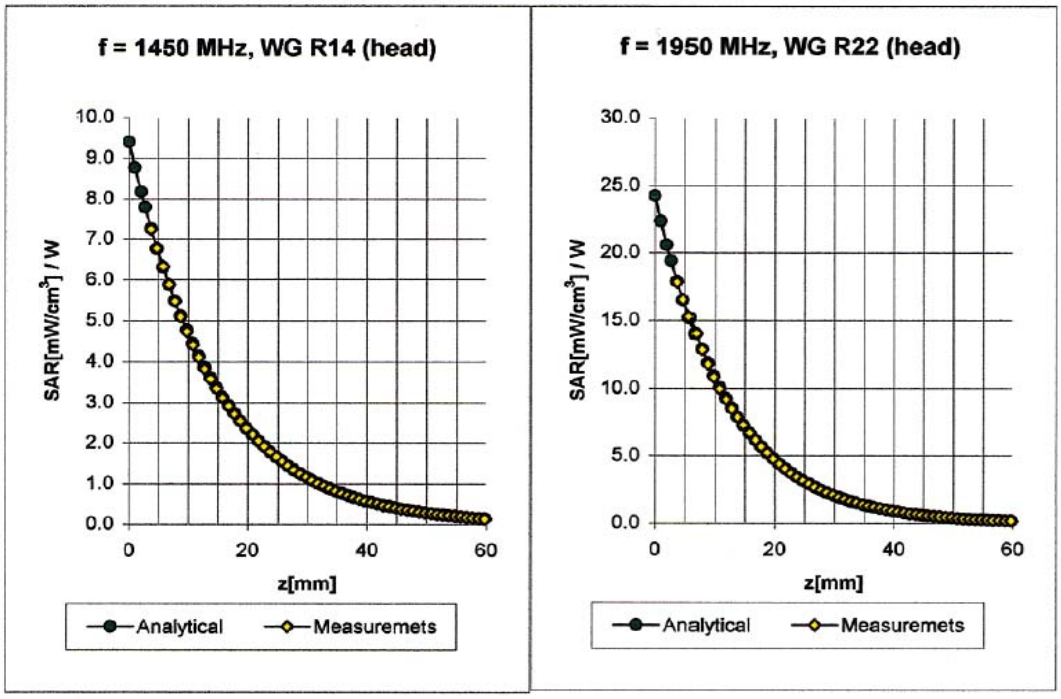
Conversion Factor Assessment



Head **1450 MHz** **ε_r = 40.5 ± 5%** **σ = 1.20 ± 5% mho/m**

ConvF X	**6.1** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**6.1** ± 8.9% (k=2)	Alpha	**0.49**
ConvF Z	**6.1** ± 8.9% (k=2)	Depth	**2.34**

Head **1950 MHz** **ε_r = 40.0 ± 5%** **σ = 1.40 ± 5% mho/m**

ConvF X	**5.2** ± 8.9% (k=2)	Boundary effect:	
ConvF Y	**5.2** ± 8.9% (k=2)	Alpha	**0.47**
ConvF Z	**5.2** ± 8.9% (k=2)	Depth	**2.68**

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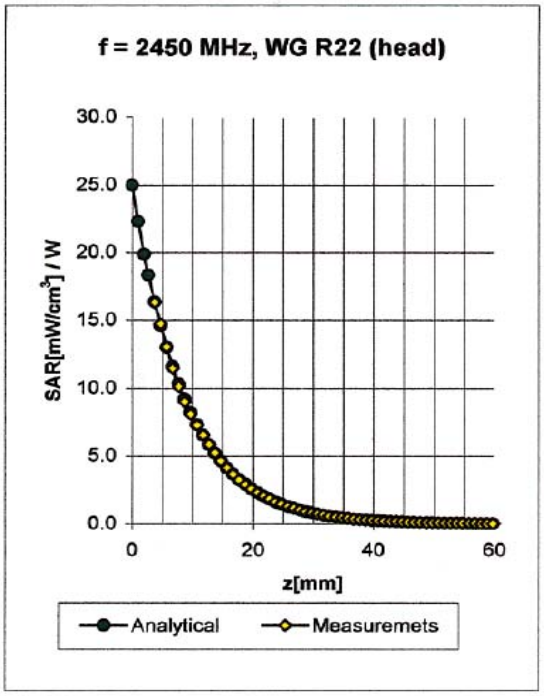
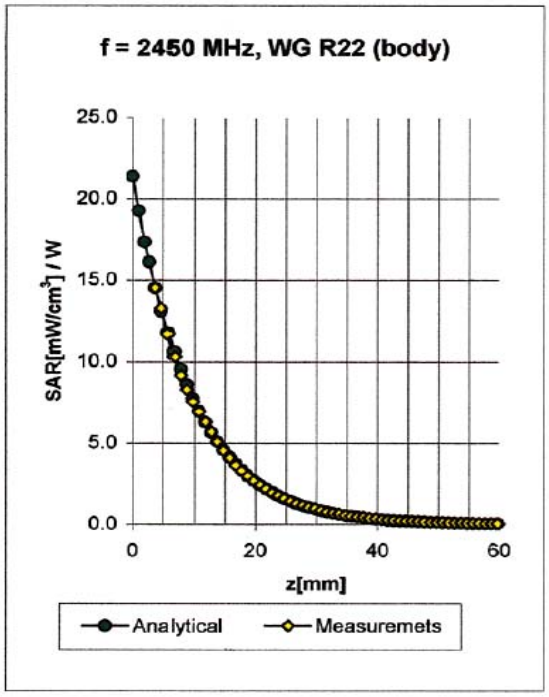
Conversion Factor Assessment





2450	**Head**	**MHz**	ε_r **= 39.2 ± 5%**		**σ = 1.80 ± 5% mho/m**	
	ConvF X	**4.9**	± 8.9% (k=2)		Boundary effect:	
	ConvF Y	**4.9**	± 8.9% (k=2)		Alpha	**1.00**
	ConvF Z	**4.9**	± 8.9% (k=2)		Depth	**1.66**

2450	**Body**	**MHz**	ε_r **= 52.7 ± 5%**		**σ = 1.95 ± 5% mho/m**	
	ConvF X	**4.4**	± 8.9% (k=2)		Boundary effect:	
	ConvF Y	**4.4**	± 8.9% (k=2)		Alpha	**1.00**
	ConvF Z	**4.4**	± 8.9% (k=2)		Depth	**1.72**

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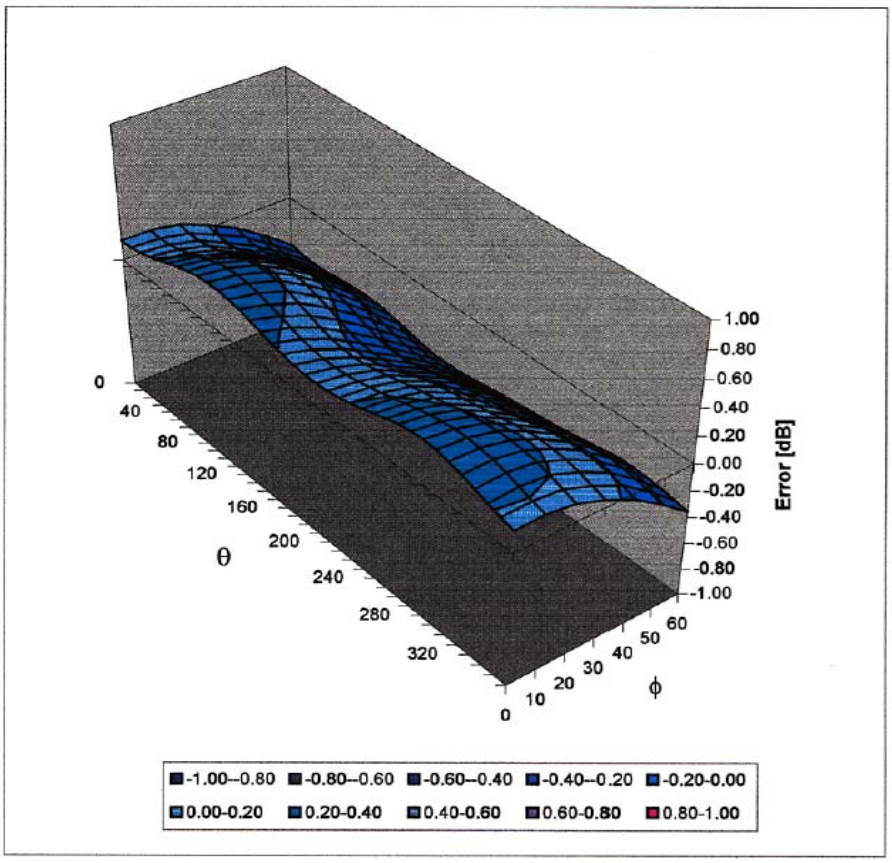
Deviation from Isotropy in HSL

Error (θ,ϕ), f = 900 MHz



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