SAR EVALUATION REPORT

Report No. : 24FE0211-HO-1

Applicant	:	**DENSO WAVE INCORPORATED**
Type of Equipment	:	**Wireless LAN adapter**
Model No.	:	**KCS**
FCC ID	:	**PZWKCS**
Test standard	:	**FCC47CFR 2.1093** **FCC OET Bulletin 65, Supplement C**
Test Result	:	**Complied**
Max SAR Measured	:	**1.2W/kg(Body, 2412MHz)**

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 : January 29,2004

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	:	DENSO WAVE INCORPORATED
Brand Name	:	DENSO
Address	:	1-1, Showa-cho, Kariya-shi, Aichi-ken 448-8661, Japan
Telephone Number	:	81-566-61-3858
Facsimile Number	:	81-566-25-4741
Contact Person	:	Noritaka Hirao

SECTION 2 : Equipment under test (Wireless LAN adapter)

2.1 Identification of Wireless LAN adapter

APPLICANT	:	DENSO WAVE INCORPORATED
Type of Equipment	:	Wireless LAN adapter
Model No.	:	KCS
Serial No.	:	K03633100001C01
Country of Manufacture	:	Taiwan
Receipt Date of Sample	:	January 28,2004
Condition of EUT	:	Production model
Category Identified	:	Portable device

2.2 Product description of Wireless LAN adapter

Tx Frequency	:	2412MHz~2462MHz
Modulation	:	DSSS
Rating	:	DC3.3 - 3.5V
Max.Output Power Tested	:	15.75 dBm Peak Conducted
Antenna Type	:	Chip Antenna:YOKOWO YCE-5208DN

SECTION 3 : Requirements for compliance testing defined by the FCC

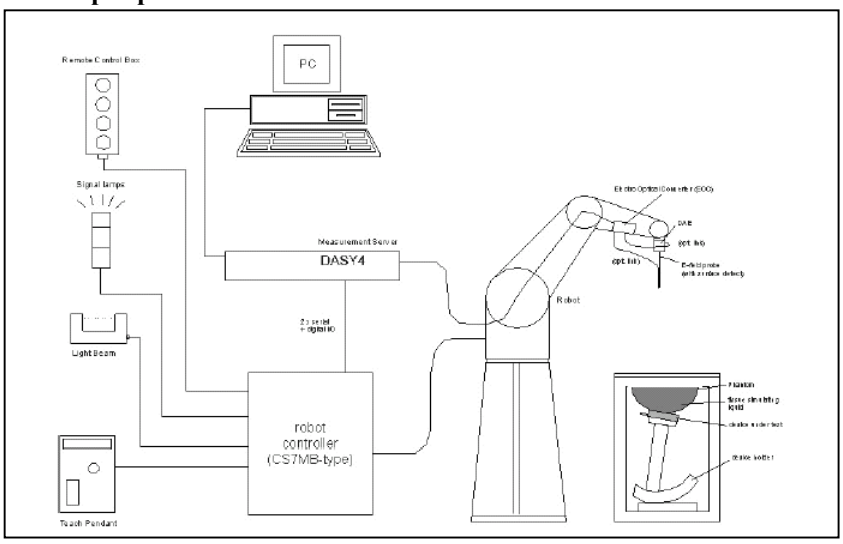
The US Federal Communications Commission has released the report and order “Guidelines for Evaluating the Environmental Effects of RF Radiation", ET Docket No. 93-62 in August 1996. The order requires routine SAR evaluation prior to equipment authorization of portable transmitter devices, including portable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

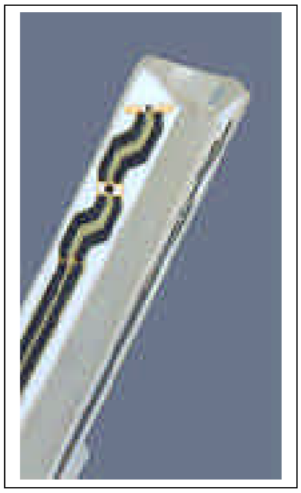
12. Tissue simulating liquid mixed according to the given recipes.

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

4.2 System components

4.2.1 ET3DV6 Probe Specification

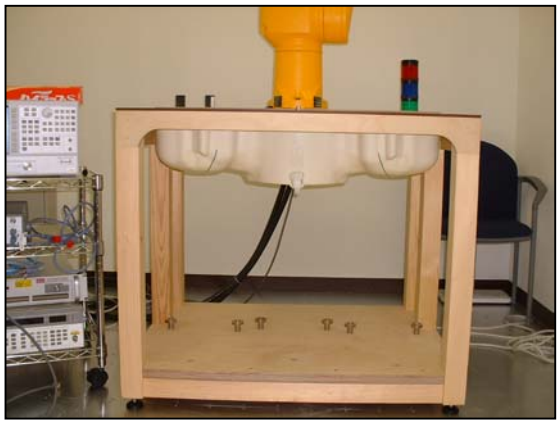
Construction:
Symmetrical design with triangular core
Built-in optical fiber for surface detection System
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., glycol ether)
Calibration:
Basic Broad Band calibration in air from 10 MHz to 2.5 GHz
In brain 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 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.	:	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

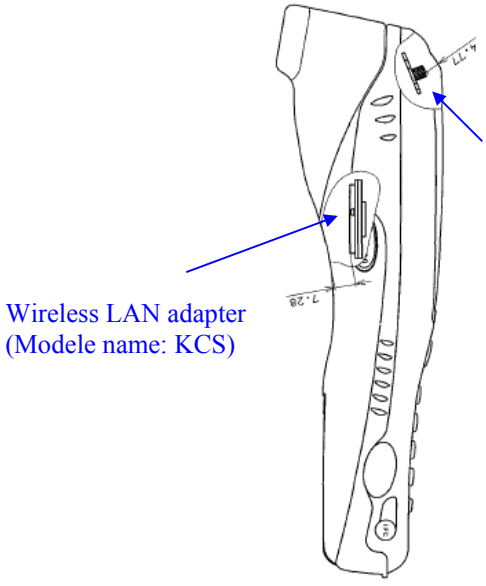
Type	:	SAM Twin Phantom V4.0
Shell Material	:	Fiberglass
Thickness	:	2.0 +/-0.2 mm
Volume	:	Approx. 20 liters
Manufacture	:	Schimid & Partner Engineering AG

SECTION 6 : Measurement outline

This EUT was manufactured by DENSO and will be inserted into only Bar-code Handy Terminal which was manufactured by DENSO.
The detail of host device that we used for SAR testing is shown in the following.

6.1 Information of PC

Type of Equipment	:	Bar-code Handy Terminal
Model No.	:	BHT-100QW
Serial No.	:	5496900029400008
Manufacture	:	DENSO CORPORATION



SECTION 7 : Test setup of EUT

7.1 Photographs of test setup

We tested the Bar-code Handy Terminal (Model No.: BHT-100QW) with which this EUT was inserted.
When users operate or carry the Bar-code Handy Terminal, 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.Front : The test was performed in touch and distanced 5mm ,10mm and 15mm with front surface of Bar-code Handy Terminal to the flat phantom.

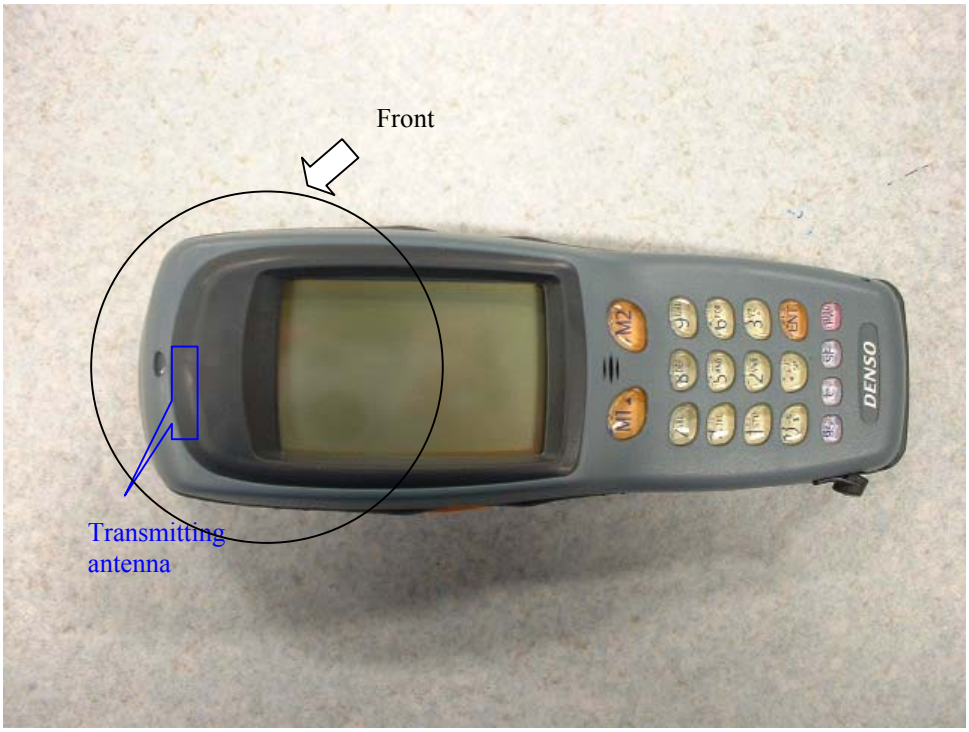
2.Back : The test was performed in touch with back surface of Bar-code Handy Terminal to the flat phantom.

3.Right Side : The test was performed in touch with right side of Bar-code Handy Terminal to the flat phantom.

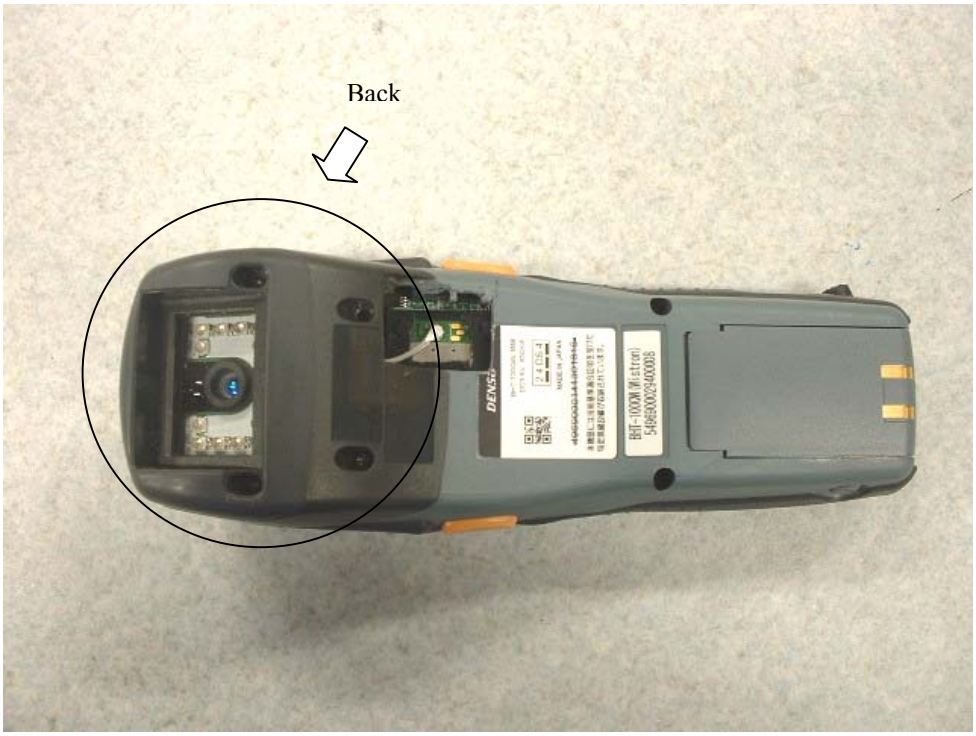
4.Left Side : The test was performed in touch with left side of Bar-code Handy Terminal to the flat phantom.

5.Top : The test was performed in touch with top of Bar-code Handy Terminal to the flat phantom.

1. Front

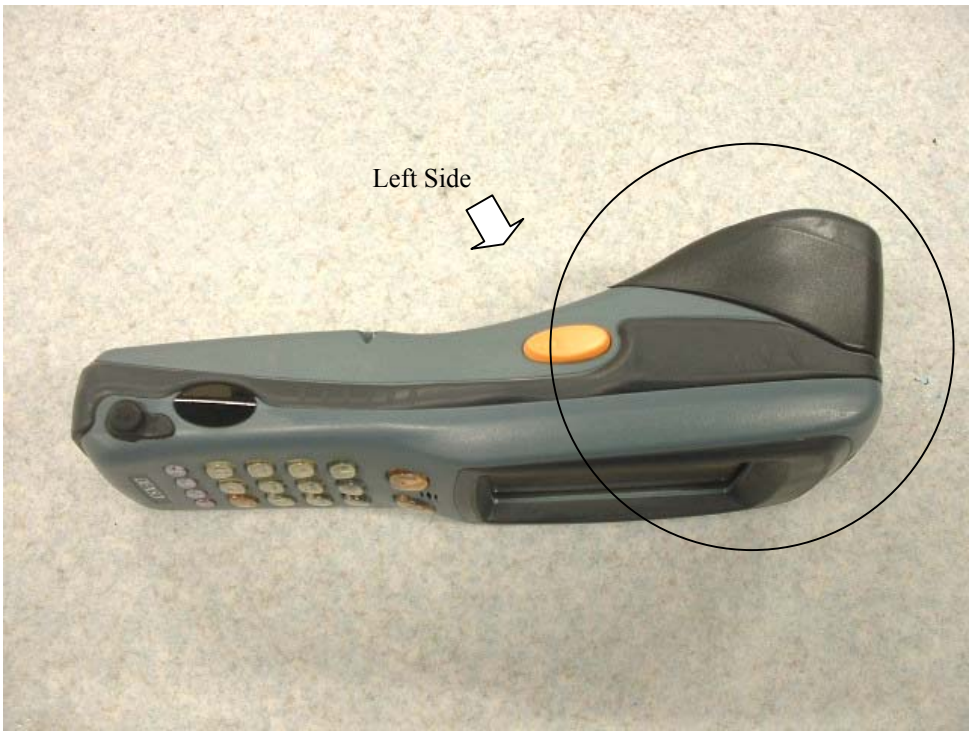


2. Back

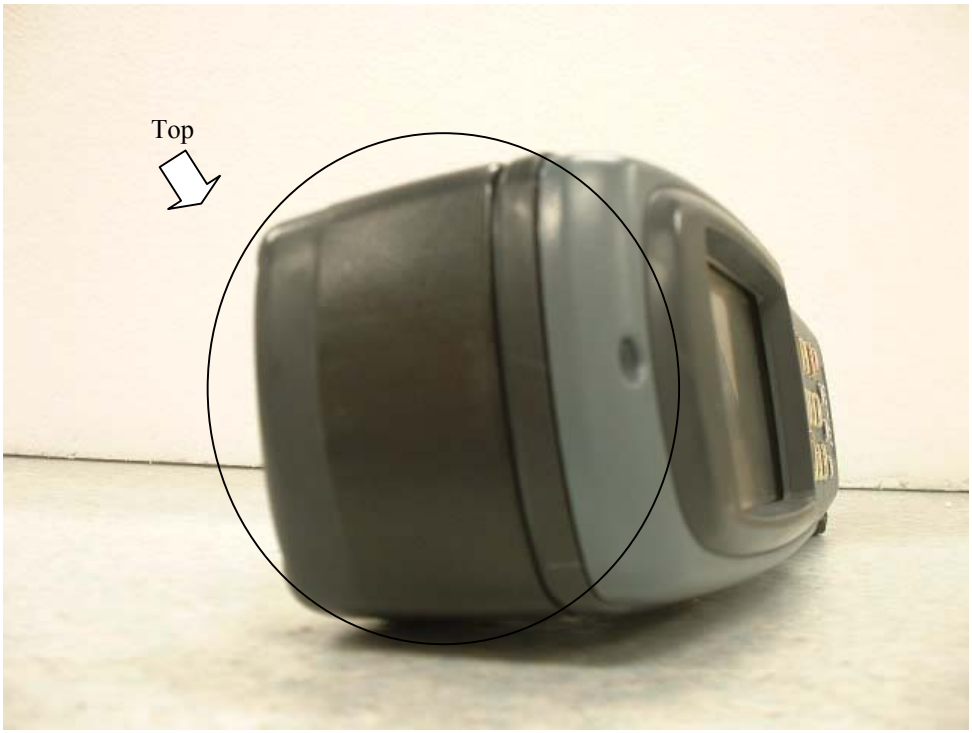


3. Right Side

4. Left Side



5. Top



7.2 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)

7.3 Distance between Bar-code Handy Terminal and Phantom

The position for the highest SAR value of this EUT was at ”Front” position.
The measurement was performed with the distance, 5mm, 10mm, and 15mm to check if the distance 0mm may not have the worst value. As a result, the distance 0mm had the worst value.

SECTION 8 : 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.)	±5.0	Rectangular	√3	0.64	±1.8	∞
Liquid permittivity (target)	±5.0	Rectangular	√3	0.6	±1.7	∞
Liquid permittivity (meas.)	±5.0	Rectangular	√3	0.6	±1.7	∞
Combined Standard Uncertainty					**±10.37**	
Expanded Uncertainty (k=2)					**±20.7**	

SECTION 9 : 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.) : **22.5**
Relative Humidity (%) : **31**
Lquid depth (cm) : **15.3**

Date : January 29,2004
Measured By : Miyo Ikuta

DIELECTRIC PARAMETERS MEASUREMENT RESULTS						
Liquid Temp [deg.c]		Parameters	Target Value	Measured	Deviation [%]	Limit [%]
Before	After					
23.6	23.6	Relative Permittivity εr	39.2	37.7	-3.8	+/-5
		Coductivity σ [mho/m]	1.80	1.85	2.8	+/-5

8.1.2 Muscle 2450MHz

Type of liquid : **Muscle 2450 MHz**
Ambient temperature (deg.c.) : **22.3**
Relative Humidity (%) : **32**
Liquid depth (cm) : **15.2**

Date : January 29,2004
Measured By : Miyo Ikuta

DIELECTRIC PARAMETERS MEASUREMENT RESULTS						
Liquid Temp [deg.c]		Parameters	Target Value	Measured	Deviation [%]	Limit [%]
Before	After					
23.0	23.0	Relative Permittivity εr	52.7	50.1	-4.9	+/-5
		Coductivity σ [mho/m]	1.95	1.95	0.0	+/-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 10 : System validation data

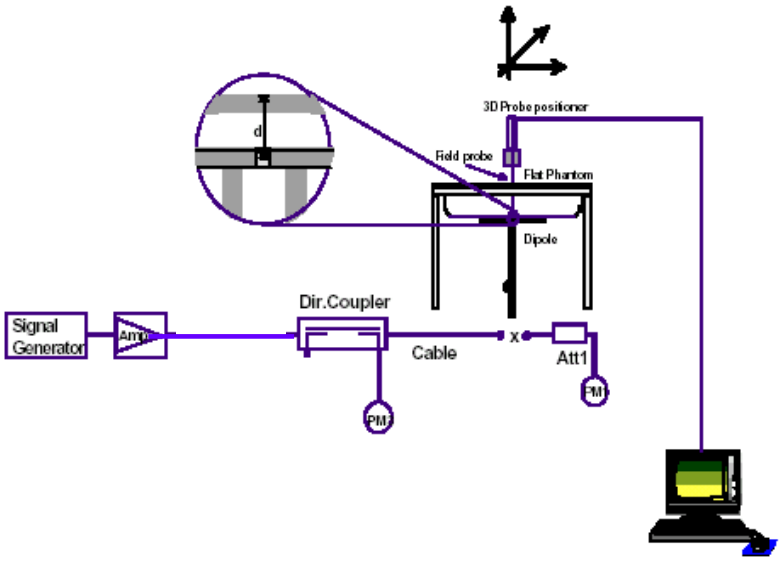
Prior to the assessment, the system validation kit was used to test whether the system was operating within its specifications of +/-10%. The validation results are tabulated below. Please refer to APPENDIX 3.

Type of liquid	:	**HEAD 2450MHz**
Frequency	:	**2450MHz**
Liquid depth (cm)	:	**15.3**
Ambient temperature (deg.c.)	:	**22.5**
Relative Humidity (%)	:	**31**
Dipole	:	**D2450V2 SN:713**
Power	:	**250mW**

Date : January 29,2004
Measured By : Miyo Ikuta

SYSTEM PERFORMANCE CHECK									
Liquid (HEAD 2450MHz)						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		
23.6	23.6	39.2	37.7	1.80	1.85	13.1	13.7	4.6	+/-10

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



Test system for the system performance check setup diagram

2450MHz System performance check setup

SECTION 11 : Evaluation procedure

The evaluation was performed with the following procedure:

Step 1: Measurement of the E-field 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 Bar-code Handy Terminal 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 E-field value at the same location as in Step 1. It is measured SAR-drift(the difference between the E-field measured in Step 4 and Step 1)

SECTION 12 : 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 13 : SAR Measurement results

12.1 Conducted power measurement results

Date : January 29,2004
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 [%]
2412	3.8	10	1.95	15.75	37.6	3.8	10	1.95	15.75	37.6	0.0	+/-5
2437	3.5	10	1.95	15.45	35.1	3.5	10	1.95	15.45	35.1	0.0	+/-5
2462	3.3	10	1.95	15.25	33.5	3.2	10	1.95	15.15	32.7	-2.3	+/-5

12.2 Body 2450MHz SAR

Liquid Depth (cm)	:	**15.2**	Model	:	**KCS**
Parameters	:	ε_r =**50.1**, σ =**1.95**	Serial No.	:	**K03633100001C01**
Ambient Temperature[deg.c.]	:	**22.3**	Modulation	:	**DSSS**
Relative Humidity (%)	:	**32**	Crest factor	:	**1**

Date : January 29,2004
Measured By : Miyo Ikuta

BODY SAR MEASUREMENT RESULTS								
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
Mid	2437	Flat	Fixed	Front	0	22.3	22.3	**0.997**
Mid	2437	Flat	Fixed	Back	0	22.3	22.3	**0.0117**
Mid	2437	Flat	Fixed	Right Side	0	22.3	22.3	**0.0596**
Mid	2437	Flat	Fixed	Left Side	0	22.3	22.3	**0.0905**
Mid	2437	Flat	Fixed	Top	0	22.3	22.3	**0.694**
Low	2412	Flat	Fixed	Front	0	22.3	22.3	**1.2**
High	2462	Flat	Fixed	Front	0	22.3	22.2	**0.954**
Low	2412	Flat	Fixed	Front	5	22.2	22.1	**0.671**
Low	2412	Flat	Fixed	Front	10	22.1	22.1	**0.566**
Low	2412	Flat	Fixed	Front	15	22.1	22.1	**0.164**
ANSI / IEEE C95.1 1992 - SAFETY LIMIT Spatial Peak Uncontrolled Exposure / General Population						**Body SAR: 1.6 W/kg (averaged over 1 gram)**		

* The position of EUT of the highest SAR value is touch to the flat phantom at front position and 2412MHz.

SECTION 14 : 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	100332	2003/08/26	2004/08/25
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	Agilent	US40010300	08498-60012	2003/12/16	2004/12/15
Attenuator	Orient Microwave	BX10-0476-00	-	2003/03/31	2004/03/30
Microwave Cable	Storm	-	90-011-080/03-04-001	2003/04/30	2004/04/29
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 15 : 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.

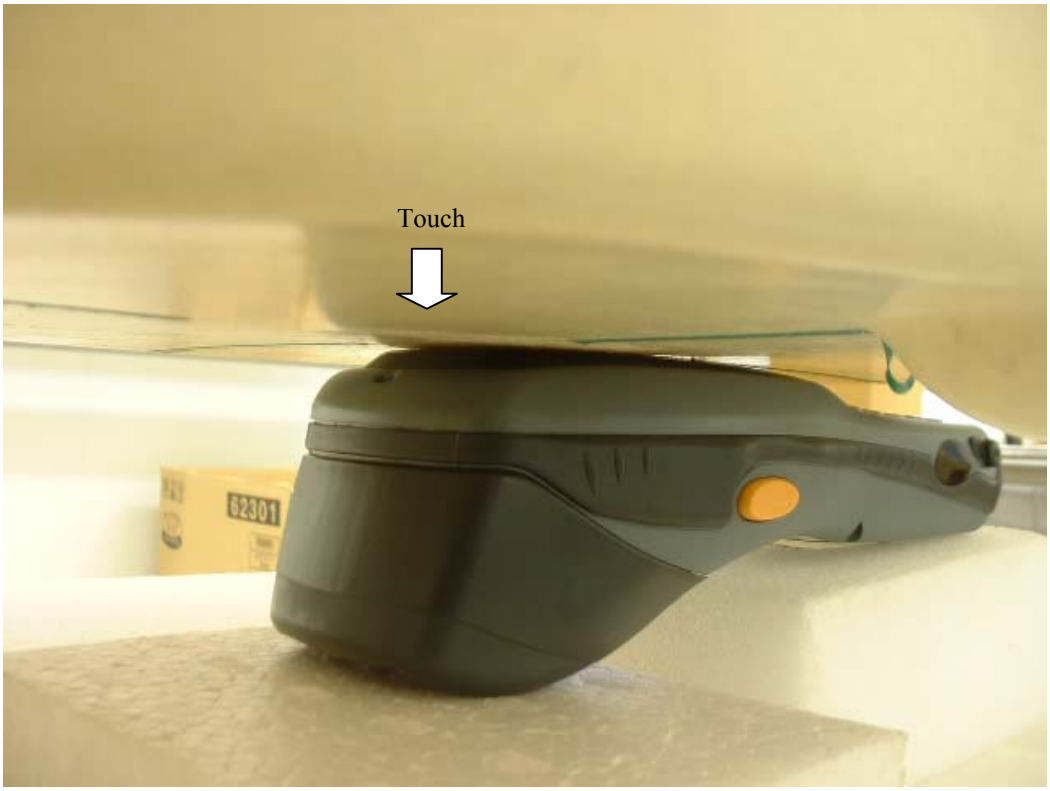
[4] W. Gander, Computermathematik, Birkhaeuser, Basel, 1992.

[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.

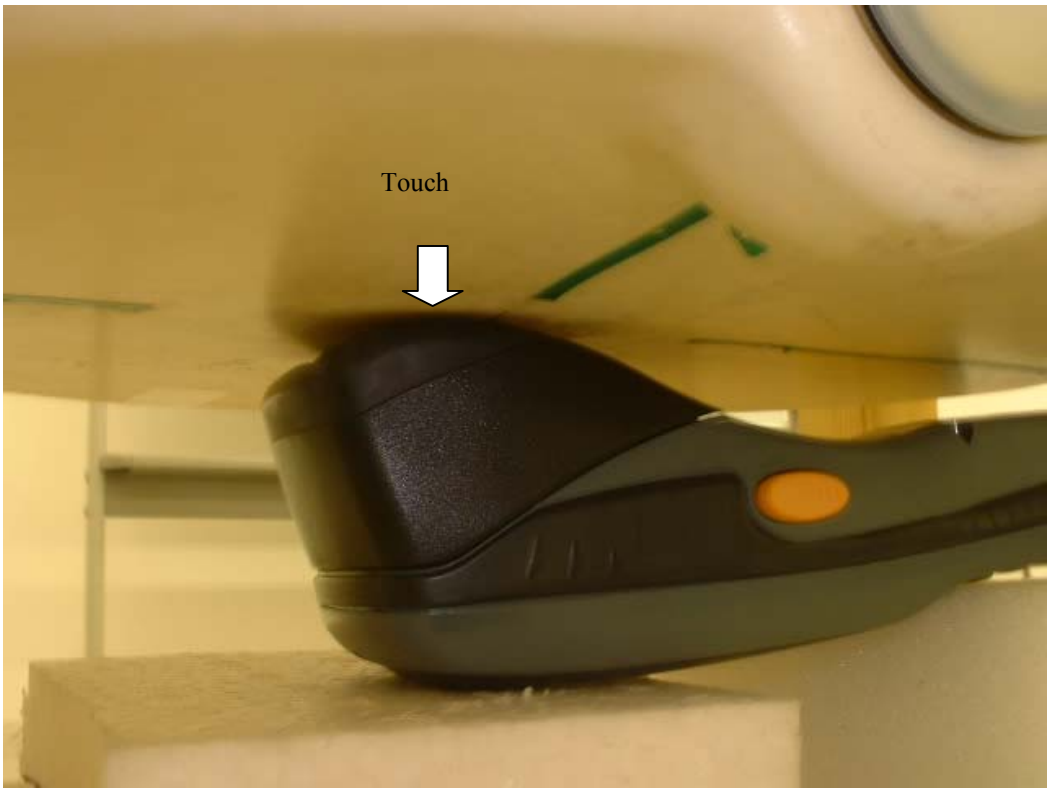
[6] Barry N. Taylor and Christ E. Kuyatt, "Guidelines for evaluating and expressing the uncertainty of NIST measurement results", Tech. Rep., National Institute of Standards and Technology,1994.

APPENDIX 1 : Photographs of test setup

Front

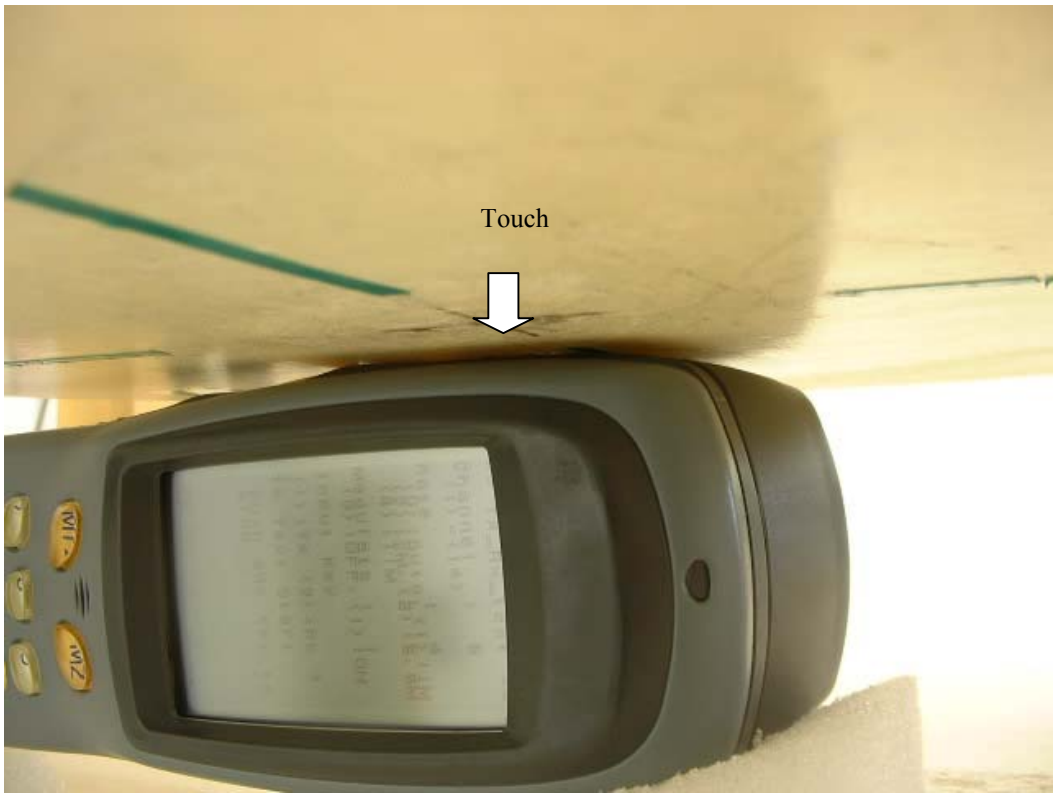


Back

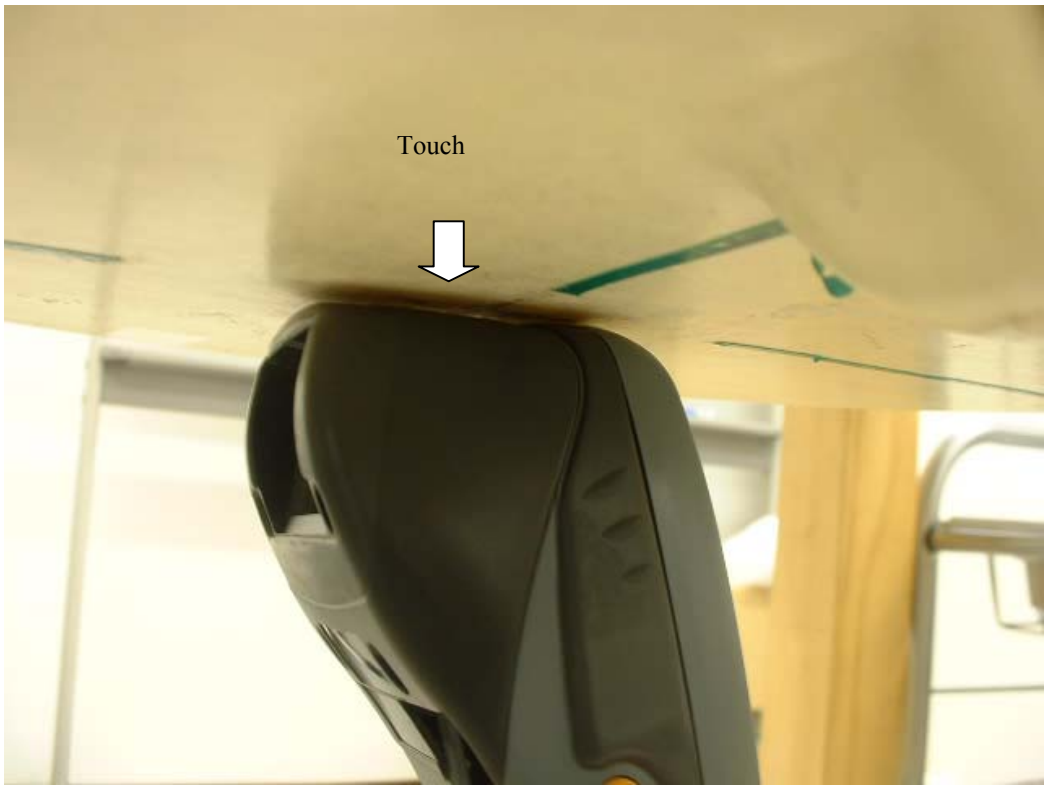


Right Side

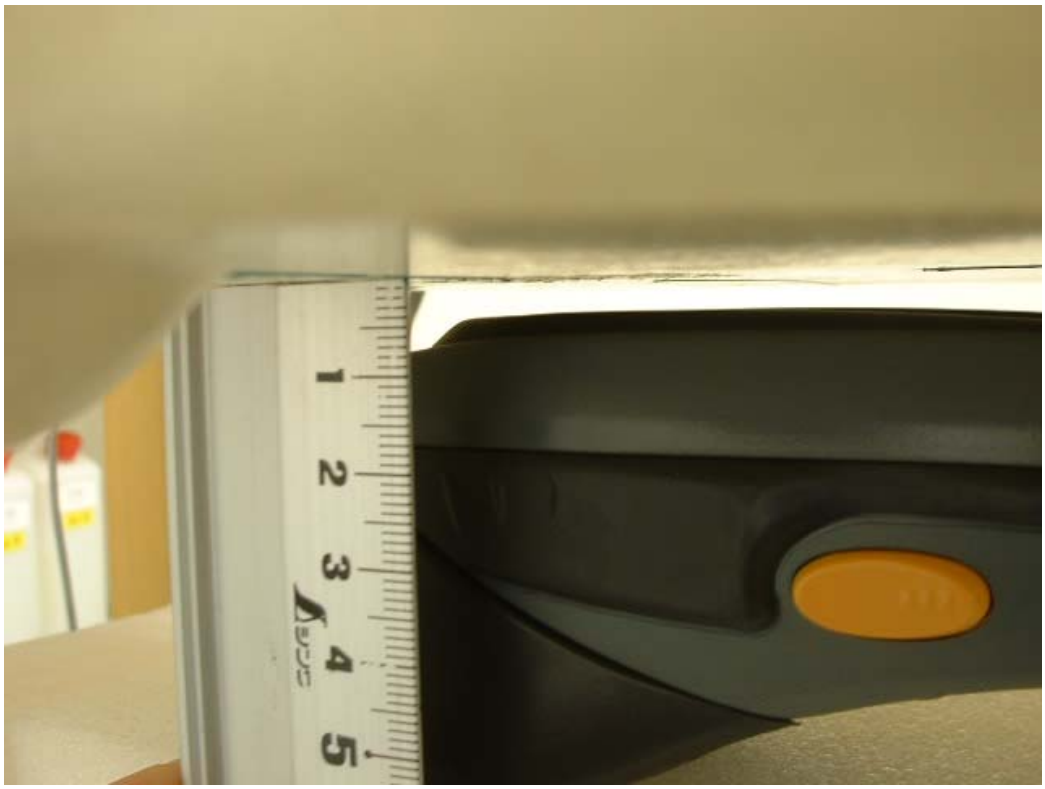
Left Side



Top



Front 5mm



Front 10mm

UL Apex Co., Ltd.
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

Front 15mm

APPENDIX 2 : SAR Measurement data

KCS / Body / Front / 2437MHz

Crest factor: 1
Medium: M2450 (σ = 1.95 mho/m, ε_r = 50.1, ρ = 1000 kg/m^3)
Phantom section: Flat Section

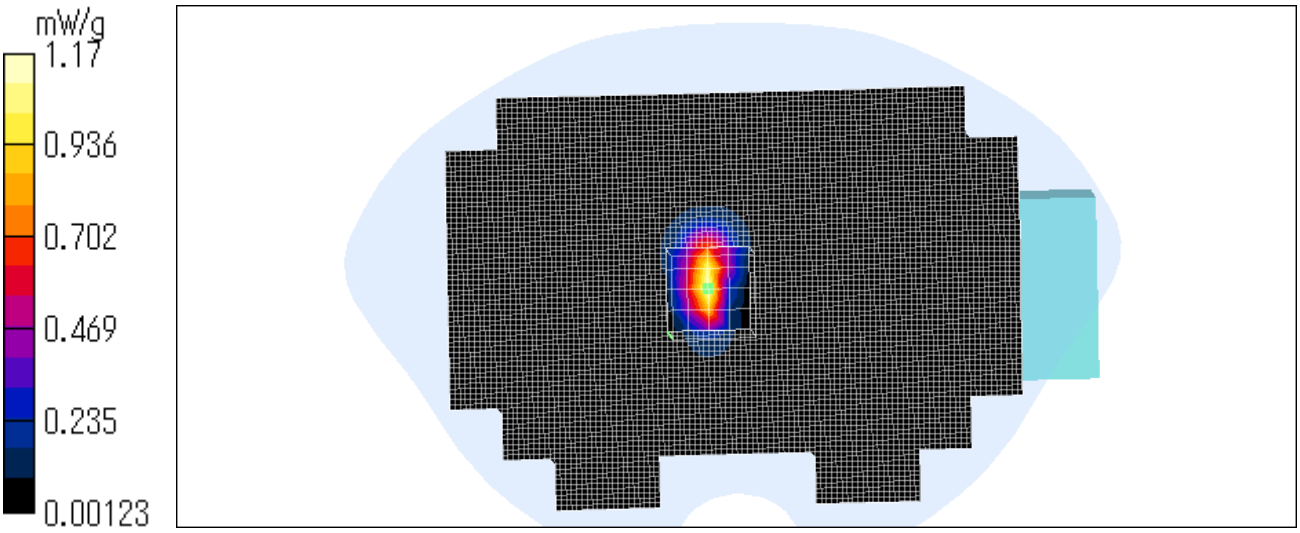
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.3, 4.3, 4.3); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 1.21 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 2.52 W/kg
SAR(1 g) = 0.997 mW/g; SAR(10 g) = 0.394 mW/g
Maximum value of SAR = 1.17 mW/g

Test date = 01 / 29 / 04
Reference Value = 7.1 V/m
Power Drift = -0.2 dB

Ambient Temperature : 22.3 degree.c
Liquid Temperature : Before 22.3 degree.C , After 22.3 degree.C



KCS / Body / Back / 2437MHz

Crest factor: 1
Medium: M2450 (σ = 1.95 mho/m, ε_r = 50.1, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.3, 4.3, 4.3); 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

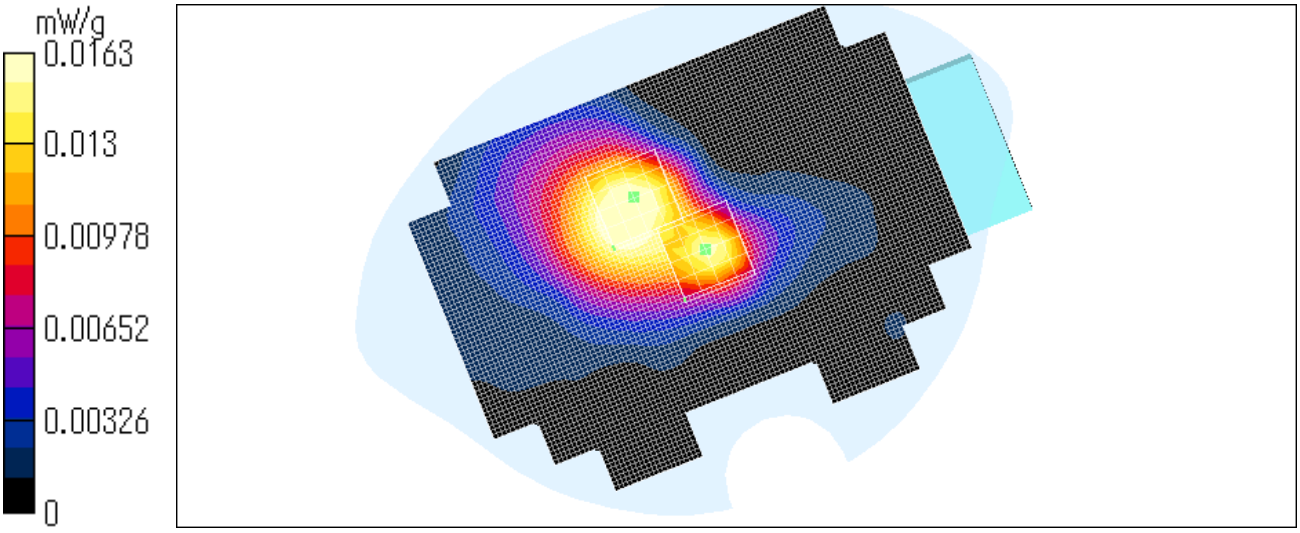
Area Scan (81x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.0179 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 0.0346 W/kg
SAR(1 g) = 0.0177 mW/g; SAR(10 g) = 0.00995 mW/g
Maximum value of SAR = 0.0183 mW/g

Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 0.032 W/kg
SAR(1 g) = 0.0153 mW/g; SAR(10 g) = 0.00805 mW/g
Maximum value of SAR = 0.0163 mW/g

Test date = 01 / 29 / 04
Reference Value = 3.03 V/m
Power Drift = -0.2 dB

Ambient Temperature : 22.3 degree.c
Liquid Temperature : Before 22.3 degree.C , After 22.3 degree.C



KCS / Body / Right side / 2437MHz

Crest factor: 1
Medium: M2450 (σ = 1.95 mho/m, ε_r = 50.1, ρ = 1000 kg/m^3)
Phantom section: Flat Section

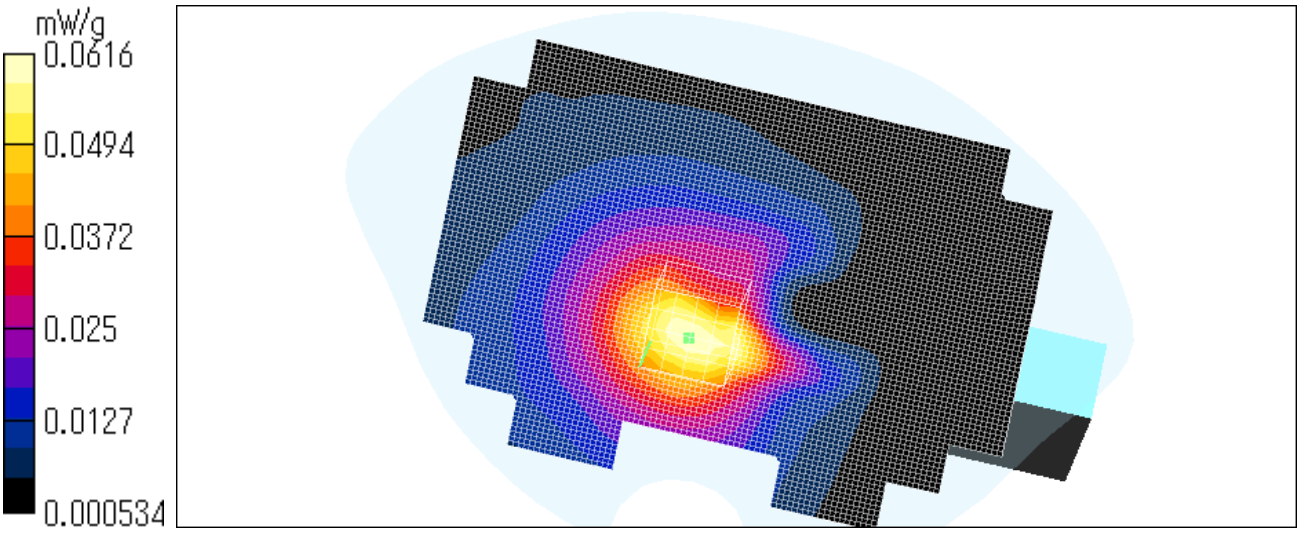
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.3, 4.3, 4.3); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.062 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 0.118 W/kg
SAR(1 g) = 0.0596 mW/g; SAR(10 g) = 0.0336 mW/g
Maximum value of SAR = 0.0616 mW/g

Test date = 01 / 29 / 04
Reference Value = 3.72 V/m
Power Drift = -0.08 dB

Ambient Temperature : 22.3 degree.c
Liquid Temperature : Before 22.3 degree.C , After 22.3 degree.C



KCS / Body / Left side / 2437MHz

Crest factor: 1
Medium: M2450 (σ = 1.95 mho/m, ε_r = 50.1, ρ = 1000 kg/m^3)
Phantom section: Flat Section

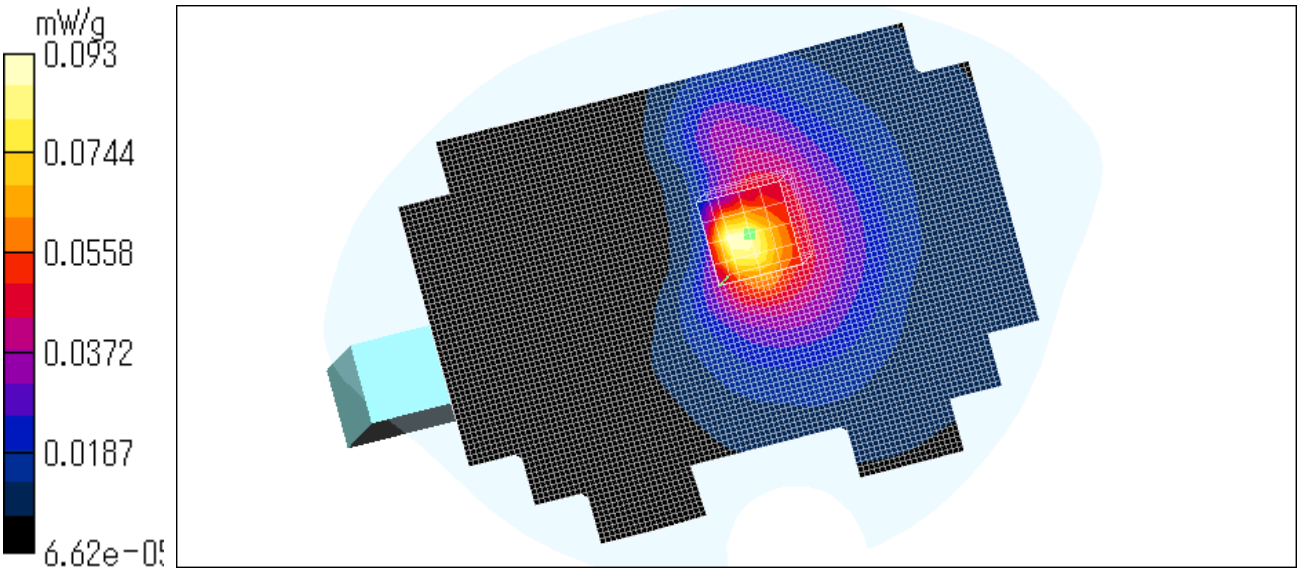
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.3, 4.3, 4.3); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.0944 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 0.19 W/kg
SAR(1 g) = 0.0905 mW/g; SAR(10 g) = 0.0457 mW/g
Maximum value of SAR = 0.093 mW/g

Test date = 01 / 29 / 04
Reference Value = 4.13 V/m
Power Drift = 0.1 dB

Ambient Temperature : 22.3 degree.c
Liquid Temperature : Before 22.3 degree.C , After 22.3 degree.C



KCS / Body / Top / 2437MHz

Crest factor: 1
Medium: M2450 (σ = 1.95 mho/m, ε_r = 50.1, ρ = 1000 kg/m^3)
Phantom section: Flat Section

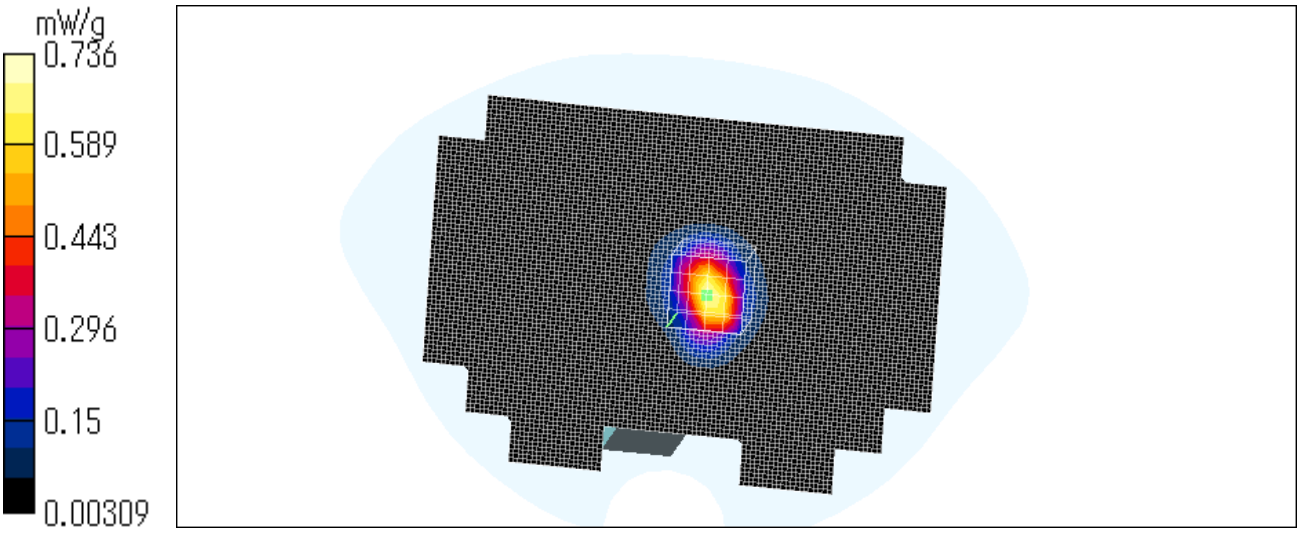
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.3, 4.3, 4.3); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.763 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 1.48 W/kg
SAR(1 g) = 0.694 mW/g; SAR(10 g) = 0.323 mW/g
Maximum value of SAR = 0.736 mW/g

Test date = 01 / 29 / 04
Reference Value = 14.4 V/m
Power Drift = -0.2 dB

Ambient Temperature : 22.3 degree.c
Liquid Temperature : Before 22.3 degree.C , After 22.3 degree.C



KCS / Body / Front 0mm / 2412MHz

Crest factor: 1
Medium: M2450 (σ = 1.95 mho/m, ε_r = 50.1, ρ = 1000 kg/m^3)
Phantom section: Flat Section

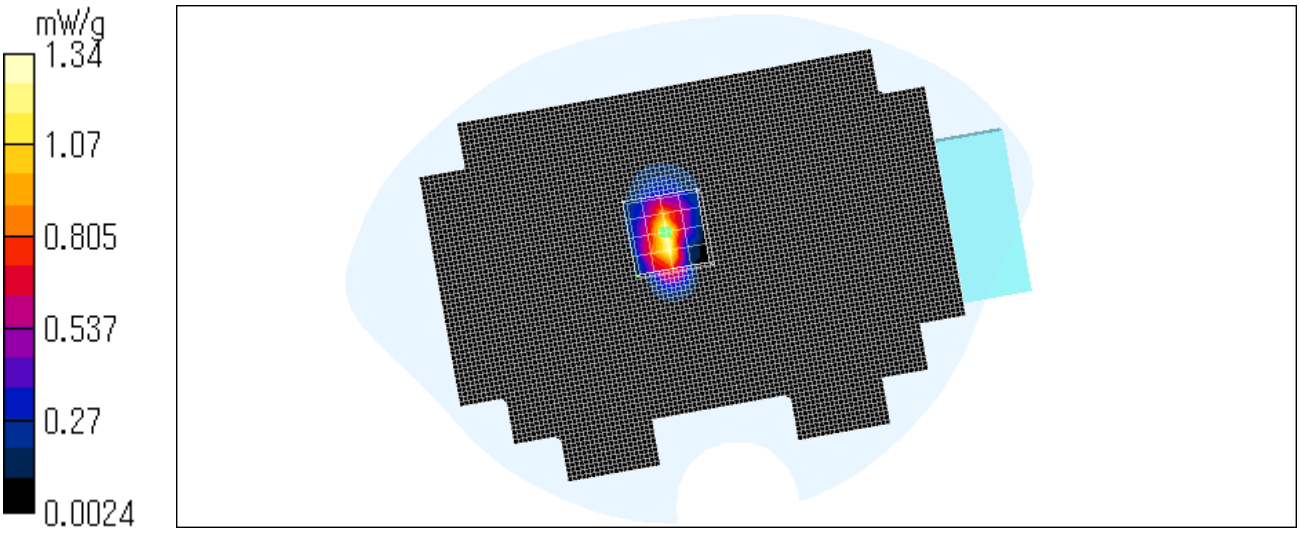
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.3, 4.3, 4.3); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 1.28 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 3.05 W/kg
SAR(1 g) = 1.2 mW/g; SAR(10 g) = 0.477 mW/g
Maximum value of SAR = 1.34 mW/g

Test date = 01 / 29 / 04
Reference Value = 5.47 V/m
Power Drift = 0.1 dB

Ambient Temperature : 22.3 degree.c
Liquid Temperature : Before 22.3 degree.C , After 22.3 degree.C

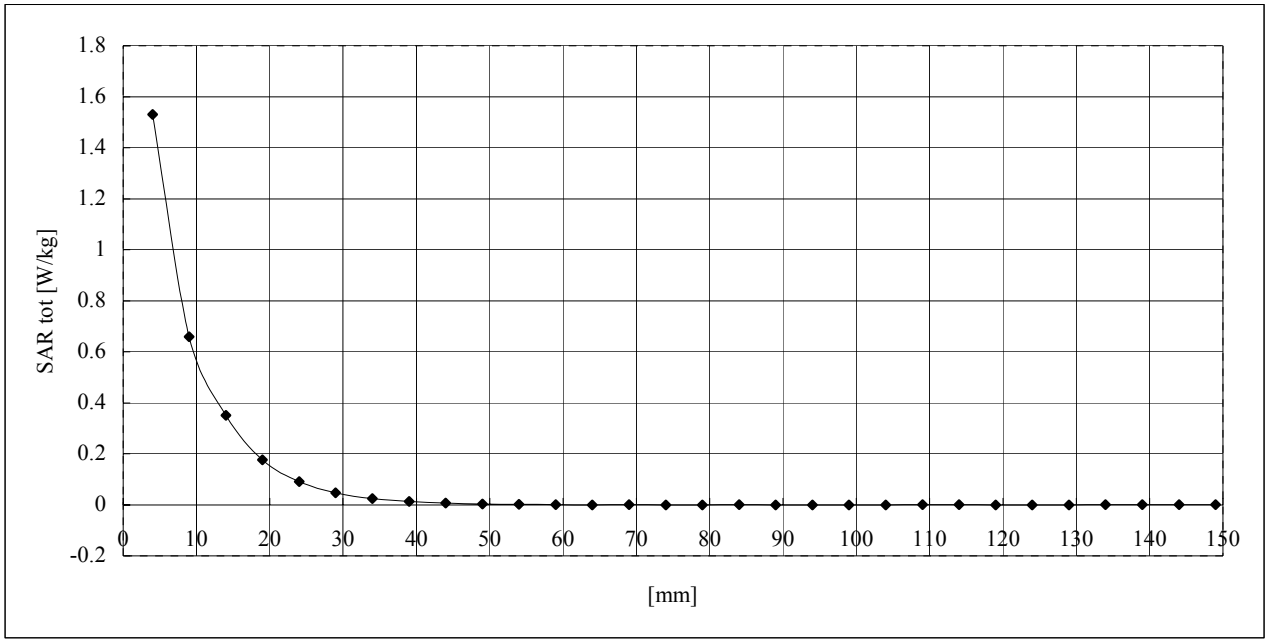


Z-axis scan at max SAR location

KCS / Body / Front 0mm / 2412MHz

Crest factor: 1
Medium: M2450 (σ = 1.95 mho/m, ε_r = 50.1, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.3, 4.3, 4.3); 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



KCS / Body / / Front 0mm / 2462MHz

Crest factor: 1
Medium: M2450 (σ = 1.95 mho/m, ε_r = 50.1, ρ = 1000 kg/m^3)
Phantom section: Flat Section

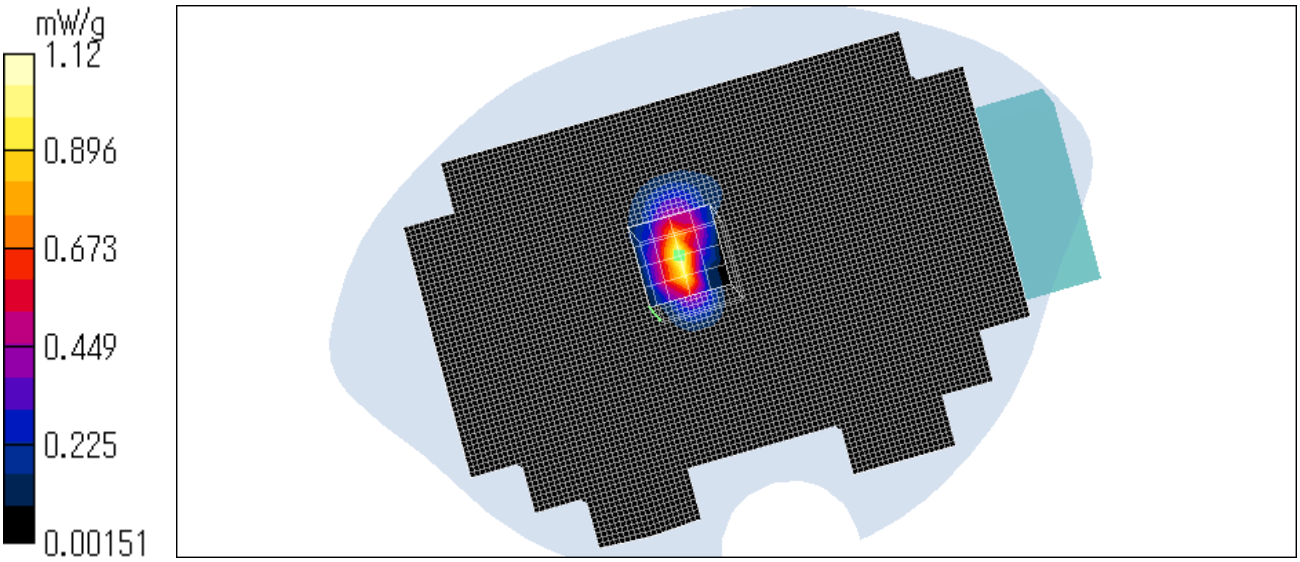
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.3, 4.3, 4.3); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 1.06 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 2.39 W/kg
SAR(1 g) = 0.954 mW/g; SAR(10 g) = 0.378 mW/g
Maximum value of SAR = 1.12 mW/g

Test date = 01 / 29 / 04
Reference Value = 6.05 V/m
Power Drift = -0.1 dB

Ambient Temperature : 22.3 degree.c
Liquid Temperature : Before 22.3 degree.C , After 22.2 degree.C



KCS / Body / / Front 5mm/ 2412MHz

Crest factor: 1
Medium: M2450 (σ = 1.95 mho/m, ε_r = 50.1, ρ = 1000 kg/m^3)
Phantom section: Flat Section

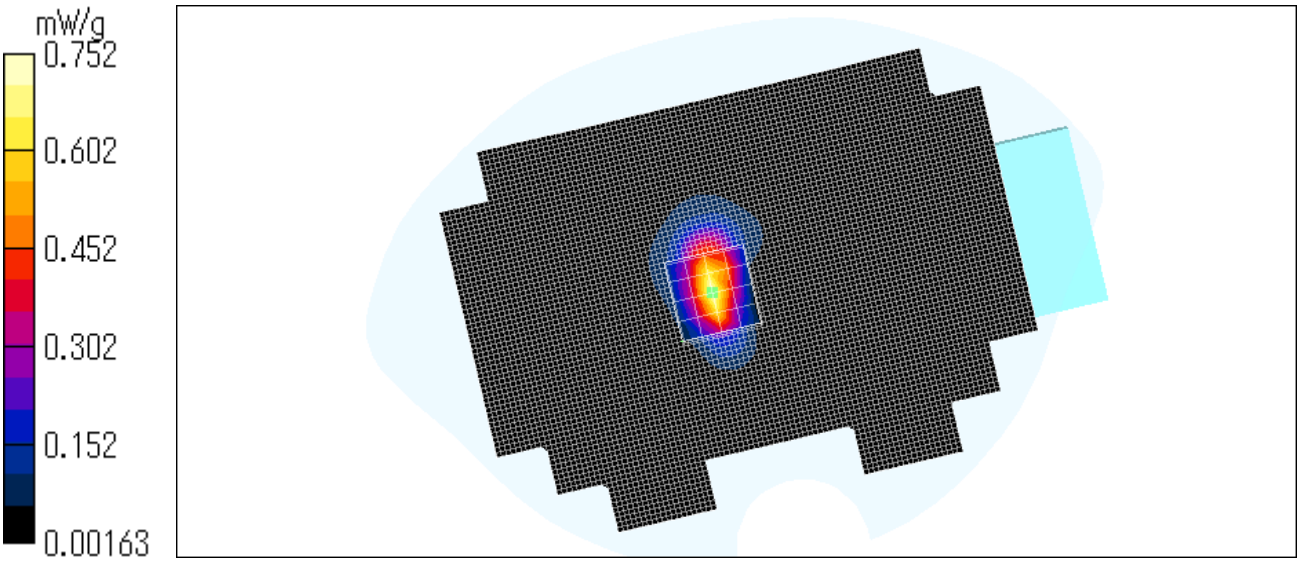
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.3, 4.3, 4.3); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.788 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 1.54 W/kg
SAR(1 g) = 0.671 mW/g; SAR(10 g) = 0.294 mW/g
Maximum value of SAR = 0.752 mW/g

Test date = 01 / 29 / 04
Reference Value = 8.2 V/m
Power Drift = -0.1 dB

Ambient Temperature : 22.3 degree.c
Liquid Temperature : Before 22.2 degree.C , After 22.1 degree.C



KCS / Body / Front 10mm / 2412MHz

Crest factor: 1
Medium: M2450 (σ = 1.95 mho/m, ε_r = 50.1, ρ = 1000 kg/m^3)
Phantom section: Flat Section

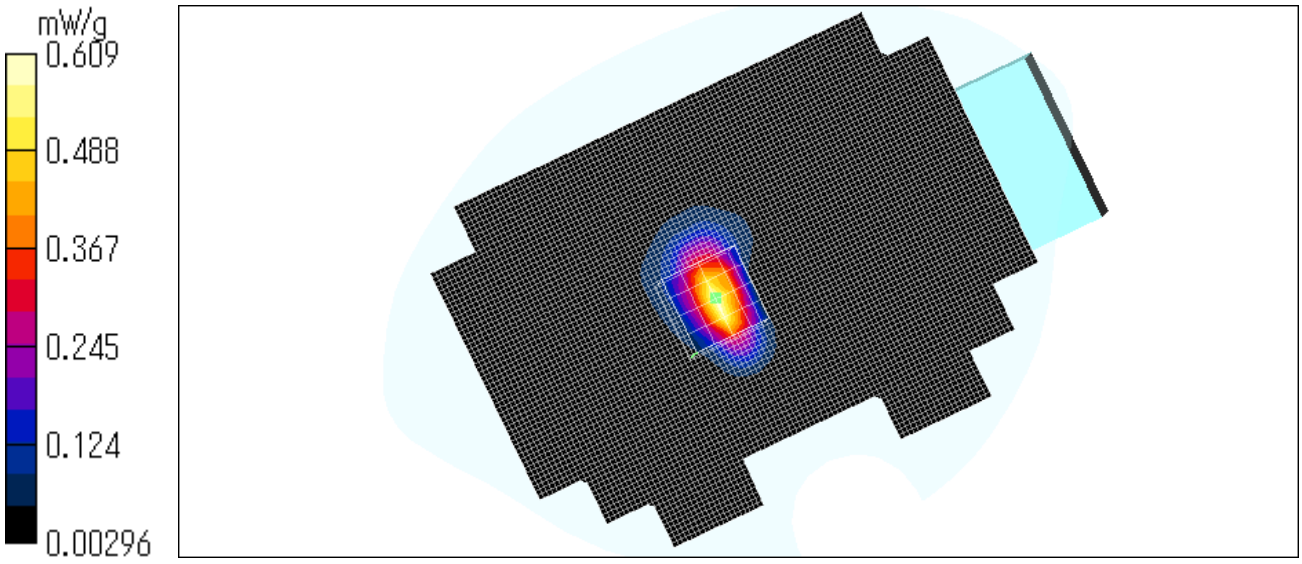
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.3, 4.3, 4.3); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.666 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 1.27 W/kg
SAR(1 g) = 0.566 mW/g; SAR(10 g) = 0.255 mW/g
Maximum value of SAR = 0.609 mW/g

Test date = 01 / 29 / 04
Reference Value = 10.3 V/m
Power Drift = -0.06 dB

Ambient Temperature : 22.3 degree.c
Liquid Temperature : Before 22.1 degree.C , After 22.1 degree.C



KCS / Body / Front 15mm/ 2412MHz

Crest factor: 1
Medium: M2450 (σ = 1.95 mho/m, ε_r = 50.1, ρ = 1000 kg/m^3)
Phantom section: Flat Section

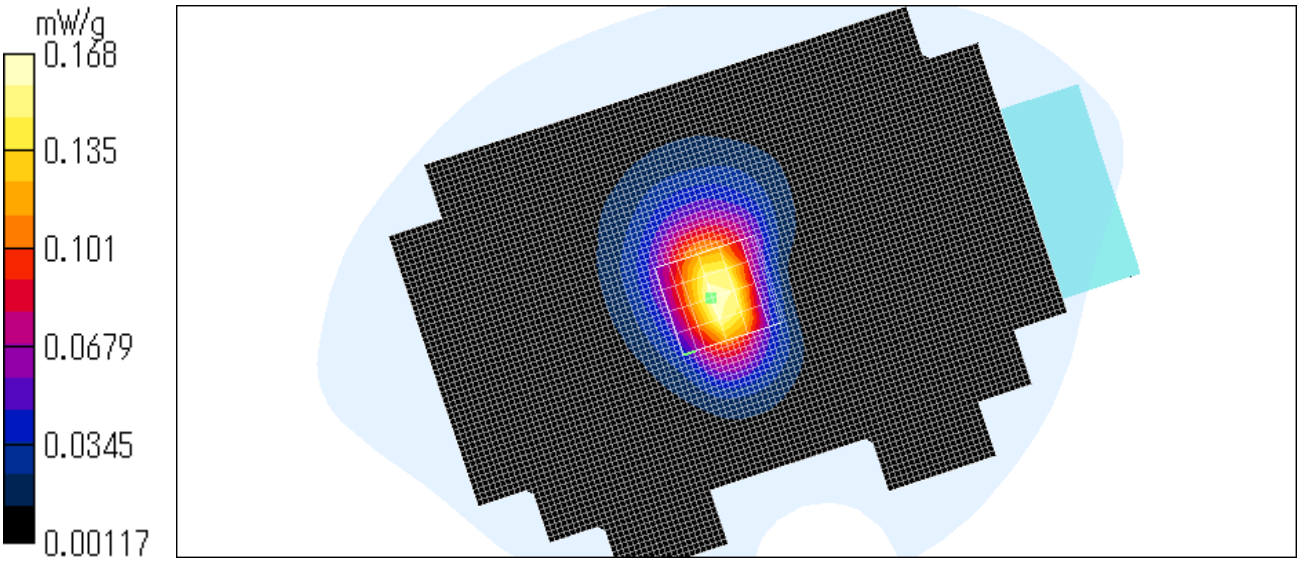
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.3, 4.3, 4.3); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (81x111x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 0.169 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 0.323 W/kg
SAR(1 g) = 0.164 mW/g; SAR(10 g) = 0.0853 mW/g
Maximum value of SAR = 0.168 mW/g

Test date = 01 / 29 / 04
Reference Value = 9.36 V/m
Power Drift = -0.1 dB

Ambient Temperature : 22.3 degree.c
Liquid Temperature : Before 22.1 degree.C , After 22.1 degree.C



APPENDIX 3 : Validation Measurement data

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

Crest factor: 1
Medium: HSL2450 (σ = 1.85 mho/m, ε_r = 37.7, ρ = 1000 kg/m^3)
Phantom section: Flat Section

Dipole 2450 MHz;
- Type: D2450V2; Serial: SN:713

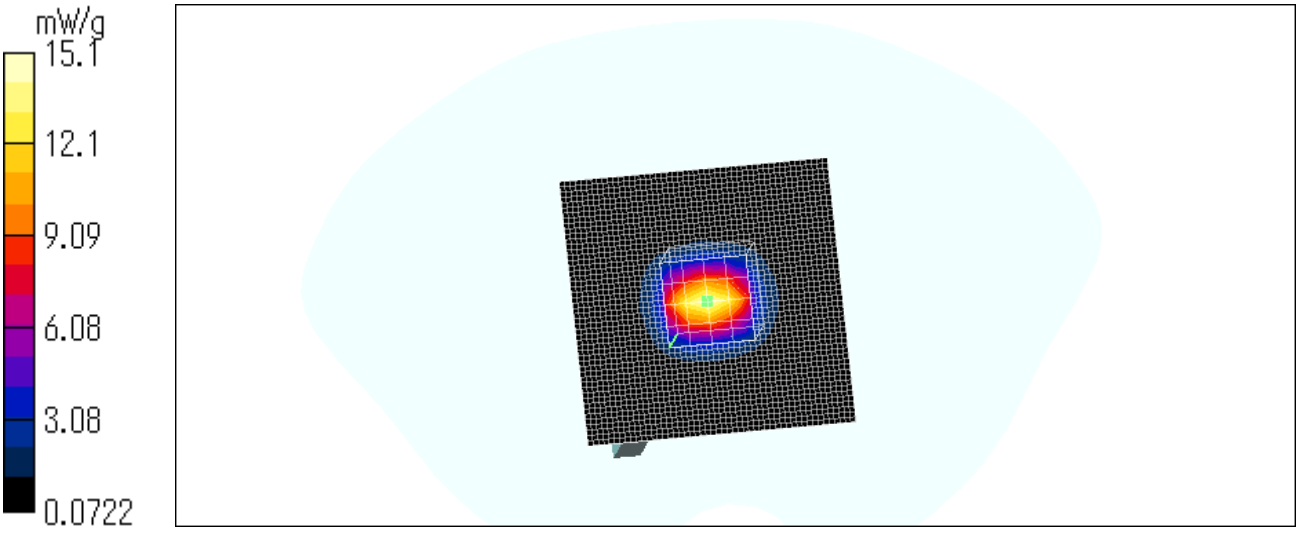
DASY4 Configuration:
- Probe: ET3DV6 - SN1685; ConvF(4.7, 4.7, 4.7); Calibrated: 2003/10/10
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Phantom: SAM 1196
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm
Maximum value of SAR = 17.6 mW/g

Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Peak SAR (extrapolated) = 28.8 W/kg
SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.22 mW/g
Maximum value of SAR = 15.1 mW/g

Test date = 01 / 29 / 04
Reference Value = 96.9 V/m
Power Drift = 0.002 dB

Ambient Temperature : 22.5 degree.c
Liquid Temperature : Before 23.6 degree.C , After 23.6 degree.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. Vellen
Approved by:	Nikolai Kuster

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**