MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*
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Dosimetric Assessment
Test Report

for the

Hospira, Inc.
PlumA + Sedona Wireless Enabled Infuser

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

Prepared for

Hospira, Inc.
755 Jarvis Drive
Morgan Hill, CA 95037

Engineering Statement: The measurements shown in this report were made in accordance with the procedures specified in Supplement C to OET Bulletin 65 of the Federal Communications Commission (FCC) Guidelines [FCC 2001] and Industry Canada RSS-102 for uncontrolled exposure. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. It is further stated that upon the basis of the measurements made, the equipment evaluated is capable of compliance for localized specific absorption rate (SAR) for uncontrolled environment/general population exposure limits specified in ANSI/IEEE Std. C95.1-1999.

SAR Evaluation
Certificate of Compliance

FCC ID: STJ-20677
APPLICANT: Hospira, Inc.

Applicant Name and Address: Hospira, Inc.
755 Jarvis Drive
Morgan Hill, CA 95037
USA

Test Location: MET Laboratories, Inc.
4855 Patrick Henry Dr. Bldg #6
Santa Clara, CA 95054
USA

EUT:	PlumA + Sedona Wireless Enabled Infuser		
Date of Receipt:	May 24, 2004		
Device Category:	FCC 15.247, RSS-102		
RF exposure environment:	Uncontrolled Exposure/General Population		
RF exposure category:	Portable		
Power supply:	Primary Power: 120 Vac, 60 Hz Secondary: 6V 4.2Ah Rechargeable Sealed Lead-Acid Battery		
Antenna:	Surface Mount Ring Type Inverted F		
Production/prototype:	Production		
Modulation:	DTS		
Crest Factor:	90		
TX Range:	2412.0 – 2462.0MHz		
Maximum RF Power Output 2400MHz DTS Mode:	2412.0 MHz	Peak Conducted	18.05dBm
	2437.0 MHz	Peak Conducted	19.10dBm
	2462.0 MHz	Peak Conducted	19.59dBm
Maximum SAR Measurement	Host Model 11971-04-08	**0.0059 mW/g**	
	Host Model 12391-04-03	**0.00423 mW/g**	

Shawn McMillen
Senior Engineer

INTRODUCTION

This measurement report demonstrates that the Hospira, Inc., PlumA + Sedona Wireless Enabled Infuser FCC ID: STJ-20677 described within this report complies with the Specific Absorption Rate (SAR) RF exposure requirements specified in ANSI/IEEE Std. C95.1-1999 and FCC 47 CFR §2.1093 for the General Population / Uncontrolled Exposure environment. The test procedures described in FCC OET Bulletin 65, Supplement C, Edition 01-01 were employed.

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

SAR DEFINITION

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

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

Figure 1.1
SAR Mathematical Equation

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

$$SAR = \sigma E^2 / \rho$$

where:

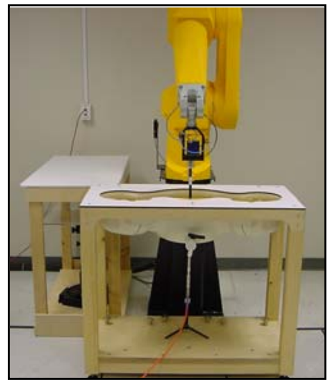
- σ - conductivity of the tissue - simulant material (S/m)
- ρ - mass density of the tissue - simulant material (kg/m3)
- E - Total RMS electric field strength (V/m)

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

DESCRIPTION OF DEVICE UNDER TEST (EUT)

Applicant:	Hospira, Inc.		
Description of Test Item:	PlumA + Sedona Wireless Enabled Infuser		
FCC ID:	STJ-20677		
IC ID:	5627A-20677		
Sedona Wireless Enabled Infuser Part Number:	840-9S205-001		
Serial Number:	D075087-003		
Supply Voltage:	Primary Power: 120 Vac, 60 Hz Secondary: 6V 4.2Ah Rechargeable Sealed Lead-Acid Battery		
Antenna Type(s) Tested:	Surface Mount Ring Type Inverted F		
Modes and Bands of Operation:	DTS 2450MHz		
Maximum Duty Cycle Tested:	10%		
Transmitter Frequency Range (MHz)	2412.0 – 2462.0MHz		
Tested Frequency (MHz)	2412.0 MHz	2437.0 MHz	2462.0 MHz
Maximum RF Power Output 2400MHz DTS Mode:	2412.0 MHz	Peak Conducted	18.05dBm
	2437.0 MHz	Peak Conducted	19.10dBm
	2462.0 MHz	Peak Conducted	19.59dBm
Maximum SAR Measured	Host Model 11971-04-08	**0.0059 mW/g**	
	Host Model 12391-04-03	**0.00423 mW/g**	
Application Type:	Certification		
Exposure Category:	Uncontrolled Environment / General Population		
FCC and IC Rule Part(s):	FCC 47 CFR §2.1093, Part 15.247 Subpart C, RSS-102		
Standards:	IEEE Std. 1528-2003, FCC OET Bulletin 65, Supplement C, Edition 01-01		

SAR MEASUREMENT SYSTEM



MET Laboratories, Inc SAR measurement facility utilizes the DASY4 Professional Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland for performing SAR compliance tests. The DASY4 measurement system is comprised of the measurement server, robot controller, computer, near-field probe, probe alignment sensor, specific anthropomorphic mannequin (SAM) phantom, and various planar phantoms for brain and/or body SAR evaluations. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). The Cell controller system contain the power supply, robot controller, teach pendant (Joystick), and remote control, is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the DASY4 measurement server. The DAE4 utilizes a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit.

Transmission to the DASY4 measurement server is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. The sensor systems are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

MEASUREMENT SUMMARY

HOST 11971-04-08 BODY SAR MEASUREMENT RESULTS (2450MHz) Band									
Freq (MHz)	**Chan**	**Test Mode**	**Conducted Power Before/After (dBm)**	**Power Supply**	**Antenna Type**	**EUT Test Position**	**Phantom Section**	**Antenna housing Sep. Dist. (cm)**	**Measured SAR 1g (W/kg)**
2437.0	6	DTS	19.10	AC	Ring	Back	Planar	0.0	0.0059
2437.0	6	DTS	19.10	Lead Acid	Ring	Back	Planar	0.0	0.00468
2437.0	6	DTS	19.10	AC	Ring	Side	Planar	0.0	0.00363
2437.0	6	DTS	19.10	AC	Ring	Top	Planar	0.0	0.00393
ANSI/IEEE C95.1 1992 – SAFETY LIMIT BODY: 1.6 W/kg (averaged over 1 gram) Spatial Peak – Uncontrolled Exposure/General Population									

Measured Mixture Type	2450 MHz Body		Date Tested	May 24, 2005
Dielectric Constant εr	IEEE Target	Measured	Crest Factor	90
	52.7	51.5	Ambient Temperature (C)	21.4
Conductivity σ (mho/m)	IEEE Target	Measured	Fluid Temperature (C)	20.8
	1.95	2.01	Fluid Depth	≥15cm

HOST 12391-04-03 BODY SAR MEASUREMENT RESULTS (2450MHz) Band									
Freq (MHz)	**Chan**	**Test Mode**	**Conducted Power Before/After (dBm)**	**Power Supply**	**Antenna Type**	**EUT Test Position**	**Phantom Section**	**Antenna housing Sep. Dist. (cm)**	**Measured SAR 1g (W/kg)**
2437.0	6	DTS	19.10	AC	Ring	Back	Planar	0.0	0.00423
2437.0	6	DTS	19.10	Lead Acid	Ring	Back	Planar	0.0	0.00345
2437.0	6	DTS	19.10	AC	Ring	Side	Planar	0.0	0.000982
2437.0	6	DTS	19.10	AC	Ring	Top	Planar	0.0	0.00352
ANSI/IEEE C95.1 1992 – SAFETY LIMIT BODY: 1.6 W/kg (averaged over 1 gram) Spatial Peak – Uncontrolled Exposure/General Population									

Measured Mixture Type	2450 MHz Body		Date Tested	May 24, 2005
Dielectric Constant εr	IEEE Target	Measured	Crest Factor	90
	52.7	51.5	Ambient Temperature (C)	21.4
Conductivity σ (mho/m)	IEEE Target	Measured	Fluid Temperature (C)	20.8
	1.95	2.01	Fluid Depth	≥15cm

DETAILS OF SAR EVALUATION

The Hospira, Inc., PlumA + Sedona Wireless Enabled Infuser was determined to be compliant for localized Specific Absorption Rate based on the test provisions and conditions described below.

1. The EUT was tested for body SAR in three different orientations. The EUT was placed with the back, top and side of the EUT next to the planar section of the phantom in order to facilitate a 0.0cm separation between the antenna housing and the phantom surface. The EUT was tested at the mid channel of the TX band. The transmitter was placed into frame mode at the highest data rate. If the mid channel SAR values were >3dB from the limit, low and high channels were considered optional.

2. The EUT was placed into a test mode using software at a data rate of 11 Mbps which produced the highest conducted power. The unit communicated with the base station over the course of the evaluation in normal 802.11 b frame mode. The duty cycle was set to 10%. The conducted power levels were measured before and after each test using an Anritsu Power Meter ML2488A according to the procedures described in FCC 47 CFR 2.1046.

3. The SAR evaluations were performed with AC power and a fully charged battery.

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

5. The fluid temperature was measured prior to and after each SAR evaluation to ensure the temperature remained within ±2 deg C of the temperature of the fluid when the dielectric properties were measured.

6. During the SAR evaluations if a distribution produced several hotspots over the course of the area scan, each hotspot was evaluated separately.

7. The measurement results were either at or near the noise floor of the SAR system. The antenna type produced obscure SAR results. In order to verify that the measurement results were accurate, various scans were performed at different sampling durations. An initial area and zoom scan was performed using a 0.5 second sampling duration. An additional area and zoom scan was performed using a sampling duration of 2.0 seconds. Both plots produced the same SAR distribution. It is therefore assumed that the SAR plots represent the actual RF exposure for this device.

EVALUATION PROCEDURES

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

(i) For devices held to the ear during normal operation, both the left and right ear positions were evaluated using the SAM phantom.
(ii) For body-worn and face-held devices a planar phantom was used.

The SAR was determined by a pre-defined procedure within the DASY4 software. Upon completion of a reference check, the exposed region of the phantom was scanned near the inner surface with a grid spacing of 15mm x 15mm.

An area scan was determined as follows:

Based on the defined area scan grid, a more detailed grid is created to increase the points by a factor of 10. The interpolation function then evaluates all field values between corresponding measurement points.

A linear search is applied to find all the candidate maxima. Subsequently, all maxima are removed that are >2 dB from the global maximum. The remaining maxima are then used to position the cube scans.

A 1g and 10g spatial peak SAR was determined as follows:

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

Interpolated data is used to calculate the average SAR over 1g and 10g cubes by spatially discretizing the entire measured cube. The volume used to determine the averaged SAR is a 1mm grid (42875 interpolated points).

Z-Scan was determined as follows:

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

DATA EVALUATION PROCEDURES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

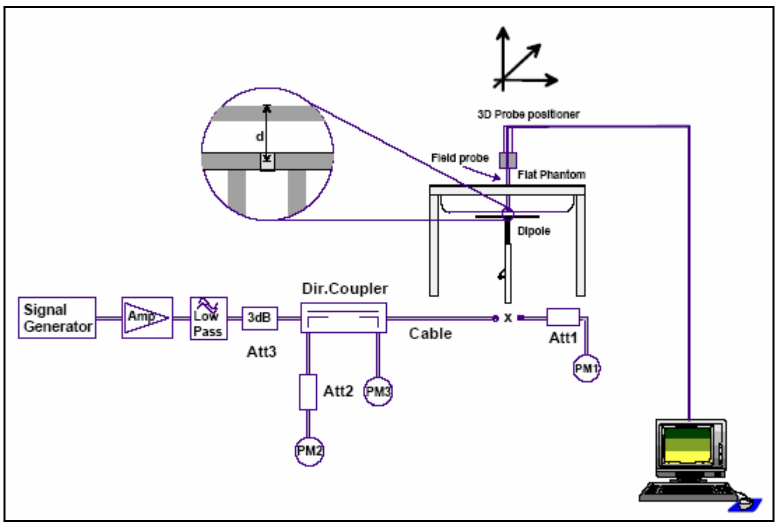
with P_{pwe} = Equivalent power density of a plane wave in mW/cm2
E_{tot} = total electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

SYSTEM PERFORMANCE CHECK

Prior to the SAR evaluation a system check was performed in the planar section of the SAM phantom with a 2450 MHz dipole. The dielectric parameters of the simulated brain fluid were measured prior to the system performance check using an 85070D Dielectric Probe Kit and an 8722D Network Analyzer. A forward power of 250mW was applied to the dipole and the system was verified to a tolerance of +10%.

Test Date	2450MHz Equivalent Tissue	SAR 1g (W/kg)		Permittivity Constant εr		Conductivity σ (mho/m)		Ambient Temp. (C)	Fluid Temp. (C)	Fluid Depth (cm)
		Calibrated Target	Measured	IEEE Target	Measured	IEEE Target	Measured			
05/24/05	Head	50.4±5%	52.4	39.2 ±5%	40.8	1.80±10%	1.86	22.2	21.1	≥15

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



SIMULATED EQUIVALENT TISSUES

Simulated Tissue Mixture		
Ingredient	**2450MHz Head Validation**	**2450MHz Body EUT**
Water	46.7%	73.3%
DGMBE	53.3%	26.7%

SAR SAFETY LIMITS

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

Notes:

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

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

ROBOT SYSTEM SPECIFICATIONS

1.1. SPECIFICATIONS

Positioner:

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

1.2. DATA ACQUISITION ELECTRONIC (DAE) SYSTEM:

Cell Controller

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

Data Converter

Features:	Signal Amplifier, multiplexer, A/D converter, and control logic
Software:	DASY4 software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock

Dasy4 Measurement Server

Function:	Real-time data evaluation for field measurements and surface detection
Hardware:	PC/104 166MHz Pentium CPU; 32 MB chipdisk; 64 MB RAM
Connections:	COM1, COM2, DAE, Robot, Ethernet, Service Interface

E-Field Probe

Model:	ET3DV6
Serial No.:	1793
Construction:	Triangular core fiber optic detection system
Frequency:	10 MHz to 6 GHz
Linearity:	± 0.2 dB (30 MHz to 3 GHz)

EX-Probe

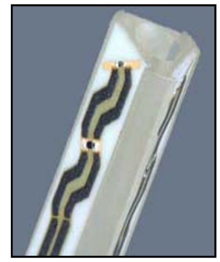
Model:	EX3DV3
Serial No.	3511
Construction:	Triangular core
Frequency:	10 MHz to > 6 GHz
Linearity:	± 0.2 dB (30 MHz to 3 GHz)

1.3. PHANTOM(S):

Validation & Evaluation Phantom

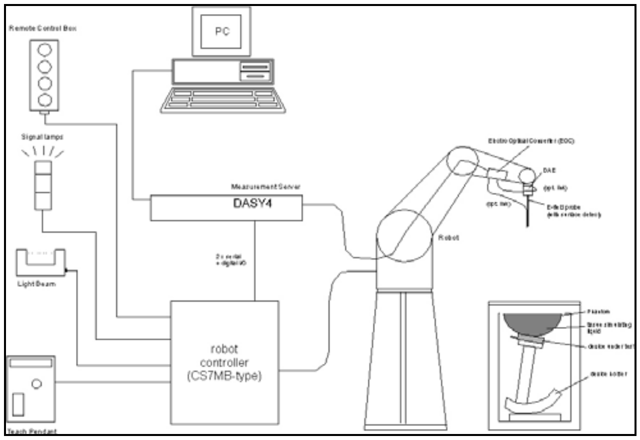
Type:	SAM V4.0C
Shell Material:	Fiberglass
Thickness:	2.0 0.1 mm
Volume:	Approx. 20 liters

PROBE SPECIFICATIONS (ET3DV6)



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

SAR Measurement System



Measurement System Diagram

1.4. RX90BL ROBOT

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

1.5. ROBOT CONTROLLER

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

1.6. LIGHT BEAM SWITCH

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

1.7. DATA ACQUISITION ELECTRONICS

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

1.8. ELECTO-OPTICAL CONVERTER (EOC)

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

1.9. MEASUREMENT SERVER

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

1.10. DOSIMETRIC PROBE

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

1.11. SAM PHANTOM

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

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

1.12. PLANAR PHANTOM

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

1.13. VALIDATION PLANAR PHANTOM

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

1.14. DEVICE HOLDER

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

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

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

1.15. SYSTEM VALIDATION KITS

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

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

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

Return loss: >20 dB at specified validation position

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

TEST EQUIPMENT LIST

Test Equipment	Serial Number	Calibration Date
DASY4 System Robot ETVDV6 EX3DV3 DAE3 300MHz Dipole 450MHz Dipole 835MHz Dipole 1900MHz Dipole 2450MHz Dipole SAM Phantom V4.0C EUT Planar Phantom Validation Phantom	 FO3/SX19A1/A/01 1793 3511 584 003 004 493 001 002 N/A N/A N/A	 N/A Sept 2003 Jan 2004 Sept 2003 Dec 2004 Dec 2004 Sept 2003 Feb 2004 Feb 2004 N/A N/A N/A
85070D Dielectric Probe Kt	N/A	N/A
83650B Signal Generator	3844A00910	June 2006
HP E4418B Power Meter	GB40205140	June 2006
HP 8482A Power Sensor	2607A11286	June 2006
HP 8722D Vector Network Analyzer	3S36140188	March 2006
Anritsu Power Meter ML2488A	6K00001832	June 2006
Anritsu Power Sensor	030864	Jan 2006
Mini-Circuits Power Amplifier	D111903#8	N/A

MEASUREMENT UNCERTAINTIES

1.16. UNCERTAINTY ASSESSMENT FOR EUT

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

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

1.17. UNCERTAINTY ASSESSMENT FOR SYSTEM VALIDATION

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

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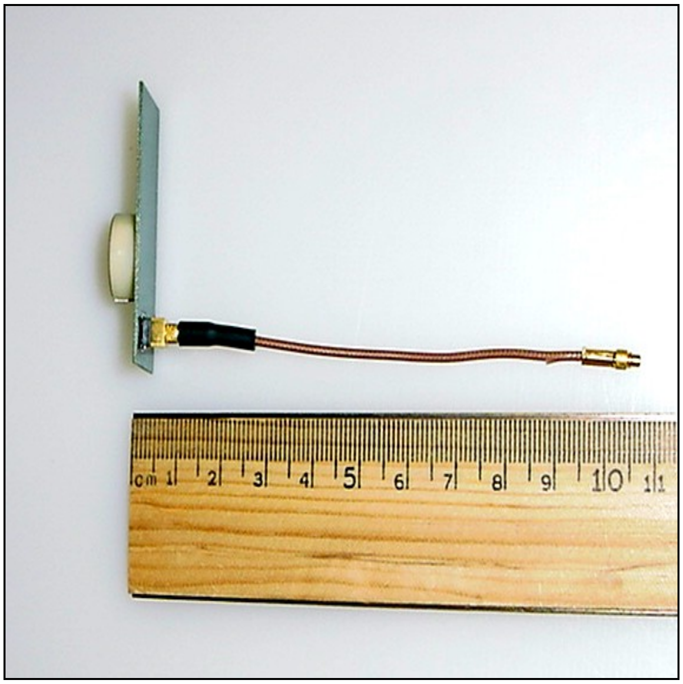
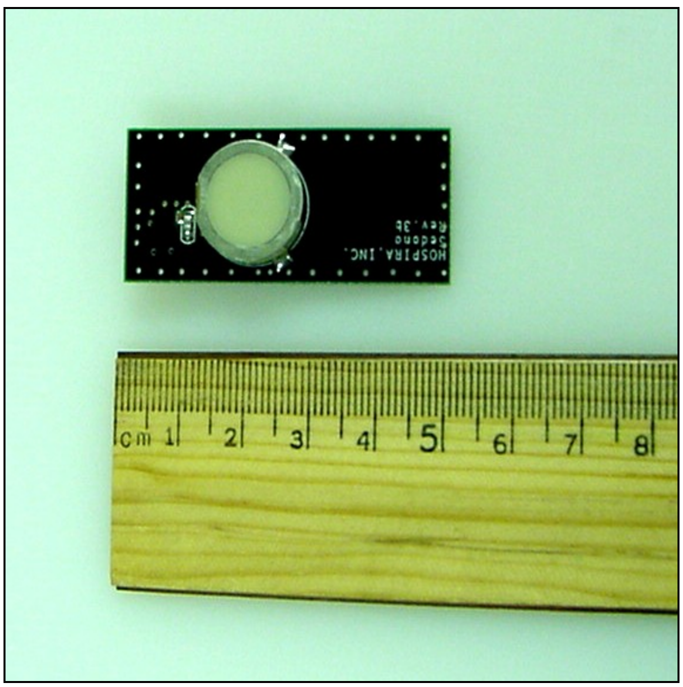
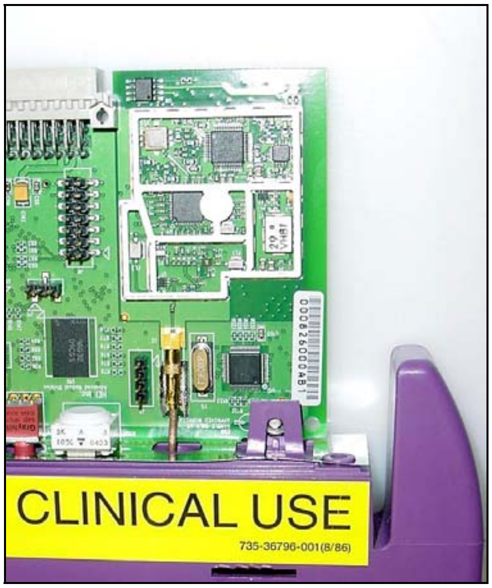
EUT PHOTOS



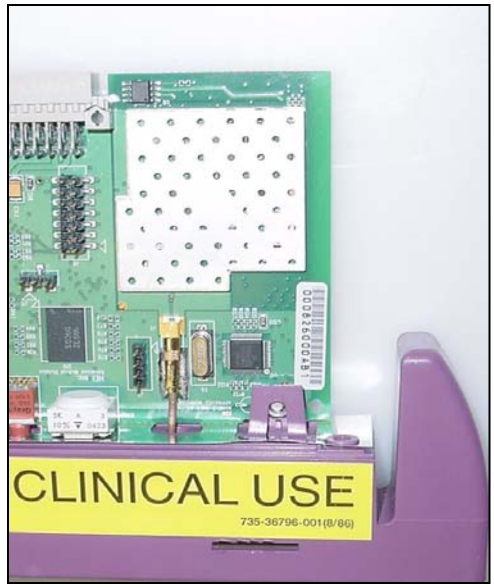
Photograph 1. Antenna and coaxial cable



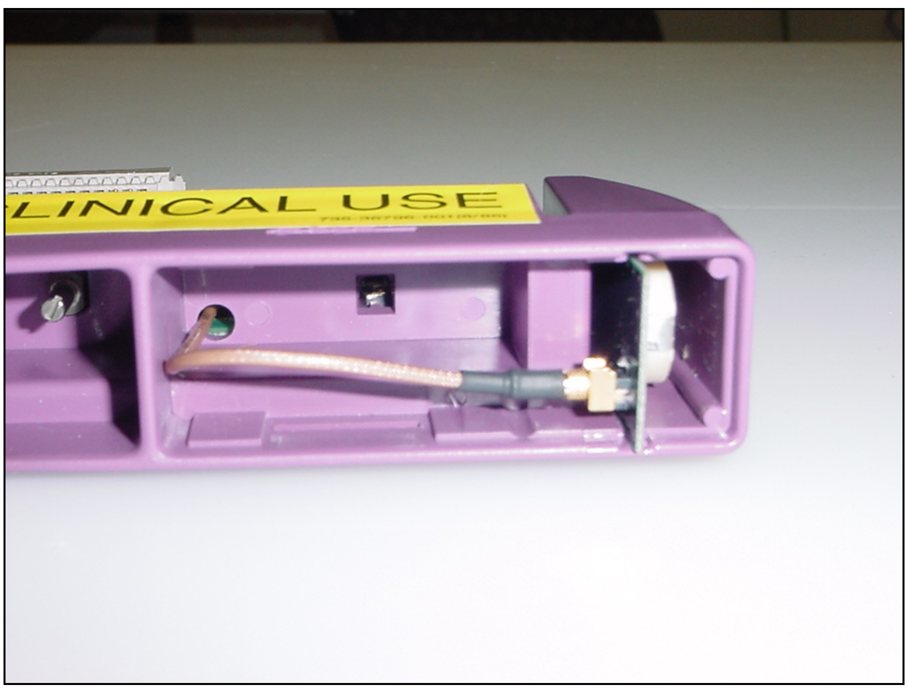
Photograph 2. Top view of antenna



Photograph 3. RF board with Cans removed



Photograph 4. RF board with Cans



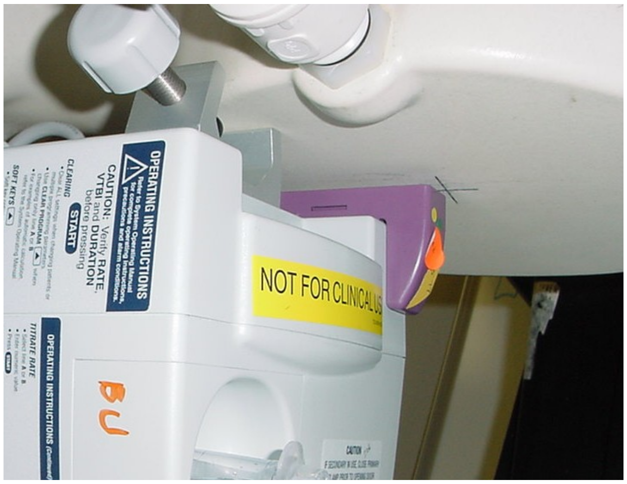
Photograph 5. Antenna mounted in housing

TEST SET-UP

Photograph 6. Back Side of EUT Model 11971-04-08

Photograph 7. TOP of EUT Model 11971-04-08

Photograph 8. Side of EUT Model 11971-04-08



Photograph 9. Back Side of EUT Model 12391-04-03

Photograph 10. Top of EUT Model 12391-04-03

Photograph 11. Side of EUT Model 12391-04-03

APPENDIX A - SAR MEASUREMENT DATA

Mid Ch 2437MHz Back of EUT with AC Power

DUT: Hospira; Type: DTS; Host Model Number 11971-04-08

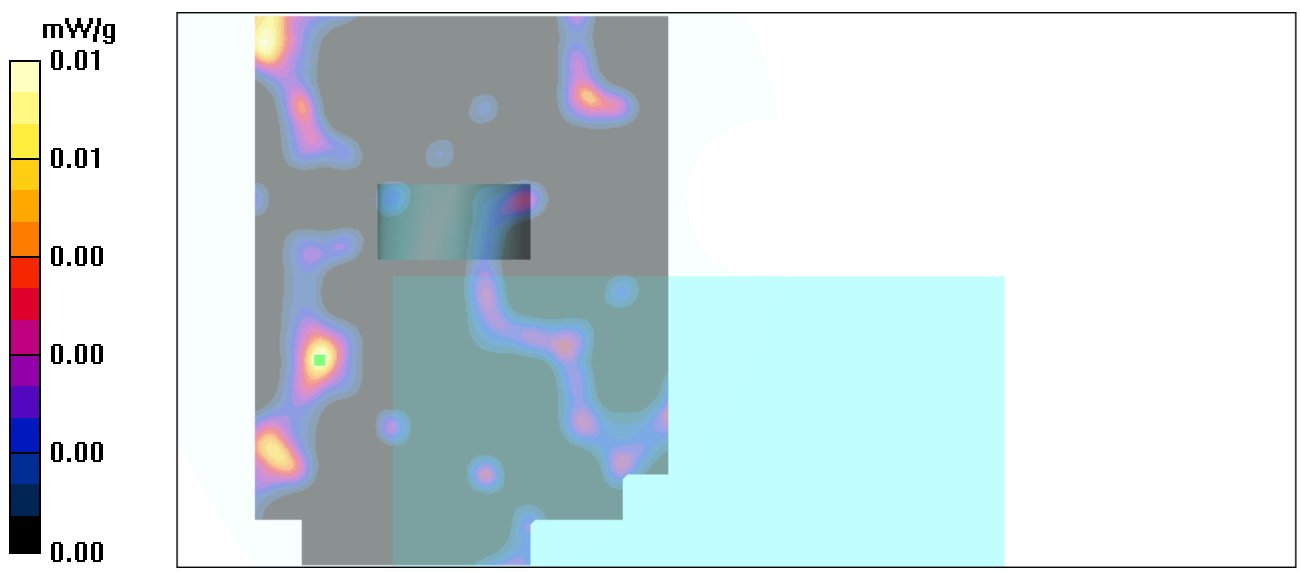
Ambient Temp: 21.4 deg C; Fluid Temp: 20.8 deg C

Communication System: DTS ; ; Frequency: 2437 MHz;Duty Cycle: 1:90
Medium: M2450 Medium parameters used f = 2450 MHz; $\sigma = 2.01$ mho/m; $\varepsilon_r = 50.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

- Probe: EX3DV3 - SN3511; ConvF(7.66, 7.66, 7.66); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/16/2003
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Area Scan (91x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.01 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.638 V/m; Power Drift = 0.102 dB
Peak SAR (extrapolated) = 0.017 W/kg
SAR(1 g) = 0.0059 mW/g; SAR(10 g) = 0.00365 mW/g
Maximum value of SAR (measured) = 0.01 mW/g



Mid Ch 2437MHz Back of EUTwith Battery Power

DUT: Hospira; Type: DTS; Host Model Number 11971-04-08

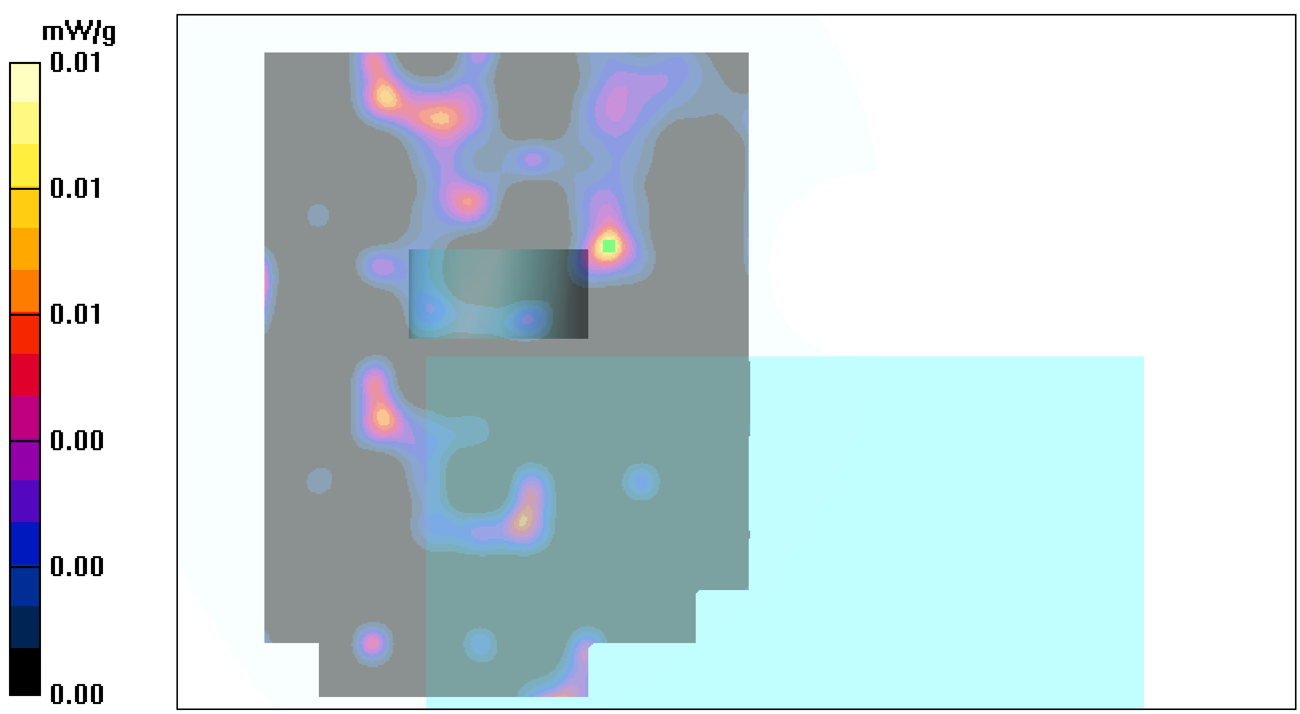
Ambient Temp: 21.4 deg C; Fluid Temp: 20.8 deg C

Communication System: DTS ; ; Frequency: 2437 MHz;Duty Cycle: 1:90
Medium: M2450 Medium parameters used f = 2450 MHz; $\sigma = 2.01$ mho/m; $\varepsilon_r = 50.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

- Probe: EX3DV3 - SN3511; ConvF(7.66, 7.66, 7.66); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/16/2003
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Area Scan (91x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.01 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.78 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.01 W/kg
SAR(1 g) = 0.00468 mW/g; SAR(10 g) = 0.00228 mW/g
Maximum value of SAR (measured) = 0.01 mW/g



Mid Ch 2437MHz Side of EUT with AC Power

DUT: Hospira; Type: DTS; Host Model Number 11971-04-08

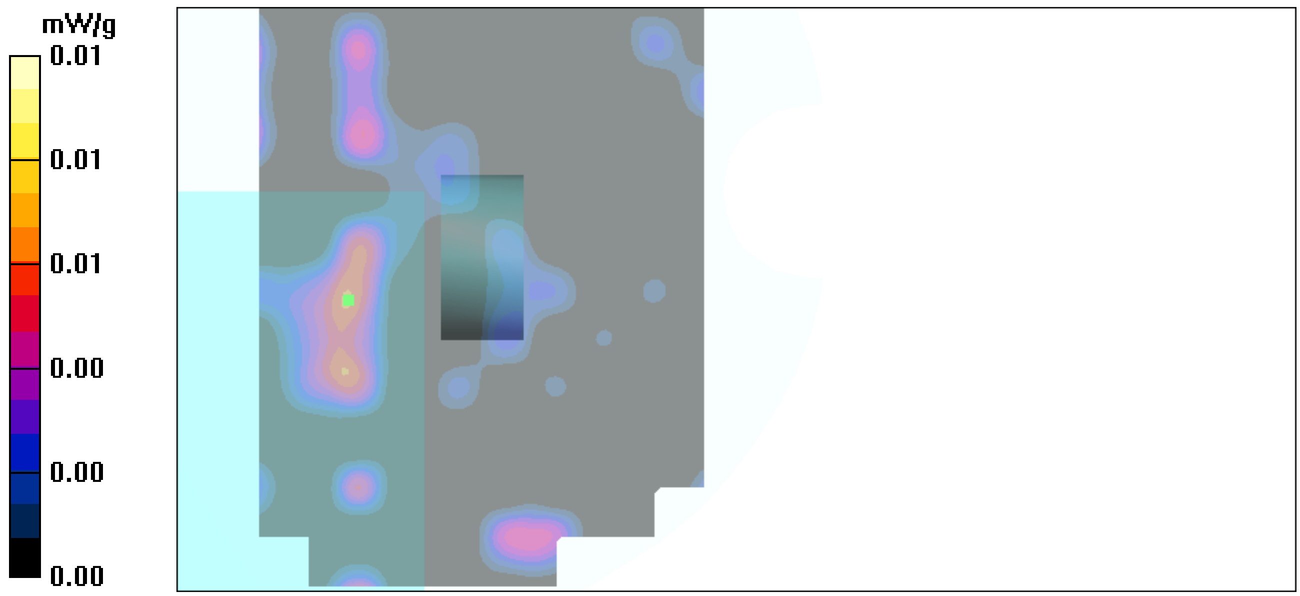
Ambient Temp: 21.4 deg C; Fluid Temp: 20.8 deg C

Communication System: DTS ; ; Frequency: 2437 MHz;Duty Cycle: 1:90
Medium: M2450 Medium parameters used f = 2450 MHz; $\sigma = 2.01$ mho/m; $\varepsilon_r = 50.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

- Probe: EX3DV3 - SN3511; ConvF(7.66, 7.66, 7.66); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/16/2003
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Area Scan (91x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.01 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.979 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 0.01 W/kg
SAR(1 g) = 0.00363 mW/g; SAR(10 g) = 0.00287 mW/g
Maximum value of SAR (measured) = 0.01 mW/g



Mid Ch 2437MHz Top of EUT with AC Power

DUT: Hospira; Type: DTS; Host Model Number 11971-04-08

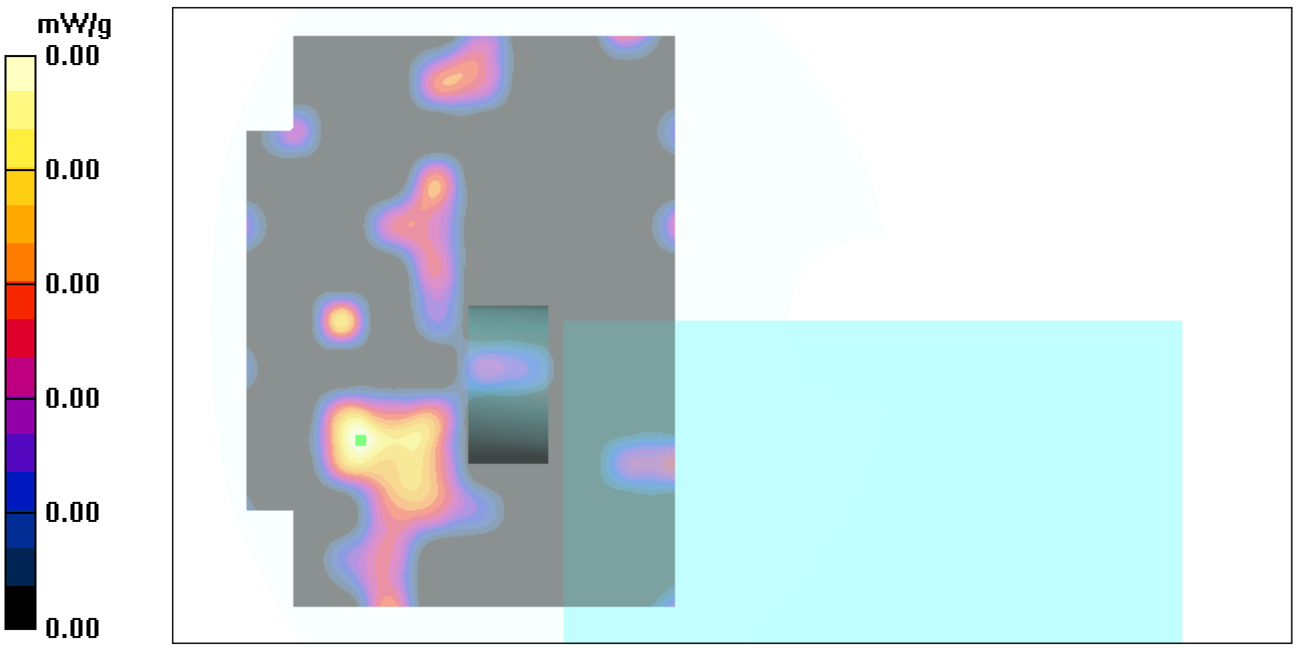
Ambient Temp: 21.4 deg C; Fluid Temp: 20.8 deg C

Communication System: DTS ; ; Frequency: 2437 MHz;Duty Cycle: 1:90
Medium: M2450 Medium parameters used f = 2450 MHz; σ = 2.01 mho/m; ε_r = 50.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV3 - SN3511; ConvF(7.66, 7.66, 7.66); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/16/2003
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Area Scan (91x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.00 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.874 V/m; Power Drift = 0.066 dB
Peak SAR (extrapolated) = 0.01 W/kg
SAR(1 g) = 0.00393 mW/g; SAR(10 g) = 0.00187 mW/g
Maximum value of SAR (measured) = 0.01 mW/g



Mid Ch 2437MHz Back of EUT with AC Power

DUT: Hospira; Type: DTS; Host Model Number 12391-04-03

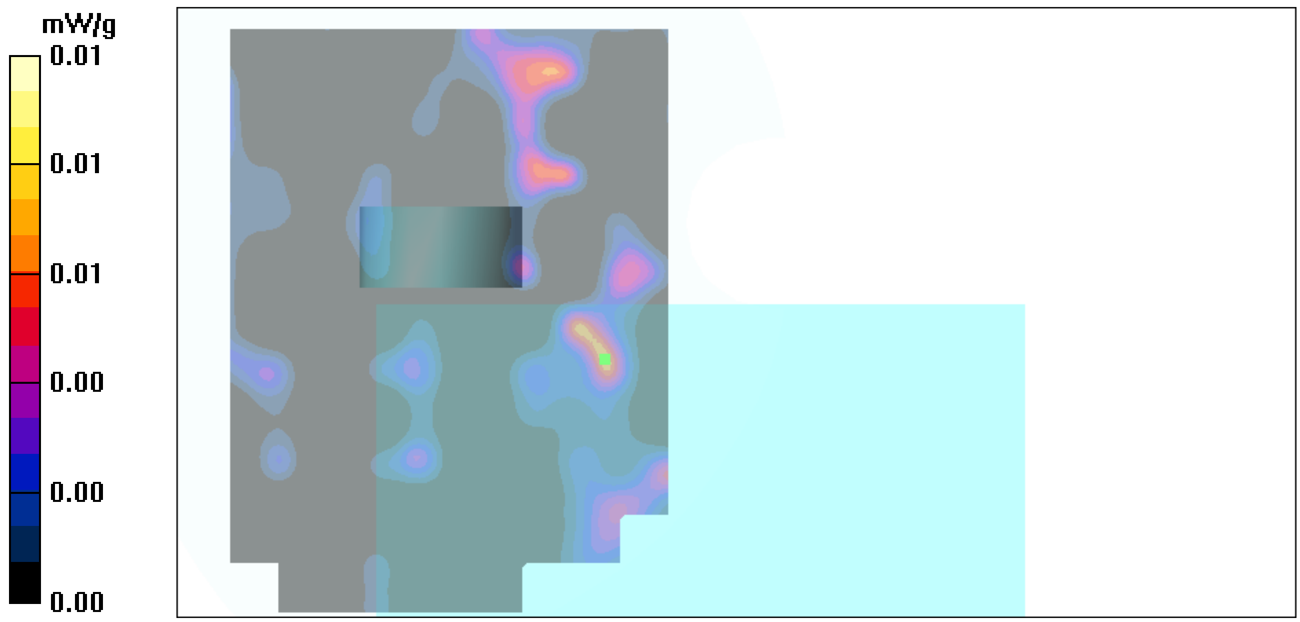
Ambient Temp: 21.4 deg C; Fluid Temp: 20.8 deg C

Communication System: DTS ; ; Frequency: 2437 MHz;Duty Cycle: 1:90
Medium: M2450 Medium parameters used f = 2450 MHz; σ = 2.01 mho/m; ε_r = 50.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV3 - SN3511; ConvF(7.66, 7.66, 7.66); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/16/2003
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Area Scan (91x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.01 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.768 V/m; Power Drift = 0.196 dB
Peak SAR (extrapolated) = 0.012 W/kg
SAR(1 g) = 0.00423 mW/g; SAR(10 g) = 0.00185 mW/g
Maximum value of SAR (measured) = 0.01 mW/g



Mid Ch 2437MHz Back EUT with Battery Power

DUT: Hospira; Type: DTS; Host Model Number 12391-04-03

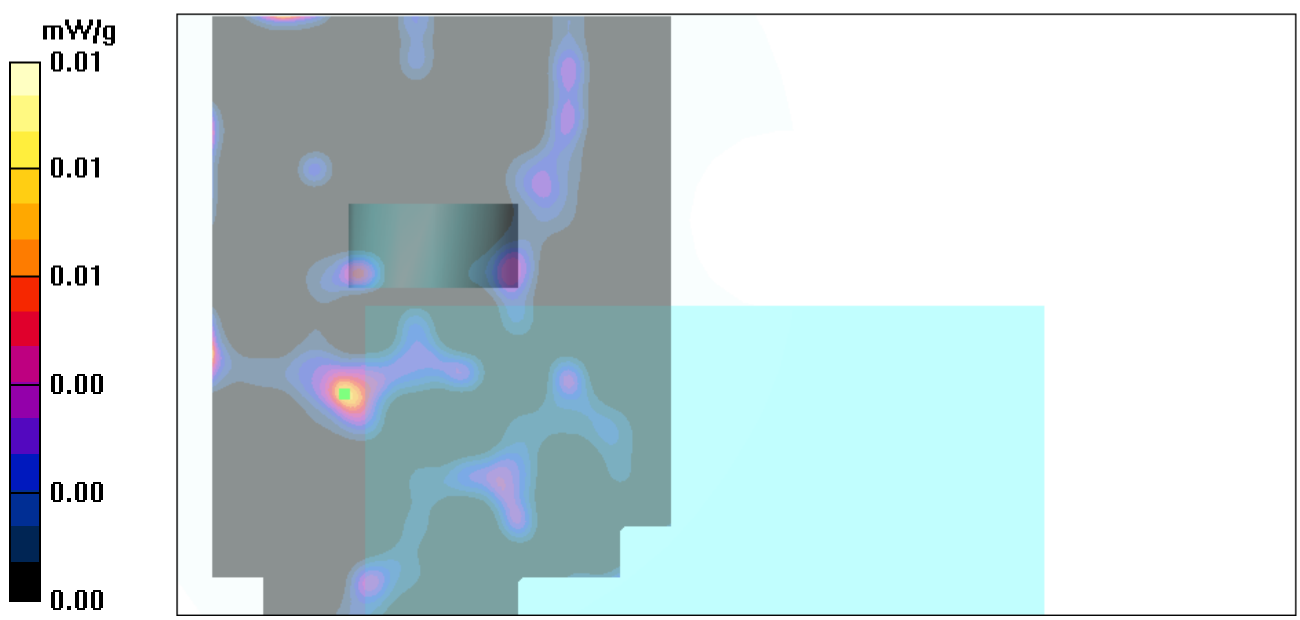
Ambient Temp: 21.4 deg C; Fluid Temp: 20.8 deg C

Communication System: DTS ; ; Frequency: 2437 MHz;Duty Cycle: 1:90
Medium: M2450 Medium parameters used f = 2450 MHz; σ = 2.01 mho/m; ε_r = 50.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

- Probe: EX3DV3 - SN3511; ConvF(7.66, 7.66, 7.66); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/16/2003
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Area Scan (91x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.01 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.638 V/m; Power Drift = -0.37 dB
Peak SAR (extrapolated) = 0.01 W/kg
SAR(1 g) = 0.00345 mW/g; SAR(10 g) = 0.00165 mW/g
Maximum value of SAR (measured) = 0.01 mW/g



Mid Ch 2437MHz Side of EUT with AC Power

DUT: Hospira; Type: DTS; Host Model Number 12391-04-03

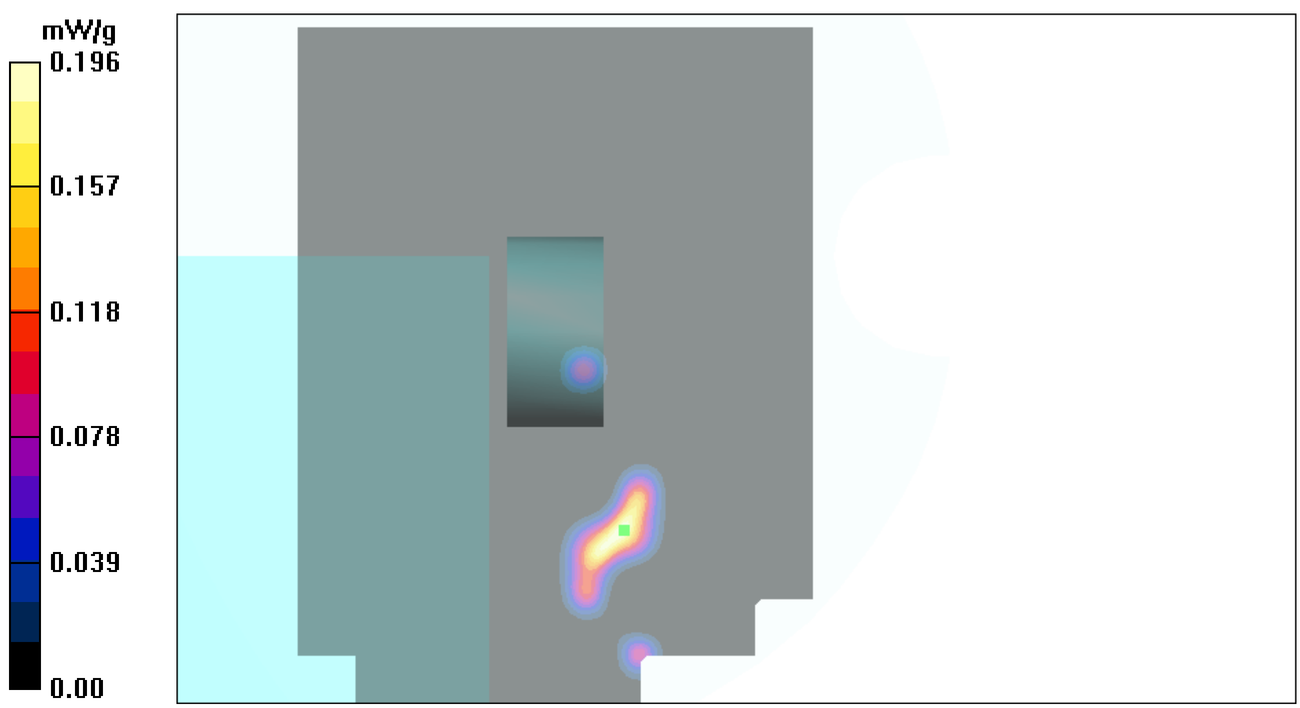
Ambient Temp: 21.4 deg C; Fluid Temp: 20.8 deg C

Communication System: DTS ; ; Frequency: 2437 MHz;Duty Cycle: 1:90
Medium: M2450 Medium parameters used f = 2450 MHz; $\sigma = 2.01$ mho/m; $\varepsilon_r = 50.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

- Probe: EX3DV3 - SN3511; ConvF(7.66, 7.66, 7.66); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/16/2003
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Area Scan (91x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.196 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.656 V/m; Power Drift = 0.242 dB
Peak SAR (extrapolated) = 0.00 W/kg
SAR(1 g) = 0.000982 mW/g; SAR(10 g) = 0.000237 mW/g
Maximum value of SAR (measured) = 0.025 mW/g



Mid Ch 2437MHz Top of EUT with Battery Power

DUT: Hospira; Type: DTS; Host Model Number 12391-04-03

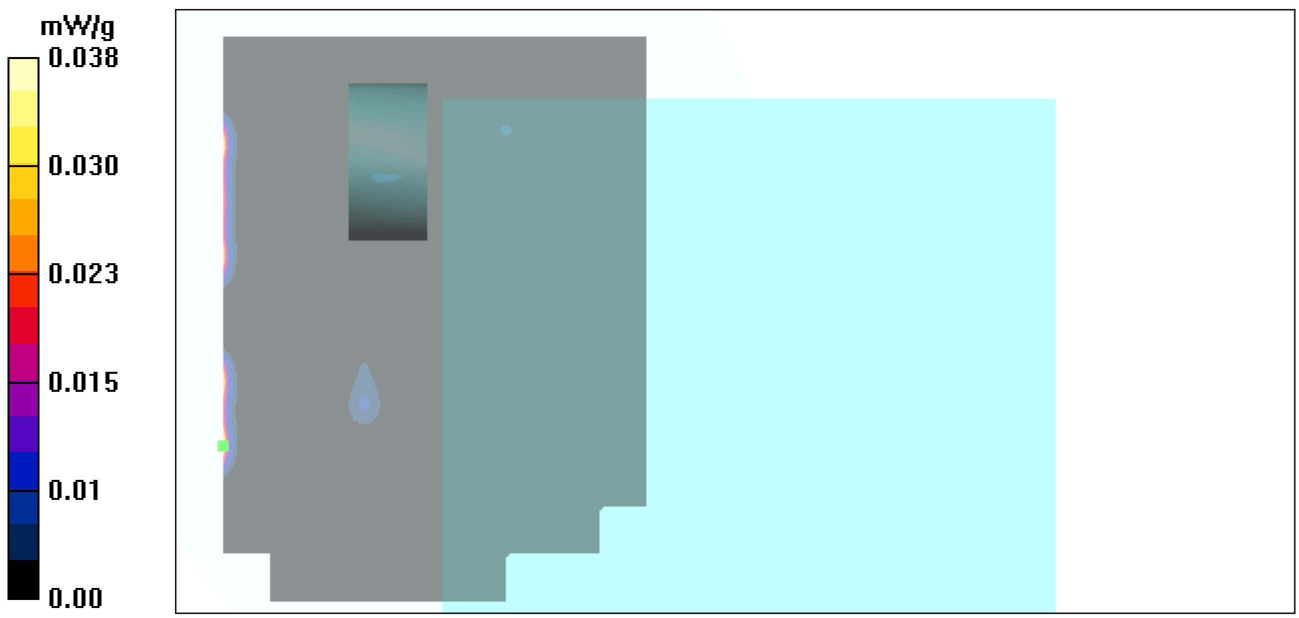
Ambient Temp: 21.4 deg C; Fluid Temp: 20.8 deg C

Communication System: DTS ; ; Frequency: 2437 MHz;Duty Cycle: 1:90
Medium: M2450 Medium parameters used f = 2450 MHz; $\sigma = 2.01$ mho/m; $\varepsilon_r = 50.7$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

- Probe: EX3DV3 - SN3511; ConvF(7.66, 7.66, 7.66); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/16/2003
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Area Scan (91x121x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.038 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.12 V/m; Power Drift = 0.41 dB
Peak SAR (extrapolated) = 0.098 W/kg
SAR(1 g) = 0.00352 mW/g; SAR(10 g) = 0.00246 mW/g
Maximum value of SAR (measured) = 0.059 mW/g



APPENDIX B - SYSTEM VALIDATION

System Validation **Date/Time: 05/24/2005**

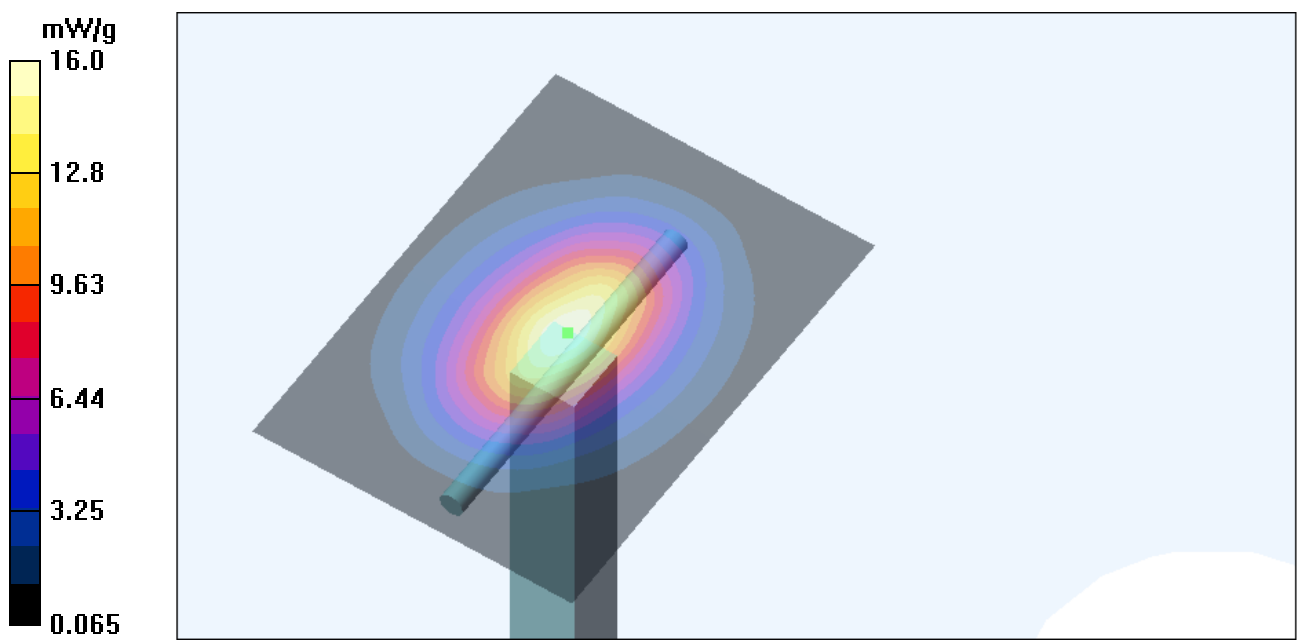
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 002

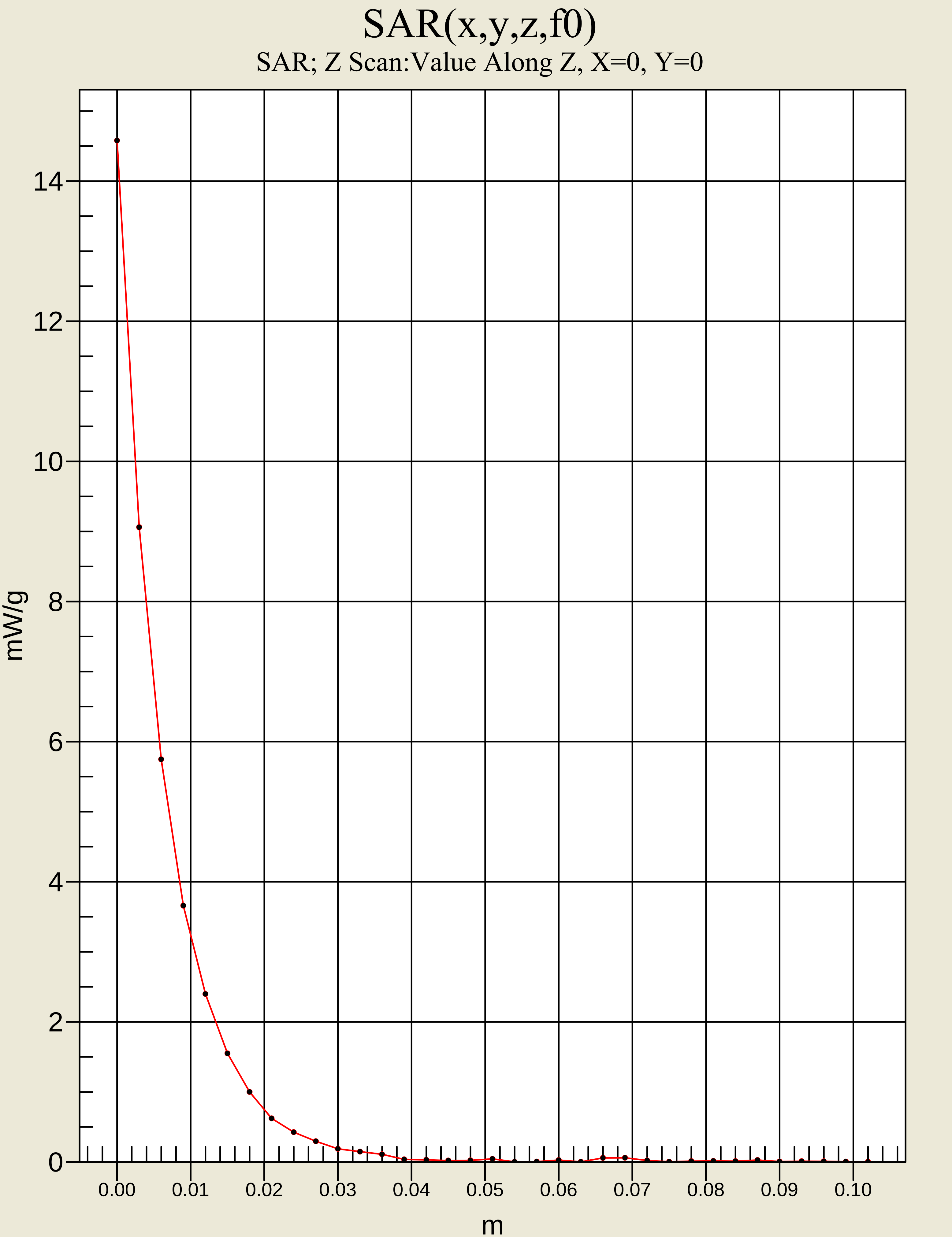
Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL2450
Medium parameters used: f = 2450 MHz; σ = 1.86 mho/m; ε_r = 40.8; ρ = 1000kg/m^3
Phantom section: Flat Section

- Probe: EX3DV3 - SN3511; ConvF(7.5, 7.5, 7.5); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/16/2003
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Area Scan (51x71x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 16.0 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 90.1 V/m; Power Drift = 0.023 dB
Peak SAR (extrapolated) = 28.5 W/kg
SAR(1 g) = 13.1 mW/g; SAR(10 g) = 5.84 mW/g
Maximum value of SAR (measured) = 15.0 mW/g




SAR(x,y,z,f0)
SAR; Z Scan:Value Along Z, X=0, Y=0
mW/g
14
12
10
8
6
4
2
0
0.00
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.10
m

APPENDIX C – PROBE CALIBRATION CERTIFICATE

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

Client **MET Laboratories EMC**

CALIBRATION CERTIFICATE

Object(s)	EX3DV3 - SN:3511
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	January 23, 2004
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

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

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

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Reference 20 dB Attenuator	SN: 5086 (20b)	3-Apr-03 (METAS, No. 251-0340)	Apr-04
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator R&S SMT06	100058	23-May-01 (SPEAG, in house check May-03)	In house check: May-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-03)	In house check: Oct 05

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

Date issued: January 26, 2004

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

Probe EX3DV3

SN:3511

Manufactured:	December 15, 2003
Last calibrated:	January 23, 2004

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: EX3DV3 SN:3511

Sensitivity in Free Space

NormX	**0.77** $\mu V/(V/m)^2$
NormY	**0.64** $\mu V/(V/m)^2$
NormZ	**0.65** $\mu V/(V/m)^2$

Diode Compression[A]

DCP X	**97**	mV
DCP Y	**97**	mV
DCP Z	**97**	mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Plese see Page 7.

Boundary Effect

Head **5500 MHz** **Typical SAR gradient: 28 % per mm**

Sensor Cener to Phantom Surface Distance		**2.0 mm**	**3.0 mm**
SAR_{be} [%]	Without Correction Algorithm	16.0	8.6
SAR_{be} [%]	With Correction Algorithm	0.0	0.0

Sensor Offset

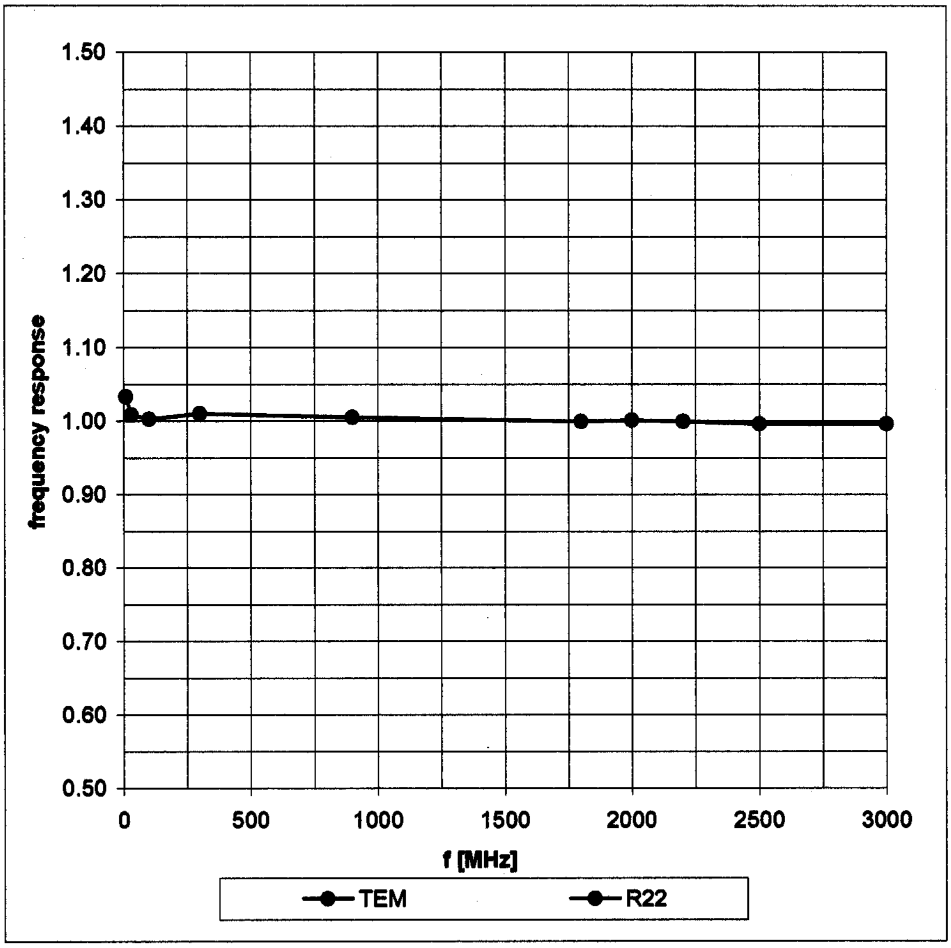
Probe Tip to Sensor Center **1.0** mm

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

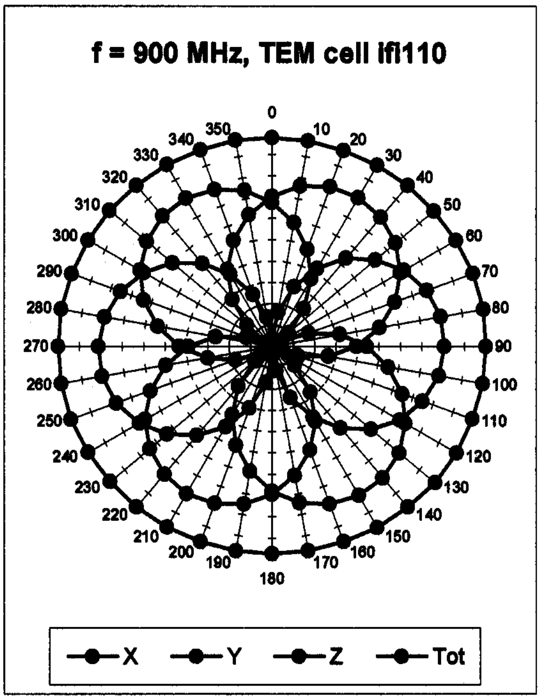
[A] numerical linearization parameter: uncertainty not required

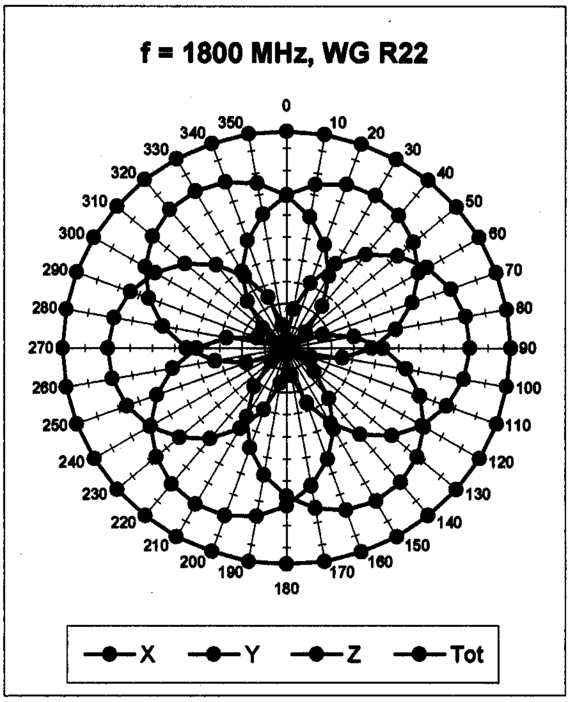
Frequency Response of E-Field

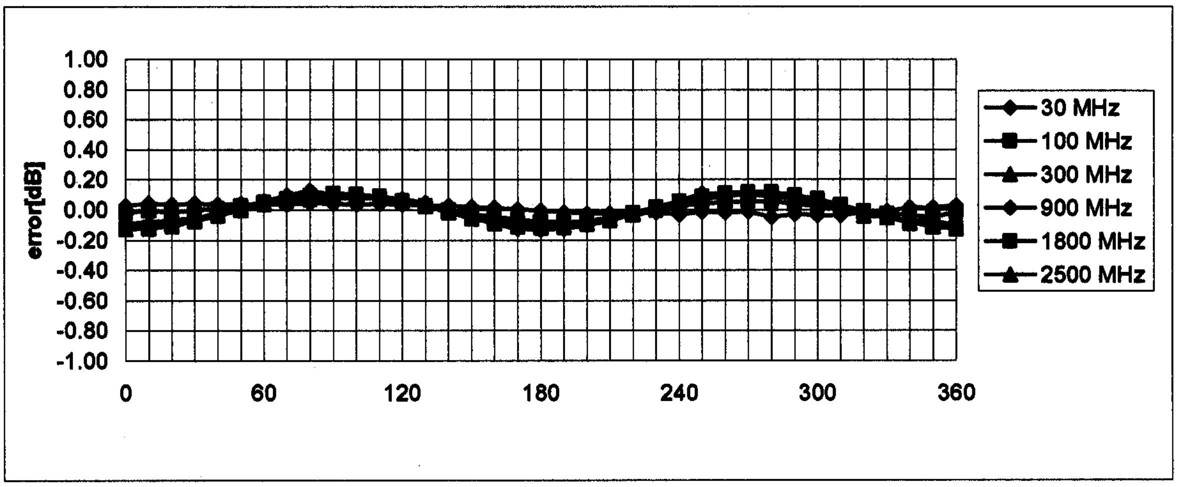
(TEM-Cell:ifi110, Waveguide R22)



Receiving Pattern (ϕ), θ = 0°



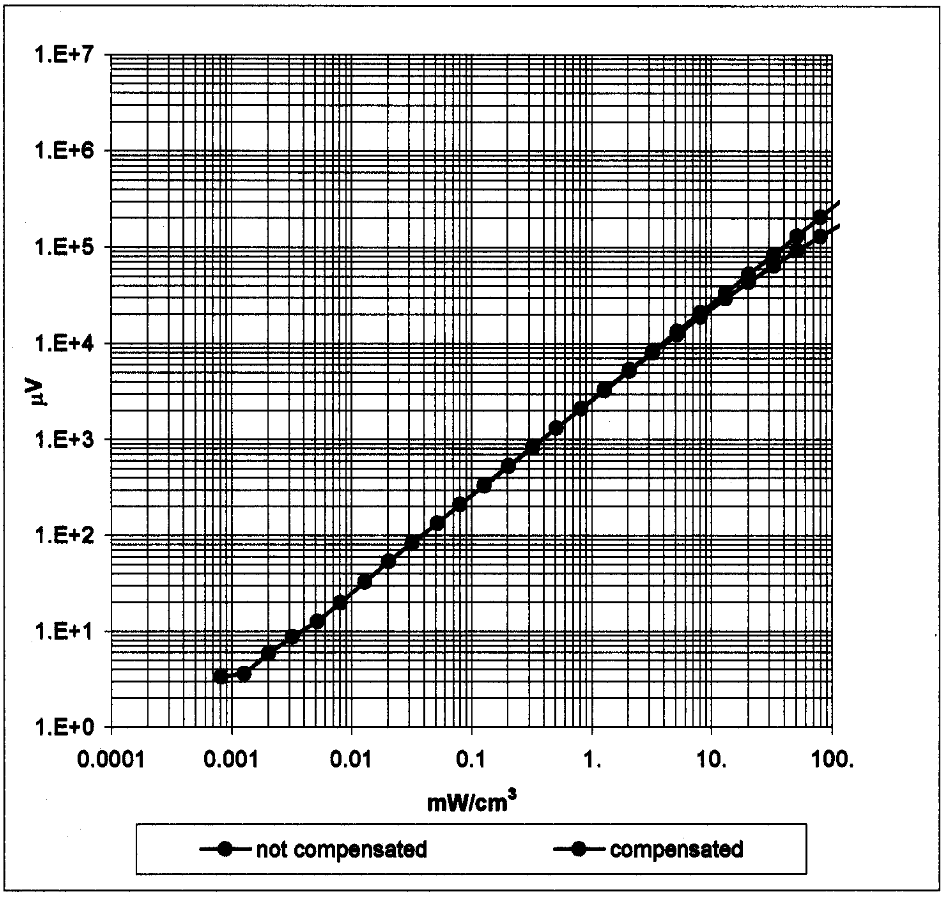


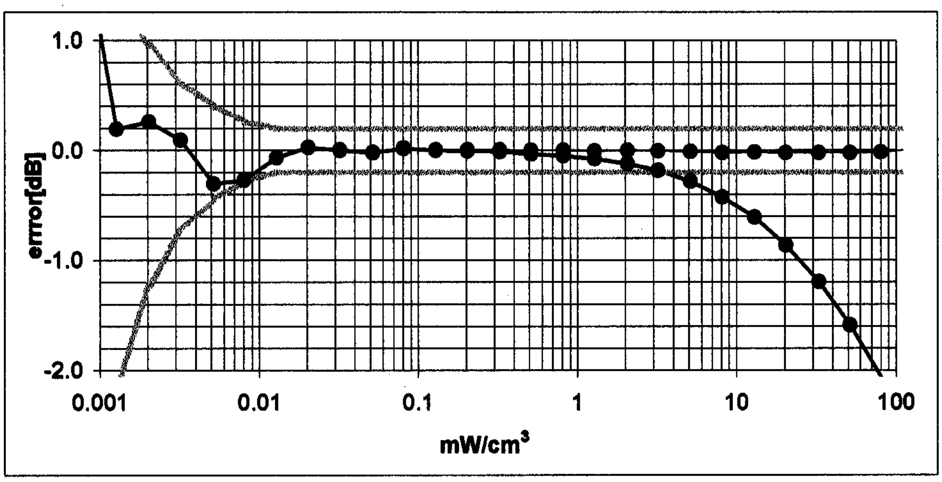


Axial Isotropy Error < ± 0.2 dB

Dynamic Range f(SAR_{head})

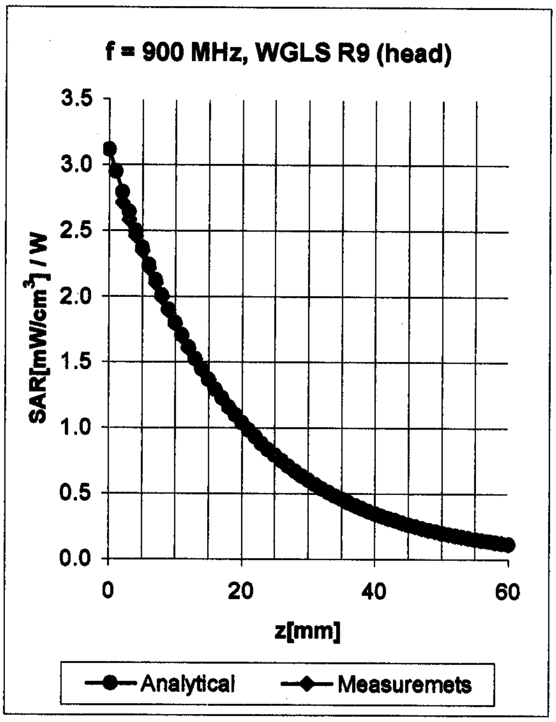
(Waveguide R22)

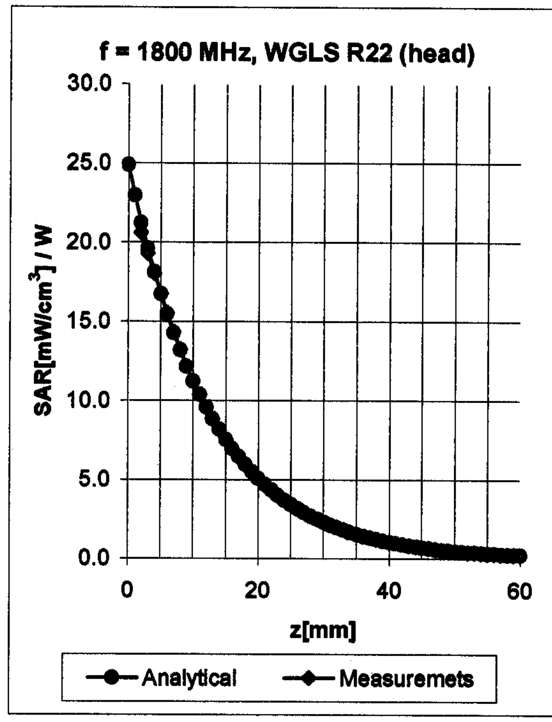




Probe Linearity < ± 0.2 dB

Conversion Factor Assessment



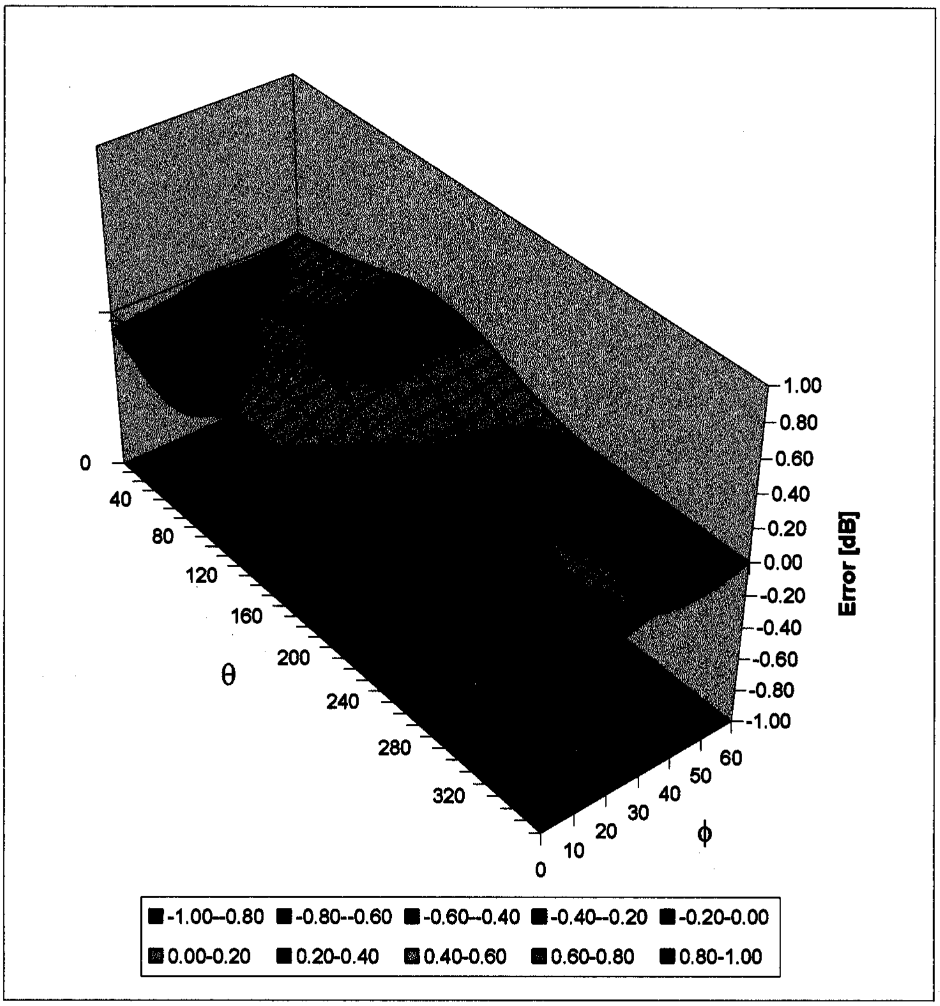


f [MHz]	Validity [MHz][B]	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
900	800-1000	Head	41.5 ± 5%	0.97 ± 5%	0.18	1.60	9.43	± 11.3% (k=2)
1800	1710-1910	Head	40.0 ± 5%	1.40 ± 5%	0.20	2.00	8.11	± 11.7% (k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	0.15	2.00	7.50	± 9.7% (k=2)
5500	5225-5775	Head	35.6 ± 5%	4.96 ± 5%	0.42	1.80	4.46	± 22.6% (k=2)
2450	2400-2500	Body	52.7 ± 5%	1.95 ± 5%	0.15	2.00	7.66	± 9.7% (k=2)
5500	5225-5775	Body	48.6 ± 5%	5.65 ± 5%	0.45	1.90	3.84	± 22.6% (k=2)

[B] The total standard uncertainty is calculated as root-sum-square of standard uncertainty of the Conversion Factor at calibration frequency and the standard uncertainty for the indicated frequency band.

Deviation from Isotropy in HSL

Error (θ,φ), f = 900 MHz



Spherical Isotropy Error < ± 0.4 dB

APPENDIX D – DIPOLE CALIBRATION CERTIFICATE

2400 MHz System Validation Dipole

Type:	2450Mhz

Serial Number:	002

Place of Calibration:	**MET Laboratories, Inc.** 4855 Patrick Henry Dr. Bldg #6 Santa Clara, CA 95054USA

Date of Calibration:	09 February 2004

MET Laboratories, Inc certifies that this device has been calibrated on the date indicated above.

:

Approved By:

Shawn McMillen
SAR Compliance Manager

1. Measurement Conditions

The DASY4 System with a dosimetric E-Field probe EX3DV3 (3511), Conversion factor 7.5 at 2450 MHz was used for the measurements.

The measurements were performed in the flat section of the SAM twin phantom filled with head tissue simulating solution of the following electrical parameters at 1900 MHz:

Relative Dielectricity	38	±5%
Conductivity	1.88	±5%

The dipole was mounted so that the dipole feed point was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to solution surface. A loss-less dielectric spacer was used during measurements for accurate distance positioning.

The course 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 measurement 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 average SAR values measured with the dosimetric probe EX3DV3 (3511), and applying advanced extrapolation are:

Averaged over 1cm^3 (1g) of tissue:	50.4 mW/g
Averaged over 10cm^3 (10g) of tissue:	22.8 mW/g

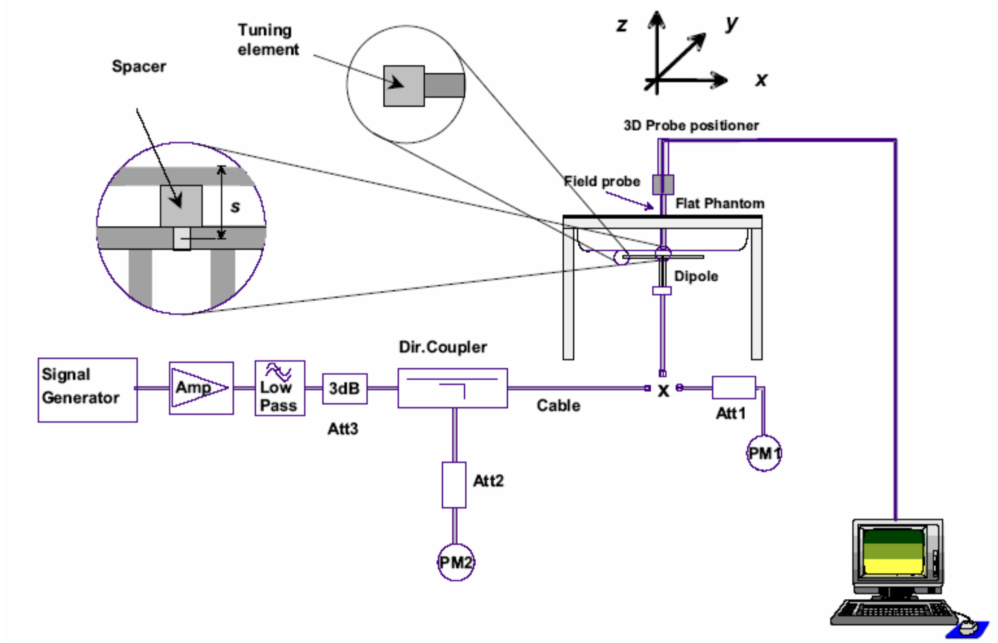
3. Dipole Impedance and Return Loss

The dipole was positioned at the flat phantom sections according to section 1 with the 10mm spacer. The impedance and return loss measurements are

Complex impedance at 1900 MHz	Re{Z}= 47.568 Ω
	Im {Z}= 1.4141Ω
Return Loss at 1900 MHz	-30.849 dB

4. SAR Measurement

The SAR measurement was performed with the E-field probe in mechanical detection mode only. The setup and determination of the forward power into the dipole was performed using the following procedures.



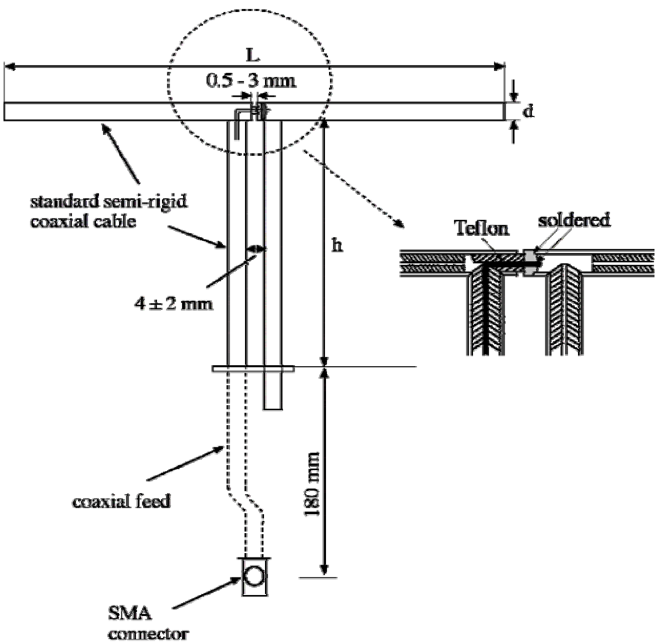
First the power meter PM1 (including attenuator Att1) is connected to the RF cable to measure the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at the dipole connector (taking into account the attenuation of Att1) as read by power meter PM2. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter PM2. If the signal generator does not allow adjustment in 0.01dB steps, the remaining difference at PM2 must be taken into consideration. The matching of the dipole should be checked using a network analyzer to ensure that the reflected power is at least 20 dB below the forward power.

4. Handling

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

5. Design

The validation dipole is made of standard semi ridged coaxial cable and is constructed in accordance with the IEEE Std "Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques". The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.



Frequency (MHz)	L (mm)	h (mm)	d (mm)
300	396.0	250.0	6.35
450	270.0	166.7	6.35
835	161.0	89.8	3.6
900	149.0	83.3	3.6
1450	89.1	51.7	3.6
1800	72.0	41.7	3.6
1900	68.0	39.5	3.6
2000	64.5	37.5	3.6
2450	51.8	30.4	3.6
3000	41.5	25.0	3.6

Validation Dipole Dimensions

File Name: 2450MHz

02/09/04

2450MHz Dipole

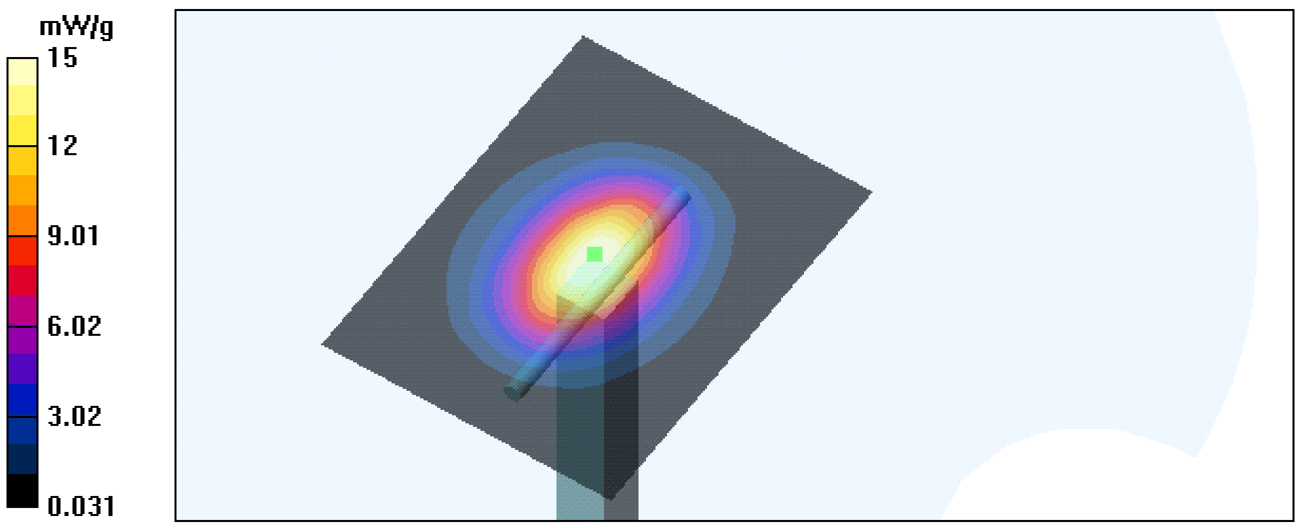
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:002

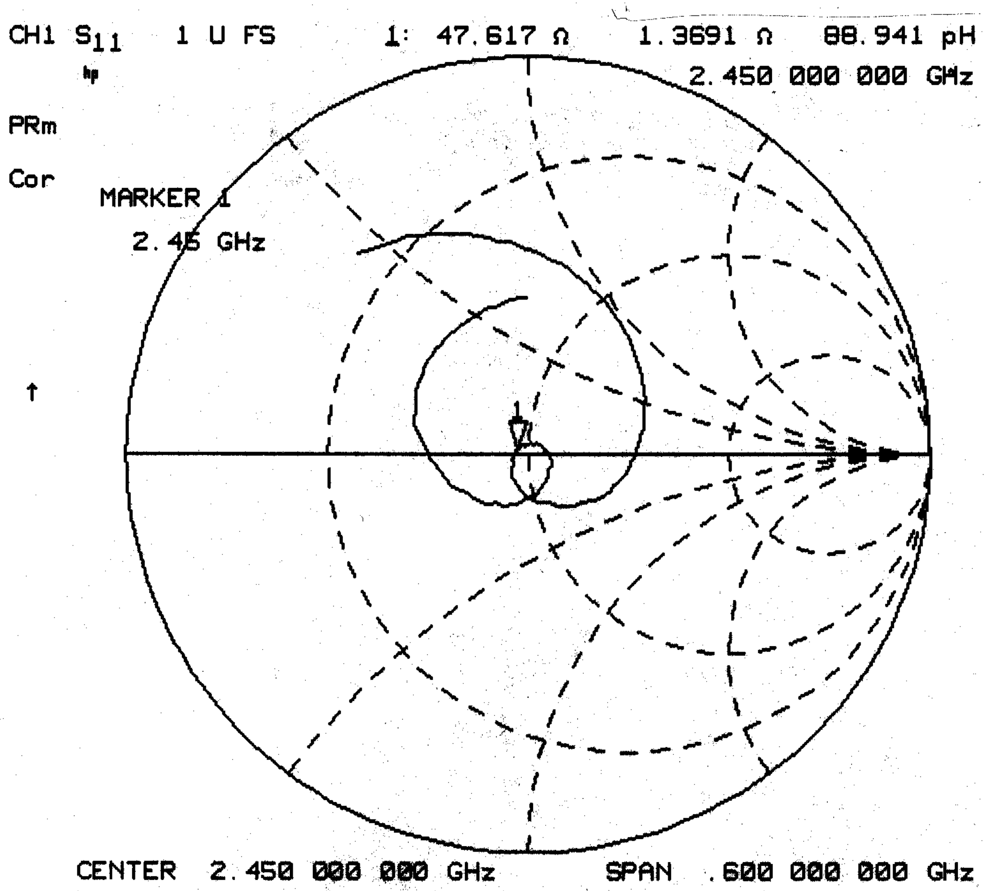
Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used: f = 2450 MHz; σ = 1.88 mho/m; ε_r = 38.0; ρ = 1000 kg/m^3
Phantom section: Flat Section

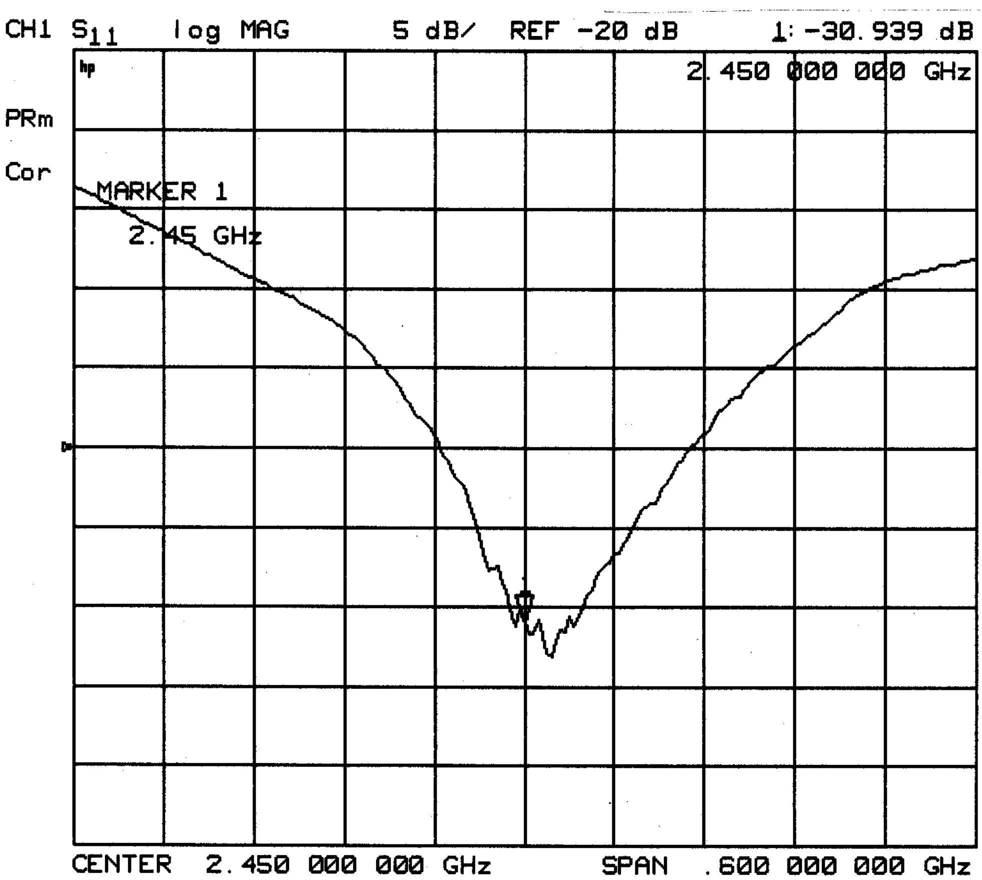
Ambient Temp 24.2 deg C; Fluid Temp 23.9deg C

- Probe: EX3DV3 - SN3511; ConvF(7.5, 7.5, 7.5); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/16/2003
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112

Area Scan (61x81x1): Measurement grid: dx=10mm, dy=10mm
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.3 V/m; Power Drift = -0.1 dB
Maximum value of SAR (measured) = 14.5 mW/g
Peak SAR (extrapolated) = 27.4 W/kg
SAR(1 g) = 12.6 mW/g; SAR(10 g) = 5.69 mW/g




CH1 S_{11} 1 U FS 1: 47.617 Ω 1.3691 Ω 88.941 pH
2.450 000 000 GHz
PRm
Cor
MARKER 1
2.45 GHz
CENTER 2.450 000 000 GHz SPAN .600 000 000 GHz


CH1 S_{11} log MAG 5 dB/ REF -20 dB 1: -30.939 dB
2.450 000 000 GHz
PRm
Cor
MARKER 1
2.45 GHz
CENTER 2.450 000 000 GHz SPAN .600 000 000 GHz

APPENDIX E - MEASURED FLUID DIELECTRIC PARAMETERS

2450MHz Head

May 24, 2005

Frequency	e'	e''
2.400000000 GHz	41.0584	13.5150
2.402000000 GHz	41.0466	13.5351
2.404000000 GHz	41.0369	13.5240
2.406000000 GHz	41.0377	13.5449
2.408000000 GHz	41.0261	13.5650
2.410000000 GHz	41.0273	13.5797
2.412000000 GHz	41.0126	13.5761
2.414000000 GHz	41.0056	13.5979
2.416000000 GHz	40.9881	13.6144
2.418000000 GHz	40.9746	13.5921
2.420000000 GHz	40.9432	13.5827
2.422000000 GHz	40.9343	13.5888
2.424000000 GHz	40.9314	13.5984
2.426000000 GHz	40.9156	13.5900
2.428000000 GHz	40.9292	13.6114
2.430000000 GHz	40.8999	13.6209
2.432000000 GHz	40.9063	13.6076
2.434000000 GHz	40.8944	13.6134
2.436000000 GHz	40.9013	13.6437
2.438000000 GHz	40.8746	13.6657
2.440000000 GHz	40.8617	13.6636
2.442000000 GHz	40.8449	13.6769
2.444000000 GHz	40.8339	13.6966
2.446000000 GHz	40.8138	13.7128
2.448000000 GHz	40.8186	13.7303
2.450000000 GHz	40.8146	13.7380
2.452000000 GHz	40.7902	13.7523
2.454000000 GHz	40.7799	13.7627
2.456000000 GHz	40.7635	13.7728
2.458000000 GHz	40.7584	13.7757
2.460000000 GHz	40.7405	13.7872
2.462000000 GHz	40.7267	13.7803
2.464000000 GHz	40.7281	13.7805
2.466000000 GHz	40.7126	13.7782
2.468000000 GHz	40.7008	13.7930
2.470000000 GHz	40.6982	13.8084
2.472000000 GHz	40.6810	13.8106
2.474000000 GHz	40.6778	13.8120
2.476000000 GHz	40.6684	13.8131
2.478000000 GHz	40.6707	13.8271
2.480000000 GHz	40.6585	13.8249
2.482000000 GHz	40.6521	13.8291
2.484000000 GHz	40.6334	13.8328
2.486000000 GHz	40.6271	13.8370
2.488000000 GHz	40.6299	13.8448

2450MHz Body

May 24, 2005

Frequency	e'	e''
2.349999872 GHz	52.0189	14.3650
2.353854460 GHz	52.0103	14.3820
2.357709048 GHz	51.9959	14.4062
2.361563635 GHz	51.9707	14.4213
2.365418223 GHz	51.9530	14.4422
2.369272811 GHz	51.9482	14.4552
2.373159011 GHz	51.9368	14.4687
2.377045211 GHz	51.9080	14.4738
2.380931412 GHz	51.8764	14.4824
2.384817612 GHz	51.8516	14.4904
2.388703812 GHz	51.8344	14.5226
2.392621884 GHz	51.8165	14.5298
2.396539956 GHz	51.7967	14.5656
2.400458028 GHz	51.7739	14.5865
2.404376100 GHz	51.7585	14.6133
2.408294172 GHz	51.7509	14.6158
2.412244377 GHz	51.7278	14.6450
2.416194582 GHz	51.7024	14.6660
2.420144787 GHz	51.6908	14.6737
2.424094992 GHz	51.6642	14.6964
2.428045197 GHz	51.6632	14.7062
2.432027798 GHz	51.6326	14.7342
2.436010400 GHz	51.6241	14.7497
2.439993002 GHz	51.6096	14.7692
2.443975603 GHz	51.5879	14.7827
2.447958205 GHz	51.5460	14.7919
2.451973469 GHz	51.5337	14.7826
2.455988733 GHz	51.5061	14.8117
2.460003997 GHz	51.4909	14.8475
2.464019261 GHz	51.4832	14.8592
2.468034525 GHz	51.4657	14.8720
2.472082719 GHz	51.4444	14.8786
2.476130913 GHz	51.4241	14.8916
2.480179107 GHz	51.4096	14.8972
2.484227301 GHz	51.3785	14.9015
2.488275495 GHz	51.3586	14.9144
2.492356890 GHz	51.3537	14.9270
2.496438284 GHz	51.3365	14.9328
2.500519679 GHz	51.3128	14.9510
2.504601073 GHz	51.3097	14.9615
2.508682467 GHz	51.2859	14.9763
2.512797334 GHz	51.2581	14.9850
2.516912201 GHz	51.2190	14.9934
2.521027068 GHz	51.2121	15.0207
2.525141935 GHz	51.1971	15.0358

APPENDIX F – PHANTOM CERTIFICATE OF CONFORMITY

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

Certificate of conformity / First Article Inspection

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

Tests

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

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

Standards

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

Conformity

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

Date 7.8.2003

Signature / Stamp

speag
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