MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*

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Dosimetric Assessment Test Report

for the

Pepper Computer Inc.,
Pepper Wireless PAD

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

Prepared for

Pepper Computer Inc.
10 Maguire Road, Suite 221
Lexington, MA 02421

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: S5Y1234
APPLICANT: Pepper Computer Inc.

Applicant Name and Address: Pepper Computer Inc.
10 Maguire Road, Suite 221
Lexington, MA 02421
USA

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

EUT:	Pepper Wireless PAD		
Date of Receipt:	May 31, 2005		
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: 5VDC		
Antenna:	Internal		
Production/prototype:	Production		
Modulation:	DTS		
Duty Cycle:	25%		
TX Range:	2412.0 – 2462.0MHz		
Maximum RF Power Output 2450MHz Band DTS Mode:	2437.0 MHz	EIRP	0.1 dBm
Maximum SAR Measurement	**0.089mW/g**		

Shawn McMillen
Senior Engineer

INTRODUCTION

This measurement report demonstrates that the Pepper Computer Inc., Pepper Wireless PAD FCC ID: S5Y1234 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).

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

where:

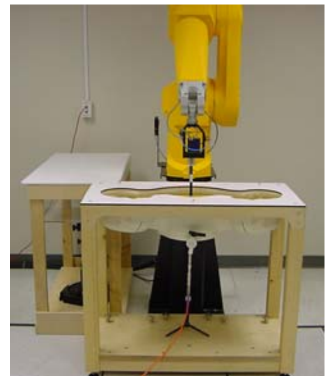
σ - conductivity of the tissue - simulant material (S/m)
ρ - mass density of the tissue - simulant material (kg/m3)
E - Total RMS electric field strength (V/m)

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:	Pepper Computer Inc.		
Description of Test Item:	Pepper Wireless PAD Model PP20624		
Pepper Pad FCC ID:	S5Y1234		
GEMTEK 802.11b 11Mbps Wireless LAN CF Card FCC ID:	MXF-F910131		
Bluetooth Chip Set:	Infineon Model ROK104001		
Supply Voltage:	Primary Power: 120 VAC, 60 Hz Secondary: 5VDC		
Antenna Type(s) Tested:	Internal		
Modes and Bands of Operation:	DTS 2450MHz		
Maximum Duty Cycle Tested:	25%		
Transmitter Frequency Range (MHz)	2412.0 – 2462.0MHz		
Tested Frequency (MHz)	2437.0 MHz		
Maximum RF Power Output 2450MHz Band DTS Mode:	2437.0 MHz	EIRP	0.1dBm
Maximum SAR Measured	0.089mW/g @ mid channel		
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

BODY SAR MEASUREMENT RESULTS (2450MHz) Band									
Freq (MHz)	Chan	Test Mode	EIRP	Power Supply	Antenna Type	EUT Test Position	Phantom Section	Antenna housing Sep. Dist. (cm)	Measured SAR 1g (W/kg)
2437.0	Mid	DTS	0.1	Battery	Internal	Back	Planar	0.0	0.083
2437.0	Mid	DTS + Bluetooth	0.1	AC	Internal	Back	Planar	0.0	0.089
2437.0	Mid	DTS	0.1	AC	Internal	Top	Planar	0.0	0.039
2437.0	Mid	DTS	0.1	AC	Internal	Front End	Planar	0.0	0.081
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 31, 2005
Dielectric Constant εr	IEEE Target	Measured	Duty Cycle	25%
	52.7	54.1	Ambient Temperature (C)	20.9
Conductivity σ (mho/m)	IEEE Target	Measured	Fluid Temperature (C)	20.8
	1.95	1.93	Fluid Depth	≥15cm

DETAILS OF SAR EVALUATION

The Pepper Computer Inc., Pepper Wireless PAD 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 two different orientations. The EUT was placed with the back, top and front end next to the planar section of the phantom in order to facilitate a 0.0cm separation between the EUT housing and the phantom surface. The EUT was tested at the mid channel of the TX band. 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 11mb/sec which produced the highest conducted power level. The unit communicated with the base station over the course of the evaluation.

3. Duty Cycle Determination:
   a. Method one – A Unix "Time" command was utilized which measures the amount of time it took to transfer a video file to the nearest millisecond. The transfer was repeated 16 times on the Pepper Pad to get an average transfer time which came to 9.954 seconds. Based on the MTU size, headers etc, it was estimated that 26.3 million bits were transferred during this timeframe. The theoretical or max transfer during this time based on the WiFi fundamental bit rate of 11 mb/sec was 109.5 mb/sec. Dividing the two values gave an estimated minimum TX duty cycle of 24.05%.
   b. Method two – The transfer was observed on the interface itself of all packets using the "ethereal" sniffer program. A trace of the entire file transfer from file open to close was captured. The observed file was transferred in 4096 byte blocks with 79 bytes of header added to each packet (each block is 4 packets, 3 of 1314 and 1 of 470 bytes). All the blocks sent were averaged, and it was found that each packet sent was 2ms second apart and each block of four packets started, on average, 13.7 ms apart. Based on this, the 13.7ms fundamental time to transfer without error was roughly 3.2 ms out of 13.7 ms, which calculated to a duty cycle of roughly 23.42%. The duty cycle was rounded to 25% for simplicity.

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

5. 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.

6. The fluid and air 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.

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

8. The measurement results were either at or near the noise floor of the SAR system. 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.

9. Z-axis scans were performed during the EUT SAR measurements. However, since the magnitude of the SAR is at or near the measurement floor of the system, the z-axis scan only produced random noise. Therefore, the z-axis scans for the EUT SAR measurements were not included in this test report

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)
μV/(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.

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

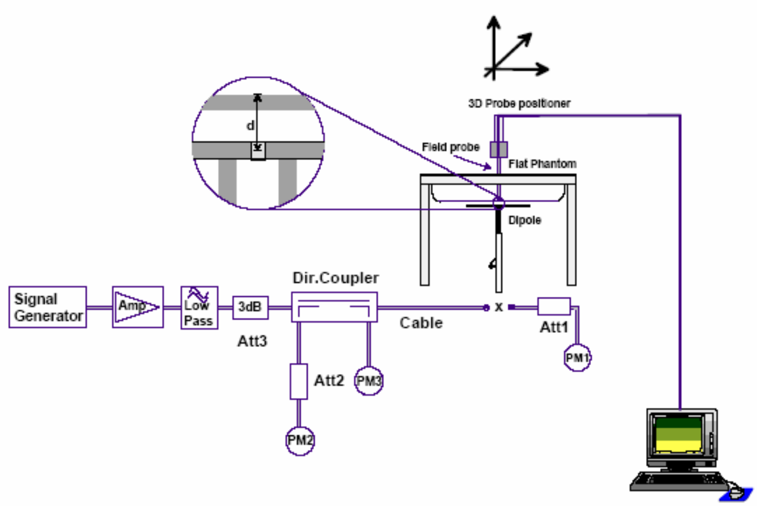
with P_{pwe} = Equivalent power density of a plane wave in mW/cm2
E_{tot} = total electric field strength in V/m
H_{tot} = total magnetic field strength in A/m

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			
05/31/05	Head	50.4±5%	48.0	39.2 ±5%	38.0	1.80±10%	1.78	20.9	20.6	≥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 SPECIFICATION

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

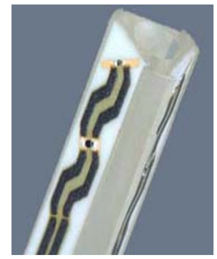
Model:	EX3DV3
Serial No.	3511
Construction:	Triangular core
Frequency:	10 MHz to > 6 GHz
Linearity:	± 0.2 dB (30 MHz to 3 GHz)

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)

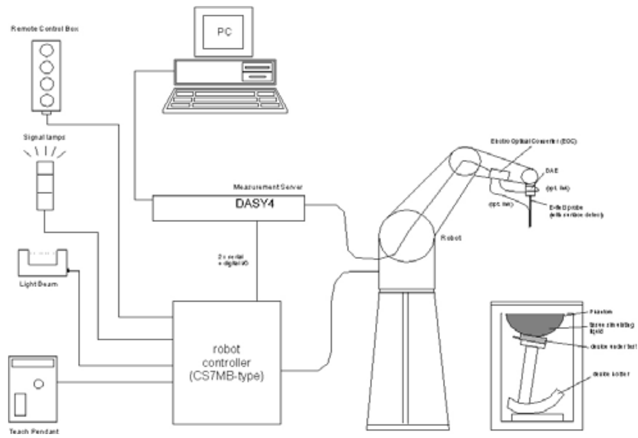
Dynamic Range: 5 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB

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 $\varepsilon = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

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

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 2004
HP E4418B Power Meter	GB40205140	June 2004
HP 8482A Power Sensor	2607A11286	June 2004
HP 8722D Vector Network Analyzer	3S36140188	March 2005
Anritsu Power Meter ML2488A	6K00001832	June 2004
Anritsu Power Sensor	030864	Jan 2004
Mini-Circuits Power Amplifier	D111903#8	N/A

MEASUREMENT UNCERTANTIES

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.

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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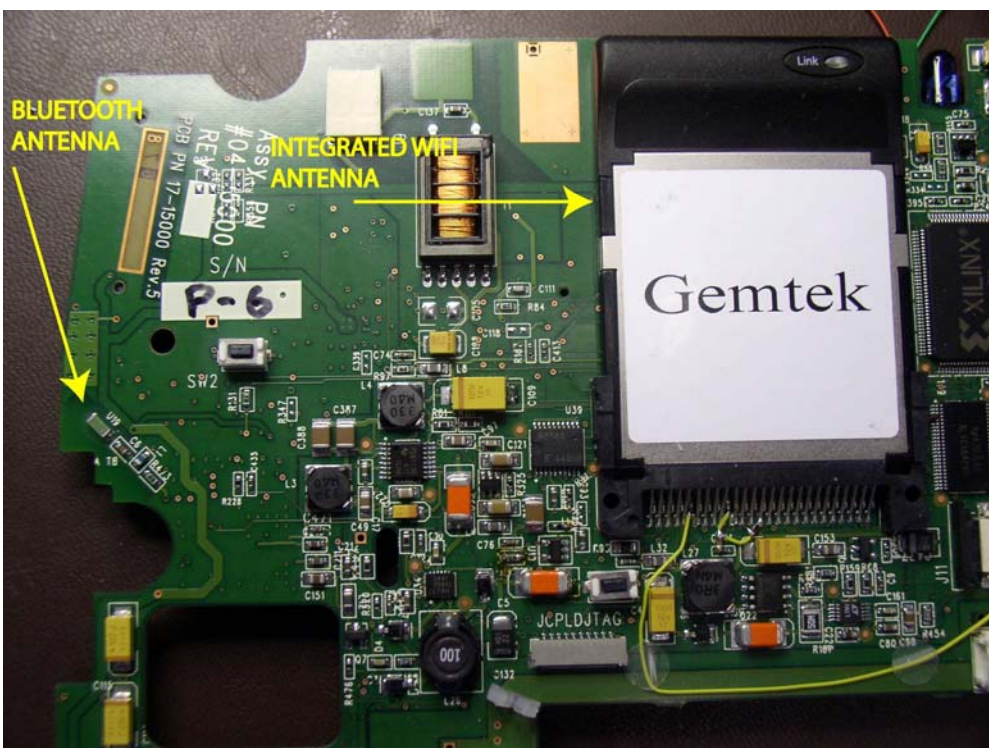
EUT PHOTOS

Photograph 1. Front of EUT

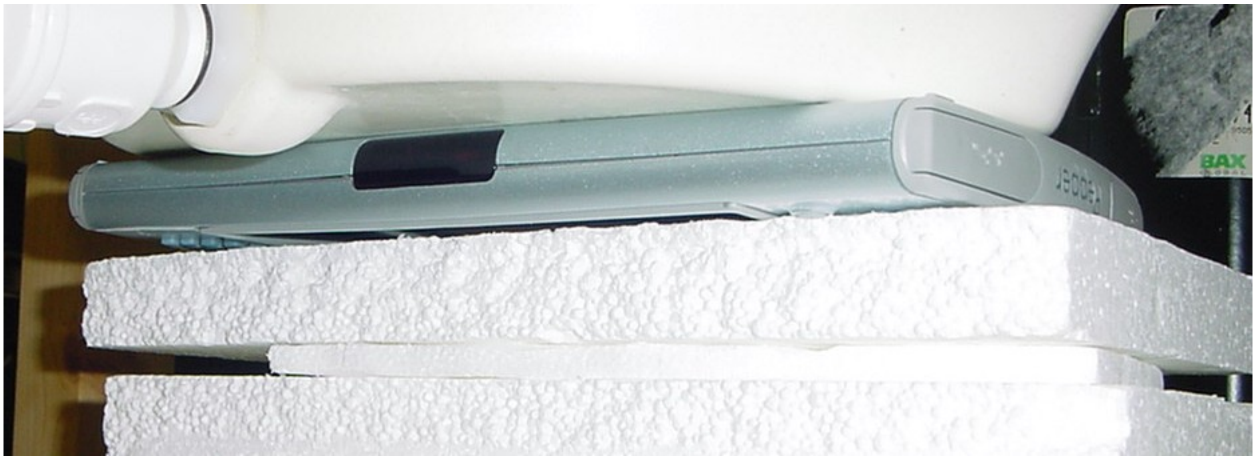
Photograph 2. Back of EUT

Photograph 3. EUT Internal View

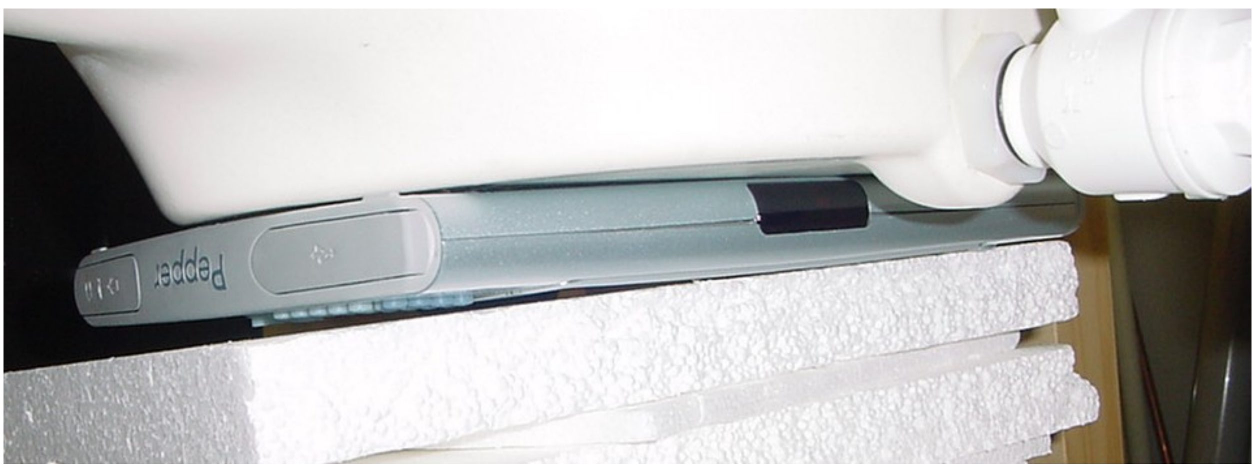


Photograph 4. Location of EUT Antennas

TEST SET-UP

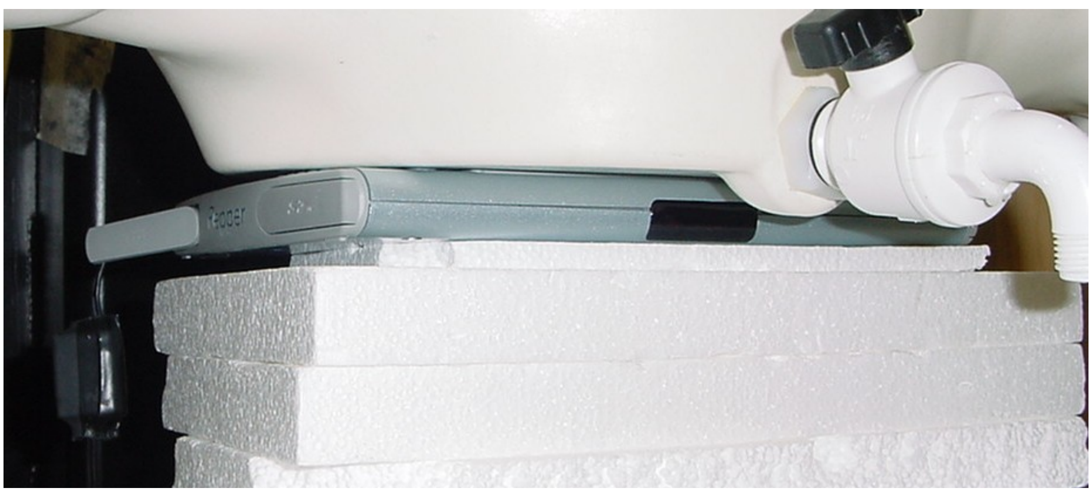


Photograph 5. Back Side of EUT at 0.0 cm Separation



Photograph 6. Back Side of EUT at 0.0 cm Separation

Photograph 7. Front Side of EUT at 0.0 cm Separation



Photograph 8. Front Side of EUT at 0.0 cm Separation

Photograph 9. Top End of EUT at 0.0 cm Separation

Photograph 10. Top End of EUT 0.0 cm Separation

APPENDIX A - SAR MEASUREMENT DATA

Mid ch 2437MHz Back side of EUT with Battery

Date: 5/31/2005

DUT: Pepper Computer, Inc.; Type: Pepper Wireless PAD

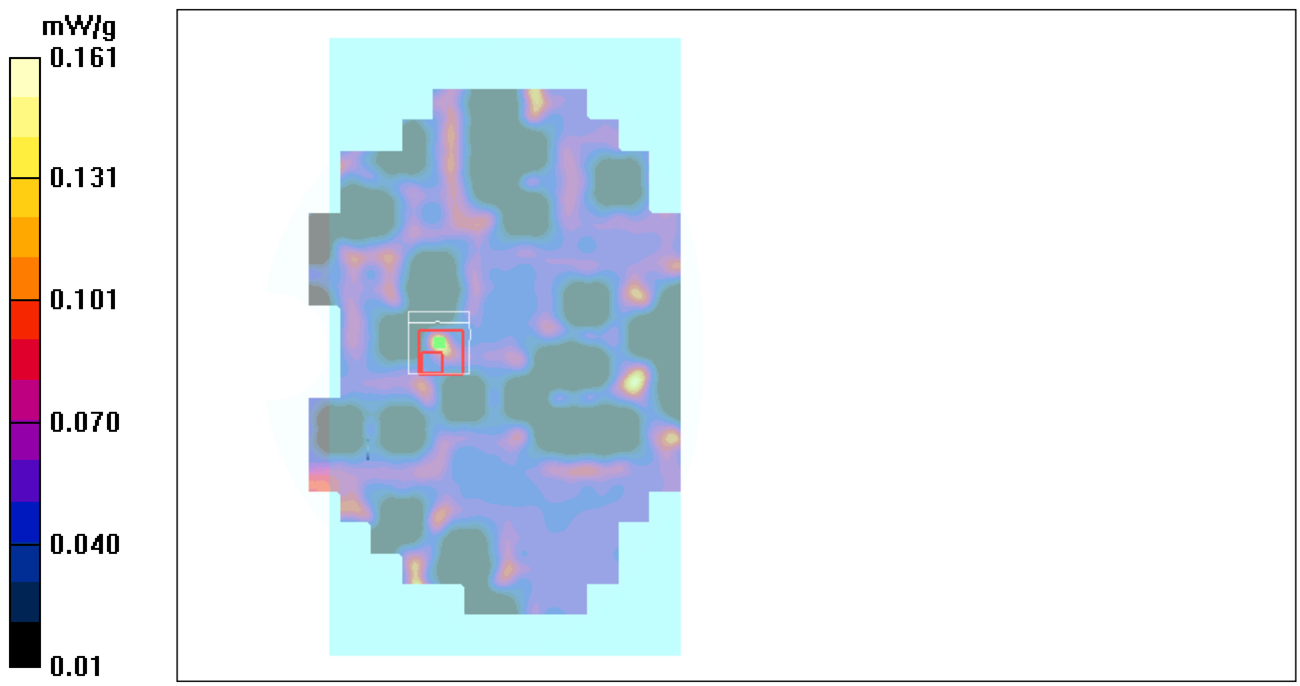
Ambient Temp: 20.9 deg C; Fluid Temp: 20.8 deg C

Communication System: DTS ; Frequency: 2437 MHz;Duty Cycle: 1:4
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 1.93 mho/m; ε_r = 54.1; 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 (131x171x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.152 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.12 V/m; Power Drift = -0.41dB
Peak SAR (extrapolated) = 0.290 W/kg
SAR(1 g) = 0.083 mW/g; SAR(10 g) = 0.061 mW/g
Maximum value of SAR (measured) = 0.160 mW/g



Mid ch 2437MHz Back side of EUT with Bluetooth on and with AC Power

Date: 5/31/2005

DUT: Pepper Computer Inc.; Type: Pepper Wireless PAD

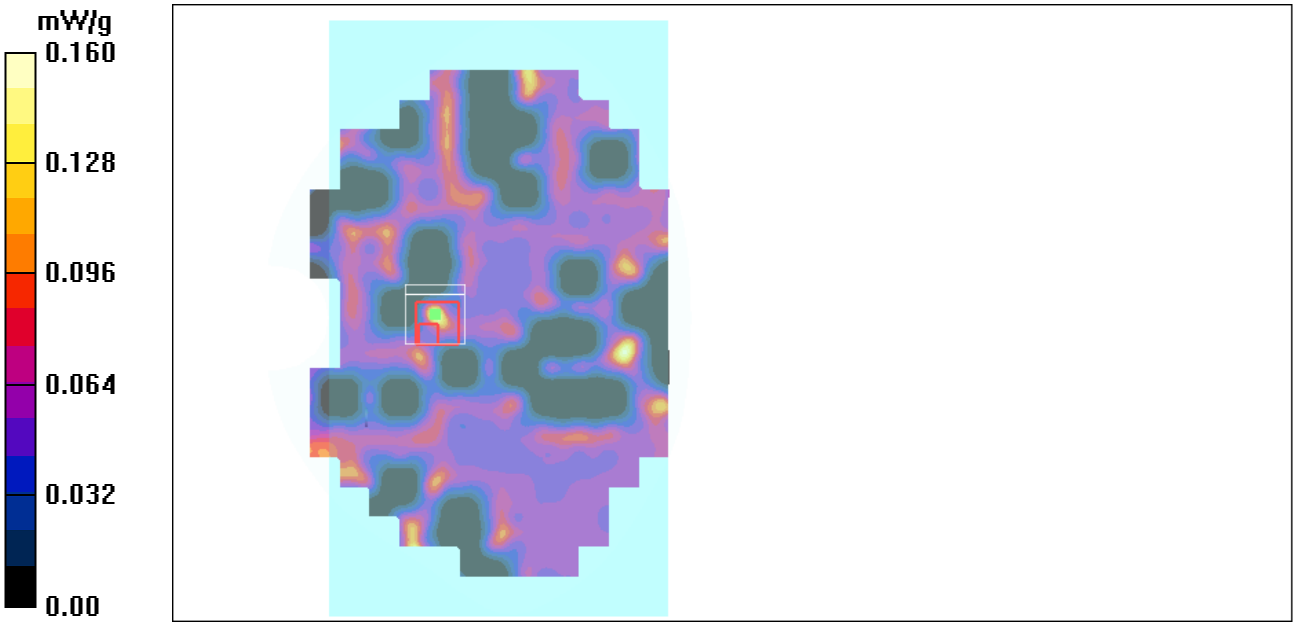
Ambient Temp: 20.9 deg C; Fluid Temp: 20.8 deg C

Communication System: DTS ; Frequency: 2437 MHz;Duty Cycle: 1:4
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 1.93 mho/m; ε_r = 54.1; 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 (131x171x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.160 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.12 V/m; Power Drift = -0.3dB
Peak SAR (extrapolated) = 0.305 W/kg
SAR(1 g) = 0.089 mW/g; SAR(10 g) = 0.065 mW/g
Maximum value of SAR (measured) = 0.167 mW/g



Mid ch 2437MHz Top Side of EUT with AC Power

Date: 5/31/2005

DUT: Pepper Computer Inc.; Type: Pepper Wireless PAD

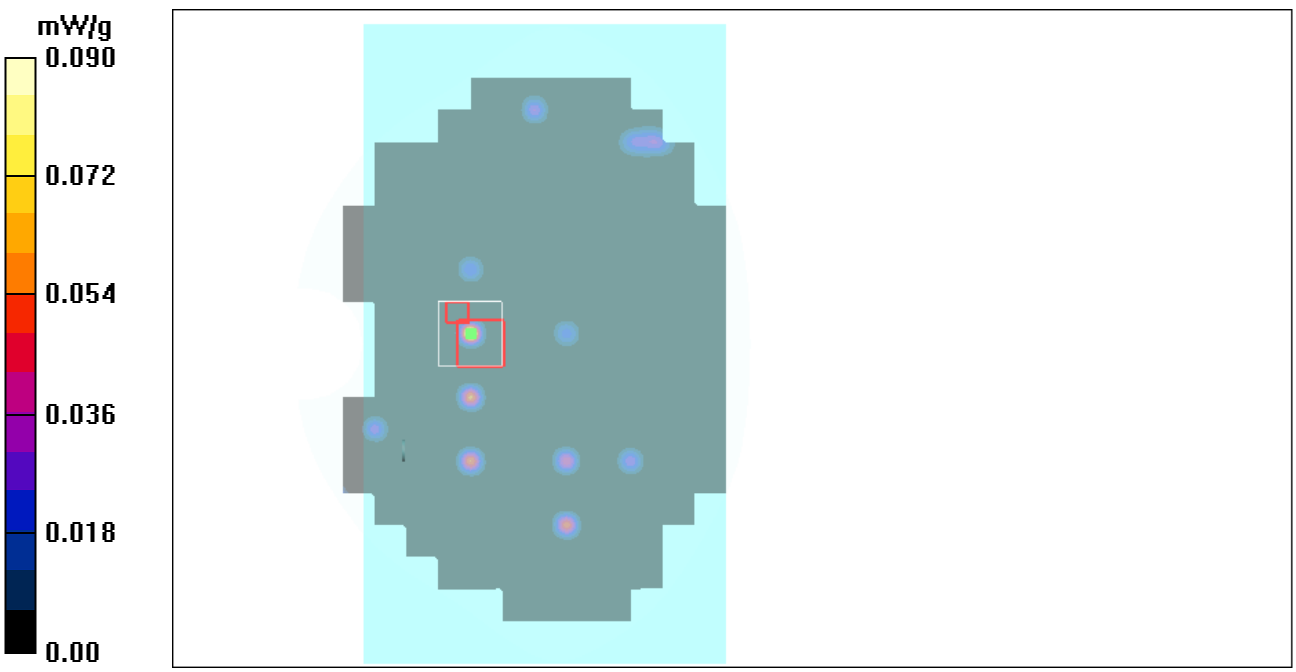
Ambient Temp: 20.9 deg C; Fluid Temp: 20.8 deg C

Communication System: DTS ; Frequency: 2437 MHz;Duty Cycle: 1:4
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 1.93 mho/m; ε_r = 54.1; 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 (131x171x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.089 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.18 V/m; Power Drift = -0.37dB
Peak SAR (extrapolated) = 0.211 W/kg
SAR(1 g) = 0.039 mW/g; SAR(10 g) = 0.015 mW/g
Maximum value of SAR (measured) = 0.144 mW/g



Mid Ch 2437MHz Front End of EUT with AC Power

Date: 5/31/2005

DUT: Pepper Computer Inc.; Type: Pepper Wireless PAD

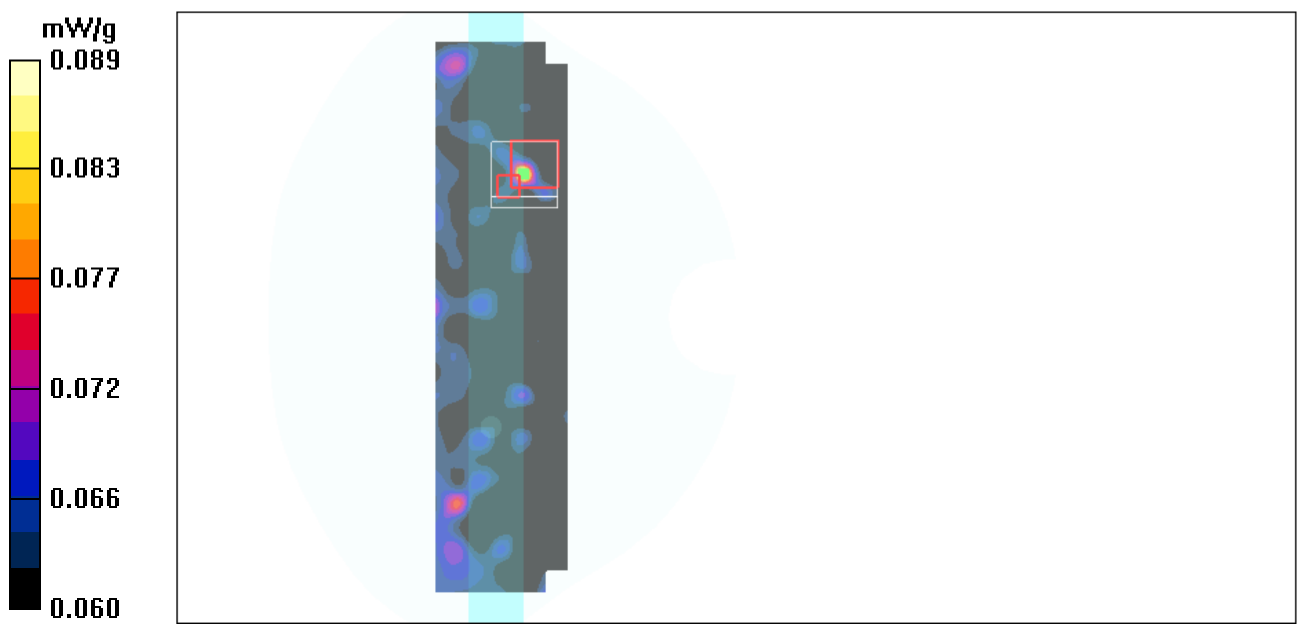
Ambient Temp: 20.9 deg C; Fluid Temp: 20.8 deg C

Communication System: DTS ; Frequency: 2437 MHz;Duty Cycle: 1:4
Medium: M2450 Medium parameters used: f = 2450 MHz; $\sigma = 1.93$ mho/m; $\varepsilon_r = 54.1$; $\rho = 1000$ 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 (61x251x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.087 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.54 V/m; Power Drift = 0.481 dB
Peak SAR (extrapolated) = 0.305 W/kg
SAR(1 g) = 0.081 mW/g; SAR(10 g) = 0.062 mW/g
Maximum value of SAR (measured) = 0.152 mW/g



APPENDIX B - SYSTEM PERFORMANCE CHECK

System Validation

Date: 05/31/2005

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

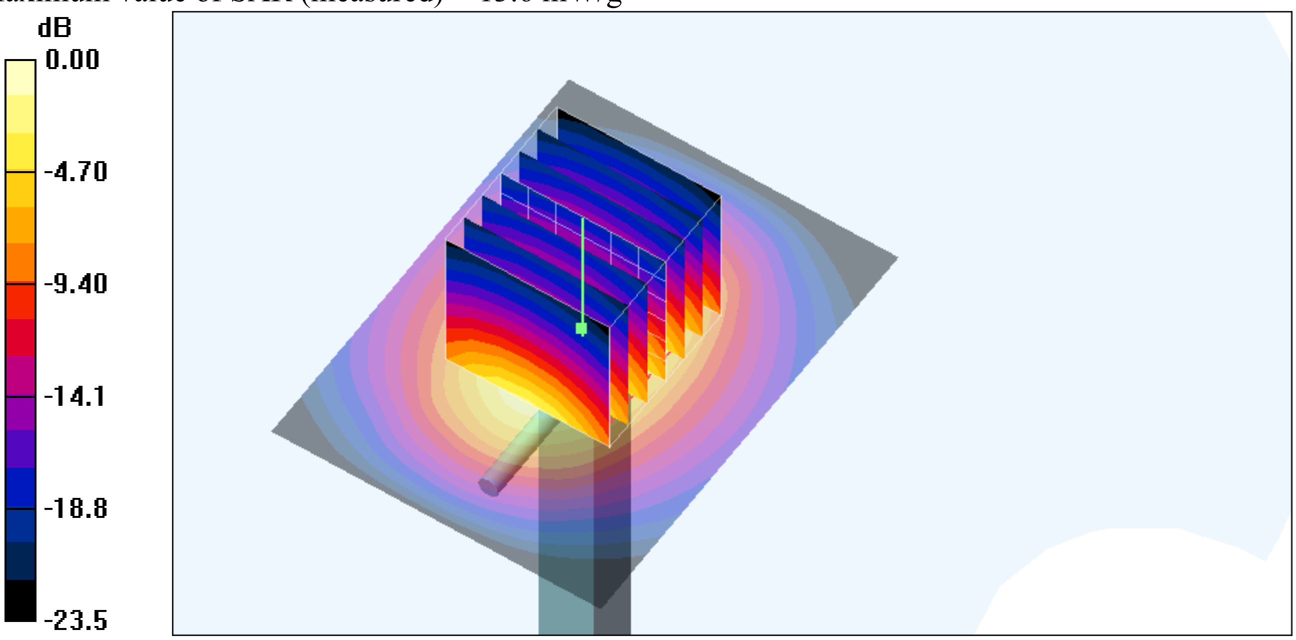
Ambient Temp: 20.9 deg C; Fluid Temp: 20.6 deg C

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used: f = 2450 MHz; σ = 1.78 mho/m; ε_r = 38; ρ = 1000 kg/m^3
Phantom section: Flat Section

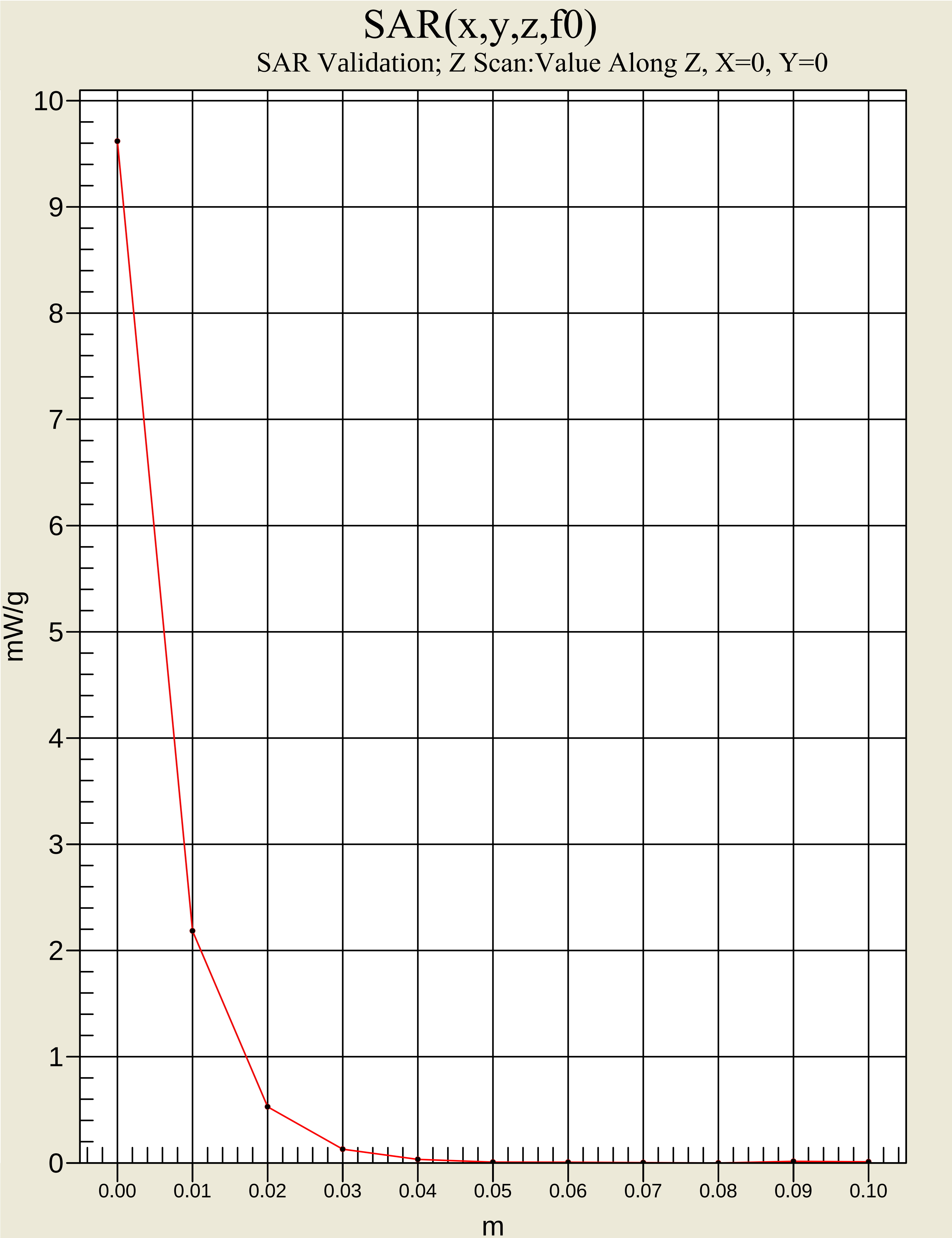
- Probe: EX3DV3 - SN3511; ConvF(7.5, 7.5, 7.5); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn584; Calibrated: 9/16/2003
- Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build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

Area Scan (61x81x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 14.2 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.1 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 25.9 W/kg
SAR(1 g) = 12 mW/g; SAR(10 g) = 5.38 mW/g
Maximum value of SAR (measured) = 13.6 mW/g



0 dB = 13.7mW/g


SAR(x,y,z,f0)
SAR Validation; Z Scan:Value Along Z, X=0, Y=0
mW/g
10
9
8
7
6
5
4
3
2
1
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	
Approved by:	Katja Pokovic	Laboratory Director	

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

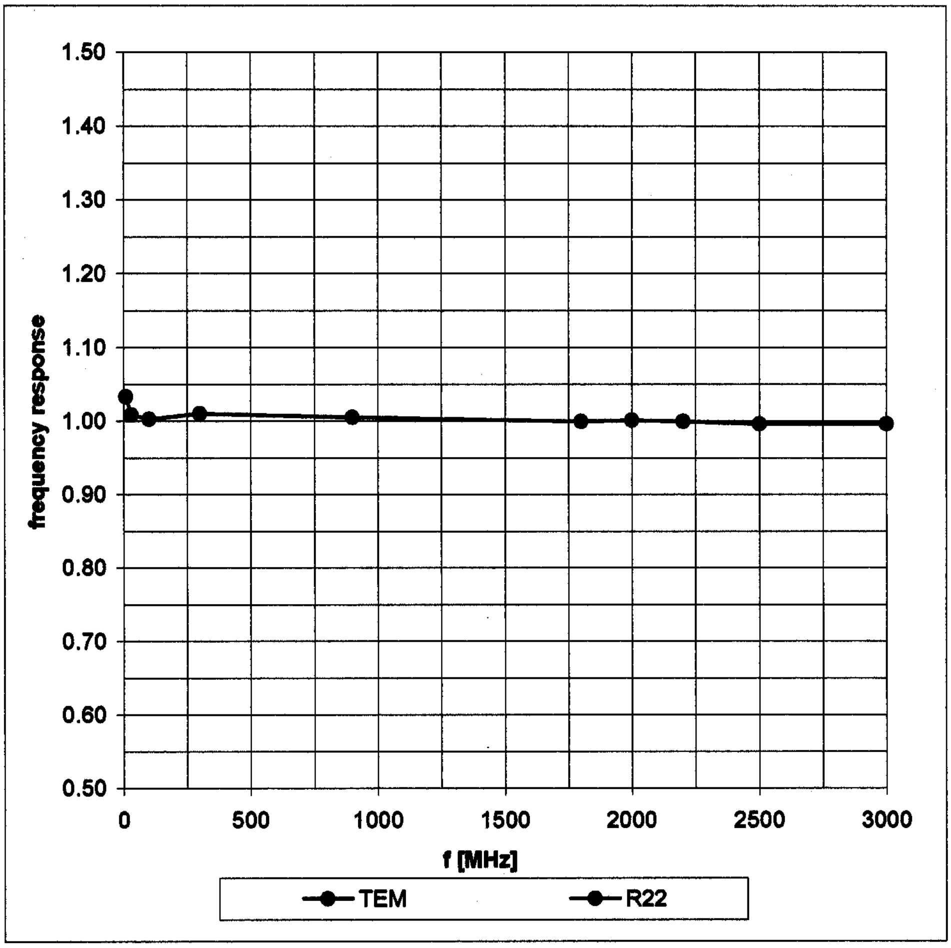
Probe Tip to Sensor Center	**1.0**	mm

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%.

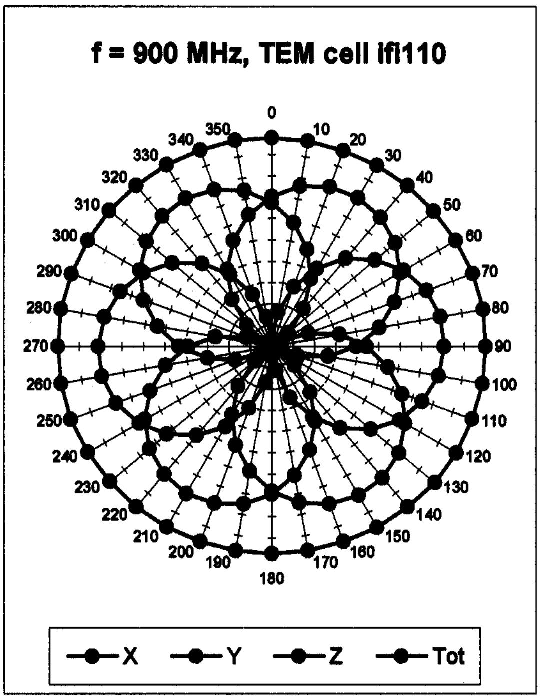
[A] numerical linearization parameter: uncertainty not required

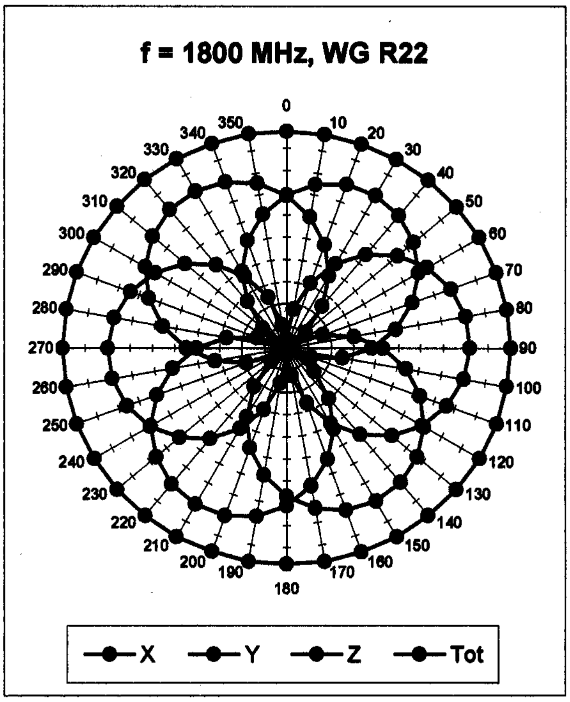
Frequency Response of E-Field

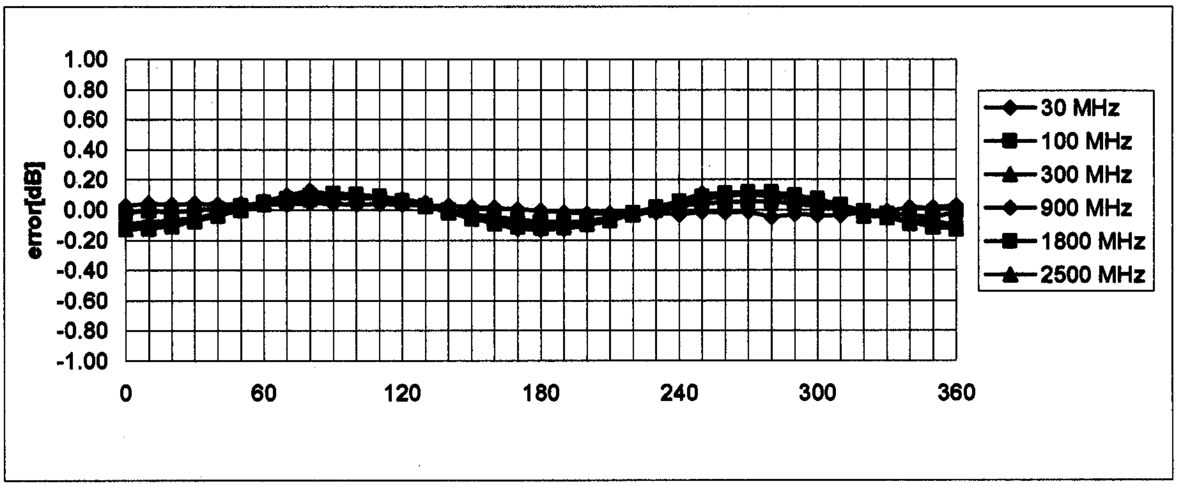
(TEM-Cell:ifi110, Waveguide R22)



Receiving Pattern (ϕ), θ = 0°



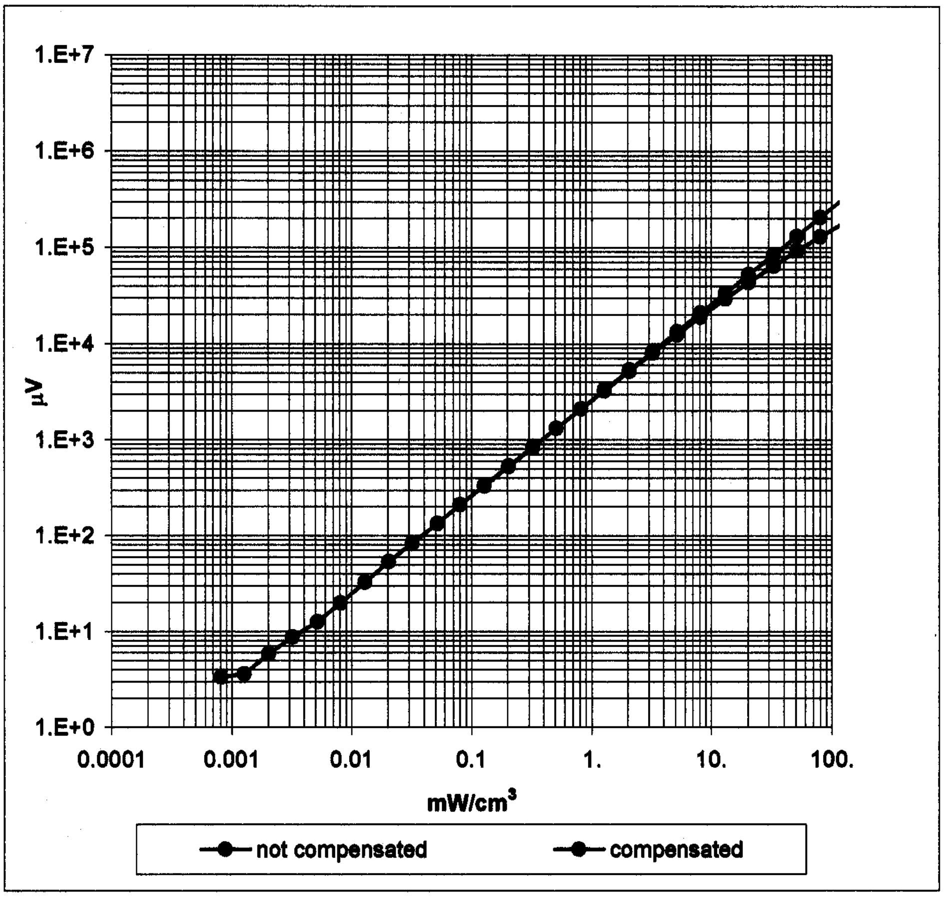


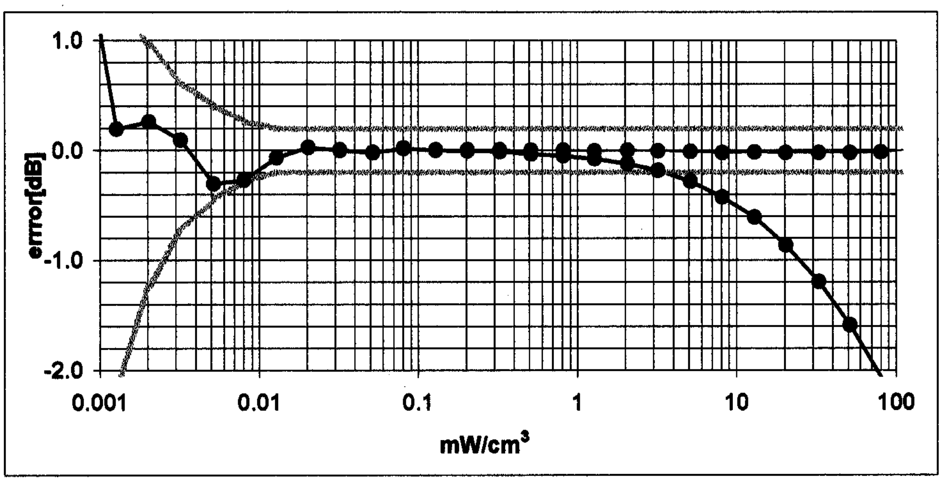


Axial Isotropy Error < ± 0.2 dB

Dynamic Range f(SAR_{head})

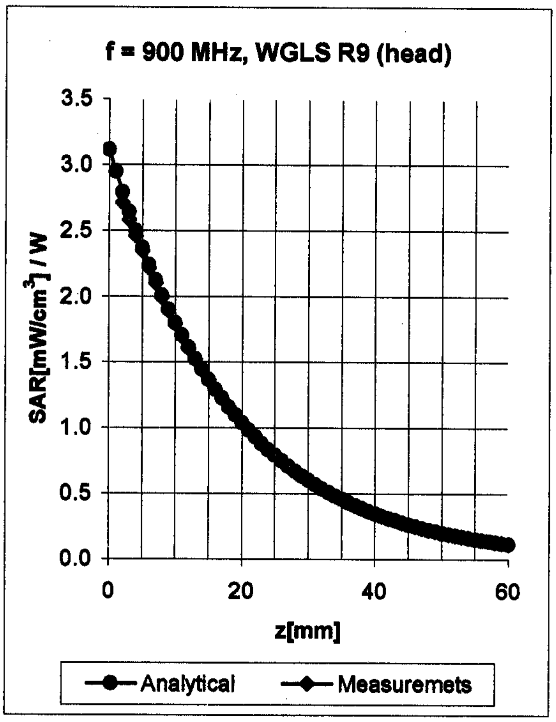
(Waveguide R22)

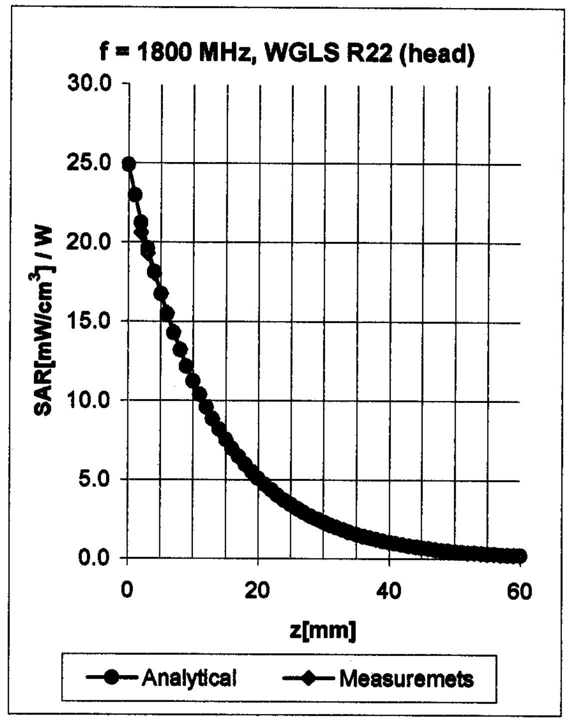




Probe Linearity < ± 0.2 dB

Conversion Factor Assessment



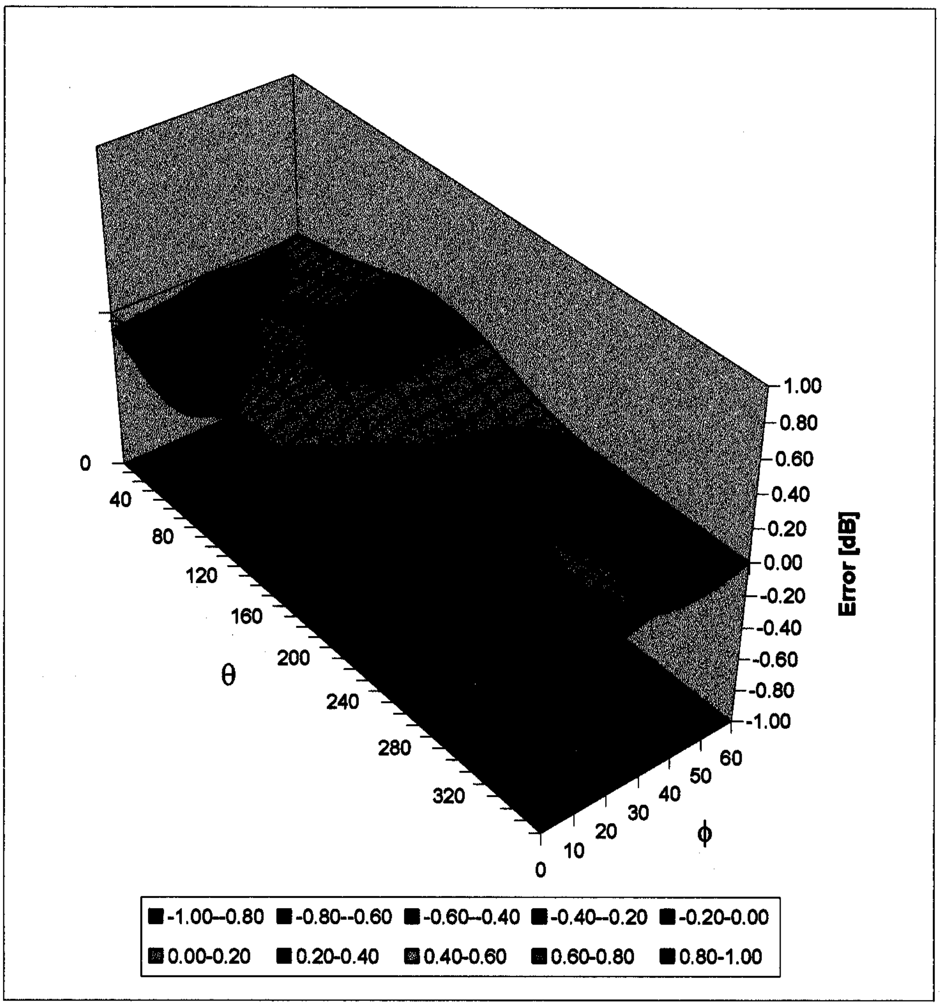


f [MHz]	Validity [MHz][B]	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
900	800-1000	Head	41.5 ± 5%	0.97 ± 5%	0.18	1.60	9.43	± 11.3% (k=2)
1800	1710-1910	Head	40.0 ± 5%	1.40 ± 5%	0.20	2.00	8.11	± 11.7% (k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	0.15	2.00	7.50	± 9.7% (k=2)
5500	5225-5775	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

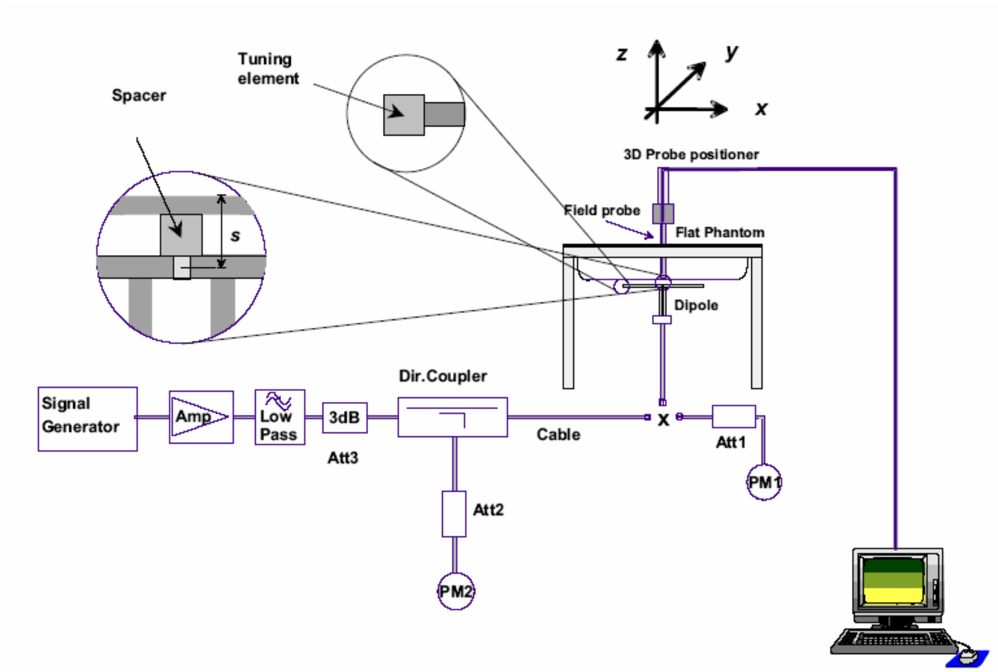
3. Dipole Impedance and Return Loss

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.



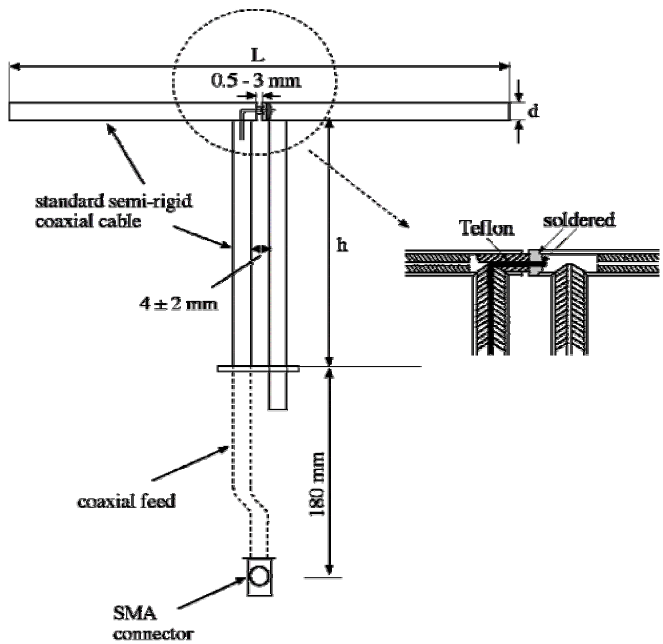
First the power meter PM1 (including attenuator Att1) is connected to the RF cable to measure the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at the dipole connector (taking into account the attenuation of Att1) as read by 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

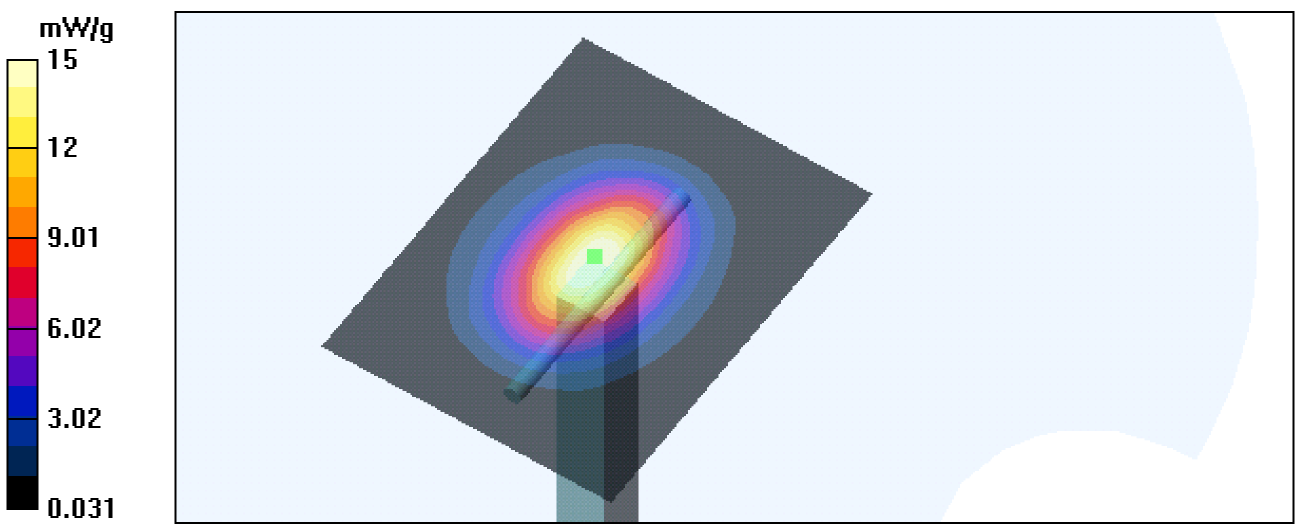
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:002

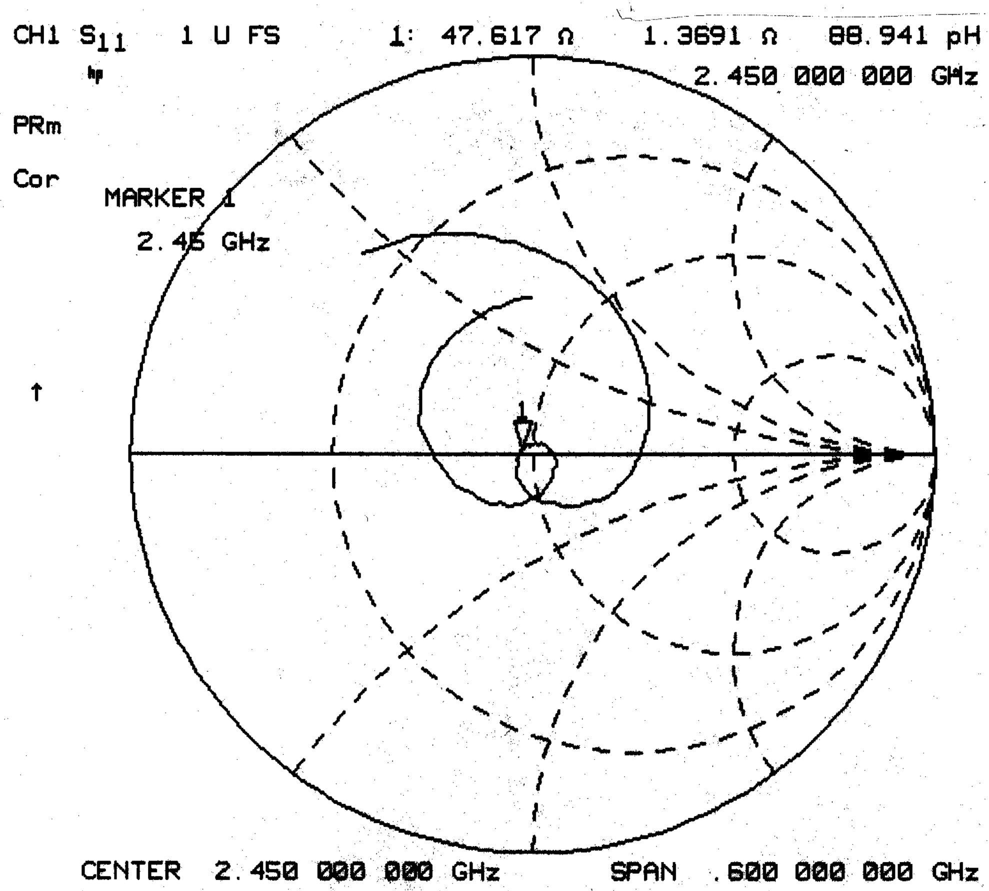
Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used: f = 2450 MHz; σ = 1.88 mho/m; ε_r = 38.0; ρ = 1000 kg/m^3
Phantom section: Flat Section

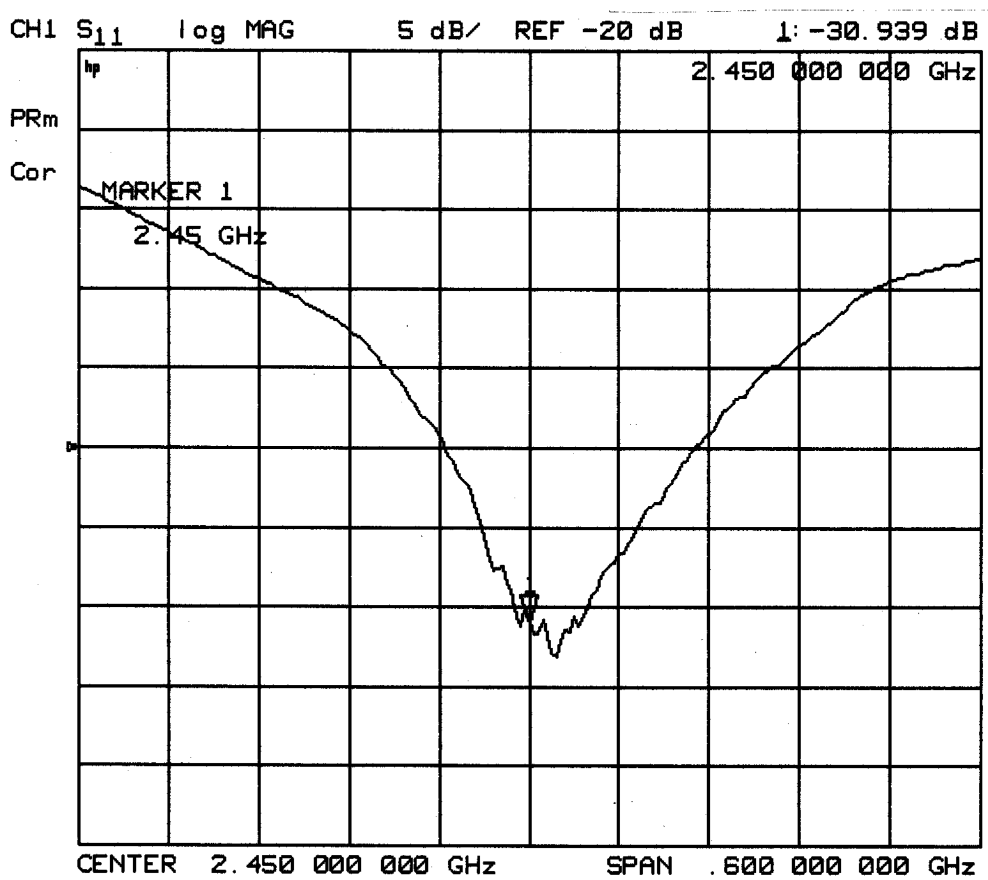
Ambient Temp 24.2 deg C; Fluid Temp 23.9deg C

- 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 S11 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 S11 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 for System Validation

May 31, 2005

Frequency	e'	e''
2.349999872 GHz	38.5707	12.8839
2.353854460 GHz	38.5618	12.9002
2.357709048 GHz	38.5613	12.8986
2.361563635 GHz	38.5613	12.8940
2.365418223 GHz	38.5592	12.9077
2.369272811 GHz	38.5728	12.9199
2.373159011 GHz	38.5597	12.8951
2.377045211 GHz	38.5314	12.9103
2.380931412 GHz	38.4974	12.9078
2.384817612 GHz	38.4562	12.9169
2.388703812 GHz	38.4195	12.9141
2.392621884 GHz	38.3978	12.9298
2.396539956 GHz	38.3760	12.9624
2.400458028 GHz	38.3615	13.0141
2.404376100 GHz	38.3564	13.0360
2.408294172 GHz	38.3448	13.0633
2.412244377 GHz	38.3557	13.0668
2.416194582 GHz	38.3480	13.0882
2.420144787 GHz	38.3377	13.0755
2.424094992 GHz	38.3061	13.0637
2.428045197 GHz	38.2824	13.0649
2.432027798 GHz	38.2814	13.0837
2.436010400 GHz	38.2481	13.1067
2.439993002 GHz	38.2133	13.1310
2.443975603 GHz	38.1698	13.1514
2.447958205 GHz	38.1398	13.1609
2.451973469 GHz	38.0877	13.1499
2.455988733 GHz	38.0623	13.1613
2.460003997 GHz	38.0673	13.1893
2.464019261 GHz	38.0810	13.2211
2.468034525 GHz	38.0886	13.2552
2.472082719 GHz	38.1122	13.2650
2.476130913 GHz	38.1027	13.2580
2.480179107 GHz	38.0851	13.2743
2.484227301 GHz	38.0627	13.2449
2.488275495 GHz	38.0250	13.2201
2.492356890 GHz	38.0058	13.2407
2.496438284 GHz	37.9639	13.2471
2.500519679 GHz	37.9184	13.2457
2.504601073 GHz	37.8773	13.2626
2.508682467 GHz	37.8510	13.2838
2.512797334 GHz	37.8289	13.2934
2.516912201 GHz	37.8123	13.3094
2.521027068 GHz	37.7969	13.3465
2.525141935 GHz	37.7940	13.3785

2450MHz Body for EUT Testing

May 31, 2005

Frequency	e'	e''
2.400000000 GHz	54.4041	13.7667
2.402000000 GHz	54.3991	13.8025
2.404000000 GHz	54.3894	13.8047
2.406000000 GHz	54.3846	13.8165
2.408000000 GHz	54.3242	13.8225
2.410000000 GHz	54.2989	13.8217
2.412000000 GHz	54.2942	13.8094
2.414000000 GHz	54.2949	13.8460
2.416000000 GHz	54.2764	13.8683
2.418000000 GHz	54.3097	13.8693
2.420000000 GHz	54.2971	13.8959
2.422000000 GHz	54.2792	13.9095
2.424000000 GHz	54.2685	13.8894
2.426000000 GHz	54.2374	13.9049
2.428000000 GHz	54.2259	13.9021
2.430000000 GHz	54.2680	13.9033
2.432000000 GHz	54.2620	13.9374
2.434000000 GHz	54.2539	13.9460
2.436000000 GHz	54.2248	13.9390
2.438000000 GHz	54.1931	13.9715
2.440000000 GHz	54.2146	13.9483
2.442000000 GHz	54.2118	13.9903
2.444000000 GHz	54.2183	14.1035
2.446000000 GHz	54.2192	14.1243
2.448000000 GHz	54.2107	14.1500
2.450000000 GHz	54.1808	14.2362
2.452000000 GHz	54.1609	14.2533
2.454000000 GHz	54.1592	14.2778
2.456000000 GHz	54.1517	14.2982
2.458000000 GHz	54.1351	14.2028
2.460000000 GHz	54.1579	14.2303
2.462000000 GHz	54.1151	14.2305
2.464000000 GHz	54.1190	14.2033
2.466000000 GHz	54.1108	14.1369
2.468000000 GHz	54.0953	14.1686
2.470000000 GHz	54.1076	14.1823
2.472000000 GHz	54.1286	14.1963
2.474000000 GHz	54.1340	14.2196
2.476000000 GHz	54.1181	14.2155
2.478000000 GHz	54.1044	14.2247
2.480000000 GHz	54.0848	14.2177
2.482000000 GHz	54.0855	14.2314
2.484000000 GHz	54.0779	14.2566
2.486000000 GHz	54.0832	14.2559
2.488000000 GHz	54.0628	14.2744

APPENDIX F – PHANTOM CERTIFICATE OF CONFORMITY

Schmid & Partner Engineering AG

s p e a g

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

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

s p e a g
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