Face side/DSSS mode/mid ch /battery power

Date/Time: 4/17/2006 3:56:47 PM

DUT: Verifone Vx670W; Type: 802.11b/g;

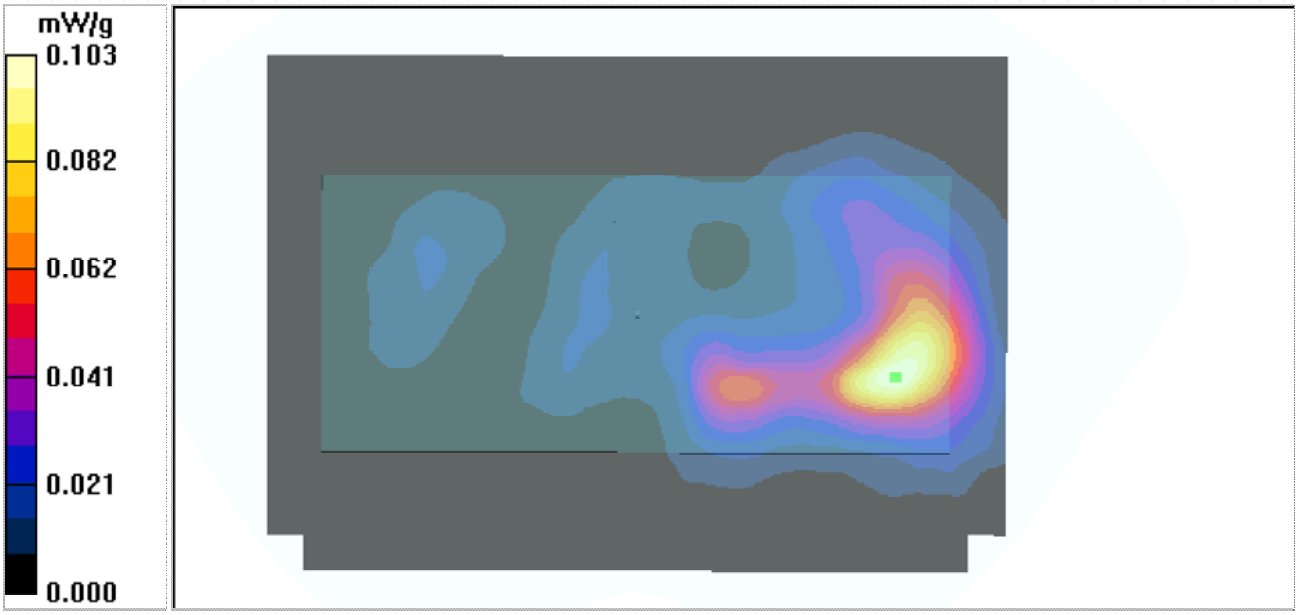
Medium Notes: Fluid Temp: 22.1 deg C, Ambient Temp: 22.9 deg C

Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 2.04 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

Probe: EX3DV3 - SN3511; ConvF(7.8, 7.8, 7.8); Calibrated: 1/23/2006
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE3 Sn584; Calibrated: 9/22/2005
Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

2450MHz/Area Scan (141x201x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.103 mW/g

2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.24 V/m; Power Drift = -0.093 dB
Peak SAR (extrapolated) = 0.174 W/kg
SAR(1 g) = 0.092 mW/g; SAR(10 g) = 0.047 mW/g
Maximum value of SAR (measured) = 0.103 mW/g



Face side/DSSS mode/mid ch/ext power

Date/Time: 4/17/2006 2:10:20 PM

DUT: Verifone Vx670W; Type: 802.11b/g;

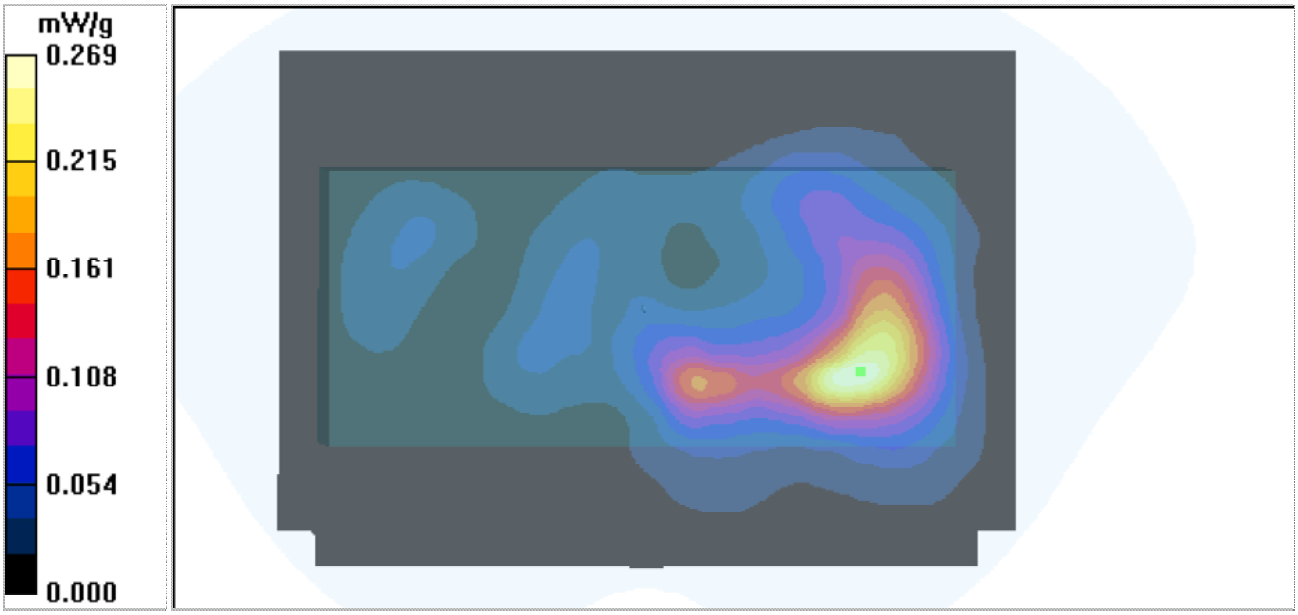
Medium Notes: Fluid Temp: 22.1 deg C, Ambient Temp: 22.9 deg C

Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 2.04 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

Probe: EX3DV3 - SN3511; ConvF(7.8, 7.8, 7.8); Calibrated: 1/23/2006
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE3 Sn584; Calibrated: 9/22/2005
Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

2450MHz/Area Scan (141x201x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.269 mW/g

2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.64 V/m; Power Drift = 0.055 dB
Peak SAR (extrapolated) = 0.461 W/kg
SAR(1 g) = 0.244 mW/g; SAR(10 g) = 0.124 mW/g
Maximum value of SAR (measured) = 0.278 mW/g



Face side/OFDM mode/mid ch/battery power

Date/Time: 4/17/2006 10:33:23 AM

DUT: Verifone Vx670W; Type: 802.11b/g;

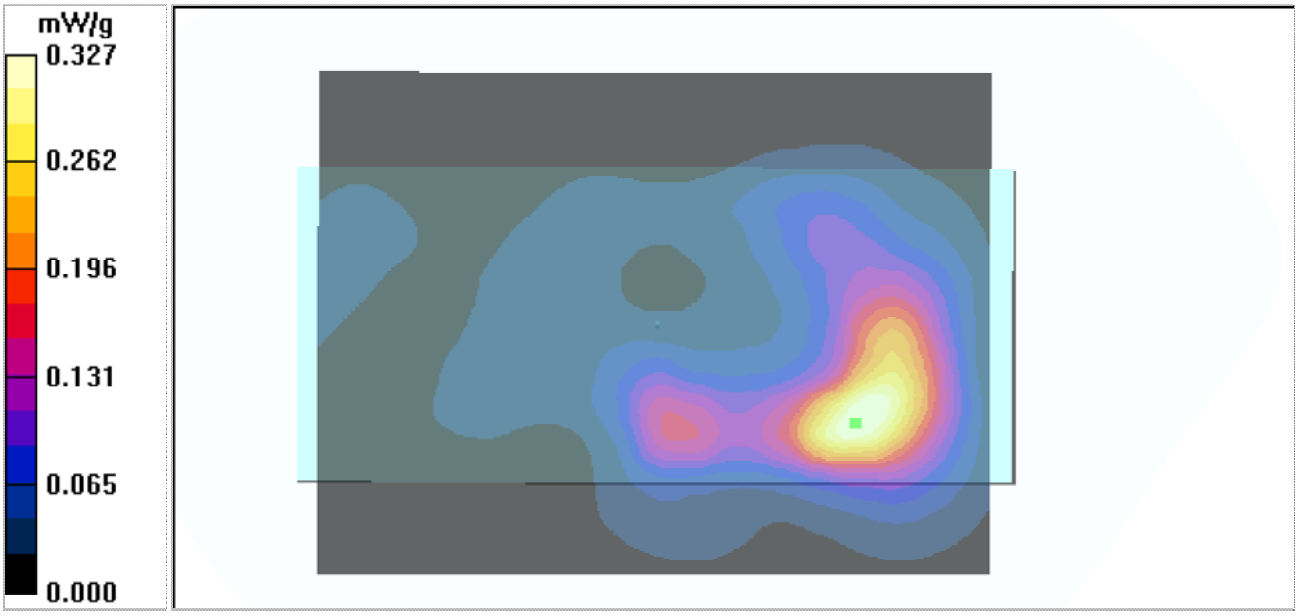
Medium Notes: Fluid Temp: 22.1 deg C, Ambient Temp: 22.9 deg C

Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 2.04 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

Probe: EX3DV3 - SN3511; ConvF(7.8, 7.8, 7.8); Calibrated: 1/23/2006
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE3 Sn584; Calibrated: 9/22/2005
Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

2450MHz/Area Scan (121x161x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.327 mW/g

2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.90 V/m; Power Drift = 0.115 dB
Peak SAR (extrapolated) = 0.583 W/kg
SAR(1 g) = 0.301 mW/g; SAR(10 g) = 0.151 mW/g
Maximum value of SAR (measured) = 0.343 mW/g



Face side/OFDM mode/mid ch/ext power

Date/Time: 4/17/2006 9:55:48 AM

DUT: Verifone Vx670W; Type: 802.11b/g;

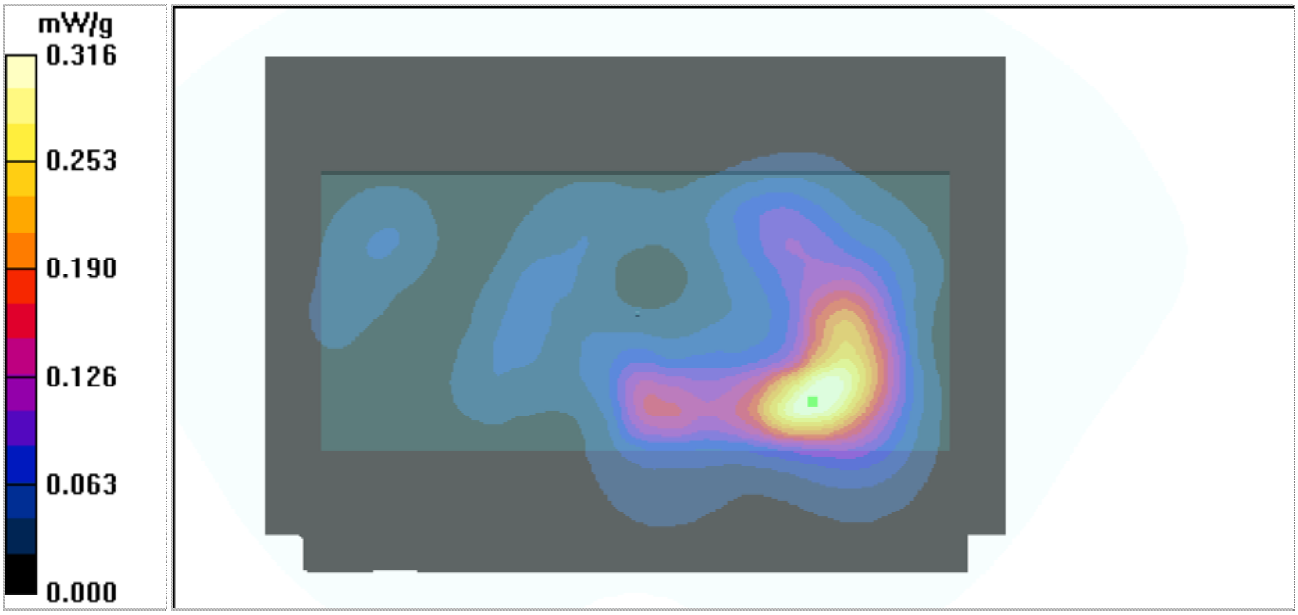
Medium Notes: Fluid Temp: 22.1 deg C, Ambient Temp: 22.9 deg C

Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 2.04 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

Probe: EX3DV3 - SN3511; ConvF(7.8, 7.8, 7.8); Calibrated: 1/23/2006
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE3 Sn584; Calibrated: 9/22/2005
Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

2450MHz/Area Scan (141x201x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.316 mW/g

2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.63 V/m; Power Drift = -0.198 dB
Peak SAR (extrapolated) = 0.568 W/kg
SAR(1 g) = 0.287 mW/g; SAR(10 g) = 0.144 mW/g
Maximum value of SAR (measured) = 0.329 mW/g



Front End/ DSSS mode/mid ch/battery power

Date/Time: 4/17/2006 4:37:14 PM

DUT: Verifone Vx670W; Type: 802.11b/g;

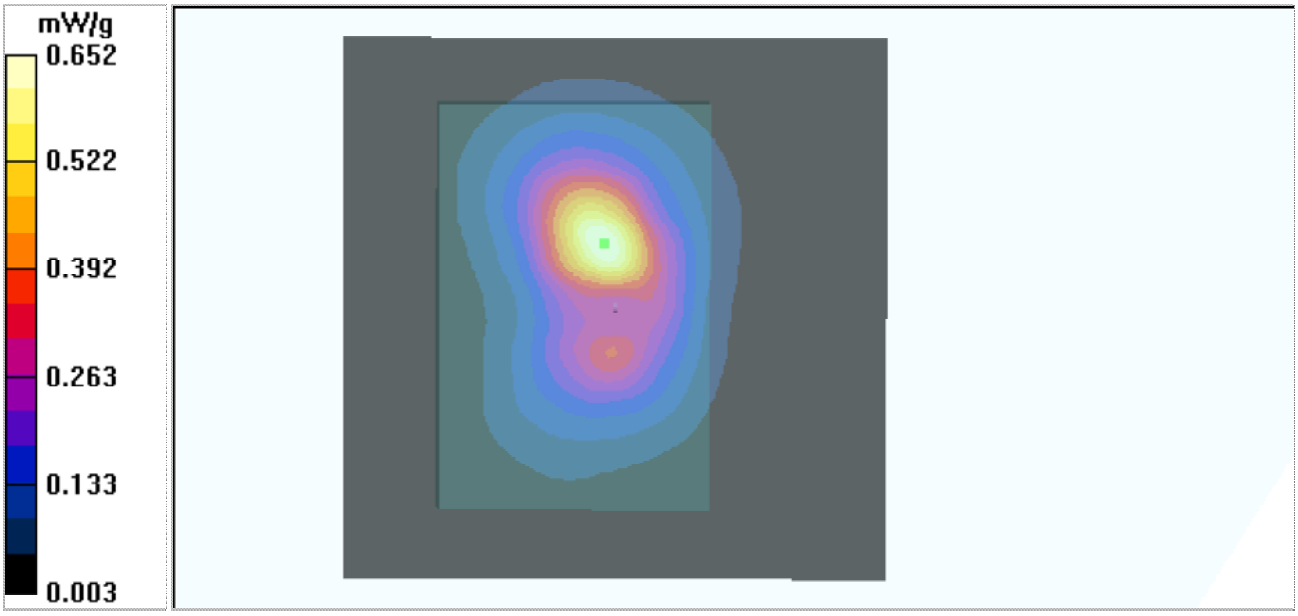
Medium Notes: Fluid Temp: 22.1 deg C, Ambient Temp: 22.9 deg C

Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 2.04 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

Probe: EX3DV3 - SN3511; ConvF(7.8, 7.8, 7.8); Calibrated: 1/23/2006
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE3 Sn584; Calibrated: 9/22/2005
Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

2450MHz/Area Scan (101x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.652 mW/g

2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.6 V/m; Power Drift = -0.066 dB
Peak SAR (extrapolated) = 1.40 W/kg
SAR(1 g) = 0.569 mW/g; SAR(10 g) = 0.232 mW/g
Maximum value of SAR (measured) = 0.697 mW/g



Front End/ DSSS mode/ mid ch/ext power

Date/Time: 4/17/2006 5:02:00 PM

DUT: Verifone Vx670W; Type: 802.11b/g;

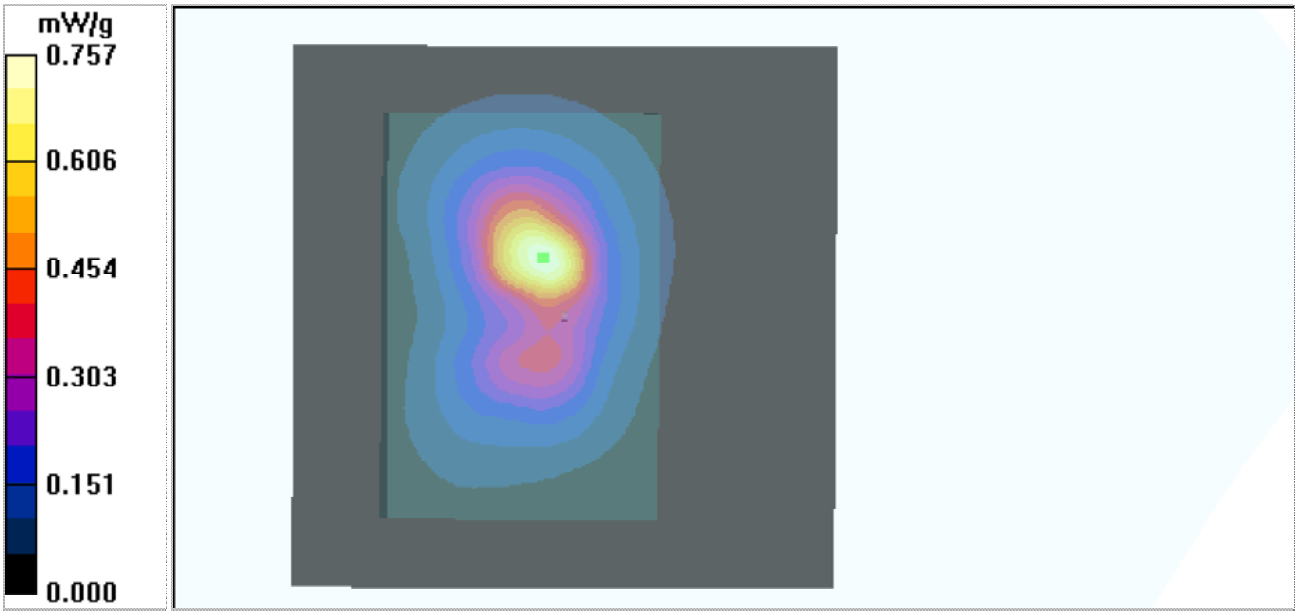
Medium Notes: Fluid Temp: 22.1 deg C, Ambient Temp: 22.9 deg C

Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 2.04 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

Probe: EX3DV3 - SN3511; ConvF(7.8, 7.8, 7.8); Calibrated: 1/23/2006
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE3 Sn584; Calibrated: 9/22/2005
Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

2450MHz/Area Scan (101x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.757 mW/g

2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.1 V/m; Power Drift = 0.004 dB
Peak SAR (extrapolated) = 1.53 W/kg
SAR(1 g) = 0.617 mW/g; SAR(10 g) = 0.249 mW/g
Maximum value of SAR (measured) = 0.764 mW/g



Front End/ OFDM Mode/ mid ch/battery power

Date/Time: 4/17/2006 5:25:00 PM

DUT: Verifone Vx670W; Type: 802.11b/g;

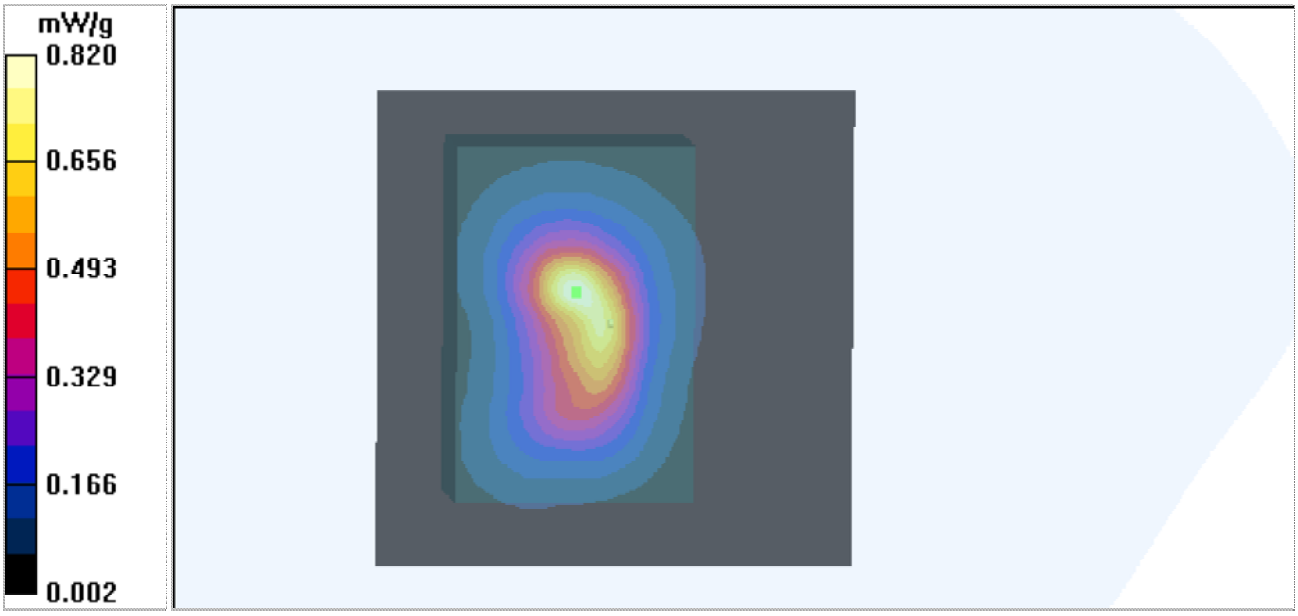
Medium Notes: Fluid Temp: 22.1 deg C, Ambient Temp: 22.9 deg C

Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 2.04 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

Probe: EX3DV3 - SN3511; ConvF(7.8, 7.8, 7.8); Calibrated: 1/23/2006
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE3 Sn584; Calibrated: 9/22/2005
Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

2450MHz/Area Scan (101x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.820 mW/g

2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.9 V/m; Power Drift = 0.009 dB
Peak SAR (extrapolated) = 1.92 W/kg
SAR(1 g) = 0.780 mW/g; SAR(10 g) = 0.312 mW/g
Maximum value of SAR (measured) = 0.899 mW/g



Front End/OFDM Mode/mid ch/ext power

Date/Time: 4/1/2006 5:54:30 PM

DUT: Verifone Vx670W; Type: 802.11b/g;

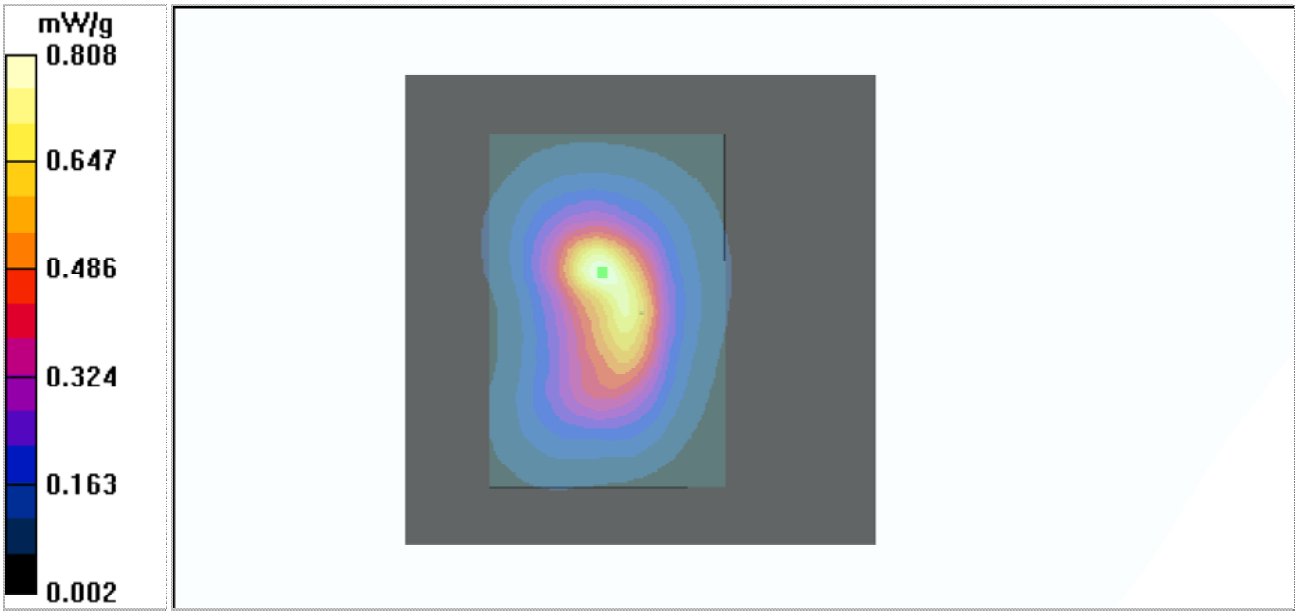
Medium Notes: Fluid Temp: 22.1 deg C, Ambient Temp: 22.9 deg C

Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 2.04 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

Probe: EX3DV3 - SN3511; ConvF(7.8, 7.8, 7.8); Calibrated: 1/23/2006
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE3 Sn584; Calibrated: 9/22/2005
Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

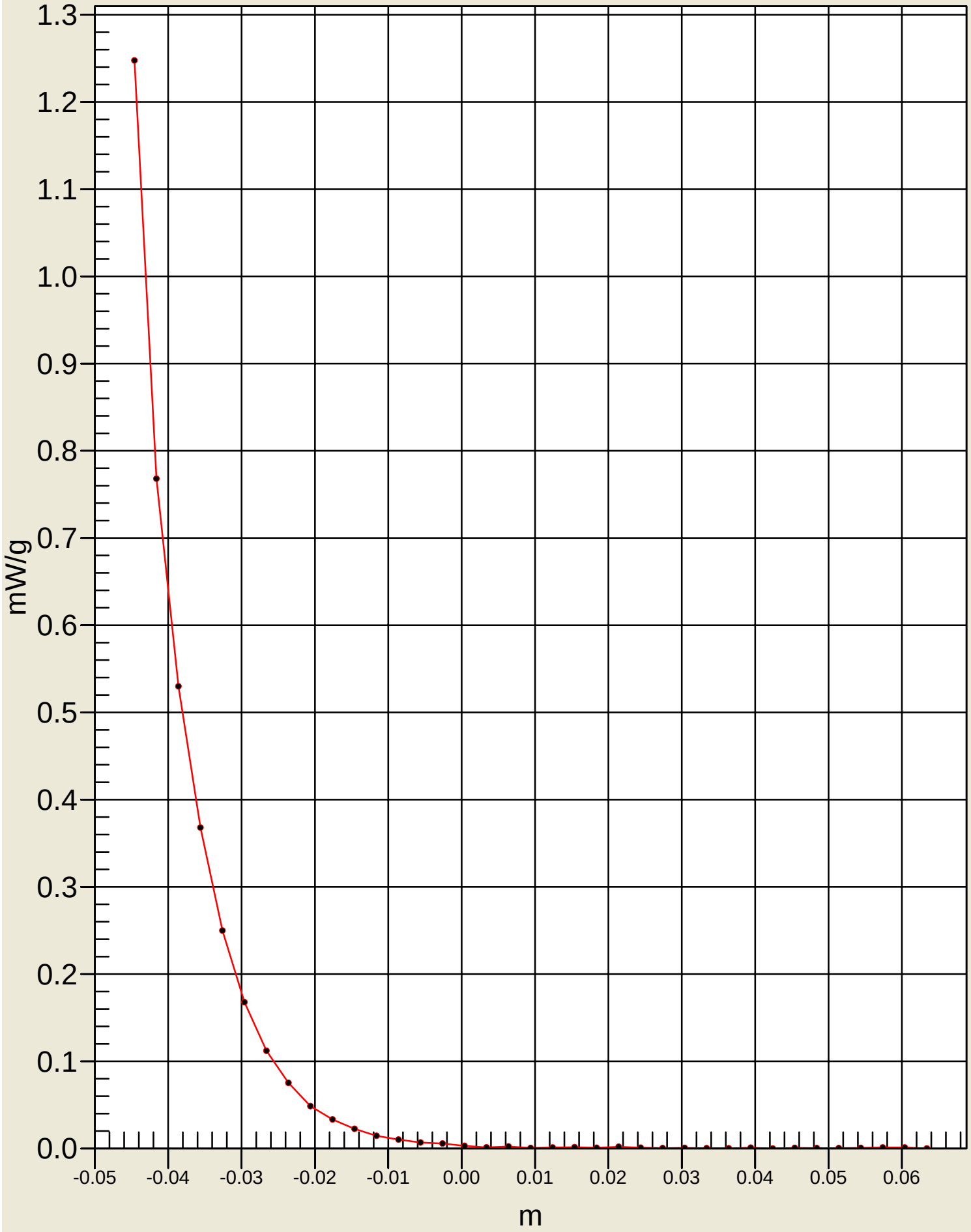
2450MHz/Area Scan (101x101x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.808 mW/g

2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 17.6 V/m; Power Drift = -0.013 dB
Peak SAR (extrapolated) = 1.96 W/kg
SAR(1 g) = 0.781 mW/g; SAR(10 g) = 0.310 mW/g
Maximum value of SAR (measured) = 0.897 mW/g



SAR(x,y,z,f0)

SAR; Z Front End OFDM Mode



APPENDIX B – SYSTEM PERFORMANCE CHECK

Validation 2450MHz Body

Date/Time: 4/17/2006 8:26:57 AM

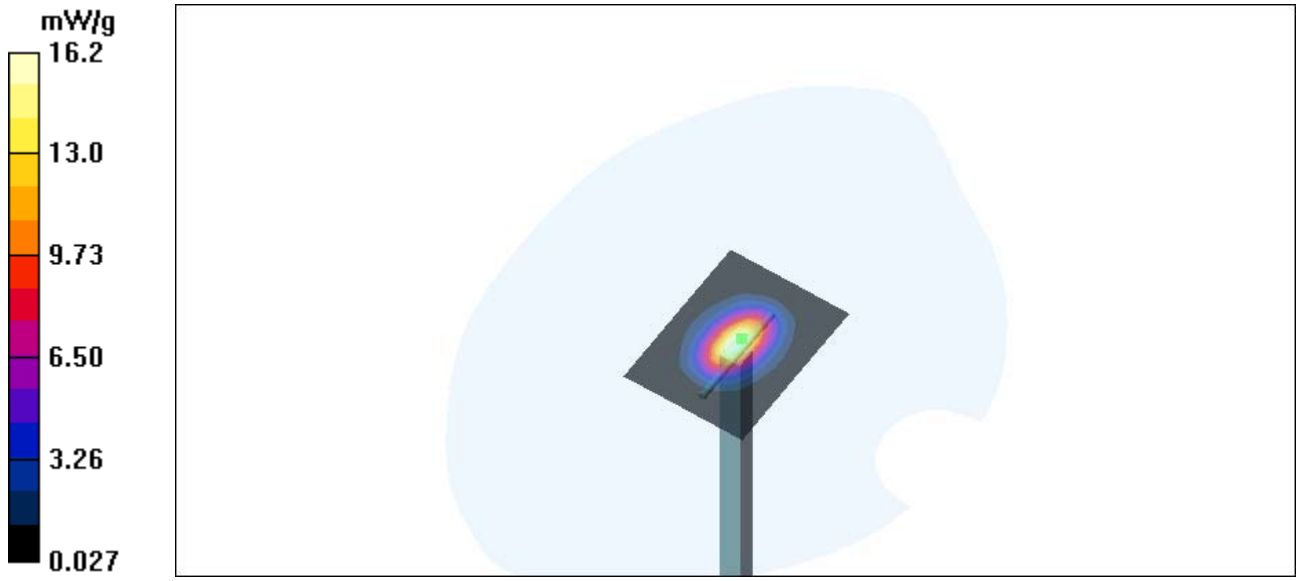
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 1S2452

Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 2.04 mho/m; ε_r = 54.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

Probe: EX3DV3 - SN3511; ConvF(7.8, 7.8, 7.8); Calibrated: 1/23/2006
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE3 Sn584; Calibrated: 9/22/2005
Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

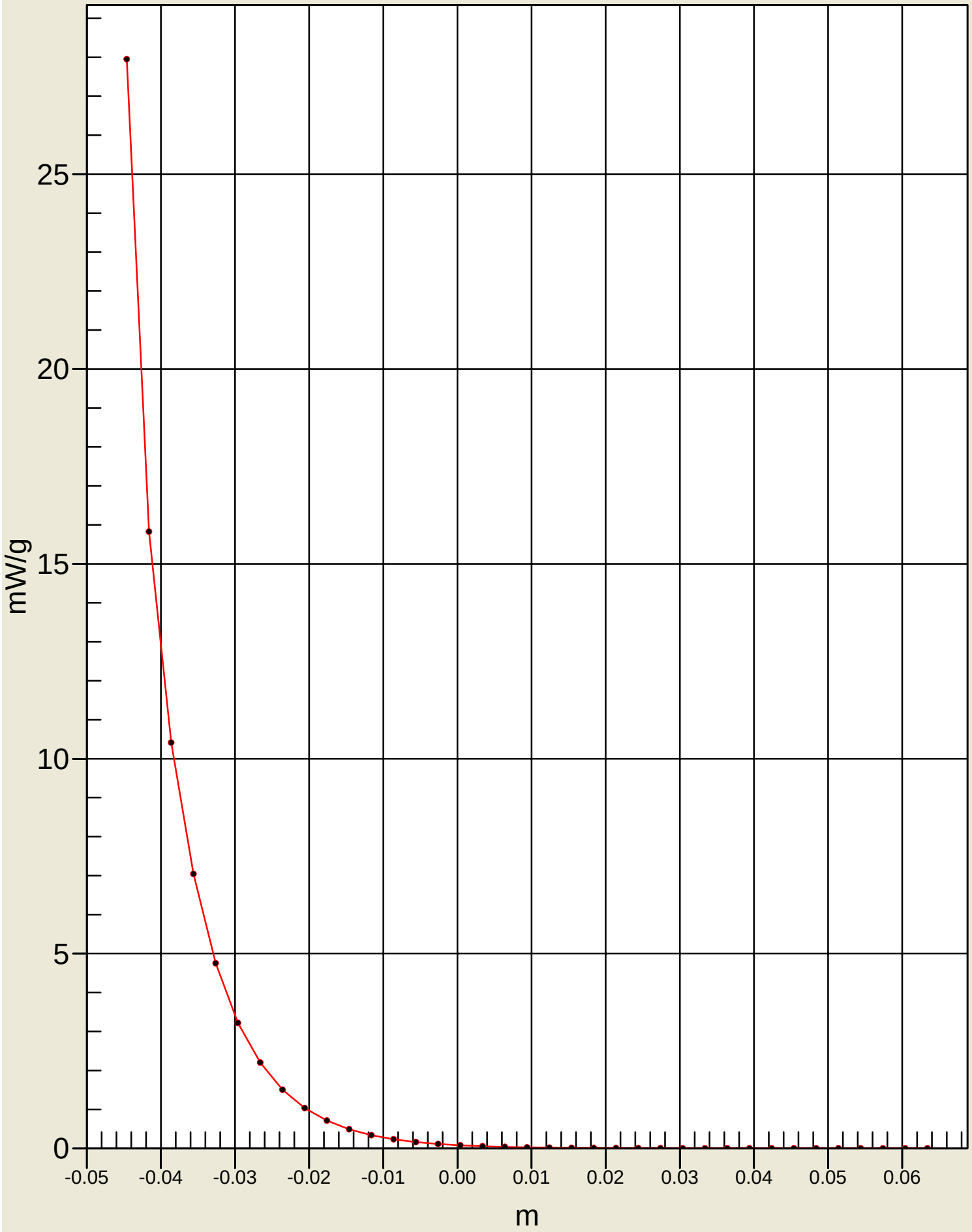
Area Scan (61x81x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 16.2 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 88.7 V/m; Power Drift = -0.010 dB
Peak SAR (extrapolated) = 28.6 W/kg
SAR(1 g) = 13.9 mW/g; SAR(10 g) = 6.36 mW/g
Maximum value of SAR (measured) = 15.8 mW/g



SAR(x,y,z,f0)

SAR; Z Scan:2450MHz Validation



APPENDIX C – PROBE CALIBRATION CERTIFICATE

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **MET Laboratories**

Certificate No: EX3-3511_Jan06

CALIBRATION CERTIFICATE

Object	EX3DV3 - SN:3511
Calibration procedure(s)	QA CAL-01.v5 and QA CAL-14.v3 Calibration procedure for dosimetric E-field probes
Calibration date:	January 23, 2006
Condition of the calibrated item	In Tolerance

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 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41495277	3-May-05 (METAS, No. 251-00466)	May-06
Power sensor E4412A	MY41498087	3-May-05 (METAS, No. 251-00466)	May-06
Reference 3 dB Attenuator	SN: S5054 (3c)	11-Aug-05 (METAS, No. 251-00499)	Aug-06
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-05 (METAS, No. 251-00467)	May-06
Reference 30 dB Attenuator	SN: S5129 (30b)	11-Aug-05 (METAS, No. 251-00500)	Aug-06
Reference Probe ES3DV2	SN: 3013	2-Jan-06 (SPEAG, No. ES3-3013_Jan06)	Jan-07
DAE4	SN: 654	27-Oct-05 (SPEAG, No. DAE4-654_Oct05)	Oct-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov 06

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: January 23, 2006

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe EX3DV3

SN:3511

Manufactured:	December 15, 2003
Last calibrated:	January 23, 2004
Recalibrated:	January 23, 2006

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: EX3DV3 SN:3511

Sensitivity in Free Space[A] Diode Compression[B]

NormX	**0.770** ± 10.1%	$\mu V/(V/m)^2$	DCP X	**96** mV
NormY	**0.606** ± 10.1%	$\mu V/(V/m)^2$	DCP Y	**96** mV
NormZ	**0.634** ± 10.1%	$\mu V/(V/m)^2$	DCP Z	**96** mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

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

Sensor Center to Phantom Surface Distance		**2.0 mm**	**3.0 mm**
SAR_{be} [%]	Without Correction Algorithm	3.3	1.3
SAR_{be} [%]	With Correction Algorithm	0.2	0.4

TSL **1810 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**2.0 mm**	**3.0 mm**
SAR_{be} [%]	Without Correction Algorithm	2.5	1.3
SAR_{be} [%]	With Correction Algorithm	0.4	0.4

Sensor Offset

Probe Tip to Sensor Center	**1.0** mm

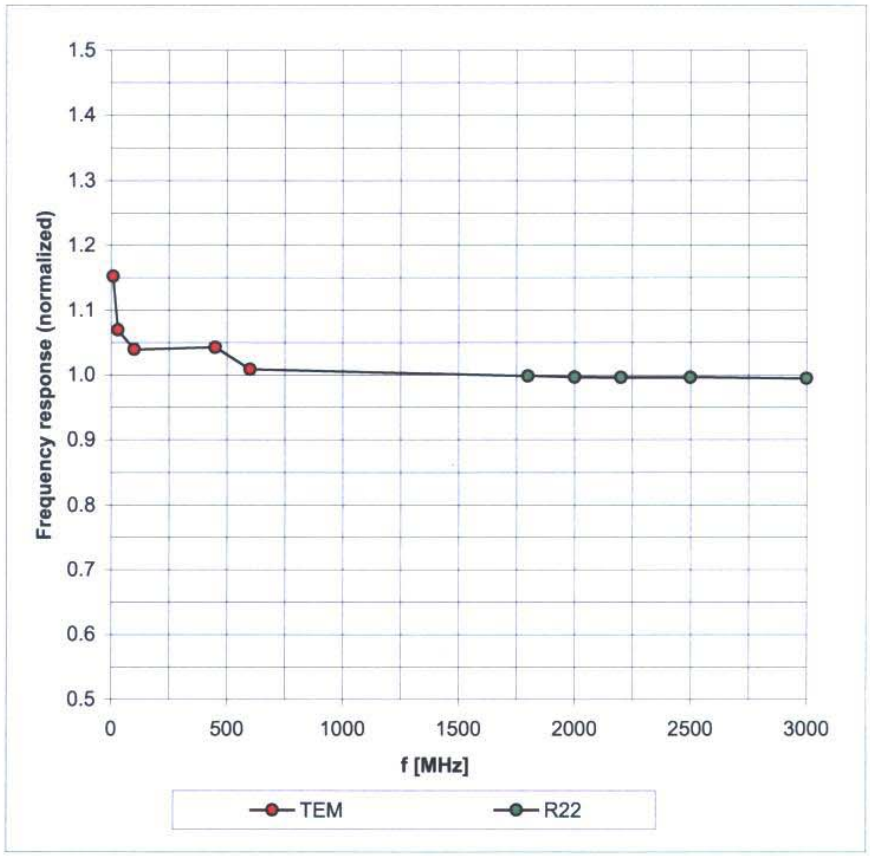
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 8).

[B] Numerical linearization parameter: uncertainty not required.

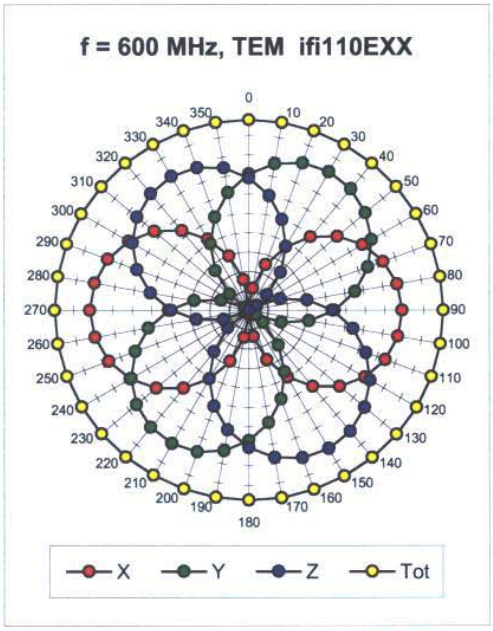
Frequency Response of E-Field

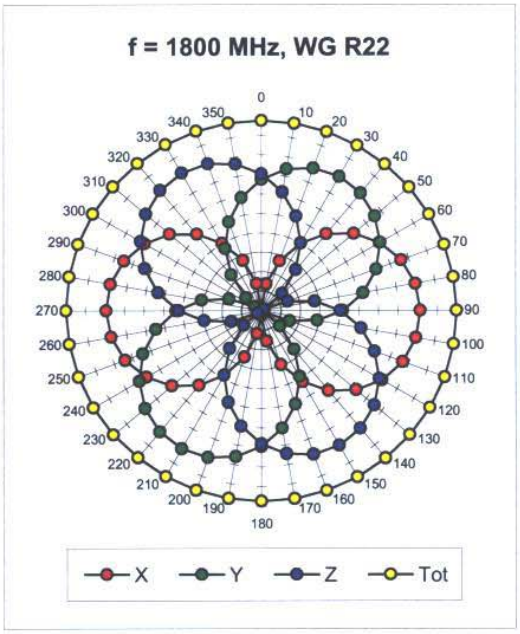
(TEM-Cell:ifi110 EXX, Waveguide: R22)

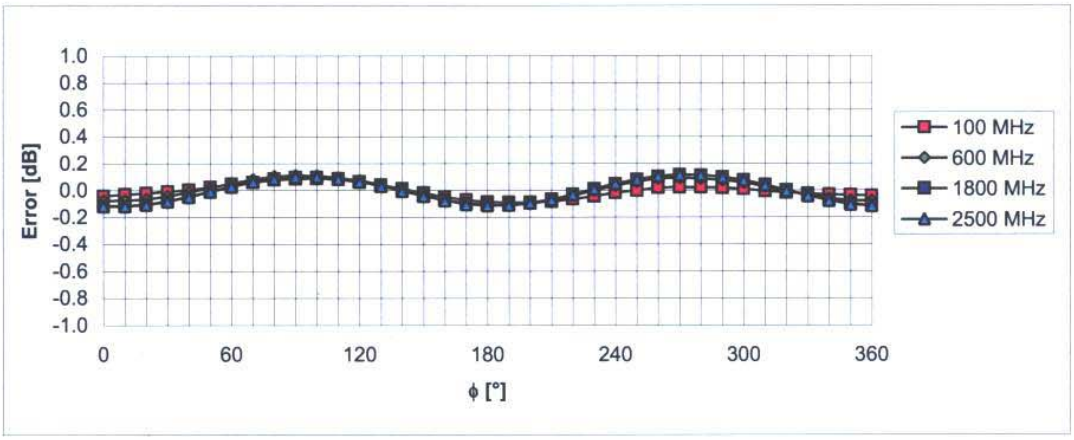


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



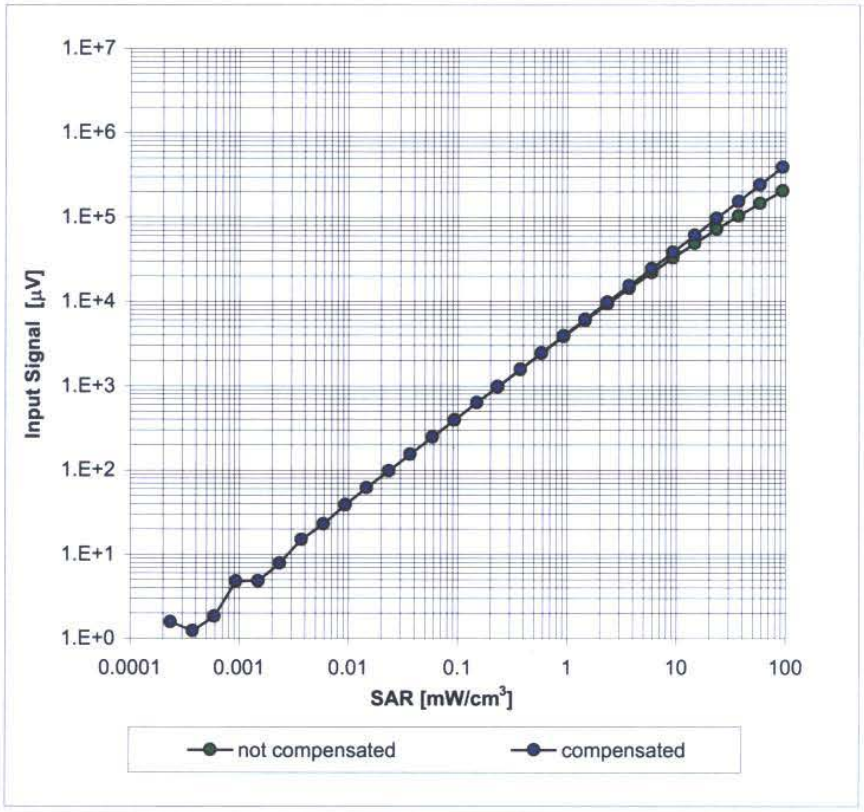


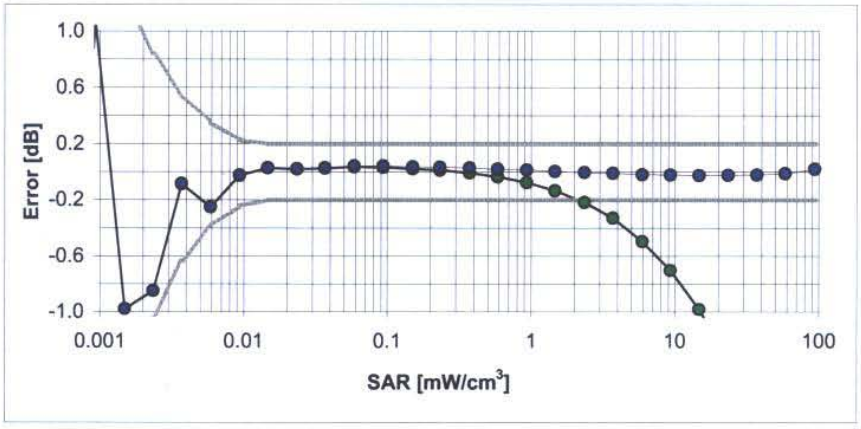


Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})

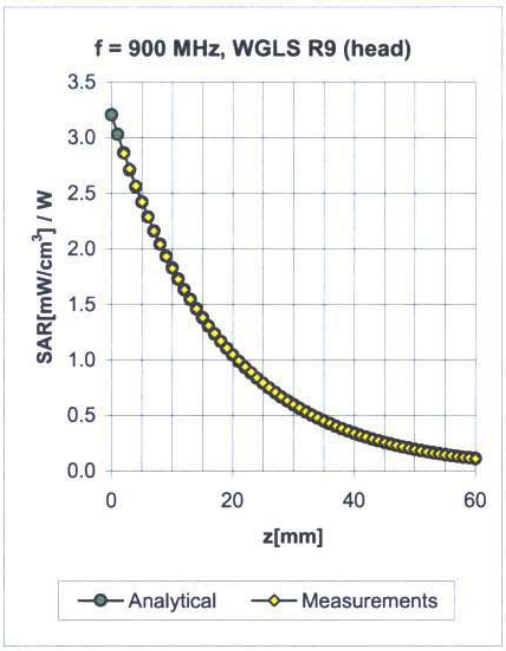
(Waveguide R22, f = 1800 MHz)

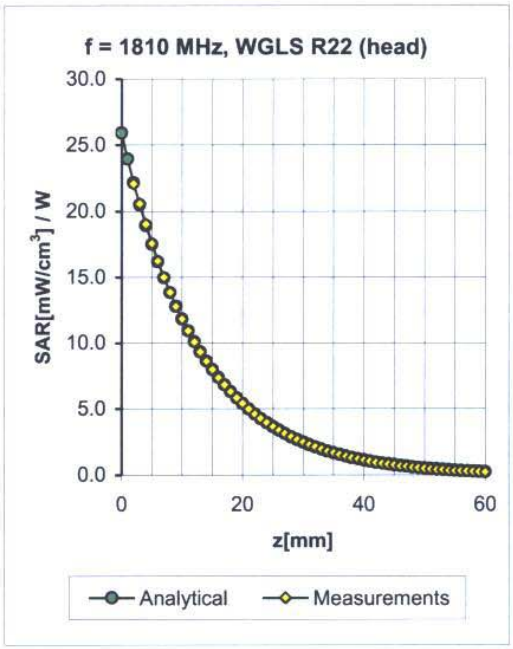




Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment



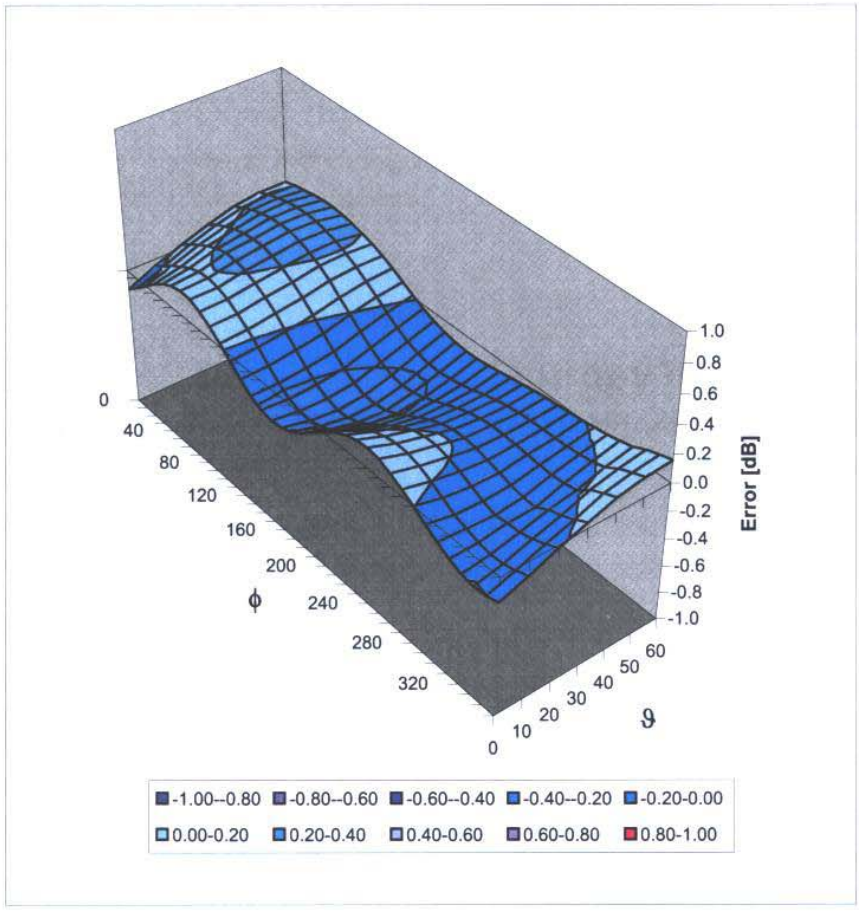


f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.58	0.70	9.68 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.29	0.86	8.41 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.49	0.55	7.64 ± 11.8% (k=2)
5500	± 50 / ± 100	Head	35.6 ± 5%	4.96 ± 5%	0.49	1.10	4.70 ± 13.1% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.57	0.72	9.55 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.21	1.95	8.14 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.99	0.39	7.80 ± 11.8% (k=2)
5200	± 50 / ± 100	Body	49.0 ± 5%	5.30 ± 5%	0.44	1.69	4.68 ± 13.1% (k=2)
5500	± 50 / ± 100	Body	48.6 ± 5%	5.65 ± 5%	0.45	1.68	4.30 ± 13.1% (k=2)
5800	± 50 / ± 100	Body	48.2 ± 5%	6.00 ± 5%	0.46	1.69	4.10 ± 13.1% (k=2)

[C] **The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.**

Deviation from Isotropy in HSL

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

APPENDIX D – DIPOLE CALIBRATION CERTIFICATE

2450 MHz Dipole Calibration

Type:	2450Mhz

Serial Number:	1S2452

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

Date of Calibration:	March 9, 2006

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 factors 7.64 for Head and 7.8 for Muscle at 2450 MHz were used for the measurements.

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

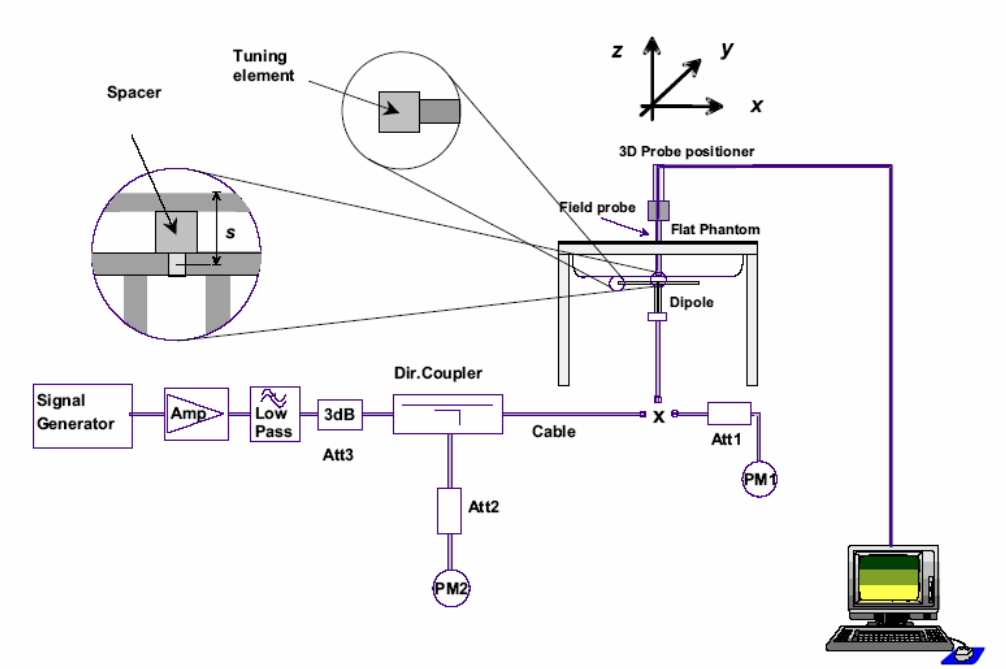
Head	**Relative Dielectricity**	39.5	±5%
	Conductivity	1.80	±5%
Muscle	**Relative Dielectricity**	52.7	±5%
	Conductivity	1.95	±5%

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

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.



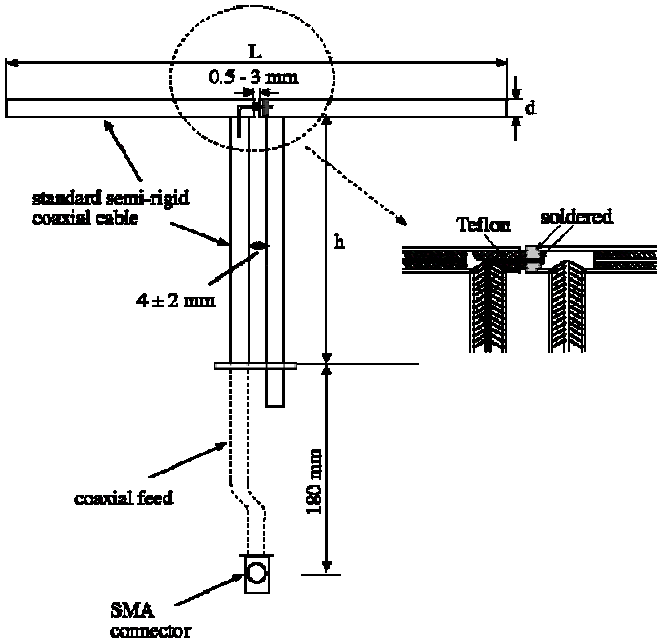
First the power meter PM1 (including attenuator Att1) is connected to the RF cable to measure the forward power at the location of the dipole connector (X). The signal generator is adjusted for the desired forward power at the dipole connector (taking into account the attenuation of Att1) as read by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

3. 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.

4. Construction

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

CALIBRATION CERTIFICATE

Object: 2450MHz Validation Dipole

Calibration Procedure: Calibration procedure for a validation dipole

Calibration Date: March 9, 2006

Condition of the Calibrated Item: In Tolerance

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 a closed laboratory facility: environment temperature (22 ± 3) ^{o}C and humidity < 70%

Calibration equipment used

Model Type	Serial Number	MET Asset #	Cal Date
Anritsu Power Meter ML2488A	6K00001832	1S2430	June 2005
Anritsu Power Sensor	030864	1S2432	Jan 2005
HP E4418B Power Meter	GB40205140	1S2276	June 2005
HP 8482A Power Sensor	2607A11286	1S2140	June 2005
83650B Signal Generator	3844A00910	1S2278	June 2005
HP 8722D Vector Network Analyzer	3S36140188	1S2272	March 2006

Calibrated by: Shawn McMillen (Name) Senior Engineer (Function)  (Signature)

This calibration certificate shall not be reproduced except in full

Date of Issue: March 9, 2006

Calibration procedure for validation dipole

Calibration is performed according to the following standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communication Devices: Measurement Techniques", December 2003
b) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300MHz – 3GHz), July 2001
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Bulletin 65 Supplement C (Edition01-01).

Additional Documents

d) DASY4 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions: Further details are available from the Validation Report at the end of the certificate. All Figures stated in the certificate are valid at the frequency indicated.
- Antenna check: The antenna is checked for straightness using a straight edge placed parallel to the dipole arms prior to installing it against the phantom surface.
- The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Antenna flatness: The spacer thickness used for the 2450MHz dipole is 10.00mm +/- 0.2mm. To insure the antenna is within +/- 2 degrees of flatness to the phantom surface use a caliper to measure the dipole ends from the surface of the phantom.
- Vector Network Analyzer: The network analyzer is calibrated as per the user's manual.
- Feed Point Impedance and Return Loss: These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. A Return Loss >20dB ensures low reflected power. No uncertainty required.
- Electrical Delay: One-way delay between the SMA connector and the antenna feed point. No Uncertainty required.
- SAR measured: SAR measured at the stated antenna input power.
- SAR normalized: SAR as measured, normalized to an input power of 1W at the antenna connector. No Uncertainty required
- SAR for nominal head and muscle parameters: The measured TSL parameters are used to calculate the SAR results.

Measurement Conditions

DASY system configuration

DASY Version	DASY4	V4.6
Extrapolation	Advanced Extrapolation	
Phantom	Planar Validation Phantom	1S2450
Dipole Spacer		
Distance Dipole Center-TSL	10.00mm ± 0.2mm	With spacer
Area Scan resolution	dx, dy = 10mm	
Zoom Scan resolution	dx, dy, dz = 5mm	
Frequency	2450MHz ± 1MHz	

Head TSL Parameters

The following parameters and calculations were applied

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL Parameters	22.0 °C	39.2	1.80
Measured Head TSL Parameters		39.5 ±5%	1.80 ±5%
Head TSL Temperature during Test	21.8 °C	--	--

Muscle TSL Parameters

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL Parameters	22.0 °C	52.7	1.95
Measured Head TSL Parameters		52.7 ±5%	1.95 ±5%
Head TSL Temperature during Test	22.0 °C	--	--

Measurement Uncertainty of Dipole Calibration

Error Description	**Uncertainty Value ±%**	**Probability Distribution**	**Divisor**	c_i **1g**	**Standard Uncertainty ±% (1g)**
Anritsu Power Meter ML2488A	± 1.4	normal	2	1	± 0.7
Anritsu Power Sensor	± 1.4	normal	2	1	± 0.7
HP E4418B Power Meter	± 0.2	normal	2	1	± 0.1
HP 8482A Power Sensor	± 0.8	normal	2	1	± 0.4
83650B Signal Generator	± 2.0	normal	2	1	± 1.0
HP 8722D Vector Network Analyzer	± 2.0	normal	2	1	± 1.0
Combined Standard Uncertainty					± 3.9

SAR results with Head TSL and system uncertainty

SAR averaged over 1 cm^3 (1g) of Head TSL	Condition	
SAR Normalized	Normalized to 1 W	56.8 mW/g
SAR for nominal Head TSL Parameters	Normalized to 1W	56.8 ± 24.29% mW/g (k=2)

SAR averaged over 1 cm^3 (10g) of Head TSL	Condition	
SAR Normalized	Normalized to 1 W	25.6 mW/g
SAR for nominal Head TSL Parameters	Normalized to 1W	25.6 ± 23.51% mW/g (k=2)

SAR results with Muscle TSL and system uncertainty

SAR averaged over 1 cm^3 (1g) of Head TSL	Condition	
SAR Normalized	Normalized to 1 W	53.6 mW/g
SAR for nominal Head TSL Parameters	Normalized to 1W	53.6 ± 24.29% mW/g (k=2)

SAR averaged over 1 cm^3 (10g) of Head TSL	Condition	
SAR Normalized	Normalized to 1 W	24.4 mW/g
SAR for nominal Head TSL Parameters	Normalized to 1W	24.4 ± 23.51% mW/g (k=2)

2450MHz Diploe Calibration

Date/Time: 3/09/2006 3:31:59 PM

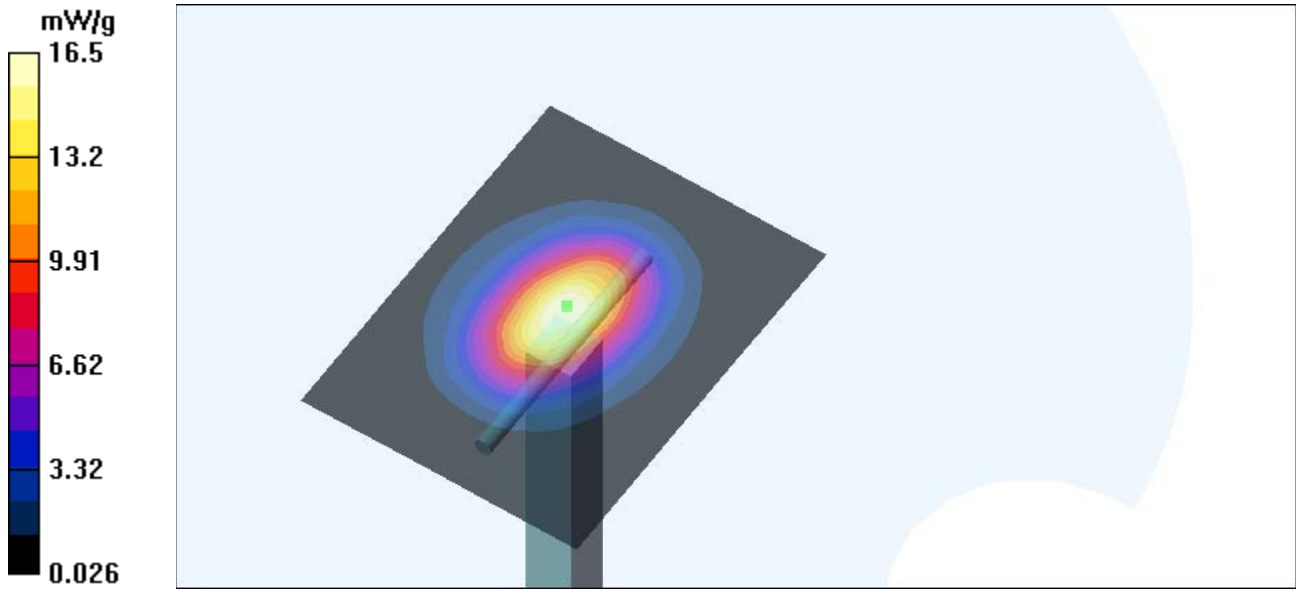
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 1S2452

Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL2450 Medium parameters used: f = 2450 MHz; σ = 1.8 mho/m; ε_r = 39.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

Probe: EX3DV3 - SN3511; ConvF(7.64, 7.64, 7.64); Calibrated: 1/23/2006
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE3 Sn584; Calibrated: 9/22/2005
Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Area Scan (61x81x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 16.5 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.0 V/m; Power Drift = -0.015 dB
Peak SAR (extrapolated) = 31.1 W/kg
SAR(1 g) = 14.2 mW/g; SAR(10 g) = 6.42 mW/g
Maximum value of SAR (measured) = 16.0 mW/g



2450MHz Body calibration

Date/Time: 3/09/2006 9:06:50 AM

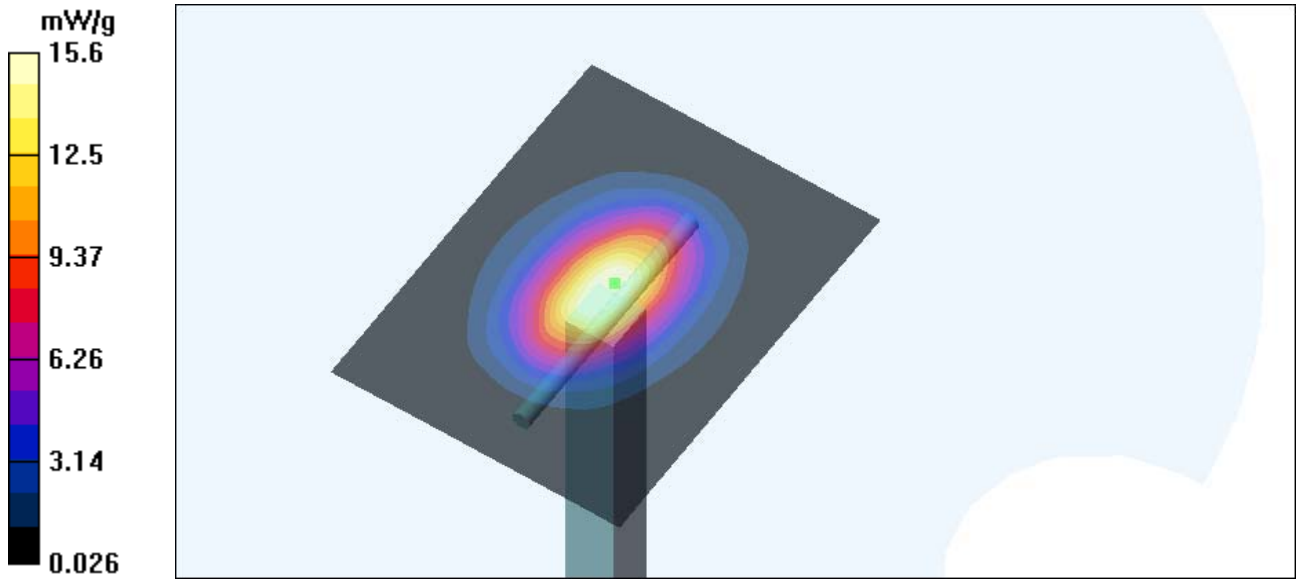
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 1S2452

Communication System: CW; ; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: M2450 Medium parameters used: f = 2450 MHz; σ = 1.95 mho/m; ε_r = 52.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

Probe: EX3DV3 - SN3511; ConvF(7.8, 7.8, 7.8); Calibrated: 1/23/2006
Sensor-Surface: 4mm (Mechanical Surface Detection)
Electronics: DAE3 Sn584; Calibrated: 9/22/2005
Phantom: SAM with CRP; Type: SAM; Serial: TP 1310
Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Area Scan (61x81x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 15.6 mW/g

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.1 V/m; Power Drift = -0.047 dB
Peak SAR (extrapolated) = 27.6 W/kg
SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.12 mW/g
Maximum value of SAR (measured) = 15.3 mW/g



APPENDIX E – MEASURED FLUID DIELECTRIC PARAMETERS

2450MHz Body

April 17, 2006 07:56 AM

Frequency	e'	e''
2.400000000 GHz	54.8886	14.8350
2.402000000 GHz	54.8807	14.8505
2.404000000 GHz	54.8633	14.8708
2.406000000 GHz	54.8594	14.8891
2.408000000 GHz	54.8266	14.8979
2.410000000 GHz	54.8138	14.9364
2.412000000 GHz	54.7797	14.9592
2.414000000 GHz	54.7363	14.9540
2.416000000 GHz	54.7514	14.9590
2.418000000 GHz	54.7651	14.9659
2.420000000 GHz	54.7706	14.9638
2.422000000 GHz	54.7608	14.9743
2.424000000 GHz	54.7372	14.9954
2.426000000 GHz	54.7426	15.0258
2.428000000 GHz	54.7158	15.0148
2.430000000 GHz	54.7102	14.9952
2.432000000 GHz	54.6878	15.0110
2.434000000 GHz	54.6400	14.9963
2.436000000 GHz	54.6209	14.9995
2.438000000 GHz	54.6005	15.0166
2.440000000 GHz	54.5809	15.0165
2.442000000 GHz	54.5973	15.0485
2.444000000 GHz	54.6056	15.0509
2.446000000 GHz	54.5917	15.0430
2.448000000 GHz	54.5829	15.0445
2.450000000 GHz	54.5956	15.0410
2.452000000 GHz	54.5945	15.0482
2.454000000 GHz	54.5979	15.0615
2.456000000 GHz	54.6228	15.0696
2.458000000 GHz	54.6104	15.0803
2.460000000 GHz	54.6000	15.0923
2.462000000 GHz	54.6126	15.0766
2.464000000 GHz	54.6171	15.0845
2.466000000 GHz	54.6235	15.0937
2.468000000 GHz	54.6558	15.0833
2.470000000 GHz	54.6954	15.0956
2.472000000 GHz	54.7039	15.0856
2.474000000 GHz	54.7074	15.0866
2.476000000 GHz	54.7051	15.1039
2.478000000 GHz	54.7311	15.1062
2.480000000 GHz	54.7333	15.1091
2.482000000 GHz	54.8433	15.1414
2.484000000 GHz	54.8807	15.1692
2.486000000 GHz	54.8602	15.1793
2.488000000 GHz	54.8562	15.1950

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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