3.3 E-Field Probe Calibration

Probes were calibrated by the manufacturer in the TEM cell ifi 110. To ensure consistency, a strict protocol was followed. The conversion factor (ConF) between this calibration and the measurement in the tissue simulation solution was performed by comparison with temperature measurement and computer simulations. Probe calibration factors are included in Appendix C.

3.4 Measurement Uncertainty

The uncertainty budget has been determined for the DASY3 measurement system according to the NIS81 [5] and the NIST 1297 [6] documents and is given in the following table. The extended uncertainty (K=2) was assessed to be 23.5 %

UNCERTAINTY BUDGET				
Uncertainty Description	**Error**	**Distrib.**	**Weight**	**Std.Dev.**
Probe Uncertainty				
Axial isotropy	±0.2 dB	U-shape	0.5	±2.4 %
Spherical isotropy	±0.4 dB	U-shape	0.5	±4.8 %
Isotropy from gradient	±0.5 dB	U-shape	0	
Spatial resolution	±0.5 %	Normal	1	±0.5 %
Linearity error	±0.2 dB	Rectang.	1	±2.7 %
Calibration error	±3.3 %	Normal	1	±3.3 %
SAR Evaluation Uncertainty				
Data acquisition error	±1 %	Rectang.	1	±0.6 %
ELF and RF disturbances	±0.25 %	Normal	1	±0.25 %
Conductivity assessment	±10 %	Rectang.	1	±5.8 %
Spatial Peak SAR Evaluation Uncertainty				
Extrapol boundary effect	±3 %	Normal	1	±3 %
Probe positioning error	±0.1 mm	Normal	1	±1 %
Integrat. and cube orient	±3 %	Normal	1	±3 %
Cube shape inaccuracies	±2 %	Rectang.	1	±1.2 %
Device positioning	±6 %	Normal	1	±6 %
Combined Uncertainties				**±11.7 %**

3.5 Measurement Tractability

All measurements described in this report are traceable to National Institute of Standards and Technology (NIST) standards or appropriate national standards.

4.0 WARNING LABEL INFORMATION - USA

See User Manual.

5.0 REFERENCES

[1] ANSI, *ANSI/IEEE C95.1-1991: IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300 GHz*, The Institute of electrical and Electronics Engineers, Inc., New York, NY 10017, 1992

[2] Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields", OET Bulletin 65, FCC, Washington, D.C. 20554, 1997

[3] Thomas Schmid, Oliver Egger, and Niels Kuster, "Automated E-field scanning system for dosimetric assessments", *IEEE Transaction on Microwave Theory and Techniques*, vol. 44, pp. 105-113, Jan. 1996.

[4] Niels Kuster, Ralph Kastle, and Thomas Schmid, "Dosimetic evaluation of mobile communications equipment with know precision", IEICE Transactions on Communications, vol. E80-B, no. 5, pp.645-652, May 1997.

[5] NIS81, NAMAS, "The treatment of uncertainty in EMC measurement", Tech. Rep., NAMAS Executive, National Physical Laboratory, Teddinton, Middlesex, England, 1994.

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

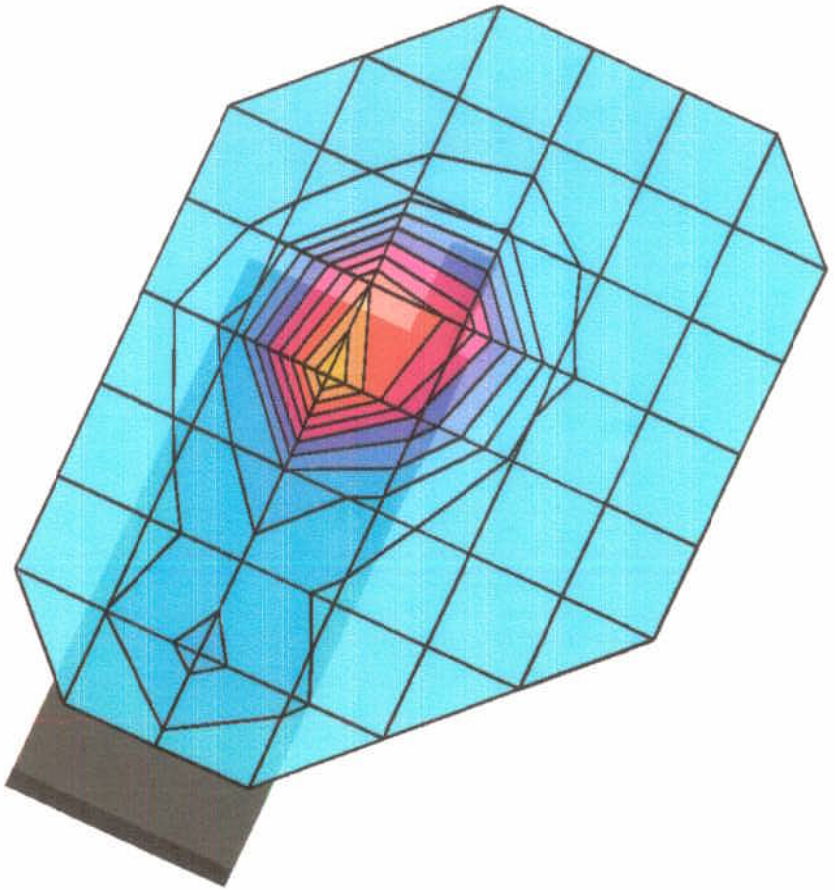
APPENDIX A - SAR Evaluation Data

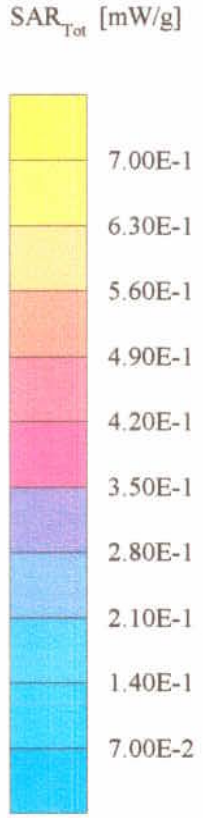
Please note that the graphical visualization of the phone position onto the SAR distribution gives only limited information on the current distribution of the device, since the curvature of the head results in graphical distortion. Full information can only be obtained either by H-field scans in free space or SAR evaluation with a flat phantom.

Powerdrift is the measurement of power drift of the device over one complete SAR scan.

Shintom GDU325 #1

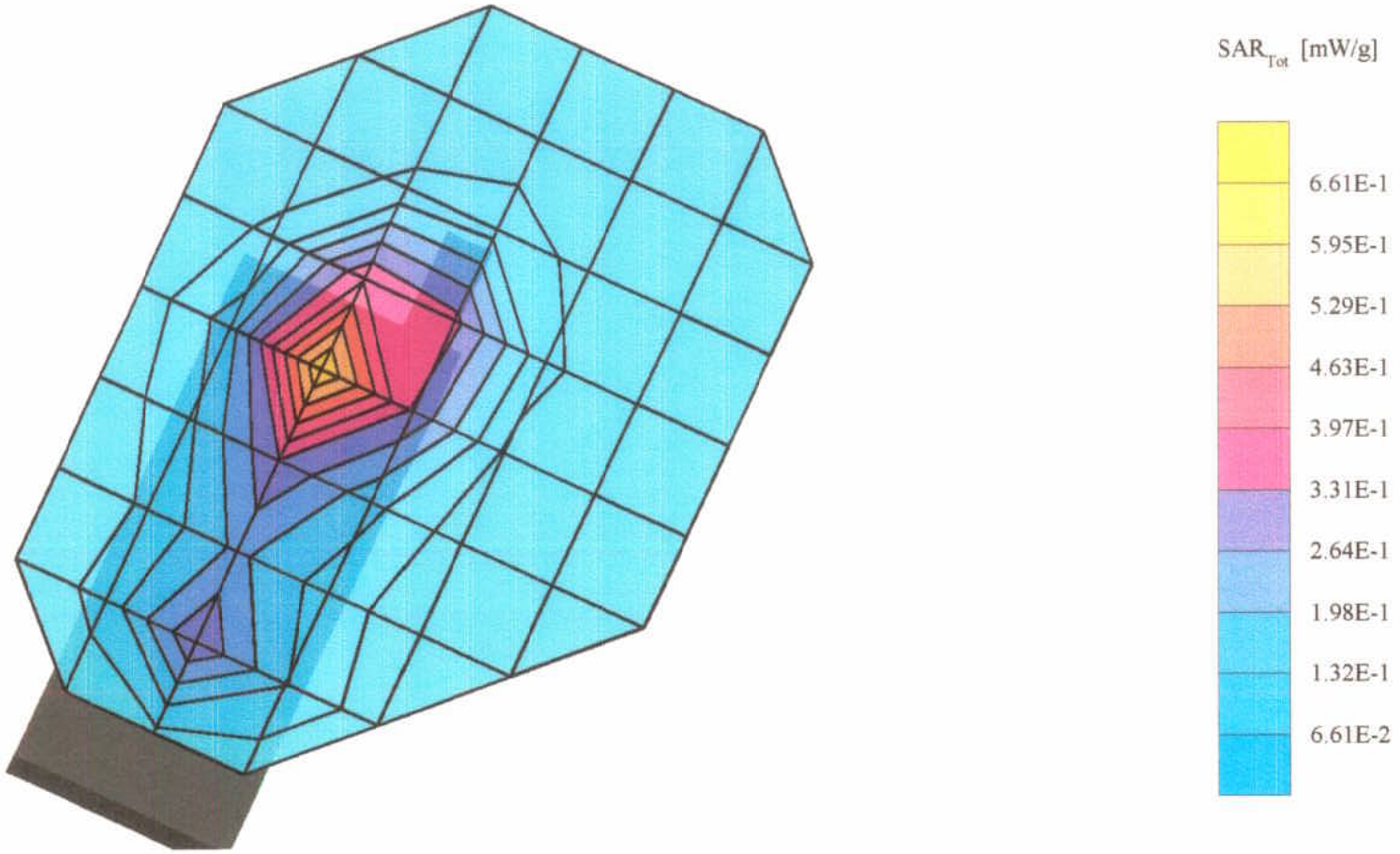
Generic Twin Phantom; Left Hand _X Section; Position: (80°,65°); Frequency: 1850 MHz
Probe: ET3DV5 - SN1333; ConvF(5.03,5.03,5.03); Crest factor: 8.0; Brain1900 MHz: σ = 1.77 mho/m ε_r = 42.8 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.732 mW/g, SAR (10g): 0.393 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.00 dB





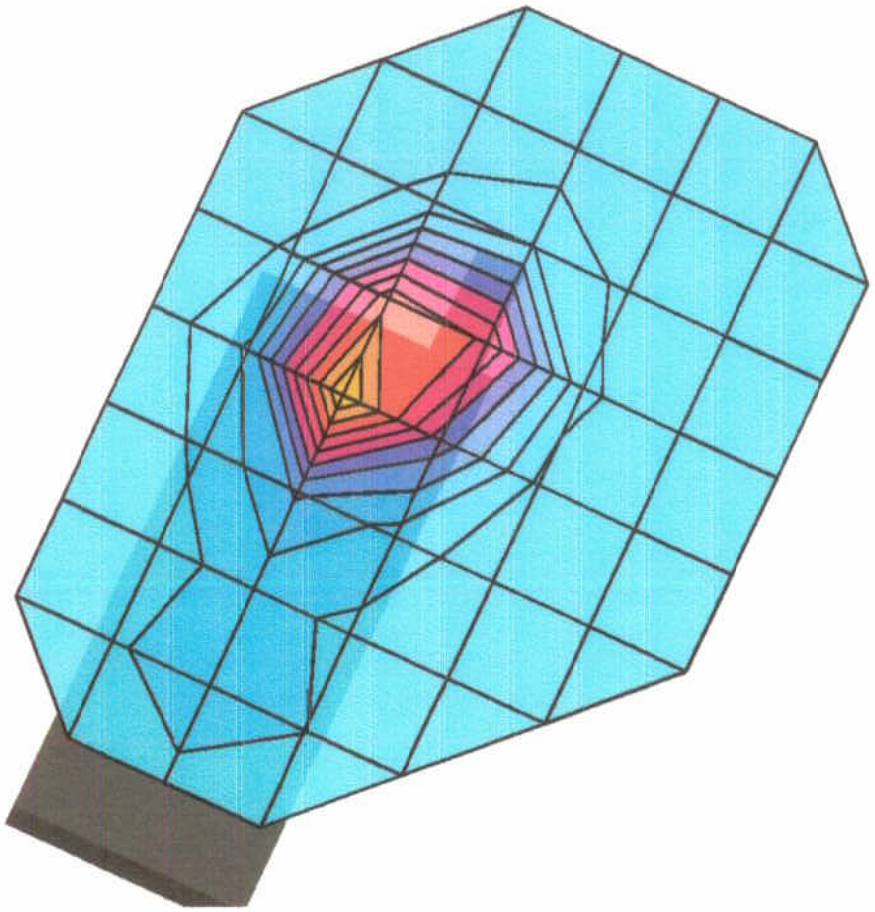
Shintom GDU325 #2

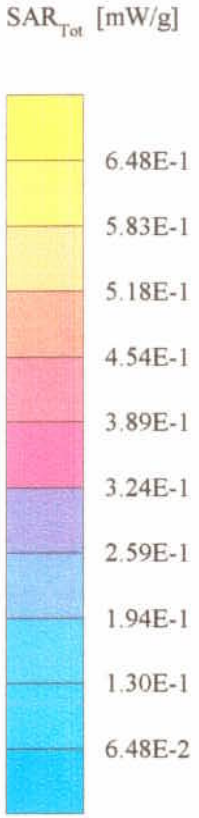
Generic Twin Phantom; Left Hand _X Section; Position: (80°,65°); Frequency: 1850 MHz
Probe: ET3DV5 - SN1333; ConvF(5.03,5.03,5.03); Crest factor: 8.0; Brain1900 MHz: σ = 1.77 mho/m ε_r = 42.8 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.588 mW/g, SAR (10g): 0.328 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.05 dB



Shintom GDU325 #3

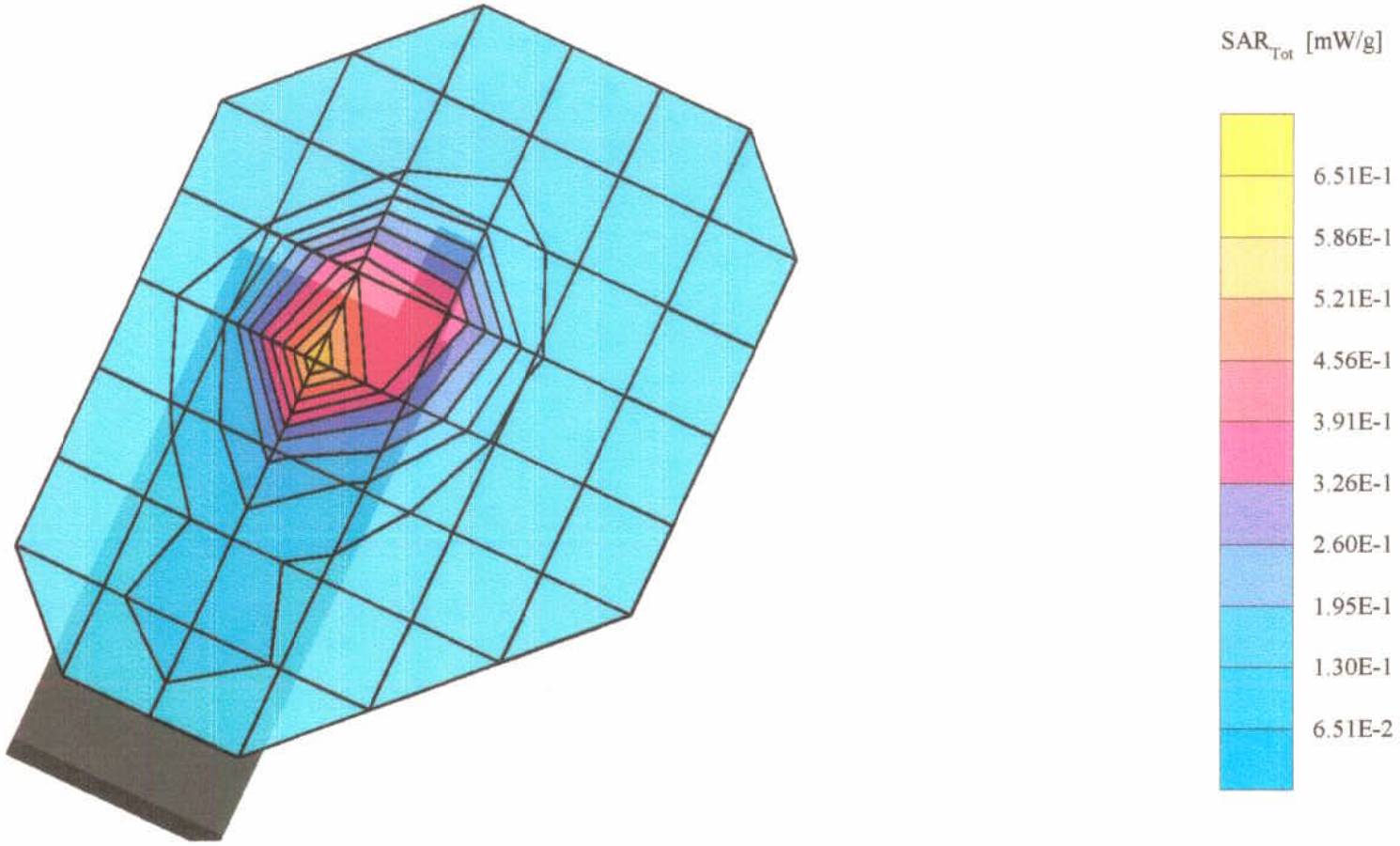
Generic Twin Phantom; Left Hand _X Section; Position: (80°,65°); Frequency: 1880 MHz
Probe: ET3DV5 - SN1333; ConvF(5.03,5.03,5.03); Crest factor: 8.0; Brain1900 MHz: σ = 1.77 mho/m ε_r = 42.8 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.684 mW/g, SAR (10g): 0.363 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.06 dB





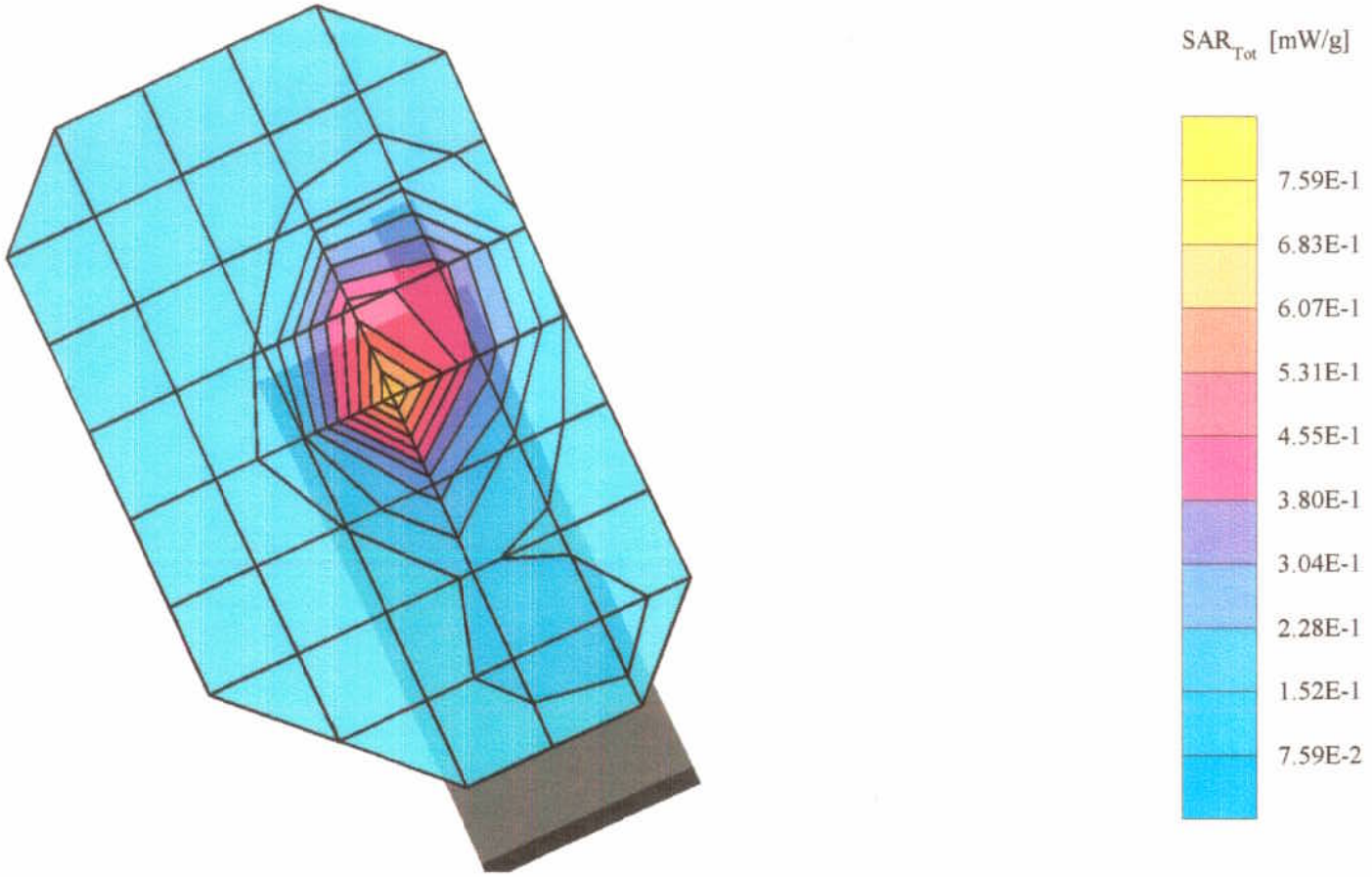
Shintom GDU325 #4

Generic Twin Phantom; Left Hand _X Section; Position: (80°,65°); Frequency: 1910 MHz
Probe: ET3DV5 - SN1333; ConvF(5.03,5.03,5.03); Crest factor: 8.0; Brain1900 MHz: σ = 1.77 mho/m ε_r = 42.8 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.670 mW/g, SAR (10g): 0.354 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.08 dB



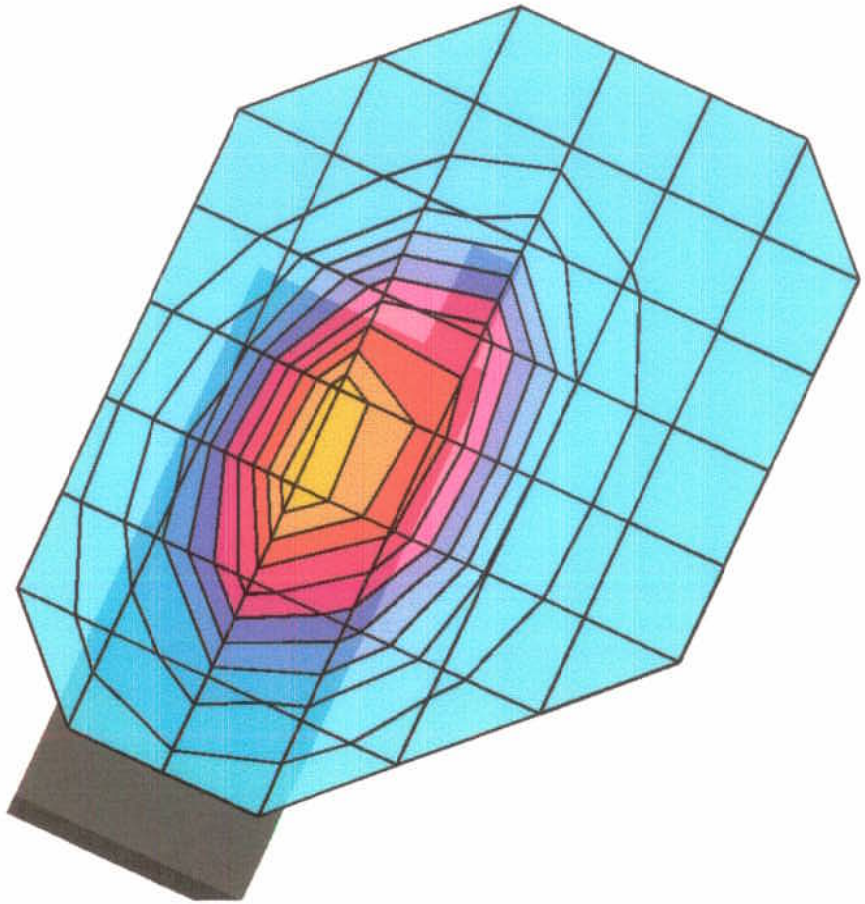
Shintom GDU325 #5

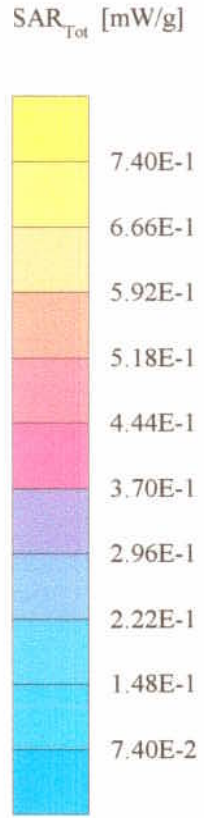
Generic Twin Phantom; Right Hand Section; Position: (80°,65°); Frequency: 1850 MHz
Probe: ET3DV5 - SN1333; ConvF(5.03,5.03,5.03); Crest factor: 8.0; Brain1900 MHz: σ = 1.77 mho/m ε_r = 42.8 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.731 mW/g, SAR (10g): 0.392 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.11 dB



Shintom GDU325 #6

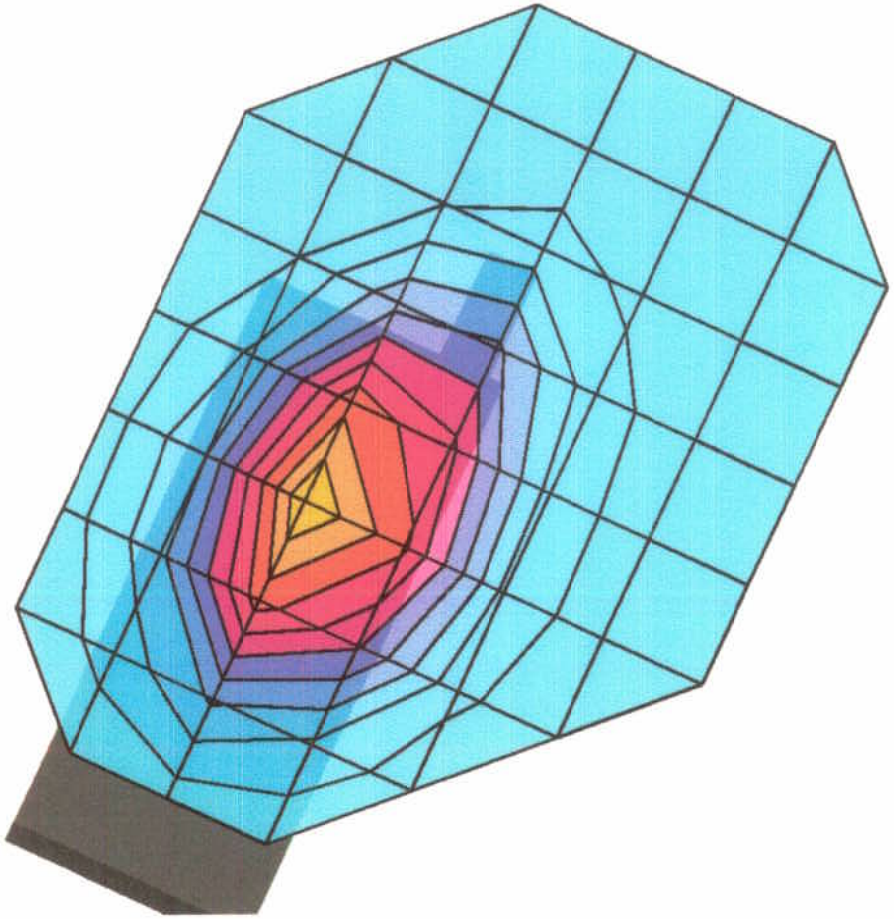
Generic Twin Phantom; Left Hand _X Section; Position: (80°,65°); Frequency: 890 MHz
Probe: ET3DV5 - SN1333; ConvF(5.70,5.70,5.70); Crest factor: 8.0; Brain 900MHz: σ = 0.81 mho/m ε_r = 45.5 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.786 mW/g, SAR (10g): 0.548 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.02 dB

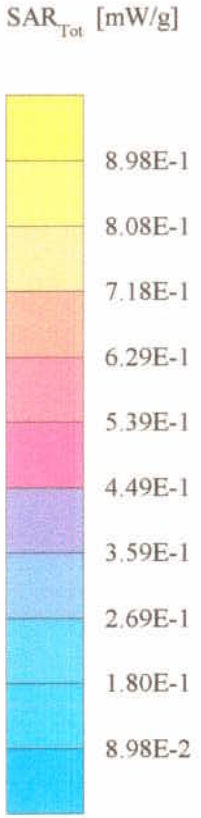




Shintom GDU325 #7

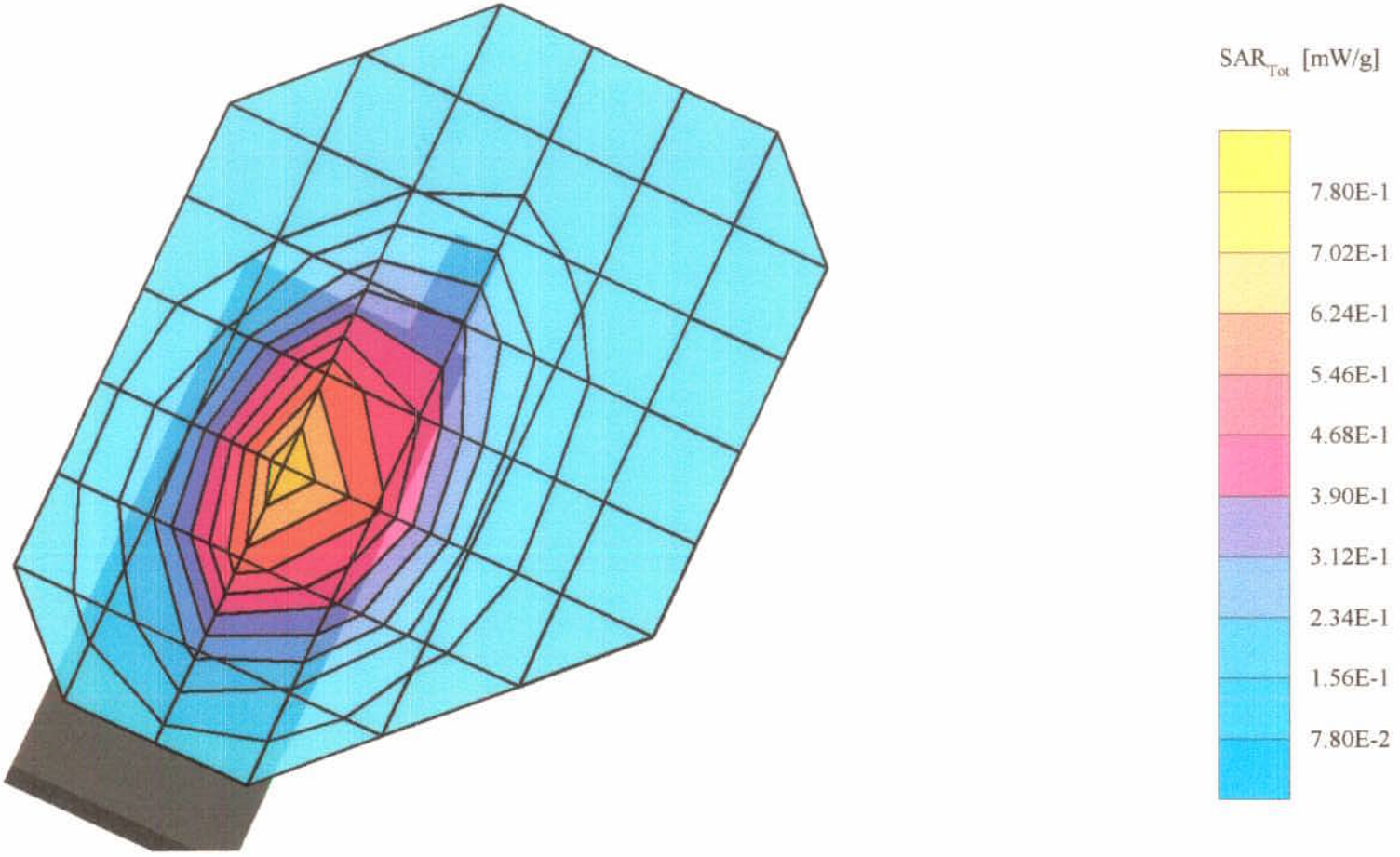
Generic Twin Phantom; Left Hand _X Section; Position: (80°,65°); Frequency: 890 MHz
Probe: ET3DV5 - SN1333; ConvF(5.70,5.70,5.70); Crest factor: 8.0; Brain 900MHz: σ = 0.81 mho/m ε_r = 45.5 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.937 mW/g, SAR (10g): 0.635 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.03 dB





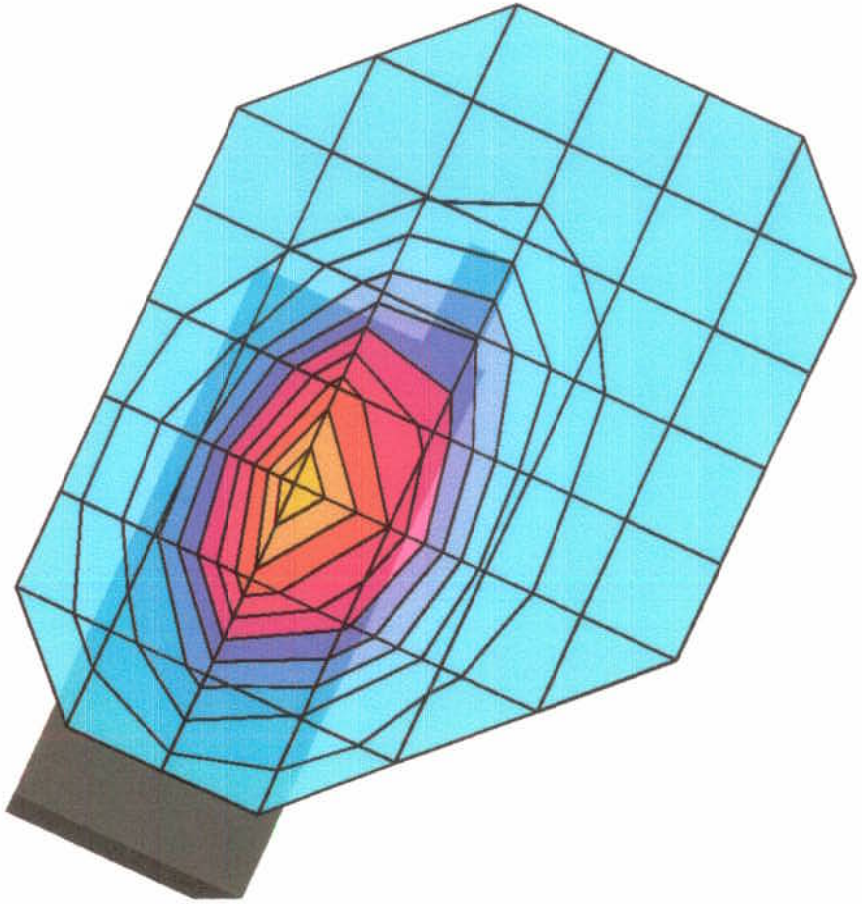
Shintom GDU325 #8

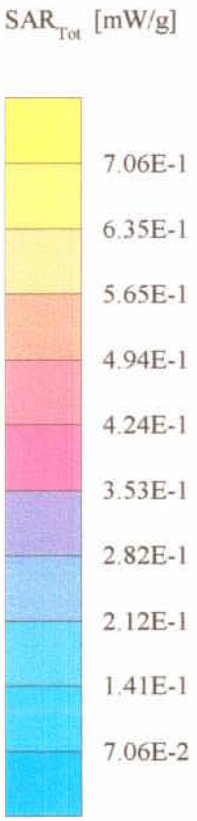
Generic Twin Phantom; Left Hand _X Section; Position: (80°,65°); Frequency: 902 MHz
Probe: ET3DV5 - SN1333; ConvF(5.70,5.70,5.70); Crest factor: 8.0; Brain 900MHz: σ = 0.81 mho/m ε_r = 45.5 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.826 mW/g, SAR (10g): 0.556 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.01 dB



Shintom GDU325 #9

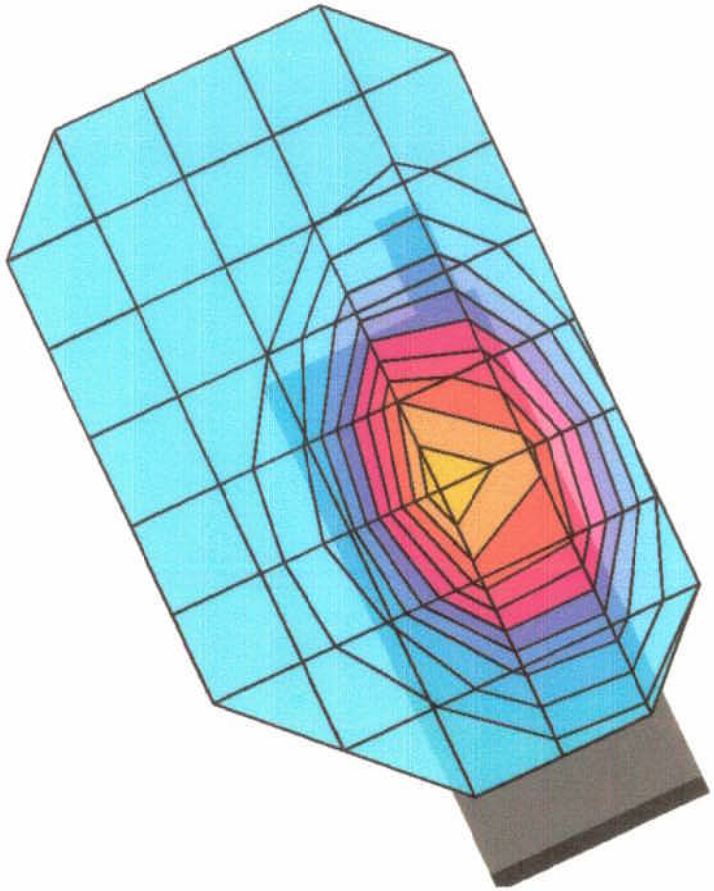
Generic Twin Phantom; Left Hand _X Section; Position: (80°,65°); Frequency: 915 MHz
Probe: ET3DV5 - SN1333; ConvF(5.70,5.70,5.70); Crest factor: 8.0; Brain 900MHz: σ = 0.81 mho/m ε_r = 45.5 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.733 mW/g, SAR (10g): 0.496 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.01 dB

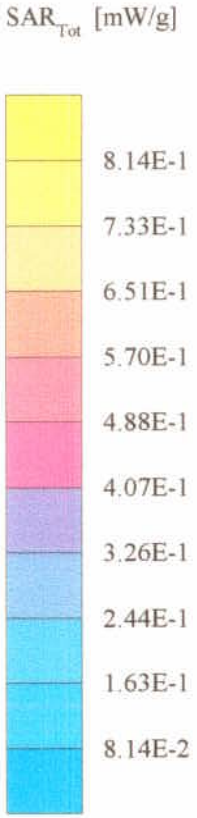




Shintom GDU325 #10

Generic Twin Phantom; Right Hand Section; Position: (80°,65°); Frequency: 890 MHz
Probe: ET3DV5 - SN1333; ConvF(5.70,5.70,5.70); Crest factor: 8.0; Brain 900MHz: σ = 0.81 mho/m ε_r = 45.5 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.910 mW/g, SAR (10g): 0.618 mW/g, (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.28 dB





APPENDIX B - E-Field Probe Calibration Data

See attached.

Schmid & Partner
Engineering AG

Staffelstrasse 8, 8045 Zurich, Switzerland, Telefon +41 1 280 08 60, Fax +41 1 280 08 64

Calibration Certificate

Dosimetric E-Field Probe

Type:	**ET3DV5**
Serial Number:	**1333**
Place of Calibration:	**Zurich**
Date of Calibration:	**April 10, 2000**
Calibration Interval:	**12 months**

Schmid & Partner Engineering AG hereby certifies, that this device has been calibrated on the date indicated above. The calibration was performed in accordance with specifications and procedures of Schmid & Partner Engineering AG.

Wherever applicable, the standards used in the calibration process are traceable to international standards. In all other cases the standards of the Laboratory for EMF and Microwave Electronics at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland have been applied.

Calibrated by:	Nikolaus Kuster
Approved by:	C. Eyl

Schmid & Partner
Engineering AG

Staffelstrasse 8, 8045 Zurich, Switzerland, Telefon +41 1 280 08 60, Fax +41 1 280 08 64

Probe ET3DV5

SN:1333

Manufactured:	December 20, 1997
Last calibration:	March 18, 1999
Recalibrated:	April 10, 2000

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV5 SN:1333

Sensitivity in Free Space

NormX	**2.39** $\mu V/(V/m)^2$
NormY	**2.36** $\mu V/(V/m)^2$
NormZ	**2.34** $\mu V/(V/m)^2$

Diode Compression

DCP X	**100** mV
DCP Y	**100** mV
DCP Z	**100** mV

Sensitivity in Tissue Simulating Liquid

Brain **450 MHz** ε_r **= 48 ± 5%** σ **= 0.50 ± 10% mho/m**

ConvF X	**6.03**	extrapolated	Boundary effect:	
ConvF Y	**6.03**	extrapolated	Alpha	**0.13**
ConvF Z	**6.03**	extrapolated	Depth	**3.57**

Brain **900 MHz** ε_r **= 42.5 ± 5%** σ **= 0.86 ± 10% mho/m**

ConvF X	**5.70**	± 7% (k=2)	Boundary effect:	
ConvF Y	**5.70**	± 7% (k=2)	Alpha	**0.34**
ConvF Z	**5.70**	± 7% (k=2)	Depth	**3.00**

Brain **1500 MHz** ε_r **= 41 ± 5%** σ **= 1.32 ± 10% mho/m**

ConvF X	**5.25**	interpolated	Boundary effect:	
ConvF Y	**5.25**	interpolated	Alpha	**0.61**
ConvF Z	**5.25**	interpolated	Depth	**2.23**

Brain **1800 MHz** ε_r **= 41 ± 5%** σ **= 1.69 ± 10% mho/m**

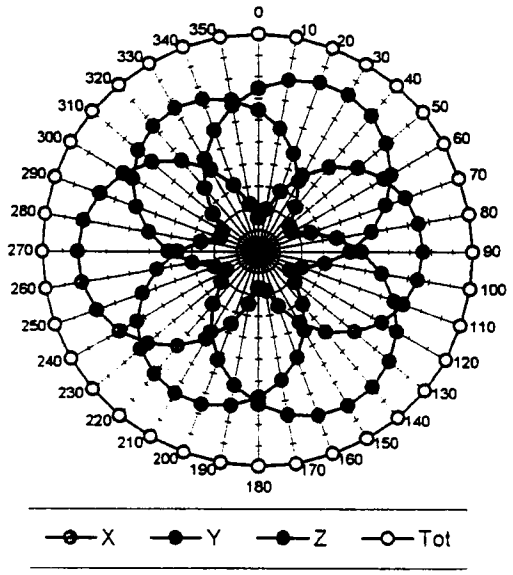
ConvF X	**5.03**	± 7% (k=2)	Boundary effect:	
ConvF Y	**5.03**	± 7% (k=2)	Alpha	**0.74**
ConvF Z	**5.03**	± 7% (k=2)	Depth	**1.85**

Sensor Offset

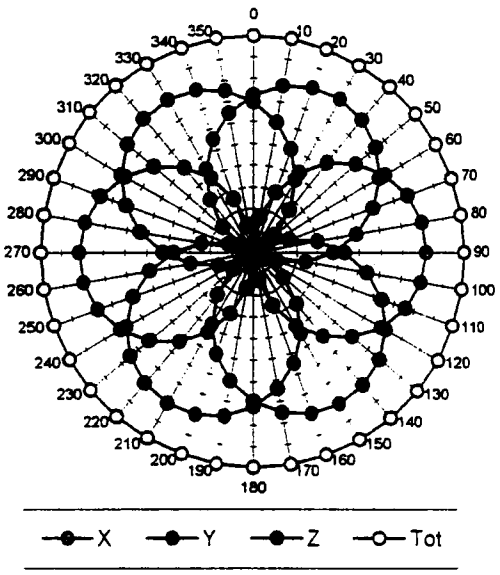
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.9 ± 0.2**	mm

Receiving Pattern (ϕ), θ = 0°

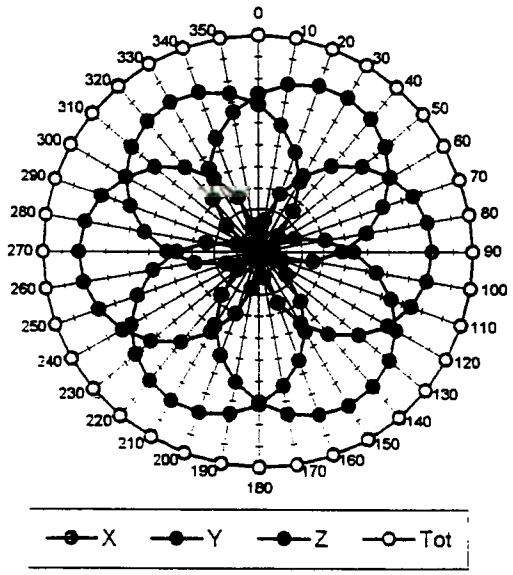
f = 30 MHz, TEM cell ifi110



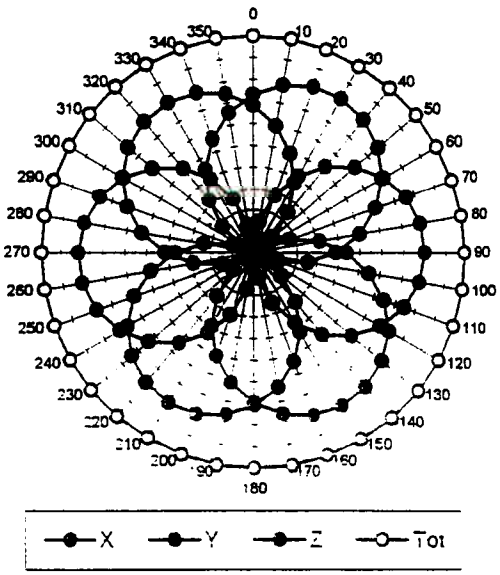
f = 100 MHz, TEM cell ifi110

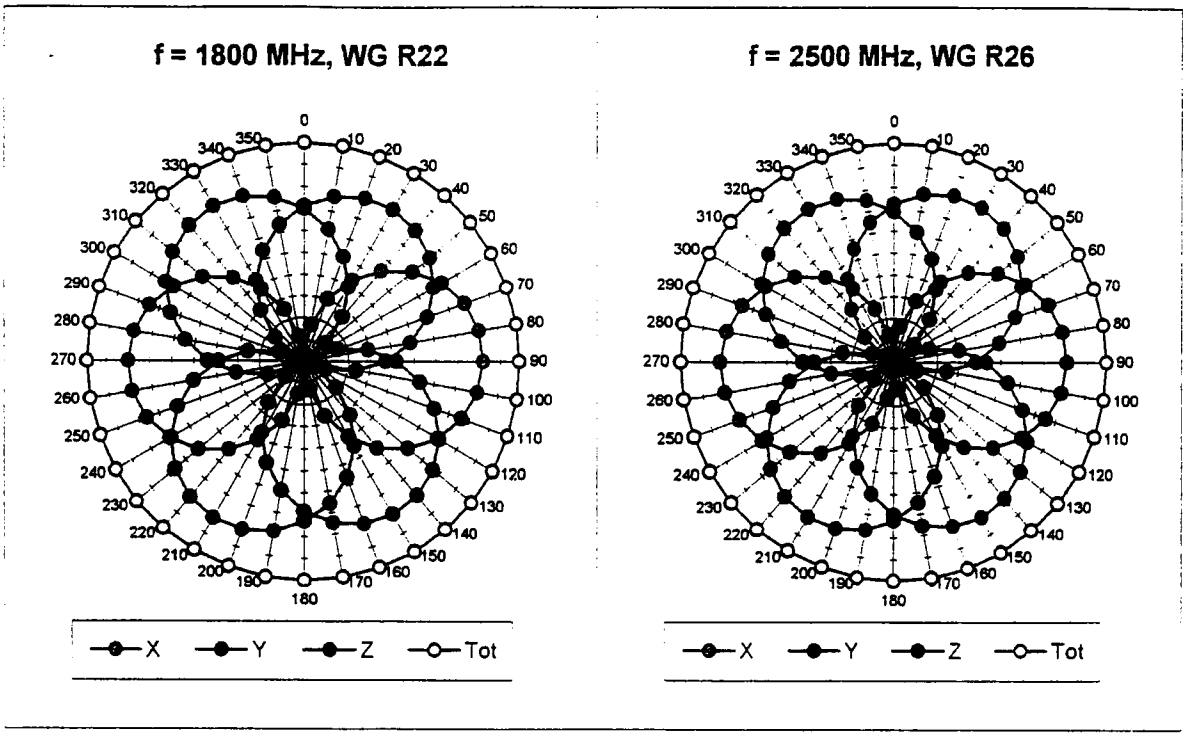


f = 300 MHz, TEM cell ifi110

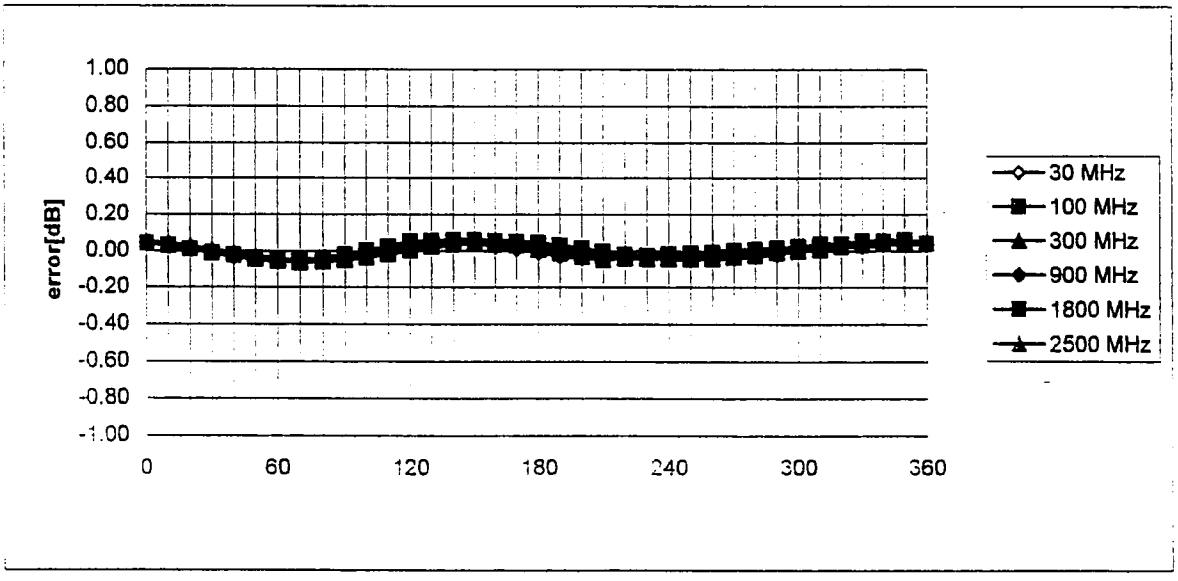


f = 900 MHz, TEM cell ifi110



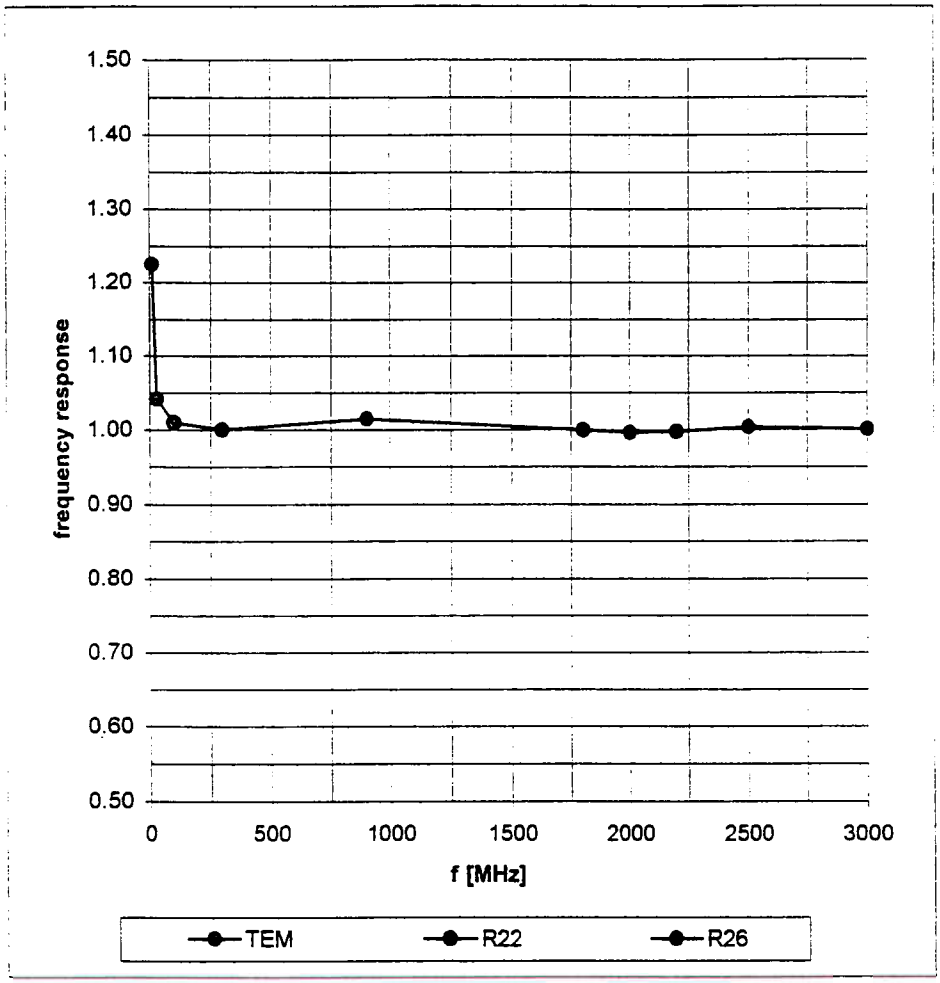


Isotropy Error (ϕ), θ = 0°



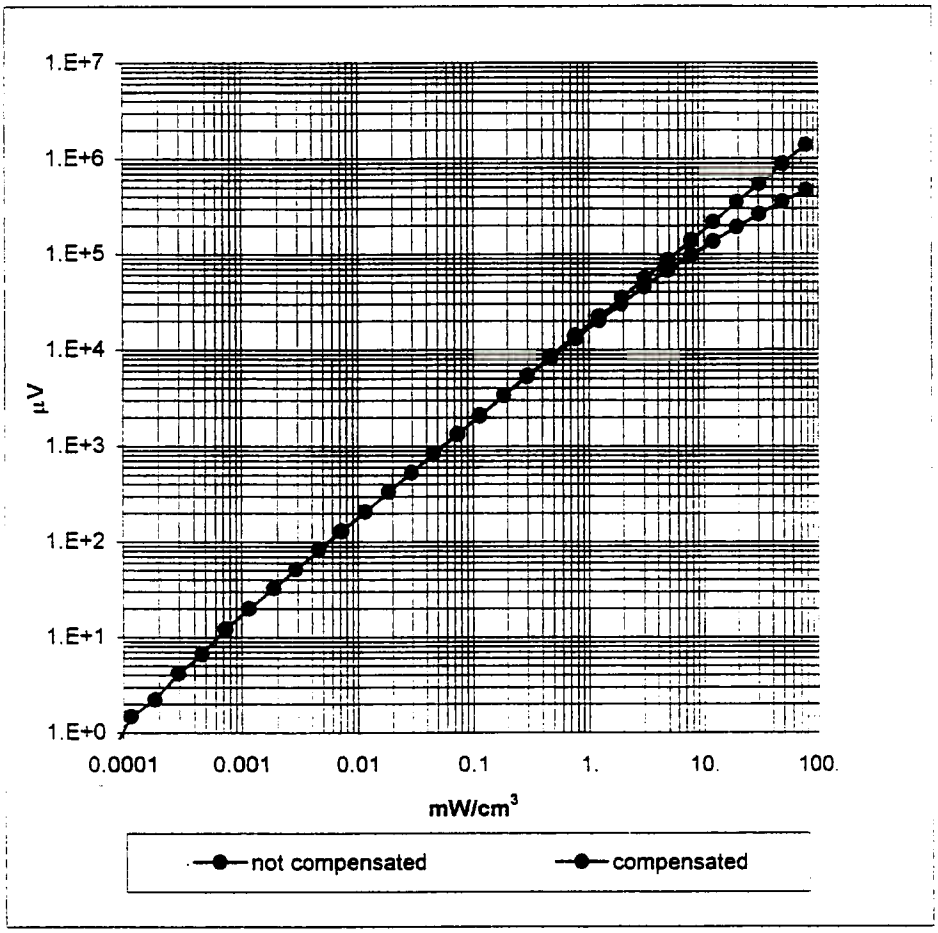
Frequency Response of E-Field

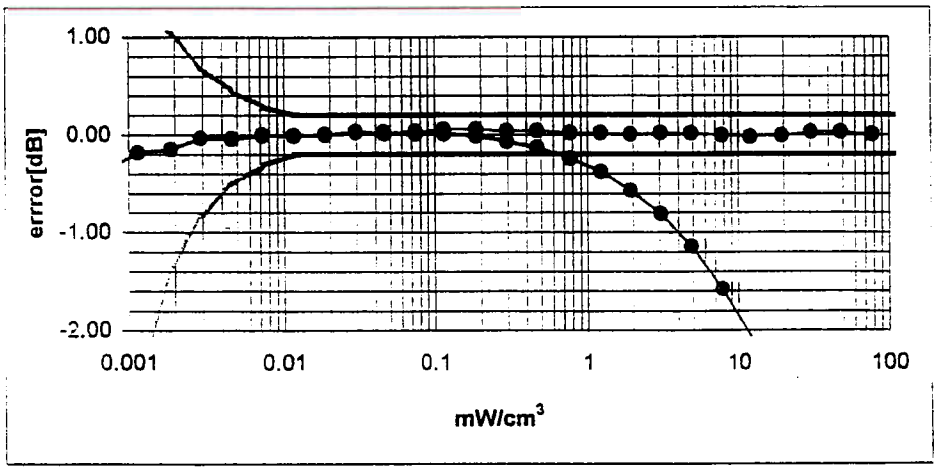
(TEM-Cell:ifi110, Waveguide R22, R26)



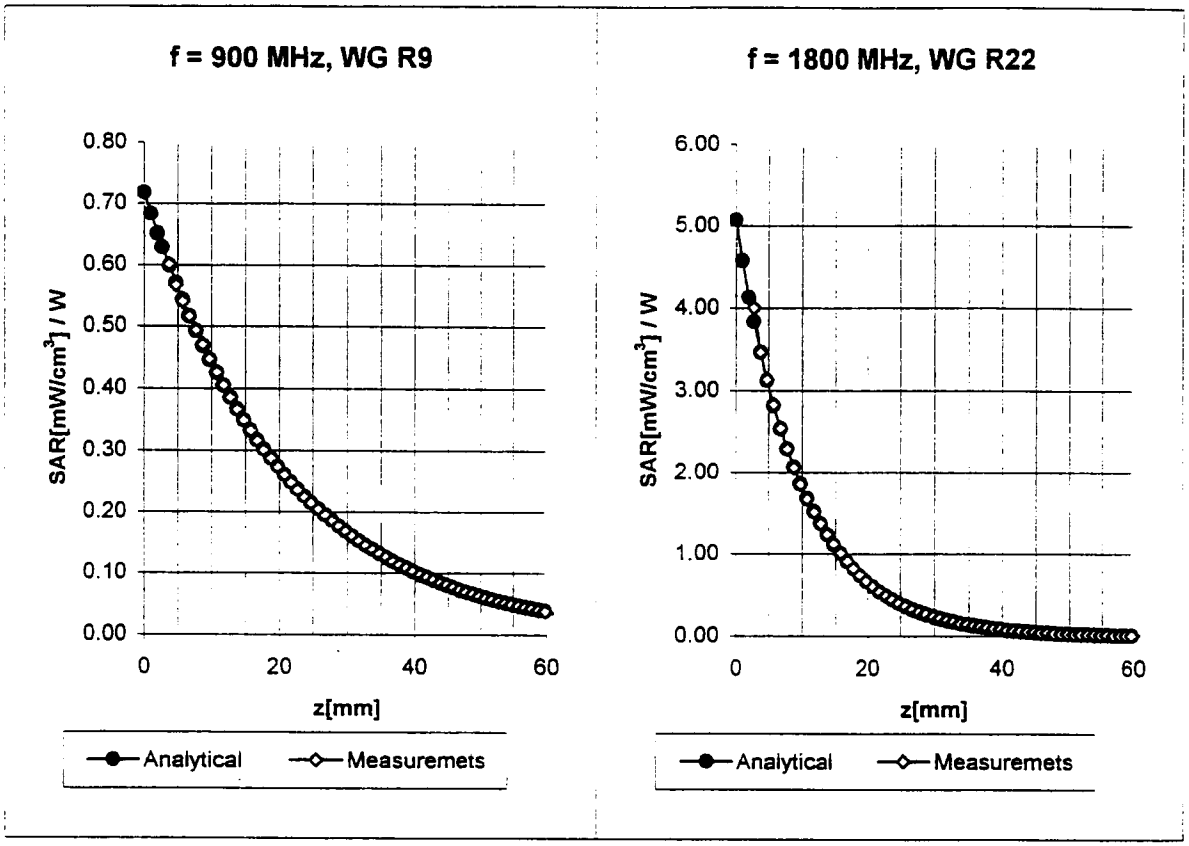
Dynamic Range f(SAR_{brain})

(TEM-Cell:ifi110)



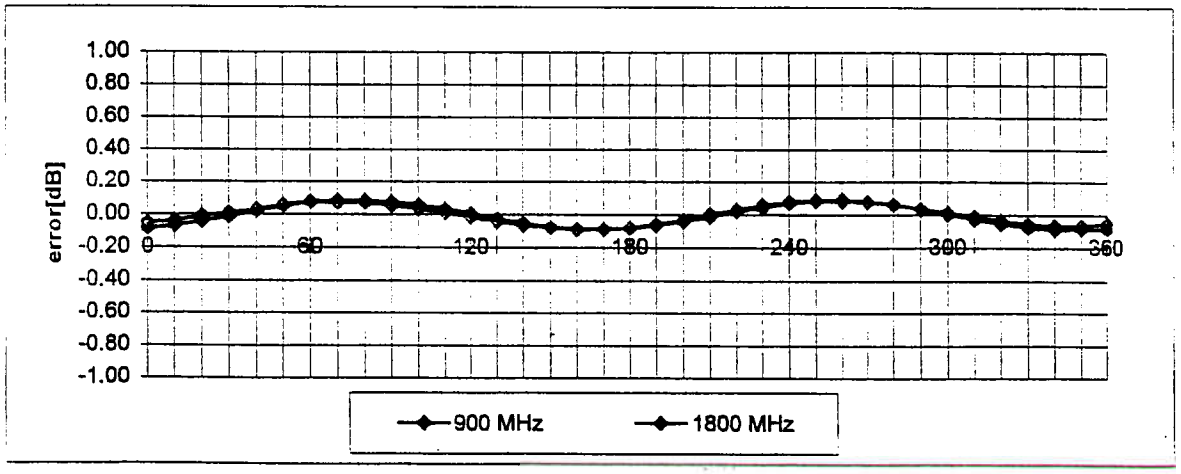


Conversion Factor Assessment



Receiving Pattern (ϕ)

(in brain tissue, z = 5 mm)



6.0 DOCUMENT HISTORY

Revision/ Job Number	Writer Initials	Date	Change
1.0 /J	SS	February 16, 2001	Original document