

Schmid & Partner Engineering AG

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Calibration Certificate

Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1560

Place of Calibration:

Zurich

Date of Calibration:

September 27, 2002

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:

N. Vetter

Approved by:

Alvin Kof

Probe ET3DV6

SN:1560

Manufactured:	December 1, 2000
Last calibration:	February 20, 2001
Recalibrated:	September 27, 2002

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1560

Sensitivity in Free Space

NormX	1.48 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.50 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.42 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

DCP X	93	mV
DCP Y	93	mV
DCP Z	93	mV

Sensitivity in Tissue Simulating Liquid

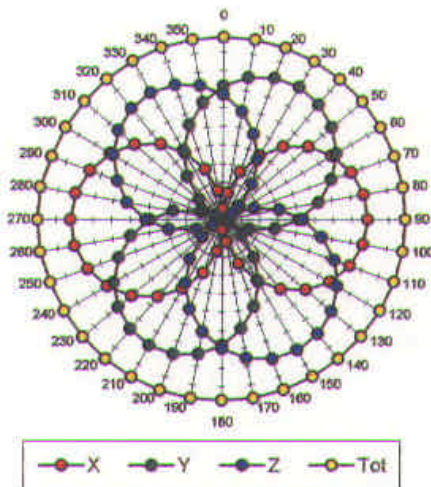
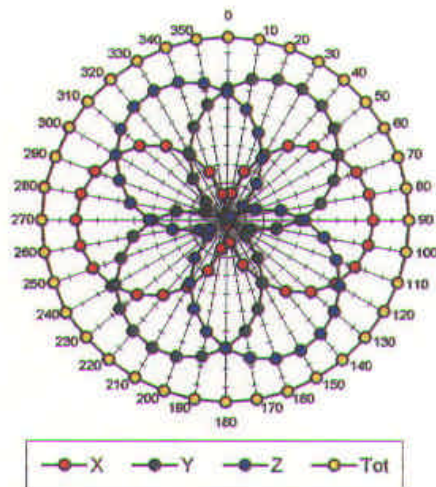
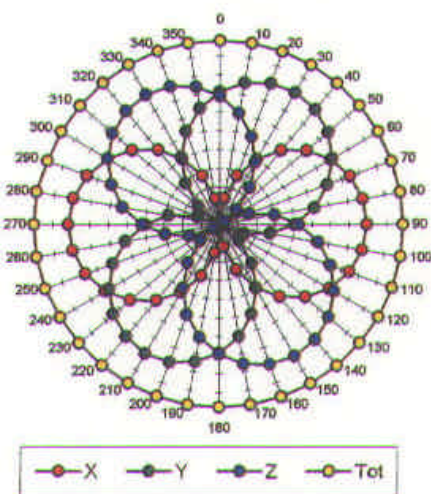
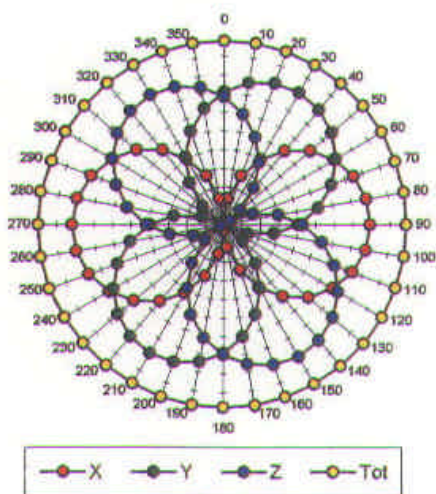
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\% \text{ mho/m}$
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
ConvF X	6.9 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.9 $\pm 9.5\%$ (k=2)	Alpha	0.60
ConvF Z	6.9 $\pm 9.5\%$ (k=2)	Depth	1.69
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\% \text{ mho/m}$
ConvF X	5.4 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	5.4 $\pm 9.5\%$ (k=2)	Alpha	0.49
ConvF Z	5.4 $\pm 9.5\%$ (k=2)	Depth	2.36

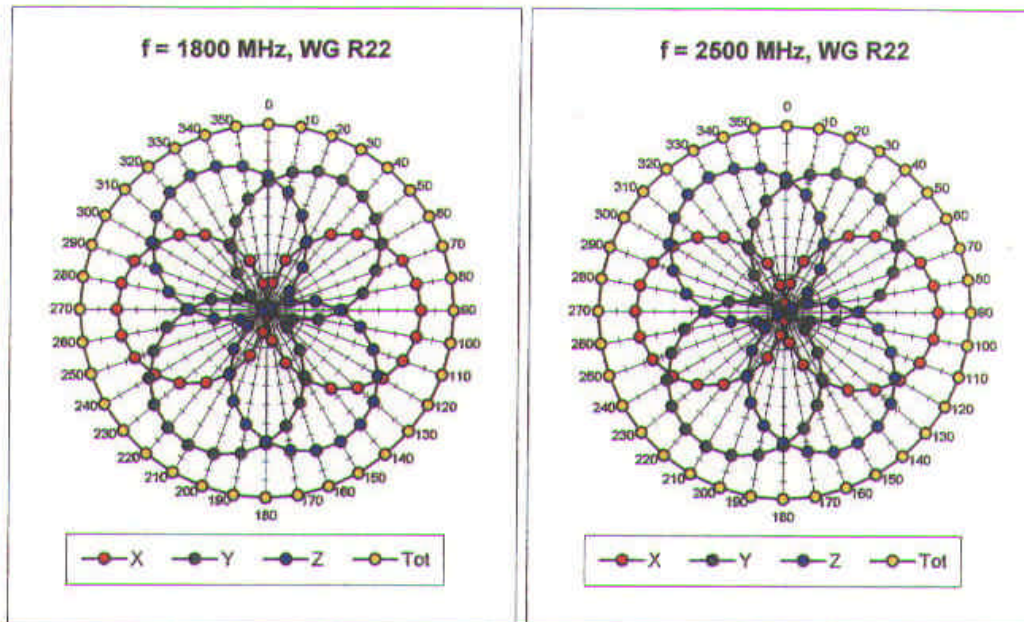
Boundary Effect

Head	835 MHz	Typical SAR gradient: 5 % per mm	
Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%]	Without Correction Algorithm	7.3	3.7
SAR _{be} [%]	With Correction Algorithm	0.0	0.2
Head	1900 MHz	Typical SAR gradient: 10 % per mm	
Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%]	Without Correction Algorithm	11.1	7.6
SAR _{be} [%]	With Correction Algorithm	0.2	0.4

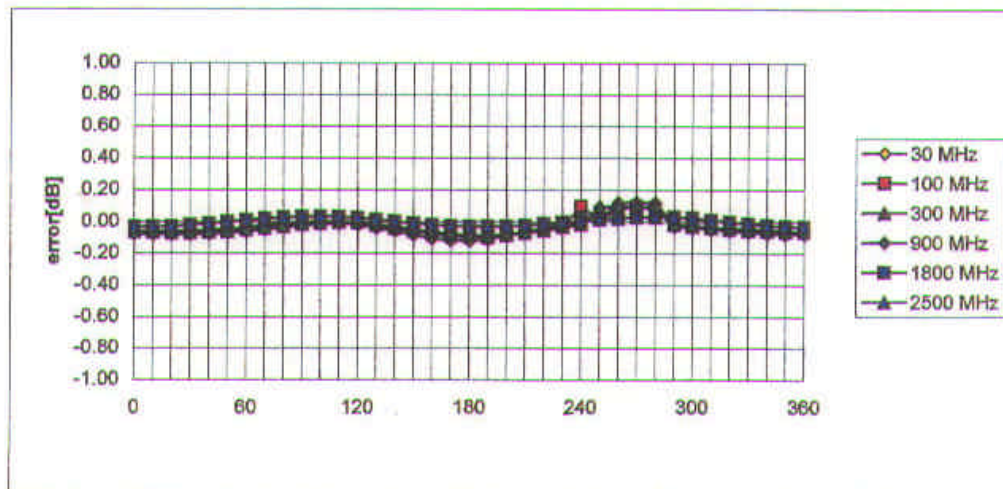
Sensor Offset

Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.3 $\pm$ 0.2	mm

Receiving Pattern (ϕ), $\theta = 0^\circ$ $f = 30 \text{ MHz}$, TEM cell ifi110 $f = 100 \text{ MHz}$, TEM cell ifi110 $f = 300 \text{ MHz}$, TEM cell ifi110 $f = 900 \text{ MHz}$, TEM cell ifi110

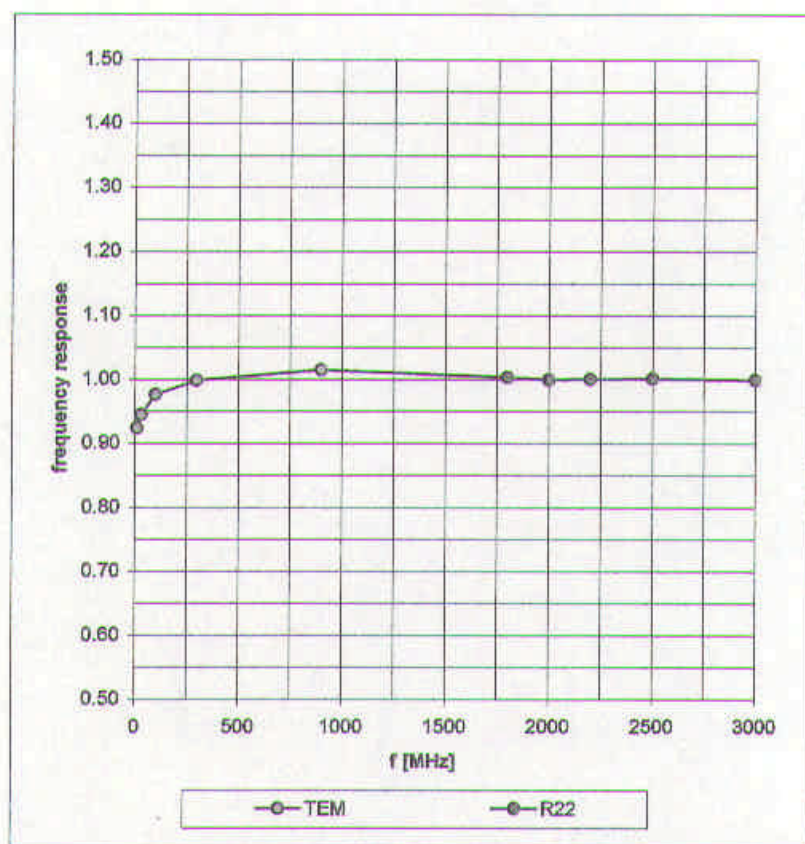


Isotropy Error (ϕ), $\theta = 0^\circ$

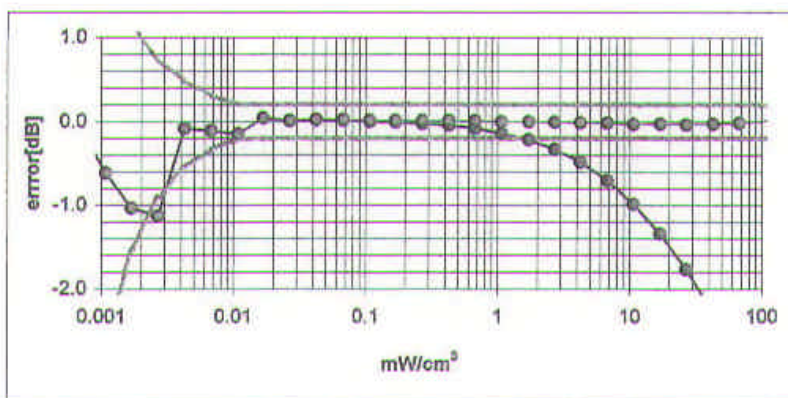
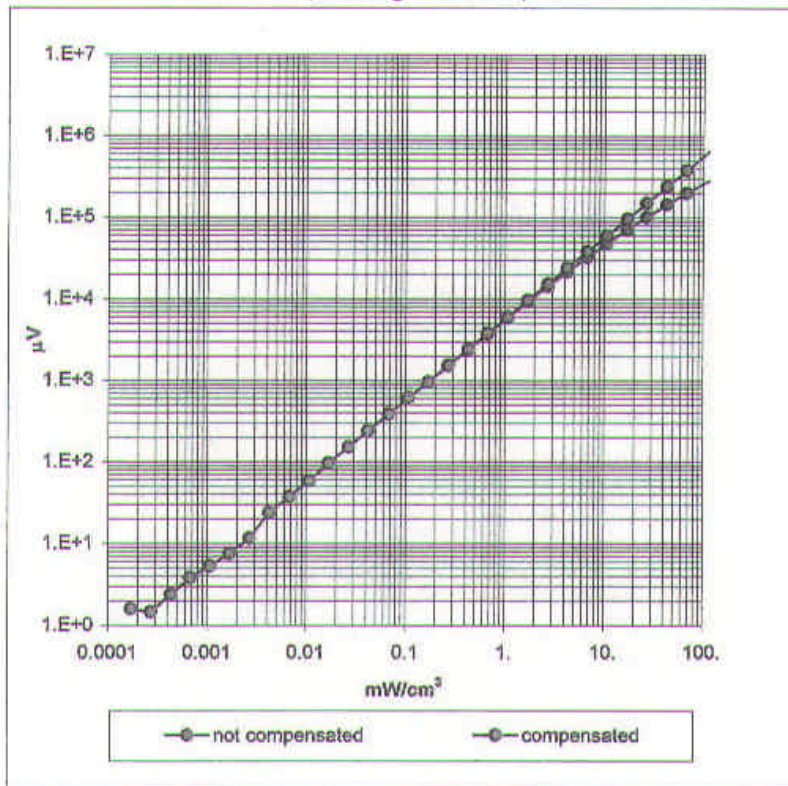


Frequency Response of E-Field

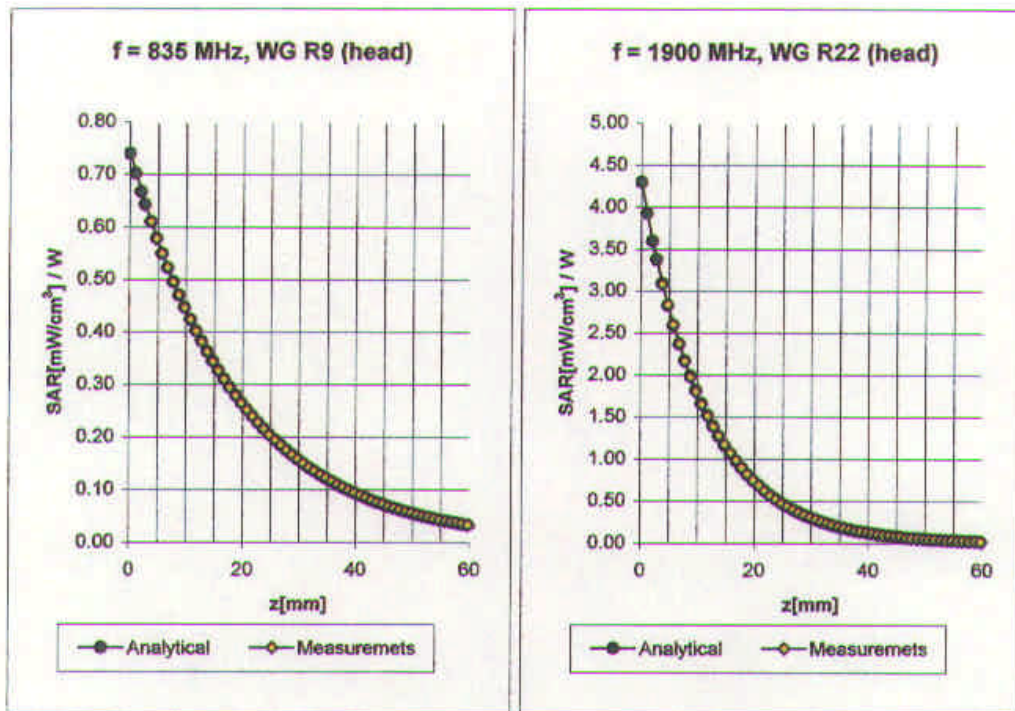
(TEM-Cell:ifi110, Waveguide R22)



Dynamic Range $f(\text{SAR}_{\text{brain}})$ (Waveguide R22)

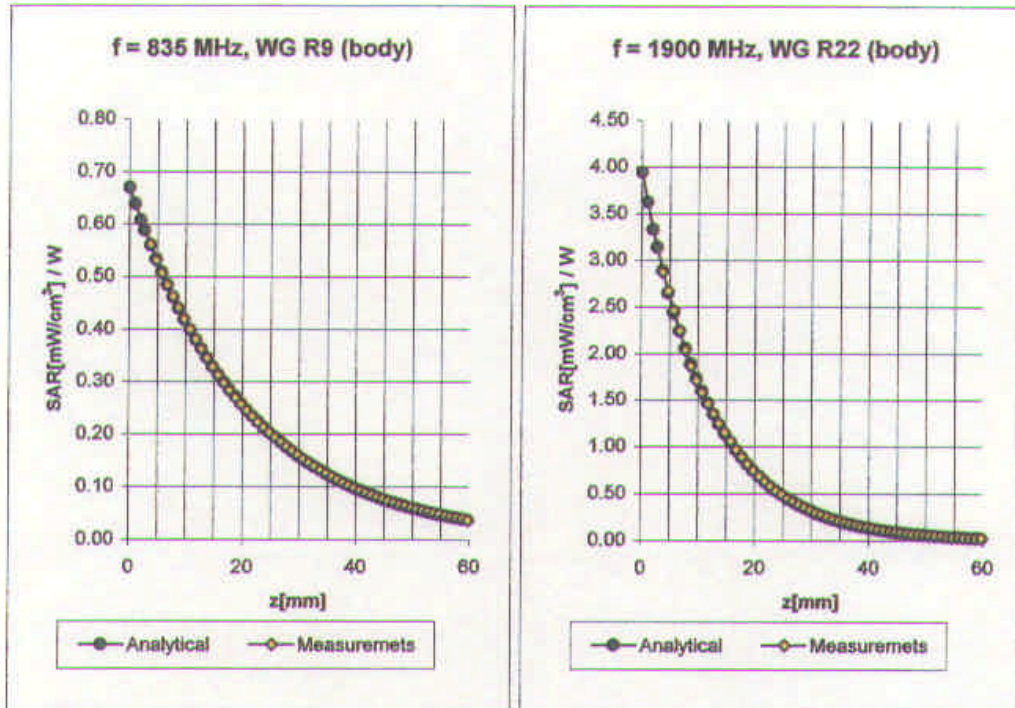


Conversion Factor Assessment



Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
	ConvF X	$6.9 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$6.9 \pm 9.5\%$ (k=2)	Alpha 0.60
	ConvF Z	$6.9 \pm 9.5\%$ (k=2)	Depth 1.69
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
	ConvF X	$5.4 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$5.4 \pm 9.5\%$ (k=2)	Alpha 0.49
	ConvF Z	$5.4 \pm 9.5\%$ (k=2)	Depth 2.36

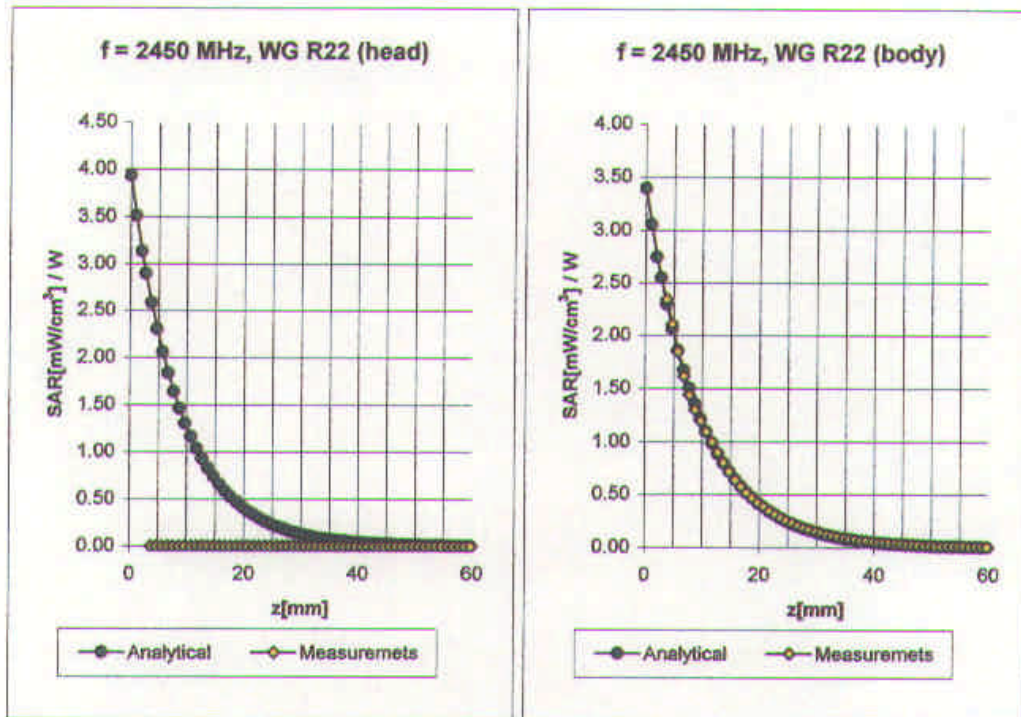
Conversion Factor Assessment



Body	835 MHz	$\epsilon_r = 55.2 \pm 5\%$	$\sigma = 0.97 \pm 5\% \text{ mho/m}$
Body	900 MHz	$\epsilon_r = 55.0 \pm 5\%$	$\sigma = 1.05 \pm 5\% \text{ mho/m}$
ConvF X	6.6 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.6 $\pm 9.5\%$ (k=2)	Alpha	0.33
ConvF Z	6.6 $\pm 9.5\%$ (k=2)	Depth	2.60

Body	1900 MHz	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$
Body	1800 MHz	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 5\% \text{ mho/m}$
ConvF X	4.9 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	4.9 $\pm 9.5\%$ (k=2)	Alpha	0.64
ConvF Z	4.9 $\pm 9.5\%$ (k=2)	Depth	2.24

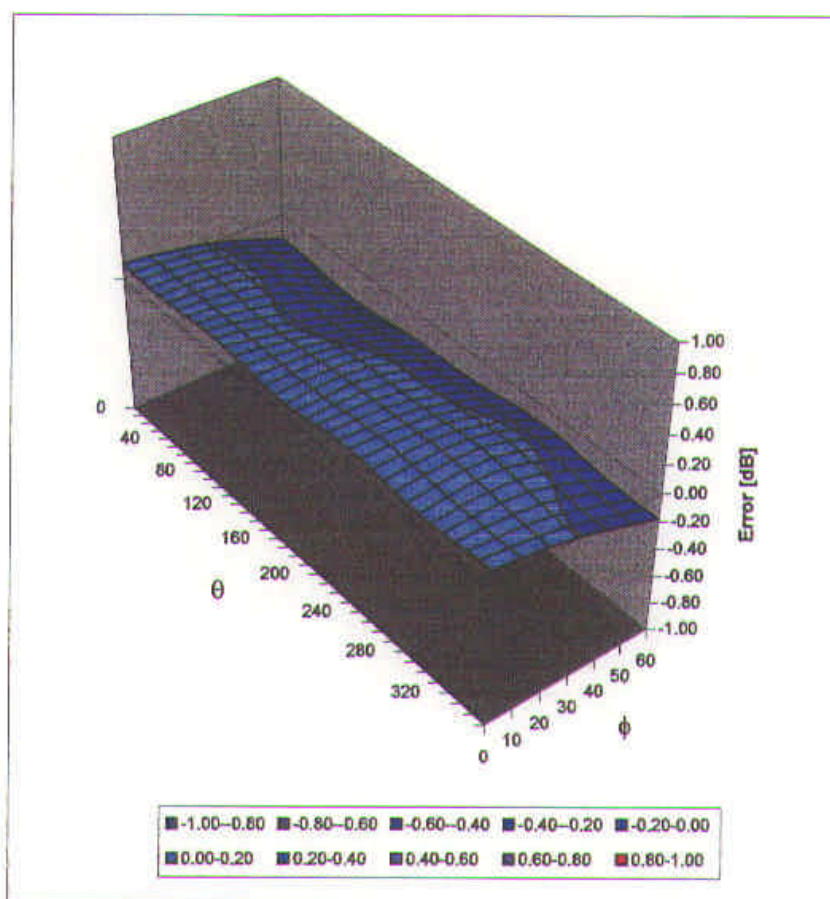
Conversion Factor Assessment



2450	Head	MHz	$\epsilon_r = 39.2 \pm 5\%$	$\sigma = 1.80 \pm 5\% \text{ mho/m}$
	ConvF X		$4.9 \pm 8.9\% (k=2)$	Boundary effect:
	ConvF Y		$4.9 \pm 8.9\% (k=2)$	Alpha 1.00
	ConvF Z		$4.9 \pm 8.9\% (k=2)$	Depth 1.60
2450	Body	MHz	$\epsilon_r = 62.7 \pm 5\%$	$\sigma = 1.95 \pm 5\% \text{ mho/m}$
	ConvF X		$4.4 \pm 8.9\% (k=2)$	Boundary effect:
	ConvF Y		$4.4 \pm 8.9\% (k=2)$	Alpha 1.00
	ConvF Z		$4.4 \pm 8.9\% (k=2)$	Depth 1.50

Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz



Additional Conversion Factors for Dosimetric E-Field Probe

Type:

ET3DV6

Serial Number:

1560

Place of Assessment:

Zurich

Date of Assessment:

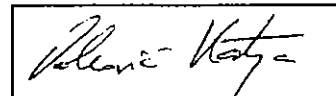
September 30, 2002

Probe Calibration Date:

September 27, 2002

Schmid & Partner Engineering AG hereby certifies that conversion factor(s) of this probe have been evaluated on the date indicated above. The assessment was performed using the FDTD numerical code SEMCAD of Schmid & Partner Engineering AG. Since the evaluation is coupled with measured conversion factors, it has to be recalculated yearly, i.e., following the re-calibration schedule of the probe. The uncertainty of the numerical assessment is based on the extrapolation from measured value at 900 MHz or at 1800 MHz.

Assessed by:



Dosimetric E-Field Probe ET3DV6 SN: 1560

Conversion factor ($\pm$ standard deviation)

150 MHz ConvF $8.6 \pm 8\%$

$$\begin{aligned}\epsilon_r &= 52.3 \pm 5\% \\ \sigma &= 0.76 \pm 5\% \text{ mho/m}\end{aligned}$$

(Head tissue)

150 MHz ConvF $8.5 \pm 8\%$

$$\begin{aligned}\epsilon_r &= 61.9 \pm 5\% \\ \sigma &= 0.80 \pm 5\% \text{ mho/m}\end{aligned}$$

(Body tissue)

450 MHz ConvF $7.9 \pm 8\%$

$$\begin{aligned}\epsilon_r &= 45.1 \pm 5\% \\ \sigma &= 0.85 \pm 5\% \text{ mho/m}\end{aligned}$$

(Head tissue)

450 MHz ConvF $7.7 \pm 8\%$

$$\begin{aligned}\epsilon_r &= 56.7 \pm 5\% \\ \sigma &= 0.94 \pm 5\% \text{ mho/m}\end{aligned}$$

(Body tissue)