

APPENDIX D - PROBE CALIBRATION

Probe ET3DV6

SN:1590

Manufactured:	March 19, 2001
Calibrated:	March 26, 2001

Calibrated for System DASY3

DASY3 - Parameters of Probe: ET3DV6 SN:1590

Sensitivity in Free Space

NormX	1.77 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.91 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.67 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

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

Sensitivity in Tissue Simulating Liquid

Head **450 MHz** $\epsilon_r = 43.5 \pm 5\%$ $s = 0.87 \pm 10\% \text{ mho/m}$

ConvF X	7.36 extrapolated	Boundary effect:
ConvF Y	7.36 extrapolated	Alpha 0.29
ConvF Z	7.36 extrapolated	Depth 2.72

Head **900 MHz** $\epsilon_r = 42 \pm 5\%$ $s = 0.97 \pm 10\% \text{ mho/m}$

ConvF X	6.83 $\pm 7\%$ (k=2)	Boundary effect:
ConvF Y	6.83 $\pm 7\%$ (k=2)	Alpha 0.37
ConvF Z	6.83 $\pm 7\%$ (k=2)	Depth 2.48

Head **1500 MHz** $\epsilon_r = 40.4 \pm 5\%$ $s = 1.23 \pm 10\% \text{ mho/m}$

ConvF X	6.13 interpolated	Boundary effect:
ConvF Y	6.13 interpolated	Alpha 0.47
ConvF Z	6.13 interpolated	Depth 2.17

Head **1800 MHz** $\epsilon_r = 40 \pm 5\%$ $s = 1.40 \pm 10\% \text{ mho/m}$

ConvF X	5.78 $\pm 7\%$ (k=2)	Boundary effect:
ConvF Y	5.78 $\pm 7\%$ (k=2)	Alpha 0.53
ConvF Z	5.78 $\pm 7\%$ (k=2)	Depth 2.01

Sensor Offset

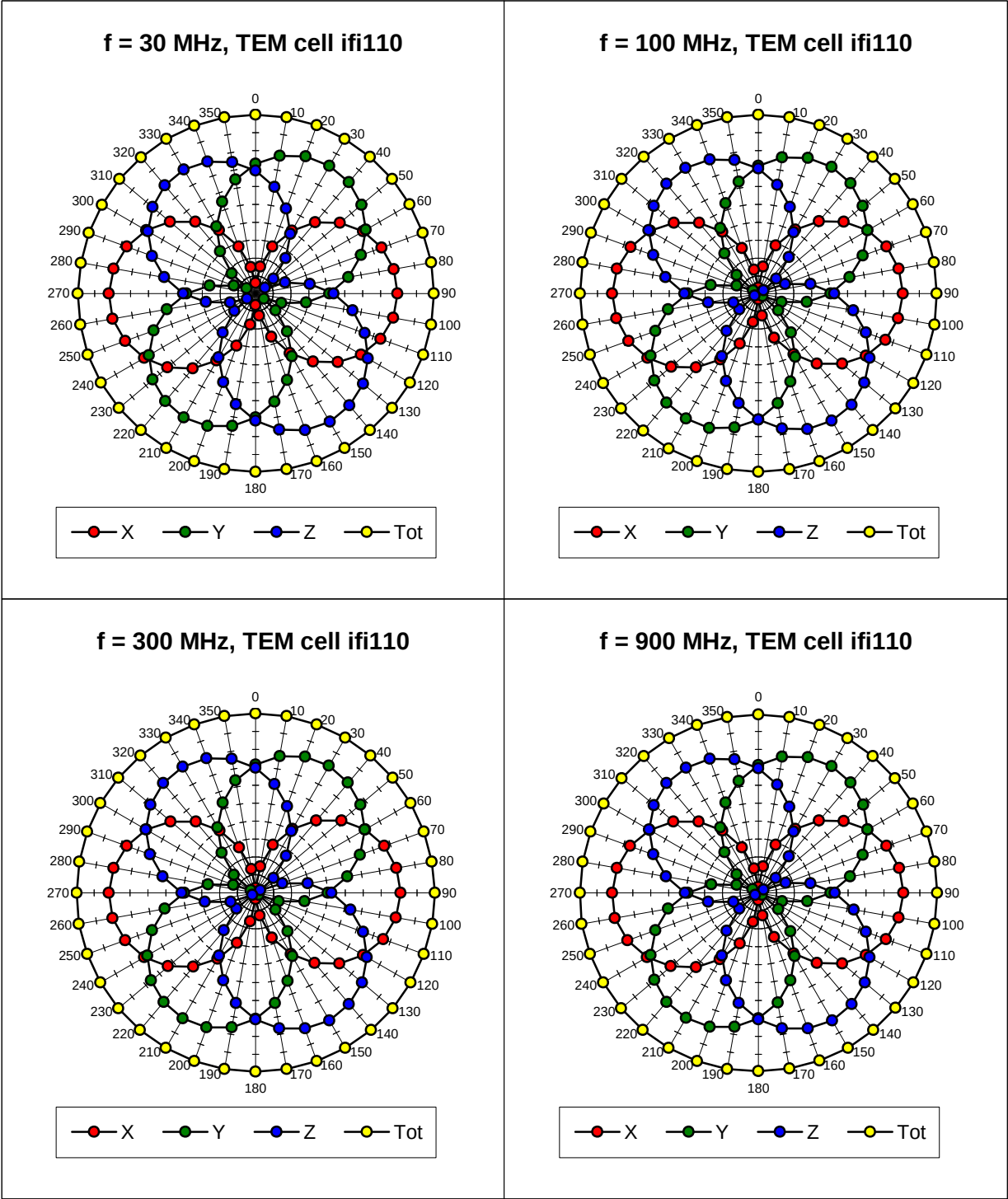
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.2 $\pm$ 0.2	mm

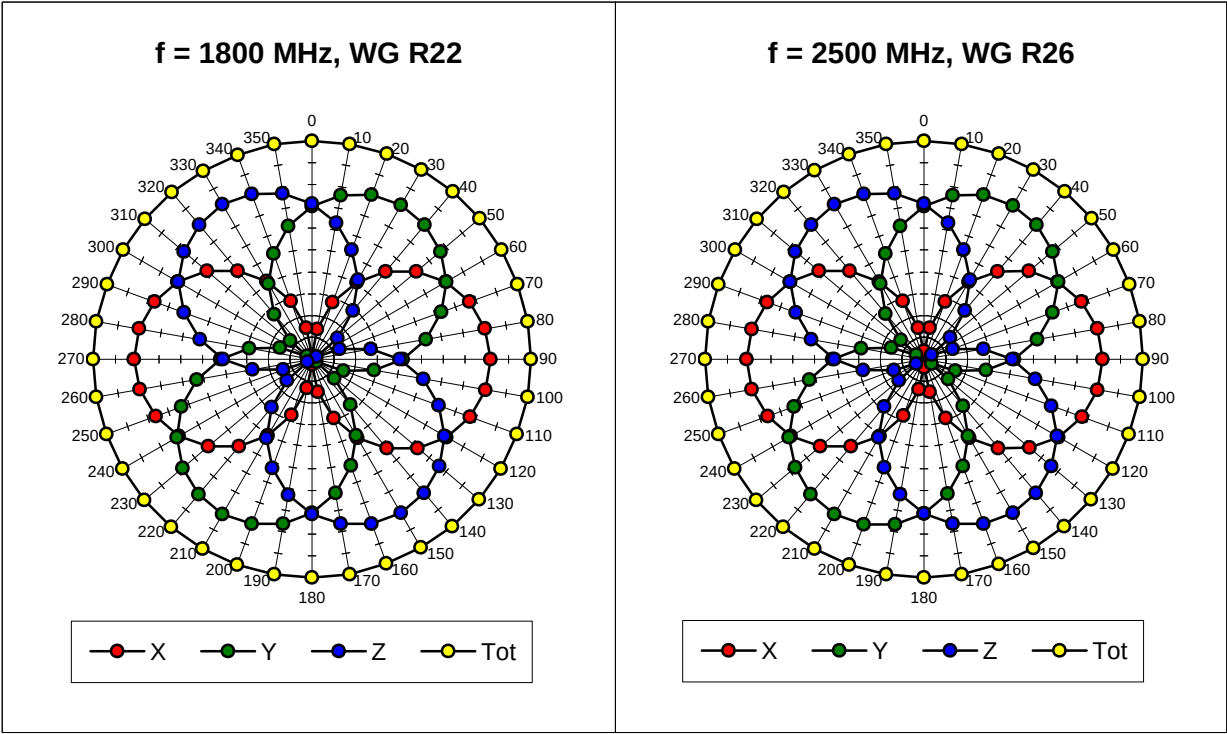
ET3DV6 SN:1590

DASY3 - Parameters of Probe: ET3DV6 SN: 1590

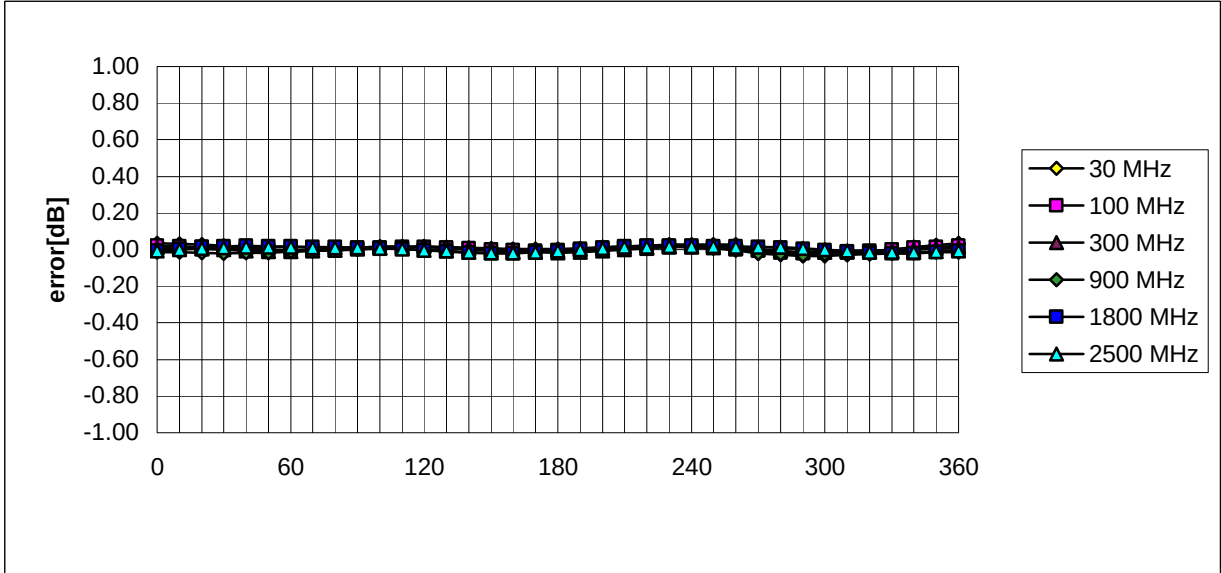
Body	450 MHz	$\epsilon_r = 56.7 \pm 5\%$	$\sigma = 0.94 \pm 10\%$ mho/m
ConvF X	7.23	extrapolated	
ConvF Y	7.23	extrapolated	
ConvF Z	7.23	extrapolated	
Body	900 MHz	$\epsilon_r = 55.0 \pm 5\%$	$\sigma = 1.05 \pm 10\%$ mho/m
ConvF X	6.61	$\pm 7\%$ (k=2)	
ConvF Y	6.61	$\pm 7\%$ (k=2)	
ConvF Z	6.61	$\pm 7\%$ (k=2)	
Body	1500 MHz	$\epsilon_r = 54.0 \pm 5\%$	$\sigma = 1.30 \pm 10\%$ mho/m
ConvF X	5.78	interpolated	
ConvF Y	5.78	interpolated	
ConvF Z	5.78	interpolated	
Body	1800 MHz	$\epsilon_r = 53.3 \pm 5\%$	$\sigma = 1.52 \pm 10\%$ mho/m
ConvF X	5.36	$\pm 7\%$ (k=2)	
ConvF Y	5.36	$\pm 7\%$ (k=2)	
ConvF Z	5.36	$\pm 7\%$ (k=2)	

Receiving Pattern (f) , q = 0°

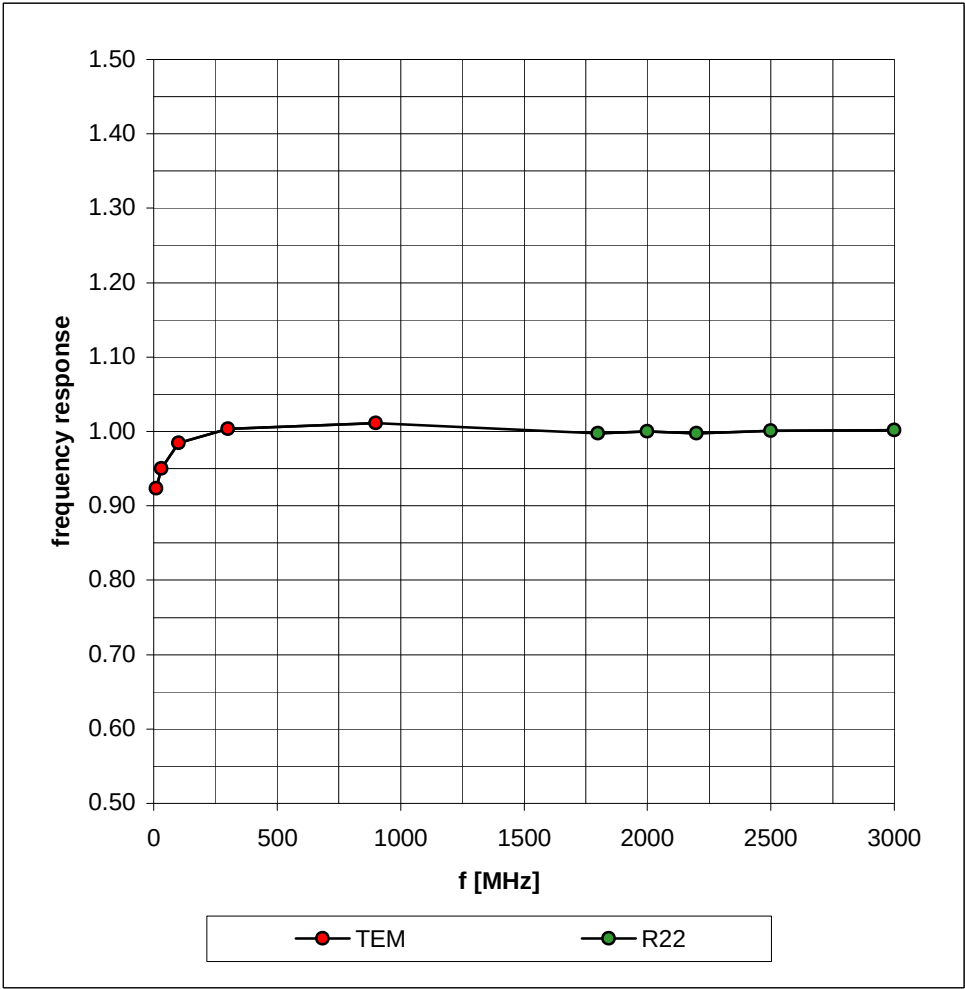




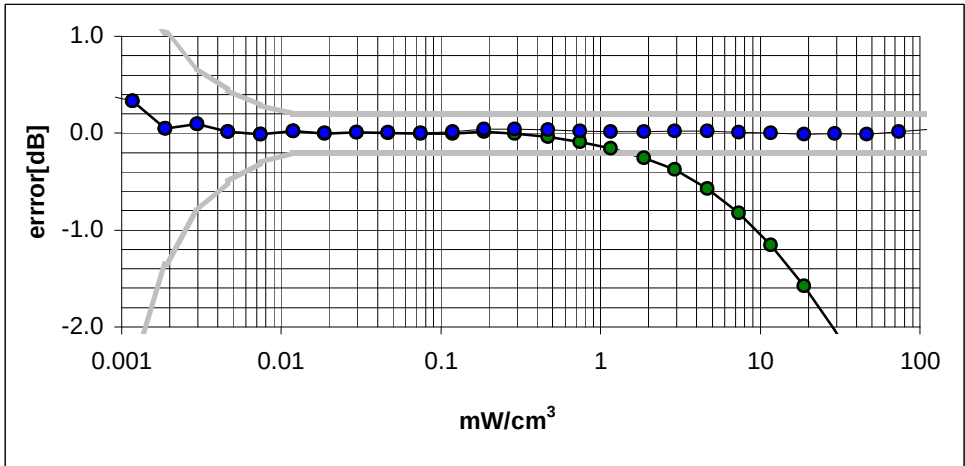
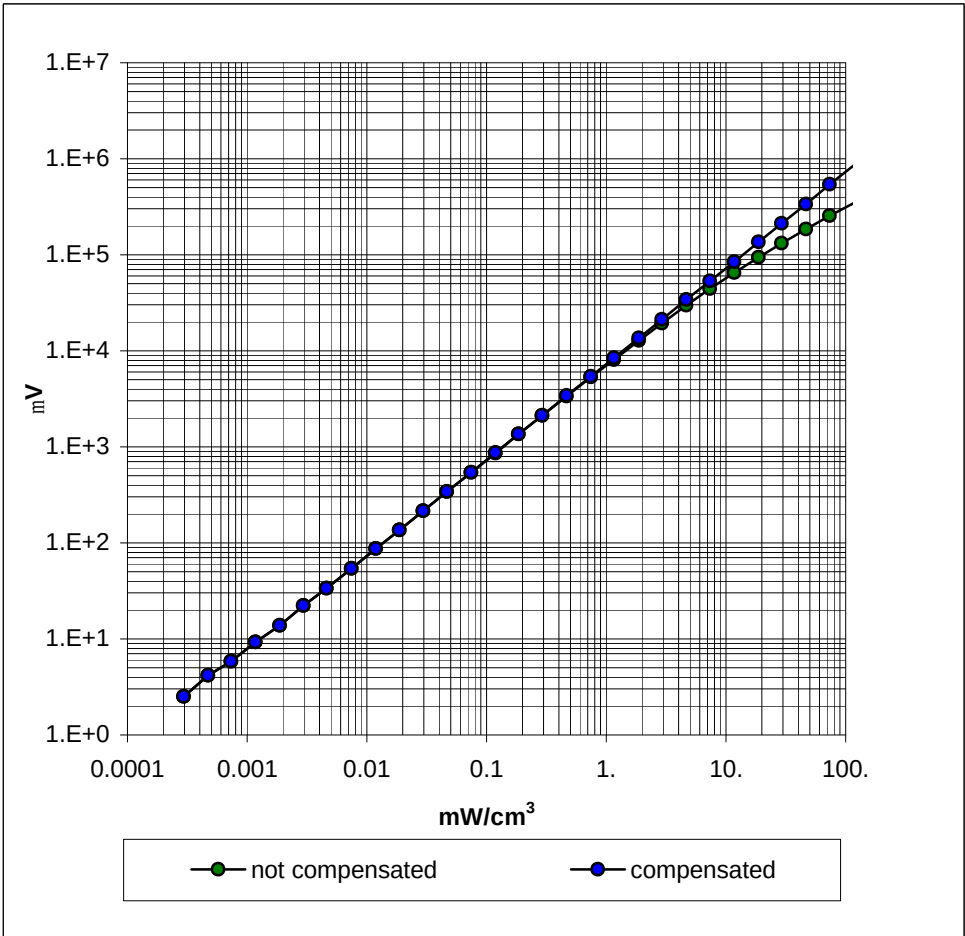
Isotropy Error (f), q = 0°



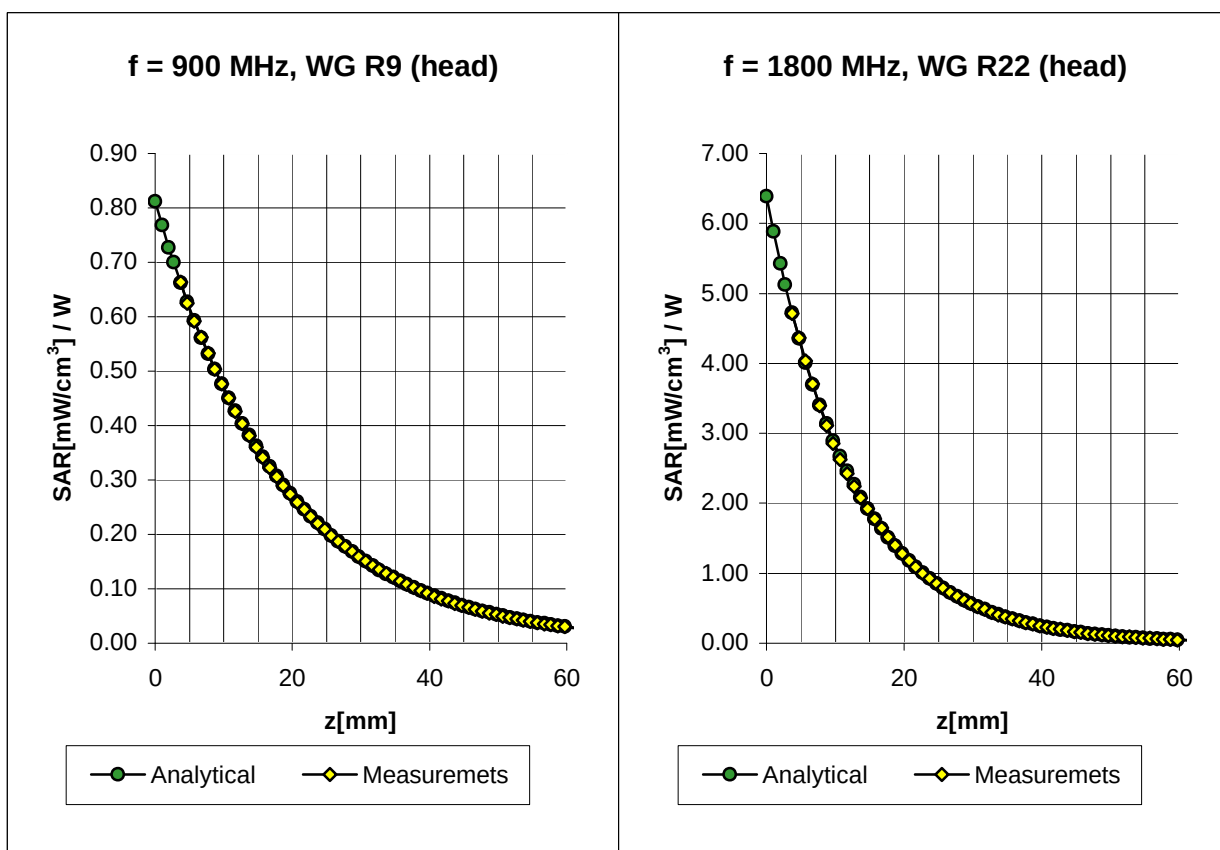
Frequency Response of E-Field
(TEM-Cell:ifi110, Waveguide R22)



Dynamic Range f(SAR_{brain})
(TEM-Cell:ifi110)



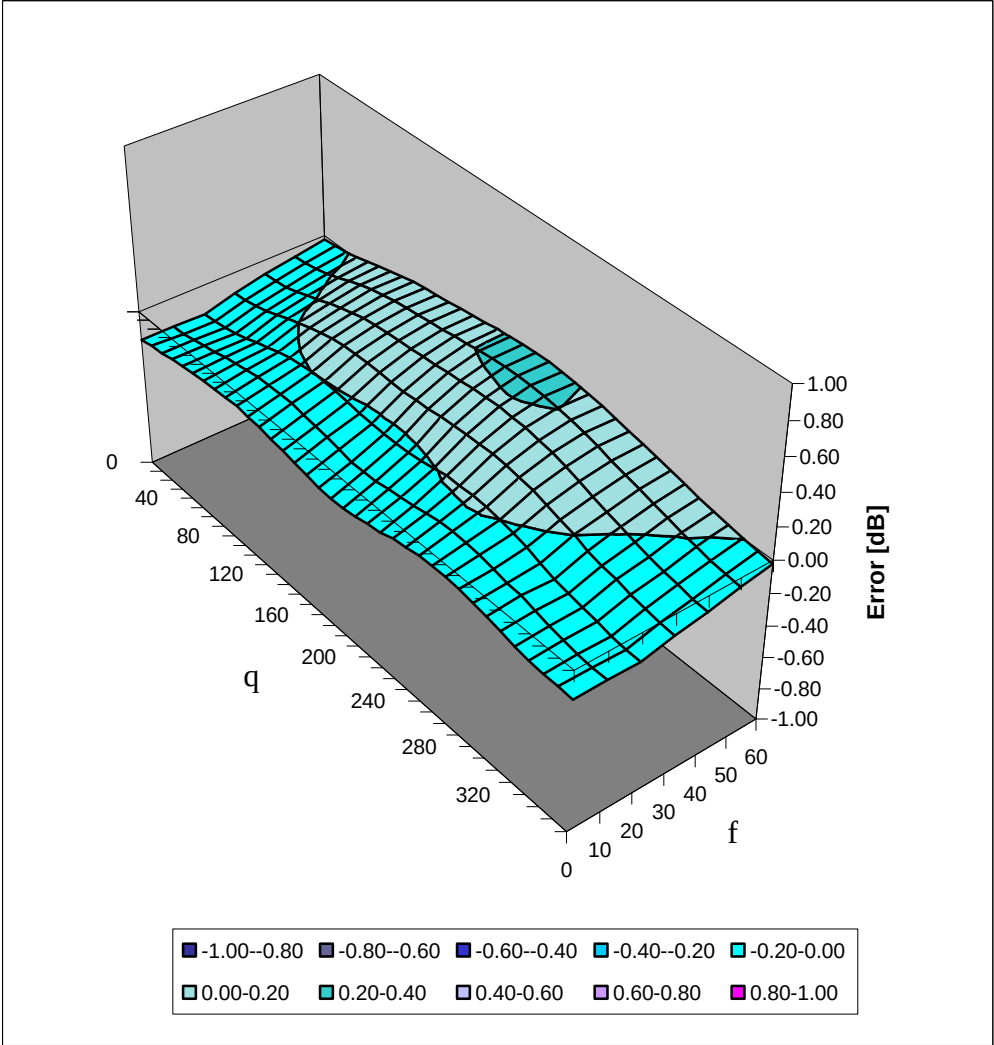
Conversion Factor Assessment



ET3DV6 SN:1590

Deviation from Isotropy in HSL

Error (qf), $f = 900$ MHz



APPENDIX E - SAR SENSITIVITIES

Application Note: SAR Sensitivities

Introduction

The measured SAR-values in homogeneous phantoms depend strongly on the electrical parameters of the liquid. Liquids with exactly matching parameters are difficult to produce; there is always a small error involved in the production or measurement of the liquid parameters. The following sensitivities allow the estimation of the influence of small parameter errors on the measured SAR values. The calculations are based on an approximation formula [1] for the SAR of an electrical dipole near the phantom surface and a adapted plane wave approximation for the penetration depth. The sensitivities are given in percent SAR change per percent change in the controlling parameter:

$$S(x) = \frac{d \text{ SAR} / \text{ SAR}}{d x / x}$$

The controlling parameters x are:

- ϵ : permittivity
- σ : conductivity
- ρ : brain density (= one over integration volume)

For example: If The liquid permittivity increases by 2 percent and the sensitivity of the SAR to permittivity is -0.6 then the SAR will decrease by 1.2 percent.

The sensitivities are given for surface SAR values and averaged SAR values for 1 g and 10 g cubes and for dipole distances d of 10mm (for frequencies below 1000 MHz) and 15mm (for frequencies above 1000 MHz) from the liquid surface.

Liquid parameters are as proposed in the new standards (e.g., IEEE 1528).

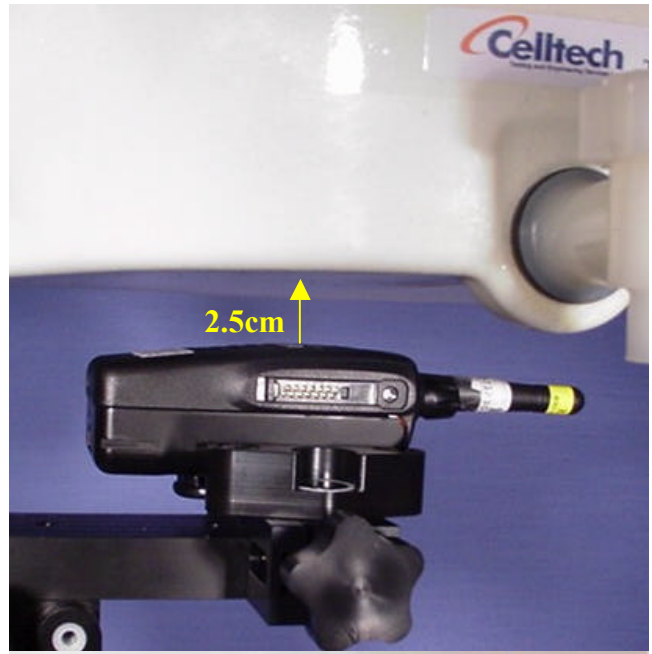
References

- [1] N. Kuster and Q. Balzano, "Energy absorption mechanism by biological bodies in the near field of dipole antennas above 300 MHz", *IEEE Transactions on Vehicular Technology*, vol. 41(1), pp. 17-23, 1992.

Parameter	ϵ	σ	ρ
f=300 MHz ($\epsilon_r=45.3$, $\sigma=0.87\text{S/m}$, $\rho=1\text{g/cm}^3$)			
d=15mm: Surface	- 0.41	+ 0.48	—
1 g	- 0.33	+ 0.28	0.08
10 g	- 0.26	+ 0.09	0.16
f=450 MHz ($\epsilon_r=43.5$, $\sigma=0.87\text{S/m}$, $\rho=1\text{g/cm}^3$)			
d=15mm: Surface	- 0.56	+ 0.67	—
1 g	- 0.46	+ 0.43	0.09
10 g	- 0.37	+ 0.22	0.17
f=835 MHz ($\epsilon_r=41.5$, $\sigma=0.90\text{S/m}$, $\rho=1\text{g/cm}^3$)			
d=15mm: Surface	- 0.70	+ 0.86	—
1 g	- 0.57	+ 0.59	0.10
10 g	- 0.45	+ 0.35	0.18
f=900 MHz ($\epsilon_r=41.5$, $\sigma=0.97\text{S/m}$, $\rho=1\text{g/cm}^3$)			
d=15mm: Surface	- 0.69	+ 0.86	—
1 g	- 0.55	+ 0.57	0.10
10 g	- 0.44	+ 0.32	0.19
f=1450 MHz ($\epsilon_r=40.5$, $\sigma=1.20\text{S/m}$, $\rho=1\text{g/cm}^3$)			
d=10mm: Surface	- 0.73	+ 0.91	—
1 g	- 0.55	+ 0.55	0.12
10 g	- 0.42	+ 0.27	0.22
f=1800 MHz ($\epsilon_r=40.0$, $\sigma=1.40\text{S/m}$, $\rho=1\text{g/cm}^3$)			
d=10mm: Surface	- 0.73	+ 0.92	—
1 g	- 0.52	+ 0.51	0.14
10 g	- 0.38	+ 0.21	0.24
f=1900 MHz ($\epsilon_r=40.0$, $\sigma=1.40\text{S/m}$, $\rho=1\text{g/cm}^3$)			
d=10mm: Surface	- 0.73	+ 0.93	—
1 g	- 0.53	+ 0.51	0.14
10 g	- 0.39	+ 0.22	0.24
f=2000 MHz ($\epsilon_r=40.0$, $\sigma=1.40\text{S/m}$, $\rho=1\text{g/cm}^3$)			
d=10mm: Surface	- 0.74	+ 0.94	—
1 g	- 0.53	+ 0.52	0.14
10 g	- 0.39	+ 0.22	0.24
f=2450 MHz ($\epsilon_r=39.2$, $\sigma=1.80\text{S/m}$, $\rho=1\text{g/cm}^3$)			
d=10mm: Surface	- 0.74	+ 0.93	—
1 g	- 0.49	+ 0.41	0.17
10 g	- 0.34	+ 0.12	0.28
f=3000 MHz ($\epsilon_r=38.5$, $\sigma=2.40\text{S/m}$, $\rho=1\text{g/cm}^3$)			
d=10mm: Surface	- 0.75	+ 0.90	—
1 g	- 0.45	+ 0.28	0.21
10 g	- 0.32	+ 0.02	0.31

APPENDIX F - SAR TEST SETUP PHOTOGRAPHS

FACE-HELD SAR TEST SETUP PHOTOGRAPHS 2.5cm Separation Distance



BODY-WORN SAR TEST SETUP PHOTOGRAPHS
with Belt-Clip & Speaker-Microphone
(Belt-Clip providing 1.0cm separation distance)

