

***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	<b>1.77</b> $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	<b>1.91</b> $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	<b>1.67</b> $\mu\text{V}/(\text{V}/\text{m})^2$

### Diode Compression

DCP X	<b>100</b> mV
DCP Y	<b>100</b> mV
DCP Z	<b>100</b> mV

### Sensitivity in Tissue Simulating Liquid

**Head**                      **450 MHz**                       $\epsilon_r = 43.5 \pm 5\%$                        $S = 0.87 \pm 10\%$  mho/m

ConvF X	<b>7.36</b> extrapolated	Boundary effect:
ConvF Y	<b>7.36</b> extrapolated	Alpha <b>0.29</b>
ConvF Z	<b>7.36</b> extrapolated	Depth <b>2.72</b>

**Head**                      **900 MHz**                       $\epsilon_r = 42 \pm 5\%$                        $S = 0.97 \pm 10\%$  mho/m

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

**Head**                      **1500 MHz**                       $\epsilon_r = 40.4 \pm 5\%$                        $S = 1.23 \pm 10\%$  mho/m

ConvF X	<b>6.13</b> interpolated	Boundary effect:
ConvF Y	<b>6.13</b> interpolated	Alpha <b>0.47</b>
ConvF Z	<b>6.13</b> interpolated	Depth <b>2.17</b>

**Head**                      **1800 MHz**                       $\epsilon_r = 40 \pm 5\%$                        $S = 1.40 \pm 10\%$  mho/m

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

### Sensor Offset

Probe Tip to Sensor Center	<b>2.7</b>	mm
Optical Surface Detection	<b>1.2 <math>\pm</math> 0.2</b>	mm

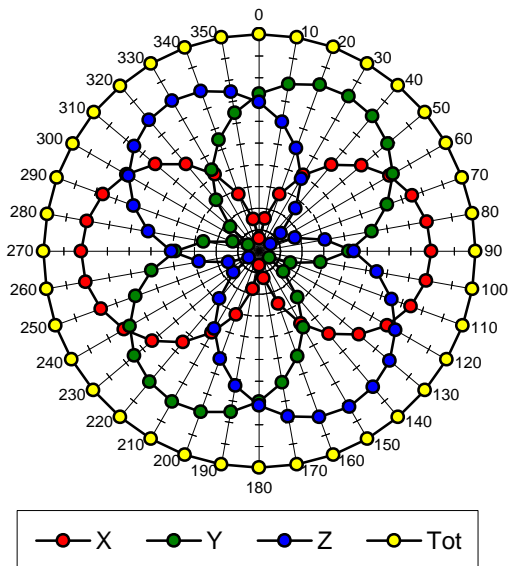
ET3DV6 SN:1590

## DASY3 - Parameters of Probe: ET3DV6 SN: 1590

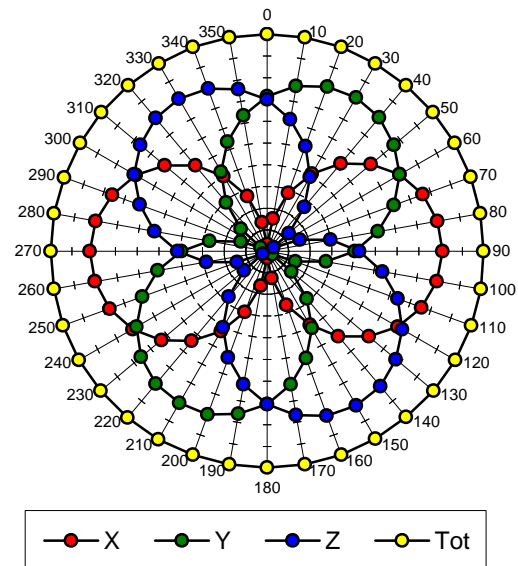
<b>Body</b>	<b>450 MHz</b>	<b><math>e_r = 56.7 \pm 5\%</math></b>	<b><math>\sigma = 0.94 \pm 10\%</math> mho/m</b>
	ConvF X	<b>7.23</b> extrapolated	
	ConvF Y	<b>7.23</b> extrapolated	
	ConvF Z	<b>7.23</b> extrapolated	
<b>Body</b>	<b>900 MHz</b>	<b><math>e_r = 55.0 \pm 5\%</math></b>	<b><math>\sigma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

## Receiving Pattern ( $f$ ), $q = 0^\circ$

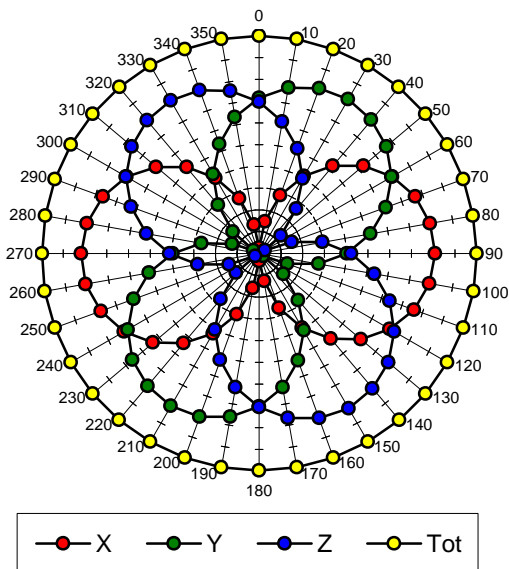
**f = 30 MHz, TEM cell ifi110**



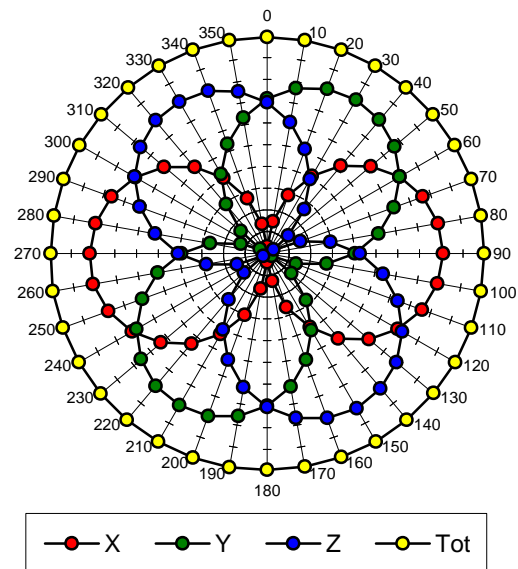
**f = 100 MHz, TEM cell ifi110**

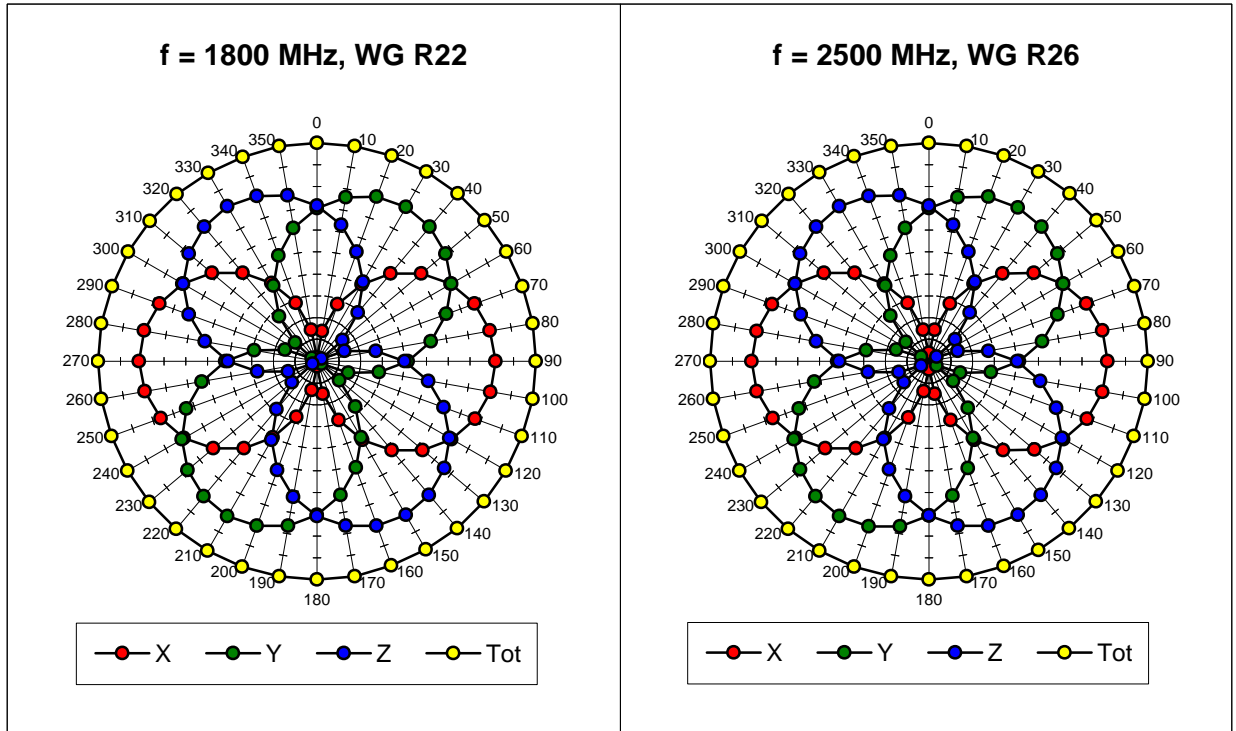


**f = 300 MHz, TEM cell ifi110**

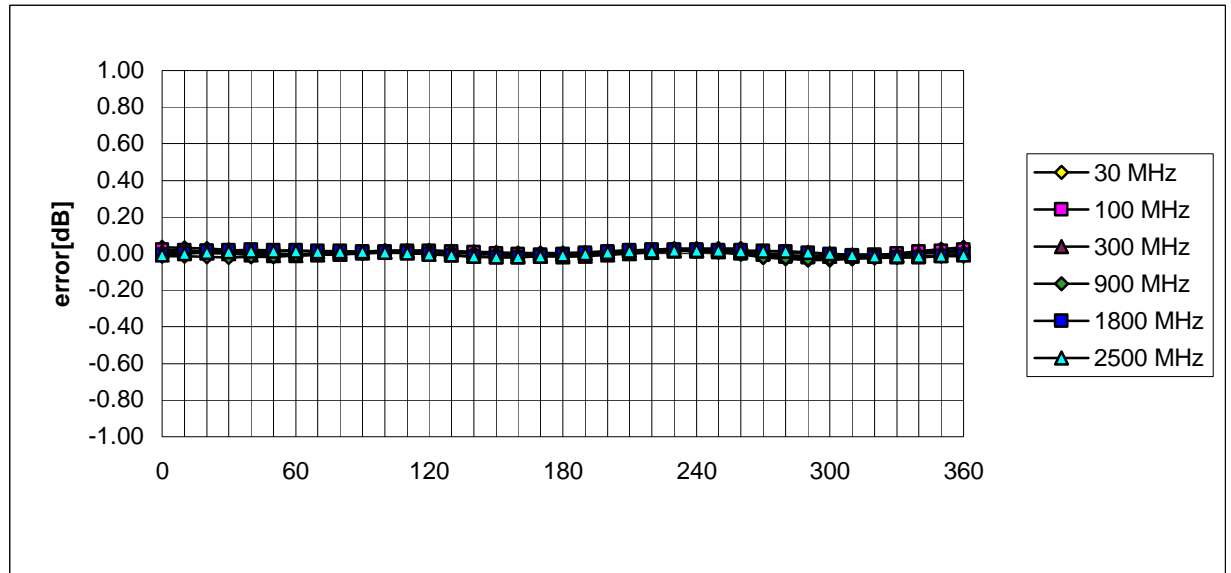


**f = 900 MHz, TEM cell ifi110**



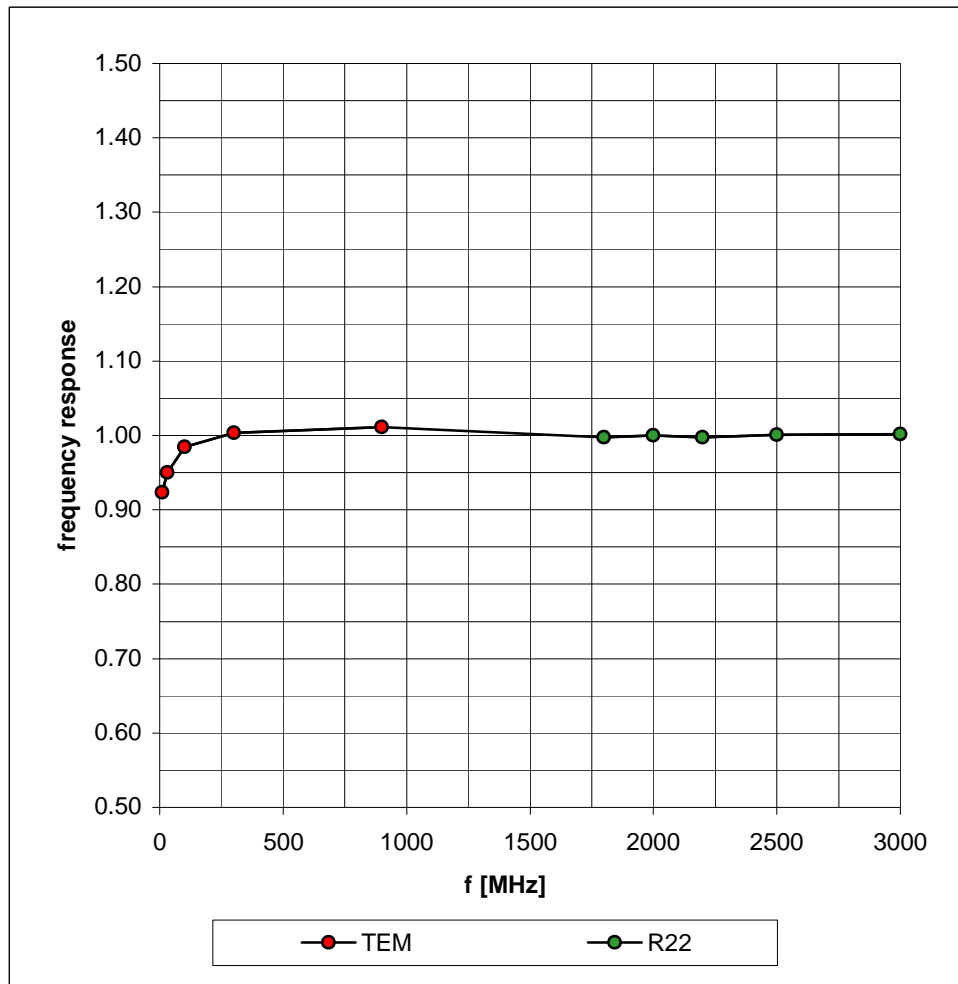


### Isotropy Error (f), q = 0°

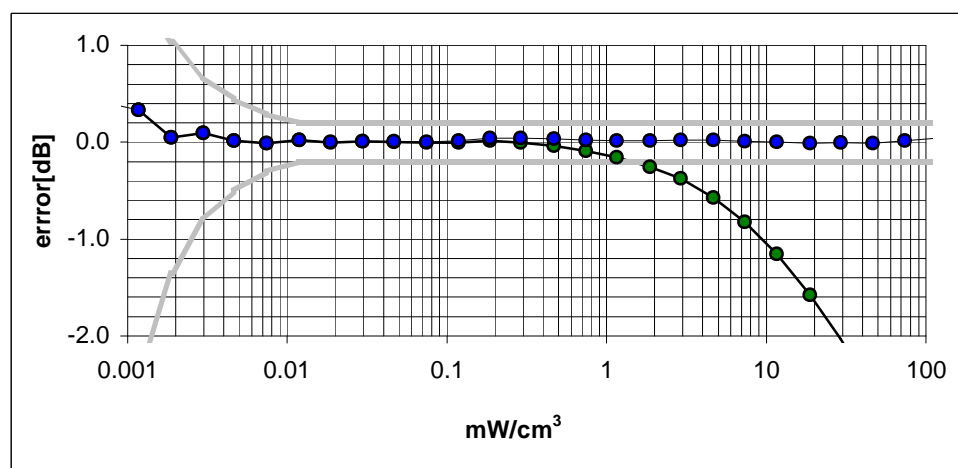
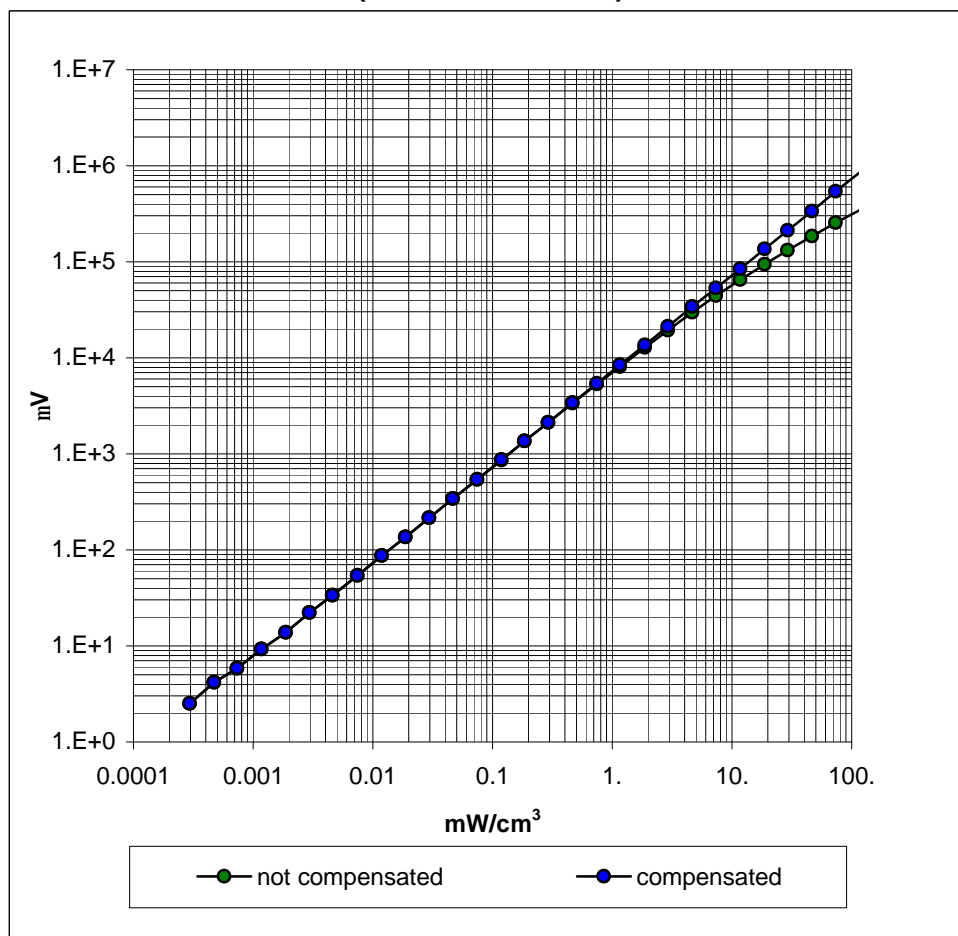


# Frequency Response of E-Field

( TEM-Cell:ifi110, Waveguide R22)

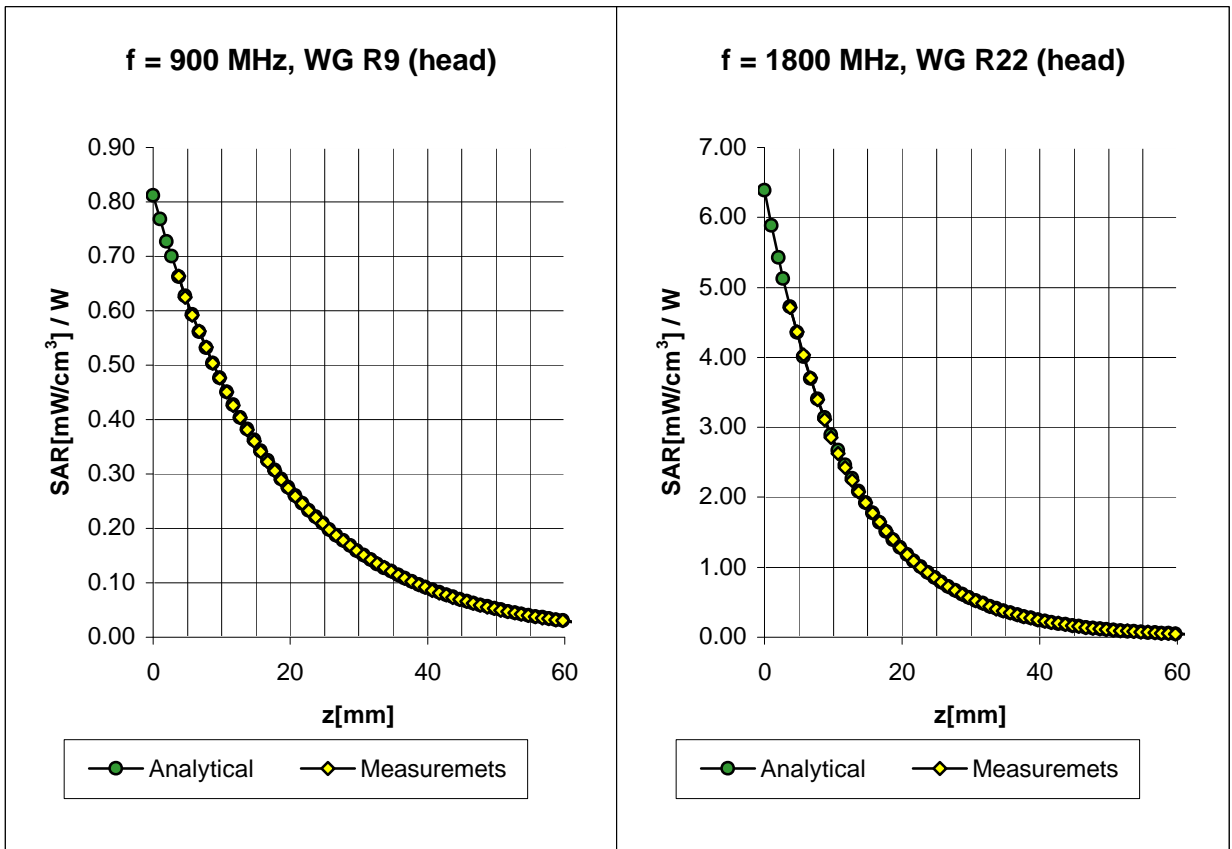


## Dynamic Range f(SAR<sub>brain</sub>) ( TEM-Cell:ifi110 )





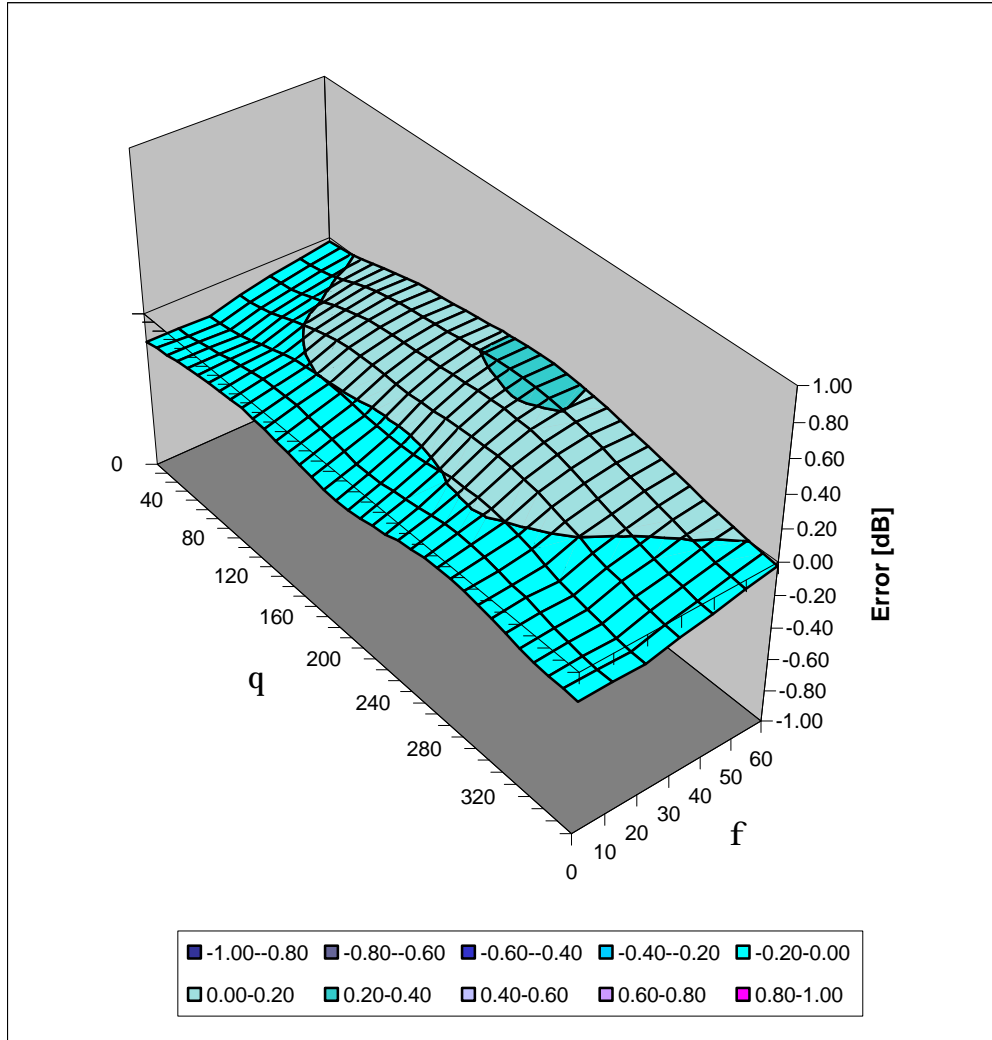
# Conversion Factor Assessment



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# 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:

- $\varepsilon$  : permittivity
- $\sigma$  : conductivity
- $\rho$  : 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).

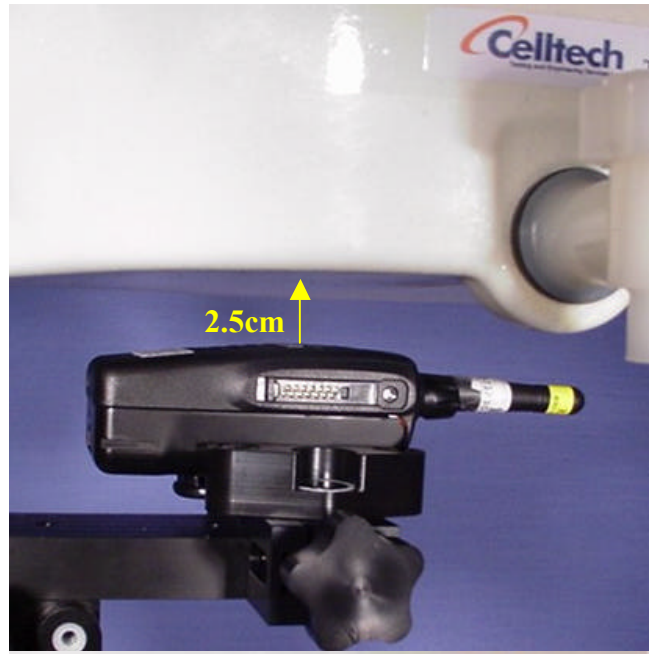
## References

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

