

**ATTACHMENT
PROBE CALIBRATION**

DIGITAL EMC

Schmid & Partner Engineering AG

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Additional Conversion Factors for Dosimetric E-Field Probe

| | |
|-------------------------|-------------------|
| Type: | ET3DV6 |
| Serial Number: | 1703 |
| Place of Assessment: | Zurich |
| Date of Assessment: | February 10, 2003 |
| Probe Calibration Date: | February 7, 2003 |

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:1703

Conversion factor (\pm standard deviation)

450 MHz ConvF 7.7 \pm 8%

| |
|---|
| $\epsilon_r = 43.5 \pm 5\%$ $\sigma = 0.87 \pm 5\%$ mho/m (head tissue) |
|---|

450 MHz ConvF 7.9 \pm 8%

| |
|---|
| $\epsilon_r = 56.7 \pm 5\%$ $\sigma = 0.94 \pm 5\%$ mho/m (body tissue) |
|---|

Probe ET3DV6

SN:1703

| | |
|-------------------|------------------|
| Manufactured: | July 3, 2002 |
| Last calibration: | July 29, 2002 |
| Recalibrated: | February 7, 2003 |

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1703

Sensitivity in Free Space

| | |
|-------|---|
| NormX | 1.64 $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormY | 1.71 $\mu\text{V}/(\text{V}/\text{m})^2$ |
| NormZ | 1.71 $\mu\text{V}/(\text{V}/\text{m})^2$ |

Diode Compression

| | | |
|-------|-----------|----|
| DCP X | 95 | mV |
| DCP Y | 95 | mV |
| DCP Z | 95 | mV |

Sensitivity in Tissue Simulating Liquid

| | | | |
|---------|------------------------------|-----------------------------|-------------------------------|
| Head | 900 MHz | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.97 \pm 5\%$ mho/m |
| Head | 835 MHz | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.90 \pm 5\%$ mho/m |
| ConvF X | 6.8 $\pm 9.5\%$ (k=2) | | Boundary effect: |
| ConvF Y | 6.8 $\pm 9.5\%$ (k=2) | | Alpha 0.35 |
| ConvF Z | 6.8 $\pm 9.5\%$ (k=2) | | Depth 2.73 |
| Head | 1800 MHz | $\epsilon_r = 40.0 \pm 5\%$ | $\sigma = 1.40 \pm 5\%$ mho/m |
| Head | 1900 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 0.47 |
| ConvF Z | 5.4 $\pm 9.5\%$ (k=2) | | Depth 2.78 |

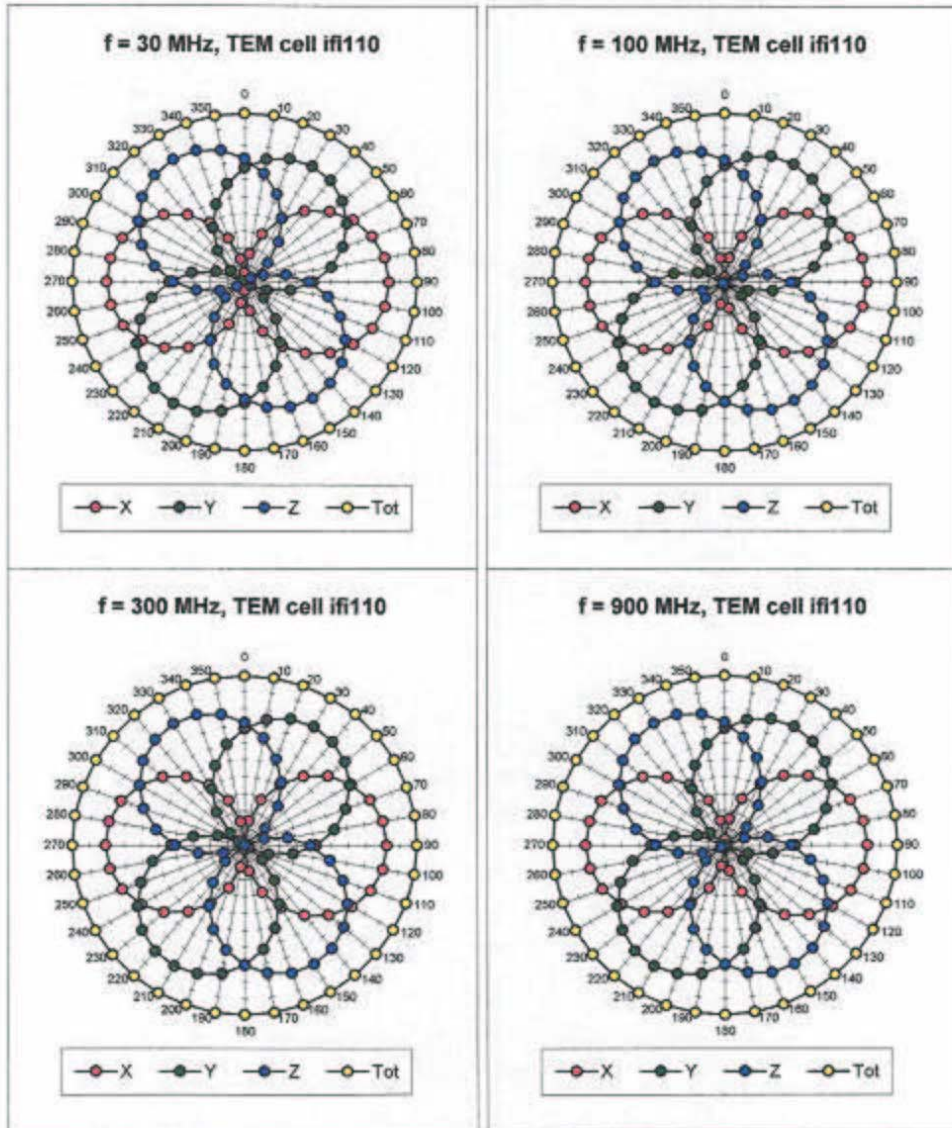
Boundary Effect

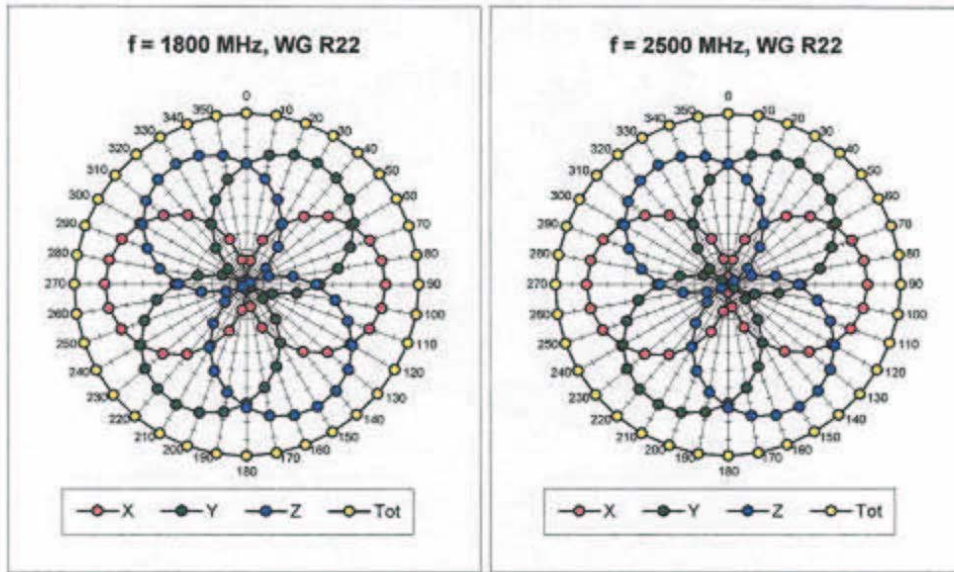
| | | | |
|------|--|-----------------------------------|-------------|
| Head | 900 MHz | Typical SAR gradient: 5 % per mm | |
| | Probe Tip to Boundary | 1 mm | 2 mm |
| | SAR _{be} [%] Without Correction Algorithm | 10.3 | 6.0 |
| | SAR _{be} [%] With Correction Algorithm | 0.4 | 0.6 |
| Head | 1800 MHz | Typical SAR gradient: 10 % per mm | |
| | Probe Tip to Boundary | 1 mm | 2 mm |
| | SAR _{be} [%] Without Correction Algorithm | 13.8 | 9.5 |
| | SAR _{be} [%] With Correction Algorithm | 0.2 | 0.1 |

Sensor Offset

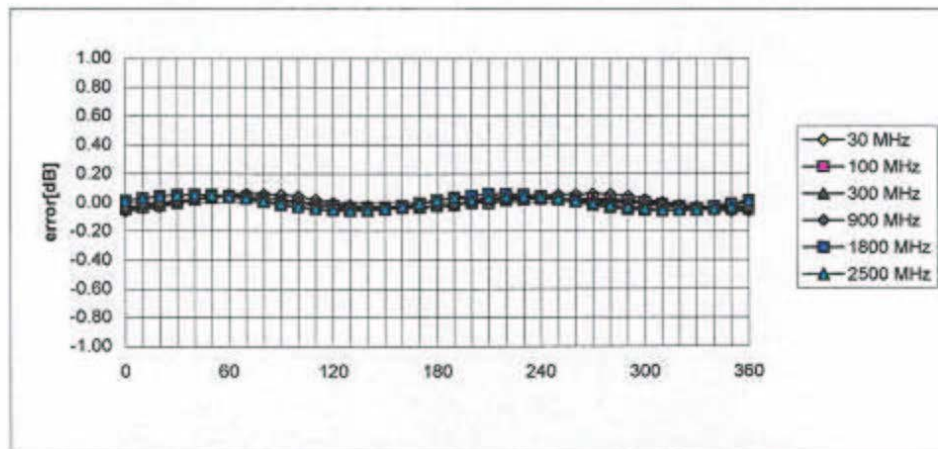
| | | |
|----------------------------|---------------------------------|----|
| Probe Tip to Sensor Center | 2.7 | mm |
| Optical Surface Detection | 1.6 \pm 0.2 | mm |

Receiving Pattern (ϕ), $\theta = 0^\circ$

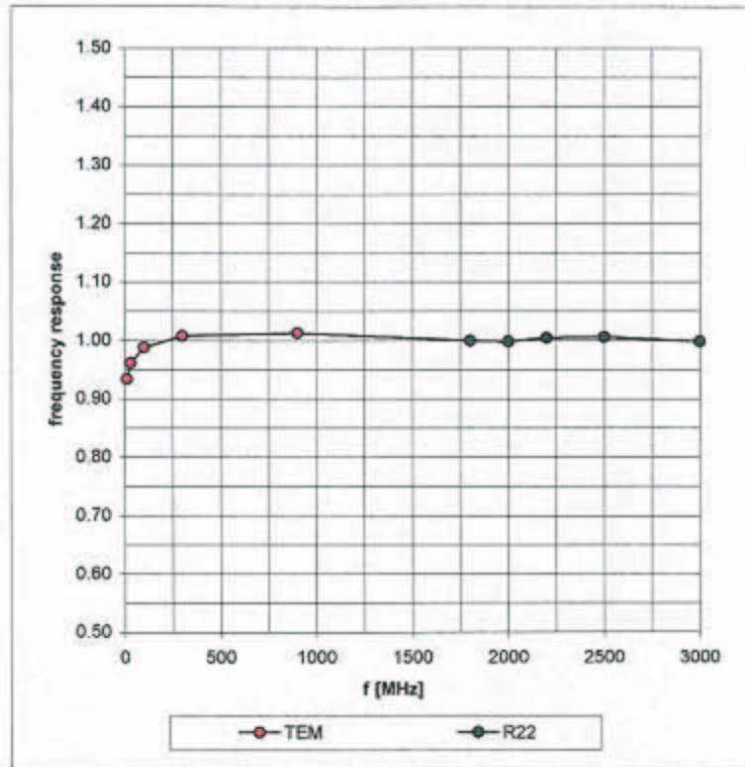




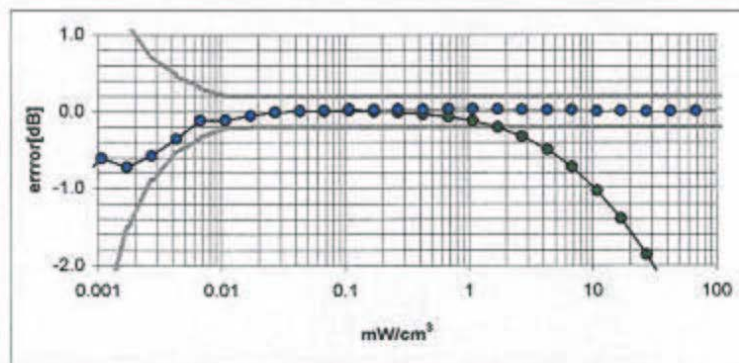
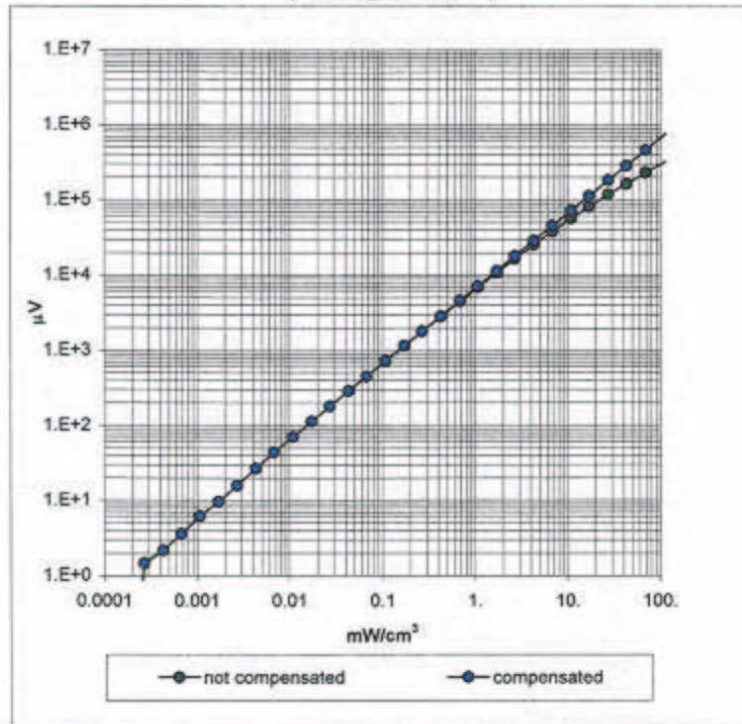
Isotropy Error (ϕ), $\theta = 0^\circ$



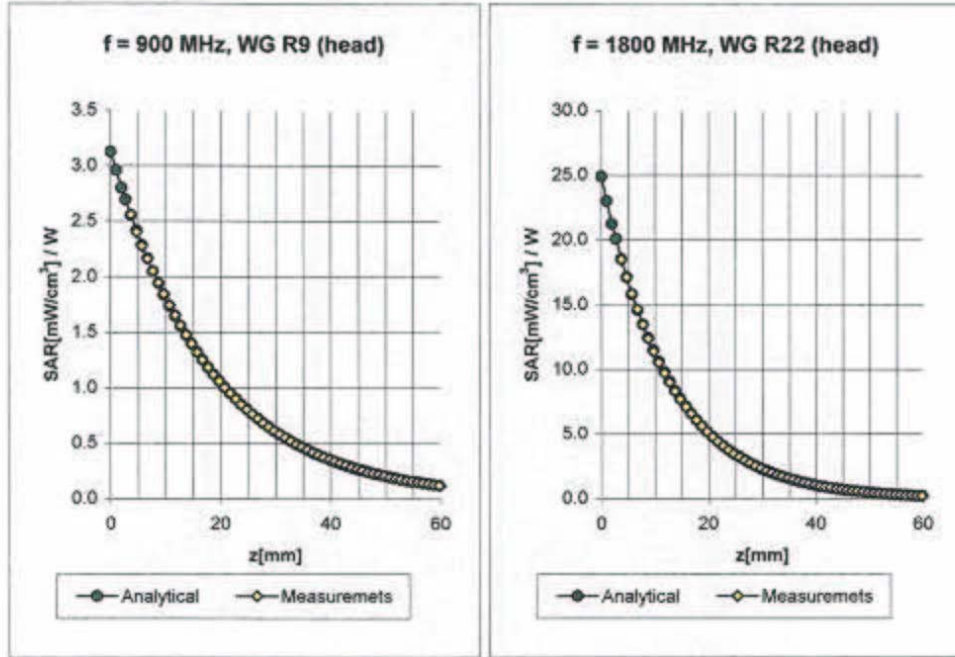
Frequency Response of E-Field (TEM-Cell:ifi110, Waveguide R22)



Dynamic Range f(SAR_{brain}) (Waveguide R22)

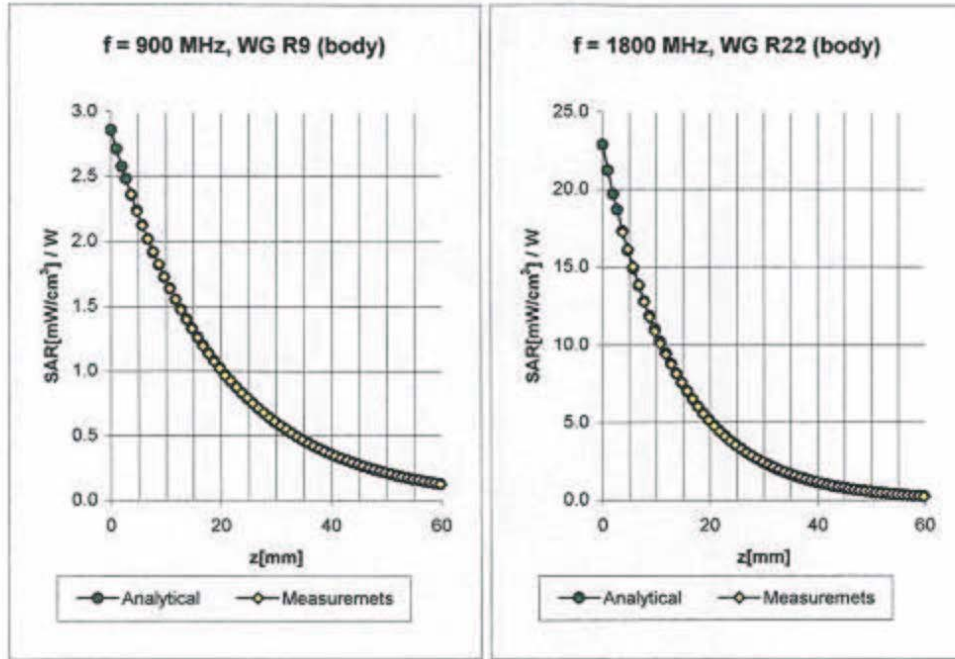


Conversion Factor Assessment



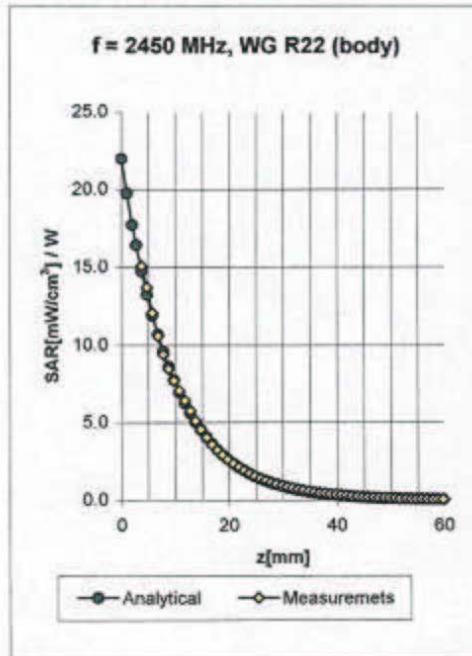
| | | | |
|------|-----------------|------------------------------|-------------------------------|
| Head | 900 MHz | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.97 \pm 5\%$ mho/m |
| Head | 835 MHz | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.90 \pm 5\%$ mho/m |
| | ConvF X | 6.8 $\pm 9.5\%$ (k=2) | Boundary effect: |
| | ConvF Y | 6.8 $\pm 9.5\%$ (k=2) | Alpha 0.35 |
| | ConvF Z | 6.8 $\pm 9.5\%$ (k=2) | Depth 2.73 |
| | | | |
| Head | 1800 MHz | $\epsilon_r = 40.0 \pm 5\%$ | $\sigma = 1.40 \pm 5\%$ mho/m |
| Head | 1900 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 0.47 |
| | ConvF Z | 5.4 $\pm 9.5\%$ (k=2) | Depth 2.78 |

Conversion Factor Assessment



| | | | | |
|------|----------|-----------------------------|-------------------------------|-------------|
| Body | 900 MHz | $\epsilon_r = 55.0 \pm 5\%$ | $\sigma = 1.05 \pm 5\%$ mho/m | |
| Body | 835 MHz | $\epsilon_r = 55.2 \pm 5\%$ | $\sigma = 0.97 \pm 5\%$ mho/m | |
| | ConvF X | $6.6 \pm 9.5\%$ (k=2) | Boundary effect: | |
| | ConvF Y | $6.6 \pm 9.5\%$ (k=2) | Alpha | 0.42 |
| | ConvF Z | $6.6 \pm 9.5\%$ (k=2) | Depth | 2.37 |
| | | | | |
| Body | 1800 MHz | $\epsilon_r = 53.3 \pm 5\%$ | $\sigma = 1.52 \pm 5\%$ mho/m | |
| Body | 1900 MHz | $\epsilon_r = 53.3 \pm 5\%$ | $\sigma = 1.52 \pm 5\%$ mho/m | |
| | ConvF X | $4.9 \pm 9.5\%$ (k=2) | Boundary effect: | |
| | ConvF Y | $4.9 \pm 9.5\%$ (k=2) | Alpha | 0.53 |
| | ConvF Z | $4.9 \pm 9.5\%$ (k=2) | Depth | 2.77 |

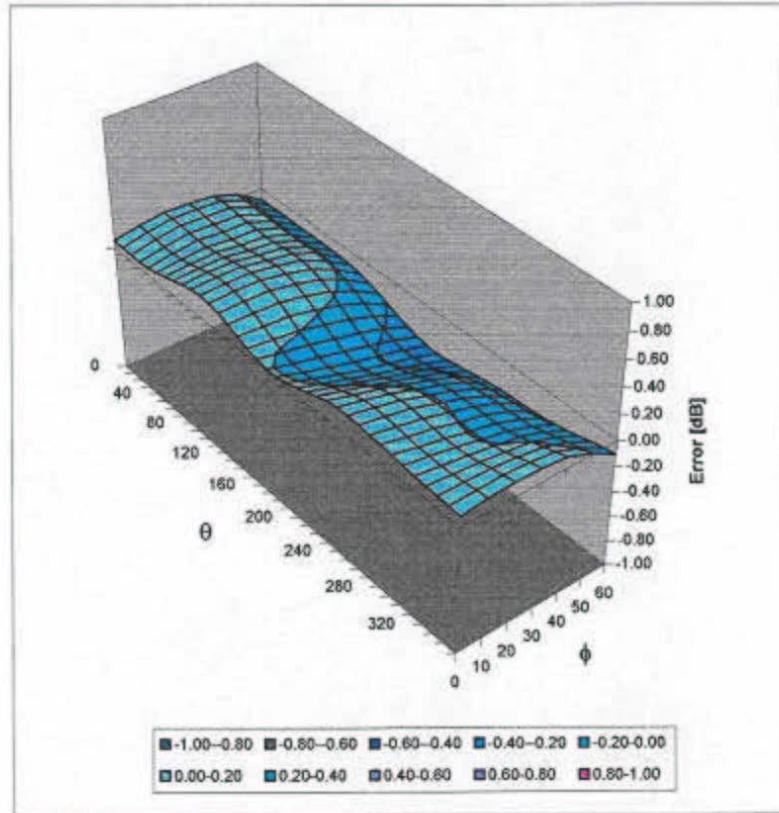
Conversion Factor Assessment



| | | | | |
|-------------|-------------|------------|-----------------------------|---------------------------------------|
| 2450 | Body | MHz | $\epsilon_r = 52.7 \pm 5\%$ | $\sigma = 1.95 \pm 5\% \text{ mho/m}$ |
| | ConvF X | 4.7 | $\pm 8.9\%$ (k=2) | Boundary effect: |
| | ConvF Y | 4.7 | $\pm 8.9\%$ (k=2) | Alpha 1.50 |
| | ConvF Z | 4.7 | $\pm 8.9\%$ (k=2) | Depth 1.45 |

Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz



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SN:1703

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DASY - Parameters of Probe: ET3DV6 SN:1703

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Sensitivity in Tissue Simulating Liquid

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|---------|------------------------------|-----------------------------|---------------------------------------|
| Head | 900 MHz | $\epsilon_r = 41.5 \pm 5\%$ | $\sigma = 0.97 \pm 5\% \text{ mho/m}$ |
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| ConvF X | 6.8 $\pm 9.5\%$ (k=2) | | Boundary effect: |
| ConvF Y | 6.8 $\pm 9.5\%$ (k=2) | | Alpha 0.35 |
| ConvF Z | 6.8 $\pm 9.5\%$ (k=2) | | Depth 2.73 |
| Head | 1800 MHz | $\epsilon_r = 40.0 \pm 5\%$ | $\sigma = 1.40 \pm 5\% \text{ mho/m}$ |
| Head | 1900 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: |
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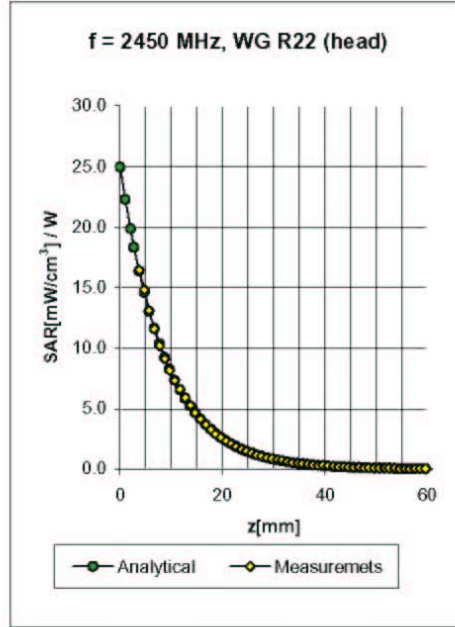
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Sensor Offset

| | | |
|----------------------------|---------------------------------|----|
| Probe Tip to Sensor Center | 2.7 | mm |
| Optical Surface Detection | 1.6 \pm 0.2 | mm |

Conversion Factor Assessment



| | | | | |
|-------------|-------------|-------------------|-----------------------------|-------------------------------|
| Head | 2450 | MHz | $\epsilon_r = 39.2 \pm 5\%$ | $\sigma = 1.80 \pm 5\%$ mho/m |
| ConvF X | 5.1 | $\pm 8.9\%$ (k=2) | Boundary effect: | |
| ConvF Y | 5.1 | $\pm 8.9\%$ (k=2) | Alpha | 0.90 |
| ConvF Z | 5.1 | $\pm 8.9\%$ (k=2) | Depth | 1.93 |