

Client **Motorola MRO (Harvard)**

CALIBRATION CERTIFICATE

Object(s) **ET3DV6 - SN:1513**

Calibration procedure(s) **QA CAL-01.v2
Calibration procedure for dosimetric E-field probes**

Calibration date: **January 17, 2003**

Condition of the calibrated item **In Tolerance (according to the specific calibration document)**

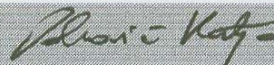
This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date	Scheduled Calibration
RF generator HP 8684C	US3642U01700	4-Aug-99 (in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	8-Mar-02	Mar-03
Power sensor HP 8481A	MY41092180	18-Sep-02	Sep-03
Power meter EPM E4419B	GB41293874	13-Sep-02	Sep-03
Network Analyzer HP 8753E	US38432426	3-May-00	In house check: May 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01	Sep-03

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	

Approved by:	Katja Pokovic	Laboratory Director	
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Date issued: January 17, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Probe ET3DV6R

SN:1513

Manufactured:	May 3, 2002
Last calibration:	May 8, 2002
Repaired:	December 16, 2002
Recalibrated:	January 17, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6R SN:1513**Sensitivity in Free Space****Diode Compression**

NormX	2.21 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	94	mV
NormY	2.00 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	94	mV
NormZ	2.02 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	94	mV

Sensitivity in Tissue Simulating Liquid

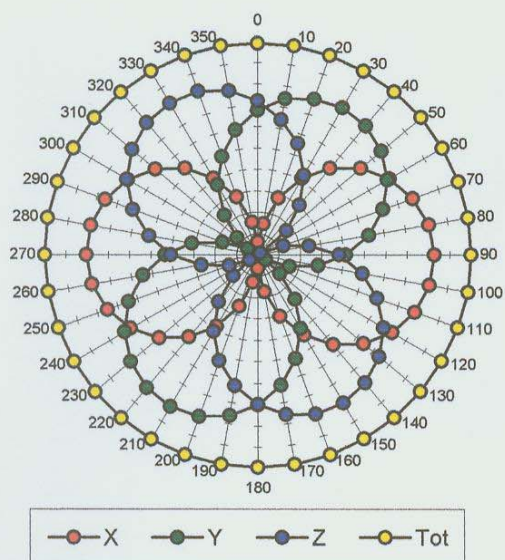
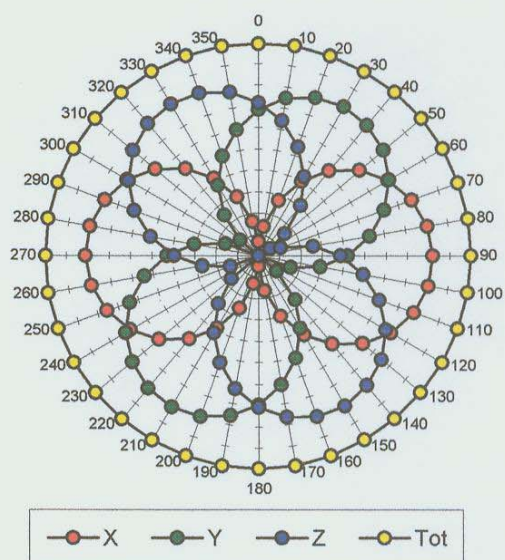
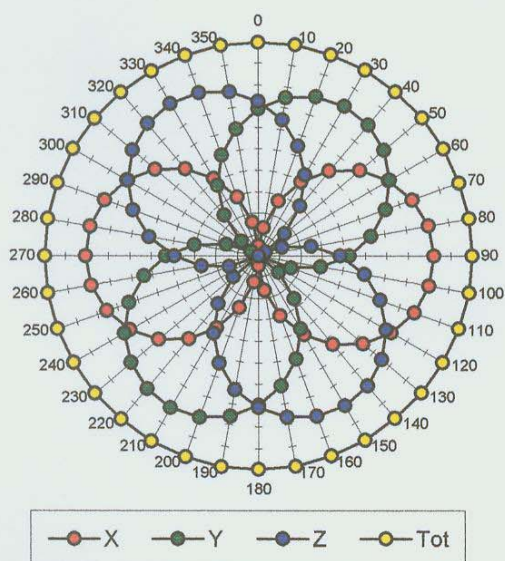
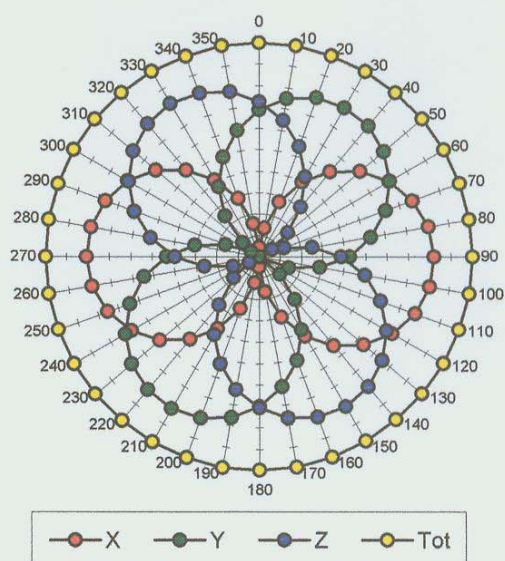
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m
ConvF X	6.0 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.0 $\pm 9.5\%$ (k=2)	Alpha	0.56
ConvF Z	6.0 $\pm 9.5\%$ (k=2)	Depth	1.95
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
ConvF X	4.9 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	4.9 $\pm 9.5\%$ (k=2)	Alpha	0.50
ConvF Z	4.9 $\pm 9.5\%$ (k=2)	Depth	2.63

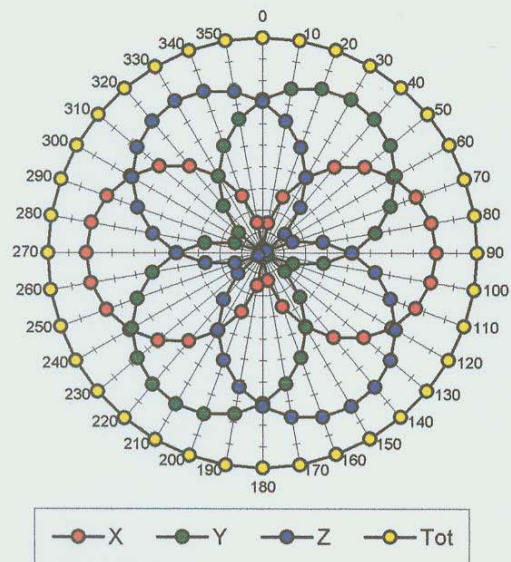
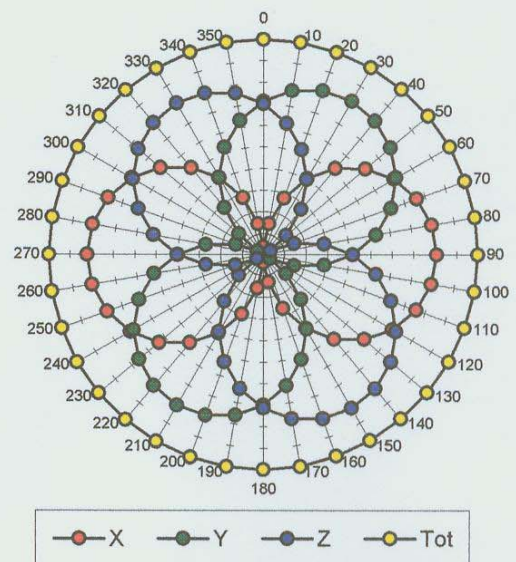
Boundary Effect

Head	900 MHz	Typical SAR gradient: 5 % per mm		
Probe Tip to Boundary		1 mm	2 mm	
SAR _{be} [%]	Without Correction Algorithm	9.3	4.9	
SAR _{be} [%]	With Correction Algorithm	0.2	0.4	
Head	1800 MHz	Typical SAR gradient: 10 % per mm		
Probe Tip to Boundary		1 mm	2 mm	
SAR _{be} [%]	Without Correction Algorithm	13.9	9.3	
SAR _{be} [%]	With Correction Algorithm	0.2	0.1	

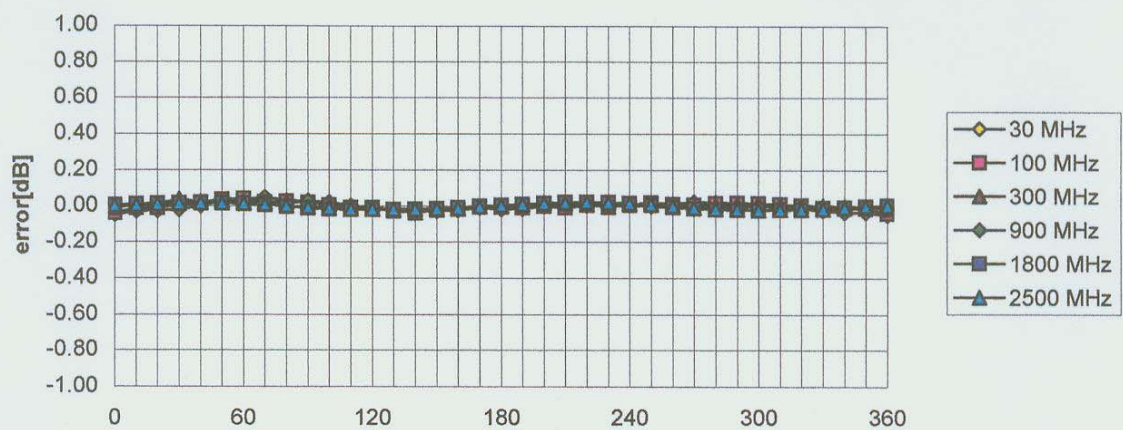
Sensor Offset

Probe Tip to Sensor Center	2.7	mm
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Receiving Pattern (ϕ), $\theta = 0^\circ$ $f = 30 \text{ MHz}$, TEM cell if110 $f = 100 \text{ MHz}$, TEM cell if110 $f = 300 \text{ MHz}$, TEM cell if110 $f = 900 \text{ MHz}$, TEM cell if110

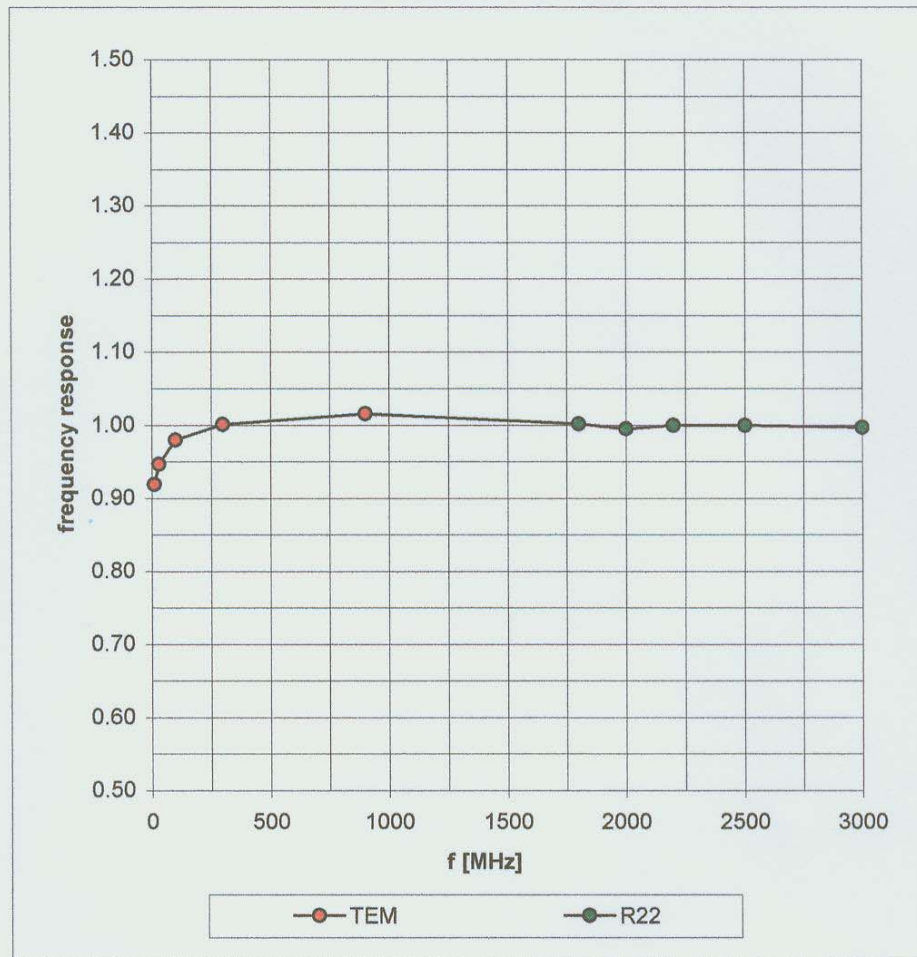
$f = 1800 \text{ MHz, WG R22}$  $f = 2500 \text{ MHz, WG R22}$ 

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

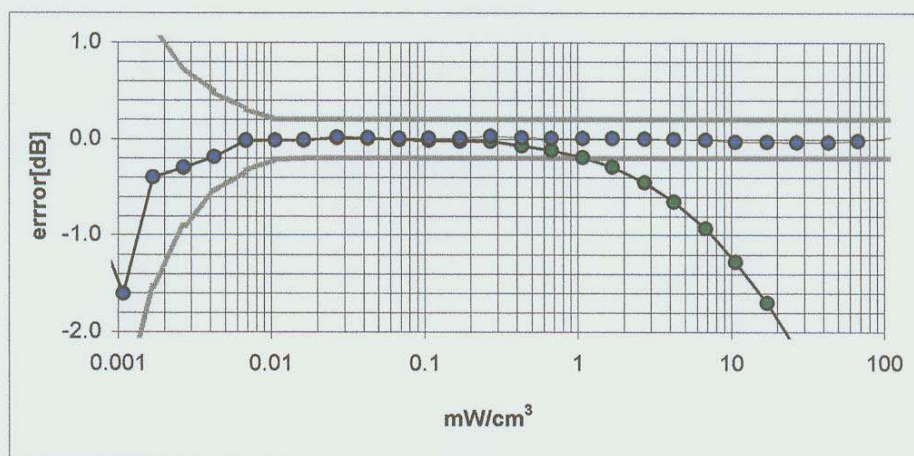
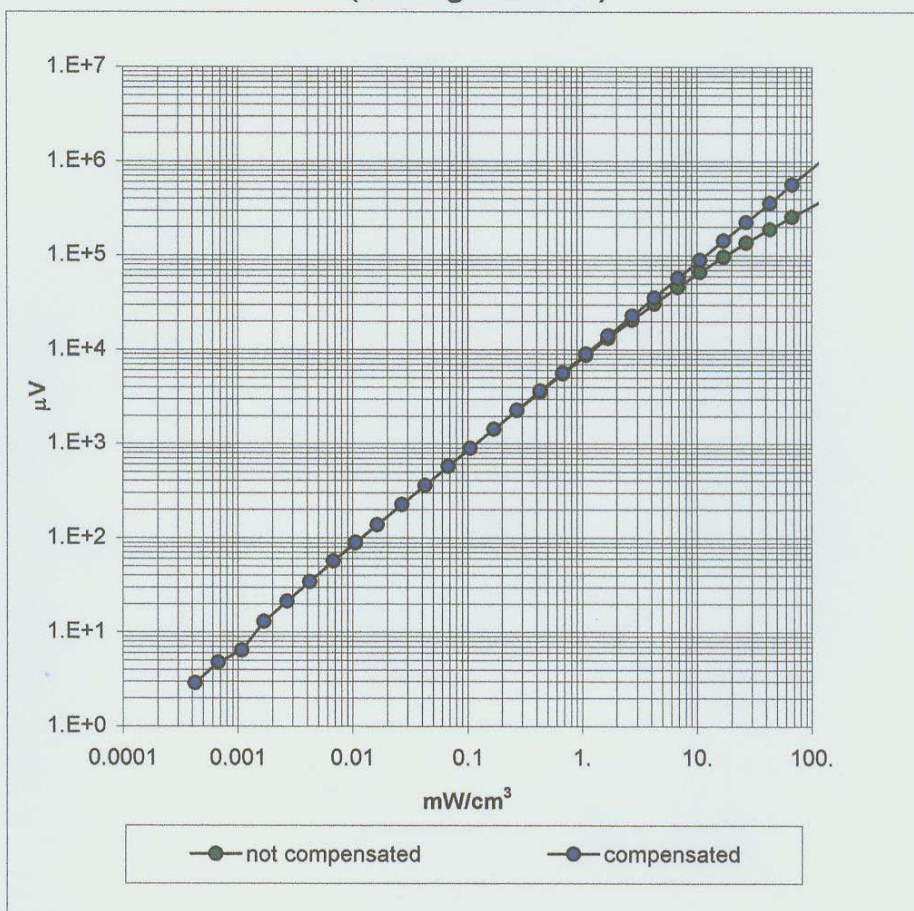


Frequency Response of E-Field

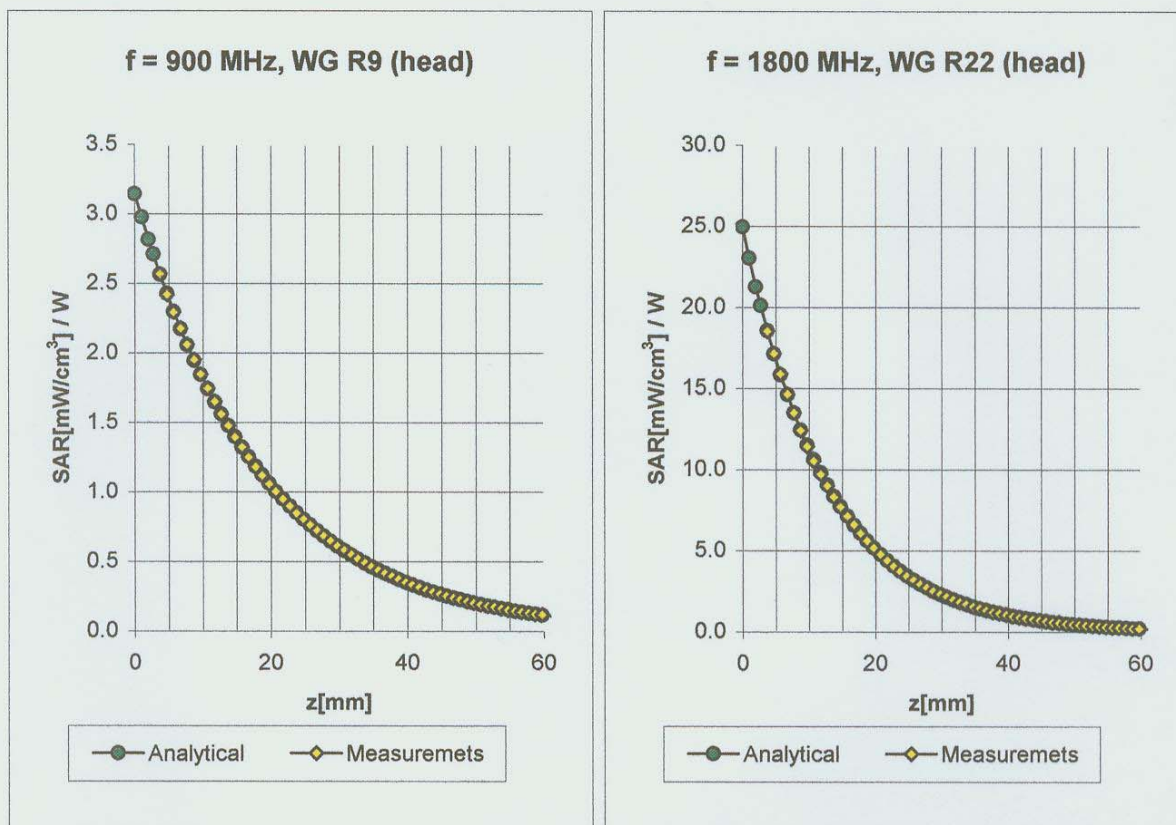
(TEM-Cell:ifi110, Waveguide R22)



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

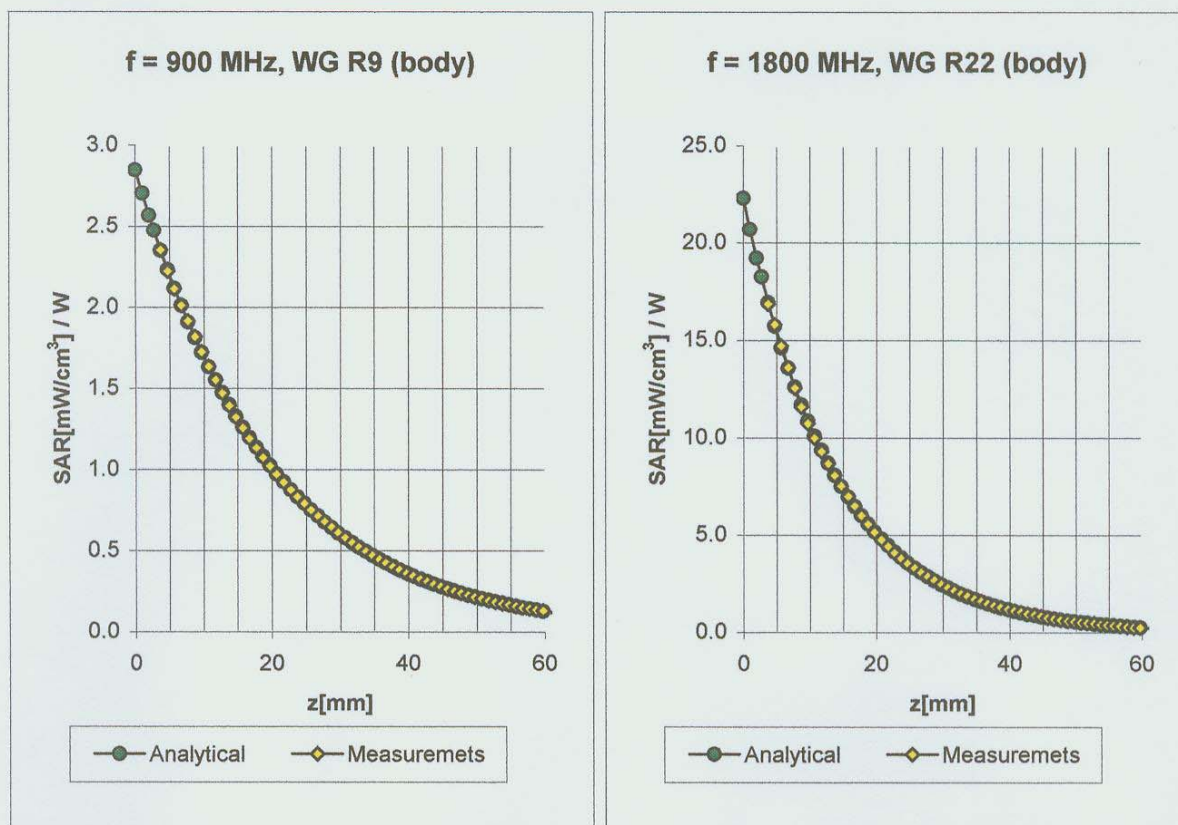


Conversion Factor Assessment



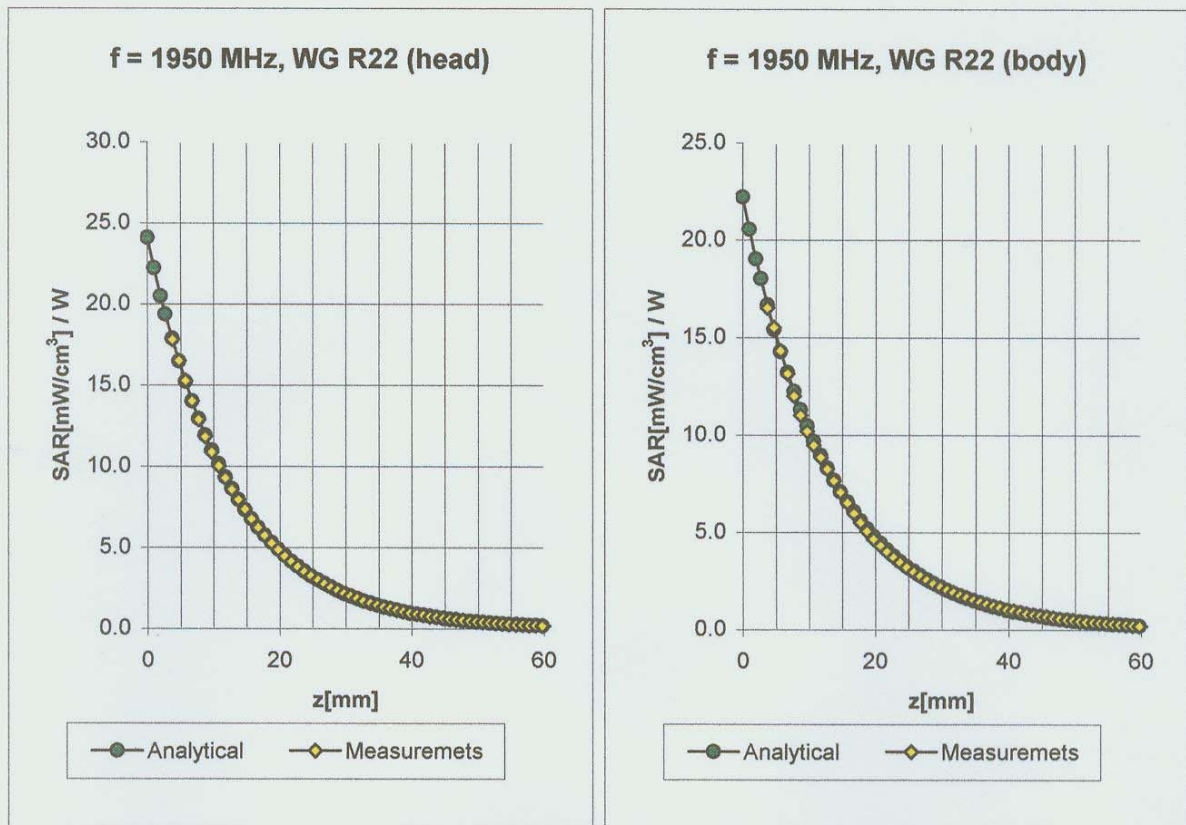
Head	900 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.97 \pm 5\%$ mho/m
Head	835 MHz	$\epsilon_r = 41.5 \pm 5\%$	$\sigma = 0.90 \pm 5\%$ mho/m
	ConvF X	$6.0 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$6.0 \pm 9.5\%$ (k=2)	Alpha 0.56
	ConvF Z	$6.0 \pm 9.5\%$ (k=2)	Depth 1.95
Head	1800 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
Head	1900 MHz	$\epsilon_r = 40.0 \pm 5\%$	$\sigma = 1.40 \pm 5\%$ mho/m
	ConvF X	$4.9 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$4.9 \pm 9.5\%$ (k=2)	Alpha 0.50
	ConvF Z	$4.9 \pm 9.5\%$ (k=2)	Depth 2.63

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	$5.8 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$5.8 \pm 9.5\%$ (k=2)	Alpha 0.45
	ConvF Z	$5.8 \pm 9.5\%$ (k=2)	Depth 2.35
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	$4.4 \pm 9.5\%$ (k=2)	Boundary effect:
	ConvF Y	$4.4 \pm 9.5\%$ (k=2)	Alpha 0.57
	ConvF Z	$4.4 \pm 9.5\%$ (k=2)	Depth 2.66

Conversion Factor Assessment



Head 1950 MHz $\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\%$ mho/m

ConvF X **4.6** $\pm 8.9\%$ (k=2)

Boundary effect:

ConvF Y **4.6** $\pm 8.9\%$ (k=2)

Alpha **0.55**

ConvF Z **4.6** $\pm 8.9\%$ (k=2)

Depth **2.57**

Body 1950 MHz $\epsilon_r = 53.3 \pm 5\%$ $\sigma = 1.52 \pm 5\%$ mho/m

ConvF X **4.2** $\pm 8.9\%$ (k=2)

Boundary effect:

ConvF Y **4.2** $\pm 8.9\%$ (k=2)

Alpha **0.80**

ConvF Z **4.2** $\pm 8.9\%$ (k=2)

Depth **2.14**

Deviation from Isotropy in HSL

Error (θ, ϕ), $f = 900$ MHz

