

Client **Samsung (Dymstec)**

CALIBRATION CERTIFICATE

Object(s) **ET3DV6 - SN: 1735**

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

Calibration date: **November 20, 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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Reference 20 dB Attenuator	SN: 5086 (20b)	3-Apr-03 (METAS No. 251-0340)	Apr-04
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-03)	In house check: Oct 05

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: November 21, 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 ET3DV6

SN:1735

Manufactured:	September 27, 2002
Last calibration:	December 16, 2002
Recalibrated:	November 20, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV6 SN:1735

Sensitivity in Free Space

NormX	1.58 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.69 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.63 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

DCP X	95	mV
DCP Y	95	mV
DCP Z	95	mV

Sensitivity in Tissue Simulating Liquid

Head **900 MHz** $\epsilon_r = 41.5 \pm 5\%$ $\sigma = 0.97 \pm 5\% \text{ mho/m}$
 Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	7.0 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	7.0 $\pm 9.5\%$ (k=2)	Alpha 0.33
ConvF Z	7.0 $\pm 9.5\%$ (k=2)	Depth 2.43

Head **1800 MHz** $\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\% \text{ mho/m}$
 Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	5.6 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	5.6 $\pm 9.5\%$ (k=2)	Alpha 0.42
ConvF Z	5.6 $\pm 9.5\%$ (k=2)	Depth 2.70

Boundary Effect

Head **900 MHz** **Typical SAR gradient: 5 % per mm**

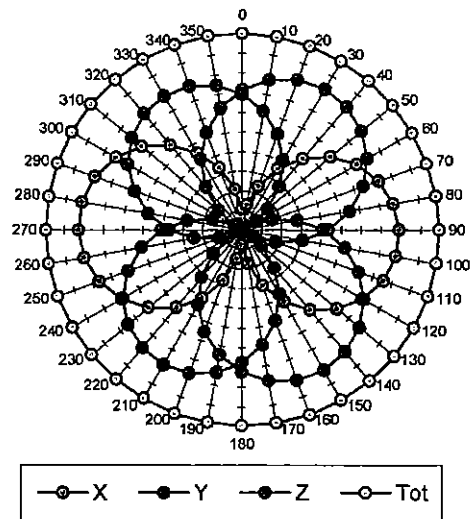
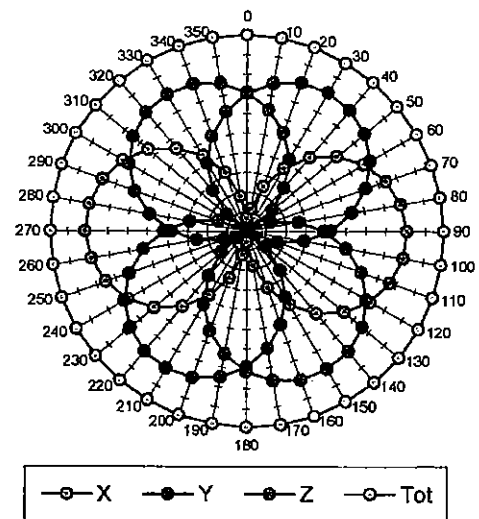
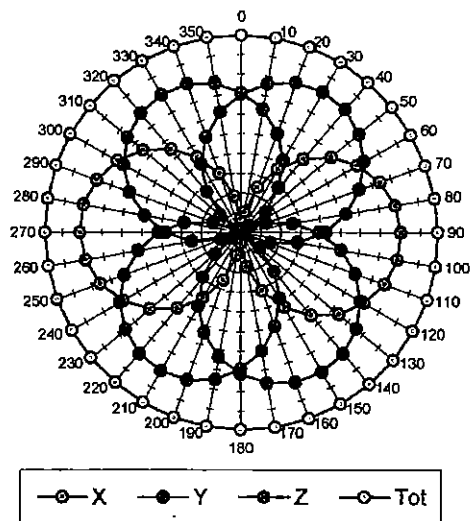
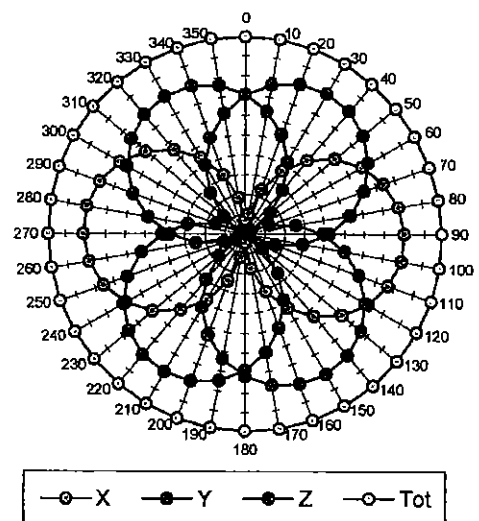
Probe Tip to Boundary	1 mm	2 mm
SAR _{ba} [%] Without Correction Algorithm	8.1	4.6
SAR _{ba} [%] With Correction Algorithm	0.2	0.4

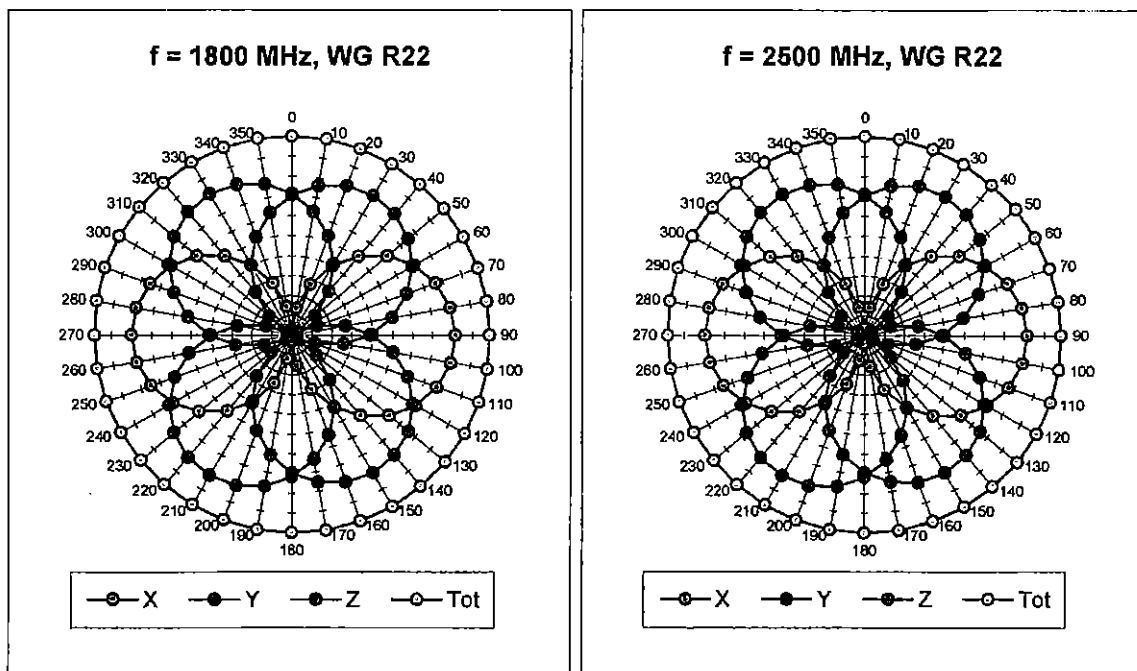
Head **1800 MHz** **Typical SAR gradient: 10 % per mm**

Probe Tip to Boundary	1 mm	2 mm
SAR _{ba} [%] Without Correction Algorithm	13.1	9.3
SAR _{ba} [%] With Correction Algorithm	0.4	0.3

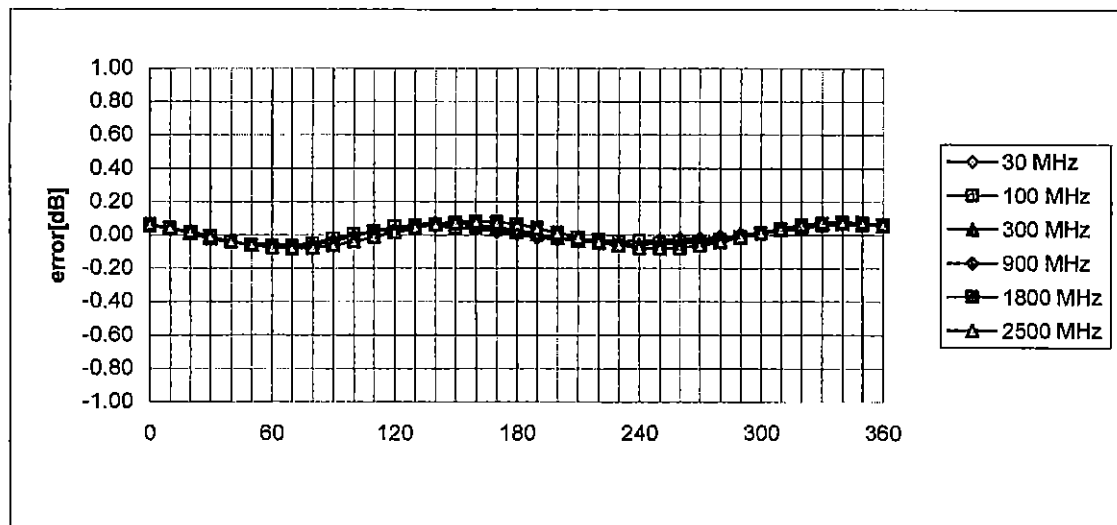
Sensor Offset

Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.1 $\pm$ 0.2	mm

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

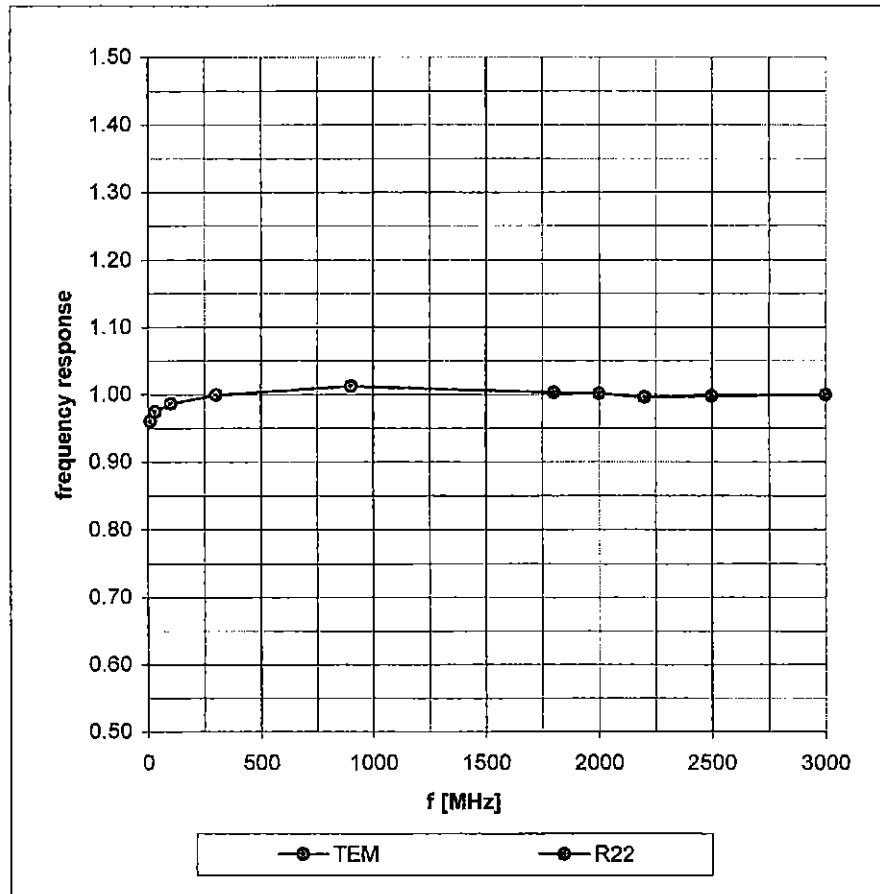


Isotropy Error (ϕ), $\theta = 0^\circ$

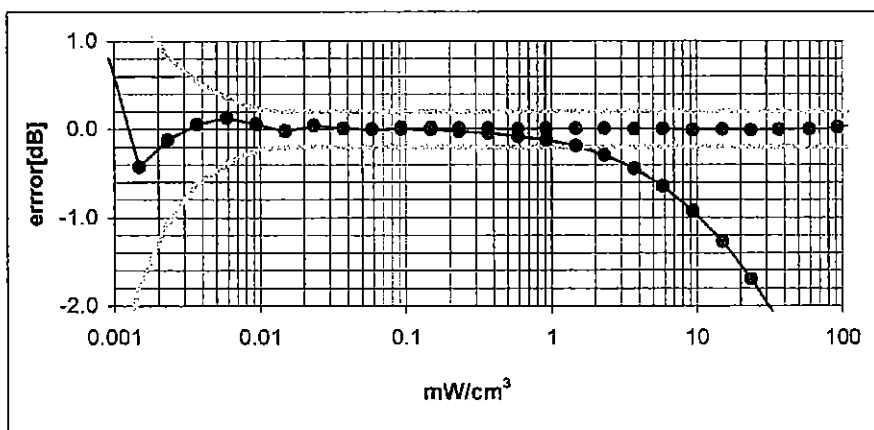
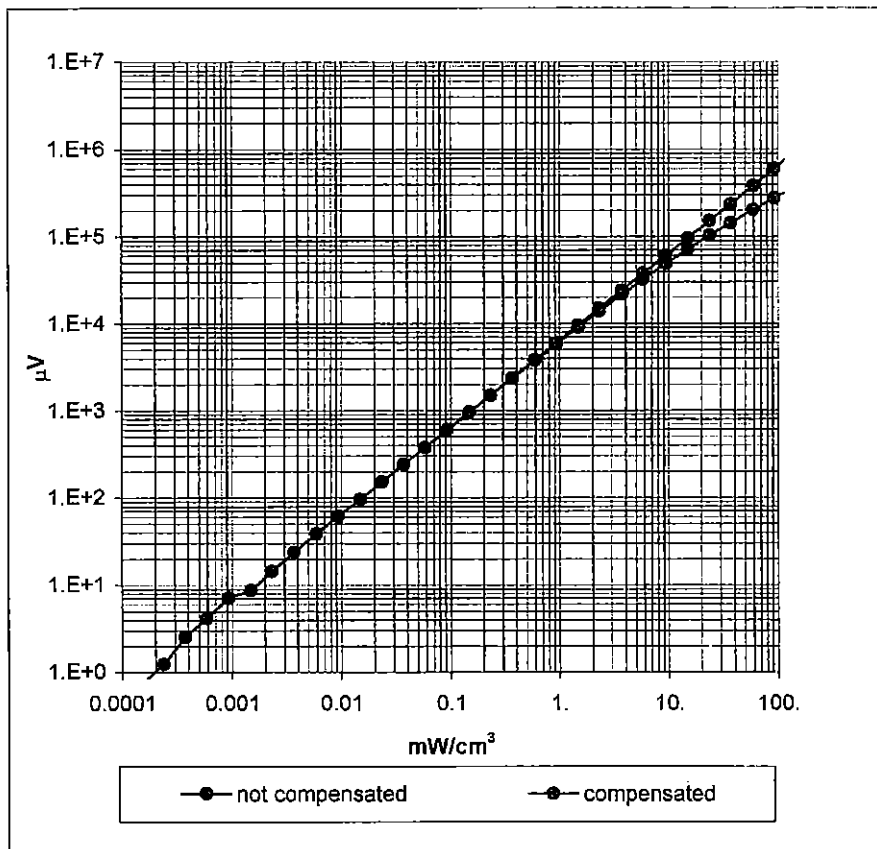


Frequency Response of E-Field

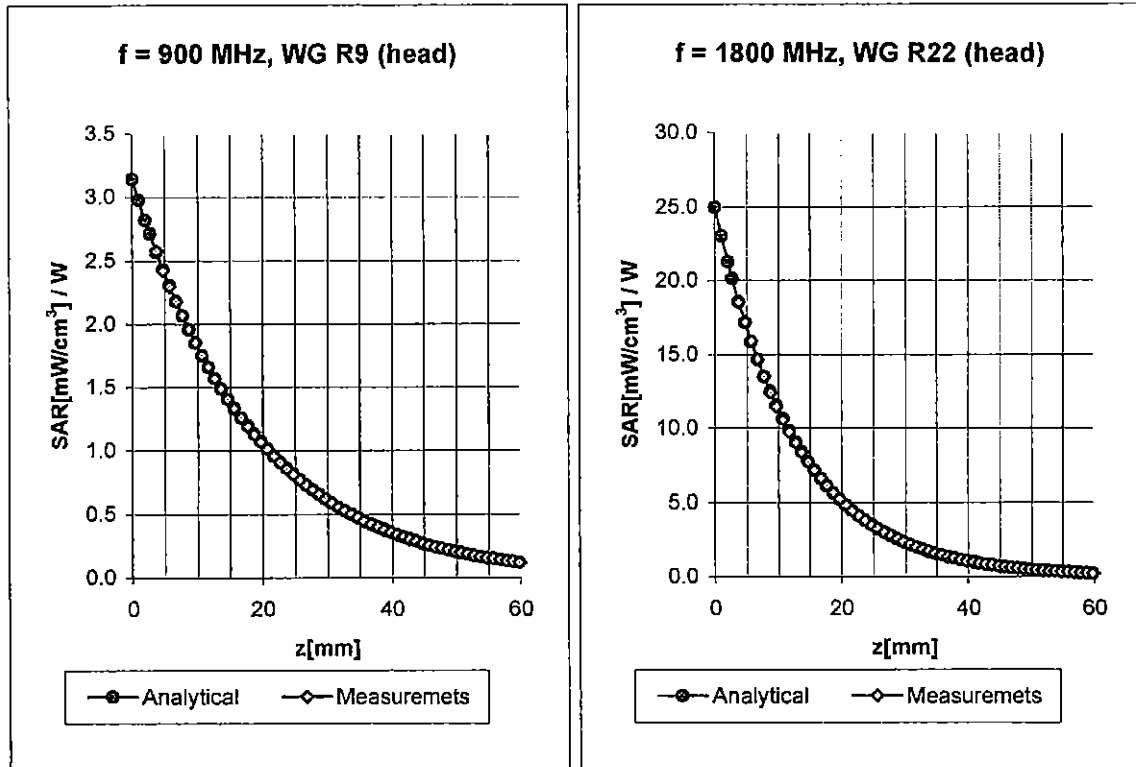
(TEM-Cell:ifi110, Waveguide R22)



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



Conversion Factor Assessment



Head 900 MHz $\epsilon_r = 41.5 \pm 5\%$ $\sigma = 0.97 \pm 5\% \text{ mho/m}$

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

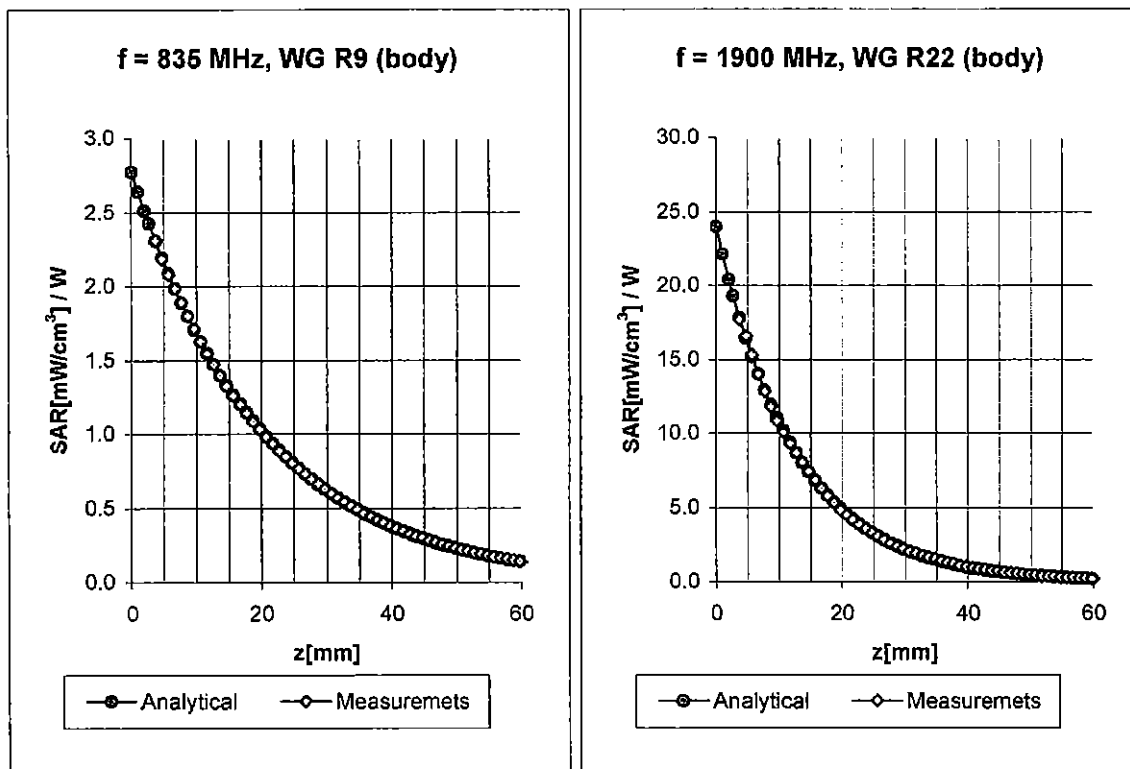
ConvF X	7.0 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	7.0 $\pm 9.5\%$ (k=2)	Alpha 0.33
ConvF Z	7.0 $\pm 9.5\%$ (k=2)	Depth 2.43

Head 1800 MHz $\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\% \text{ mho/m}$

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	5.6 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	5.6 $\pm 9.5\%$ (k=2)	Alpha 0.42
ConvF Z	5.6 $\pm 9.5\%$ (k=2)	Depth 2.70

Conversion Factor Assessment



Body **835 MHz** $\epsilon_r = 55.2 \pm 5\%$ $\sigma = 0.97 \pm 5\% \text{ mho/m}$

Valid for f=750-950 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

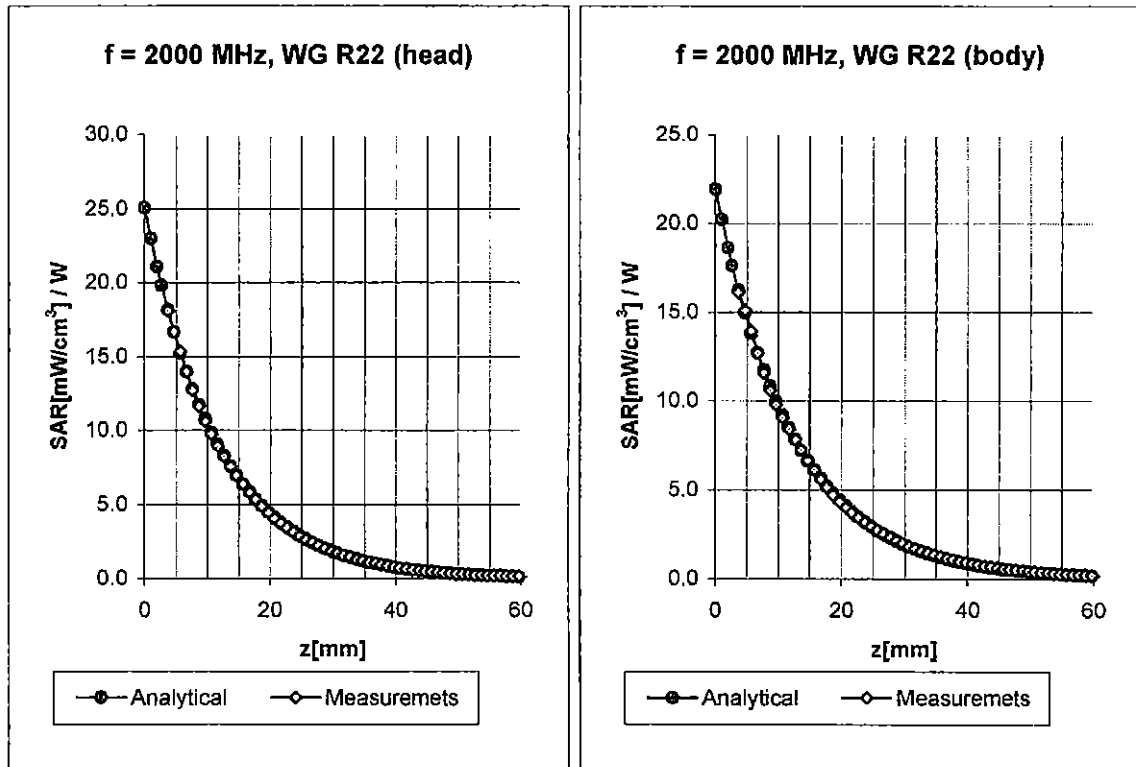
ConvF X	6.9 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	6.9 $\pm 9.5\%$ (k=2)	Alpha 0.32
ConvF Z	6.9 $\pm 9.5\%$ (k=2)	Depth 2.64

Body **1900 MHz** $\epsilon_r = 53.3 \pm 5\%$ $\sigma = 1.52 \pm 5\% \text{ mho/m}$

Valid for f=1800-2000 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.7 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	4.7 $\pm 9.5\%$ (k=2)	Alpha 0.60
ConvF Z	4.7 $\pm 9.5\%$ (k=2)	Depth 2.57

Conversion Factor Assessment



Head **2000 MHz** $\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\% \text{ mho/m}$

Valid for f=1900-2100 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	5.1 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	5.1 $\pm 9.5\%$ (k=2)	Alpha 0.50
ConvF Z	5.1 $\pm 9.5\%$ (k=2)	Depth 2.60

Body **2000 MHz** $\epsilon_r = 53.3 \pm 5\%$ $\sigma = 1.52 \pm 5\% \text{ mho/m}$

Valid for f=1900-2100 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.7 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	4.7 $\pm 9.5\%$ (k=2)	Alpha 0.66
ConvF Z	4.7 $\pm 9.5\%$ (k=2)	Depth 2.32

Deviation from Isotropy in HSL

Error ($\theta\phi$), $f = 900$ MHz

