

APPENDIX C.

Calibration Certificate(s)

Client

Nokia Oyj, Oulu

CALIBRATION CERTIFICATE

Object(s) ET3DV6 - SN:1765

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

Calibration date: April 16, 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	2-Apr-03	Apr-04
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	

Date issued: April 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 ET3DV

SN:1765

Manufactured:	January 20, 2003
Last calibration:	April 16, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV SN:1765

Sensitivity in Free Space

NormX	1.60 $\mu\text{V}/(\text{V}/\text{m})^2$
NormY	1.81 $\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	1.86 $\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression

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

Sensitivity in Tissue Simulating Liquid

Head **835 MHz** $\epsilon_r = 41.5 \pm 5\%$ $\sigma = 0.90 \pm 5\%$ mho/m
Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	6.6 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	6.6 $\pm 9.5\%$ (k=2)	Alpha 0.66
ConvF Z	6.6 $\pm 9.5\%$ (k=2)	Depth 1.81

Head **1880 MHz** $\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\%$ mho/m
Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	5.2 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	5.2 $\pm 9.5\%$ (k=2)	Alpha 0.59
ConvF Z	5.2 $\pm 9.5\%$ (k=2)	Depth 2.38

Boundary Effect

Head **835 MHz** Typical SAR gradient: 5 % per mm

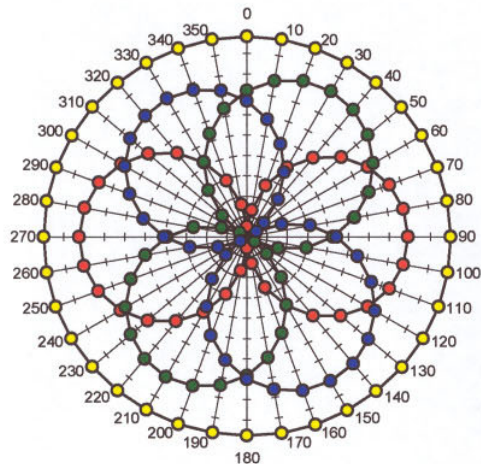
Probe Tip to Boundary	1 mm	2 mm
SAR _{be} [%] Without Correction Algorithm	9.4	4.8
SAR _{be} [%] With Correction Algorithm	0.1	0.3

Head **1880 MHz** Typical SAR gradient: 10 % per mm

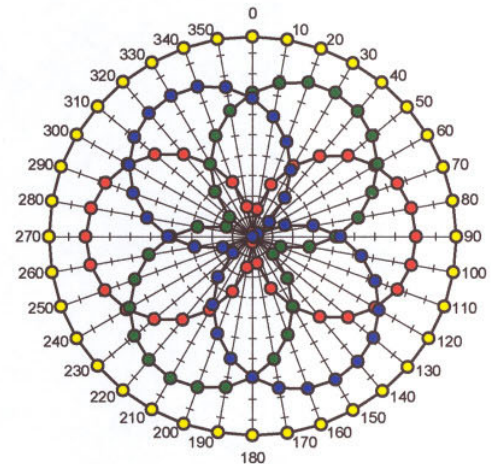
Probe Tip to Boundary	1 mm	2 mm
SAR _{be} [%] Without Correction Algorithm	14.0	9.2
SAR _{be} [%] With Correction Algorithm	0.2	0.3

Sensor Offset

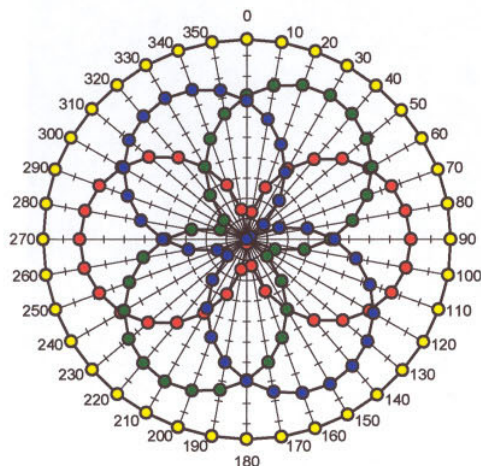
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.2 $\pm$ 0.2	mm

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

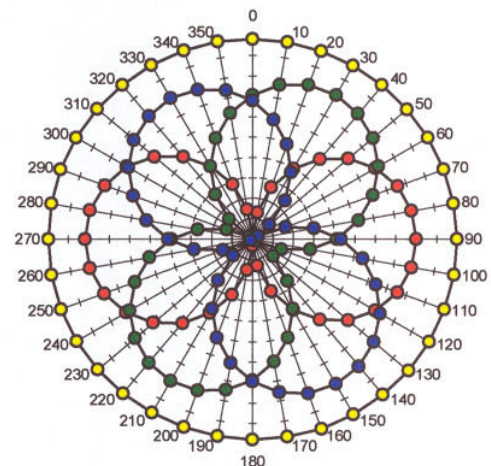
—●— X —●— Y —●— Z —●— Tot

f = 100 MHz, TEM cell ifi110

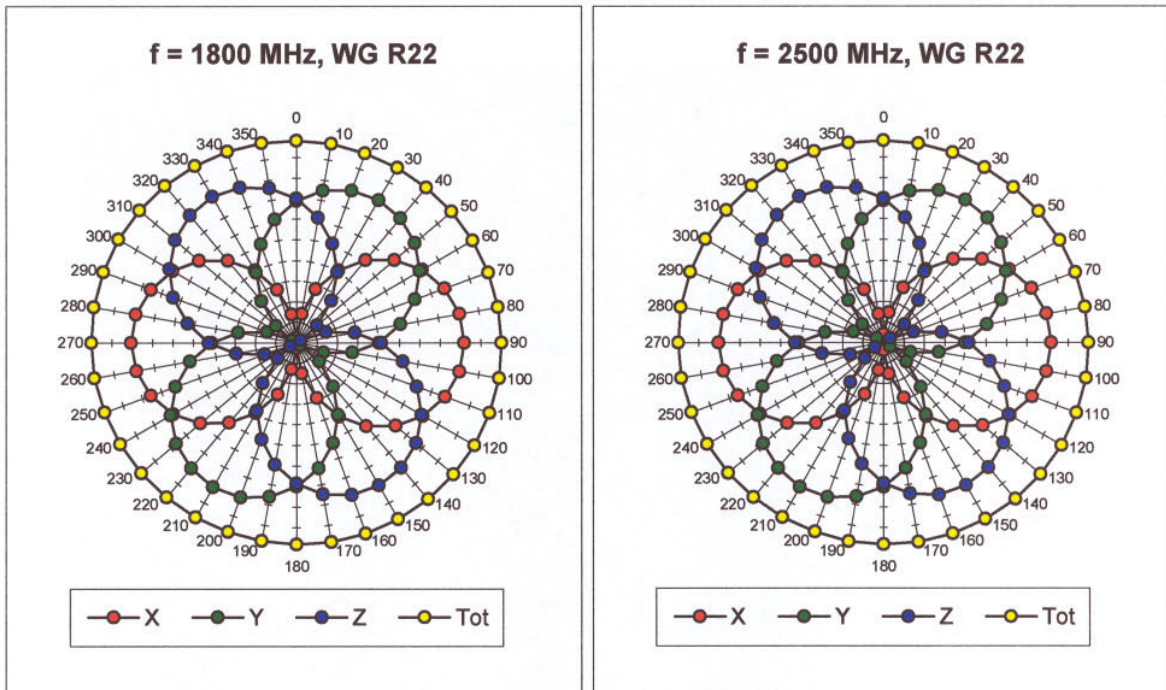
—●— X —●— Y —●— Z —●— Tot

f = 300 MHz, TEM cell ifi110

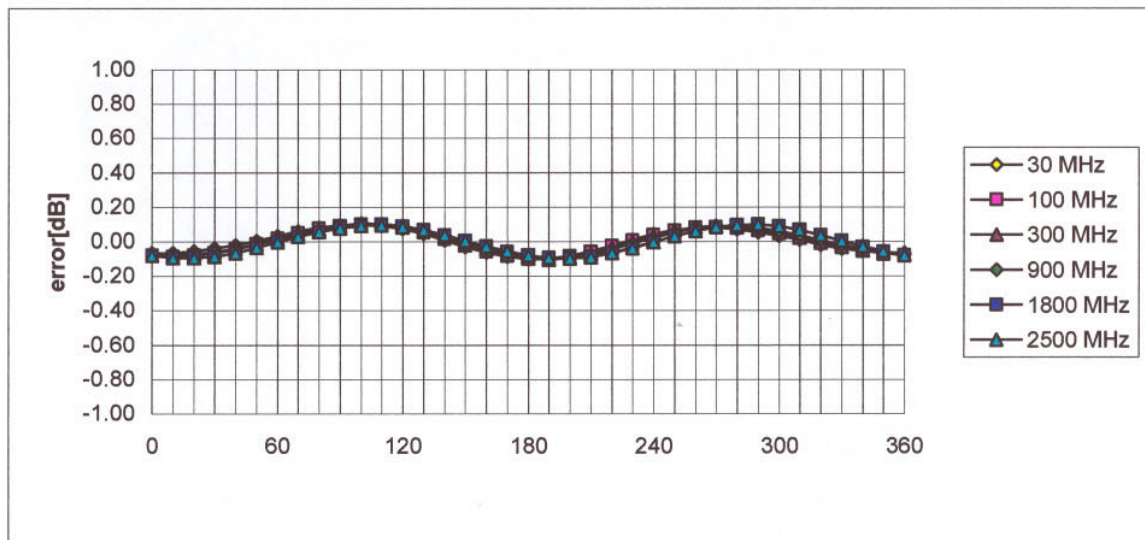
—●— X —●— Y —●— Z —●— Tot

f = 900 MHz, TEM cell ifi110

—●— X —●— Y —●— Z —●— Tot

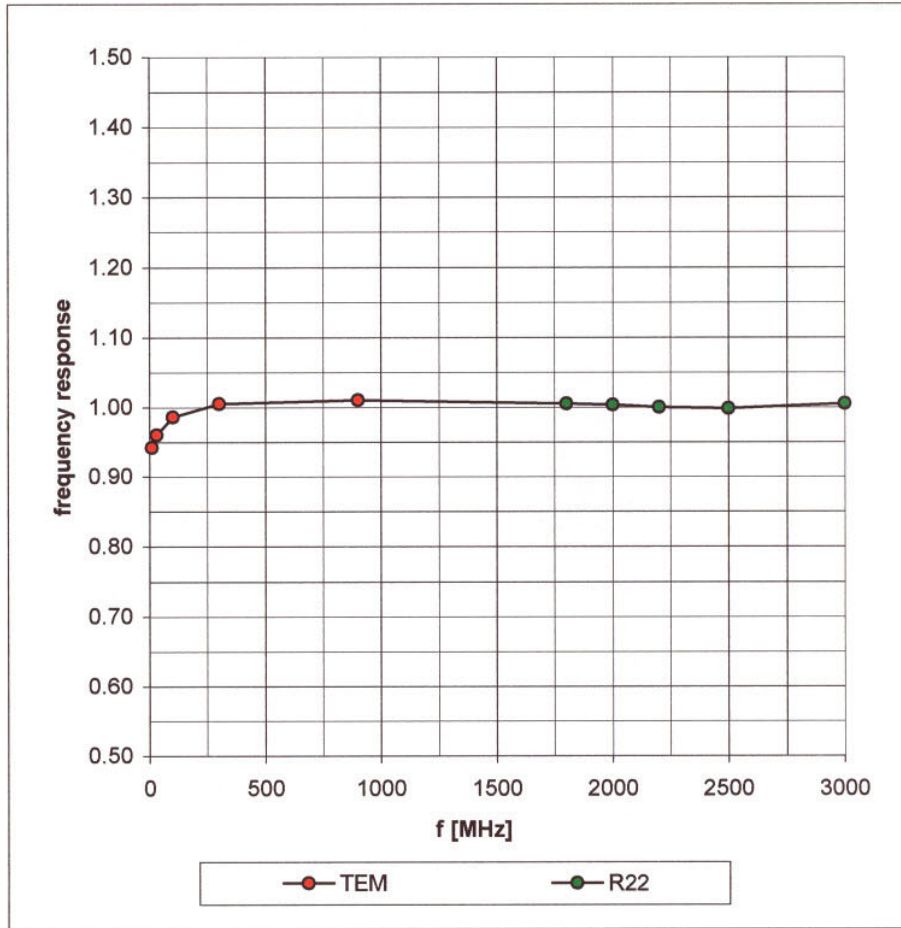


Isotropy Error (ϕ), $\theta = 0^\circ$

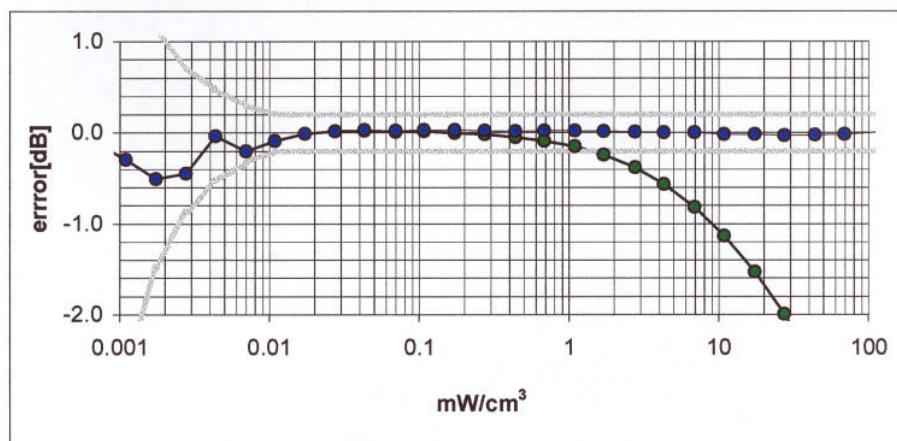
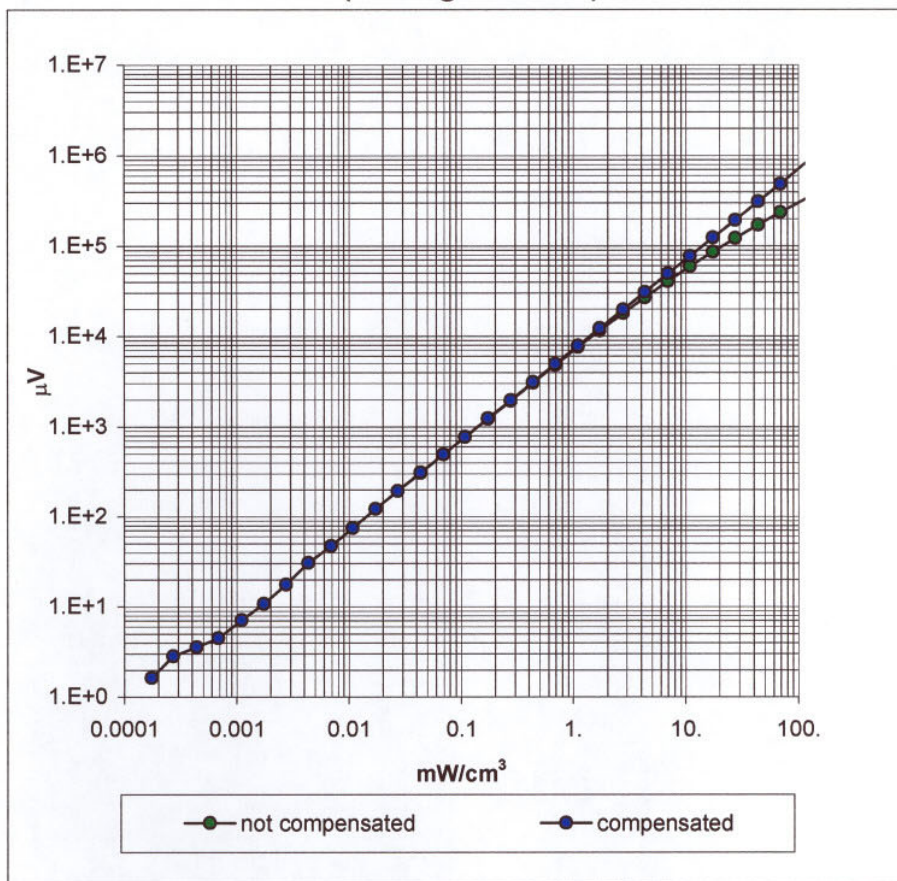


Frequency Response of E-Field

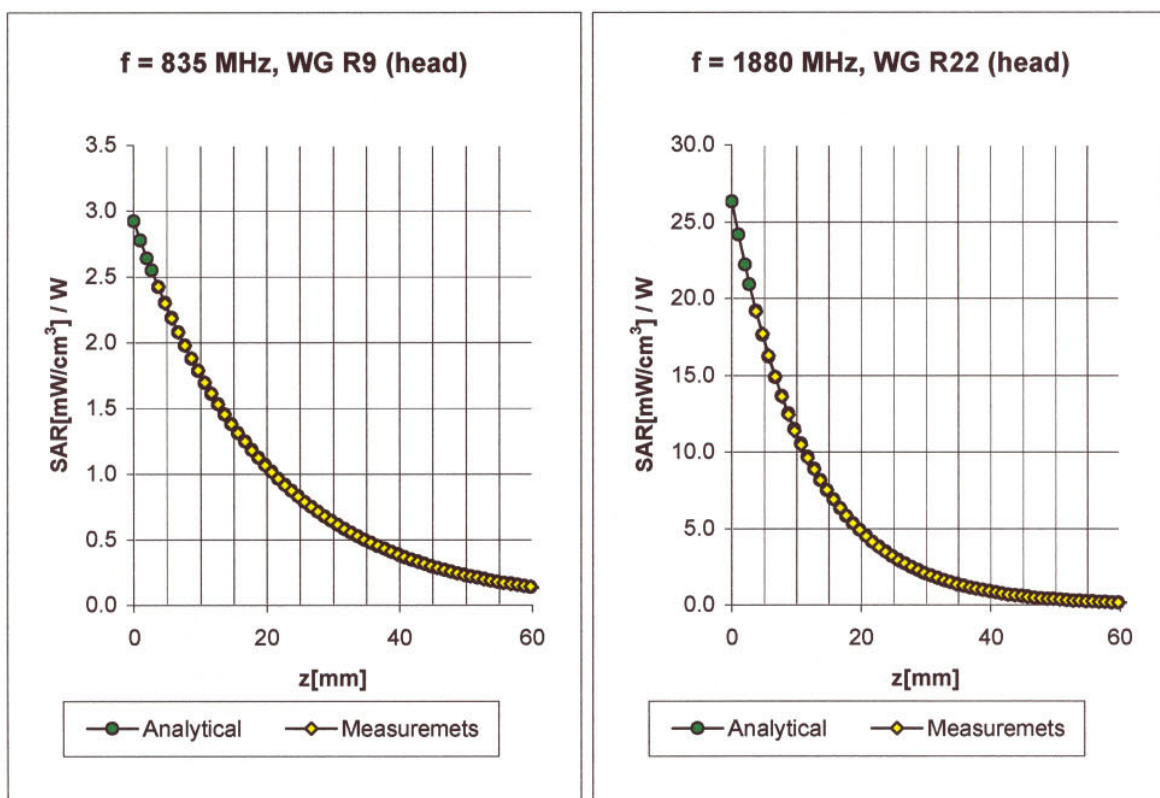
(TEM-Cell:ifi110, Waveguide R22)



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



Conversion Factor Assessment



Head 835 MHz $\epsilon_r = 41.5 \pm 5\%$ $\sigma = 0.90 \pm 5\%$ mho/m

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

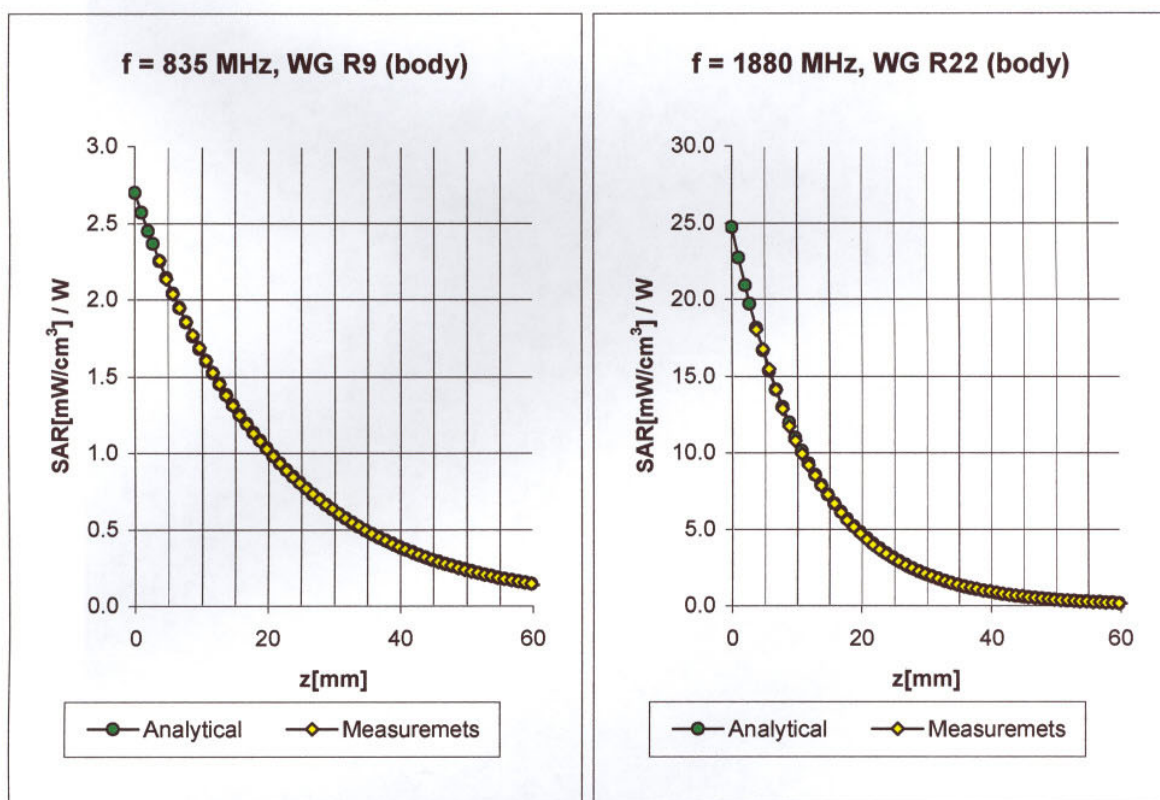
ConvF X	6.6 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	6.6 $\pm 9.5\%$ (k=2)	Alpha 0.66
ConvF Z	6.6 $\pm 9.5\%$ (k=2)	Depth 1.81

Head 1880 MHz $\epsilon_r = 40.0 \pm 5\%$ $\sigma = 1.40 \pm 5\%$ mho/m

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

ConvF X	5.2 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	5.2 $\pm 9.5\%$ (k=2)	Alpha 0.59
ConvF Z	5.2 $\pm 9.5\%$ (k=2)	Depth 2.38

Conversion Factor Assessment



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

Valid for f=800-1000 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

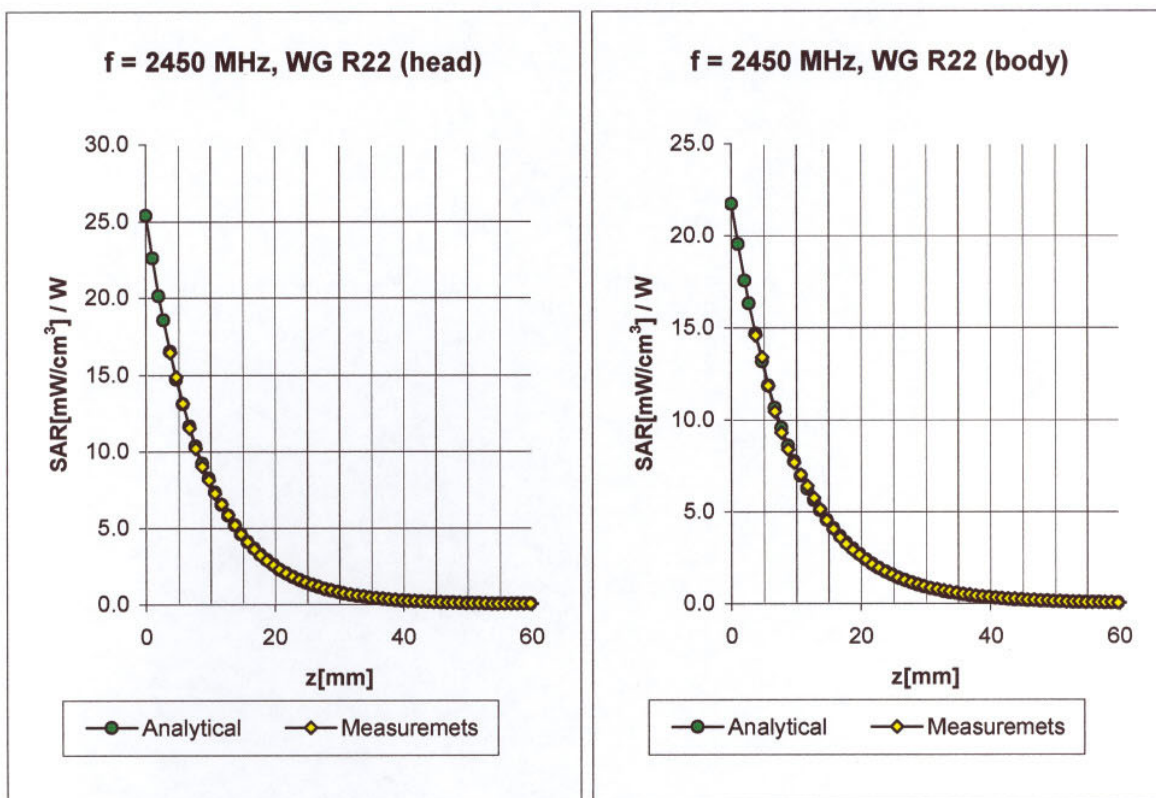
ConvF X	6.4 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.4 $\pm 9.5\%$ (k=2)	Alpha	0.50
ConvF Z	6.4 $\pm 9.5\%$ (k=2)	Depth	2.16

Body **1880 MHz** $\epsilon_r = 53.3 \pm 5\%$ $\sigma = 1.52 \pm 5\% \text{ mho/m}$

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.9 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	4.9 $\pm 9.5\%$ (k=2)	Alpha	0.65
ConvF Z	4.9 $\pm 9.5\%$ (k=2)	Depth	2.41

Conversion Factor Assessment



Head 2450 MHz $\epsilon_r = 39.2 \pm 5\%$ $\sigma = 1.80 \pm 5\%$ mho/m

Valid for f=2400-2500 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	5.1 $\pm 8.9\%$ (k=2)	Boundary effect:
ConvF Y	5.1 $\pm 8.9\%$ (k=2)	Alpha 1.30
ConvF Z	5.1 $\pm 8.9\%$ (k=2)	Depth 1.60

Body 2450 MHz $\epsilon_r = 52.7 \pm 5\%$ $\sigma = 1.95 \pm 5\%$ mho/m

Valid for f=2400-2500 MHz with BODY Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.6 $\pm 8.9\%$ (k=2)	Boundary effect:
ConvF Y	4.6 $\pm 8.9\%$ (k=2)	Alpha 1.57
ConvF Z	4.6 $\pm 8.9\%$ (k=2)	Depth 1.54

Deviation from Isotropy in HSL

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

