

Client **C&C Taiwan (Auden)**

CALIBRATION CERTIFICATE

Object(s) **ES3DV2 - SN:3023**

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

Calibration date: **September 23, 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 (Agilent, No. 20020918)	In house check: Oct 03
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 (Agilent, No. 24BR1033101)	In house check: Oct 03

Calibrated by: **Name** **Function**
Katja Polkovik **Laboratory Director**

Approved by: **Niels Kuster** **Quality Manager**

Signature

Date issued: October 5, 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 ES3DV2

SN:3023

Manufactured:	April 15, 2003
Last calibration:	September 23, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV2 SN:3023

Sensitivity in Free Space

Diode Compression

NormX	0.85 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	96	mV
NormY	0.94 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	96	mV
NormZ	1.01 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	96	mV

Sensitivity in Tissue Simulating Liquid

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

ConvF X	6.0 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.0 $\pm 9.5\%$ (k=2)	Alpha	0.33
ConvF Z	6.0 $\pm 9.5\%$ (k=2)	Depth	1.66

Head **1800 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	4.9 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	4.9 $\pm 9.5\%$ (k=2)	Alpha	0.23
ConvF Z	4.9 $\pm 9.5\%$ (k=2)	Depth	2.54

Boundary Effect

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

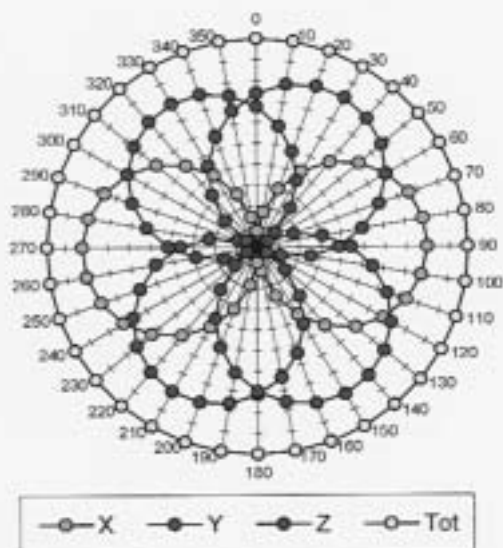
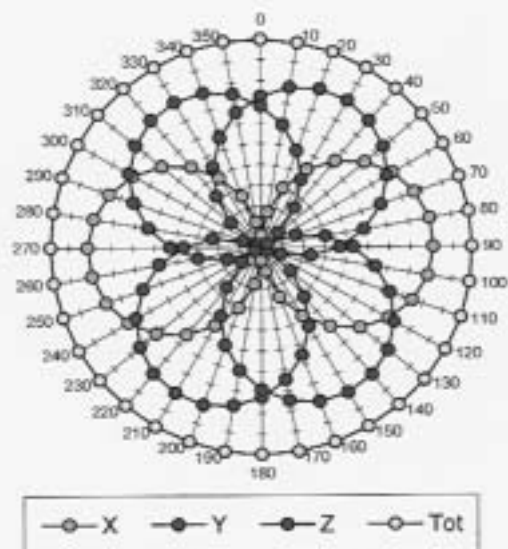
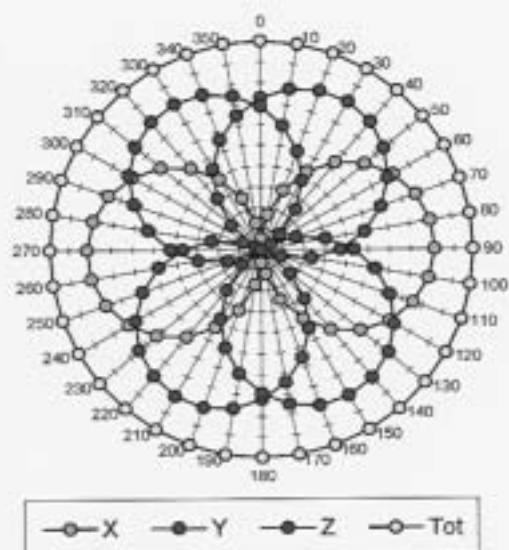
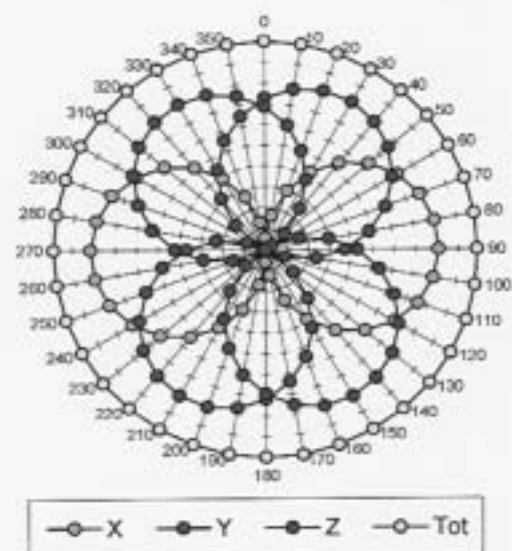
Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%] Without Correction Algorithm		5.8	2.8
SAR _{be} [%] With Correction Algorithm		0.1	0.3

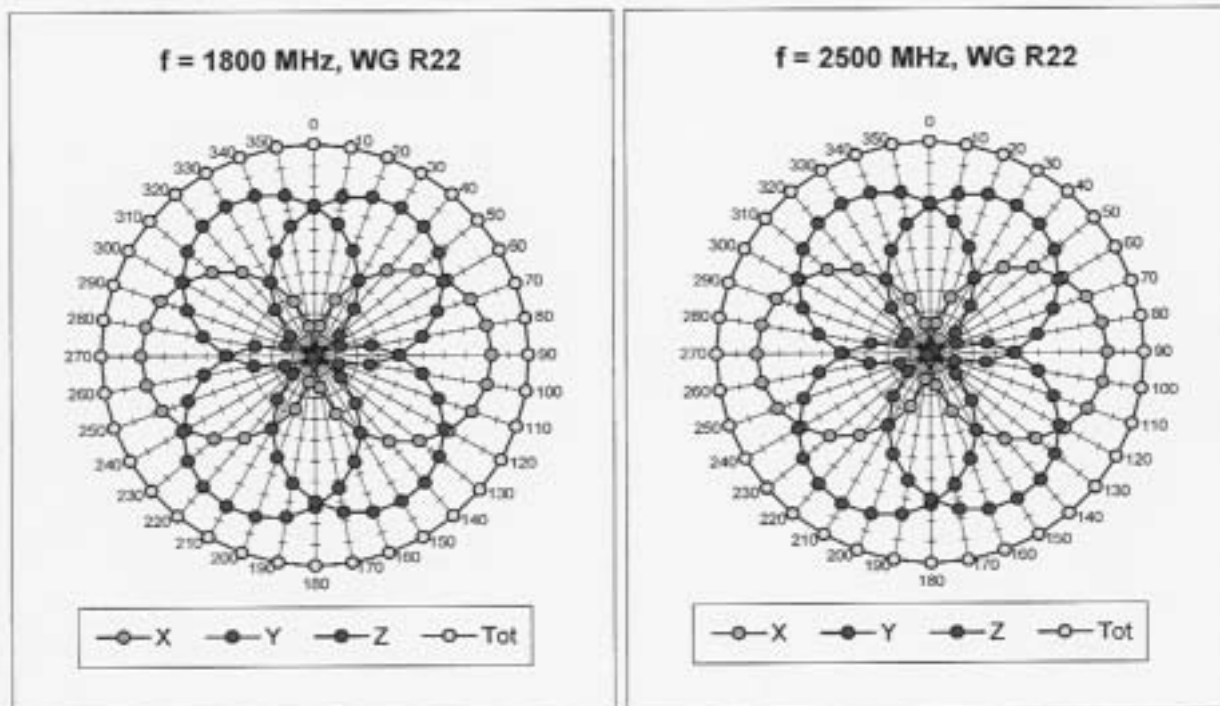
Head **1800 MHz** Typical SAR gradient: 10 % per mm

Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%] Without Correction Algorithm		7.7	4.7
SAR _{be} [%] With Correction Algorithm		0.1	0.3

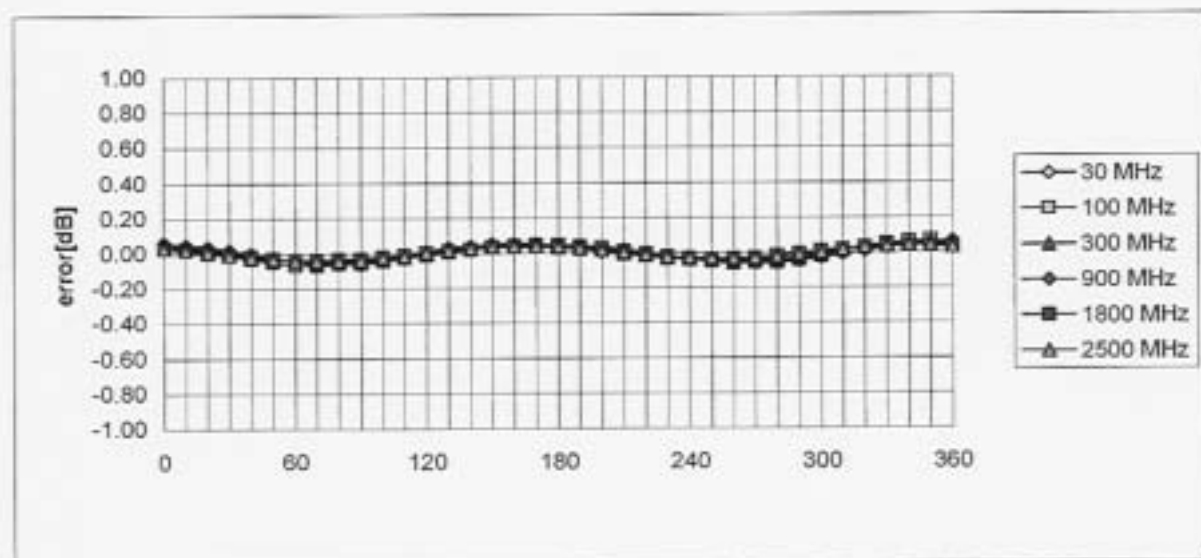
Sensor Offset

Probe Tip to Sensor Center	2.0	mm
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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**

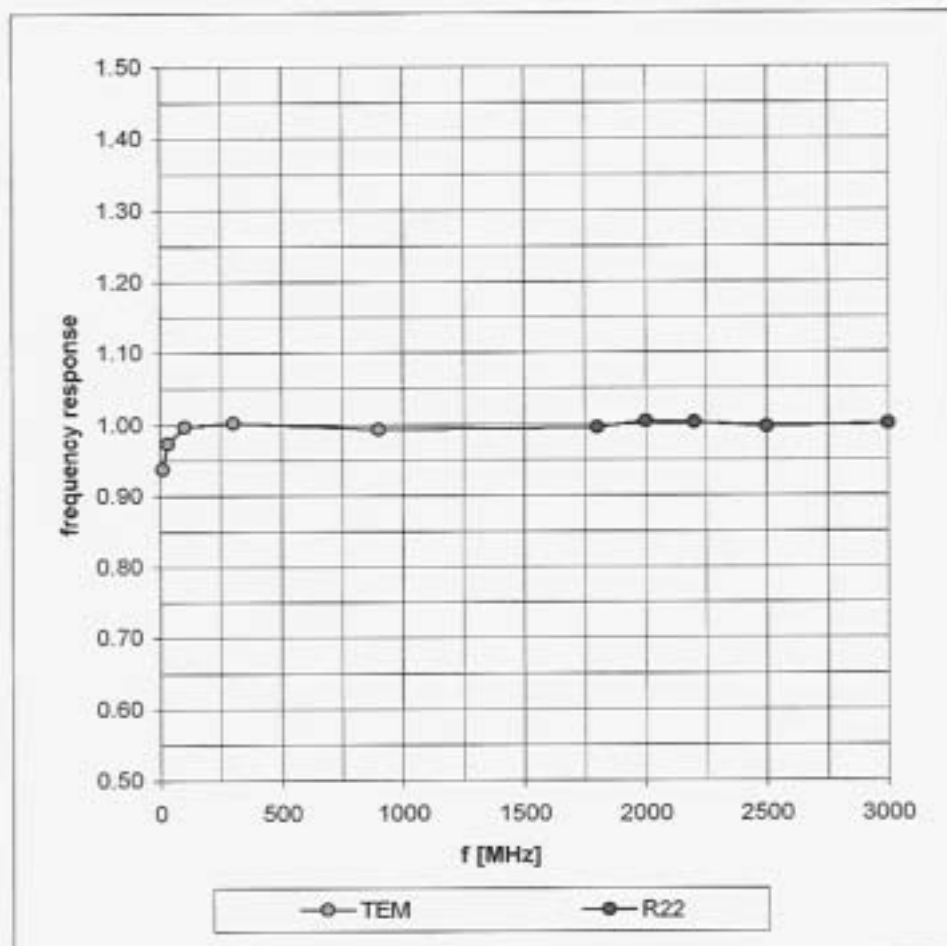


Isotropy Error (ϕ), $\theta = 0^\circ$

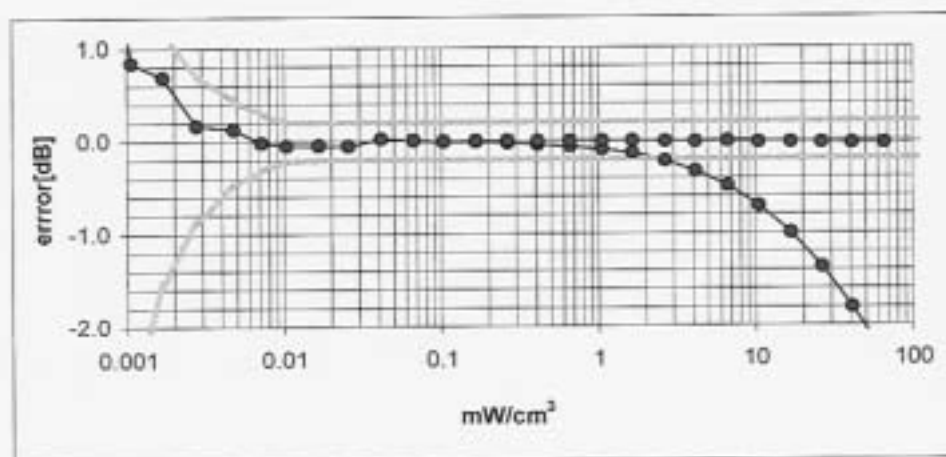
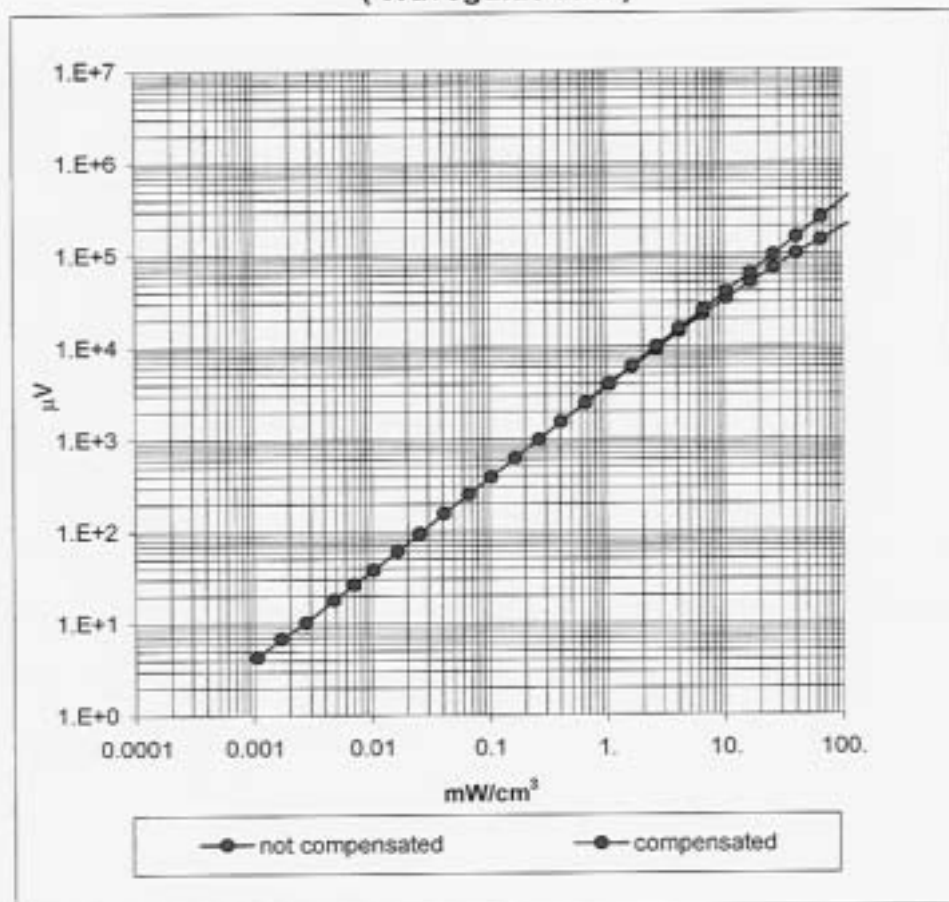


Frequency Response of E-Field

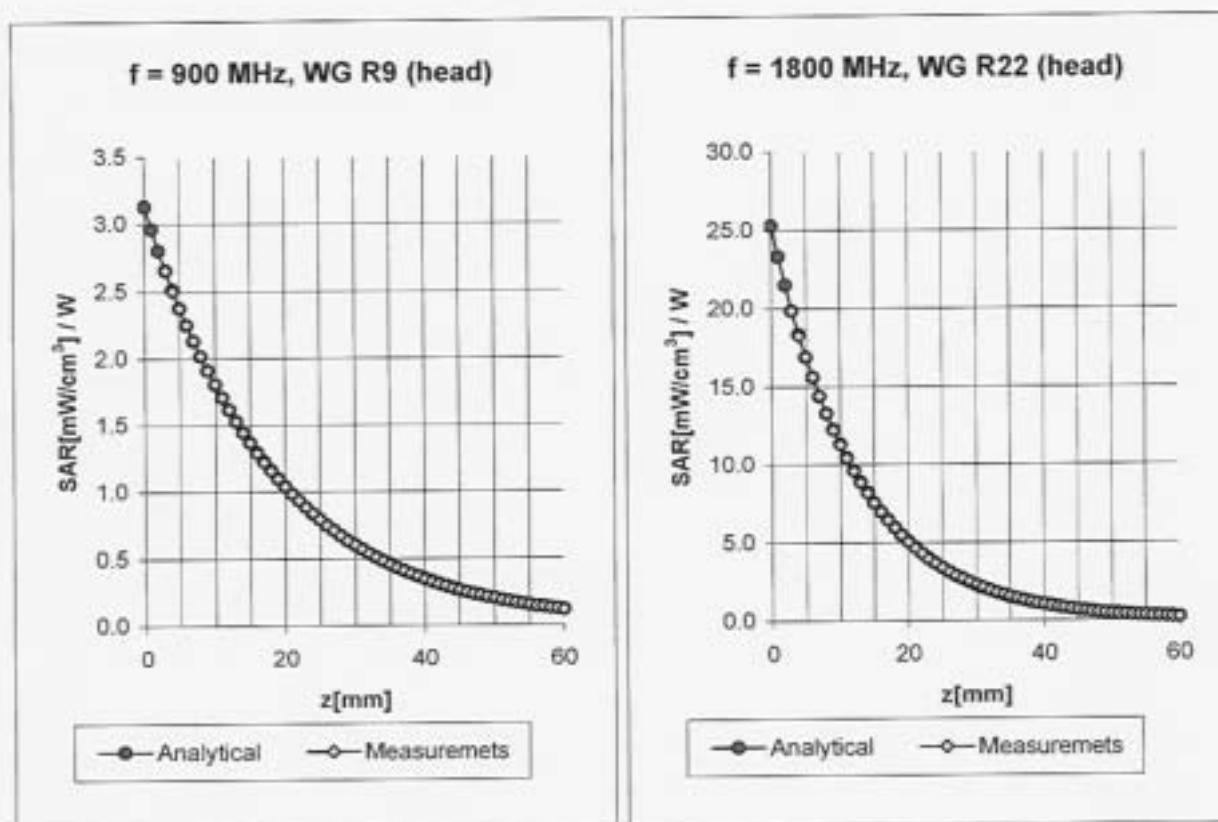
(TEM-Cell:ifi110, Waveguide R22)



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



Conversion Factor Assessment



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

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

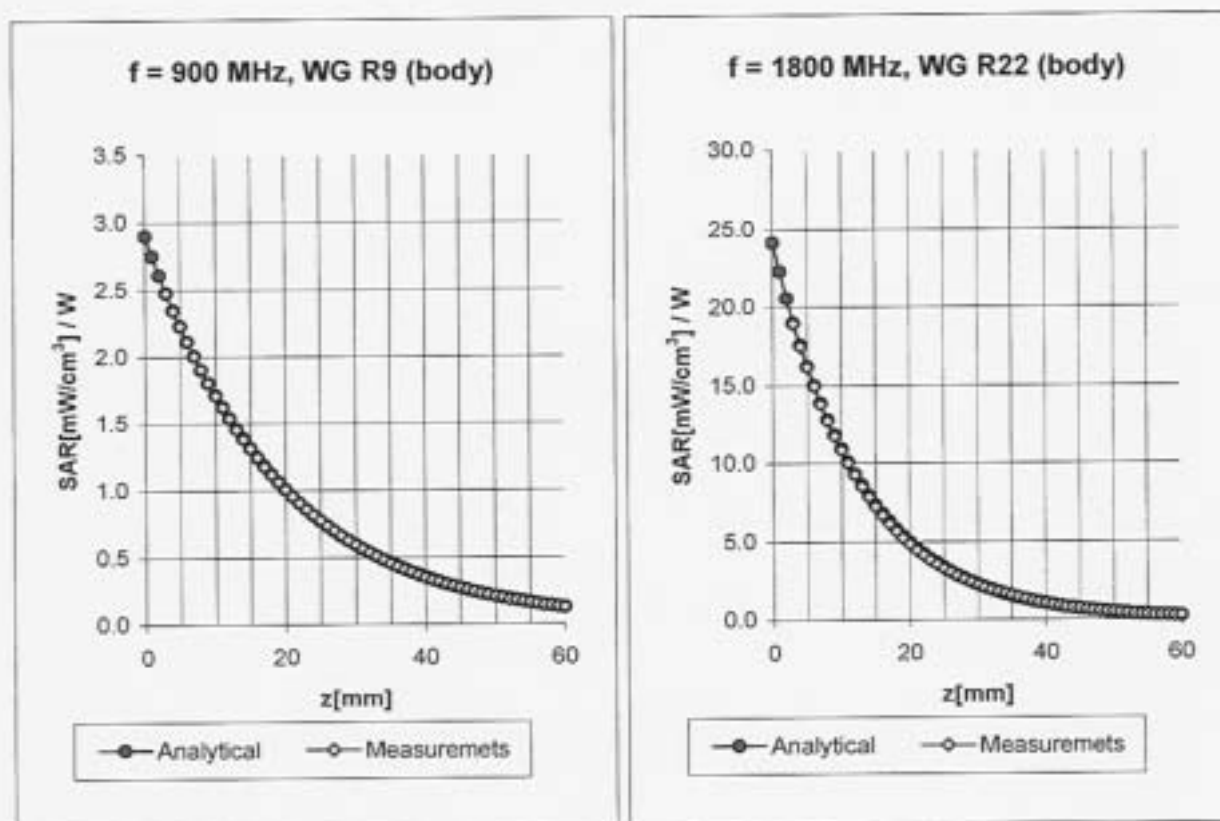
ConvF X	6.0 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	6.0 $\pm 9.5\%$ (k=2)	Alpha 0.33
ConvF Z	6.0 $\pm 9.5\%$ (k=2)	Depth 1.66

Head 1800 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	4.9 $\pm 9.5\%$ (k=2)	Boundary effect:
ConvF Y	4.9 $\pm 9.5\%$ (k=2)	Alpha 0.23
ConvF Z	4.9 $\pm 9.5\%$ (k=2)	Depth 2.54

Conversion Factor Assessment



Body 900 MHz $\epsilon_r = 55.0 \pm 5\%$ $\sigma = 1.05 \pm 5\% \text{ mho/m}$

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

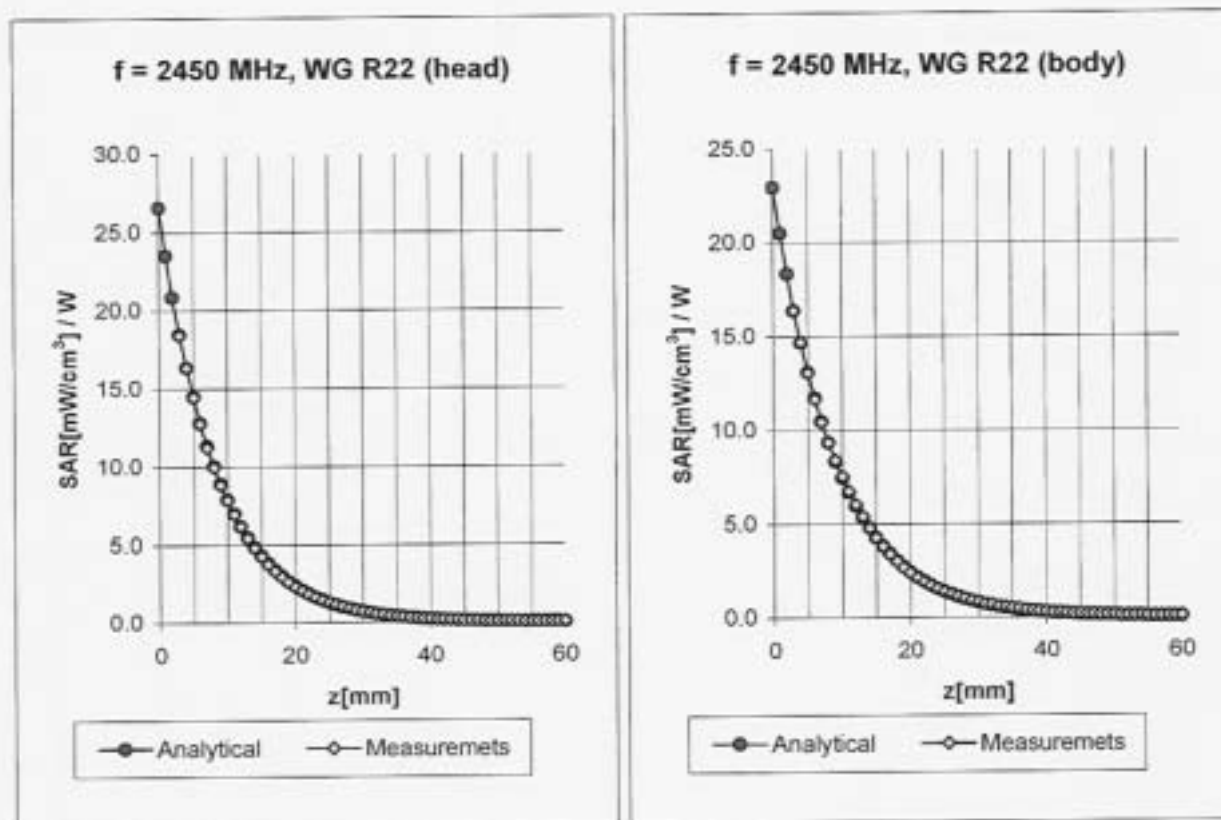
ConvF X	6.0 $\pm$ 9.5% (k=2)	Boundary effect:
ConvF Y	6.0 $\pm$ 9.5% (k=2)	Alpha 0.43
ConvF Z	6.0 $\pm$ 9.5% (k=2)	Depth 1.44

Body 1800 MHz $\epsilon_r = 53.3 \pm 5\%$ $\sigma = 1.52 \pm 5\% \text{ mho/m}$

Valid for $f=1710\text{-}1910 \text{ MHz}$ with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.5 $\pm$ 9.5% (k=2)	Boundary effect:
ConvF Y	4.5 $\pm$ 9.5% (k=2)	Alpha 0.26
ConvF Z	4.5 $\pm$ 9.5% (k=2)	Depth 2.61

Conversion Factor Assessment



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

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

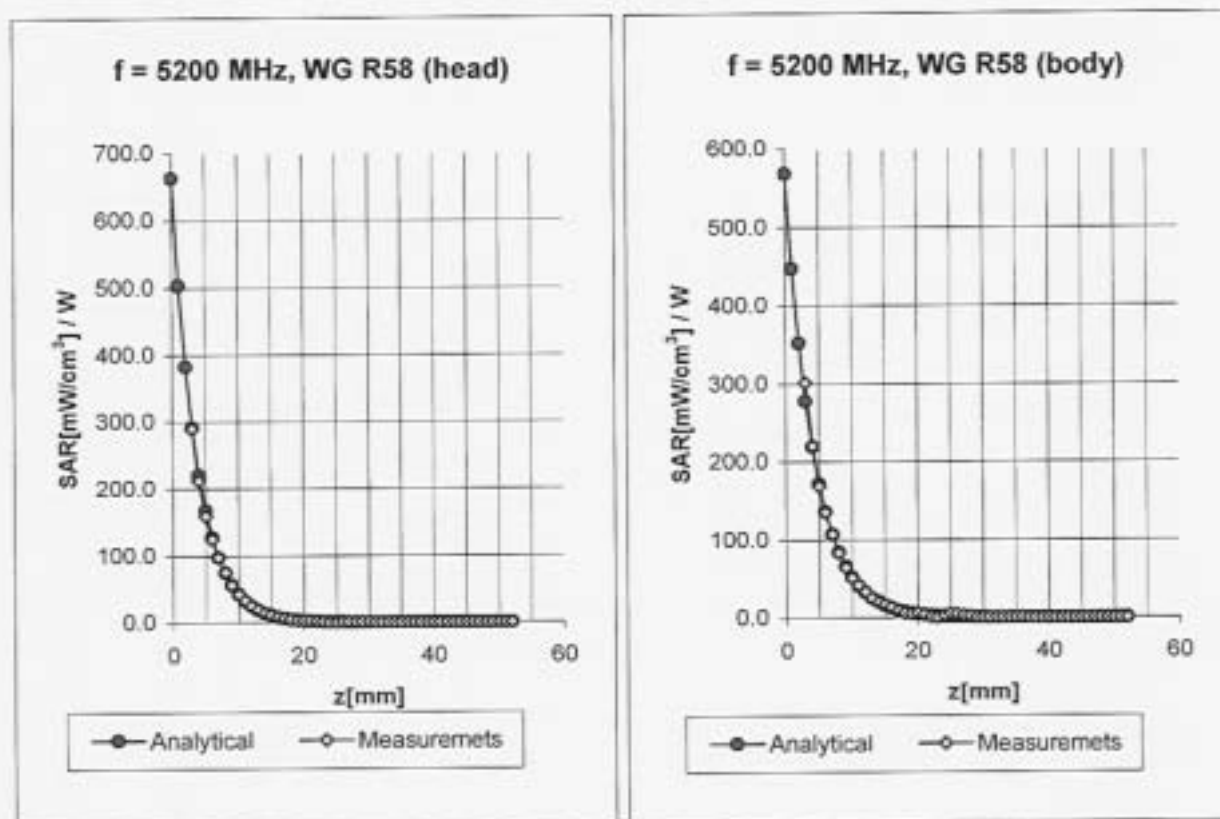
ConvF X	4.4 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	4.4 $\pm 9.5\%$ (k=2)	Alpha	0.38
ConvF Z	4.4 $\pm 9.5\%$ (k=2)	Depth	1.66

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

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

ConvF X	4.1 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	4.1 $\pm 9.5\%$ (k=2)	Alpha	0.35
ConvF Z	4.1 $\pm 9.5\%$ (k=2)	Depth	1.94

Conversion Factor Assessment



Head **5200 MHz** $\epsilon_r = 36.0 \pm 5\%$ $\sigma = 4.66 \pm 5\%$ mho/m

Valid for f=4940-5460 MHz with Head Tissue Simulating Liquid according to OET65-SuppC

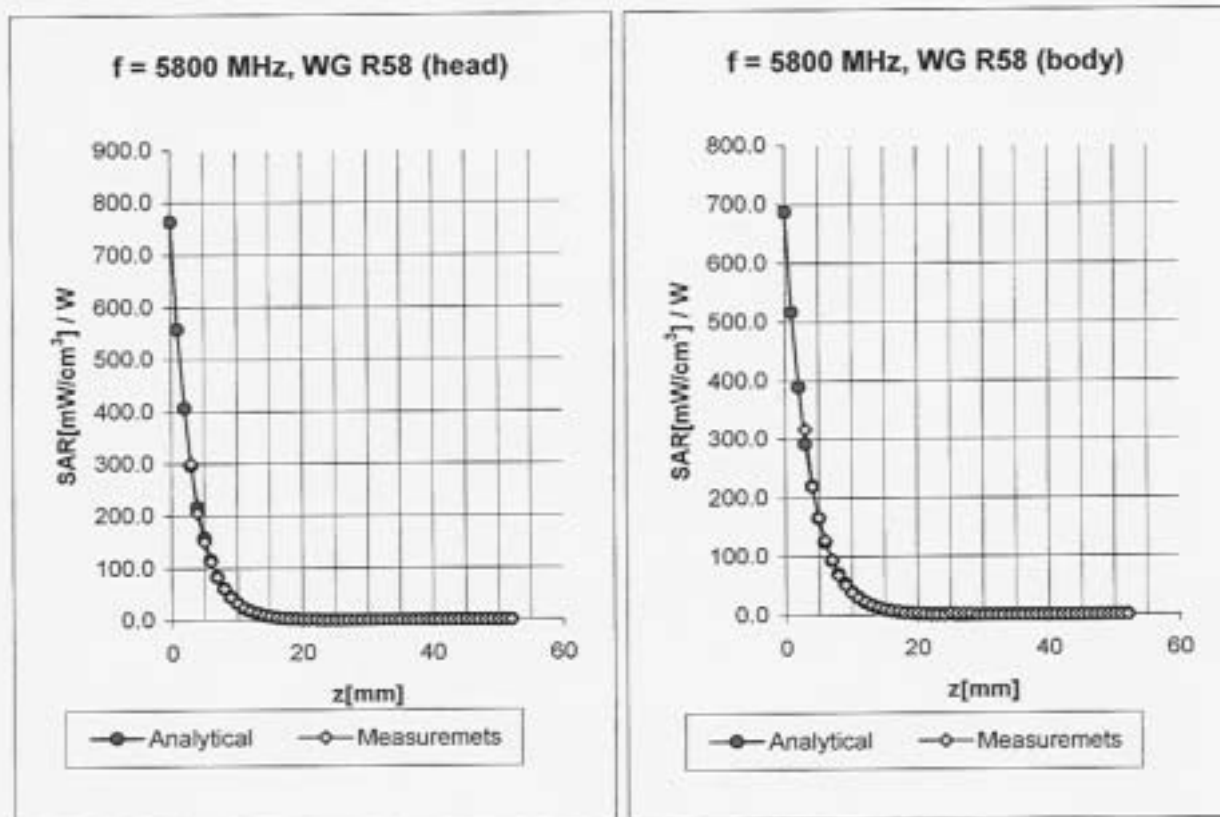
ConvF X	2.70 $\pm 16.6\%$ (k=2)	Boundary effect:	
ConvF Y	2.70 $\pm 16.6\%$ (k=2)	Alpha	0.75
ConvF Z	2.70 $\pm 16.6\%$ (k=2)	Depth	1.45

Body **5200 MHz** $\epsilon_r = 49.0 \pm 5\%$ $\sigma = 5.30 \pm 5\%$ mho/m

Valid for f=4940-5460 MHz with Body Tissue Simulating Liquid according to OET65-SuppC

ConvF X	1.82 $\pm 16.6\%$ (k=2)	Boundary effect:	
ConvF Y	1.82 $\pm 16.6\%$ (k=2)	Alpha	0.90
ConvF Z	1.82 $\pm 16.6\%$ (k=2)	Depth	1.70

Conversion Factor Assessment



Head **5800 MHz** $\epsilon_r = 35.3 \pm 5\%$ $\sigma = 5.27 \pm 5\% \text{ mho/m}$

Valid for f=4940-5460 MHz with Head Tissue Simulating Liquid according to OET65-SuppC

ConvF X	2.40 $\pm 16.6\%$ (k=2)	Boundary effect:	
ConvF Y	2.40 $\pm 16.6\%$ (k=2)	Alpha	0.89
ConvF Z	2.40 $\pm 16.6\%$ (k=2)	Depth	1.30

Body **5800 MHz** $\epsilon_r = 48.2 \pm 5\%$ $\sigma = 6.0 \pm 5\% \text{ mho/m}$

Valid for f=4940-5460 MHz with Body Tissue Simulating Liquid according to OET65-SuppC

ConvF X	1.50 $\pm 16.6\%$ (k=2)	Boundary effect:	
ConvF Y	1.50 $\pm 16.6\%$ (k=2)	Alpha	1.01
ConvF Z	1.50 $\pm 16.6\%$ (k=2)	Depth	1.85

Deviation from Isotropy in HSL

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

