



Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Client **Auden > Sporton Int. Inc.**

CALIBRATION CERTIFICATE

Object(s) **ET3DV6 - SN:1788**

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

Calibration date: **August 29, 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
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor HP 8461A	MY41092180	18-Sep-02 (Agilent, No. 20020916)	Sep-03
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01 (ELCAL, No 2360)	Sep-03

Calibrated by: **Nino Vetterli** Name **Technician** Function **Signature**

Approved by: **Katja Pokorny** Laboratory Director **Signature**

Date issued: August 28, 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.



Schmid & Partner Engineering AG

s p e a g

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Probe ET3DV6

SN:1788

Manufactured: May 28, 2003
Last calibration: August 29, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)



ET3DV6 SN:1788

August 29, 2003

DASY - Parameters of Probe: ET3DV6 SN:1788

Sensitivity in Free Space

Diode Compression

NormX	1.68 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	95	mV
NormY	1.62 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	95	mV
NormZ	1.71 $\mu\text{V}/(\text{V}/\text{m})^2$	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

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	0.34
ConvF Z	6.6 $\pm 9.5\%$ (k=2)	Depth	2.48

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	5.3 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	5.3 $\pm 9.5\%$ (k=2)	Alpha	0.43
ConvF Z	5.3 $\pm 9.5\%$ (k=2)	Depth	2.80

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%]	Without Correction Algorithm	8.7	5.0
SAR _{be} [%]	With Correction Algorithm	0.3	0.5

Head 1800 MHz Typical SAR gradient: 10 % per mm

Probe Tip to Boundary		1 mm	2 mm
SAR _{be} [%]	Without Correction Algorithm	12.8	8.9
SAR _{be} [%]	With Correction Algorithm	0.3	0.1

Sensor Offset

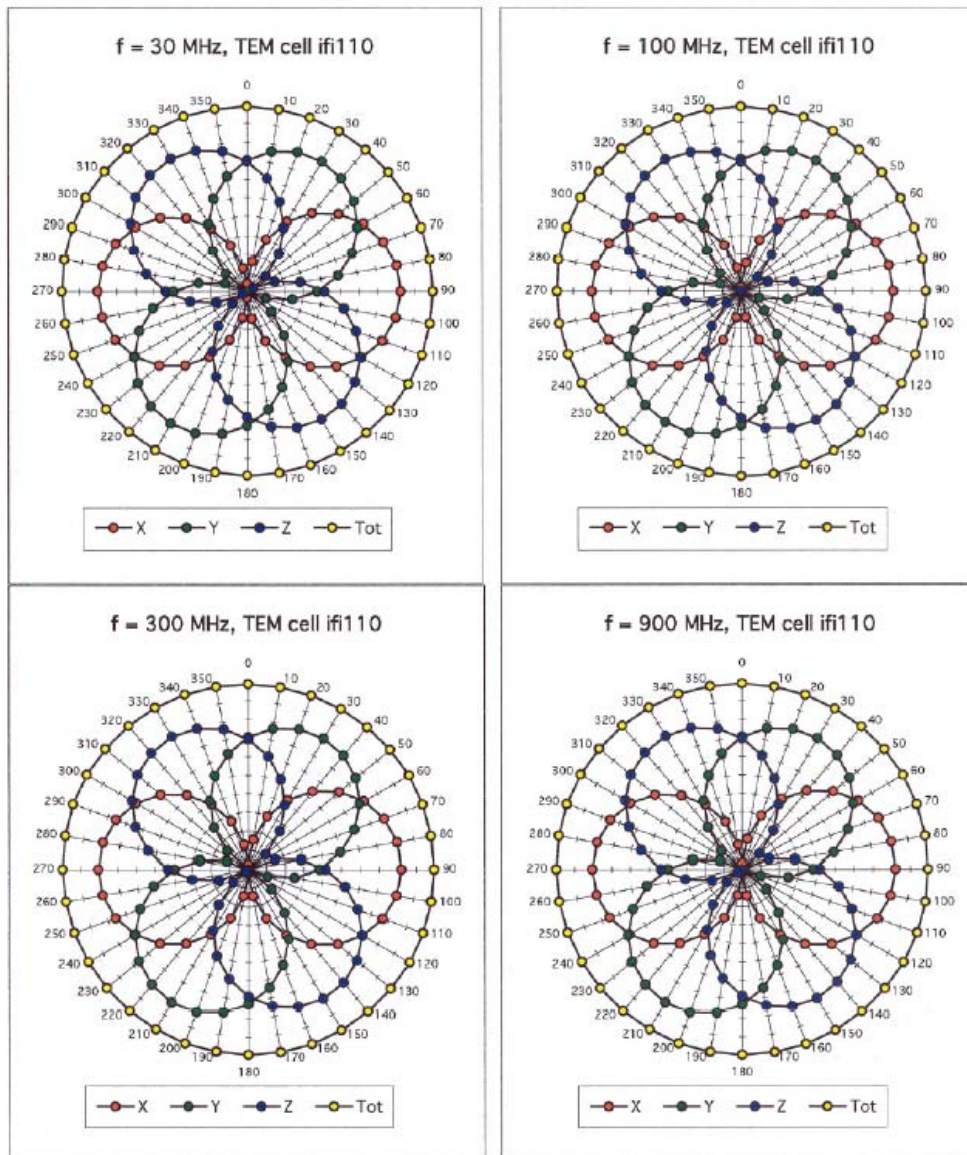
Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.6 $\pm$ 0.2	mm



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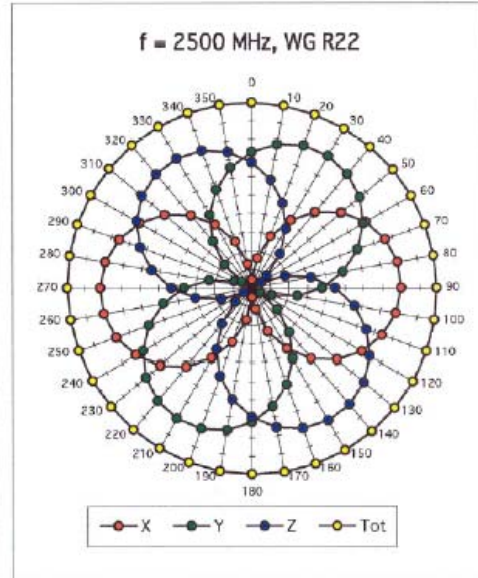
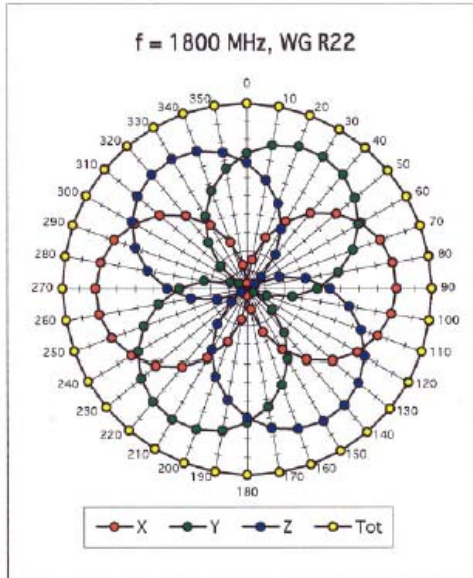
Receiving Pattern (ϕ), $\theta = 0^\circ$



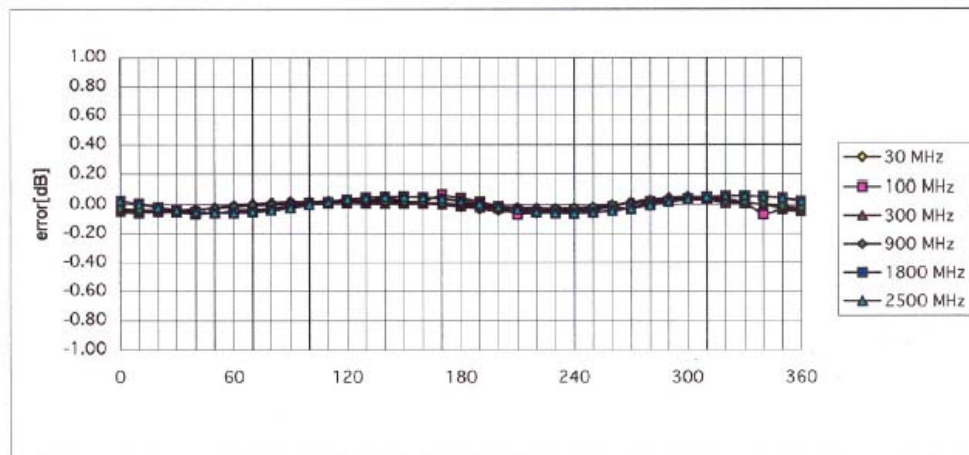


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Isotropy Error (ϕ), $\theta = 0^\circ$



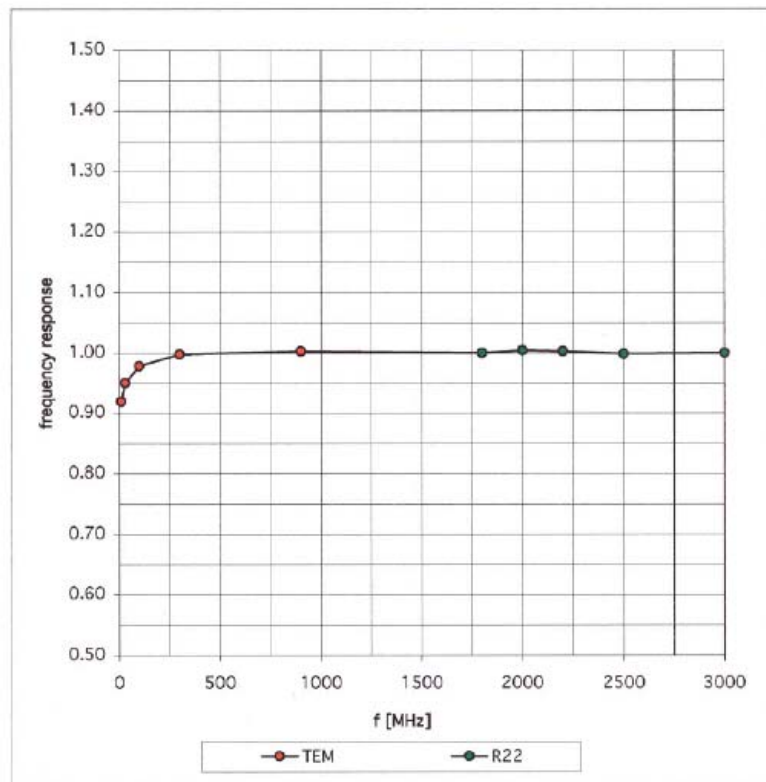


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Frequency Response of E-Field

(TEM-Cell:ifi110, Waveguide R22)



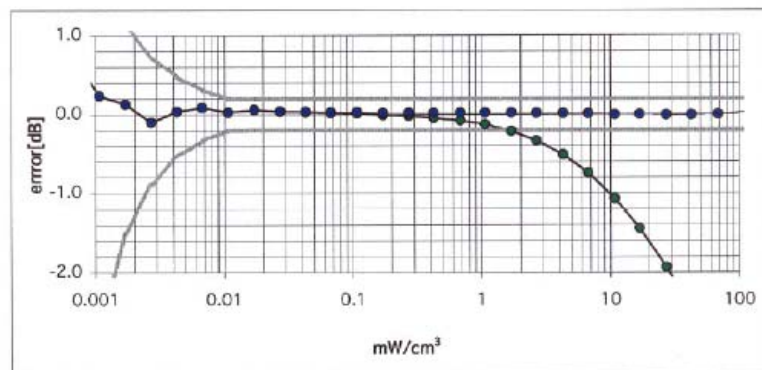
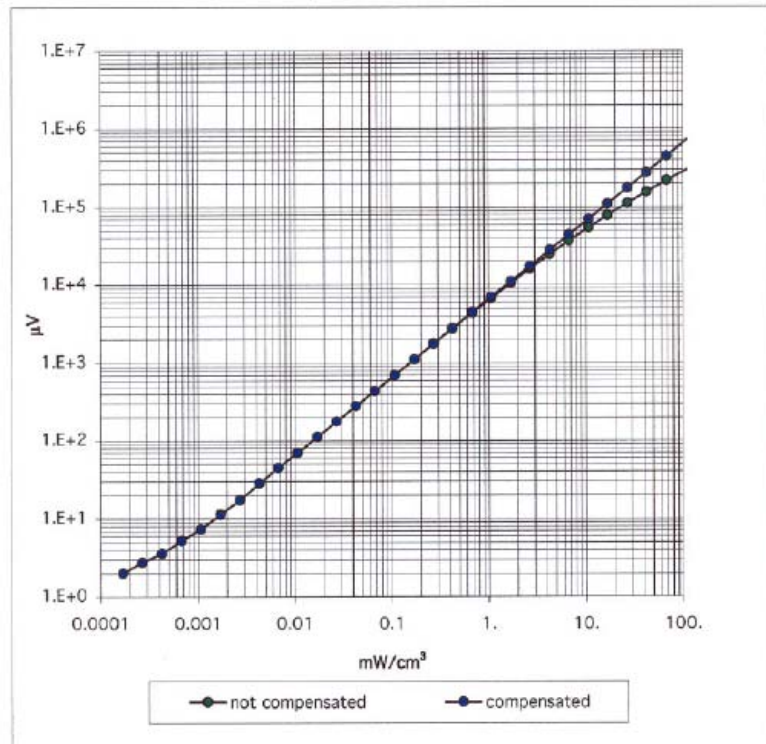


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Dynamic Range $f(\text{SAR}_{\text{brain}})$

(Waveguide R22)

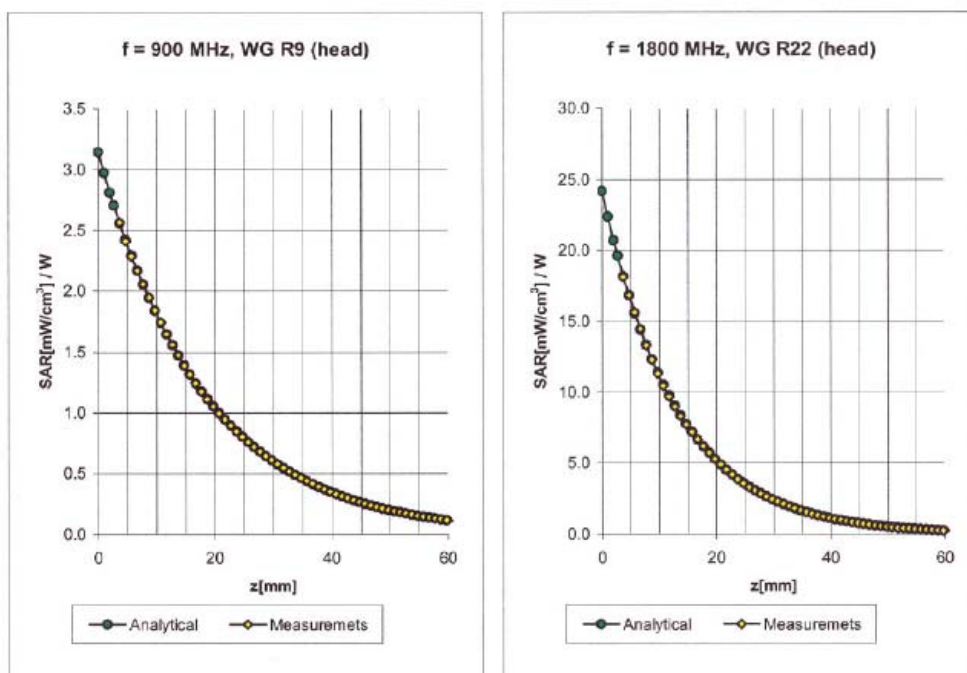




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Conversion Factor Assessment



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

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ConvF Z	6.6 $\pm 9.5\%$ (k=2)	Depth	2.48

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

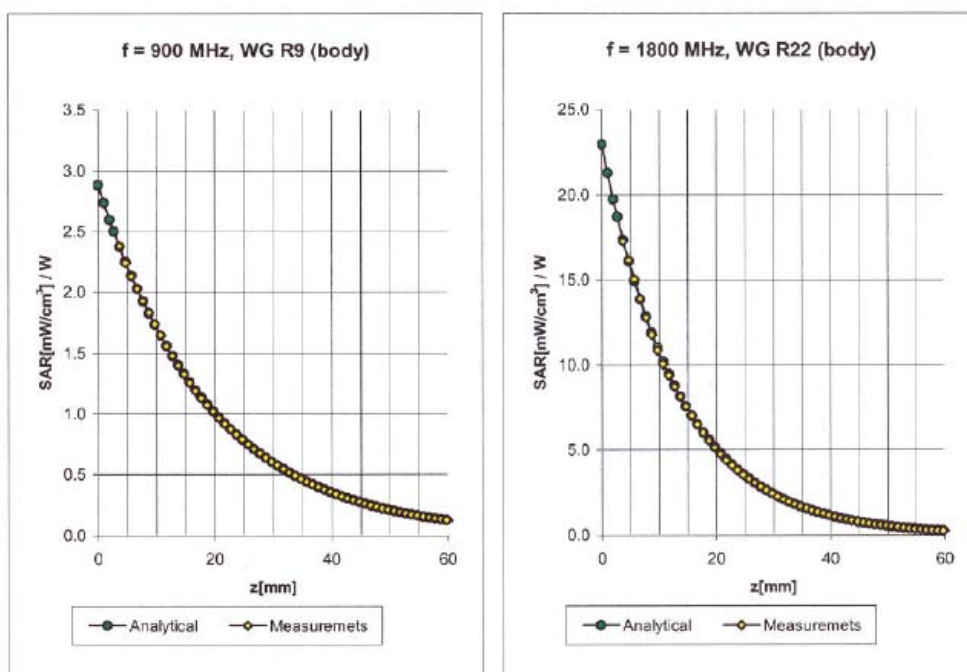
ConvF X	5.3 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	5.3 $\pm 9.5\%$ (k=2)	Alpha	0.43
ConvF Z	5.3 $\pm 9.5\%$ (k=2)	Depth	2.80



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Conversion Factor Assessment



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

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

ConvF X	6.5 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	6.5 $\pm 9.5\%$ (k=2)	Alpha	0.31
ConvF Z	6.5 $\pm 9.5\%$ (k=2)	Depth	2.92

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

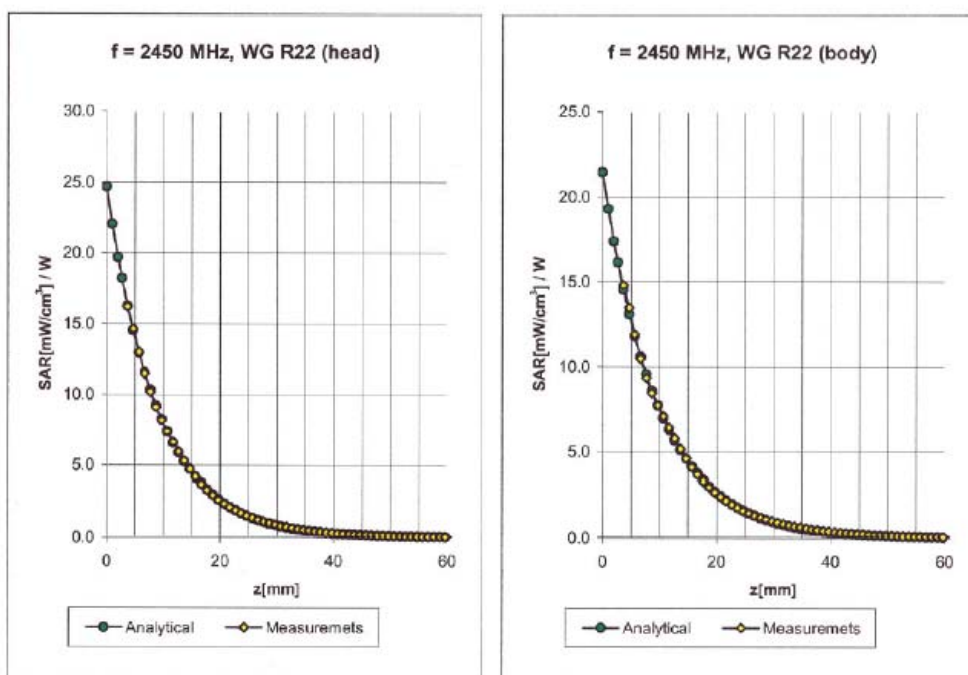
Valid for f=1710-1910 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	5.0 $\pm 9.5\%$ (k=2)	Boundary effect:	
ConvF Y	5.0 $\pm 9.5\%$ (k=2)	Alpha	0.51
ConvF Z	5.0 $\pm 9.5\%$ (k=2)	Depth	2.78

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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	4.7 $\pm 8.9\%$ (k=2)	Boundary effect:	
ConvF Y	4.7 $\pm 8.9\%$ (k=2)	Alpha	0.99
ConvF Z	4.7 $\pm 8.9\%$ (k=2)	Depth	1.81

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	4.5 $\pm 8.9\%$ (k=2)	Boundary effect:	
ConvF Y	4.5 $\pm 8.9\%$ (k=2)	Alpha	1.01
ConvF Z	4.5 $\pm 8.9\%$ (k=2)	Depth	1.74

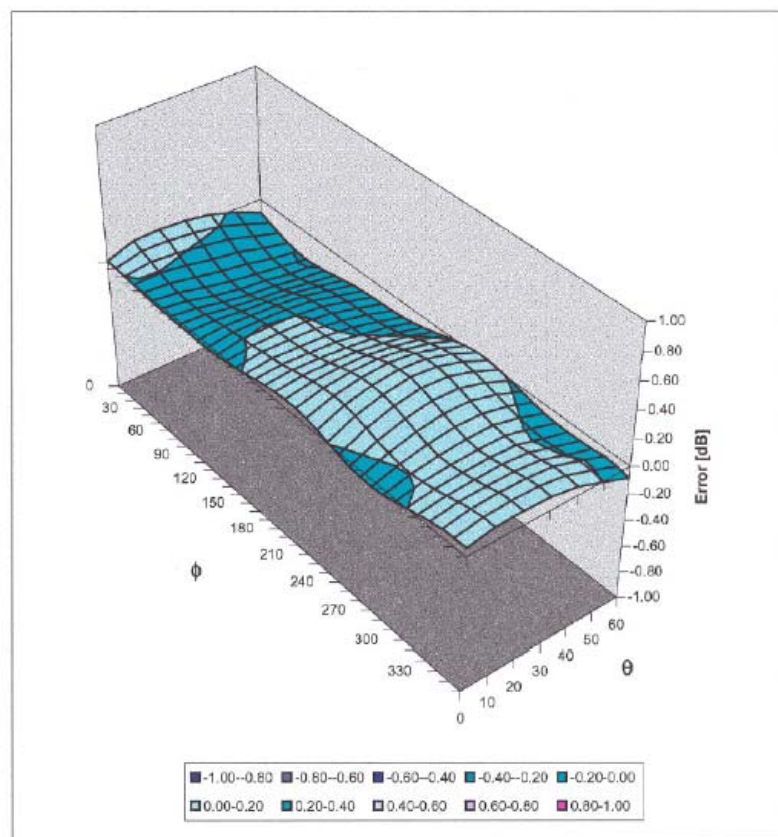


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Deviation from Isotropy in HSL

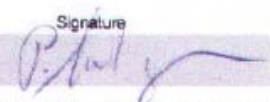
Error (θ, ϕ), $f = 900$ MHz





**Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland

Client **Sporton (Auden)**

CALIBRATION CERTIFICATE			
Object(s)	DAE3 – SD 000 D03 AA – SN:577		
Calibration procedure(s)	QA CAL-06.v4 Calibration procedure for the data acquisition unit (DAE)		
Calibration date:	21.11.2003		
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
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03	Sep-05
Calibrated by:	Name Philipp Storchenegger	Function Technician	Signature 
Approved by:	Name Fin Bornholt	Function R&D Director	Signature 
Date issued: 21.11.2003			
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.			



DAE3 SN: 577

DATE: 21.11.2003

1. Cal Lab. Incoming Inspection & Pre Test

Modification Status	Note Status here → → → →	BC
Visual Inspection	Note anomalies.....	None
Pre Test	Indication	Yes/No
Probe Touch	Function	Yes
Probe Collision	Function	Yes
Probe Touch&Collision	Function	Yes

2. DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V , full range = 400 mV
Low Range: 1LSB = 61nV , full range = 4 mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.434	403.889	404.352
Low Range	3.94303	3.94784	3.9501
Connector Angle to be used in DASY System	127 °		

High Range	Input	Reading in μ V	% Error
Channel X + Input	200mV	200000.6	0.00
	20mV	20000.9	0.00
Channel X - Input	20mV	-19992.7	-0.04
Channel Y + Input	200mV	200000.6	0.00
	20mV	19999.1	0.00
Channel Y - Input	20mV	-19994.7	-0.03
Channel Z + Input	200mV	199999.8	0.00
	20mV	19998.1	-0.01
Channel Z - Input	20mV	-19999.2	0.00

Low Range	Input	Reading in μ V	% Error
Channel X + Input	2mV	1999.94	0.00
	0.2mV	199.08	-0.46
Channel X - Input	0.2mV	-200.24	0.12
Channel Y + Input	2mV	1999.98	0.00
	0.2mV	199.50	-0.25
Channel Y - Input	0.2mV	-200.80	0.40
Channel Z + Input	2mV	1999.98	0.00
	0.2mV	199.11	-0.44
Channel Z - Input	0.2mV	-201.12	0.56

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DATE: 21.11.2003

3. Common mode sensitivity

DASY measurement parameters:

Auto Zero Time: 3 sec,
High/Low Range

Measuring time: 3 sec

in μV	Common mode Input Voltage	High Range Reading	Low Range Reading
Channel X	200mV	12.00	11.9
	- 200mV	-10.76	-12.44
Channel Y	200mV	-8.55	-8.51
	- 200mV	7.58	6.67
Channel Z	200mV	-0.86	-0.58
	- 200mV	-0.85	-0.77

4. Channel separation

DASY measurement parameters:

Auto Zero Time: 3 sec,
High Range

Measuring time: 3 sec

in μV	Input Voltage	Channel X	Channel Y	Channel Z
Channel X	200mV	-	1.96	0.28
Channel Y	200mV	0.66	-	3.59
Channel Z	200mV	-0.89	-0.11	-

5.1 AD-Converter Values with Input Voltage set to 2.0 VDC

in Zero Low	Low Range Max - Min	Max.	Min
Channel X	17	16137	16120
Channel Y	27	16767	16740
Channel Z	8	15103	15077

5.2 AD-Converter Values with inputs shorted

in LSB	Low Range	High Range
Channel X	16134	15955
Channel Y	16740	15960
Channel Z	15093	16252

6. Input Offset Measurement

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DATE: 21.11.2003

DASY measurement parameters:

Auto Zero Time: 3 sec,

Measuring time: 3 sec

Number of measurements:

100, Low Range

Input 10M Ω

in μ V	Average	min. Offset	max. Offset	Std. Deviation
Channel X	-0.64	-1.84	0.71	0.49
Channel Y	-1.77	-3.93	0.94	0.58
Channel Z	-2.21	-3.14	-0.81	0.34

Input shorted

in μ V	Average	min. Offset	max. Offset	Std. Deviation
Channel X	0.12	-1.34	1.45	0.69
Channel Y	-0.69	-1.39	0.30	0.26
Channel Z	-0.94	-1.58	-0.30	0.23

7. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

8. Input Resistance

In MOhm	Calibrating	Measuring
Channel X	0.2000	197.1
Channel Y	0.1999	200.3
Channel Z	0.2001	198.3

9. Low Battery Alarm Voltage

in V	Alarm Level
Supply (+ Vcc)	7.58
Supply (- Vcc)	-7.65

10. Power Consumption

in mA	Switched off	Stand by	Transmitting
Supply (+ Vcc)	0.00	5.65	13.7
Supply (- Vcc)	-0.01	-7.69	-8.97