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 8481A | MY41092180 | 18-Sep-02 (Agilent, No. 20020918) | 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 |

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

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.

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Schmid & Partner Engineering AG

s p e a g

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info@speag.com, http://www.speag.com

# 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 $\mu V/(V/m)^2$ | DCP X | 95 | mV |
| NormY | 1.62 $\mu V/(V/m)^2$ | DCP Y | 95 | mV |
| NormZ | 1.71 $\mu V/(V/m)^2$ | DCP Z | 95 | mV |

## Sensitivity in Tissue Simulating Liquid

Head 900 MHz $\varepsilon_r$ = 41.5 ± 5% $\sigma$ = 0.97 ± 5% mho/m

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

| | | | |
|---|---|---|---|
| ConvF X | 6.6 ± 9.5% (k=2) | Boundary effect: | |
| ConvF Y | 6.6 ± 9.5% (k=2) | Alpha | 0.34 |
| ConvF Z | 6.6 ± 9.5% (k=2) | Depth | 2.48 |

Head 1800 MHz $\varepsilon_r$ = 40.0 ± 5% $\sigma$ = 1.40 ± 5% mho/m

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

| | | | |
|---|---|---|---|
| ConvF X | 5.3 ± 9.5% (k=2) | Boundary effect: | |
| ConvF Y | 5.3 ± 9.5% (k=2) | Alpha | 0.43 |
| ConvF Z | 5.3 ± 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 ± 0.2 | mm |

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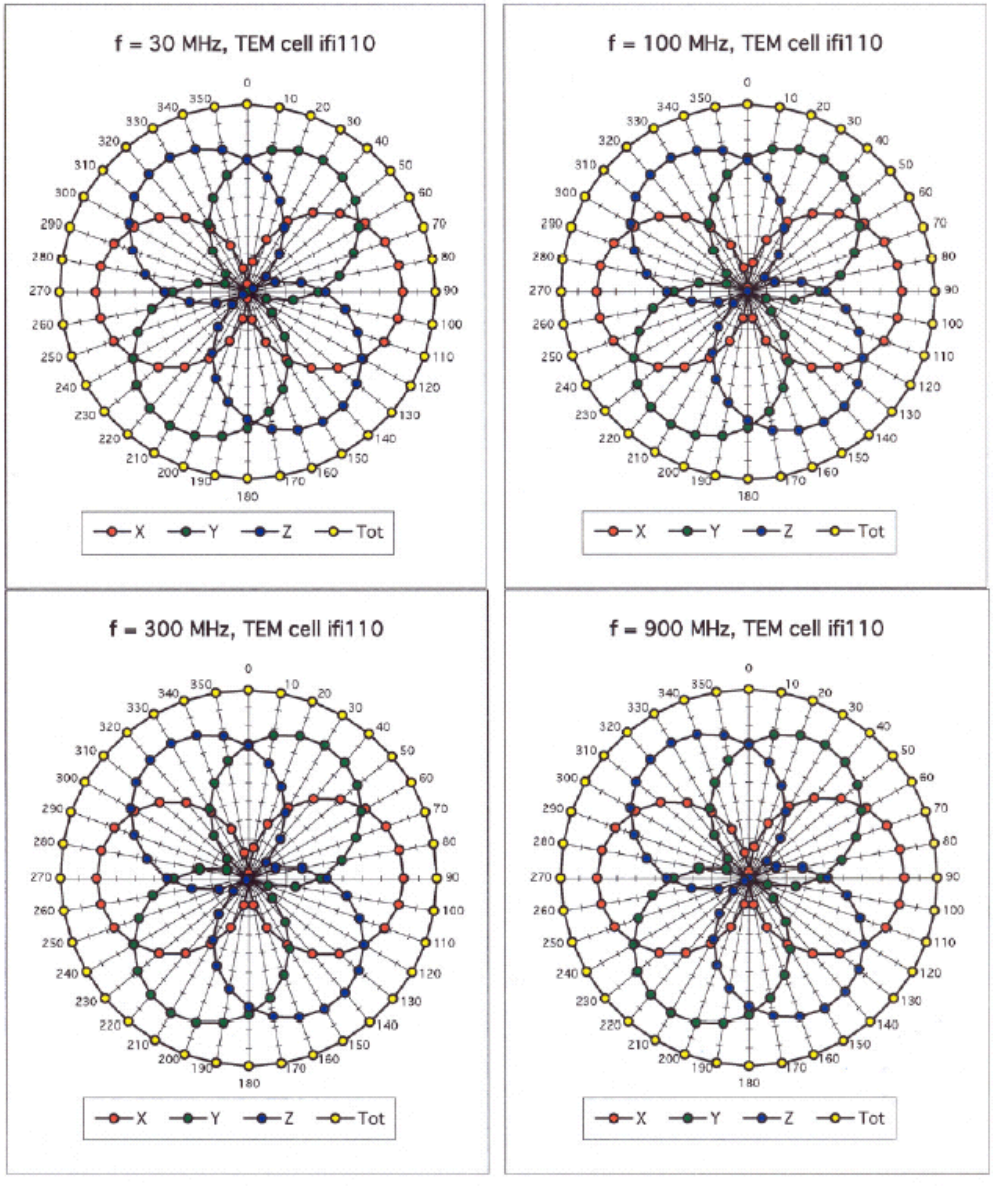
## Receiving Pattern (ϕ), θ = 0°



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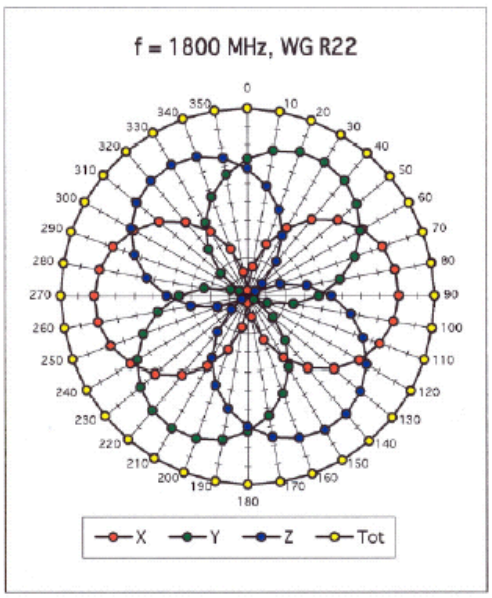
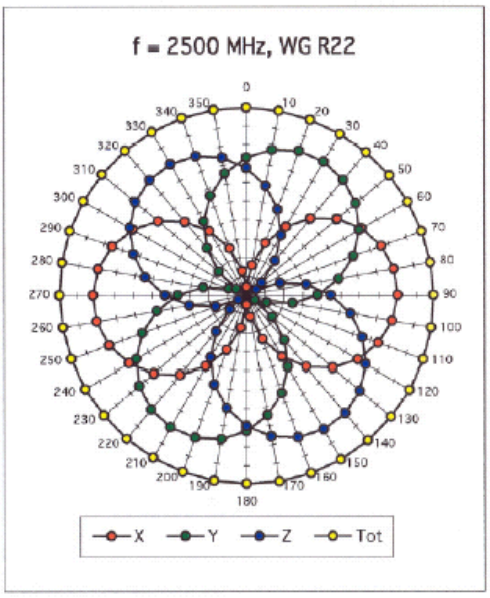
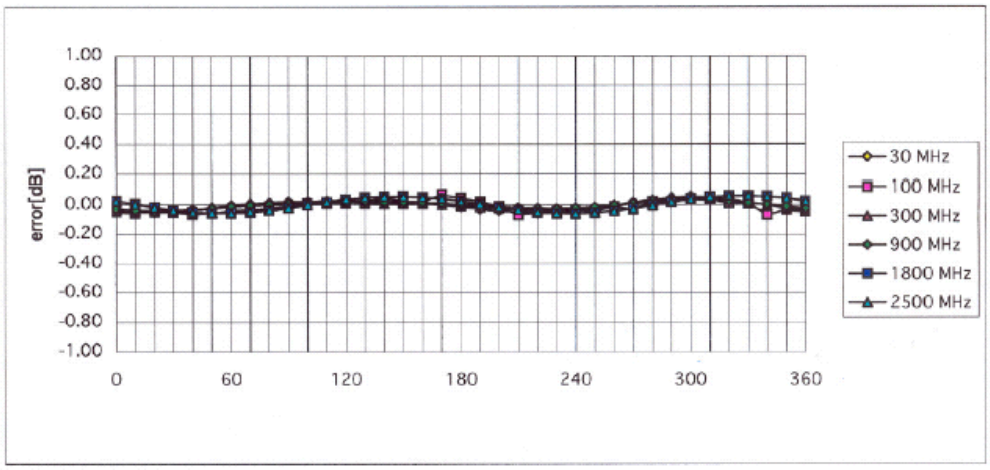



## Isotropy Error (ϕ), θ = 0°



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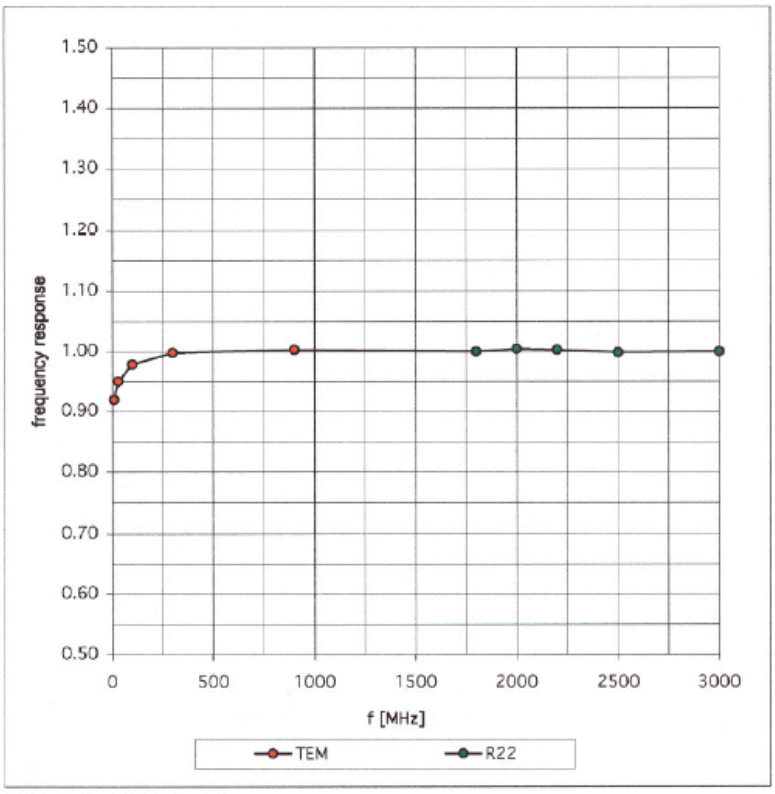
## Frequency Response of E-Field

( TEM-Cell:ifi110, Waveguide R22)



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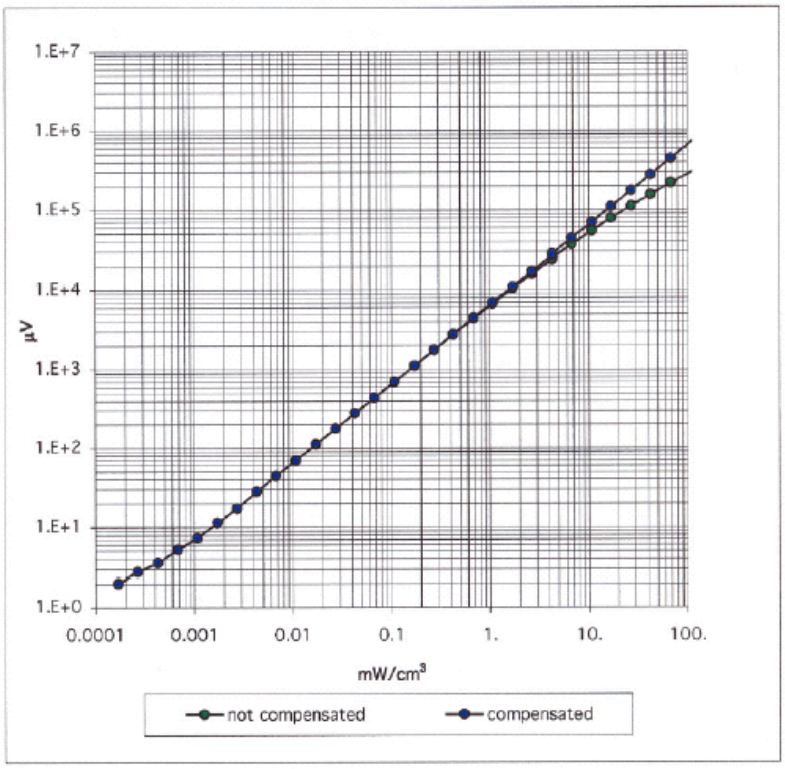
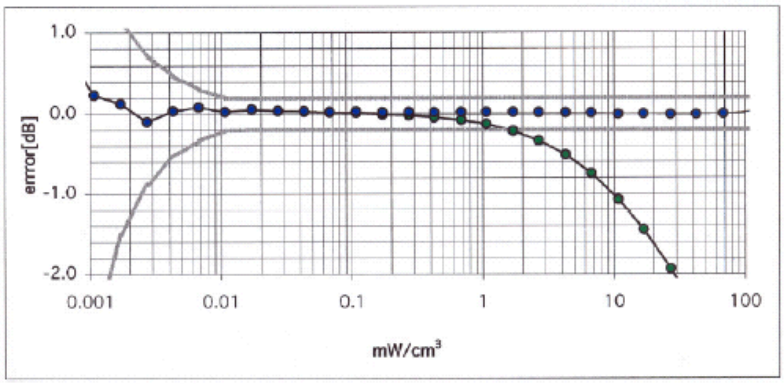
## Dynamic Range f($SAR_{brain}$)

( Waveguide R22 )



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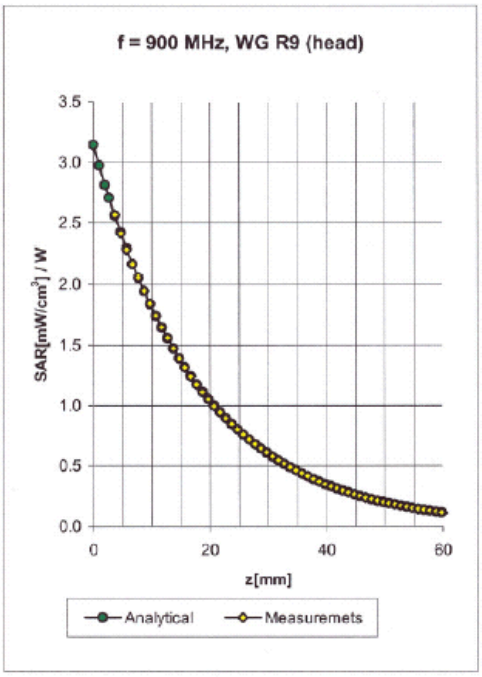
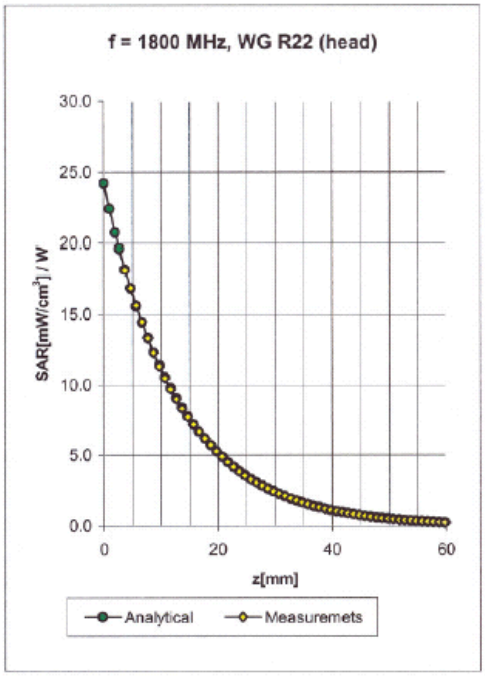
## Conversion Factor Assessment




Head 900 MHz $\varepsilon_r$ = 41.5 ± 5% $\sigma$ = 0.97 ± 5% mho/m

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

| | | | |
|---|---|---|---|
| ConvF X | 6.6 ± 9.5% (k=2) | Boundary effect: | |
| ConvF Y | 6.6 ± 9.5% (k=2) | Alpha | 0.34 |
| ConvF Z | 6.6 ± 9.5% (k=2) | Depth | 2.48 |

Head 1800 MHz $\varepsilon_r$ = 40.0 ± 5% $\sigma$ = 1.40 ± 5% mho/m

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

| | | | |
|---|---|---|---|
| ConvF X | 5.3 ± 9.5% (k=2) | Boundary effect: | |
| ConvF Y | 5.3 ± 9.5% (k=2) | Alpha | 0.43 |
| ConvF Z | 5.3 ± 9.5% (k=2) | Depth | 2.80 |

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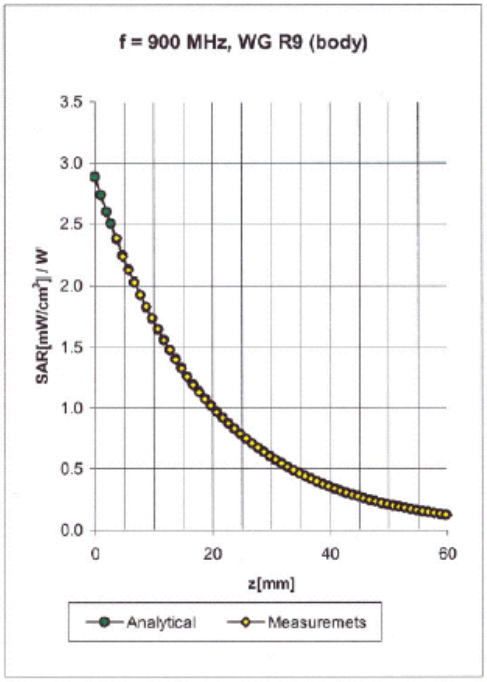
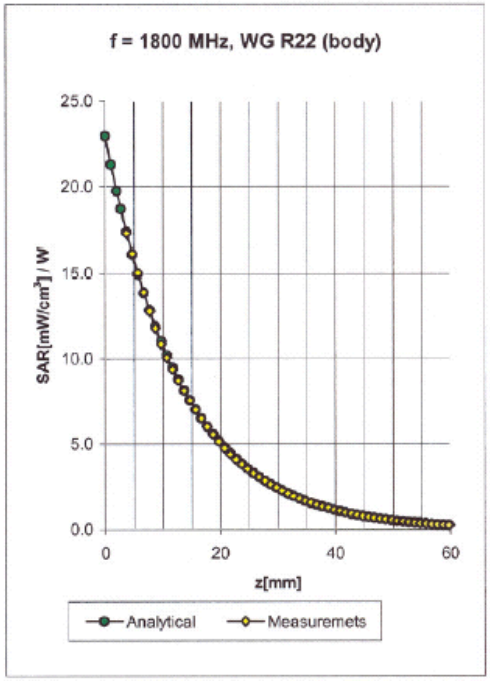
## Conversion Factor Assessment




Body 900 MHz $\varepsilon_r$ = 55.0 ± 5% $\sigma$ = 1.05 ± 5% mho/m

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

| | | | |
|---|---|---|---|
| ConvF X | 6.5 ± 9.5% (k=2) | Boundary effect: | |
| ConvF Y | 6.5 ± 9.5% (k=2) | Alpha | 0.31 |
| ConvF Z | 6.5 ± 9.5% (k=2) | Depth | 2.92 |

Body 1800 MHz $\varepsilon_r$ = 53.3 ± 5% $\sigma$ = 1.52 ± 5% mho/m

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

| | | | |
|---|---|---|---|
| ConvF X | 5.0 ± 9.5% (k=2) | Boundary effect: | |
| ConvF Y | 5.0 ± 9.5% (k=2) | Alpha | 0.51 |
| ConvF Z | 5.0 ± 9.5% (k=2) | Depth | 2.78 |

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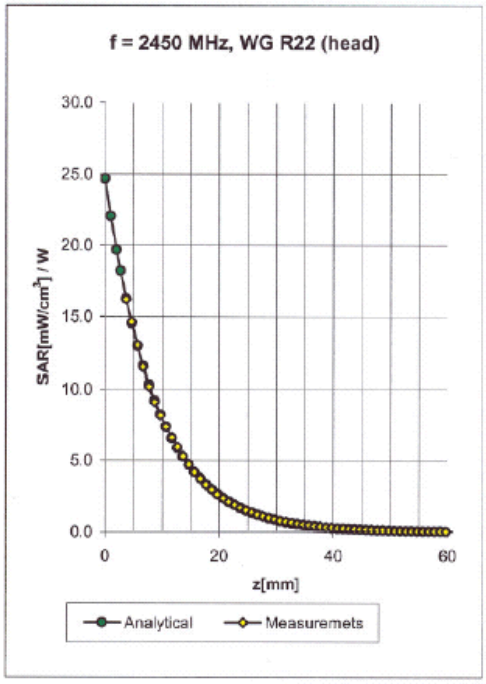
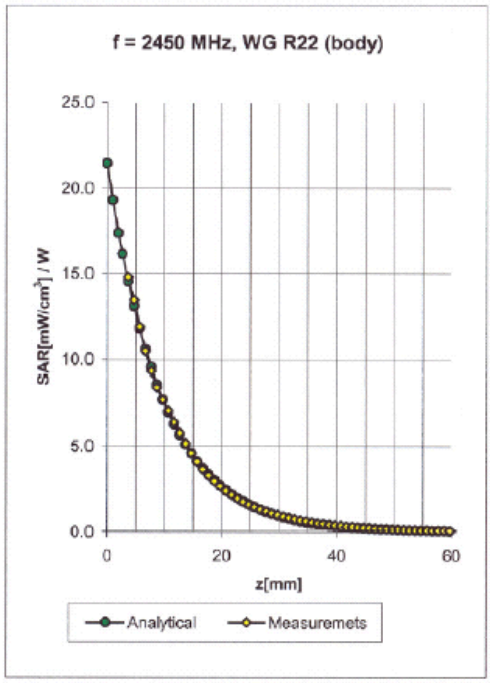
## Conversion Factor Assessment




Head 2450 MHz $\varepsilon_r$ = 39.2 ± 5% $\sigma$ = 1.80 ± 5% mho/m

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

| | | | |
|---|---|---|---|
| ConvF X | 4.7 ± 8.9% (k=2) | Boundary effect: | |
| ConvF Y | 4.7 ± 8.9% (k=2) | Alpha | 0.99 |
| ConvF Z | 4.7 ± 8.9% (k=2) | Depth | 1.81 |

Body 2450 MHz $\varepsilon_r$ = 52.7 ± 5% $\sigma$ = 1.95 ± 5% mho/m

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

| | | | |
|---|---|---|---|
| ConvF X | 4.5 ± 8.9% (k=2) | Boundary effect: | |
| ConvF Y | 4.5 ± 8.9% (k=2) | Alpha | 1.01 |
| ConvF Z | 4.5 ± 8.9% (k=2) | Depth | 1.74 |

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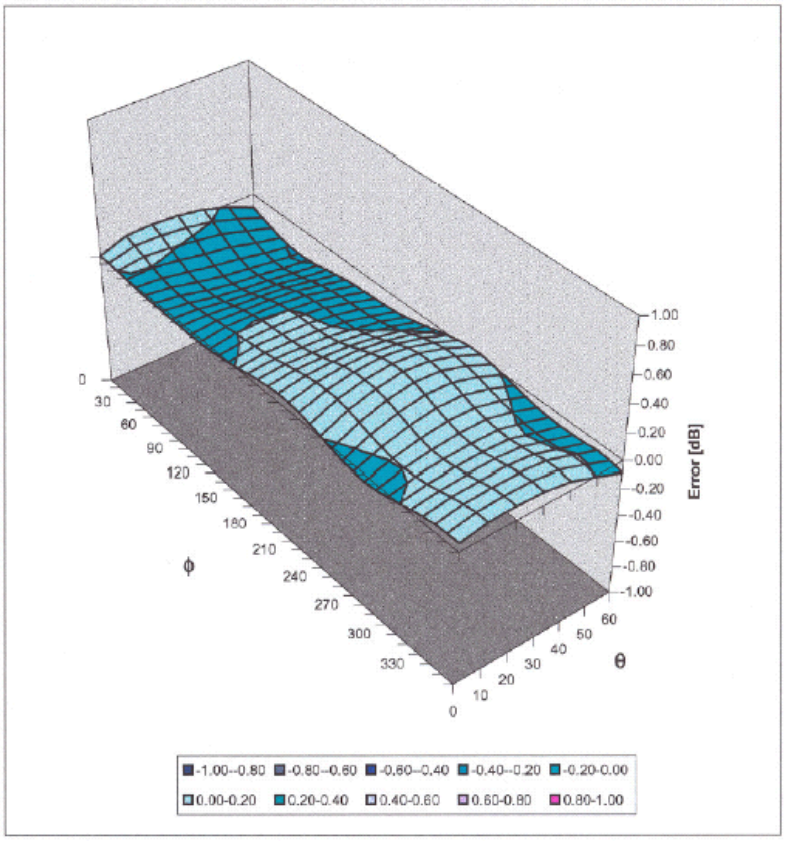
## Deviation from Isotropy in HSL

Error (θ,ϕ), f = 900 MHz



**Calibration Laboratory of**
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Engineering AG
**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<br>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 |

| | Name | Function | Signature |
|---|---|---|---|
| Calibrated by: | Philipp Storchenegger | Technician | |
| Approved by: | Fin Bomholt | R&D Director | |

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 = 6.1μV , 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 μV | % 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 μV | % 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 |

DAE3 SN: 577 DATE: 21.11.2003

## 3. Common mode sensitivity

DASY measurement parameters:
Auto Zero Time: 3 sec, Measuring time: 3 sec
High/Low Range

| 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, Measuring time: 3 sec
High Range

| 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

DAE3 SN: 577 DATE: 21.11.2003

DASY measurement parameters:
Auto Zero Time: 3 sec, Measuring time: 3 sec
Number of measurements: 100, Low Range

Input 10MΩ

| in µV | 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 µV | 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 |