Test Laboratory: Sporton International Inc. SAR Testing Lab Date/Time: 7/12/2005 03:55:03 AM

Body_802.11a Ch161_Left Touch_20050712_Holster

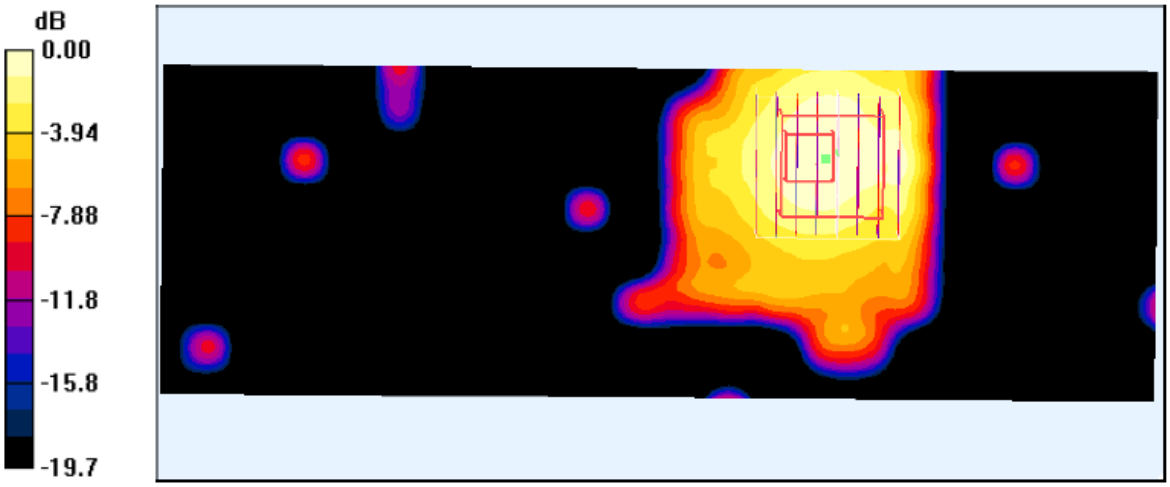
DUT: 453101-03; Type: Mobile Computet; Serial: MC3090

Communication System: 802.11a; Frequency: 5805 MHz;Duty Cycle: 1:1
Medium: MSL_5800 Medium parameters used: f = 5805 MHz; σ = 6.18 mho/m; ε_r = 46.7; ρ = 1000 kg/m^3
Ambient Temperature：22.5 ℃; Liquid Temperature：22.2 ℃

DASY4 Configuration:
- Probe: EX3DV3 - SN3514; ConvF(3.85, 3.85, 3.85); Calibrated: 1/23/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: DAE not calibrated
- Phantom: SAM 12; Type: QD 000 P40 C; Serial: TP-1150
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Ch161/Area Scan (71x211x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.912 mW/g

Ch161/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 2.60 V/m; Power Drift = 0.132 dB
Peak SAR (extrapolated) = 2.50 W/kg
SAR(1 g) = 0.551 mW/g; SAR(10 g) = 0.223 mW/g
Maximum value of SAR (measured) = 0.887 mW/g



0 dB = 0.887mW/g

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Test Laboratory: Sporton International Inc. SAR Testing Lab Date/Time: 7/12/2005 11:07:10 PM

Body_802.11a Ch48_Left Touch_20050712_Holster

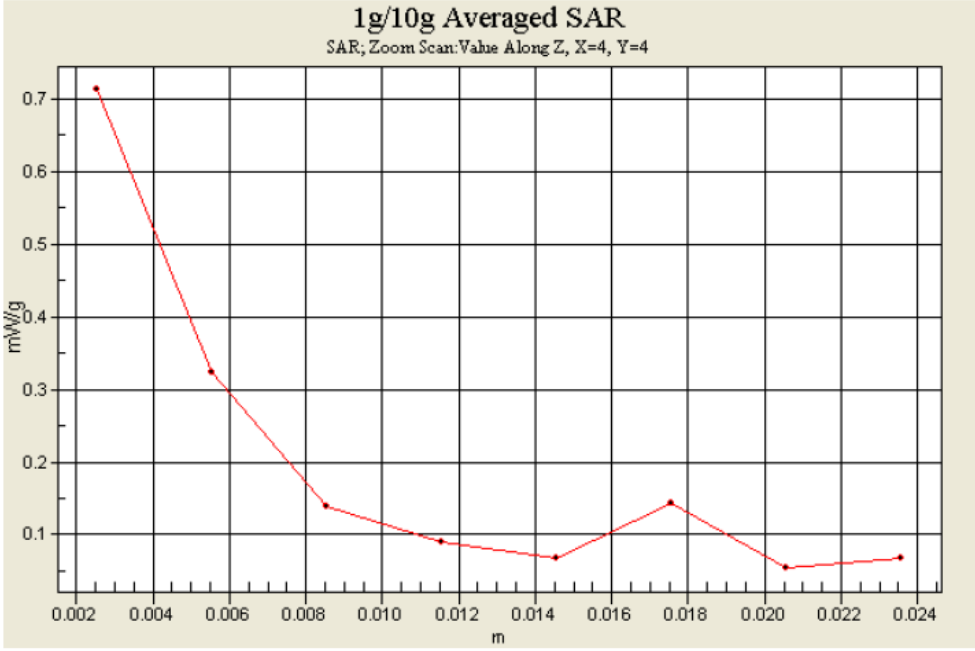
DUT: 453101-03; Type: Mobile Computet; Serial: MC3090

Communication System: 802.11a; Frequency: 5240 MHz;Duty Cycle: 1:1
Medium: MSL_5200 Medium parameters used: f = 5240 MHz; σ = 5.46 mho/m; ε_r = 48.1; ρ = 1000 kg/m^3
Ambient Temperature：22.3 ℃; Liquid Temperature：22.1 ℃

DASY4 Configuration:
- Probe: EX3DV3 - SN3514; ConvF(4.14, 4.14, 4.14); Calibrated: 1/23/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: DAE not calibrated
- Phantom: SAM 12; Type: QD 000 P40 C; Serial: TP-1150
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Ch48/Area Scan (71x211x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.777 mW/g

Ch48/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 2.60 V/m; Power Drift = 0.057 dB
Peak SAR (extrapolated) = 2.15 W/kg
SAR(1 g) = 0.422 mW/g; SAR(10 g) = 0.178 mW/g
Maximum value of SAR (measured) = 0.713 mW/g



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Test Laboratory: Sporton International Inc. SAR Testing Lab Date/Time: 7/12/2005 2:29:00 AM

Body_802.11a Ch64_Left Touch_20050712_Holster

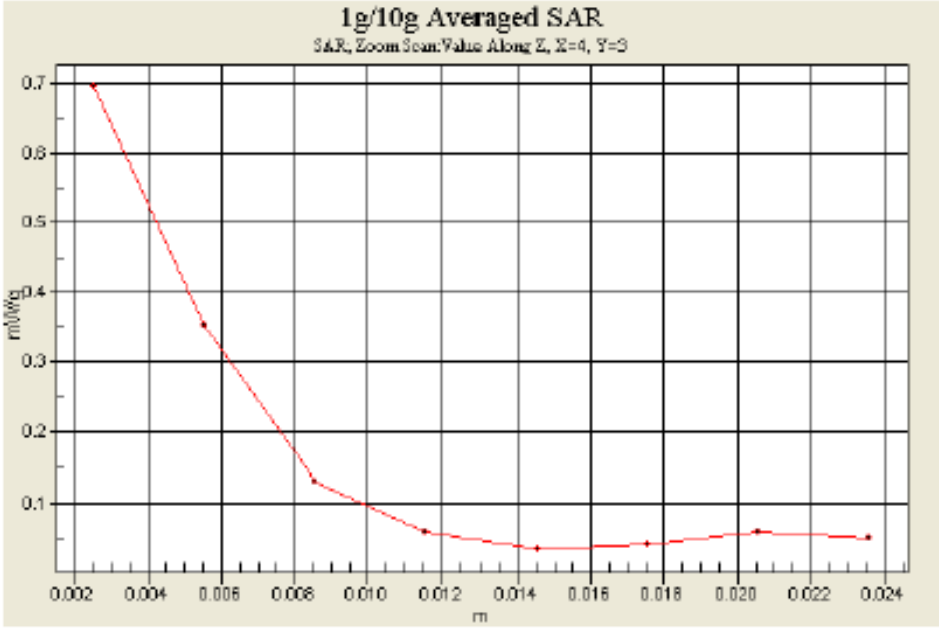
DUT: 453101-03; Type: Mobile Computet; Serial: MC3090

Communication System: 802.11a; Frequency: 5320 MHz;Duty Cycle: 1:1
Medium: MSL_5200 Medium parameters used: f = 5320 MHz; σ = 5.54 mho/m; ε_r = 47.9; ρ = 1000 kg/m^3
Ambient Temperature : 22.4 ℃; Liquid Temperature : 22.2 ℃

DASY4 Configuration:
- Probe: EX3DV3 - SN3514; ConvF(4.14, 4.14, 4.14); Calibrated: 1/23/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: DAE not calibrated
- Phantom: SAM 12; Type: QD 000 P40 C; Serial: TP-1150
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Ch64/Area Scan (71x211x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 0.715 mW/g

Ch64/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 1.39 V/m; Power Drift = 0.414 dB
Peak SAR (extrapolated) = 1.17 W/kg
SAR(1 g) = 0.445 mW/g; SAR(10 g) = 0.182 mW/g
Maximum value of SAR (measured) = 0.694 mW/g



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Test Laboratory: Sporton International Inc. SAR Testing Lab Date/Time: 7/12/2005 3:59:39 AM

Body_802.11a Ch157_Left Touch_20050712_Holster

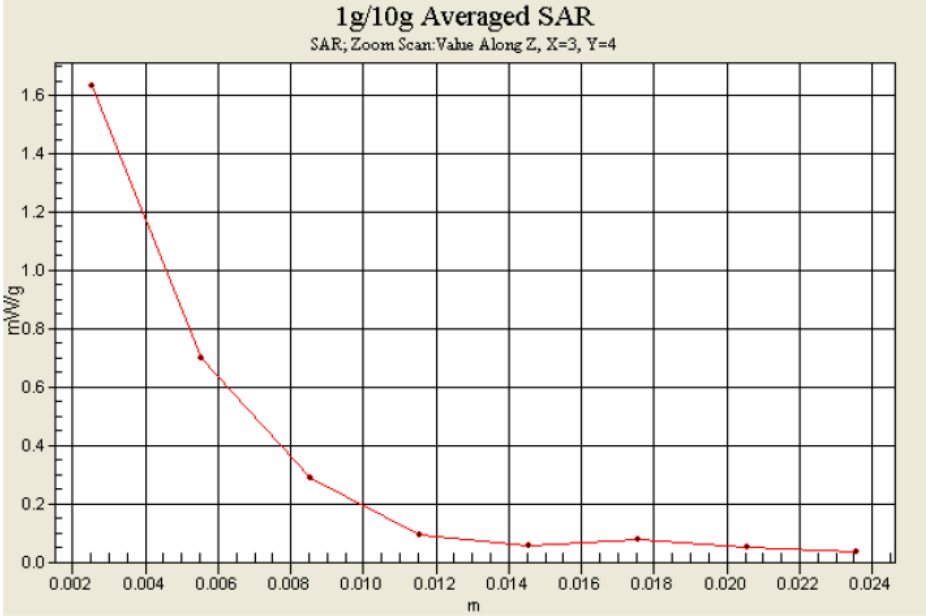
DUT: 453101-03; Type: Mobile Computet; Serial: MC3090

Communication System: 802.11a; Frequency: 5785 MHz;Duty Cycle: 1:1
Medium: MSL_5800 Medium parameters used: f = 5785 MHz; σ = 6.14 mho/m; ε_r = 46.8; ρ = 1000 kg/m^3
Ambient Temperature：22.3 ℃; Liquid Temperature：22.1 ℃

DASY4 Configuration:
- Probe: EX3DV3 - SN3514; ConvF(3.85, 3.85, 3.85); Calibrated: 1/23/2004
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: DAE not calibrated
- Phantom: SAM 12; Type: QD 000 P40 C; Serial: TP-1150
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Ch157/Area Scan (71x211x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (interpolated) = 1.36 mW/g

Ch157/Zoom Scan (8x8x8)/Cube 0: Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Reference Value = 2.73 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.86 W/kg
SAR(1 g) = 0.790 mW/g; SAR(10 g) = 0.143 mW/g
Maximum value of SAR (measured) = 1.63 mW/g



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Appendix C – Calibration Data

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

Client **Sporton (Auden)**

CALIBRATION CERTIFICATE

Object(s)	D5GHzV2 - SN:1006
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	January 22, 2004
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
Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04
RF generator R&S SMT06	100005	23-May-01 (SPEAG, in house check May-03)	In house check: May-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Oct 05

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Laboratory Director	
Approved by:	Fin Bomholt	R&D Director	

Date issued: January 26, 2004

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.

880-KP0301061-A Page 1 (1)

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Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

DASY

Dipole Validation Kit

Type: D5GHzV2

Serial: 1006

Manufactured: August 28, 2003
Calibrated: January 22, 2004

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1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with **head simulating solution** of the following electrical parameters:

Frequency:	**5200 MHz**	
Relative Dielectricity	**36.3**	± 5%
Conductivity	**4.57 mho/m**	± 5%
Frequency:	**5800 MHz**	
Relative Dielectricity	**35.4**	± 5%
Conductivity	**5.20 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe EX3DV3 - SN:3503 was used for the measurements. The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. Lossless spacer was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 10mm was aligned with the dipole. Special 8x8x8 fine cube was chosen for cube integration (dx=dy=4.3mm, dz=3mm). Distance between probe sensors and phantom surface was set to 2.5 mm. The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement with DASY System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figures supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured at **5200 MHz (Head Tissue)** with the dosimetric probe EX3DV3 SN:3503 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue: **84.0 mW/g** ± 20.3 % (k=2)[1]

averaged over 10 cm^3 (10 g) of tissue: **23.4 mW/g** ± 19.8 % (k=2)[1]

The resulting averaged SAR-values measured **at 5800 MHz (Head Tissue)** with the dosimetric probe EX3DV3 SN:3503 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue: **84.0 mW/g** ± 20.3 % (k=2)[2]

averaged over 10 cm^3 (10 g) of tissue: **23.5 mW/g** ± 19.8 % (k=2)[2]

[1] Target dipole values determined by FDTD (feedpoint impedance set to 50 Ohm). The values are SAR_1g=76.5 mW/g, SAR_10g=21.6 mW/g and SAR_peak=310.3 mW/g.

[2] Target dipole values determined by FDTD (feedpoint impedance set to 50 Ohm). The values are SAR_1g=78.0 mW/g, SAR_10g=21.9 mW/g and SAR_peak=340.9 mW/g.

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3. Dipole Transformation Parameters

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint (please refer to the graphics attached to this document). The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1. 201ns**	(one direction)
Transmission factor:	**0.974**	(voltage transmission, one direction)

4. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with **body simulating solution** of the following electrical parameters:

Frequency:	**5200 MHz**	
Relative Dielectricity	**49.7**	± 5%
Conductivity	**5.18 mho/m**	± 5%
Frequency:	**5800 MHz**	
Relative Dielectricity	**48.5**	± 5%
Conductivity	**6.01 mho/m**	± 5%

The DASY3 System with a dosimetric E-field probe EX3DV3 - SN:3503 was used for the measurements. The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. Lossless spacer was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 10mm was aligned with the dipole. The 8x8x8 fine cube was chosen for cube integration (dx=dy=4.3mm, dz=3mm). Distance between probe sensors and phantom surface was set to 2.5 mm. The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

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5. SAR Measurement with DASY System

Standard SAR-measurements were performed according to the measurement conditions described in section 4. The results (see figures supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured at **5200 MHz (Body Tissue)** with the dosimetric probe EX3DV3 SN:3503 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**78.0 mW/g** ± 20.3 % (k=2)[3]
averaged over 10 cm^3 (10 g) of tissue:	**22.0 mW/g** ± 19.8 % (k=2)[3]

The resulting averaged SAR-values measured **at 5800 MHz (Body Tissue)** with the dosimetric probe EX3DV3 SN:3503 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**76.6 mW/g** ± 20.3 % (k=2)[4]
averaged over 10 cm^3 (10 g) of tissue:	**21.1 mW/g** ± 19.8 % (k=2)[4]

6. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

7. Design

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

Small end caps have been added to the dipole arms in order to increase frequency bandwidth at the position as explained in Sections 1and 4.

8. Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

[3] Target dipole values determined by FDTD (feedpoint impedance set to 50 Ohm). The values are SAR_1g=71.8 mW/g, SAR_10g=20.1 mW/g and SAR_peak=284.7 mW/g.

[4] Target dipole values determined by FDTD (feedpoint impedance set to 50 Ohm). The values are SAR_1g=74.1 mW/g, SAR_10g=20.5 mW/g and SAR_peak=324.7 mW/g.

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Date/Time: 01/21/04 10:34:27

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Serial: D5GHzV2 - SN:1006

Communication System: CW-5GHz;Duty Cycle: 1:1;Medium: HSL5800
Medium parameters used: f = 5200 MHz; σ = 4.57 mho/m; ε_r = 36.3; ρ = 1000 kg/m^3
Medium parameters used: f = 5800 MHz; σ = 5.2 mho/m; ε_r = 35.4; ρ = 1000 kg/m^3

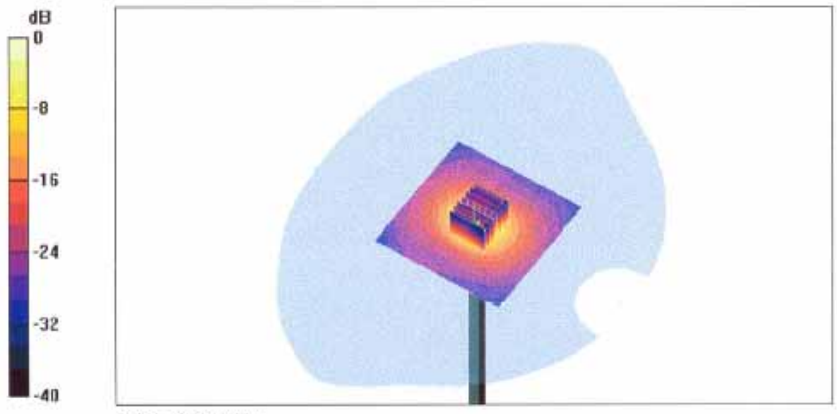
DASY4 Configuration:

- Probe: EX3DV3 - SN3503; ConvF(5.7, 5.7, 5.7)
  ConvF(5, 5, 5); Calibrated: 6/27/2003
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 600; Calibrated: 9/30/2003
- Phantom: SAM with CRP - TP:1312; Phantom section: Flat Section
- Measurement SW: DASY4, V4.2 Build 21; Postprocessing SW: SEMCAD, V2.0 Build 14

d=10mm, Pin=250mW, f=5200 MHz/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Reference Value = 95.1 V/m
Power Drift = -0.1 dB
Maximum value of SAR = 39 mW/g

d=10mm, Pin=250mW, f=5800 MHz/Zoom Scan (8x8x8), dist=2.5mm (7x7x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Peak SAR (extrapolated) = 86.5 W/kg
SAR(1 g) = 21 mW/g; SAR(10 g) = 5.88 mW/g

d=10mm, Pin=250mW, f=5200 MHz/Zoom Scan (8x8x8), dist=2.5mm (7x7x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Peak SAR (extrapolated) = 81.9 W/kg
SAR(1 g) = 21 mW/g; SAR(10 g) = 5.84 mW/g



0 dB = 35.5mW/g

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Date/Time: 01/22/04 11:07:10

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Serial: D5GHzV2 - SN:1006

Communication System: CW-5GHz;Duty Cycle: 1:1;Medium: MSL5800
Medium parameters used: f = 5200 MHz; σ = 5.18 mho/m; ε_r = 49.7; ρ = 1000 kg/m^3
Medium parameters used: f = 5800 MHz; σ = 6.01 mho/m; ε_r = 48.5; ρ = 1000 kg/m^3

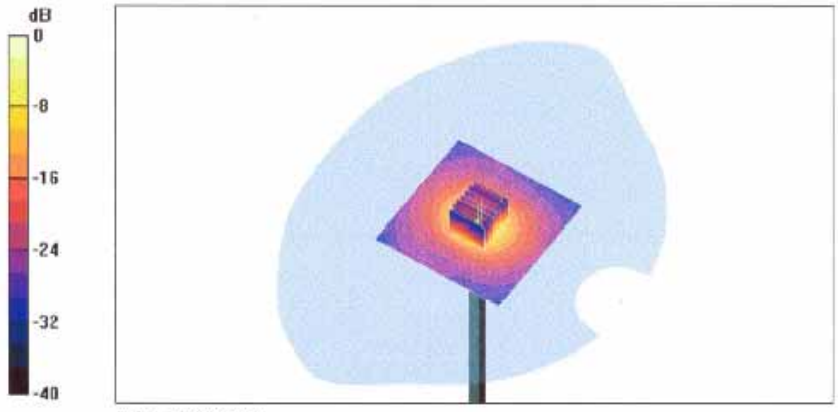
DASY4 Configuration:

- Probe: ESX3DV3 - SN3503; ConvF(5, 5, 5)
  ConvF(4.6, 4.6, 4.6); Calibrated: 6/27/2003
- Sensor-Surface: 2.5mm (Mechanical Surface Detection)
- Electronics: DAE4 600; Calibrated: 9/30/2003
- Phantom: SAM with CRP - TP:1312; Phantom section: Flat Section
- Measurement SW: DASY4, V4.2 Build 21; Postprocessing SW: SEMCAD, V2.0 Build 14

d=10mm, Pin=250mW, f=5200 MHz/Area Scan (91x91x1): Measurement grid: dx=10mm, dy=10mm
Reference Value = 80.2 V/m
Power Drift = -0.007 dB
Maximum value of SAR = 36.8 mW/g

d=10mm, Pin=250mW, f=5800 MHz/Zoom Scan (8x8x8), dist=2.5mm (7x7x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Peak SAR (extrapolated) = 78.4 W/kg
SAR(1 g) = 19.2 mW/g; SAR(10 g) = 5.28 mW/g

d=10mm, Pin=250mW, f=5200 MHz/Zoom Scan (8x8x8), dist=2.5mm (7x7x8)/Cube 0:
Measurement grid: dx=4.3mm, dy=4.3mm, dz=3mm
Peak SAR (extrapolated) = 69.7 W/kg
SAR(1 g) = 19.5 mW/g; SAR(10 g) = 5.49 mW/g



0 dB = 32.8mW/g

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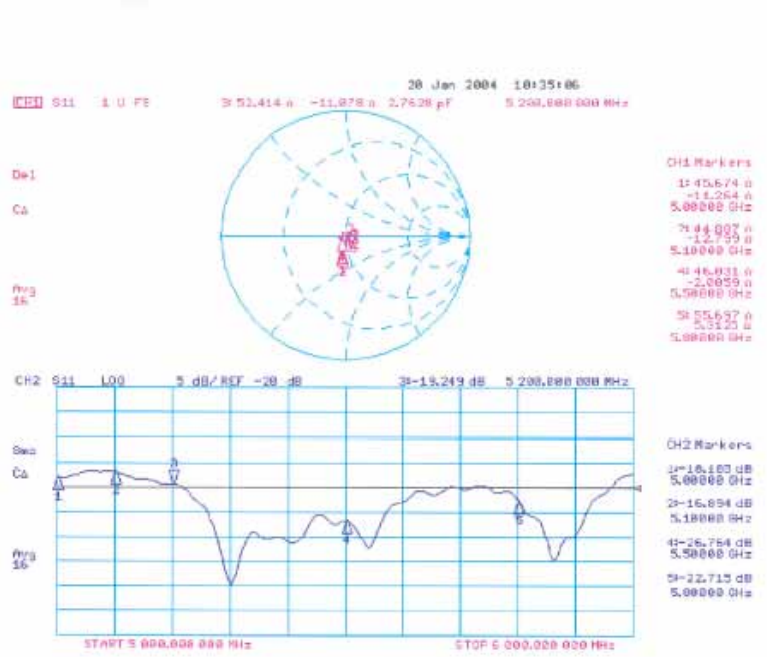

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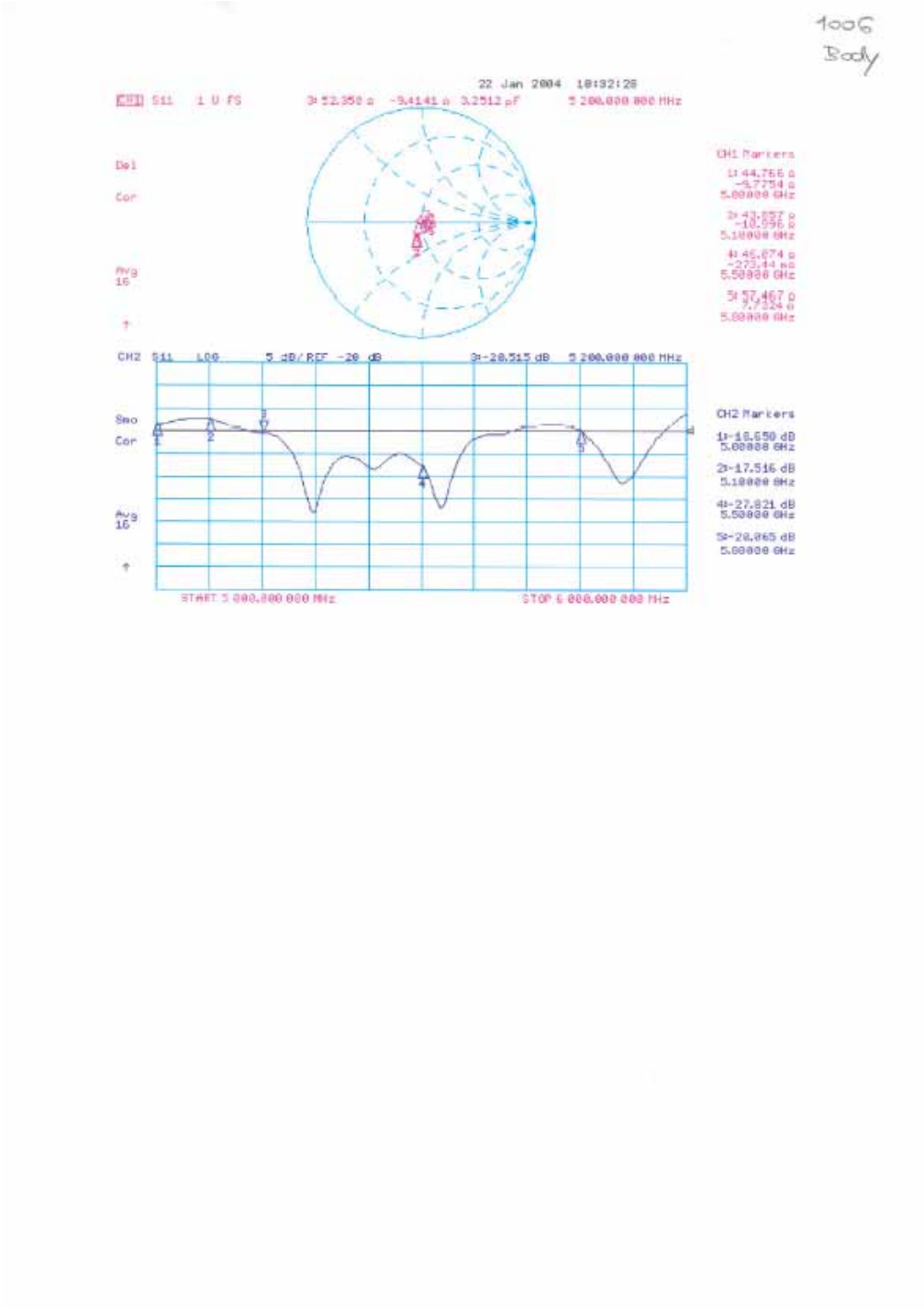

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Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

Client **Sporton International Inc. (Auden)**

CALIBRATION CERTIFICATE

Object(s)	EX3DV3 - SN:3514
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date	January 23, 2004
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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 R&S SMT06	100058	23-May-01 (SPEAG, in house check May-03)	In house check: May-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: January 26, 2004

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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Probe EX3DV3

SN:3514

Manufactured: December 15, 2003
Last calibrated: January 23, 2004

Calibrated for DASY Systems
(Note: non-compatible with DASY2 system!)

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EX3DV3 SN:3514 January 23, 2004

DASY - Parameters of Probe: EX3DV3 SN:3514

Sensitivity in Free Space

		Diode Compression[A]		
NormX	0.66 μV/(V/m)^2	DCP X	97	mV
NormY	0.67 μV/(V/m)^2	DCP Y	97	mV
NormZ	0.60 μV/(V/m)^2	DCP Z	97	mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Plese see Page 7.

Boundary Effect

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

Sensor Cener to Phantom Surface Distance		2.0 mm	3.0 mm
SAR_{be} [%]	Without Correction Algorithm	3.2	1.2
SAR_{be} [%]	With Correction Algorithm	0.6	0.1

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

Sensor to Surface Distance		2.0 mm	3.0 mm
SAR_{be} [%]	Without Correction Algorithm	4.9	3.1
SAR_{be} [%]	With Correction Algorithm	1.7	0.5

Sensor Offset

Probe Tip to Sensor Center	1.0	mm

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] numerical linearization parameter: uncertainty not required

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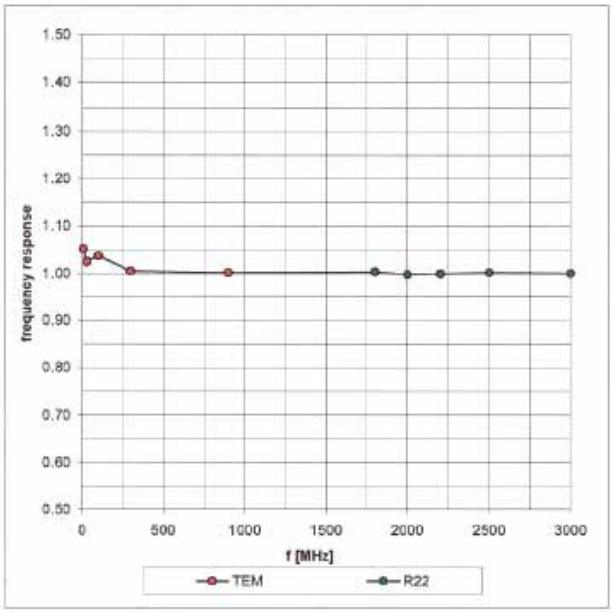
EX3DV3 SN:3514 January 23, 2004

Frequency Response of E-Field

(TEM-Cell:ifi110, Waveguide R22)



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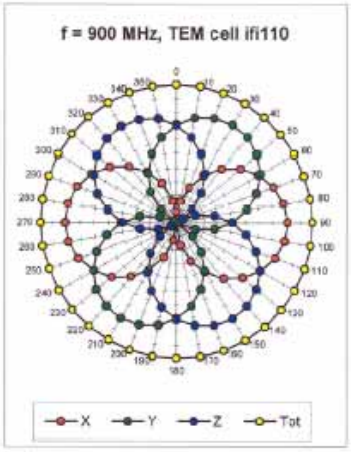
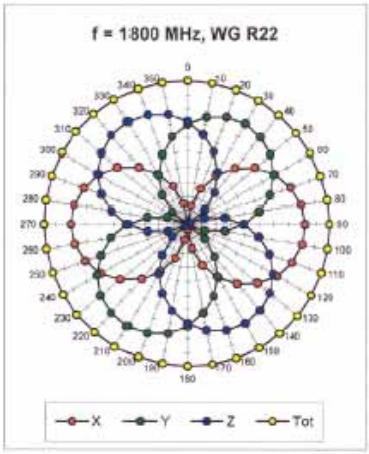
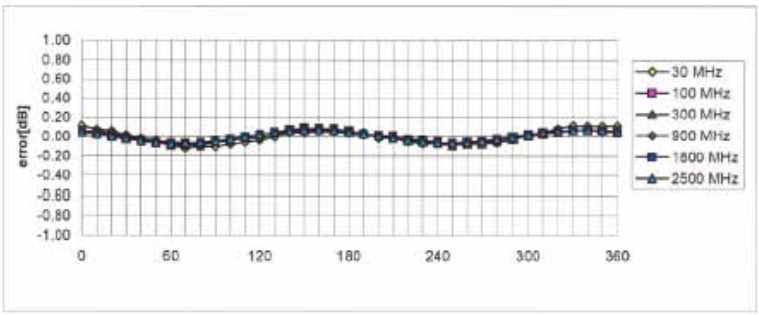
Receiving Pattern (ϕ) , θ = 0°







Axial Isotropy Error < ± 0.2 dB

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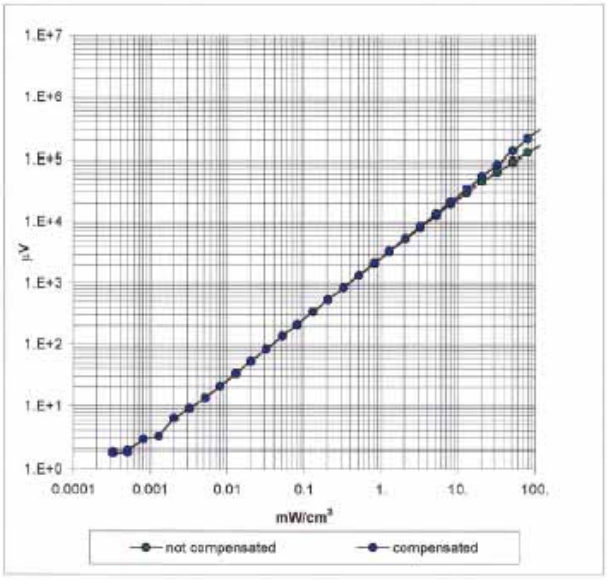
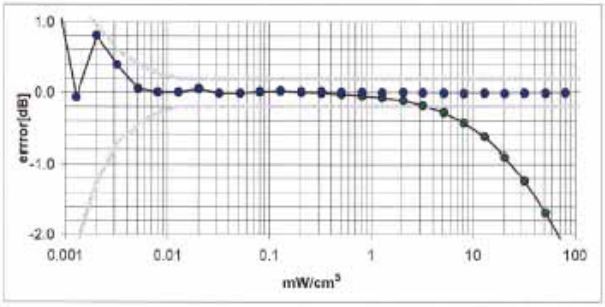
Dynamic Range f(SAR_{head})

(Waveguide R22)





Probe Linearity < ± 0.2 dB

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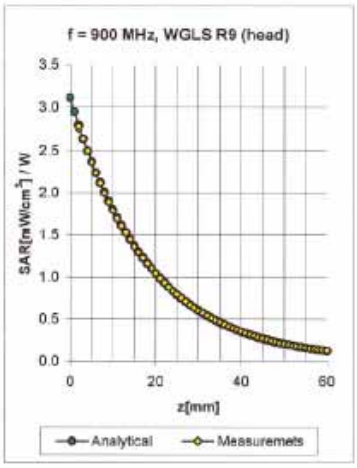
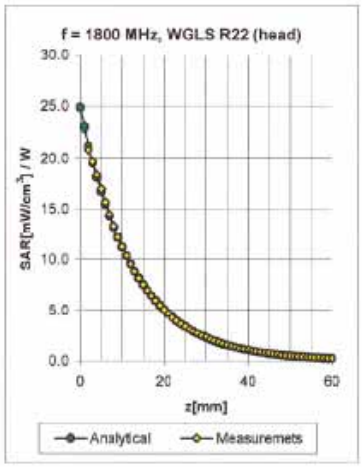
Conversion Factor Assessment





f [MHz]	Validity [MHz][B]	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	800-1000	Head	41.5 ± 5%	0.97 ± 5%	0.45	0.80	9.59 ± 11.3% (k=2)
1800	1710-1910	Head	40.0 ± 5%	1.40 ± 5%	0.39	1.10	8.30 ± 11.7% (k=2)
5200	4940-5460	Head	36.0 ± 5%	4.66 ± 5%	0.42	1.80	4.88 ± 21.8% (k=2)
5800	5510-6090	Head	35.3 ± 5%	5.27 ± 5%	0.42	1.80	4.38 ± 23.4% (k=2)
5200	4940-5460	Body	49.0 ± 5%	5.30 ± 5%	0.45	1.90	4.14 ± 21.8% (k=2)
5800	5510-6090	Body	48.2 ± 5%	6.00 ± 5%	0.43	1.90	3.85 ± 23.4% (k=2)

[B] The total standard uncertainty is calculated as root-sum-square of standard uncertainty of the Conversion Factor at calibration frequency and the standard uncertainty for the indicated frequency band.

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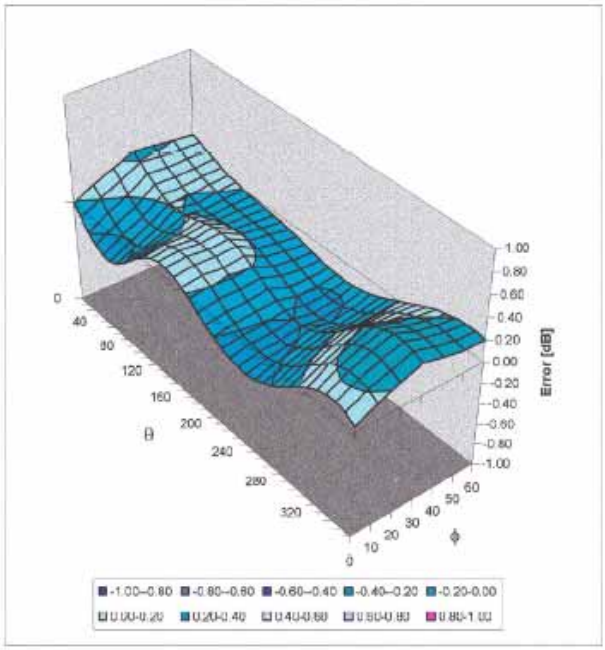
Deviation from Isotropy in HSL

Error (θ,ϕ), f = 900 MHz



Spherical Isotropy Error < ± 0.4 dB

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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **Sporton (Auden)**

Certificate No: DAE3-577_Nov04

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AA - SN: 577
Calibration procedure(s)	QA CAL-06.v10 Calibration procedure for the data acquisition unit (DAE)
Calibration date:	November 17, 2004
Condition of the calibrated item	In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	7-Sep-04 (Sintrel, No.E-040073)	Sep-05
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1002	16-Jul-04 (SPEAG, in house check)	In house check Jul-05

	Name	Function	Signature
Calibrated by:	Eric Hainfeld	Technician	
Approved by:	Fin Bomholt	R&D Director	i.V.

Issued: November 17, 2004

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Accreditation No.: SCS 108

Glossary

DAE	digital acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters contain technical information as a result from the performance test and require no uncertainty.
- *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
- *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
- *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
- *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
- *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
- *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
- *Input resistance:* DAE input resistance at the connector, during internal auto-zeroing and during measurement.
- *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
- *Power consumption:* Typical value for information. Supply currents in various operating modes.

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DC Voltage Measurement

A/D - Converter Resolution nominal

High Range:	1LSB =	6.1μV ,	full range =	-100...+300 mV
Low Range:	1LSB =	61nV ,	full range =	-1.....+3mV

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

Calibration Factors	X	Y	Z
High Range	404.437 ± 0.1% (k=2)	403.891 ± 0.1% (k=2)	404.359 ± 0.1% (k=2)
Low Range	3.94121 ± 0.7% (k=2)	3.89867 ± 0.7% (k=2)	3.95408 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	127 ° ± 1 °

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Appendix

1. DC Voltage Linearity

High Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	200000	200000.6	0.00
Channel X	+ Input	20000	20001.77	0.01
Channel X	- Input	20000	-19991.81	-0.04
Channel Y	+ Input	200000	199999.7	0.00
Channel Y	+ Input	20000	19999.20	0.00
Channel Y	- Input	20000	-19994.82	-0.03
Channel Z	+ Input	200000	200000.2	0.00
Channel Z	+ Input	20000	19996.22	-0.02
Channel Z	- Input	20000	-19996.74	-0.02

Low Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	2000	2000	0.00
Channel X	+ Input	200	200.05	0.03
Channel X	- Input	200	-200.88	0.44
Channel Y	+ Input	2000	1999.9	0.00
Channel Y	+ Input	200	199.73	-0.13
Channel Y	- Input	200	-200.53	0.27
Channel Z	+ Input	2000	2000.1	0.00
Channel Z	+ Input	200	199.25	-0.38
Channel Z	- Input	200	-201.42	0.71

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	13.15	12.30
	- 200	-12.61	-12.86
Channel Y	200	-7.43	-7.53
	- 200	6.30	6.52
Channel Z	200	-0.16	0.31
	- 200	-1.51	-1.48

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	1.90	-0.22
Channel Y	200	1.47	-	4.60
Channel Z	200	-1.40	-0.08	-

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4. AD-Converter Values with inputs shorted

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

	High Range (LSB)	Low Range (LSB)
Channel X	15948	15814
Channel Y	15960	16073
Channel Z	16236	16172

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.03	-3.07	1.24	0.58
Channel Y	-0.66	-2.19	1.96	0.55
Channel Z	-0.91	-2.82	0.42	0.39

6. Input Offset Current

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

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2000	199.3
Channel Y	0.2000	200.4
Channel Z	0.2001	199.5

8. Low Battery Alarm Voltage (verified during pre test)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (verified during pre test)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.0	+6	+14
Supply (- Vcc)	–0.01	-8	-9

10. Common Mode Bit Generation (verified during pre test)

Typical values	Bit set to High at Common Mode Error (V_{DC})
Channel X, Y, Z	+1.25

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