Test Laboratory: Sporton International Inc. SAR Testing Lab Date/Time: 10/15/2005 2:13:14 PM

Body_PCS_Ch512_Keypad Down_1.5cm_20051015_Bluetooth

DUT: 592007_Close; Type: GSM Tri-Band Mobile Phone; Serial: 356985000000598

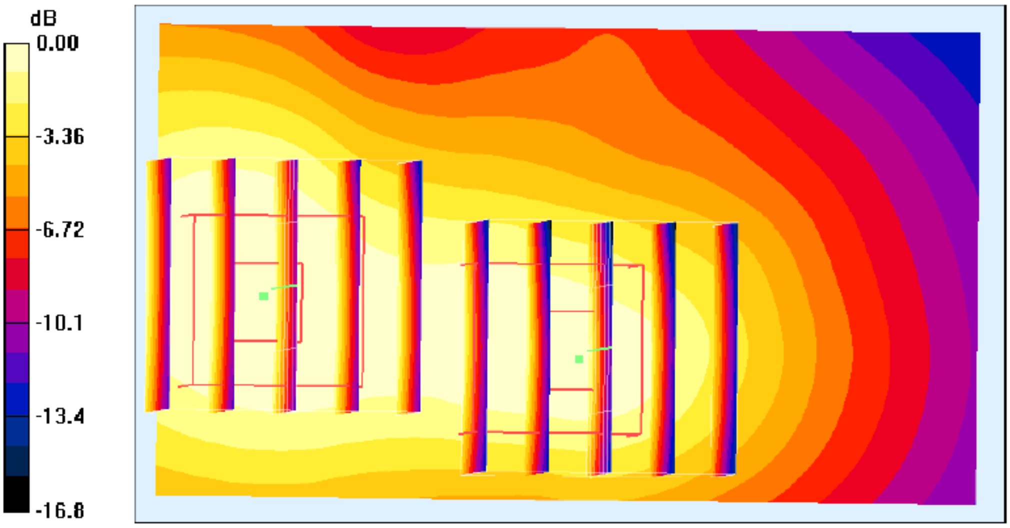
Communication System: PCS 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:2
Medium: MSL_1900 Medium parameters used : f = 1850.2 MHz; σ = 1.51 mho/m; ε_r = 51.5; ρ = 1000 kg/m^3
Ambient Temperature：22.4 ℃; Liquid Temperature：22.0 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1788; ConvF(4.56, 4.56, 4.56); Calibrated: 9/30/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 11/17/2004
- 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

Ch512/Area Scan (41x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.868 mW/g

Ch512/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.0 V/m; Power Drift = -0.051 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.789 mW/g; SAR(10 g) = 0.507 mW/g
Maximum value of SAR (measured) = 0.848 mW/g

Ch512/Zoom Scan (5x5x7)/Cube 1: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.0 V/m; Power Drift = -0.351 dB
Peak SAR (extrapolated) = 1.19 W/kg
SAR(1 g) = 0.733 mW/g; SAR(10 g) = 0.434 mW/g
Maximum value of SAR (measured) = 0.802 mW/g



0 dB = 0.802mW/g

Test Laboratory: Sporton International Inc. SAR Testing Lab Date/Time: 10/3/2005 9:39:07 PM

Right Cheek_PCS_Ch661_Close_20051003

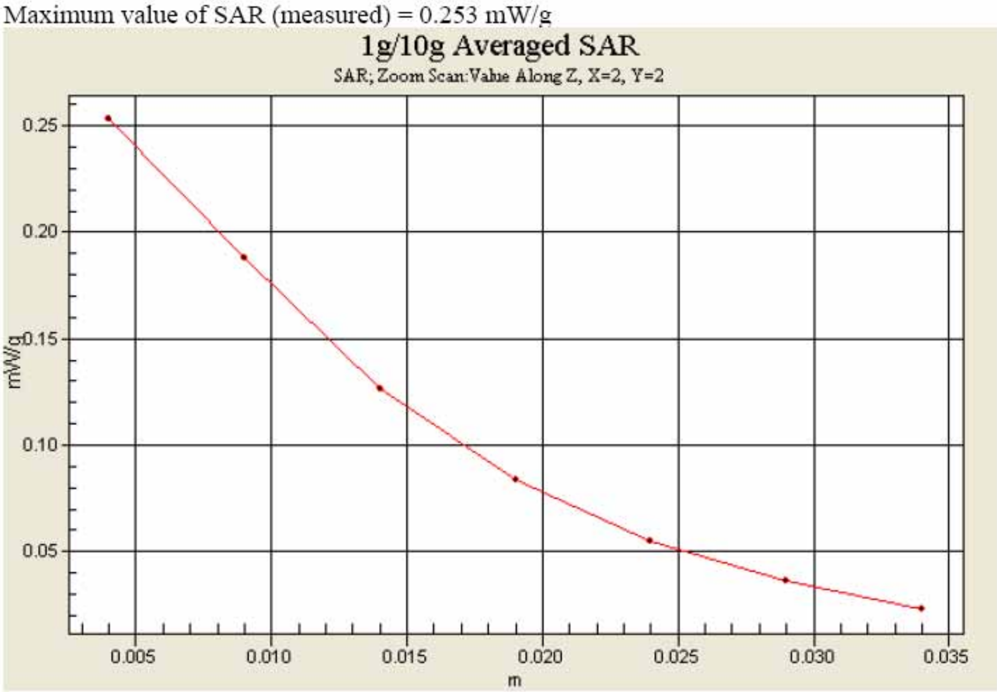
DUT: 592007_Close; Type: GSM Tri-Band Mobile Phone; Serial: 356985000000598

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: HSL_1900 Medium parameters used: f = 1880 MHz; σ = 1.44 mho/m; ε_r = 39.7; ρ = 1000 kg/m^3
Ambient Temperature：22.0 ℃; Liquid Temperature：21.7 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1788; ConvF(5.16, 5.16, 5.16); Calibrated: 9/30/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 11/17/2004
- 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

Ch661/Area Scan (41x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.258 mW/g

Ch661/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.6 V/m; Power Drift = -0.049 dB
Peak SAR (extrapolated) = 0.305 W/kg
SAR(1 g) = 0.233 mW/g; SAR(10 g) = 0.149 mW/g
Maximum value of SAR (measured) = 0.253 mW/g



Test Laboratory: Sporton International Inc. SAR Testing Lab Date/Time: 10/15/2005 2:13:14 PM

Body_PCS_Ch512_Keypad Down_1.5cm_20051015_Bluetooth_2D

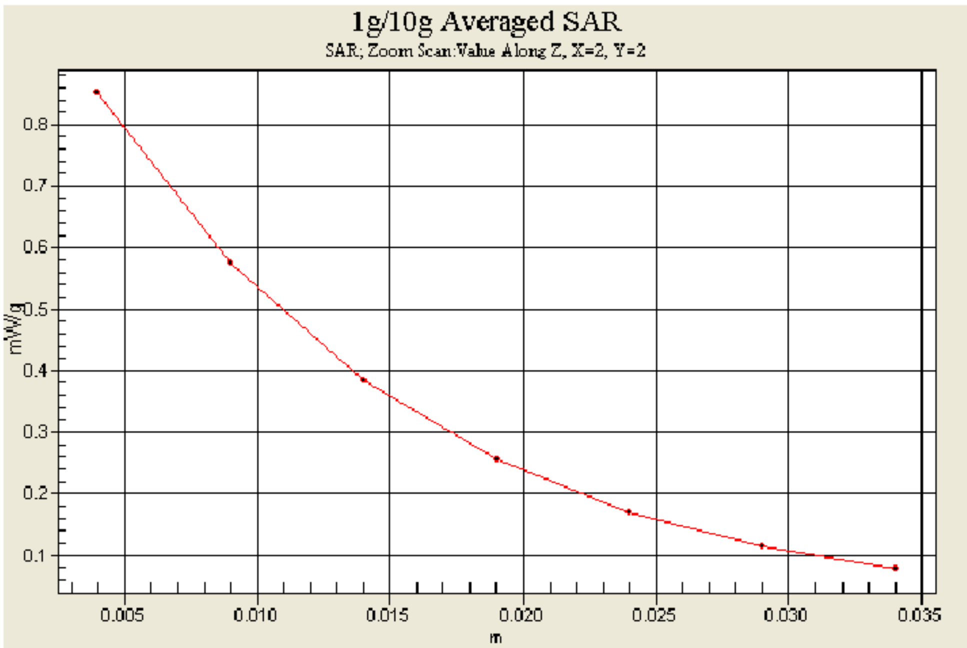
DUT: 592007_Close; Type: GSM Tri-Band Mobile Phone; Serial: 356985000000598

Communication System: PCS 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:2
Medium: MSL_1900 Medium parameters used (interpolated): f = 1850.2 MHz; σ = 1.51 mho/m; ε_r = 51.5; ρ = 1000 kg/m^3
Ambient Temperature : 22.0 ℃; Liquid Temperature : 21.6 ℃

DASY4 Configuration:
- Probe: ET3DV6 - SN1788; ConvF(4.56, 4.56, 4.56); Calibrated: 9/30/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn577; Calibrated: 11/17/2004
- 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

Ch512/Area Scan (41x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.868 mW/g

Ch512/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 12.0 V/m; Power Drift = -0.351 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.789 mW/g; SAR(10 g) = 0.507 mW/g
Maximum value of SAR (measured) = 0.848 mW/g



Appendix C – Calibration Data

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

Client Sproton Int. (Auden)

CALIBRATION CERTIFICATE

Object(s)	D1900V2 - SN:5d041
Calibration procedure(s)	QA CAL-05 v2 Calibration procedure for dipole validation kits
Calibration date:	February 17, 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 E442	GB37480704	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	US37292783	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-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:	Judith Mueller	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: February 18, 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)

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: D1900V2

Serial: 5d041

Manufactured: July 4, 2003
Calibrated: February 17, 2004

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with **head simulating liquid** of the following electrical parameters at 1900 MHz:

Relative Dielectricity	**38.8**	± 5%
Conductivity	**1.47 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 4.96 at 1900 MHz) 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. The included distance spacer was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**41.6 mW/g** ± 16.8 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**21.6 mW/g** ± 16.2 % (k=2)[1]

[1] validation uncertainty

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.200 ns**	(one direction)
Transmission factor:	**0.993**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance spacer was in place during impedance measurements.

Feedpoint impedance at 1900 MHz:	Re{Z} = **51.2 Ω**
	Im {Z} = **4.9Ω**
Return Loss at 1900 MHz	**-26.1 dB**

4. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with **body simulating tissue** of the following electrical parameters at 1900 MHz:

Relative Dielectricity	**52.5**	± 5%
Conductivity	**1.58 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 4.57 at 1900 MHz) 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. The included distance spacer was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

5. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 4. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**42.0 mW/g** ± 16.8 % (k=2)[2]
averaged over 10 cm^3 (10 g) of tissue:	**22.0 mW/g** ± 16.2 % (k=2)[2]

6. Dipole Impedance and Return Loss

The dipole was positioned at the flat phantom sections according to section 4 and the distance spacer was in place during impedance measurements.

Feedpoint impedance at 1900 MHz:	Re{Z} = **46.6 Ω**
	Im {Z} = **5.1 Ω**
Return Loss at 1900 MHz	**-24.0 dB**

7. 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.

8. 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 improve matching when loaded according to the position as explained in Section 1. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

9. Power Test

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

[2] validation uncertainty

Date/Time: 02/17/04 14:13:01

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN5d041

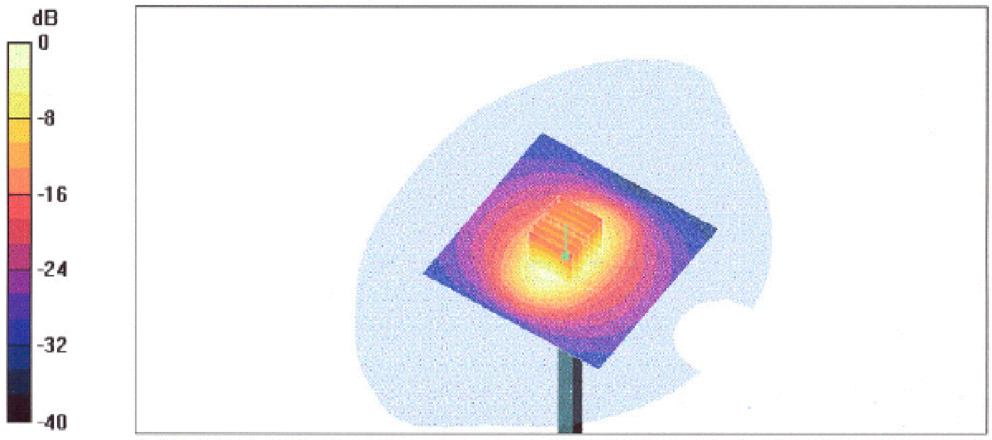
Communication System: CW-1900; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL 1900 MHz;
Medium parameters used: f = 1900 MHz; σ = 1.47 mho/m; ε_r = 38.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

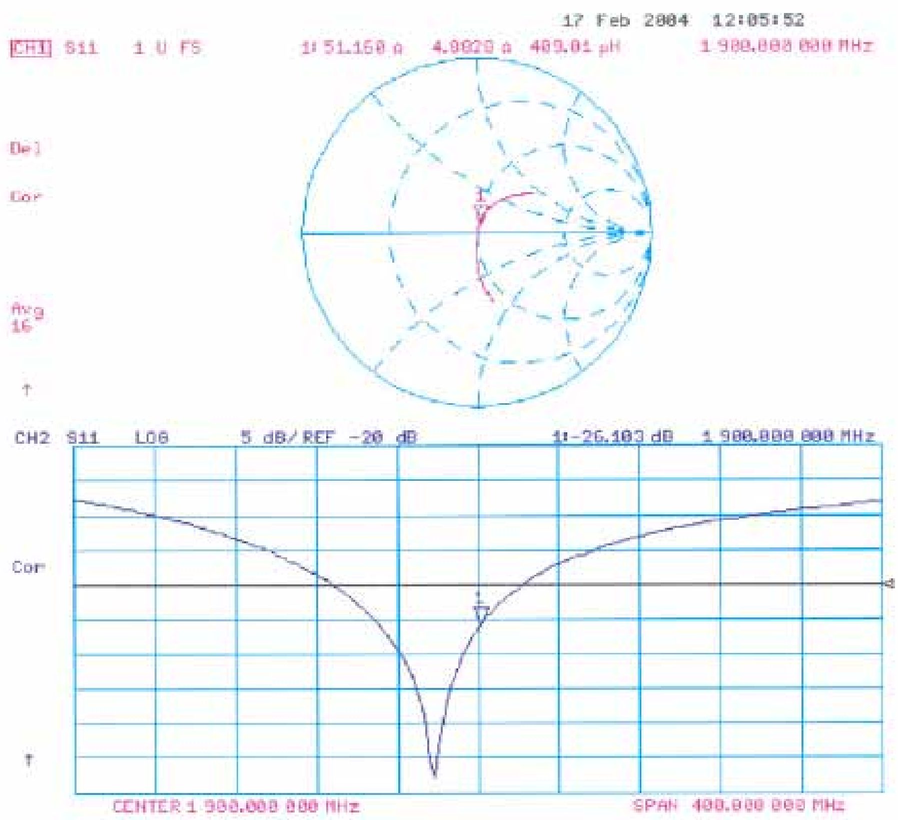
- Probe: ET3DV6 - SN1507; ConvF(4.96, 4.96, 4.96); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn411; Calibrated: 11/6/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006;
- Measurement SW: DASY4, V4.2 Build 30; Postprocessing SW: SEMCAD, V1.8 Build 98

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 93.8 V/m
Power Drift = 0.002 dB
Maximum value of SAR = 11.8 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 18.7 W/kg
SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.39 mW/g
Reference Value = 93.8 V/m
Power Drift = 0.002 dB
Maximum value of SAR = 11.7 mW/g



0 dB = 11.7mW/g


17 Feb 2004 12:05:52
CH1 S11 1 U FS 1: 51.150 Ω 4.9820 Ω 409.01 pH 1 900.000 000 MHz
Del
Cor
Avg
16
CH2 S11 LOG 5 dB/ REF -20 dB 1:-26.103 dB 1 900.000 000 MHz
Cor
CENTER 1 900.000 000 MHz
SPAN 400.000 000 MHz

Date/Time: 02/09/04 15:58:45

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN5d041

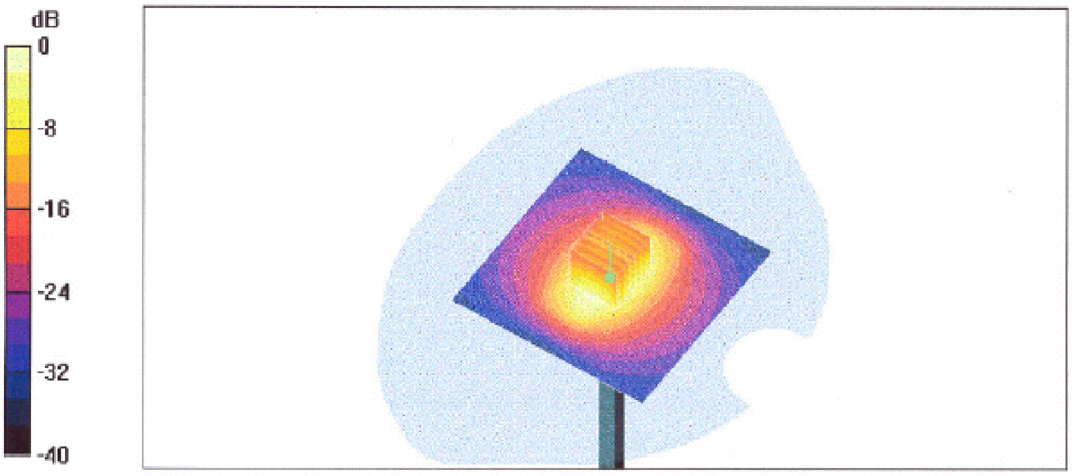
Communication System: CW-1900; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: Muscle 1900 MHz;
Medium parameters used: f = 1900 MHz; σ = 1.58 mho/m; ε_r = 52.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

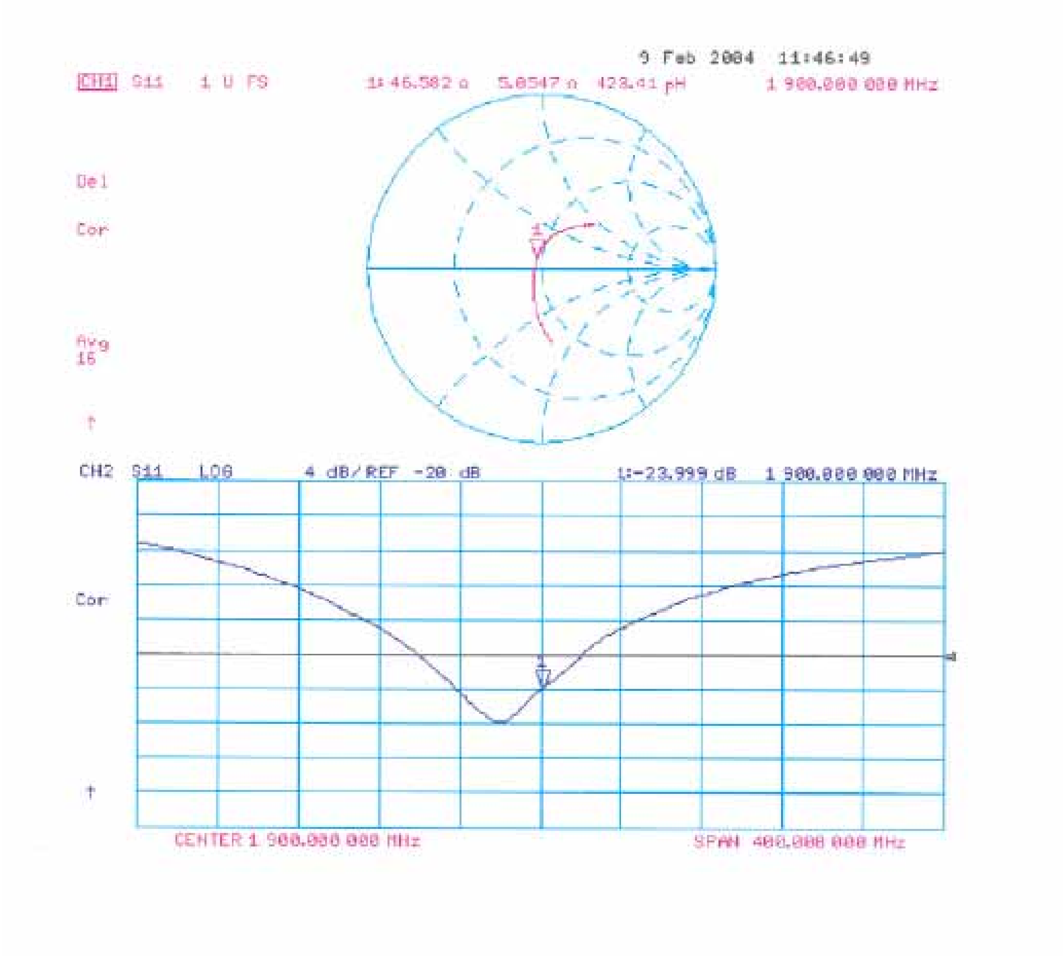
- Probe: ET3DV6 - SN1507; ConvF(4.57, 4.57, 4.57); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 11/6/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006;
- Measurement SW: DASY4, V4.2 Build 25; Postprocessing SW: SEMCAD, V1.8 Build 101

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 92.6 V/m; Power Drift = 0.0 dB
Maximum value of SAR (interpolated) = 11.8 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 92.6 V/m; Power Drift = 0.0 dB
Maximum value of SAR (measured) = 11.9 mW/g
Peak SAR (extrapolated) = 18.8 W/kg
SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.49 mW/g



0 dB = 11.9mW/g


9 Feb 2004 11:46:49
CH1 S11 1 U FS 1: 46.582 Ω 5.0547 Ω 423.41 pH 1 900.000 000 MHz
Del
Cor
Avg
16
CH2 S11 LOG 4 dB/ REF -20 dB 1:-23.999 dB 1 900.000 000 MHz
Cor
CENTER 1 900.000 000 MHz SPAN 400.000 000 MHz

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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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: **ET3-1788_Sep04**

CALIBRATION CERTIFICATE

Object	ET3DV6 - SN:1788
Calibration procedure(s)	QA CAL-01.v5 Calibration procedure for dosimetric E-field probes
Calibration date:	September 30, 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
Power meter E4419B	GB41293874	5-May-04 (METAS, No. 251-00388)	May-05
Power sensor E4412A	MY41495277	5-May-04 (METAS, No. 251-00388)	May-05
Reference 3 dB Attenuator	SN: S5054 (3c)	3-Apr-03 (METAS, No. 251-00403)	Aug-05
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-04 (METAS, No. 251-00389)	May-05
Reference 30 dB Attenuator	SN: S5129 (30b)	3-Apr-03 (METAS, No. 251-00404)	Aug-05
Reference Probe ES3DV2	SN:3013	8-Jan-04 (SPEAG, No. ES3-3013_Jan04)	Jan-05
DAE4	SN: 617	26-May-04 (SPEAG, No. DAE4-617_May04)	May-05

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Nov 04

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Laboratory Technician	N. Vetter
Approved by:	Katja Pokovic	Technical Manager	

Issued: October 1, 2004

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: ET3-1788_Sep04 Page 1 of 9

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

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Swiss Calibration Service

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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**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY 4.3 B17 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ET3DV6

SN:1788

Manufactured:	May 28, 2003
Last calibrated:	August 29, 2003
Recalibrated:	September 30, 2004

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ET3DV6 SN:1788   September 30, 2004

DASY - Parameters of Probe: ET3DV6 SN:1788

Sensitivity in Free Space[A]   Diode Compression[B]

NormX	**1.68** ± 9.9%	$\mu V/(V/m)^2$	DCP X	**94** mV
NormY	**1.70** ± 9.9%	$\mu V/(V/m)^2$	DCP Y	**94** mV
NormZ	**1.74** ± 9.9%	$\mu V/(V/m)^2$	DCP Z	**94** mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

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

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	8.1	4.4
SAR_{be} [%]	With Correction Algorithm	0.7	0.1

TSL **1810 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		**3.7 mm**	**4.7 mm**
SAR_{be} [%]	Without Correction Algorithm	12.0	8.2
SAR_{be} [%]	With Correction Algorithm	0.9	0.1

Sensor Offset

Probe Tip to Sensor Center   **2.7** mm

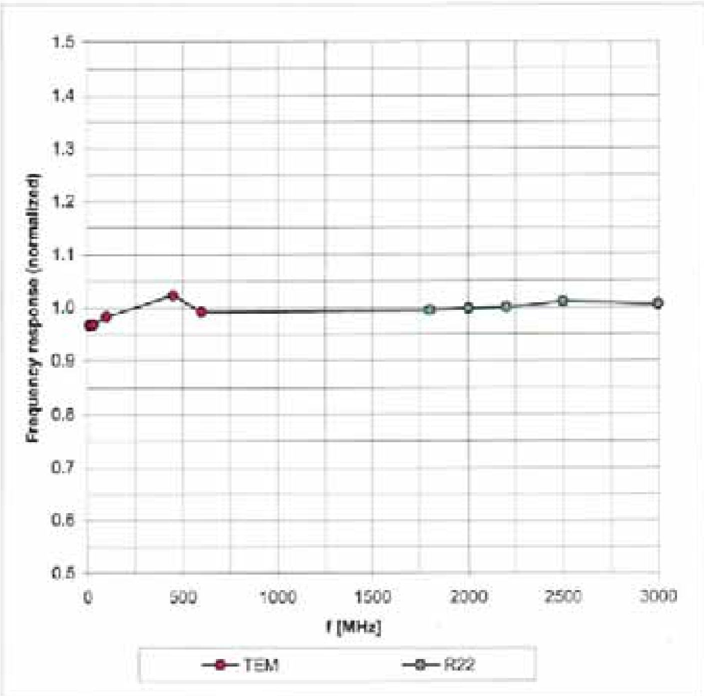
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Page 8).
[B] Numerical linearization parameter: uncertainty not required.

ET3DV6 SN:1788 September 30, 2004

Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)

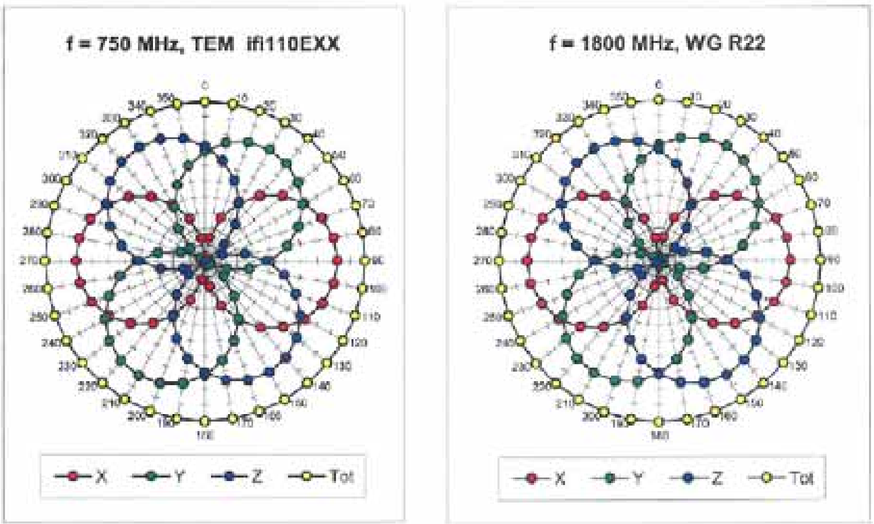


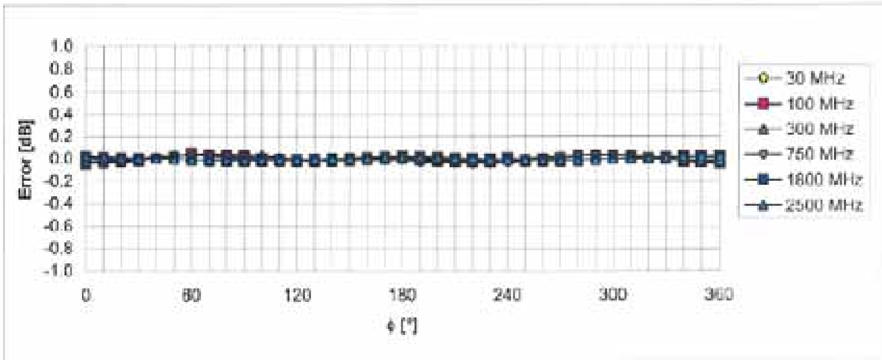
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

ET3DV6 SN:1788

September 30, 2004

Receiving Pattern (φ), ϑ = 0°





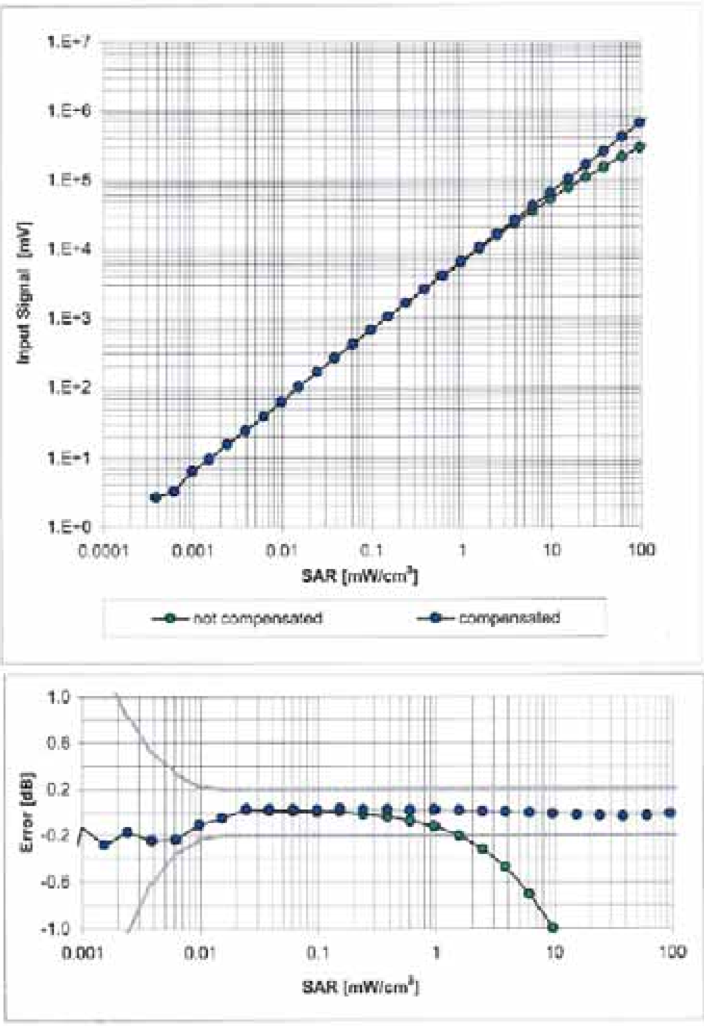
Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

ET3DV6 SN:1788

September 30, 2004

Dynamic Range f(SAR_{head})

(Waveguide R22, f = 1800 MHz)



Uncertainty of Linearity Assessment: ± 0.6% (k=2)

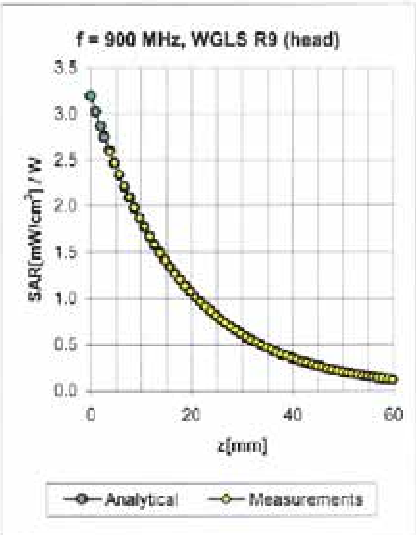
Certificate No: ET3-1788_Sep04

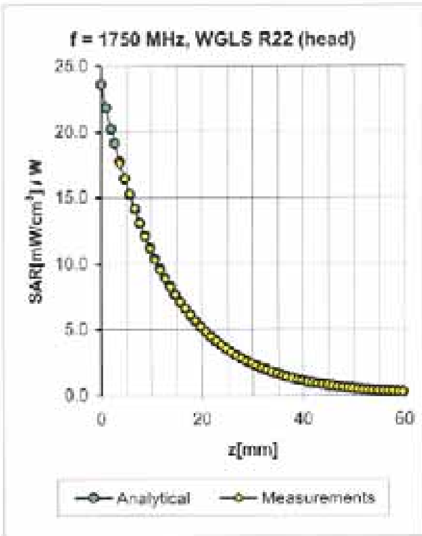
Page 7 of 9

ET3DV6 SN:1788

September 30, 2004

Conversion Factor Assessment





f [MHz]	Validity [MHz][C]	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	1.12	1.42	6.74 ± 11.0% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	1.07	1.44	6.63 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.56	2.31	5.37 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.55	2.42	5.16 ± 11.0% (k=2)
2000	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.54	2.59	4.88 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.65	2.22	4.56 ± 11.8% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	1.04	1.52	6.53 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.89	1.56	6.17 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.53	2.74	4.73 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.55	2.82	4.56 ± 11.0% (k=2)
2000	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.54	2.88	4.43 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.72	2.00	4.26 ± 11.8% (k=2)

[C] The validity of ± 100 MHz only applies for DASY 4.3 B17 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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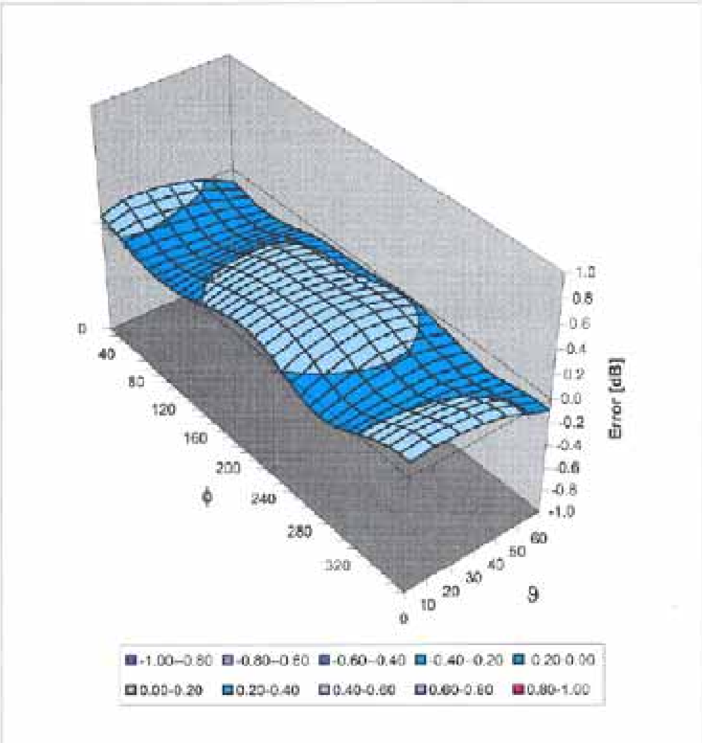
ET3DV6 SN:1788

September 30, 2004

Deviation from Isotropy in HSL

Error (φ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

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S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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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	18-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. M. Keller

Issued: November 17, 2004

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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Calibration Laboratory of
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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.

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 °

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	-

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