

**Measurement Conditions**

DASY system configuration, as far as not given on page 1.

<b>DASY Version</b>	DASY4	V4.7
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom V5.0	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	1900 MHz ± 1 MHz	

**Head TSL parameters**

The following parameters and calculations were applied.

	<b>Temperature</b>	<b>Permittivity</b>	<b>Conductivity</b>
<b>Nominal Head TSL parameters</b>	22.0 °C	40.0	1.40 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	38.8 ± 6 %	1.47 mho/m ± 6 %
<b>Head TSL temperature during test</b>	(22.0 ± 0.2) °C	---	---

**SAR result with Head TSL**

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	9.84 mW / g
SAR normalized	normalized to 1W	39.4 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>37.8 mW / g ± 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	5.06 mW / g
SAR normalized	normalized to 1W	20.2 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>19.8 mW / g ± 16.5 % (k=2)</b>

<sup>1</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

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## Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	53.3	1.52 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	52.4 ± 6 %	1.59 mho/m ± 6 %
<b>Body TSL temperature during test</b>	(22.0 ± 0.2) °C	---	---

## SAR result with Body TSL

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	Condition	
SAR measured	250 mW input power	10.20 mW / g
SAR normalized	normalized to 1W	40.8 mW / g
<b>SAR for nominal Body TSL parameters <sup>2</sup></b>	normalized to 1W	<b>39.4 mW / g ± 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	condition	
SAR measured	250 mW input power	5.36 mW / g
SAR normalized	normalized to 1W	21.4 mW / g
<b>SAR for nominal Body TSL parameters <sup>2</sup></b>	normalized to 1W	<b>21.0 mW / g ± 16.5 % (k=2)</b>

<sup>2</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

**Appendix**

**Antenna Parameters with Head TSL**

Impedance, transformed to feed point	54.6 $\Omega$ + 5.8 j $\Omega$
Return Loss	- 23.0 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	47.6 $\Omega$ + 7.0 j $\Omega$
Return Loss	- 22.4 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.202 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

**Additional EUT Data**

Manufactured by	SPEAG
Manufactured on	Dezember 10, 2004

**DASY4 Validation Report for Head TSL**

Date/Time: 22.07.2008 10:51:12

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d060**

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.47$  mho/m;  $\epsilon_r = 38.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

**DASY4 Configuration:**

- Probe: ES3DV2 - SN3025; ConvF(4.9, 4.9, 4.9); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

**Pin = 250 mW; dip = 10 mm, scan at 3.4mm/Zoom Scan (dist=3.4mm, probe 0deg)**

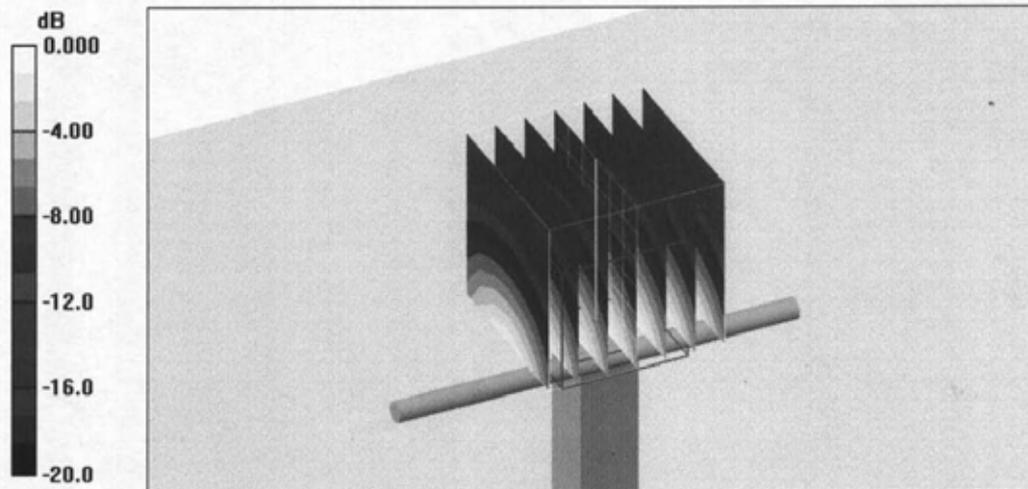
**(7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm**

Reference Value = 91.9 V/m; Power Drift = 0.053 dB

Peak SAR (extrapolated) = 18.2 W/kg

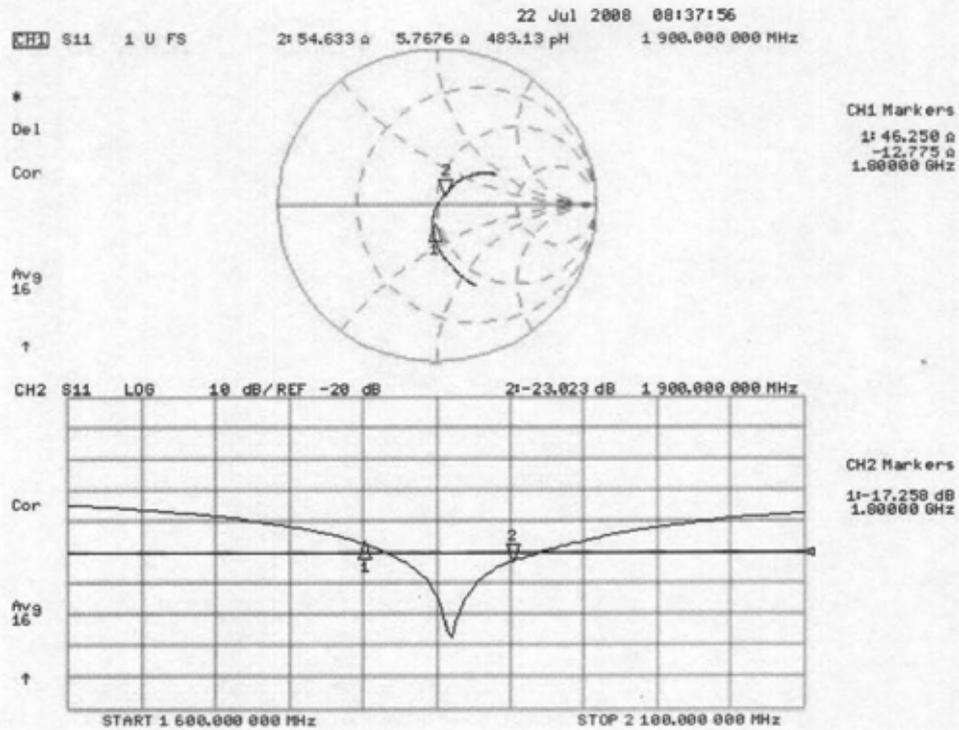
**SAR(1 g) = 9.84 mW/g; SAR(10 g) = 5.06 mW/g**

Maximum value of SAR (measured) = 11.9 mW/g



0 dB = 11.9mW/g

Impedance Measurement Plot for Head TSL



**DASY4 Validation Report for Body TSL**

Date/Time: 14.07.2008 13:49:34

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d060**

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL U10 BB;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.59$  mho/m;  $\epsilon_r = 52.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

**DASY4 Configuration:**

- Probe: ES3DV2 - SN3025; ConvF(4.5, 4.5, 4.5); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184
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**Pin = 250 mW; dip = 10 mm, scan at 3.4mm/Zoom Scan (dist=3.4mm, probe 0deg)**

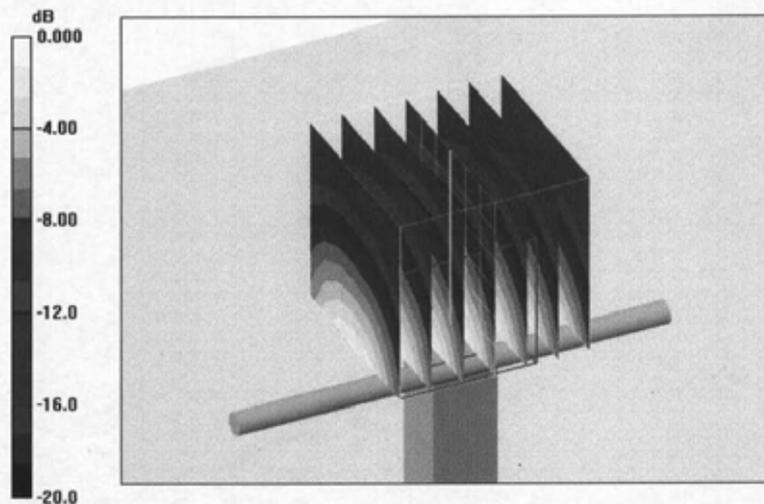
**(7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 90.3 V/m; Power Drift = -0.001 dB

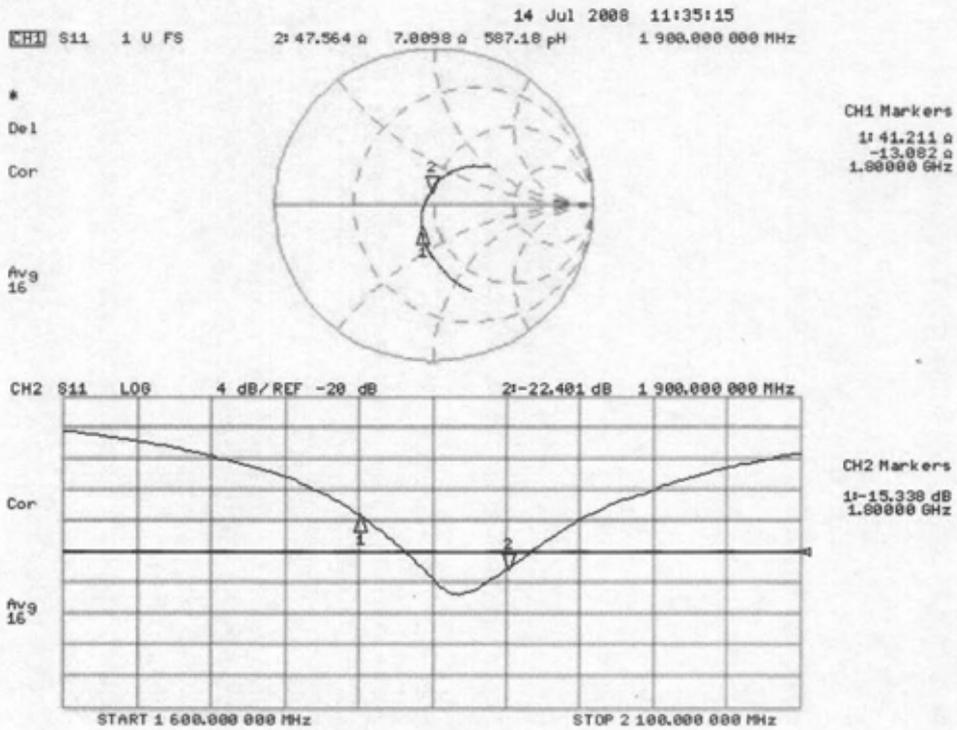
Peak SAR (extrapolated) = 18.1 W/kg

**SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.36 mW/g**

Maximum value of SAR (measured) = 12.3 mW/g



Impedance Measurement Plot for Body TSL



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**ANNEX F: DAE3 CALIBRATION CERTIFICATE**

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



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
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 **TMC**

Certificate No: **DAE3-536\_Aug08**

**CALIBRATION CERTIFICATE**

Object: **DAE3 - SD 000 D03 AA - SN: 536**

Calibration procedure(s): **QA CAL-06.v12  
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **August 28, 2008**

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 (Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	04-Oct-07 (No: 6467)	Oct-08
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-07 (No: 6465)	Oct-08
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	06-Jun-08 (in house check)	In house check: Jun-09

Calibrated by: **Name: Eric Hainfeld, Function: Technician, Signature: [Signature]**

Approved by: **Name: Fin Bornholt, Function: R&D Director, Signature: [Signature]**

Issued: August 28, 2008

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

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



**S** Schweizerischer Kalibrierdienst  
**C** Service suisse d'étalonnage  
**S** Servizio svizzero di taratura  
**S** Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)  
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

DAE data 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 as documented in the Appendix 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 = 6.1 $\mu$ V , 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	405.300 $\pm$ 0.1% (k=2)	405.268 $\pm$ 0.1% (k=2)	405.016 $\pm$ 0.1% (k=2)
Low Range	3.99714 $\pm$ 0.7% (k=2)	3.98326 $\pm$ 0.7% (k=2)	3.99748 $\pm$ 0.7% (k=2)

**Connector Angle**

Connector Angle to be used in DASY system	29 $^{\circ}$ $\pm$ 1 $^{\circ}$
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### Appendix

#### 1. DC Voltage Linearity

High Range	Input ( $\mu\text{V}$ )	Reading ( $\mu\text{V}$ )	Error (%)
Channel X + Input	200000	200000.1	0.00
Channel X + Input	20000	20004.02	0.02
Channel X - Input	20000	-19999.39	0.00
Channel Y + Input	200000	200000.2	0.00
Channel Y + Input	20000	20005.47	0.03
Channel Y - Input	20000	-20000.81	0.00
Channel Z + Input	200000	200000.2	0.00
Channel Z + Input	20000	20003.45	0.02
Channel Z - Input	20000	-20004.17	0.02

Low Range	Input ( $\mu\text{V}$ )	Reading ( $\mu\text{V}$ )	Error (%)
Channel X + Input	2000	2000.1	0.00
Channel X + Input	200	199.94	-0.03
Channel X - Input	200	-199.87	-0.06
Channel Y + Input	2000	2000	0.00
Channel Y + Input	200	199.53	-0.24
Channel Y - Input	200	-199.88	-0.06
Channel Z + Input	2000	2000.1	0.00
Channel Z + Input	200	198.68	-0.66
Channel Z - Input	200	-201.09	0.55

#### 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 ( $\mu\text{V}$ )	Low Range Average Reading ( $\mu\text{V}$ )
Channel X	200	20.74	20.84
	- 200	-20.15	-21.59
Channel Y	200	20.84	20.81
	- 200	-22.13	-21.66
Channel Z	200	-8.34	-8.84
	- 200	6.99	7.01

#### 3. Channel separation

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

	Input Voltage (mV)	Channel X ( $\mu\text{V}$ )	Channel Y ( $\mu\text{V}$ )	Channel Z ( $\mu\text{V}$ )
Channel X	200	-	-0.48	-0.24
Channel Y	200	-0.12	-	2.63
Channel Z	200	-2.59	-0.19	-

**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	16047	15921
Channel Y	16153	16136
Channel Z	16201	16095

**5. Input Offset Measurement**

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

Input 10M $\Omega$

	Average ( $\mu$ V)	min. Offset ( $\mu$ V)	max. Offset ( $\mu$ V)	Std. Deviation ( $\mu$ V)
Channel X	0.89	-0.27	2.49	0.47
Channel Y	-1.24	-2.18	0.71	0.43
Channel Z	-1.23	-2.13	-0.11	0.38

**6. Input Offset Current**

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

**7. Input Resistance**

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2000	202.1
Channel Y	0.2000	202.1
Channel Z	0.2000	203.3

**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

**ANNEX G: THE EUT APPEARANCES AND TEST CONFIGURATION**



Picture 4: Constituents of the sample



Picture 5: Left Hand Touch Cheek Position



Picture 6: Left Hand Tilt 15 Degree Position



Picture 7: Right Hand Touch Cheek Position



Picture 8: Right Hand Tilt 15 Degree Position



Picture 9: Body, The EUT display towards ground, the distance from handset to the bottom of the Phantom is 15mm)



Picture 10: Body, The EUT display towards phantom, the distance from handset to the bottom of the Phantom is 15mm)