



## Calibration Certificate of DASY

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



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Accréditation No.: SCS 108

Client Sporton (Auden)

Certificate No: D835V2-499\_Mar08

### CALIBRATION CERTIFICATE

Object D835V2 - SN: 499

Calibration procedure(s) QA CAL-05.v7  
Calibration procedure for dipole validation kits

Calibration date March 17, 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  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Power sensor HP 8481A	US37292783	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Reference 20 dB Attenuator	SN: 5086 (20g)	07-Aug-07 (METAS, No 217-00718)	Aug-08
Reference Probe ES3DV2	SN: 3025	01-Mar-08 (SPEAG, No. ES3-3025_Mar08)	Mar-09
DAE4	SN 909	03-Sep-07 (SPEAG, No. DAE4-909_Sep07)	Sep-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-07)	In house check: Oct-08
RF generator R&S SMT-06	100005	04-Aug-99 (SPEAG, in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Oct-07)	In house check: Oct-08

Calibrated by:	Name	Function	Signature
	Claudio Laubler	Laboratory Technician	

Approved by:	Name	Function	Signature
	Katja Pokovit	Technical Manager	

Issued: March 17, 2008

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

### Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

### 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) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### Additional Documentation:

- d) DASY4 System Handbook

### Methods Applied and Interpretation of Parameters:

- **Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- **Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- **Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- **Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- **SAR measured:** SAR measured at the stated antenna input power.
- **SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- **SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.



## Calibration Certificate of DASY

### Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	$dx, dy, dz = 5 \text{ mm}$	
Frequency	$835 \text{ MHz} \pm 1 \text{ MHz}$	

### Head TSL parameters

The following parameters and calculations were applied

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	$22.0 \text{ }^{\circ}\text{C}$	41.5	0.90 mho/m
Measured Head TSL parameters	$(22.0 \pm 0.2) \text{ }^{\circ}\text{C}$	$41.5 \pm 6 \text{ \%}$	$0.90 \text{ mho/m} \pm 6 \text{ \%}$
Head TSL temperature during test	$(22.0 \pm 0.2) \text{ }^{\circ}\text{C}$	—	—

### SAR result with Head TSL

SAR averaged over $1 \text{ cm}^3$ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.29 mW / g
SAR normalized	normalized to 1W	9.16 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	9.16 mW / g $\pm 17.0 \text{ \% (k=2)}$

SAR averaged over $10 \text{ cm}^3$ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.50 mW / g
SAR normalized	normalized to 1W	6.00 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	6.00 mW / g $\pm 16.5 \text{ \% (k=2)}$

<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	55.2	0.97 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	54.0 ± 6 %	1.00 mho/m ± 6 %
<b>Body TSL temperature during test</b>	(22.0 ± 0.2) °C	—	—

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.48 mW / g
SAR normalized	normalized to 1W	9.84 mW / g
SAR for nominal Body TSL parameters. <sup>2</sup>	normalized to 1W	9.52 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.63 mW / g
SAR normalized	normalized to 1W	6.52 mW / g
SAR for nominal Body TSL parameters. <sup>2</sup>	normalized to 1W	6.37 mW / g ± 16.5 % (k=2)

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



## Calibration Certificate of DASY

### Appendix

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.9 $\Omega$ - 2.3 $\mu\Omega$
Return Loss	-26.9 dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.2 $\Omega$ - 3.3 $\mu\Omega$
Return Loss	-29.3 dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.392 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	July 10, 2003



**DASY4 Validation Report for Head TSL**

Date/Time: 17.03.2008 11:32:45

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:499**

Communication System: CW-835; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL 900 MHz;

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.9$  mho/m;  $\epsilon_r = 41.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(6.09, 6.09, 6.09); Calibrated: 01.03.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sa909; Calibrated: 03.09.2007
- Phantom: Flat Phantom 4.9L, Type: QD000P49AA, ;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 172

**Unnamed procedure/Zoom Scan (7x7x7)/Cube 0:**

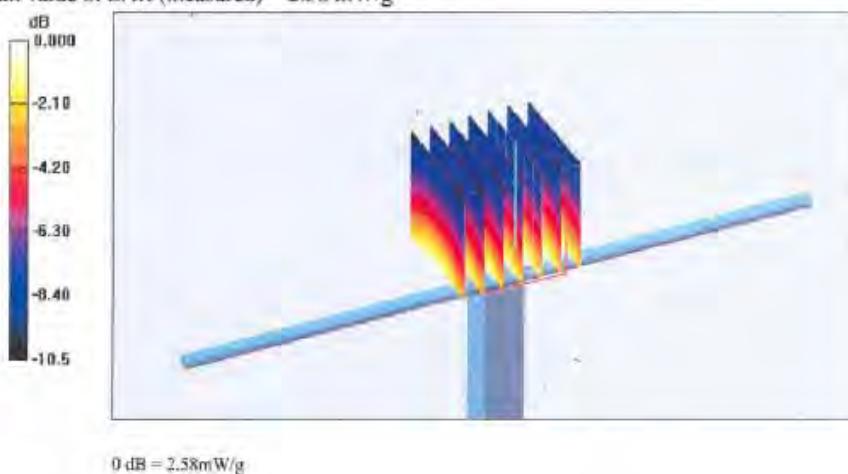
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.9 V/m; Power Drift = -0.005 dB

Peak SAR (extrapolated) = 3.34 W/kg

SAR(1 g) = 2.29 mW/g; SAR(10 g) = 1.5 mW/g

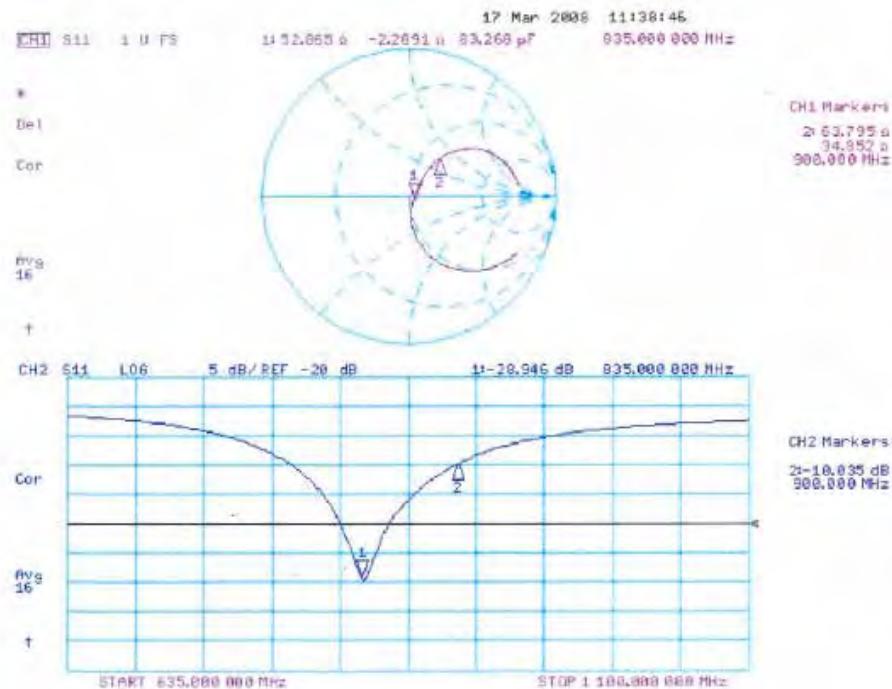
Maximum value of SAR (measured) = 2.58 mW/g



0 dB = 2.58mW/g



Impedance Measurement Plot for Head TSL





**DASY4 Validation Report for Body TSL**

Date/Time: 10.03.2008 12:48:36

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:499**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL900;

Medium parameters used:  $f = 835$  MHz;  $\sigma = 1$  mho/m;  $\epsilon_r = 54$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(5.85, 5.85, 5.85); Calibrated: 01.03.2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 03.09.2007
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; -
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 172

**Pin = 250mW, d = 15mm/Zoom Scan (7x7x7)/Cube 0:**

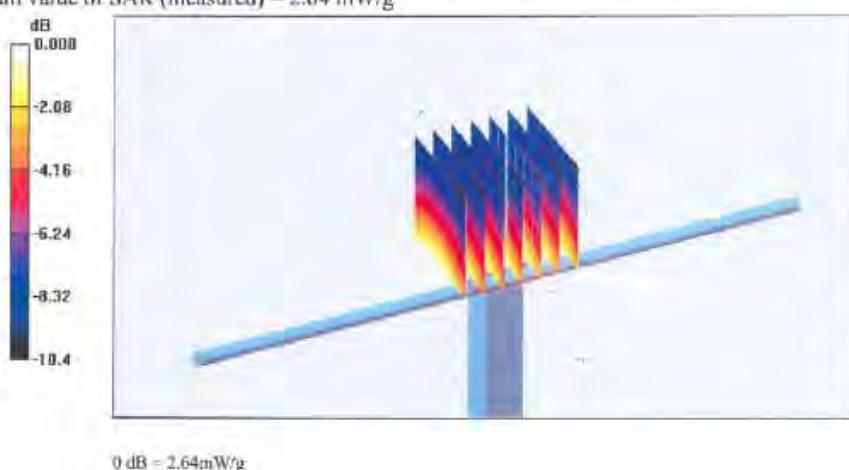
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 51.8 V/m; Power Drift = 0.036 dB

Peak SAR (extrapolated) = 3.59 W/kg

SAR(1 g) = 2.46 mW/g; SAR(10 g) = 1.63 mW/g

Maximum value of SAR (measured) = 2.64 mW/g

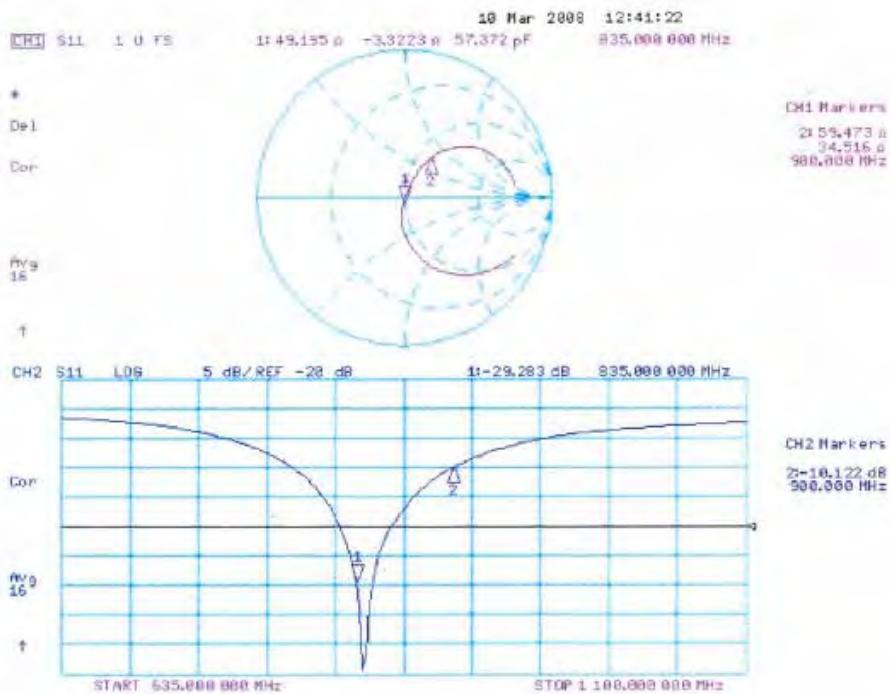


0 dB = 2.64mW/g



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### Impedance Measurement Plot for Body TSL





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Client **Sportun (Auden)**

Accreditation No.: **SCS 108**

Certificate No: **D835V2-4d091\_Nov09**

### CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d091**

Calibration procedure(s) **QA CAL-05.v7**  
 Calibration procedure for dipole validation kits

Calibration date: **November 23, 2009**

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  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-09 (No. 217-01086)	Oct-10
Power sensor HP 8481A	US37292783	06-Oct-09 (No. 217-01086)	Oct-10
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV3	SN: 3205	26-Jun-09 (No. ES3-3205_Jun09)	Jun-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10

Calibrated by: **Name: Jeton Kastrati** **Function: Laboratory Technician**

Approved by: **Katja Pokovic** **Technical Manager**

Issued: November 24, 2009

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Accreditation No.: **SCS 108**

### Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

### 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) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### Additional Documentation:

- d) DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.



### Measurement Conditions

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

<b>DASY Version</b>	DASY5	V5.2
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom V4.9	
<b>Distance Dipole Center - TSL</b>	15 mm	with Spacer
<b>Zoom Scan Resolution</b>	dx, dy, dz = 5 mm	
<b>Frequency</b>	835 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Head TSL parameters</b>	22.2 °C	41.5	0.90 mho/m
<b>Measured Head TSL parameters</b>	(22.0 ± 0.2) °C	41.6 ± 6 %	0.89 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	2.38 mW / g
SAR normalized	normalized to 1W	9.52 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>9.60 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	1.56 mW / g
SAR normalized	normalized to 1W	6.24 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	<b>6.28 mW /g ± 16.5 % (k=2)</b>



### **Body TSL parameters**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
<b>Nominal Body TSL parameters</b>	22.0 °C	55.2	0.97 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	53.2 ± 6 %	1.01 mho/m ± 6 %
<b>Body TSL temperature during test</b>	(21.8 ± 0.2) °C	---	---

### **SAR result with Body TSL**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.55 mW / g
SAR normalized	normalized to 1W	10.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.80 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.67 mW / g
SAR normalized	normalized to 1W	6.68 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.49 mW / g ± 16.5 % (k=2)



## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.0 $\Omega$ - 1.4 $j\Omega$
Return Loss	- 32.3 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.5 $\Omega$ - 3.1 $j\Omega$
Return Loss	- 29.2 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.406 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	September 15, 2008



**DASY5 Validation Report for Head TSL**

Date/Time: 23.11.2009 10:32:03

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d091**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL900

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.89$  mho/m;  $\epsilon_r = 41.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.04, 6.04, 6.04); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

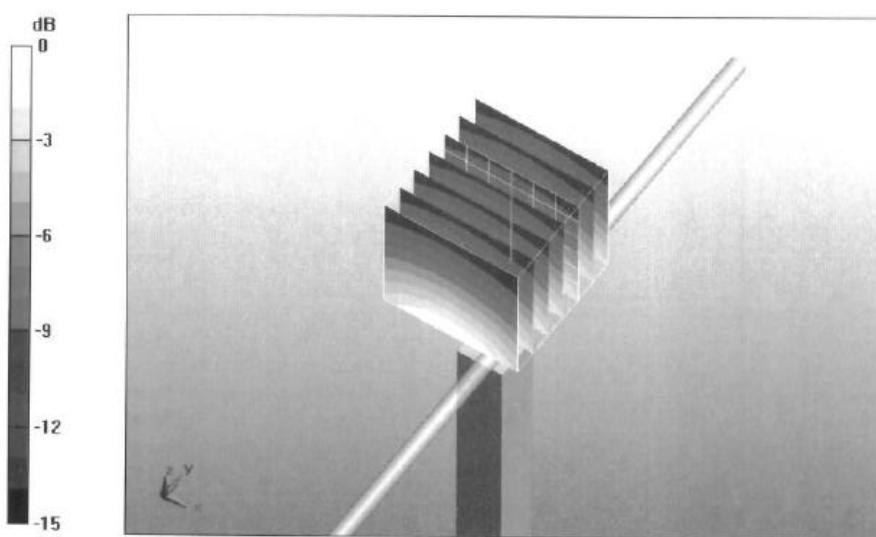
**Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 57.3 V/m; Power Drift = 0.020 dB

Peak SAR (extrapolated) = 3.56 W/kg

**SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.56 mW/g**

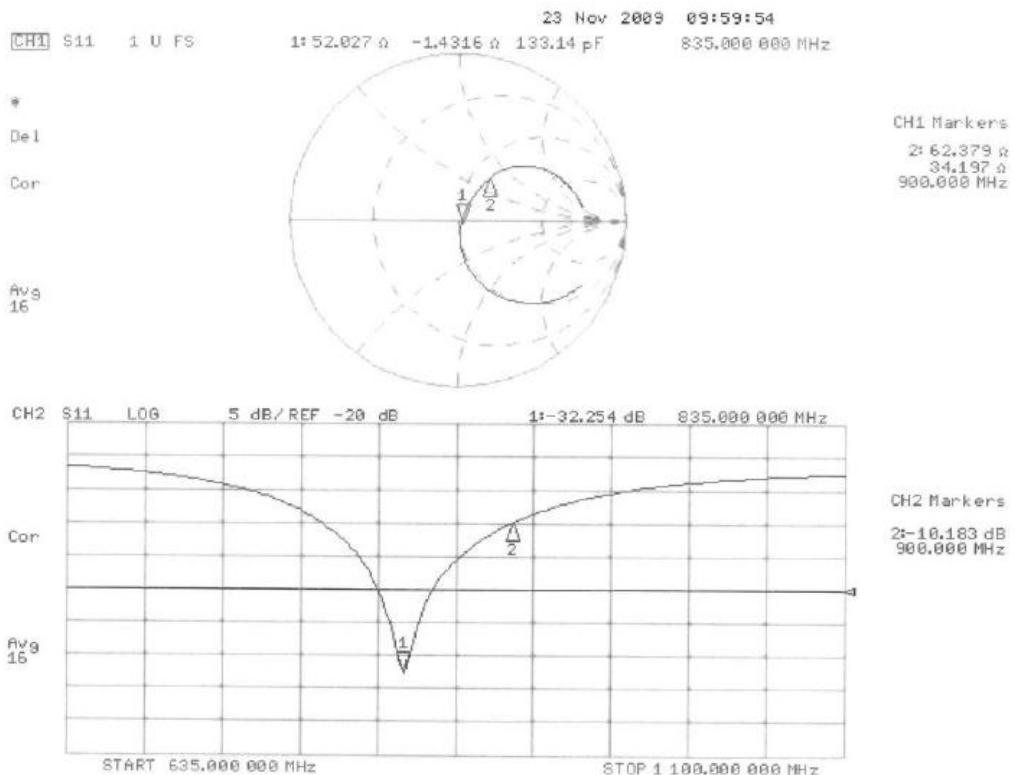
Maximum value of SAR (measured) = 2.78 mW/g



0 dB = 2.78mW/g



Impedance Measurement Plot for Head TSL





**DASY5 Validation Report for Body**

Date/Time: 16.11.2009 10:48:20

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:4d091**

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: MSL900

Medium parameters used:  $f = 835$  MHz;  $\sigma = 1.01$  mho/m;  $\epsilon_r = 53.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.97, 5.97, 5.97); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

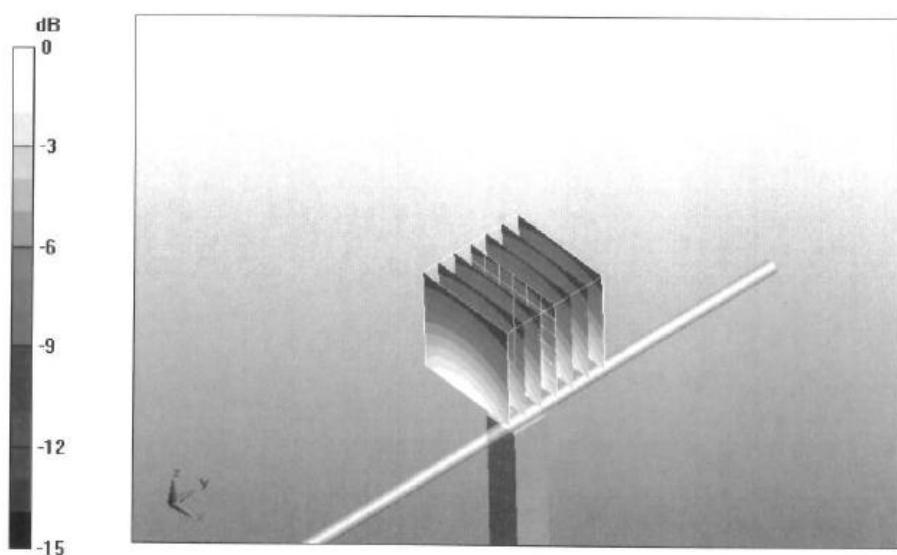
**Pin250 mW/d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.7 V/m; Power Drift = 0.016 dB

Peak SAR (extrapolated) = 3.79 W/kg

**SAR(1 g) = 2.55 mW/g; SAR(10 g) = 1.67 mW/g**

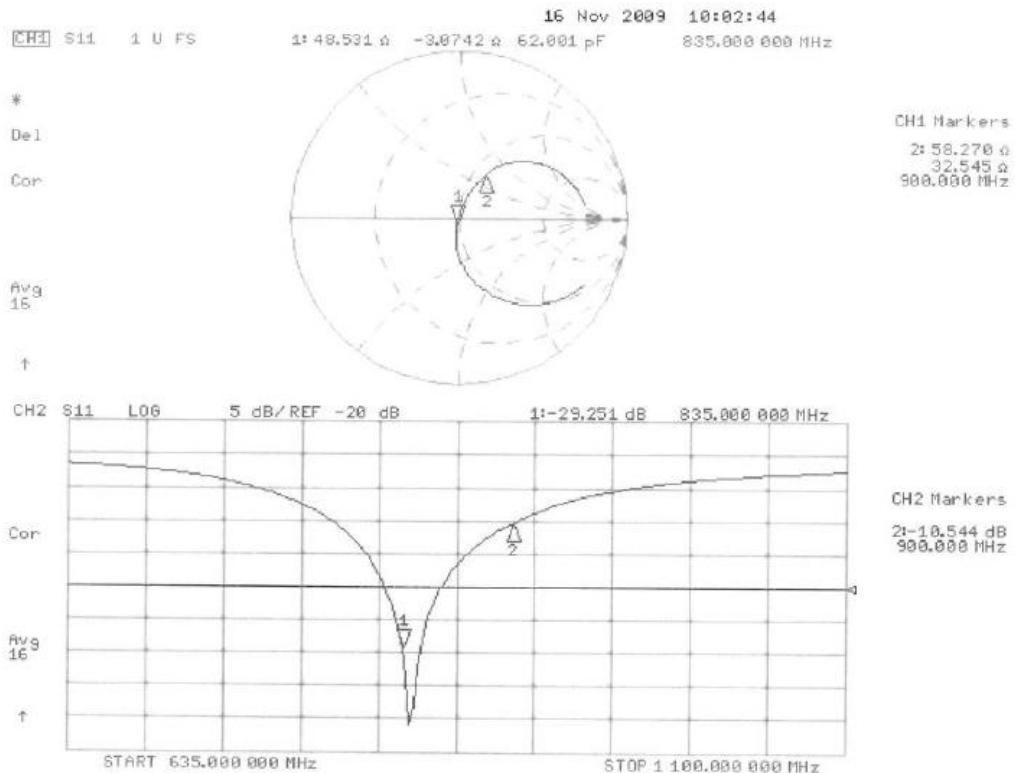
Maximum value of SAR (measured) = 2.95 mW/g



0 dB = 2.95mW/g



**Impedance Measurement Plot for Body TSL**





## Calibration Certificate of DASY

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Accreditation No.: **SCS 108**

Client **Sporton (Auden)**

Certificate No: **D1800V2-2d076\_Jul09**

### CALIBRATION CERTIFICATE

Object

**D1800V2 - SN: 2d076**

Calibration procedure(s)

**QA CAL-05.v7**  
 Calibration procedure for dipole validation kits

Calibration date:

**July 20, 2009**

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 EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV2	SN: 3025	30-Apr-09 (No. ES3-3025_Apr09)	Apr-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

Calibrated by:	Name	Function	Signature
	Claudio Leubler	Laboratory Technician	

Approved by:	Name	Function	Signature
	Katja Pokovic	Technical Manager	

Issued: July 22, 2009

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## Calibration Certificate of DASY

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



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**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:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

### 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) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### Additional Documentation:

- d) DASY4/5 System Handbook

### Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.



## Calibration Certificate of DASY

### Measurement Conditions

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

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1800 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.0 ± 6 %	1.37 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	***	***

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	condition	
SAR measured	250 mW input power	9.65 mW /g
SAR normalized	normalized to 1W	38.6 mW /g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	39.3 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.12 mW /g
SAR normalized	normalized to 1W	20.5 mW /g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	20.7 mW / g ± 16.5 % (k=2)

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



## Calibration Certificate of DASY

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.6 ± 6 %	1.48 mho/m ± 6 %
Body TSL temperature during test	(21.4 ± 0.2) °C	---	---

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	condition	
SAR measured	250 mW input power	9.53 mW /g
SAR normalized	normalized to 1W	38.1 mW /g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	38.8 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.07 mW /g
SAR normalized	normalized to 1W	20.3 mW /g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	20.5 mW / g ± 16.5 % (k=2)

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



## Calibration Certificate of DASY

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### Appendix

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.9 $\Omega$ - 4.0 $\mu\Omega$
Return Loss	- 27.5 dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.7 $\Omega$ - 4.0 $\mu\Omega$
Return Loss	- 23.1 dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.210 ns
----------------------------------	----------

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	May 26, 2003



**DASY5 Validation Report for Head TSL**

Date/Time: 20.07.2009 12:17:31

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1800 MHz; Type: D1800V2; Serial: SN:2d076**

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium: HSL U11 BB

Medium parameters used:  $f = 1800$  MHz;  $\sigma = 1.37$  mho/m;  $\epsilon_r = 41.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.93, 4.93, 4.93); Calibrated: 30.04.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

**Pin = 250 mW; dip = 10 mm, scan at 3.0mm/Zoom Scan (dist=3mm, probe 0deg)**

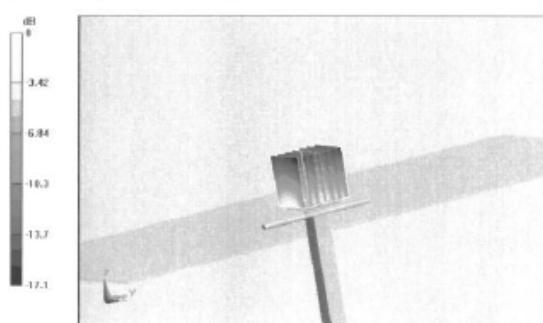
**(7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.7 V/m; Power Drift = 0.067 dB

Peak SAR (extrapolated) = 17.4 W/kg

**SAR(1 g) = 9.65 mW/g; SAR(10 g) = 5.12 mW/g**

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

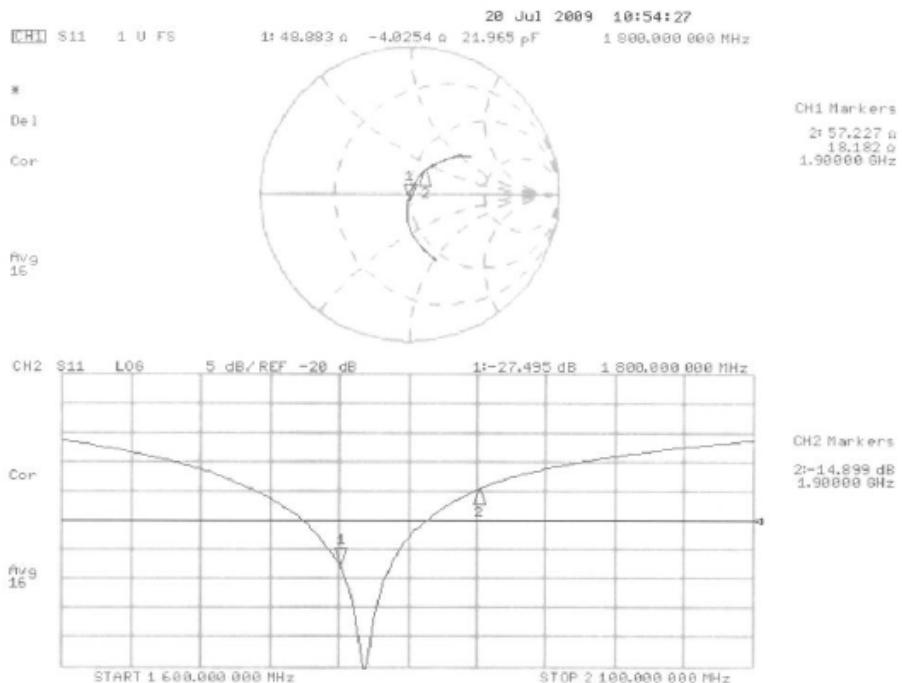


0 dB = 11.9mW/g



## Calibration Certificate of DASY

### Impedance Measurement Plot for Head TSL





## Calibration Certificate of DASY

### DASY5 Validation Report for Body TSL

Date/Time: 14.07.2009 14:24:29

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1800 MHz; Type: D1800V2; Serial: SN:2d076**

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium: MSL U10 BB

Medium parameters used:  $f = 1800$  MHz;  $\sigma = 1.48$  mho/m;  $\epsilon_r = 53.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.62, 4.62, 4.62); Calibrated: 30.04.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

**Pin = 250 mW; dip = 10 mm, scan at 3.0mm/Zoom Scan (dist=3.0mm, probe 0deg)**

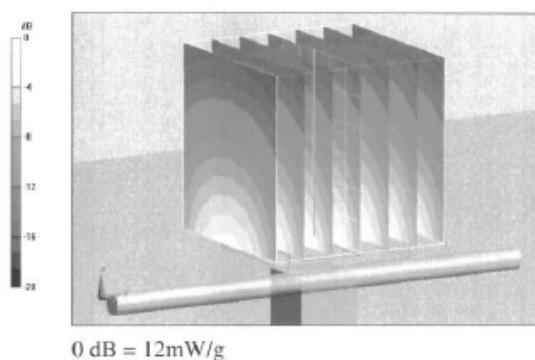
**(7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.5 V/m; Power Drift = 0.042 dB

Peak SAR (extrapolated) = 16.6 W/kg

SAR(1 g) = 9.53 mW/g; SAR(10 g) = 5.07 mW/g

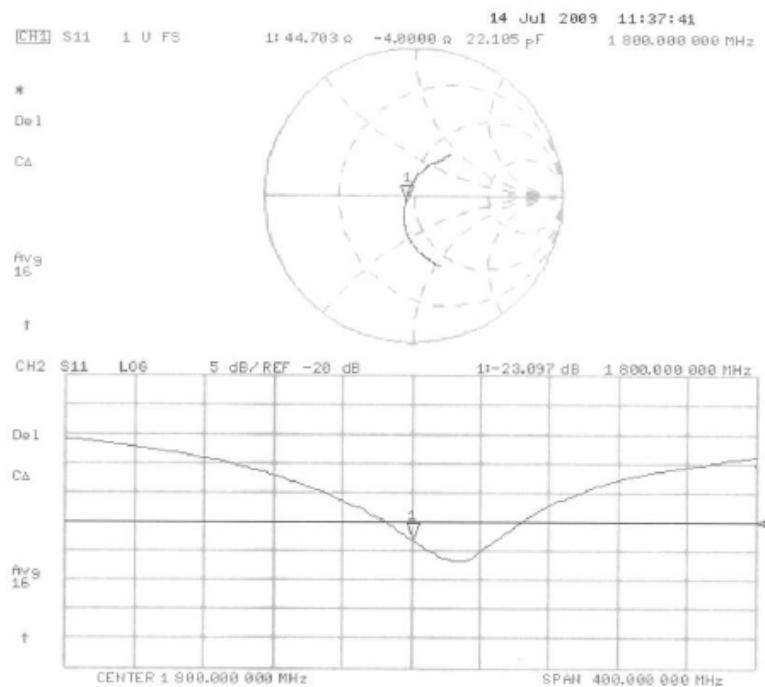
Maximum value of SAR (measured) = 12 mW/g





## Calibration Certificate of DASY

### Impedance Measurement Plot for Body TSL





## Calibration Certificate of DASY

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Sportun (Auden)**

Certificate No: **D1900V2-5d041\_Mar08**

### CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d041**

Calibration procedure(s) **QA CAL-05.v7**  
Calibration procedure for dipole validation kits

Calibration date: **March 18, 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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB374807/04	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Power sensor HP 8481A	US57292793	04-Oct-07 (METAS, No. 217-00736)	Oct-08
Reference 20 dB Attenuator	SN: 5086 (20g)	07-Aug-07 (METAS, No. 217-00718)	Aug-08
Reference 10 dB Attenuator	SN: 5047.2 (10r)	07-Aug-07 (METAS, No. 217-00718)	Aug-08
Reference Probe ESDBV2	SN: 3025	01-Mar-03 (SPEAG, No. ES3-3025_Mar-03)	Mar-08
DAE4	SN 909	3-Sep-08 (SPEAG, No. DAE4-909_Sep07)	Sep-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY4/092317	18-Oct-02 (SPEAG, in house check Oct-07)	In house check: Oct-08
RF generator R&S SMT-06	100005	4-Aug-99 (SPEAG, in house check Oct-07)	In house check: Oct-08
Network Analyzer HP 8753E	US57390585/S4706	18-Oct-01 (SPEAG, in house check Oct-07)	In house check: Oct-08
Power meter EPM-442A	GB37480704	04-Oct-07 (METAS, No. 217-00736)	Oct-08

Calibrated by:	Name	Function	Signature
	Marcel Fahr	Laboratory Technician	
Approved by:	Katja Pölkovc	Technical Manager	

Issued: March 18, 2008

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## Calibration Certificate of DASY

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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
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

### Calibration is Performed According to the Following Standards:

- 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
- 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
- Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

### Additional Documentation:

- DASY4 System Handbook

### Methods Applied and Interpretation of Parameters:

- Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:* SAR measured at the stated antenna input power
- SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.



## Calibration Certificate of DASY

### Measurement Conditions

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

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

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.2 ± 6 %	1.47 mho/m ± 6 %
Head TSL temperature during test	(21.1 ± 0.2) °C	—	—

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 mW / g
SAR normalized	normalized to 1W	40.4 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	39.5 mW / g ± 17.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.20 mW / g
SAR normalized	normalized to 1W	20.6 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	20.6 mW / g ± 16.5 % (k=2)

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



## Calibration Certificate of DASY

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.6 ± 6 %	1.57 mho/m ± 6 %
Body TSL temperature during test	(21.4 ± 0.2) °C	—	—

### SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.4 mW / g
SAR normalized	normalized to 1W	41.6 mW / g
SAR for nominal Body TSL parameters <sup>a</sup>	normalized to 1W	40.1 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.44 mW / g
SAR normalized	normalized to 1W	21.8 mW / g
SAR for nominal Body TSL parameters <sup>a</sup>	normalized to 1W	21.3 mW / g ± 16.5 % (k=2)

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



## Calibration Certificate of DASY

### Appendix

#### Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.0 $\Omega$ + 5.1 $\text{j}\Omega$
Return Loss	-24.2 dB

#### Antenna Parameters with Body TSL

Impedance, transformed to feed point	48.0 $\Omega$ + 6.1 $\text{j}\Omega$
Return Loss	-23.6 dB

#### General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 ns
----------------------------------	----------

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	July 04, 2003



## Calibration Certificate of DASY

### DASY4 Validation Report for Head TSL

Date/Time: 18.03.2008 12:05:10

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d041

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;  $\epsilon_r = 40.2$ ;  $\rho = 1000$  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: 01.03.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 03.09.2007
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 172

#### Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:

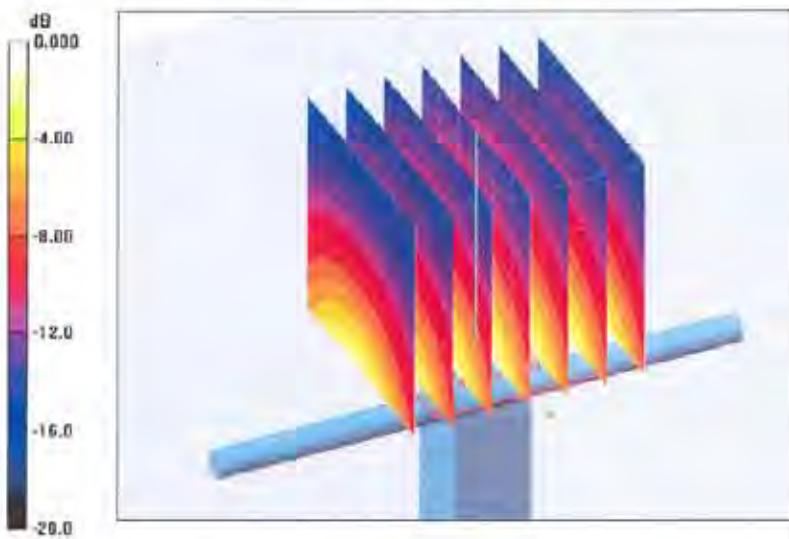
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.7 V/m; Power Drift = 0.013 dB

Peak SAR (extrapolated) = 19.1 W/kg

SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.2 mW/g

Maximum value of SAR (measured) = 11.8 mW/g

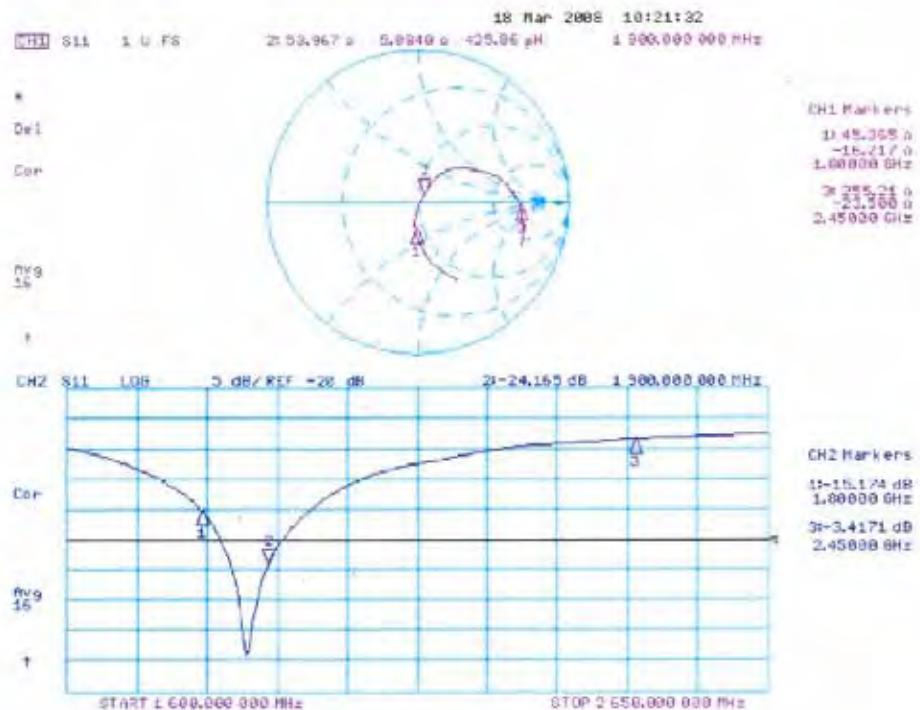


0 dB = 11.8mW/g



## Calibration Certificate of DASY

### Impedance Measurement Plot for Head TSL





DASY4 Validation Report for Body TSL

Date/Time: 14.03.2008 13:22:24

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d041

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

Medium: MSL U10 BB;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.57$  mho/m;  $\epsilon_r = 51.7$ ;  $\rho = 1000$  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: 01.03.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn909; Calibrated: 03.09.2007
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA;
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 172.

**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:**

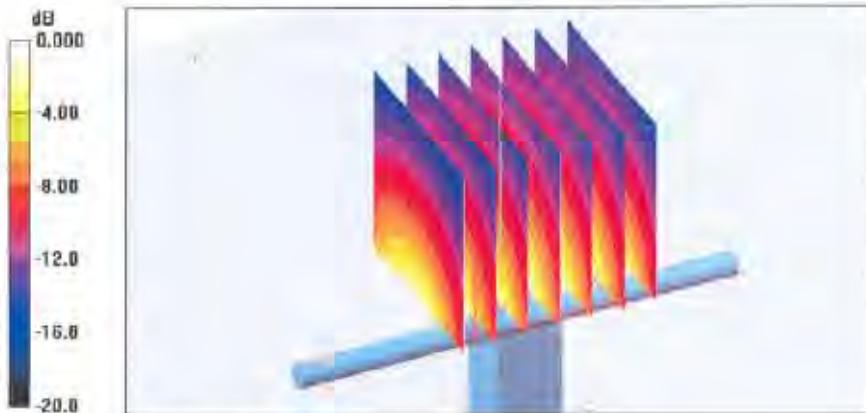
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.7 V/m; Power Drift = 0.004 dB

Peak SAR (extrapolated) = 18.6 W/kg

SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.44 mW/g

Maximum value of SAR (measured) = 12.0 mW/g



0 dB = 12.0 mW/g



Impedance Measurement Plot for Body TSL

