

### Impedance Measurement Plot for Head TSL

Certificate No: D1900V2-5d027\_Apr09

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### **DASY5 Validation Report for Body TSL**

Date/Time: 21.04.2009 14:59:34

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d027

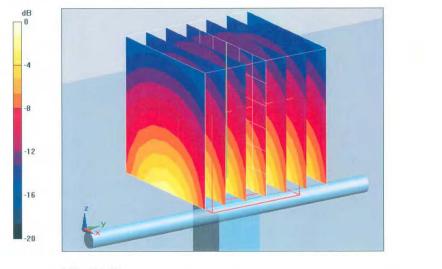
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium: MSL U10 BB Medium parameters used: f = 1900 MHz;  $\sigma = 1.56 \text{ mho/m}$ ;  $\varepsilon_r = 55$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 SN3025; ConvF(4.5, 4.5, 4.5); Calibrated: 28.04.2008 .
- 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/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96 V/m; Power Drift = 0.016 dB Peak SAR (extrapolated) = 18.5 W/kg SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.58 mW/g Maximum value of SAR (measured) = 13.4 mW/g



 $0 \, dB = 13.4 \, mW/g$ 

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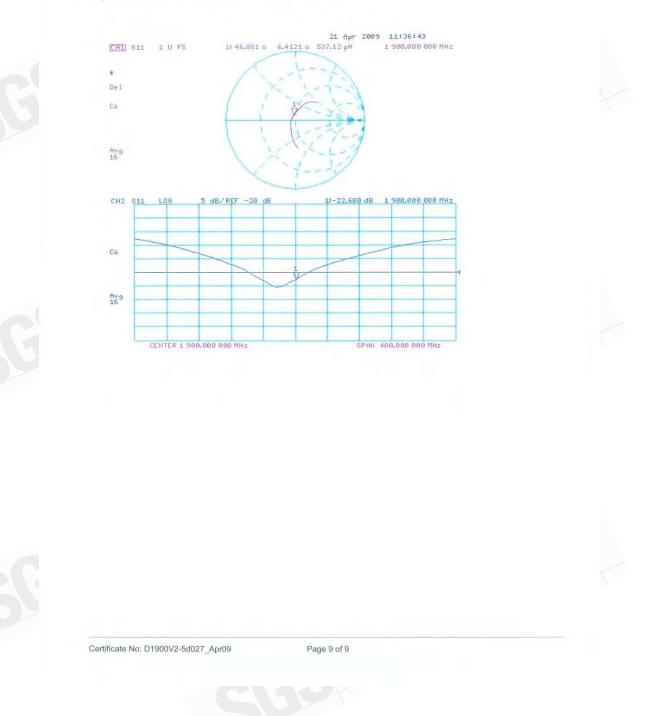
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### Impedance Measurement Plot for Body TSL



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Multilateral Agreement for the r	e is one of the signatorie recognition of calibration		
Client SGS (Auden)	CERTIFICATE		D1750V2_1008_May09
Object	D1750V2 - SN: 1		
Calibration procedure(s)	QA CAL-05.v6 Calibration proce	dure for dipole validation kits	
Calibration date:	May 7, 2009		
Condition of the calibrated item	In Tolerance		and the second second
The measurements and the unce	ertainties with confidence p cted in the closed laborator	onal standards, which realize the physical units robability are given on the following pages and y facility: environment temperature $(22 \pm 3)^{\circ}C$ a	are part of the certificate.
The measurements and the unce All calibrations have been conduc Calibration Equipment used (M& Primary Standards Power meter EPM-442A	ertainties with confidence p cted in the closed laborator TE critical for calibration) ID # GB37480704	robability are given on the following pages and y facility: environment temperature (22 ± 3)°C a Cal Date (Calibrated by, Certificate No.) 08-Oct-08 (No. 217-00898)	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09
The measurements and the unce All calibrations have been conduc Calibration Equipment used (M& Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator	ertainties with confidence p cted in the closed laborator TE critical for calibration) ID # GB37480704 US37292783 SN: 5086 (209)	robability are given on the following pages and y facility: environment temperature (22 ± 3)°C a Cal Date (Calibrated by, Certificate No.) 08-Oct-08 (No. 217-00898) 08-Oct-08 (No. 217-00898) 31-Mar-09 (No. 217-01025)	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09 Oct-09 Mar-10
The measurements and the unce All calibrations have been conduct Calibration Equipment used (M& Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV2	tertainties with confidence p ted in the closed laborator TE critical for calibration) ID # GB37480704 US37292783 SN: 5086 (20g) SN: 5047.2 / 06327 SN: 3025	Cal Date (Calibrated by, Certificate No.)           08-Oct-08 (No. 217-00898)           31-Mar-09 (No. 217-01025)           31-Mar-09 (No. 217-01029)           30-Apr-09 (No. 217-01029)	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09 Oct-09 Mar-10 Mar-10 Apr-10
The measurements and the unce All calibrations have been conduct Calibration Equipment used (M& Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV2 DAE4	rtainties with confidence p cted in the closed laborator TE critical for calibration) ID # GB37480704 US37292783 SN: 5086 (20g) SN: 5087.2 / 06327 SN: 3025 SN: 601	Cal Date (Calibrated by, Certificate No.)           08-Oct-08 (No. 217-00898)           03-Oct-08 (No. 217-00898)           31-Mar-09 (No. 217-01025)           31-Mar-09 (No. ES3-3025_Apr09)           07-Mar-09 (No. DAE4-601_Mar09)	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09 Oct-09 Mar-10 Mar-10 Mar-10 Mar-10
The measurements and the unce All calibrations have been conduc Calibration Equipment used (M& Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV2 DAE4 Secondary Standards	rtainties with confidence p cted in the closed laborator TE critical for calibration) ID # GB37480704 US37292783 SN: 5086 (20g) SN: 5087.2 / 06327 SN: 3025 SN: 601 ID #	Cal Date (Calibrated by, Certificate No.) 08-Oct-08 (No. 217-00898) 08-Oct-08 (No. 217-00898) 08-Oct-08 (No. 217-00898) 31-Mar-09 (No. 217-01025) 31-Mar-09 (No. 217-01029) 30-Apr-09 (No. ES3-3025_Apr09) 07-Mar-09 (No. DAE4-601_Mar09) Check Date (in house)	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09 Oct-09 Mar-10 Mar-10 Mar-10 Mar-10 Scheduled Check
The measurements and the unce All calibrations have been conduct Calibration Equipment used (M& Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV2 DAE4 Secondary Standards Power sensor HP 8481A RF generator R&S SMT-06	rtainties with confidence p cted in the closed laborator TE critical for calibration) ID # GB37480704 US37292783 SN: 5086 (20g) SN: 5087.2 / 06327 SN: 3025 SN: 601	Cal Date (Calibrated by, Certificate No.)           08-Oct-08 (No. 217-00898)           03-Oct-08 (No. 217-00898)           31-Mar-09 (No. 217-01025)           31-Mar-09 (No. ES3-3025_Apr09)           07-Mar-09 (No. DAE4-601_Mar09)	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09 Oct-09 Mar-10 Mar-10 Mar-10 Mar-10
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The measurements and the unce All calibrations have been conduc Calibration Equipment used (M& Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV2 DAE4 Secondary Standards Power sensor HP 8481A RF generator R&S SMT-06 Network Analyzer HP 8753E	in the closed laborator           TE critical for calibration)           ID #           GB37480704           US37292783           SN: 5086 (20g)           SN: 5086 (20g)           SN: 5086 (20g)           SN: 5086 (20g)           SN: 608           ID #           MY41092317           100005           US37390585 S4206	robability are given on the following pages and y facility: environment temperature (22 ± 3)°C a Cal Date (Calibrated by, Certificate No.) 08-Oct-08 (No. 217-00898) 08-Oct-08 (No. 217-00898) 31-Mar-09 (No. 217-01025) 31-Mar-09 (No. 217-01029) 30-Apr-09 (No. ES3-3025_Apr09) 07-Mar-09 (No. DAE4-601_Mar09) Check Date (in house) 18-Oct-02 (in house check Oct-07) 4-Aug-99 (in house check Oct-07) 18-Oct-01 (in house check Oct-08) Function	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09 Oct-09 Mar-10 Mar-10 Mar-10 Mar-10 Scheduled Check In house check: Oct-09 In house check: Oct-09 In house check: Oct-09

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# Report No. : EN/2009/90001 Page : 165 of 194

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

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Accreditation No.: SCS 108



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

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

### 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.

Certificate No: D1750V2-1008\_May09

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#### **Measurement Conditions**

DASY sve nfiguration as far as not given on nage 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	1750 MHz ± 1 MHz	

# Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.37 mho/m ± 6 %
Head TSL temperature during test	(21.8 ± 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	9.59 mW / g
SAR normalized	normalized to 1W	38.4 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	38.1 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	5.04 mW / g
SAR normalized	normalized to 1W	20.2 mW / g

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

Certificate No: D1750V2-1008\_May09

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台灣檢驗科技股份有限公司



### **Body TSL parameters**

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.2 ± 6 %	1.43 mho/m ± 6 %
Body TSL temperature during test	(21.2 ± 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	9.25 mW / g
SAR normalized	normalized to 1W	37.0 mW/g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	38.3 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	5.01 mW / g
SAR normalized	normalized to 1W	20.0 mW / g
	normalized to 1W	20.4 mW / g ± 16.5 % (k=2)

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

Certificate No: D1750V2-1008\_May09

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### Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.6 Ω + 0.6 jΩ	
Return Loss	- 35.4 dB	

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.8 Ω + 1.5 jΩ	
Return Loss	- 28.8 dB	

### **General Antenna Parameters and Design**

Electrical Delay (one direction)	1.225 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	February 11, 2009

Certificate No: D1750V2-1008\_May09

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### **DASY5 Validation Report for Head TSL**

Date/Time: 07.05.2009 10:22:08

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1008

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium: HSL U10 BB Medium parameters used: f = 1750 MHz;  $\sigma$  = 1.37 mho/m;  $\epsilon_r$  = 38.9;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC)

**DASY5** Configuration:

- Probe: ES3DV2 SN3025; ConvF(5.04, 5.04, 5.04); 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=3.0mm, probe 0deg) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 96.3 V/m; Power Drift = 0.029 dB Peak SAR (extrapolated) = 17.5 W/kg SAR(1 g) = 9.59 mW/g; SAR(10 g) = 5.04 mW/g Maximum value of SAR (measured) = 11.8 mW/g



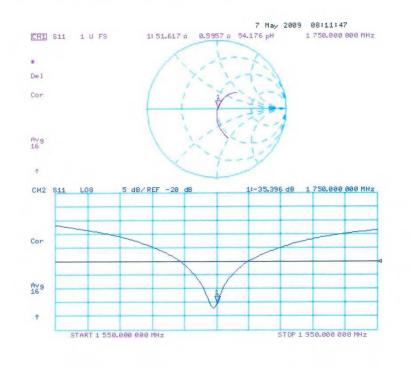
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### Impedance Measurement Plot for Head TSL



Certificate No: D1750V2-1008\_May09

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Report No. : EN/2009/90001 Page : 171 of 194

### **DASY5 Validation Report for Body TSL**

Date/Time: 07.05.2009 13:54:57

Test Laboratory: SPEAG, Zurich, Switzerland

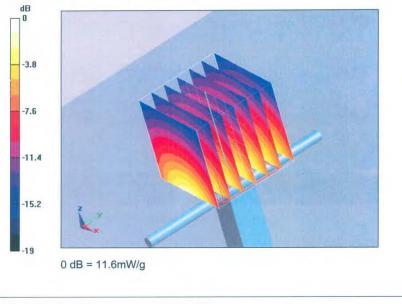
# DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN:1008

Communication System: CW; Frequency: 1750 MHz; Duty Cycle: 1:1 Medium: MSL U10 Medium parameters used: f = 1750 MHz;  $\sigma$  = 1.43 mho/m;  $\epsilon_r$  = 55.3;  $\rho$  = 1000 kg/m<sup>3</sup> Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 SN3025; ConvF(4.71, 4.71, 4.71); 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=3.4mm, probe 0deg) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm Reference Value = 93.6 V/m; Power Drift = 0.018 dB Peak SAR (extrapolated) = 15.7 W/kg SAR(1 g) = 9.25 mW/g; SAR(10 g) = 5.01 mW/g Maximum value of SAR (measured) = 11.6 mW/g



Certificate No: D1750V2-1008 May09

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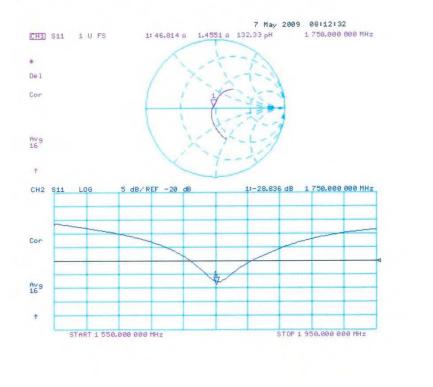
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No.134, Wu Kung Road, Wuku Industrial Zone, Taipei County, Taiwan /台北縣五股工業區五工路 134 號 t (886-2) 2299-3279 f (886-2) 2298-0488 www.tw.sgs.com



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Certificate No: D1750V2-1008\_May09

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# Report No. : EN/2009/90001 Page : 173 of 194

Accredited by the Swiss Accred			No.: SCS 108
The Swiss Accreditation Service Multilateral Agreement for the re			
Client SGS (Auden)	sognition of calibration		D2450V2-727_Apr09
			D2450V2-121_Apr05
CALIBRATION C	ERTIFICATE		
Object	D2450V2 - SN: 7	27	
Calibration procedure(s)	QA CAL-05.v7		
		dure for dipole validation kits	
Calibration date:	April 27, 2009		
Condition of the calibrated item	In Tolerance		
The measurements and the unce	rtainties with confidence p	ional standards, which realize the physical units robability are given on the following pages and	are part of the certificate.
The measurements and the unce All calibrations have been conduc	rtainties with confidence p		are part of the certificate.
The measurements and the unce All calibrations have been conduc Calibration Equipment used (M&T	rtainties with confidence p	robability are given on the following pages and	are part of the certificate.
The measurements and the unce All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Power meter EPM-442A	rtainties with confidence p eted in the closed laborator TE critical for calibration)	robability are given on the following pages and ry facility: environment temperature (22 ± 3)°C Cal Date (Calibrated by, Certificate No.) 08-Oct-08 (No. 217-00898)	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09
The measurements and the unce All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Power meter EPM-442A Power sensor HP 8481A	rtainties with confidence p ted in the closed laborator 'E critical for calibration) ID # GB37480704 US37292783	robability are given on the following pages and ry facility: environment temperature (22 ± 3)°C. Cal Date (Calibrated by, Certificate No.) 08-Oct-08 (No. 217-00898) 08-Oct-08 (No. 217-00898)	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09 Oct-09
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The measurements and the unce All calibrations have been conduc Calibration Equipment used (M&T Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination	rtainties with confidence p ted in the closed laborator 'E critical for calibration) ID # GB37480704 US37292783	robability are given on the following pages and ry facility: environment temperature (22 ± 3)°C. Cal Date (Calibrated by, Certificate No.) 08-Oct-08 (No. 217-00898) 08-Oct-08 (No. 217-00898)	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09 Oct-09
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The measurements and the unce All calibrations have been conduct Calibration Equipment used (M&T Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV2 DAE4 Secondary Standards Power sensor HP 8481A	rtainties with confidence p ted in the closed laborator TE critical for calibration) ID # GB37480704 US37292783 SN: 5086 (20g) SN: 5047.2 / 06327 SN: 3025 SN: 601 ID # MY41092317	robability are given on the following pages and ry facility: environment temperature (22 ± 3)°C. Cal Date (Calibrated by, Certificate No.) 08-Oct-08 (No. 217-00898) 08-Oct-08 (No. 217-00898) 31-Mar-09 (No. 217-01025) 31-Mar-09 (No. 217-01025) 31-Mar-09 (No. 217-01029) 28-Apr-08 (No. ES3-3025_Apr08) 07-Mar-09 (No. DAE4-601_Mar09) Check Date (in house) 18-Oct-02 (in house check Oct-07)	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09 Oct-09 Mar-10 Mar-10 Apr-09 Mar-10 Scheduled Check In house check: Oct-09
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The measurements and the unce All calibrations have been conduc Calibration Equipment used (M&1 Primary Standards Power meter EPM-442A Power sensor HP 8481A Reference 20 dB Attenuator Type-N mismatch combination Reference Probe ES3DV2 DAE4 Secondary Standards Power sensor HP 8481A RF generator R&S SMT-06	rtainties with confidence p ted in the closed laborator TE critical for calibration) ID # GB37480704 US37292783 SN: 5086 (20g) SN: 5047.2 / 06327 SN: 3025 SN: 601 ID # MY41092317	robability are given on the following pages and ry facility: environment temperature (22 ± 3)°C. Cal Date (Calibrated by, Certificate No.) 08-Oct-08 (No. 217-00898) 08-Oct-08 (No. 217-00898) 31-Mar-09 (No. 217-01025) 31-Mar-09 (No. 217-01025) 31-Mar-09 (No. 217-01029) 28-Apr-08 (No. ES3-3025_Apr08) 07-Mar-09 (No. DAE4-601_Mar09) Check Date (in house) 18-Oct-02 (in house check Oct-07)	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09 Oct-09 Mar-10 Mar-10 Apr-09 Mar-10 Scheduled Check In house check: Oct-09
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The measurements and the unce	rtainties with confidence p ted in the closed laborator TE critical for calibration) ID # GB37480704 US37292783 SN: 5086 (20g) SN: 5047.2 / 06327 SN: 601 ID # MY41092317 100005 US37390585 S4206 Name	robability are given on the following pages and ry facility: environment temperature (22 ± 3)°C. Cal Date (Calibrated by, Certificate No.) 08-Oct-08 (No. 217-00898) 08-Oct-08 (No. 217-00898) 31-Mar-09 (No. 217-01025) 31-Mar-09 (No. 217-01029) 28-Apr-08 (No. ES3-3025_Apr08) 07-Mar-09 (No. DAE4-601_Mar09) Check Date (in house) 18-Oct-02 (in house check Oct-07) 4-Aug-99 (in house check Oct-07) 18-Oct-01 (in house check Oct-08) Function	are part of the certificate. and humidity < 70%. Scheduled Calibration Oct-09 Oct-09 Mar-10 Mar-10 Mar-10 Apr-09 Mar-10 Scheduled Check In house check: Oct-09 In house check: Oct-09 In house check: Oct-09

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





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

Accreditation No.: SCS 108

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

### 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.

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### **Measurement Conditions**

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

DASY5	V5.0
Advanced Extrapolation	
Modular Flat Phantom V5.0	
10 mm	with Spacer
dx, dy, dz = 5 mm	
2450 MHz ± 1 MHz	
	Advanced Extrapolation Modular Flat Phantom V5.0 10 mm dx, dy, dz = 5 mm

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.0 ± 6 %	1.82 mho/m ± 6 %
Head TSL temperature during test	(21.6 ± 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	13.5 mW / g
SAR normalized	normalized to 1W	54.0 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	53.3 mW /g ± 17.0 % (k=2)
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL SAR measured	condition 250 mW input power	6.28 mW / g
Access of the second se		6.28 mW / g 25.1 mW / g

<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
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.4 ± 6 %	1.98 mho/m ± 6 %
Body TSL temperature during test	(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	13.2 mW / g
SAR normalized	normalized to 1W	52.8 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	52.8 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	6.18 mW / g
SAR normalized	normalized to 1W	24.7 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	24.8 mW /g ± 16.5 % (k=2)





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### Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.1 Ω + 1.2 jΩ
Return Loss	- 26.1 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.5 Ω + 3.3 jΩ
Return Loss	- 29.6 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.149 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	January 09, 2003	

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### **DASY5 Validation Report for Head TSL**

Date/Time: 27.04.2009 13:40:04

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN727

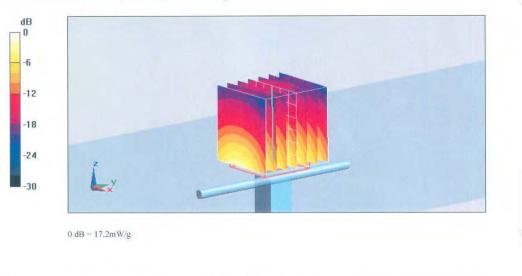
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium: HSL U10 BB Medium parameters used: f = 2450 MHz;  $\sigma = 1.82 \text{ mho/m}$ ;  $\epsilon_r = 38$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 SN3025; ConvF(4.4, 4.4, 4.4); Calibrated: 28.04.2008 .
- 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; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.3 V/m; Power Drift = 0.036 dB Peak SAR (extrapolated) = 28.3 W/kg SAR(1 g) = 13.5 mW/g; SAR(10 g) = 6.28 mW/gMaximum value of SAR (measured) = 17.2 mW/g



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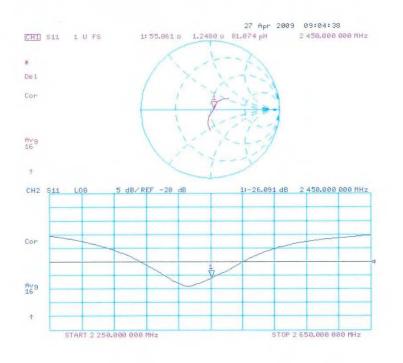
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# Impedance Measurement Plot for Head TSL



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# **DASY5 Validation Report for Body TSL**

Date/Time: 22.04.2009 13:12:14

Test Laboratory: SPEAG, Zurich, Switzerland

### DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:727

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1 Medium: MSL U10 BB Medium parameters used: f = 2450 MHz;  $\sigma = 1.98 \text{ mho/m}$ ;  $\varepsilon_r = 54.4$ ;  $\rho = 1000 \text{ kg/m}^3$ Phantom section: Flat Section Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 SN3025; ConvF(4.07, 4.07, 4.07); Calibrated: 28.04.2008 .
- 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; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.9 V/m; Power Drift = 0.031 dB Peak SAR (extrapolated) = 26.5 W/kg SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.18 mW/g Maximum value of SAR (measured) = 17.3 mW/g



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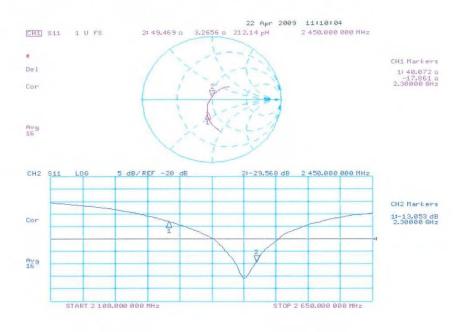
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### Impedance Measurement Plot for Body TSL



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# End of 1<sup>st</sup> part of report

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