

SONY VGN-SZ58N

Body worn

1880 MHz

### GPRS+GSM Towards ground - Middle/Zoom Scan (7x7x7)

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

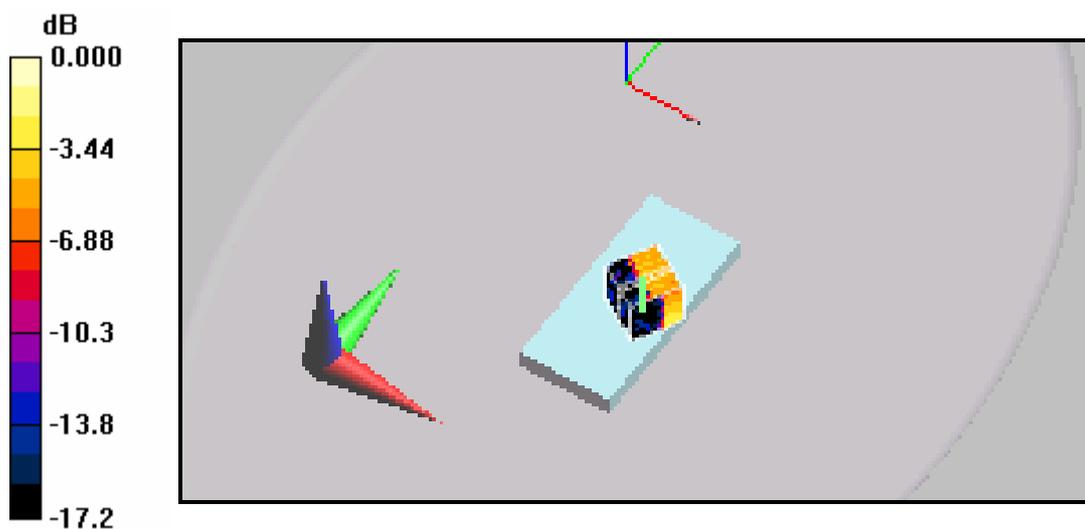
Reference Value = 15.6 V/m; Power Drift = -0.00769 dB

Peak SAR (extrapolated) = 3.13 W/kg

**SAR(1 g) = 0.902 mW/g; SAR(10 g) = 0.316 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.926 mW/g



0 dB = 0.926 mW/g

SONY VGN-SZ58N

Body worn

1850.2 MHz

**GPRS+GSM Towards ground - Low/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

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

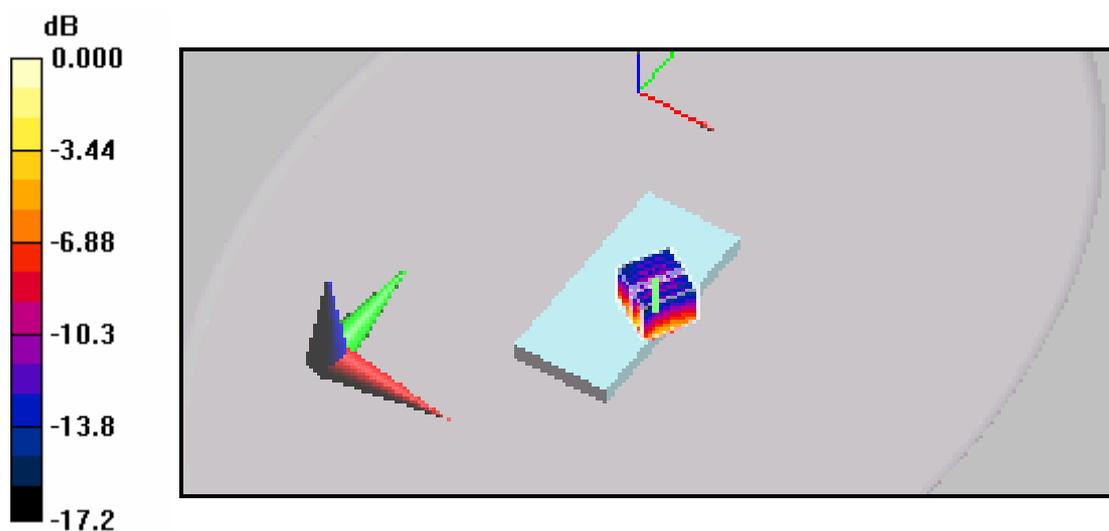
Reference Value = 15.3 V/m; Power Drift = -0.00279 dB

Peak SAR (extrapolated) = 1.69 W/kg

**SAR(1 g) = 0.910 mW/g; SAR(10 g) = 0.454 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 1.01 mW/g



0 dB = 1.01 mW/g

SONY VGN-SZ58N

Body worn

1909.8 MHz

**GPRS+GSM Towards ground - high/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

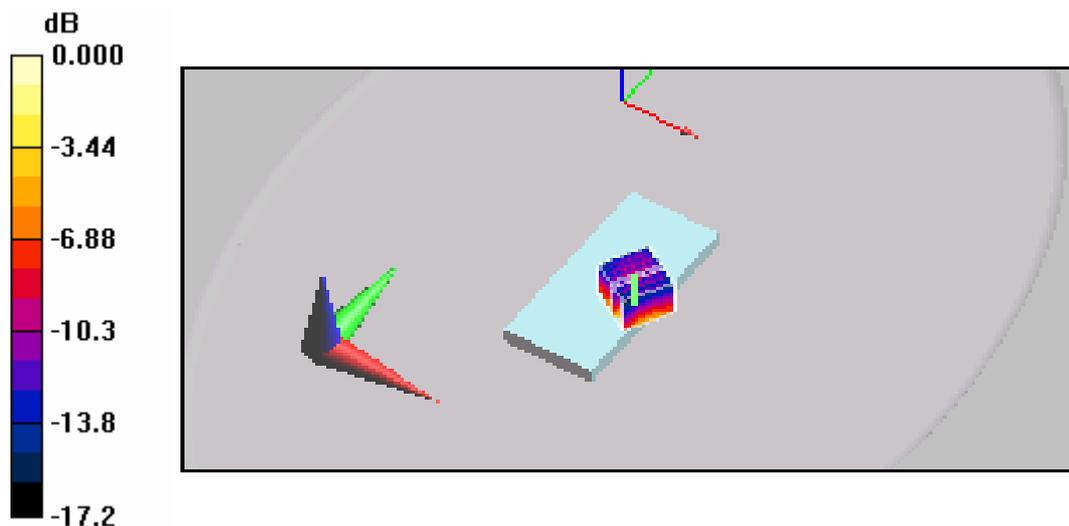
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 16.3 V/m; Power Drift = 0.032 dB

Peak SAR (extrapolated) = 1.88 W/kg

**SAR(1 g) = 0.998 mW/g; SAR(10 g) = 0.488 mW/g**

Maximum value of SAR (measured) = 1.13 mW/g



0 dB = 1.13 mW/g

SONY VGN-SZ58N

Body worn

1880 MHz

**EGPRS Towards ground -Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

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

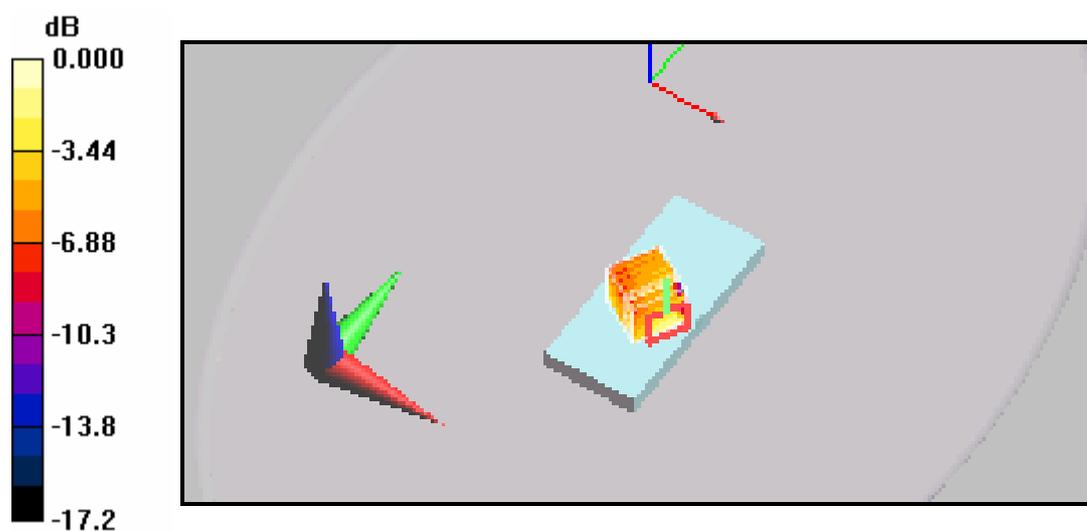
Reference Value = 7.82 V/m; Power Drift = -0.101 dB

Peak SAR (extrapolated) = 0.556 W/kg

**SAR(1 g) = 0.280 mW/g; SAR(10 g) = 0.104 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.324 mW/g



0 dB = 0.324 mW/g

IBM 2672-AEC

Body worn

1880 MHz

**EGPRS Towards ground -Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

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

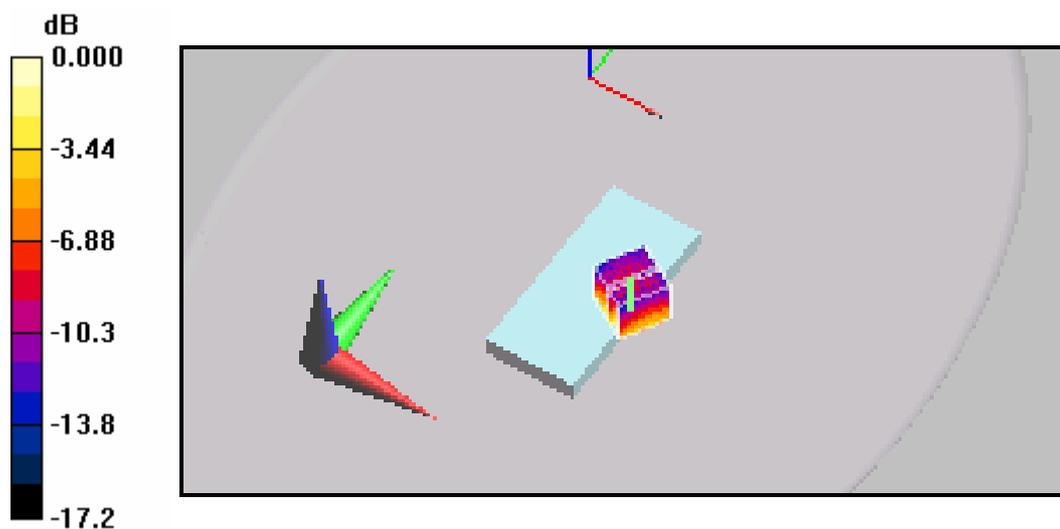
Reference Value = 5.67 V/m; Power Drift = 0.085 dB

Peak SAR (extrapolated) = 0.326 W/kg

**SAR(1 g) = 0.193 mW/g; SAR(10 g) = 0.105 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.215 mW/g



0 dB = 0.215 mW/g

DELL LATITUDE D620

Body worn

1880 MHz

**EGPRS Towards ground -Middle/Zoom Scan (7x7x7) (7x7x7)/Cube 0:**

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

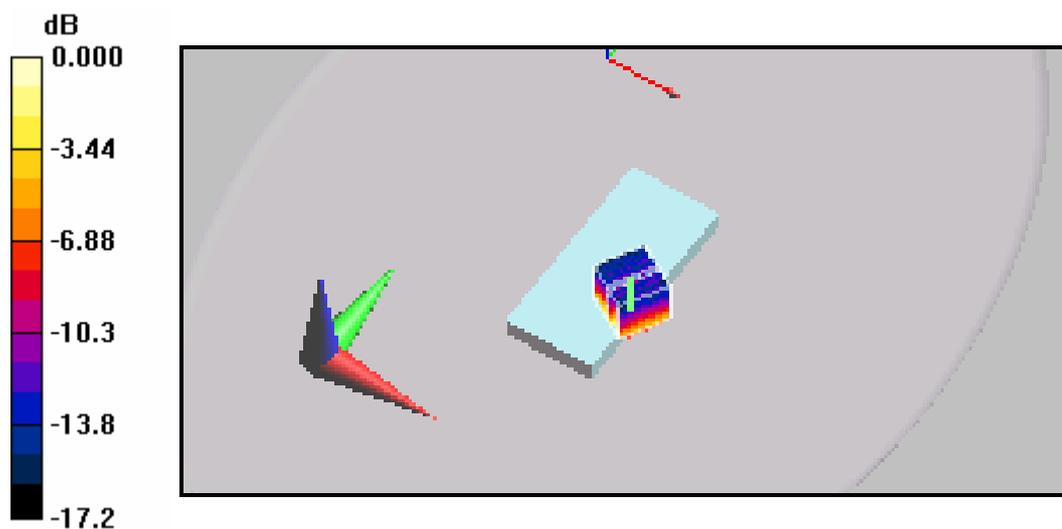
Reference Value = 2.94 V/m; Power Drift = -0.065 dB

Peak SAR (extrapolated) = 0.115 W/kg

**SAR(1 g) = 0.070 mW/g; SAR(10 g) = 0.042 mW/g**

[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 0.077 mW/g.



0 dB = 0.077 mW/g

## 7.7 Pictures of the device under test



Front view of the IBM 2672-AEC



Front view of the SONY VGN-SZ58N



Front view of the DELL LATITUDE D620

## 7.8 Test Positions for the Device under test



Lap Held Position with the IBM 2672-AEC Notebook



Lap Held Position with the SONY VGN-SZ58N Notebook



Lap Held Position with the DELL LATITUDE D620 Notebook

### 7.9 Picture to demonstrate the required liquid depth

the liquid depth in the used SAM phantoms



Liquid depth for SAR Measurement

### 7.10 Simplified Performance Checking

The simplified performance check was realized using the dipole validation kits. The input power of the dipole antennas were 250mW (cw signal) and they were placed under the flat part of the SAM phantom. The results are listed in the Table 7 .The target values were adopted from the manufactures calibration certificates which are attached in the appendix. Table 9 includes the uncertainty assessment for the system performance checking which was suggested by the IEC 62209-1-2005 and determined by Schmid & Partner Engineering AG. The expanded uncertainty is assessed to be  $\pm 21.9\%$ .

		SAR <sub>1g</sub> [w/kg]	$\epsilon_r$	$\sigma$ [S/m]	Temperature	
					Ambient[°C]	Liquid[°C]
835MHz	Target Value	2.74	55.2±2.7	0.97±0.10	15-30	-
	Measured Value	2.5	53.9	1.00	24.0	22.3

**Table17: Validation results, 835 MHz**

		SAR <sub>1g</sub> [w/kg]	$\epsilon_r$	$\sigma$ [S/m]	Temperature	
					Ambient[°C]	Liquid[°C]
1900MHz	Target Value	9.85	53.3±2.7	1.52±0.15	15-30	-
	Measured Value	9.9	51.8	1.56	24.0	22.3

**Table 18: Validation results, 1900 MHz**

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 Engineering AG  
 Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: SCS 108

Client

Certificate No: DAE4-720\_Oct06

### CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BC - SN: 720

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

Calibration date: October 20, 2006

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	13-Oct-06 (Eical AG, No: 5492)	Oct-07
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-06 (Eical AG, No: 5478)	Oct-07
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1002	15-Jun-06 (SPEAG, in house check)	In house check Jun-07

Calibrated by:	Name Stefano Giannotta	Function Technician	Signature 
Approved by:	Fin Bomholt	R&D Director	

Issued: October 24, 2006

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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 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 = 6.1 $\mu$ 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	403.516 $\pm$ 0.1% (k=2)	404.992 $\pm$ 0.1% (k=2)	403.380 $\pm$ 0.1% (k=2)
Low Range	3.94744 $\pm$ 0.7% (k=2)	3.96221 $\pm$ 0.7% (k=2)	3.92472 $\pm$ 0.7% (k=2)

**Connector Angle**

Connector Angle to be used in DASY system	168 $^{\circ}$ $\pm$ 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	20002.44	0.01
Channel X - Input	20000	-20003.13	0.02
Channel Y + Input	200000	200000.1	0.00
Channel Y + Input	20000	20003.34	0.02
Channel Y - Input	20000	-19999.90	0.00
Channel Z + Input	200000	200000.1	0.00
Channel Z + Input	20000	20002.21	0.01
Channel Z - Input	20000	-20007.43	0.04

Low Range	Input ( $\mu\text{V}$ )	Reading ( $\mu\text{V}$ )	Error (%)
Channel X + Input	2000	2000.0	0.00
Channel X + Input	200	199.49	-0.25
Channel X - Input	200	-200.73	0.36
Channel Y + Input	2000	2000.0	0.00
Channel Y + Input	200	199.23	-0.38
Channel Y - Input	200	-200.97	0.48
Channel Z + Input	2000	2000.0	0.00
Channel Z + Input	200	199.31	-0.34
Channel Z - Input	200	-200.03	0.02

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	-7.41	-6.36
	-200	7.68	7.12
Channel Y	200	15.98	15.73
	-200	-17.35	-17.00
Channel Z	200	-15.99	-16.32
	-200	15.87	15.36

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	-	1.61	0.69
Channel Y	200	-0.57	-	3.69
Channel Z	200	-2.01	1.14	-

**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	16159	15943
Channel Y	16202	16035
Channel Z	16513	13928

**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	0.73	-1.17	2.20	0.61
Channel Y	-1.50	-2.60	-0.21	0.44
Channel Z	-0.68	-2.10	1.37	0.66

**6. Input Offset Current**

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

**7. Input Resistance**

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2000	198.3
Channel Y	0.1999	199.8
Channel Z	0.2001	199.3

**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

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Accreditation No.: SCS 108

Client

Certificate No: DAE4-725\_Feb07

### CALIBRATION CERTIFICATE

Object: DAE4 - SD 000 D04 BG - SN: 725

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

Calibration date: February 26, 2007

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	13-Oct-06 (Elcal AG, No: 5492)	Oct-07
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-06 (Elcal AG, No: 5478)	Oct-07
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1002	15-Jun-06 (SPEAG, in house check)	In house check Jun-07

Calibrated by: Daniel Steinacher, Technician, Signature: *Daniel Steinacher*

Approved by: Fin Bomholt, R&D Director, Signature: *F. Bomholt*

Issued: February 26, 2007

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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 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 = 6.1 $\mu$ 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	404.194 $\pm$ 0.1% (k=2)	404.944 $\pm$ 0.1% (k=2)	404.514 $\pm$ 0.1% (k=2)
Low Range	3.89608 $\pm$ 0.7% (k=2)	3.97890 $\pm$ 0.7% (k=2)	3.97682 $\pm$ 0.7% (k=2)

### Connector Angle

Connector Angle to be used in DASY system	236 $^{\circ}$ $\pm$ 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	199999.4	0.00
Channel X + Input	20000	20008.02	0.04
Channel X - Input	20000	-19999.77	0.00
Channel Y + Input	200000	199999.9	0.00
Channel Y + Input	20000	20006.16	0.03
Channel Y - Input	20000	-20002.13	0.01
Channel Z + Input	200000	199999.3	0.00
Channel Z + Input	20000	20005.13	0.03
Channel Z - Input	20000	-20002.90	0.01

Low Range	Input ( $\mu\text{V}$ )	Reading ( $\mu\text{V}$ )	Error (%)
Channel X + Input	2000	2000.1	0.00
Channel X + Input	200	200.53	0.26
Channel X - Input	200	-199.86	-0.07
Channel Y + Input	2000	1999.9	0.00
Channel Y + Input	200	199.83	-0.08
Channel Y - Input	200	-200.83	0.42
Channel Z + Input	2000	1999.9	0.00
Channel Z + Input	200	199.07	-0.47
Channel Z - Input	200	-201.05	0.53

**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	9.53	8.54
	- 200	-6.95	-8.23
Channel Y	200	-10.33	-10.58
	- 200	10.35	9.71
Channel Z	200	-3.28	-3.83
	- 200	3.18	2.12

**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	-	3.17	-0.11
Channel Y	200	1.30	-	4.28
Channel Z	200	-0.39	1.82	-

**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	16234	17028
Channel Y	16225	15769
Channel Z	16101	15831

**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	-0.38	-2.01	2.01	0.39
Channel Y	-2.66	-3.87	-0.19	0.43
Channel Z	-1.36	-2.75	0.08	0.41

**6. Input Offset Current**

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

**7. Input Resistance**

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2001	201.0
Channel Y	0.2000	202.0
Channel Z	0.2000	200.2

**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

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Accreditation No.: SCS 108

Client SRMC (MTT)

Certificate No: D900V2-171\_Mar06

### CALIBRATION CERTIFICATE

Object D900V2 - SN: 171

Calibration procedure(s) QA CAL-05.v6  
 Calibration procedure for dipole validation kits

Calibration date: March 10, 2006

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	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Power sensor HP 8481A	US37292783	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Reference 20 dB Attenuator	SN: 5086 (20g)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference 10 dB Attenuator	SN: 5047.2 (10r)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference Probe ES3DV2 (HF)	SN 3025	28-Oct-05 (SPEAG, No. ES3-3025_Oct05)	Oct-06
DAE4	SN 601	15-Dec-05 (SPEAG, No. DAE4-601_Jan05)	Dec-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov-06

	Name	Function	Signature
Calibrated by:	Mike Meili	Laboratory Technician	<i>M. Meili</i>
Approved by:	Katja Pokovic	Technical Manager	<i>Katja Pokovic</i>

Issued: March 14, 2006

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**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) 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
- 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.

### 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
Area Scan resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	900 MHz ± 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.97 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.9 ± 6 %	0.96 mho/m ± 6 %
Head TSL temperature during test	(22.3 ± 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	2.74 mW / g
SAR normalized	normalized to 1W	11.0 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>11.1 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.76 mW / g
SAR normalized	normalized to 1W	7.04 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>7.09 mW / g ± 16.5 % (k=2)</b>

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

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.7 $\Omega$ - 8.1 $j\Omega$
Return Loss	- 21.4 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.399 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	September 23, 2002

### DASY4 Validation Report for Head TSL

Date/Time: 10.03.2006 14:23:31

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN:171**

Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB;

Medium parameters used:  $f = 900$  MHz;  $\sigma = 0.96$  mho/m;  $\epsilon_r = 41.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025 (HF); ConvF(5.82, 5.82, 5.82); Calibrated: 28.10.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA
- Measurement SW: DASY4, V4.7 Build 14; Postprocessing SW: SEMCAD, V1.8 Build 165

**Pin = 250 mW; d = 10 mm/Area Scan (81x81x1):**

Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 2.98 mW/g

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

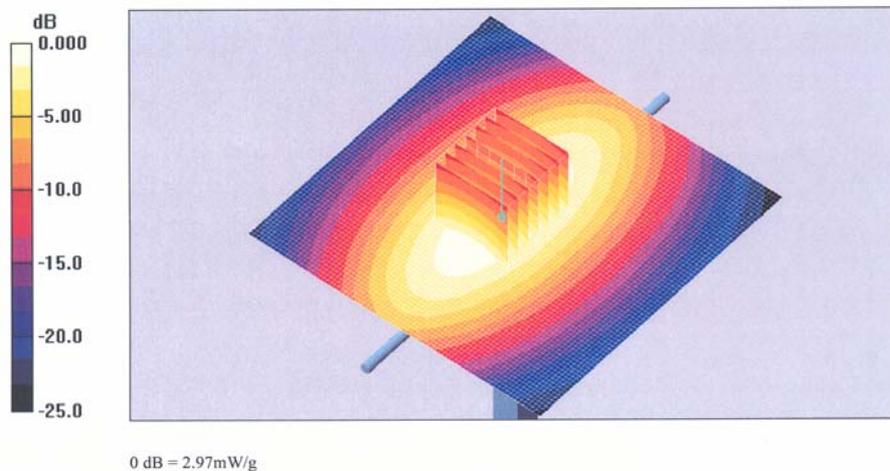
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.6 V/m; Power Drift = -0.025 dB

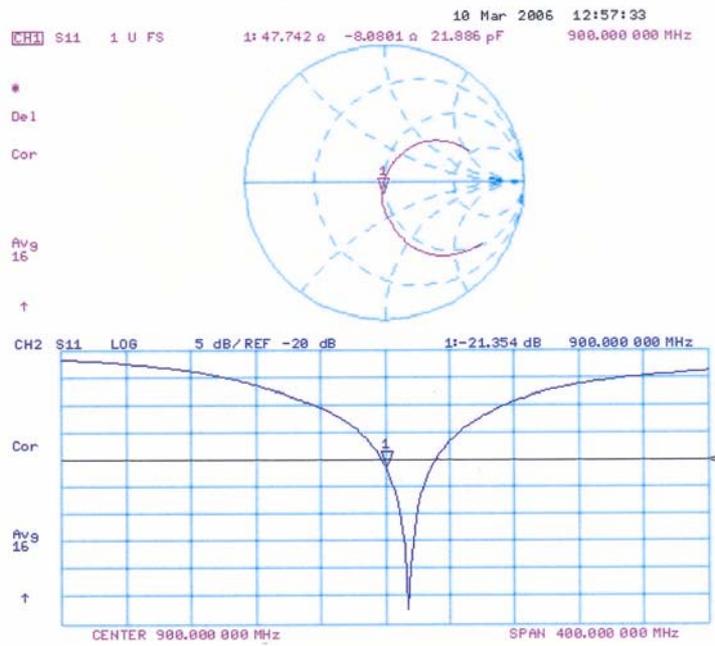
Peak SAR (extrapolated) = 4.22 W/kg

**SAR(1 g) = 2.74 mW/g; SAR(10 g) = 1.76 mW/g**

Maximum value of SAR (measured) = 2.97 mW/g



### Impedance Measurement Plot for Head TSL



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Accreditation No.: SCS 108

Client **SRMC (MTT)**

Certificate No: **D1800V2-2d084 Mar06**

### CALIBRATION CERTIFICATE

Object **D1800V2 - SN: 2d084**

Calibration procedure(s) **QA CAL-05.v6  
 Calibration procedure for dipole validation kits**

Calibration date: **March 8, 2006**

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	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Power sensor HP 8481A	US37292783	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Reference 20 dB Attenuator	SN: 5086 (20g)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference 10 dB Attenuator	SN: 5047.2 (10r)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference Probe ES3DV2	SN: 3025	28-Oct-05 (SPEAG, No. ES3-3025_Oct05)	Oct-06
DAE4	SN: 601	15-Dec-05 (SPEAG, No. DAE4-601_Dec05)	Dec-06
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov-06

Calibrated by: **Name: Mike Meili, Function: Laboratory Technician, Signature: M. Meili**

Approved by: **Name: Katja Pokovic, Function: Technical Manager, Signature: [Handwritten]**

Issued: March 10, 2006

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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) 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
- 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.

**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
Area Scan resolution	dx, dy = 15 mm	
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	39.4 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature during test	(22.2 ± 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	9.85 mW /g
SAR normalized	normalized to 1W	39.4 mW /g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>39.4 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.21 mW /g
SAR normalized	normalized to 1W	20.8 mW /g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>20.8 mW / g ± 16.5 % (k=2)</b>

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

## DASY4 Validation Report for Head TSL

Date/Time: 08.03.2006 12:21:19

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1800 MHz; Type: D1800V2; Serial: SN:2d084**

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

Medium: HSL U10 BB;

Medium parameters used:  $f = 1800$  MHz;  $\sigma = 1.38$  mho/m;  $\epsilon_r = 39.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

### DASY4 Configuration:

- Probe: ES3DV2 - SN3025 (HF); ConvF(4.87, 4.87, 4.87); Calibrated: 28.10.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 16; Postprocessing SW: SEMCAD, V1.8 Build 165

**Pin = 250 mW; d = 10 mm/Area Scan (71x71x1):** Measurement grid: dx=15mm, dy=15mm

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

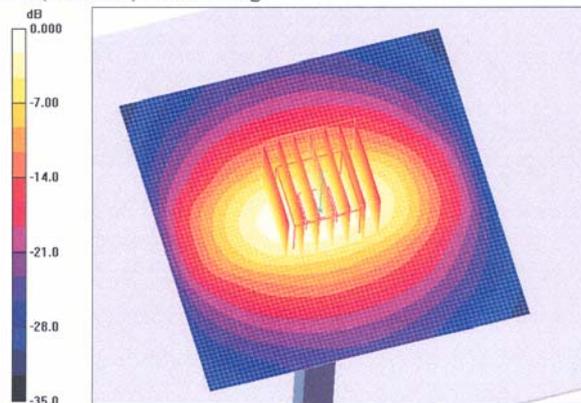
**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.3 V/m; Power Drift = -0.007 dB

Peak SAR (extrapolated) = 17.7 W/kg

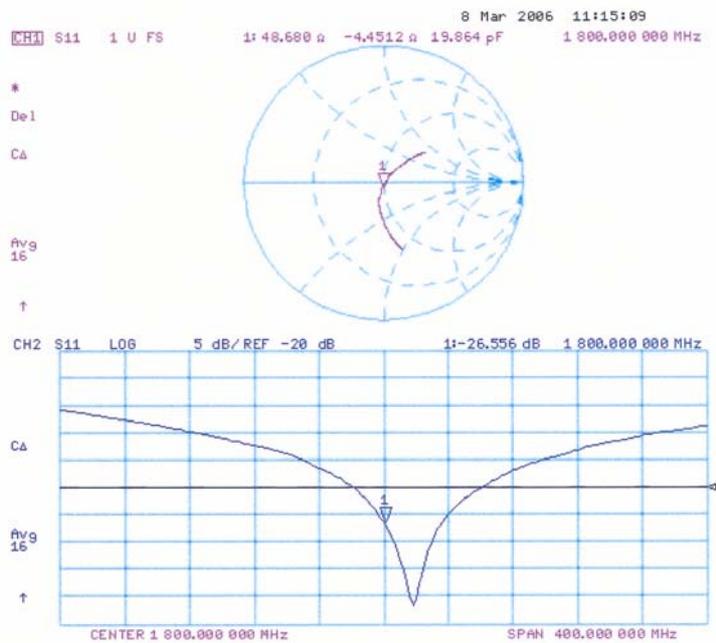
**SAR(1 g) = 9.85 mW/g; SAR(10 g) = 5.21 mW/g**

Maximum value of SAR (measured) = 11.1 mW/g



0 dB = 11.1mW/g

### Impedance Measurement Plot for Head TSL



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Accreditation No.: SCS 108

Client **SRMC (MTT)**

Certificate No: **ES3-3127\_Jan07**

### CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3127**

Calibration procedure(s) **QA CAL-01.v5  
 Calibration procedure for dosimetric E-field probes**

Calibration date: **January 24, 2007**

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-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495277	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41498087	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5086 (20b)	4-Apr-06 (METAS, No. 251-00558)	Apr-07
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe ES3DV2	SN: 3013	4-Jan-07 (SPEAG, No. ES3-3013_Jan07)	Jan-08
DAE4	SN: 654	21-Jun-06 (SPEAG, No. DAE4-654_Jun06)	Jun-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: January 24, 2007

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#### Glossary:

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
Polarization $\varphi$	$\varphi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

#### 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

#### Methods Applied and Interpretation of Parameters:

- NORM<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not effect the E<sup>2</sup>-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)<sub>x,y,z</sub> = NORM<sub>x,y,z</sub> \* 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*.
- DCP<sub>x,y,z</sub>**: 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  $f \leq 800$  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 NORM<sub>x,y,z</sub> \* *ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from  $\pm 50$  MHz to  $\pm 100$  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.

ES3DV3 SN:3127

January 24, 2007

# Probe ES3DV3

## SN:3127

Manufactured: July 11, 2006  
Calibrated: January 24, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

ES3DV3 SN:3127

January 24, 2007

### DASY - Parameters of Probe: ES3DV3 SN:3127

Sensitivity in Free Space <sup>A</sup>			Diode Compression <sup>B</sup>	
NormX	1.25 ± 10.1%	$\mu V/(V/m)^2$	DCP X	94 mV
NormY	1.29 ± 10.1%	$\mu V/(V/m)^2$	DCP Y	95 mV
NormZ	1.21 ± 10.1%	$\mu V/(V/m)^2$	DCP Z	96 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	3.0 mm	4.0 mm
	SAR <sub>be</sub> [%] Without Correction Algorithm	5.7	2.6
	SAR <sub>be</sub> [%] With Correction Algorithm	0.0	0.2

TSL	1750 MHz	Typical SAR gradient: 10 % per mm	
	Sensor Center to Phantom Surface Distance	3.0 mm	4.0 mm
	SAR <sub>be</sub> [%] Without Correction Algorithm	4.0	1.8
	SAR <sub>be</sub> [%] With Correction Algorithm	0.1	0.1

#### Sensor Offset

Probe Tip to Sensor Center **2.0 mm**

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

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 8).

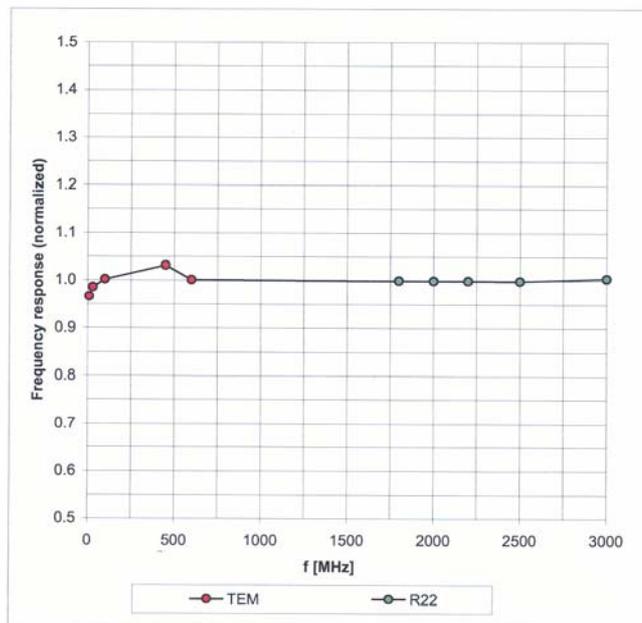
<sup>B</sup> Numerical linearization parameter: uncertainty not required.

ES3DV3 SN:3127

January 24, 2007

### Frequency Response of E-Field

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

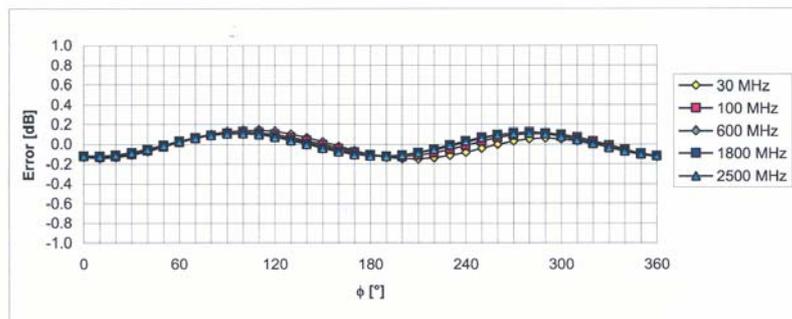
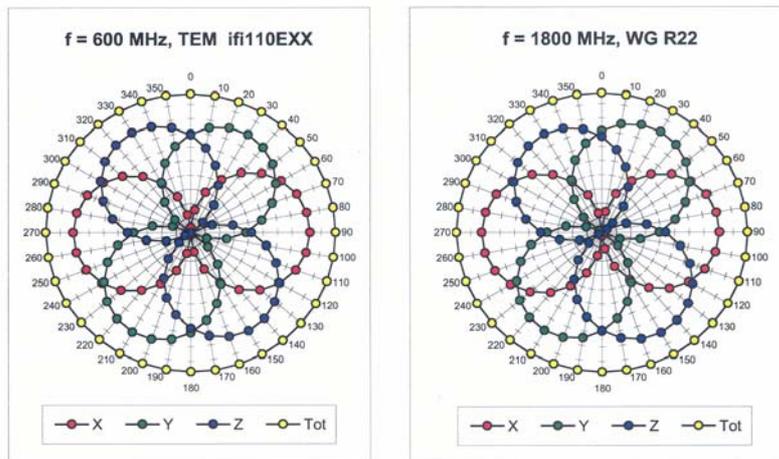


Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)

ES3DV3 SN:3127

January 24, 2007

Receiving Pattern ( $\phi$ ),  $\vartheta = 0^\circ$

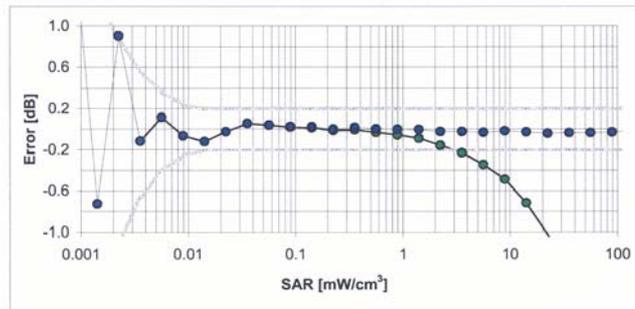
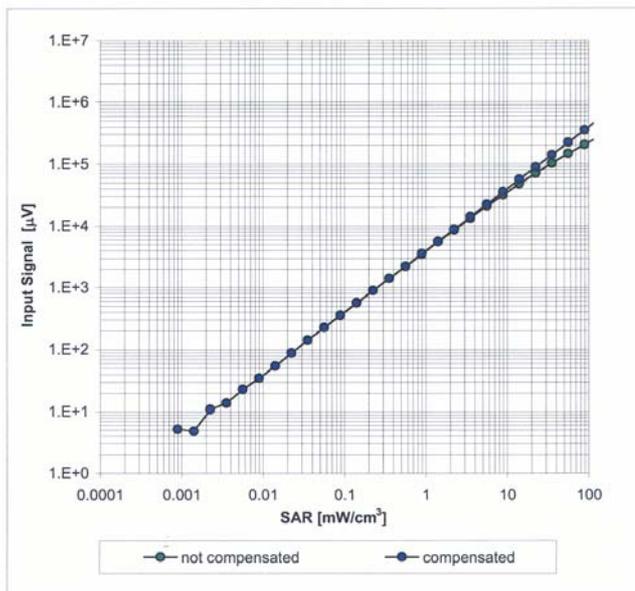


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  (k=2)

ES3DV3 SN:3127

January 24, 2007

### Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800 \text{ MHz}$ )

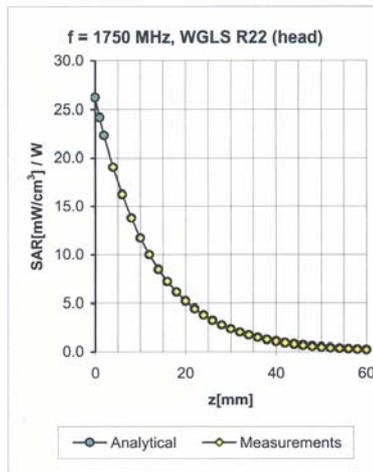
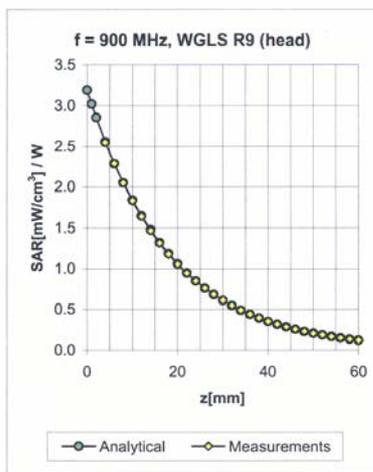


Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

ES3DV3 SN:3127

January 24, 2007

### Conversion Factor Assessment



f [MHz]	Validity [MHz] <sup>c</sup>	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.90	1.12	6.19 ± 11.0% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.99	1.12	6.21 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.94	1.15	4.93 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.77	1.34	4.87 ± 11.0% (k=2)
2000	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.84	1.24	4.66 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.72	1.37	4.47 ± 11.8% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.90	1.12	6.34 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.90	1.14	6.03 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.75	1.45	4.83 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.84	1.26	4.64 ± 11.0% (k=2)
2000	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.85	1.25	4.45 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.90	1.06	4.16 ± 11.8% (k=2)

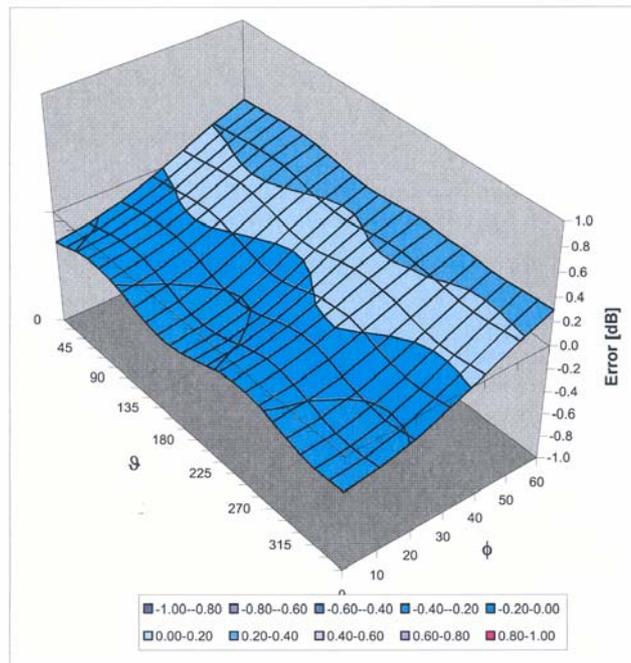
<sup>c</sup> The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

ES3DV3 SN:3127

January 24, 2007

### Deviation from Isotropy in HSL

Error ( $\phi$ ,  $\theta$ ),  $f = 900$  MHz



Uncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

## 7.11 Certificate of conformity

Schmid & Partner Engineering AG

**s p e a g**

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info@speag.com, http://www.speag.com

### Certificate of conformity / First Article Inspection

Item	SAM Twin Phantom V4.0
Type No	QD 000 P40 C
Series No	TP-1150 and higher
Manufacturer / Origin	Untersee Composites Hauptstr. 69 CH-8559 Fruthwilen Switzerland

#### Tests

The series production process used allows the limitation to test of first articles.

Complete tests were made on the pre-series Type No. QD 000 P40 AA, Serial No. TP-1001 and on the series first article Type No. QD 000 P40 BA, Serial No. TP-1006. Certain parameters have been retested using further series units (called samples).

Test	Requirement	Details	Units tested
Shape	Compliance with the geometry according to the CAD model.	IT'IS CAD File (*)	First article, Samples
Material thickness	Compliant with the requirements according to the standards	2mm +/- 0.2mm in specific areas; 6mm +/- 0.2mm at ERP	First article, Samples
Material parameters	Dielectric parameters for required frequencies	200 MHz – 3 GHz Relative permittivity < 5 Loss tangent < 0.05.	Material sample TP 104-5
Material resistivity	The material has been tested to be compatible with the liquids defined in the standards if handled and cleaned according to the instructions	DEGMBE based simulating liquids	Pre-series, First article, Samples

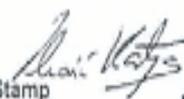
#### Standards

- [1] CENELEC EN 50361
  - [2] IEEE Std 1528-200x Draft CD 1.1 (Dec 02)
- [1] and [3].

#### Conformity

Based on the sample tests above, we certify that this item is in compliance with the uncertainty requirements of SAR measurements specified in standard [1] and draft standards [2] and [3].

Date 7.8.2003

Signature / Stamp 

Schmid & Partner  
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