



Appendix for the Report

Dosimetric Assessment of the UHF Handheld Transceiver (portable device) Thrane & Thrane SAILOR SP3550 (FCC ID: TCOSP3550)

According to the FCC Requirements

Calibration Data

January 09, 2008
IMST GmbH
Carl-Friedrich-Gauß-Str. 2
D-47475 Kamp-Lintfort

Customer Nemko AS Gasevikveien 8 N-2007 Kjeller

dasy_report_fcc_850_1900_cal_data_2.0.doc/08.01.2005/CH

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





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Accredited by the Swiss Federal Office of Metrology and Accreditation The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates Accreditation No.: SCS 108

Object Calibration procedure(s)		:1669	
Calibration procedure(s)			
	Calibration proc	and QA CAL-12.v4 cedure for dosimetric E-field probes	
Calibration date:	February 15, 20	007	
Condition of the calibrated item	In Tolerance		
	cted in the closed laborate	probability are given on the following pages and are ory facility: environment temperature (22 ± 3)°C and	
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
letwork 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	Mi Ky
	Fin Bomholt		F. Ronfielt

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Glossary:

TSL tissue simulating liquid NORMx,y,z sensitivity in free space

ConF sensitivity in TSL / NORMx,y,z
DCP diode compression point
Polarization φ rotation around probe axis

Polarization 9 9 rotation around an axis that is in the plane normal to probe axis (at

measurement center), i.e., 9 = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

 a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003

 b) CENELEC EN 50361, "Basic standard for the measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300 MHz - 3 GHz), July 2001

Methods Applied and Interpretation of Parameters:

- NORMx,y,z: Assessed for E-field polarization 9 = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not effect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)x,y,z = NORMx,y,z * frequency_response (see Frequency Response Chart). This
 linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of
 the frequency response is included in the stated uncertainty of ConvF.
- DCPx,y,z: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- ConvF and Boundary Effect Parameters: Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORMx,y,z * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy): in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

ET3DV6R SN:1669 February 15, 2007

Probe ET3DV6R

SN:1669

Manufactured: February 8, 2002
Last calibrated: February 15, 2006
Recalibrated: February 15, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: ET3-1669_Feb07

DASY - Parameters of Probe: ET3DV6R SN:1669

Sensitivity in Fre	e Space ^A	Dioc		de Compression ^E	
NormX	1.73 ± 10.1%	$\mu V/(V/m)^2$	DCP X	94 mV	
NormY	1.89 ± 10.1%	$\mu V/(V/m)^2$	DCP Y	94 mV	
NormZ	1.78 ± 10.1%	$\mu V/(V/m)^2$	DCP Z	94 mV	

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL

900 MHz

Typical SAR gradient: 5 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	9.7	5.2
SAR _{be} [%]	With Correction Algorithm	0.1	0.3

TSL

1810 MHz

Typical SAR gradient: 10 % per mm

Sensor Cente	er to Phantom Surface Distance	3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	14.1	9.8
SAR _{be} [%]	With Correction Algorithm	0.2	0.2

Sensor Offset

Probe Tip to Sensor Center

2.7 mm

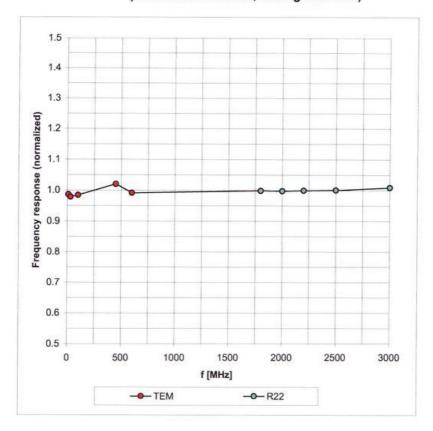
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 8).

⁸ Numerical linearization parameter: uncertainty not required.

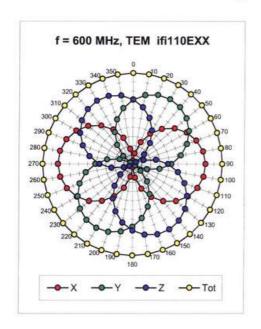
Frequency Response of E-Field

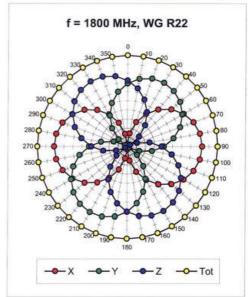
(TEM-Cell:ifi110 EXX, Waveguide: R22)

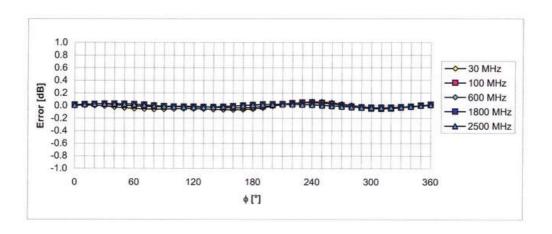


Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

Receiving Pattern (ϕ), ϑ = 0°



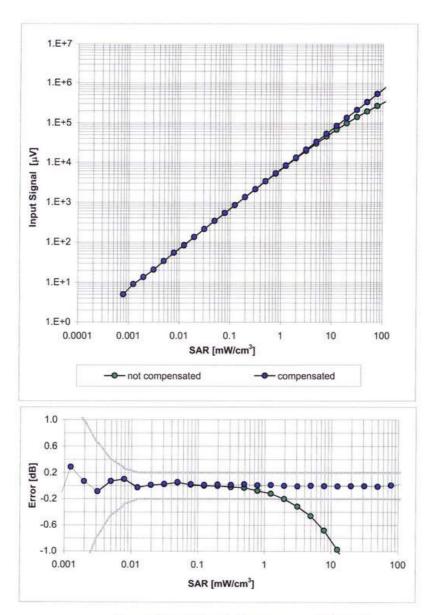




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

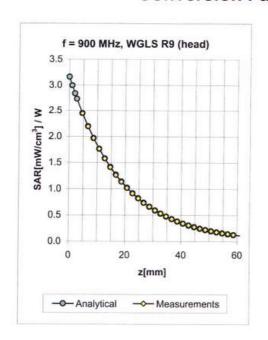
Dynamic Range f(SAR_{head})

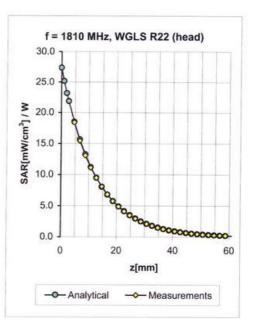
(Waveguide R22, f = 1800 MHz)



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

Conversion Factor Assessment



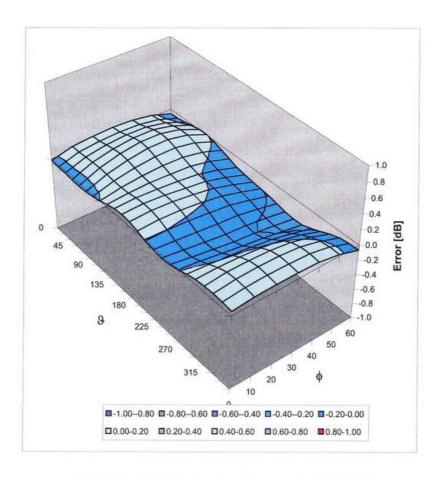


f [MHz]	Validity [MHz] ^C	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.34	1.87	7.32 ± 13.3% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.32	2.54	6.49 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.49	2.64	5.26 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.51	2.68	4.93 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.62	2.04	4.59 ± 11.8% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.30	1.92	7.83 ± 13.3% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.31	2.75	6.22 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.59	2.61	4.72 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.63	2.43	4.49 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.55	2.27	4.09 ± 11.8% (k=2)

 $^{^{\}rm C}$ The validity of \pm 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.

Deviation from Isotropy in HSL

Error (φ, θ), f = 900 MHz



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

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

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Certificate No: D450V2-1014_Dec06

Accreditation No.: SCS 108

CALIBRATION CERTIFICATE

Object D450V2 - SN: 1014

Calibration procedure(s) QA CAL-15.v4

Calibration Procedure for dipole validation kits below 800 MHz

Calibration date: December 14, 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 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 Probe ET3DV6	SN 1507	19-Oct-06 (SPEAG, No. ET3-1507_Jul06)	Jul-07
DAE4	SN 601	15-Dec-05 (SPEAG, No. DAE4-601_Dec05)	Dec-06
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:	Claudio Leubler	Technical Manager	(h)
Approved by:	Katja Pokovic	Quality Manager	21 111

Issued: December 14, 2006

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

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Glossary:

TSL tissue simulating liquid

ConF 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.

Certificate No: D450V2-1014 Dec06 Page 2 of 9

Measurement Conditions

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

DASY Version	DASY4	V4.7
Extrapolation	Advanced Extrapolation	
Phantom	Flat Phantom V4.4	Shell thickness: 6 ± 0.2 mm
Distance Dipole Center - TSL	15 mm	with Spacer
Area Scan Resolution	dx, dy = 15 mm	
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	43.5	0.87 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	43.6 ± 6 %	0.86 mho/m ± 6 %
Head TSL temperature during test	(22.0 ± 0.2) °C	7200	12.000

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	398 mW input power	2.04 mW / g
SAR normalized	normalized to 1W	5.13 mW / g
SAR for nominal Head TSL parameters 1	normalized to 1W	5.16 mW / g ± 18.1 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	398 mW input power	1.38 mW / g
SAR normalized	normalized to 1W	3.47 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	3.48 mW / g ± 17.6 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	56.7	0.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.9 ± 6 %	0.94 mho/m ± 6 %
Body TSL temperature during test	(22.4 ± 0.2) °C		

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	condition	
SAR measured	398 mW input power	1.90 mW/g
SAR normalized	normalized to 1W	4.77 mW / g
SAR for nominal Body TSL parameters ¹	normalized to 1W	4.73 mW / g ± 18.1 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	398 mW input power	1.27 mW / g
SAR normalized	normalized to 1W	3.19 mW / g
SAR for nominal Body TSL parameters 1	normalized to 1W	3.17 mW / g ± 17.6 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$57.6 \Omega - 2.8 j\Omega$	
Return Loss	- 22.4 dB	

Antenna Parameters with Body TSL

Impedance, transformed to feed point	54.2 Ω - 5.4 jΩ	
Return Loss	- 23.7 dB	

General Antenna Parameters and Design

Electrical Delay (one direction)	1.355 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	April 25, 2003	

DASY4 Validation Report for Head TSL

Date/Time: 14.12.2006 12:26:01

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - SN:1014

Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1

Medium: HSL450;

Medium parameters used: f = 450 MHz; $\sigma = 0.86 \text{ mho/m}$; $\varepsilon_r = 43.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

Probe: ET3DV6 - SN1507 (LF); ConvF(6.61, 6.61, 6.61); Calibrated: 19.10.2006

· Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 15.12.2005

Phantom: Flat Phantom 4.4; Type: Flat Phantom 4.4;;

Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

d=15mm, Pin=398mW 2/Area Scan (61x131x1):

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

Maximum value of SAR (interpolated) = 2.16 mW/g

d=15mm, Pin=398mW 2/Zoom Scan (7x7x7)/Cube 0:

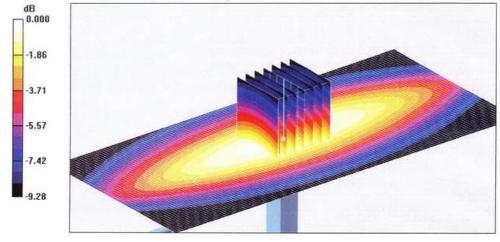
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 52.5 V/m; Power Drift = -0.032 dB

Peak SAR (extrapolated) = 3.00 W/kg

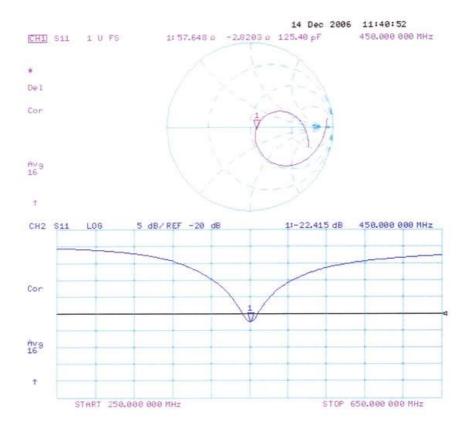
SAR(1 g) = 2.04 mW/g; SAR(10 g) = 1.38 mW/g

Maximum value of SAR (measured) = 2.19 mW/g



0 dB = 2.19 mW/g

Impedance Measurement Plot for Head TSL



DASY4 Validation Report for Body TSL

Date/Time: 14.12.2006 15:11:30

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 450 MHz; Type: D450V2; Serial: D450V2 - SN:1014

Communication System: CW; Frequency: 450 MHz; Duty Cycle: 1:1

Medium: MSL450;

Medium parameters used: f = 450 MHz; $\sigma = 0.94$ mho/m; $\epsilon_r = 55.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

Probe: ET3DV6 - SN1507 (LF); ConvF(7.18, 7.18, 7.18); Calibrated: 19.10.2006

Sensor-Surface: 4mm (Mechanical Surface Detection)

Electronics: DAE4 Sn601; Calibrated: 15.12.2005

Phantom: Flat Phantom 4.4; Type: Flat Phantom 4.4;;

Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

d=15mm, Pin=398mW/Area Scan (61x201x1):

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

Maximum value of SAR (interpolated) = 2.03 mW/g

d=15mm, Pin=398mW/Zoom Scan (7x7x7)/Cube 0:

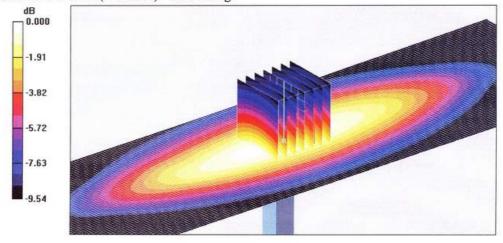
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 48.1 V/m; Power Drift = -0.010 dB

Peak SAR (extrapolated) = 2.84 W/kg

SAR(1 g) = 1.9 mW/g; SAR(10 g) = 1.27 mW/g

Maximum value of SAR (measured) = 2.03 mW/g



0 dB = 2.03 mW/g

Impedance Measurement Plot for Body TSL

