

SAR Compliance Test Report

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Measurements made by:	Rolf Rundgren, Kai Niskala		

Tested device:	RM-10		
FCC ID:	PYARM-10	IC:	661V-RM10

Supplement reports:	-
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Testing has been carried out in accordance with:	47CFR §2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01) Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields RSS-102 Evaluation Procedure for Mobile and Portable Radio Transmitters with Respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields IEEE 1528 - 2003 IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
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Documentation:	The documentation of the testing performed on the tested devices is archived for 15 years at TCC Nokia.
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Test results:	The tested device complies with the requirements in respect of all parameters subject to the test. The test results and statements relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory.
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Date and signatures:	Digitally signed by Kai Niskala DN: cn=Kai Niskala, c=FI, o=Nokia, ou=CertMT, email=kai.niskala@nokia.com
For the contents:	 Date: 2005.12.12 10:28:08 +02'00'
	Kai Niskala Test System Manager

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	2005-11-18 to 2005-12-07
SN, HW and SW numbers of tested device	SN: 004400/69/174497/1; HWID: 3100; SW: 05w33_44; DUT#: 10877
Batteries used in testing	BL-6C: DUT#'s: 30517, 30518
Headsets used in testing	HS-6; DUT#: 30435
Other accessories used in testing	Mini-SD Card
State of sample	Prototype unit
Notes	

1.2 Maximum Results

The maximum measured SAR values for Head configuration and Body Worn configuration are given in section 1.2.1 and 1.2.2 respectively. The device conforms to the requirements of the standard(s) when the maximum measured SAR value is less than or equal to the limit.

1.2.1 Head Configuration

Mode	Ch / f (MHz)	Radiated power	Position	Measured SAR value (1g avg)	Scaled* SAR value (1g avg)	SAR limit (1g avg)	Result
GSM1900	661 / 1880.0	30.2 dBm EIRP	Right, Cheek	0.44 W/kg	0.49 W/kg	1.6 W/kg	PASSED
WLAN2450	1 / 2412.0	23.7 dBm EIRP	Right, Cheek	0.44 W/kg	0.49 W/kg	1.6 W/kg	PASSED
GSM1900 + WLAN2450	-	-	Right, Cheek	0.88 W/kg	0.99 W/kg	1.6 W/kg	PASSED

1.2.2 Body Worn Configuration

Mode	Ch / f (MHz)	Radiated power	Separation distance	Measured SAR value (1g avg)	Scaled* SAR value (1g avg)	SAR limit (1g avg)	Result
GSM1900	810 / 1909.8	28.3 dBm EIRP	1.5 cm	0.55 W/kg	0.62 W/kg	1.6 W/kg	PASSED
WLAN2450	11 / 2462.0	20.6 dBm EIRP	1.5 cm	0.05 W/kg	0.06 W/kg	1.6 W/kg	PASSED
GSM1900 + WLAN2450	-	-	1.5 cm	0.60 W/kg	0.67 W/kg	1.6 W/kg	PASSED

*SAR values are scaled up by 12% to cover measurement drift.

1.2.3 Maximum Drift

Maximum drift covered by 12% scaling up of the SAR values	Maximum drift during measurements
0.5dB	0.26 dB

1.2.4 Measurement Uncertainty

Expanded Uncertainty (k=2) 95%	± 25.8%
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2. DESCRIPTION OF THE DEVICE UNDER TEST

Device category	Portable
Exposure environment	General population / uncontrolled

Modes and Bands of Operation	GSM 1900	GPRS 1900	EGPRS 1900	BT	WLAN
Modulation Mode	GMSK	GMSK	GMSK / 8PSK	GFSK	
Duty Cycle	1/8	1/8 or 2/8	1/8 or 2/8		1
Transmitter Frequency Range (MHz)	1850 - 1910	1850 - 1910	1850 - 1910	2402-2480	2412-2462

Outside of USA and Canada, the transmitter of the device is capable of operating also in 900/1800/2100 bands, which are not part of this filing.

This device has Voice-over-IP/Dual Transfer Mode capability for use at the ear. Therefore, SAR for 2-slot GPRS mode was evaluated against the head profile of the phantom.

8PSK EGPRS mode was not measured, because maximum averaged output power is lower in 8PSK EGPRS mode than in GPRS mode.

2.1 Picture of the Device



2.2 Description of the Antenna

The device has an internal patch antenna.

3. TEST CONDITIONS

3.1 Temperature and Humidity

Ambient temperature (°C):	20.5 to 24.0
Ambient humidity (RH %):	30 to 55

3.2 Test Signal, Frequencies and Output Power

The device was put into operation by using a call tester. Communication between the device and the call tester was established by air link.

The device output power was set to maximum power level for all tests; a fully charged battery was used for every test sequence.

In all operating bands the measurements were performed on lowest, middle and highest channels.

The radiated output power of the device was measured by a separate test laboratory on the same unit as used for SAR testing.

4. DESCRIPTION OF THE TEST EQUIPMENT

4.1 Measurement System and Components

The measurements were performed using an automated near-field scanning system, DASY4, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland. The SAR extrapolation algorithm used in all measurements was the 'advanced extrapolation' algorithm.

The following table lists calibration dates of SPEAG components:

Test Equipment	Serial Number	Calibration interval	Calibration expiry
DAE4	555	12 months	2006-02
E-field Probe ET3DV6	1765	12 months	2006-02
E-field Probe ET3DV6	1766	12 months	2006-04
Dipole Validation Kit, D1900V2	5d030	24 months	2007-02
Dipole Validation Kit, D2450V2	729	24 months	2007-02
DASY4 software	Version 4.6	-	-

Additional test equipment used in testing:

Test Equipment	Model	Serial Number	Calibration interval	Calibration expiry
Signal Generator	HP 8657B	3630U08114	12 months	2006-02
Amplifier	Amplifier Research 5S1G4	306024	-	-
Power Meter	R&S NRT	101143	12 months	2006-02
Power Sensor	R&S NRT-Z43	100239	12 months	2006-02
Power Meter	E4416A	GB41291465	12 months	2006-02
Power Sensor	E9323A	US40411045	12 months	2006-02
Thermometer	Fluke 51 II	84350048	12 months	2006-02
Thermometer	Fluke 52 II	82810048	12 months	2006-02
Network Analyzer	HP 8753D	3410A08934	12 months	2006-02
Dielectric Probe Kit	Agilent 85070D	US01440162	-	-
Radio Communication Tester	CMU 200	100084	12 months	2006-05
Radio Communication Tester	CMU 200	106354	12 months	2006-04

4.1.1 Isotropic E-field Probe Type ET3DV6

Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., butyl diglycol)
Calibration	Calibration certificate in Appendix C
Frequency	10 MHz to 3 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Optical Surface Detection	± 0.2 mm repeatability in air and clear liquids over diffuse reflecting surfaces
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.4 dB in HSL (rotation normal to probe axis)
Dynamic Range	5 μ W/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 16 mm Body diameter: 12 mm Tip diameter: 6.8 mm Distance from probe tip to dipole centers: 2.7 mm
Application	General dosimetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

4.2 Phantoms

The phantom used for all tests i.e. for both system checking and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The phantom conforms to the requirements of IEEE 1528 - 2003.

System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

The SPEAG device holder (see Section 5.1) was used to position the device in all tests whilst a tripod was used to position the validation dipoles against the flat section of phantom.

4.3 Tissue Simulants

Recommended values for the dielectric parameters of the tissue simulants are given in IEEE 1528 - 2003 and FCC Supplement C to OET Bulletin 65. All tests were carried out using simulants

whose dielectric parameters were within $\pm 5\%$ of the recommended values. All tests were carried out within 24 hours of measuring the dielectric parameters.

The depth of the tissue simulant was 15.0 ± 0.5 cm measured from the ear reference point during system checking and device measurements.

4.3.1 Tissue Simulant Recipes

The following recipes were used for Head and Body tissue simulants:

1900MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	54.50	70.25
Tween 20	45.23	29.41
Salt	0.27	0.34

2450MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	56.0	70.2
Tween 20	44.0	29.62
Salt	-	0.18

4.3.2 System Checking

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulants were measured every day using the dielectric probe kit and the network analyser. A system check measurement was made following the determination of the dielectric parameters of the simulant, using the dipole validation kit. A power level of 250 mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom. The system checking results (dielectric parameters and SAR values) are given in the table below.

System checking, head tissue simulant

f [MHz]	Description	SAR [W/kg], 1g	Dielectric Parameters		Temp [°C]
			ϵ_r	σ [S/m]	
1900	Reference result	9.76	39.5	1.46	
	$\pm 10\%$ window	8.78 – 10.74			
	2005-12-01	10.6	40.1	1.44	22.5
	2005-12-05	10.1	40.1	1.44	21.8
	2005-12-07	10.1	40.2	1.43	21.8
2450	Reference result	14.2	39.9	1.78	
	$\pm 10\%$ window	12.8 – 15.6			
	2005-11-22	14.0	38.5	1.87	22.3

System checking, body tissue simulant

f [MHz]	Description	SAR [W/kg], 1g	Dielectric Parameters		Temp [°C]
			ϵ_r	σ [S/m]	
2450	Reference result	13.4	52.3	2.01	
	$\pm 10\%$ window	12.1 – 14.7			
	2005-11-23	13.7	51.3	1.99	22.5

Plots of the system checking scans are given in Appendix A.

4.3.3 Tissue Simulants used in the Measurements

Head tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp [°C]
		ϵ_r	σ [S/m]	
1880	Recommended value	40.0	1.40	
	$\pm 5\%$ window	38.0 – 42.0	1.33 – 1.47	
	2005-12-01	40.2	1.43	22.0
	2005-12-05	40.1	1.42	22.0
2442	Recommended value	39.2	1.79	
	$\pm 5\%$ window	37.3 – 41.2	1.70 – 1.88	
	2005-11-22	38.5	1.86	22.0

Body tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp [°C]
		ϵ_r	σ [S/m]	
1880	Recommended value	53.3	1.52	
	$\pm 5\%$ window	50.6 – 56.0	1.44 – 1.60	
	2005-12-05	53.6	1.48	22.0
	2005-12-07	53.3	1.52	22.0
2442	Recommended value	52.7	1.94	
	$\pm 5\%$ window	50.1 – 55.3	1.85 – 2.04	
	2005-11-23	51.3	1.98	22.0

5. DESCRIPTION OF THE TEST PROCEDURE

5.1 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the Dasy system.



Device holder supplied by SPEAG

A Nokia designed spacer (illustrated below) was used to position the device within the SPEAG holder. The spacer positions the device so that the holder has minimal effect on the test results but still holds the device securely. The spacer was removed before the tests.



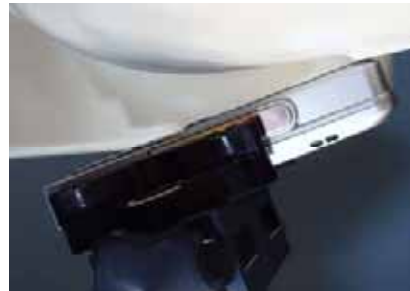
Nokia spacer

5.2 Test Positions

5.2.1 Against Phantom Head

Measurements were made in “cheek” and “tilt” positions on both the left hand and right hand sides of the phantom.

The positions used in the measurements were according to IEEE 1528 - 2003 "IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques".



Photos of the device in “cheek” position

Photos of the device in “tilt” position

5.2.2 Body Worn Configuration

The device was placed in the SPEAG holder using the Nokia spacer and placed below the flat section of the phantom. The distance between the device and the phantom was kept at the separation distance indicated in the photo below using a separate flat spacer that was removed before the start of the measurements. The device was oriented with its antenna facing the phantom since this orientation gives higher results.



Photo of the device positioned for Body SAR measurement. The spacer was removed for the tests.

5.3 Scan Procedures

First, area scans were used for determination of the field distribution. Next, a zoom scan, a minimum of 5x5x7 points covering a volume of at least 30x30x30mm, was performed around the highest E-field value to determine the averaged SAR value. Drift was determined by measuring the same point at the start of the area scan and again at the end of the zoom scan.

5.4 SAR Averaging Methods

The maximum SAR value was averaged over a cube of tissue using interpolation and extrapolation.

The interpolation, extrapolation and maximum search routines within Dasy4 are all based on the modified Quadratic Shepard's method (Robert J. Renka, "Multivariate Interpolation Of Large Sets Of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148).

The interpolation scheme combines a least-square fitted function method with a weighted average method. A trivariate 3-D / bivariate 2-D quadratic function is computed for each measurement point and fitted to neighbouring points by a least-square method. For the zoom scan, inverse distance weighting is incorporated to fit distant points more accurately. The interpolating function is finally calculated as a weighted average of the quadratics.

In the zoom scan, the interpolation function is used to extrapolate the Peak SAR from the deepest measurement points to the inner surface of the phantom.

6. MEASUREMENT UNCERTAINTY

Table 6.1 – Measurement uncertainty evaluation

Uncertainty Component	Section in IEEE 1528	Tol. (%)	Prob Dist	Div	C_i	$C_i \cdot U_i$ (%)	V_i
Measurement System							
Probe Calibration	E2.1	±5.9	N	1	1	±5.9	∞
Axial Isotropy	E2.2	±4.7	R	√3	$(1-c_p)^{1/2}$	±1.9	∞
Hemispherical Isotropy	E2.2	±9.6	R	√3	$(c_p)^{1/2}$	±3.9	∞
Boundary Effect	E2.3	±1.0	R	√3	1	±0.6	∞
Linearity	E2.4	±4.7	R	√3	1	±2.7	∞
System Detection Limits	E2.5	±1.0	R	√3	1	±0.6	∞
Readout Electronics	E2.6	±1.0	N	1	1	±1.0	∞
Response Time	E2.7	±0.8	R	√3	1	±0.5	∞
Integration Time	E2.8	±2.6	R	√3	1	±1.5	∞
RF Ambient Conditions - Noise	E6.1	±3.0	R	√3	1	±1.7	∞
RF Ambient Conditions - Reflections	E6.1	±3.0	R	√3	1	±1.7	∞
Probe Positioner Mechanical Tolerance	E6.2	±0.4	R	√3	1	±0.2	∞
Probe Positioning with respect to Phantom Shell	E6.3	±2.9	R	√3	1	±1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E5	±3.9	R	√3	1	±2.3	∞
Test sample Related							
Test Sample Positioning	E4.2	±6.0	N	1	1	±6.0	11
Device Holder Uncertainty	E4.1	±5.0	N	1	1	±5.0	7
Output Power Variation - SAR drift measurement	6.6.3	±0.0	R	√3	1	±0.0	∞
Phantom and Tissue Parameters							
Phantom Uncertainty (shape and thickness tolerances)	E3.1	±4.0	R	√3	1	±2.3	∞
Conductivity Target - tolerance	E3.2	±5.0	R	√3	0.64	±1.8	∞
Conductivity - measurement uncertainty	E3.3	±5.5	N	1	0.64	±3.5	5
Permittivity Target - tolerance	E3.2	±5.0	R	√3	0.6	±1.7	∞
Permittivity - measurement uncertainty	E3.3	±2.9	N	1	0.6	±1.7	5
Combined Standard Uncertainty			RSS			±12.9	116
Coverage Factor for 95%			k=2				
Expanded Uncertainty						±25.8	

7. RESULTS

The measured Head SAR values for the test device are tabulated below:

1900MHz Head SAR results

Option used	Test configuration		SAR, averaged over 1g (W/kg)		
			Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz
2-slot GPRS	Power		26.9 dBm	28.4 dBm	28.9 dBm
Flip closed	Left	Cheek		0.25	
GSM	Power		29.0 dBm	30.3 dBm	28.3 dBm
Flip closed	Left	Cheek		0.26	
		Tilt		0.12	
	Right	Cheek		0.39	
		Tilt		0.27	
GSM	Power		27.7 dBm	30.2 dBm	27.4 dBm
Flip open	Left	Cheek		0.28	
		Tilt		0.23	
	Right	Cheek	0.43	0.44	0.37
		Tilt		0.23	
Flip open	Right, Cheek repeated without SD card			0.38	
Flip open	Right, Cheek repeated with SD card, with BT active			0.37	

2450MHz Head SAR results

Option used	Test configuration		SAR, averaged over 1g (W/kg)		
			Ch 1 2412.0 MHz	Ch 6 2437.0 MHz	Ch 11 2462.0 MHz
WLAN	Power		20.1 dBm	20.9 dBm	20.6 dBm
Flip closed	Left	Cheek		0.29	
		Tilt		0.06	
	Right	Cheek		0.34	
		Tilt		0.07	
WLAN	Power		23.7 dBm	23.2 dBm	19.7 dBm
Flip open	Left	Cheek		0.24	
		Tilt		0.09	
	Right	Cheek	0.44	0.36	0.28
		Tilt		0.06	
Flip open	Right, Cheek repeated without SD card		0.43		

The measured Body SAR values for the test device are tabulated below:

1900MHz Body SAR results

Option used	Test configuration		SAR, averaged over 1g (W/kg)		
			Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz
2-slot GPRS	Power		26.9 dBm	28.4 dBm	28.9 dBm
Flip closed	Without headset				0.44
GSM	Power		29.0 dBm	30.3 dBm	28.3 dBm
Flip closed	Without headset		0.47	0.46	0.54
	Headset HS-6		0.46	0.44	0.43
Flip closed	Without headset repeated without SD card				0.46
Flip closed	Without headset repeated with BT active				0.55

2450MHz Body SAR results

Option used	Test configuration	SAR, averaged over 1g (W/kg)		
		Ch 1 2412.0 MHz	Ch 6 2437.0 MHz	Ch 11 2462.0 MHz
WLAN	Power	20.1 dBm	20.9 dBm	20.6 dBm
Flip closed	Without headset	0.04	0.04	0.05
	Headset HS-6	0.04	0.03	0.04

Simultaneous transmissions: Combined SAR results

Test configuration	Combined 1g SAR values		
	WLAN	1900	WLAN + 1900
Head: Left, Cheek	0.29	0.28	0.57
Head: Left, Tilt	0.09	0.23	0.32
Head: Right, Cheek	0.44	0.44	0.88
Head: Right, Tilt	0.07	0.27	0.34
Body: Without Headset	0.05	0.55	0.60
Body: With Headset	0.04	0.46	0.50

Combining the maximum SAR values of WLAN2450 and the cellular band tends to overestimate the SAR value since their maxima do not necessarily occur in the same location.

Plots of the Measurement scans are given in Appendix B.

APPENDIX A: SYSTEM CHECKING SCANS

Date/Time: 01.12.2005 14:38:48

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: D1900V2; Serial: D1900V2 - SN:5d030

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

Medium: HSL1900 Medium parameters used (interpolated): $f = 1900$ MHz; $\sigma = 1.44$ mho/m; $\epsilon_r = 40.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.9, 4.9, 4.9); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

d=10mm, Pin=250mW, t=22.5 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (interpolated) = 12.9 mW/g

d=10mm, Pin=250mW, t=22.5 C/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

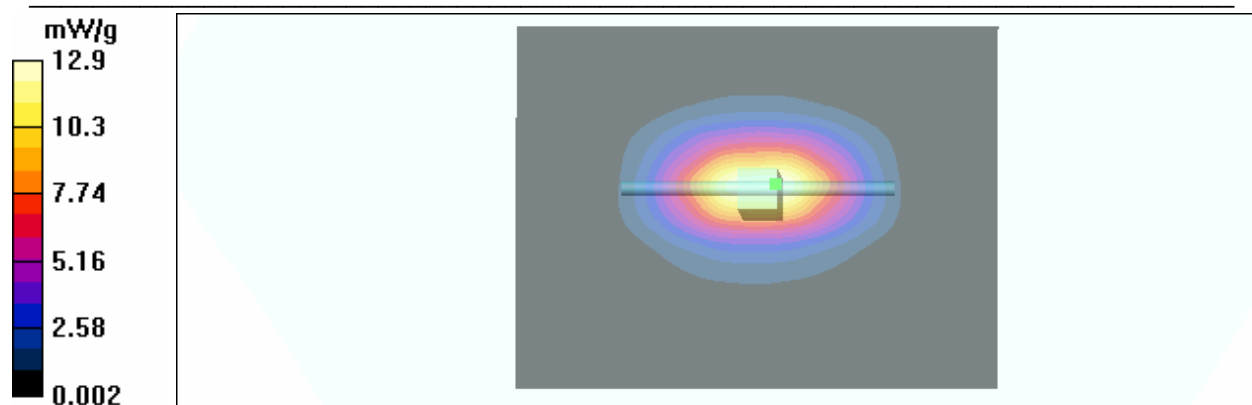
Reference Value = 97.4 V/m; Power Drift = -0.024 dB

Peak SAR (extrapolated) = 18.1 W/kg

SAR(1 g) = 10.6 mW/g; SAR(10 g) = 5.52 mW/g

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

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



Date/Time: 05.12.2005 09:25:19

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: D1900V2; Serial: D1900V2 - SN:5d030

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

Medium: HSL1900 Medium parameters used (interpolated): $f = 1900$ MHz; $\sigma = 1.44$ mho/m; $\epsilon_r = 40.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.9, 4.9, 4.9); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

d=10mm, Pin=250mW, t=22.5 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (interpolated) = 12.1 mW/g

d=10mm, Pin=250mW, t=22.5 C/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

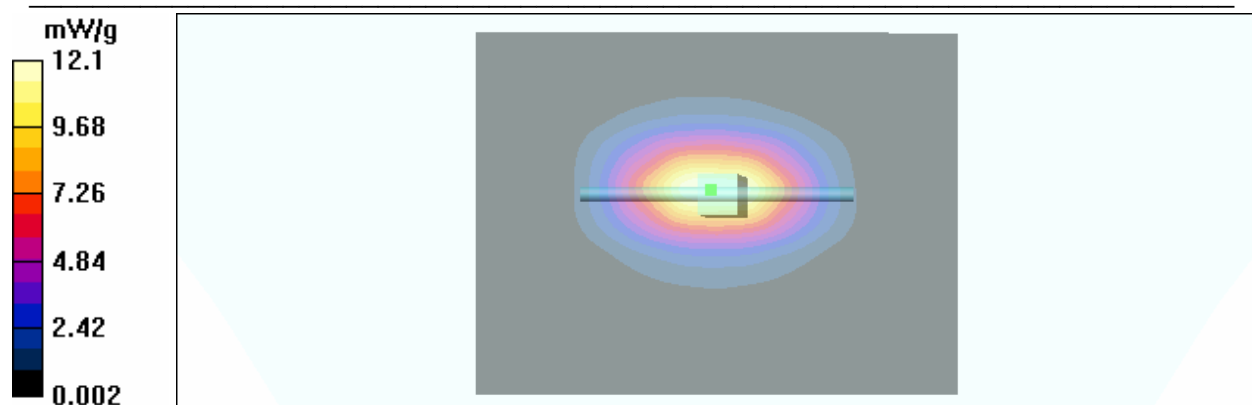
Reference Value = 94.9 V/m; Power Drift = -0.016 dB

Peak SAR (extrapolated) = 17.3 W/kg

SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.36 mW/g

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

Maximum value of SAR (measured) = 11.4 mW/g



Date/Time: 07.12.2005 09:00:49

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: D1900V2; Serial: D1900V2 - SN:5d030

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

Medium: HSL1900 Medium parameters used (interpolated): $f = 1900$ MHz; $\sigma = 1.43$ mho/m; $\epsilon_r = 40.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.9, 4.9, 4.9); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

d=10mm, Pin=250mW, t=21.9 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (interpolated) = 12.2 mW/g

d=10mm, Pin=250mW, t=21.9 C/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

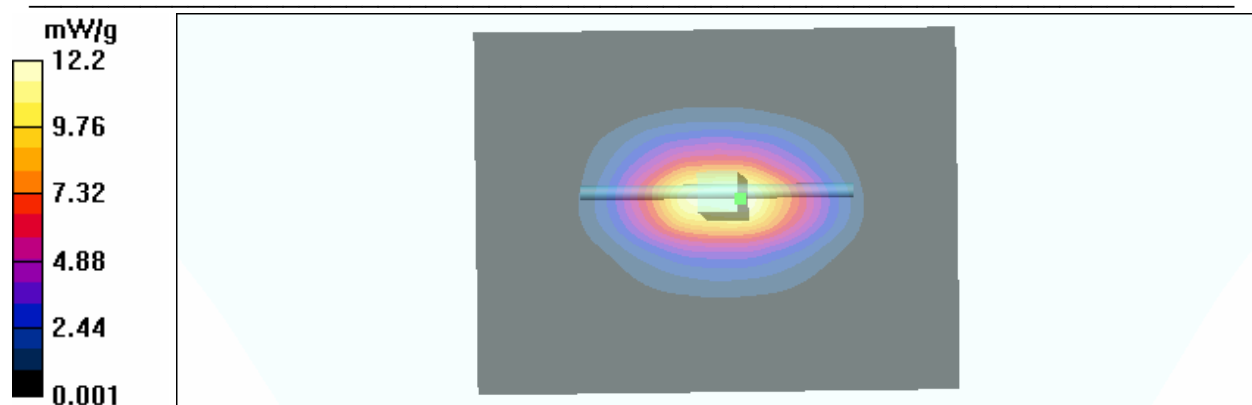
Reference Value = 95.6 V/m; Power Drift = -0.059 dB

Peak SAR (extrapolated) = 17.4 W/kg

SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.34 mW/g

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

Maximum value of SAR (measured) = 11.6 mW/g



Date/Time: 22.11.2005 09:59:10

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: D2450V2; Serial: D2450V2 - SN:729

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used (interpolated): $f = 2450$ MHz; $\sigma = 1.87$ mho/m; $\epsilon_r = 38.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

d=10mm, Pin=250mW, t=22.3 C/Zoom Scan (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.5 V/m; Power Drift = -0.038 dB

Peak SAR (extrapolated) = 30.0 W/kg

SAR(1 g) = 14 mW/g; SAR(10 g) = 6.48 mW/g

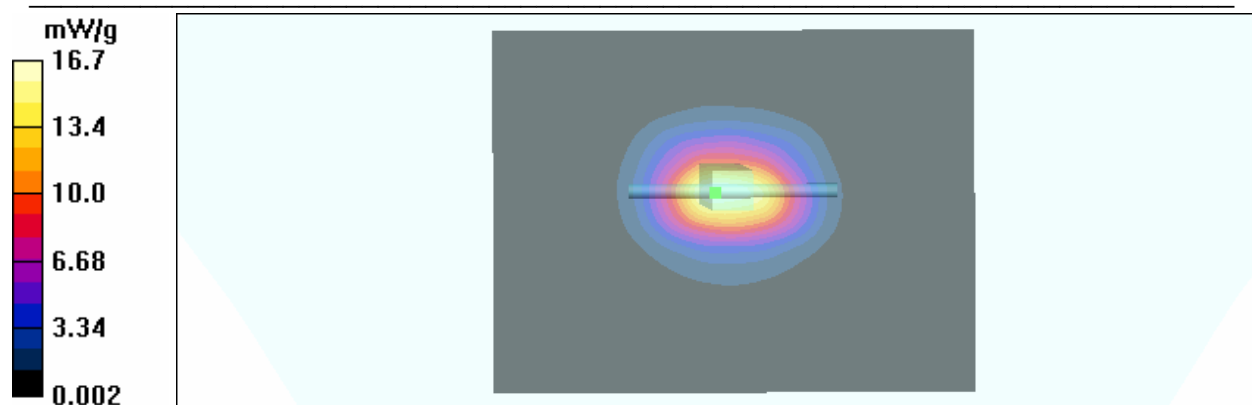
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 15.9 mW/g

d=10mm, Pin=250mW, t=22.3 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (interpolated) = 16.7 mW/g



Date/Time: 23.11.2005 07:32:00

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: D2450V2; Serial: D2450V2 - SN:729

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: BSL2450 Medium parameters used (interpolated): $f = 2450$ MHz; $\sigma = 1.99$ mho/m; $\epsilon_r = 51.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.35, 4.35, 4.35); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 2; Type: SAM 4.0; Serial: 1272
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

d=10mm, Pin=250mW, t=22.5 C/Zoom Scan (7x7x7)/Cube 0: Measurement grid:

dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.9 V/m; Power Drift = -0.064 dB

Peak SAR (extrapolated) = 30.4 W/kg

SAR(1 g) = 13.7 mW/g; SAR(10 g) = 6.35 mW/g

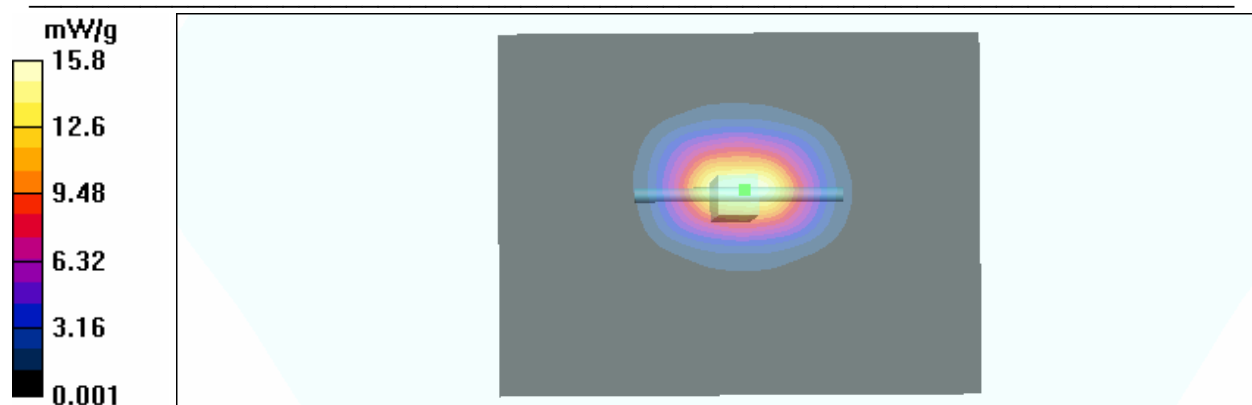
[Info: Interpolated medium parameters used for SAR evaluation.](#)

Maximum value of SAR (measured) = 15.4 mW/g

d=10mm, Pin=250mW, t=22.5 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (interpolated) = 15.8 mW/g



APPENDIX B: MEASUREMENT SCANS

Date/Time: 02.12.2005 11:39:24

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10;Serial: 004400/69/174497/1

Communication System: 2-slot GPRS 1900; Frequency: 1880 MHz;Duty Cycle: 1:4.2

Medium: HSL1900 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.43$ mho/m; $\epsilon_r = 40.2$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.9, 4.9, 4.9); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Cheek position - Middle, $t=22.1$ C,/Zoom Scan (5x5x7) (5x5x7)/Cube 0:

Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 10.5 V/m; Power Drift = -0.143 dB

Peak SAR (extrapolated) = 0.342 W/kg

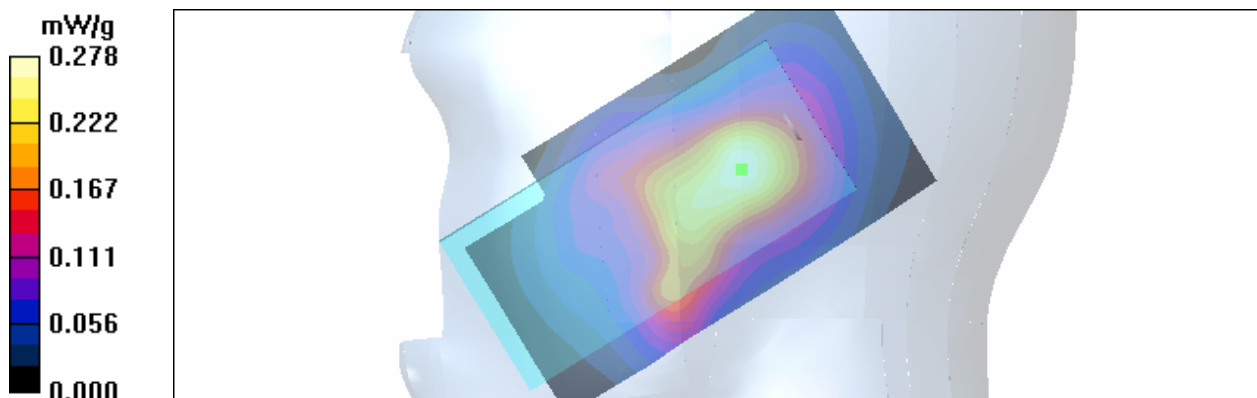
SAR(1 g) = 0.245 mW/g; SAR(10 g) = 0.159 mW/g

Maximum value of SAR (measured) = 0.262 mW/g

Cheek position - Middle, $t=22.1$ C,/Area Scan (51x91x1): Measurement grid:

$dx=15$ mm, $dy=15$ mm

Maximum value of SAR (interpolated) = 0.278 mW/g



Date/Time: 02.12.2005 10:57:18

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10;Serial: 004400/69/174497/1

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: HSL1900 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.43 \text{ mho/m}$; $\epsilon_r = 40.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.9, 4.9, 4.9); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Cheek position - Middle, $t=22.1 \text{ C}$,/Zoom Scan (5x5x7) (5x5x7)/Cube 0:

Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 10.2 V/m ; Power Drift = -0.123 dB

Peak SAR (extrapolated) = 0.357 W/kg

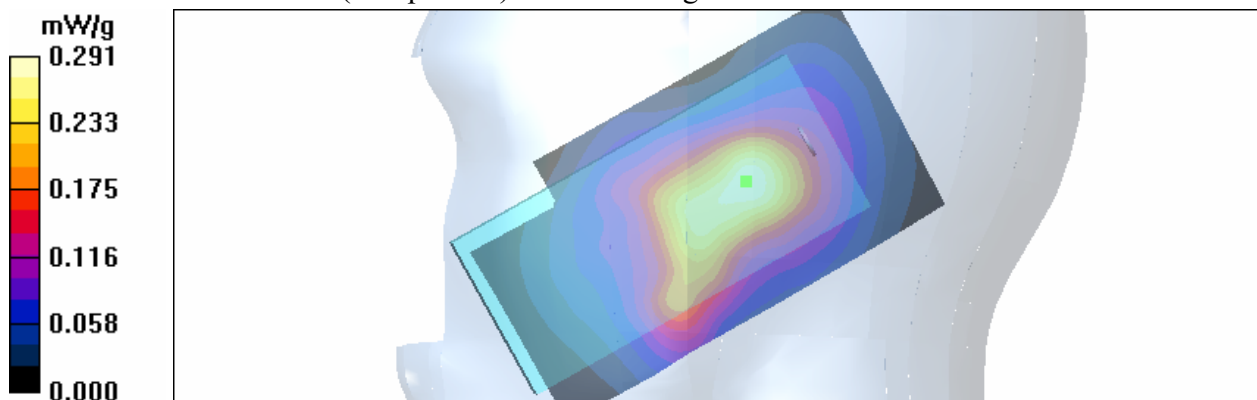
SAR(1 g) = 0.257 mW/g ; SAR(10 g) = 0.168 mW/g

Maximum value of SAR (measured) = 0.273 mW/g

Cheek position - Middle, $t=22.1 \text{ C}$,/Area Scan (51x91x1): Measurement grid:

$dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.291 mW/g



Date/Time: 02.12.2005 12:17:42

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10;Serial: 004400/69/174497/1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium: HSL1900 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.43 \text{ mho/m}$; $\epsilon_r = 40.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.9, 4.9, 4.9); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Tilt position - Middle, $t=22.0 \text{ C}$,/Area Scan (51x91x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.134 mW/g

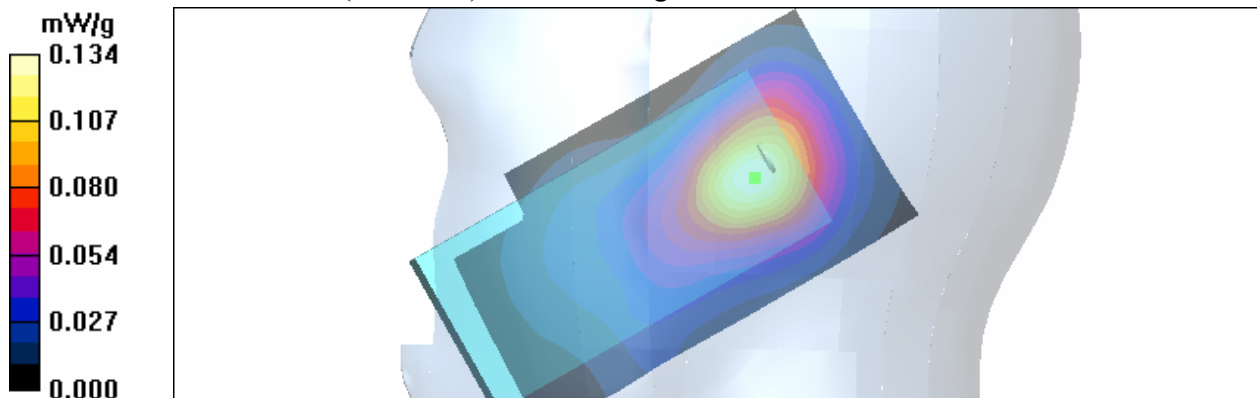
Tilt position - Middle, $t=22.0 \text{ C}$,/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 9.62 V/m ; Power Drift = 0.044 dB

Peak SAR (extrapolated) = 0.170 W/kg

SAR(1 g) = 0.115 mW/g ; SAR(10 g) = 0.071 mW/g

Maximum value of SAR (measured) = 0.125 mW/g



Date/Time: 02.12.2005 14:08:01

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10;Serial: 004400/69/174497/1

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: HSL1900 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.43 \text{ mho/m}$; $\epsilon_r = 40.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.9, 4.9, 4.9); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Cheek position - Middle, $t=21.9 \text{ C}$,/Zoom Scan (5x5x7) (5x5x7)/Cube 0:

Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 12.9 V/m ; Power Drift = -0.040 dB

Peak SAR (extrapolated) = 0.571 W/kg

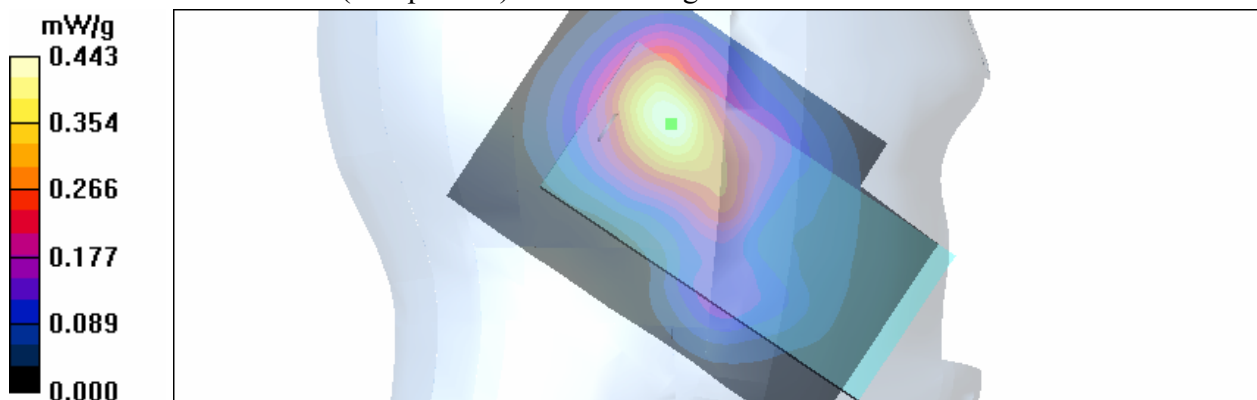
SAR(1 g) = 0.387 mW/g ; SAR(10 g) = 0.231 mW/g

Maximum value of SAR (measured) = 0.432 mW/g

Cheek position - Middle, $t=21.9 \text{ C}$,/Area Scan (61x91x1): Measurement grid:

$dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.443 mW/g



Date/Time: 02.12.2005 14:25:20

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10;Serial: 004400/69/174497/1

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3

Medium: HSL1900 Medium parameters used: $f = 1880$ MHz; $\sigma = 1.43$ mho/m; $\epsilon_r = 40.2$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.9, 4.9, 4.9); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Tilt position - Middle, t=21.9 C./Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 14.3 V/m; Power Drift = -0.047 dB

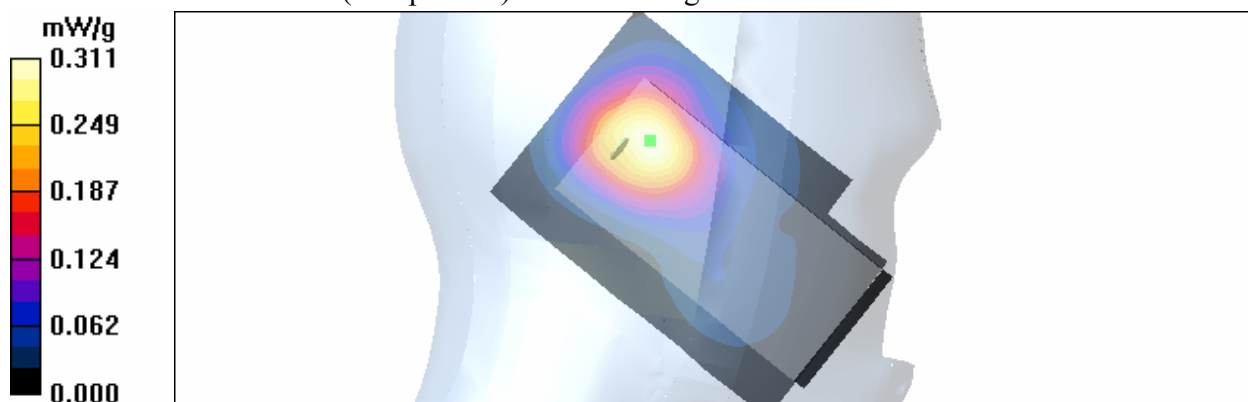
Peak SAR (extrapolated) = 0.391 W/kg

SAR(1 g) = 0.271 mW/g; SAR(10 g) = 0.169 mW/g

Maximum value of SAR (measured) = 0.293 mW/g

Tilt position - Middle, t=21.9 C./Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.311 mW/g



Date/Time: 02.12.2005 13:16:53

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10; Serial: 004400/69/174497/1

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: HSL1900 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.43 \text{ mho/m}$; $\epsilon_r = 40.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.9, 4.9, 4.9); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Cheek position - Middle, $t=21.9 \text{ C}$,/Zoom Scan (5x5x7) (5x5x7)/Cube 0:

Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 11.0 V/m ; Power Drift = -0.093 dB

Peak SAR (extrapolated) = 0.379 W/kg

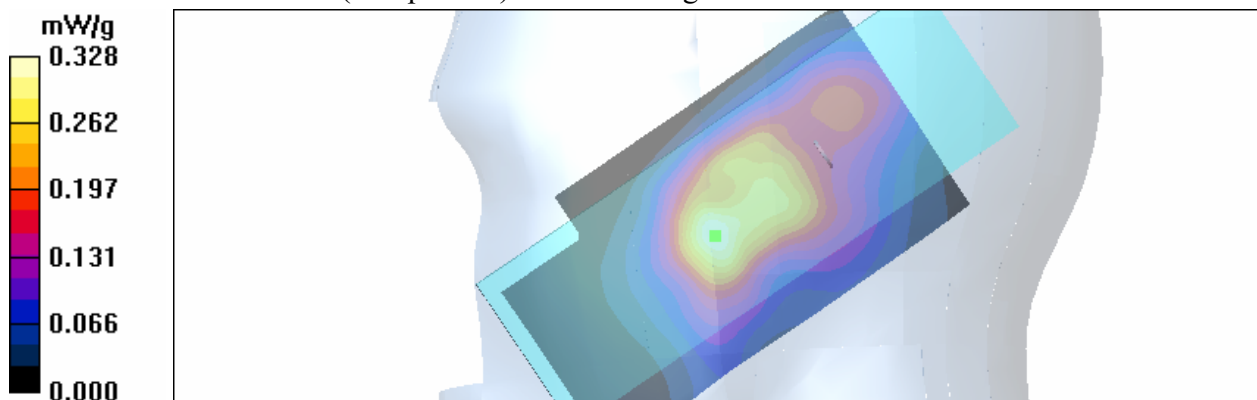
SAR(1 g) = 0.279 mW/g ; SAR(10 g) = 0.173 mW/g

Maximum value of SAR (measured) = 0.296 mW/g

Cheek position - Middle, $t=21.9 \text{ C}$,/Area Scan (51x91x1): Measurement grid:

$dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.328 mW/g



Date/Time: 02.12.2005 13:34:54

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10;Serial: 004400/69/174497/1

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: HSL1900 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.43 \text{ mho/m}$; $\epsilon_r = 40.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.9, 4.9, 4.9); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Tilt position - Middle, $t=21.9 \text{ C}$,/Area Scan (51x91x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.242 mW/g

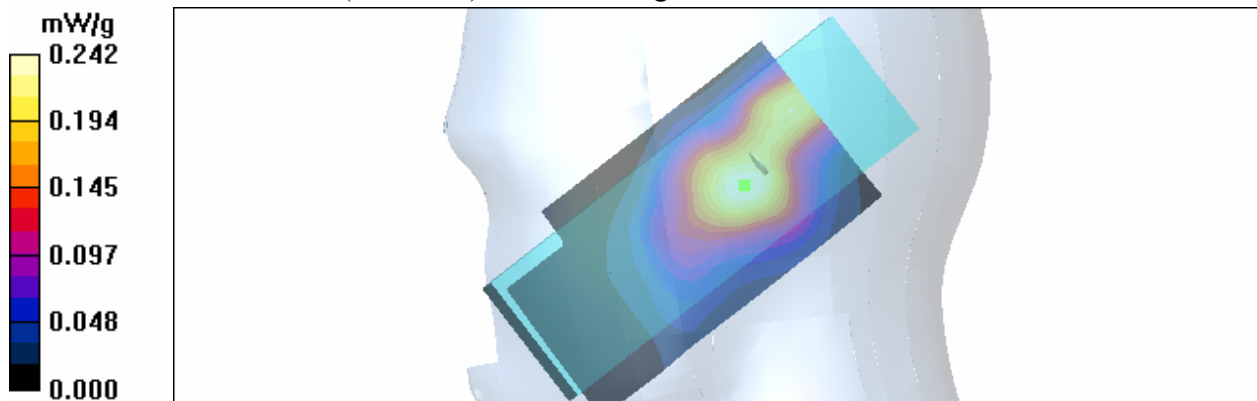
Tilt position - Middle, $t=21.9 \text{ C}$,/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 13.1 V/m ; Power Drift = -0.082 dB

Peak SAR (extrapolated) = 0.359 W/kg

SAR(1 g) = 0.228 mW/g ; SAR(10 g) = 0.135 mW/g

Maximum value of SAR (measured) = 0.251 mW/g



Date/Time: 02.12.2005 14:44:05

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10; Serial: 004400/69/174497/1

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: HSL1900 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.43 \text{ mho/m}$; $\epsilon_r = 40.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.9, 4.9, 4.9); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Cheek position - Middle, $t=21.9 \text{ C}$,/Zoom Scan (5x5x7) (5x5x7)/Cube 0:

Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 14.1 V/m ; Power Drift = -0.035 dB

Peak SAR (extrapolated) = 0.749 W/kg

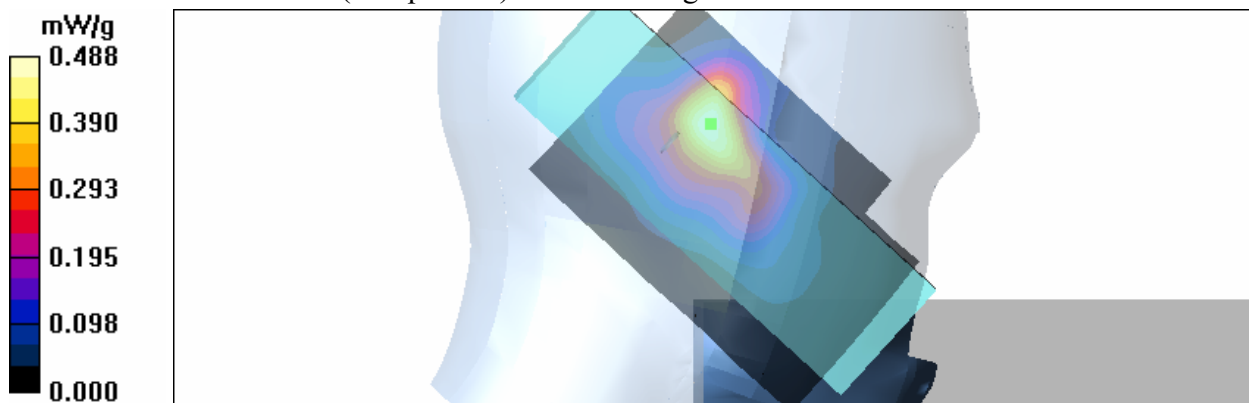
SAR(1 g) = 0.435 mW/g ; SAR(10 g) = 0.240 mW/g

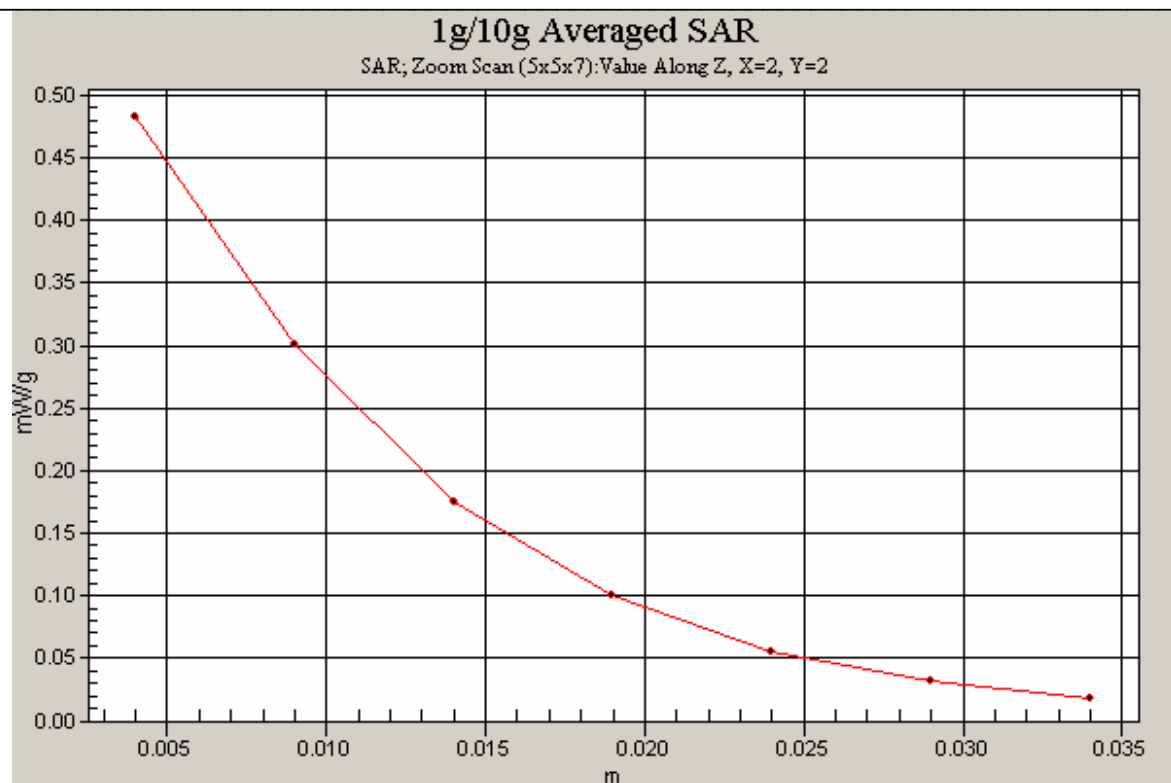
Maximum value of SAR (measured) = 0.482 mW/g

Cheek position - Middle, $t=21.9 \text{ C}$,/Area Scan (61x91x1): Measurement grid:

$dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.488 mW/g





Date/Time: 05.12.2005 10:01:53

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10; Serial: 004400/69/174497/1

Communication System: GSM 1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium: HSL1900 Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.42 \text{ mho/m}$; $\epsilon_r = 40.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.9, 4.9, 4.9); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 4; Type: SAM 4.0; Serial: 1342
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Tilt position - Middle, $t=21.8 \text{ C}$,/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 13.0 V/m ; Power Drift = -0.127 dB

Peak SAR (extrapolated) = 0.385 W/kg

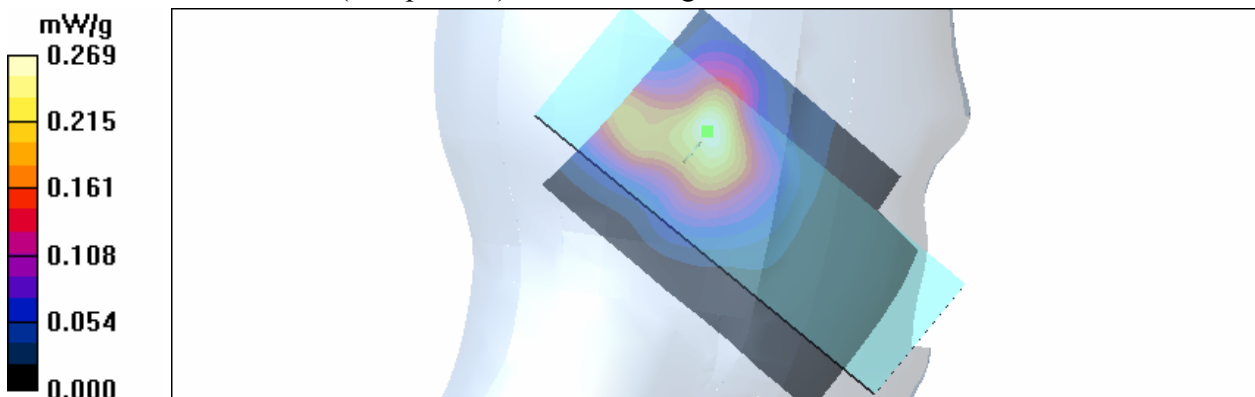
SAR(1 g) = 0.228 mW/g ; SAR(10 g) = 0.134 mW/g

Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube. This cube might not incorporate the absolute averaged SAR. Please consider a refinement of the Area Scan measurement.

Maximum value of SAR (measured) = 0.252 mW/g

Tilt position - Middle, $t=21.8 \text{ C}$,/Area Scan (61x91x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.269 mW/g



Date/Time: 22.11.2005 10:34:07

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10; Serial: 004400/69/174497/1

Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437 \text{ MHz}$; $\sigma = 1.85 \text{ mho/m}$; $\epsilon_r = 38.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Cheek position - Middle, $t=22.3 \text{ C}$,/Area Scan (51x91x1): Measurement grid:

$dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.327 mW/g

Cheek position - Middle, $t=22.3 \text{ C}$,/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

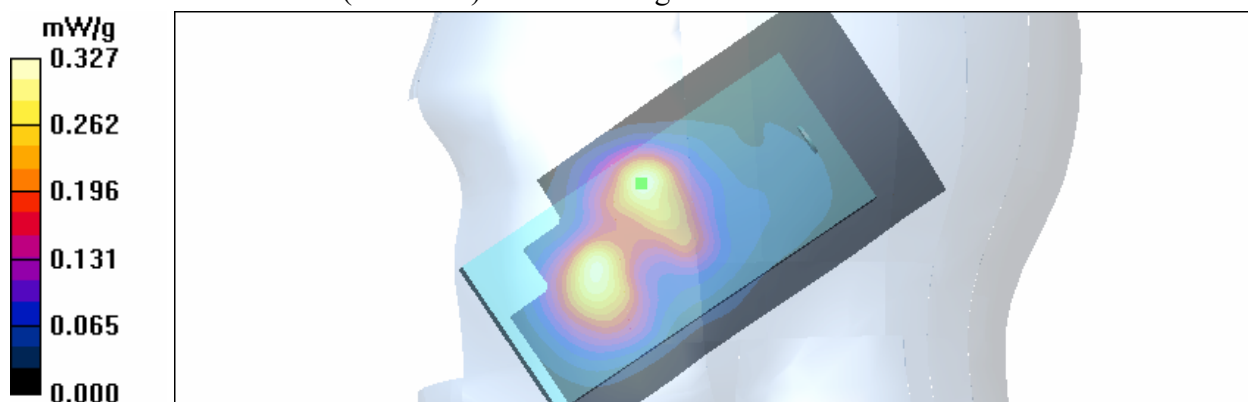
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 3.62 V/m; Power Drift = 0.111 dB

Peak SAR (extrapolated) = 0.653 W/kg

SAR(1 g) = 0.286 mW/g; SAR(10 g) = 0.140 mW/g

Maximum value of SAR (measured) = 0.321 mW/g



Date/Time: 22.11.2005 11:02:57

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10;Serial: 004400/69/174497/1

Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437 \text{ MHz}$; $\sigma = 1.85 \text{ mho/m}$; $\epsilon_r = 38.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Tilt position - Middle, $t=22.3 \text{ C}$,/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 5.57 V/m ; Power Drift = 0.015 dB

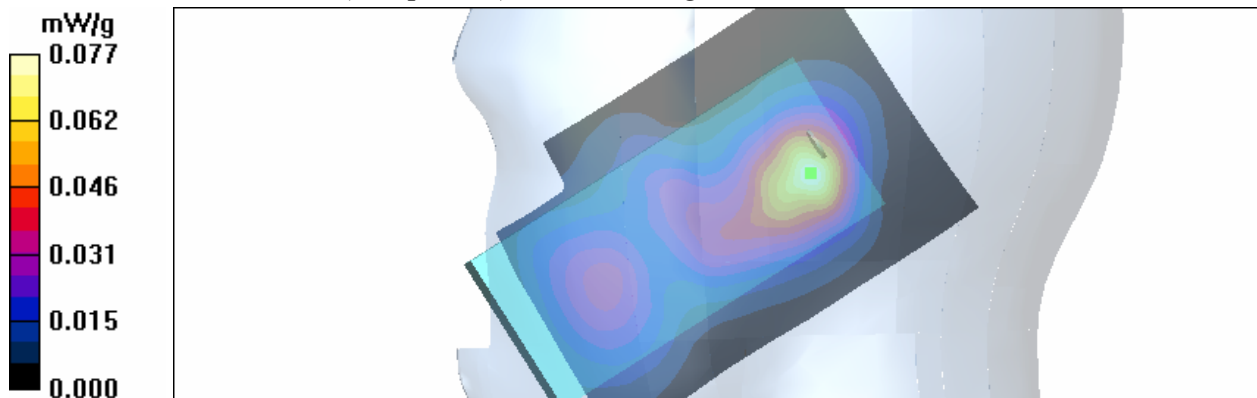
Peak SAR (extrapolated) = 0.116 W/kg

SAR(1 g) = 0.060 mW/g ; SAR(10 g) = 0.032 mW/g

Maximum value of SAR (measured) = 0.066 mW/g

Tilt position - Middle, $t=22.3 \text{ C}$,/Area Scan (61x91x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.077 mW/g



Date/Time: 22.11.2005 12:19:48

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10; Serial: 004400/69/174497/1

Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437 \text{ MHz}$; $\sigma = 1.85 \text{ mho/m}$; $\epsilon_r = 38.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Cheek position - Middle, $t=22.0 \text{ C}$ /Zoom Scan (7x7x7) (7x7x7)/Cube 0:

Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 4.52 V/m ; Power Drift = 0.049 dB

Peak SAR (extrapolated) = 0.792 W/kg

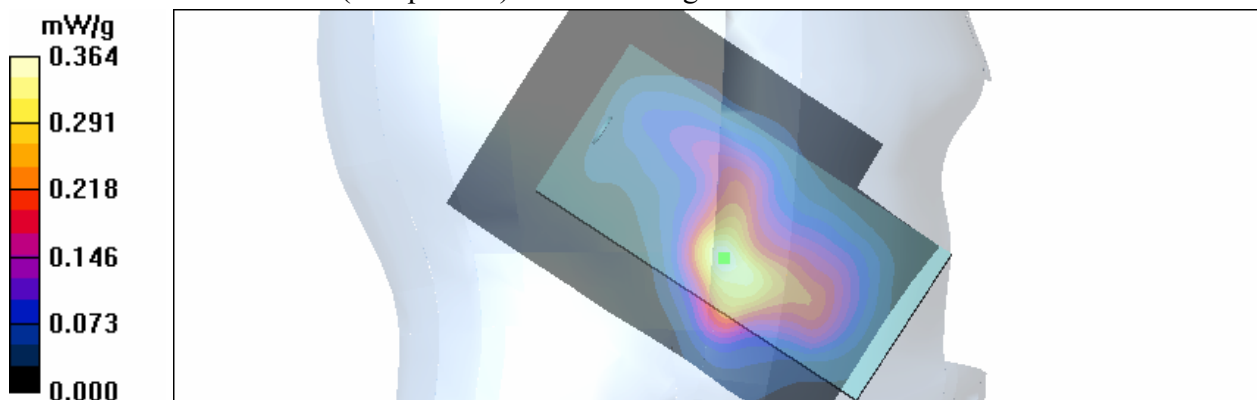
SAR(1 g) = 0.335 mW/g ; SAR(10 g) = 0.162 mW/g

Maximum value of SAR (measured) = 0.375 mW/g

Cheek position - Middle, $t=22.0 \text{ C}$ /Area Scan (61x91x1): Measurement grid:

$dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.364 mW/g



Date/Time: 22.11.2005 12:34:21

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10; Serial: 004400/69/174497/1

Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.85$ mho/m; $\epsilon_r = 38.6$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Tilt position - Middle, t=22.0 C./Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.083 mW/g

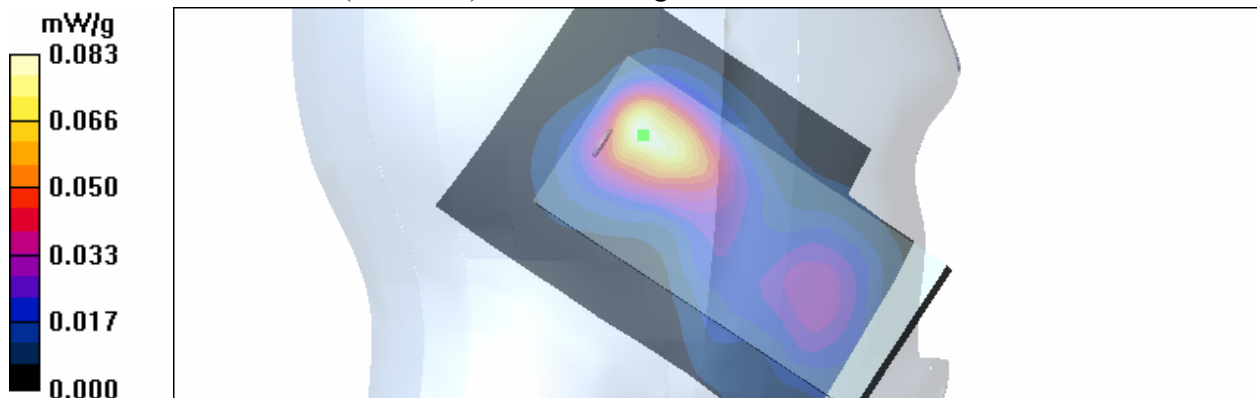
Tilt position - Middle, t=22.0 C./Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.98 V/m; Power Drift = 0.026 dB

Peak SAR (extrapolated) = 0.120 W/kg

SAR(1 g) = 0.066 mW/g; SAR(10 g) = 0.036 mW/g

Maximum value of SAR (measured) = 0.071 mW/g



Date/Time: 22.11.2005 11:23:32

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10; Serial: 004400/69/174497/1

Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437 \text{ MHz}$; $\sigma = 1.85 \text{ mho/m}$; $\epsilon_r = 38.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Cheek position - Middle, $t=22.0 \text{ C}$,/Area Scan (51x91x1): Measurement grid:

$dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.292 mW/g

Cheek position - Middle, $t=22.0 \text{ C}$,/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

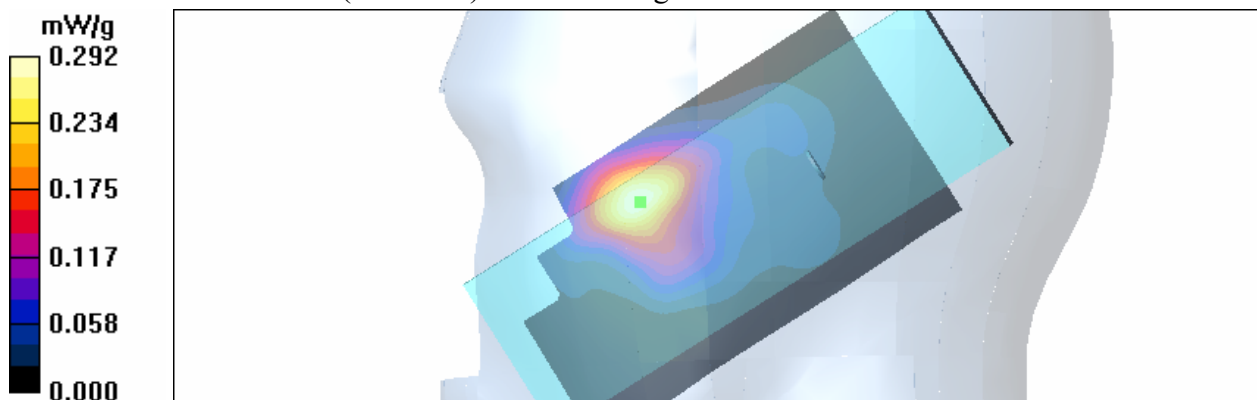
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 4.13 V/m; Power Drift = -0.258 dB

Peak SAR (extrapolated) = 0.473 W/kg

SAR(1 g) = 0.241 mW/g; SAR(10 g) = 0.124 mW/g

Maximum value of SAR (measured) = 0.266 mW/g



Date/Time: 22.11.2005 11:52:13

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10;Serial: 004400/69/174497/1

Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437 \text{ MHz}$; $\sigma = 1.85 \text{ mho/m}$; $\epsilon_r = 38.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Tilt position - Middle, $t=22.0 \text{ C}$,/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 5.52 V/m ; Power Drift = 0.046 dB

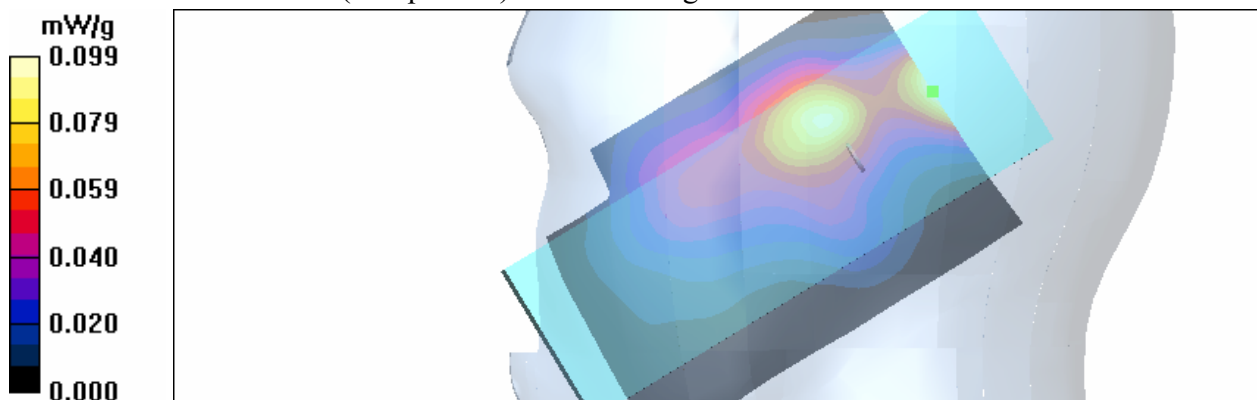
Peak SAR (extrapolated) = 0.158 W/kg

SAR(1 g) = 0.090 mW/g ; SAR(10 g) = 0.047 mW/g

Maximum value of SAR (measured) = 0.100 mW/g

Tilt position - Middle, $t=22.0 \text{ C}$,/Area Scan (61x91x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.099 mW/g



Date/Time: 22.11.2005 14:09:44

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10;Serial: 004400/69/174497/1

Communication System: WLAN; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.81$ mho/m; $\epsilon_r = 38.7$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Cheek position - Low, t=22.0 C,/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.05 V/m; Power Drift = -0.104 dB

Peak SAR (extrapolated) = 0.901 W/kg

SAR(1 g) = 0.441 mW/g; SAR(10 g) = 0.209 mW/g

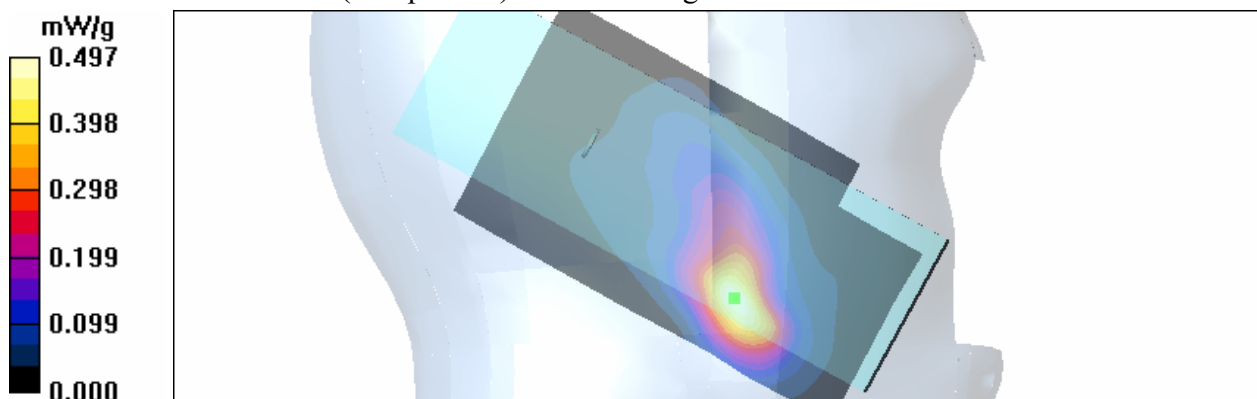
[Info: Interpolated medium parameters used for SAR evaluation.](#)

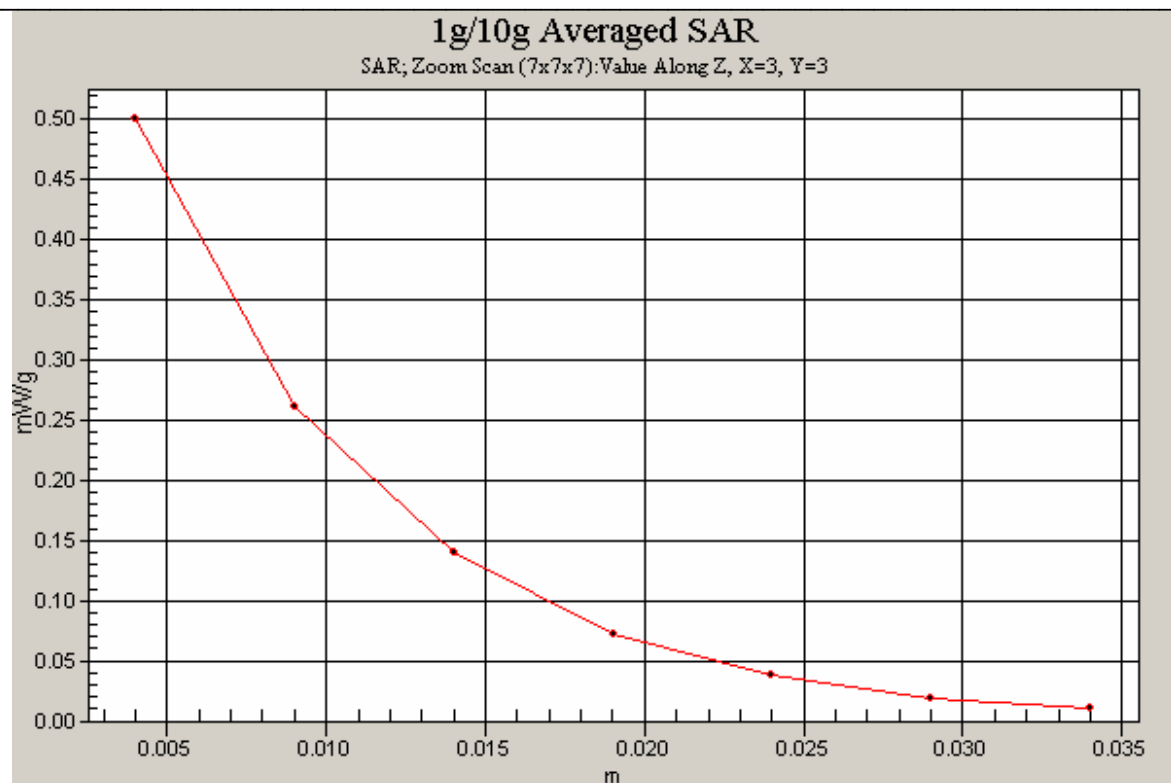
Maximum value of SAR (measured) = 0.501 mW/g

Cheek position - Low, t=22.0 C,/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (interpolated) = 0.497 mW/g





Date/Time: 22.11.2005 13:36:48

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10;Serial: 004400/69/174497/1

Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: HSL2450 Medium parameters used: $f = 2437$ MHz; $\sigma = 1.85$ mho/m; $\epsilon_r = 38.6$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.55, 4.55, 4.55); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Tilt position - Middle, t=22.0 C,/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.067 mW/g

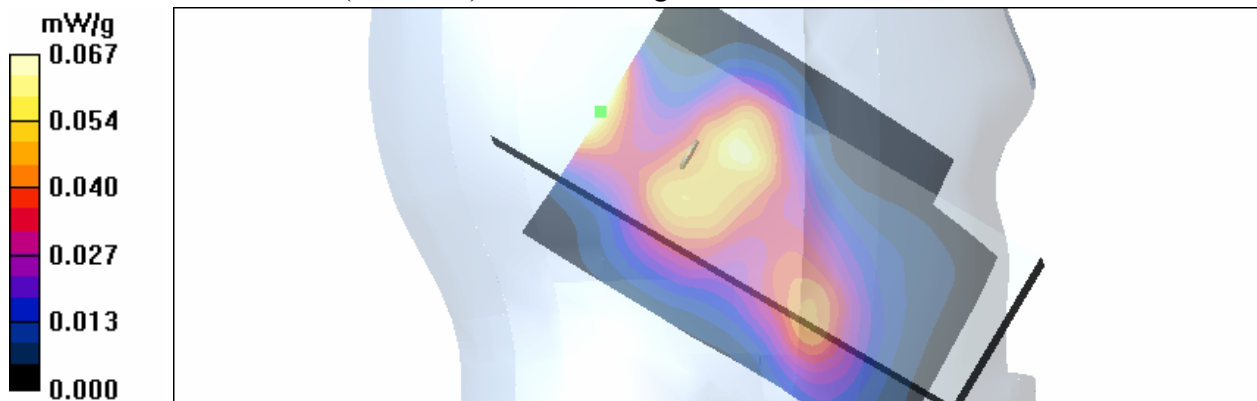
Tilt position - Middle, t=22.0 C,/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 5.26 V/m; Power Drift = -0.103 dB

Peak SAR (extrapolated) = 0.100 W/kg

SAR(1 g) = 0.062 mW/g; SAR(10 g) = 0.034 mW/g

Maximum value of SAR (measured) = 0.067 mW/g



Date/Time: 07.12.2005 10:26:05

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10; Serial: 004400/69/174497/1; without Headset

Communication System: 2-slot GPRS 1900; Frequency: 1909.8 MHz; Duty Cycle: 1:4.2

Medium: BSL1900 Medium parameters used: $f = 1910$ MHz; $\sigma = 1.55$ mho/m; $\epsilon_r = 53.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.42, 4.42, 4.42); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection) Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Body worn - High, $t=21.8$ C, /Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid:

$dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 17.7 V/m; Power Drift = -0.161 dB

Peak SAR (extrapolated) = 0.706 W/kg

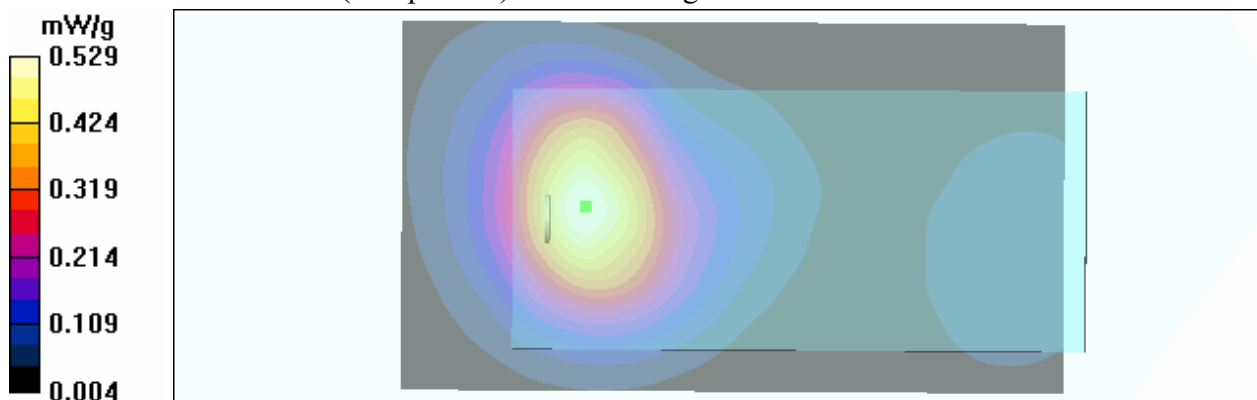
SAR(1 g) = 0.440 mW/g; SAR(10 g) = 0.264 mW/g

Maximum value of SAR (measured) = 0.476 mW/g

Body worn - High, $t=21.8$ C, /Area Scan (51x91x1): Measurement grid: $dx=15$ mm,

$dy=15$ mm

Maximum value of SAR (interpolated) = 0.529 mW/g



Date/Time: 05.12.2005 13:14:27

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10; Serial: 004400/69/174497/1; with headset HS-6

Communication System: GSM 1900; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3

Medium: BSL1900 Medium parameters used (interpolated): $f = 1850.2 \text{ MHz}$; $\sigma = 1.45 \text{ mho/m}$; $\epsilon_r = 53.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.42, 4.42, 4.42); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Body worn - Low, $t=21.5 \text{ C}$,/Area Scan (51x91x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (interpolated) = 0.534 mW/g

Body worn - Low, $t=21.5 \text{ C}$,/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

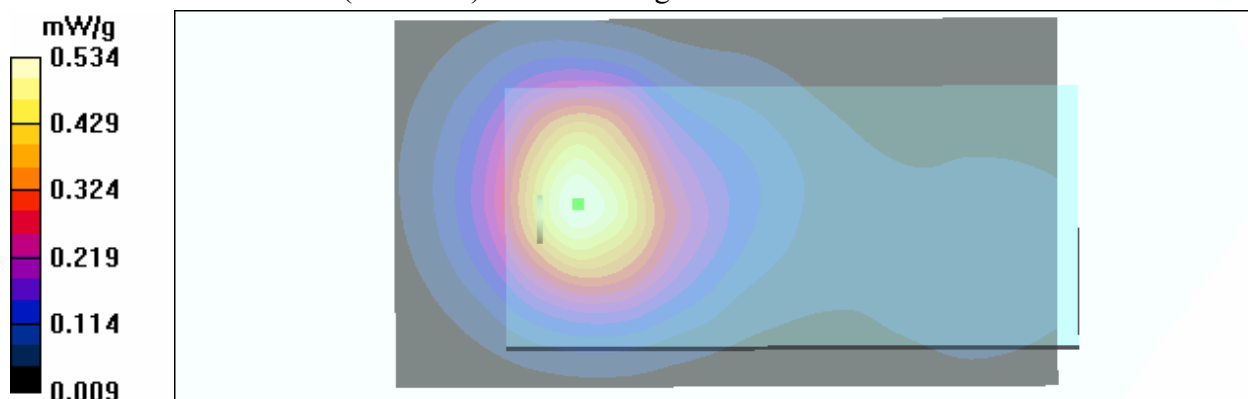
Reference Value = 18.2 V/m; Power Drift = -0.041 dB

Peak SAR (extrapolated) = 0.695 W/kg

SAR(1 g) = 0.461 mW/g; SAR(10 g) = 0.284 mW/g

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

Maximum value of SAR (measured) = 0.503 mW/g



Date/Time: 05.12.2005 14:39:03

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10; Serial: 004400/69/174497/1; without Headset; BT active

Communication System: GSM 1900; Frequency: 1909.8 MHz; Duty Cycle: 1:8.3

Medium: BSL1900 Medium parameters used: $f = 1910$ MHz; $\sigma = 1.51$ mho/m; $\epsilon_r = 53.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1766; ConvF(4.42, 4.42, 4.42); Calibrated: 22.04.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection) Sensor-Surface: 4mm (Mechanical And Optical Surface Detection (Locations From Previous Scan Used))
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 1; Type: SAM 4.0; Serial: 1275
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Body worn - High, $t=21.5$ C, /Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid:

$dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 20.2 V/m; Power Drift = -0.018 dB

Peak SAR (extrapolated) = 0.885 W/kg

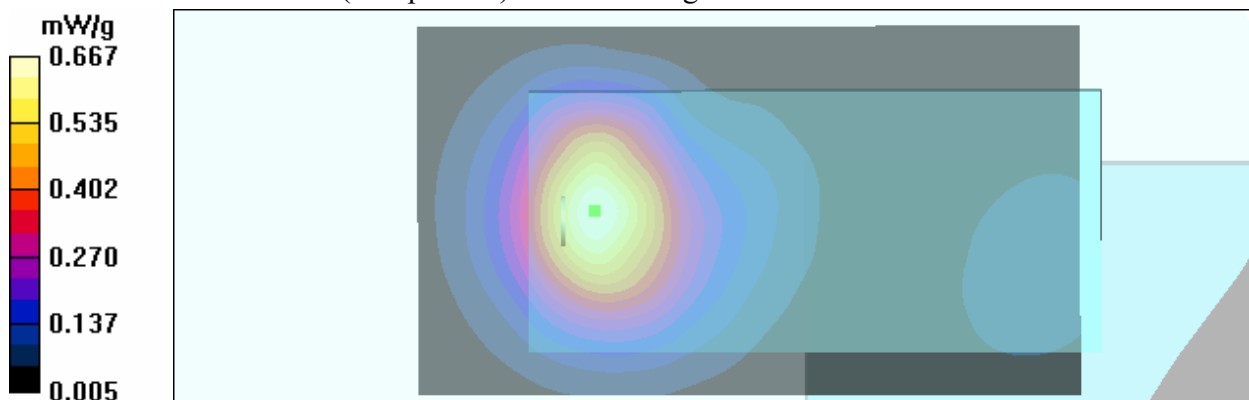
SAR(1 g) = 0.554 mW/g; SAR(10 g) = 0.329 mW/g

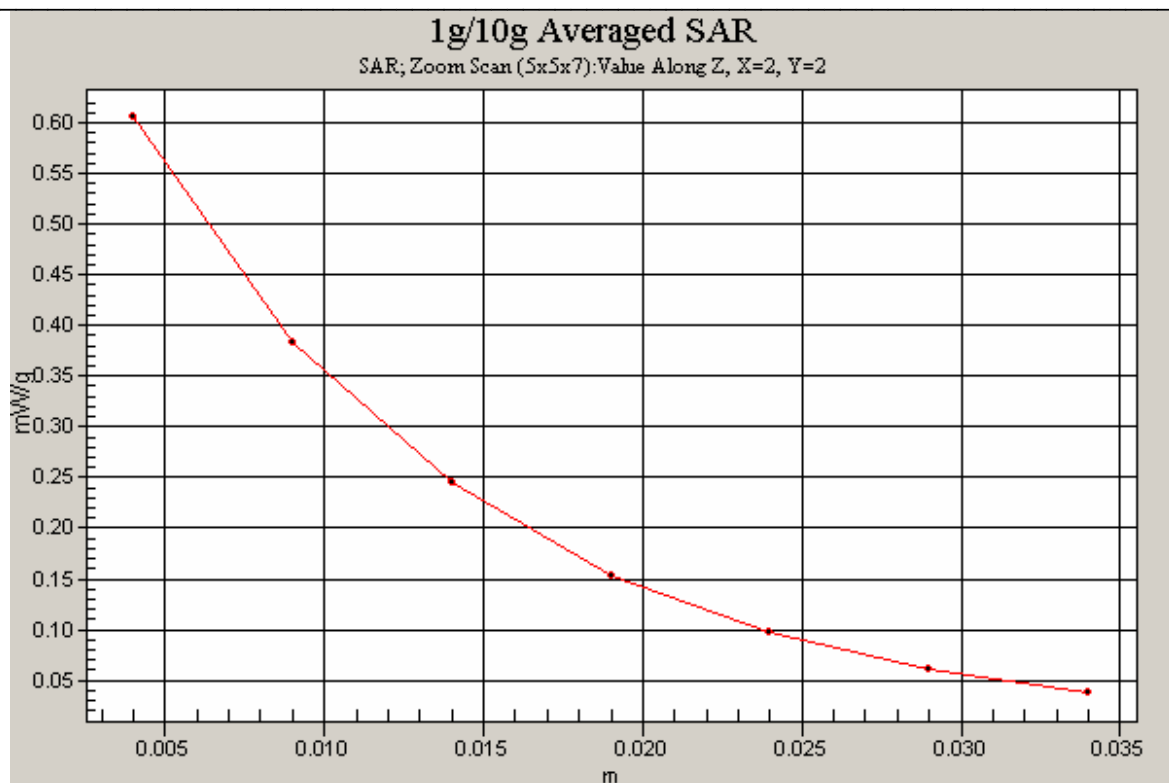
Maximum value of SAR (measured) = 0.605 mW/g

Body worn - High, $t=21.5$ C, /Area Scan (51x91x1): Measurement grid: $dx=15$ mm,

$dy=15$ mm

Maximum value of SAR (interpolated) = 0.667 mW/g





Date/Time: 23.11.2005 08:38:25

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10; Serial: 004400/69/174497/1; without headset

Communication System: WLAN; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: BSL2450 Medium parameters used (interpolated): $f = 2462$ MHz; $\sigma = 2.02$ mho/m; $\epsilon_r = 51.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.35, 4.35, 4.35); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 2; Type: SAM 4.0; Serial: 1272
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Body worn - High, $t=22.2$ C, /Area Scan (51x91x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

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

Maximum value of SAR (interpolated) = 0.050 mW/g

Body worn - High, $t=22.2$ C, /Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

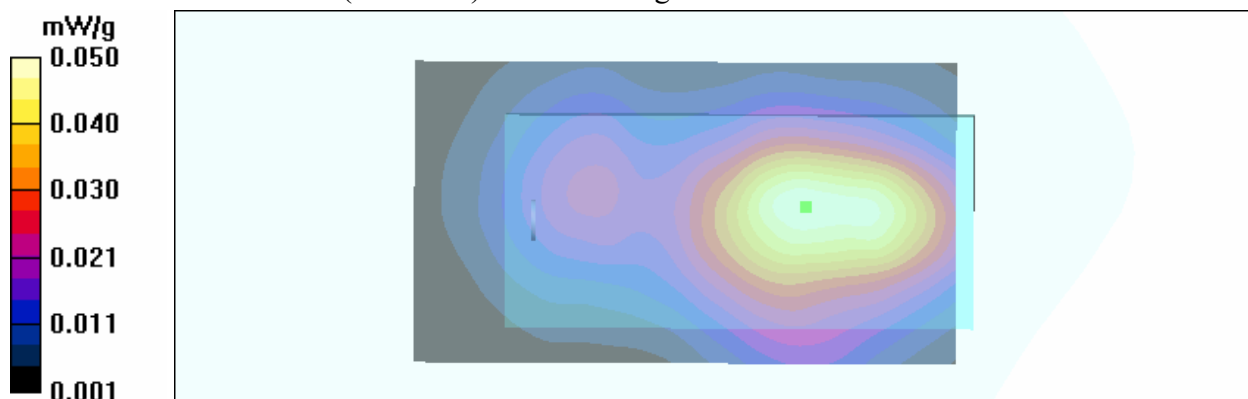
Reference Value = 2.89 V/m; Power Drift = 0.097 dB

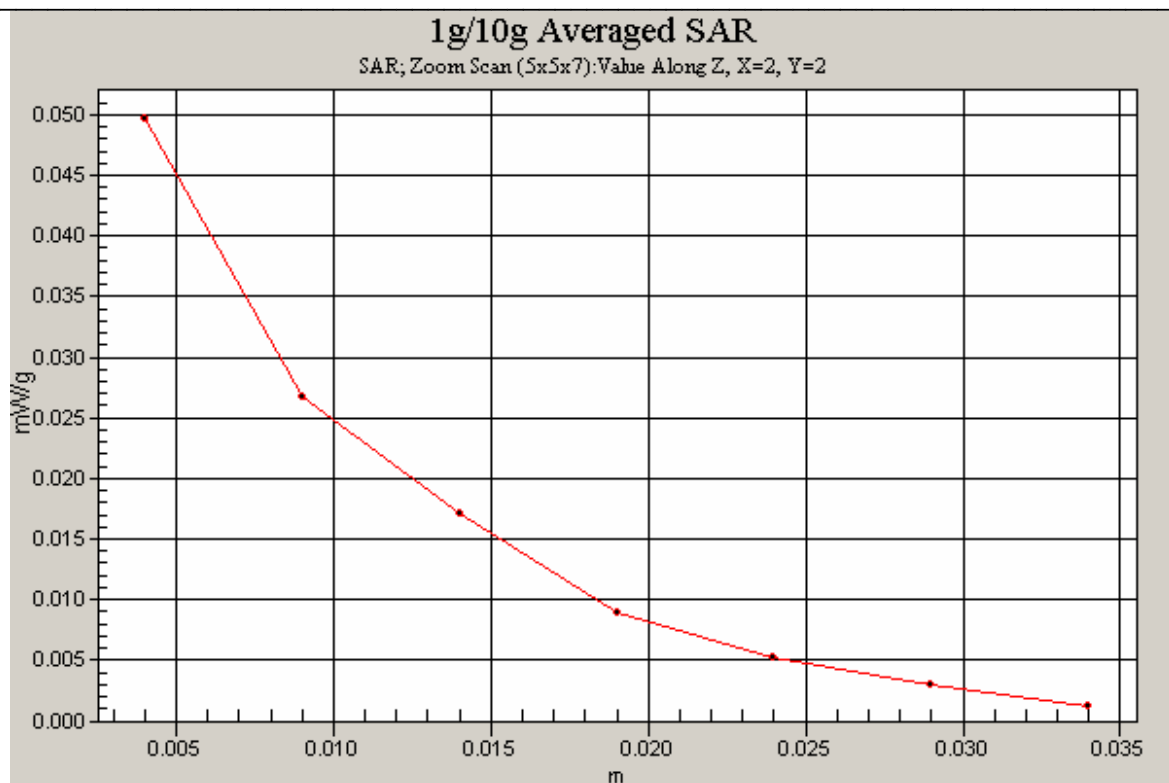
Peak SAR (extrapolated) = 0.097 W/kg

SAR(1 g) = 0.047 mW/g; SAR(10 g) = 0.027 mW/g

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

Maximum value of SAR (measured) = 0.050 mW/g





Date/Time: 23.11.2005 11:19:17

Test Laboratory: TCC Nokia, Oulu Laboratory

Type: RM-10; Serial: 004400/69/174497/1; with headset HS-6

Communication System: WLAN; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium: BSL2450 Medium parameters used (interpolated): $f = 2462 \text{ MHz}$; $\sigma = 2.02 \text{ mho/m}$; $\epsilon_r = 51.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1765; ConvF(4.35, 4.35, 4.35); Calibrated: 24.02.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn555; Calibrated: 21.02.2005
- Phantom: SAM 2; Type: SAM 4.0; Serial: 1272
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Body worn - High, $t=21.8 \text{ C}$,/Area Scan (51x91x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (interpolated) = 0.044 mW/g

Body worn - High, $t=21.8 \text{ C}$,/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

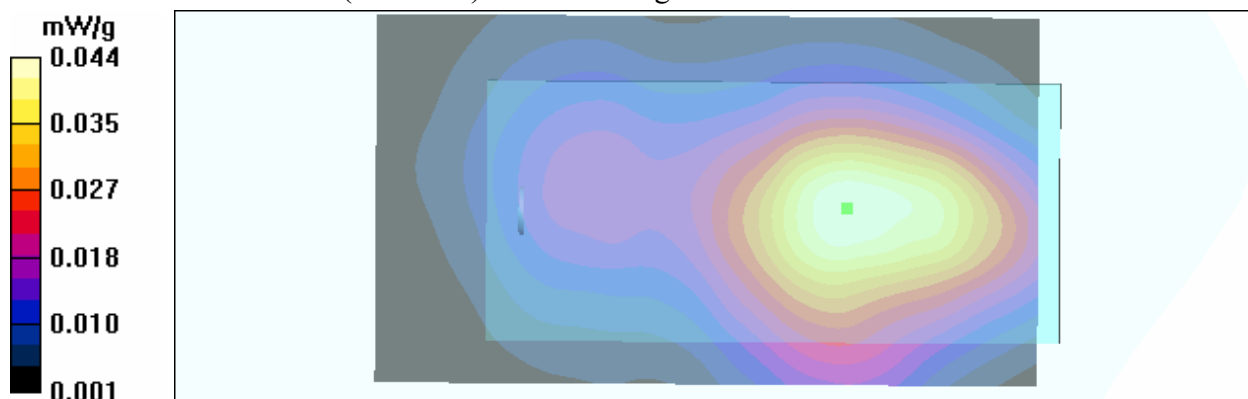
Reference Value = 2.65 V/m ; Power Drift = 0.210 dB

Peak SAR (extrapolated) = 0.085 W/kg

SAR(1 g) = 0.042 mW/g ; SAR(10 g) = 0.024 mW/g

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

Maximum value of SAR (measured) = 0.044 mW/g



APPENDIX C: RELEVANT PAGES FROM PROBE CALIBRATION REPORT(S)



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**

Client **Nokia Oulu**

Certificate No: **ET3-1765_Feb05**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1765**

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

Calibration date: **February 24, 2005**

Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	5-May-04 (METAS, No. 251-00388)	May-05
Power sensor E4412A	MY41495277	5-May-04 (METAS, No. 251-00388)	May-05
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-04 (METAS, No. 251-00403)	Aug-05
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-04 (METAS, No. 251-00389)	May-05
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-04 (METAS, No. 251-00404)	Aug-05
Reference Probe ES3DV2	SN: 3013	7-Jan-05 (SPEAG, No. ES3-3013_Jan05)	Jan-06
DAE4	SN: 617	19-Jan-05 (SPEAG, No. DAE4-617_Jan05)	Jan-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov 05

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Laboratory Technician	

Approved by:	Katja Pokovic	Technical Manager	
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Issued: February 25, 2005

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

DASY - Parameters of Probe: ET3DV6 SN:1765

Sensitivity in Free Space^A

Diode Compression^B

NormX	1.61 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	93 mV
NormY	1.86 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	93 mV
NormZ	1.94 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	93 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	8.7	4.4
SAR _{be} [%]	With Correction Algorithm	0.6	0.1

TSL 1750 MHz Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	13.1	8.4
SAR _{be} [%]	With Correction Algorithm	0.6	0.1

Sensor Offset

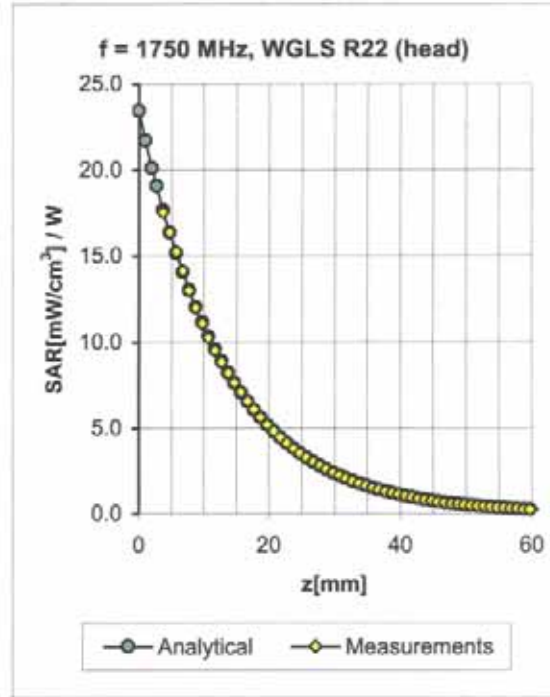
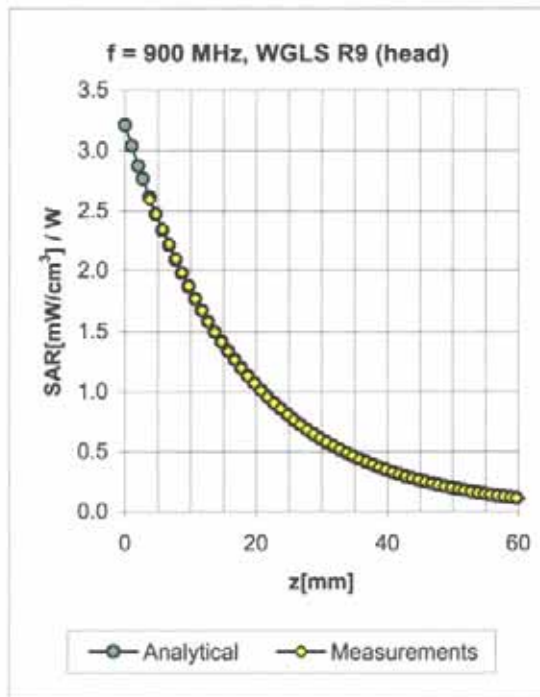
Probe Tip to Sensor Center 2.7 mm

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).

^B Numerical linearization parameter: uncertainty not required.

Conversion Factor Assessment



f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	1.22	1.42	6.72 ± 11.0% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	1.28	1.37	6.43 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.68	2.14	5.21 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.65	2.30	5.13 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.60	2.48	4.89 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.72	2.21	4.55 ± 11.8% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	1.24	1.45	6.32 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	1.17	1.50	6.00 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.60	2.64	4.75 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.60	2.71	4.67 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.66	2.42	4.50 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.78	1.95	4.35 ± 11.8% (k=2)

^c 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.



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Nokia Oulu**

Certificate No: **ET3-1766_Apr05**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1766**

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

Calibration date: **April 22, 2005**

Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	5-May-04 (METAS, No. 251-00388)	May-05
Power sensor E4412A	MY41495277	5-May-04 (METAS, No. 251-00388)	May-05
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-04 (METAS, No. 251-00403)	Aug-05
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-04 (METAS, No. 251-00389)	May-05
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-04 (METAS, No. 251-00404)	Aug-05
Reference Probe ES3DV2	SN: 3013	7-Jan-05 (SPEAG, No. ES3-3013_Jan05)	Jan-06
DAE4	SN: 617	19-Jan-05 (SPEAG, No. DAE4-617_Jan05)	Jan-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov 05

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 25, 2005

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DASY - Parameters of Probe: ET3DV6 SN:1766**Sensitivity in Free Space^A****Diode Compression^B**

NormX	1.99 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	93 mV
NormY	1.71 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	93 mV
NormZ	1.89 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	93 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	8.8	4.5
SAR _{be} [%]	With Correction Algorithm	0.1	0.3

TSL 1750 MHz Typical SAR gradient: 10 % per mm

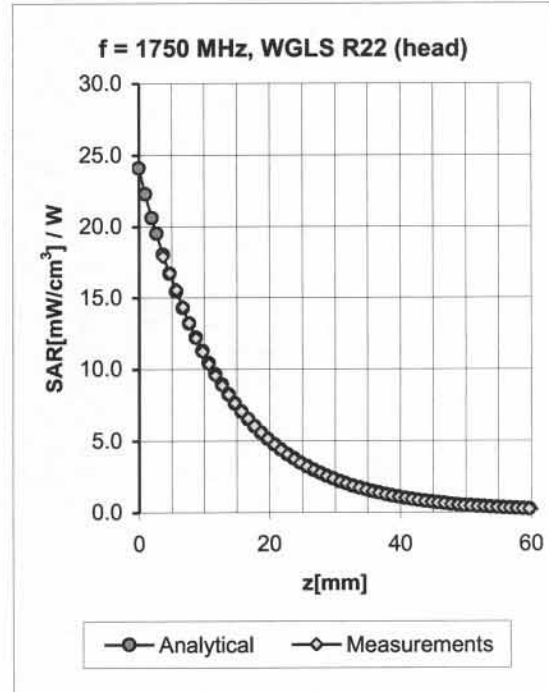
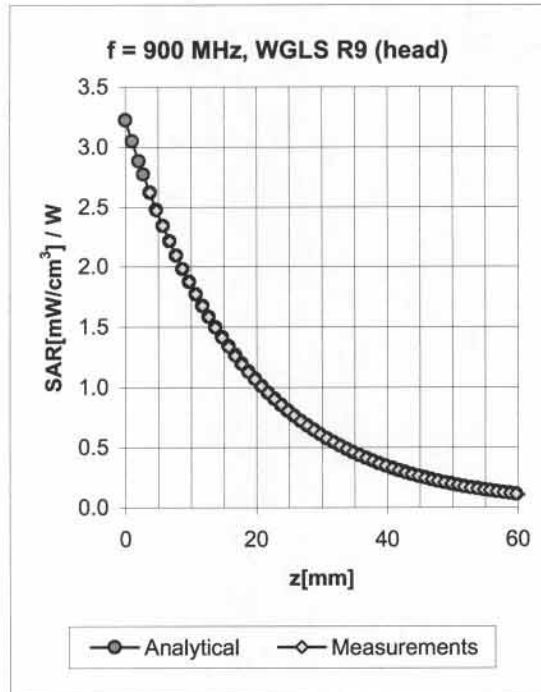
Sensor Center to Phantom Surface Distance		3.7 mm	4.7 mm
SAR _{be} [%]	Without Correction Algorithm	13.2	8.8
SAR _{be} [%]	With Correction Algorithm	0.9	0.1

Sensor OffsetProbe 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).^B Numerical linearization parameter: uncertainty not required.

Conversion Factor Assessment



f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.66	1.77	6.37 ± 11.0% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.68	1.74	6.16 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.65	2.24	5.04 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.64	2.36	4.90 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.64	2.38	4.75 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.74	2.13	4.35 ± 11.8% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.53	2.03	6.32 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.53	2.06	5.98 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.63	2.59	4.59 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.63	2.64	4.42 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.66	2.45	4.25 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.82	1.95	4.08 ± 11.8% (k=2)

^c 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.

APPENDIX D: RELEVANT PAGES FROM DIPOLE VALIDATION KIT REPORT(S)



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 Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **Nokia Oulu 2**

Certificate No: **D1900V2-5d030_Feb05**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d030**

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

Calibration date: **February 18, 2005**

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 E442	GB37480704	12-Oct-04 (METAS, No. 251-00412)	Oct-05
Power sensor HP 8481A	US37292783	12-Oct-04 (METAS, No. 251-00412)	Oct-05
Reference 20 dB Attenuator	SN: 5086 (20g)	10-Aug-04 (METAS, No 251-00402)	Aug-05
Reference 10 dB Attenuator	SN: 5047.2 (10r)	10-Aug-04 (METAS, No 251-00402)	Aug-05
Reference Probe ET3DV6	SN 1507	26-Oct-04 (SPEAG, No. ET3-1507_Oct04)	Oct-05
DAE4	SN 601	07-Jan-05 (SPEAG, No. DAE4-601_Jan05)	Jan-06

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-03)	In house check: Oct-05
RF generator R&S SML-03	100698	27-Mar-02 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov 05

	Name	Function	Signature
Calibrated by:	Mike Meili	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 25, 2005

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DASY4 Validation Report for Head TSL

Date/Time: 18.02.2005 15:49:29

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d030

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

Medium: HSL 1800 MHz;

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.46$ mho/m; $\epsilon_r = 39.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(4.96, 4.96, 4.96); Calibrated: 26.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.01.2005
- Phantom: Flat Phantom 5.0; Type: QD000P50AA; Serial: 1001;
- Measurement SW: DASY4, V4.5 Build 11; Postprocessing SW: SEMCAD, V1.8 Build 144

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 11.2 mW/g

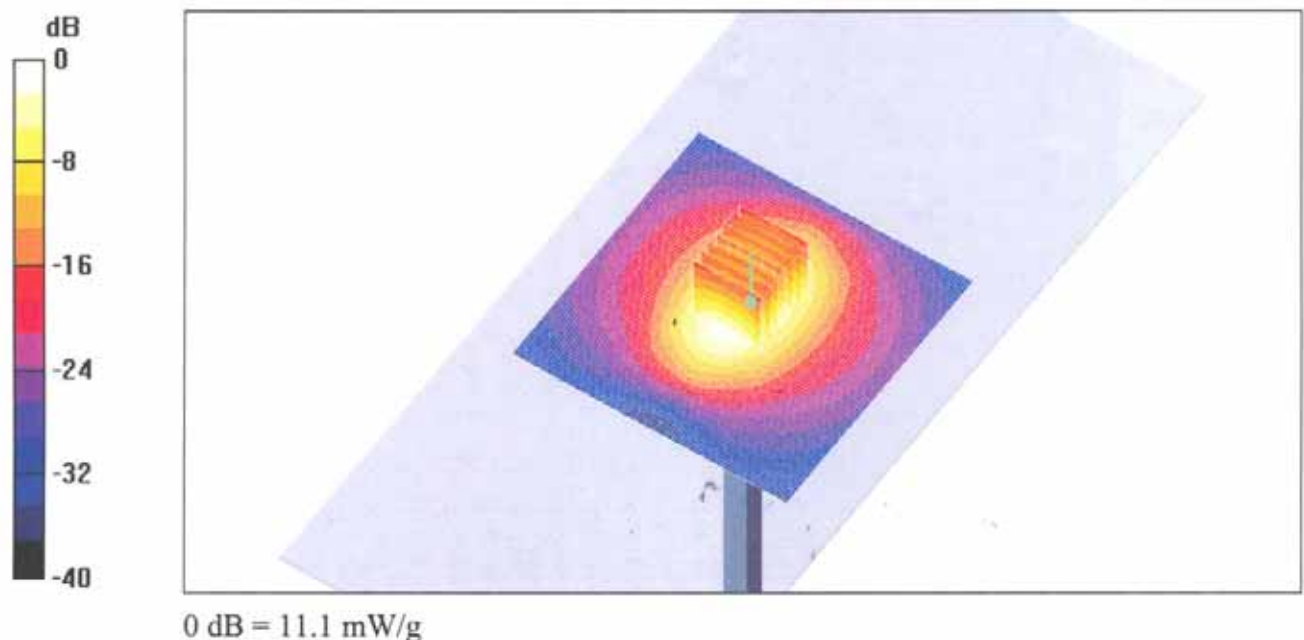
Pin = 250 mW; d = 10 mm/Zoom Scan 2 (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 88.4 V/m; Power Drift = 0.020 dB

Peak SAR (extrapolated) = 17.1 W/kg

SAR(1 g) = 9.76 mW/g; SAR(10 g) = 5.09 mW/g

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



Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d030

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

Medium: Muscle 1800 MHz;

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.57$ mho/m; $\epsilon_r = 52.2$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(4.43, 4.43, 4.43); Calibrated: 26.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.01.2005
- Phantom: Flat Phantom 5.0; Type: QD000P50AA; Serial: 1001;
- Measurement SW: DASY4, V4.5 Build 13; Postprocessing SW: SEMCAD, V1.8 Build 142

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 11.5 mW/g

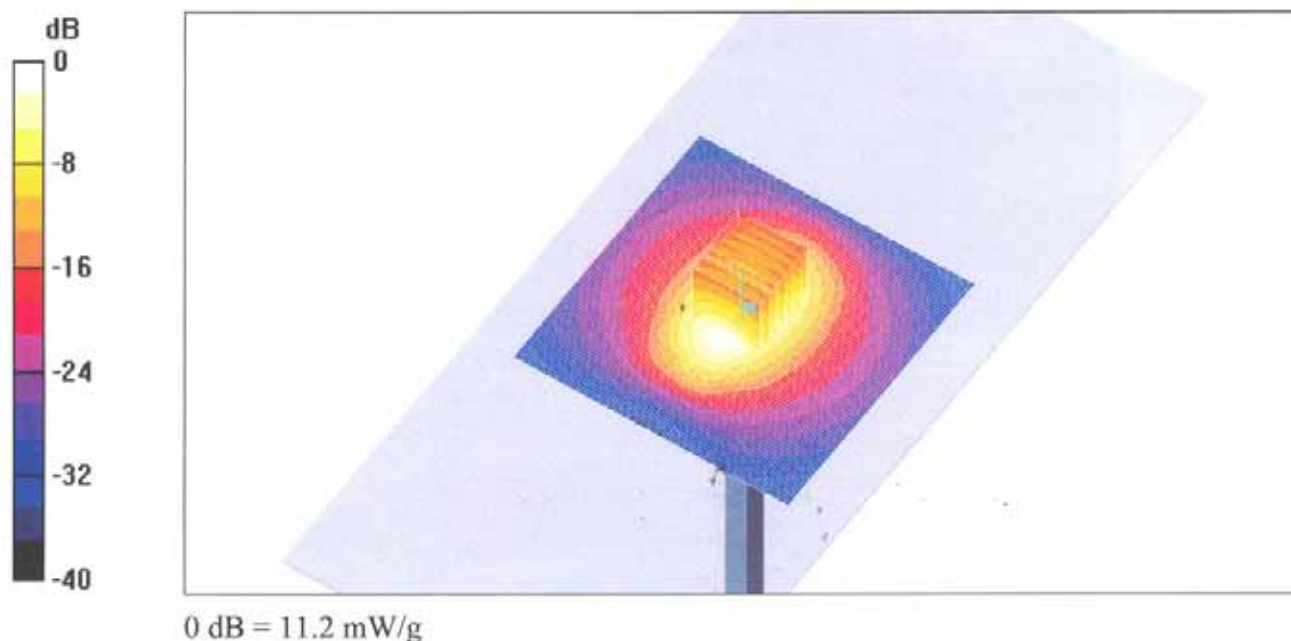
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.4 V/m; Power Drift = 0.0 dB

Peak SAR (extrapolated) = 16.7 W/kg

SAR(1 g) = 9.94 mW/g; SAR(10 g) = 5.3 mW/g

Maximum value of SAR (measured) = 11.2 mW/g





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Accreditation No.: **SCS 108**

Client **Nokia Oulu 2**

Certificate No: **D2450V2-729_Feb05**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 729**

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

Calibration date: **February 10, 2005**

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 E442	GB37480704	12-Oct-04 (METAS, No. 251-00412)	Oct-05
Power sensor HP 8481A	US37292783	12-Oct-04 (METAS, No. 251-00412)	Oct-05
Reference 20 dB Attenuator	SN: 5086 (20g)	10-Aug-04 (METAS, No 251-00402)	Aug-05
Reference 10 dB Attenuator	SN: 5047.2 (10r)	10-Aug-04 (METAS, No 251-00402)	Aug-05
Reference Probe ES3DV2	SN 3025	29-Oct-04 (SPEAG, No. ES3-3025_Oct04)	Oct-05
DAE4	SN 601	07-Jan-05 (SPEAG, No. DAE4-601_Jan05)	Jan-06
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-03)	In house check: Oct-05
RF generator R&S SML-03	100698	27-Mar-02 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-04)	In house check: Nov-05

Calibrated by: **Name** **Function** **Signature**
Mike Meili **Laboratory Technician**

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

Issued: February 11, 2005

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

DASY4 Validation Report for Head TSL

Date/Time: 09.02.2005 15:01:26

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN729

Communication System: CW-2450; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB;

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.78$ mho/m; $\epsilon_r = 39.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.4, 4.4, 4.4); Calibrated: 29.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.07.2004
- Phantom: Flat Phantom 5.0; Type: QD000P50AA; Serial: 1001;
- Measurement SW: DASY4, V4.5 Build 11; Postprocessing SW: SEMCAD, V1.8 Build 142

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 16.7 mW/g

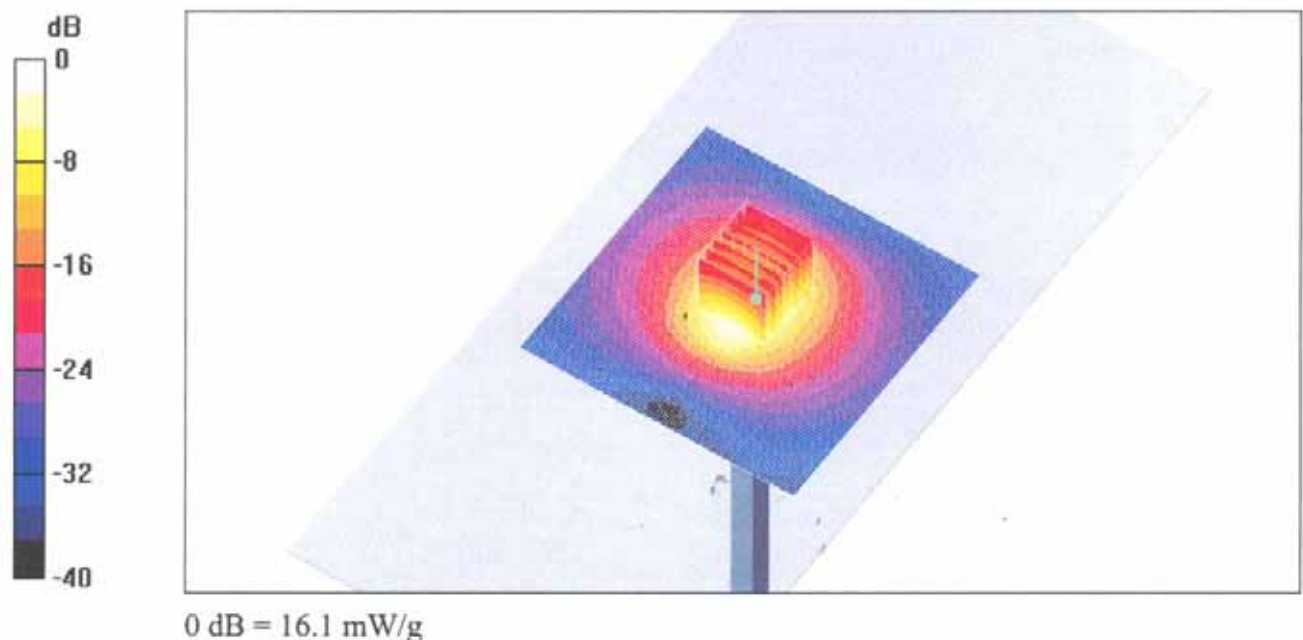
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.1 V/m; Power Drift = 0.0 dB

Peak SAR (extrapolated) = 28.9 W/kg

SAR(1 g) = 14.2 mW/g; SAR(10 g) = 6.6 mW/g

Maximum value of SAR (measured) = 16.1 mW/g



DASY4 Validation Report for Body TSL

Date/Time: 10.02.2005 11:57:43

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN729

Communication System: CW-2450; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: M2450;

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.01$ mho/m; $\epsilon_r = 52.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.13, 4.13, 4.13); Calibrated: 29.10.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.07.2004
- Phantom: Flat Phantom 5.0; Type: QD000P50AA; Serial: 1001;
- Measurement SW: DASY4, V4.5 Build 11; Postprocessing SW: SEMCAD, V1.8 Build 142

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 15.7 mW/g

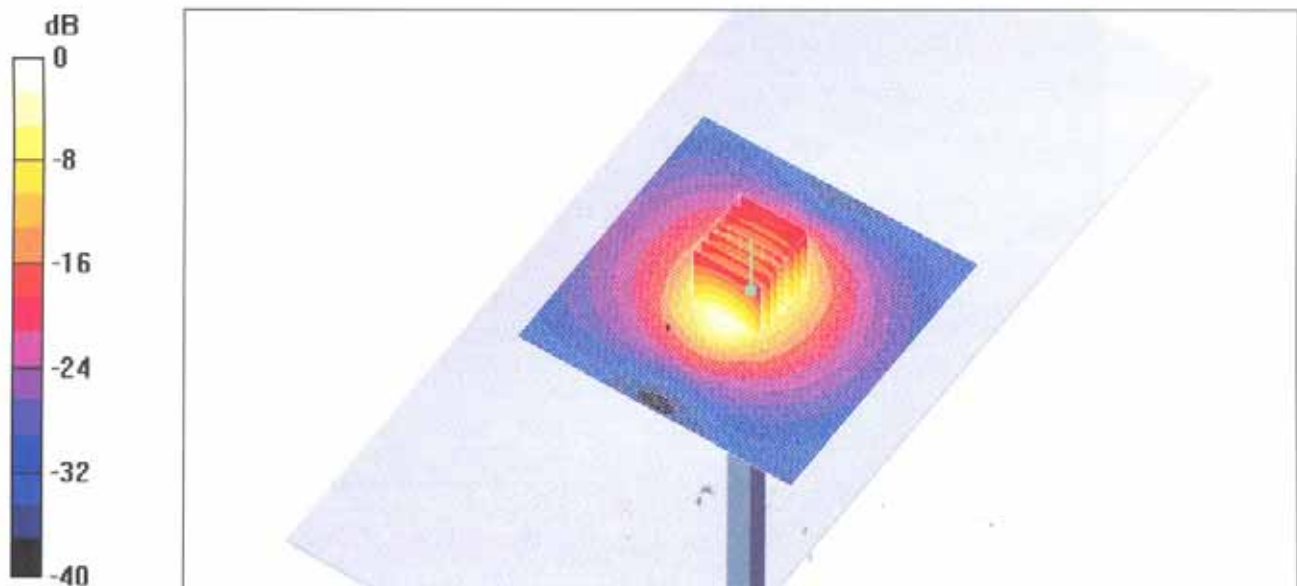
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 86.7 V/m; Power Drift = 0.0 dB

Peak SAR (extrapolated) = 27.3 W/kg

SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.19 mW/g

Maximum value of SAR (measured) = 15.2 mW/g



0 dB = 15.2 mW/g