

SAR Compliance Test Report

Test report no.:	Salo_SAR_0535_03	Date of report:	2005-08-31
Template version:	4a	Number of pages:	39
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Tested device:	RH-69		
FCC ID:	QTLRH-69	IC:	661AB-RH69
Supplement reports:	-		
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		
Documentation:	The documentation of the testing performed on the tested devices is archived for 15 years at TCC Nokia.		
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.		

Date and signatures:

For the contents:

Virpi Tuominen
Senior Design Engineer

CONTENTS

1. SUMMARY OF SAR TEST REPORT.....	3
1.1 TEST DETAILS.....	3
1.2 MAXIMUM RESULTS.....	3
1.2.1 Head Configuration.....	3
1.2.2 Body Worn Configuration	3
1.2.3 Maximum Drift	4
1.2.4 Measurement Uncertainty	4
2. DESCRIPTION OF THE DEVICE UNDER TEST	4
2.1 PICTURE OF THE DEVICE.....	4
2.2 DESCRIPTION OF THE ANTENNA	5
3. TEST CONDITIONS	5
3.1 TEMPERATURE AND HUMIDITY	5
3.2 TEST SIGNAL, FREQUENCIES AND OUTPUT POWER.....	5
4. DESCRIPTION OF THE TEST EQUIPMENT	5
4.1 MEASUREMENT SYSTEM AND COMPONENTS	5
4.1.1 Isotropic E-field Probe SN: 1396.....	6
4.2 PHANTOMS	7
4.3 TISSUE SIMULANTS	7
4.3.1 Tissue Simulant Recipes	7
4.3.2 System Checking	8
4.3.3 Tissue Simulants used in the Measurements:.....	9
5. DESCRIPTION OF THE TEST PROCEDURE	10
5.1 DEVICE HOLDER.....	10
5.2 TEST POSITIONS.....	10
5.2.1 Against Phantom Head.....	10
5.2.2 Body Worn Configuration	11
5.3 SCAN PROCEDURES.....	11
5.4 SAR AVERAGING METHODS.....	12
6. MEASUREMENT UNCERTAINTY	13
7. RESULTS	14
APPENDIX A: SYSTEM CHECKING SCANS.....	16
APPENDIX B: MEASUREMENT SCANS.....	21
APPENDIX C: RELEVANT PAGES FROM PROBE CALIBRATION REPORT(S)	38
APPENDIX D: RELEVANT PAGES FROM DIPOLE VALIDATION KIT REPORT(S)	39

1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	2005-08-22 to 2005-08-30
SN, HW and SW numbers of tested device	SN: 001004/00/199001/0, HW: 0508, SW: 3.30, DUT: 10736
Batteries used in testing	BL-5CA, DUT: 10740, 10741
Headsets used in testing	HDE-2, DUT: 10742
Other accessories used in testing	-
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
GSM850	251 / 848.8	31.8dBm ERP	Right Cheek	1.08 W/kg	1.21 W/kg	1.6 W/kg	PASSED
GSM1900	810 / 1909.8	32.8dBm EIRP	Left Tilt	0.92 W/kg	1.03 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
GSM850	190 / 836.6	31.0 dBm ERP	1.5cm	1.06 W/kg	1.19 W/kg	1.6 W/kg	PASSED
GSM1900	512 / 1850.2	31.9 dBm EIRP	1.5cm	0.53 W/kg	0.59 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	-0.2dB

1.2.4 Measurement Uncertainty

Expanded Uncertainty (k=2) 95%	± 27.4%
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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 850 / 1900
Modulation Mode	GMSK
Duty Cycle	1/8
Transmitter Frequency Range (MHz)	824 – 849 1850 - 1910

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):	22.0 to 22.5
Ambient humidity (RH %):	45 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 software version 4.5, 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
DAE V1	388	12 months	2006-01
E-field Probe ET3DV6	1396	12 months	2006-01
Dipole Validation Kit, D835V2	462	24 months	2006-07
Dipole Validation Kit, D1900V2	5d013	24 months	2006-07

Additional test equipment used in testing:

Test Equipment	Model	Serial Number	Calibration interval	Calibration expiry
Signal Generator	SML03	101265	12 months	2006-07
Amplifier	ZHL-42 (SMA)	N072095-5	12 months	2006-07
Power Meter	NRVS	849305/028	12 months	2006-07
Power Sensor	NRV-Z32	839176/020	12 months	2006-07
Call Tester	CMU 200	101111	-	-
Call Tester	MT8820A	6100225540	-	-
Vector Network Analyzer	8753E	US38432928	12 months	2005-10
Dielectric Probe Kit	85070B	US33020420	-	-

4.1.1 Isotropic E-field Probe SN: 1396

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
Application	Distance from probe tip to dipole centers: 2.7 mm 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:

800MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	51.50	50.65
Tween 20	47.35	-
Sugar	-	48.21
Preservative	-	0.20
Salt	1.15	0.94

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

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]	
835	Reference result	2.45	41.8	0.92	
	$\pm 10\%$ window	2.20 – 2.70			
	2005-08-26	2.43	41.8	0.92	21.9
1900	Reference result	10.0	39.4	1.44	
	$\pm 10\%$ window	9.0 – 11.0			
	2005-08-23	10.5	38.8	1.42	22.0

System checking, body tissue simulant

f [MHz]	Description	SAR [W/kg], 1g	Dielectric Parameters		Temp [°C]
			ϵ_r	σ [S/m]	
	Reference result	2.45	54.6	0.99	
	$\pm 10\%$ window	2.20 – 2.70			
835	2005-08-30	2.43	54.0	0.95	21.9
	Reference result	10.4	52.2	1.58	
	$\pm 10\%$ window	9.4 – 11.4			
1900	2005-08-22	10.1	53.3	1.55	21.7

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]	
	Recommended value	41.5	0.90	
	$\pm 5\%$ window	39.4 – 43.6	0.86 – 0.95	
836	2005-08-26	41.7	0.92	21.0
	Recommended value	40.0	1.40	
	$\pm 5\%$ window	38.0 – 42.0	1.33 – 1.47	
1880	2005-08-23	38.9	1.41	21.0

Body tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp [°C]
		ϵ_r	σ [S/m]	
	Recommended value	55.2	0.97	
	$\pm 5\%$ window	52.4 – 58.0	0.92 – 1.02	
836	2005-08-30	54.0	0.95	21.0
	Recommended value	53.3	1.52	
	$\pm 5\%$ window	50.6 – 56.0	1.44 – 1.60	
1880	2005-08-22	53.4	1.53	21.0

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".



Photo of the device in “cheek” position



Photo 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	G_i	$G_i \cdot U_i$ (%)	V_i
Measurement System							
Probe Calibration	E2.1	±5.8	N	1	1	±5.8	∞
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	±8.3	R	√3	1	±4.8	∞
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	E5.2	±3.9	R	√3	1	±2.3	∞
Test sample Related							
Test Sample Positioning	E4.2.1	±6.0	N	1	1	±6.0	11
Device Holder Uncertainty	E4.1.1	±5.0	N	1	1	±5.0	7
Output Power Variation - SAR drift measurement	6.6.3	±10.0 0.0	R	√3	1	±5.80 .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			±13.7	148
Coverage Factor for 95%			k=2				
Expanded Uncertainty						±27.4	

7. RESULTS

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

850MHz, Head SAR results

Mode	Test configuration		SAR, averaged over 1g (W/kg)		
			Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz
GSM850	Power		31.8 dBm	31.0 dBm	31.8 dBm
	Left	Cheek	0.604	0.877	1.06
		Tilt	-	0.606	-
	Right	Cheek	0.667	0.989	1.08
		Tilt	-	0.559	-

1900MHz, Head SAR results

Mode	Test configuration		SAR, averaged over 1g (W/kg)		
			Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz
GSM1900	Power		31.9 dBm	32.7 dBm	32.8 dBm
	Left	Cheek	-	0.781	-
		Tilt	0.738	0.821	0.916
	Right	Cheek	-	0.597	-
		Tilt	-	0.708	-

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

850MHz, Body SAR results

Mode	Test configuration	SAR, averaged over 1g (W/kg)		
		Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz
GSM 850	Power	31.8 dBm	31.0 dBm	31.8 dBm
	Without headset	0.975	1.06	0.862
	Headset HDE-2	0.677	0.768	0.752

1900MHz, Body SAR results

Mode	Test configuration	SAR, averaged over 1g (W/kg)		
		Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz
GSM1900	Power	31.9 dBm	32.7 dBm	32.8 dBm
	Without headset	0.478	0.500	0.484
	Headset HDE-2	0.525	0.511	0.521

Plots of the Measurement scans are given in Appendix B.

APPENDIX A: SYSTEM CHECKING SCANS

Date/Time: 2005-08-26
Test Laboratory: TCC Nokia
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 462
Program Name: System Check

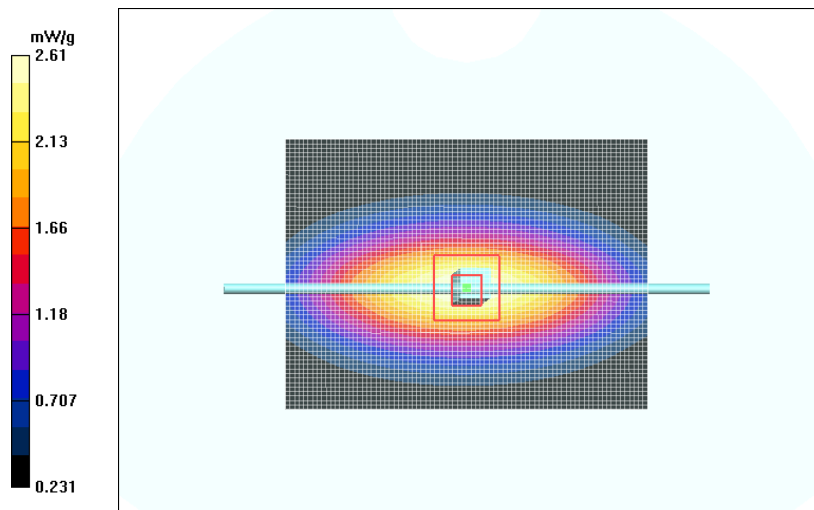
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.922 \text{ mho/m}$; $\epsilon_r = 41.8$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(6.87, 6.87, 6.87); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

d=15mm, Pin=248mW, t=21.9 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.61 mW/g

d=15mm, Pin=248mW, t=21.9 C/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.0 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.62 W/kg
SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.58 mW/g
Maximum value of SAR (measured) = 2.61 mW/g



Date/Time: 2005-08-23
Test Laboratory: TCC Nokia
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d013
Program Name: System Check

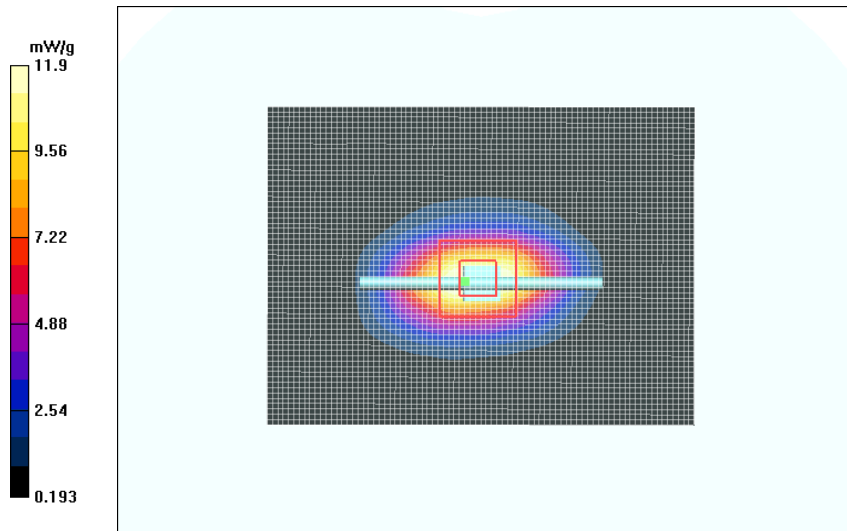
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1900$ MHz; $\sigma = 1.42$ mho/m; $\epsilon_r = 38.8$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(5.25, 5.25, 5.25); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

d=15mm, Pin=250mW, t=22.0 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 12.6 mW/g

d=15mm, Pin=250mW, t=22.0 C/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.9 V/m; Power Drift = -0.128 dB
Peak SAR (extrapolated) = 18.2 W/kg
SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.55 mW/g
Maximum value of SAR (measured) = 11.9 mW/g



Date/Time: 2005-08-30
Test Laboratory: TCC Nokia
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 462
Program Name: System Check

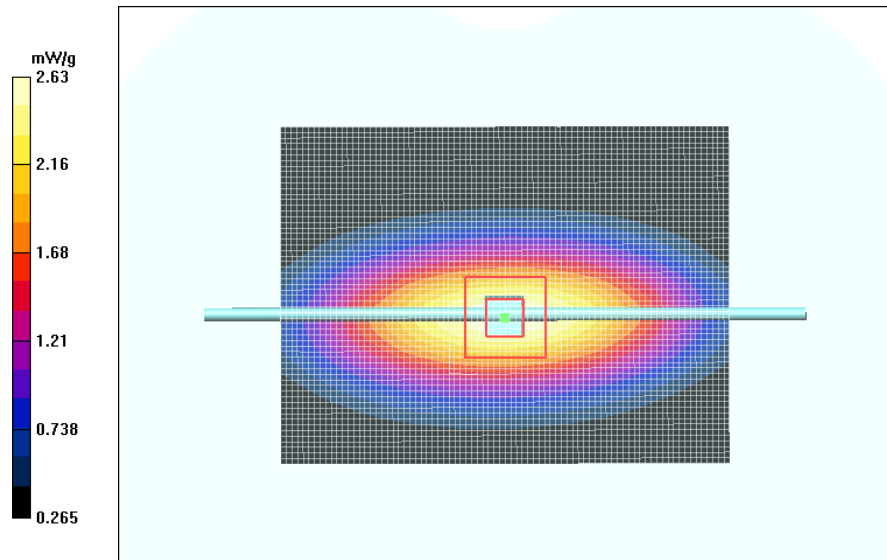
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.95 \text{ mho/m}$; $\epsilon_r = 54$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(6.62, 6.62, 6.62); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

d=15mm, Pin=250mW, t=21.9 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.60 mW/g

d=15mm, Pin=250mW, t=21.9 C/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 54.3 V/m; Power Drift = 0.011 dB
Peak SAR (extrapolated) = 3.52 W/kg
SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.6 mW/g
Maximum value of SAR (measured) = 2.63 mW/g



Date/Time: 2005-08-22
Test Laboratory: TCC Nokia
DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d013
Program Name: System Check

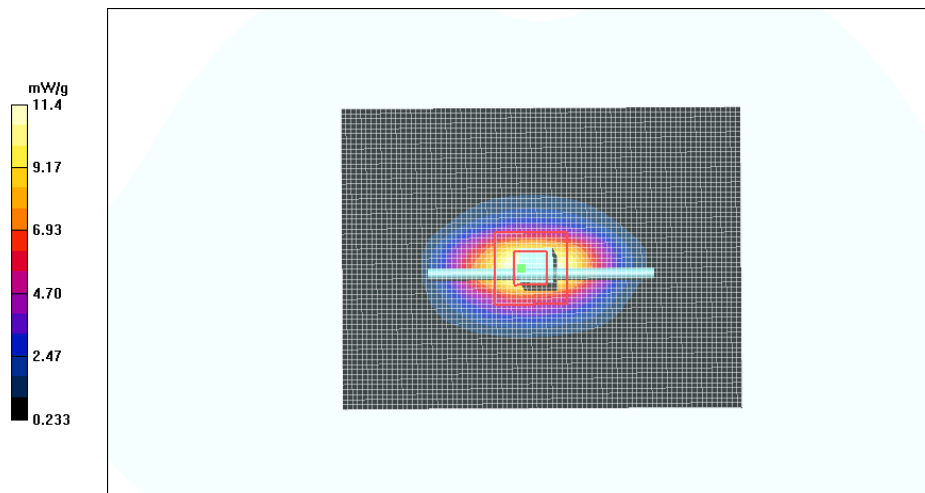
Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1900$ MHz; $\sigma = 1.55$ mho/m; $\epsilon_r = 53.3$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(4.64, 4.64, 4.64); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

d=15mm, Pin=250mW, t=21.7 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 12.1 mW/g

d=15mm, Pin=250mW, t=21.7 C/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 89.4 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 17.4 W/kg
SAR(1 g) = 10.1 mW/g; SAR(10 g) = 5.36 mW/g
Maximum value of SAR (measured) = 11.4 mW/g



APPENDIX B: MEASUREMENT SCANS

Date/Time: 2005-08-26
Test Laboratory: TCC Nokia
Type: RH-69; Serial: 001004/00/199001/0
Program Name: Head Measurement - Left, Advanced extrapolation, t=21.5 C

Communication System: GSM850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): $f = 848.8 \text{ MHz}$; $\sigma = 0.93 \text{ mho/m}$; $\epsilon_r = 41.7$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(6.87, 6.87, 6.87); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Cheek position/Area Scan (41x81x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (interpolated) = 1.16 mW/g

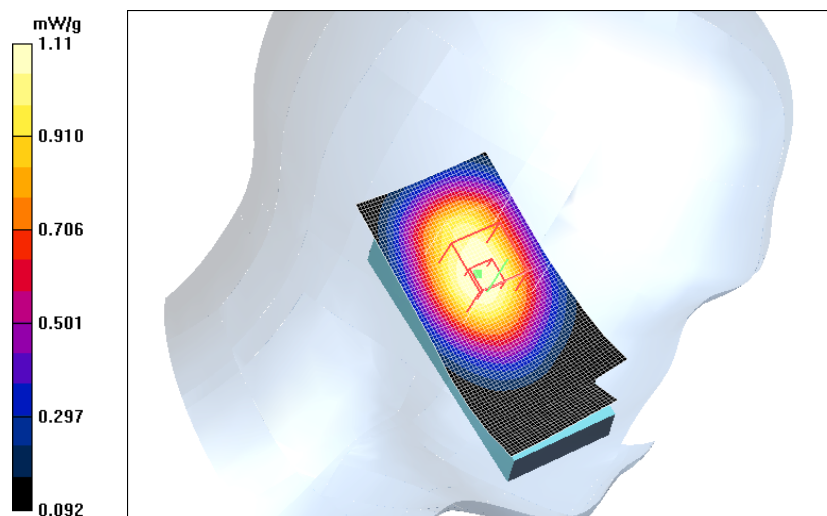
Cheek position/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 30.6 V/m; Power Drift = -0.013 dB

Peak SAR (extrapolated) = 1.45 W/kg

SAR(1 g) = 1.06 mW/g; SAR(10 g) = 0.744 mW/g

Maximum value of SAR (measured) = 1.11 mW/g



Date/Time: 2005-08-26
Test Laboratory: TCC Nokia
Type: RH-69; Serial: 001004/00/199001/0
Program Name: Head Measurement - Left, Advanced extrapolation, t=21.3 C

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.922$ mho/m; $\epsilon_r = 41.7$; $\rho = 1000$ kg/m³
Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(6.87, 6.87, 6.87); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Tilt position/Area Scan (41x81x1): Measurement grid: dx=15mm, Dy=15mm

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

Maximum value of SAR (interpolated) = 0.651 mW/g

Tilt position/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

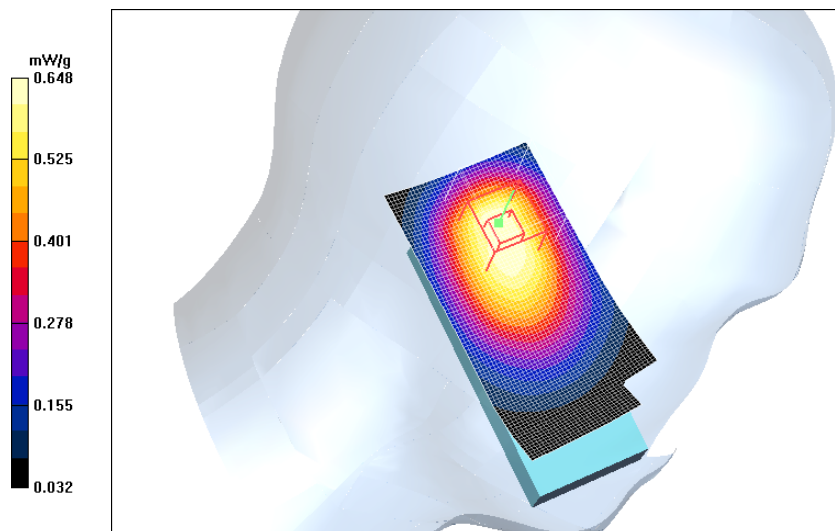
Reference Value = 26.6 V/m; Power Drift = -0.198 dB

Peak SAR (extrapolated) = 0.939 W/kg

SAR(1 g) = 0.606 mW/g; SAR(10 g) = 0.400 mW/g

Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube.

Maximum value of SAR (measured) = 0.648 mW/g



Date/Time: 2005-08-26
Test Laboratory: TCC Nokia
Type: RH-69; Serial: 001004/00/199001/0
Program Name: Head Measurement - Right, Advanced Extrapolation, t=21.2 C

Communication System: GSM850; Frequency: 848.8 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): $f = 848.8 \text{ MHz}$; $\sigma = 0.93 \text{ mho/m}$; $\epsilon_r = 41.7$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(6.87, 6.87, 6.87); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Cheek position/Area Scan (41x81x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (interpolated) = 1.17 mW/g

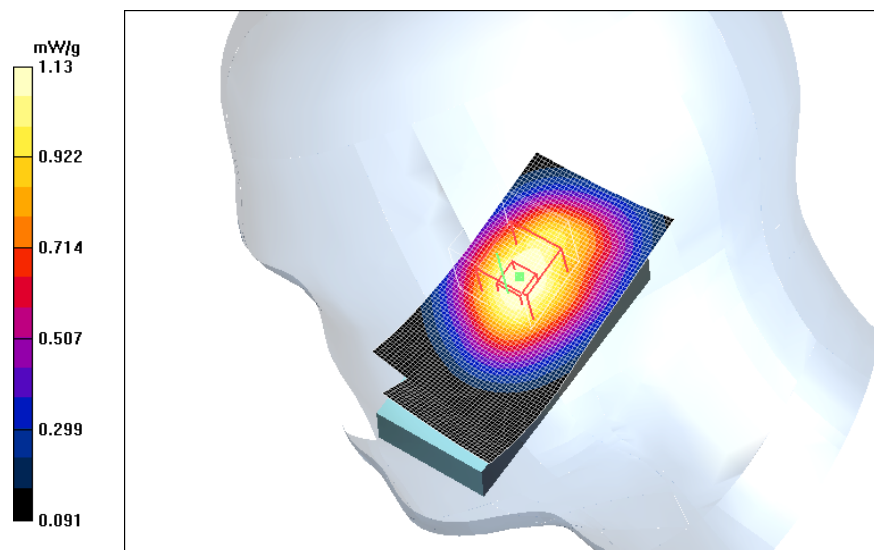
Cheek position/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

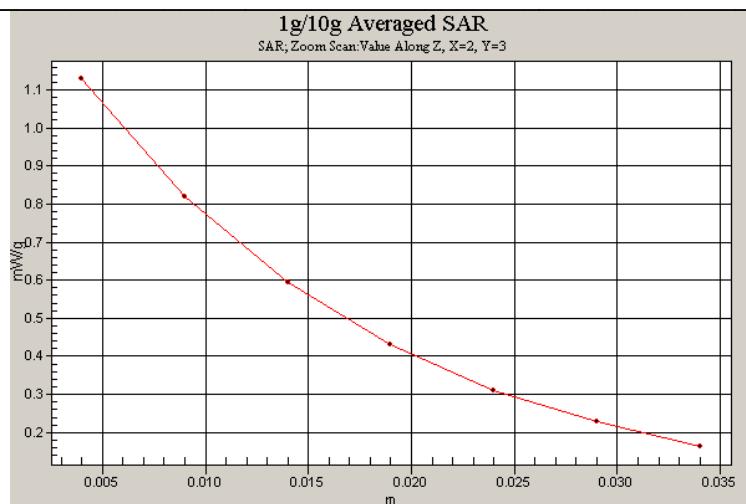
Reference Value = 29.7 V/m; Power Drift = -0.058 dB

Peak SAR (extrapolated) = 1.50 W/kg

SAR(1 g) = 1.08 mW/g; SAR(10 g) = 0.756 mW/g

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





Date/Time: 2005-08-26
Test Laboratory: TCC Nokia
Type: RH-69; Serial: 001004/00/199001/0
Program Name: Head Measurement - Right, Advanced Extrapolation, t=21.1 C

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.922$ mho/m; $\epsilon_r = 41.7$; $\rho = 1000$ kg/m³
Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(6.87, 6.87, 6.87); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Tilt position /Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (interpolated) = 0.608 mW/g

Tilt position /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

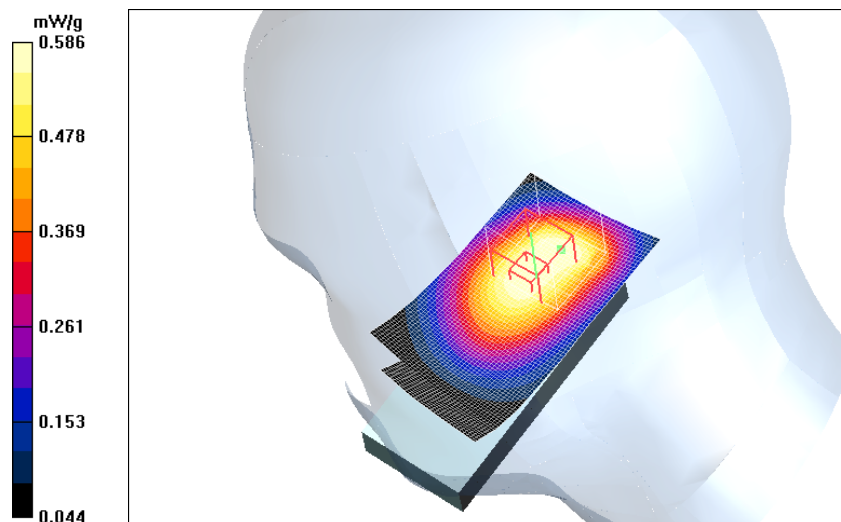
Reference Value = 25.3 V/m; Power Drift = 0.014 dB

Peak SAR (extrapolated) = 0.738 W/kg

SAR(1 g) = 0.559 mW/g; SAR(10 g) = 0.398 mW/g

Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube.

Maximum value of SAR (measured) = 0.586 mW/g



Date/Time: 2005-08-23
Test Laboratory: TCC Nokia
Type: RH-69; Serial: 001004/00/199001/0
Program Name: Head Measurement - Left, Advanced extrapolation, t=20.4 C

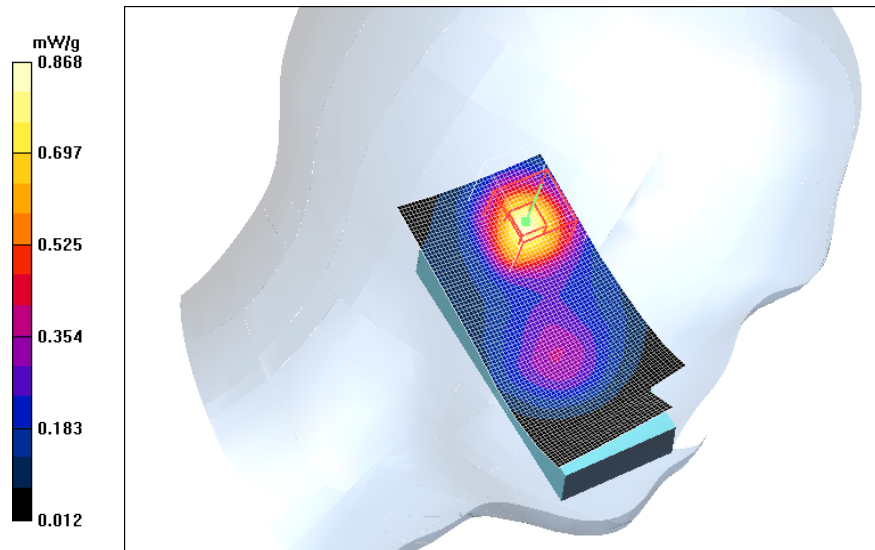
Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium parameters used: $f = 1880$ MHz; $\sigma = 1.41$ mho/m; $\epsilon_r = 38.9$; $\rho = 1000$ kg/m³
Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(5.25, 5.25, 5.25); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Cheek position/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.843 mW/g

Cheek position/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 19.5 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 1.36 W/kg
SAR(1 g) = 0.781 mW/g; SAR(10 g) = 0.407 mW/g
Maximum value of SAR (measured) = 0.868 mW/g



Date/Time: 2005-08-23
Test Laboratory: TCC Nokia
Type: RH-69; Serial: 001004/00/199001/0
Program Name: Head Measurement - Left, Advanced extrapolation, t=20.3 C

Communication System: GSM1900; Frequency: 1909.8 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): $f = 1909.8$ MHz; $\sigma = 1.43$ mho/m; $\epsilon_r = 38.8$; $\rho = 1000$ kg/m³
Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(5.25, 5.25, 5.25); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Tilt position/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (interpolated) = 1.08 mW/g

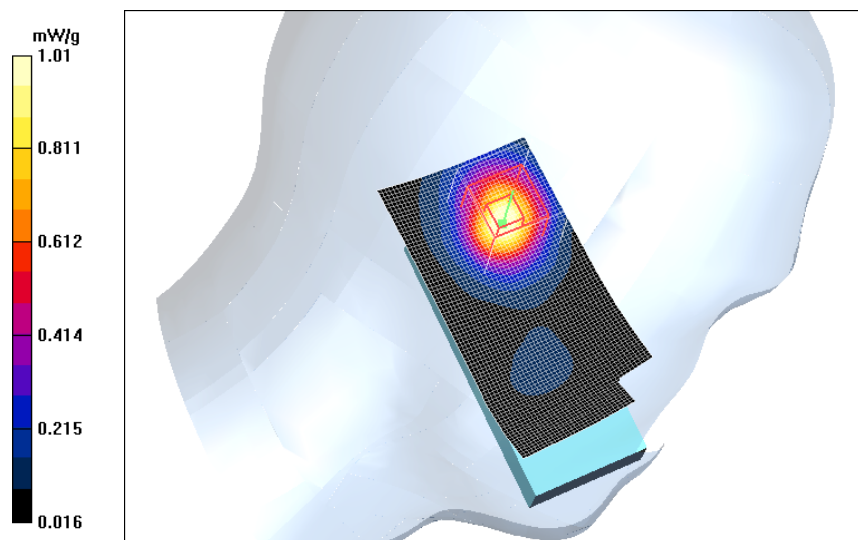
Tilt position/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

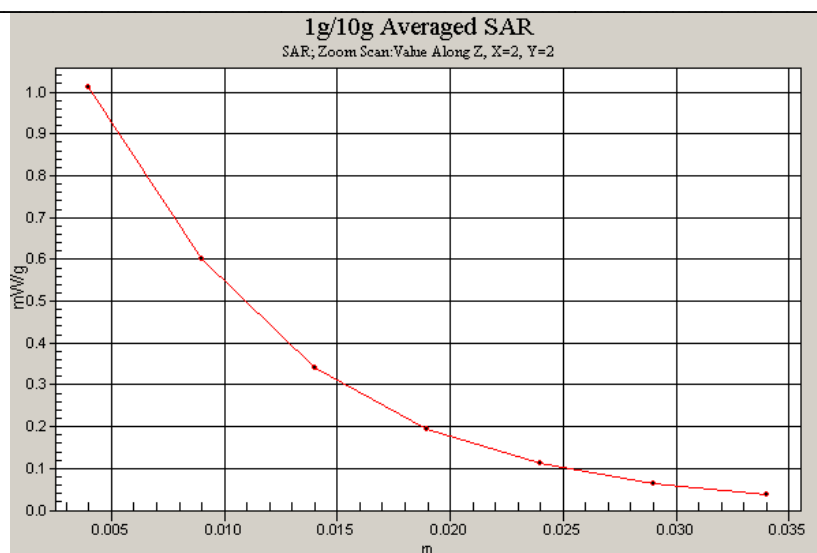
Reference Value = 23.9 V/m; Power Drift = -0.070 dB

Peak SAR (extrapolated) = 1.62 W/kg

SAR(1 g) = 0.916 mW/g; SAR(10 g) = 0.472 mW/g

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





Date/Time: 2005-08-23
Test Laboratory: TCC Nokia
Type: RH-69; Serial: 001004/00/199001/0
Program Name: Head Measurement - Right, Advanced Extrapolation, t=20.3 C

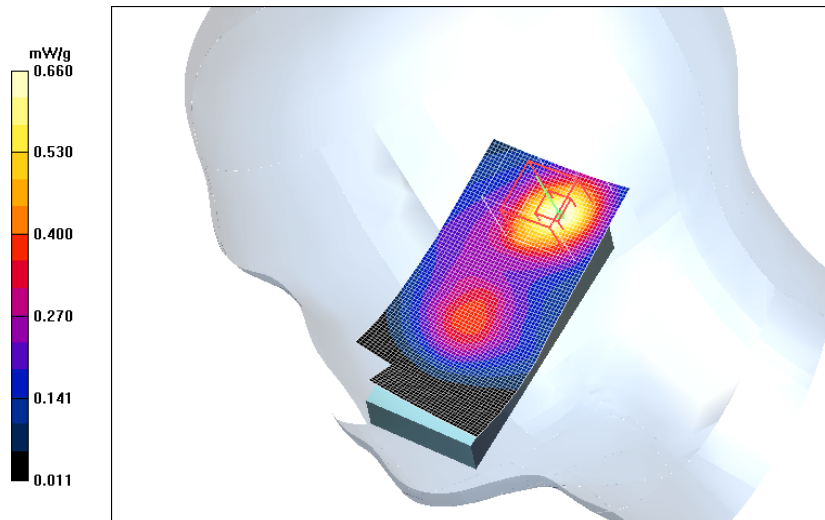
Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.41 \text{ mho/m}$; $\epsilon_r = 38.9$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(5.25, 5.25, 5.25); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Cheek position/Area Scan (41x81x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
Maximum value of SAR (interpolated) = 0.676 mW/g

Cheek position/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$
Reference Value = 21.0 V/m; Power Drift = -0.055 dB
Peak SAR (extrapolated) = 1.01 W/kg
SAR(1 g) = 0.597 mW/g; SAR(10 g) = 0.332 mW/g
Maximum value of SAR (measured) = 0.660 mW/g



Date/Time: 2005-08-23
Test Laboratory: TCC Nokia
Type: RH-69; Serial: 001004/00/199001/0
Program Name: Head Measurement - Right, Advanced Extrapolation, t=20.3 C

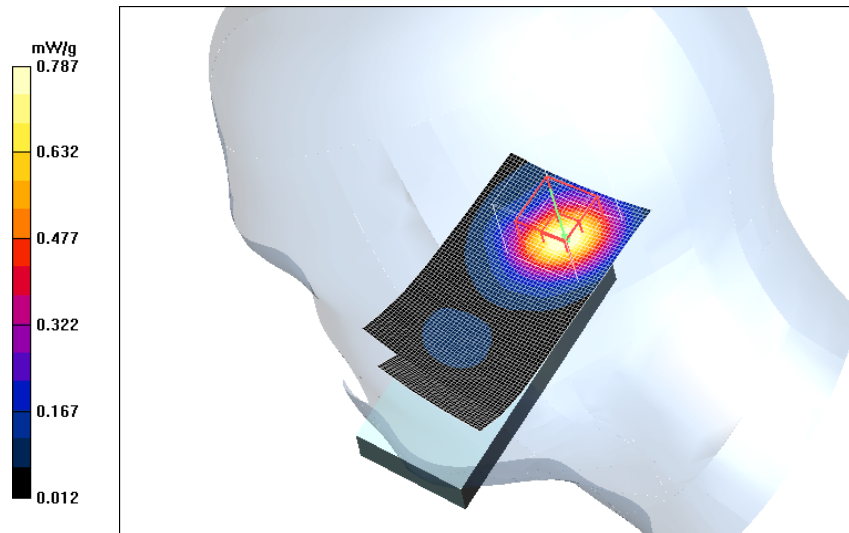
Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.41 \text{ mho/m}$; $\epsilon_r = 38.9$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(5.25, 5.25, 5.25); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Tilt position/Area Scan (41x81x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
Maximum value of SAR (interpolated) = 0.835 mW/g

Tilt position/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$
Reference Value = 23.3 V/m; Power Drift = -0.019 dB
Peak SAR (extrapolated) = 1.24 W/kg
SAR(1 g) = 0.708 mW/g; SAR(10 g) = 0.377 mW/g
Maximum value of SAR (measured) = 0.787 mW/g



Date/Time: 2005-08-30
Test Laboratory: TCC Nokia
Type: RH-69; Serial: 001004/00/199001/0
Program Name: Body measurement, Advanced Extrapolation, t=21.8 C, no headset

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): $f = 836.6 \text{ MHz}$; $\sigma = 0.952 \text{ mho/m}$; $\epsilon_r = 54$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(6.62, 6.62, 6.62); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body Measurement/Area Scan (41x81x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (interpolated) = 1.15 mW/g

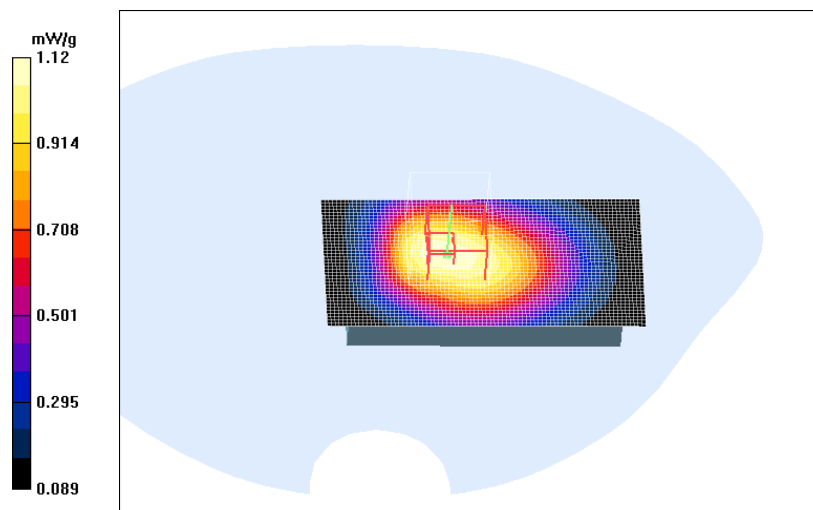
Body Measurement/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

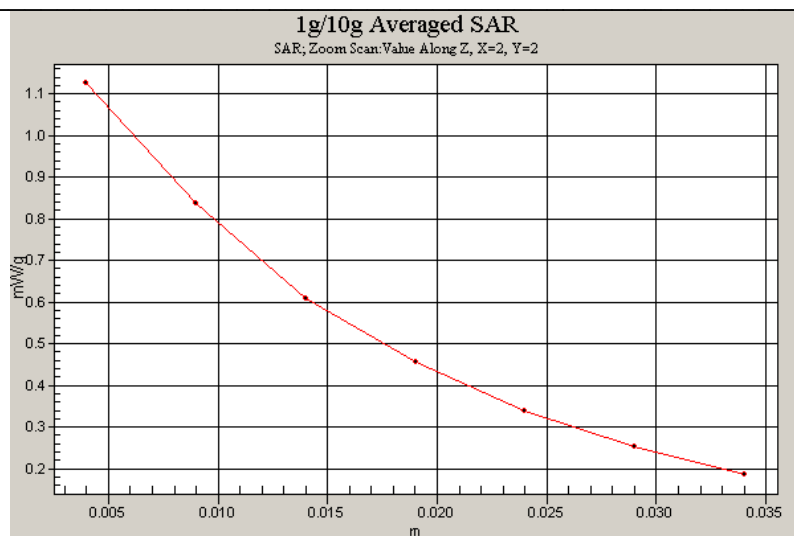
Reference Value = 20.3 V/m; Power Drift = -0.141 dB

Peak SAR (extrapolated) = 1.49 W/kg

SAR(1 g) = 1.06 mW/g; SAR(10 g) = 0.750 mW/g

Maximum value of SAR (measured) = 1.12 mW/g





Date/Time: 2005-08-30
Test Laboratory: TCC Nokia
Type: RH-69; Serial: 001004/00/199001/0
Program Name: Body measurement, Advanced Extrapolation, t=21.5 C, HDE-2

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): $f = 836.6 \text{ MHz}$; $\sigma = 0.952 \text{ mho/m}$; $\epsilon_r = 54$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(6.62, 6.62, 6.62); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body Measurement/Area Scan (41x81x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (interpolated) = 0.842 mW/g

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

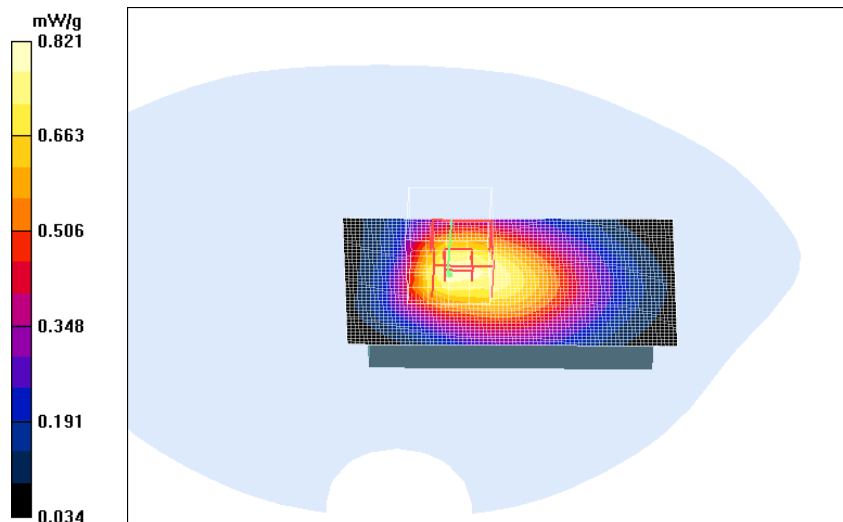
Reference Value = 17.8 V/m; Power Drift = -0.067 dB

Peak SAR (extrapolated) = 1.12 W/kg

SAR(1 g) = 0.768 mW/g; SAR(10 g) = 0.523 mW/g

Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube.

Maximum value of SAR (measured) = 0.821 mW/g



Date/Time: 2005-08-22

Test Laboratory: TCC Nokia

Type: RH-69; Serial: 001004/00/199001/0

Program Name: Body measurement, Advanced Extrapolation, t=21.4 C, no headset

Communication System: GSM1900; Frequency: 1880 MHz; Duty Cycle: 1:8.3

Medium parameters used: $f = 1880$ MHz; $\sigma = 1.53$ mho/m; $\epsilon_r = 53.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(4.64, 4.64, 4.64); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body Measurement/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.577 mW/g

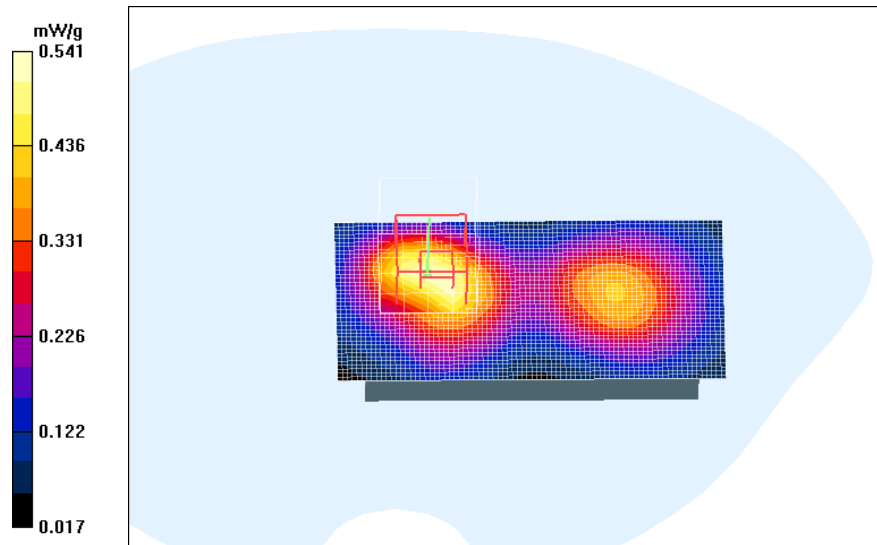
Body Measurement/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 15.2 V/m; Power Drift = -0.074 dB

Peak SAR (extrapolated) = 0.859 W/kg

SAR(1 g) = 0.500 mW/g; SAR(10 g) = 0.297 mW/g

Maximum value of SAR (measured) = 0.541 mW/g



Date/Time: 2005-08-22
Test Laboratory: TCC Nokia
Type: RH-69; Serial: 001004/00/199001/0
Program Name: Body measurement, Advanced Extrapolation, t=21.1 C, HDE-2

Communication System: GSM1900; Frequency: 1850.2 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.5$ mho/m; $\epsilon_r = 53.5$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1396; ConvF(4.64, 4.64, 4.64); Calibrated: 20.01.2005
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 07.01.2005
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 146

Body Measurement/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm

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

Maximum value of SAR (interpolated) = 0.610 mW/g

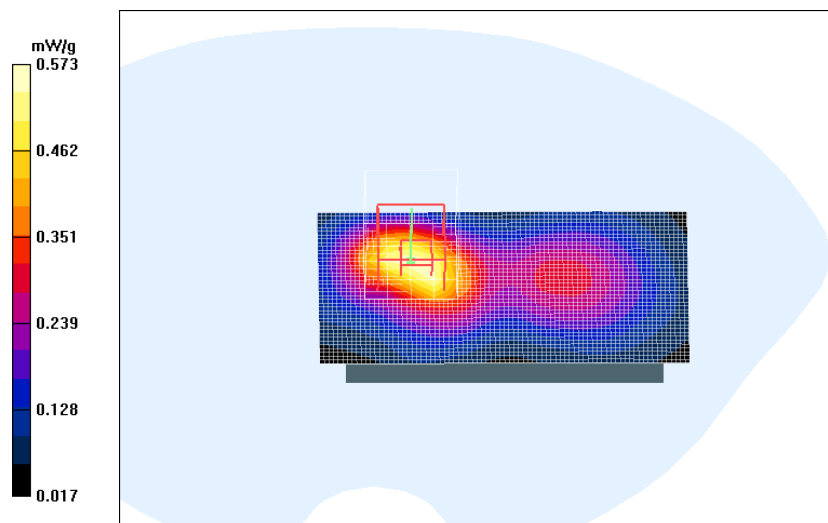
Body Measurement/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

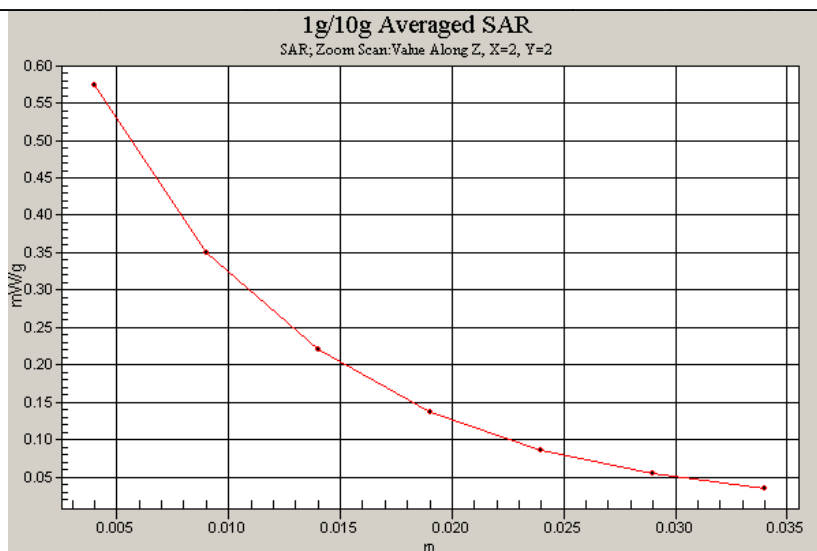
Reference Value = 14.8 V/m; Power Drift = -0.023 dB

Peak SAR (extrapolated) = 0.897 W/kg

SAR(1 g) = 0.525 mW/g; SAR(10 g) = 0.305 mW/g

Maximum value of SAR (measured) = 0.573 mW/g





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

E-field probe, SN: 1396
See the next three pages



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 Salo TCC**

Certificate No: **ET3-1396_Jan05**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1396**

Calibration procedure(s) **QA CAL-01.v5 and QA CAL-13.v4
Calibration procedure for dosimetric E-field probes**

Calibration date: **January 20, 2005**

Condition of the calibrated item **In Tolerance**

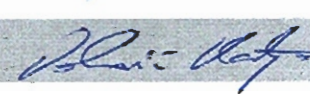
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

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	29-Sep-04 (SPEAG, No. DAE4-617_Sep04)	Sep-05

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: January 20, 2005

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

DASY - Parameters of Probe: ET3DV6 SN:1396

Sensitivity in Free Space ^A			Diode Compression ^B	
NormX	1.81 ± 10.1%	μV/(V/m) ²	DCP X	91 mV
NormY	1.80 ± 10.1%	μV/(V/m) ²	DCP Y	91 mV
NormZ	1.93 ± 10.1%	μV/(V/m) ²	DCP Z	91 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	8.1	4.4	
SAR _{be} [%]	With Correction Algorithm	0.1	0.2	
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	11.6	8.0	
SAR _{be} [%]	With Correction Algorithm	0.7	0.3	

Sensor Offset

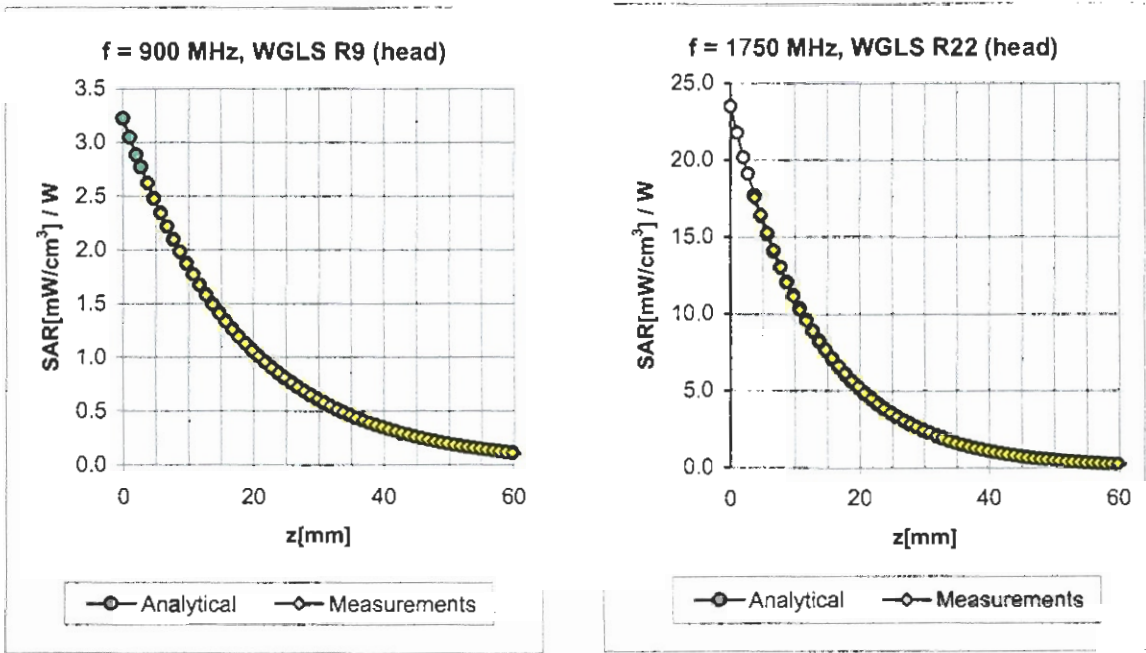
Probe Tip to Sensor Center	2.7 mm
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The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 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
300	± 50 / ± 100	Head	45.3 ± 5%	0.87 ± 5%	0.48	1.68	7.89 ± 13.3% (k=2)
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.15	1.84	7.98 ± 13.3% (k=2)
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.60	1.76	6.87 ± 11.0% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.54	1.86	6.55 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.55	2.29	5.44 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.53	2.47	5.25 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.51	2.70	4.85 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.62	2.27	4.59 ± 11.8% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.13	1.66	7.78 ± 13.3% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.43	2.16	6.62 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.45	2.16	6.32 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.52	2.71	4.81 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.53	2.90	4.64 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.54	2.66	4.50 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.58	2.37	4.18 ± 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)

835MHz dipole, SN: 462
1900MHz dipole: SN: 5d013
See the next six pages.

Client

Nokia Salo TCC

CALIBRATION CERTIFICATE

Object(s)

D835V2 - SN:462

Calibration procedure(s)

QA CAL-05.v2
Calibration procedure for dipole validation kits

Calibration date:

July 14, 2004

Condition of the calibrated item

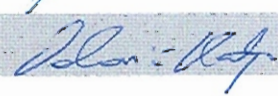
In Tolerance (according to the specific calibration document)

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E442	GB37480704	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	US37292783	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Oct 05

	Name	Function	Signature
Calibrated by:	Judith Mueller	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: July 15, 2004

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN462

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

Medium: HSL 835 MHz;

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.92 \text{ mho/m}$; $\epsilon_r = 41.8$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DAS4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.3, 6.3, 6.3); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn903; Calibrated: 2/19/2004
- Phantom: Flat Phantom half size; Type: QD000P49AA; Serial: SN:1001;
- Measurement SW: DAS4, V4.3 Build 8; Postprocessing SW: SEMCAD, V1.8 Build 117

Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
Maximum value of SAR (interpolated) = 2.62 mW/g

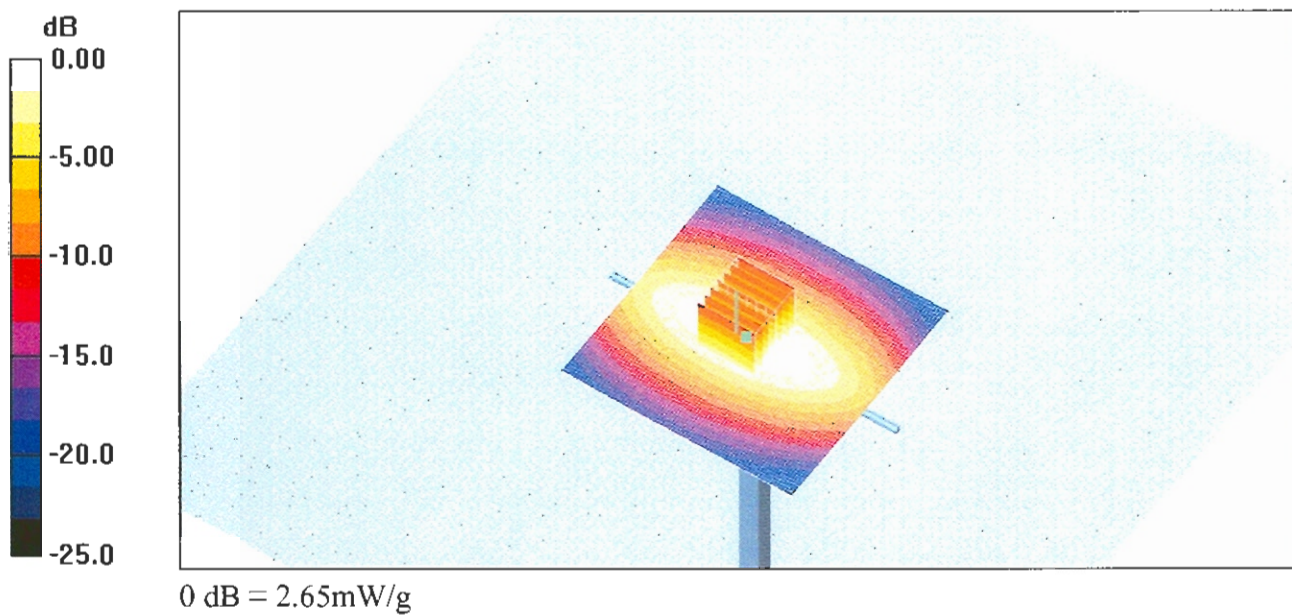
Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 55.1 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.72 W/kg

SAR(1 g) = 2.45 mW/g; SAR(10 g) = 1.59 mW/g

Maximum value of SAR (measured) = 2.65 mW/g



Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN462

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

Medium: Muscle 835 MHz;

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.99 \text{ mho/m}$; $\epsilon_r = 54.6$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.13, 6.13, 6.13); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn903; Calibrated: 2/19/2004
- Phantom: Flat Phantom half size; Type: QD000P49AA; Serial: SN:1001;
- Measurement SW: DASY4, V4.3 Build 8; Postprocessing SW: SEMCAD, V1.8 Build 117

Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
Maximum value of SAR (interpolated) = 2.64 mW/g

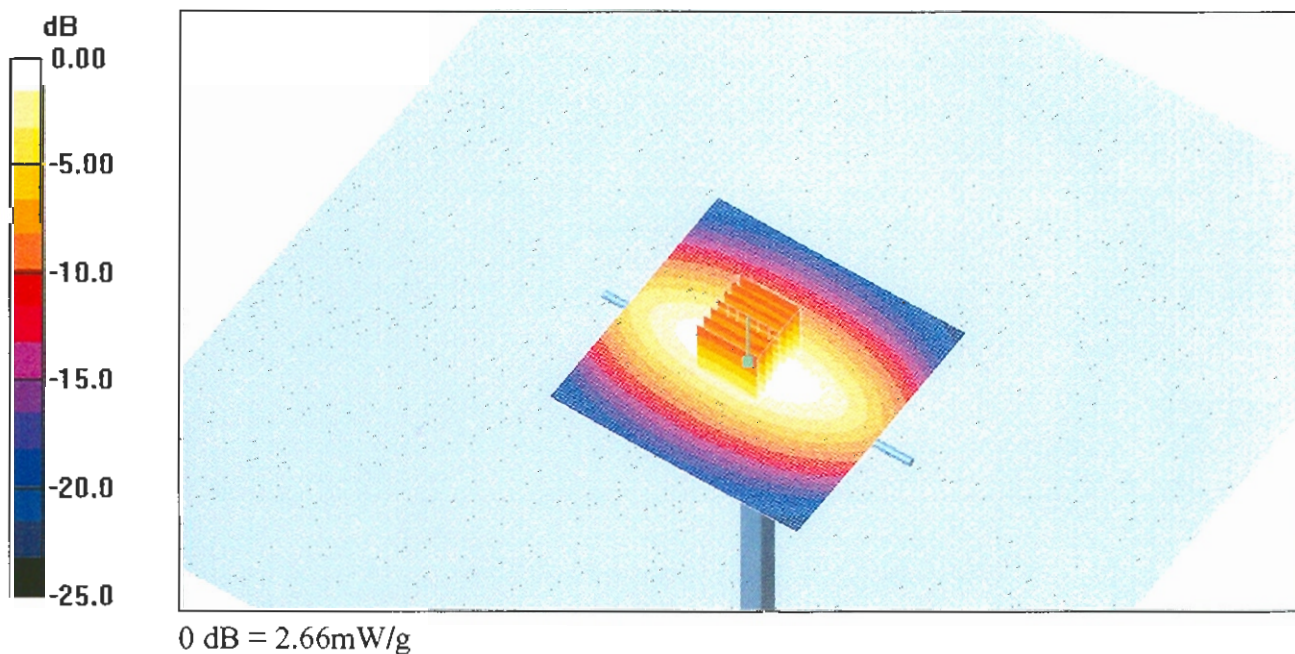
Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 53.6 V/m; Power Drift = 0.00 dB

Peak SAR (extrapolated) = 3.59 W/kg

SAR(1 g) = 2.45 mW/g; SAR(10 g) = 1.61 mW/g

Maximum value of SAR (measured) = 2.66 mW/g



Client **Nokia Salo TCC**

CALIBRATION CERTIFICATE

Object(s) **D1900V2 - SN:5d013**

Calibration procedure(s) **QA CAL-05.v2
Calibration procedure for dipole validation kits**

Calibration date: **July 13, 2004**

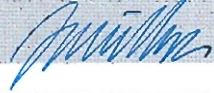
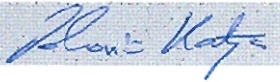
Condition of the calibrated item **In Tolerance (according to the specific calibration document)**

This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E442	GB37480704	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	US37292783	6-Nov-03 (METAS, No. 252-0254)	Nov-04
Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Oct 05

	Name	Function	Signature
Calibrated by:	Judith Mueller	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date issued: July 15, 2004

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN5d013

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

Medium: HSL 1900 MHz;

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.44$ mho/m; $\epsilon_r = 39.4$; $\rho = 1000$ 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: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn903; Calibrated: 2/19/2004
- Phantom: Flat Phantom quarter size; Type: QD000P50AA; Serial: SN:1002;
- Measurement SW: DASY4, V4.3 Build 8; Postprocessing SW: SEMCAD, V1.8 Build 117

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 11.4 mW/g

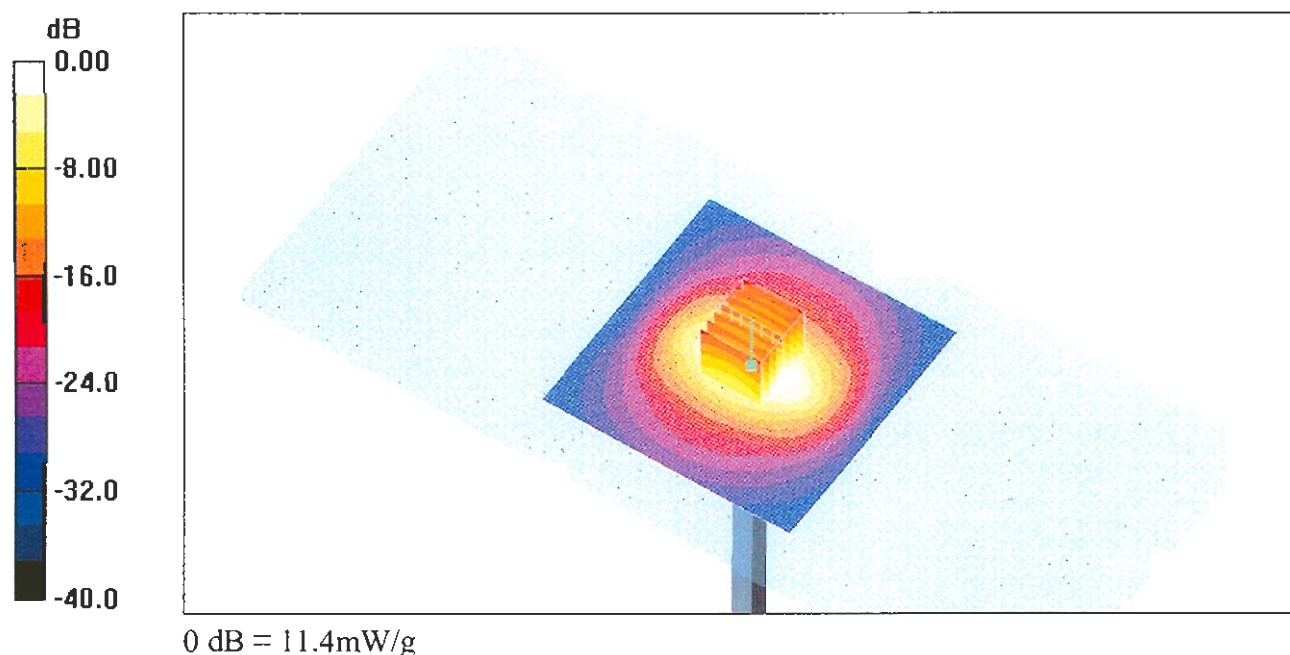
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.6 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 17.9 W/kg

SAR(1 g) = 10 mW/g; SAR(10 g) = 5.24 mW/g

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



Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN5d013

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

Medium: Muscle 1900 MHz;

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.58$ 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(4.57, 4.57, 4.57); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn903; Calibrated: 2/19/2004
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006;
- Measurement SW: DASY4, V4.3 Build 8; Postprocessing SW: SEMCAD, V1.8 Build 117

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 12.0 mW/g

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

Reference Value = 82.5 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 18.9 W/kg

SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.41 mW/g

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

