

SAR Compliance Test Report

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Tested device:	RM-157		
FCC ID:	QVVRM-157	IC:	661AE-RM157
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:

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	2006-09-07 to 2006-09-11
SN, HW and SW numbers of tested device	SN: 004400/92/178303/9, HW: 3019, SW: V 02.1.125_B3, DUT: 28547
Batteries used in testing	BL-5F, DUT: 28496, 28497, 28498
Headsets used in testing	HS-6, DUT: 28715
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
2-slot GPRS1900	512/1850.2	27.8 dBm EIRP	Left, Cheek	0.332 W/kg	0.37 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
2-slot GPRS1900	512/1850.2	27.3 dBm EIRP	1.5 cm	0.477 W/kg	0.53 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	0.38 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
Modulation Mode	GMSK	GMSK	GMSK / 8PSK	GFSK
Duty Cycle	1/8	1/8 to 2/8	1/8 to 2/8	
Transmitter Frequency Range (MHz)	1850 - 1910	1850 - 1910	1850 - 1910	2402-2480

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

This device has Dual Transfer Mode capability for use at the ear. Therefore, SAR for multi slot GPRS mode was evaluated against the head profile of the phantom.

2.1 Picture of the Device



2.2 Description of the Antenna

The device has an internal antenna.

3. TEST CONDITIONS

3.1 Temperature and Humidity

Ambient temperature (°C):	20.5 to 22.5
Ambient humidity (RH %):	35 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(s) 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
DAE3	339	12 months	2007-08
E-field Probe ET3DV6	1808	12 months	2007-08
Dipole Validation Kit, D1900V2	5d026	24 months	2008-02
DASY4 software	Version 4.7	-	-

Additional test equipment used in testing:

Test Equipment	Model	Serial Number	Calibration interval	Calibration expiry
Signal Generator	SME06	848650/011	36 months	2008-07
Amplifier	ZHL-42W	E012903	-	-
Power Meter	NRP	100808	24 months	2008-03
Power Sensor	NRP-Z51	100412	12 months	2007-02
Call Tester	CMU200	836203/022	-	-
Call Tester	4400M	0411216	-	-
Vector Network Analyzer	AT8753ES	MY40001091	12 months	-
Dielectric Probe Kit	HP85070B	US33020403	-	-

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 checks 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	54.88	69.02
Butyl Diglycol	44.91	30.76
Salt	0.21	0.22

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	9.83	39.4	1.42	
	$\pm 10\%$ window	8.85 - 10.81			
	2006-09-07	9.58	38.6	1.39	21.3

System checking, body tissue simulant

f [MHz]	Description	SAR [W/kg], 1g	Dielectric Parameters		Temp [°C]
			ϵ_r	σ [S/m]	
1900	Reference result	10.0	54.8	1.54	
	$\pm 10\%$ window	9.0 - 11.0			
	2006-09-11	10.2	53.1	1.56	20.6

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	21.3
	$\pm 5\%$ window	38.0 – 42.0	1.33 – 1.47	
	2006-09-07	38.7	1.37	

Body tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp [°C]
		ϵ_r	σ [S/m]	
1880	Recommended value	53.3	1.52	20.6
	$\pm 5\%$ window	50.6 – 56.0	1.44 – 1.60	
	2006-09-11	53.2	1.54	

5. DESCRIPTION OF THE TEST PROCEDURE

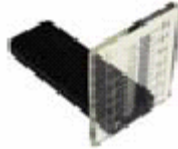
5.1 Device Holder

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".

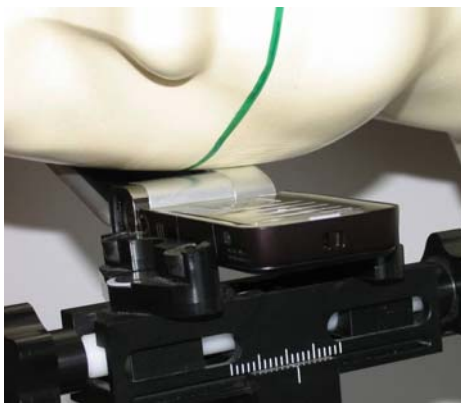


Photo of the device in “cheek” position

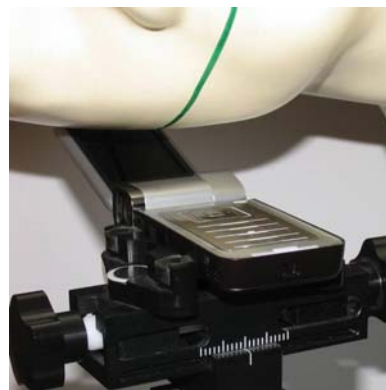


Photo of the device in “tilt” position

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.

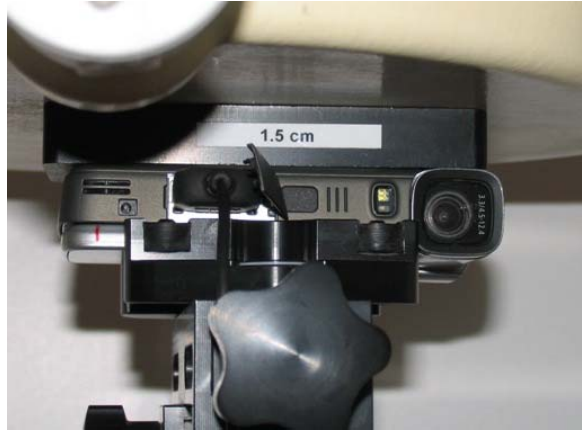


Photo of the device positioned for Body SAR measurement.
The spacer was removed for the tests.

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	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:

1900 MHz 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
GSM	Power		27.8 dBm	28.4 dBm	28.2 dBm
Flip open	Left	Cheek	-	0.176	-
		Tilt	-	-	-
	Right	Cheek	-	-	-
		Tilt	-	-	-
2-slot GPRS	Power		27.8 dBm	28.3 dBm	28.1 dBm
Flip open	Left	Cheek	0.332	0.330	0.324
		Tilt	-	0.095	-
	Right	Cheek	-	0.171	-
		Tilt	-	0.069	-
2-slot EGPRS	Power		27.2 dBm	27.7 dBm	27.3 dBm
Flip open	Left	Cheek	0.158	-	-
		Tilt	-	-	-
	Right	Cheek	-	-	-
		Tilt	-	-	-
2-slot GPRS Flip open	Left Cheek BT active		0.330	-	-

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

1900 MHz 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	27.3 dBm	27.6 dBm	26.5 dBm
Flip closed	Without headset	0.420	0.339	0.308
	Headset HS-6	0.436	0.372	0.335
Flip closed	Headset HS-6 BT active	0.477	-	-

Plots of the Measurement scans are given in Appendix B.

APPENDIX A: SYSTEM CHECKING SCANS

See the following pages

Date/Time: 2006-09-07 14:46:04

Test Laboratory: TCC Copenhagen

Type: D1900V2; Serial: 5d026

Communication System: Continuous Wave

Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: Head 1900; Medium Notes: Medium Temperature: t=21.3C

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.39$ mho/m; $\epsilon_r = 38.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1808; Probe Notes:
- ConvF(5.02, 5.02, 5.02); Calibrated: 2006-08-24
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2006-08-22
- Phantom: SAM 3; Type: Twin Phantom; Serial: TP-1302
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

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

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

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

Reference Value = 94.2 V/m; Power Drift = 0.074 dB

Peak SAR (extrapolated) = 16.1 W/kg

SAR(1 g) = 9.58 mW/g; SAR(10 g) = 5.09 mW/g

Maximum value of SAR (measured) = 10.9 mW/g



Date/Time: 2006-09-11 07:56:32

Test Laboratory: TCC Copenhagen

Type: D1900V2; Serial: 5d026

Communication System: Continuous Wave

Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: Body 1900; Medium Notes: Medium Temperature: $t=20.6$ C

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.56$ mho/m; $\epsilon_r = 53.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1808; Probe Notes:
- ConvF(4.4, 4.4, 4.4); Calibrated: 2006-08-24
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2006-08-22
- Phantom: SAM 3; Type: Twin Phantom; Serial: TP-1302
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

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

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

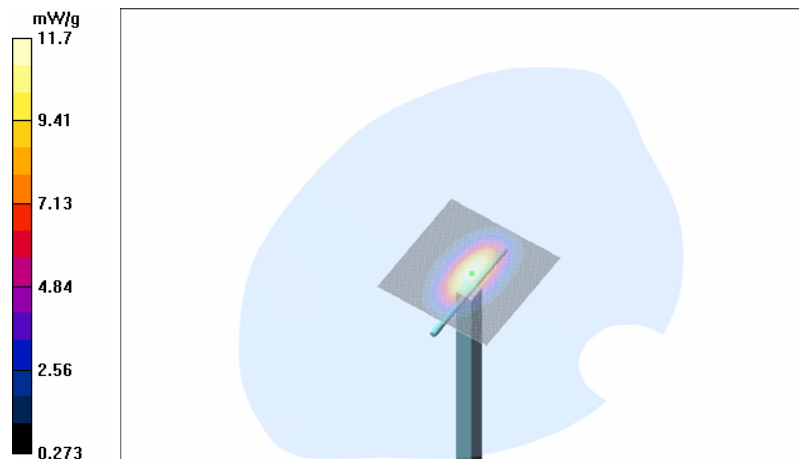
d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.8 V/m; Power Drift = 0.036 dB

Peak SAR (extrapolated) = 16.0 W/kg

SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.54 mW/g

Maximum value of SAR (measured) = 11.7 mW/g



APPENDIX B: MEASUREMENT SCANS

See the following pages

Date/Time: 2006-09-07 15:53:20

Test Laboratory: TCC Copenhagen
Type: RM-157; Serial: 004400/92/178303/9

Communication System: GSM 1900
Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium: Head 1900; Medium Notes: Medium Temperature: $t=21.3^{\circ}\text{C}$
Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.37 \text{ mho/m}$; $\epsilon_r = 38.7$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Left Section

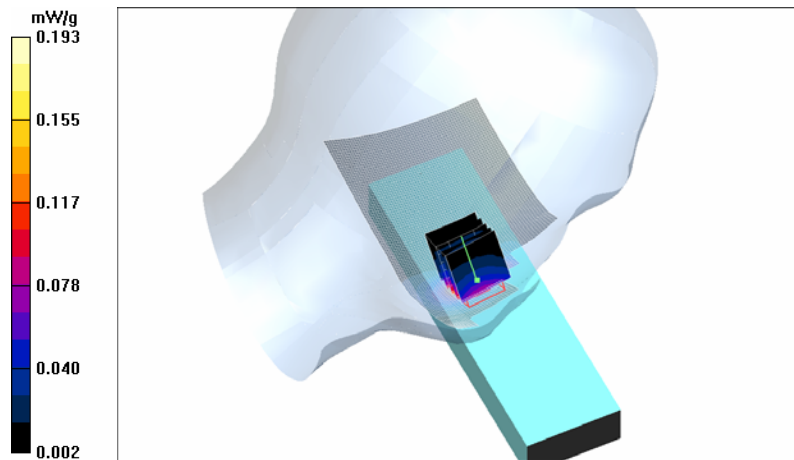
DASY4 Configuration:
- Probe: ET3DV6 - SN1808; Probe Notes:
- ConvF(5.02, 5.02, 5.02); Calibrated: 2006-08-24
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2006-08-22
- Phantom: SAM 3; Type: Twin Phantom; Serial: TP-1302
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Cheek position - Middle/Area Scan – Flip open (61x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
Maximum value of SAR (interpolated) = 0.213 mW/g

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

Reference Value = 1.79 V/m; Power Drift = -0.067 dB
Peak SAR (extrapolated) = 0.256 W/kg

SAR(1 g) = 0.176 mW/g; SAR(10 g) = 0.101 mW/g
Maximum value of SAR (measured) = 0.193 mW/g



Date/Time: 2006-09-07 17:59:33

Test Laboratory: TCC Copenhagen
Type: RM-157; Serial: 004400/92/178303/9

Communication System: 2-slot GPRS1900
Frequency: 1850.2 MHz; Duty Cycle: 1:4.2
Medium: Head 1900; Medium Notes: Medium Temperature: $t=21.3^{\circ}\text{C}$
Medium parameters used (interpolated): $f = 1850.2 \text{ MHz}$; $\sigma = 1.34 \text{ mho/m}$; $\epsilon_r = 38.9$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1808; Probe Notes:
- ConvF(5.02, 5.02, 5.02); Calibrated: 2006-08-24
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2006-08-22
- Phantom: SAM 3; Type: Twin Phantom; Serial: TP-1302
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Cheek position - Low/Area Scan – Flip open (61x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

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

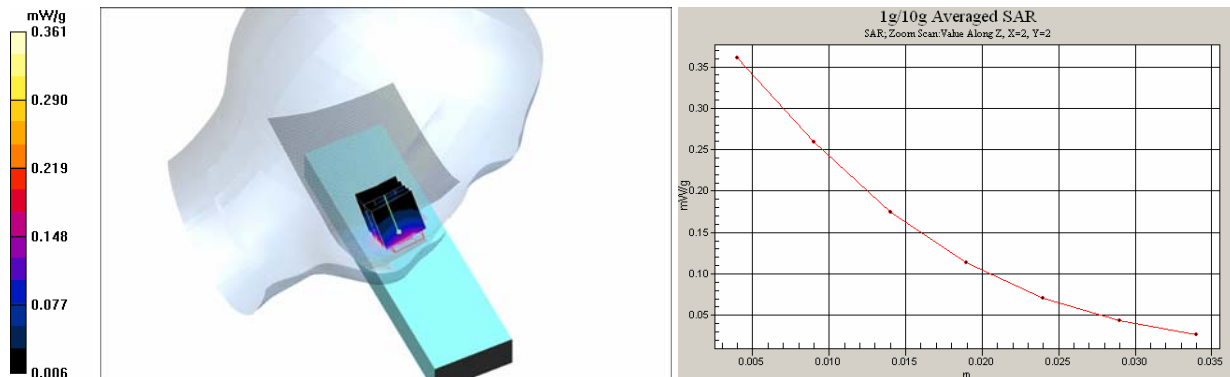
Cheek position - Low/Zoom Scan – Flip open (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 1.91 V/m; Power Drift = -0.144 dB

Peak SAR (extrapolated) = 0.476 W/kg

SAR(1 g) = 0.332 mW/g; SAR(10 g) = 0.194 mW/g

Maximum value of SAR (measured) = 0.361 mW/g



Date/Time: 2006-09-07 16:54:14

Test Laboratory: TCC Copenhagen
Type: RM-157; Serial: 004400/92/178303/9

Communication System: 2-slot GPRS1900
Frequency: 1880 MHz; Duty Cycle: 1:4.2
Medium: Head 1900; Medium Notes: Medium Temperature: $t=21.3^{\circ}\text{C}$
Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.37 \text{ mho/m}$; $\epsilon_r = 38.7$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Left Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1808; Probe Notes:
- ConvF(5.02, 5.02, 5.02); Calibrated: 2006-08-24
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2006-08-22
- Phantom: SAM 3; Type: Twin Phantom; Serial: TP-1302
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Tilt position - Middle/Area Scan – Flip open (61x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
Maximum value of SAR (interpolated) = 0.110 mW/g

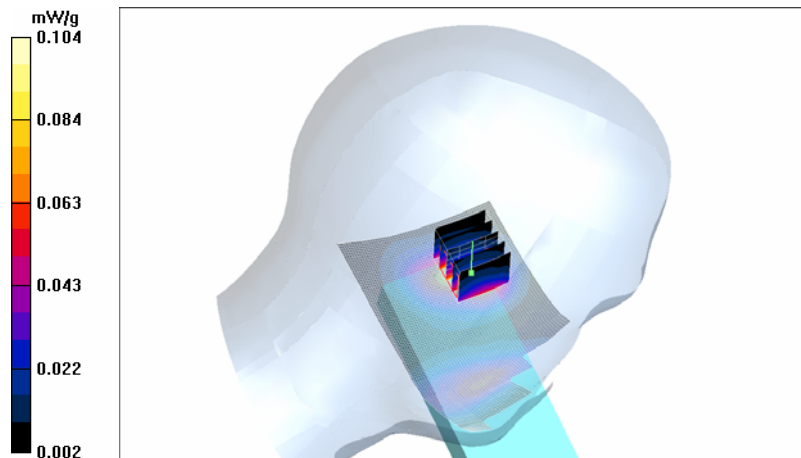
Tilt position - Middle/Zoom Scan – Flip open (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 6.92 V/m ; Power Drift = -0.035 dB

Peak SAR (extrapolated) = 0.138 W/kg

SAR(1 g) = 0.095 mW/g ; SAR(10 g) = 0.057 mW/g

Maximum value of SAR (measured) = 0.104 mW/g



Date/Time: 2006-09-07 19:59:10

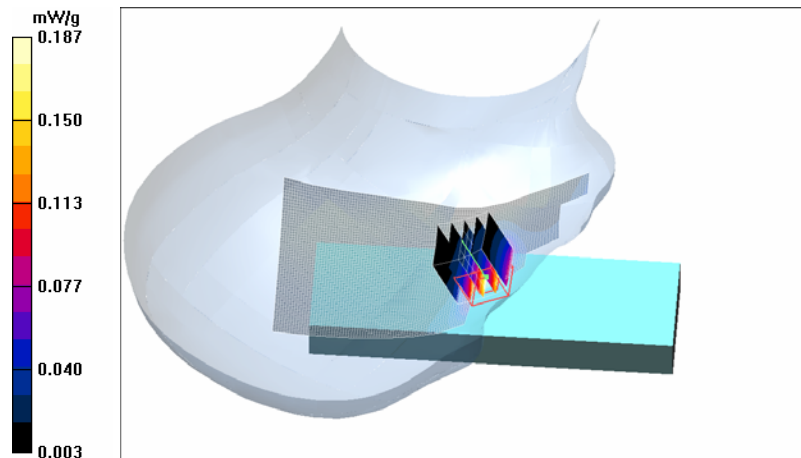
Test Laboratory: TCC Copenhagen
Type: RM-157; Serial: 004400/92/178303/9

Communication System: 2-slot GPRS1900
Frequency: 1880 MHz; Duty Cycle: 1:4.2
Medium: Head 1900; Medium Notes: Medium Temperature: $t=21.3^{\circ}\text{C}$
Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.37 \text{ mho/m}$; $\epsilon_r = 38.7$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Right Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1808; Probe Notes:
- ConvF(5.02, 5.02, 5.02); Calibrated: 2006-08-24
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2006-08-22
- Phantom: SAM 3; Type: Twin Phantom; Serial: TP-1302
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Cheek position - Middle/Area Scan – Flip open (61x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
Maximum value of SAR (interpolated) = 0.211 mW/g

Cheek position - Middle/Zoom Scan – Flip open (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$
Reference Value = 3.19 V/m; Power Drift = 0.041 dB
Peak SAR (extrapolated) = 0.250 W/kg
SAR(1 g) = 0.171 mW/g; SAR(10 g) = 0.101 mW/g
Maximum value of SAR (measured) = 0.187 mW/g



Date/Time: 2006-09-07 17:36:16

Test Laboratory: TCC Copenhagen
Type: RM-157; Serial: 004400/92/178303/9

Communication System: 2-slot GPRS1900
Frequency: 1880 MHz; Duty Cycle: 1:4.2
Medium: Head 1900; Medium Notes: Medium Temperature: $t=21.3^{\circ}\text{C}$
Medium parameters used: $f = 1880 \text{ MHz}$; $\sigma = 1.37 \text{ mho/m}$; $\epsilon_r = 38.7$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Right Section

DASY4 Configuration:

- Probe: ET3DV6 - SN1808; Probe Notes:
- ConvF(5.02, 5.02, 5.02); Calibrated: 2006-08-24
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2006-08-22
- Phantom: SAM 3; Type: Twin Phantom; Serial: TP-1302
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

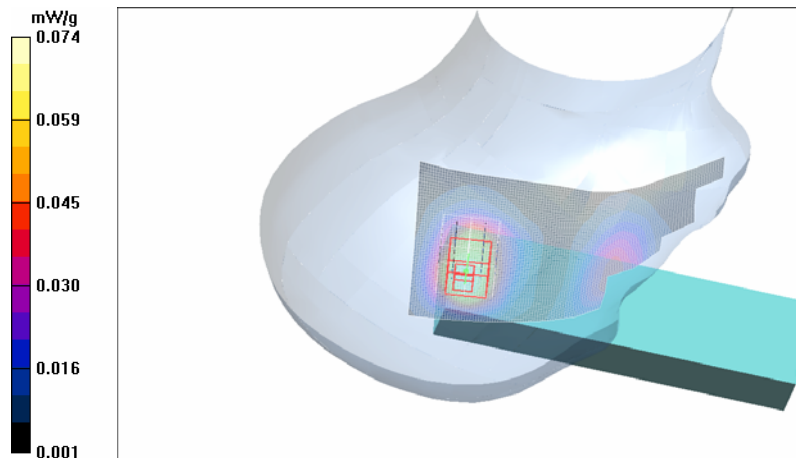
Tilt position - Middle/Area Scan – Flip open (61x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$
Maximum value of SAR (interpolated) = 0.074 mW/g

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

Reference Value = 7.19 V/m ; Power Drift = -0.116 dB
Peak SAR (extrapolated) = 0.100 W/kg

SAR(1 g) = 0.069 mW/g ; SAR(10 g) = 0.043 mW/g

Maximum value of SAR (measured) = 0.074 mW/g



Date/Time: 2006-09-07 19:27:31

Test Laboratory: TCC Copenhagen
Type: RM-157; Serial: 004400/92/178303/9

Communication System: 2-slot EGPRS1900
Frequency: 1850.2 MHz; Duty Cycle: 1:4.2
Medium: Head 1900; Medium Notes: Medium Temperature: $t=21.3^{\circ}\text{C}$
Medium parameters used (interpolated): $f = 1850.2 \text{ MHz}$; $\sigma = 1.34 \text{ mho/m}$; $\epsilon_r = 38.9$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Left Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1808; Probe Notes:
- ConvF(5.02, 5.02, 5.02); Calibrated: 2006-08-24
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2006-08-22
- Phantom: SAM 3; Type: Twin Phantom; Serial: TP-1302
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Cheek position - Low/Area Scan – Flip open (61x151x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (interpolated) = 0.181 mW/g

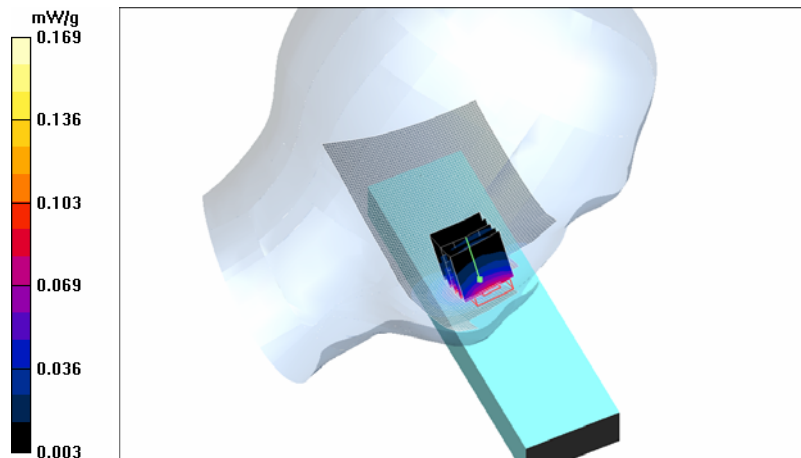
Cheek position - Low/Zoom Scan – Flip open (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 1.26 V/m; Power Drift = -0.163 dB

Peak SAR (extrapolated) = 0.237 W/kg

SAR(1 g) = 0.158 mW/g; SAR(10 g) = 0.092 mW/g

Maximum value of SAR (measured) = 0.169 mW/g



Date/Time: 2006-09-11 09:36:42

Test Laboratory: TCC Copenhagen
Type: RM-157; Serial: 004400/92/178303/9

Communication System: 2-slot GPRS1900
Frequency: 1850.2 MHz; Duty Cycle: 1:4.2
Medium: Body 1900; Medium Notes: Medium Temperature: $t=20.6\text{ }^{\circ}\text{C}$
Medium parameters used (interpolated): $f = 1850.2\text{ MHz}$; $\sigma = 1.51\text{ mho/m}$; $\epsilon_r = 53.3$; $\rho = 1000\text{ kg/m}^3$
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1808; Probe Notes:
- ConvF(4.4, 4.4, 4.4); Calibrated: 2006-08-24
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2006-08-22
- Phantom: SAM 3; Type: Twin Phantom; Serial: TP-1302
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body - Low - No Accessory/Area Scan – Flip closed (61x91x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (interpolated) = 0.502 mW/g

Body - Low - No Accessory/Zoom Scan – Flip closed (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

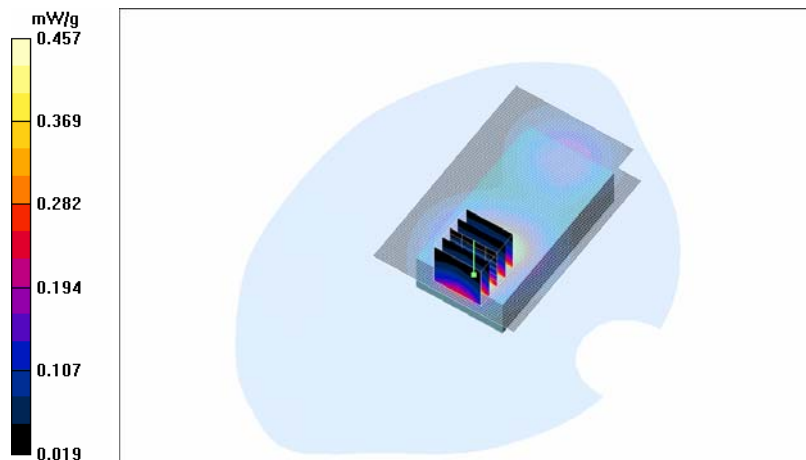
Reference Value = 18.7 V/m; Power Drift = -0.053 dB

Peak SAR (extrapolated) = 0.660 W/kg

SAR(1 g) = 0.420 mW/g; SAR(10 g) = 0.259 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) = 0.457 mW/g



Date/Time: 2006-09-11 11:30:38

Test Laboratory: TCC Copenhagen
Type: RM-157; Serial: 004400/92/178303/9

Communication System: 2-slot GPRS1900
Frequency: 1850.2 MHz; Duty Cycle: 1:4.2
Medium: Body 1900; Medium Notes: Medium Temperature: $t=20.6$ C
Medium parameters used (interpolated): $f = 1850.2$ MHz; $\sigma = 1.51$ mho/m; $\epsilon_r = 53.3$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1808; Probe Notes:
- ConvF(4.4, 4.4, 4.4); Calibrated: 2006-08-24
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2006-08-22
- Phantom: SAM 3; Type: Twin Phantom; Serial: TP-1302
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body - Low - HS-6/Area Scan – Flip closed (61x91x1): Measurement grid: $dx=15$ mm, $dy=15$ mm

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

Maximum value of SAR (interpolated) = 0.525 mW/g

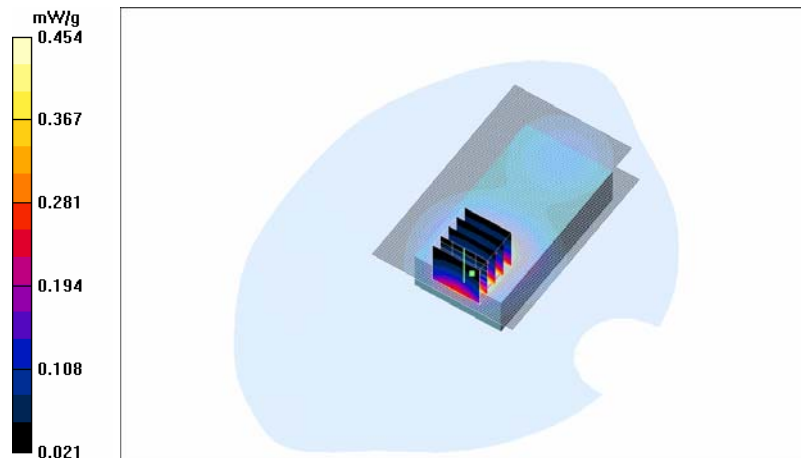
Body - Low - HS-6/Zoom Scan – Flip closed (5x5x7)/Cube 0: Measurement grid: $dx=7.5$ mm, $dy=7.5$ mm, $dz=5$ mm

Reference Value = 19.2 V/m; Power Drift = -0.033 dB

Peak SAR (extrapolated) = 0.642 W/kg

SAR(1 g) = 0.436 mW/g; SAR(10 g) = 0.274 mW/g

Maximum value of SAR (measured) = 0.454 mW/g



Date/Time: 2006-09-11 12:08:01

Test Laboratory: TCC Copenhagen
Type: RM-157; Serial: 004400/92/178303/9

Communication System: 2-slot GPRS1900
Frequency: 1850.2 MHz; Duty Cycle: 1:4.2
Medium: Body 1900; Medium Notes: Medium Temperature: $t=20.6\text{ }^{\circ}\text{C}$
Medium parameters used (interpolated): $f = 1850.2\text{ MHz}$; $\sigma = 1.51\text{ mho/m}$; $\epsilon_r = 53.3$; $\rho = 1000\text{ kg/m}^3$
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1808; Probe Notes:
- ConvF(4.4, 4.4, 4.4); Calibrated: 2006-08-24
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection (Locations From Previous Scan Used))Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn339; Calibrated: 2006-08-22
- Phantom: SAM 3; Type: Twin Phantom; Serial: TP-1302
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

Body - Low - HS-6 - BT active/Area Scan – Flip closed (61x91x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

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

Maximum value of SAR (interpolated) = 0.564 mW/g

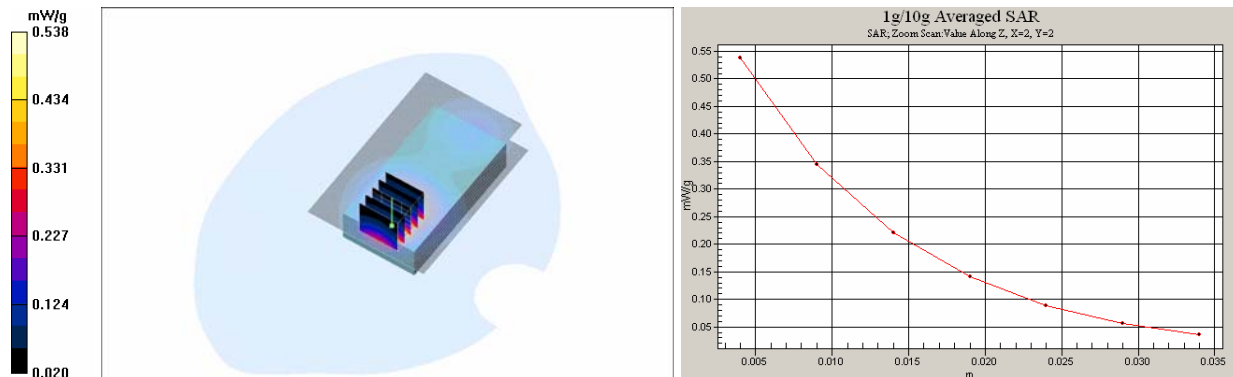
Body - Low - HS-6 - BT active/Zoom Scan – Flip closed (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 19.9 V/m ; Power Drift = 0.010 dB

Peak SAR (extrapolated) = 0.727 W/kg

SAR(1 g) = 0.477 mW/g ; SAR(10 g) = 0.295 mW/g

Maximum value of SAR (measured) = 0.538 mW/g



APPENDIX C: RELEVANT PAGES FROM PROBE CALIBRATION REPORT

See the following 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 Denmark A/S**

Certificate No: **ET3-1808_Aug06**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1808**

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

Calibration date: **August 24, 2006**

Condition of the calibrated item **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

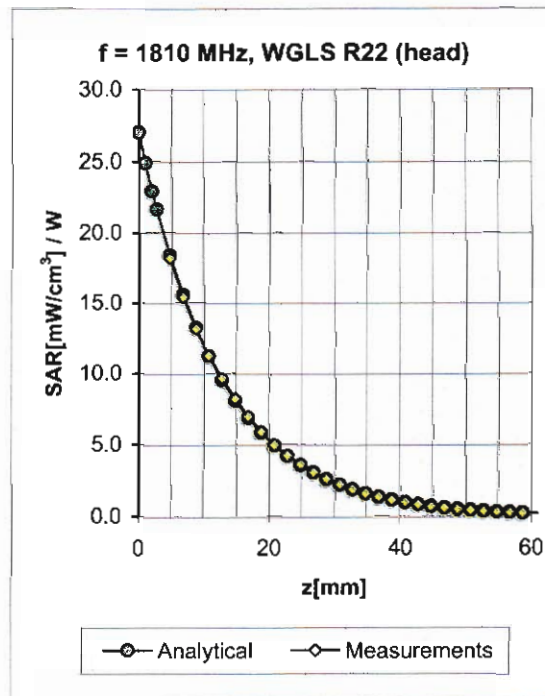
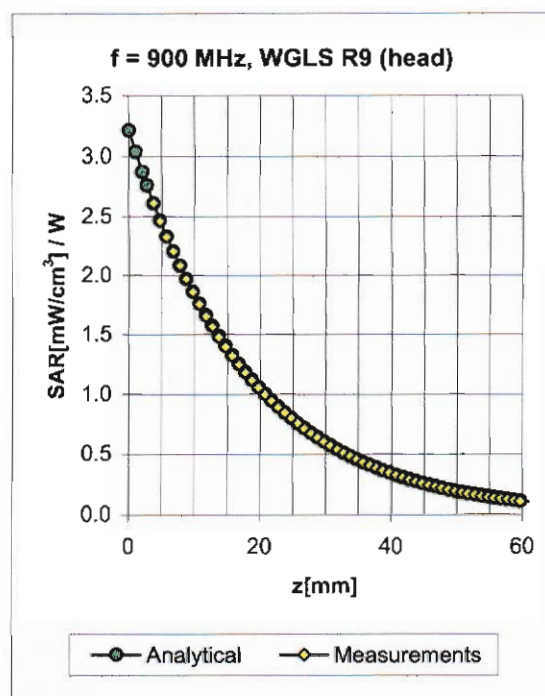
Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41495277	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Power sensor E4412A	MY41498087	5-Apr-06 (METAS, No. 251-00557)	Apr-07
Reference 3 dB Attenuator	SN: S5054 (3c)	10-Aug-06 (METAS, No. 217-00592)	Aug-07
Reference 20 dB Attenuator	SN: S5086 (20b)	4-Apr-06 (METAS, No. 251-00558)	Apr-07
Reference 30 dB Attenuator	SN: S5129 (30b)	10-Aug-06 (METAS, No. 217-00593)	Aug-07
Reference Probe ES3DV2	SN: 3013	2-Jan-06 (SPEAG, No. ES3-3013_Jan06)	Jan-07
DAE4	SN: 654	21-Jun-06 (SPEAG, No. DAE4-654_Jun06)	Jun-07
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov 06

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

Issued: August 24, 2006

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

Conversion Factor Assessment



f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.59	1.83	6.06 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.50	2.77	5.02 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.55	2.71	4.76 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.50	2.40	4.29 ± 11.8% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.52	2.04	5.88 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.64	2.89	4.40 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.69	2.61	4.22 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.55	1.61	4.00 ± 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

See the following 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 Denmark A/S**

Certificate No: **D1900V2-5d026_Feb06/2**

CALIBRATION CERTIFICATE (Replacement of No: D1900V2-5d026_Feb06)

Object **D1900V2 - SN: 5d026**

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

Calibration date: **February 21, 2006**

Condition of the calibrated item **In Tolerance**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Power sensor HP 8481A	US37292783	04-Oct-05 (METAS, No. 251-00516)	Oct-06
Reference 20 dB Attenuator	SN: 5086 (20g)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference 10 dB Attenuator	SN: 5047.2 (10r)	11-Aug-05 (METAS, No 251-00498)	Aug-06
Reference Probe ET3DV6	SN 1507	28-Oct-05 (SPEAG, No. ET3-1507_Oct05)	Oct-06
DAE4	SN 601	15-Dec-05 (SPEAG, No. DAE4-601_Dec05)	Dec-06
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Nov-05)	In house check: Nov-06

	Name	Function	Signature
Calibrated by:	Mike Meili	Laboratory Technician	

	Name	Function	Signature
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 9, 2006

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

DASY4 Validation Report for Head TSL

Date/Time: 21.02.2006 13:52:34

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d026

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

Medium: HSL U10 BB;

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.42$ 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 (HF); ConvF(4.74, 4.74, 4.74); Calibrated: 28.10.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA
- Measurement SW: DASY4, V4.6 Build 57; Postprocessing SW: SEMCAD, V1.8 Build 160

Pin = 250 mW; d = 10 mm/Area Scan (71x71x1):

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

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

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

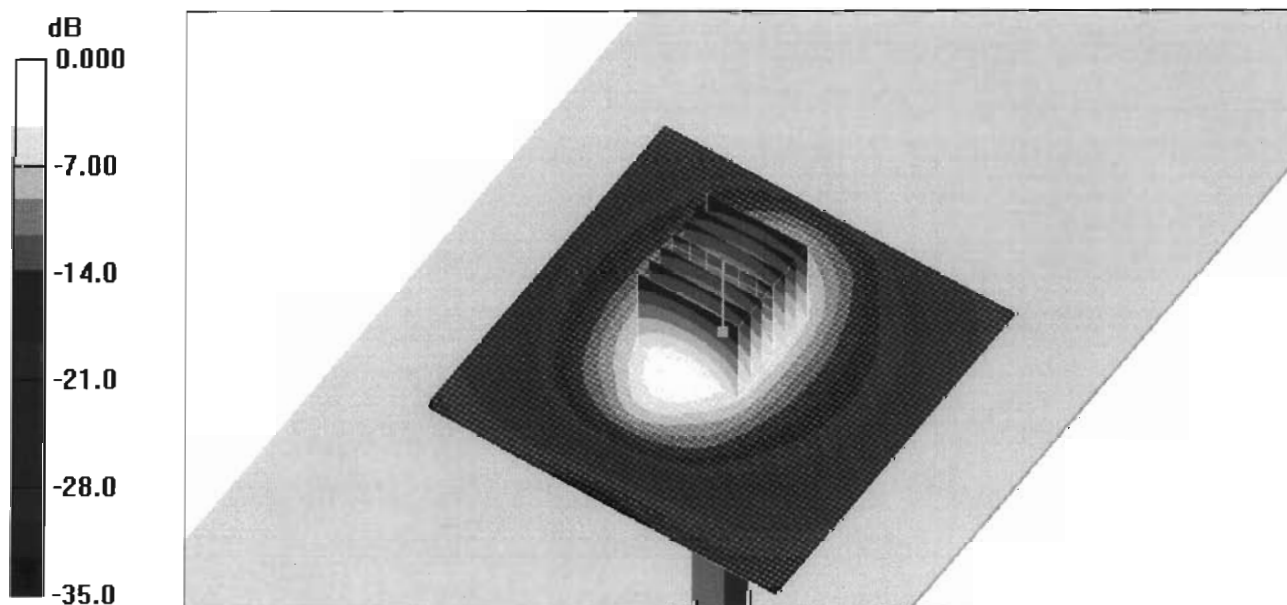
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 84.2 V/m; Power Drift = -0.015 dB

Peak SAR (extrapolated) = 16.6 W/kg

SAR(1 g) = 9.83 mW/g; SAR(10 g) = 5.2 mW/g

Maximum value of SAR (measured) = 11.0 mW/g



0 dB = 11.0mW/g

DASY4 Validation Report for Body TSL

Date/Time: 21.02.2006 15:46:28

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:5d026

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

Medium: MSL U10;

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.54$ mho/m; $\epsilon_r = 54.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(4.3, 4.3, 4.3); Calibrated: 28.10.2005
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA
- Measurement SW: DASY4, V4.6 Build 57; Postprocessing SW: SEMCAD, V1.8 Build 160

Pin = 250 mW; d = 10 mm/Area Scan (71x71x1):

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

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

Pin = 250 mW; d = 10 mm/Zoom Scan 2 (7x7x7)/Cube 0:

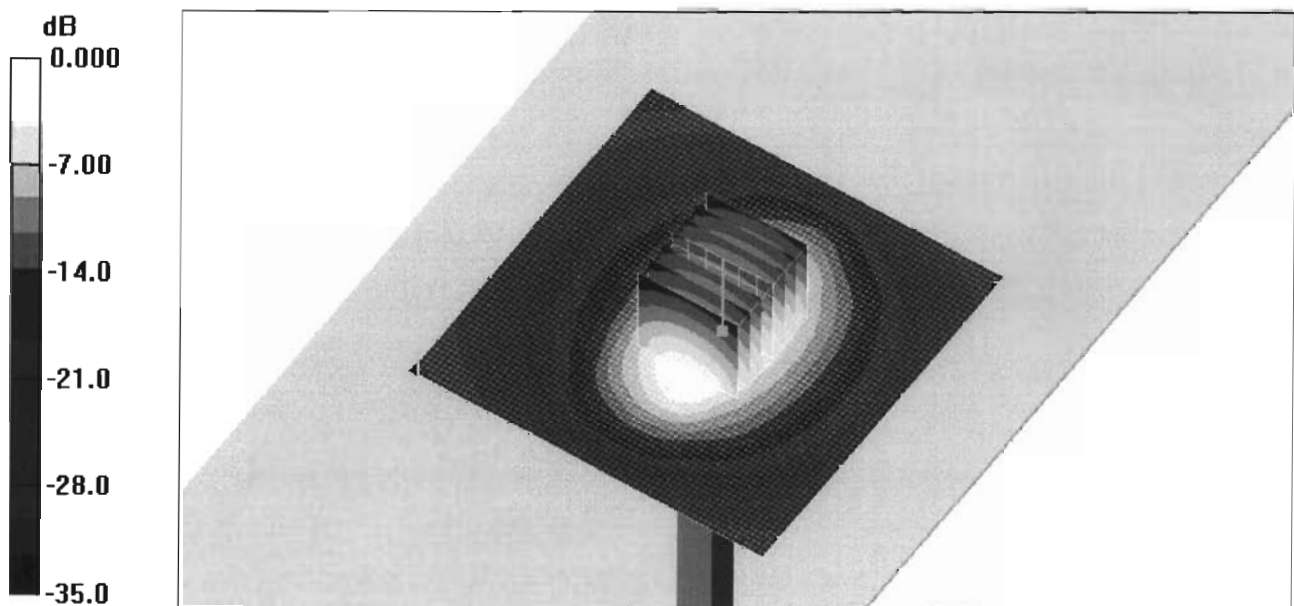
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 83.1 V/m; Power Drift = -0.066 dB

Peak SAR (extrapolated) = 17.3 W/kg

SAR(1 g) = 10 mW/g; SAR(10 g) = 5.38 mW/g

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



0 dB = 11.5mW/g