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Nokia

T117 (EN ISO/IEC 17025)

SAR Compliance Test Report

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Testing laboratory:	TCC Salo P.O. Box 86 Joensuunkatu 7H / Kiila 1B FIN-24101 SALO, FINLAND Tel. +358 (0) 7180 08000 Fax. +358 (0) 7180 45220	Client:	Nokia Denmark A/S Frederikskaj DK-1790 Copenhagen V Denmark Tel. +45 33 29 29 29 Fax. +45 33 29 20 01
Responsible test engineer:	Virpi Tuominen	Product contact person:	Ole Soerensen
Measurements made by:	Janne Hirsimäki, Virpi Tuominen		
Tested device:	RH-36		
FCC ID:	QTKRH-36X	IC:	661AD-RH36
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: 2005-01-11

For the contents:

Virpi Tuomien
Senior Design Engineer

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	2004-12-08 to 2004-12-14
SN, HW and SW numbers of tested device	SN: 01044100/158878/3, HW: 0874, SW: 4.22, DUT: 10296
Batteries used in testing	BL-5C, DUT: 10295, 10297
Headsets used in testing	HDC-5, DUT: 06590
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)	ERP/EIRP	Position	SAR limit (1g avg)	Measured SAR value (1g avg)	Result
GSM850	128 / 824.2	26.3 dBm	Left Cheek	1.6 W/kg	0.66 W/kg	PASSED
GSM1900	810 / 1909.8	31.5 dBm	Right Tilt	1.6 W/kg	0.97 W/kg	PASSED

1.2.2 Body Worn Configuration

Mode	Ch / *f* (MHz)	ERP/EIRP	Separation distance	SAR limit (1g avg)	Measured SAR value (1g avg)	Result
GSM850	190 / 836.6	26.6 dBm	1.5cm	1.6 W/kg	0.64 W/kg	PASSED
GSM1900	810 / 1909.8	31.5 dBm	1.5cm	1.6 W/kg	0.64 W/kg	PASSED

1.2.3 Maximum Drift

Maximum drift during measurements	0.2 dB

1.2.4 Measurement Uncertainty

Extended Uncertainty (k=2) 95%	± 29.8 %

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2. DESCRIPTION OF THE DEVICE UNDER TEST

Device category	Portable	
Exposure environment	General population/uncontrolled	
Unit type	Prototype unit	
Modes of Operation	GSM850	GSM1900
Modulation Mode	GMSK	GMSK
Duty Cycle	1/8	1/8
Transmitter Frequency Range (MHz)	824.2 – 848.8	1850.2 - 1909.8

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

Period of measurement:	2004-12-08 to 2004-12-14
Ambient temperature (°C):	22.3 to 22.5
Ambient humidity (RH %):	30 to 40

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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 power output 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, DASY 4 software version 4.4, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland. The SAR extrapolation algorithm used in all measurements on the device was the 'worst-case extrapolation' algorithm.

The following table lists calibration dates of SPEAG components:

Test Equipment	Serial Number	Calibration interval	Calibration expiry
DASY3 DAE V1	388	12 months	05 / 2005
E-field Probe ET3DV6	1395	12 months	08 / 2005
Dipole Validation Kit, D835V2	462	24 months	07 / 2006
Dipole Validation Kit, D900V2	056	24 months	01 / 2006
Dipole Validation Kit, D1900V2	5d013	24 months	07 / 2006

Additional test equipment used in testing:

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Test Equipment	Model	Serial Number	Calibration interval	Calibration expiry
Signal Generator	SML03	101265	12 months	09 / 2005
Amplifier	ZHL-42 (SMA)	N072095-5	12 months	07 / 2005
Power Meter	NRVS	849305/028	12 months	07 / 2005
Power Sensor	NRV-Z32	839176/020	12 months	07 / 2005
Call Tester	CMU 200	101111	12 months	09 / 2005
Vector Network Analyzer	8753E	US38432928	12 months	10 / 2005
Dielectric Probe Kit	85070B	US33020420	-	-

4.1.1 Isotropic E-field Probe SN: 1395

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 µW/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 validation testing and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The phantom conforms to the requirements of IEEE 1528 - 2003.

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Validation tests were 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 Simulating Liquids

Recommended values for the dielectric parameters of the simulating liquids are given in IEEE 1528 - 2003 and FCC Supplement C to OET Bulletin 65. All tests were carried out using liquids whose dielectric parameters were within ± 5% of the recommended values. All tests were carried out within 24 hours of measuring the dielectric parameters.

The depth of the liquid was 15.0 ± 0.5 cm measured from the ear reference point during validation and device measurements.

4.3.1 Liquid Recipes

The following recipes were used for Head and Body liquids:

800MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	39.74	50.75
HEC	0.25	-
Sugar	58.31	48.21
Preservative	0.15	0.10
Salt	1.55	0.94

1900MHz band

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

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1900MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	-	69.02
Butyl Diglycol	-	30.76
Salt	-	0.22

4.3.2 Verification of the System

The manufacturer calibrates the probes annually. Dielectric parameters of the simulating liquids were measured every day using the dielectric probe kit and the network analyser. A SAR measurement was made following the determination of the dielectric parameters of the liquids, 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 validation results (dielectric parameters and SAR values) are given in the table below.

System verification, 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	N/A
	± 10% window	2.21 – 2.70			
	2004-12-08	2.54	41.3	0.92	21.2
	2004-12-13	2.58	41.4	0.92	21.4
1900	Reference result	10.0	39.4	1.44	N/A
	± 10% window	9.00 – 11.00			
	2004-12-14	10.5	39.6	1.44	22.0

System verification, body tissue simulant

f [MHz]	Description	SAR [W/kg], 1g	Dielectric Parameters		Temp [°C]
			ε_r	σ [S/m]	
900	Reference result	2.76	54.4	1.04	N/A
	± 10% window	2.48 – 3.04			
	2004-12-13	2.71	52.7	1.01	22.1

Plots of the Verification scans are given in Appendix A.

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4.3.3 Tissue Simulants used in the Measurements

Head tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp
		ε_r	σ [S/m]	[°C]
836	Recommended value	41.5	0.90	N/A
	± 5% window	39.4 – 43.6	0.86 – 0.95	
	2004-12-08	41.3	0.92	21.0
	2004-12-13	41.3	0.92	21.0
1880	Recommended value	40.0	1.40	N/A
	± 5% window	38.0 – 42.0	1.33 – 1.47	
	2004-12-14	39.8	1.42	21.0

Body tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp
		ε_r	σ [S/m]	[°C]
836	Recommended value	55.2	0.97	N/A
	± 5% window	52.4 – 58.0	0.92 – 1.02	
	2004-12-13	53.3	0.95	21.0
1880	Recommended value	53.3	1.52	N/A
	± 5% window	50.6 – 56.0	1.44 – 1.60	
	2004-12-14	53.2	1.52	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.

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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”.

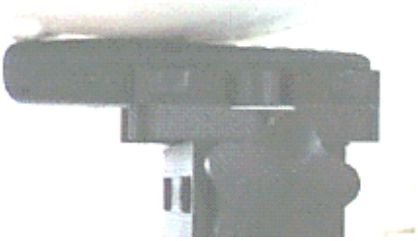

Photo of the device in “cheek” position.

Photo of the device in “tilt” position.

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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 gave higher results.

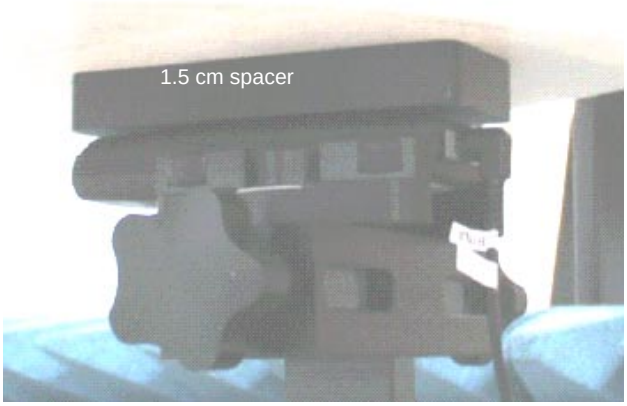

Photo of the device positioned for Body SAR measurement.
The spacer was removed for the tests.

5.3 Scan Procedures

First coarse scans were used for determination of the field distribution. Next a cube scan, a minimum of 5x5x7 points covering a cube 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 coarse scan and again at the end of the cube 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

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measurement point and fitted to neighbouring points by a least-square method. For the cube 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 cube scan, the interpolation function is used to extrapolate the Peak SAR from the deepest measurement points to the inner surface of the phantom.

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6. MEASUREMENT UNCERTAINTY

Table 6.1 – Measurement uncertainty evaluation

Uncertainty Component	Section in IEEE 1528	Tol. (%)	Prob Dist	Div	c_i	$c_i . u_i$ (%)	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	R	√3	1	±5.8	∞
Phantom and Tissue Parameters							
Phantom Uncertainty (shape and thickness tolerances)	E3.1	±4.0	R	√3	1	±2.3	∞
Liquid Conductivity Target - tolerance	E3.2	±5.0	R	√3	0.64	±1.8	∞
Liquid Conductivity - measurement uncertainty	E3.3	±5.5	N	1	0.64	±3.5	5
Liquid Permittivity Target tolerance	E3.2	±5.0	R	√3	0.6	±1.7	∞
Liquid Permittivity - measurement uncertainty	E3.3	±2.9	N	1	0.6	±1.7	5
Combined Standard Uncertainty			RSS			**±14.9**	206
Coverage Factor for 95%			**k=2**				
Expanded Standard Uncertainty						**±29.8**	

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7. RESULTS

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

GSM850, Head SAR results

Position		SAR, averaged over 1g (W/kg)		
		Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz
Power level		26.3 dBm	26.6 dBm	26.9 dBm
Left	Cheek	**0.660**	0.575	0.611
	Tilt	-	0.441	-
Right	Cheek	-	0.487	-
	Tilt	-	0.402	-

GSM1900, Head SAR results

Position		SAR, averaged over 1g (W/kg)		
		Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz
Power level		29.5 dBm	32.6 dBm	31.5 dBm
Left	Cheek	-	0.491	-
	Tilt	-	0.711	-
Right	Cheek	-	0.649	-
	Tilt	0.609	0.856	**0.974**

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

GSM850, Body SAR results

Body-worn location setup	SAR, averaged over 1g (W/kg)		
	Ch 128 824.2 MHz	Ch 190 836.6 MHz	Ch 251 848.8 MHz
Power level	**26.3 dBm**	**26.6 dBm**	**26.9 dBm**
Without headset	0.588	**0.638**	0.556
Headset HDC-5	0.499	0.317	0.295

GSM1900, Body SAR results

Body-worn location setup	SAR, averaged over 1g (W/kg)		
	Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz
Power level	**29.5 dBm**	**32.6 dBm**	**31.5 dBm**
Without headset	0.531	0.614	**0.643**
Headset HDC-5	0.357	0.481	0.566

Plots of the Measurement scans are given in Appendix B.

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APPENDIX A: VALIDATION SCANS

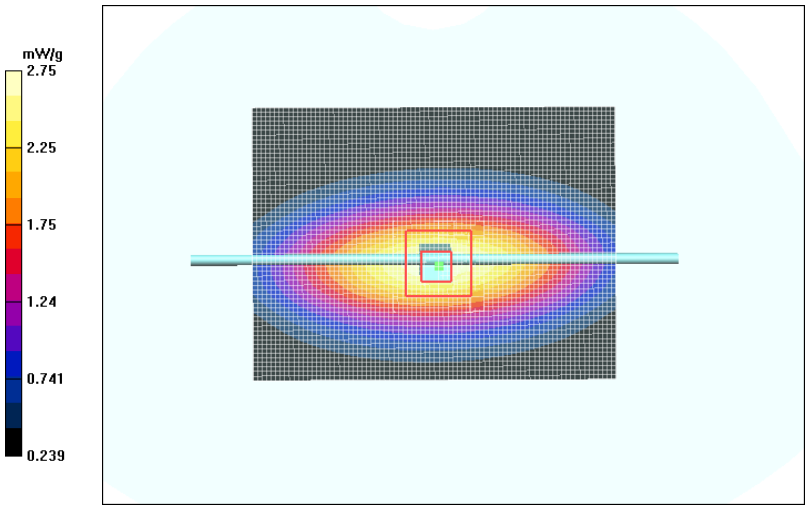
Date: 2004-12-08
Test Laboratory: TCC Nokia
Dipole 835 MHz; Type: D835V2; SN:462; System Performance Check

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.917 mho/m; ε_r = 41.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(6.42, 6.42, 6.42); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

d=15mm, Pin=250mW, t=21.2 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.72 mW/g

d=15mm, Pin=250mW, t=21.2 C/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.5 V/m; Power Drift = 0.002 dB
Peak SAR (extrapolated) = 3.8 W/kg
SAR(1 g) = 2.54 mW/g; SAR(10 g) = 1.65 mW/g
Maximum value of SAR (measured) = 2.75 mW/g



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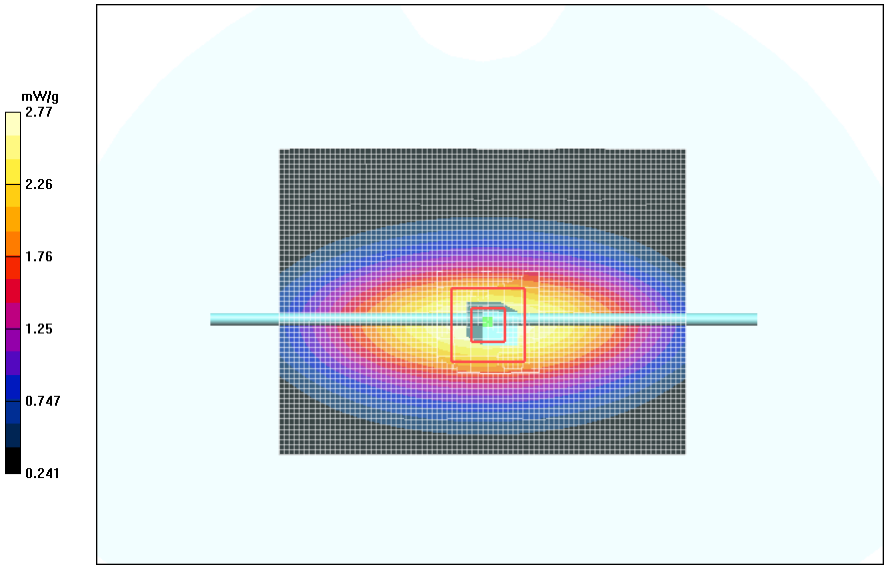
Date: 2004-12-13
Test Laboratory: TCC Nokia
Dipole 835 MHz; Type: D835V2; SN:462; System Performance Check

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.917 mho/m; ε_r = 41.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(6.42, 6.42, 6.42); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

d=15mm, Pin=252mW, t=21.4 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.76 mW/g

d=15mm, Pin=252mW, t=21.4 C/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.5 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 3.84 W/kg
SAR(1 g) = 2.58 mW/g; SAR(10 g) = 1.67 mW/g
Maximum value of SAR (measured) = 2.77 mW/g



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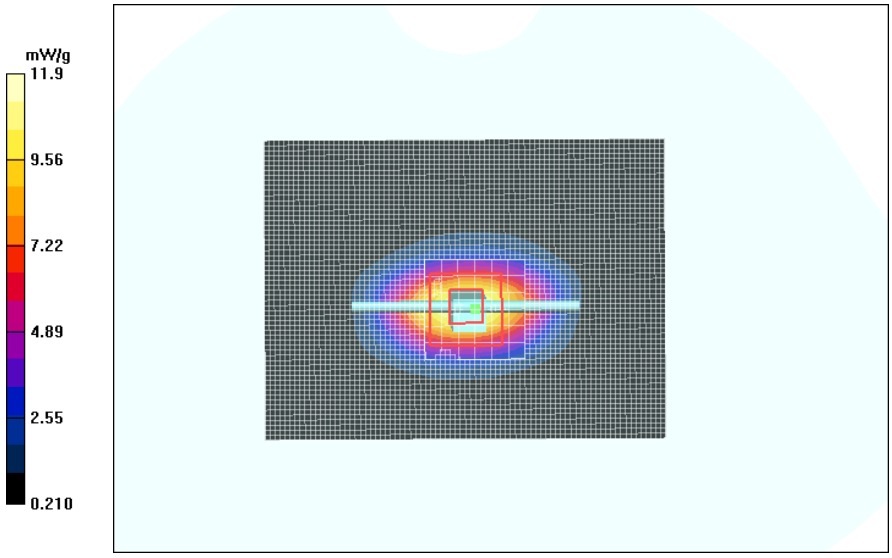
Date: 2004-12-14
Test Laboratory: TCC Nokia
Dipole 1900 MHz; Type: D1900V2; Serial: SN:5d013; System Performance Check

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 1900 MHz; σ = 1.44 mho/m; ε_r = 39.6; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(4.93, 4.93, 4.93); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

d=15mm, Pin=250mW, t=22.0 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 12.7 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 = 98.3 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 18 W/kg
SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.57 mW/g
Maximum value of SAR (measured) = 11.9 mW/g



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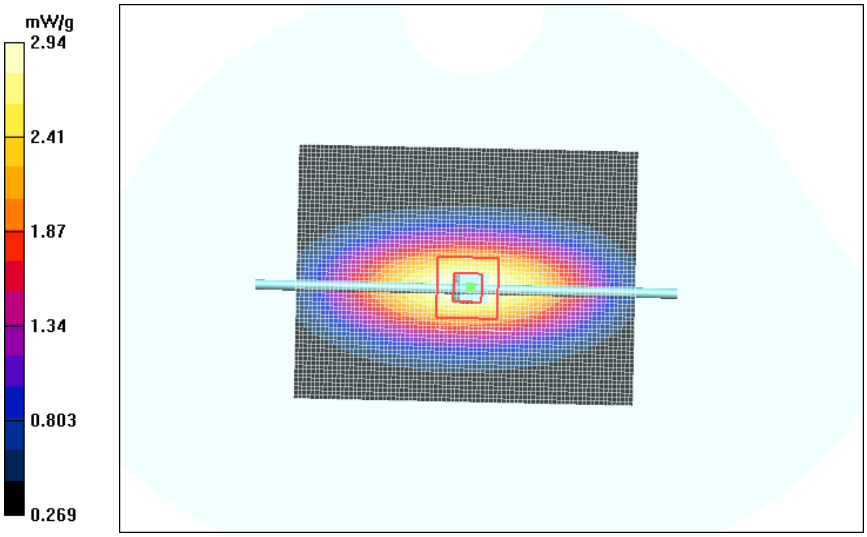
Date: 2004-12-13
Test Laboratory: TCC Nokia
Dipole 900 MHz; Type: D900V2; SN:056; System Performance Check
Communication System: CW; Frequency: 900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 900 MHz; σ = 1.01 mho/m; ε_r = 52.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(6.01, 6.01, 6.01); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

d=15mm, Pin=247mW, t=22.1 C/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.97 mW/g

d=15mm, Pin=247mW, t=22.1 C/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.6 V/m; Power Drift = -0.1 dB
Peak SAR (extrapolated) = 3.91 W/kg
SAR(1 g) = 2.71 mW/g; SAR(10 g) = 1.77 mW/g
Maximum value of SAR (measured) = 2.94 mW/g



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APPENDIX B: MEASUREMENT SCANS

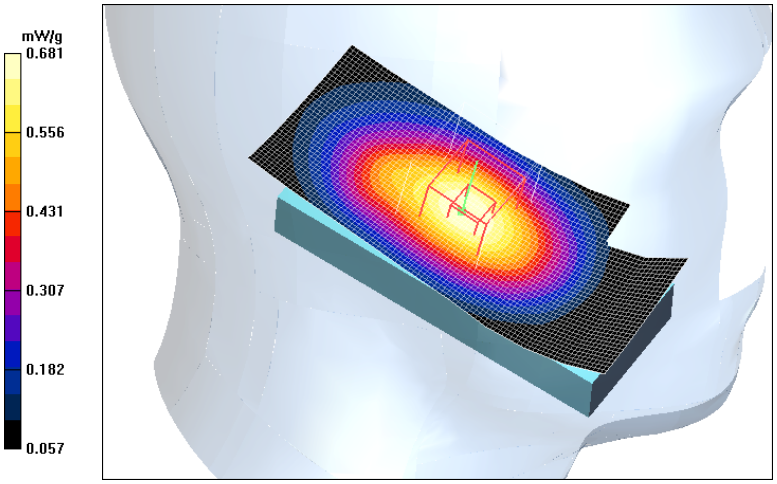
Date/Time: 2004-12-13
Test Laboratory: TCC Nokia
Type: RH-36; FCC head measurement – Left

Communication System: GSM850; Frequency: 824.2 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.91 mho/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(6.42, 6.42, 6.42); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Cheek position - Low, t=20.2 C, worst-case extrapolation/Area Scan (41x91x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (interpolated) = 0.681 mW/g

Cheek position - Low, t=20.2 C, worst- case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 21.9 V/m; Power Drift = 0.1 dB
Peak SAR (extrapolated) = 0.991 W/kg
SAR(1 g) = 0.660 mW/g; SAR(10 g) = 0.441 mW/g
Maximum value of SAR (measured) = 0.681 mW/g



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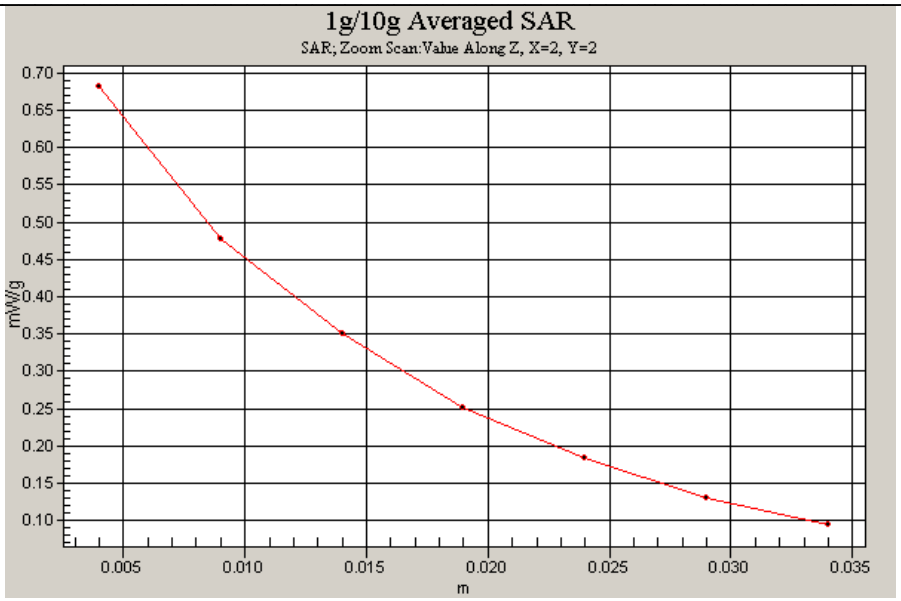

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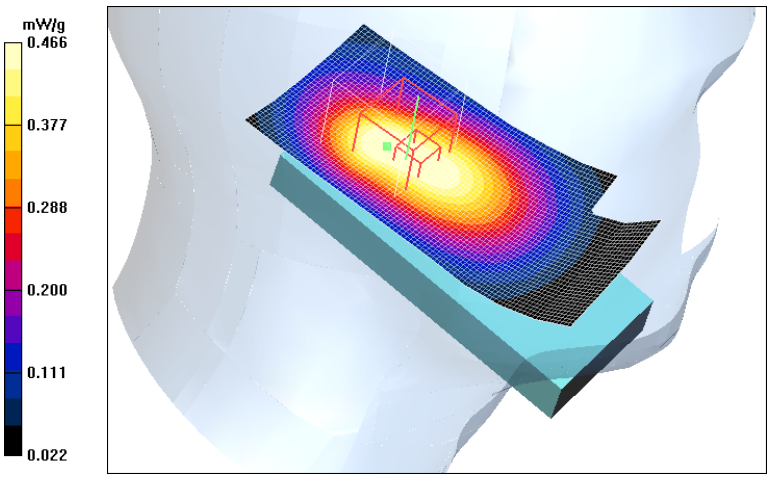
Date: 2004-12-13
Test Laboratory: TCC Nokia
Type: RH-36; FCC head measurement – Left

Communication System: GSM850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.918 mho/m; ε_r = 41.3; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(6.42, 6.42, 6.42); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Tilt position - Middle, t=21.2 C, worst-case extrapolation/Area Scan (41x91x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (interpolated) = 0.493 mW/g

Tilt position - Middle, t=21.2 C, worst-case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 22 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 0.866 W/kg
SAR(1 g) = 0.441 mW/g; SAR(10 g) = 0.287 mW/g
Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube.
Maximum value of SAR (measured) = 0.466 mW/g



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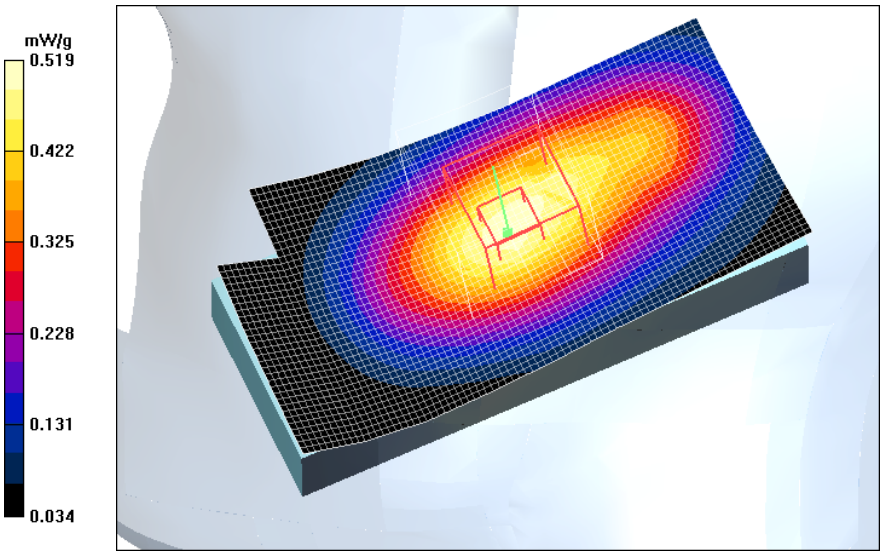
Date: 2004-12-08
Test Laboratory: TCC Nokia
Type: RH-36; FCC head measurement - Right
Communication System: GSM850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.919 mho/m; ε_r = 41.3; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(6.42, 6.42, 6.42); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Cheek position - Middle, t=21.1 C, worst-case extrapolation/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (interpolated) = 0.507 mW/g

Cheek position - Middle, t=21.1 C, worst-case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 18.6 V/m; Power Drift = 0.2 dB
Peak SAR (extrapolated) = 0.737 W/kg
SAR(1 g) = 0.487 mW/g; SAR(10 g) = 0.323 mW/g
Maximum value of SAR (measured) = 0.519 mW/g



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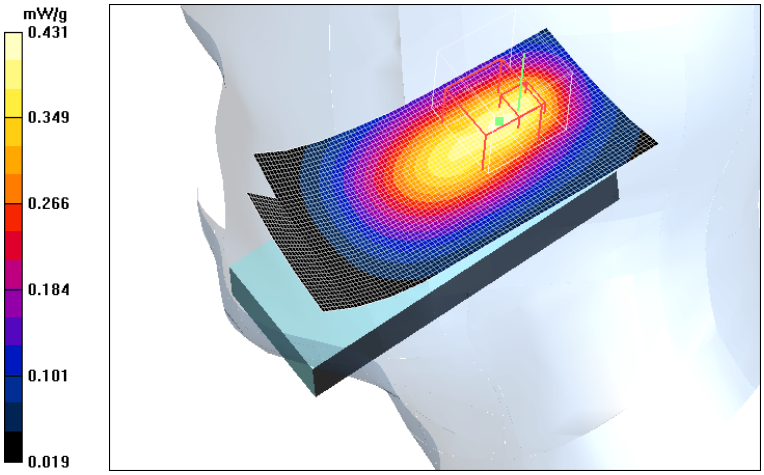
Date: 2004-12-13
Test Laboratory: TCC Nokia
Type: RH-36; FCC head measurement – Right

Communication System: GSM850; Frequency: 836.6 MHz; Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.918 mho/m; ε_r = 41.3; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(6.42, 6.42, 6.42); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Tilt position - Middle, t=20.9 C, worst-case extrapolation/Area Scan (41x91x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (interpolated) = 0.410 mW/g

Tilt position - Middle, t=20.9 C, worst-case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 19.3 V/m; Power Drift = 0.1 dB
Peak SAR (extrapolated) = 0.871 W/kg
SAR(1 g) = 0.402 mW/g; SAR(10 g) = 0.242 mW/g
Warning: Maximum averaged SAR over 10 g is located on the boundary of the measurement cube.
Maximum value of SAR (measured) = 0.431 mW/g



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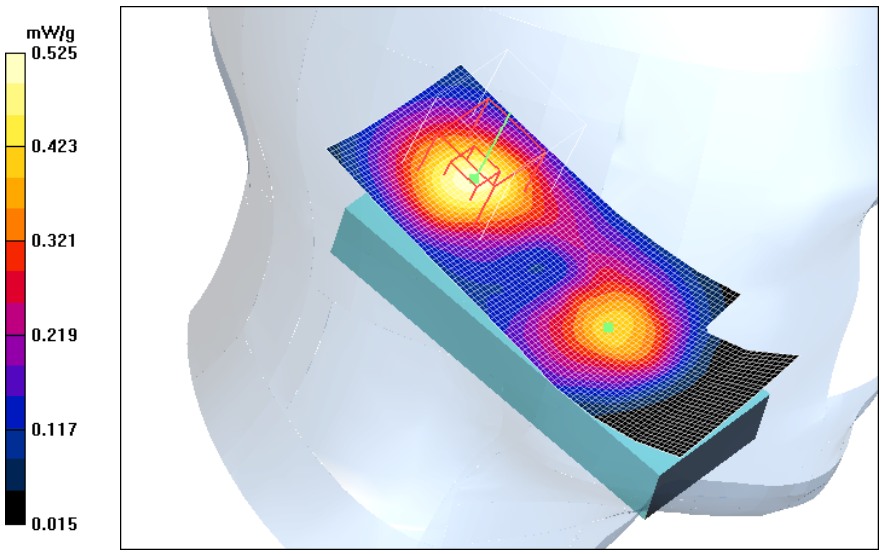
Date: 2004-12-14
Test Laboratory: TCC Nokia
Type: RH-36; FCC head measurement – Left

Communication System: GSM1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; σ = 1.42 mho/m; ε_r = 39.8; ρ = 1000 kg/m^3
Phantom section: Left Section
DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(4.93, 4.93, 4.93); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Cheek position - Middle, t=21.7 C, worst-case extrapolation/Area Scan (41x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.510 mW/g

Cheek position - Middle, t=21.7 C, worst-case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 18.8 V/m; Power Drift = -0.003 dB
Peak SAR (extrapolated) = 0.989 W/kg
SAR(1 g) = 0.491 mW/g; SAR(10 g) = 0.280 mW/g
Maximum value of SAR (measured) = 0.525 mW/g



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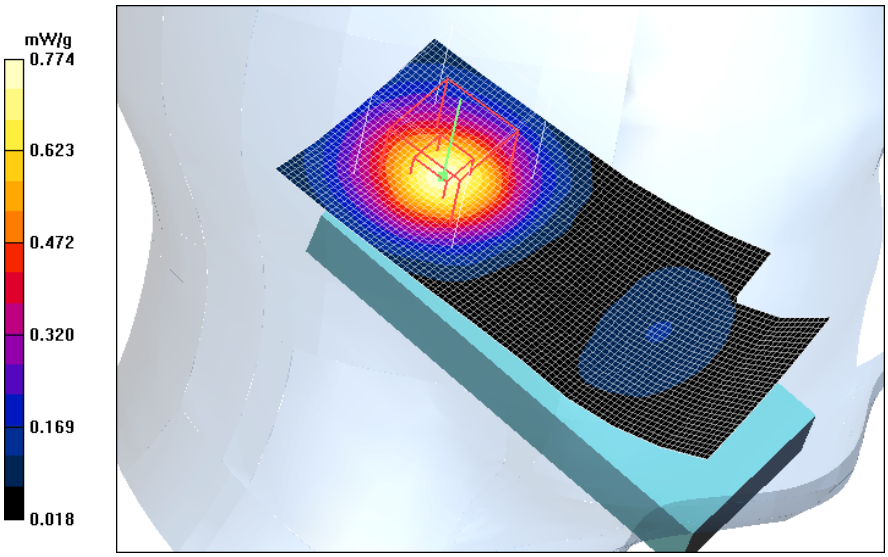
Date: 2004-12-14
Test Laboratory: TCC Nokia
Type: RH-36; FCC head measurement – Left

Communication System: GSM1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; σ = 1.42 mho/m; ε_r = 39.8; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(4.93, 4.93, 4.93); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Tilt position - Middle, t=21.4 C, worst case extrapolation/Area Scan (41x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.755 mW/g

Tilt position - Middle, t=21.4 C, worst case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 22.7 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 1.49 W/kg
SAR(1 g) = 0.711 mW/g; SAR(10 g) = 0.382 mW/g
Maximum value of SAR (measured) = 0.774 mW/g



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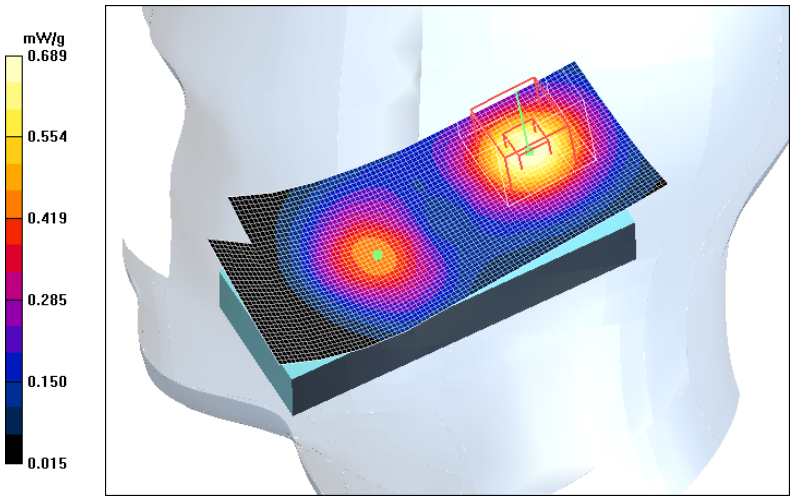
Date: 2004-12-14
Test Laboratory: TCC Nokia
Type: RH-36; FCC head measurement – Right

Communication System: GSM1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium parameters used: f = 1880 MHz; σ = 1.42 mho/m; ε_r = 39.8; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(4.93, 4.93, 4.93); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Cheek position - Middle, t=21.1 C, worst case extrapolation/Area Scan (41x91x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.717 mW/g

Cheek position - Middle, t=21.1 C, worst case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 20.2 V/m; Power Drift = 0.005 dB
Peak SAR (extrapolated) = 1.33 W/kg
SAR(1 g) = 0.649 mW/g; SAR(10 g) = 0.357 mW/g
Maximum value of SAR (measured) = 0.689 mW/g



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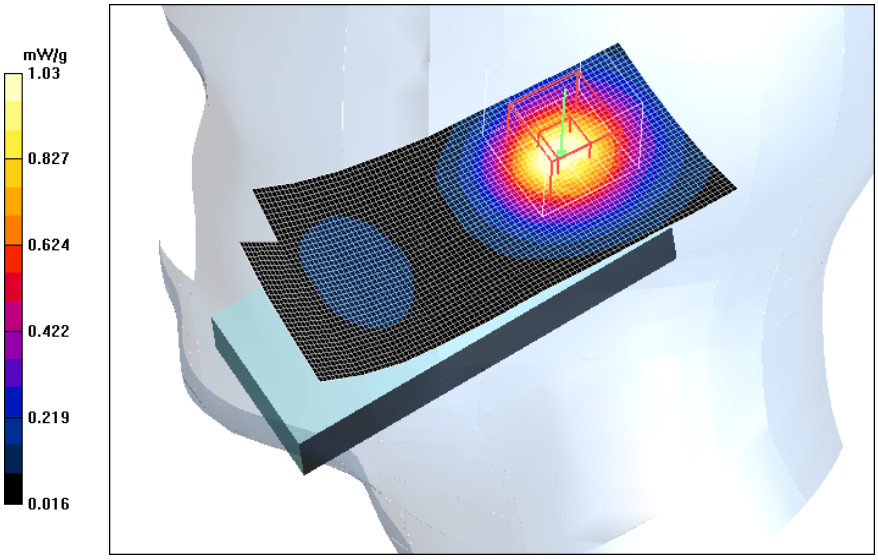
Date: 2004-12-14
Test Laboratory: TCC Nokia
Type: RH-36; FCC head measurement – Right

Communication System: GSM1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 1909.8 MHz; σ = 1.45 mho/m; ε_r = 39.6; ρ = 1000 kg/m^3
Phantom section: Right Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(4.93, 4.93, 4.93); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 2; Type: Twin SAM 040 CA; Serial: TP - 1177
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Tilt position - High, t=20.6 C, worst-case extrapolation/Area Scan (41x91x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (interpolated) = 1.11 mW/g

Tilt position - High, t=20.6 C, worst-case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 24.2 V/m; Power Drift = 0.1 dB
Peak SAR (extrapolated) = 2.18 W/kg
SAR(1 g) = 0.974 mW/g; SAR(10 g) = 0.508 mW/g
Maximum value of SAR (measured) = 1.03 mW/g



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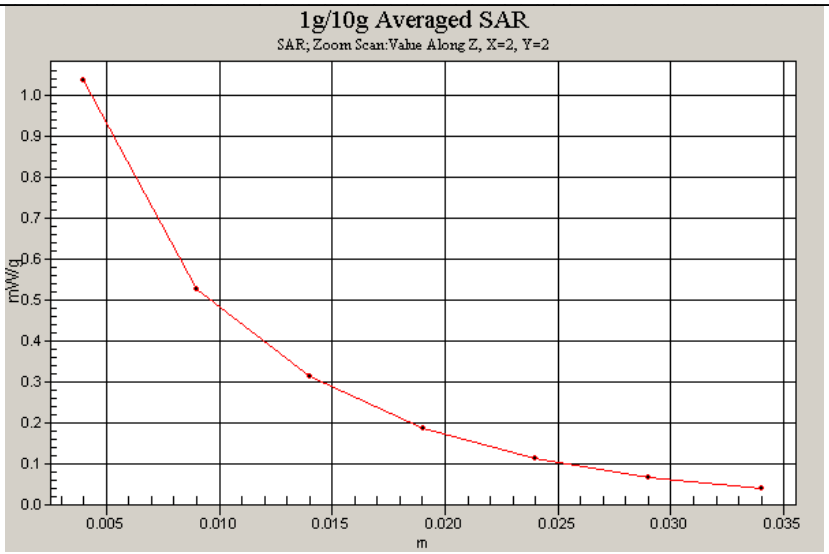

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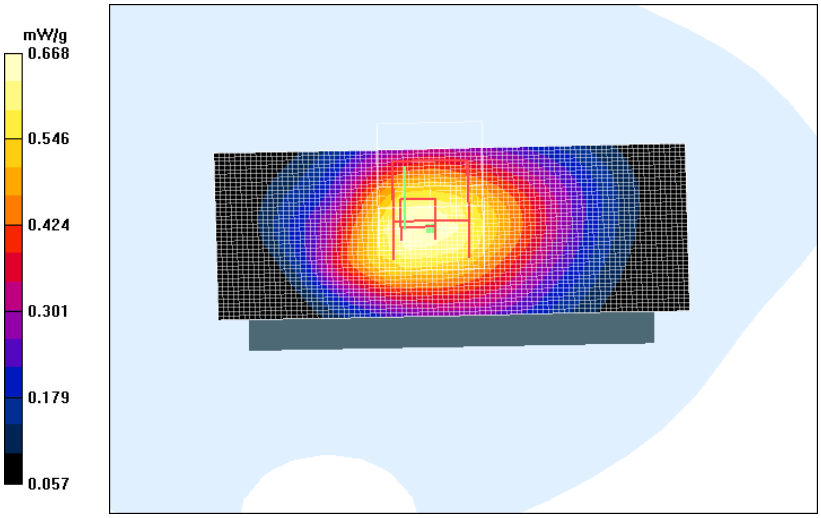
Date: 2004-12-13
Test Laboratory: TCC Nokia
Type: RH-36; Body measurement

Communication System: GSM850; Frequency: 836.6 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 836.6 MHz; σ = 0.946 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(6.17, 6.17, 6.17); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Body worn - Middle, t=20.6 C, 15mm, worst-case extrapolation/Area Scan (41x91x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (interpolated) = 0.669 mW/g

Body worn - Middle, t=20.6 C, 15mm, worst-case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 17.1 V/m; Power Drift = -0.0 dB
Peak SAR (extrapolated) = 1.02 W/kg
SAR(1 g) = 0.638 mW/g; SAR(10 g) = 0.437 mW/g
Maximum value of SAR (measured) = 0.668 mW/g



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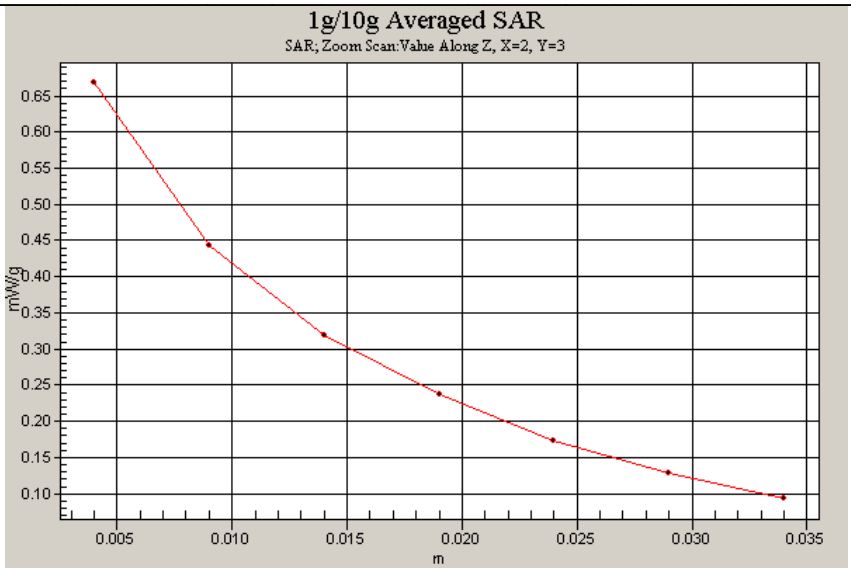

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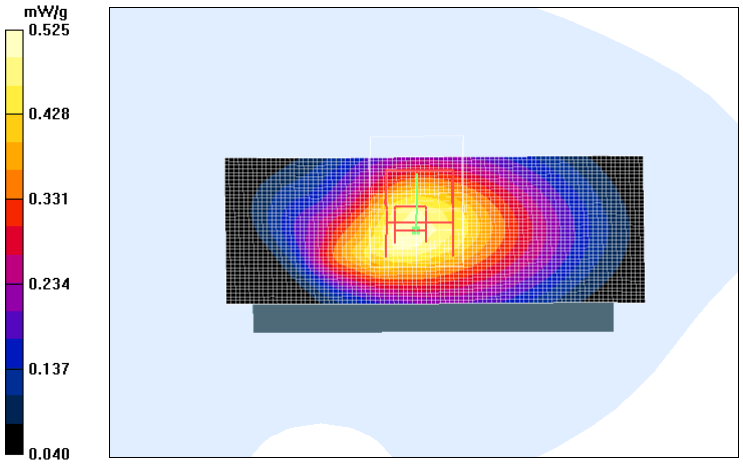
Date: 2004-12-13
Test Laboratory: TCC Nokia
Type: RH-36; Body measurement

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 824.2 MHz; σ = 0.935 mho/m; ε_r = 53.4; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(6.17, 6.17, 6.17); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Body worn - Low, t=20.4 C, 15mm, Headset: HDC-5, worst-case extrapolation/Area Scan (41x91x1):
Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (interpolated) = 0.527 mW/g

Body worn - Low, t=20.4 C, 15mm, Headset: HDC-5, worst-case extrapolation/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 15.9 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 0.800 W/kg
SAR(1 g) = 0.499 mW/g; SAR(10 g) = 0.338 mW/g
Maximum value of SAR (measured) = 0.525 mW/g



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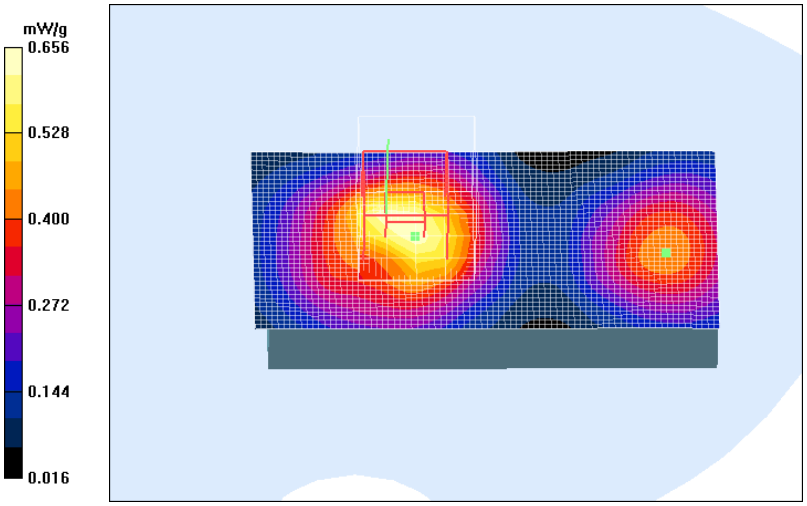
Date: 2004-12-14
Test Laboratory: TCC Nokia
Type: RH-36; Body measurement

Communication System: GSM1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 1909.8 MHz; σ = 1.55 mho/m; ε_r = 53.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(4.38, 4.38, 4.38); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Body worn -High, t=21.2 C, worst-case extrapolation, Headset: no/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (interpolated) = 0.678 mW/g

Body worn -High, t=21.2 C, worst-case extrapolation, Headset: no/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 16.8 V/m; Power Drift = -0.009 dB
Peak SAR (extrapolated) = 1.39 W/kg
SAR(1 g) = 0.643 mW/g; SAR(10 g) = 0.364 mW/g
Maximum value of SAR (measured) = 0.656 mW/g



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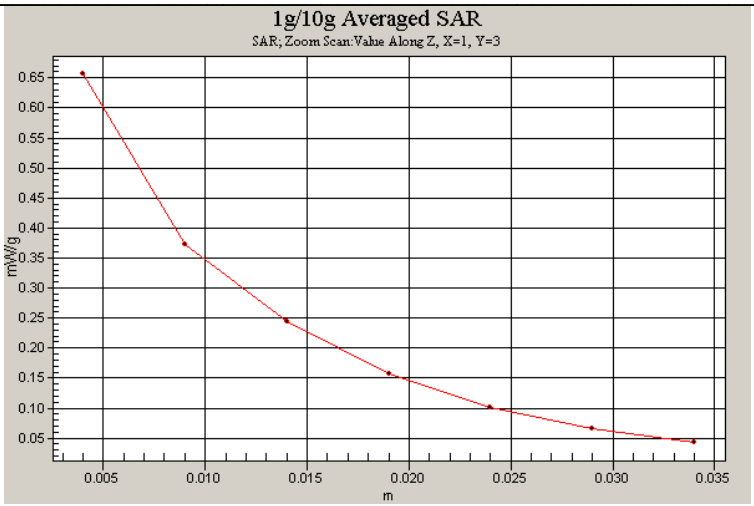

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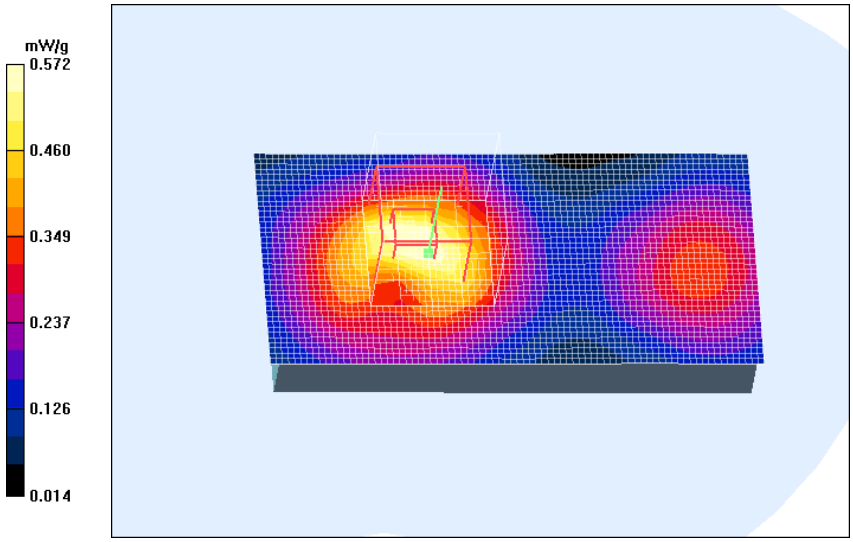
Date: 2004-12-14
Test Laboratory: TCC Nokia
Type: RH-36; Body measurement

Communication System: GSM1900; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium parameters used (interpolated): f = 1909.8 MHz; σ = 1.55 mho/m; ε_r = 53.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1395; ConvF(4.38, 4.38, 4.38); Calibrated: 26.08.2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn388; Calibrated: 24.05.2004
- Phantom: SAM 1; Type: Twin SAM 040 CA; Serial: TP-1179
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Body worn -High, t=21.2 C, worst case extrapolation, Headset: HDC-5/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm
Info: Interpolated medium parameters used for SAR evaluation!
Maximum value of SAR (interpolated) = 0.559 mW/g

Body worn -High, t=21.2 C, worst case extrapolation, Headset: HDC-5/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 17.2 V/m; Power Drift = 0.0 dB
Peak SAR (extrapolated) = 1.24 W/kg
SAR(1 g) = 0.566 mW/g; SAR(10 g) = 0.316 mW/g
Maximum value of SAR (measured) = 0.572 mW/g



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

ET3DV6 E-field probe, SN: 1395
See the next three pages.

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

Client **Nokia Salo TCC**

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1395
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	August 26, 2004
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

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 +/- 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 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 20 dB Attenuator	SN: 5086 (20b)	3-May-04 (METAS, No 251-00389)	May-05
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct03)	In house check: Oct 05
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug02)	In house check: Aug05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct03)	In house check: Oct 05

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

Date issued: August 26, 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.

DASY - Parameters of Probe: ET3DV6 SN:1395

Sensitivity in Free Space

NormX	**1.74** $\mu V/(V/m)^2$	DCP X	**92**	mV
NormY	**1.75** $\mu V/(V/m)^2$	DCP Y	**92**	mV
NormZ	**1.71** $\mu V/(V/m)^2$	DCP Z	**92**	mV

Diode Compression[A]

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Plese see Page 7.

Boundary Effect

Head **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	10.2	5.0
SAR_{be} [%]	With Correction Algorithm	0.0	0.1

Head **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	15.0	9.7
SAR_{be} [%]	With Correction Algorithm	0.1	0.0

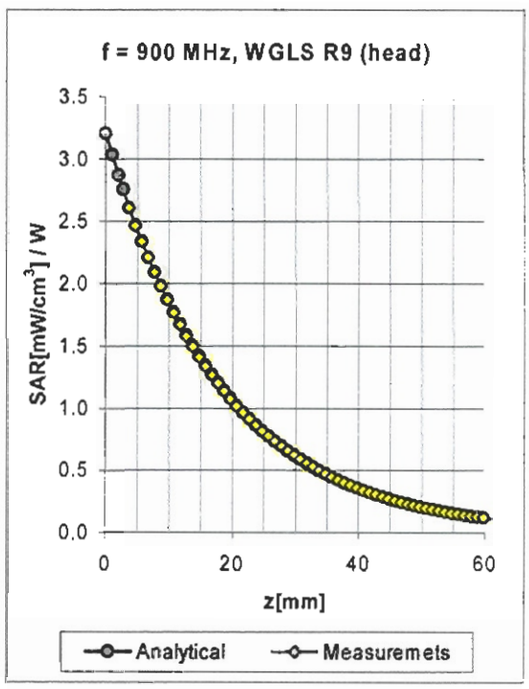
Sensor Offset

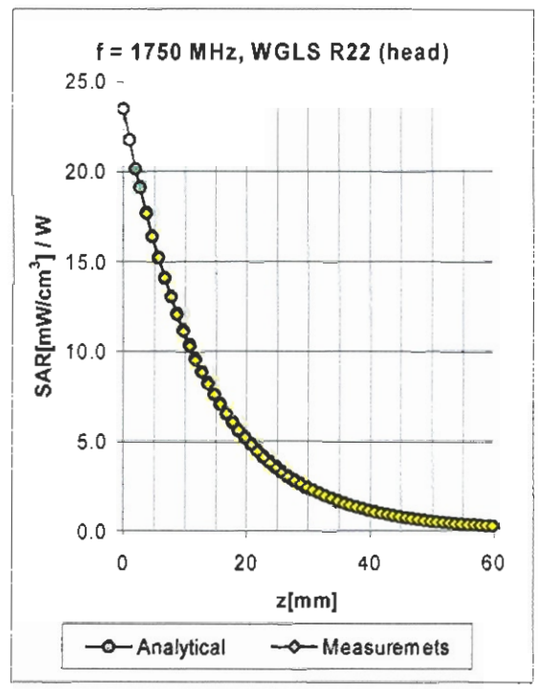
Probe Tip to Sensor Center	**2.7** mm
Optical Surface Detection	**in tolerance**

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] numerical linearization parameter: uncertainty not required

Conversion Factor Assessment





f [MHz]	Validity [MHz][B]	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	785-885	Head	41.5 ± 5%	0.90 ± 5%	0.80	1.73	6.42 ± 9.7% (k=2)
900	850-950	Head	41.5 ± 5%	0.97 ± 5%	0.96	1.58	6.25 ± 9.7% (k=2)
1750	1700-1800	Head	40.0 ± 5%	1.40 ± 5%	0.56	2.55	5.15 ± 9.7% (k=2)
1900	1850-1950	Head	40.0 ± 5%	1.40 ± 5%	0.58	2.72	4.93 ± 9.7% (k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	1.19	1.73	4.55 ± 9.7% (k=2)
835	785-885	Body	55.2 ± 5%	0.97 ± 5%	0.94	1.61	6.17 ± 9.7% (k=2)
900	850-950	Body	55.0 ± 5%	1.05 ± 5%	0.87	1.71	6.01 ± 9.7% (k=2)
1750	1700-1800	Body	53.3 ± 5%	1.52 ± 5%	0.58	2.80	4.56 ± 9.7% (k=2)
1900	1850-1950	Body	53.3 ± 5%	1.52 ± 5%	0.64	2.78	4.38 ± 9.7% (k=2)
2450	2400-2500	Body	52.7 ± 5%	1.95 ± 5%	1.99	1.20	4.34 ± 9.7% (k=2)

[B] The total standard uncertainty is calculated as root-sum-square of standard uncertainty of the Conversion Factor at calibration frequency and the standard uncertainty for the indicated frequency band.

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

Dipole D835V2, SN: 056
Dipole D900V2, SN: 462
Dipole D1900V2, SN: 5d013

See the next nine pages.

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Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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.

Date/Time: 07/12/04 11:28:47

Test Laboratory: SPEAG, Zurich, Switzerland

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

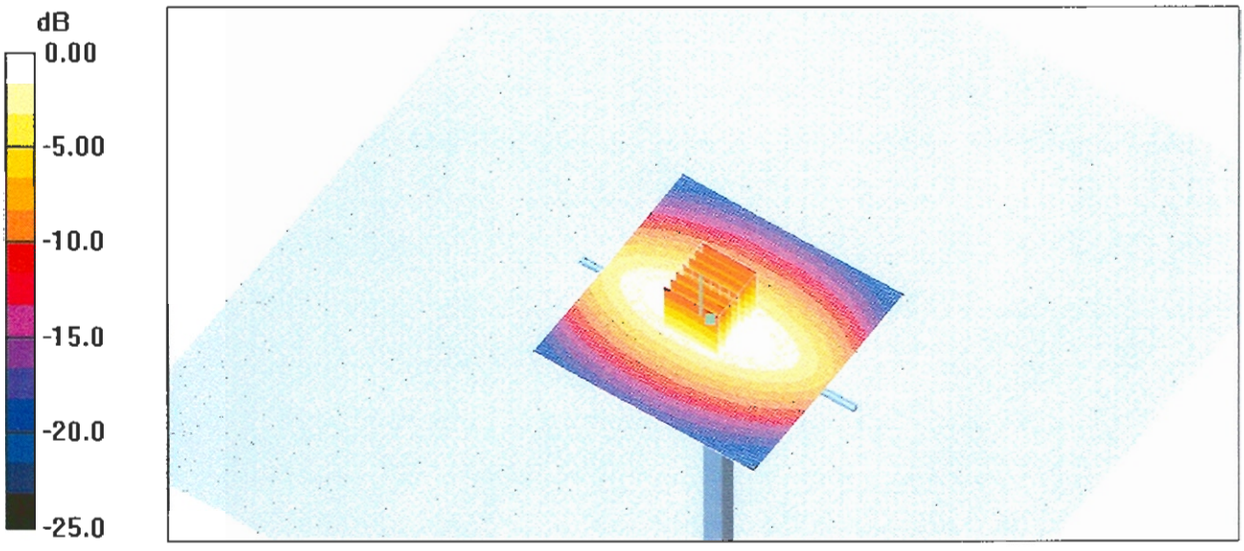
Communication System: CW-835; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: HSL 835 MHz;
Medium parameters used: f = 835 MHz; σ = 0.92 mho/m; ε_r = 41.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

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: DASY4, V4.3 Build 8; Postprocessing SW: SEMCAD, V1.8 Build 117

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

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



0 dB = 2.65mW/g

Date/Time: 07/14/04 13:16:14

Test Laboratory: SPEAG, Zurich, Switzerland

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

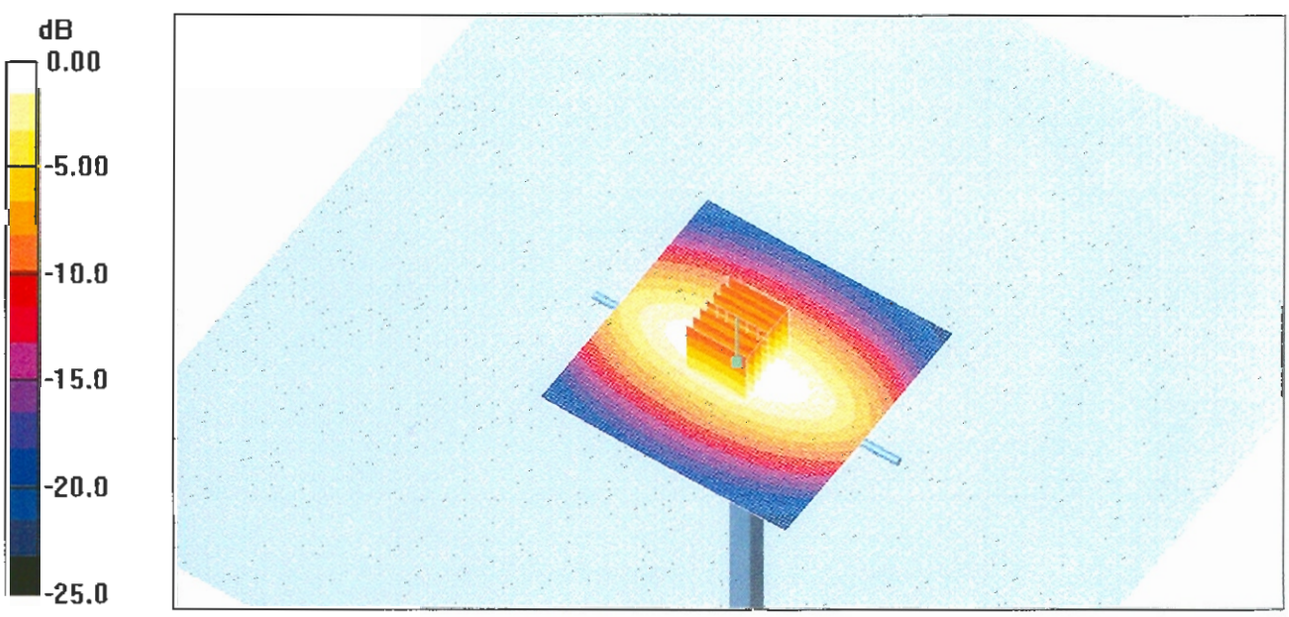
Communication System: CW-835; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: Muscle 835 MHz;
Medium parameters used: f = 835 MHz; σ = 0.99 mho/m; ε_r = 54.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

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=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.64 mW/g

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



0 dB = 2.66mW/g

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

Client Nokia TCC Salo

CALIBRATION CERTIFICATE

Object(s)	D900V2 - SN:056
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	January 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: January 19, 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.

Date/Time: 01/13/04 13:47:42

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN056

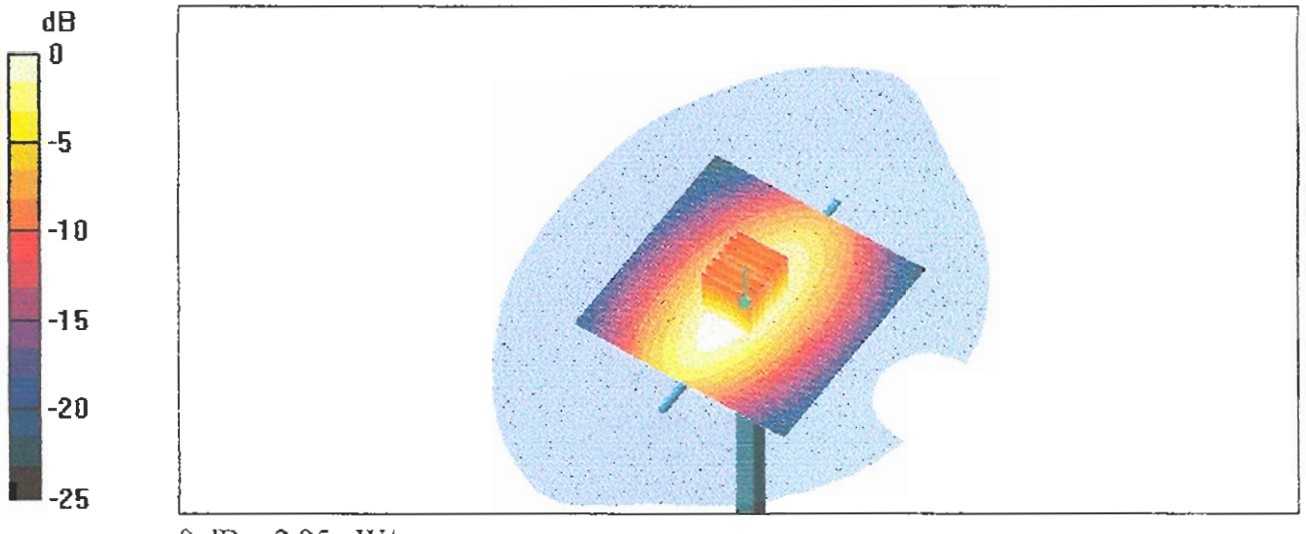
Communication System: CW-900; Frequency: 900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 900 MHz; σ = 0.94 mho/m; ε_r = 40.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.6, 6.6, 6.6); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- Measurement SW: DASY4, V4.2 Build 12; Postprocessing SW: SEMCAD, V1.8 Build 93

Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 57.3 V/m
Power Drift = 0.009 dB
Maximum value of SAR = 2.85 mW/g

Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 3.95 W/kg
SAR(1 g) = 2.64 mW/g; SAR(10 g) = 1.7 mW/g
Reference Value = 57.3 V/m
Power Drift = 0.009 dB
Maximum value of SAR = 2.85 mW/g



0 dB = 2.85mW/g

Date/Time: 01/12/04 14:12:15

Body

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 900 MHz; Type: D900V2; Serial: D900V2 - SN056

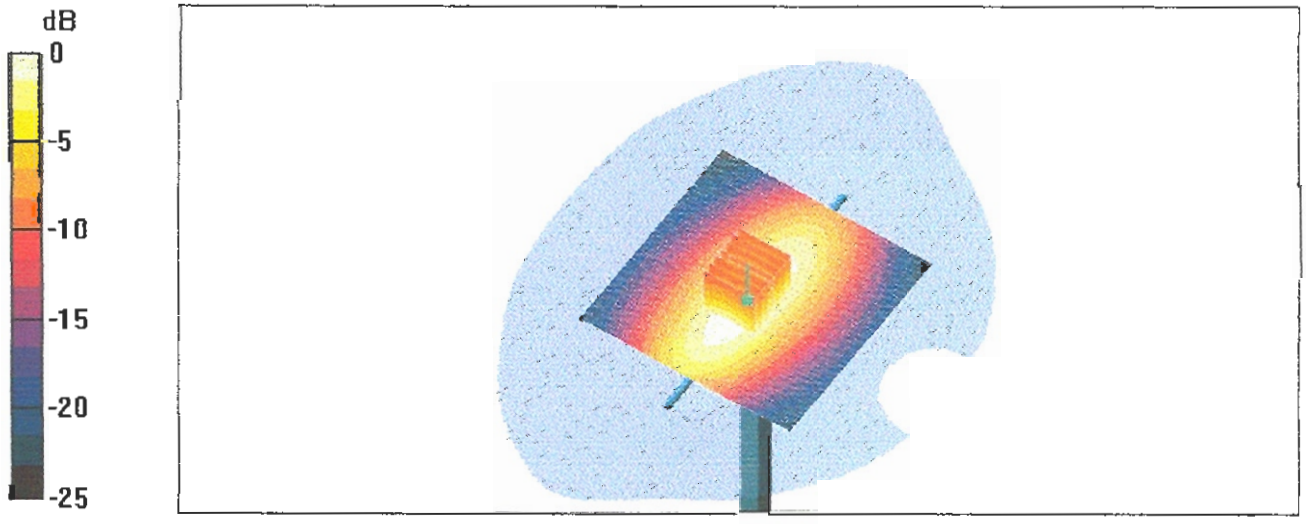
Communication System: CW-900; Frequency: 900 MHz;Duty Cycle: 1:1
Medium parameters used: f = 900 MHz; σ = 1.04 mho/m; ε_r = 54.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.3, 6.3, 6.3); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- Measurement SW: DASY4, V4.2 Build 12; Postprocessing SW: SEMCAD, V1.8 Build 93

Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 55.8 V/m
Power Drift = -0.0 dB
Maximum value of SAR = 2.98 mW/g

Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 4.1 W/kg
SAR(1 g) = 2.76 mW/g; SAR(10 g) = 1.79 mW/g
Reference Value = 55.8 V/m
Power Drift = -0.0 dB
Maximum value of SAR = 3 mW/g



0 dB = 3mW/g

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

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.

Date/Time: 07/13/04 11:09:33

Test Laboratory: SPEAG, Zurich, Switzerland

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

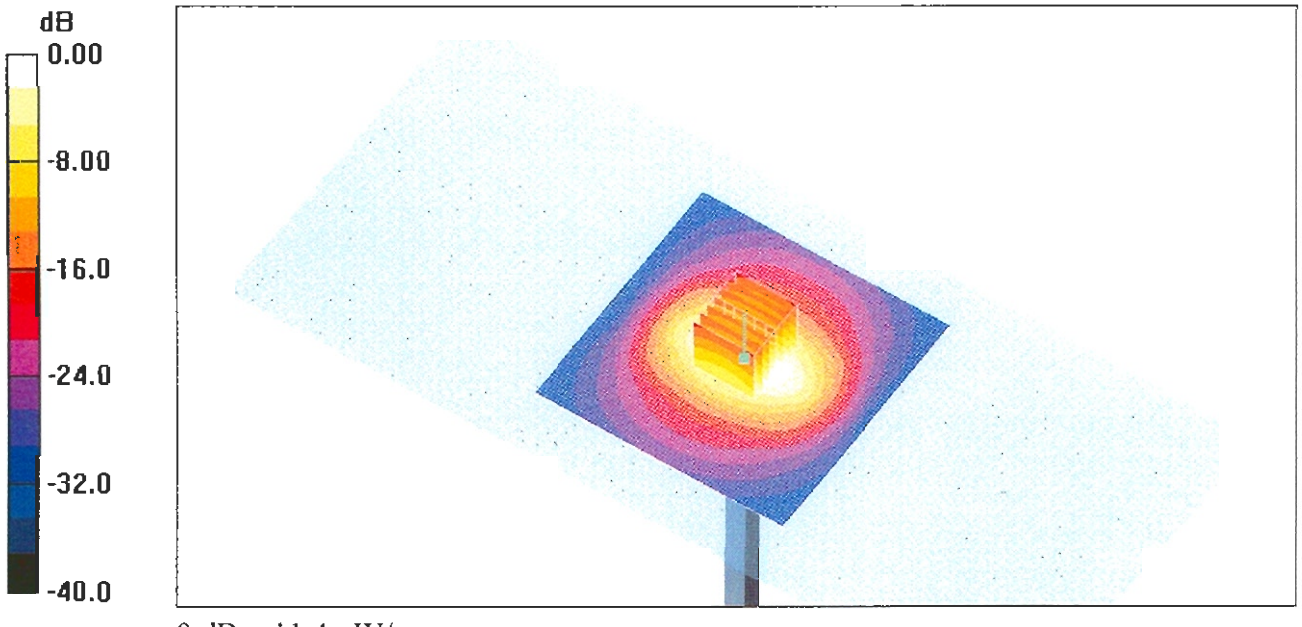
Communication System: CW-1900; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL 1900 MHz;
Medium parameters used: f = 1900 MHz; σ = 1.44 mho/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

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



0 dB = 11.4mW/g

Date/Time: 07/07/04 17:18:35

Test Laboratory: SPEAG, Zurich, Switzerland

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

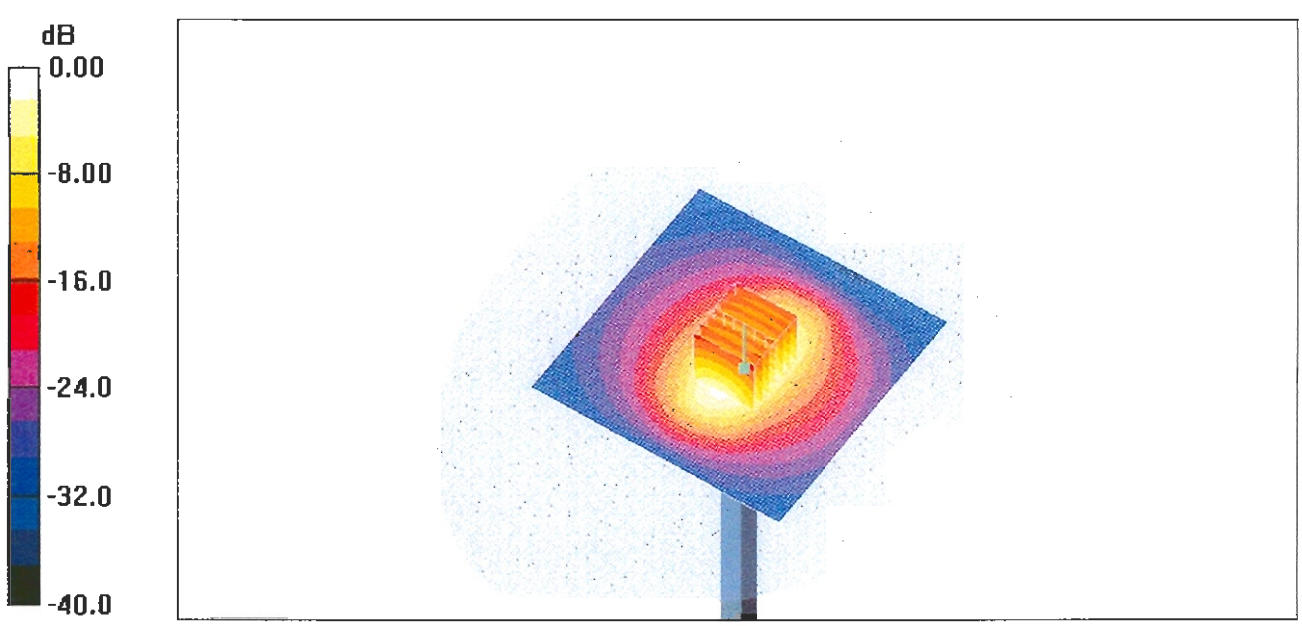
Communication System: CW-1900; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: Muscle 1900 MHz;
Medium parameters used: f = 1900 MHz; σ = 1.58 mho/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

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



0 dB = 11.8mW/g