
SAR Compliance Test Report

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Measurements made by:	Cindy Trinh		
Tested device:	RH-77		
FCC ID:	QMNRH-77	IC:	Not Applicable
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 Dallas.		
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:	2005-05-09		
For the contents:			



Nerina Walton
Lab Manager



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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	2005-03-04 to 2005-03-10
SN, HW and SW numbers of tested device	044/13030208, 4002, 0200b02.nep 044/13030345, 4002, 0200b02.nep 044/12799539, 4001, 0200b02.nep
Batteries used in testing	BL-5C
Headsets used in testing	HS-2R
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)	Conducted power	Position	SAR limit (1g avg)	Measured SAR value (1g avg)	Result
CDMA800	1013/824.70	25.3 dBm	Left Cheek	1.6 W/kg	1.33 W/kg	PASSED

1.2.2 Body Worn Configuration

Mode	Ch / f (MHz)	Conducted power	Separation distance	SAR limit (1g avg)	Measured SAR value (1g avg)	Result
CDMA800	1013/824.70	25.3 dBm	2.2 cm	1.6 W/kg	1.02 W/kg	PASSED

1.2.3 Maximum Drift

Maximum drift during measurements	0.23 dB
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1.2.4 Measurement Uncertainty

Extended Uncertainty (k=2) 95%	$\pm 29.8 \%$
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2. DESCRIPTION OF THE DEVICE UNDER TEST

Device category	Portable
Exposure environment	General population / uncontrolled

Modes and Bands of Operation	CDMA 800
Modulation Mode	QPSK
Duty Cycle	1
Transmitter Frequency Range (MHz)	824 – 849

2.1 Picture of the Device



2.2 Description of the Antenna

The device has an internal patch antenna.

3. TEST CONDITIONS

3.1 Temperature and Humidity

Ambient temperature (°C):	22.0 to 23.0
Ambient humidity (RH %):	38 to 57

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.

4. DESCRIPTION OF THE TEST EQUIPMENT

4.1 Measurement System and Components

The measurements were performed using an automated near-field scanning system, DASY4 software version 4.4, 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
DAE V1	377	12 months	2005-09
E-field Probe ET3DV6	1504	12 months	2005-09
Dipole Validation Kit, D835V2	455	24 months	2005-10

Additional test equipment used in testing:

Test Equipment	Model	Serial Number	Calibration interval	Calibration expiry
Amplifier	AR 551G2	25583	-	-
Dielectric Probe Kit	Agilent 85070D	US01440005	-	-
Signal Generator	R&S SMT06	100243	12 months	2005-06
Vector Network Analyzer	Agilent 8753ES	US39174327	12 months	2006-01
Power Meter	Boonton 4232A	26001	12 months	2005-06
Power Sensor	Boonton 51015	31143	12 months	2005-06
Power Sensor	Boonton 51015	31144	12 months	2005-06
Call Tester	R&S CMU200	838392/027	12 months	2005-08

4.1.1 Isotropic E-field Probe SN1504

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

4.2 Phantoms

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

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

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

4.3 Tissue Simulants

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

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

4.3.1 Tissue Simulant Recipes

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

800MHz band		
Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	51.07	65.45
HEC	0.23	-
Sugar	47.31	34.31
Preservative	0.24	0.10
Salt	1.15	0.62

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]	
	Reference result	2.37	43.0	0.90	
	$\pm 10\%$ window	2.13 – 2.61			
835	2005-03-04	2.42	41.3	0.90	21.3
	2005-03-07	2.50	41.2	0.90	21.2
	2005-03-09	2.34	41.4	0.88	21.1

System checking, body tissue simulant

f [MHz]	Description	SAR [W/kg], 1g	Dielectric Parameters		Temp [°C]
			ϵ_r	σ [S/m]	
	Reference result	2.48	55.0	0.98	
	$\pm 10\%$ window	2.23 – 2.73			
835	2005-03-08	2.44	53.5	0.94	21.6
	2005-03-10	2.43	54.6	0.94	21.5

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

4.3.3 Tissue Simulants used in the Measurements

Head tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp
		ϵ_r	σ [S/m]	[°C]
	Recommended value	41.5	0.90	
	$\pm 5\%$ window	39.4 – 43.6	0.86 – 0.95	
836.5	2005-03-04	41.3	0.90	21.3
	2005-03-07	41.2	0.90	21.2
	2005-03-09	41.3	0.89	21.1

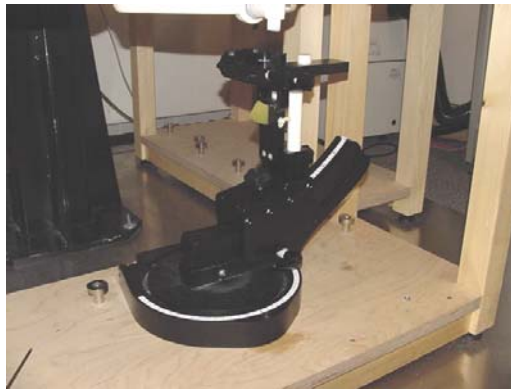
Body tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp
		ϵ_r	σ [S/m]	[°C]
	Recommended value	55.2	0.97	
	$\pm 5\%$ window	52.4 – 58.0	0.92 – 1.02	
836.5	2005-03-08	53.5	0.94	21.6
	2005-03-10	54.6	0.94	21.5

5. DESCRIPTION OF THE TEST PROCEDURE

5.1 Device Holder

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



Device holder supplied by SPEAG

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



Nokia spacer

5.2 Test Positions

5.2.1 Against Phantom Head

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

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



Photo of the device in “cheek” position

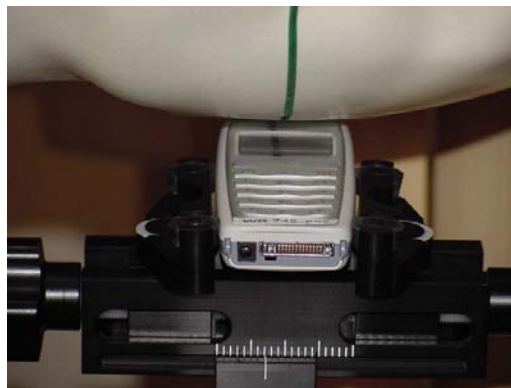


Photo of the device in “tilt” position

5.2.2 Body Worn Configuration

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



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

5.3 Scan Procedures

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

5.4 SAR Averaging Methods

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

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

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

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

6. MEASUREMENT UNCERTAINTY

Table 6.1 – Measurement uncertainty evaluation

Uncertainty Component	Section in IEEE 1528	Tol. (%)	Prob Dist	Div	G_i	$G_i \cdot U_i$ (%)	V_i
Measurement System							
Probe Calibration	E2.1	± 5.8	N	1	1	± 5.8	∞
Axial Isotropy	E2.2	± 4.7	R	$\sqrt{3}$	$(1-c_p)^{1/2}$	± 1.9	∞
Hemispherical Isotropy	E2.2	± 9.6	R	$\sqrt{3}$	$(c_p)^{1/2}$	± 3.9	∞
Boundary Effect	E2.3	± 8.3	R	$\sqrt{3}$	1	± 4.8	∞
Linearity	E2.4	± 4.7	R	$\sqrt{3}$	1	± 2.7	∞
System Detection Limits	E2.5	± 1.0	R	$\sqrt{3}$	1	± 0.6	∞
Readout Electronics	E2.6	± 1.0	N	1	1	± 1.0	∞
Response Time	E2.7	± 0.8	R	$\sqrt{3}$	1	± 0.5	∞
Integration Time	E2.8	± 2.6	R	$\sqrt{3}$	1	± 1.5	∞
RF Ambient Conditions - Noise	E6.1	± 3.0	R	$\sqrt{3}$	1	± 1.7	∞
RF Ambient Conditions - Reflections	E6.1	± 3.0	R	$\sqrt{3}$	1	± 1.7	∞
Probe Positioner Mechanical Tolerance	E6.2	± 0.4	R	$\sqrt{3}$	1	± 0.2	∞
Probe Positioning with respect to Phantom Shell	E6.3	± 2.9	R	$\sqrt{3}$	1	± 1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E5.2	± 3.9	R	$\sqrt{3}$	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	$\sqrt{3}$	1	± 5.8	∞
Phantom and Tissue Parameters							
Phantom Uncertainty (shape and thickness tolerances)	E3.1	± 4.0	R	$\sqrt{3}$	1	± 2.3	∞
Conductivity Target - tolerance	E3.2	± 5.0	R	$\sqrt{3}$	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	$\sqrt{3}$	0.6	± 1.7	∞
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	

7. RESULTS

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

Head SAR results

Hardware ID	UI Option	Test configuration		SAR, averaged over 1g (W/kg)		
				Ch 1013 824.70 MHz	Ch 384 836.52 MHz	Ch 777 848.31 MHz
4002	SDI	Power level		25.2 dBm	25.8 dBm	24.2 dBm
		Left	Cheek	1.24	1.16	1.15
			Tilt	-	0.54	-
		Right	Cheek	1.16	1.19	1.22
			Tilt	-	0.65	-
4002	Innolux	Power level		25.3 dBm	25.7 dBm	24.3 dBm
		Left	Cheek	1.33	1.07	1.10
			Tilt	-	0.57	-
		Right	Cheek	1.25	1.01	1.17
			Tilt	-	0.65	-
4001	Innolux	Power level		25.3 dBm	25.8 dBm	24.3 dBm
		Left	Cheek	1.31	1.12	1.18
			Tilt	-	0.60	-
		Right	Cheek	1.12	1.26	1.17
			Tilt	-	0.71	-

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

Body SAR results

Hardware ID	UI Option	Test configuration	SAR, averaged over 1g (W/kg)		
			Ch 1013 824.7 MHz	Ch 384 836.52 MHz	Ch 777 848.31 MHz
4002	SDI	Power level	25.2 dBm	25.8 dBm	24.2 dBm
		Without headset	0.93	0.81	0.57
		HS-2R Headset	0.61	0.59	0.37
4002	Innolux	Power level	25.3 dBm	25.7 dBm	24.3 dBm
		Without headset	0.98	0.97	0.58
		HS-2R Headset	0.64	0.61	0.46
4002	Innolux	Power level	25.3 dBm	25.8 dBm	24.3 dBm
		Without headset	1.02	0.92	0.59
		HS-2R Headset	0.62	0.55	0.43

Plots of the Measurement scans are given in Appendix B.

APPENDIX A: SYSTEM CHECKING SCANS

Date/Time: 3/4/2005 8:56:23 AM
Test Laboratory: TCC Dallas

835MHz Head System Check

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.898 \text{ mho/m}$; $\epsilon_r = 41.3$; $\rho = 1000 \text{ kg/m}^3$
Liquid Temperature: 21.3

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.73, 6.73, 6.73); Calibrated: 9/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM1 Cellular Head; Phantom section: Flat Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 146

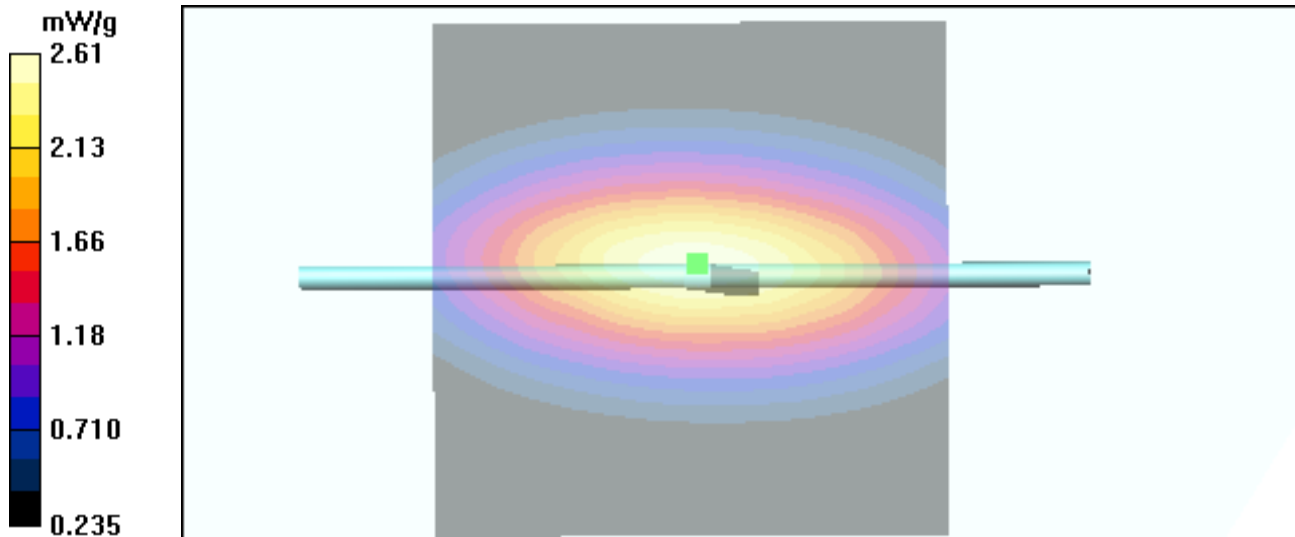
835MHz System Check/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.7 V/m; Power Drift = -0.036 dB

Peak SAR (extrapolated) = 3.61 W/kg

SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.57 mW/g

Maximum value of SAR (measured) = 2.61 mW/g



Date/Time: 03/07/2005 08:58:49
Test Laboratory: TCC Dallas

835MHz Head System Check

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.895 \text{ mho/m}$; $\epsilon_r = 41.2$; $\rho = 1000 \text{ kg/m}^3$
Liquid Temperature: 21.5

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.73, 6.73, 6.73); Calibrated: 09/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM1 Cellular Head; Phantom section: Flat Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 145

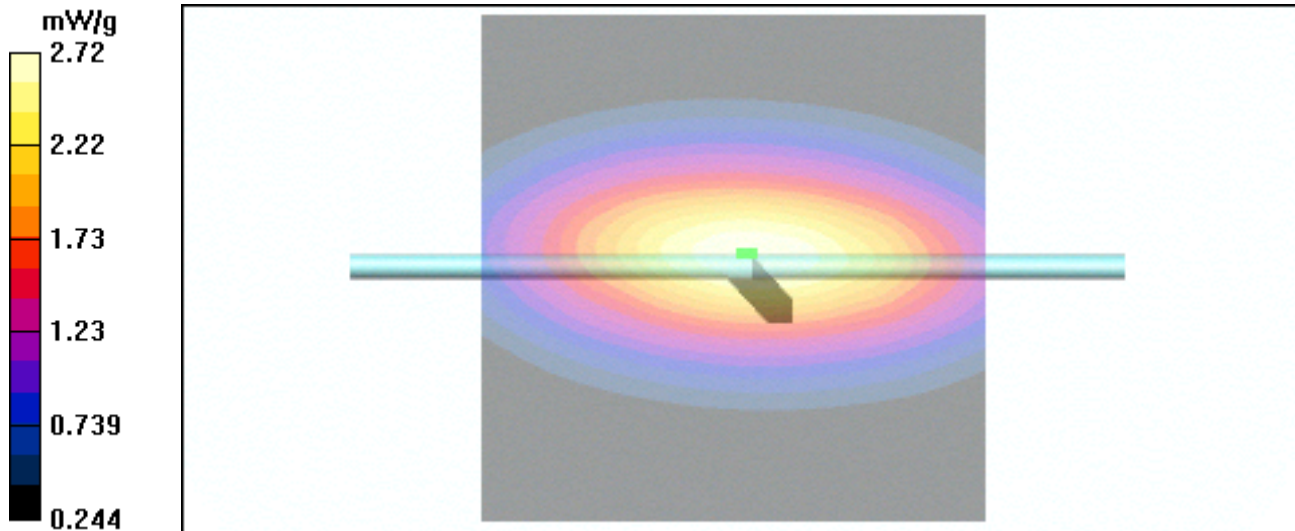
835MHz System Check/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 55.2 V/m; Power Drift = 0.228 dB

Peak SAR (extrapolated) = 3.75 W/kg

SAR(1 g) = 2.5 mW/g; SAR(10 g) = 1.63 mW/g

Maximum value of SAR (measured) = 2.72 mW/g



Date/Time: 03/09/2005 09:04:24
Test Laboratory: TCC Dallas

835MHz Head System Check

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.884 \text{ mho/m}$; $\epsilon_r = 41.4$; $\rho = 1000 \text{ kg/m}^3$
Liquid Temperature: 21.1

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.73, 6.73, 6.73); Calibrated: 09/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM1 Cellular Head; Phantom section: Flat Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 145

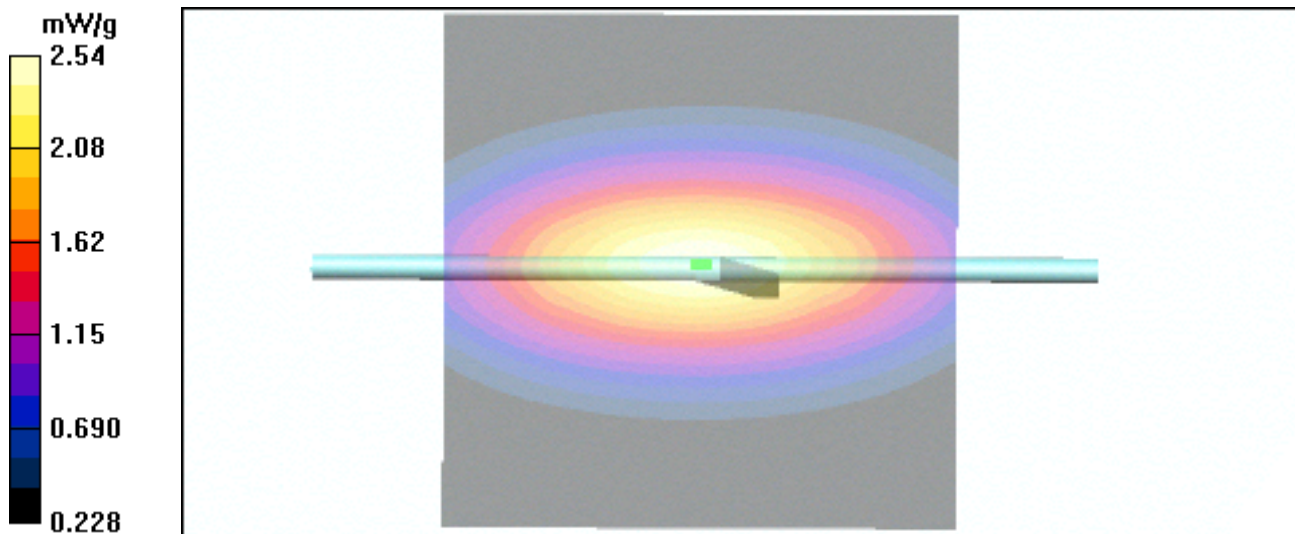
835MHz System Check/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 55.2 V/m; Power Drift = 0.046 dB

Peak SAR (extrapolated) = 3.48 W/kg

SAR(1 g) = 2.34 mW/g; SAR(10 g) = 1.53 mW/g

Maximum value of SAR (measured) = 2.54 mW/g



Date/Time: 03/08/2005 10:50:02
Test Laboratory: TCC Dallas

835MHz Body System Check

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.941 \text{ mho/m}$; $\epsilon_r = 53.5$; $\rho = 1000 \text{ kg/m}^3$
Liquid Temperature: 21.6

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.3, 6.3, 6.3); Calibrated: 09/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM2 Cellular Body; Phantom section: Flat Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 145

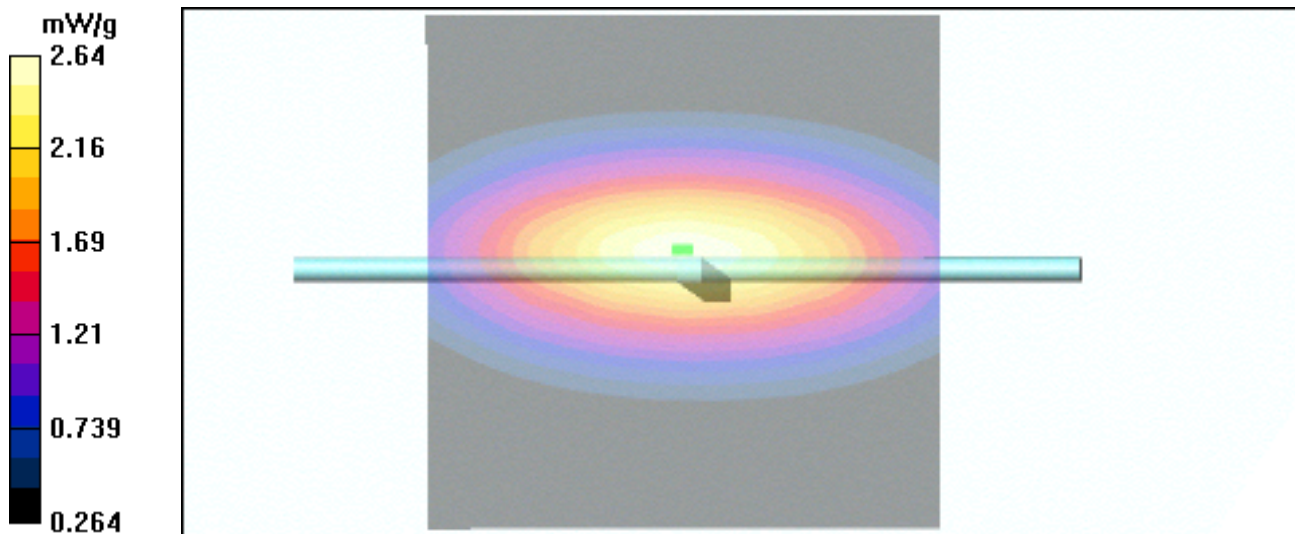
835MHz System Check/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 54.3 V/m; Power Drift = 0.051 dB

Peak SAR (extrapolated) = 3.52 W/kg

SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.62 mW/g

Maximum value of SAR (measured) = 2.64 mW/g



Date/Time: 3/10/2005 9:55:54 AM
Test Laboratory: TCC Dallas

835MHz Body System Check

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.936 \text{ mho/m}$; $\epsilon_r = 54.6$; $\rho = 1000 \text{ kg/m}^3$
Liquid Temperature: 21.5

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.3, 6.3, 6.3); Calibrated: 9/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM2 Cellular Body; Phantom section: Flat Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 146

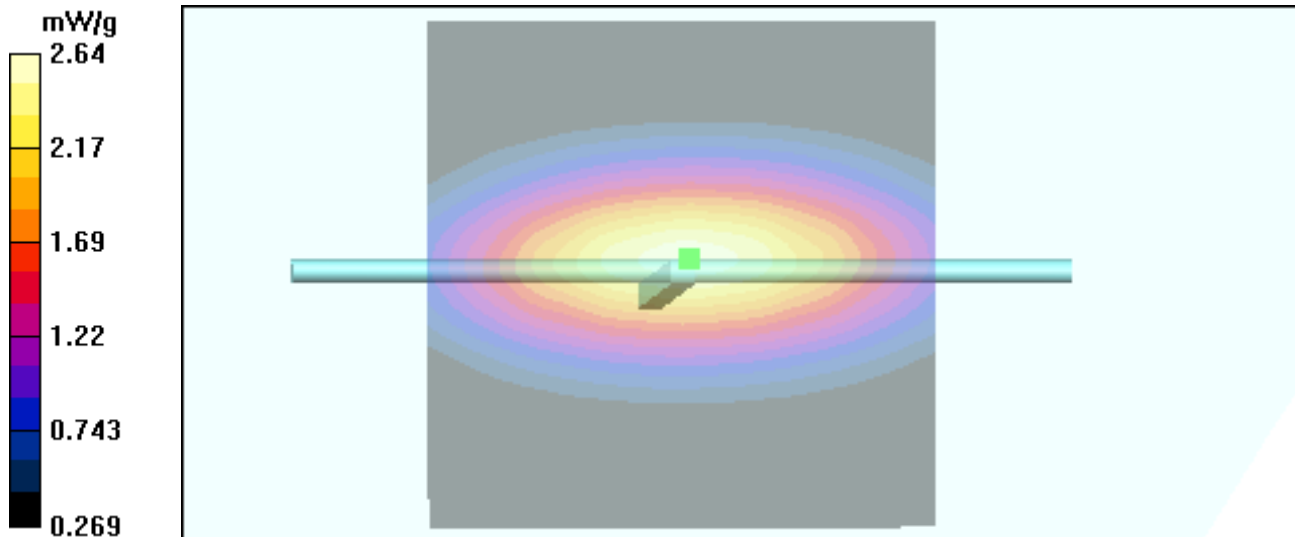
835MHz validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 54.9 V/m; Power Drift = 0.024 dB

Peak SAR (extrapolated) = 3.49 W/kg

SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.61 mW/g

Maximum value of SAR (measured) = 2.64 mW/g



APPENDIX B: MEASUREMENT SCANS

Date/Time: 03/09/2005 11:45:46
Test Laboratory: TCC Dallas

RH-77, CDMA800, Channel 1013, Left Cheek position with BL-5C battery and Innolux UI

Communication System: CDMA800; Frequency: 824.7 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 824.7 \text{ MHz}$; $\sigma = 0.874 \text{ mho/m}$; $\epsilon_r = 41.5$; $\rho = 1000 \text{ kg/m}^3$
Liquid Temperature: 21.1

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.73, 6.73, 6.73); Calibrated: 09/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM1 Cellular Head; Phantom section: Left Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 145

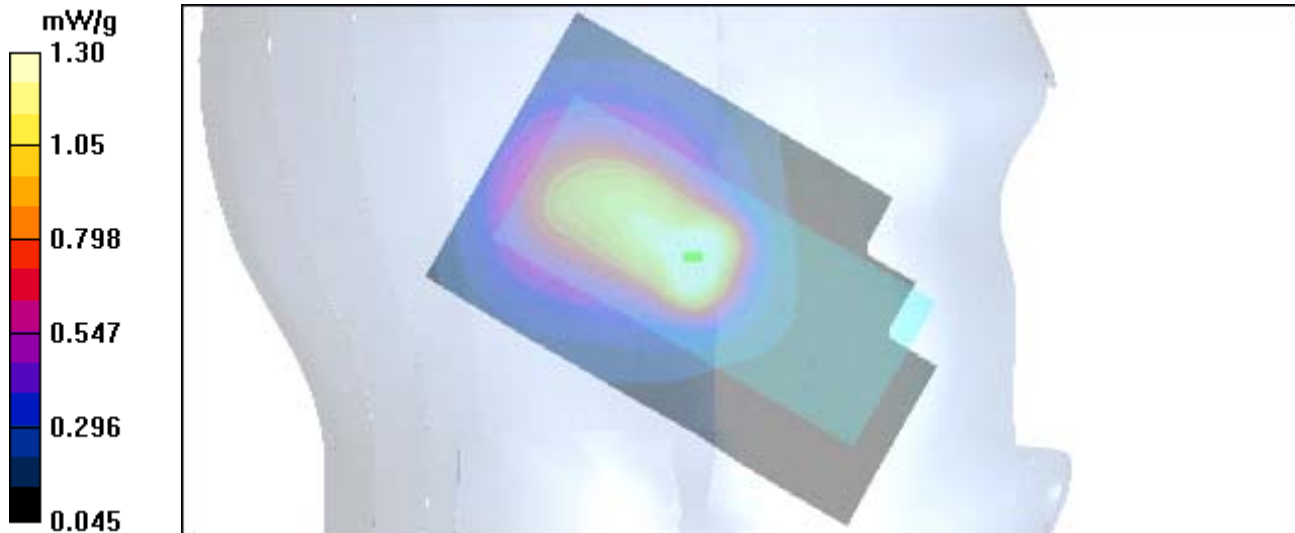
Left Cheek/Zoom Scan 1 (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 32.2 V/m; Power Drift = 0.015 dB

Peak SAR (extrapolated) = 3.13 W/kg

SAR(1 g) = 1.33 mW/g; SAR(10 g) = 0.745 mW/g

Maximum value of SAR (measured) = 1.30 mW/g



Date/Time: 03/09/2005 11:45:46

Test Laboratory: TCC Dallas

RH-77, CDMA800, Channel 1013, Left Cheek position with BL-5C battery and Innolux UI

Communication System: CDMA800; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 824.7$ MHz; $\sigma = 0.874$ mho/m; $\epsilon_r = 41.5$; $\rho = 1000$ kg/m³

Liquid Temperature: 21.1

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.73, 6.73, 6.73); Calibrated: 09/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM1 Cellular Head; Phantom section: Left Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 145

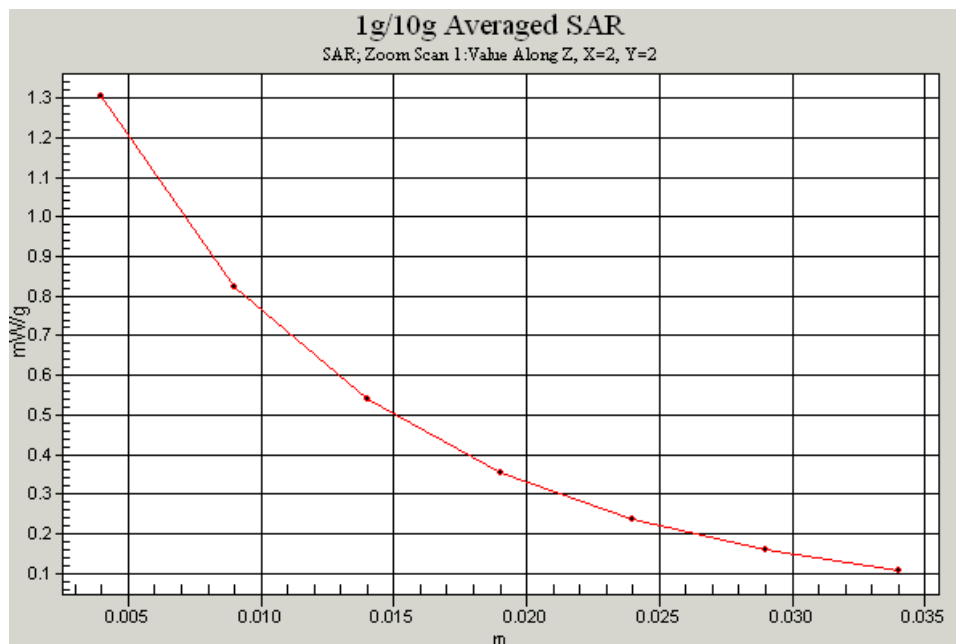
Left Cheek/Zoom Scan 1 (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 32.2 V/m; Power Drift = 0.015 dB

Peak SAR (extrapolated) = 3.13 W/kg

SAR(1 g) = 1.33 mW/g; SAR(10 g) = 0.745 mW/g

Maximum value of SAR (measured) = 1.30 mW/g



Date/Time: 3/9/2005 4:49:26 PM
Test Laboratory: TCC Dallas

RH-77, CDMA800, Channel 384, Left Tilt Position with BL-5C battery and Innolux UI

Communication System: CDMA800; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 836.52$ MHz; $\sigma = 0.886$ mho/m; $\epsilon_r = 41.3$; $\rho = 1000$ kg/m³
Liquid Temperature: 21.1

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.73, 6.73, 6.73); Calibrated: 9/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM1 Cellular Head; Phantom section: Left Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 146

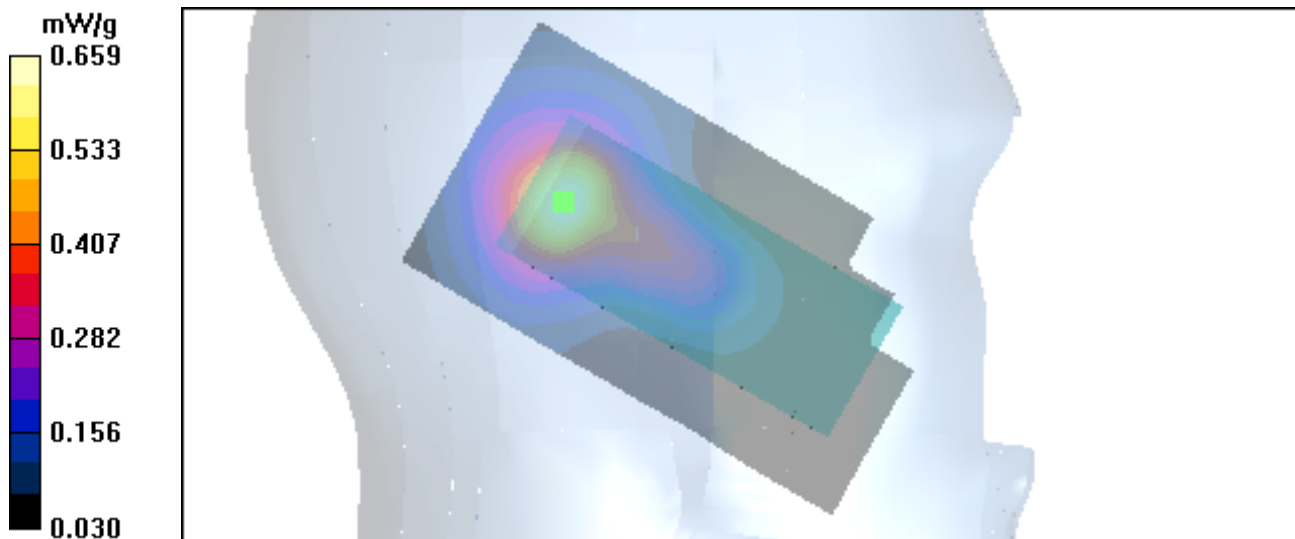
Left Tilt/Zoom Scan 1 (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.7 V/m; Power Drift = -0.084 dB

Peak SAR (extrapolated) = 1.21 W/kg

SAR(1 g) = 0.596 mW/g; SAR(10 g) = 0.329 mW/g

Maximum value of SAR (measured) = 0.659 mW/g



Date/Time: 3/9/2005 3:06:33 PM
Test Laboratory: TCC Dallas

RH-77, CDMA800, Channel 384, Right Cheek Position with BL-5C battery and Innolux UI

Communication System: CDMA800; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 836.52$ MHz; $\sigma = 0.886$ mho/m; $\epsilon_r = 41.3$; $\rho = 1000$ kg/m³
Liquid Temperature: 21.1

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.73, 6.73, 6.73); Calibrated: 9/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM1 Cellular Head; Phantom section: Right Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 146

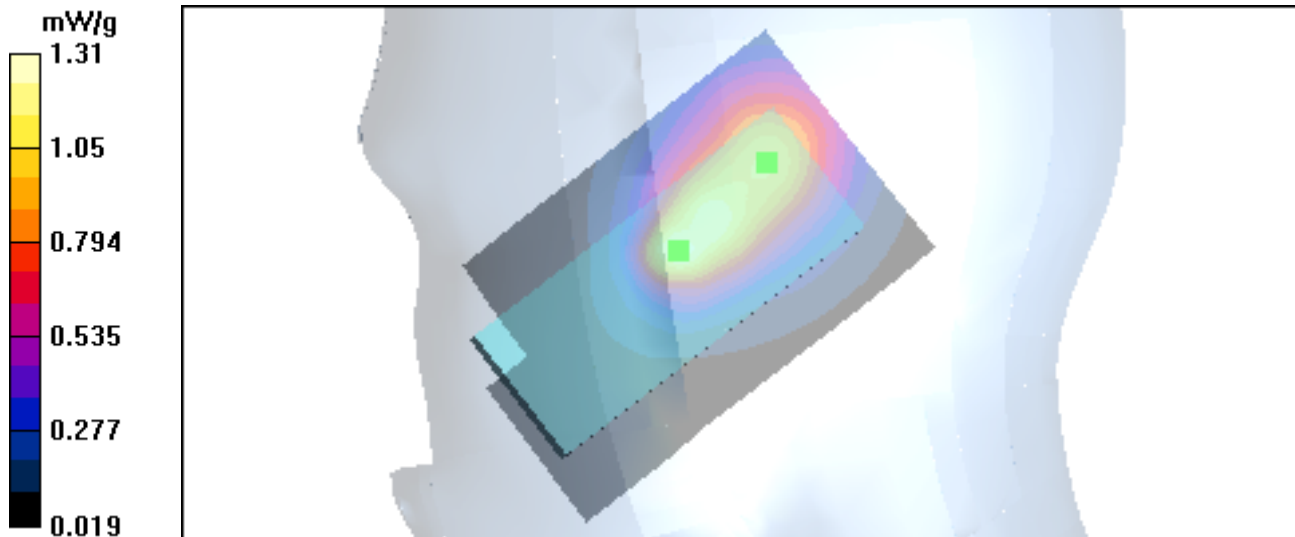
Right Cheek/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 30.7 V/m; Power Drift = 0.056 dB

Peak SAR (extrapolated) = 2.83 W/kg

SAR(1 g) = 1.26 mW/g; SAR(10 g) = 0.720 mW/g

Maximum value of SAR (measured) = 1.31 mW/g



Date/Time: 3/9/2005 4:24:11 PM
Test Laboratory: TCC Dallas

RH-77, CDMA800, Channel 384, Right Tilt Position with BL-5C battery and Innolux UI

Communication System: CDMA800; Frequency: 836.52 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 836.52$ MHz; $\sigma = 0.886$ mho/m; $\epsilon_r = 41.3$; $\rho = 1000$ kg/m³
Liquid Temperature: 21.1

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.73, 6.73, 6.73); Calibrated: 9/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM1 Cellular Head; Phantom section: Right Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 146

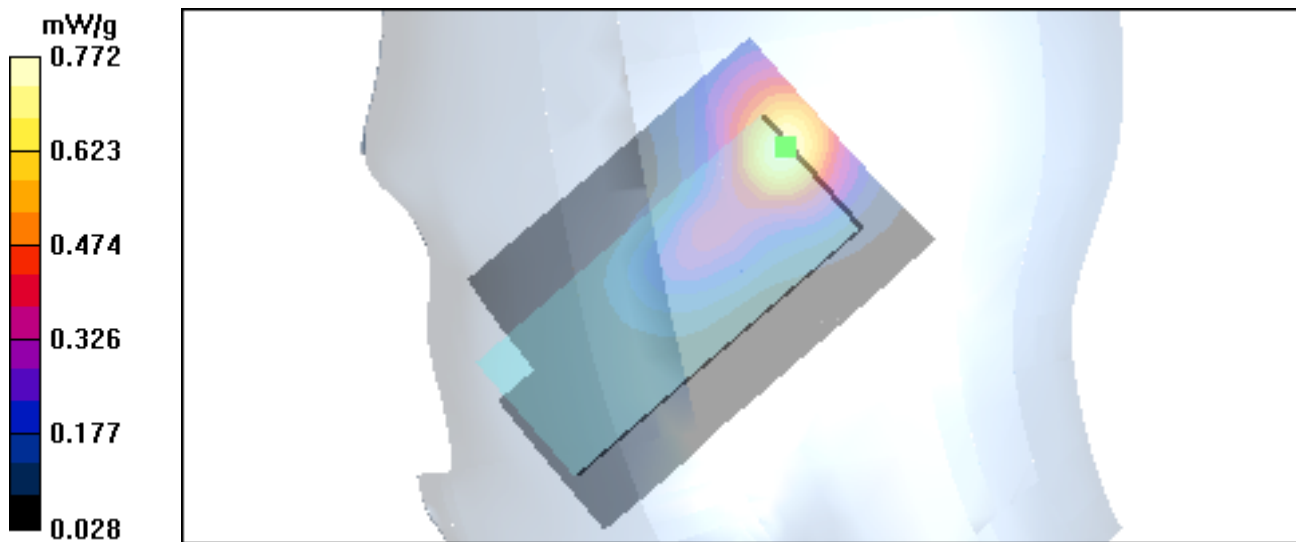
Right Tilt/Zoom Scan 1 (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.8 V/m; Power Drift = 0.090 dB

Peak SAR (extrapolated) = 1.51 W/kg

SAR(1 g) = 0.706 mW/g; SAR(10 g) = 0.376 mW/g

Maximum value of SAR (measured) = 0.772 mW/g



Date/Time: 3/10/2005 11:06:03 AM
Test Laboratory: TCC Dallas

RH-77, CDMA800, Channel 1013, Body position with 2.2cm spacer, BL-5C battery and Innolux UI

Communication System: CDMA800; Frequency: 824.7 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 824.7 \text{ MHz}$; $\sigma = 0.93 \text{ mho/m}$; $\epsilon_r = 54.7$; $\rho = 1000 \text{ kg/m}^3$
Liquid Temperature: 21.5

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.3, 6.3, 6.3); Calibrated: 9/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM2 Cellular Body; Phantom section: Flat Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 146

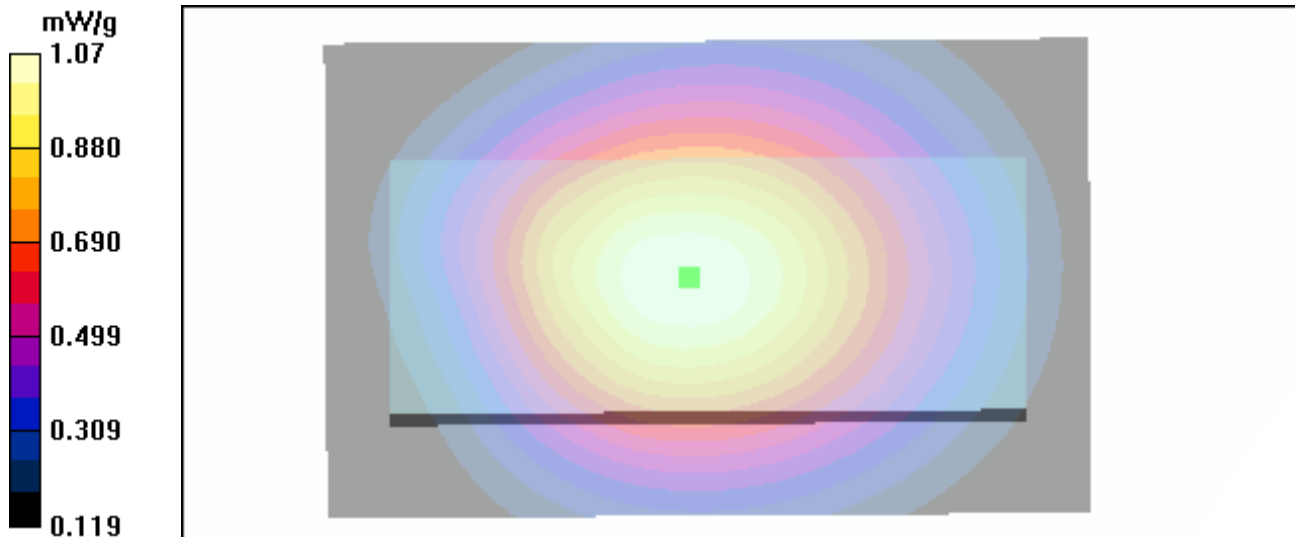
Body/Zoom Scan 1 (5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 20.6 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.53 W/kg

SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.711 mW/g

Maximum value of SAR (measured) = 1.07 mW/g



Date/Time: 3/10/2005 11:06:03 AM

Test Laboratory: TCC Dallas

RH-77, CDMA800, Channel 1013, Body position with 2.2cm spacer, BL-5C battery and Innolux UI

Communication System: CDMA800; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 824.7$ MHz; $\sigma = 0.93$ mho/m; $\epsilon_r = 54.7$; $\rho = 1000$ kg/m³

Liquid Temperature: 21.5

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.3, 6.3, 6.3); Calibrated: 9/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM2 Cellular Body; Phantom section: Flat Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 146

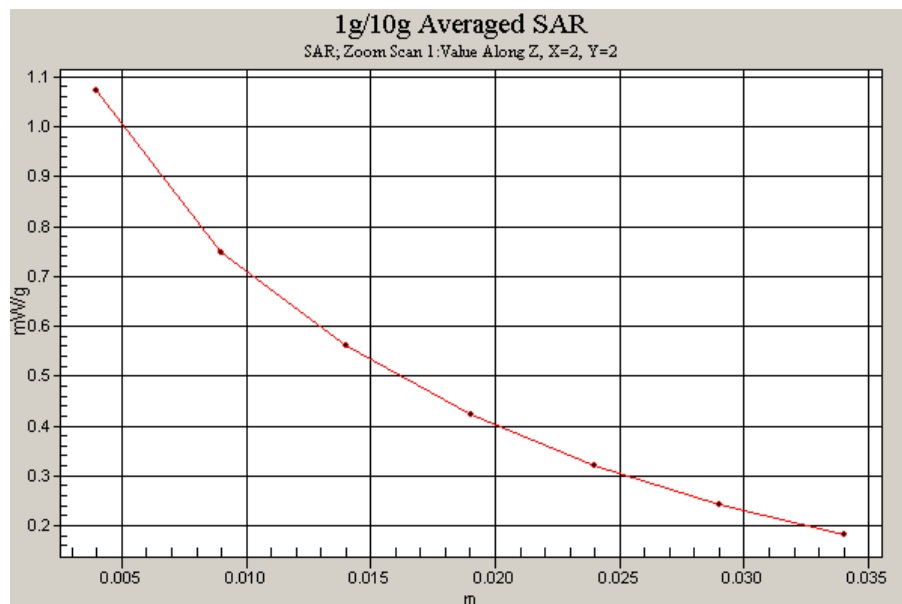
Body/Zoom Scan 1 (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 20.6 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 1.53 W/kg

SAR(1 g) = 1.02 mW/g; SAR(10 g) = 0.711 mW/g

Maximum value of SAR (measured) = 1.07 mW/g



Date/Time: 3/8/2005 4:21:12 PM
Test Laboratory: TCC Dallas

RH-77, CDMA800, Channel 1013, Body Position with 2.2cm spacer, BL-5C Battery, HS-2R Headset and Innolux UI

Communication System: CDMA800; Frequency: 824.7 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 824.7$ MHz; $\sigma = 0.93$ mho/m; $\epsilon_r = 53.5$; $\rho = 1000$ kg/m³
Liquid Temperature: 21.6

DASY4 Configuration:

- Probe: ET3DV6 - SN1504; ConvF(6.3, 6.3, 6.3); Calibrated: 9/22/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn377;
- Phantom: SAM2 Cellular Body; Phantom section: Flat Section
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 146

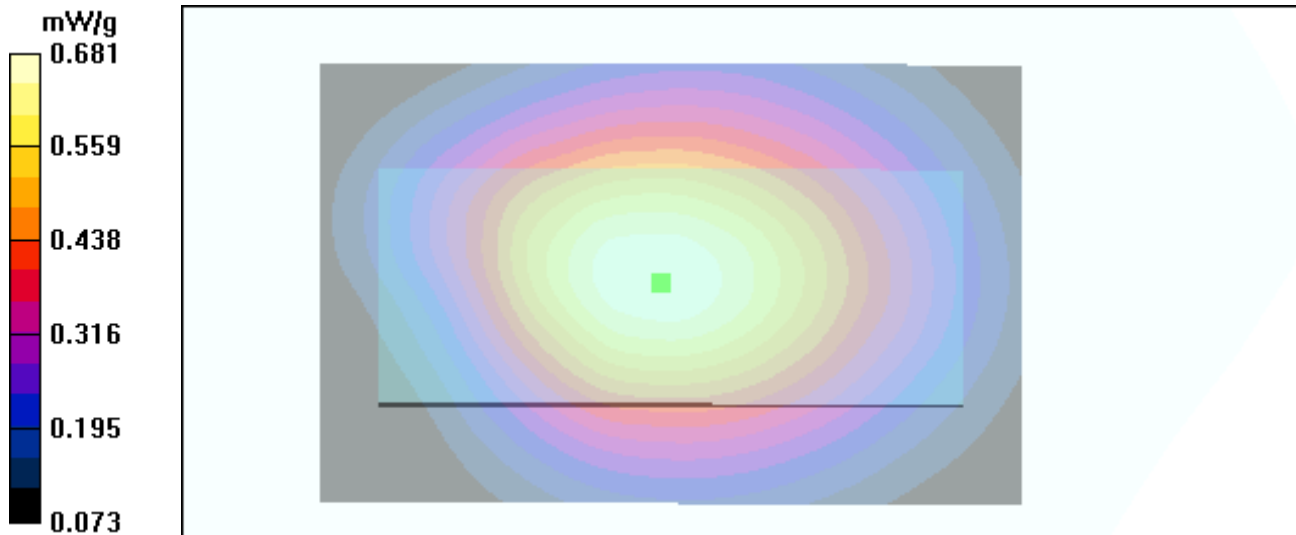
Body/Zoom Scan 1 (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 16.6 V/m; Power Drift = 0.054 dB

Peak SAR (extrapolated) = 0.947 W/kg

SAR(1 g) = 0.644 mW/g; SAR(10 g) = 0.452 mW/g

Maximum value of SAR (measured) = 0.681 mW/g



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



Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **Nokia TX**

Certificate No: **ET3-1504_Sep04**

CALIBRATION CERTIFICATE			
Object	ET3DV6 - SN:1504		
Calibration procedure(s)	QA CAL-01.v5 Calibration procedure for dosimetric E-field probes		
Calibration date:	September 22, 2004		
Condition of the calibrated item	In Tolerance		
This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate. All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%. Calibration Equipment used (M&TE critical for calibration)			
Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	5-May-04 (METAS, No. 251-00388)	May-05
Power sensor E4412A	MY41495277	5-May-04 (METAS, No. 251-00388)	May-05
Reference 3 dB Attenuator	SN: S5054 (3c)	3-Apr-03 (METAS, No. 251-00403)	Aug-05
Reference 20 dB Attenuator	SN: S5086 (20b)	3-May-04 (METAS, No. 251-00389)	May-05
Reference 30 dB Attenuator	SN: S5129 (30b)	3-Apr-03 (METAS, No. 251-00404)	Aug-05
Reference Probe ES3DV2	SN:3013	8-Jan-04 (SPEAG, No. ES3-3013_Jan04)	Jan-05
DAE4	SN: 617	26-May-04 (SPEAG, No. DAE4-617_May04)	May-05
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Dec-03)	In house check: Dec-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Nov 04
Calibrated by:	Name Nic Vetterli	Function Laboratory Technician	Signature
Approved by:	Name Kaja Polovic	Function Technical Manager	Signature
			Issued: September 24, 2004
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.			

DASY - Parameters of Probe: ET3DV6 SN:1504

Sensitivity in Free Space ^A			Diode Compression ^B	
NormX	2.18 ± 9.9%	μV/(V/m) ²	DCP X	91 mV
NormY	1.82 ± 9.9%	μV/(V/m) ²	DCP Y	91 mV
NormZ	1.72 ± 9.9%	μV/(V/m) ²	DCP Z	91 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL	900 MHz	Typical SAR gradient: 5 % per mm	
	Sensor Center to Phantom Surface Distance	3.7 mm	4.7 mm
	SAR _{be} [%] Without Correction Algorithm	9.3	4.8
	SAR _{be} [%] With Correction Algorithm	0.1	0.1
TSL	1900 MHz	Typical SAR gradient: 10 % per mm	
	Sensor Center to Phantom Surface Distance	3.7 mm	4.7 mm
	SAR _{be} [%] Without Correction Algorithm	13.9	9.3
	SAR _{be} [%] With Correction Algorithm	0.7	0.2

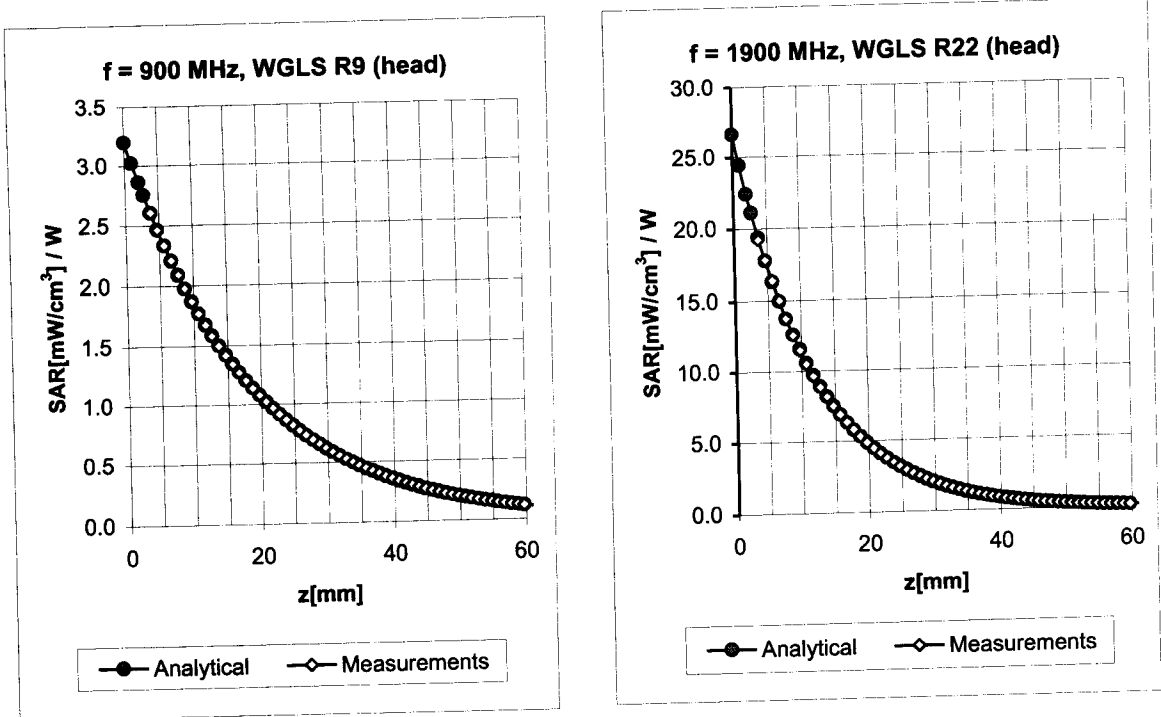
Sensor Offset

Probe Tip to Sensor Center	2.7 mm
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The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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

Conversion Factor Assessment



f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	± 50 / ± 100	Head	41.5 ± 5%	0.90 ± 5%	0.77	1.65	6.73 ± 11.0% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.73	1.73	6.42 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.72	2.06	5.30 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.64	2.30	5.13 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.74	2.24	4.54 ± 11.8% (k=2)
835	± 50 / ± 100	Body	55.2 ± 5%	0.97 ± 5%	0.60	1.94	6.30 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.59	2.00	6.03 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.63	2.55	4.67 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.62	2.65	4.56 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.80	1.95	4.32 ± 11.8% (k=2)

^c The validity of ± 100 MHz only applies for DASY 4.3 B17 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

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

Client **Nokia Inc., Texas**

CALIBRATION CERTIFICATE

Object(s) **D835V2 - SN 455**

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

Calibration date: **October 3, 2003**

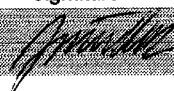
Condition of the calibrated item **In Tolerance (according to the specific calibration document)**

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 sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04
Power sensor HP 8481A	US37292783	30-Oct-02 (METAS, No. 252-0236)	Oct-03
Power meter EPM E442	GB37480704	30-Oct-02 (METAS, No. 252-0236)	Oct-03
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 (Agilent, No. 24BR1033101)	In house check: Oct 03

	Name	Function	Signature
Calibrated by:	Judith Mueller	Technician	

	Name	Function
Approved by:	Katja Pokovic	Laboratory Director

Date issued: October 10, 2003

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

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN455

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

Medium: HSL 835 MHz ($\sigma = 0.9$ mho/m, $\epsilon_r = 43$, $\rho = 1000$ kg/m³)

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(6.7, 6.7, 6.7); 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, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.8 Build 60

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

Reference Value = 55.4 V/m

Power Drift = -0.007 dB

Maximum value of SAR = 2.56 mW/g

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

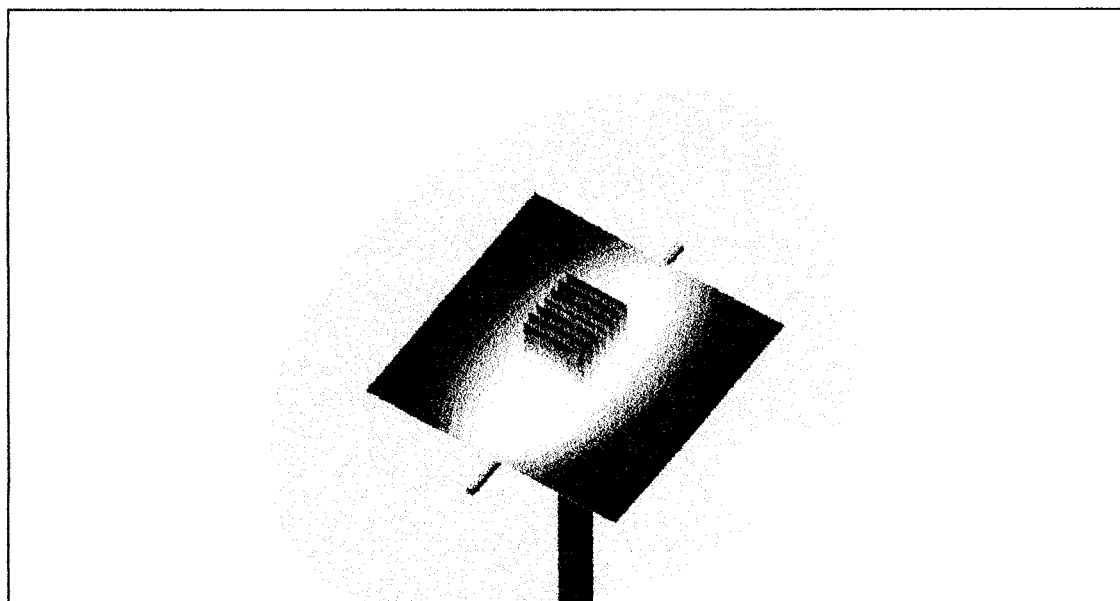
Peak SAR (extrapolated) = 3.52 W/kg

SAR(1 g) = 2.37 mW/g; SAR(10 g) = 1.56 mW/g

Reference Value = 55.4 V/m

Power Drift = -0.007 dB

Maximum value of SAR = 2.56 mW/g



0 dB = 2.56mW/g

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN455

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

Medium: Muscle 835 MHz ($\sigma = 0.98$ mho/m, $\epsilon_r = 54.98$, $\rho = 1000$ kg/m³)

Phantom section: Flat Section

Measurement Standard: DAS4 (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: DAS4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.8 Build 60

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

Reference Value = 54.8 V/m

Power Drift = -0.006 dB

Maximum value of SAR = 2.66 mW/g

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

Peak SAR (extrapolated) = 3.6 W/kg

SAR(1 g) = 2.48 mW/g; SAR(10 g) = 1.64 mW/g

Reference Value = 54.8 V/m

Power Drift = -0.006 dB

Maximum value of SAR = 2.68 mW/g

