



SAR Compliance Test Report

Test report no.: WR751.001
Template version: 4
Testing laboratory: TCC San Diego
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Client:

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Measurements made by:

Tested device:

RH-57

QMNRH-57

IC: -

Supplement reports:

FCC ID:

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

IFFF 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 San Diego.

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:

2005-03-17

For the contents:

Nerina Walton Lab Manager Julian Kim Senior Certification Engineer

SAR Report WR751.001 Applicant: Nokia Corporation Type: RH-57





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SAR Report	Type: RH-57

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	2005-03-09 to 2005-03-15
SN, HW and SW numbers of	SN:044/06010734
tested device	HW: 6003
	SW: V 0190V0100.nep
Batteries used in testing	BL-5C
Headsets used in testing	HS-5 and 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
CDMA 800	1013 / 824.70	24.9 dBm	Left Cheek	1.6 W/kg	1.48 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
CDMA 800	1013 / 824.70	24.9 dBm	1.5 cm	1.6 W/kg	0.96 W/kg	PASSED





1.2.3	Maximum	Drift
-------	---------	-------

Maximum drift during measurements	U 3E 4B
i Maximum unit uurinu measurements	0.25 dB

1.2.4 Measurement Uncertainty

Extended Uncertainty (k=2) 95%	± 29.8 %
Extended unicertainty (K-Z) 95%	± 29.0 %





2. DESCRIPTION OF THE DEVICE UNDER TEST

Device category	Portable
Exposure environment	General Public

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 22.9
Ambient humidity (RH %):	34 to 59

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, 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
DAE V1	604	12 months	2005-10
E-field Probe ET3DV6	1739	12 months	2005-08
Dipole Validation Kit, D835V2	478	24 months	2006-10

Additional test equipment used in testing:





2005-05

Calibration Calibration **Test Equipment** Model Serial Number interval expiry Signal Generator Agilent E4436B US 39260114 24 months 2006-05 **Amplifier** Milmega 1004832 AS0822-8L **Power Meter** Agilent E4417A GB41290918 12 months 2005-10 **Power Sensor** Agilent E9327A US 40440896 12 months 2005-03 **Call Tester** Agilent US 40440119 12 months 2006-06 8960/E5515C

4.1.1 Isotropic E-field Probe SN1739

Vector Network Analyzer

Dielectric Probe Kit

Optical Surface

Construction Symmetrical design with triangular core

Built-in optical fiber for surface detection system

Built-in shielding against static charges

Agilent 8753ES

Agilent

85070D

PEEK enclosure material (resistant to organic solvents, e.g., butyl

MY40002861

US 01440165

12 months

diglycol)

Calibration Calibration certificate in Appendix C

10 MHz to 3 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 3 GHz) Frequency

± 0.2 mm repeatability in air and clear liquids over diffuse Detection reflecting surfaces

Directivity ± 0.2 dB in HSL (rotation around probe axis)

± 0.4 dB in HSL (rotation normal to probe axis)

Dynamic Range $5 \mu W/g$ to > 100 mW/g; Linearity: \pm 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 twinheaded "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 simulating liquids are given in IEEE 1528 - 2003 and FCC Supplement C to 0ET 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	39.74	55.97
HEC	0.25	1.21
Sugar	58.31	41.76
Preservative	0.15	0.27
Salt	1.55	0.79





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

		SAR [W/kg],	Dielectric Parameters		Temp
f [MHz]	Description	1 g	εr	σ [S/m]	[°C]
	Reference result	2.34	41.8	0.89	N/A
	$\pm10\%$ window	2.11 - 2.57			
835	2005-03-09	2.42	41.4	0.89	22.9
	2005-03-10	2.43	42.3	0.90	22.4

System checking, body tissue simulant

	SAR [W/kg],	Dielectric Parameters		Temp
Description	1 g	8r	σ [S/m]	[°C]
Reference result	2.44	54.3	1.00	N/A
$\pm10\%$ window	2.20 – 2.68			
2005-03-14	2.45	54.1	0.95	22.8
2005-03-15	2.50	53.6	0.95	22.0
	Reference result ± 10% window 2005-03-14	Description 1g Reference result 2.44 ± 10% window 2.20 - 2.68 2005-03-14 2.45	Description 1g εr Reference result 2.44 54.3 ± 10% window 2.20 – 2.68 2005-03-14 2.45 54.1	Description 1g εr σ [S/m] Reference result 2.44 54.3 1.00 ± 10% window 2.20 – 2.68 54.1 0.95 2005-03-14 2.45 54.1 0.95

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





4.3.3 Tissue Simulants used in the Measurements

Head tissue simulant measurements

		Dielectric F	Temp	
f [MHz]	Description	8r	σ [S/m]	[°C]
	Recommended value	41.5	0.90	N/A
	\pm 5% window	39.4 – 43.6	0.86 - 0.95	
836.5	2005-03-09	41.4	0.89	22.9
	2005-03-10	42.2	0.90	22.4

Body tissue simulant measurements

		Dielectric I	Temp				
f [MHz]	Description	εr	σ [S/m]	[°C]			
	Recommended value	55.2	0.97	N/A			
	± 5% window	52.4 – 58.0	0.92 - 1.02				
836.5	2005-03-14	54.0	0.95	22.8			
	2005-03-15	53.6	0.95	22.0			





5. DESCRIPTION OF THE TEST PROCEDURE

5.1 Device Holder

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



Device holder supplied by SPEAG

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



Nokia spacer

5.2 Test Positions

5.2.1 Against Phantom Head

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

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







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 gave higher results.

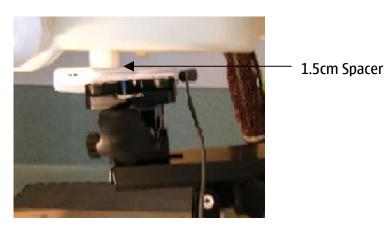


Photo of the device positioned for Body SAR measurement. The spacer was removed for the tests.

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

Table 6.1 – Measurement uncertainty evaluation							
Uncertainty Component	Section in IEEE 1528	Tol. (%)	Prob Dist	Div	Ci	C _i .U _i (%)	Vi
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	8
Response Time	E2.7	±0.8	R	√3	1	±0.5	8
Integration Time	E2.8	±2.6	R	√3	1	±1.5	∞
RF Ambient Conditions - Noise	E6.1	±3.0	R	√3	1	±1.7	8
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	8
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	∞
Conductivity Target - tolerance	E3.2	±5.0	R	√3	0.64	±1.8	00
Conductivity - measurement uncertainty	E3.3	±5.5	N	1	0.64	±3.5	5
		±5.0	R	√3	0.6	±1.7	∞
Permittivity - measurement uncertainty E3.3 ±2.9			N	1	0.6	±1.7	5
Combined Standard Uncertainty						±14.9	206
Coverage Factor for 95%							
Expanded Standard Uncertainty						±29.8	





7. RESULTS

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

800MHz CDMA Head SAR Results

		SAR, averaged over 1g (W/kg)				
Posi	ition	Ch 1013	Ch 384	Ch 777		
		824.70 MHz	836.52 MHz	848.31 MHz		
Power level		24.9 dBm	25.1 dBm	24.0 dBm		
Left	Cheek	1.48	1.07	1.25		
	Tilt	0.62	0.45	0.58		
Right	Cheek	1.44	1.04	1.02		
	Tilt	0.67	0.52	0.66		

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

800MHz CDMA Body SAR Results

Goot the Collin Body Sak Results						
	SAR, averaged over 1g (W/kg)					
Body-worn location setup	Ch 1013	Ch 384	Ch 777			
	824.70 MHz	836.52 MHz	848.31 MHz			
Power level	24.9 dBm	25.1 dBm	24.0 dBm			
Headset HS-5	0.86	0.83	0.78			
Headset HS-2R	0.96	0.90	0.60			

Plots of the Measurement scans are given in Appendix B.





APPENDIX A: SYSTEM CHECKING SCANS





Date: 2005-03-09; Test Laboratory: TCC San Diego

Dipole 835 MHz; Serial No. 478; Head Validation

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

Medium parameters used: f = 835 MHz; σ = 0.892 mho/m; ϵ_{r} = 41.4; ρ = 1000 kg/m³; Temperature (liq.) = 22.9 °C

Phantom section: Flat Section; Advanced Extrapolation

DASY4 Configuration:

- Probe: ET3DV6 - SN1739; ConvF(6.79, 6.79, 6.79); Calibrated: 08/26/2004

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

Electronics: DAE4 Sn604; Calibrated: 10/28/2004
 Phantom: SAM1; Type: SAM; Serial: TP-1035

- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

835MHz validation/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

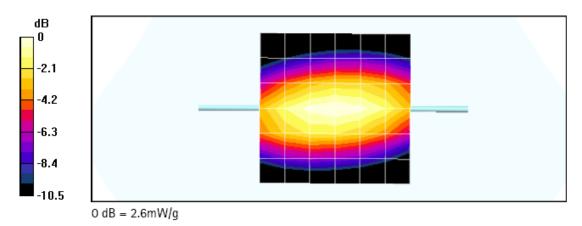
Maximum value of SAR (measured) = 2.63 mW/g

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

Reference Value = 55.6 V/m; Power Drift = -0.007 dB

Peak SAR (extrapolated) = 3.65 W/kg

SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.58 mW/gMaximum value of SAR (measured) = 2.6 mW/g







Date: 2005-03-10; Test Laboratory: TCC San Diego

Dipole 835 MHz; Serial No. 478; Head Validation

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

Medium parameters used: f = 835 MHz; σ = 0.901 mho/m; ϵ_r = 42.3; ρ = 1000 kg/m³; Temperature (liq.) = 22.4 °C

Phantom section: Flat Section; Advanced Extrapolation

DASY4 Configuration:

- Probe: ET3DV6 - SN1739; ConvF(6.79, 6.79, 6.79); Calibrated: 08/26/2004

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE4 Sn604; Calibrated: 10/28/2004

- Phantom: SAM1; Type: SAM; Serial: TP-1035

- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

835MHz validation/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

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

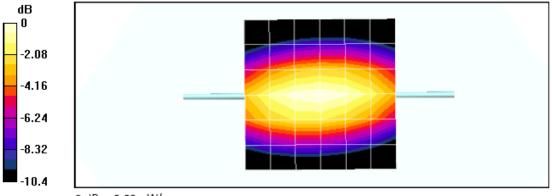
835MHz validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.5 V/m; Power Drift = -0.0 dB

Peak SAR (extrapolated) = 3.68 W/kg

SAR(1 g) = 2.43 mW/g; SAR(10 g) = 1.58 mW/g

Maximum value of SAR (measured) = 2.63 mW/g



0 dB = 2.63 mW/g





Date: 2005-03-14; Test Laboratory: TCC San Diego

Dipole 835 MHz; Serial No. 478; Body Validation

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

Medium parameters used: f = 835 MHz; $\sigma = 0.953$ mho/m; $\epsilon_r = 54.1$; $\rho = 1000$ kg/m³; Temperature (liq.) = 22.8 °C

Phantom section: Flat Section; Advanced Extrapolation

DASY4 Configuration:

- Probe: ET3DV6 - SN1739; ConvF(6.47, 6.47, 6.47); Calibrated: 08/26/2004

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)

- Electronics: DAE4 Sn604; Calibrated: 10/28/2004

- Phantom: SAM2; Type: SAM; Serial: TP-1279

- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

835MHz validation/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 2.68 mW/g

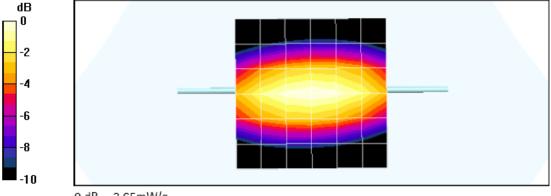
835MHz validation/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 54.8 V/m; Power Drift = 0.002 dB

Peak SAR (extrapolated) = 3.58 W/kg

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

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



0 dB = 2.65 mW/g





Date: 2005-03-15; Test Laboratory: TCC San Diego

Dipole 835 MHz; Serial No. 478; Body Validation

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

Medium parameters used: f = 835 MHz; σ = 0.953 mho/m; ϵ_r = 53.6; ρ = 1000 kg/m³; Temperature (liq.) = 22.0 °C

Phantom section: Flat Section; Advanced Extrapolation

DASY4 Configuration:

Probe: ET3DV6 - SN1739; ConvF(6.47, 6.47, 6.47); Calibrated: 08/26/2004

- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn604; Calibrated: 10/28/2004
- Phantom: SAM2; Type: SAM; Serial: TP-1279
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

835MHz validation/Area Scan (7x7x1): Measurement grid: dx=15mm, dy=15mm

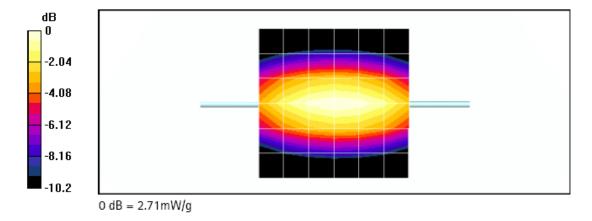
Maximum value of SAR (measured) = 2.72 mW/g

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

Reference Value = 55.2 V/m; Power Drift = -0.0 dB

Peak SAR (extrapolated) = 3.67 W/kg

SAR(1 g) = 2.5 mW/g; SAR(10 g) = 1.65 mW/g Maximum value of SAR (measured) = 2.71 mW/g









APPENDIX B: MEASUREMENT SCANS





Date: 2005-03-09; Test Laboratory: TCC San Diego

Type: RH-57; HWID: 6003; Serial No. 044/06010734

Communication System: CDMA800; Channel 1013; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 824.7 MHz; $\sigma = 0.882 \text{ mho/m}$; $\epsilon_r = 41.5$; $\rho = 1000 \text{ kg/m}^3$;

Temperature (liq.) = 22.9°C

Phantom section: Left Section; Worst Case Extrapolation

DASY4 Configuration:

- Probe: ET3DV6 SN1739; ConvF(6.79, 6.79, 6.79); Calibrated: 08/26/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn604; Calibrated: 10/28/2004
- Phantom: SAM1; Type: SAM; Serial: TP-1035
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

left cheek/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm

Reference Value = 34.8 V/m; Power Drift = -0.0 dB Maximum value of SAR (interpolated) = 1.78 mW/g

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

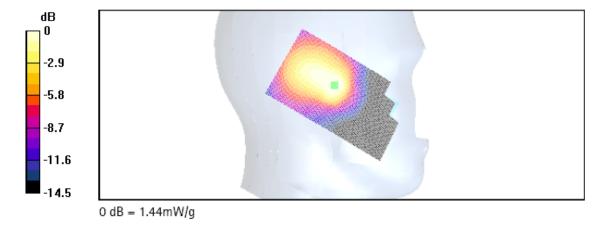
Reference Value = 34.8 V/m; Power Drift = -0.0 dB

Maximum value of SAR (measured) = 1.44 mW/g

Peak SAR (extrapolated) = 3.4 W/kg

SAR(1 g) = 1.48 mW/g; SAR(10 g) = 0.844 mW/g

Info: Interpolated medium parameters used for SAR evaluation!







Date: 2005-03-09; Test Laboratory: TCC San Diego

Type: RH-57; HWID: 6003; Serial No: 044/06010734

Communication System: CDMA800; Channel 1013; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 824.7 MHz; $\sigma = 0.882 \text{ mho/m}$; $\epsilon_z = 41.5$; $\rho = 1000 \text{ kg/m}^3$;

Temperature (liq.) = 22.9 °C

Phantom section: Left Section; Worst Case Extrapolation

DASY4 Configuration:

- Probe: ET3DV6 SN1739; ConvF(6.79, 6.79, 6.79); Calibrated: 08/26/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn604; Calibrated: 10/28/2004
- Phantom: SAM1; Type: SAM; Serial: TP-1035
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

left cheek/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm

Reference Value = 34.8 V/m; Power Drift = -0.0 dB Maximum value of SAR (interpolated) = 1.78 mW/g

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

Reference Value = 34.8 V/m; Power Drift = -0.0 dB

Maximum value of SAR (measured) = 1.44 mW/g

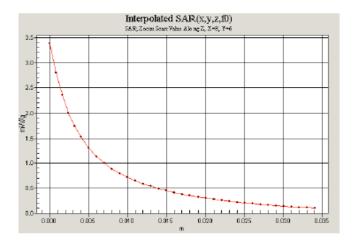
Peak SAR (extrapolated) = 3.4 W/kg

SAR(1 g) = 1.48 mW/g; SAR(10 g) = 0.844 mW/g

left cheek/Zoom Scan (21x21x36)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 34.8 V/m; Power Drift = -0.0 dB Maximum value of SAR (interpolated) = 3.4 mW/g

Info: Interpolated medium parameters used for SAR evaluation!



SAR Report WR751.001 Applicant: Nokia Corporation Type: RH-57





Date: 2005-03-09; Test Laboratory: TCC San Diego

Type: RH-57; HWID: 6003; Serial No. 044/06010734

Communication System: CDMA800; Channel: 1013; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 824.7 MHz; $\sigma = 0.882 \text{ mho/m}$; $\epsilon_r = 41.5$; $\rho = 1000 \text{ kg/m}^3$;

Temperature (liq.) = 22.9°C

Phantom section: Left Section; Worst Case Extrapolation

DASY4 Configuration:

- Probe: ET3DV6 SN1739; ConvF(6.79, 6.79, 6.79); Calibrated: 08/26/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn604; Calibrated: 10/28/2004
- Phantom: SAM1; Type: SAM; Serial: T-1035
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

left tilt/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm

Reference Value = 26.5 V/m; Power Drift = 0.1 dB Maximum value of SAR (interpolated) = 0.633 mW/g

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

Reference Value = 26.5 V/m; Power Drift = 0.1 dB

Maximum value of SAR (measured) = 0.661 mW/g

Peak SAR (extrapolated) = 1.2 W/kg

SAR(1 q) = 0.615 mW/q; SAR(10 q) = 0.352 mW/q

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

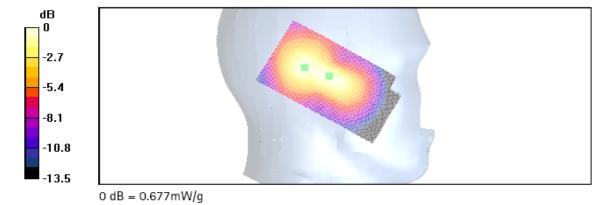
Reference Value = 26.5 V/m; Power Drift = 0.1 dB

Maximum value of SAR (measured) = 0.677 mW/g

Peak SAR (extrapolated) = 1.24 W/kg

SAR(1 g) = 0.618 mW/g; SAR(10 g) = 0.358 mW/g

Info: Interpolated medium parameters used for SAR evaluation!



SAR Report WR751.001

Applicant: Nokia Corporation

Type: RH-57





Date: 2005-03-10; Test Laboratory: TCC San Diego

Type: RH-57; HWID: 6003; Serial No. 044/06010734

Communication System: CDMA800; Channel: 1013; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 824.7 MHz; $\sigma = 0.891 \text{ mho/m}$; $\epsilon_r = 42.4$; $\rho = 1000 \text{ kg/m}^3$;

Temperature (liq.) = 22.4°C

Phantom section: Right Section; Worst Case Extrapolation

DASY4 Configuration:

- Probe: ET3DV6 SN1739; ConvF(6.79, 6.79, 6.79); Calibrated: 08/26/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn604; Calibrated: 10/28/2004
- Phantom: SAM1; Type: SAM; Serial: T-1035
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Right cheek/Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Reference Value = 33.2 V/m; Power Drift = 0.006 dB Maximum value of SAR (interpolated) = 1.6 mW/g

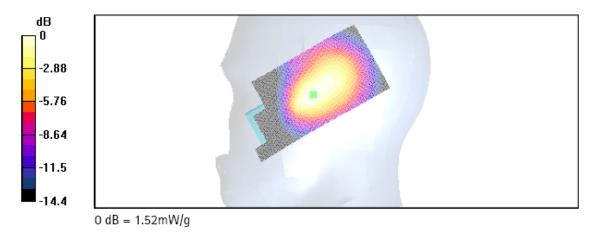
Right cheek/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 33.2 V/m; Power Drift = 0.006 dB Maximum value of SAR (measured) = 1.52 mW/g

Peak SAR (extrapolated) = 3.24 W/kg

SAR(1 g) = 1.44 mW/g; SAR(10 g) = 0.852 mW/g

Info: Interpolated medium parameters used for SAR evaluation!



SAR Report WR751.001 Applicant: Nokia Corporation





Date: 2005-03-10; Test Laboratory: TCC San Diego

Type: RH-57; HWID: 6003; Serial No. 044/06010734

Communication System: CDMA800; Channel: 1013; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 824.7 MHz; $\sigma = 0.891 \text{ mho/m}$; $\epsilon_r = 42.4$; $\rho = 1000 \text{ kg/m}^3$;

Temperature (liq.) = 22.4°C

Phantom section: Right Section; Worst Case Extrapolation

DASY4 Configuration:

- Probe: ET3DV6 SN1739; ConvF(6.79, 6.79, 6.79); Calibrated: 08/26/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn604; Calibrated: 10/28/2004
- Phantom: SAM1; Type: SAM; Serial: T-1035
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Right tilt/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm

Reference Value = 25.1 V/m; Power Drift = -0.1 dB Maximum value of SAR (interpolated) = 0.729 mW/g

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

Reference Value = 25.1 V/m; Power Drift = -0.1 dB

Maximum value of SAR (measured) = 0.730 mW/g

Peak SAR (extraplated) = 1.37 W/kg

SAR(1 q) = 0.669 mW/q; SAR(10 q) = 0.372 mW/q

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

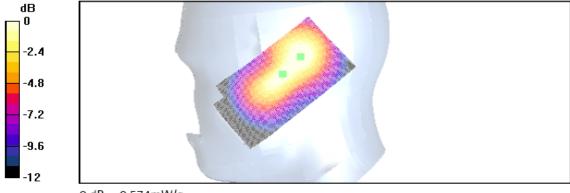
Reference Value = 25.1 V/m; Power Drift = -0.1 dB

Maximum value of SAR (measured) = 0.574 mW/g

Peak SAR (extrapolated) = 0.991 W/kg

SAR(1 g) = 0.516 mW/g; SAR(10 g) = 0.312 mW/g

Info: Interpolated medium parameters used for SAR evaluation!



0 dB = 0.574 mW/g

SAR Report WR751.001

Applicant: Nokia Corporation

Type: RH-57





Date: 2005-03-14; Test Laboratory: TCC San Diego

Type: RH-57; HWID: 6003; Serial No: 044/06010734; with headset HS-2R

Communication System: CDMA800; Channel 1013; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 824.7 MHz; $\sigma = 0.942 \text{ mho/m}$; $\epsilon_r = 54.1$; $\rho = 1000 \text{ kg/m}^3$;

Temperature (liq.) = 22.8°C

Phantom section: Flat Section; Worst Case Extrapolation

DASY4 Configuration:

- Probe: ET3DV6 SN1739; ConvF(6.47, 6.47, 6.47); Calibrated: 08/26/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn604; Calibrated: 10/28/2004
- Phantom: SAM2; Type: SAM; Serial: TP-1279
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Body/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Reference Value = 18.3 V/m; Power Drift = -0.1 dB Maximum value of SAR (interpolated) = 1.03 mW/g

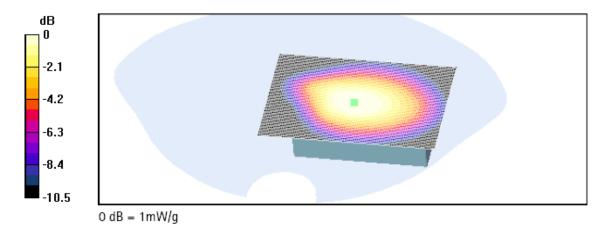
Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 18.3 V/m; Power Drift = -0.1 dB Maximum value of SAR (measured) = 1 mW/g

Peak SAR (extrapolated) = 1.44 W/kg

SAR(1 g) = 0.956 mW/g; SAR(10 g) = 0.660 mW/g

Info: Interpolated medium parameters used for SAR evaluation!



SAR Report WR751.001 Applicant: Nokia Corporation





Date: 2005-03-14; Test Laboratory: TCC San Diego

Type: RH-57; HWID: 6003; Serial No: 044/06010734; with headset HS-2R

Communication System: CDMA800; Channel 1013; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 824.7 MHz; $\sigma = 0.942 \text{ mho/m}$; $\epsilon_z = 54.1$; $\rho = 1000 \text{ kg/m}^3$;

Temperature (liq.) = 22.8°C

Phantom section: Flat Section; Worst Case Extrapolation

DASY4 Configuration:

- Probe: ET3DV6 SN1739; ConvF(6.47, 6.47, 6.47); Calibrated: 08/26/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn604; Calibrated: 10/28/2004
- Phantom: SAM2; Type: SAM; Serial: TP-1279
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Body/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Reference Value = 18.3 V/m; Power Drift = -0.1 dB Maximum value of SAR (interpolated) = 1.03 mW/g

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

Reference Value = 18.3 V/m; Power Drift = -0.1 dB Maximum value of SAR (measured) = 1 mW/g

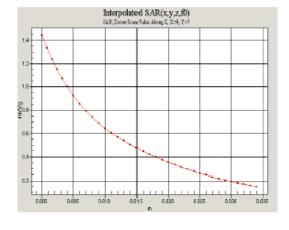
Peak SAR (extrapolated) = 1.44 W/kg

SAR(1 g) = 0.956 mW/g; SAR(10 g) = 0.660 mW/g

Body/Zoom Scan (21x21x36)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 18.3 V/m; Power Drift = -0.1 dB Maximum value of SAR (interpolated) = 1.44 mW/g

Info: Interpolated medium parameters used for SAR evaluation!



SAR Report WR751.001 Applicant: Nokia Corporation Type: RH-57





Date: 2005-03-15; Test Laboratory: TCC San Diego

Type: RH-57; HWID: 6003; Serial No: 044/06010734; with headset HS-5

Communication System: CDMA800; Channel: 1013; Frequency: 824.7 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 824.7 MHz; $\sigma = 0.942 \text{ mho/m}$; $\epsilon_r = 53.7$; $\rho = 1000 \text{ kg/m}^3$;

Temperature (lig.) = 22.0°C

Phantom section: Flat Section; Worst Case Extrapolation

DASY4 Configuration:

- Probe: ET3DV6 SN1739; ConvF(6.47, 6.47, 6.47); Calibrated: 08/26/2004
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE4 Sn604; Calibrated: 10/28/2004
- Phantom: SAM2; Type: SAM; Serial: TP-1279
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Body/Area Scan (61x91x1): Measurement grid: dx=15mm, dy=15mm

Reference Value = 19.2 V/m; Power Drift = -0.0 dB Maximum value of SAR (interpolated) = 0.901 mW/g

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

Reference Value = 19.2 V/m; Power Drift = -0.0 dB Maximum value of SAR (measured) = 0.907 mW/g

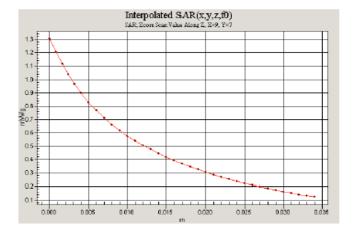
Peak SAR (extrapolated) = 1.3 W/kg

SAR(1 g) = 0.857 mW/g; SAR(10 g) = 0.581 mW/g

Body/Zoom Scan (21x21x36)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 19.2 V/m; Power Drift = -0.0 dBMaximum value of SAR (interpolated) = 1.3 mW/g

Info: Interpolated medium parameters used for SAR evaluation!



SAR Report WR751.001 Applicant: Nokia Corporation Type: RH-57





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





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

Client

Nokia SD

CALIBRATION C	ERTIFICAT	E						
Object(s)	ET3DV6 - SN:1739							
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes							
Calibration date:	August 26, 200	04						
Condition of the calibrated item	In Tolerance (a	according to the specific calibratio	n document)					
	-	onal standards, which realize the physical units of m robability are given on the following pages and are p						
All calibrations have been conducted	d in the closed laborator	ry 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		8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04					
Power sensor HP 8481A RF generator HP 8684C	MY41092180 US3642U01700	18-Sep-02 (SPEAG, in house check Oot03) 4-Aug-99 (SPEAG, in house check Aug02)	In house check: Oct 05 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	D1660					
Approved by:	Katja Pokovic	Laboratory Director	Awi Kofa					
			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.								

SAR Report WR751.001 Applicant: Nokia Corporation

880-KP0301061-A

Type: RH-57

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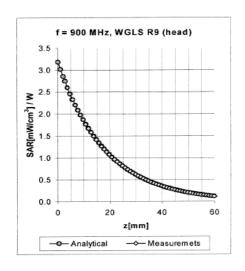


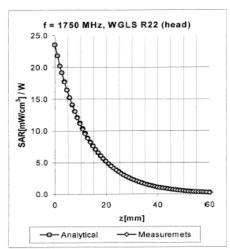


ET3DV6 SN:1739

August 26, 2004

Conversion Factor Assessment





f [MHz]	Validity [MHz] ⁸	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	785-885	Head	41.5 ± 5%	0.90 ± 5%	0.81	1.52	6.79 ± 9.7% (k=2)
900	850-950	Head	41.5 ± 5%	0.97 ± 5%	0.61	1.77	6.50 ± 9.7% (k=2)
1750	1700-1800	Head	40.0 ± 5%	1.40 ± 5%	0.44	2.65	5.26 ± 9.7% (k=2)
1900	1850-1950	Head	40.0 ± 5%	1.40 ± 5%	0.47	2.69	5.10 ± 9.7% (k=2)
2450	2400-2500	Head	39.2 ± 5%	$1.80 \pm 5\%$	0.93	1.84	4.53 ± 9.7% (k=2)
835	785-885	Body	55.2 ± 5%	$0.97 \pm 5\%$	0.58	1.84	6.47 ± 9.7% (k=2)
900	850-950	Body	55.0 ± 5%	1.05 ± 5%	0.44	2.23	6.12 ± 9.7% (k=2)
1750	1700-1800	Body	53.3 ± 5%	1.52 ± 5%	0.50	2.80	4.66 ± 9.7% (k=2)
1900	1850-1950	Body	53.3 ± 5%	1.52 ± 5%	0.57	2.70	4.57 ± 9.7% (k=2)
2450	2400-2500	Body	52.7 ± 5%	1.95 ± 5%	1.12	1.60	4.22 ± 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.

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





Calibration Laboratory of Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accreditation No.: SCS 108

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

Client Nokia SD Certificate No: D835V2-478_Oct04/2

CALIBRATION CERTIFICATE (Replacement of No: D835V2-478_Oct04) D835V2 - SN: 478 Object QA CAL-05.v6 Calibration procedure(s) Calibration procedure for dipole validation kits October 22, 2004 Calibration date: 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) Cal Date (Calibrated by, Certificate No.) Scheduled Calibration Primary Standards GB37480704 Oct-05 Power meter EPM E442 12-Oct-04 (METAS, No. 251-00412) Power sensor HP 8481A US37292783 12-Oct-04 (METAS, No. 251-00412) Oct-05 Reference 20 dB Attenuator SN: 5086 (20g) 10-Aug-04 (METAS, No 251-00402) Aug-05 SN: 5047.2 (10r) 10-Aug-04 (METAS, No 251-00402) Aug-05 Reference 10 dB Attenuator SN 1680 23-Feb-04 (SPEAG, No. ET3-1680_Feb04) Feb-05 Reference Probe ET3DV6 22-Jul-04 (SPEAG, No. DAE4-601_Jul04) Jul-05 DAE4 SN 601 Secondary Standards ID# Check Date (in house) Scheduled Check Power sensor HP 8481A MY41092317 18-Oct-02 (SPEAG, in house check Oct-03) In house check: Oct-05 100698 RF generator R&S SML-03 27-Mar-02 (SPEAG, in house check Dec-03) In house check: Dec-05 Network Analyzer HP 8753E US37390585 S4206 18-Oct-01 (SPEAG, in house check Nov-03) In house check: Nov 04 Function Name Katja Pokovic Technical Manager Calibrated by: Niels Kuster Quality Manager Approved by: Issued: November 15, 2004 This calibration certificate shall not be reproduced except in full without written approval of the laboratory

Certificate No: D835V2-478_Oct04/2 Page 1 of 9





DASY4 Validation Report for Head TSL

Date/Time: 10/22/04 19:01:22

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN478

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

Medium: HSL 835 MHz;

Medium parameters used: f = 835 MHz; $\sigma = 0.89$ mho/m; $\epsilon_r = 41.8$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 SN1680; ConvF(6.4, 6.4, 6.4); Calibrated: 23.02.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.07.2004
- Phantom: Flat Phantom half size; Type: QD000P49AA; Serial: SN:1001;
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

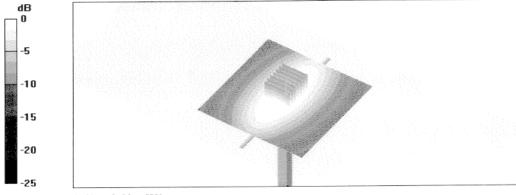
Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm Maximum value of SAR (interpolated) = 2.49 mW/g

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

Reference Value = 54.1 V/m; Power Drift = 0.0 dB

Peak SAR (extrapolated) = 3.41 W/kg

SAR(1 g) = 2.34 mW/g; SAR(10 g) = 1.54 mW/gMaximum value of SAR (measured) = 2.53 mW/g



0 dB = 2.53 mW/g

Certificate No: D835V2-478_Oct04/2

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DASY4 Validation Report for Body TSL

Date/Time: 10/22/04 18:58:12

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN478

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

Medium: Muscle 835 MHz;

Medium parameters used: f = 835 MHz; $\sigma = 1$ mho/m; $\varepsilon_r = 54.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 SN1680; ConvF(6.31, 6.31, 6.31); Calibrated: 23.02.2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 22.07.2004
- Phantom: Flat Phantom half size; Type: QD000P49AA; Serial: SN:1001;
- Measurement SW: DASY4, V4.4 Build 3; Postprocessing SW: SEMCAD, V1.8 Build 130

Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm Maximum value of SAR (interpolated) = 2.61 mW/g

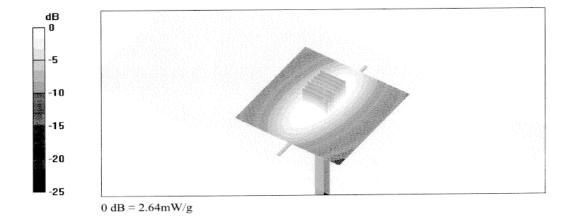
Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,

dz=5mm

Reference Value = 51.6 V/m; Power Drift = 0.0 dB

Peak SAR (extrapolated) = 3.54 W/kg

SAR(1 g) = 2.44 mW/g; SAR(10 g) = 1.61 mW/gMaximum value of SAR (measured) = 2.64 mW/g



Certificate No: D835V2-478_Oct04/2

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