NOKIA

NOKIA MOBILE PHONES

Nokia Mobile Phones Salo
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12 February, 2004

Federal Communications Commission,
Authorization & Evaluation Division,
7435 Oakland Mills Road
Columbia, MD. 21046

Attention: Equipment Authorization Branch

We hereby certify that the transceiver FCC ID: PYARM-2 complies with ANSI/IEEE C95.1-1992 Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.

Compliance was determined by testing appropriate parameters according to standard.

NOKIA MOBILE PHONES

Pekka Lonka
Product Program Manager, NES Salo

T117 (EN ISO/IEC 17025)

SAR Compliance Test Report

Test report no.:	Salo_SAR0406_05	**Date of report:**	2004-02-13
Template version:	2	**Number of pages:**	40
Testing laboratory:	TCC Salo, P.O. Box 86 Joensuunkatu 7E / Kiila 1B FIN-24101 SALO, FINLAND Tel. +358 (0) 7180 08000 Fax. +358 (0) 7180 45220	**Client:**	Nokia Corporation P.O. Box 86 Joensuunkatu 7E FIN-24101 SALO, FINLAND Tel. +358 (0) 7180 08000 Fax. +358 (0) 7180 44277
Responsible test engineer:	Virpi Tuominen	**Product contact person:**	Harri Kankare
Measurements made by:	Virpi Tuominen		
Tested device:	RM-2		
FCC ID (USA):	PYARM-2	**Industry Canada ID:**	661V-RM2
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 P1528/D1.2, April 21, 2003
Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques

Documentation: The documentation of the testing performed on the tested devices is archived for 15 years at TCC Salo.

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: **2004-02-13**

For the contents:

Kai Uusitalo
Engineering Manager, EMC

Virpi Tuominen
Senior Design Engineer

CONTENTS

1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	04.02.2004 to 06.02.2004
SN, HW and SW numbers of tested device	SN: 004400/40/170147/7, HW: 8.0, SW: 3.26, DUT: 06941
Batteries used in testing	BLC-2, DUT #'s: 06207, 06249, 06621, 06911
Headsets used in testing	HS-5, HW: 0.2, DUT: 06939 HDS-3, HW: 4.0, MV: 6.2, SW: 4.0, DUT: 06909
Other accessories used in testing	-
State of sample	-
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)	EIRP	Position	SAR limit (1g avg)	Measured SAR value (1g avg)	Result
GSM 1900	512 / 1850	32.0 dBm	Left Tilt	1.6 W/kg	0.75 W/kg	PASSED

1.2.2 Body Worn Configuration

Mode	Ch / *f* (MHz)	EIRP	Separation distance	SAR limit (1g avg)	Measured SAR value (1g avg)	Result
GPRS 1900 (2-slot TX)	512 / 1850	32.0 dBm	2.2 cm	1.6 W/kg	0.86 W/kg	PASSED

1.2.3 Maximum Drift

Maximum drift during measurements	-0.21 dB

1.2.4 Measurement Uncertainty

Extended Uncertainty (k=2) 95%	± 29.1 %

2. DESCRIPTION OF THE DEVICE UNDER TEST

Device category	Portable			
Exposure environment	General population/uncontrolled			
Modes and Bands of Operation	GSM 1900	GPRS (GSM)	EGPRS(EDGE)	BT
Modulation Mode	GMSK	GMSK	8PSK	GFSK
Duty Cycle	1/8	1/8 or 2/8		
Transmitter Frequency Range (MHz)	1850.2 - 1909.8	1850.2 - 1909.8	1850.2 - 1909.8	2400.0 – 2483.5

Outside of USA and Canada, the transmitter of the device is capable of operating also in GSM900 and in GSM1800, which are not part of this filing.

EGPRS mode was not measured, because maximum averaged output power is more than 3 dB lower in EGPRS mode than in GPRS mode.

2.1 Picture of the Device

Device with flip closed.

Device with flip open.

2.2 Description of the Antenna

The device has an internal patch antenna.

3. TEST CONDITIONS

3.1 Temperature and Humidity

Period of measurement:	2004-02-04 to 2004-02-06
Ambient temperature (°C):	22.0 to 22.1
Ambient humidity (RH %):	37 to 38

3.2 Test Signal, Frequencies, and Output Power

The device was put into operation by using call testers. Communication between the device and the call tester was established by air links.

The device output power was set to maximum power level for all tests; a fully charged battery was used for every test sequence.

In all operating bands the measurements were performed on lowest, middle and highest channels.

The radiated power for this device was measured in EMC laboratory of Konette Design Center OY in Hyvinkää / Finland.

4. DESCRIPTION OF THE TEST EQUIPMENT

4.1 Measurement System and Components

The measurements were performed using an automated near-field scanning system, DASY 3 software version 3.1d, 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	372	12 months	08/2004
E-field Probe ET3DV6	1395	12 months	08/2004
Dipole Validation Kit, D1800V2	256	24 months	01/2006
Dipole Validation Kit, D1900V2	5d013	24 months	07/2004

Additional test equipment used in testing:

Test Equipment	Model	Serial Number	Calibration interval	Calibration expiry
Signal Generator	SML03	101265	12 months	06/2004
Amplifier	ZHL-42 (SMA)	N072095-5	-	-
Power Meter	NRVS	849305/028	12 months	07/2004
Power Sensor	NRV-Z32	839176/020	12 months	07/2004
Call Tester	CMU 200	101111	12 months	07/2004
Call Tester	CMU 200	835734/049	12 months	04/2004
Vector Network Analyzer	8753E	US38432928	12 months	10/2004
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 A
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 P1528/D1.2, April 21, 2003 (as established by sub committee SCC-34/SC-2).

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 P1528/D1.2, April 21, 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:

1900MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	54.88	69.02
Butyl Diglycol	44.91	30.76
Salt	0.21	0.22

4.3.2 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]	
1900	Reference result ± 10% window	11.0 9.90 to 12.1	39.8	1.46	N/A
	2004-02-04	11.2	37.9	1.44	21.2

System verification, body tissue simulant

f [MHz]	Description	SAR [W/kg], 1g	Dielectric Parameters		Temp [°C]
			ε_r	σ [S/m]	
1800	Reference result ± 10% window	9.49 8.54 to 10.4	53.2	1.49	N/A
	2004-02-05	9.10	51.3	1.45	20.6
	2004-02-06	10.4	50.7	1.46	20.5

Plots of the Verification scans are given in Appendix A.

4.3.3 Tissue Simulants used in the Measurements

Head tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp [°C]
		ε_r	σ [S/m]	
1880	Recommended value ± 5% window	40.0 38.0 to 42.0	1.40 1.33 to 1.47	N/A
	2004-02-04	38.0	1.42	21.0

Body tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp [°C]
		ε_r	σ [S/m]	
1880	Recommended value ± 5% window	53.3 50.6 to 56.0	1.52 1.44 to 1.60	N/A
	2004-02-05	50.9	1.53	21.0
	2004-02-06	50.6	1.54	21.0

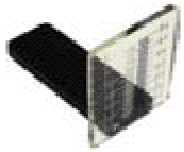
5. DESCRIPTION OF THE TEST PROCEDURE

5.1 Device Holder

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

Device holder supplied by SPEAG

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



Nokia spacer

5.2 Test Positions

5.2.1 Against Phantom Head

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

The positions used in the measurements were according to IEEE P1528/D1.2 April 21 2003 "Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”.

Device, flip closed, in cheek position.

Device, flip open, in cheek position.

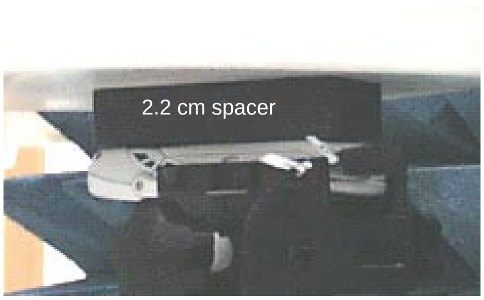
Device, flip closed, in tilted position.

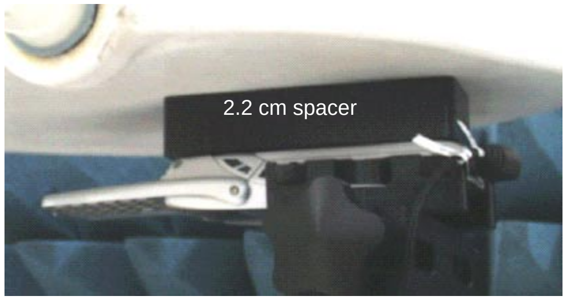
Device, flip open, in tilt position. Tilt is 10° instead of 15°, because flip touches the phantom if tilt angle is increased over 10°.

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 2.2

cm 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.





Photos of the device positioned for Body SAR measurement with flip closed and with flip open. 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, 5x5x7, 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 of the points was done with a 3d-Spline. The 3d-Spline comprised three one-dimensional splines with the "Not a knot" -condition [W. Gander, Computermathematik, p. 141-150] (x, y and z -directions) [Numerical Recipes in C, Second Edition, p 123].

The extrapolation was based on least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 30 mm in all z-axis, a fourth order polynomial was calculated. This polynomial was then used to evaluate the points between the phantom surface and the probe tip. The points, calculated from the phantom surface, were at 1mm spacing.

Surface detection distance used in the SAR calculation algorithm was 1.4 mm.

6. MEASUREMENT UNCERTAINTY

Table 6.1 – Measurement uncertainty evaluation

Uncertainty Component	P1528 Sec	Tol. (%)	Prob Dist	Div	c_i	u_i (%)	v_i
Measurement System							
Probe Calibration	E2.1	±4.8	N	1	1	±4.8	∞
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			**±14.5**	187
Coverage Factor for 95%			**k=2**				
Expanded Standard Uncertainty						**±29.1**	

7. RESULTS

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

1900MHz Head SAR results

Mode and Band	Flip option	Position		SAR, averaged over 1g (W/kg) Ch 512 1850 MHz	Ch 661 1880 MHz	Ch 810 1910 MHz
GSM 1900	closed	Power level		**32.0 dBm**	**31.9 dBm**	**31.2 dBm**
		Left	Cheek	0.693	0.624	0.600
			Tilt	**0.745**	0.618	0.610
		Right	Cheek	-	0.379	-
			Tilt	-	0.470	-
GSM 1900	open	Power level		**28.8 dBm**	**29.5 dBm**	**27.7 dBm**
		Left	Cheek	-	0.120	-
			Tilt	0.153	0.153	0.160
		Right	Cheek	-	0.0976	-
			Tilt	-	0.121	-
GSM 1900	closed	Left Tilt, BT active		0.740	-	-

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

1900MHz Body SAR results

Mode and Band	Flip option	Body-worn location setup	SAR, averaged over 1g (W/kg) Ch 512 1850 MHz	Ch 661 1880 MHz	Ch 810 1910 MHz
GPRS 1900 (2-slot TX)	closed	Power level	**32.0 dBm**	**31.9 dBm**	**31.2 dBm**
		Headset HS-5	**0.845**	0.719	0.642
		Headset HDS-3	0.828	0.723	0.635
GPRS 1900 (2-slot TX)	open	Power level	**28.8 dBm**	**29.5 dBm**	**27.7 dBm**
		Headset HS-5	0.435	0.389	0.341
		Headset HDS-3	0.485	0.371	0.330
GPRS 1900 (2-slot TX)	closed	HS-5, BT active	**0.855**	-	-

Plots of the Measurement scans are given in Appendix B.

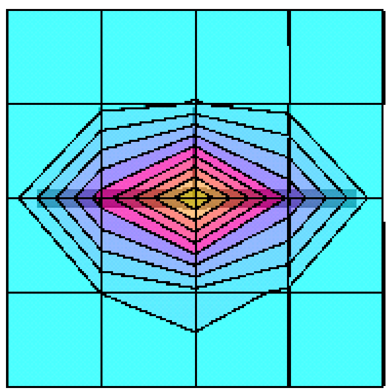
APPENDIX A: VALIDATION SCANS

System verification, head tissue simulant, 1900 MHz

2004-02-04
t(liq.)=21.2°C

Dipole 1900 MHz

SAM 2; Flat
Probe: ET3DV6 - SN1395; ConvF(5.20,5.20,5.20); Crest factor: 1.0; Brain 1900 MHz: σ = 1.44 mho/m ϵ_r = 37.9 ρ = 1.00 g/cm^3
Cubes (2): Peak: 21.7 mW/g ± 0.02 dB, SAR (1g): 11.2 mW/g ± 0.02 dB, SAR (10g): 5.68 mW/g ± 0.01 dB, (Worst-case extrapolation)
Penetration depth: 7.8 (7.3, 8.8) [mm]
Powerdrift: -0.02 dB

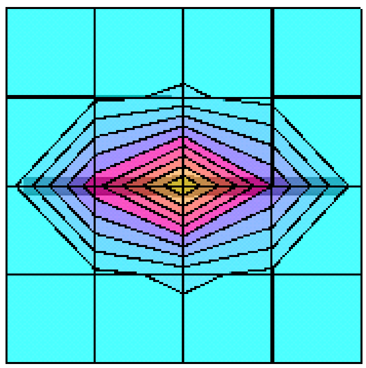


System verification, body tissue simulant, 1800 MHz

2004-02-05
t(liq.)=20.6°C

Dipole 1800 MHz

SAM 2; Flat
Probe: ET3DV6 - SN1395; ConvF(4.90,4.90,4.90); Crest factor: 1.0; B0DY 1800 MHz: σ = 1.45 mho/m ϵ_r = 51.3 ρ = 1.00 g/cm^3
Cubes (2): Peak: 15.5 mW/g ± 0.01 dB, SAR (1g): 9.10 mW/g ± 0.02 dB, SAR (10g): 4.93 mW/g ± 0.03 dB, (Advanced extrapolation)
Penetration depth: 9.8 (9.7, 10.2) [mm]
Powerdrift: 0.02 dB

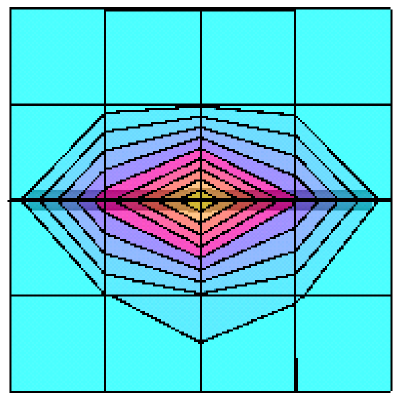


System verification, body tissue simulant, 1800 MHz

2004-02-06
t(liq.)=20.5℃

Dipole 1800 MHz

SAM 2; Flat
Probe: ET3DV6 - SN1395; ConvF(4.90,4.90,4.90); Crest factor: 1.0; BODY 1800 MHz: σ = 1.46 mho/m ε_r = 50.7 ρ = 1.00 g/cm^3
Cubes (2): Peak: 20.1 mW/g ± 0.18 dB, SAR (1g): 10.4 mW/g ± 0.09 dB, SAR (10g): 5.32 mW/g ± 0.03 dB, (Worst-case extrapolation)
Penetration depth: 8.5 (7.7, 10.0) [mm]
Powerdrift: 0.01 dB



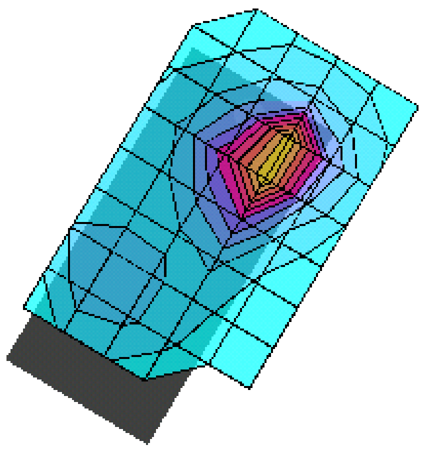
APPENDIX B: MEASUREMENT SCANS

Left Cheek

RM-2, Flip closed, GSM 1900

2004-02-04
t(liq.)=20.5℃

SAM 2 Phantom; Left Hand Section; Position: (90°,59°); Frequency: 1850 MHz
Probe: ET3DV6 - SN1395; ConvF(5.20,5.20,5.20); Crest factor: 8.0; Brain 1880 MHz: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.693 mW/g, SAR (10g): 0.332 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.13 dB

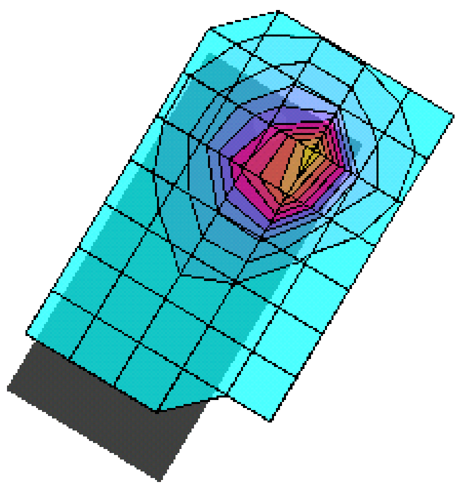


Left Tilt

RM-2, Flip closed, GSM 1900

2004-02-04
t(liq.)=20.4°C

SAM 2 Phantom; Left Hand Section; Position: (90°,59°); Frequency: 1850 MHz
Probe: ET3DV6 - SN1395; ConvF(5.20,5.20,5.20); Crest factor: 8.0; Brain 1880 MHz: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.745 mW/g, SAR (10g): 0.365 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.11 dB

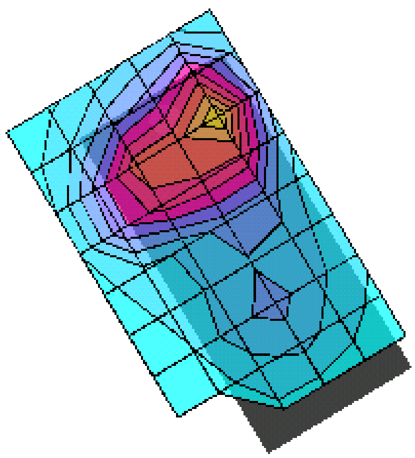


Right Cheek

RM-2, Flip closed, GSM 1900

2004-02-04
t(liq.)=20.7°C

SAM 2 Phantom; Righ Hand Section; Position: (90°,301°); Frequency: 1880 MHz
Probe: ET3DV6 - SN1395; ConvF(5.20,5.20,5.20); Crest factor: 8.0; Brain 1880 MHz: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.379 mW/g, SAR (10g): 0.204 mW/g * Max outside, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.12 dB

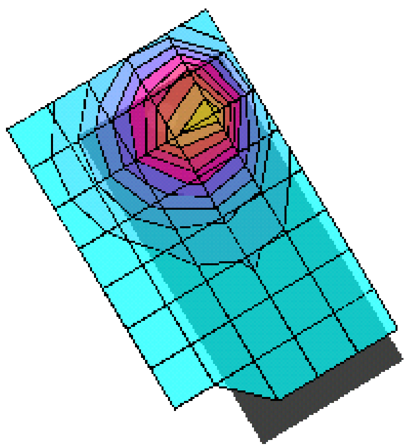


Right Tilt

RM-2, Flip closed, GSM 1900

2004-02-04
t(liq.)=20.6°C

SAM 2 Phantom; Righ Hand Section; Position: (90°,301°); Frequency: 1880 MHz
Probe: ET3DV6 - SN1395; ConvF(5.20,5.20,5.20); Crest factor: 8.0; Brain 1880 MHz: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.470 mW/g, SAR (10g): 0.246 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.08 dB

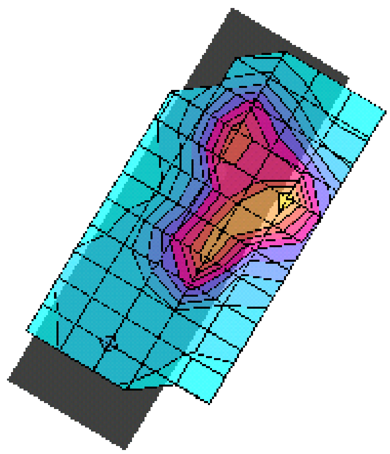


Left Cheek

RM-2, Flip open, GSM 1900

2004-02-04
t(liq.)=20.1°C

SAM 2 Phantom; Left Hand Section; Position: (90°,59°); Frequency: 1880 MHz
Probe: ET3DV6 - SN1395; ConvF(5.20,5.20,5.20); Crest factor: 8.0; Brain 1880 MHz: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.120 mW/g, SAR (10g): 0.0651 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.07 dB

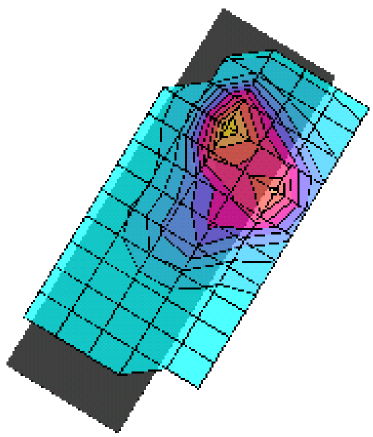


Left Tilt

RM-2, Flip open, GSM 1900

2004-02-04
t(liq.)=19.7℃

SAM 2 Phantom; Left Hand Section; Position: (90°,59°); Frequency: 1910 MHz
Probe: ET3DV6 - SN1395; ConvF(5.20,5.20,5.20); Crest factor: 8.0; Brain 1880 MHz: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.160 mW/g, SAR (10g): 0.0873 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.03 dB

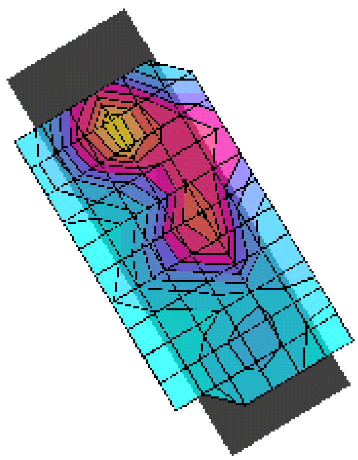


Right Cheek

RM-2, Flip open, GSM 1900

2004-02-04
t(liq.)=19.9°C

SAM 2 Phantom; Righ Hand Section; Position: (90°,301°); Frequency: 1880 MHz
Probe: ET3DV6 - SN1395; ConvF(5.20,5.20,5.20); Crest factor: 8.0; Brain 1880 MHz: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.0976 mW/g, SAR (10g): 0.0562 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: 0.06 dB

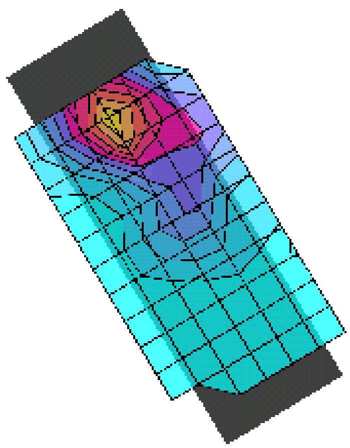


Right Tilt

RM-2, Flip open, GSM 1900

2004-02-04
t(liq.)=19.9°C

SAM 2 Phantom; Righ Hand Section; Position: (90°,301°); Frequency: 1880 MHz
Probe: ET3DV6 - SN1395; ConvF(5.20,5.20,5.20); Crest factor: 8.0; Brain 1880 MHz: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.121 mW/g, SAR (10g): 0.0688 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 10.0
Powerdrift: 0.12 dB

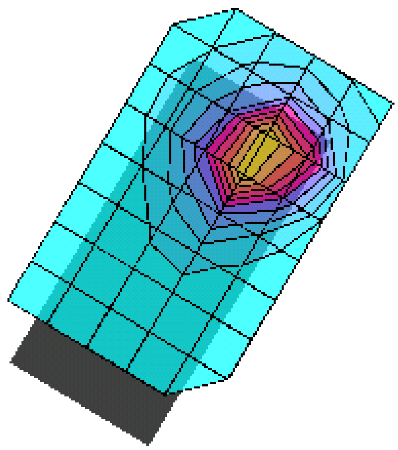


Left Tilt

RM-2, Flip closed, BT active, GSM 1900

2004-02-04
t(liq.)=19.7°C

SAM 2 Phantom; Left Hand Section; Position: (90°,59°); Frequency: 1850 MHz
Probe: ET3DV6 - SN1395; ConvF(5.20,5.20,5.20); Crest factor: 8.0; Brain 1880 MHz: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.740 mW/g, SAR (10g): 0.372 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.15 dB

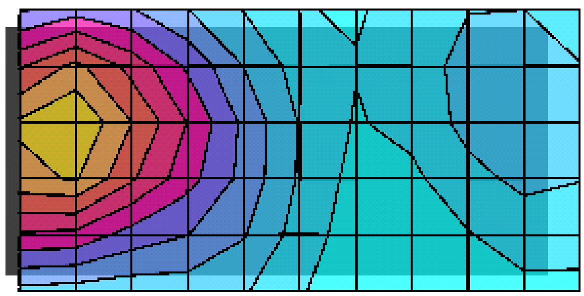


Body position

RM-2, Flip closed, HS-5, GSM 1900

2004-02-05
t(liq.)=20.4°C

SAM 2 Phantom; Flat Section; Position: (270°,90°); Frequency: 1850 MHz
Probe: ET3DV6 - SN1395; ConvF(4.90,4.90,4.90); Crest factor: 4.0; BODY 1880 MHz: σ = 1.53 mho/m ε_r = 50.9 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.845 mW/g, SAR (10g): 0.506 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 12.0
Powerdrift: -0.11 dB

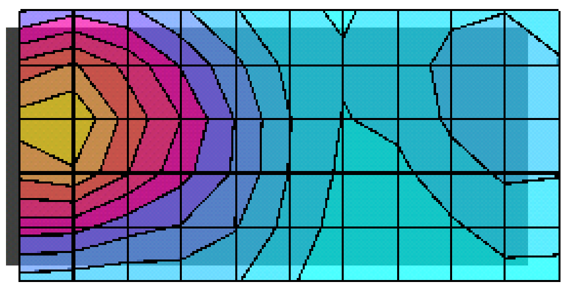


Body position

RM-2, Flip closed, HDS-3, GSM 1900

2004-02-05
t(liq.)=20.3℃

SAM 2 Phantom; Flat Section; Position: (270°,90°); Frequency: 1850 MHz
Probe: ET3DV6 - SN1395; ConvF(4.90,4.90,4.90); Crest factor: 4.0; BODY 1880 MHz: σ = 1.53 mho/m ε_r = 50.9 ρ = 1.00 g/cm³
Cube 5x5x7: SAR (1g): 0.828 mW/g, SAR (10g): 0.498 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 12.0
Powerdrift: -0.11 dB

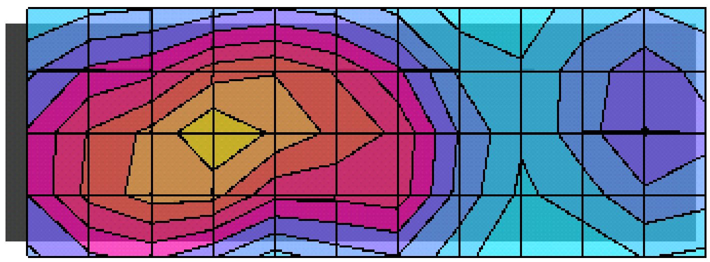


Body position

RM-2, Flip open, HS-5, GSM 1900

2004-02-06
t(liq.)=20.2°C

SAM 2 Phantom; Flat Section; Position: (270°,90°); Frequency: 1850 MHz
Probe: ET3DV6 - SN1395; ConvF(4.90,4.90,4.90); Crest factor: 4.0; BODY 1880 MHz: σ = 1.54 mho/m ε_r = 50.6 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.435 mW/g, SAR (10g): 0.266 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 15.0
Powerdrift: -0.17 dB

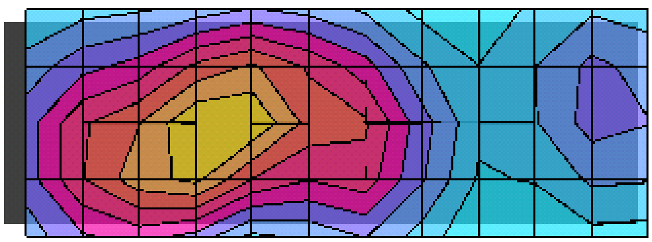


Body position

RM-2, Flip open, HDS-3, GSM 1900

2004-02-06
t(liq.)=20.1℃

SAM 2 Phantom; Flat Section; Position: (270°,90°); Frequency: 1850 MHz
Probe: ET3DV6 - SN1395; ConvF(4.90,4.90,4.90); Crest factor: 4.0; B0DY 1880 MHz: σ = 1.54 mho/m ε_r = 50.6 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.485 mW/g, SAR (10g): 0.296 mW/g, (Worst-case extrapolation)
Coarse: Dx = 15.0, Dy = 15.0, Dz = 15.0
Powerdrift: -0.11 dB

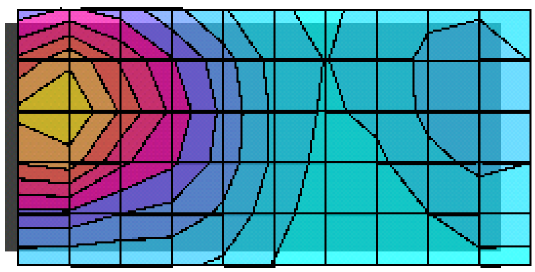


Body position

RM-2, Flip closed, HDS-3, BT active, GSM 1900

2004-02-05
t(liq.)=20.0°C

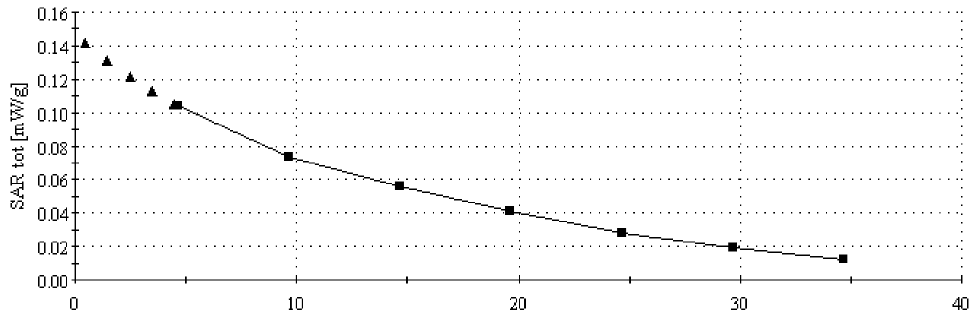
SAM 2 Phantom; Flat Section; Position: (270°,90°); Frequency: 1850 MHz
Probe: ET3DV6 - SN1395; ConvF(4.90,4.90,4.90); Crest factor: 4.0; BODY 1880 MHz: σ = 1.53 mho/m ε_r = 50.9 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.855 mW/g, SAR (10g): 0.513 mW/g, (Worst-case extrapolation)
Coarse: Dx = 12.0, Dy = 12.0, Dz = 12.0
Powerdrift: -0.12 dB



Z-PLOT corresponding Maximum Head SAR result / GSM 1900:
Maximum point of
RM-2, Flip closed, Left Tilt, GSM 1900

2004-02-04
t(liq.)=20.4°C

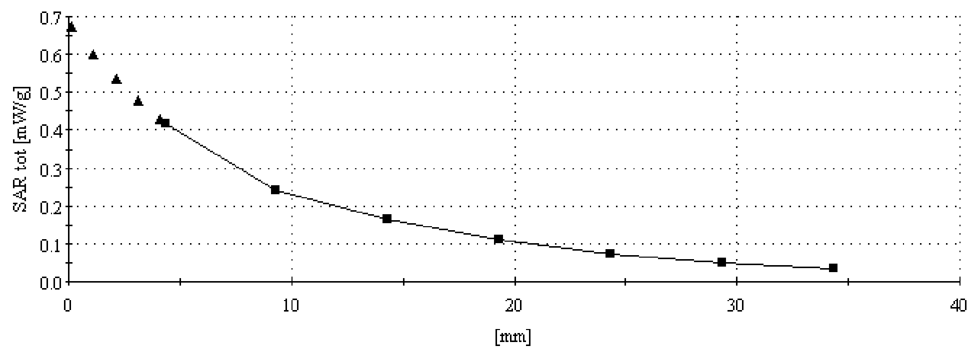
SAM 2 Phantom; Left Hand Section; Position: (90°,59°); Frequency: 1850 MHz
Probe: ET3DV6 - SN1395; ConvF(5.20,5.20,5.20); Crest factor: 8.0; Brain 1880 MHz: σ = 1.42 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.745 mW/g, SAR (10g): 0.365 mW/g, (Worst-case extrapolation)
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0



Z-PLOT corresponding Maximum Body SAR result / GPRS 1900:
Maximum point of
RM-2, Flip closed, HS-5, Body 2.2 cm, BT active, GSM 1900

2004-02-05
t(liq.)=20.0°C

SAM 2 Phantom; Flat Section; Position: (270°,90°); Frequency: 1850 MHz
Probe: ET3DV6 - SN1395; ConvF(4.90,4.90,4.90); Crest factor: 4.0; B0DY 1880 MHz: σ = 1.53 mho/m ε_r = 50.9 ρ = 1.00 g/cm^3
Cube 5x5x7: SAR (1g): 0.855 mW/g, SAR (10g): 0.513 mW/g, (Worst-case extrapolation)
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0



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

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

Client: Nokia TCC Salo

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1395
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	August 28, 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
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (Agilent, No. 20020918)	Sep-03
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01 (ELCAL, No.2360)	Sep-03

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

Date issued: August 28, 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.

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ET3DV6 SN:1395 August 28, 2003

DASY - Parameters of Probe: ET3DV6 SN:1395

Sensitivity in Free Space

NormX	**1.71**	$\mu V/(V/m)^2$
NormY	**1.74**	$\mu V/(V/m)^2$
NormZ	**1.66**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**94**	mV
DCP Y	**94**	mV
DCP Z	**94**	mV

Sensitivity in Tissue Simulating Liquid

Head 900 MHz ε_r = 41.5 ± 5% σ = 0.97 ± 5% mho/m

Valid for f=800-1000 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	6.3 ± 9.5% (k=2)		Boundary effect:	
ConvF Y	6.3 ± 9.5% (k=2)		Alpha	**0.42**
ConvF Z	6.3 ± 9.5% (k=2)		Depth	**2.59**

Head 1800 MHz ε_r = 40.0 ± 5% σ = 1.40 ± 5% mho/m

Valid for f=1710-1910 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	5.2 ± 9.5% (k=2)		Boundary effect:	
ConvF Y	5.2 ± 9.5% (k=2)		Alpha	**0.54**
ConvF Z	5.2 ± 9.5% (k=2)		Depth	**2.56**

Boundary Effect

Head 900 MHz Typical SAR gradient: 5 % per mm

Probe Tip to Boundary		1 mm	2 mm
SAR_{be} [%]	Without Correction Algorithm	11.7	6.7
SAR_{be} [%]	With Correction Algorithm	0.4	0.6

Head 1800 MHz Typical SAR gradient: 10 % per mm

Probe Tip to Boundary		1 mm	2 mm
SAR_{be} [%]	Without Correction Algorithm	14.5	9.4
SAR_{be} [%]	With Correction Algorithm	0.1	0.1

Sensor Offset

Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.7 ± 0.2**	mm

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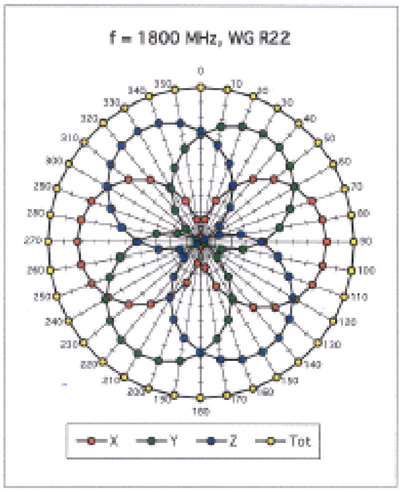
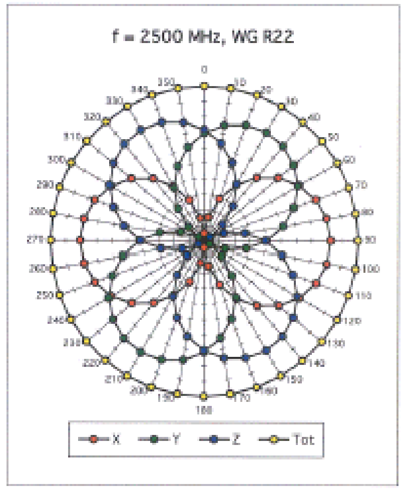
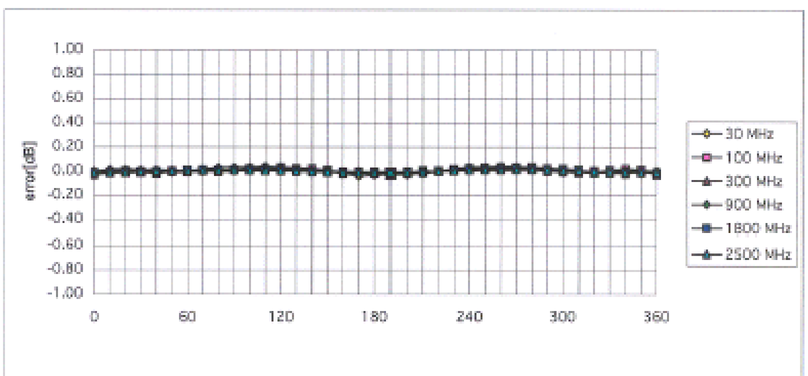


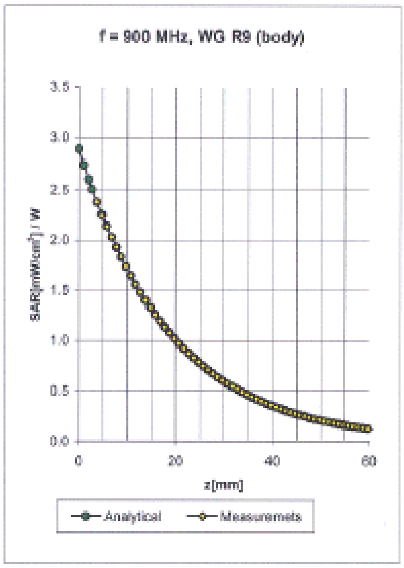


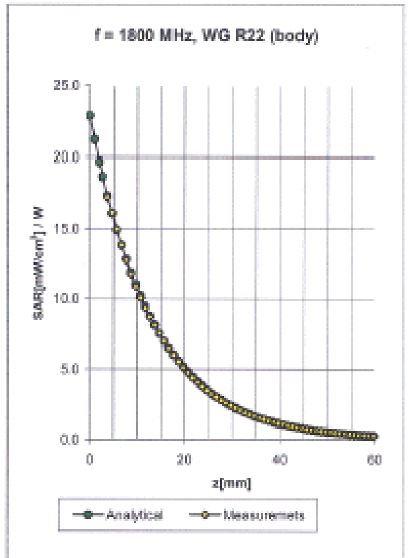
Isotropy Error (ϕ), θ = 0°



ET3DV6 SN:1395 August 26, 2003

Conversion Factor Assessment





Body 900 MHz ε_r = 55.0 ± 5% σ = 1.05 ± 5% mho/m

Valid for f=800-1000 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	6.2	±9.5% (k=2)	Boundary effect:	
ConvF Y	6.2	±9.5% (k=2)	Alpha	0.49
ConvF Z	6.2	±9.5% (k=2)	Depth	2.37

Body 1800 MHz ε_r = 53.3 ± 5% σ = 1.52 ± 5% mho/m

Valid for f=1710-1910 MHz with Body Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	4.9	±9.5% (k=2)	Boundary effect:	
ConvF Y	4.9	±9.5% (k=2)	Alpha	0.61
ConvF Z	4.9	±9.5% (k=2)	Depth	2.60

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

1900 MHz dipole, head calibration:

Schmid & Partner
Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland, Phone +41 1 245 97 00, Fax +41 1 245 97 79

DASY3

Dipole Validation Kit

Type: D1900V2

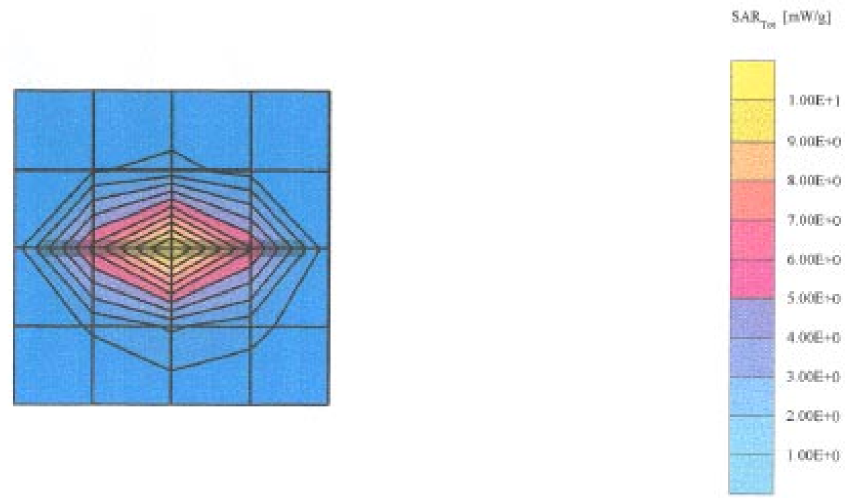
Serial: 5d013

Manufactured: April 30, 2002
Calibrated: July 1, 2002

07/01/02

Validation Dipole D1900V2 SN5d013, d = 10 mm

Frequency: 1900 MHz; Antenna Input Power: 250 [mW]
SAM Phantom; Flat Section; Grid Spacing: Dx = 20.0, Dy = 20.0, Dz = 10.0
Probe: ET3DV6 - SN1507; ConvF(5.20,5.20,5.20) at 1900 MHz; IEEE1528 1900 MHz: σ = 1.46 mho/m ε_r = 39.8 ρ = 1.00 g/cm³
Cubes (2): Peak: 20.5 mW/g ± 0.03 dB, SAR (1g): 11.0 mW/g ± 0.02 dB, SAR (10g): 5.70 mW/g ± 0.01 dB, (Worst-case extrapolation)
Penetration depth: 8.1 (7.8, 8.9) [mm]
Powerdrift: 0.02 dB



1800 MHz dipole, body calibration:

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

Client: Nokia TCC Salo

CALIBRATION CERTIFICATE

Object(s)	D1800V2 - SN:256
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	January 15, 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.

880-KP0301061-A   Page 1 (1)

Date/Time: 01/15/04 13:09:20

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN256

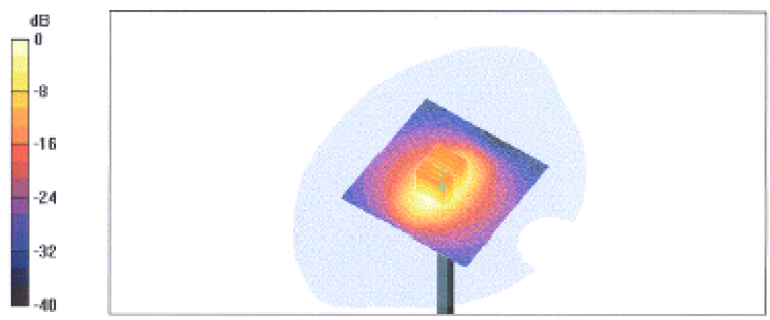
Communication System: CW-1800; Frequency: 1800 MHz;Duty Cycle: 1:1
Medium: Muscle 1800 MHz
Medium parameters used: f = 1800 MHz; $\sigma = 1.49$ mho/m; $\varepsilon_r = 53.2$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 - SN1507; ConvF(5, 5, 5); 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 = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 88.1 V/m
Power Drift = 0.0 dB
Maximum value of SAR = 10.9 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 15.9 W/kg
SAR(1 g) = 9.49 mW/g; SAR(10 g) = 5.14 mW/g
Reference Value = 88.1 V/m
Power Drift = 0.0 dB
Maximum value of SAR = 10.7 mW/g



0 dB = 10.7mW/g