SAR Compliance Test Report

Test report no.:	Not numbered	**Date of report:**	2003-08-18
Number of pages:	45	**Contact person:**	Pentti Pärnänen
		Responsible test engineer:	Pentti Pärnänen
Testing laboratory:	Nokia Corporation Yrttipellontie 6 P.O. Box 300 FIN-90401 OULU Finland Tel. +358-7180-08000 Fax. +358-7180-47222	**Client:**	Nokia Corporation Elektroniikkatie 10 P.O. Box 50 FIN-90571 OULU Finland Tel.358-7180-08000 Fax. +358-7180-47222

Tested devices:	LJPRH-30 (Detailed information for each device is listed in section 1).
Supplement reports:	
Testing has been carried out in accordance with:	47CFR §2.1093 Radiofrequency Radiation Exposure Evaluation: Portable Devices IEEE P1528-200X Draft 6.4 Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01) Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields
Documentation:	The documentation of the testing performed on the tested devices is archived for 15 years at TCC Oulu
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: 2003-08-18

For the contents:

Pentti Pärnänen Manager, TCC Oulu	Kai Niskala Test Engineer

CONTENTS

1. SUMMARY FOR SAR TEST REPORT

Date of test	2003-07-29, 2003-07-30
Contact person	Pentti Pärnänen
Test plan referred to	
FCC ID	LJPRH-30
SN, HW, SW and DUT numbers of tested device	SN: 004400/18/168990/0, HW:0903, SW: Vpa1.093
Accessories used in testing	Battery BLD-3, Headset HS-5, Headset HDS-3
Notes	
Document code	DTX07978-EN
Responsible test engineer	Pentti Pärnänen
Measurement performed by	Kai Niskala

1.1 Maximum Results Found during SAR Evaluation

The equipment is deemed to fulfil the requirements if the measured values are less than or equal to the limit. Maximum found results are reported per operating band.

1.1.1 Head Configuration

Mode	Ch / *f* (MHz)	Power [EIRP]	Position	Limit	Measured	Result
GSM1900	512/1850.20	31.2 dBm	Left tilted	1.6 W/kg	0.46 W/kg	PASSED

1.1.2 Body Worn Configuration

Mode	Ch / *f* (MHz)	Power [EIRP]	Separation	Limit	Measured	Result
GPRS1900	512/1850.20	31.2 dBm	2.2 cm	1.6 W/kg	0.95 W/kg	PASSED

1.1.3 Measurement Uncertainty

Combined Standard Uncertainty	**± 13.6%**
Expanded Standard Uncertainty (k=2)	**± 27.1%**

2. DESCRIPTION OF TESTED DEVICE

Device category	Portable device		
Exposure environment	Uncontrolled exposure		
Unit type	Prototype unit		
Case type	Fixed case		
Modes of Operation	GSM1900	GPRS1900	EGPRS1900
Modulation Mode	GMSK	GMSK	8-PSK
Duty Cycle	1/8	2/8, 1/8	1/8
Transmitter Frequency Range (MHz)	1850.2 - 1909.8	1850.2 - 1909.8	1850.2 - 1909.8

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

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

2.1 Picture of Phone

LJPRH-30

2.2 Description of the Antenna

Type	Internal integrated antenna	
Dimensions (mm)	Maximum width	40.5 mm
	Maximum length	36.8 mm
Location	Inside the back cover, near the top of the device	

2.3 Battery Options

The device was measured with battery BLD-3.

2.4 Body Worn Accessories

Compliance to the FCC body-worn RF exposure guidelines was measured using Twin SAM v4.0 flat phantom region. Separation distance between LJPRH-30 and flat-phantom was 22 mm.

3. TEST CONDITIONS

3.1 Ambient Conditions

Ambient temperature (°C)	22±2
Tissue simulating liquid temperature (°C)	22±1
Humidity	45%

3.2 RF characteristics of the test site

Tests were performed in an enclosed RF shielded environment.

3.3 Test Signal, Frequencies, and Output Power

The device was controlled by using a special test mode.

The measurements were performed on lowest, middle and highest channels.

The phone was set to maximum power level during the all tests and at the beginning of the each test the battery was fully charged. Power output was measured by A2LA accredited test laboratory, M. Flom Associates Inc., on the same unit used in SAR testing.

DASY4 system measures power drift during SAR testing by comparing e-field in the same location at the beginning and at the end of measurement. These records were used to monitor stability of power output.

4. DESCRIPTION OF THE TEST EQUIPMENT

The measurements were performed with an automated near-field scanning system, DASY4, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland.

Test Equipment	Serial Number	Due Date
DAE V1	555	03/04
E-field Probe ET3DV6	1765	04/04
Dipole Validation Kit, D1900V2	5d030	04/05

E-field probe calibration records are presented in Appendix C.

Additional equipment needed in validation

Test Equipment	Model	Serial Number	Due Date
Signal Generator	HP 8657B	3630U08114	04/04
Amplifier	Amplifier Research 5S1G4	306024	-
Power Meter	R&S NRT	101143	03/04
Power Sensor	R&S NRT-Z43	100239	03/04
Thermometer	Fluke 52 II	82810048	-
Network Analyzer	HP 8753D	3410A08934	05/04
Dielectric Probe Kit	Agilent 85070D	US01440162	-

4.1 System Accuracy Verification

The probes are calibrated annually by the manufacturer. Dielectric parameters of the simulating liquids are measured using a dielectric probe kit and a network analyzer.

The SAR measurement of the DUT were done within 24 hours of system accuracy verification, which was done using the dipole validation kit.

The dipole antenna, which is manufactured by Schmid & Partner Engineering AG, is matched to be used near flat phantom filled with tissue simulating solution. Length of 1900 MHz dipole is 68 mm with overall height of 300mm. A specific distance holder is used in the positioning of antenna to ensure correct spacing between the phantom and the dipole. Manufacturer's reference dipole data is presented in Appendix C.

Power level of 250 mW was supplied to a dipole antenna placed under the flat section of SAM phantom. The validation results are in the table below and printout of the validation test is presented in Appendix A. All the measured parameters were within the specification.

Tissue	*f* (MHz)	Description	SAR (W/kg), 1g	Dielectric Parameters		Temp (°C)
				ε_r	σ (S/m)	
Head	1900	Measured 07/29/03	10.4	39.5	1.43	22
		Reference Result	10.5	38.8	1.44	N/A
Muscle	1900	Measured 07/29/03	10.3	52.5	1.55	22
		Reference Result	10.7	51.2	1.59	N/A

4.2 Tissue Simulants

All dielectric parameters of tissue simulants were measured within 24 hours of SAR measurements. The depth of the tissue simulant in the ear reference point of the phantom was 15cm ± 5mm during all the tests. Volume for each tissue simulant was 26 liters.

4.2.1 Head Tissue Simulant

The composition of the brain tissue simulating liquid for 1900MHz is

44.91% 2-(2-butoxyethoxy) Ethanol
54.88% De-Ionized Water
0.21% Salt

f (MHz)	Description	Dielectric Parameters		Temp (°C)
		ε_r	σ (S/m)	
1880	Measured 07/29/03	39.6	1.41	22
	Recommended Values	40.0	1.40	20-26

Recommended values are adopted from OET Bulletin 65 (97-01) Supplement C (01-01).

4.2.2 Muscle Tissue Simulant

The composition of the muscle tissue simulating liquid for 1900MHz is

69.02% De-Ionized Water
30.76% Diethylene Glycol Monobutyl Ether
0.22% Salt

f (MHz)	Description	Dielectric Parameters		Temp (°C)
		ε_r	σ (S/m)	
1880	Measured 07/29/03	52.5	1.53	22
	Recommended Values	53.3	1.52	20-26

Recommended values are adopted from OET Bulletin 65 (97-01) Supplement C (01-01).

4.3 Phantoms

"SAM v4.0" phantom", manufactured by SPEAG, was used during the measurement. It has fiberglass shell integrated in a wooden table. The shape of the shell corresponds to the phantom defined by SCC34-SC2. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot.

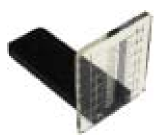
The thickness of phantom shell is 2 mm except for the ear, where an integrated ear spacer provides a 6 mm spacing from the tissue boundary. Manufacturer reports tolerance in shell thickness to be ±0.1mm.

4.4 Isotropic E-Field Probe ET3DV6

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

5. DESCRIPTION OF THE TEST PROCEDURE

5.1 Test Positions



The device was placed in holder using a special positioning tool, which aligns the bottom of the device with holder and ensures that holder contacts only to the sides of the device. After positioning is done, tool is removed. This method provides standard positioning and separation, and also ensures free space for antenna.

Device holder was provided by SPEAG together with DASY4.

5.1.1 Against Phantom Head

Measurements were made on both the "left hand" and "right hand" side of the phantom.

The device was positioned against phantom according to OET Bulletin 65 (97-01) Supplement C (01-01) . Definitions of terms used in aligning the device to a head phantom are available in IEEE Draft Standard P1528-2001 “Recommended Practice for Determining the Spatial-Peak Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques”

5.1.1.1 Initial Ear Position

The device was initially positioned with the earpiece region pressed against the ear spacer of a head phantom parallel to the “Neck-Front” line defined along the base of the ear spacer that contains the “ear reference point”. The “test device reference point” is aligned to the “ear reference point” on the head phantom and the “vertical centerline” is aligned to the “phantom reference plane”.

5.1.1.2 Cheek Position

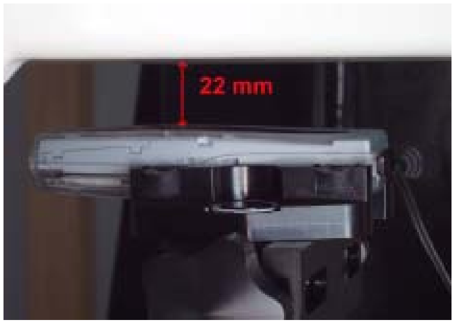
“Initial ear position” alignments are maintained and the device is brought toward the mouth of the head phantom by pivoting along the “Neck-Front” line until any point on the display, keypad or mouthpiece portions of the handset is in contact with the phantom or when any portion of a foldout, sliding or similar keypad cover opened to its intended self-adjusting normal use position is in contact with the cheek or mouth of the phantom.


5.1.1.3 Tilt Position

In the “Cheek Position”, if the earpiece of the device is not in full contact with the phantom’s ear spacer and the peak SAR location for the “cheek position” is located at the ear spacer region or corresponds to the earpiece region of the handset, the device is returned to the “initial ear position” by rotating it away from the mouth until the earpiece is in full contact with the ear spacer. Otherwise, the device is moved away from the cheek perpendicular to the line passes through both “ear reference points” for approximate 2-3 cm. While it is in this position, the device is tilted away from the mouth with respect to the “test device reference point” by 15°. After the tilt, it is then moved back toward the head perpendicular to the line passes through both “ear reference points” until the device touches the phantom or the ear spacer. If the antenna touches the head first, the positioning process is repeated with a tilt angle less than 15° so that the device and its antenna would touch the phantom simultaneously.

5.1.2 Body Worn Configuration

Body worn measurements were performed with antenna facing towards the flat part of the phantom with separation distance of 22mm. Headsets HS-5 and HDS-3 were connected during measurements. All body worn measurements were performed in GPRS mode.



5.2 Scan Procedures

First coarse scans are used for quick determination of the field distribution. Next a cube scan, 5x5x7 points; spacing between each point 7.5x7.5x5 mm, is performed around the highest E-field value to determine the averaged SAR-distribution over 1g.

5.3 SAR Averaging Methods

The maximum SAR value is averaged over its volume using interpolation and extrapolation.

The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of 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 is based on least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 30 mm in all z-axis, polynomials of order four are calculated. This polynomial is then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1mm from one another.

6. MEASUREMENT UNCERTAINTY

6.1 Description of Individual Measurement Uncertainty

6.1.1 Assessment Uncertainty

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	±1.0	R	√3	1	±0.6	∞
Linearity	E2.4	±4.7	R	√3	1	±2.7	∞
System Detection Limits	E2.5	±1.0	R	√3	1	±0.6	∞
Readout Electronics	E2.6	±1.0	N	1	1	±1.0	∞
Response Time	E2.7	±0.8	R	√3	1	±0.5	∞
Integration Time	E2.8	±2.6	R	√3	1	±1.5	∞
RF Ambient Conditions - Noise	E6.1	±3.0	R	√3	1	±1.7	∞
RF Ambient Conditions - Reflections	E6.1	±3.0	R	√3	1	±1.7	∞
Probe Positioner Mechanical Tolerance	E6.2	±0.4	R	√3	1	±0.2	∞
Probe Positioning with respect to Phantom Shell	E6.3	±2.9	R	√3	1	±1.7	∞
Extrapolation, interpolation and Integration Algorithms for Max. SAR Evaluation	E5.2	±1.0	R	√3	1	±0.6	∞
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			±13.6	161
Coverage Factor for 95%			k=2				
Expanded Standard Uncertainty						±27.1	

7. RESULTS

Corresponding SAR distribution printouts of maximum results in every operating mode and position are shown in Appendix B. It also includes Z-plots of maximum measurement results in head and body worn configurations. The SAR distributions are substantially similar or equivalent to the plots submitted regardless of used channel in each mode and position. The coarse scans used in the head configuration measurements cover the whole head region.

7.1 Head Configuration

Mode	Channel/ *f* (MHz)	Power EIRP (dBm)	SAR, averaged over 1g (W/kg)			
			Left-hand		Right-hand	
			Cheek	Tilted	Cheek	Tilted
GSM 1900	512/1850.20	31.2		**0.46**		
	661/1880.00	28.9	0.38	0.39	0.37	0.34
	810/1909.80	25.9		0.30		

7.2 Body Worn Configuration

Mode	Channel/ *f* (MHz)	Power EIRP (dBm)	SAR, averaged over 1g (W/kg)	
			Headset HS-5	Headset HDS-3
GPRS 1900	512/1850.20	31.2	**0.95**	0.92
	661/1880.00	28.9	0.84	0.81
	810/1909.80	25.9	0.68	0.60

APPENDIX A.

Validation Test Printouts

Date/Time: 07/29/03 09:42:08

Test Laboratory: Nokia Mobile Phones, Oulu; DTX07978-EN

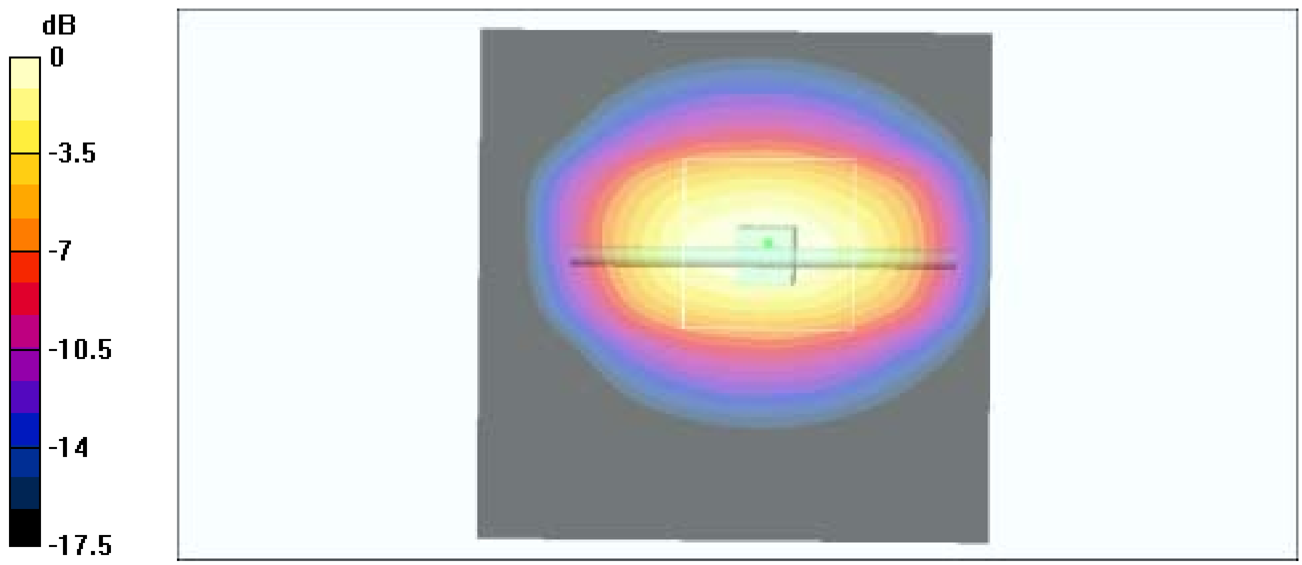
DUT: Dipole 1900 MHz; Type: D1900V2; Serial:5d030

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL1900 (σ = 1.43274 mho/m, ε_r = 39.4578, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1765; ConvF(5.2, 5.2, 5.2); Calibrated: 16.04.2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn555; Calibrated: 06.03.2003
- Phantom: SAM 3; Type: SAM 4.0; Serial: 1215
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Head 1900, t=21.9 C/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 94.8 V/m
Power Drift = 0.01 dB
Maximum value of SAR = 11.8 mW/g

Head 1900, t=21.9 C/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 18.5 W/kg
SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.37 mW/g
Reference Value = 94.8 V/m
Power Drift = 0.01 dB
Maximum value of SAR = 11.7 mW/g



0 dB = 11.7mW/g

Date/Time: 07/29/03 15:30:53

Test Laboratory: Nokia Mobile Phones, Oulu; DTX07978-EN

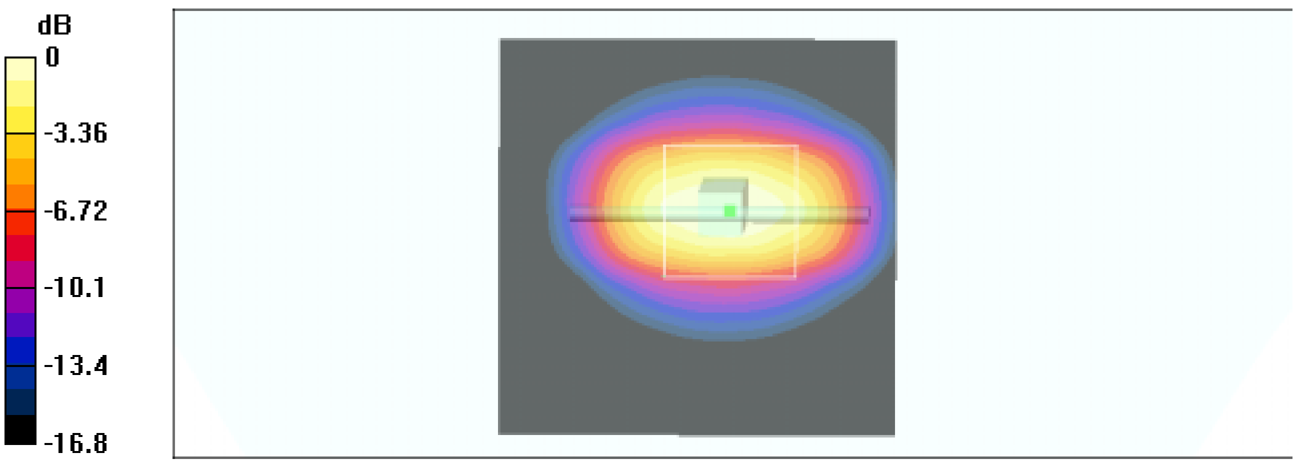
DUT: Dipole 1900 MHz; Type: D1900V2; Serial:5d030

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: BSL1900 (σ = 1.55035 mho/m, ε_r = 52.4481, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1765; ConvF(4.9, 4.9, 4.9); Calibrated: 16.04.2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn555; Calibrated: 06.03.2003
- Phantom: SAM 3; Type: SAM 4.0; Serial: 1215
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Muscle 1900, t=22.3 C/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 92.1 V/m
Power Drift = -0.06 dB
Maximum value of SAR = 12.3 mW/g

Muscle 1900, t=22.3 C/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Peak SAR (extrapolated) = 18.1 W/kg
SAR(1 g) = 10.3 mW/g; SAR(10 g) = 5.4 mW/g
Reference Value = 92.1 V/m
Power Drift = -0.06 dB
Maximum value of SAR = 11.5 mW/g



0 dB = 11.5mW/g

APPENDIX B.

SAR Distribution Printouts

Date/Time: 07/29/03 10:31:43

Test Laboratory: Nokia Mobile Phones, Oulu; DTX07978-EN

DUT: LJPRH-30; Type: RH-30; Serial: 004400/18/168990/0

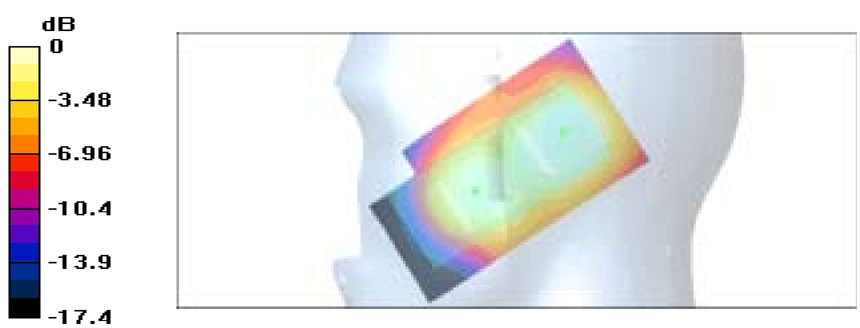
Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: HSL1900 (σ = 1.41155 mho/m, ε_r = 39.5579, ρ = 1000 kg/m^3)
Phantom section: Left Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1765; ConvF(5.2, 5.2, 5.2); Calibrated: 16.04.2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn555; Calibrated: 06.03.2003
- Phantom: SAM 3; Type: SAM 4.0; Serial: 1215
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

cheek, t=21.9 C, worst case extrapolation/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 16.9 V/m
Power Drift = -0.09 dB
Maximum value of SAR = 0.393 mW/g

cheek, t=21.9 C, worst case extrapolation/Zoom Scan (5x5x7)/Cube 0 (upper): Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Peak SAR (extrapolated) = 0.689 W/kg
SAR(1 g) = 0.384 mW/g; SAR(10 g) = 0.22 mW/g
Reference Value = 16.9 V/m
Power Drift = -0.09 dB
Maximum value of SAR = 0.401 mW/g

cheek, t=21.9 C, worst case extrapolation/Zoom Scan (5x5x7)/Cube 1 (lower): Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Peak SAR (extrapolated) = 0.494 W/kg
SAR(1 g) = 0.281 mW/g; SAR(10 g) = 0.168 mW/g
Reference Value = 16.9 V/m
Power Drift = -0.09 dB
Maximum value of SAR = 0.29 mW/g



0 dB = 0.29mW/g

Date/Time: 07/29/03 12:43:23

Test Laboratory: Nokia Mobile Phones, Oulu; DTX07978-EN

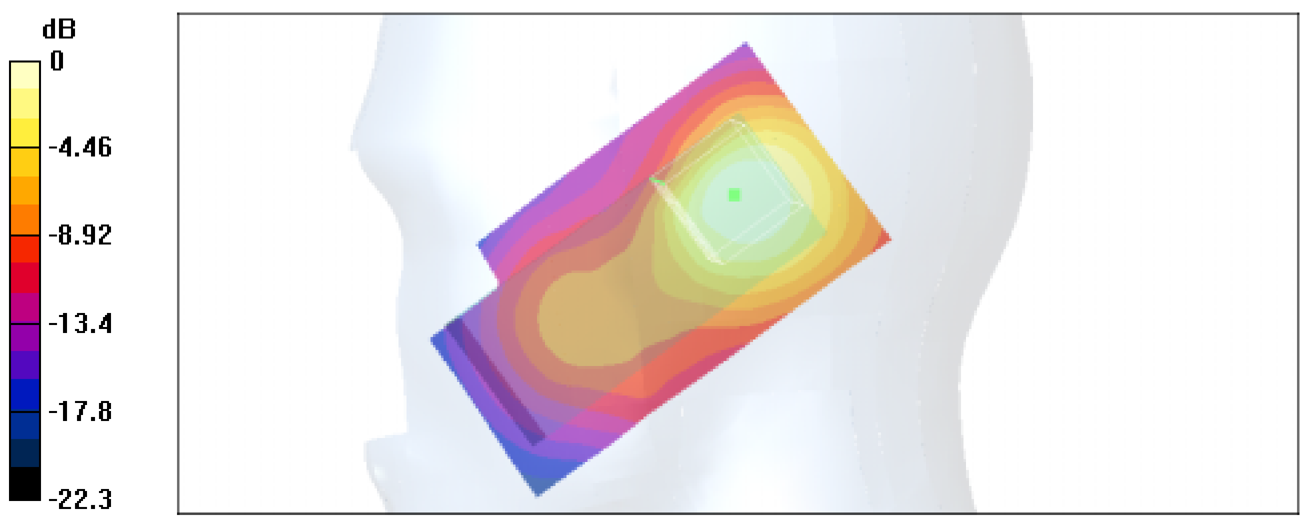
DUT: LJPRH-30; Type: RH-30; Serial: 004400/18/168990/0

Communication System: GSM 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: HSL1900 (σ = 1.38227 mho/m, ε_r = 39.7047, ρ = 1000 kg/m^3)
Phantom section: Left Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1765; ConvF(5.2, 5.2, 5.2); Calibrated: 16.04.2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn555; Calibrated: 06.03.2003
- Phantom: SAM 3; Type: SAM 4.0; Serial: 1215
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Tilted, t=21.9 C, worst case extrapolation/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 18.8 V/m
Power Drift = -0.06 dB
Maximum value of SAR = 0.524 mW/g

Tilted, t=21.9 C, worst case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Peak SAR (extrapolated) = 0.839 W/kg
SAR(1 g) = 0.463 mW/g; SAR(10 g) = 0.261 mW/g
Reference Value = 18.8 V/m
Power Drift = -0.06 dB
Maximum value of SAR = 0.465 mW/g



0 dB = 0.465mW/g

Date/Time: 07/29/03 11:46:39

Test Laboratory: Nokia Mobile Phones, Oulu; DTX07978-EN

DUT: LJPRH-30; Type: RH-30; Serial: 004400/18/168990/0

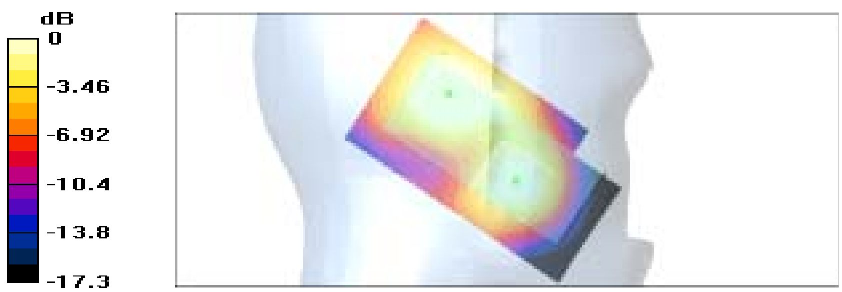
Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: HSL1900 (σ = 1.41155 mho/m, ε_r = 39.5579, ρ = 1000 kg/m^3)
Phantom section: Right Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1765; ConvF(5.2, 5.2, 5.2); Calibrated: 16.04.2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn555; Calibrated: 06.03.2003
- Phantom: SAM 3; Type: SAM 4.0; Serial: 1215
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Cheek, t=21.8 C, worst case extrapolation/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 14.6 V/m
Power Drift = -0.07 dB
Maximum value of SAR = 0.398 mW/g

Cheek, t=21.8 C, worst case extrapolation/Zoom Scan (5x5x7)/Cube 0 (upper): Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Peak SAR (extrapolated) = 0.759 W/kg
SAR(1 g) = 0.372 mW/g; SAR(10 g) = 0.21 mW/g
Reference Value = 14.6 V/m
Power Drift = -0.07 dB
Maximum value of SAR = 0.383 mW/g

Cheek, t=21.8 C, worst case extrapolation/Zoom Scan (5x5x7)/Cube 1 (lower): Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Peak SAR (extrapolated) = 0.52 W/kg
SAR(1 g) = 0.294 mW/g; SAR(10 g) = 0.171 mW/g
Reference Value = 14.6 V/m
Power Drift = -0.07 dB
Maximum value of SAR = 0.313 mW/g



0 dB = 0.313mW/g

Date/Time: 07/29/03 12:13:37

Test Laboratory: Nokia Mobile Phones, Oulu; DTX07978-EN

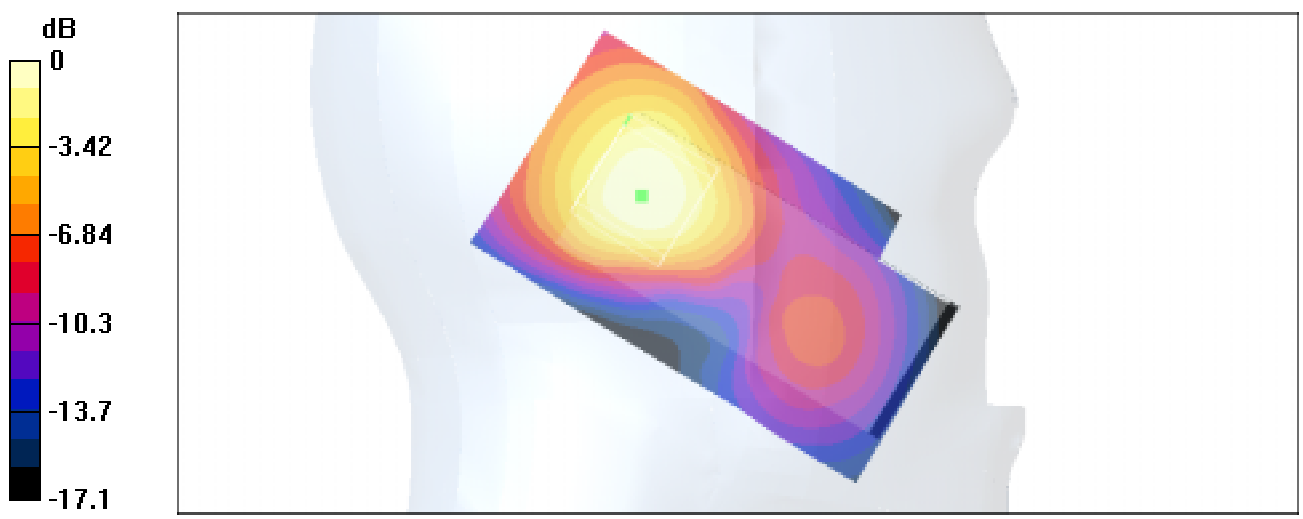
DUT: LJPRH-30; Type: RH-30; Serial: 004400/18/168990/0

Communication System: GSM 1900; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: HSL1900 (σ = 1.41155 mho/m, ε_r = 39.5579, ρ = 1000 kg/m^3)
Phantom section: Right Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1765; ConvF(5.2, 5.2, 5.2); Calibrated: 16.04.2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn555; Calibrated: 06.03.2003
- Phantom: SAM 3; Type: SAM 4.0; Serial: 1215
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Tilted, t=21.8 C, worst case extrapolation/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 15.8 V/m
Power Drift = -0.08 dB
Maximum value of SAR = 0.37 mW/g

Tilted, t=21.8 C, worst case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Peak SAR (extrapolated) = 0.608 W/kg
SAR(1 g) = 0.34 mW/g; SAR(10 g) = 0.196 mW/g
Reference Value = 15.8 V/m
Power Drift = -0.08 dB
Maximum value of SAR = 0.356 mW/g



0 dB = 0.356mW/g

Date/Time: 07/29/03 16:52:52

Test Laboratory: Nokia Mobile Phones, Oulu; DTX07978-EN

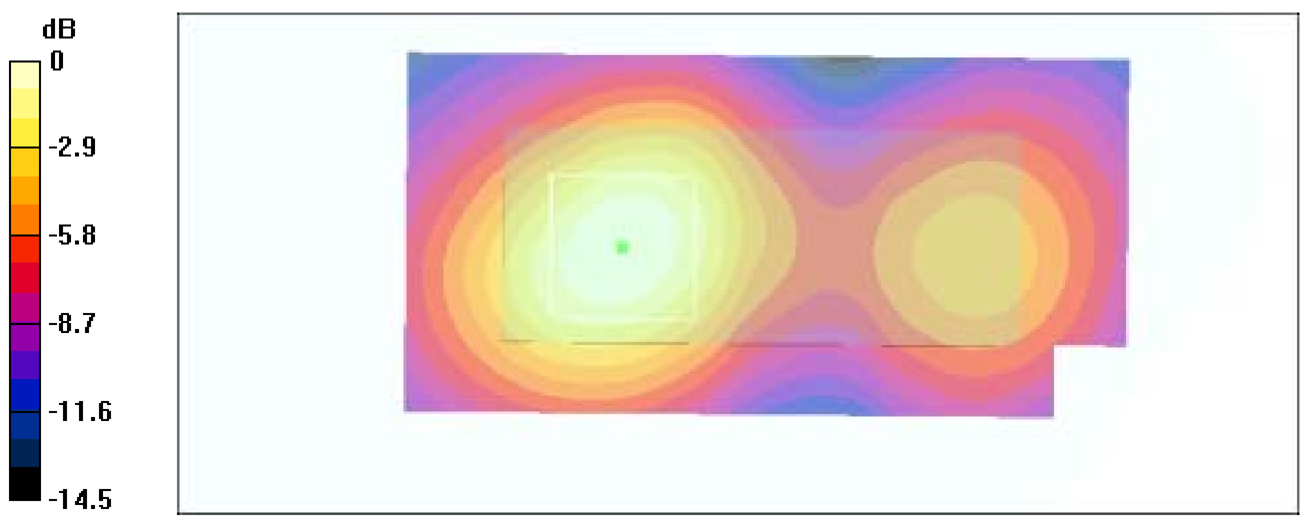
DUT: LJPRH-30; Type: RH-30; Serial: 004400/18/168990/0; Headset: HS-5

Communication System: GPRS 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:4.2
Medium: BSL1900 (σ = 1.50186 mho/m, ε_r = 52.6821, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1765; ConvF(4.9, 4.9, 4.9); Calibrated: 16.04.2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn555; Calibrated: 06.03.2003
- Phantom: SAM 3; Type: SAM 4.0; Serial: 1215
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Body worn, t=22.3 C, worst case extrapolation/Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 21.3 V/m
Power Drift = -0.1 dB
Maximum value of SAR = 0.996 mW/g

Body worn, t=22.3 C, worst case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Peak SAR (extrapolated) = 1.81 W/kg
SAR(1 g) = 0.945 mW/g; SAR(10 g) = 0.553 mW/g
Reference Value = 21.3 V/m
Power Drift = -0.1 dB
Maximum value of SAR = 0.984 mW/g



0 dB = 0.984mW/g

Date/Time: 07/30/03 09:13:57

Test Laboratory: Nokia Mobile Phones, Oulu; DTX07978-EN

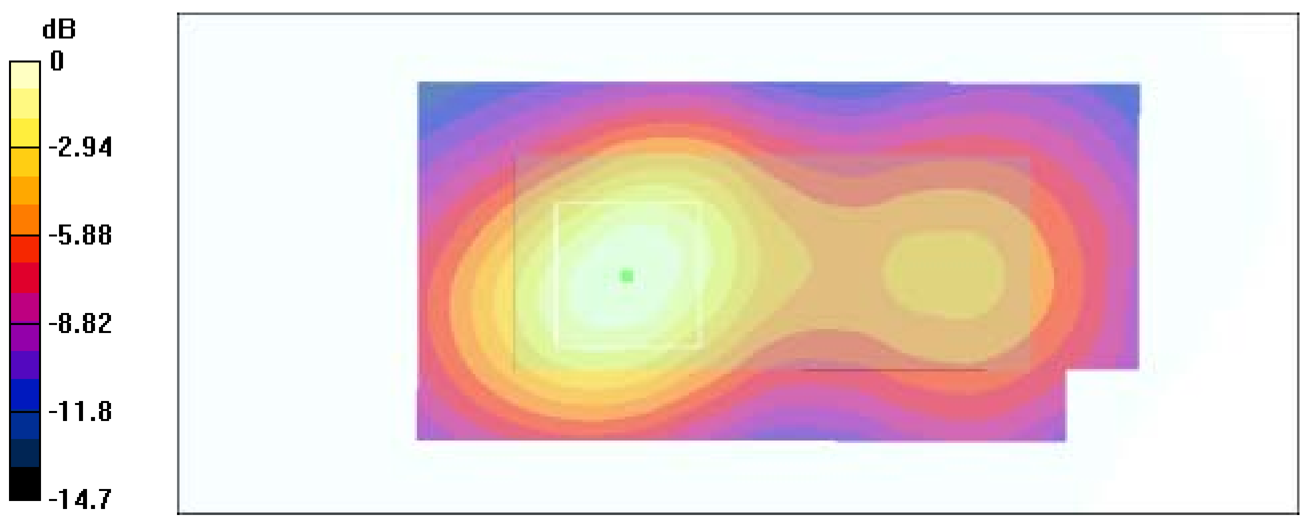
DUT: LJPRH-30; Type: RH-30; Serial: 004400/18/168990/0; Headset: HDS-3

Communication System: GPRS 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:4.2
Medium: BSL1900 (σ = 1.50186 mho/m, ε_r = 52.6821, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1765; ConvF(4.9, 4.9, 4.9); Calibrated: 16.04.2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn555; Calibrated: 06.03.2003
- Phantom: SAM 3; Type: SAM 4.0; Serial: 1215
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Body worn, t=22.2 C, worst case extrapolation/Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 21.3 V/m
Power Drift = -0.1 dB
Maximum value of SAR = 0.968 mW/g

Body worn, t=22.2 C, worst case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Peak SAR (extrapolated) = 1.8 W/kg
SAR(1 g) = 0.922 mW/g; SAR(10 g) = 0.53 mW/g
Reference Value = 21.3 V/m
Power Drift = -0.1 dB
Maximum value of SAR = 0.964 mW/g



0 dB = 0.964mW/g

Date/Time: 07/29/03 12:43:23

Test Laboratory: Nokia Mobile Phones, Oulu; DTX07978-EN

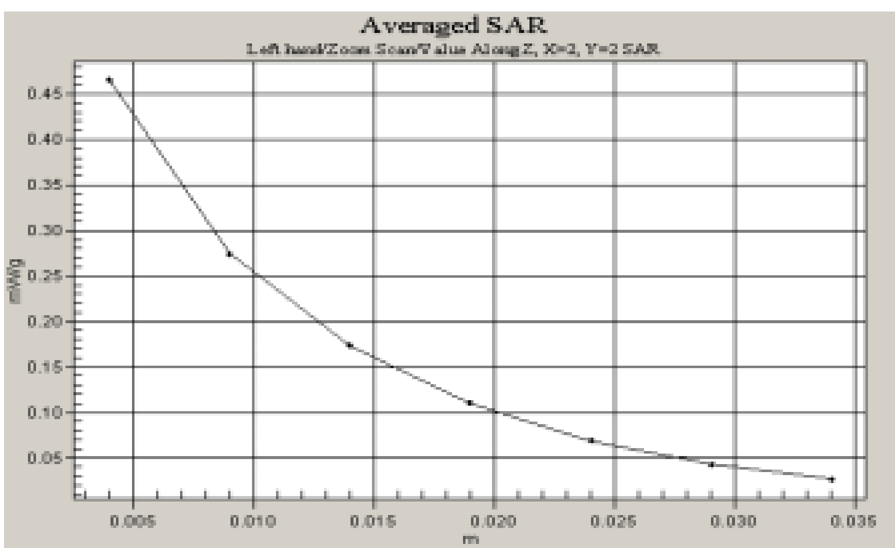
DUT: LJPRH-30; Type: RH-30; Serial: 004400/18/168990/0

Communication System: GSM 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: HSL1900 (σ = 1.38227 mho/m, ε_r = 39.7047, ρ = 1000 kg/m^3)
Phantom section: Left Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1765; ConvF(5.2, 5.2, 5.2); Calibrated: 16.04.2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn555; Calibrated: 06.03.2003
- Phantom: SAM 3; Type: SAM 4.0; Serial: 1215
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Tilted, t=21.9 C, worst case extrapolation/Area Scan (51x91x1): Measurement grid: dx=15mm, dy=15mm
Reference Value = 18.8 V/m
Power Drift = -0.06 dB
Maximum value of SAR = 0.524 mW/g

Tilted, t=21.9 C, worst case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Peak SAR (extrapolated) = 0.839 W/kg
SAR(1 g) = 0.463 mW/g; SAR(10 g) = 0.261 mW/g
Reference Value = 18.8 V/m
Power Drift = -0.06 dB
Maximum value of SAR = 0.465 mW/g



Date/Time: 07/29/03 16:52:52

Test Laboratory: Nokia Mobile Phones, Oulu; DTX07978-EN

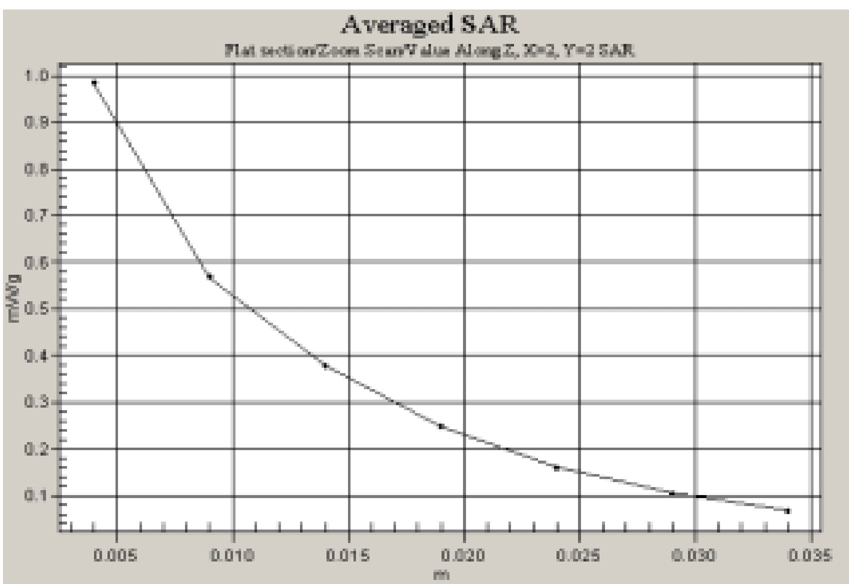
DUT: LJPRH-30; Type: RH-30; Serial: 004400/18/168990/0

Communication System: GPRS 1900; Frequency: 1850.2 MHz;Duty Cycle: 1:4.2
Medium: BSL1900 (σ = 1.50186 mho/m, ε_r = 52.6821, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1765; ConvF(4.9, 4.9, 4.9); Calibrated: 16.04.2003
- Sensor-Surface: 4mm (Mechanical And Optical Surface Detection)
- Electronics: DAE3 Sn555; Calibrated: 06.03.2003
- Phantom: SAM 3; Type: SAM 4.0; Serial: 1215
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Body worn, t=22.3 C, worst case extrapolation/Area Scan (51x101x1): Measurement grid:
dx=15mm, dy=15mm
Reference Value = 21.3 V/m
Power Drift = -0.1 dB
Maximum value of SAR = 0.996 mW/g

Body worn, t=22.3 C, worst case extrapolation/Zoom Scan (5x5x7)/Cube 0: Measurement grid:
dx=7.5mm, dy=7.5mm, dz=5mm
Peak SAR (extrapolated) = 1.81 W/kg
SAR(1 g) = 0.945 mW/g; SAR(10 g) = 0.553 mW/g
Reference Value = 21.3 V/m
Power Drift = -0.1 dB
Maximum value of SAR = 0.984 mW/g



APPENDIX C.

Calibration Certificate(s)

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

Client **Nokia Oyj, Oulu**

CALIBRATION CERTIFICATE

Object(s)	ET3DV6 - SN:1765
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	April 16, 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	Scheduled Calibration
RF generator HP 8684C	US3642U01700	4-Aug-99 (in house check Aug-02)	In house check: Aug-05
Power sensor E4412A	MY41495277	2-Apr-03	Apr-04
Power sensor HP 8481A	MY41092180	18-Sep-02	Sep-03
Power meter EPM E4419B	GB41293874	13-Sep-02	Sep-03
Network Analyzer HP 8753E	US38432426	3-May-00	In house check: May 03
Fluke Process Calibrator Type 702	SN: 6295803	3-Sep-01	Sep-03

	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	D. Vetterli
Approved by:	Katja Pokovic	Laboratory Director	[signature]

Date issued: April 17, 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.

Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

Probe ET3DV

SN:1765

Manufactured: January 20, 2003
Last calibration: April 16, 2003

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ET3DV SN:1765

Sensitivity in Free Space

NormX	**1.60**	$\mu V/(V/m)^2$
NormY	**1.81**	$\mu V/(V/m)^2$
NormZ	**1.86**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**95**	mV
DCP Y	**95**	mV
DCP Z	**95**	mV

Sensitivity in Tissue Simulating Liquid

Head 835 MHz ε_r = 41.5 ± 5% σ = 0.90 ± 5% mho/m

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

ConvF X	**6.6** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**6.6** ± 9.5% (k=2)		Alpha	**0.66**
ConvF Z	**6.6** ± 9.5% (k=2)		Depth	**1.81**

Head 1880 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	**0.59**
ConvF Z	**5.2** ± 9.5% (k=2)		Depth	**2.38**

Boundary Effect

Head 835 MHz Typical SAR gradient: 5 % per mm

Probe Tip to Boundary	**1 mm**	**2 mm**
SAR_{be} [%] Without Correction Algorithm	9.4	4.8
SAR_{be} [%] With Correction Algorithm	0.1	0.3

Head 1880 MHz Typical SAR gradient: 10 % per mm

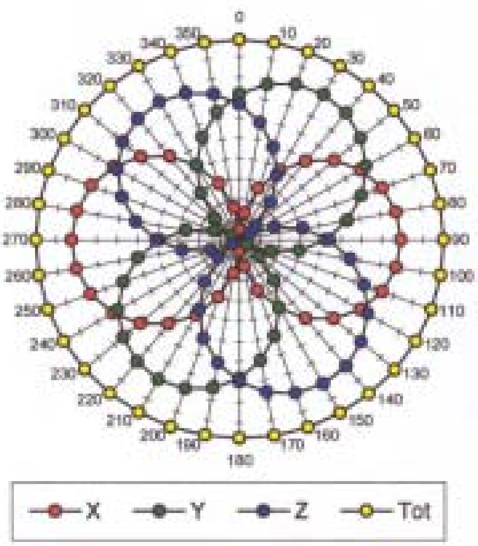
Probe Tip to Boundary	**1 mm**	**2 mm**
SAR_{be} [%] Without Correction Algorithm	14.0	9.2
SAR_{be} [%] With Correction Algorithm	0.2	0.3

Sensor Offset

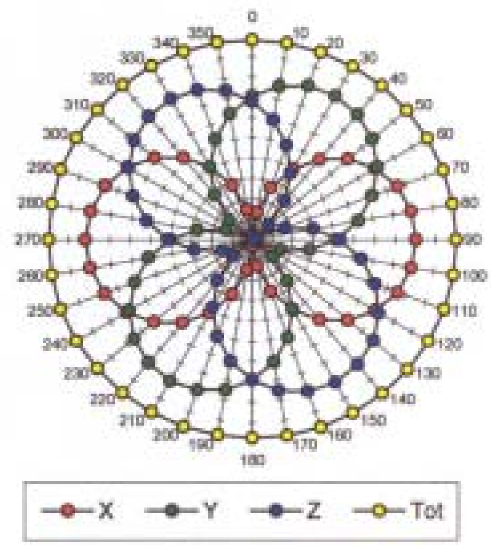
Probe Tip to Sensor Center	**2.7**	mm
Optical Surface Detection	**1.2 ± 0.2**	mm

Receiving Pattern (ϕ , θ = 0°

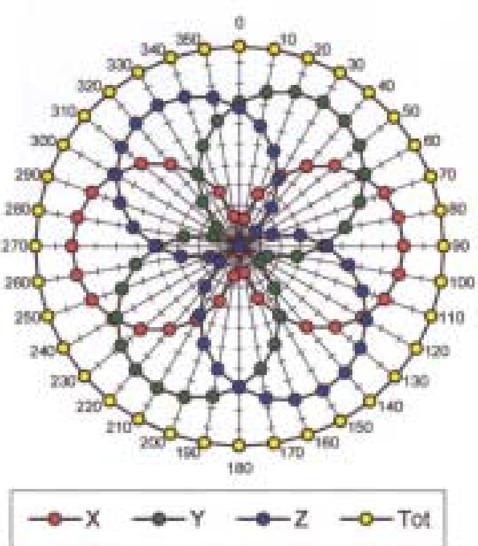
f = 30 MHz, TEM cell ifi110



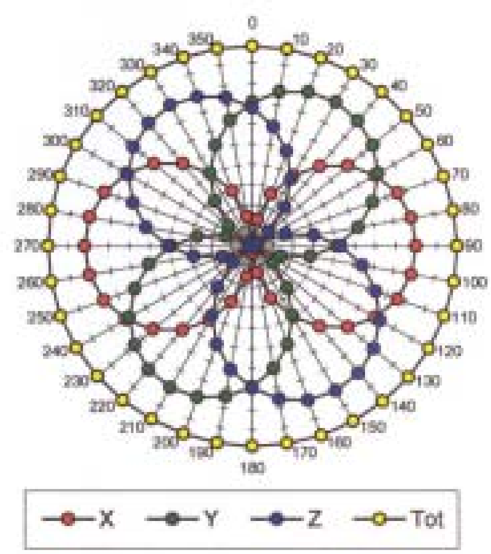
f = 100 MHz, TEM cell ifi110

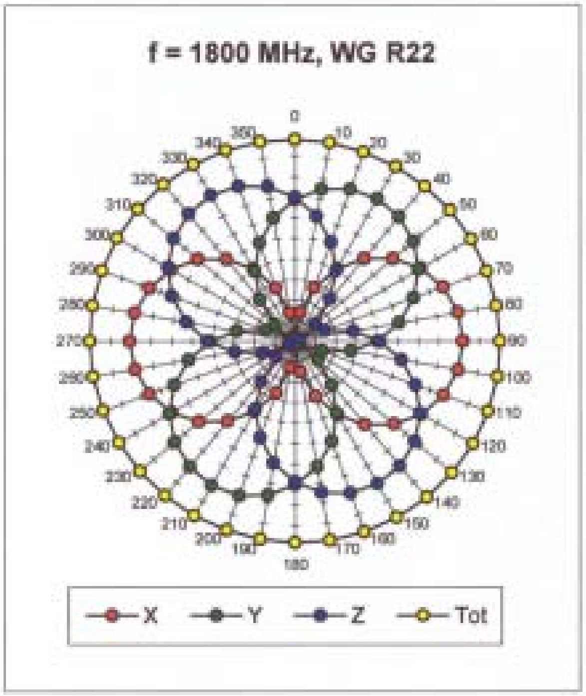


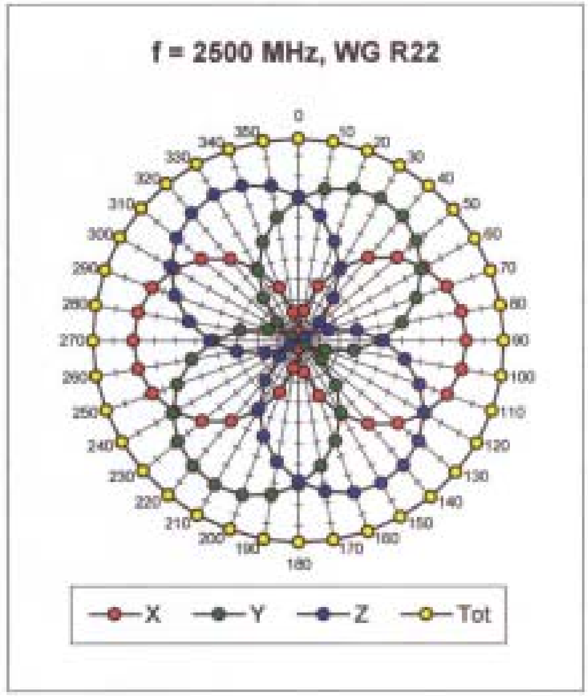
f = 300 MHz, TEM cell ifi110



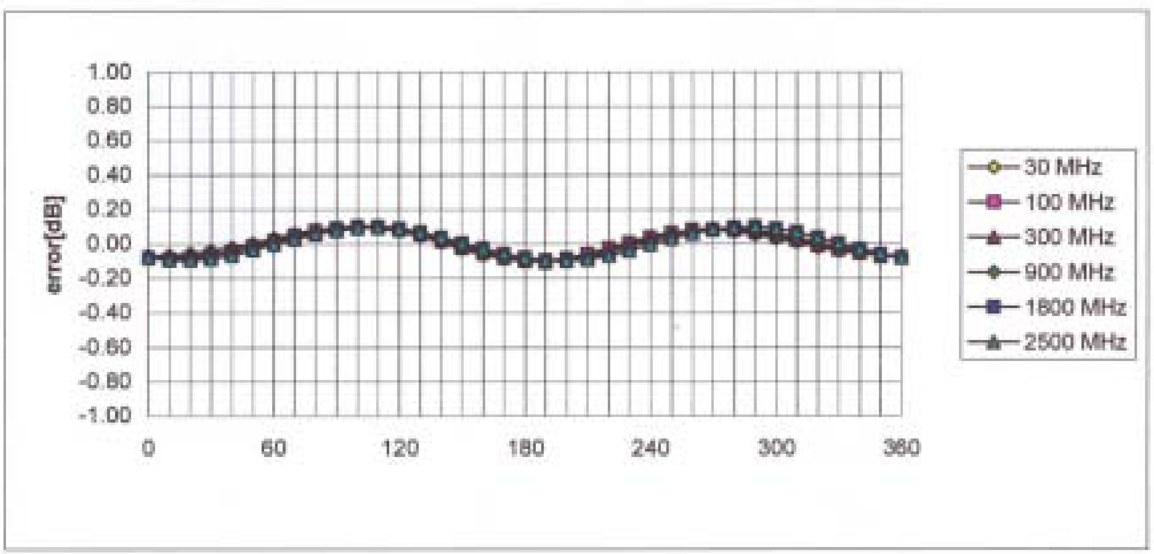
f = 900 MHz, TEM cell ifi110





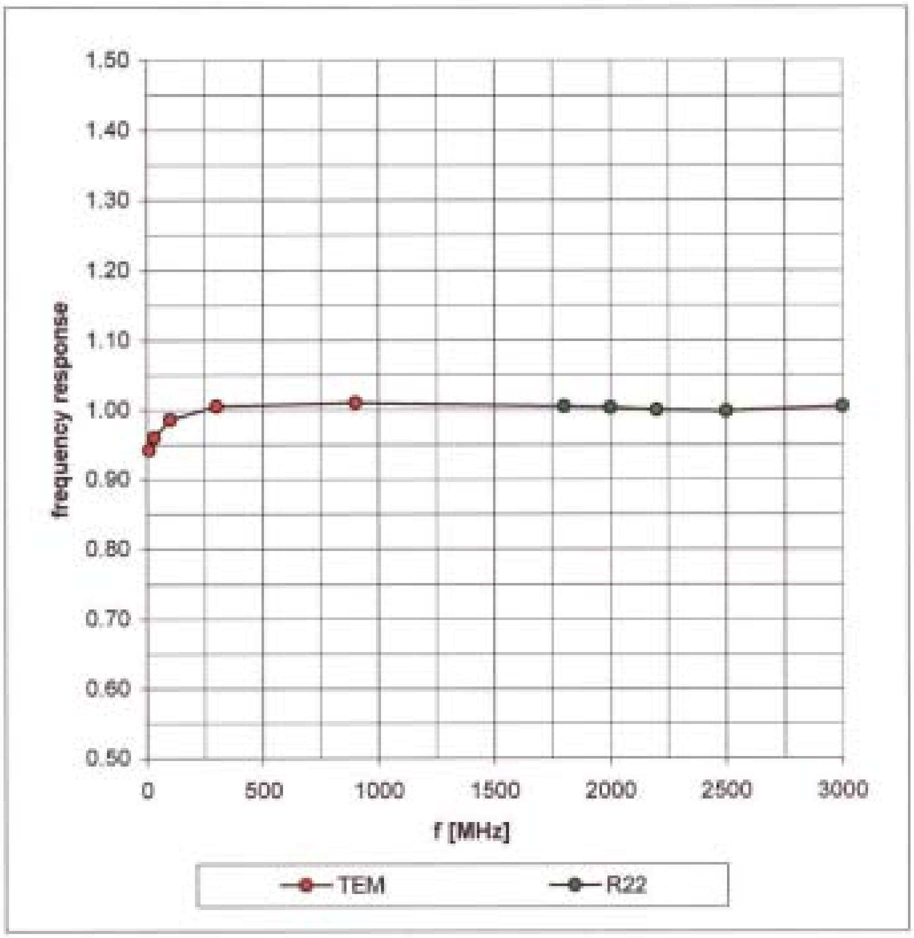


Isotropy Error (ϕ), θ = 0°



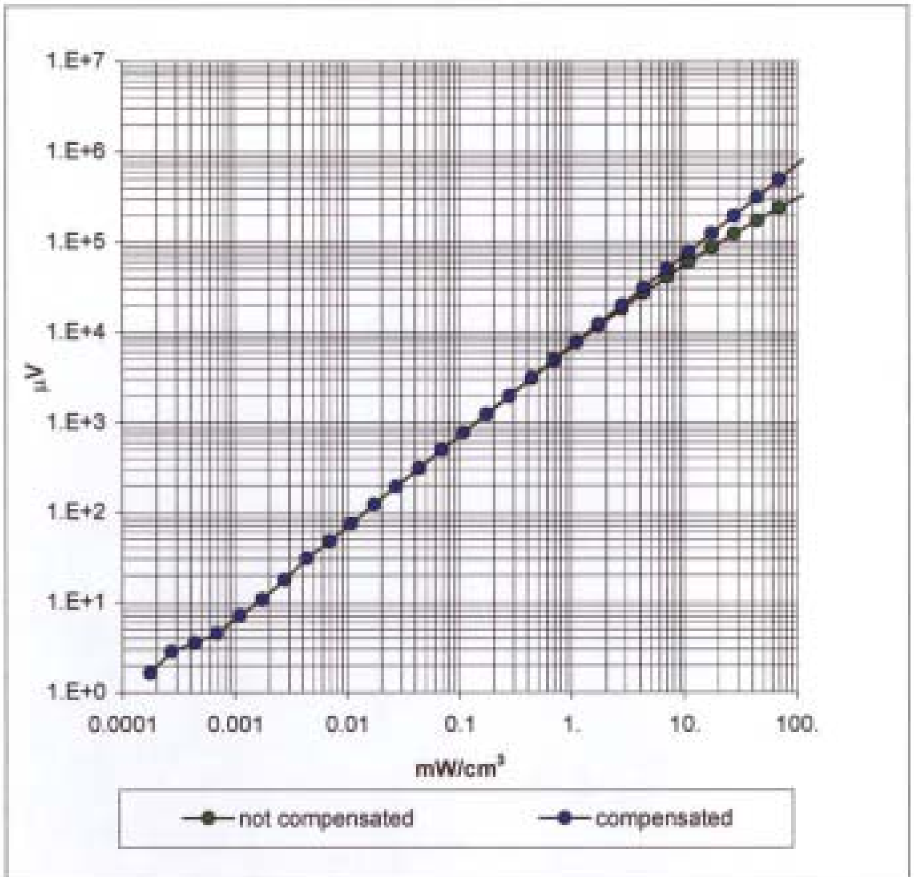
Frequency Response of E-Field

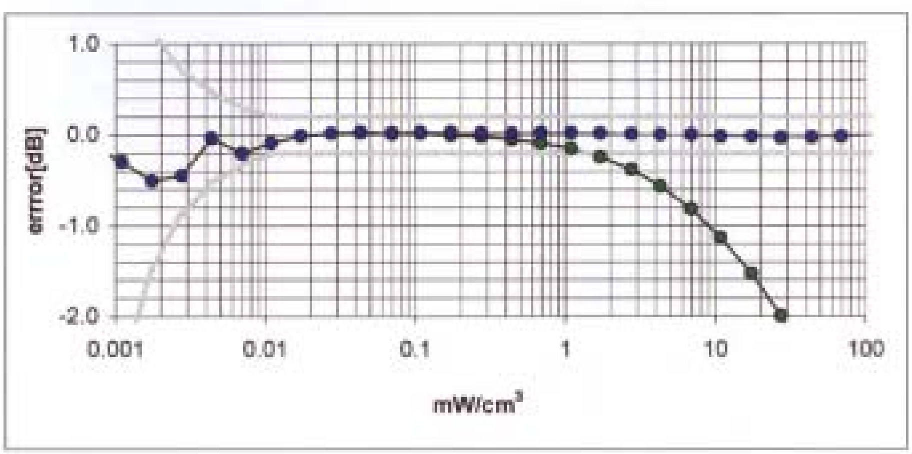
(TEM-Cell:ifi110, Waveguide R22)



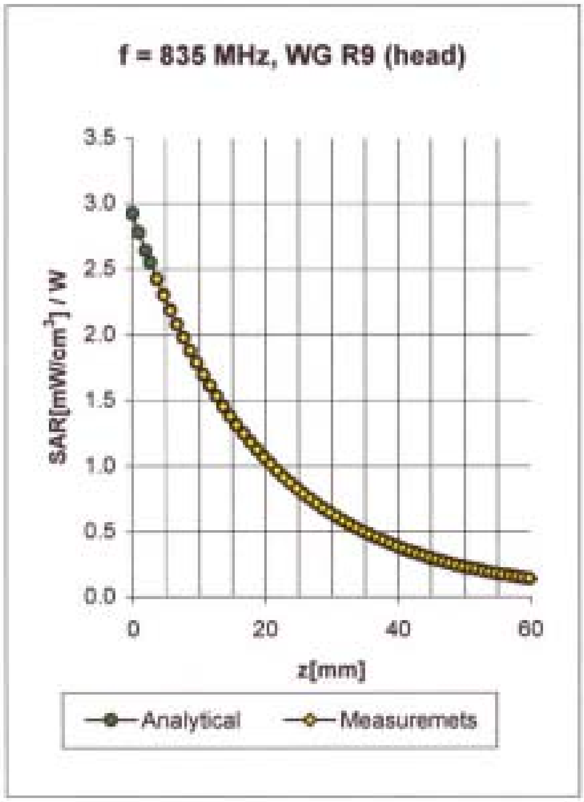
Dynamic Range f(SAR_{brain})

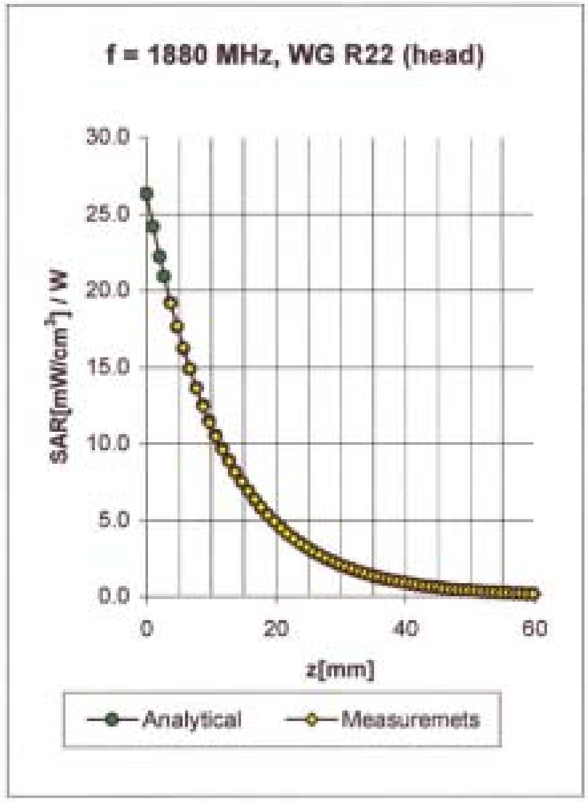
(Waveguide R22)





Conversion Factor Assessment





Head **835 MHz** ε_r **= 41.5 ± 5%** σ **= 0.90 ± 5% mho/m**

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

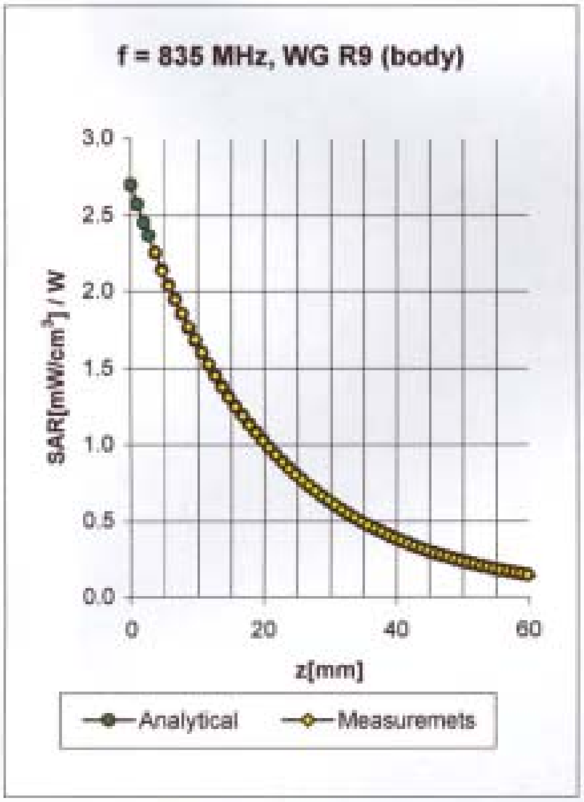
ConvF X	**6.6** ± 9.5% (k=2)		Boundary effect:	
ConvF Y	**6.6** ± 9.5% (k=2)		Alpha	**0.66**
ConvF Z	**6.6** ± 9.5% (k=2)		Depth	**1.81**

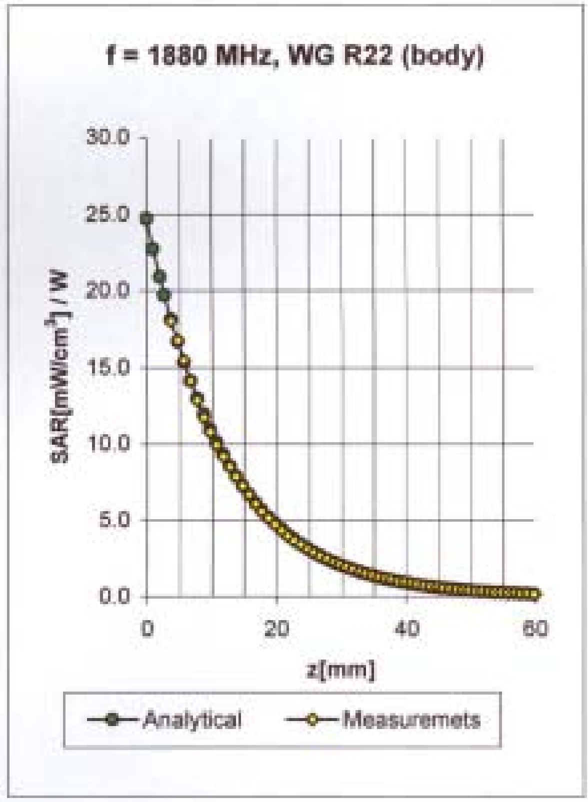
Head **1880 MHz** ε_r **= 40.0 ± 5%** σ **= 1.40 ± 5% mho/m**

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	**0.59**
ConvF Z	**5.2** ± 9.5% (k=2)		Depth	**2.38**

Conversion Factor Assessment





Body **835 MHz** **ε_r = 55.2 ± 5%** **σ = 0.97 ± 5% mho/m**

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

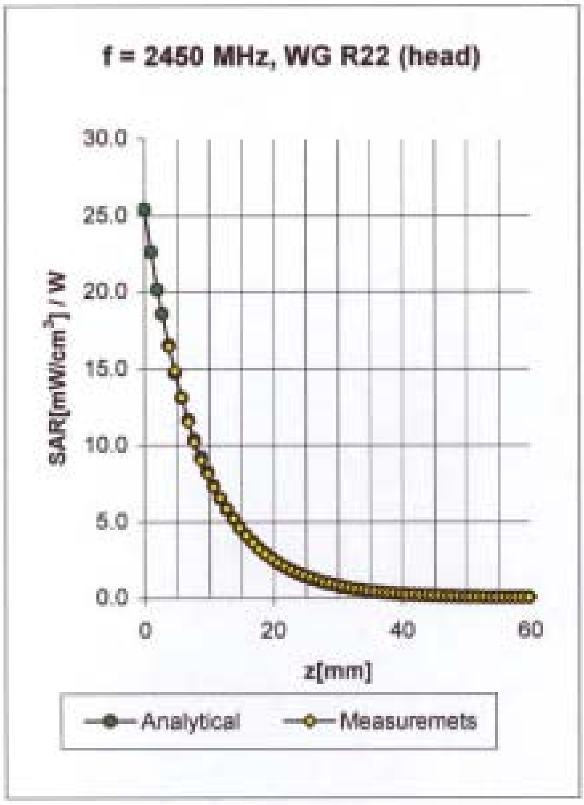
ConvF X	**6.4** ± 9.5% (k=2)	Boundary effect:	
ConvF Y	**6.4** ± 9.5% (k=2)	Alpha	**0.50**
ConvF Z	**6.4** ± 9.5% (k=2)	Depth	**2.16**

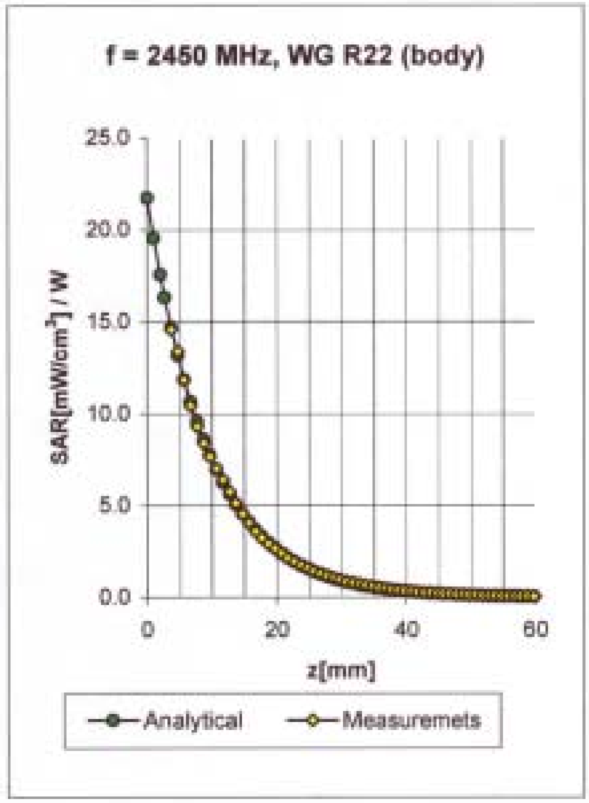
Body **1880 MHz** **ε_r = 53.3 ± 5%** **σ = 1.52 ± 5% mho/m**

Valid for f=1710-1910 MHz with Head 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	**0.65**
ConvF Z	**4.9** ± 9.5% (k=2)	Depth	**2.41**

Conversion Factor Assessment





Head **2450** **MHz** ε_r **= 39.2 ± 5%** σ **= 1.80 ± 5% mho/m**

Valid for f=2400-2500 MHz with Head Tissue Simulating Liquid according to EN 50361, P1528-200X

ConvF X	**5.1** ± 8.9% (k=2)		Boundary effect:	
ConvF Y	**5.1** ± 8.9% (k=2)		Alpha	**1.30**
ConvF Z	**5.1** ± 8.9% (k=2)		Depth	**1.60**

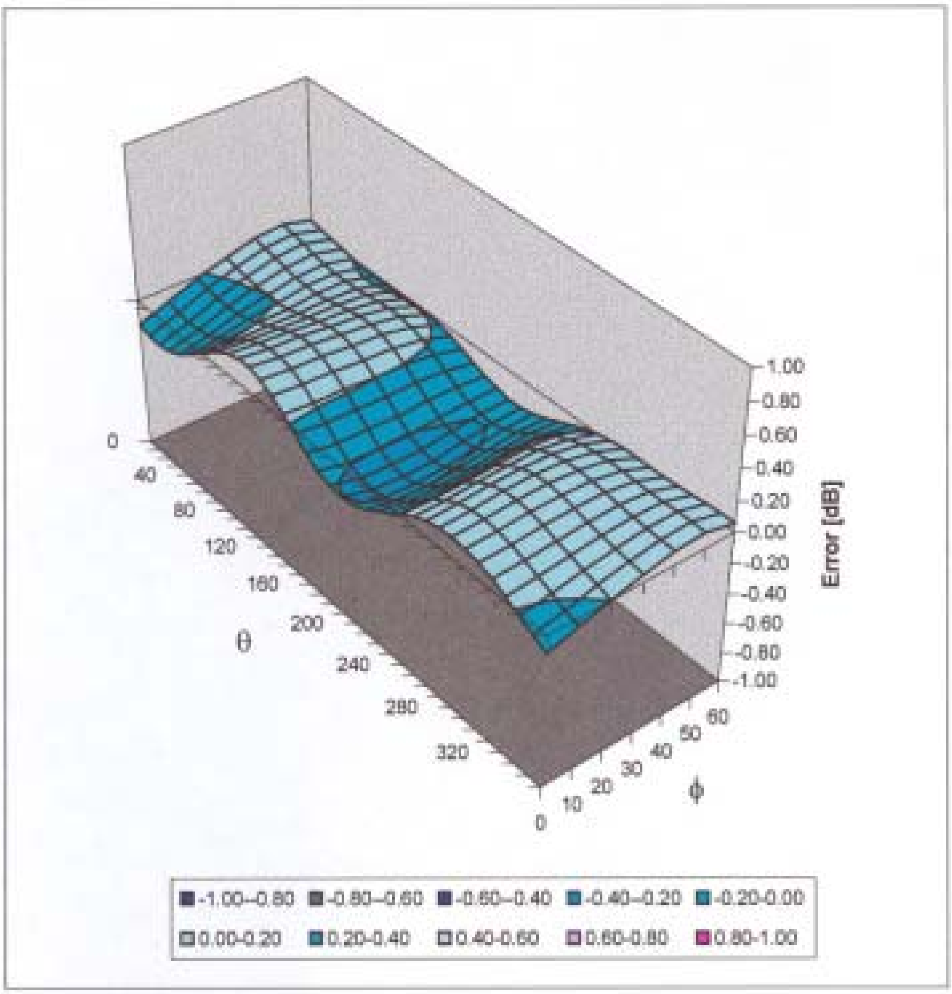
Body **2450** **MHz** ε_r **= 52.7 ± 5%** σ **= 1.95 ± 5% mho/m**

Valid for f=2400-2500 MHz with BODY Tissue Simulating Liquid according to OET 65 Suppl. C

ConvF X	**4.6** ± 8.9% (k=2)		Boundary effect:	
ConvF Y	**4.6** ± 8.9% (k=2)		Alpha	**1.57**
ConvF Z	**4.6** ± 8.9% (k=2)		Depth	**1.54**

Deviation from Isotropy in HSL

Error (θϕ), f = 900 MHz



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

Client **Nokia Oyj, Oulu**

CALIBRATION CERTIFICATE

Object(s)	D1900V2 - SN:5d030
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	April 8, 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	Scheduled Calibration
RF generator R&S SML-03	100698	27-Mar-2002	In house check: Mar-05
Power sensor HP 8481A	MY41092317	18-Oct-02	Oct-04
Power sensor HP 8481A	US37292783	30-Oct-02	Oct-03
Power meter EPM E442	GB37480704	30-Oct-02	Oct-03
Network Analyzer HP 8753E	US38432426	3-May-00	In house check: May 03

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

Date issued: April 11, 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.

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 1 245 9700, Fax +41 1 245 9779
info@speag.com, http://www.speag.com

DASY

Dipole Validation Kit

Type: D1900V2

Serial: 5d030

Manufactured: December 17, 2002
Calibrated: April 8, 2003

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with head simulating solution of the following electrical parameters at 1900 MHz:

Relative Dielectricity	**38.8**	± 5%
Conductivity	**1.44 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.2 at 1900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**42.0 mW/g** ± 16.8 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**21.7 mW/g** ± 16.2 % (k=2)[1]

[1] validation uncertainty

3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay:	**1.189 ns**	(one direction)
Transmission factor:	**0.990**	(voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 1900 MHz:	Re{Z} = **50.8 Ω**
	Im {Z} = **3.5 Ω**
Return Loss at 1900 MHz	**-28.8 dB**

4. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with body simulating glycol solution of the following electrical parameters at 1900 MHz:

Relative Dielectricity	**51.2**	± 5%
Conductivity	**1.59 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 4.8 at 1900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.
The dipole input power (forward power) was 250mW ± 3 %. The results are normalized to 1W input power.

5. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 4. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the advanced extrapolation are:

averaged over 1 cm^3 (1 g) of tissue:	**42.8 mW/g** ± 16.8 % (k=2)[2]
averaged over 10 cm^3 (10 g) of tissue:	**22.1 mW/g** ± 16.2 % (k=2)[2]

6. Dipole Impedance and Return Loss

The dipole was positioned at the flat phantom sections according to section 4 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 1900 MHz:	Re{Z} = **46.9 Ω**
	Im {Z} = **4.0 Ω**
Return Loss at 1900 MHz	**-25.5 dB**

7. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

8. Design

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

Small end caps have been added to the dipole arms in order to improve matching when loaded according to the position as explained in Section 1. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

9. Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

---

[2] validation uncertainty

Date/Time: 04/01/03 15:53:35

Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN5d030_SN1507_HSL1900_010403.da4

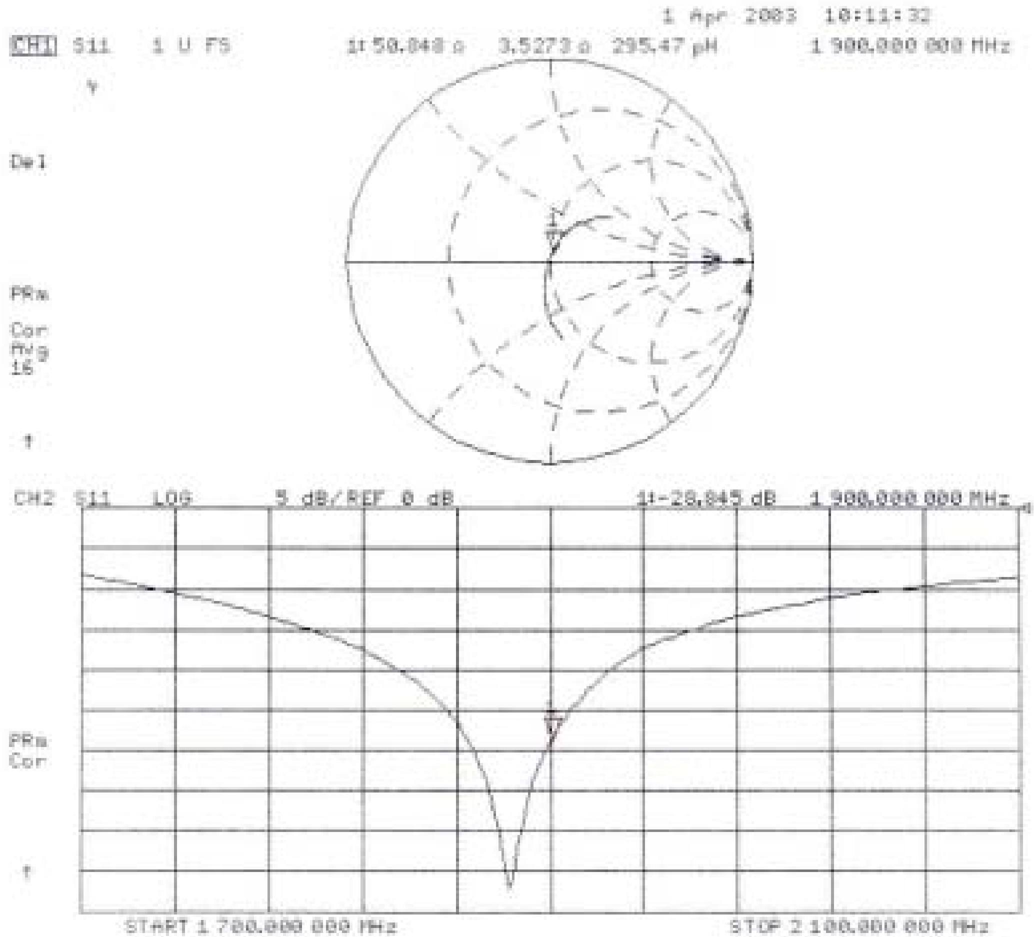
DUT: Dipole 1900 MHz; Serial: D1900V2 - SN5d030
Program: Dipole Calibration

Communication System: CW-1900; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL 1900 MHz; (σ = 1.44 mho/m, ε_r = 38.78, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1507; ConvF(5.2, 5.2, 5.2); 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 33; Postprocessing SW: SEMCAD, V1.6 Build 109

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.5 V/m
Peak SAR = 18.4 W/kg
SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.42 mW/g
Power Drift = 0.03 dB

5J030


1 Apr 2003 10:11:32
CH1 S11 1 U FS
1: 50.840 Ω 3.5273 Ω 295.47 pH
1 900.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG 5 dB/REF 0 dB
1: -28.845 dB 1 900.000 000 MHz
PRm
Cor
START 1 700.000 000 MHz
STOP 2 100.000 000 MHz

Date/Time: 04/08/03 14:15:07

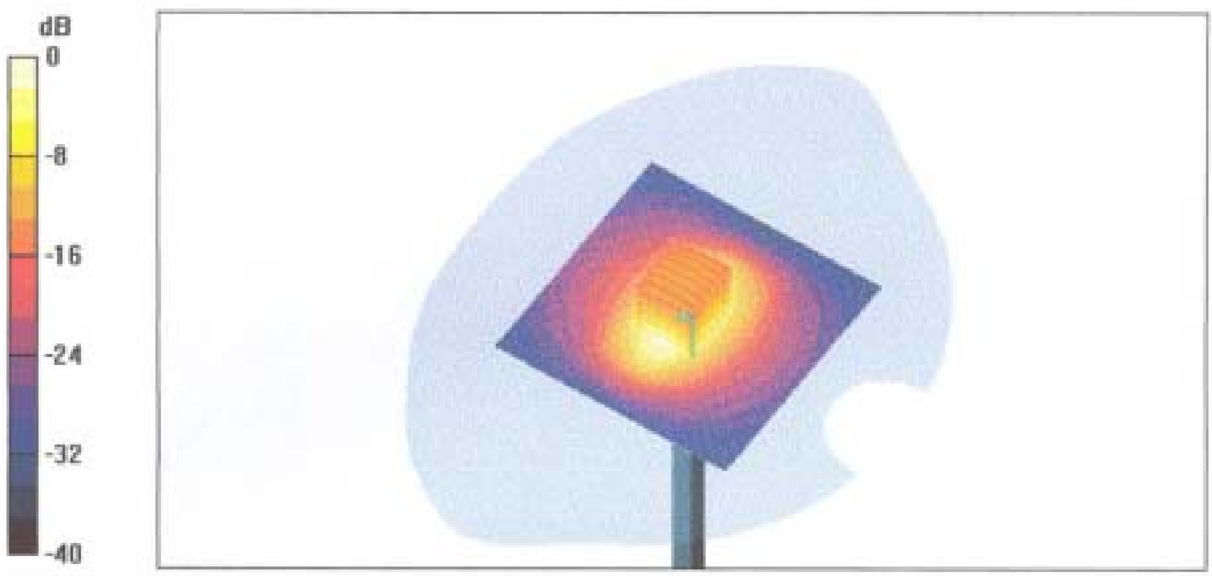
Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN5d030_SN1507_M1900_080403.da4

DUT: Dipole 1900 MHz; Serial: D1900V2 - SN5d030
Program: Dipole Calibration

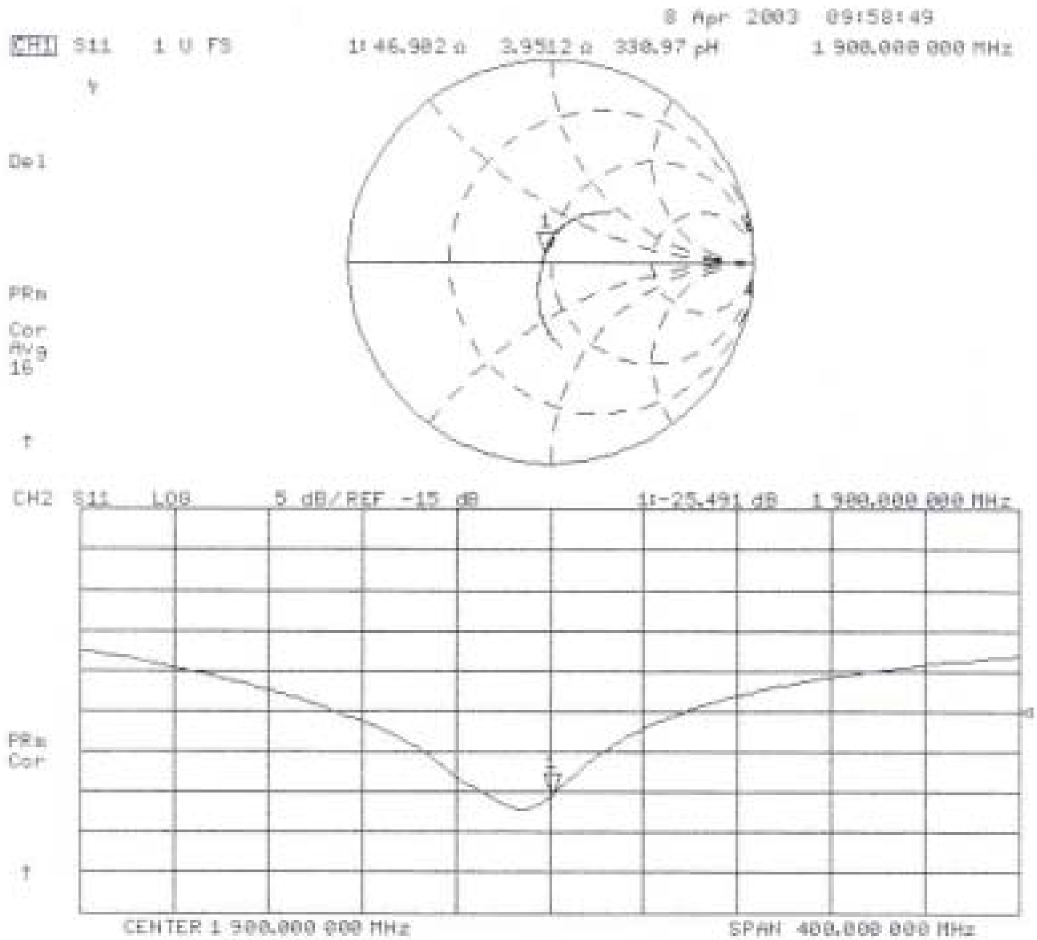
Communication System: CW-1900; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: Muscle 1900 MHz; (σ = 1.59 mho/m, ε_r = 51.2, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1507; ConvF(4.8, 4.8, 4.8); 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 33; Postprocessing SW: SEMCAD, V1.6 Build 109

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 91.4 V/m
Peak SAR = *18.7 W/kg*
SAR(1 g) = 10.7 mW/g; SAR(10 g) = 5.52 mW/g
Power Drift = 0.03 dB



5d030
Body


8 Apr 2003 09:58:49
CH1 S11 1 U FS 1: 46.902 Ω 3.9512 Ω 330.97 pH 1 900.000 000 MHz
Del
PRm
Cor
Avg
16
CH2 S11 LOG 5 dB/REF -15 dB 1:-25.491 dB 1 900.000 000 MHz
PRm
Cor
CENTER 1 900.000 000 MHz
SPAN 400.000 000 MHz