TCC
Copenhagen

DANAK
Reg. Nr. 416

SAR Compliance Test Report

Test report no.:	DTX10154-EN	Date of report:	April 13, 2004
Template version:	3	Number of pages:	20
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Responsible test engineer:	Leif Funch Klysner	Product contact person:	Ernest Mayer
Measurements made by:	Lili Nie		
Tested device:	RH-52		
FCC ID:	QVVRH-52	IC ID:	661AE-RH52
Supplement reports:	-		

Testing has been carried out in accordance with:

47CFR §2.1093
Radiofrequency Radiation Exposure Evaluation: Portable Devices

FCC OET Bulletin 65 (Edition 97-01), Supplement C (Edition 01-01)
Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields

RSS-102
Evaluation Procedure for Mobile and Portable Radio Transmitters with Respect to Health Canada's Safety Code 6 for Exposure of Humans to Radio Frequency Fields

IEEE 1528 - 2003
IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques

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

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: 04/13/2004

For the contents:

Ruben Hansen
Engineering Manager

Leif Funch Klysner
Test Engineer

CONTENTS

1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Period of test	02/13/2004 – 02/24/2004
SN, HW and SW numbers of tested device	SN: 004400/36/160794/6 HW: 3006 SW: 3.0405.1_BT DUT#233517
Batteries used in testing	BL-5C. DUT#233524, 233525, 233538
Headsets used in testing	HS-5 DUT#233555, HS-10 DUT#233556
Other accessories used in testing	MMC Card DUT#233526
State of sample	Prototype unit
Notes	

1.2 Maximum Results

The maximum measured SAR values for Head configuration and Body Worn configuration are given in section 1.2.1 and 1.2.2 respectively. The device conforms to the requirements of the standard(s) when the maximum measured SAR value is less than or equal to the limit.

1.2.1 Head Configuration

Mode	Ch / *f* (MHz)	ERP	Position	SAR limit (1g avg)	Measured SAR value (1g avg)	Result
GSM850	251 / 848.8	30.7dBm	Right, Cheek + MMC Card + BT	1.6 W/kg	0.72 W/kg	PASSED

Mode	Ch / *f* (MHz)	EIRP	Position	SAR limit (1g avg)	Measured SAR value (1g avg)	Result
GSM1900	661 / 1880.0	27.02dBm	Left, Tilt + BT	1.6 W/kg	0.90 W/kg	PASSED

1.2.2 Body Worn Configuration

Mode	Ch / *f* (MHz)	ERP	Separation distance	SAR limit (1g avg)	Measured SAR value (1g avg)	Result
GPRS850	189 / 836.4	30.4dBm	2.2 cm	1.6 W/kg	0.42 W/kg	PASSED

Mode	Ch / *f* (MHz)	EIRP	Separation distance	SAR limit (1g avg)	Measured SAR value (1g avg)	Result
GPRS1900	661 / 1880.0	27.02dBm	2.2 cm	1.6 W/kg	0.88 W/kg	PASSED

1.2.3 Maximum Drift

Maximum drift during measurements	0.32 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

Modes and Bands of Operation	GSM 850	GSM 1900	GPRS (GSM)	BT
Modulation Mode	GMSK	GMSK	GMSK	GFSK
Duty Cycle	1/8	1/8	1/8 or 2/8	
Transmitter Frequency Range (MHz)	824.2 – 848.8	1850.2 - 1909.8	824.2 – 848.8 / 1850.2 - 1909.8	2400.0 – 2483.5

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

2.1 Picture of the Device

2.2 Description of the Antenna

The device has an internal patch antenna.

3. TEST CONDITIONS

3.1 Temperature and Humidity

Period of measurement:	02/13/2004 – 02/24/2004
Ambient temperature (°C):	22 ±1
Ambient humidity (RH %):	45 ±10

3.2 Test Signal, Frequencies, and Output Power

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

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

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

The power output was measured by a separate test laboratory on the same unit as used for SAR testing.

4. DESCRIPTION OF THE TEST EQUIPMENT

4.1 Measurement System and Components

The measurements were performed using an automated near-field scanning system, DASY3 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	501	12 months	01/2005
E-field Probe ET3DV6R	1429	12 months	01/2005
Dipole Validation Kit, D835V2	476	24 months	02/2005
Dipole Validation Kit, D1900V2	5d026	24 months	02/2005

Additional test equipment used in testing:

Test Equipment	Model	Serial Number	Calibration interval	Calibration expiry
Signal Generator	SMIQ03B	826046/034	36 months	02/2007
Amplifier	ZHL-42W	E012903	-	-
Power Meter	NRVD	840297/008	24 months	11/2005
Power Sensor	NRV-Z51	100184	24 months	11/2005
Call Tester	4400M	0411216	-	-
Vector Network Analyzer	AT8753ES	MY40001091	12 months	09/2004
Dielectric Probe Kit	HP85070B	US33020403	-	-

4.1.1 Isotropic E-field Probe 1429

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

4.2 Phantoms

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

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

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

4.3 Simulating Liquids

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

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

4.3.1 Liquid Recipes

The following recipes were used for Head and Body liquids:

835MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	45.43	64.78
Diacetin	53.31	34.28
Preservative	1.13	0.79
Salt	0.12	0.15

1900MHz band

Ingredient	Head (% by weight)	Body (% by weight)
Deionised Water	48.45	65.07
Diacetin	50.90	34.46
Preservative	0.35	0.08
Salt	0.30	0.39

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]
			εr	σ [S/m]	
835	Reference result	2.41	41.5	0.89	N/A
	± 10% window	2.17 – 2.65			
	02/13/2004	2.40	40.9	0.90	22 ±1
1900	Reference result	10.4	38.6	1.46	N/A
	± 10% window	9.4 – 11.4			
	02/13/2004	10.2	37.9	1.47	22 ±1
	02/16/2004	10.2	37.9	1.48	22 ±1

System verification, body tissue simulant

f [MHz]	Description	SAR [W/kg], 1g	Dielectric Parameters		Temp [°C]
			εr	σ [S/m]	
835	Reference result	2.53	54.0	0.96	N/A
	± 10% window	2.28 - 2.78			
	02/23/2004	2.67	57.7	0.99	22 ±1
	02/24/2004	2.65	57.5	0.99	22 ±1
1900	Reference result	10.6	51.2	1.59	N/A
	± 10% window	9.5 – 11.7			
	02/18/2004	10.2	53.3	1.60	22 ±1
	02/20/2004	9.88	53.4	1.56	22 ±1

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]
		εr	σ [S/m]	
836	Recommended value	41.5	0.90	N/A
	± 5% window	39.4 – 43.6	0.86 – 0.95	
	02/13/2004	40.9	0.90	22 ±1
1880	Recommended value	40.0	1.40	N/A
	± 5% window	38.0 – 42.0	1.33 – 1.47	
	02/13/2004	38.0	1.45	22 ±1
	02/16/2004	38.0	1.46	22 ±1

Body tissue simulant measurements

f [MHz]	Description	Dielectric Parameters		Temp [°C]
		εr	σ [S/m]	
836	Recommended value	55.2	0.97	N/A
	± 5% window	52.5 – 58.0	0.92 – 1.02	
	02/23/2004	57.7	0.99	22 ±1
	02/24/2004	57.5	0.99	22 ±1
1880	Recommended value	53.3	1.52	N/A
	± 5% window	50.6 – 56.0	1.44 – 1.60	
	02/18/2004	53.4	1.58	22 ±1
	02/20/2004	53.4	1.56	22 ±1

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 belowcm using a separate flat spacer that was removed before the start of the measurements. The device was oriented with its antenna facing the phantom since this orientation gave higher results.

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

5.3 Scan Procedures

First coarse scans were used for determination of the field distribution. Next a cube scan, 5x5x7 points covering a volume of 32x32x30mm 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 2.0 mm.

6. MEASUREMENT UNCERTAINTY

Table 6.1 – Measurement uncertainty evaluation

Uncertainty Component	Section in IEEE 1528	Tol. (%)	Prob Dist	Div	c_i	$c_i . u_i$ (%)	v_i
Measurement System							
Probe Calibration	E2.1	±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:

850MHz Head SAR results

Mode and Band	Position		SAR, averaged over 1g (W/kg)		
			Ch 128 824.2 MHz	Ch 189 836.4 MHz	Ch 251 848.8 MHz
GSM850	Power level (ERP)		29.8 dBm	30.4 dBm	30.7 dBm
	Left	Cheek		0.56	
		Tilt		0.39	
	Right	Cheek	0.45	0.62	**0.65**
		Tilt		0.33	
	Highest SAR value measurement in this band repeated with MMC Card and BT active				**0.72**

Basic testing was carried out without an MMC Card and with BT active.

1900MHz Head SAR results

Mode and Band	Position		SAR, averaged over 1g (W/kg)		
			Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz
GSM1900	Power level (EIRP)		27.2 dBm	27.02 dBm	28.07 dBm
	Left	Cheek		0.84	
		Tilt	0.87	**0.90**	0.72
	Right	Cheek		0.53	
		Tilt		0.68	
	Highest SAR value measurement in this band repeated with MMC Card and BT active			**0.85**	

Basic testing was carried out without an MMC Card and with BT active.

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

850MHz Body SAR results

Mode and Band	Body-worn location setup	SAR, averaged over 1g (W/kg)		
		Ch 128 824.2 MHz	Ch 189 836.4 MHz	Ch 251 848.8 MHz
2-slot GPRS850	Power level (ERP)	29.8 dBm	30.4 dBm	30.7 dBm
	Headset HS-5	0.34	**0.42**	0.29
	Headset HS-10	0.27	0.34	0.30
	Highest SAR value measurement in this mode repeated with MMC Card and BT active		**0.38**	

Basic testing was carried out without an MMC Card and with BT active.

1900MHz Body SAR results

Mode and Band	Body-worn location setup	SAR, averaged over 1g (W/kg)		
		Ch 512 1850.2 MHz	Ch 661 1880.0 MHz	Ch 810 1909.8 MHz
2-slot GPRS1900	Power level (EIRP)	27.2 dBm	27.02 dBm	28.07 dBm
	Headset HS-5	0.78	**0.88**	0.81
	Headset HS-10	0.77	0.83	0.80
	Highest SAR value measurement in this mode repeated with MMC Card and BT active		**0.87**	

Basic testing was carried out without an MMC Card and with BT active.

Plots of the Measurement scans are given in Appendix B.

APPENDIX A: VALIDATION SCANS

See the following pages.

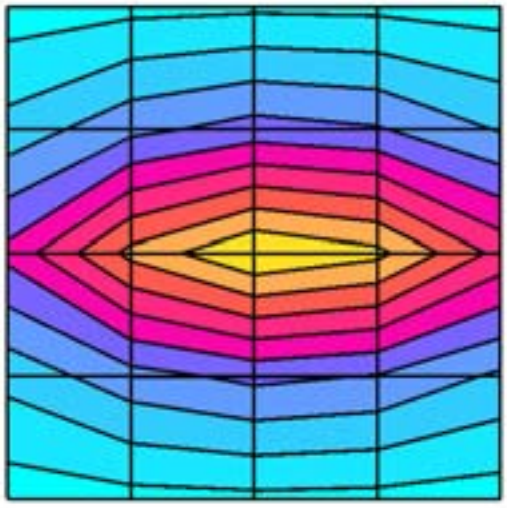
02/13/04

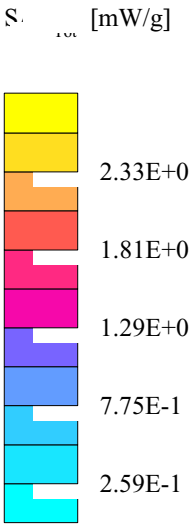
Dipole 835 MHz

Continous Wave, 835 MHz; Crest factor: 1.0

Phantom: SAM Low Band; Section:
Medium Name: Head 835 MHz: $\sigma = 0.90$ mho/m $\varepsilon_r = 40.9$ $\rho = 1.00$ g/cm^3
Probe: ET3DV6R - SN1431; ConvF(6.20,6.20,6.20)
Cube 5x5x7: SAR (1g): 2.40 mW/g, SAR (10g): 1.57 mW/g, (Advanced extrapolation)
Antenna out: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.05 dB
Temperature (°C) = 22 ±1

Filename: Head - 13-02-04 - 2





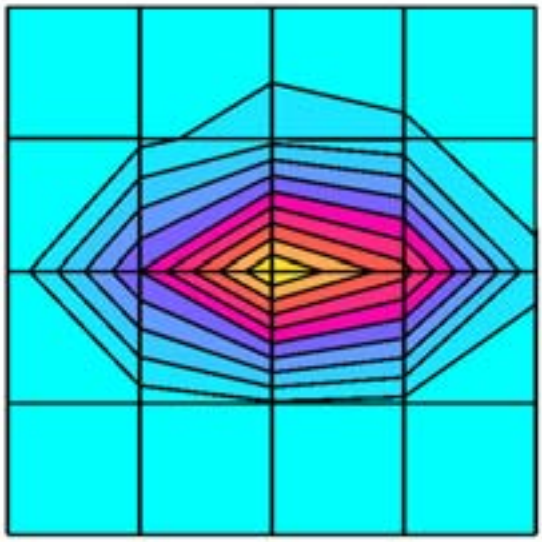
02/13/04

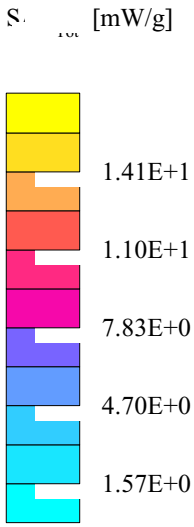
Dipole 1900 MHz

Continous Wave, 1900 MHz; Crest factor: 1.0

Phantom: SAM High Band; Section:
Medium Name: Head 1900 MHz: $\sigma = 1.47$ mho/m $\varepsilon_r = 37.9$ $\rho = 1.00$ g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.87,4.87,4.87)
Cube 5x5x7: SAR (1g): 10.2 mW/g, SAR (10g): 5.28 mW/g, (Advanced extrapolation)
Area Scan: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.13 dB
Temperature (°C) = 22 ±1

Filename: Head - 13-02-04 - 1





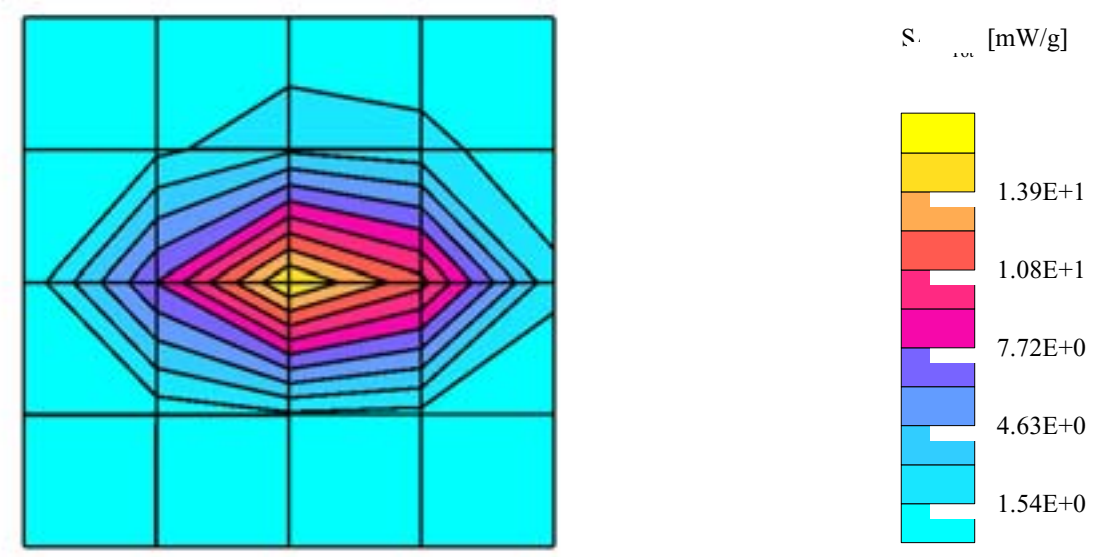
02/16/04

Dipole 1900 MHz

Continous Wave, 1900 MHz; Crest factor: 1.0

Phantom: SAM High Band; Section:
Medium Name: Head 1900 MHz: $\sigma = 1.48$ mho/m $\varepsilon_r = 37.9$ $\rho = 1.00$ g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.87,4.87,4.87)
Cube 5x5x7: SAR (1g): 10.2 mW/g, SAR (10g): 5.29 mW/g, (Advanced extrapolation)
Area Scan: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.02 dB
Temperature (°C) = 22 ±1

Filename: Head - 16-02-04 - 2



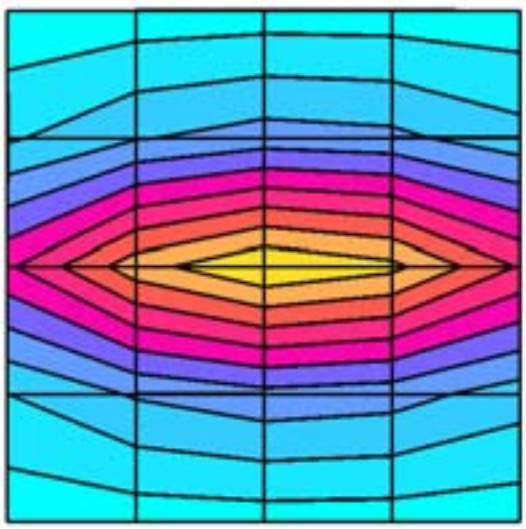
02/23/04

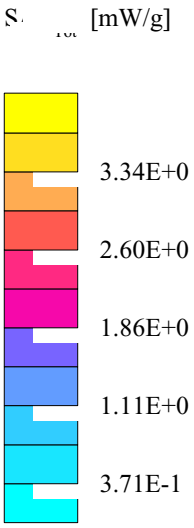
Dipole 835 MHz

Continous Wave, 835 MHz; Crest factor: 1.0

Phantom: SAM Low Band; Section:
Medium Name: Body 835 MHz: $\sigma = 0.99$ mho/m $\varepsilon_r = 57.7$ $\rho = 1.00$ g/cm^3
Probe: ET3DV6R - SN1429; ConvF(5.91,5.91,5.91)
Cube 5x5x7: SAR (1g): 2.67 mW/g, SAR (10g): 1.75 mW/g, (Advanced extrapolation)
Antenna out: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.04 dB
Temperature (°C) = 22 ±1

Filename: Body - 23-02-04 - 1





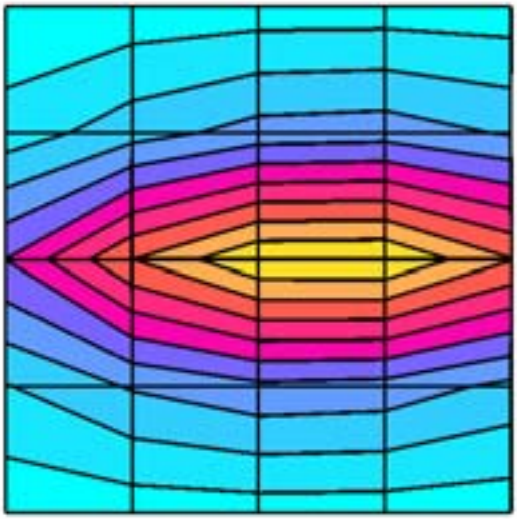
02/24/04

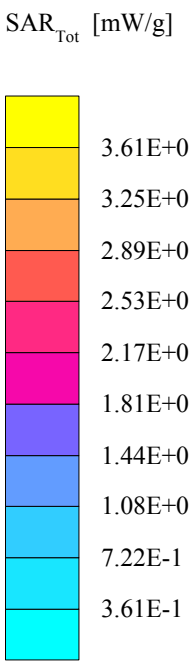
Dipole 835 MHz

Continous Wave, 835 MHz; Crest factor: 1.0

Phantom: SAM Low Band; Section:
Medium Name: Body 835 MHz: σ = 0.99 mho/m ε_r = 57.5 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(5.91,5.91,5.91)
Cube 5x5x7: SAR (1g): 2.65 mW/g, SAR (10g): 1.73 mW/g, (Advanced extrapolation)
Antenna out: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.05 dB
Temperature (°C) = 22 ±1

Filename: Body - 24-02-04 - 1





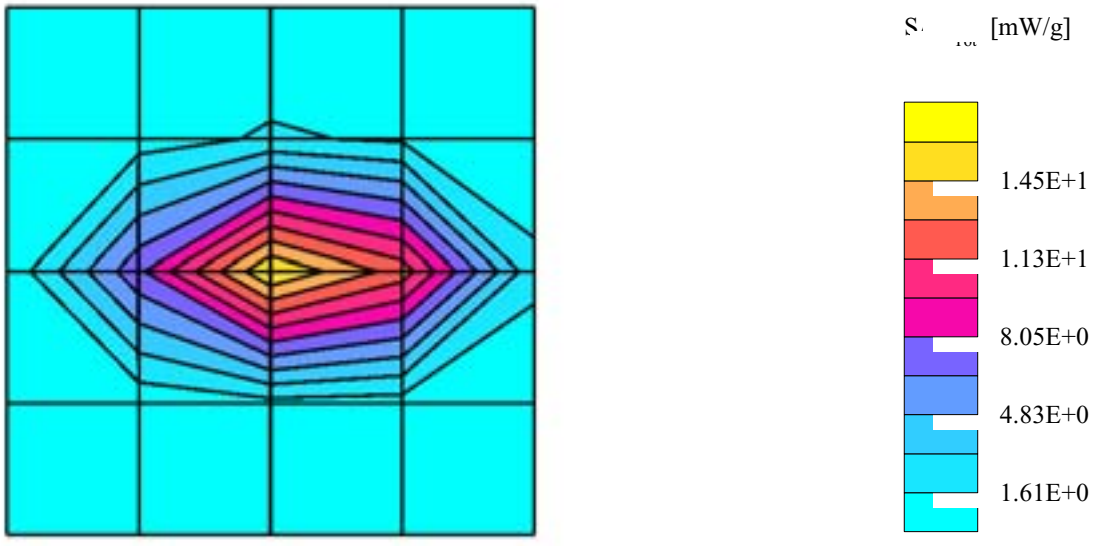
02/18/04

Dipole 1900 MHz

Continous Wave, 1900 MHz; Crest factor: 1.0

Phantom: SAM Body; Section:
Medium Name: Body 1900 MHz: $\sigma = 1.60$ mho/m $\varepsilon_r = 53.3$ $\rho = 1.00$ g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.33,4.33,4.33)
Cube 5x5x7: SAR (1g): 10.2 mW/g, SAR (10g): 5.40 mW/g, (Advanced extrapolation)
Area Scan: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.02 dB
Temperature (°C) = 22 ±1

Filename: Body - 18-02-04 - 2



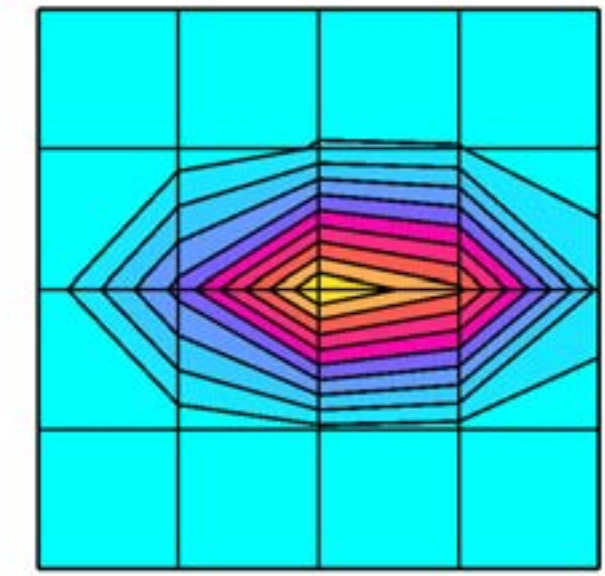
02/20/04

Dipole 1900 MHz

Continous Wave, 1900 MHz; Crest factor: 1.0

Phantom: SAM Body; Section:
Medium Name: Body 1900 MHz: $\sigma = 1.56$ mho/m $\varepsilon_r = 53.4$ $\rho = 1.00$ g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.33,4.33,4.33)
Cube 5x5x7: SAR (1g): 9.88 mW/g, SAR (10g): 5.22 mW/g, (Advanced extrapolation)
Area Scan: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.04 dB
Temperature (°C) = 22 ±1

Filename: Body - 20-02-04 - 1



APPENDIX B: MEASUREMENT SCANS

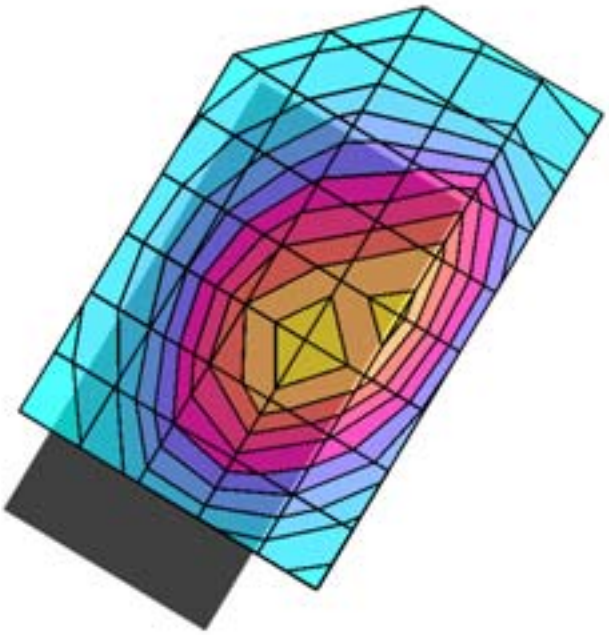
See the following pages.

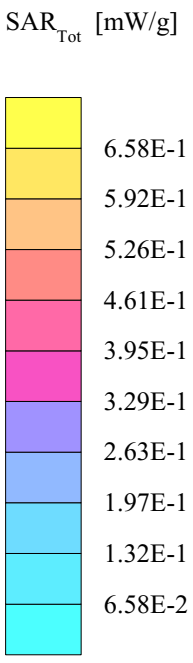
RH-52

Mode: GSM + BT; CH 189 = 836.4 MHz; Crest factor: 8.0

Phantom: SAM Low Band; Section: Left Hand
Medium Name: Head 835 MHz: $\sigma = 0.90$ mho/m $\varepsilon_r = 40.9$ $\rho = 1.00$ g/cm^3
Probe: ET3DV6R - SN1429; ConvF(6.09,6.09,6.09)
Cube 5x5x7: SAR (1g): 0.560 mW/g, SAR (10g): 0.392 mW/g, (Worst-case extrapolation)
Antenna out: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.04 dB
Temperature (°C) = 22 ±1

Filename: Left-Cheek-GSM850-No MMC-BT-CH 189



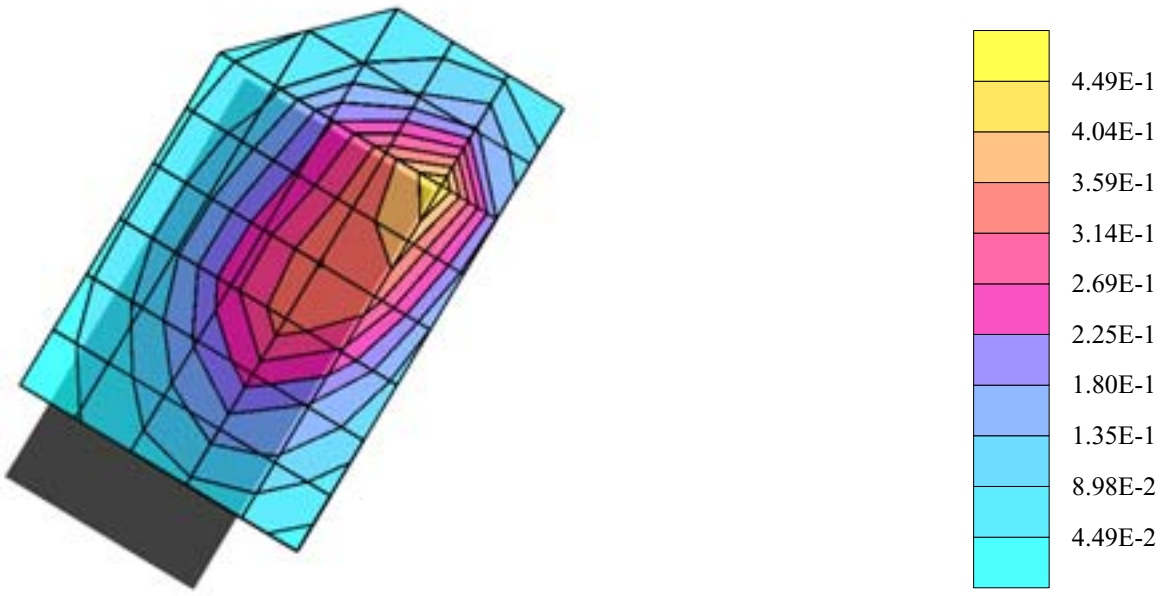


RH-52

Mode: GSM + BT; CH 189 = 836.4 MHz; Crest factor: 8.0

Phantom: SAM Low Band; Section: Left Hand
Medium Name: Head 835 MHz: σ = 0.90 mho/m ε_r = 40.9 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(6.09,6.09,6.09)
Cubes (2): SAR (1g): 0.391 mW/g ± 0.04 dB, SAR (10g): 0.220 mW/g ± 0.02 dB, (Worst-case extrapolation)
Antenna out: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.01 dB
Temperature (°C) = 22 ±1

Filename: Left-Tilted-GSM850-No MMC-BT-CH 189



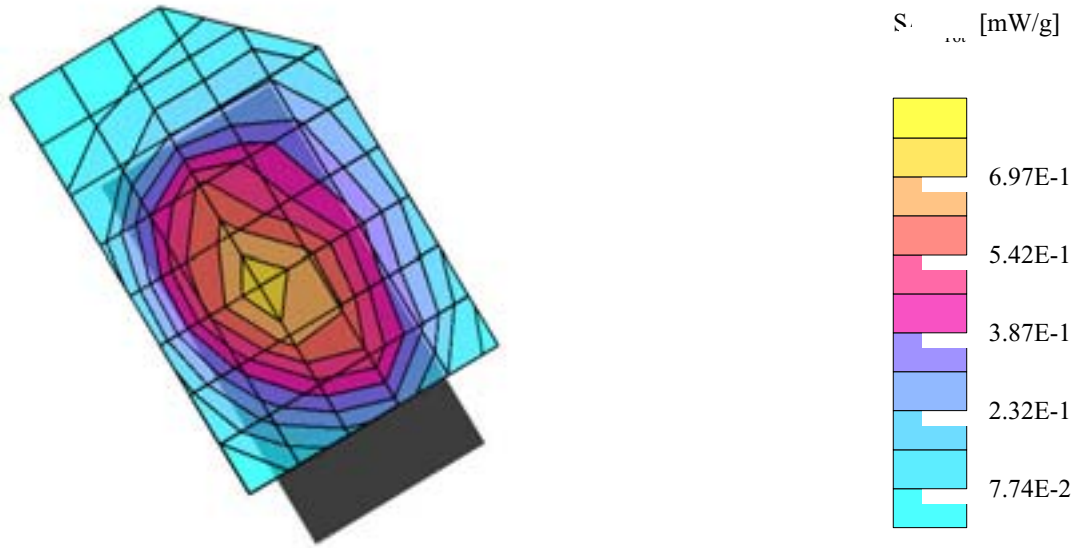
02/13/04

RH-52

Mode: GSM + BT; CH 251 = 848.8 MHz; Crest factor: 8.0

Phantom: SAM Low Band; Section: Righ Hand
Medium Name: Head 835 MHz: $\sigma = 0.90$ mho/m $\varepsilon_r = 40.9$ $\rho = 1.00$ g/cm^3
Probe: ET3DV6R - SN1429; ConvF(6.09,6.09,6.09)
Cube 5x5x7: SAR (1g): 0.649 mW/g, SAR (10g): 0.447 mW/g, (Worst-case extrapolation)
Antenna out: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.05 dB
Temperature (°C) = 22 ±1

Filename: Right-Cheek-GSM850-No MMC-BT-CH 251

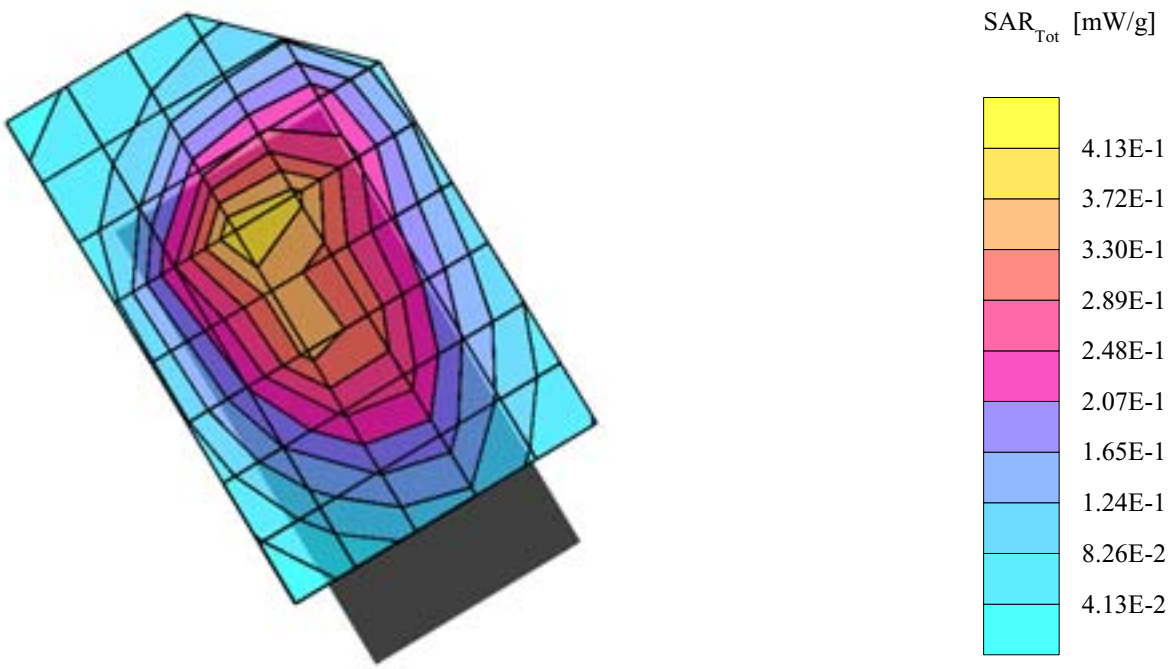


RH-52

Mode: GSM + BT; CH 189 = 836.4 MHz; Crest factor: 8.0

Phantom: SAM Low Band; Section: Righ Hand
Medium Name: Head 835 MHz: $\sigma = 0.90$ mho/m $\varepsilon_r = 40.9$ $\rho = 1.00$ g/cm^3
Probe: ET3DV6R - SN1429; ConvF(6.09,6.09,6.09)
Cubes (2): SAR (1g): 0.329 mW/g ± 0.07 dB, SAR (10g): 0.205 mW/g ± 0.06 dB, (Worst-case extrapolation)
Antenna out: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.01 dB
Temperature (°C) = 22 ±1

Filename: Right-Tilted-GSM850-No MMC-BT-CH 189



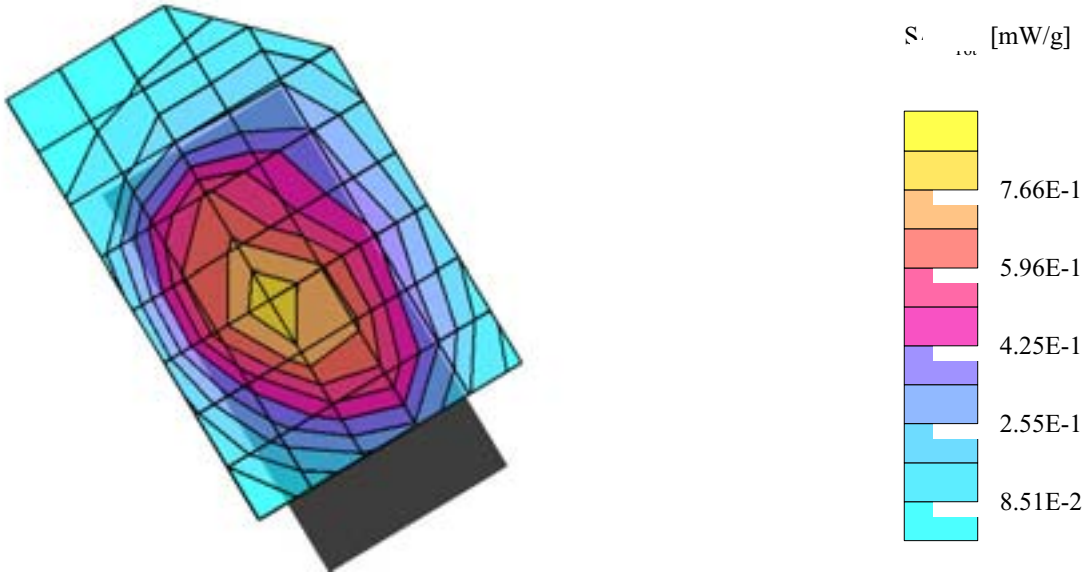
02/13/04

RH-52

Mode: GSM + BT; CH 251 = 848.8 MHz; Crest factor: 8.0

Phantom: SAM Low Band; Section: Righ Hand
Medium Name: Head 835 MHz: σ = 0.90 mho/m ε_r = 40.9 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(6.09,6.09,6.09)
Cube 5x5x7: SAR (1g): 0.716 mW/g, SAR (10g): 0.489 mW/g, (Worst-case extrapolation)
Antenna out: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.07 dB
Temperature (°C) = 22 ±1

Filename: Right-Cheek-GSM850-MMC-BT-CH 251



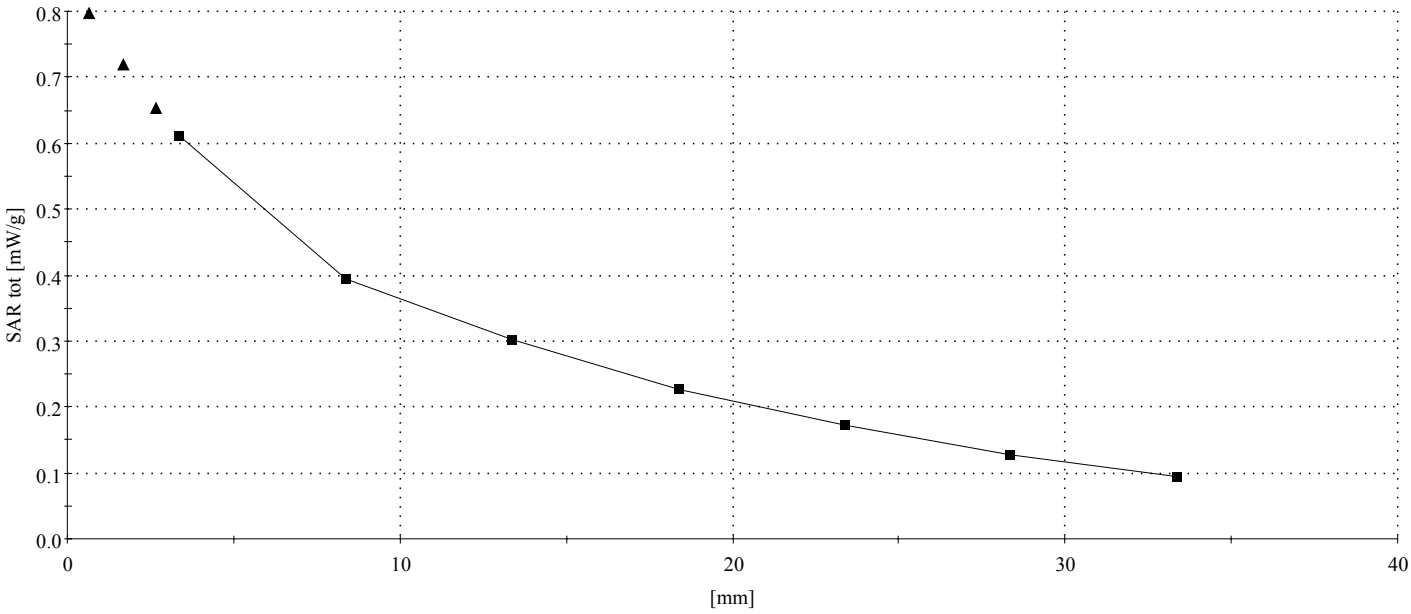
02/13/04

RH-52

Mode: GSM + BT; CH 251 = 848.8 MHz; Crest factor: 8.0

Phantom: SAM Low Band; Section: Righ Hand
Medium Name: Head 835 MHz: $\sigma = 0.90$ mho/m $\varepsilon_r = 40.9$ $\rho = 1.00$ g/cm^3
Probe: ET3DV6R - SN1429; ConvF(6.09,6.09,6.09)
Cube 5x5x7: SAR (1g): 0.716 mW/g, SAR (10g): 0.489 mW/g, (Worst-case extrapolation)
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0
Powerdrift: -0.07 dB
Temperature (°C) = 22 ±1

Filename: Right-Cheek-GSM850-MMC-BT-CH 251



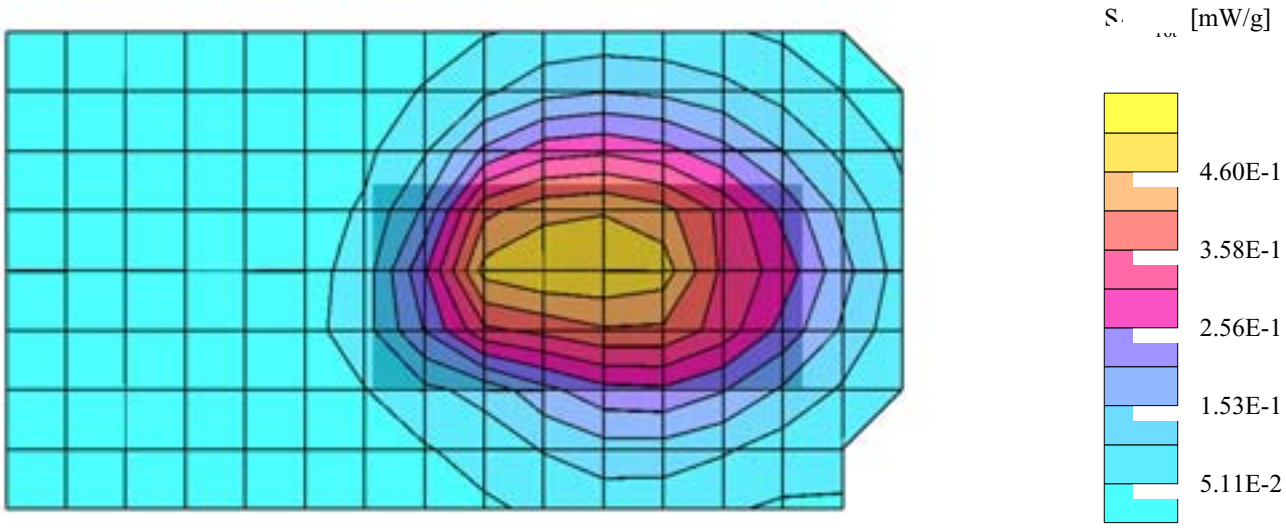
02/23/04

RH-52

Mode: GPRS + BT, 1 Downlink 2 Uplink; CH 189 = 836.4 MHz; Crest factor: 4.0

Phantom: SAM Low Band; Section: Flat
Medium Name: Body 835 MHz: $\sigma = 0.99$ mho/m $\varepsilon_r = 57.7$ $\rho = 1.00$ g/cm^3
Probe: ET3DV6R - SN1429; ConvF(5.91,5.91,5.91)
Cubes (2): SAR (1g): 0.419 mW/g ± 0.01 dB, SAR (10g): 0.281 mW/g ± 0.01 dB, (Worst-case extrapolation)
Body: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.08 dB
Temperature (°C) = 22 ±1

Filename: Body-GPRS850-No MMC-BT-CH 189

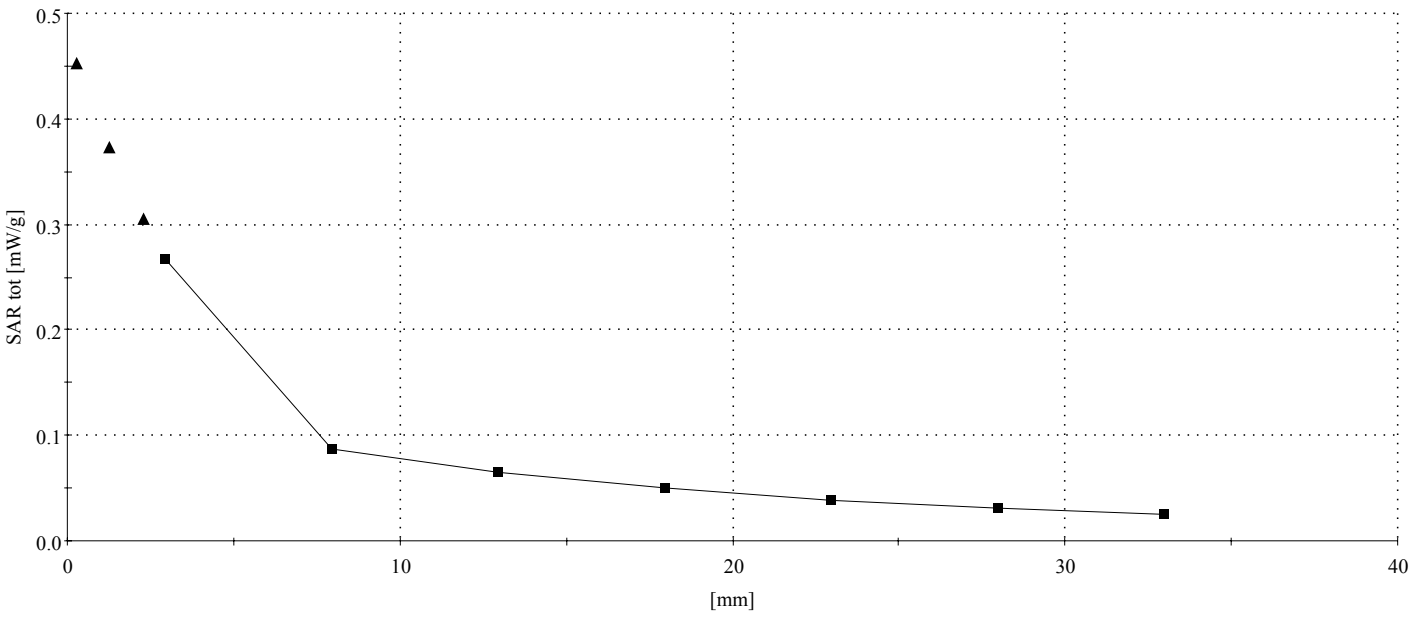


RH-52

Mode: GPRS + BT, 1 Downlink 2 Uplink; CH 189 = 836.4 MHz; Crest factor: 4.0

Phantom: SAM Low Band; Section: Flat
Medium Name: Body 835 MHz: σ = 0.99 mho/m ε_r = 57.7 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(5.91,5.91,5.91)
Cubes (2): SAR (1g): 0.419 mW/g ± 0.01 dB, SAR (10g): 0.281 mW/g ± 0.01 dB, (Worst-case extrapolation)
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0
Powerdrift: -0.08 dB
Temperature (°C) = 22 ±1

Filename: Body-GPRS850-No MMC-BT-CH 189

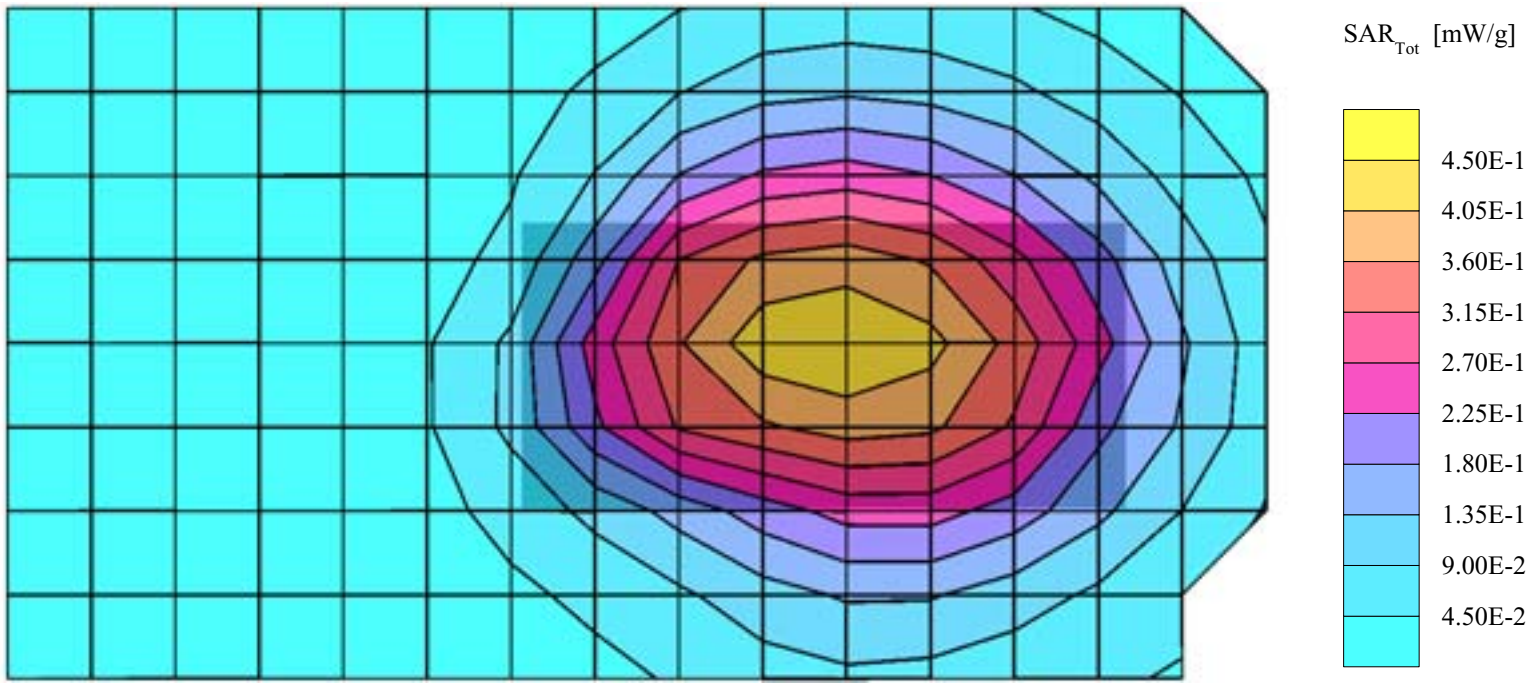


RH-52

Mode: GPRS + BT, 1 Downlink 2 Uplink; CH 189 = 836.4 MHz; Crest factor: 4.0

Phantom: SAM Low Band; Section: Flat
Medium Name: Body 835 MHz: σ = 0.99 mho/m ε_r = 57.5 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(5.91,5.91,5.91)
Cube 5x5x7: SAR (1g): 0.375 mW/g, SAR (10g): 0.262 mW/g * Max outside, (Worst-case extrapolation)
Body: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.08 dB
Temperature (°C) = 22 ±1

Filename: Body-GPRS850-MMC-BT-CH 189



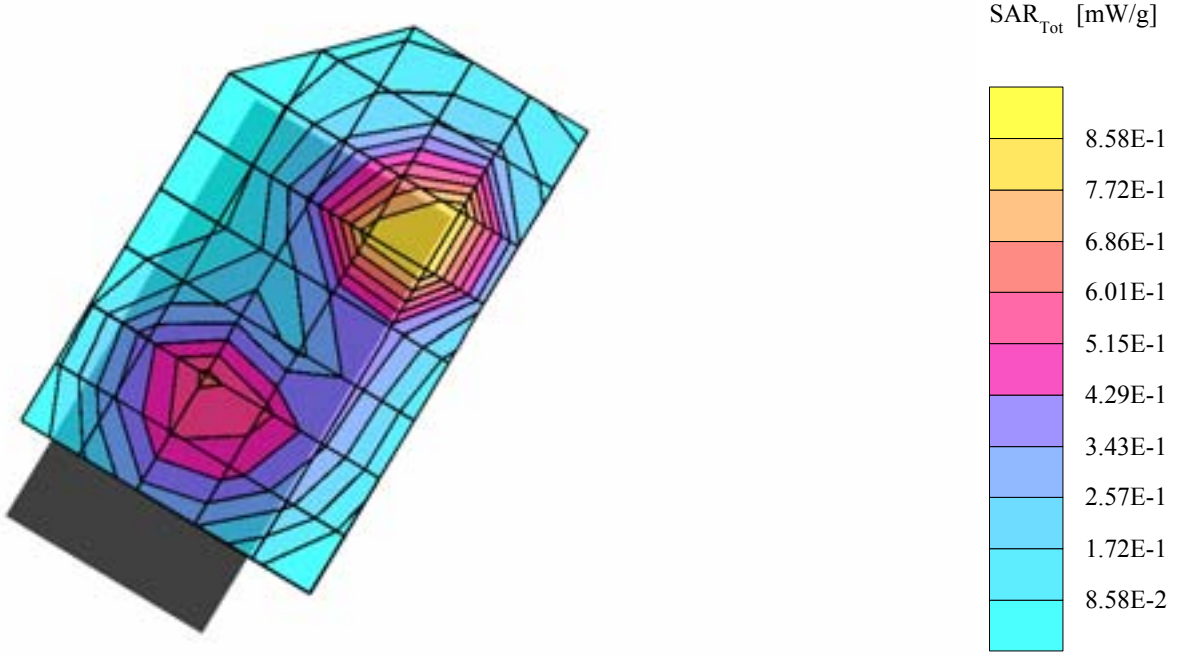
02/13/04

RH-52

Mode: GSM + BT; CH 661 = 1880.0 MHz; Crest factor: 8.0

Phantom: SAM High Band; Section: Left Hand
Medium Name: Head 1900 MHz: σ = 1.45 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.87,4.87,4.87)
Cube 5x5x7: SAR (1g): 0.841 mW/g, SAR (10g): 0.434 mW/g, (Worst-case extrapolation)
Coarse Scan: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: 0.32 dB
Temperature (°C) = 22 ±1

Filename: Left-Cheek-GSM1900-No MMC-BT-CH 661



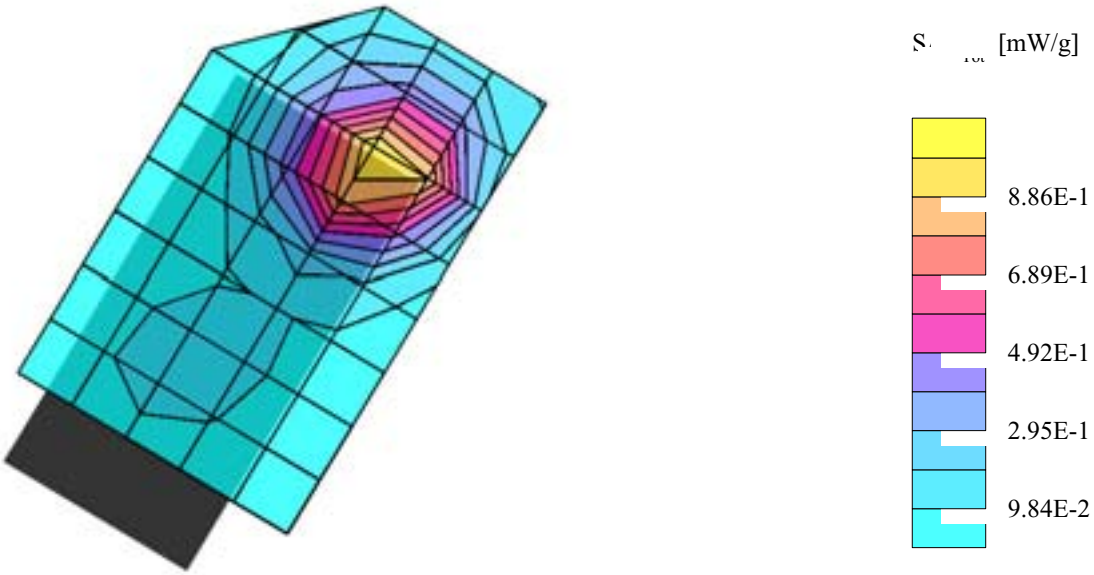
02/16/04

RH-52

Mode: GSM + BT; CH 661 = 1880.0 MHz; Crest factor: 8.0

Phantom: SAM High Band; Section: Left Hand
Medium Name: Head 1900 MHz: $\sigma = 1.46$ mho/m $\varepsilon_r = 38.0$ $\rho = 1.00$ g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.87,4.87,4.87)
Cube 5x5x7: SAR (1g): 0.896 mW/g, SAR (10g): 0.467 mW/g, (Worst-case extrapolation)
Coarse Scan: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.16 dB
Temperature (°C) = 22 ±1

Filename: Left-Tilted-GSM1900-No MMC-BT-CH 661



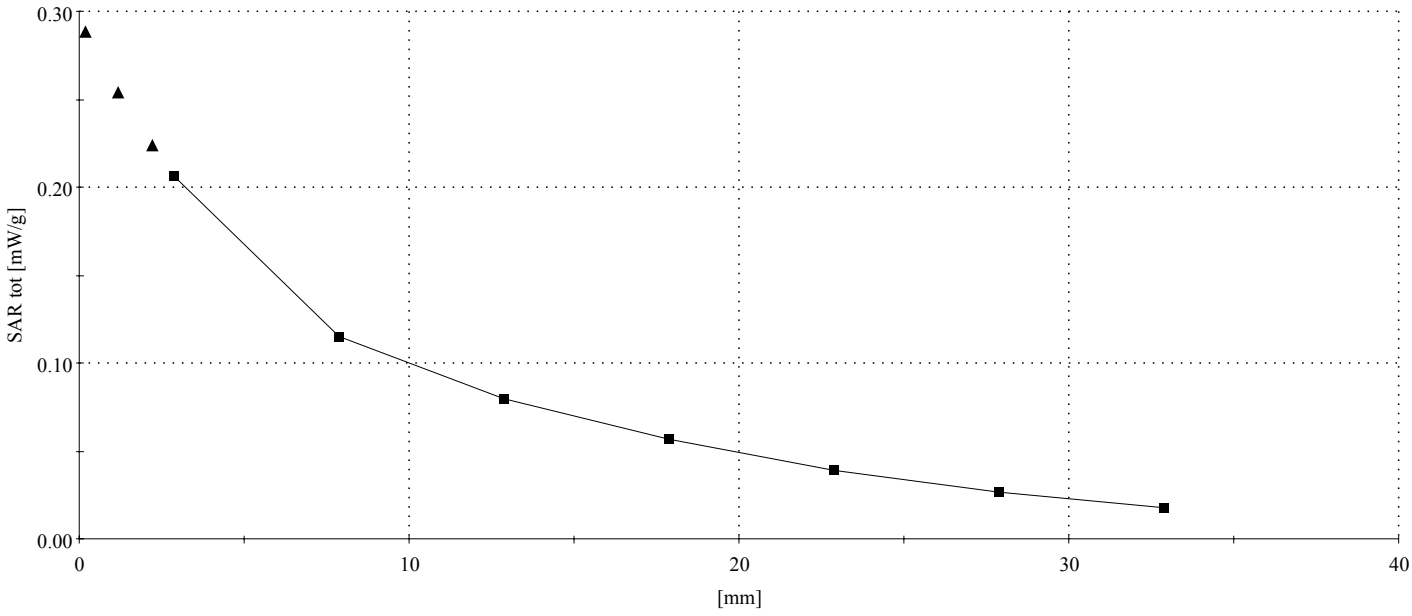
02/16/04

RH-52

Mode: GSM + BT; CH 661 = 1880.0 MHz; Crest factor: 8.0

Phantom: SAM High Band; Section: Left Hand
Medium Name: Head 1900 MHz: σ = 1.46 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.87,4.87,4.87)
Cube 5x5x7: SAR (1g): 0.896 mW/g, SAR (10g): 0.467 mW/g, (Worst-case extrapolation)
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0
Powerdrift: -0.16 dB
Temperature (°C) = 22 ±1

Filename: Left-Tilted-GSM1900-No MMC-BT-CH 661

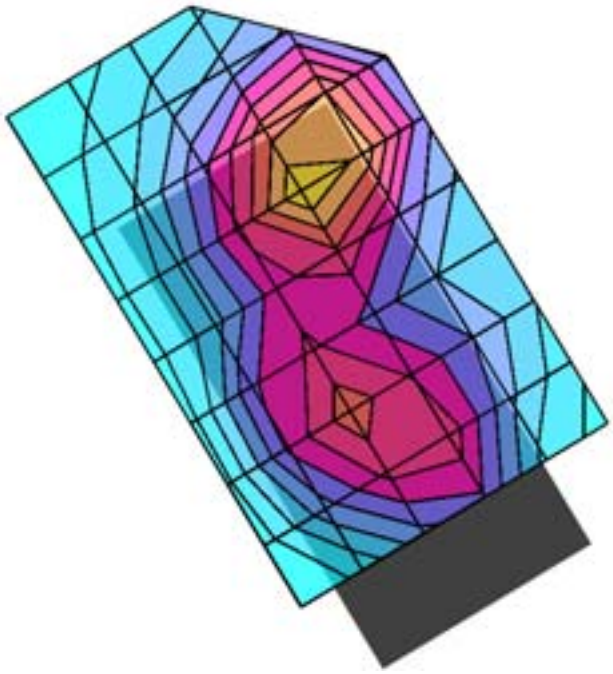


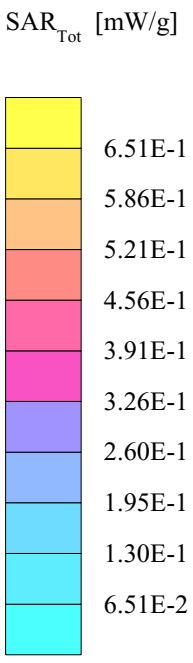
RH-52

Mode: GSM + BT; CH 661 = 1880.0 MHz; Crest factor: 8.0

Phantom: SAM High Band; Section: Righ Hand
Medium Name: Head 1900 MHz: σ = 1.46 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.87,4.87,4.87)
Cube 5x5x7: SAR (1g): 0.528 mW/g, SAR (10g): 0.298 mW/g, (Worst-case extrapolation)
Coarse Scan: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.14 dB
Temperature (°C) = 22 ±1

Filename: Right-Cheek-GSM1900-No MMC-BT-CH 661



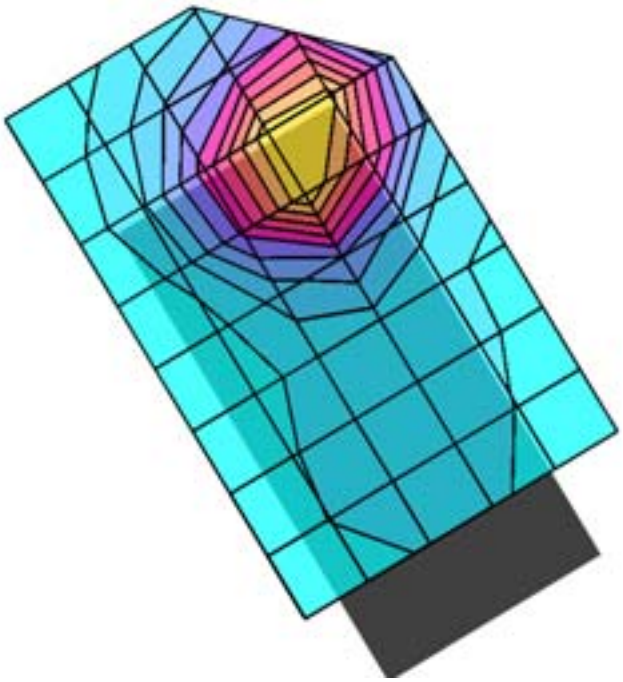


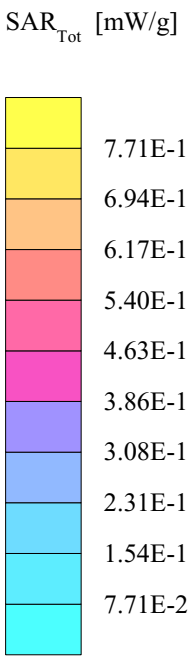
RH-52

Mode: GSM + BT; CH 661 = 1880.0 MHz; Crest factor: 8.0

Phantom: SAM High Band; Section: Righ Hand
Medium Name: Head 1900 MHz: σ = 1.46 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.87,4.87,4.87)
Cube 5x5x7: SAR (1g): 0.675 mW/g, SAR (10g): 0.371 mW/g, (Worst-case extrapolation)
Coarse Scan: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.08 dB
Temperature (°C) = 22 ±1

Filename: Right-Tilted-GSM1900-No MMC-BT-CH 661



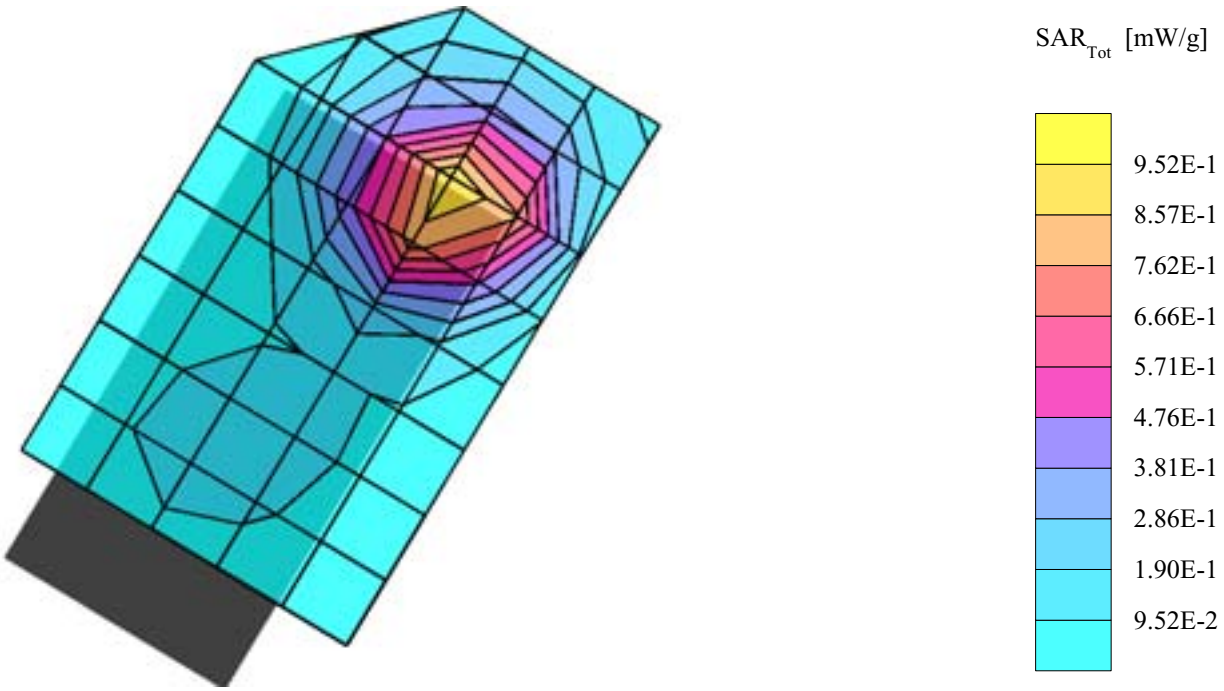


RH-52

Mode: GSM + BT; CH 661 = 1880.0 MHz; Crest factor: 8.0

Phantom: SAM High Band; Section: Left Hand
Medium Name: Head 1900 MHz: σ = 1.46 mho/m ε_r = 38.0 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.87,4.87,4.87)
Cube 5x5x7: SAR (1g): 0.846 mW/g, SAR (10g): 0.442 mW/g, (Worst-case extrapolation)
Coarse Scan: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.22 dB
Temperature (°C) = 22 ±1

Filename: Left-Tilted-GSM1900-MMC-BT-CH 661



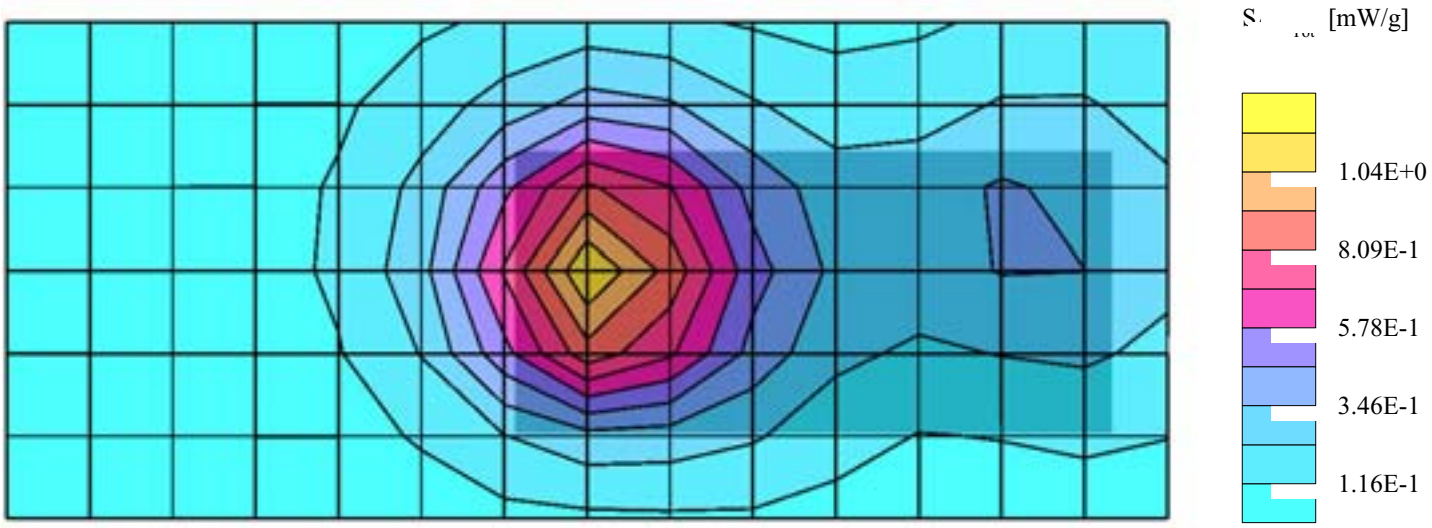
02/18/04

RH-52

Mode: GPRS + BT, 1 Downlink 2 Uplink; CH 661 = 1880.0 MHz; Crest factor: 4.0

Phantom: SAM Body; Section: Flat
Medium Name: Body 1900 MHz: σ = 1.58 mho/m ε_r = 53.4 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.33,4.33,4.33)
Cube 5x5x7: SAR (1g): 0.879 mW/g, SAR (10g): 0.524 mW/g, (Worst-case extrapolation)
Body: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.19 dB
Temperature (°C) = 22 ±1

Filename: Body-GPRS1900-No MMC-BT-CH 661



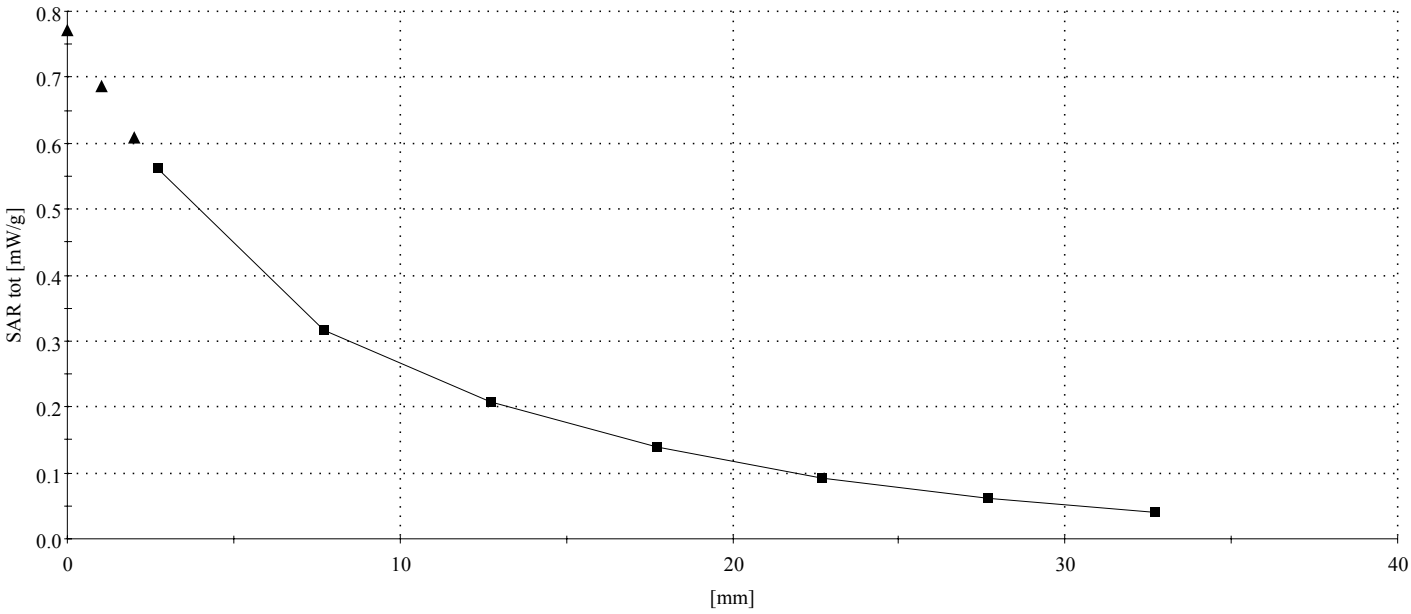
02/18/04

RH-52

Mode: GPRS + BT, 1 Downlink 2 Uplink; CH 661 = 1880.0 MHz; Crest factor: 4.0

Phantom: SAM Body; Section: Flat
Medium Name: Body 1900 MHz: σ = 1.58 mho/m ε_r = 53.4 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.33,4.33,4.33)
Cube 5x5x7: SAR (1g): 0.879 mW/g, SAR (10g): 0.524 mW/g, (Worst-case extrapolation)
Cube 5x5x7: Dx = 8.0, Dy = 8.0, Dz = 5.0
Powerdrift: -0.19 dB
Temperature (°C) = 22 ±1

Filename: Body-GPRS1900-No MMC-BT-CH 661

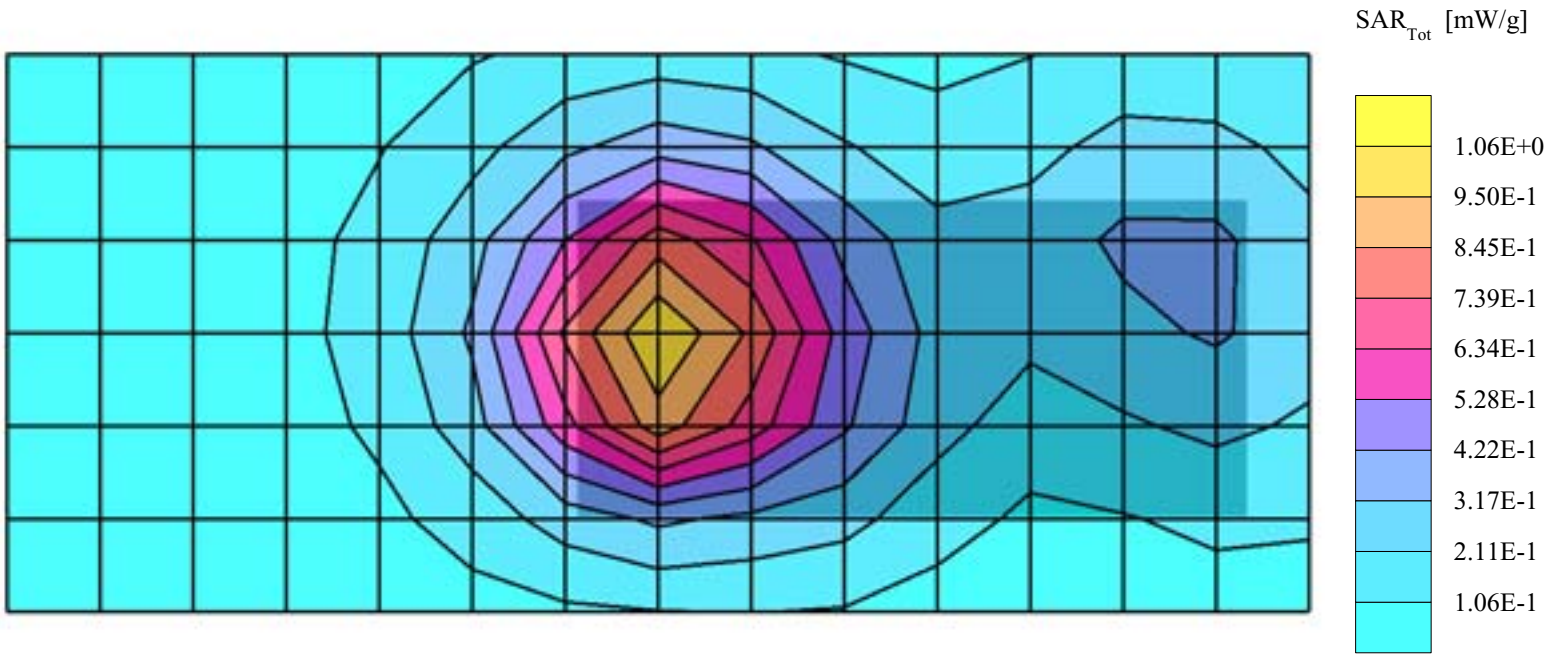


RH-52

Mode: GPRS + BT, 1 Downlink 2 Uplink; CH 661 = 1880.0 MHz; Crest factor: 4.0

Phantom: SAM Body; Section: Flat
Medium Name: Body 1900 MHz: σ = 1.56 mho/m ε_r = 53.4 ρ = 1.00 g/cm^3
Probe: ET3DV6R - SN1429; ConvF(4.33,4.33,4.33)
Cube 5x5x7: SAR (1g): 0.873 mW/g, SAR (10g): 0.514 mW/g, (Worst-case extrapolation)
Body: Dx = 15.0, Dy = 15.0, Dz = 10.0
Powerdrift: -0.16 dB
Temperature (°C) = 22 ±1

Filename: Body-GPRS1900-MMC-BT-CH 661



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

See the following pages.

1556

3/2-04

4

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

Client **Nokia DK**

CALIBRATION CERTIFICATE

Object(s)	ET3DV6R - SN:1429
Calibration procedure(s)	QA CAL-01.v2 Calibration procedure for dosimetric E-field probes
Calibration date:	January 21, 2004
Condition of the calibrated item	In Tolerance (according to the specific calibration document)

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%.

Calibration Equipment used (M&TE critical for calibration)

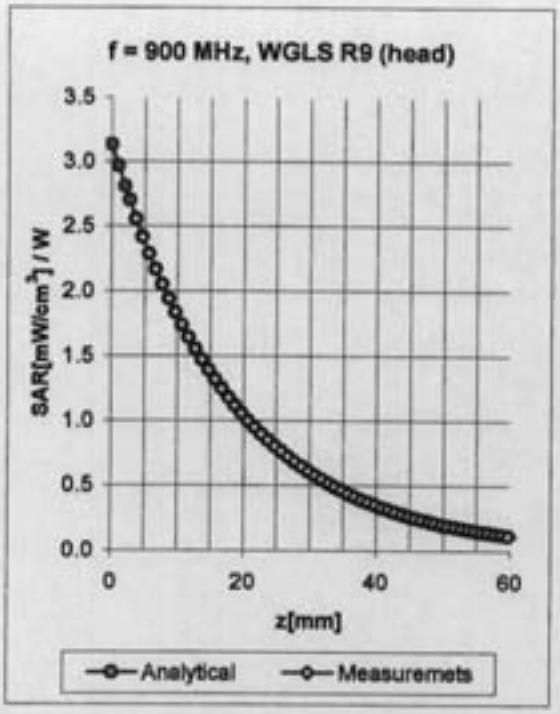
Model Type	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM E4419B	GB41293874	2-Apr-03 (METAS, No 252-0250)	Apr-04
Power sensor E4412A	MY41495277	2-Apr-03 (METAS, No 252-0250)	Apr-04
Reference 20 dB Attenuator	SN: 5086 (20b)	3-Apr-03 (METAS, No. 251-0340)	Apr-04
Fluke Process Calibrator Type 702	SN: 6295803	8-Sep-03 (Sintrel SCS No. E-030020)	Sep-04
Power sensor HP 8481A	MY41092180	18-Sep-02 (SPEAG, in house check Oct-03)	In house check: Oct 05
RF generator HP 8684C	US3642U01700	4-Aug-99 (SPEAG, in house check Aug-02)	In house check: Aug-05
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-03)	In house check: Oct 05

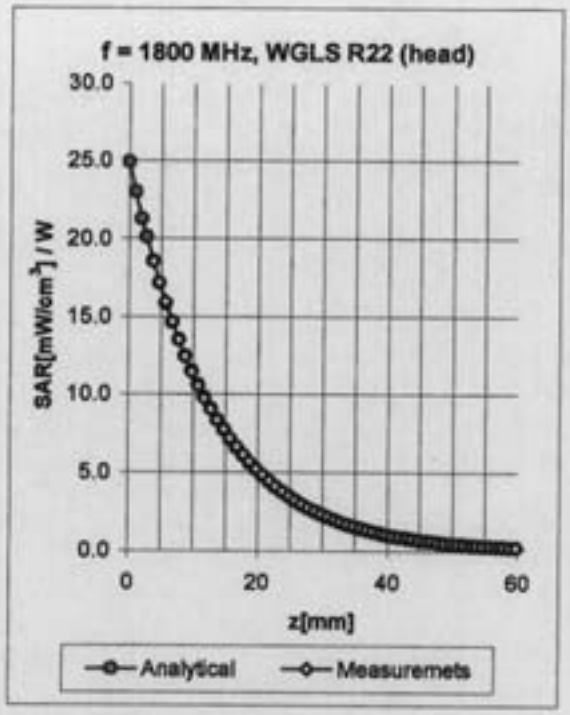
	Name	Function	Signature
Calibrated by:	Nico Vetterli	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

Date Issued: January 22, 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.

Conversion Factor Assessment





f [MHz]	Validity [MHz][B]	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	800-1000	Head	41.5 ± 5%	0.97 ± 5%	0.51	1.96	6.09 ± 11.3% (k=2)
1800	1710-1910	Head	40.0 ± 5%	1.40 ± 5%	0.47	2.60	4.87 ± 11.7% (k=2)
900	800-1000	Body	55.0 ± 5%	1.05 ± 5%	0.48	2.10	5.91 ± 11.3% (k=2)
1800	1710-1910	Body	53.3 ± 5%	1.52 ± 5%	0.55	2.70	4.33 ± 11.7% (k=2)

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

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

See the following pages.

18308

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

Client **Nokia Danmark A/S**

CALIBRATION CERTIFICATE

Object(s)	D835V2 - SN:476
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date:	February 25, 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: February 26, 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

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 835 MHz.

Relative Dielectricity	41,5	+ 5%
Conductivity	**0.89 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.7 at 835 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 15mm 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	**9.64 mW/g** ± 17.5 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue	**6.20 mW/g** ± 17.5 % (k=2)[1]

[1] validation uncertainty

Date/Time: 02/25/03 17:45:15

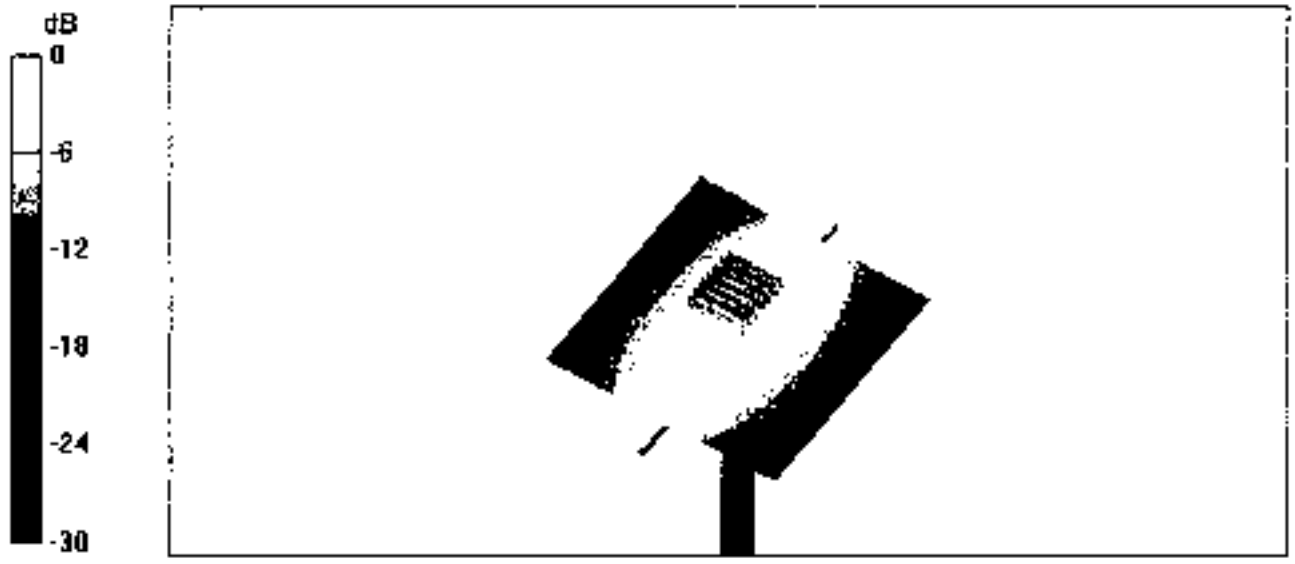
Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN476_SN1507_HSL835_250203.da4

DUT: Dipole 835 MHz; Serial: D835V2 - SN476
Program: Dipole Calibration

Communication System: CW-835, Frequency: 835 MHz, Duty Cycle: 1:1
Medium: HSL 835 MHz, (σ = 0.89 mho/m, ε_r = 41.5, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1507; ConvF(6.7, 6.7, 6.7); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- Measurement SW: DASY4, V4.1 Build 23; Postprocessing SW: SEMCAD, V1.6 Build 105

Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.2 V/m
Peak SAR = 3.57 W/kg
SAR(1 g) = 2.41 mW/g; SAR(10 g) = 1.55 mW/g
Power Drift = 0.03 dB



18308

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

Client **Nokia Denmark A/S**

CALIBRATION CERTIFICATE

Object(s)	D835V2 - SN:476
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date	April 7, 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:	Judith Mosley	Technician	
Approved by:	Katja Pokovic	Laboratory Director	

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.

25/4-03

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with body simulating solution of the following electrical parameters at 835 MHz:

Relative Dielectricity	**54.0**	± 5%
Conductivity	**0.96 mho/m**	± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.3 at 835 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 15mm 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 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:	**10.12 mW/g** ± 16.8 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue:	**6.68 mW/g** ± 16.2 % (k=2)[1]

[1] validation uncertainty

Date/Time: 04/07/03 13:58:59

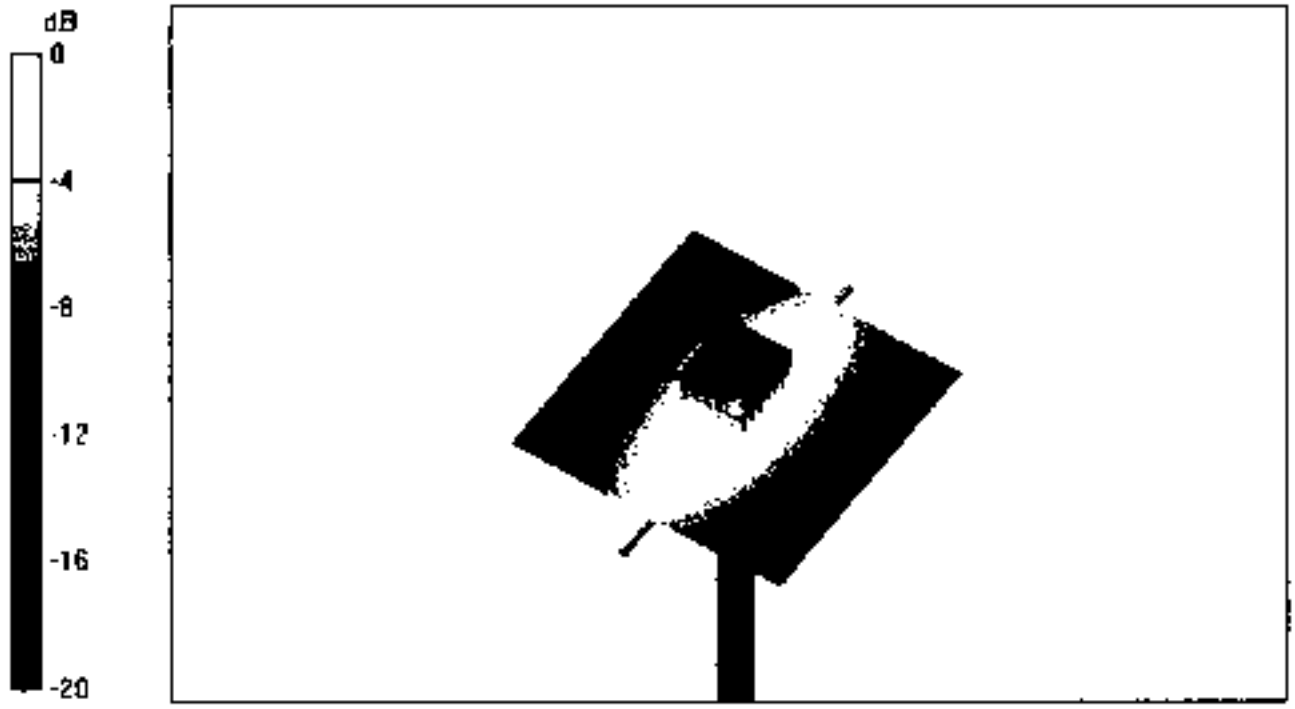
Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN476_SN1507_M835_070403.da4

DUT: Dipole 835 MHz; Serial: D835V2 - SN476
Program: Dipole Calibration

Communication System: CW-835; Frequency: 835 MHz; Duty Cycle: 1:1
Medium: Muscle 835 MHz; (σ = 0.96 mho/m, ε_r = 54.03, ρ = 1000 kg/m^3)
Phantom section: Flat Section

DASY4 Configuration:
- Probe: ET3DV6 - SN1507; ConvF(6.3, 6.3, 6.3); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 - SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP - TP1006; Type: SAM 4.0; Serial: TP:1006
- Measurement SW: DASY4, V4.1 Build 33; Postprocessing SW: SEMCAD, V1.6 Build 109

Pin = 250 mW; d = 15 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm
Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.4 V/m
Peak SAR = 3.6 W/kg
SAR(1 g) = 2.53 mW/g; SAR(10 g) = 1.67 mW/g
Power Drift = 0.02 dB



18309

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

Client **Nokia Danmark A/S**

CALIBRATION CERTIFICATE

Object(s)	D1900V2 - SN:5d026
Calibration procedure(s)	QA CAL-05.v2 Calibration procedure for dipole validation kits
Calibration date	February 26, 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: February 26, 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

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	**38.6**	± 5%
Conductivity	**1.46 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:	**41.6 mW/g** ± 17.5 % (k=2)[1]
averaged over 10 cm^3 (10 g) of tissue	**21.2 mW/g** ± 17.5 % (k=2)[1]

[1] validation uncertainty

Date:Time 02.26.03 17:17:26

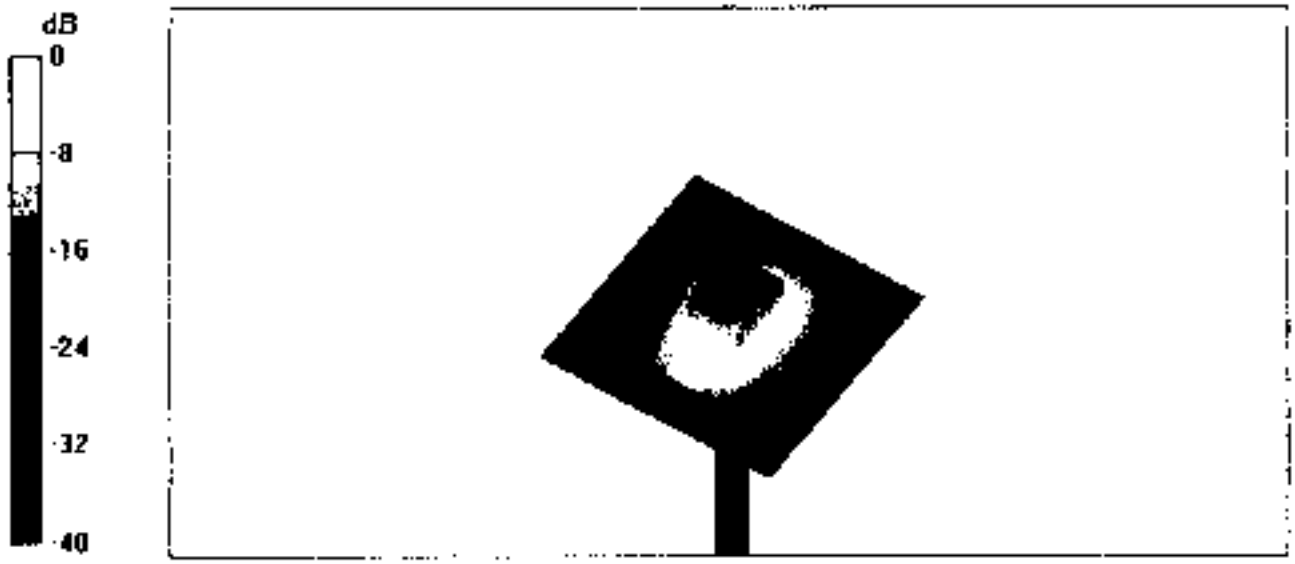
Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN5d026_SN1507_HSL1900_260203.da4

DUT: Dipole 1900 MHz; Serial: D1900V2 - SN5d026
Program: Dipole Calibration

Communication System: CW-1900; Frequency: 1900 MHz; Duty Cycle: 1:1
Medium: HSL 1900 MHz; (σ = 1.46 mho/m, ε_r = 38.6, 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 25; Postprocessing SW: SEMCAD, V1.6 Build 105

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 = 95.2 V/m
Peak SAR = 18.6 W/kg
SAR(1 g) = 10.4 mW/g, SAR(10 g) = 5.31 mW/g
Power Drift = 0.04 dB



18207

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

Client **Nokia Denmark A/S**

CALIBRATION CERTIFICATE

Object(s) **D1900V2 - SN:5d026**

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:	[redacted]	Technician	
Approved by:	[redacted]	Laboratory Director	

Date issued: April 12, 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.

15/4-03

1. 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.

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: **42.4 mW/g** + 16.8 % (k=2)[1]

averaged over 10 cm^3 (10 g) of tissue: **22.0 mW/g** ± 16.2 % (k=2)[1]

[1] validation uncertainty

Date/Time: 04/08/03 13:41:14

Test Laboratory: SPEAG, Zurich, Switzerland
File Name: SN5d026_SN1507_M1900_080403.da4

DUT: Dipole 1900 MHz; Serial: D1900V2 - SN5d026
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 = 91.2 V/m
Peak SAR = 18.6 W/kg
SAR(1 g) = 10.6 mW/g, SAR(10 g) = 5.51 mW/g
Power Drift = 0.09 dB