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LD/SEMC/BGUG/NM *Ramadan Plicanic*

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## SAR Test Report: Sony Ericsson PY7A1021043

**Date of test:** 14 and 16 June, 2004

**Laboratory:** Electromagnetic Near Field , SAR Test Laboratory  
Sonyericsson Mobile Communications AB  
Nya Vatentorget  
SE-221 82 LUND, Sweden

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Sign *Ramadan Plicanic*

### Statement of Compliance

Sony Ericsson Mobile Communications AB declares under its sole responsibility that the product

***Sony Ericsson Type AAB-1021043-BV; FCC ID: PY7A1021043***

to which this declaration relates, is in conformity with the appropriate RF exposure standards recommendations and guidelines. It also declares that the product was tested in accordance with the appropriate measurement standards, guidelines and recommended practices. Any deviations from these standards, guidelines and recommended practices are noted below:

(None)

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This test report shall not be reproduced except in full, without written approval of the laboratory.

The results and statements contained herein relate only to the items tested. The names of individuals involved may be mentioned only in connection with the statements or results from this report.

Sony Ericsson encourages all feedback, both positive and negative, on this report.



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## 2 Introduction

In this test report, compliance of the Sony Ericsson PY7A1021043 portable telephone with RF safety guidelines is demonstrated. The applicable RF safety guidelines and the SAR measurement specifications used for the test are described in the *SAR Measurement Specifications of Wireless Handsets* [1].

## 3 Device Under Test

### 3.1 Antenna Description

<b>Type</b>	Built In	
<b>Location</b>	Up on the Back	
<b>Dimensions</b>	Max length	35mm
	Max width	20mm
<b>Configuration</b>	PIFA	

### 3.2 Device description

<b>Device model</b>	PY7A1021043	
<b>Serial number</b>	CB500TH8GJ	
<b>Mode</b>	GSM 1900	GSM1900-GPRS
<b>Multiple Access Scheme</b>	TDMA	TDMA
<b>Maximum Output Power Setting</b>	30,0 dBm	28,0 dBm
<b>Factory Tolerance in Power Setting</b>	0,5 dB	0,5 dB
<b>Maximum Peak Output Power</b>	30,5 dBm	28,5 dBm
<b>Crest Factor</b>	8	4
<b>Transmitting Frequency Range(MHz)</b>	1850.2 – 1909.8	1850.2 – 1909.8
<b>Prototype or Production Unit</b>	Prototype	
<b>Device Category</b>	Portable	
<b>RF exposure environment</b>	General population / uncontrolled	



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## 4 Test equipment

### 4.1 Dosimetric system

SAR measurements were made using the DASY3 professional system (software version 3.1c) with SAM twin phantom, manufactured by Schmid & Partner Engineering AG (SPEAG). The list of calibrated equipment is given below.

<b>Description</b>	<b>Serial Number</b>	<b>Due Date</b>
DASY3 DAE V1	433	04-2005
DASY3 DAE V1	419	03-2005
E-field probe ETDV6	1585	03-2004
E-field probe ETDV6	1569	03-2004
Dipole Validation Kit, D1900V2	5d002	04-2005

### 4.2 Additional equipment

<b>Description</b>	<b>Inventory Number</b>	<b>Due Date</b>
Signal generator ESG-D4000A	INV 462935	09-2004
Directional coupler HP778D	INV 2903	01-2005
Power meter R&S NRVD	INV 483920	01-2006
Power sensor R&S NRV-Z5	INV 2333	01-2006
Power sensor R&S NRV-Z5	INV 2334	01-2006
Termination 65N50-0-11	INV 2903	07-2004
Network analyzer HP8753C	INV421671	09-2004
S-parameter test set HP85047A	INV 421670	08-2004
Dielectric probe kit HP8507D	INV 2000053	04-2005

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## 5 Electrical parameters on the tissue simulating liquid

Prior to conducting SAR measurements, the relative permittivity,  $\epsilon_r$ , and the conductivity,  $\sigma$ , of the tissue simulating liquids were measured with the dielectric probe kit. These values are shown in the table below. The mass density,  $\rho$ , entered into the DASY3 software is also given. Recommended limits for permittivity  $\epsilon_r$ , conductivity  $\sigma$  and mass density  $\rho$  are also shown.

f (MHz)	Tissue type	Limits / Measured	Dielectric Parameters		
			$\epsilon_r$	$\sigma$ (S/m)	$\rho$ (g/cm <sup>3</sup> )
1900	Head	Measured, 14/06/2004	38.8	1.43	1.00
		Recommended	40.0	1.40	1.00
1900	Body	Measured, 16/06/2004	50.0	1.52	1.00
		Recommended	53.3	1.52	1.00

## 6 System accuracy verification

A system accuracy verification of the DASY3 was performed using the dipole validation kit listed in section 3.1. The system verification test was conducted on the same day as the measurement of the DUT. Measurement made in ambient temperature 21.0-25.0 °C and humidity 46-39%. The obtained results are displayed in the table below.

RF noise had been measured in liquid when all RF equipment in lab was set off. Measured value was 0.001 mW/g in 1g mass.

f (MHz)	Tissue type	Measured / Reference	SAR (W/kg) 1g/10g	Dielectric Parameters			Liquid t(°C)
				$\epsilon_r$	$\sigma$ (S/m)	$\rho$ (g/cm <sup>3</sup> )	
1900	Head	Measured, 14/06/2004	41.2/21.0	38.8	1.43	1.00	20.5
		Reference	41.6/21.5	38.8	1.44	1.00	-
1900	Body	Measured, 16/06/2004	44.3/22.9	50.0	1.52	1.00	22.0
		Reference	43.2/22.4	51.2	1.59	1.00	-



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## 7 SAR measurement uncertainty

### **SAR measurement uncertainty evaluation for Sony Ericsson PY7A1021043 phone**

Uncertainty Component	Uncer. (%)	Prob Dist.	Div.	C <sub>i</sub>	GSM 1900	GSM-Body 1900
<b>Measurement System</b>						
Probe Calibration	±4.4	N	1	1	±4.4	±4.4
Axial Isotropy	±4.7	R	√3	0.7	±1.9	±1.9
Spherical Isotropy	±9.6	R	√3	0.7	±3.9	±3.9
Spatial resolution	±0.0	R	√3	1	±0.0	±0.0
Boundary effect	±5.5	R	√3	1	±3.2	±3.2
Probe linearity	±4.7	R	√3	1	±2.7	±2.7
Detection limit	±1.0	R	√3	1	±0.6	±0.6
Readout electronics	±1.0	N	1	1	±1.0	±1.0
Response time	±0.8	R	√3	1	±0.5	±0.5
Integration time	±1.4	R	√3	1	±0.8	±0.8
RF Ambient Conditions	±3.0	R	√3	1	±1.7	±1.7
Mech. Constraints of robot	±0.4	R	√3	1	±0.2	±0.2
Probe positioning	±2.9	R	√3	1	±1.7	±1.7
Extrap, interpolation and integration	±3.9	R	√3	1	±2.3	±2.3
<b>Measurement System Uncertainty</b>					<b>±8.3</b>	<b>±8.3</b>
<b>Test Sample Related</b>						
Device positioning	±6.0	N	0.89	1	±6.7	±6.7
Device holder uncertainty	±5.0	N	0.84	1	±5.9	±5.9
Power drift	±2.0	R	√3	1	±1.2	±1.2
<b>Test Sample Related Uncertainty</b>					<b>±9.0</b>	<b>±9.0</b>
<b>Phantom and Tissue Parameters</b>						
Phantom uncertainty	±4.0	R	√3	1	±2.3	±2.3
Liquid conductivity (meas)	±5.0	R	√3	0.6	±1.7	±1.7
Liquid conductivity (target)	±2.1/±0.0	R	√3	0.6	±0.7	±0
Liquid Permittivity (meas)	±5.0	R	√3	0.6	±1.7	±1.7
Liquid Permittivity (target)	±3.0/±6.2	R	√3	0.6	±1.0	±2.2
<b>Phantom and Tissue Parameters Uncertainty</b>					<b>±3.5</b>	<b>±4.0</b>
<b>Combined standard uncertainty</b>					<b>±12.7</b>	<b>±12.9</b>
<b>Extended standard uncertainty (k=2)</b>					<b>±25.4</b>	<b>±25.8</b>



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## 8 Test results

The measured 1-gram and 10-gram averaged SAR values of the device against the head are provided in Tables 1. The ambient humidity and temperature of test facility were 44.0% - 38.5% and 21.5 °C – 24.5 °C respectively. The depth of the head tissue simulating liquid was 15.5cm. A base station simulator was used to control the device during the SAR measurement. The phone was supplied with full-charged battery for each measurement.

For head measurement, the device was tested on the right-hand phantom (corresponding to the right side of the head) and the left-hand phantom in two phone position, cheek (touch) and tilt (cheek + 15deg). For all modes, the device was tested at the lowest, middle and highest frequencies in the transmit band.

Mode	Chanel (MHz)	Peak Output Power(dBm)	Phone Position	Liquid temp(°C)	SAR (W/kg)	
					Right-hand	Left-hand
					1g mass	1g mass
1900 GSM	512	30,3	Cheek	20.5/20.5	0.52	0.36
			Tilt	20.7/20.7	0.57	<b>0.62</b>
	661	30,4	Cheek	20.5/20.5	0.52	0.36
			Tilt	20.7/20.7	0.52	0.47
	810	30,3	Cheek	20.5/20.5	<b>0.56</b>	0.4
			Tilt	20.7/20.7	0.6	0.54

**Table1: SAR measurement result for Sony Ericsson PY7A1021043 telephone at highest possible output power. Measured against the head.**

For body measurement, the phone was tested both in speech and data mode. Phone was on 15mm distance from the phantom in two position, back and front of phone to the flat phantom. For data mode phone was only in one position (worst case), i.e. back of the phone to the phantom. Liquid was 16cm deep in flat section of the phantom.

Mode	Chanel (MHz)	Peak Output Pow(dBm)	Phone Position	Liquid temp(°C)	SAR (W/kg)	
					Back to the Phantom	Front to the Phantom
					1g mass	1g mass
1900 GSM	512	30,3	Speech	22.0/22.3	0,86	0,1
			Data-GPRS	22.5	1,13	-
	661	30,4	Speech	22.0/22.3	1,04	0,1
			Data-GPRS	22.5	1,14	-
	810	30,3	Speech	22.0/22.3	<b>1,33</b>	0,11
			Data-GPRS	22.5	<b>1,49</b>	-

**Table 2: SAR measurement result for Sony Ericsson PY7A1021043 telephone at highest possible output power. Measurement against body for speech and data communications.**


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## 9 References

- [ 1 ] R.Plicanic, "SAR Measurement Specification of Wireless Handsets", Sony Ericsson SAR Test Laboratory internal document GUG/N 03:141
- [ 2 ] Basic standard for the Measurement of Specific Absorption Rate related to human exposure to electromagnetic fields from mobile phones (300MHz-3GHz), European Standard EN 50361, July 2001
- [ 3 ] FCC, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields: Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radio Frequency Emissions," Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01).
- [ 4 ] IEEE, "Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Body Due to Wireless Communications Devices: Experimental Techniques," Std 1528-2003, June, 2003.

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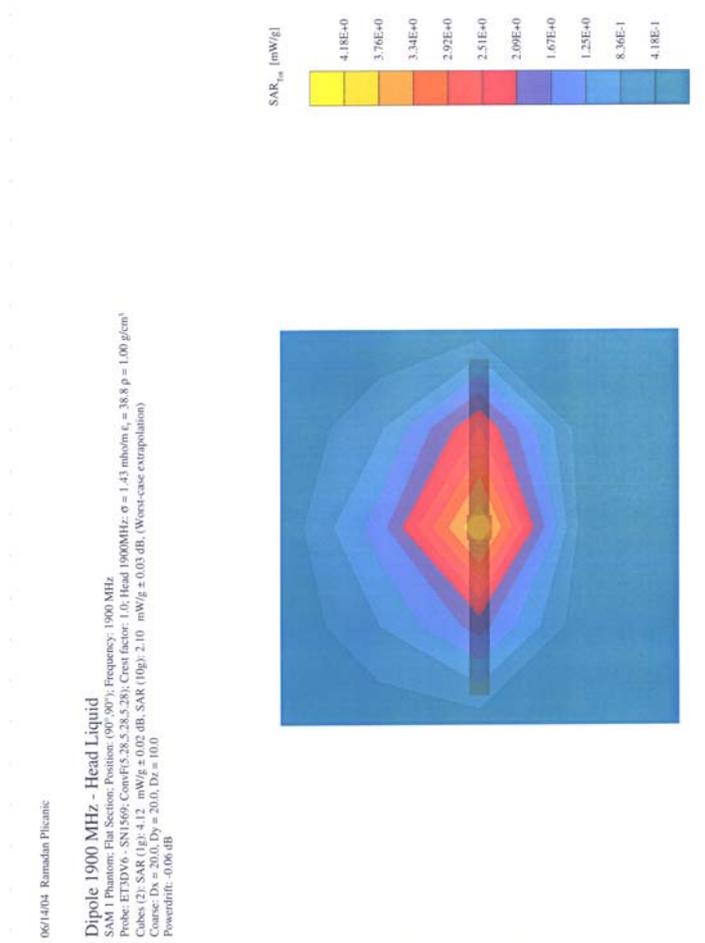
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## 10 Appendix

### 10.1 SAR distribution comparison for system accuracy verification



Validation Dipole , measured with head simulating tissue on 14/06/2004

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Date/Time: 04/09/03 18:49:39

 Test Laboratory: SPEAG, Zurich, Switzerland  
 File Name: [SN5d002\\_SN1507\\_HSL1900\\_090403.da4](#)
**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN5d002  
 Program: Dipole Calibration**

Communication System: CW-1900; Frequency: 1900 MHz; Duty Cycle: 1:1

 Medium: HSL 1900 MHz ( $\sigma = 1.44$  mho/m,  $\epsilon_r = 38.78$ ,  $\rho = 1000$  kg/m<sup>3</sup>)

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

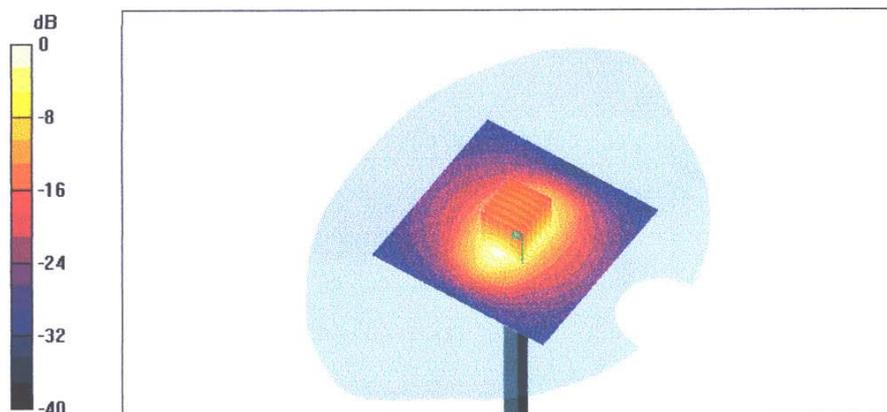
**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.2 V/m

Peak SAR = 18.2 W/kg

SAR(1 g) = 10.4 mW/g; SAR(10 g) = 5.38 mW/g

Power Drift = 0.01 dB


**1900MHz SAR distribution of validation dipole from reference measurement**

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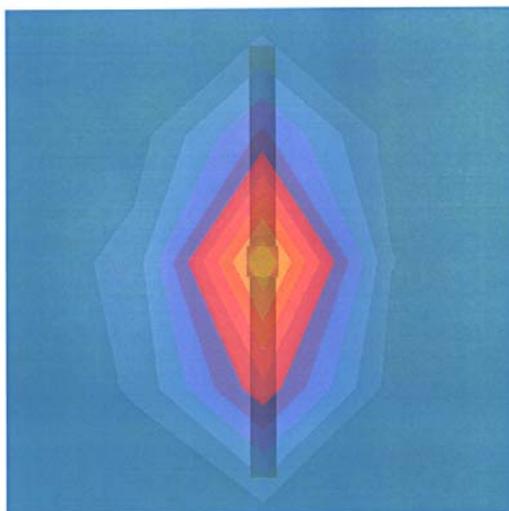
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**Dipole 1900 MHz - Body Liquid**

SAM 4 Phantom; Flat Section; Position: (90°, 90°); Frequency: 1900 MHz  
 Probe: ET3DV6 - SNI585; ConvF(4.56,4.56,4.56); Crest factor: 1.0; Muscle 1900;  $\sigma = 1.52$  mho/m  $\epsilon_r = 50.0$   $\rho = 1.09$  g/cm<sup>3</sup>  
 Cube 5x5x7; SAR (1g): 4.43 mW/g; SAR (10g): 2.29 mW/g; SAR (10g): 2.29 mW/g; (Worst-case extrapolation)  
 Course: Dx = 20.0, Dy = 20.0, Dz = 10.0  
 Powerdrift: -0.06 dB


**Validation Dipole, measured with muscle simulating tissue on 16/06/2004**

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Date/Time: 04/08/03 12:31:50

 Test Laboratory: SPEAG, Zurich, Switzerland  
 File Name: [SN5d002\\_SN1507\\_M1900\\_080403.da4](#)
**DUT: Dipole 1900 MHz; Serial: D1900V2 - SN5d002**  
**Program: Dipole Calibration**

Communication System: CW-1900; Frequency: 1900 MHz; Duty Cycle: 1:1

 Medium: Muscle 1900 MHz; ( $\sigma = 1.59$  mho/m,  $\epsilon_r = 51.2$ ,  $\rho = 1000$  kg/m<sup>3</sup>)

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

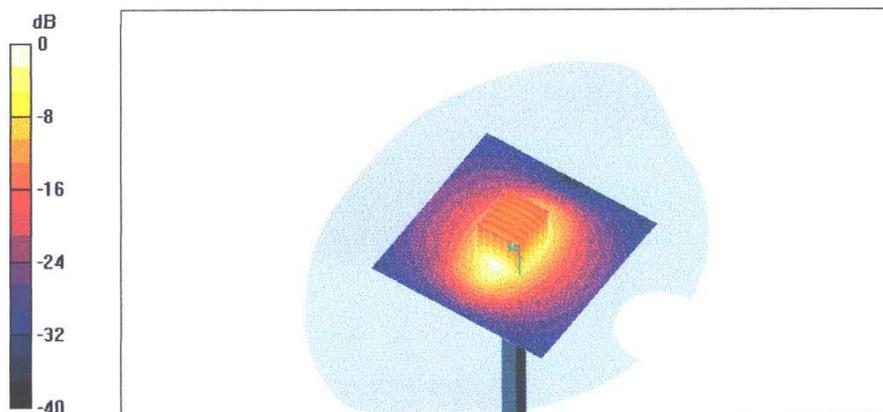
**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 92.8 V/m

Peak SAR = 18.9 W/kg

SAR(1 g) = 10.8 mW/g; SAR(10 g) = 5.6 mW/g

Power Drift = 0.02 dB


**1900MHz SAR distribution of validation dipole from reference measurement  
with muscle simulating tissue**

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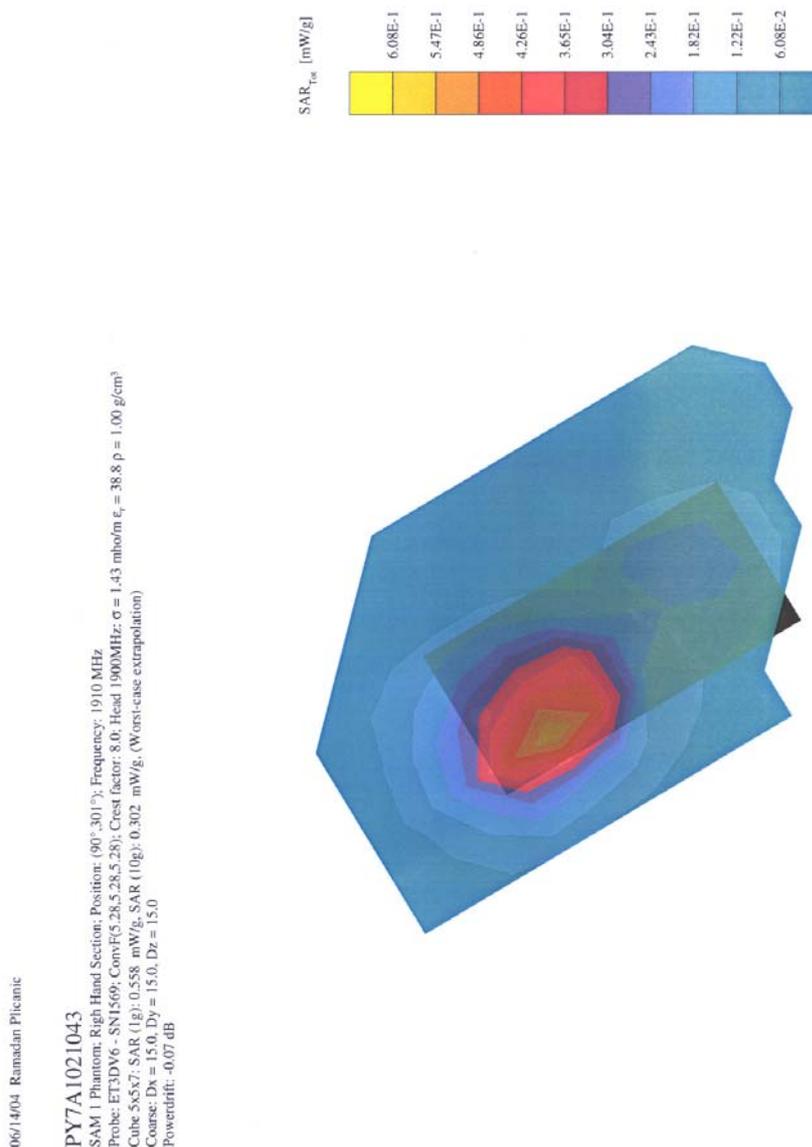
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## 10.2 SAR distribution plot



Distribution of max SAR in GSM1900 mode at 1909.8MHz. Measured against the head for cheek phone position

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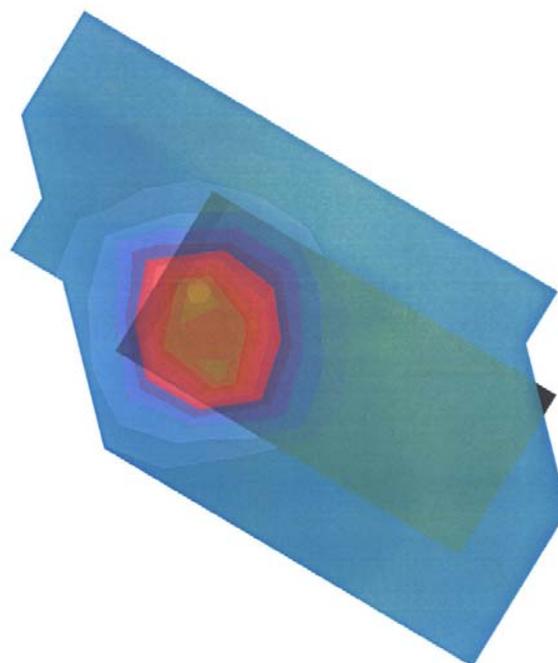
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**PY7A1021043**

SAM 1 Phantom; Left Hand Section; Position: (105°, 59°); Frequency: 1850 MHz  
 Probe: ET3DV6 - SNI 569; ConvF(5.28,5.28,5.28); Crest factor: 8.0; Head 19000MHz;  $\sigma = 1.43$  mho/m  $\epsilon_r = 38.8$   $\rho = 1.00$  g/cm<sup>3</sup>  
 Cube 5x5x7; SAR (1g): 0.615 mW/g; SAR (10g): 0.338 mW/g; (Worst-case extrapolation)  
 Course: Dx = 15.0, Dy = 15.0, Dz = 10.0  
 Powerdrift: -0.07 dB



**Distribution of max SAR in GSM1900 mode at 1850.2MHz. Measured against the head for tilt phone position**

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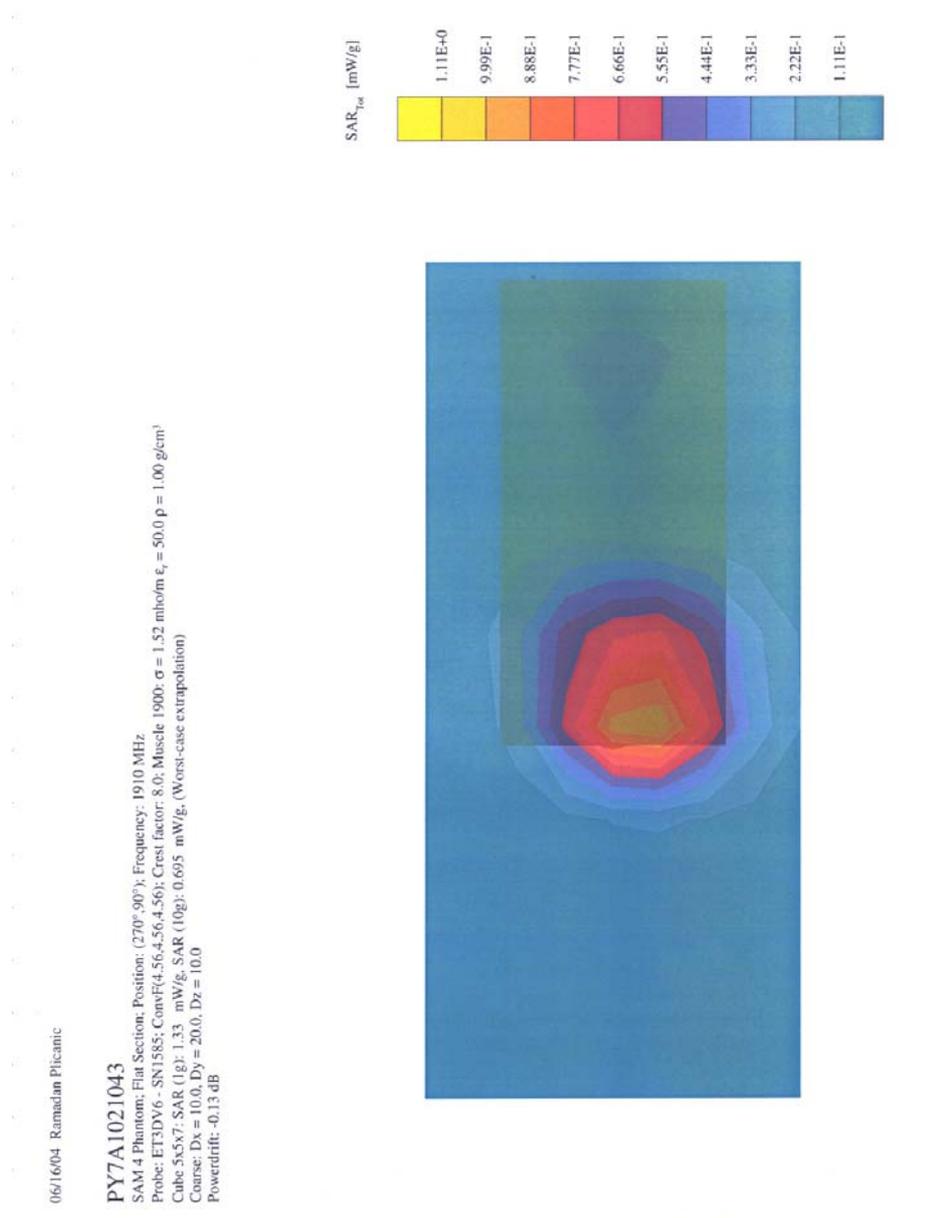
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**Distribution of max SAR in GSM1900 speech mode at 1909.8MHz. Measured against the body for back phone position to the phantom**

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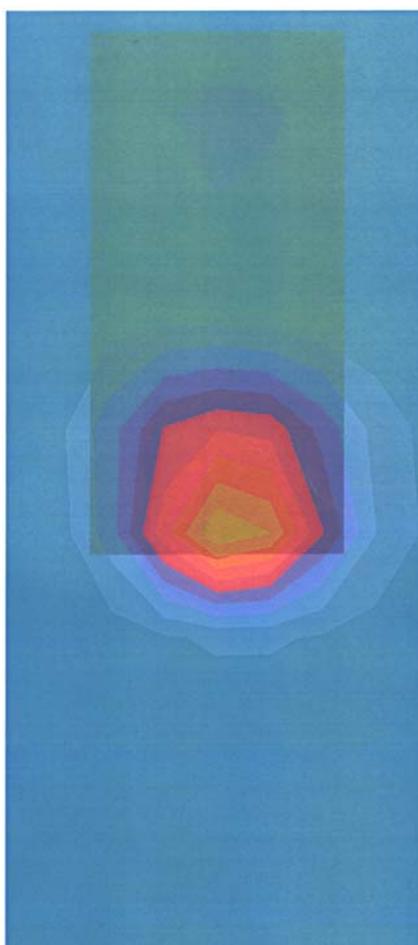
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PY7A1021043

SAM 4 Phantom; Flat Section; Position: (270°, 90°); Frequency: 1880 MHz  
 Probe: ET3DY6 - SN1585; ConvF(4.56,4.56,4.56); Crest factor: 4.0; Muscle 1900:  $\sigma = 1.52$  mho/m  $\epsilon_r = 50.0$   $\rho = 1.00$  g/cm<sup>3</sup>  
 Cube 5x5x7; SAR (1g): 1.49 mW/g; SAR (10g): 0.800 mW/g; (Worst-case extrapolation)  
 Course: Dx = 10.0, Dy = 20.0, Dz = 10.0  
 Powerdrift: -0.06 dB



**Distribution of max SAR in GSM1900 GPRS with 2Tx slot data mode at 1909.8MHz. Measured against the body for back phone position to the phantom**

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**10.3 Photographs of the device under test**



**Front and back side**



**Left side**

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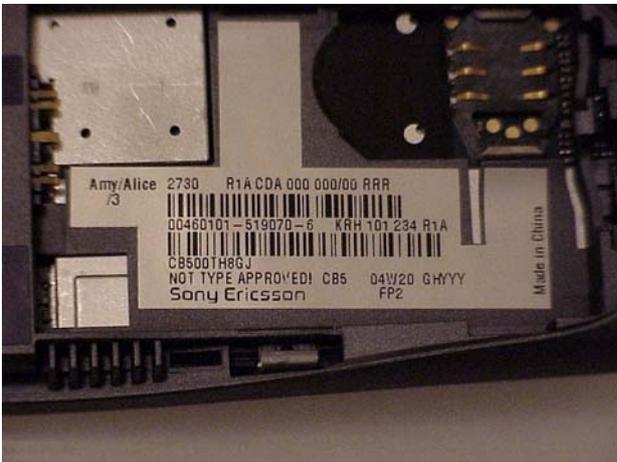
Date

Rev

Reference

040630

File



**Back side and battery**

Prepared (also subject responsible if other)

LD/SEMC/BGUG/NM *Ramadan Plicanic*

Approved

LD/SEMC/BGUG/NMC *Mats Hansson*

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GUG/N 04:135

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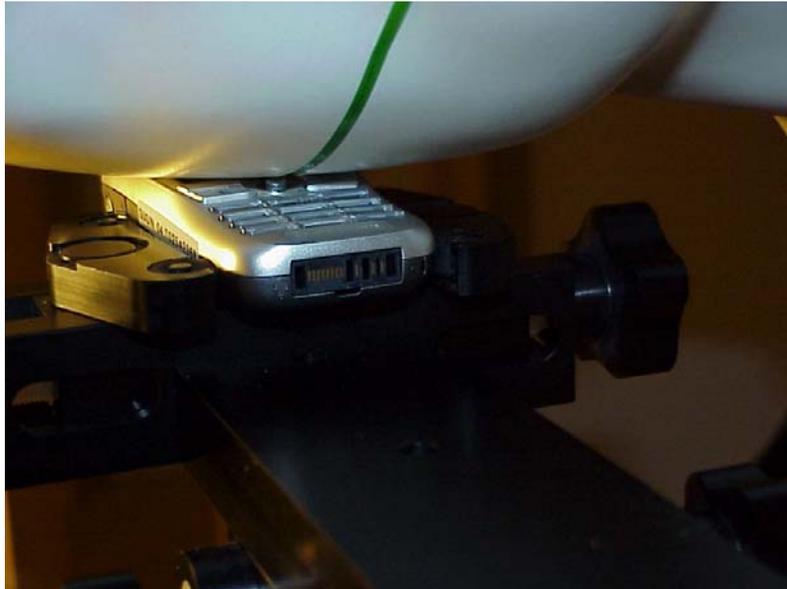
040630

Rev

Reference

File

## 10.4 Device position on SAM Twins Phantom



Device position against the head: Cheek (touch) phone position



Device position against the head: Tilt (cheek+15deg) phone position

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LD/SEMC/BGUG/NM *Ramadan Plicanic*

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**Device position against the body**

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040630

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Reference

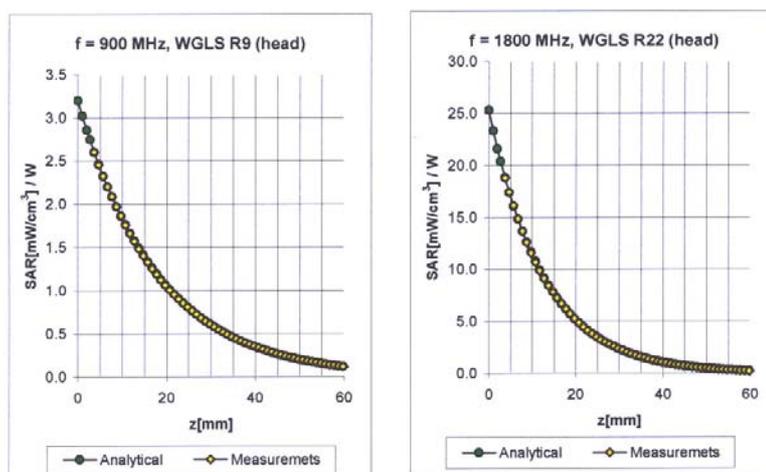
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## 10.5 Probe calibration parameters

ET3DV6 SN:1569

March 18, 2004

### Conversion Factor Assessment



f [MHz]	Validity [MHz] <sup>8</sup>	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
835	785-885	Head	41.5 ± 5%	0.90 ± 5%	0.57	1.76	7.12 ± 9.7%	(k=2)
900	850-950	Head	41.5 ± 5%	0.97 ± 5%	0.49	1.98	6.95 ± 9.7%	(k=2)
1750	1700-1800	Head	40.0 ± 5%	1.40 ± 5%	0.43	2.75	5.56 ± 9.7%	(k=2)
1900	1850-1950	Head	40.0 ± 5%	1.40 ± 5%	0.44	2.97	5.28 ± 9.7%	(k=2)
2000	1950-2050	Head	40.0 ± 5%	1.40 ± 5%	0.47	2.73	5.05 ± 9.7%	(k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	0.79	2.03	4.72 ± 9.7%	(k=2)
835	785-885	Body	55.2 ± 5%	0.97 ± 5%	0.39	2.28	6.72 ± 9.7%	(k=2)
900	850-950	Body	55.0 ± 5%	1.05 ± 5%	0.51	1.92	6.60 ± 9.7%	(k=2)
1750	1700-1800	Body	53.3 ± 5%	1.52 ± 5%	0.51	2.83	4.79 ± 9.7%	(k=2)
1900	1850-1950	Body	53.3 ± 5%	1.52 ± 5%	0.55	2.90	4.60 ± 9.7%	(k=2)
2000	1950-2050	Body	53.3 ± 5%	1.52 ± 5%	0.63	2.51	4.44 ± 9.7%	(k=2)
2450	2400-2500	Body	52.7 ± 5%	1.95 ± 5%	1.01	1.64	4.34 ± 9.7%	(k=2)

<sup>8</sup> 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.



Company Internal REPORT

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LD/SEMC/BGUG/NM Ramadan Plicanic

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LD/SEMC/BGUG/NMC Mats Hansson

040630

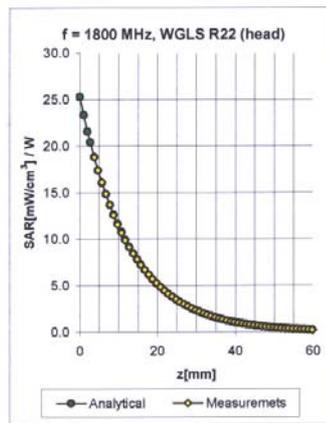
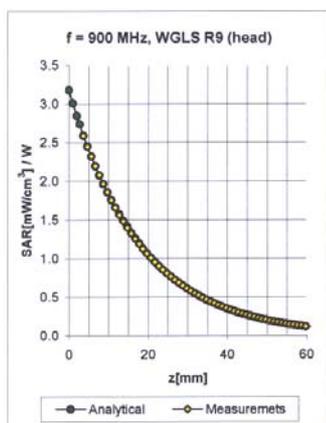
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ET3DV6 SN:1585

March 18, 2004

Conversion Factor Assessment



f [MHz]	Validity [MHz] <sup>9</sup>	Tissue	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
835	785-885	Head	41.5 ± 5%	0.90 ± 5%	0.43	2.18	6.91 ± 9.7% (k=2)
900	850-950	Head	41.5 ± 5%	0.97 ± 5%	0.58	1.83	6.67 ± 9.7% (k=2)
1750	1700-1800	Head	40.0 ± 5%	1.40 ± 5%	0.45	2.67	5.57 ± 9.7% (k=2)
1900	1850-1950	Head	40.0 ± 5%	1.40 ± 5%	0.45	2.94	5.26 ± 9.7% (k=2)
2000	1950-2050	Head	40.0 ± 5%	1.40 ± 5%	0.45	3.21	4.96 ± 9.7% (k=2)
2450	2400-2500	Head	39.2 ± 5%	1.80 ± 5%	0.80	2.03	4.74 ± 9.7% (k=2)
835	785-885	Body	55.2 ± 5%	0.97 ± 5%	0.46	2.10	6.58 ± 9.7% (k=2)
900	850-950	Body	55.0 ± 5%	1.05 ± 5%	0.81	1.51	6.38 ± 9.7% (k=2)
1750	1700-1800	Body	53.3 ± 5%	1.52 ± 5%	0.52	2.86	4.77 ± 9.7% (k=2)
1900	1850-1950	Body	53.3 ± 5%	1.52 ± 5%	0.56	2.88	4.56 ± 9.7% (k=2)
2000	1950-2050	Body	53.3 ± 5%	1.52 ± 5%	0.65	2.45	4.45 ± 9.7% (k=2)
2450	2400-2500	Body	52.7 ± 5%	1.95 ± 5%	1.01	1.60	4.36 ± 9.7% (k=2)

<sup>9</sup> 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.