

Prepared (also subject responsible if other) LD/ECS/GUF/KG Ramadan Plicanic		No. GTX/FG 01:066		
Approved GUF/KG Ramadan Plicanic	Checked ECSRAPL	Date 2001-09-03	Rev A	File H:\RR\SAR_FCC Report\T66.doc

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## SAR Test Report: T66

**Date of test:** August 16,17 and 20, 2001

**Laboratory:** Electromagnetic Near Field and Radio Frequency Dosimetry Laboratory  
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### Statement of Compliance

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

#### **Ericsson Type 1130401-BV (T66)**

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.

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

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## 1. Introduction

In this test report, compliance of the Ericsson T66 portable telephone with RF safety guidelines is demonstrated (applicable RF safety guidelines are given in [1]). The device was tested in accordance with the latest available test guidelines [1]. Detailed procedures of the test are described in the *Ericsson SAR Measurement Specification* [2].

## 2. Device Under Test

### 2.1 Antenna description

<b>Type</b>	Built in	
<b>Location</b>	Back on the top	
<b>Dimensions</b>	length	-
	width at base	-
<b>Configuration</b>	PIFA	

### 2.2 Device description

<b>Device model</b>	T66
<b>Serial number</b>	BLU100005456
<b>Mode</b>	1900 TDMA
<b>Multiple Access Scheme</b>	TDMA
<b>Maximum Output Power Setting<sup>1</sup></b>	29.0 dBm
<b>Factory Tolerance in Power Setting</b>	± 0.5dB
<b>Maximum Peak Output Power<sup>2</sup></b>	29.5 dBm
<b>Duty Cycle</b>	1 / 8
<b>Transmitting Frequency Range</b>	1850 – 1910 MHz
<b>Prototype or Production Unit</b>	Prototype

## 3. Test equipment

### 3.1 Dosimetric system

SAR measurements were made using the DASY3 professional system (software version 3.1c), manufactured by Schmid & Partner Engineering AG and installed June, 1996. The total SAR assessment uncertainty ( $K = 1$ ) of the system is  $\pm 16\%$  and includes a  $+15\%$  offset (overestimation). The extended uncertainty ( $K = 2$ ) is  $\pm 32\%$  with a  $+15\%$  offset. This results in a total uncertainty range of  $-1\%$  to  $+31\%$  for  $K = 1$ , or  $-17\%$  to  $+47\%$  for  $K = 2$ . The equipment list is given below.

<b>Description</b>	<b>Serial Number</b>	<b>Due Date</b>
DASY3 DAE V2	215	5/02
E-field probe ETDV6	1569	5/02
Dipole Validation Kit, D1800V2	228	5/03

<sup>1</sup> This is the conducted power measured at the antenna port when the device is set to its highest power setting. It is measured at the middle of the transmit frequency band. Note that the output power may be different at other frequencies.

<sup>2</sup> This equals the maximum output power setting plus the factory tolerance.

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### 3.2 Additional equipment

Description	Serial Number	Due Date
Signal Generator ESG-D4000A	INV 562935	4/02
Dielectric probe kit HP 85070B	INV 443029	7/02
Network analyzer HP 8753C	INV 421670	6/02
Power meter R&S NRVD	INV 483920	12/01
Power sensor R&S NRV-Z5	INV 2334	12/01
Wavetek 4106GPP	INV 462991	7/02

### 4. Electrical parameters of 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 program is also given. Recommended limits for maximum permittivity, minimum conductivity and maximum mass density are also shown [3]. It is seen that the measured parameters result in an overestimation of SAR compared to the recommended values.

$f$ (MHz)	Tissue type	Limits / Measured	Dielectric Parameters		
			$\epsilon_r$	$\sigma$ (S/m)	$\rho$ (g/cm <sup>3</sup> )
1800	Head	Measured, 08/14/01	39.4	1.65	1.00
		Recommended Limits[3]	40.0	1.4	1.03
	Muscle	Measured, 08/14/01	39.4	1.68	1.00
		Recommended Limits [3]	53.3	1.52	1.04

### 5. 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. The obtained results are displayed in the table below. It is seen that the system is operating within its specification, as the results are within  $\pm 5\%$  of the reference values. At 1800 MHz, reference values are provided by the manufacturer [4]. The distributions of SAR compare well with those of the reference measurements (see Appendix 1).

$f$ (MHz)	Tissue type	Measured / Reference	SAR (W/kg), 1 gram	Dielectric Parameters			Temp. (°C)
				$\epsilon_r$	$\sigma$ (S/m)	$\rho$ (g/cm <sup>3</sup> )	
1800	Head / Muscle	Measured, 08/14/01	42.4	39.4	1.65	1.00	24.5
		Reference [4]	43.6	40.0	1.7	1.00	?

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## 6. Test results

The measured 1-gram averaged SAR values of the device are provided in Tables 1 and 2. Also shown are the measured conducted output powers and the temperature of the test facility during the test. The depth of the tissue simulating liquid was 13 cm. A base station simulator was used to control the device during the SAR measurements. The phone was supplied with a fully-charged battery for the tests.

SAR measured against the head is presented in Table 1. 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 (100deg). For 1900 TDMA modes, the device was tested at the lowest, middle and highest frequencies of the transmit band.

Mode	f(MHz)	Output power (dBm)	Phone Positions	SAR, 1g (W/kg)			
				left-hand		right-hand	
				measured	calculated to max. power	measured	calculated to max. power
1900 TDMA	1850	29.5	Cheek	0.83	<b>0.83</b>	0.77	0.77
			Tilt(100deg)	0.87	0.87	0.87	0.87
	1880	29.3	Cheek	0.77	0.81	0.74	0.77
			Tilt(100deg)	0.79	0.83	0.83	<b>0.87</b>
	1910	29.0	Cheek	0.49	0.55	0.51	0.57
			Tilt(100deg)	0.57	0.64	0.49	0.55

**Table 1: SAR measurement results for the Ericsson T66 telephone at highest possible output power. Measured against the head.**

For body-worn measurements, the device was tested against a flat phantom representing the user's body. Phone was 15mm on distance from flat phantom. In Table 2, SAR values are provided for both front and back part of the phone to the phantom.

Mode	f(MHz)	Output Power (dBm)	Phone Position	SAR, 1g (W/kg)	
				measured	calculated to max. power
1900 TDMA	1850	29.5	Front	0.23	0.23
			Back	0.62	0.62
	1880	29.3	Front	0.31	0.33
			Back	0.64	0.67
	1910	29.0	Front	0.2	0.22
			Back	0.66	<b>0.74</b>

**Table 2: SAR measurement results for the Ericsson T66 telephone at highest possible output power. Measured against the body.**

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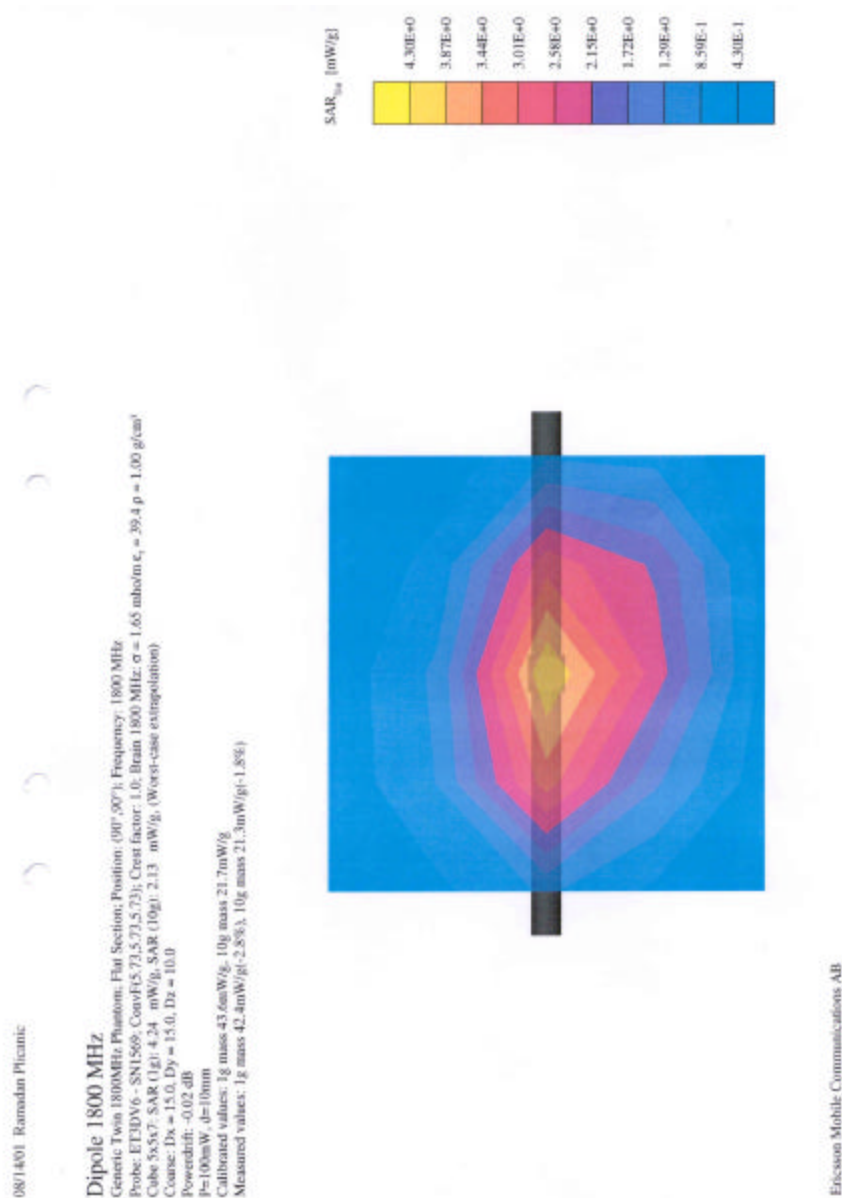
## References

- [1] C. Törnevik, "Ericsson SAR measurement specification, part 1: Introduction and Purpose," Internal Document ERA/T/U-98:446, February, 1999.
- [2] C. Törnevik, M. Siegbahn, T. Persson, M. Douglas, and R. Plicanic, "Ericsson SAR measurement specification", Internal Document ERA/T/U-98:442, February 1999.
- [3] Federal Communications Commission, "Tissue Dielectric Properties," <http://www.fcc.gov/fcc-bin/dielec.sh>.
- [4] Schmid and Partner Engineering AG, "DASY Dipole Validation Kit," Type: D1800V2, S/N: 217, February, 2000.

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## Appendix 1: SAR distribution comparison for system accuracy verification



1800 MHz SAR distribution of validation dipole antenna from system accuracy verification test. Measured with head/muscle simulating tissue on 08/14/01.

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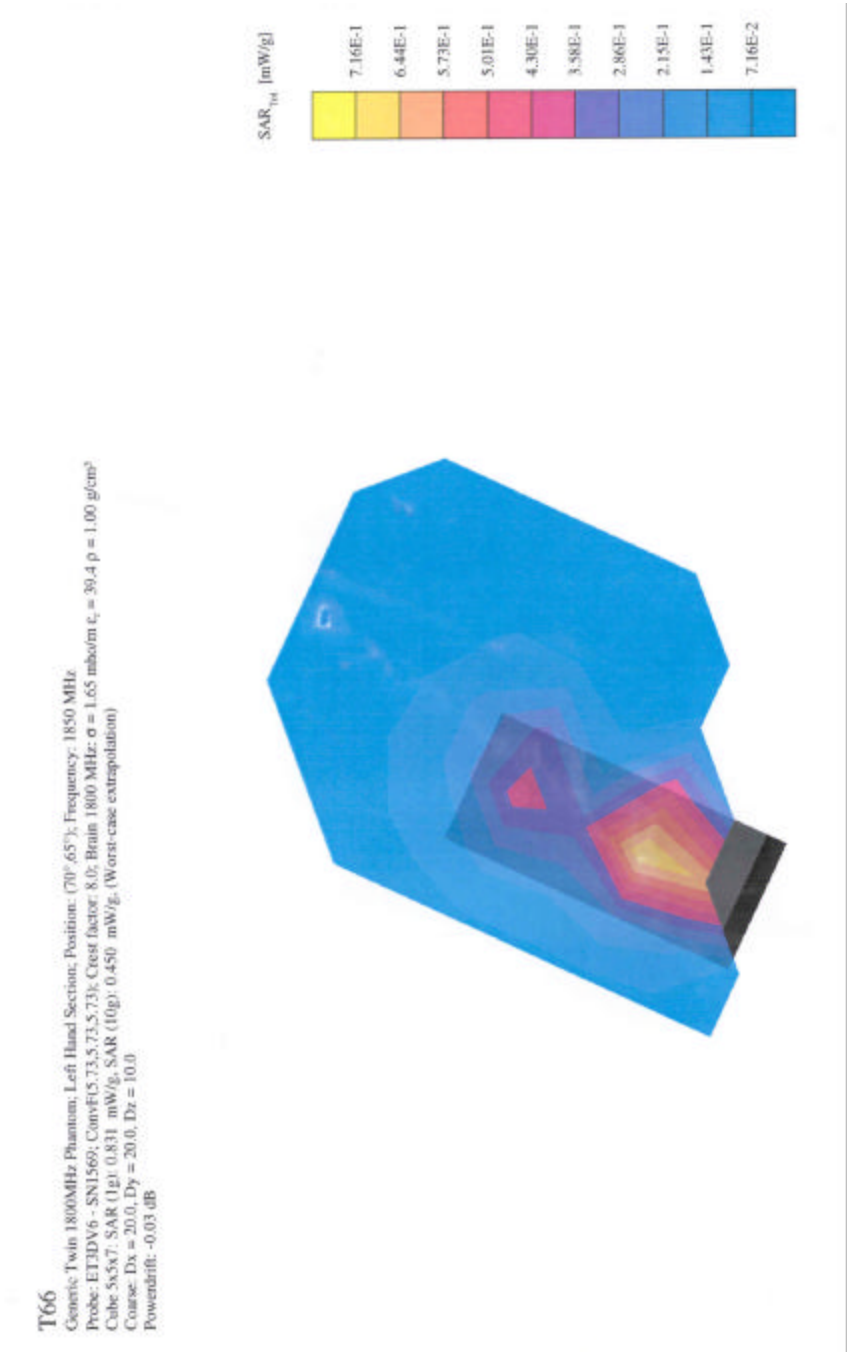
1800 MHz SAR distribution of validation dipole antenna from reference measurement.



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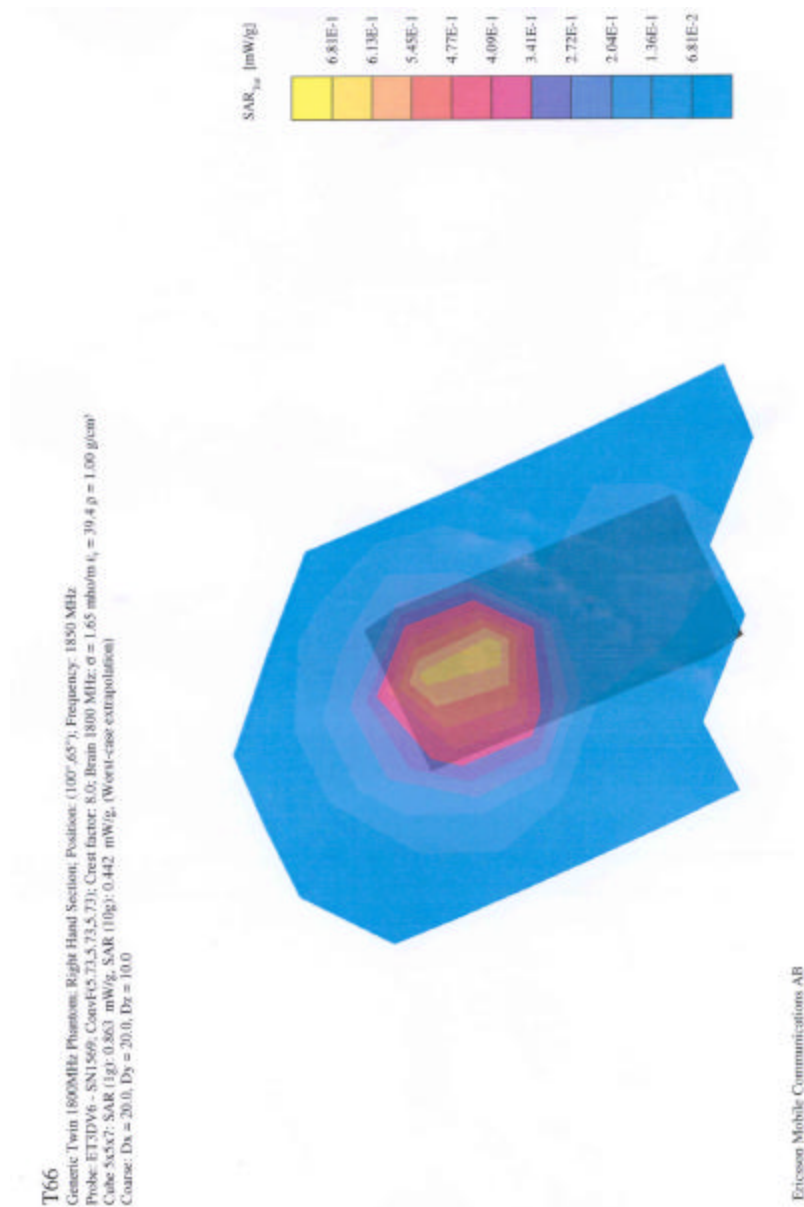
Appendix 2: SAR distribution plots



Distribution of maximum SAR in 1900 TDMA mode (at 1850 MHz). Measured against the head for cheek (touch) phone position.

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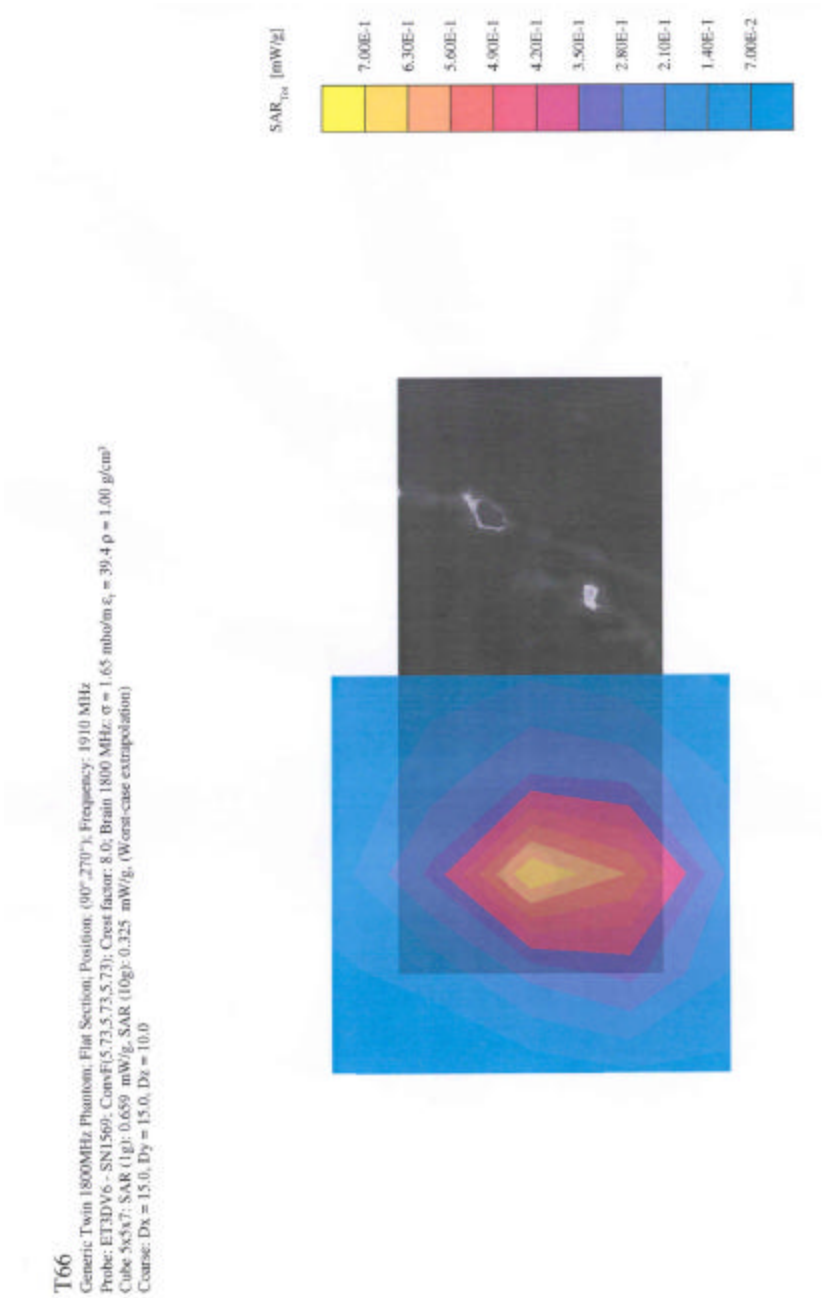
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**Distribution of maximum SAR in 1900 TDMA mode (at 1850 MHz). Measured against the head for tilt (100deg) phone position.**

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Distribution of maximum SAR in 1910 TDMA mode. Measured against the body.

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**Appendix 3: Photographs of the device under test****Front view of device.**

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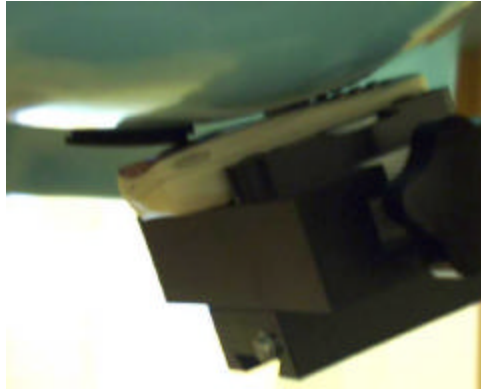


Side view of device.

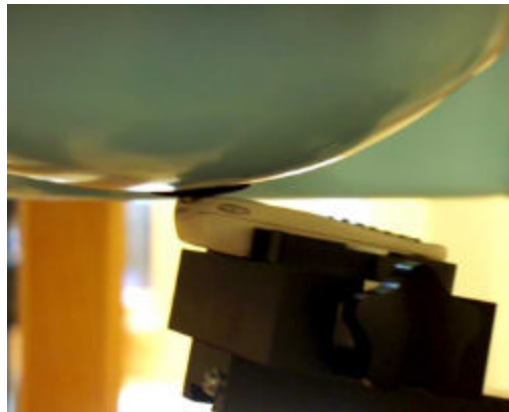
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#### Appendix 4: Position of device on Generic Twin Phantom



Device position against the head, cheek (touch) phone position.



Device position against the head, tilt (100deg) phone position

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**Front part of the phone 15mm away from the Flat Phantom**



**Back part of the phone 15mm away from the Flat Phantom**

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## Appendix 5: Probe calibration parameters for ET3DV4 SN:1101

ET3DV4 SN:1101

### DAE2 - Parameters of Probe: ET3DV4 SN:1101

#### Sensitivity in Free Space

#### Diode Compression

NormX	1.23 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	80 mV
NormY	1.36 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	80 mV
NormZ	1.17 $\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	80 mV

#### Sensitivity in Tissue Simulating Liquid

Brain	450 MHz	$\epsilon_r = 48 \pm 5\%$	$\sigma = 0.50 \pm 10\% \text{ mho/m}$
ConvF X	5.98	extrapolated	Boundary effect:
ConvF Y	5.98	extrapolated	Alpha 0.46
ConvF Z	5.98	extrapolated	Depth 1.78
Brain	900 MHz	$\epsilon_r = 42.5 \pm 5\%$	$\sigma = 0.86 \pm 10\% \text{ mho/m}$
ConvF X	5.75	$\pm 7\%$ (k=2)	Boundary effect:
ConvF Y	5.75	$\pm 7\%$ (k=2)	Alpha 0.51
ConvF Z	5.75	$\pm 7\%$ (k=2)	Depth 1.92
Brain	1500 MHz	$\epsilon_r = 41 \pm 5\%$	$\sigma = 1.32 \pm 10\% \text{ mho/m}$
ConvF X	5.44	interpolated	Boundary effect:
ConvF Y	5.44	interpolated	Alpha 0.58
ConvF Z	5.44	interpolated	Depth 2.10
Brain	1800 MHz	$\epsilon_r = 41 \pm 5\%$	$\sigma = 1.69 \pm 10\% \text{ mho/m}$
ConvF X	5.29	$\pm 7\%$ (k=2)	Boundary effect:
ConvF Y	5.29	$\pm 7\%$ (k=2)	Alpha 0.61
ConvF Z	5.29	$\pm 7\%$ (k=2)	Depth 2.19

#### Sensor Offset

Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.9 $\pm$ 0.2	mm