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SAR Test Report: R520m

Date of test: November 16 and 17, 2000

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Statement of Compliance

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

Ericsson R520m

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)

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.

Table of Contents

1. Introduction 3

2. Device Under Test 3
   2.1 Antenna description 3
   2.2 Device description 3

3. Test equipment 3
   3.1 Dosimetric system 3
   3.2 Additional equipment 4

4. Electrical parameters of the tissue simulating liquid 4

5. System accuracy verification 4

6. Test results 5

References 6

Appendix 1: SAR distribution comparison for system accuracy verification 7

Appendix 2: SAR distribution plots 9

Appendix 3: Photographs of the device under test 11

Appendix 4: Position of device on Generic Twin Phantom 13

Appendix 5: Probe calibration parameters for ET3DV5 SN:1324 15

1. Introduction

In this test report, compliance of the Ericsson R520m 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

Type	Fixed stub	
Location	Left side	
Dimensions	length	30 mm
	width at base	12/15 mm
Configuration	Meander	

2.2 Device description

Device model	R520m
Serial number	A5103GV6QR
Mode	1900 TDMA
Multiple Access Scheme	TDMA
Maximum Output Power Setting [1]	29.0 dBm
Factory Tolerance in Power Setting	± 0.5dB
Maximum Peak Output Power [2]	29.5 dBm
Duty Cycle	1 / 3
Transmitting Frequency Range	1850 – 1910 MHz
Prototype or Production Unit	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 Juny, 1996. The total SAR assessment uncertainty (K = 1) of the system is ±16% and includes a +15% offset (overestimation). The extended uncertainty (K = 2) is ±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.

Description	**Serial Number**	**Due Date**
DASY3 DAE V2	215	5/01
E-field probe ETDV4	1101	5/01
Dipole Validation Kit, D1800V2	228	5/02

[1] 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.

[2] This equals the maximum output power setting plus the factory tolerance.

3.2 Additional equipment

Description	Serial Number	Due Date
Signal Generator ESG-D4000A	INV 562935	4/00
Dielectric probe kit HP 85070B	INV 443029	7/02
Network analyzer HP 8753C	INV 421670	6/01
Power meter R&S NRVD	INV 483920	12/01
Power sensor R&S NRV-Z5	INV 2334	12/01
Wavetek 4106GPP	INV 462991	7/01

4. Electrical parameters of the tissue simulating liquid

Prior to conducting SAR measurements, the relative permittivity, ε_r, and the conductivity, σ, of the tissue simulating liquids were measured with the dielectric probe kit. These values are shown in the table below. The mass density, ρ, 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		
			e_r	s (S/m)	r (g/cm^3)
1800	Head	Measured, 11/16/00	39.2	1.67	1.00
		Recommended Limits[3]	43.5	1.15	1.03
	Muscle	Measured, 11/16/00	39.2	1.67	1.00
		Recommended Limits [3]	54.4	1.39	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 ±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)
				e_r	s (S/m)	r (g/cm^3)	
1800	Head / Muscle	Measured, 11/16/00	39.8	39.2	1.67	1.00	23.7
		Reference [4]	38.84	39.4	1.69	1.00	?

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. For 1900 TDMA modes, the device was tested at the lowest, middle and highest frequencies of the transmit band.

Mode	**Chamber Temp. (°C)**	***f* (MHz)**	**Output Power (dBm)**	**SAR, 1g (W/kg)**			
				left-hand		**right-hand**	
				measured	**calculated to max. power**	**measured**	**calculate to max. power**
1900 TDMA	24	1850	28.9	0.587	0.68	0.657	**0.76**
		1880	28.7	0.532	0.63	0.615	0.74
		1910	29.0	0.548	0.61	0.617	0.69

Table 1: SAR measurement results for the Ericsson R520m 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, using designated carry cases. Under measurement was Bluetooth transmitter on. In Table 2, SAR values are provided for the carry cases that bring the phone closest to the body (product # SXK 10972/01, R1B).

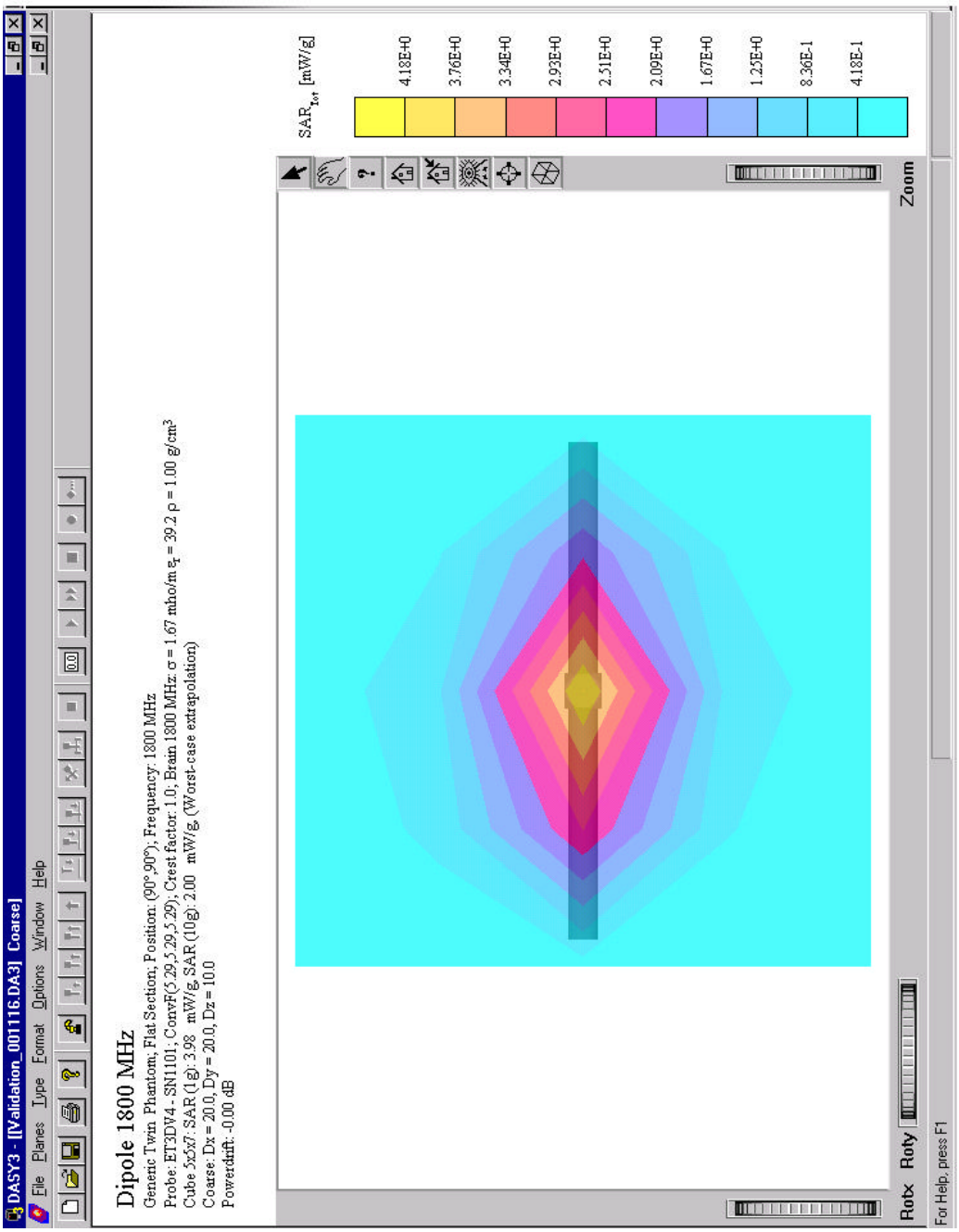
Mode	**Chamber Temp. (°C)**	***f* (MHz)**	**Output Power (dBm)**	**SAR, 1g (W/kg)**	
				SXK10972/01 R1B	
				measured	**calculated to max. power**
1900 TDMA	24.3	1850	28.9	0.358	**0.41**
		1880	28.7	0.329	0.39
		1910	29.0	0.345	0.4

Table 2: SAR measurement results for the Ericsson R520m telephone at highest possible output power. Measured against the body.

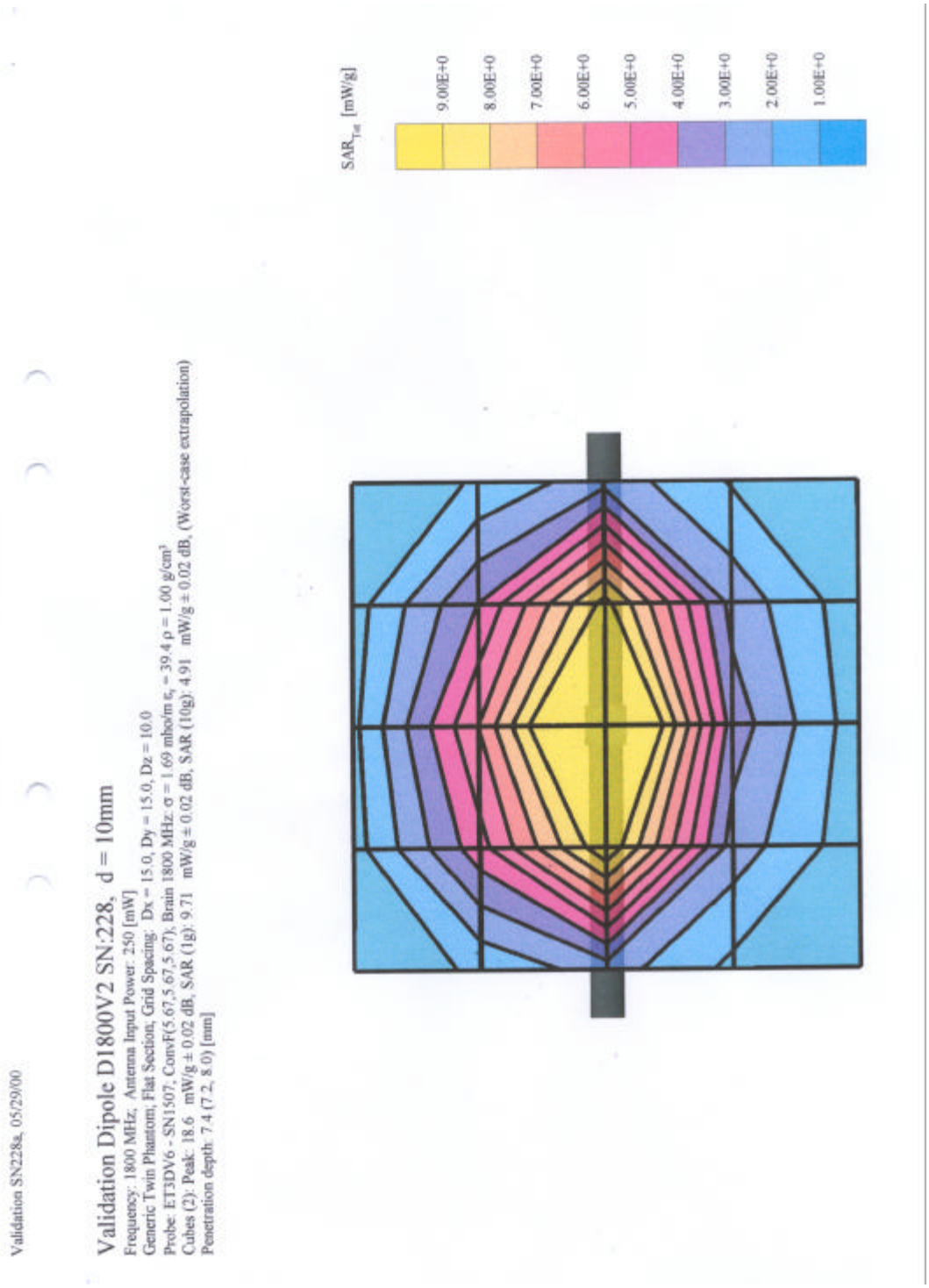
References

[1] C. Törnevik, "Ericsson SAR measurement specifiction, 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.

Appendix 1: SAR distribution comparison for system accuracy verification

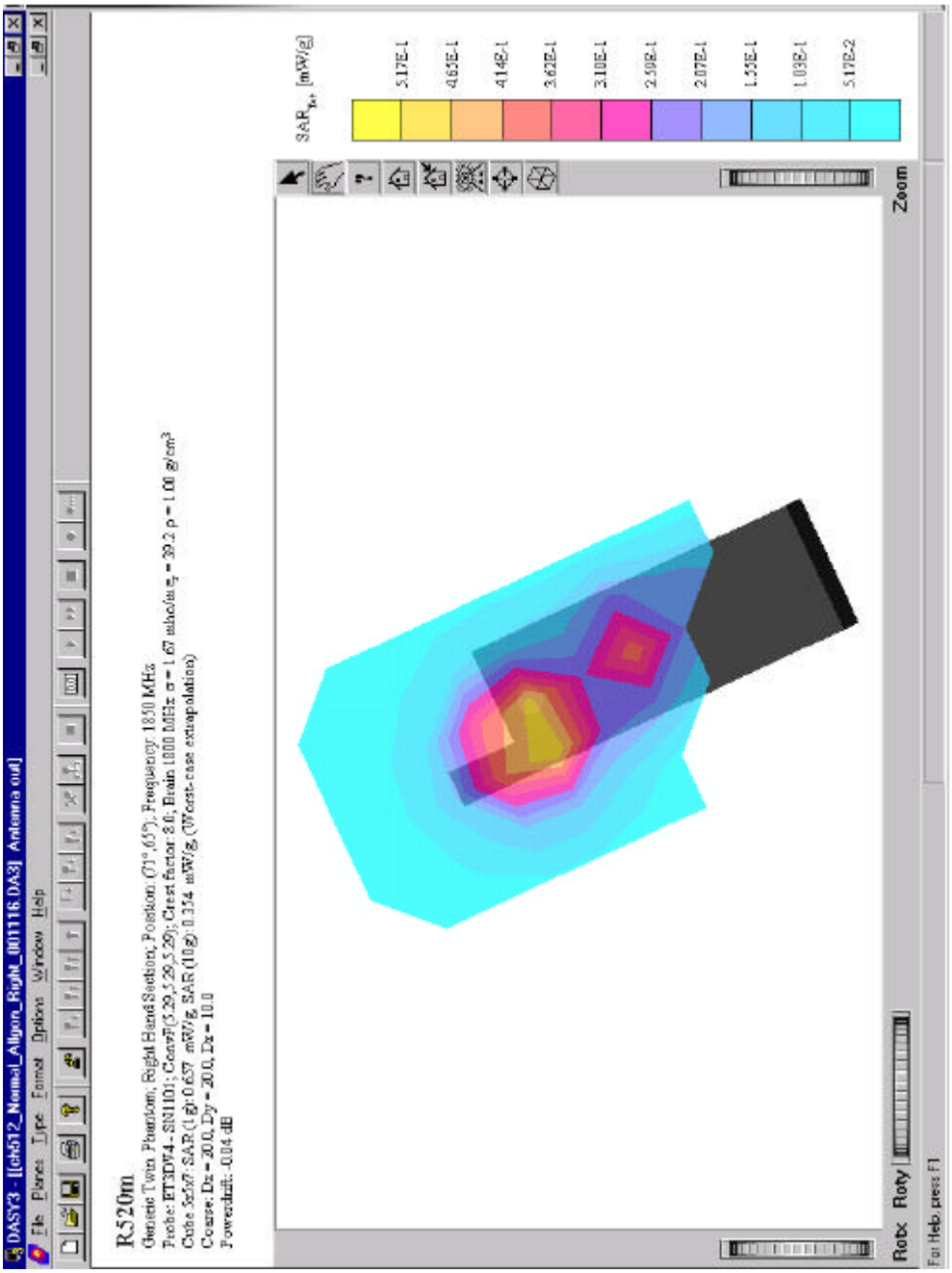


1800 MHz SAR distribution of validation dipole antenna from system accuracy verification test. Measured with head/muscle simulating tissue on 11/16/00.

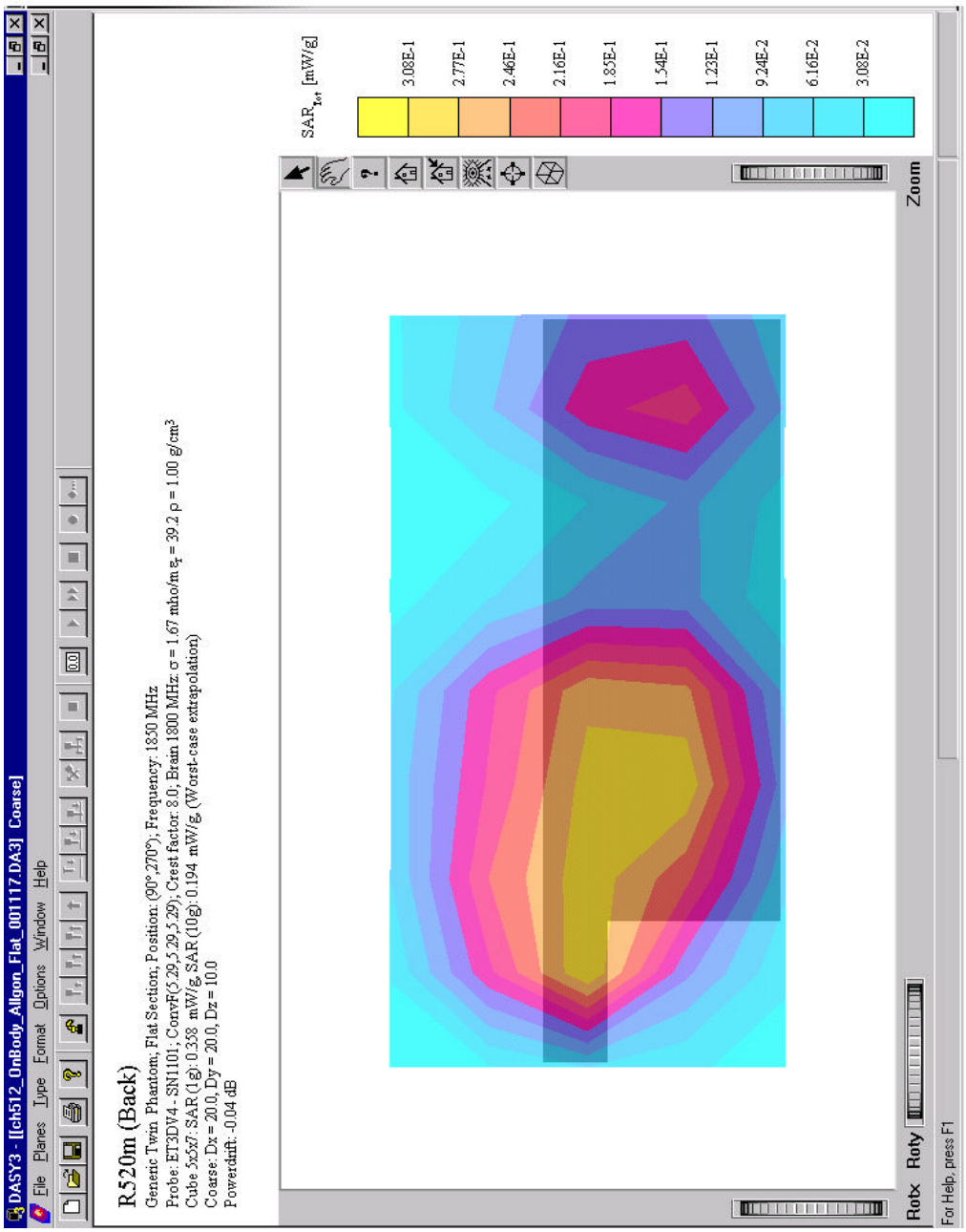


1800 MHz SAR distribution of validation dipole antenna from reference measurement.

Appendix 2: SAR distribution plots



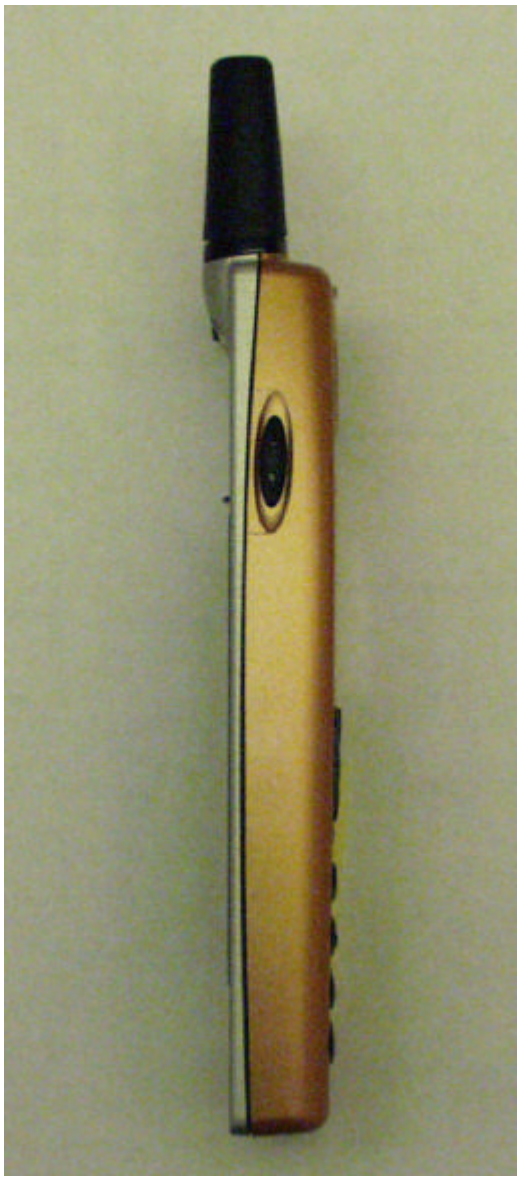
Distribution of maximum SAR in 1900 TDMA mode (at 1850 MHz). Measured against the head.



Distribution of maximum SAR in 1900 TDMA mode. Measured against the body.

Appendix 3: Photographs of the device under test

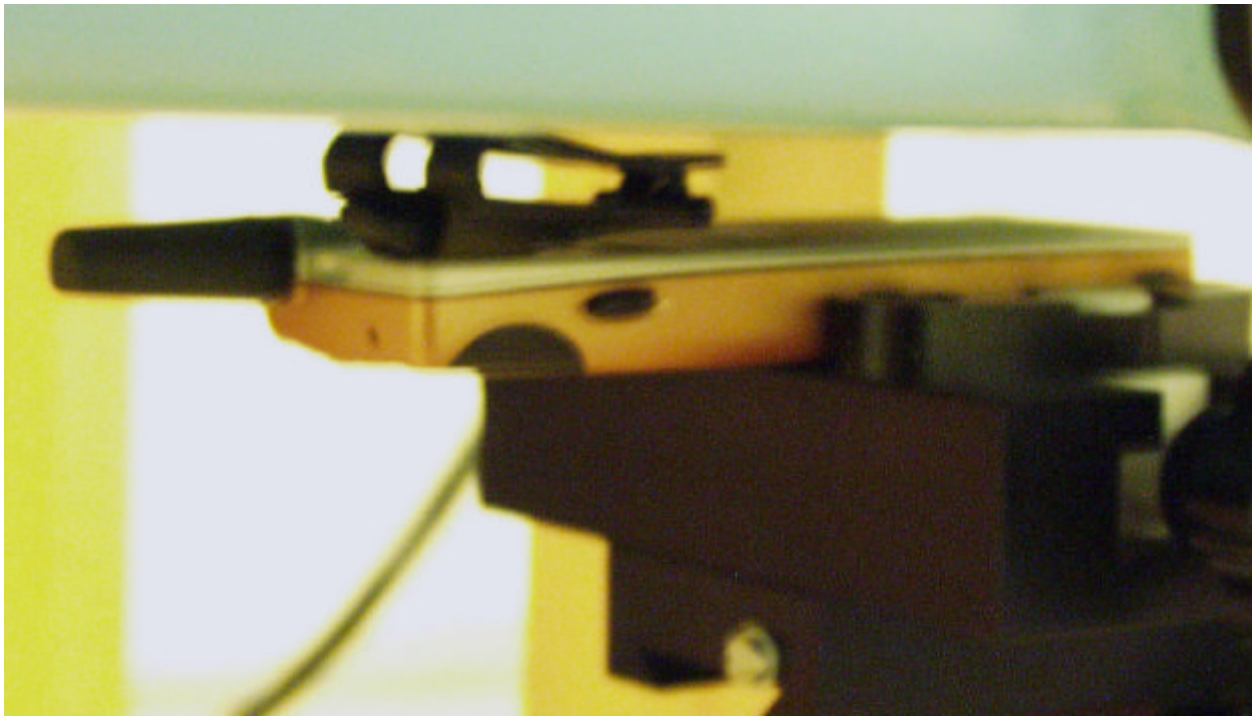
Front view of device.



Side view of device.

Appendix 4: Position of device on Generic Twin Phantom

Device position against the head.



Device position against the body with accessory SXK 10972/01, R1B.

Appendix 5: Probe calibration parameters for ET3DV4 SN:1101

ET3DV4 SN:1101

DAE2 - Parameters of Probe: ET3DV4 SN:1101

Sensitivity in Free Space

NormX	1.23 μV/(V/m)^2
NormY	1.36 μV/(V/m)^2
NormZ	1.17 μV/(V/m)^2

Diode Compression

DCP X	80 mV
DCP Y	80 mV
DCP Z	80 mV

Sensitivity in Tissue Simulating Liquid

Brain **450 MHz** ε_r = 48 ± 5% σ = 0.50 ± 10% 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** ε_r = 42.5 ± 5% σ = 0.86 ± 10% mho/m

ConvF X	5.75 ± 7% (k=2)	Boundary effect:	
ConvF Y	5.75 ± 7% (k=2)	Alpha	0.51
ConvF Z	5.75 ± 7% (k=2)	Depth	1.92

Brain **1500 MHz** ε_r = 41 ± 5% σ = 1.32 ± 10% 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** ε_r = 41 ± 5% σ = 1.69 ± 10% mho/m

ConvF X	5.29 ± 7% (k=2)	Boundary effect:	
ConvF Y	5.29 ± 7% (k=2)	Alpha	0.61
ConvF Z	5.29 ± 7% (k=2)	Depth	2.19

Sensor Offset

Probe Tip to Sensor Center	2.7	mm
Optical Surface Detection	1.9 ± 0.2	mm