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SAR Test Report: T18ds

Date of test: November 2, 1999

Laboratory: Electromagnetic Near Field and Radio Frequency Dosimetry Laboratory
Ericsson, Inc.
7001 Development Drive, P.O. Box 13969,
Research Triangle Park, NC, 27709, USA

Test Responsible: Mark Douglas, Ph.D.
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(919) 472-6334

Statement of Compliance
Ericsson, Inc. declares under its sole responsibility that the that the product

Ericsson T18ds

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.

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Table of Contents

1. Introduction

In this test report, compliance of the Ericsson T18ds 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	Right side	
Dimensions	length	30 mm
	width at base	9 mm
Configuration	Dual-band helix	

2.2 Device description

Device model	T18ds	
Serial number	UA2012ZZ7M	
Mode	800 AMPS	800 TDMA
Multiple Access Scheme	FDMA	TDMA
Maximum Output Power Setting [1]	25.5 dBm	25.5 dBm
Factory Tolerance in Power Setting	± 0.25	± 0.25
Maximum Peak Output Power [2]	25.75 dBm	25.75 dBm
Duty Cycle	1	1 / 3
Transmitting Frequency Range	824 – 849 MHz	824 – 849 MHz
Prototype or Production Unit [3]	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 February, 1998. 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 V1	345	10/00
E-field probe ETDV5	1337	3/00
Dipole Validation Kit, D900V2	035	3/00

[1] Conducted power measured at the antenna port when the device is set to its highest power setting. Measured in the middle of the transmit frequency band.
[2] This equals the maximum output power setting plus the factory tolerance.
[3] It shall be understood that a statement of compliance for a prototype unit also applies to production units [3].

3.2 Additional equipment

Description	Serial Number	Due Date
Signal Generator HP8648C	3537A01598	9/00
Dielectric probe kit HP 85070B	US33020390	2/00
Network analyzer HP 8752C	3410A03105	7/00
Power meter HP 437B	3125U13481	12/99
Power sensor HP 8482H	3318A07097	2/00
Radio communications analyzer Anritsu MT8801B	MB12477	10/00

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 satisfy the recommendations, resulting in an overestimation of SAR.

f (MHz)	Limits / Measured	Dielectric Parameters		
		ε_r	σ (S/m)	ρ (g/cm^3)
835	**Measured**	44.2	0.77	1.00
	Recommended Limits [3]	46.1	0.74	1.03
	Difference	**-4.1%**	**+4.1%**	**-2.9%**

5. System accuracy verification

A system accuracy verification of the DASY3 was performed using the dipole validation kits 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 obtained from the system manufacturer [4]. The distribution of SAR also compares well with that provided by the system manufacturer (see Appendix 1).

f (MHz)	Measured / Reference	SAR (W/kg), 1 gram	Dielectric Parameters			Temp. (°C)
			ε_r	σ (S/m)	ρ (g/cm^3)	
900	**Measured**	9.85	43.5	0.83	1.00	23
	Reference [4]	9.52	42.6	0.87	1.00	?

6. Test results

The measured SAR values and conducted output powers are shown in Table 1. The device was tested on both the right-hand phantom (corresponding to the right side of the head) and the left-hand phantom. The SAR results shown are maximum SAR values averaged over 1 g of tissue.

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. The temperature of the test facility during the tests was 22.0 ± 1 °C, and the depth of the tissue simulating liquid was 15.0 cm.

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mode	*f* (MHz)	Output Power (dBm)	SAR, 1g (W/kg)			
			left-hand		right-hand	
			measured	calculated to max. power	measured	calculated to max. power
800 AMPS	824	25.7	1.34	**1.39**	1.24	1.28
	837	25.6	1.29	1.34	1.21	1.25
	849	24.7	1.02	1.06	0.945	0.978
800 TDMA	824	25.8	0.502	**0.508**	0.443	0.448
	837	25.7	0.483	0.489	0.439	0.444
	849	24.7	0.382	0.386	0.361	0.365

Table 1: SAR measurement results for the Ericsson T18ds telephone at highest possible output power.

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, November, 1997.

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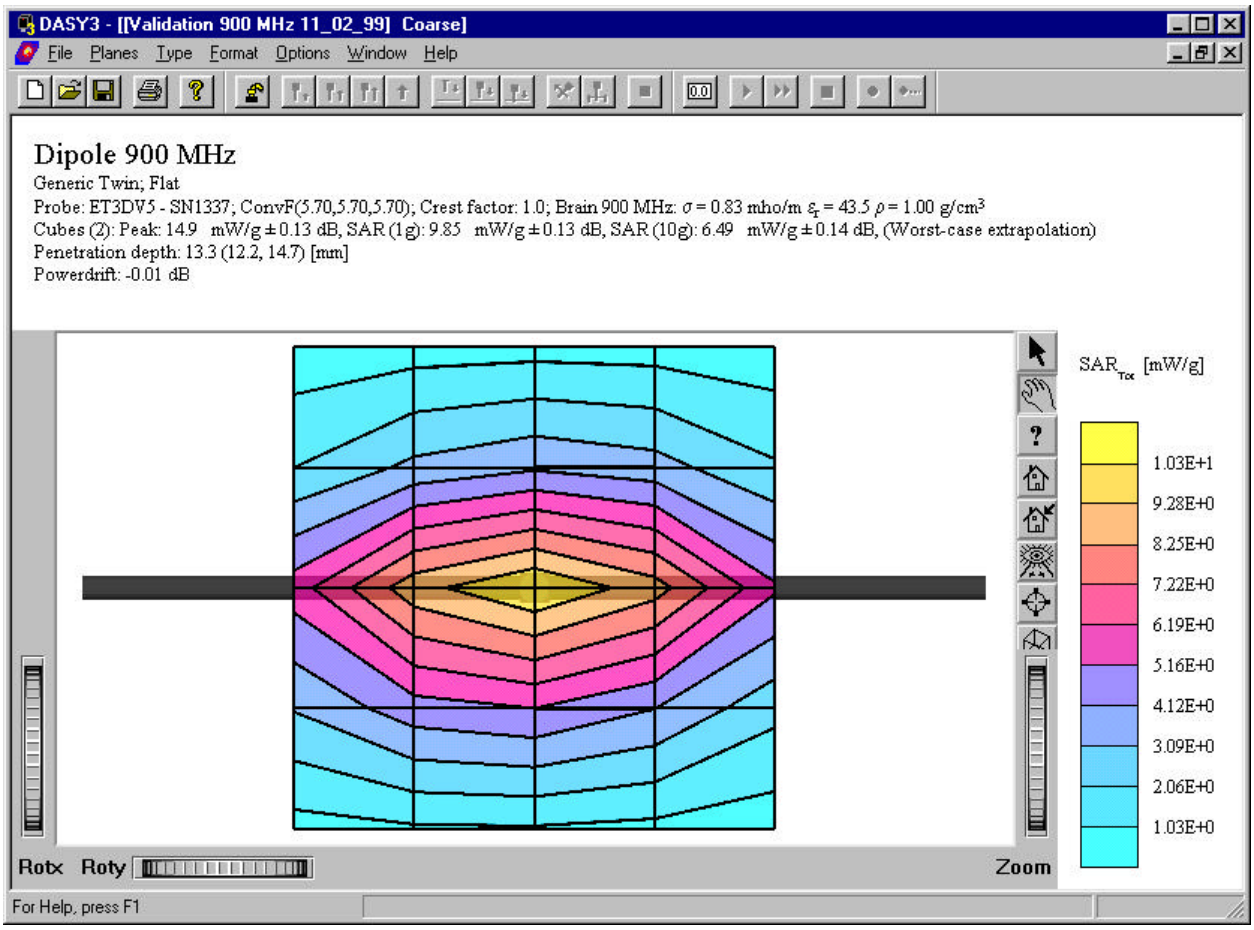
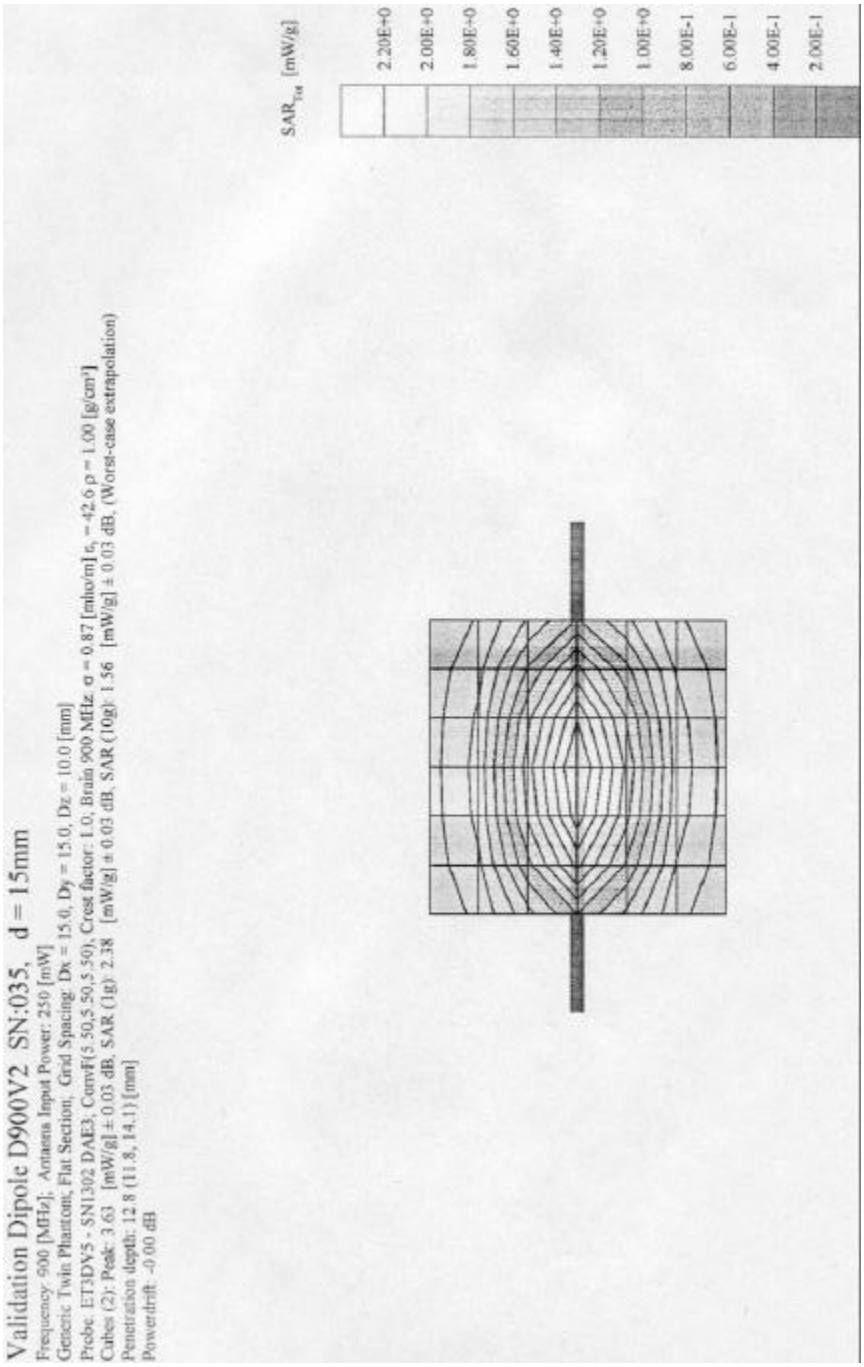
Appendix 1: SAR distribution comparison for system accuracy verification



900 MHz SAR distribution of validation dipole antenna from system accuracy verification test.



900 MHz SAR distribution of validation dipole antenna provided by system manufacturer.

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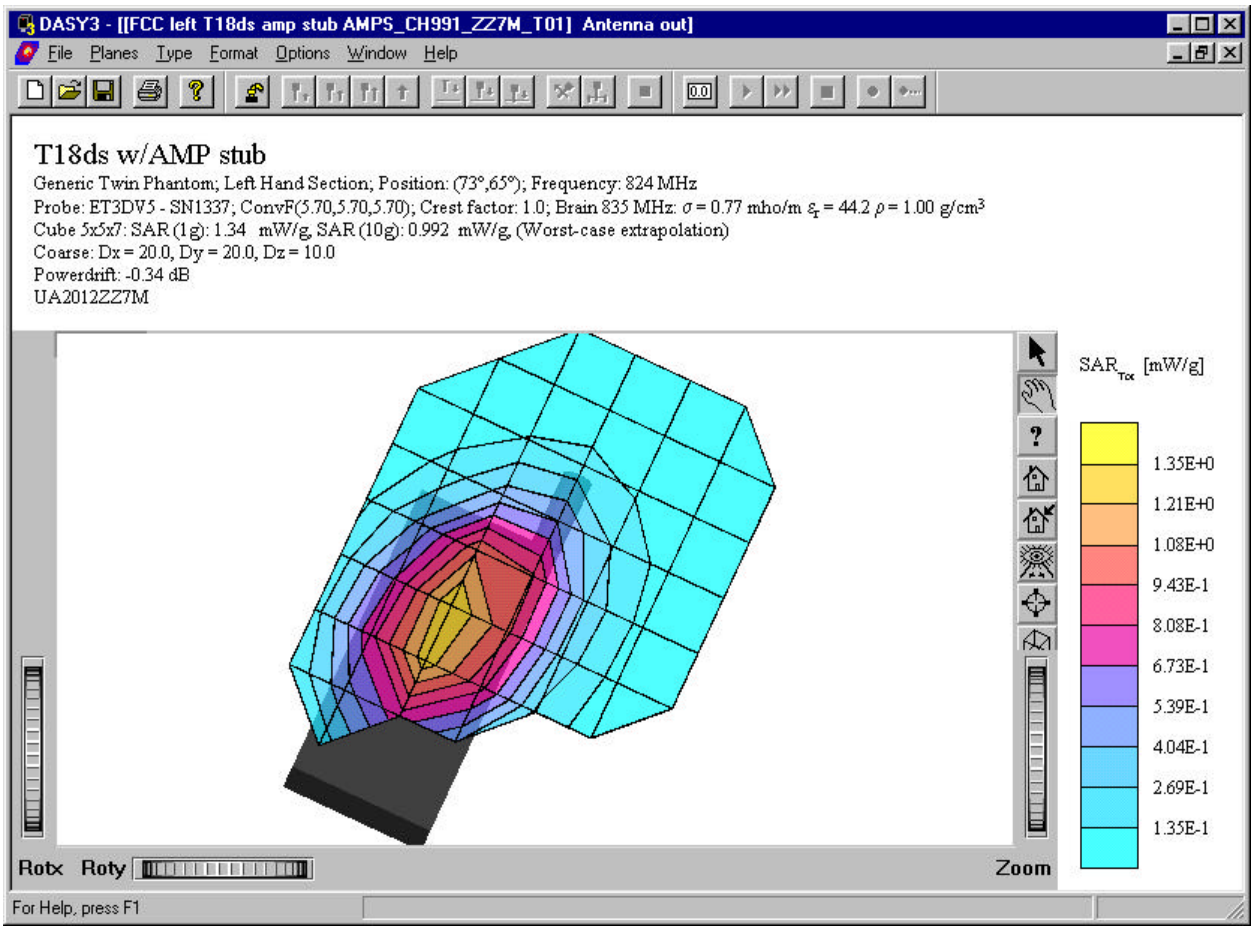
Appendix 2: SAR distribution plots



Distribution of maximum SAR in 800 AMPS band.

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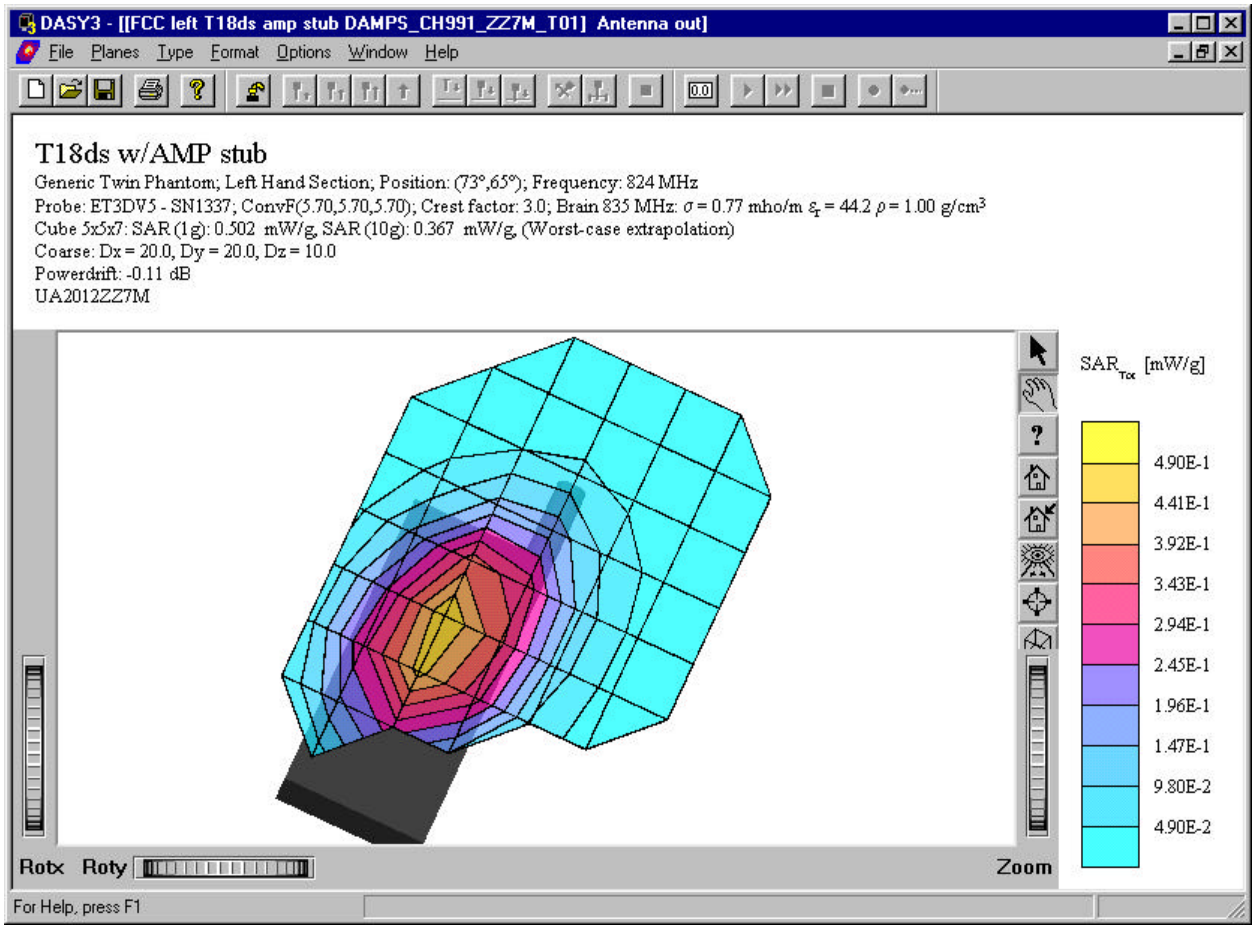

Distribution of maximum SAR in 800 TDMA band.

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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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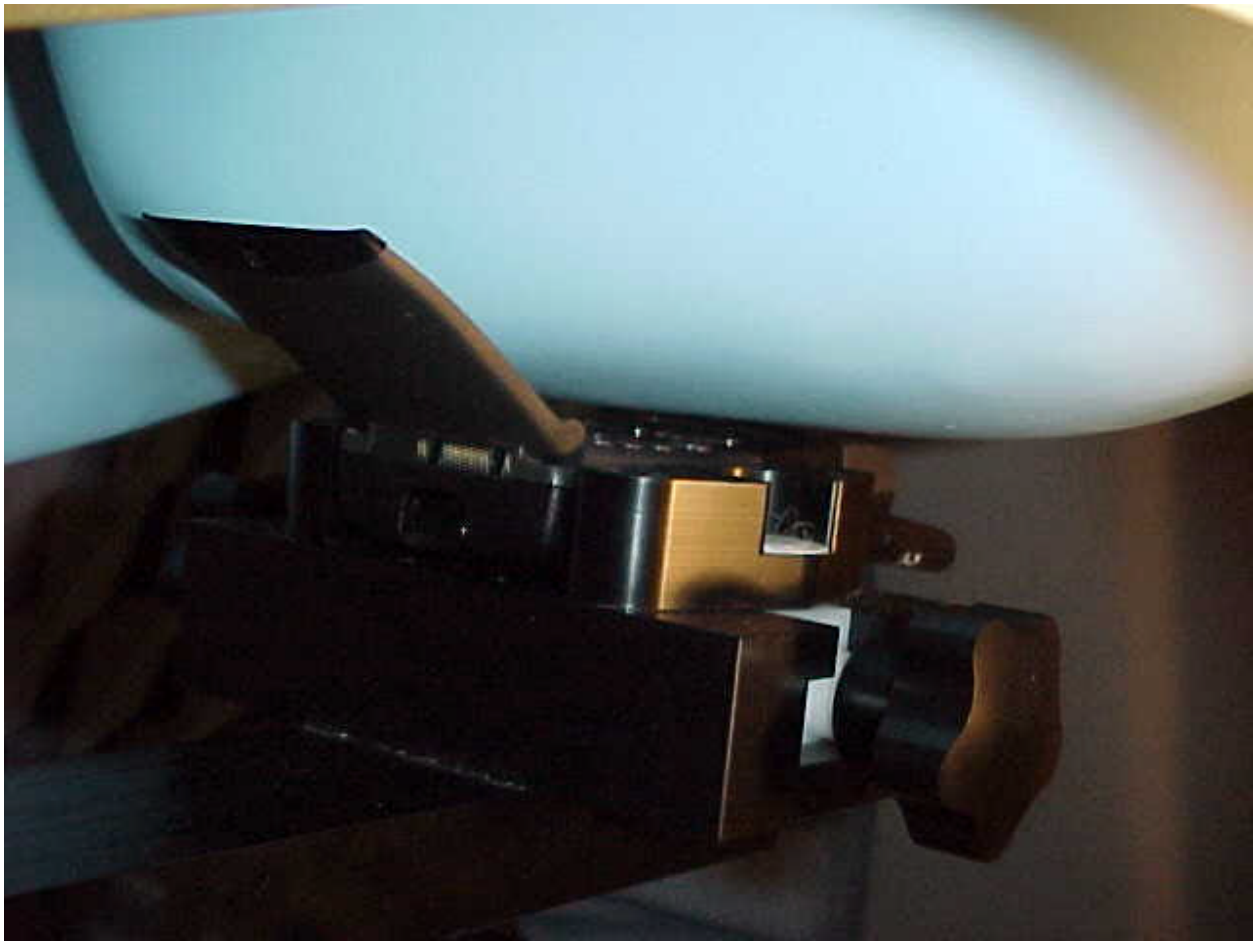
Appendix 4: Position of device on Generic Twin Phantom



Appendix 5: Probe calibration parameters for ET3DV5 SN:1337

ET3DV SN:1337

DASY3 - Parameters of Probe: ET3DV SN:1337

Sensitivity in Free Space

NormX	**2.32**	$\mu V/(V/m)^2$
NormY	**2.09**	$\mu V/(V/m)^2$
NormZ	**2.16**	$\mu V/(V/m)^2$

Diode Compression

DCP X	**98**	mV
DCP Y	**98**	mV
DCP Z	**98**	mV

Sensitivity in Tissue Simulating Liquid

450 MHz	ConvF X	**6.0**	extrapolated	ε_r = 48 ± 5%
	ConvF Y	**6.0**	extrapolated	σ = 0.50 ± 10% mho/m
	ConvF Z	**6.0**	extrapolated	(brain tissue simulating liquid)
900 MHz	ConvF X	**5.7**	± 10%	ε_r = 42.5 ± 5%
	ConvF Y	**5.7**	± 10%	σ = 0.86 ± 10% mho/m
	ConvF Z	**5.7**	± 10%	(brain tissue simulating liquid)
1500 MHz	ConvF X	**5.3**	interpolated	ε_r = 41 ± 5%
	ConvF Y	**5.3**	interpolated	σ = 1.32 ± 10% mho/m
	ConvF Z	**5.3**	interpolated	(brain tissue simulating liquid)
1800 MHz	ConvF X	**5.0**	± 10%	ε_r = 41 ± 5%
	ConvF Y	**5.0**	± 10%	σ = 1.69 ± 10% mho/m
	ConvF Z	**5.0**	± 10%	(brain tissue simulating liquid)

Sensor Offset

Probe Tip to Sensor Center	**2.7**	mm
Surface to Probe Tip	**1.9 ± 0.2**	mm