SAR Data

Per 2.1091 (c)

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Test Report: Dosimetric Assessment Measurements for the Ericsson DF 688 dual mode telephone.

1. Introduction

In this test report, Specific Absorption Rate (SAR) measurements for the Ericsson DF 688 are presented. The measurements were conducted at the experimental dosimetry chamber at Ericsson, Inc. in Research Triangle Park, North Carolina, USA. This report describes the test procedures that were used and the test results that were recorded.

2. Device Under Test (DUT)

Table 1 lists the parameters of the device under test.

Device Model	**DF 688**	
Serial Number	**UA200EPRZV**	
Antenna	**Centurion 65mm stick**	
Mode	**AMPS**	**D-AMPS**
Multiple Access Technique	**FDMA**	**TDMA**
Duty Cycle	**1**	**1/3**
Peak Power Nominal	**26 dBm**	**26 dBm**
Frequency	**837 MHz**	**837 MHz**

Table 1: Parameters of the device under test.

3. Measurement System

The measurements were made with the Dosimetric Assessment System, DASY, from Schmid & Partner AG (SPEAG) in Zurich, Switzerland [1]. This system was developed by Professor Niels Kuster and his team at the Swiss Federal Institute of Technology (ETH) in Zurich, Switzerland. The system uses the implantable E-field probe technique to evaluate the SAR inside a phantom. The E-field is automatically scanned inside a phantom head filled with a brain tissue simulating liquid. The positioning of the E-field probe inside the phantom head is done by a high precision 6 axis robot. A computer is used to control the robot and to collect the measured data.

3.1 Specification of the E-Field probe

The following is a summary of the technical data for the E-field probe that was used for the measurements:

Sensitivity in tissue simulating liquid:	1 μW/g to 100 mW/g
Linearity:	± 0.2 dB
Deviation from isotropy in tissue,	
Normal to probe axis:	± 0.3 dB
In all planes, all polarizations:	± 0.8 dB
Spatial resolution of SAR measurements:	< 0.125 cm^3
Reproducibility of probe positioning:	< ± 0.2 mm

More information about the probe is given in [2].

3.2 Brain tissue simulating liquid data

The constitutive parameters (relative permittivity, ε_r, and conductivity, σ) of the brain tissue simulating liquid are according to data provided by C. Gabriel and presented in [3]. The liquid was prepared according to the recipe in [3], and its constitutive parameters were verified using a dielectric probe kit and a Hewlett-Packard HP 8753D network analyzer. The brain tissue simulating liquid used for the SAR measurements in this report had constitutive parameter values at 900 MHz as shown in Table 2.

Mode	AMPS	D-AMPS
Relative permittivity, ε_r	41.5	42.5
Conductivity, σ (S/m)	0.85	0.85

Table 2: Constitutive parameters of the brain tissue simulating liquid.

3.3 Calibration

The system is calibrated at fixed time intervals by the system supplier (SPEAG). The calibration procedure and calibration data for the E-field probe and the data acquisition electronics used in the SAR measurements are given in [2,4,5].

3.4 Measurement Uncertainty

The total measurement uncertainty is estimated to be ± 20% [6].

4. Test Procedure

The dosimetric assessment measurements are made according to the operating manual for the DASY 3 system from SPEAG. The phone was supplied with a fully-charged battery for the tests.

4.1 Positioning of the Device Under Test

The DUT is placed in a position against the phantom head that corresponds to the intended or normal operating position. The normal position is a position that is convenient and provides good acoustic coupling. An illustration of the position used for the measurements is shown in [1]. It is defined as follows:

- The center of the device ear piece is placed at the entrance of the auditory canal as marked on the head phantom.
- The reference line of the phone is defined to be the line (on the surface of the phone case facing the phantom) which connects the center of the ear piece with the center of the bottom of the case (typically near the microphone).
- The reference line defined above shall lie in the reference plane defined by the following three points: auditory canal openings of both ears and the center of the closed mouth.
- The intended use position is defined by an angle between the reference line of the phone and the line connecting both auditory canal openings of 80°.

The device is tested in both the right hand phantom (the right side of the head) and the left hand phantom. The defined test position is in accordance with published guidelines [7].

4.2 Peak SAR determination procedure

The E-field probe is first scanned in a coarse grid over a large area inside the phantom head, in order to locate the position of the maximum SAR. The size of the scanned region is selected large enough to guarantee that all possible peak SAR areas are included. Measurements are then taken in a fine grid volume around the maximum SAR value. The size of the cubical fine grid region is approximately 30 cm^3. Numerical interpolation and extrapolation are used to determine the SAR values between measurement points in the cube and in the small region between the cube and the surface of the shell phantom which cannot be reached with the E-field probe. The 1g and 10g averaged SAR values are computed by shifting cubes with side lengths of 10 mm and 21.5 mm, respectively, over the fine grid volume. The recorded peak SAR is the maximum value of all of the evaluated positions.

5. Test results

The SAR values of the two different modes (AMPS and D-AMPS) of the DUT are shown in Table 3 for both the right and left hand phantoms. The results shown are for the maximum SAR values averaged over 1g and 10g of tissue.

Device	Mode	Phantom	Peak Output Power (dBm)	Frequency (MHz)	SAR 1g (W/kg)	SAR 10g (W/kg)
DF 688	AMPS	Left hand	25.9	837	1.13	0.798
		Right hand	25.9	837	1.32	0.871
	D-AMPS	Left hand	25.9	837	0.368	0.257
		Right hand	25.9	837	0.477	0.313

Table 3: SAR measurement results for the Ericsson DF 688 telephone.

References

[1] Schmid & Partner Engineering AG, "Preliminary Manual: DASY3 V1.0 for Windows 95," Zurich, Switzerland, Dec. 1997.

[2] Schmid & Partner Engineering AG, "Probe ET3DV5, SN: 1324," Zurich, Switzerland, Dec. 1997.

[3] Schmid & Partner Engineering AG, "Preliminary Manual: DASY3 V1.0 for Windows 95," Zurich, Switzerland, pp. 82-84, Dec. 1997.

[4] Schmid & Partner Engineering AG, "DASY – Dosimetric Assessment System: Calibration Report," Zurich, Switzerland, November, 1997.

[5] K. Meier, M. Burkhardt, T. Schmid and N. Kuster, "Broadband Calibration of E-Field Probes in Lossy Media," *IEEE Transactions on Microwave Theory and Techniques*, vol. 44, no. 10, pp. 1954-62, Oct. 1996.

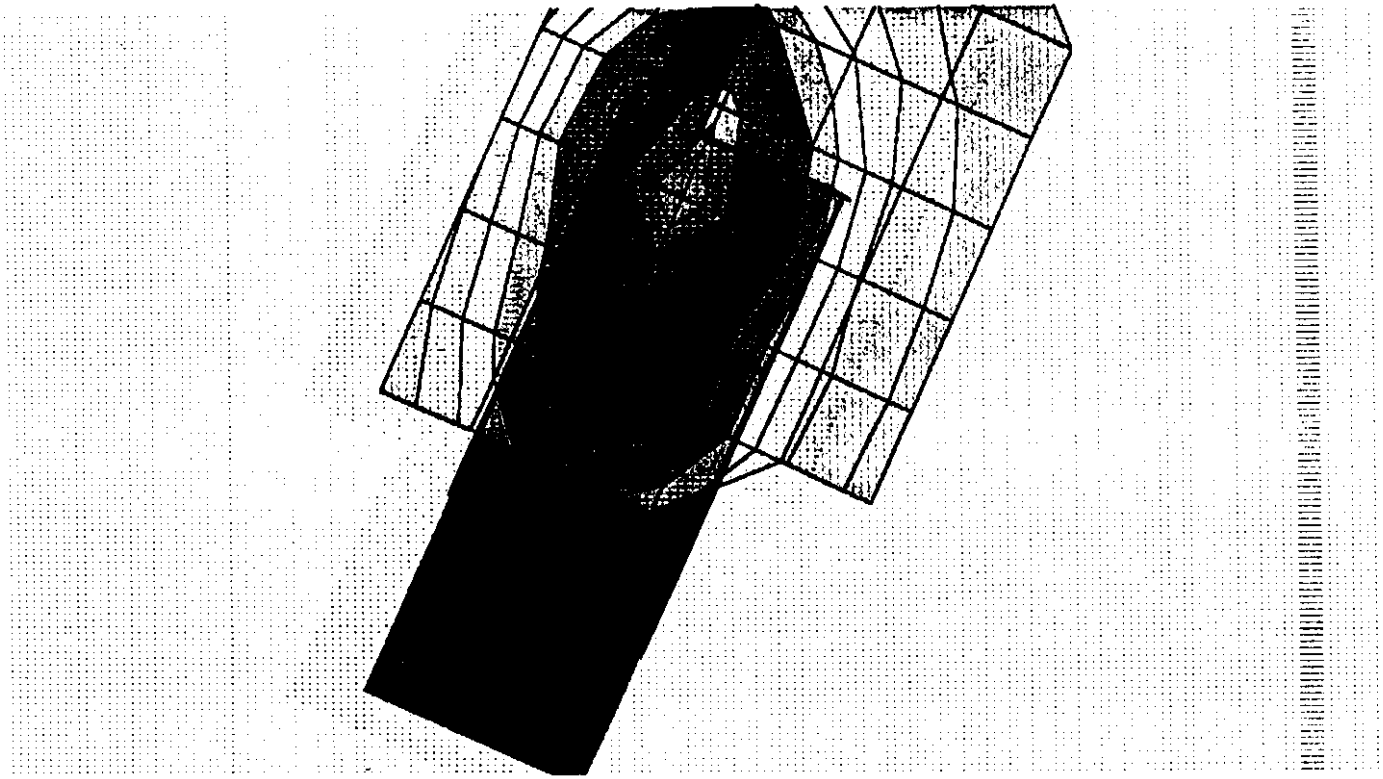
[6] N. Kuster, R. Kastle and T. Schmid, "Dosimetric Evaluation of Handheld Mobile Communications Equipment with Known Precision," *IEICE Trans.*, vol. E80-A, no. 5, May, 1997.

[7] K. Chan, R.F. Cleveland and D.L. Means, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields," Supplement C to OET Bulletin 65, Federal Communications Commission Office of Engineering & Technology, pp. 10-11, December, 1997.

03/30/98

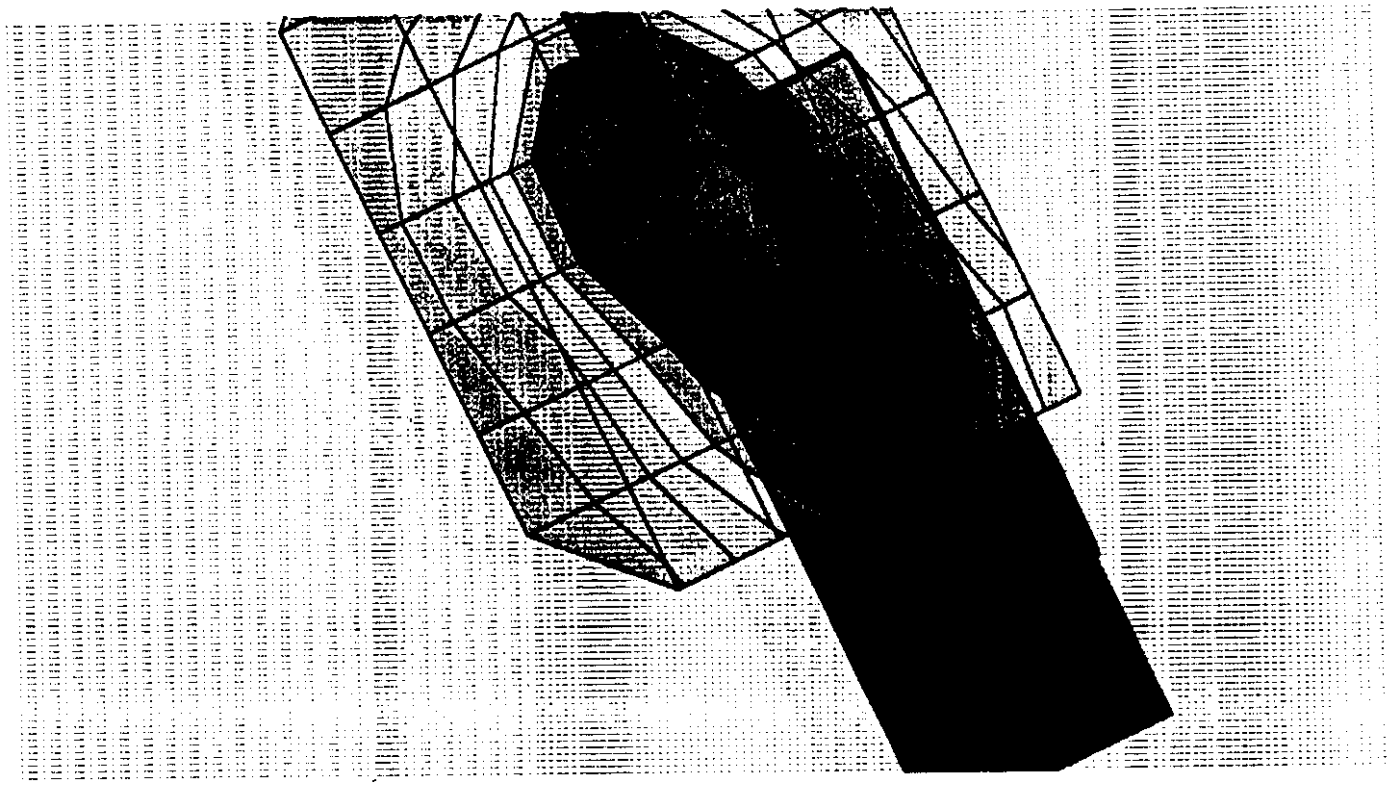
Dolly Lotta w/ 65mm Centurian

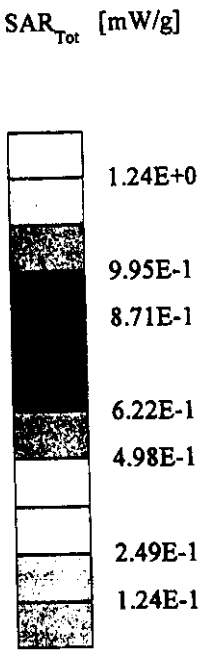
Generic Twin Phantom; Left Hand Section; Position: (80°,65°); Frequency: 900 [MHz]
Probe: ET3DV5 - SN1324; ConvF(4.94,4.94,4.94); Crest factor: 1.0; Brain 900 MHz: σ = 0.85 [mho/m] ε_r = 41.5 ρ = 1.03 [g/cm^3]
Cube 5x5x7: SAR (1g): 1.13 [mW/g], SAR (10g): 0.798 [mW/g], (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.11 dB
S/N: UA200EPRZV
OUTPUT: 390mW



Dolly Lotta w/ 65mm Centurian

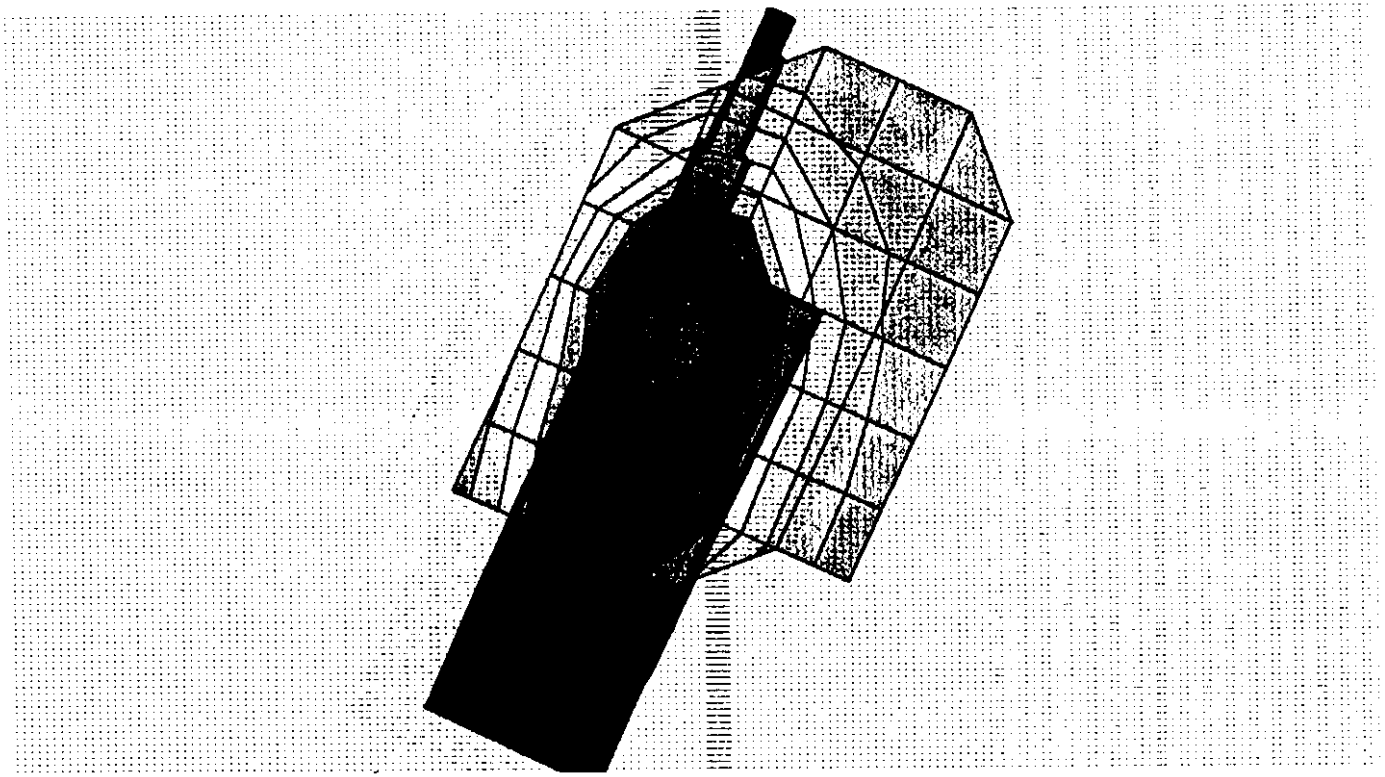
Generic Twin Phantom; Right Hand Section; Position: (80°,65°); Frequency: 900 [MHz]
Probe: ET3DV5 - SN1324; ConvF(4.94,4.94,4.94); Crest factor: 1.0; Brain 900 MHz: $\sigma = 0.85$ [mho/m] $\varepsilon_r = 41.5$ $\rho = 1.03$ [g/cm^3]
Cube 5x5x7: SAR (1g): 1.32 [mW/g], SAR (10g): 0.871 [mW/g], (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: 0.00 dB
S/N: UA200EPRZV
OUTPUT: 390mW

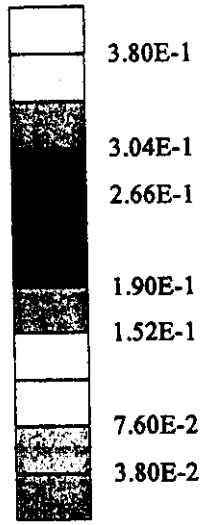




Dolly Lotta w/65mm Centurian

Generic Twin Phantom; Left Hand Section; Position: (80°,65°); Frequency: 900 [MHz]
Probe: ET3DV5 - SN1324; ConvF(4.94,4.94,4.94); Crest factor: 3.0; Brain 900 MHz: σ = 0.85 [mho/m] ε_r = 42.5 ρ = 1.03 [g/cm^3]
Cube 5x5x7: SAR (1g): 0.368 [mW/g], SAR (10g): 0.257 [mW/g], (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.01 dB
s/n: UA200EPRZV
DAMPS mode
output power: before test:





04/16/98

Dolly Lotta w/65mm Centurian

Generic Twin Phantom; Right Hand Section; Position: (80°,65°); Frequency: 900 [MHz]
Probe: ET3DV5 - SN1324; ConvF(4.94,4.94,4.94); Crest factor: 3.0; Brain 900 MHz: σ = 0.85 [mho/m] ε_r = 42.5 ρ = 1.03 [g/cm^3]
Cube 5x5x7: SAR (1g): 0.477 [mW/g], SAR (10g): 0.313 [mW/g], (Worst-case extrapolation)
Coarse: Dx = 20.0, Dy = 20.0, Dz = 10.0
Powerdrift: -0.27 dB
s/n: UA200EPRZV
output power: before test: 130mW after test: 130mW
DAMPS mode