

Uppgjord (även faktaansvarig om annan) - Prepared (also subject responsible if other) ERA/T/UD Tomas Persson		Nr - No. T/U-98:404	
Dokansv/Godk - Doc respons/Approved ERA/T/UF	Kontr - Checked	Datum - Date 1998-08-24	Rev A
		File	

Ericsson SAR Measurement Specification, part 2:

Tissue liquid preparation

1 Introduction

For the preparation of brain simulating liquid to be used in the generic twin phantom with DASY3 the following preparation procedure is used. The liquid should have properties as similar as possible to the human brain [1],[2],[3]. In total a minimum of 18 litres of liquid is required.

2.1 Ingredients

Water	distilled water
Sugar	as available in food shops
Salt	pure NaCl (>99.9%)
Cellulose	HEC Hydroxyethyl-cellulose medium viscosity (powder 75-125 mPa s, 2% in water 20 °C)
Preservative	Preventol D7 Bayer AG

2.2 Preparation materials

1. Scale
2. Stirrer with hotplate
3. Glass jar 500 ml
4. Glass jar 5 l
5. Glass jar 10 l
6. Mixing spoon (approx. 12 “)

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3.1 Recipe for brain simulating liquid at 835 MHz and 900 MHz

Ingredient	835 MHz		900 MHz	
Distilled water	43.27 %	3725 g	40.16 %	3460 g
HEC	0.93 %	80.1 g	1.00 %	86.0 g
NaCl	0.412%	35.5 g	0.692 %	59.6 g
Preventol	0.10 %	8.5 g	0.10 %	9.0 g
Sugar	55.29 %	4760 g	58.04 %	5000 g
Total amount		6.7 l		6.7 l

3.2 Recipe for brain simulating liquid at 1640 MHz and 1800 MHz

Ingredient	1640 MHz		1800 MHz	
Distilled water	44.18 %	3765 g	44.97 %	3827 g
HEC	1.00 %	85.5 g	1.0 %	85.4 g
NaCl	-	-	-	-
Preventol	0.10 %	8.4 g	0.10 %	8.3 g
Sugar	54.72 %	4663 g	53.93	4589 g
Total amount		6.7 l		6.7 l

4. Dielectric parameters for the recipes.

Parameter	835 MHz	900 MHz	1640 MHz	1800 MHz
Dielectric constant ϵ'	45.8	42.5	41.3	41.0
Conductivity σ (S/m)	0.76	0.85	1.51	1.65

The parameters are measured according to [5].

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5. Preparation procedure

1. Weigh the required amount of distilled water in a large glass jar. Begin heating and stirring and ensure that the water temperature is not more than about 75 °C.
2. When adding the different ingredients check weight of residues left in weighing containers and correct if appropriate.
4. Add the cellulose. Use about 4 dl of the heated water for mixing with the cellulose in a suitable jar to allow stirring properly with a hand mixer to avoid lumps. Add the solution to the large container on the heating plate. Adjust the speed of the magnetic stirrer and keep the solution below the boiling point. Leave the solution on the heating plate for about two hours which will allow the solution to become fairly transparent.
5. Add the preservative. Add salt if included in the selected recipe.
6. Add the sugar gently in several steps. Hand stirring to some extent is necessary in the beginning in order to allow the magnetic stirrer to work properly.
6. Keep the liquid hot but below about 75 °C for at least 12 hours. Cover the jar with plastic foam or other lid in order to avoid evaporation.
7. Turn the hotplate off. Let the brain tissue simulating liquid sit for at least 3 hours prior to performing measurement of the electrical parameters. At measurement the temperature of the liquid should be maximum 25 °C.
8. Once brain tissue simulating liquid has been measured, store mixture in designated storage container/phantom. Record information about mixing procedure and results of calibration measurement.

6. References

- [1] Gabriel C., Gabriel S., Corthout, *The dielectric properties of biological tissue: I literature survey*, Phys. Med. Biol., vol 41, pp 2231-2249, 1996.
- [2] Gabriel S., Lau R.W., Gabriel C., *The dielectric properties of biological tissues: II measurements in the frequency range 10 Hz to 20 GHz*, Phys. Med. Biol., vol 41, pp 2251-2269, 1996
- [3] Gabriel S., Lau R.W., Gabriel C., *The dielectric properties of biological tissues: III parametric models for the dielectric spectrum of tissues*, Phys. Med. Biol., vol 41, pp 2271-2293, 1996
- [4] Federal Communications Commission, Office of Engineering & Technology, *Evaluating Compliance with FCC Guidelines for Human exposure to Radiofrequency Electromagnetic Fields*. OET bulletin 65, 1997.
- [5] Persson Tomas, *Ericsson SAR measurement specification: measurements of dielectric parameters*, ERA/T/U-98:405