

## APPENDIX C DESCRIPTION OF SAR MEASUREMENT SYSTEM

### Probe Positioning System

The measurements were performed with the state of the art automated near-field scanning system **DASY5 Version 52** from Schmid & Partner Engineering AG (SPEAG). The system is based on a high precision 6-axis robot (working range greater than 1.1m), which positions the SAR measurement probes with a positional repeatability of better than  $\pm 0.02$  mm. The DASY5 fully complies with the IEEE 1528 and EN50361 SAR measurement requirements.

### E-Field Probe Type and Performance

The SAR measurements were conducted with the dosimetric probe ET3DV6 Serial: 1380 (manufactured by SPEAG) designed in the classical triangular configuration and optimised for dosimetric evaluation. The probe has been calibrated and found to be accurate to better than  $\pm 0.25$  dB. The probe is suitable for measurements close to material discontinuity at the surface of the phantom. The sensors of the probe are directly loaded with Schottky diodes and connected via highly resistive lines (length = 300 mm) to the data acquisition unit.

### Data Acquisition Electronics

The data acquisition electronics (DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. The input impedance of the DAE3 box is 200 M $\Omega$ ; the inputs are symmetrical and floating. Common mode rejection is above 80dB. Transmission to the PC-card is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The mechanical probe-mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

### Device Holder for DASY5

The DASY5 device holder supplied by SPEAG is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The rotation centres for both scales is the ear opening. Thus the device needs no repositioning when changing the angles.

The DASY5 device holder is made of low-loss material having the following dielectric parameters: relative permittivity  $\epsilon=3$  and loss tangent  $\delta=0.02$ . The amount of dielectric material has been reduced in the closest vicinity of the device, to reduce the influence on the clamp on the test results.

Refer to Appendix A2-A3 for photographs of device positioning



### Liquid Depth 15cm

During the SAR measurement process the liquid level was maintained to a level of 15cm with a tolerance of  $\pm 0.5\text{cm}$ . The following photo shows the depth of the liquid maintained during the testing.

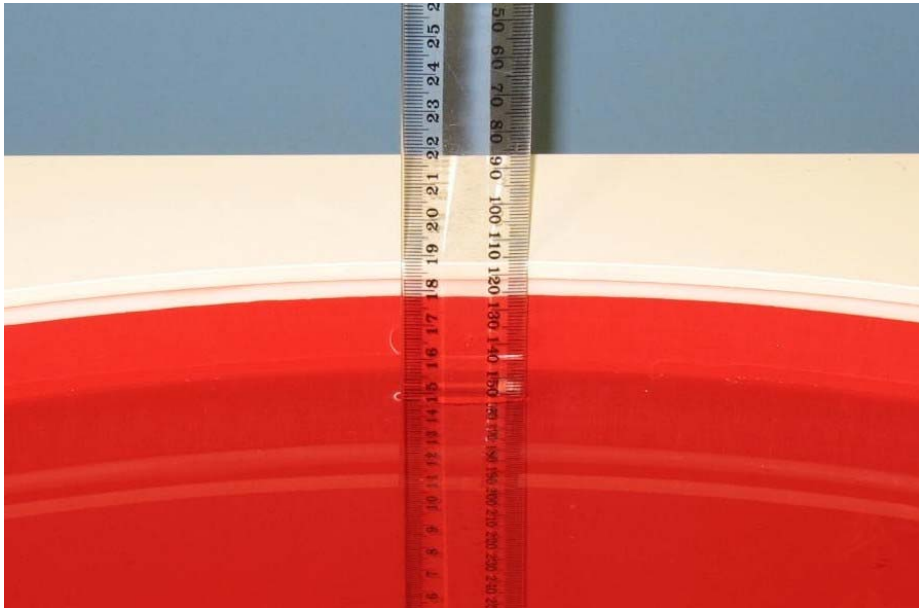


Photo of liquid Depth in Flat Phantom

### Phantom Properties (Size, Shape, Shell Thickness)

For SAR testing in the Face Frontal and Belt Clip positions (also for the System Check) an SPEAG Flat Phantom ELI 4.0 was used. The phantom thickness is  $2.0\text{mm} \pm 0.2\text{mm}$  and the phantom was filled with the required tissue simulating liquid. Table below provides a summary of the measured phantom properties

Photo 1: Flat\_Phantom ELI 4.0 2mm



### Tissue Material Properties

The dielectric parameters of the simulating liquid were measured prior to SAR assessment using the HP85070A dielectric probe kit and HP8714B Network Analyser. The target dielectric parameters are shown in the following table.

**Table: Target Brain Simulating Liquid Dielectric Values**

Frequency Band	$\epsilon_r$ (target)	$\sigma$ (target)	$\rho$ kg/m <sup>3</sup>
450 MHz	43.5 ±5% (41.3 – 45.7)	0.87 ±5% (0.82 – 0.91)	1000

**Table: Measured Body Simulating Liquid Dielectric Values**

Frequency Band	$\epsilon_r$ (target)	$\sigma$ (target)	$\rho$ kg/m <sup>3</sup>
450 MHz	56.7 ±5% (53.9 – 59.5)	0.94 ±5% (0.89 – 0.99)	1000

NOTE: The brain and muscle liquid parameters were within the required tolerances of ±5%.

### Simulated Tissue Composition Used for SAR Test

The tissue simulating liquids are created prior to the SAR evaluation and often require slight modification each day to obtain the correct dielectric parameters.

**Table: Tissue Type: Brain @ 450MHz**

Volume of Liquid: 60 Litres

Approximate Composition	% By Weight
Distilled Water	38.56
Salt	3.95
Sugar	56.32
HEC	0.98
Bactericide	0.19

**Table: Tissue Type: Muscle @ 450MHz**

Volume of Liquid: 60 Litres

Approximate Composition	% By Weight
Distilled Water	51.16
Salt	1.49
Sugar	46.78
HEC	0.52
Bactericide	0.05



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