

## APPENDIX D: SAR TISSUE SPECIFICATIONS

### Measurement Procedure for Tissue verification:

- 1) The network analyzer and probe system was configured and calibrated.
- 2) The probe was immersed in the tissue. The tissue was placed in a nonmetallic container. Trapped air bubbles beneath the flange were minimized by placing the probe at a slight angle.
- 3) The complex admittance with respect to the probe aperture was measured
- 4) The complex relative permittivity  $\epsilon'$  can be calculated from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\epsilon_r\epsilon_0}{[\ln(b/a)]^2} \int_a^b \int_a^b \int_0^\pi \cos\phi' \frac{\exp[-j\omega r(\mu_0\epsilon_r'\epsilon_0)^{1/2}]}{r} d\phi' d\rho' d\rho$$

where  $Y$  is the admittance of the probe in contact with the sample, the primed and unprimed coordinates refer to source and observation points, respectively,  $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$ ,  $\omega$  is the angular frequency, and  $j = \sqrt{-1}$ .

### 3 Composition / Information on ingredients

#### 3.2 Mixtures

**Description:** Aqueous solution with surfactants and inhibitors

**Declarable, or hazardous components:**

|                                                                        |                                                                                                                       |           |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------|
| CAS: 107-21-1<br>EINECS: 203-473-3<br>Reg.nr.: 01-2119456816-28-0000   | <b>Ethanedio</b><br>STOT RE 2, H373;<br>Acute Tox. 4, H302                                                            | >1.0-4.9% |
| CAS: 68608-26-4<br>EINECS: 271-781-5<br>Reg.nr.: 01-2119527859-22-0000 | <b>Sodium petroleum sulfonate</b><br>Eye Irrit. 2, H319                                                               | < 2.9%    |
| CAS: 107-41-5<br>EINECS: 203-489-0<br>Reg.nr.: 01-2119539582-35-0000   | <b>Hexylene Glycol / 2-Methyl-pentane-2,4-diol</b><br>Skin Irrit. 2, H315; Eye Irrit. 2, H319                         | < 2.9%    |
| CAS: 68920-66-1<br>NLP: 500-236-9<br>Reg.nr.: 01-2119489407-26-0000    | <b>Alkoxyated alcohol, &gt; C<sub>16</sub></b><br>Aquatic Chronic 2, H411;<br>Skin Irrit. 2, H315; Eye Irrit. 2, H319 | < 2.0%    |

**Additional information:**

For the wording of the listed risk phrases refer to section 16.

Not mentioned CAS-, EINECS- or registration numbers are to be regarded as Proprietary/Confidential.

The specific chemical identity and/or exact percentage concentration of proprietary components is withheld as a trade secret.

**Figure D-1**

Note: Liquid recipes are proprietary SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer tissue-equivalent liquid data sheets are provided below.

|                               |                         |                                   |
|-------------------------------|-------------------------|-----------------------------------|
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**Measurement Certificate / Material Test**

Item Name **Head Tissue Simulating Liquid (HBBL4-250V3)**  
Product No. SL AAH 005 AD (Batch: 230324-2)  
Manufacturer SPEAG

**Measurement Method**

TSL dielectric parameters measured using calibrated DAK probe.

**Setup Validation**

Validation results were within  $\pm 2.5\%$  towards the target values of Methanol.

**Target Parameters**

Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

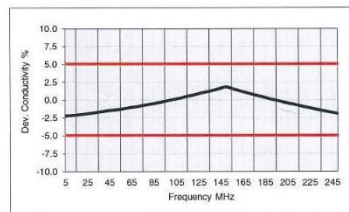
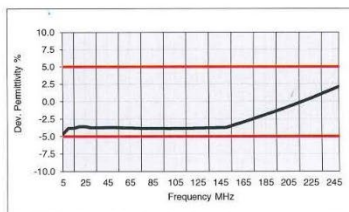
**Test Condition**

Ambient Environment temperatur ( $22 \pm 3$ )°C and humidity < 70%.  
TSL Temperature 22°C  
Test Date 27-Mar-23  
Operator WM

**Additional Information**

TSL Density 1.042 g/cm<sup>3</sup>  
TSL Heat-capacity 3.574 kJ/(kg\*K)

| f [MHz] | Measured    |              |       | Target |       |                  | Diff to Target [%] |  |
|---------|-------------|--------------|-------|--------|-------|------------------|--------------------|--|
|         | $\epsilon'$ | $\epsilon''$ | sigma | eps    | sigma | $\Delta\epsilon$ | $\Delta\sigma$     |  |
| 5       | 52.9        | 2636.98      | 0.73  | 55.5   | 0.75  | -4.6             | -2.7               |  |
| 10      | 53.3        | 1318.71      | 0.73  | 55.5   | 0.75  | -3.9             | -2.7               |  |
| 15      | 53.2        | 879.92       | 0.73  | 55.3   | 0.75  | -3.9             | -2.7               |  |
| 20      | 53.1        | 660.54       | 0.73  | 55.1   | 0.75  | -3.6             | -2.7               |  |
| 25      | 53.0        | 528.94       | 0.74  | 55.0   | 0.75  | -3.6             | -1.3               |  |
| 30      | 52.9        | 441.24       | 0.74  | 55.0   | 0.75  | -3.8             | -1.3               |  |
| 35      | 52.8        | 378.63       | 0.74  | 54.9   | 0.75  | -3.8             | -1.3               |  |
| 40      | 52.7        | 331.71       | 0.74  | 54.8   | 0.75  | -3.8             | -1.3               |  |
| 45      | 52.6        | 295.25       | 0.74  | 54.7   | 0.75  | -3.8             | -1.4               |  |
| 50      | 52.5        | 266.12       | 0.74  | 54.6   | 0.75  | -3.8             | -1.4               |  |
| 55      | 52.4        | 242.31       | 0.74  | 54.4   | 0.75  | -3.7             | -1.5               |  |
| 60      | 52.3        | 222.50       | 0.74  | 54.3   | 0.75  | -3.7             | -1.5               |  |
| 65      | 52.2        | 205.74       | 0.74  | 54.2   | 0.75  | -3.7             | -1.6               |  |
| 70      | 52.0        | 191.40       | 0.75  | 54.1   | 0.75  | -3.9             | -0.3               |  |
| 75      | 51.9        | 178.98       | 0.75  | 54.0   | 0.75  | -3.9             | -0.4               |  |
| 80      | 51.8        | 168.13       | 0.75  | 53.9   | 0.75  | -3.9             | -0.4               |  |
| 85      | 51.7        | 158.56       | 0.75  | 53.8   | 0.75  | -3.8             | -0.5               |  |
| 90      | 51.6        | 150.08       | 0.75  | 53.7   | 0.75  | -3.8             | -0.5               |  |
| 95      | 51.5        | 142.46       | 0.75  | 53.5   | 0.75  | -3.8             | -0.6               |  |
| 100     | 51.4        | 135.63       | 0.75  | 53.4   | 0.75  | -3.8             | -0.6               |  |
| 105     | 51.3        | 129.46       | 0.76  | 53.3   | 0.76  | -3.8             | 0.6                |  |
| 110     | 51.1        | 123.86       | 0.76  | 53.2   | 0.76  | -3.9             | 0.6                |  |
| 115     | 51.0        | 118.75       | 0.76  | 53.1   | 0.76  | -3.9             | 0.5                |  |
| 120     | 50.9        | 114.07       | 0.76  | 53.0   | 0.76  | -3.9             | 0.5                |  |
| 125     | 50.8        | 109.77       | 0.76  | 52.9   | 0.76  | -3.9             | 0.4                |  |
| 130     | 50.7        | 105.80       | 0.77  | 52.8   | 0.76  | -3.9             | 1.7                |  |
| 135     | 50.6        | 102.13       | 0.77  | 52.6   | 0.76  | -3.9             | 1.6                |  |
| 140     | 50.5        | 98.73        | 0.77  | 52.5   | 0.76  | -3.9             | 1.6                |  |
| 145     | 50.4        | 95.56        | 0.77  | 52.4   | 0.76  | -3.8             | 1.5                |  |
| 150     | 50.3        | 92.61        | 0.77  | 52.3   | 0.76  | -3.8             | 1.5                |  |
| 155     | 50.3        | 89.86        | 0.77  | 52.1   | 0.76  | -3.4             | 1.0                |  |
| 160     | 50.2        | 87.27        | 0.78  | 51.8   | 0.77  | -3.1             | 1.8                |  |
| 165     | 50.1        | 84.85        | 0.78  | 51.6   | 0.77  | -2.9             | 1.3                |  |
| 170     | 50.0        | 82.57        | 0.78  | 51.4   | 0.77  | -2.7             | 0.8                |  |
| 175     | 49.9        | 80.42        | 0.78  | 51.1   | 0.78  | -2.4             | 0.4                |  |
| 180     | 49.8        | 78.39        | 0.78  | 50.9   | 0.78  | -2.2             | -0.1               |  |
| 185     | 49.7        | 76.48        | 0.79  | 50.7   | 0.78  | -1.9             | 0.7                |  |
| 190     | 49.6        | 74.67        | 0.79  | 50.4   | 0.79  | -1.6             | 0.2                |  |
| 195     | 49.5        | 72.95        | 0.79  | 50.2   | 0.79  | -1.4             | -0.2               |  |
| 200     | 49.4        | 71.32        | 0.79  | 50.0   | 0.80  | -1.1             | -0.7               |  |
| 205     | 49.3        | 69.77        | 0.80  | 49.7   | 0.80  | -0.9             | 0.1                |  |
| 210     | 49.3        | 68.30        | 0.80  | 49.5   | 0.80  | -0.4             | -0.4               |  |
| 215     | 49.2        | 66.90        | 0.80  | 49.3   | 0.81  | -0.1             | -0.8               |  |
| 220     | 49.1        | 65.56        | 0.80  | 49.0   | 0.81  | 0.1              | -1.3               |  |
| 225     | 49.0        | 64.29        | 0.80  | 48.8   | 0.81  | 0.4              | -1.7               |  |
| 230     | 48.9        | 63.07        | 0.81  | 48.6   | 0.82  | 0.7              | -0.9               |  |
| 235     | 48.9        | 61.90        | 0.81  | 48.3   | 0.82  | 1.2              | -1.4               |  |
| 240     | 48.8        | 60.78        | 0.81  | 48.1   | 0.82  | 1.5              | -1.8               |  |
| 245     | 48.7        | 59.71        | 0.81  | 47.9   | 0.83  | 1.7              | -2.2               |  |
| 250     | 48.6        | 58.69        | 0.82  | 47.6   | 0.83  | 2.0              | -1.5               |  |



**Figure D-1**  
**5– 250 MHz Head Tissue Equivalent Matter**

|                               |                         |                                   |
|-------------------------------|-------------------------|-----------------------------------|
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