

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

**Measurement Certificate / Material Test**

Item Name	Head Tissue Simulating Liquid (HBBL600-10000V6)
Product No.	SL AAH U16 BC (Batch: 230313-2)
Manufacturer	SPEAG

**Measurement Method**

TSL dielectric parameters measured using calibrated DAK probe.

**Target Parameters**

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

**Test Condition**

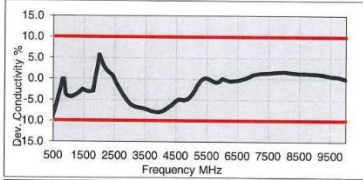
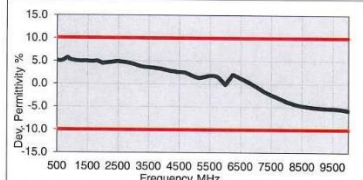
Ambient Condition 22°C ; 30% humidity  
 TSL Temperature 22°C  
 Test Date 17-Mar-23  
 Operator WM

**Additional Information**

TSL Density  
 TSL Heat-capacity

**Results**

f [MHz]	Measured			Target		Diff.to Target [%]	
	e'	e''	sigma	eps	sigma	Δ-eps	Δ-sigma
600	44.9	24.8	0.83	42.7	0.88	5.1	-5.9
750	44.2	21.0	0.88	41.9	0.89	5.4	-1.5
800	44.0	20.1	0.90	41.7	0.90	5.6	0.3
825	44.0	19.8	0.91	41.6	0.91	5.8	0.4
835	44.0	19.6	0.92	41.5	0.91	5.9	0.9
850	43.9	19.4	0.92	41.5	0.92	5.8	0.4
900	43.7	18.7	0.94	41.5	0.97	5.3	-3.1
1400	42.6	14.7	1.15	40.6	1.18	4.9	-2.5
1450	42.5	14.5	1.17	40.5	1.20	4.9	-2.5
1600	42.3	14.0	1.25	40.3	1.28	4.9	-2.7
1625	42.3	13.9	1.26	40.3	1.30	5.0	-3.0
1640	42.3	13.9	1.27	40.3	1.31	5.1	-2.8
1650	42.2	13.9	1.27	40.2	1.31	4.9	-3.3
1700	42.1	13.8	1.30	40.2	1.34	4.8	-3.1
1750	42.1	13.7	1.33	40.1	1.37	5.0	-3.0
1800	42.0	13.6	1.36	40.0	1.40	5.0	-2.9
1810	42.0	13.6	1.37	40.0	1.40	5.0	-2.1
1825	42.0	13.5	1.38	40.0	1.40	5.0	-1.4
1850	42.0	13.5	1.39	40.0	1.40	5.0	-0.7
1900	41.9	13.4	1.42	40.0	1.40	4.7	1.4
1950	41.8	13.4	1.45	40.0	1.40	4.5	3.6
2000	41.8	13.3	1.48	40.0	1.40	4.5	5.7
2050	41.7	13.3	1.51	39.9	1.44	4.5	4.5
2100	41.7	13.2	1.55	39.8	1.49	4.7	4.1
2150	41.6	13.2	1.58	39.7	1.53	4.7	3.0
2200	41.5	13.2	1.62	39.6	1.58	4.7	2.7
2250	41.4	13.2	1.65	39.6	1.62	4.7	1.7
2300	41.3	13.2	1.69	39.5	1.67	4.6	1.4
2350	41.3	13.3	1.73	39.4	1.71	4.9	1.1
2400	41.2	13.3	1.77	39.3	1.76	4.9	0.8
2450	41.1	13.3	1.81	39.2	1.80	4.8	0.6
2500	41.1	13.3	1.85	39.1	1.85	5.0	-0.2
2550	41.0	13.3	1.89	39.1	1.91	4.9	-1.0
2600	40.9	13.4	1.93	39.0	1.96	4.8	-1.7



3500	39.3	13.9	2.70	37.9	2.91	3.6	-7.2
3700	39.0	14.0	2.88	37.7	3.12	3.4	-7.7
5200	36.5	15.8	4.58	36.0	4.66	1.3	-1.5
5250	36.4	16.0	4.66	35.9	4.71	1.4	-1.0
5300	36.4	16.1	4.73	35.9	4.76	1.5	-0.5
5500	36.3	16.2	4.97	35.6	4.96	1.8	0.1
5600	36.2	16.2	5.06	35.5	5.07	1.8	-0.2
5700	36.0	16.2	5.14	35.4	5.17	1.6	-0.6
5800	35.7	16.2	5.22	35.3	5.27	1.2	-0.9
6000	35.0	16.4	5.48	35.1	5.48	-0.2	0.1
6500	34.9	16.7	6.05	34.5	6.07	1.2	-0.4
7000	33.7	17.2	6.72	33.9	6.65	-0.6	1.0
7500	32.5	17.6	7.34	33.3	7.24	-2.5	1.4
8000	31.4	17.9	7.97	32.7	7.84	-3.9	1.7
8500	30.6	18.1	8.57	32.1	8.45	-4.8	1.3
9000	29.9	18.3	9.18	31.5	9.08	-5.2	1.2
9500	29.3	18.5	9.77	31.0	9.71	-5.4	0.6
10000	28.6	18.6	10.35	30.4	10.36	-5.9	-0.1

**Figure D-2**  
**600 –10000 MHz Head Tissue Equivalent Matter**

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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.

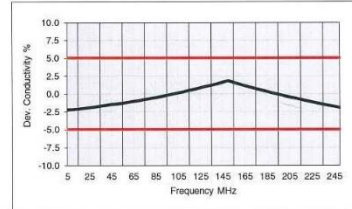
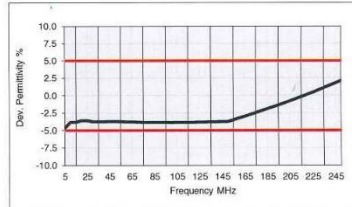
**Setup Validation**  
 Validation results were within  $\pm 2.5\%$  towards the target values of Methanol.

**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/cm3  
 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	528.84	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	150.06	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-3**  
**5– 250 MHz Head Tissue Equivalent Matter**

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