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 ε' can be calculated from the below equation (Pournaropoulos and Misra):

$$Y = \frac{j2\omega\varepsilon_r\varepsilon_0}{[\ln(b/a)]^2}\int_a^b\int_a^b\int_0^\pi \cos\phi' \frac{\exp\left[-j\omega r(\mu_0\varepsilon_r'\varepsilon_0)^{1/2}\right]}{r} d\phi' d\rho' d\rho$$

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, $r^2 = \rho^2 + \rho'^2 - 2\rho\rho'\cos\phi'$, ω 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	**Ethanediol** 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	**Sodium petroleum sulfonate** Eye Irrit. 2, H319	< 2.9%
CAS: 107-41-5 EINECS: 203-489-0 Reg.nr.: 01-2119539582-35-0000	**Hexylene Glycol / 2-Methyl-pentane-2,4-diol** Skin Irrit. 2, H315; Eye Irrit. 2, H319	< 2.9%
CAS: 68920-66-1 NLP: 500-236-9 Reg.nr.: 01-2119489407-26-0000	**Alkoxylated alcohol, > C_{16}** 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.

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
www.speag.swiss, info@speag.swiss

Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HBBL600-10000V6)**
Product No.	SL AAH U16 BC (Batch: 240521-1)
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

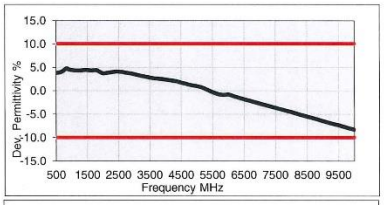
Ambient Condition	22°C ; 30% humidity
TSL Temperature	22°C
Test Date	22-May-24
Operator	CL

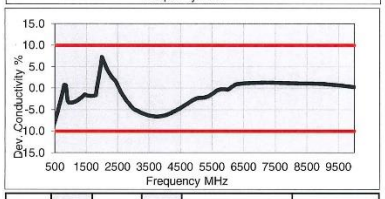
Additional Information

TSL Density
TSL Heat-capacity

Results

	Measured			Target		Diff.to Target [%]	
f [MHz]	e'	e''	sigma	eps	sigma	Δ-eps	Δ-sigma
600	44.4	25.1	0.84	42.7	0.88	3.9	-4.7
750	43.8	21.2	0.89	41.9	0.89	4.4	-0.4
800	43.6	20.3	0.90	41.7	0.90	4.6	0.3
825	43.6	19.9	0.91	41.6	0.91	4.8	0.4
835	43.6	19.7	0.92	41.5	0.91	4.9	0.9
850	43.5	19.5	0.92	41.5	0.92	4.8	0.4
900	43.4	18.8	0.94	41.5	0.97	4.6	-3.1
1400	42.4	14.9	1.16	40.6	1.18	4.5	-1.6
1450	42.3	14.7	1.18	40.5	1.20	4.4	-1.7
1600	42.1	14.2	1.26	40.3	1.28	4.4	-1.9
1625	42.1	14.1	1.28	40.3	1.30	4.5	-1.4
1640	42.1	14.1	1.29	40.3	1.31	4.6	-1.2
1650	42.0	14.0	1.29	40.2	1.31	4.4	-1.8
1700	41.9	13.9	1.32	40.2	1.34	4.3	-1.6
1750	41.8	13.8	1.35	40.1	1.37	4.3	-1.5
1800	41.8	13.7	1.38	40.0	1.40	4.5	-1.4
1810	41.8	13.7	1.39	40.0	1.40	4.5	-0.7
1825	41.8	13.7	1.40	40.0	1.40	4.5	0.0
1850	41.7	13.7	1.41	40.0	1.40	4.3	0.7
1900	41.6	13.6	1.44	40.0	1.40	4.0	2.9
1950	41.5	13.5	1.47	40.0	1.40	3.8	5.0
2000	41.5	13.5	1.50	40.0	1.40	3.8	7.1
2050	41.4	13.5	1.54	39.9	1.44	3.7	6.6
2100	41.3	13.4	1.57	39.8	1.49	3.7	5.4
2150	41.3	13.4	1.60	39.7	1.53	3.9	4.3
2200	41.2	13.4	1.64	39.6	1.58	3.9	3.9
2250	41.1	13.4	1.68	39.6	1.62	3.9	3.6
2300	41.0	13.4	1.71	39.5	1.67	3.9	2.6
2350	41.0	13.4	1.75	39.4	1.71	4.1	2.3
2400	40.9	13.4	1.79	39.3	1.76	4.1	2.0
2450	40.8	13.4	1.83	39.2	1.80	4.1	1.7
2500	40.7	13.4	1.87	39.1	1.85	4.0	0.8
2550	40.7	13.4	1.91	39.1	1.91	4.2	0.0
2600	40.6	13.5	1.95	39.0	1.96	4.1	-0.7





3500	39.0	14.0	2.73	37.9	2.91	2.8	-6.4
3700	38.7	14.1	2.91	37.7	3.12	2.6	-6.6
5200	36.2	15.7	4.55	36.0	4.66	0.6	-2.2
5250	36.1	15.8	4.60	35.9	4.71	0.4	-2.2
5300	36.0	15.8	4.66	35.9	4.76	0.3	-2.1
5500	35.5	16.0	4.89	35.6	4.96	-0.3	-1.4
5600	35.3	16.1	5.02	35.5	5.07	-0.6	-0.9
5700	35.1	16.2	5.15	35.4	5.17	-0.8	-0.4
5800	35.0	16.3	5.26	35.3	5.27	-0.9	-0.3
6000	34.8	16.3	5.46	35.1	5.48	-0.8	-0.4
6500	33.8	17.0	6.14	34.5	6.07	-1.8	1.1
7000	33.0	17.3	6.73	33.9	6.65	-2.7	1.3
7500	32.1	17.6	7.33	33.3	7.24	-3.6	1.3
8000	31.2	17.8	7.93	32.7	7.84	-4.6	1.2
8500	30.4	18.1	8.54	32.1	8.45	-5.5	1.1
9000	29.5	18.3	9.17	31.5	9.08	-6.4	1.0
9500	28.7	18.5	9.78	31.0	9.71	-7.4	0.7
10000	27.9	18.7	10.38	30.4	10.36	-8.3	0.2

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

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
www.speag.swiss, info@speag.swiss

Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HBBL4-250V3)**
Product No.	SL AAH 005 AD (Batch: 250129-1)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated DAK probe.

Setup Validation

Validation results were within ±2.5% towards the target values of Methanol.

Target Parameters

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

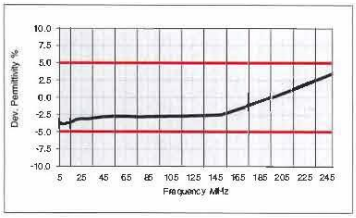
Test Condition

Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	5-Feb-25
Operator	CL

Additional Information

TSL Density	1.042 g/cm3
TSL Heat-capacity	3.574 kJ/(kg*K)

	Measured			Target		Diff.to Target [%]	
f [MHz]	ε'	ε"	sigma	eps	sigma	Δ-eps	Δ-sigma
5	53.4	2602.47	0.72	55.5	0.75	-3.7	-4.0
10	53.3	1301.69	0.72	55.5	0.75	-3.9	-4.0
15	53.3	868.51	0.72	55.3	0.75	-3.7	-4.0
20	53.3	651.94	0.73	55.1	0.75	-3.3	-2.7
25	53.3	522.03	0.73	55.0	0.75	-3.1	-2.7
30	53.3	435.45	0.73	55.0	0.75	-3.1	-2.7
35	53.2	373.64	0.73	54.9	0.75	-3.1	-2.7
40	53.2	327.33	0.73	54.8	0.75	-2.9	-2.7
45	53.1	291.35	0.73	54.7	0.75	-2.9	-2.7
50	53.0	262.60	0.73	54.6	0.75	-2.8	-2.7
55	52.9	239.10	0.73	54.4	0.75	-2.8	-2.8
60	52.8	219.54	0.73	54.3	0.75	-2.8	-2.9
65	52.7	203.02	0.73	54.2	0.75	-2.8	-2.9
70	52.6	188.87	0.74	54.1	0.75	-2.8	-1.6
75	52.5	176.62	0.74	54.0	0.75	-2.8	-1.7
80	52.4	165.91	0.74	53.9	0.75	-2.7	-1.7
85	52.3	156.47	0.74	53.8	0.75	-2.7	-1.8
90	52.2	148.09	0.74	53.7	0.75	-2.7	-1.9
95	52.1	140.60	0.74	53.5	0.75	-2.7	-1.9
100	52.0	133.87	0.74	53.4	0.75	-2.7	-2.0
105	51.9	127.78	0.75	53.3	0.76	-2.6	-0.7
110	51.8	122.26	0.75	53.2	0.76	-2.6	-0.7
115	51.7	117.22	0.75	53.1	0.76	-2.6	-0.8
120	51.6	112.61	0.75	53.0	0.76	-2.6	-0.9
125	51.5	108.37	0.75	52.9	0.76	-2.6	-0.9
130	51.4	104.46	0.76	52.8	0.76	-2.6	0.4
135	51.3	100.85	0.76	52.6	0.76	-2.5	0.3
140	51.2	97.49	0.76	52.5	0.76	-2.5	0.2
145	51.1	94.37	0.76	52.4	0.76	-2.5	0.2
150	51.0	91.46	0.76	52.3	0.76	-2.5	0.1
155	50.9	88.74	0.77	52.1	0.76	-2.2	1.0
160	50.8	86.20	0.77	51.8	0.77	-2.0	0.5
165	50.7	83.81	0.77	51.6	0.77	-1.7	0.0
170	50.6	81.56	0.77	51.4	0.77	-1.5	-0.5
175	50.5	79.45	0.77	51.1	0.78	-1.2	-0.9
180	50.4	77.45	0.78	50.9	0.78	-1.0	-0.1
185	50.3	75.56	0.78	50.7	0.78	-0.7	-0.6
190	50.3	73.78	0.78	50.4	0.79	-0.3	-1.0
195	50.2	72.09	0.78	50.2	0.79	0.0	-1.5
200	50.1	70.48	0.78	50.0	0.80	0.3	-2.0
205	50.0	68.96	0.79	49.7	0.80	0.5	-1.2
210	49.9	67.51	0.79	49.5	0.80	0.8	-1.6
215	49.8	66.13	0.79	49.3	0.81	1.1	-2.1
220	49.8	64.81	0.79	49.0	0.81	1.6	-2.5
225	49.7	63.56	0.80	48.8	0.81	1.8	-1.7
230	49.6	62.35	0.80	48.6	0.82	2.1	-2.1
235	49.5	61.21	0.80	48.3	0.82	2.4	-2.6
240	49.4	60.10	0.80	48.1	0.82	2.7	-3.0
245	49.4	59.05	0.80	47.9	0.83	3.2	-3.4
250	49.3	58.04	0.81	47.6	0.83	3.5	-2.7



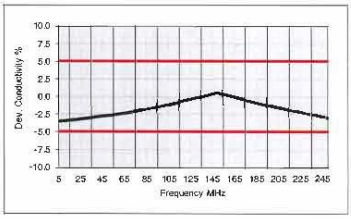


Figure D-3
5– 250 MHz Head Tissue Equivalent Matter