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.

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Measurement Certificate / Material Test

Item Name	**Body Tissue Simulating Liquid (MBBL600-6000V6)**
Product No.	SL AAM U16 BC (Batch: 230308-3)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated DAK probe.

Target Parameters

Target parameters as defined in the KDB 865664 compliance standard.

Test Condition

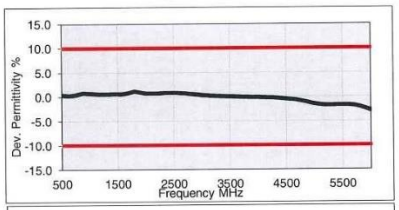
Ambient Condition	22°C ; 30% humidity
TSL Temperature	22°C
Test Date	9-Mar-23
Operator	WM

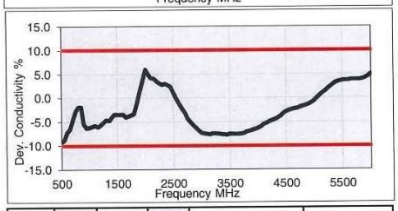
Additional Information

TSL Density
TSL Heat-capacity

Results

	Measured			Target		Diff.to Target [%]	
f [MHz]	e'	e''	sigma	eps	sigma	Δ-eps	Δ-sigma
600	56.3	26.4	0.88	56.1	0.95	0.3	-7.4
750	55.8	22.3	0.93	55.5	0.96	0.5	-3.1
800	55.6	21.4	0.95	55.3	0.97	0.5	-2.1
825	55.6	21.0	0.96	55.2	0.98	0.6	-2.0
835	55.6	20.8	0.97	55.1	0.99	0.9	-1.5
850	55.5	20.5	0.97	55.2	0.99	0.6	-2.0
900	55.4	19.8	0.99	55.0	1.05	0.7	-5.7
1400	54.4	15.8	1.23	54.1	1.28	0.6	-3.9
1450	54.3	15.6	1.25	54.0	1.30	0.6	-3.8
1600	54.1	15.1	1.34	53.8	1.39	0.5	-3.6
1625	54.1	15.0	1.36	53.8	1.41	0.7	-3.5
1640	54.1	15.0	1.37	53.7	1.42	0.7	-3.5
1650	54.1	14.9	1.37	53.7	1.43	0.8	-4.2
1700	54.0	14.8	1.40	53.6	1.46	0.8	-4.1
1750	53.9	14.8	1.44	53.4	1.49	0.9	-3.4
1800	53.9	14.7	1.47	53.3	1.52	1.1	-3.3
1810	53.9	14.7	1.48	53.3	1.52	1.1	-2.6
1825	53.9	14.6	1.49	53.3	1.52	1.1	-2.0
1850	53.8	14.6	1.50	53.3	1.52	0.9	-1.3
1900	53.8	14.6	1.54	53.3	1.52	0.9	1.3
1950	53.7	14.5	1.57	53.3	1.52	0.8	3.3
2000	53.7	14.5	1.61	53.3	1.52	0.8	5.9
2050	53.6	14.5	1.65	53.2	1.57	0.7	5.1
2100	53.5	14.4	1.69	53.2	1.62	0.6	4.3
2150	53.5	14.4	1.73	53.1	1.66	0.8	4.2
2200	53.4	14.5	1.77	53.0	1.71	0.7	3.5
2250	53.4	14.5	1.81	53.0	1.76	0.8	2.8
2300	53.3	14.5	1.86	52.9	1.81	0.8	2.8
2350	53.2	14.6	1.91	52.8	1.85	0.7	3.2
2400	53.2	14.6	1.95	52.8	1.90	0.8	2.6
2450	53.1	14.6	1.99	52.7	1.95	0.8	2.1
2500	53.1	14.7	2.04	52.6	2.02	0.9	1.0
2550	53.0	14.7	2.09	52.6	2.09	0.8	0.0
2600	52.9	14.8	2.13	52.5	2.16	0.7	-1.4





3500	51.3	15.7	3.06	51.3	3.31	0.0	-7.6
3700	51.0	15.9	3.28	51.1	3.55	-0.1	-7.6
5200	48.1	18.6	5.38	49.0	5.30	-1.8	1.6
5250	48.1	18.7	5.47	49.0	5.36	-1.8	2.0
5300	48.0	18.8	5.55	48.9	5.42	-1.8	2.5
5500	47.8	19.1	5.86	48.6	5.65	-1.7	3.6
5600	47.6	19.2	5.98	48.5	5.77	-1.7	3.7
5700	47.5	19.3	6.11	48.3	5.88	-1.8	3.8
5800	47.2	19.3	6.23	48.2	6.00	-2.1	3.8
6000	46.6	19.6	6.55	47.9	6.23	-2.9	5.1
6500							
7000							
7500							
8000							
8500							
9000							
9500							
10000							

Figure D-2
600 – 6000 MHz Body Tissue Equivalent Matter

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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

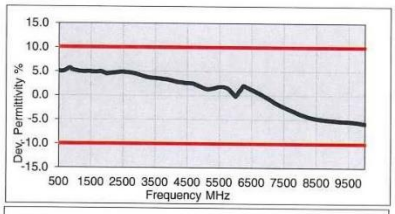
Ambient Condition	22°C ; 30% humidity
TSL Temperature	22°C
Test Date	17-Mar-23
Operator	WM

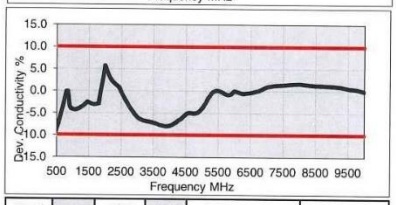
Additional Information

TSL Density
TSL Heat-capacity

Results

	Measured			Target		Diff.to Target [%]	
f [MHz]	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-3
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 ± 2.5% towards the target values of Methanol.

Target Parameters

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

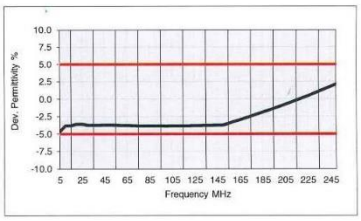
Test Condition

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

Additional Information

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

	Measured			Target		Diff.to Target [%]	
f [MHz]	e'	e''	sigma	eps	sigma	Δ-eps	Δ-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	150.06	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



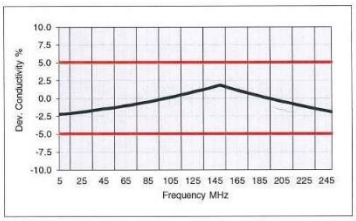


Figure D-4
5– 250 MHz Head Tissue Equivalent Matter