

Head Tissue Simulating Liquids

Application	Specific absorption rate according to standards (e.g., IEC 62209-x, IEEE 1528)		
Packaging	Plastic container of 10 liters with nozzle		
Life Time	Life time and stability of the liquid depend on usage, storage, and handling of tissue simulating liquid		
Options	Tissue simulating liquids for frequencies outside the below listed ranges are available upon request (please contact info@speag.swiss)		
Head Tissue	Parameters according to IEEE 1528 / IEC 62209-1/ IEC 62209-2 / FCC KDB 865664		
Narrow-Band Solutions (±5% Tolerance)	Product HSL300V2 HSL450V2 HSL750V2 HSL900V2	Test Frequency (MHz) 300 450 750 835, 900	Main Ingredients Water, Sugar Water, Sugar Water, Sugar Water, Sugar
Broad-Band Solutions (±5% Tolerance)	Product HBBL1350-1850V3 HBBL1550-1950V3 HBBL1900-3800V3 HBBL3500-5800V5	Test Frequency (MHz) 1450 - 1800 1750 - 1850 1950 - 3000 3500 - 5800	Main Ingredients Water, Tween Water, Tween Water, Tween Water, Oil
Broad-Band Solutions (±10% Tolerance)	Product HBBL4-250V3 HBBL1350-1850V3 HBBL1550-1950V3 HBBL1900-3800V3 HBBL600-10000V6	Test Frequency (MHz) 4 - 250 1300 - 1850 1550 - 1950 1900 - 3800 600 - 10000	Main Ingredients Water, Tween Water, Tween Water, Tween Water, Tween Water, Oil

Measurement Certificate / Material Test

Item Name	Head Tissue Simulating Liquid (HBBL600-10000V6)
Product No.	SL AAH U16 BD (Batch: 180208-1)
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

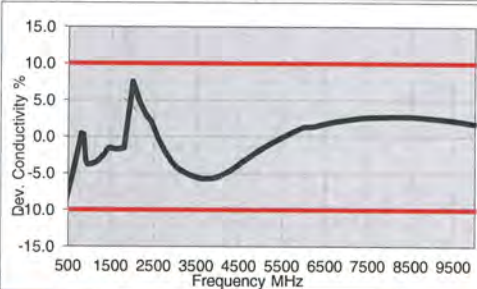
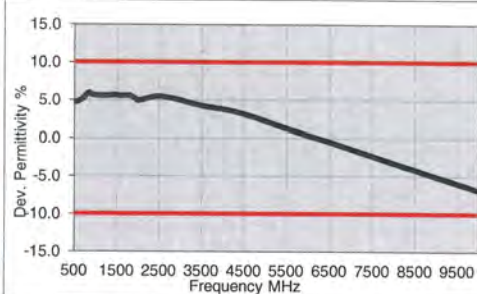
Ambient Condition 22°C ; 30% humidity
 TSL Temperature 22°C
 Test Date 8-Feb-18
 Operator WM

Additional Information

TSL Density
 TSL Heat-capacity

Results

	Measured			Target		Diff.to Target [%]	
f [MHz]	e'	e''	sigma	eps	sigma	Δ-eps	Δ-sigma
800	44.1	20.3	0.90	41.7	0.90	5.8	0.3
825	44.1	19.9	0.91	41.6	0.91	6.0	0.4
835	44.1	19.7	0.92	41.5	0.91	6.1	0.9
850	44.0	19.4	0.92	41.5	0.92	6.0	0.4
900	43.9	18.7	0.94	41.5	0.97	5.8	-3.1
1400	42.9	14.9	1.16	40.6	1.18	5.7	-1.6
1450	42.8	14.7	1.18	40.5	1.20	5.7	-1.7
1600	42.6	14.2	1.26	40.3	1.28	5.7	-1.9
1625	42.6	14.1	1.28	40.3	1.30	5.8	-1.4
1640	42.6	14.1	1.29	40.3	1.31	5.8	-1.2
1650	42.5	14.1	1.29	40.2	1.31	5.6	-1.8
1700	42.4	14.0	1.32	40.2	1.34	5.6	-1.6
1750	42.3	13.9	1.35	40.1	1.37	5.5	-1.5
1800	42.3	13.8	1.38	40.0	1.40	5.7	-1.4
1810	42.3	13.8	1.39	40.0	1.40	5.7	-0.7
1825	42.3	13.7	1.40	40.0	1.40	5.7	0.0
1850	42.2	13.7	1.41	40.0	1.40	5.5	0.7
1900	42.1	13.6	1.44	40.0	1.40	5.3	2.9
1950	42.0	13.6	1.47	40.0	1.40	5.0	5.0
2000	42.0	13.5	1.51	40.0	1.40	5.0	7.9
2050	41.9	13.5	1.54	39.9	1.44	5.0	6.6
2100	41.8	13.5	1.57	39.8	1.49	5.0	5.4
2150	41.8	13.5	1.61	39.7	1.53	5.2	5.0
2200	41.7	13.4	1.64	39.6	1.58	5.2	3.9
2250	41.6	13.4	1.68	39.6	1.62	5.2	3.6
2300	41.6	13.4	1.72	39.5	1.67	5.4	3.2
2350	41.5	13.4	1.76	39.4	1.71	5.4	2.9
2400	41.4	13.5	1.80	39.3	1.76	5.4	2.5
2450	41.4	13.5	1.84	39.2	1.80	5.6	2.2
2500	41.3	13.5	1.88	39.1	1.85	5.5	1.4
2550	41.2	13.5	1.92	39.1	1.91	5.4	0.6
2600	41.1	13.6	1.96	39.0	1.96	5.4	-0.2
3500	39.6	14.1	2.75	37.9	2.91	4.3	-5.5
3700	39.2	14.3	2.94	37.7	3.12	4.1	-5.7



5200	36.7	15.9	4.61	36.0	4.66	1.9	-1.0
5250	36.6	16.0	4.67	35.9	4.71	1.8	-0.9
5300	36.5	16.0	4.72	35.9	4.76	1.7	-0.7
5500	36.1	16.2	4.96	35.6	4.96	1.3	-0.1
5600	35.9	16.3	5.08	35.5	5.07	1.1	0.2
5700	35.7	16.4	5.19	35.4	5.17	0.9	0.5
5800	35.6	16.5	5.31	35.3	5.27	0.8	0.8
6000	35.2	16.6	5.55	35.1	5.48	0.4	1.3
6500	34.3	17.1	6.18	34.5	6.07	-0.5	1.8
7000	33.4	17.5	6.81	33.9	6.65	-1.4	2.3
7500	32.5	17.8	7.43	33.3	7.24	-2.3	2.7
8000	31.7	18.1	8.06	32.7	7.84	-3.2	2.8
8500	30.8	18.4	8.68	32.1	8.45	-4.2	2.8
9000	30.0	18.6	9.31	31.5	9.08	-5.1	2.6
9500	29.1	18.8	9.93	31.0	9.71	-5.9	2.2
10000	28.3	19.0	10.55	30.4	10.36	-6.9	1.8

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Measurement Certificate / Material Test

Item Name **Head Tissue Simulating Liquid (HBBL1900-3800V3)**
 Product No. SL AAH 196 AB (Charge: 131212-1)
 Manufacturer SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated OCP 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.

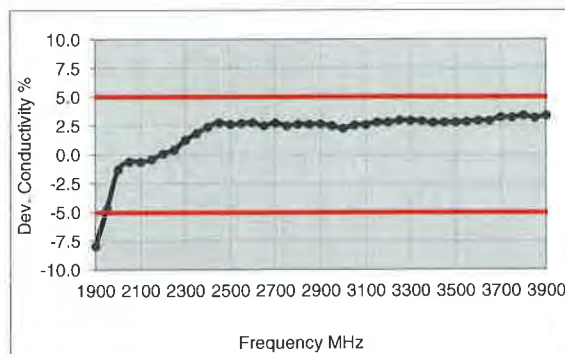
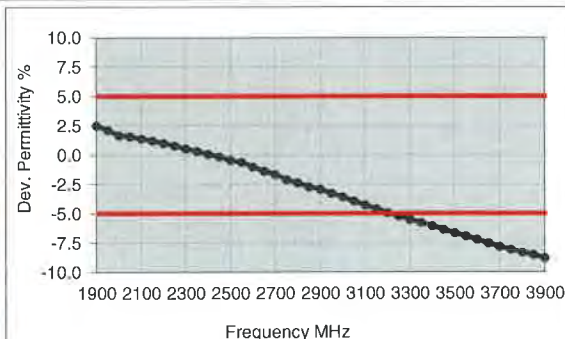
Test Condition

Ambient Environment temperatur (22 ± 3)°C and humidity < 70%.
 TSL Temperature 22°C
 Test Date 18-Dec-13
 Operator IEN

Additional Information

TSL Density 1.054 g/cm³
 TSL Heat-capacity 3.389 kJ/(kg*K)

f [MHz]	Measured			Target		Diff.to Target [%]	
	HP-e'	HP-e''	sigma	eps	sigma	Δ-eps	Δ-sigma
1900	41.0	12.2	1.3	40.0	1.4	2.5	-7.9
1950	40.8	12.3	1.3	40.0	1.4	2.1	-4.7
2000	40.7	12.4	1.4	40.0	1.4	1.7	-1.3
2050	40.5	12.6	1.4	39.9	1.4	1.6	-0.6
2100	40.4	12.7	1.5	39.8	1.5	1.4	-0.6
2150	40.2	12.8	1.5	39.7	1.5	1.2	-0.4
2200	40.0	12.9	1.6	39.6	1.6	1.0	0.1
2250	39.9	13.0	1.6	39.6	1.6	0.8	0.4
2300	39.7	13.2	1.7	39.5	1.7	0.5	1.3
2350	39.5	13.3	1.7	39.4	1.7	0.3	1.8
2400	39.3	13.5	1.8	39.3	1.8	0.1	2.4
2450	39.1	13.6	1.9	39.2	1.8	-0.1	2.8
2500	39.0	13.7	1.9	39.1	1.9	-0.4	2.6
2550	38.8	13.8	2.0	39.1	1.9	-0.6	2.7
2600	38.6	14.0	2.0	39.0	2.0	-1.0	2.8
2650	38.4	14.0	2.1	38.9	2.0	-1.4	2.5
2700	38.2	14.2	2.1	38.9	2.1	-1.7	2.7
2750	38.0	14.3	2.2	38.8	2.1	-2.1	2.5
2800	37.8	14.4	2.2	38.8	2.2	-2.4	2.6
2850	37.6	14.5	2.3	38.7	2.2	-2.7	2.6
2900	37.5	14.6	2.4	38.6	2.3	-2.9	2.6
2950	37.3	14.6	2.4	38.6	2.3	-3.3	2.5
3000	37.1	14.7	2.5	38.5	2.4	-3.6	2.3
3050	36.9	14.8	2.5	38.4	2.5	-3.9	2.6
3100	36.7	14.9	2.6	38.4	2.5	-4.3	2.6
3150	36.6	15.0	2.6	38.3	2.6	-4.6	2.8
3200	36.4	15.0	2.7	38.3	2.6	-4.9	2.8
3250	36.2	15.1	2.7	38.2	2.7	-5.2	3.0
3300	36.1	15.2	2.8	38.2	2.7	-5.5	3.0
3350	35.9	15.2	2.8	38.1	2.8	-5.8	2.9
3400	35.7	15.3	2.9	38.0	2.8	-6.0	2.8
3450	35.6	15.3	2.9	38.0	2.9	-6.3	2.8
3500	35.4	15.4	3.0	37.9	2.9	-6.6	2.8
3550	35.3	15.4	3.0	37.9	3.0	-6.9	2.9
3600	35.1	15.5	3.1	37.8	3.0	-7.2	2.9
3650	34.9	15.5	3.2	37.8	3.1	-7.5	2.9
3700	34.7	15.6	3.2	37.7	3.1	-7.8	3.2
3750	34.6	15.7	3.3	37.6	3.2	-8.1	3.2
3800	34.5	15.7	3.3	37.6	3.2	-8.3	3.4
3850	34.3	15.8	3.4	37.5	3.3	-8.5	3.2



Measurement Certificate / Material Test

Item Name Head Tissue Simulating Liquid (HBBL4-250V3)
Product No. SL AAH 005 AD (Batch: 211221-1)
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 ± 3)°C and humidity < 70%.
TSL Temperature 22°C
Test Date 7-Jan-22
Operator JML

Additional Information

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

f [MHz]	Measured			Target		Diff.to-Target [%]	
	ϵ'	ϵ''	sigma	eps	sigma	$\Delta\epsilon$	$\Delta\sigma$
5	53.7	2584.30	0.71	55.5	0.75	-3.2	-4.9
10	53.7	1282.57	0.71	55.5	0.75	-3.2	-4.9
15	53.5	855.85	0.71	55.3	0.75	-3.4	-4.8
20	53.3	642.50	0.71	55.1	0.75	-3.3	-4.7
25	53.1	514.52	0.72	55.0	0.75	-3.5	-4.6
30	52.8	429.24	0.72	55.0	0.75	-3.9	-4.5
35	52.7	368.38	0.72	54.9	0.75	-4.1	-4.4
40	52.5	322.73	0.72	54.8	0.75	-4.2	-4.2
45	52.3	287.27	0.72	54.7	0.75	-4.3	-4.1
50	52.1	258.93	0.72	54.6	0.75	-4.4	-4.0
55	52.0	235.78	0.72	54.4	0.75	-4.5	-3.9
60	51.8	216.52	0.72	54.3	0.75	-4.6	-3.8
65	51.7	200.24	0.72	54.2	0.75	-4.6	-3.7
70	51.6	188.31	0.73	54.1	0.75	-4.6	-3.6
75	51.5	174.24	0.73	54.0	0.75	-4.7	-3.4
80	51.4	163.70	0.73	53.9	0.75	-4.7	-3.3
85	51.2	154.40	0.73	53.8	0.75	-4.7	-3.1
90	51.1	146.15	0.73	53.7	0.75	-4.7	-2.9
95	51.0	138.77	0.73	53.5	0.75	-4.7	-2.6
100	50.9	132.14	0.74	53.4	0.75	-4.7	-2.6
105	50.8	126.15	0.74	53.3	0.76	-4.7	-2.4
110	50.7	120.71	0.74	53.2	0.76	-4.7	-2.2
115	50.6	115.75	0.74	53.1	0.76	-4.7	-2.1
120	50.5	111.21	0.74	53.0	0.76	-4.7	-1.9
125	50.4	107.03	0.74	52.9	0.76	-4.7	-1.7
130	50.3	103.18	0.75	52.8	0.76	-4.7	-1.5
135	50.1	99.62	0.75	52.6	0.76	-4.7	-1.3
140	50.0	96.32	0.75	52.5	0.76	-4.7	-1.1
145	49.9	93.24	0.75	52.4	0.76	-4.7	-0.8
150	49.8	90.38	0.75	52.3	0.76	-4.7	-0.6
155	49.7	87.70	0.76	52.1	0.76	-4.5	-0.8
160	49.6	85.20	0.76	51.8	0.77	-4.2	-1.0
165	49.5	82.84	0.76	51.6	0.77	-4.0	-1.2
170	49.4	80.63	0.76	51.4	0.77	-3.7	-1.4
175	49.4	78.55	0.76	51.1	0.78	-3.5	-1.6
180	49.3	76.58	0.77	50.9	0.78	-3.2	-1.8
185	49.2	74.72	0.77	50.7	0.78	-3.0	-2.0
190	49.1	72.96	0.77	50.4	0.79	-2.7	-2.2
195	49.0	71.29	0.77	50.2	0.79	-2.4	-2.3
200	48.9	69.71	0.78	50.0	0.80	-2.1	-2.5
205	48.8	68.20	0.78	49.7	0.80	-1.9	-2.7
210	48.7	66.77	0.78	49.5	0.80	-1.6	-2.8
215	48.6	65.41	0.78	49.3	0.81	-1.3	-3.0
220	48.6	64.10	0.78	49.0	0.81	-1.0	-3.2
225	48.5	62.86	0.79	48.8	0.81	-0.7	-3.3
230	48.4	61.67	0.79	48.6	0.82	-0.4	-3.5
235	48.3	60.54	0.79	48.3	0.82	0.0	-3.6
240	48.2	59.45	0.79	48.1	0.82	0.3	-3.8
245	48.1	58.41	0.80	47.9	0.83	0.6	-3.9
250	48.1	57.41	0.80	47.6	0.83	0.9	-4.1

