

Head Tissue Simulating Liquids

Head Tissue	Parameters according to IEEE Std 1528-2013 / IEC 62209 / FCC KDB 865664 D01		
Narrow-Band Solutions (±5% tolerance)	Product HSL300V2 HSL450V2 HSL750V2 HSL900V2 HSL1450V2 HSL1750V2 HSL1800V2 HSL1900V2 HSL1950V2 HSL2450V2	Test Frequency (MHz) 300 450 750 835, 900 1450, 1500, 1640 1750 1800, 1900 1900 1950, 2000 2450, 2600	Main Ingredients Water, Sugar Water, Sugar Water, Sugar Water, Sugar Water, DGBE Water, DGBE Water, DGBE Water, DGBE Water, DGBE Water, DGBE
Broad-Band Solutions (±5% tolerance)	Product HBBL30-250V3 HBBL1350-1850V3 HBBL1550-1950V3 HBBL1900-3800V3 HBBL3500-5800V5	Test Frequency (MHz) 30-250 1400-1800 1750-1900 1950-3000 3500-5800	Main Ingredients Water, Tween Water, Tween Water, Tween Water, Tween Water, Oil

Zeughausstrasse 43, 8004 Zurich, Switzerland
 Phone +41 44 245 9700, Fax +41 44 245 9779
 info@speag.com, http://www.speag.com

Measurement Certificate / Material Test

Item Name	Head Tissue Simulating Liquid (HSL900V2)
Product No.	SL AAH 090 BB (Charge: 140205-4)
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.

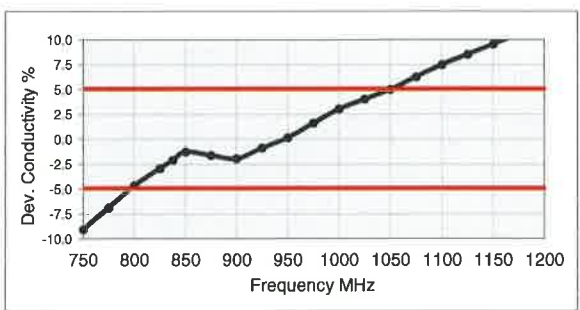
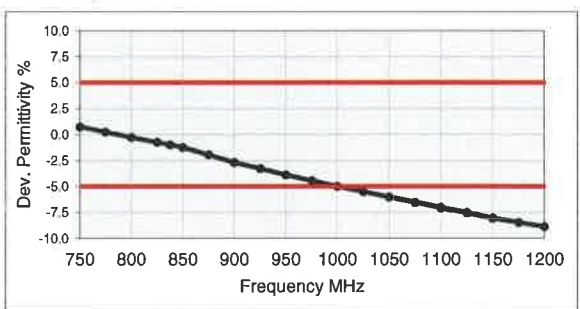
Test Condition

Ambient	Environment temperatur (22 ± 3)°C and humidity < 70%.
TSL Temperature	22°C
Test Date	12-Feb-14
Operator	IEN

Additional Information

TSL Density	1.280 g/cm ³
TSL Heat-capacity	2.942 kJ/(kg*K)

f [MHz]	Measured			Target		Diff.to Target [%]	
	HP-e'	HP-e''	sigma	eps	sigma	Δ -eps	Δ -sigma
700	42.9	19.58	0.76	42.2	0.89	1.6	-14.3
725	42.6	19.52	0.79	42.1	0.89	1.2	-11.7
750	42.3	19.47	0.81	41.9	0.89	0.8	-9.1
775	41.9	19.35	0.83	41.8	0.90	0.3	-6.8
800	41.6	19.23	0.86	41.7	0.90	-0.3	-4.6
825	41.3	19.18	0.88	41.6	0.91	-0.7	-2.9
838	41.1	19.16	0.89	41.5	0.91	-1.0	-2.1
850	41.0	19.13	0.90	41.5	0.92	-1.2	-1.2
875	40.7	19.07	0.93	41.5	0.94	-1.9	-1.6
900	40.4	19.00	0.95	41.5	0.97	-2.7	-1.9
925	40.1	18.92	0.97	41.5	0.98	-3.3	-0.9
950	39.8	18.85	1.00	41.4	0.99	-3.9	0.2
975	39.6	18.82	1.02	41.4	1.00	-4.4	1.6
1000	39.3	18.80	1.05	41.3	1.01	-5.0	3.0
1025	39.0	18.71	1.07	41.3	1.03	-5.5	4.0
1050	38.8	18.62	1.09	41.2	1.04	-6.0	5.0
1075	38.5	18.59	1.11	41.2	1.05	-6.5	6.3
1100	38.3	18.55	1.14	41.2	1.06	-7.0	7.5
1125	38.0	18.50	1.16	41.1	1.07	-7.5	8.5
1150	37.8	18.44	1.18	41.1	1.08	-8.0	9.6
1175	37.5	18.39	1.20	41.0	1.09	-8.4	10.6
1200	37.3	18.35	1.22	41.0	1.10	-8.9	11.6



Measurement Certificate / Material Test

Item Name	Head Tissue Simulating Liquid (HSL 1900)
Product No.	SL AAH 190 AA (Charge: 120112-1)
Manufacturer	SPEAG

Measurement Method

TSL dielectric parameters measured using calibrated OCP probe (type DAK).

Target Parameters

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

Test Condition

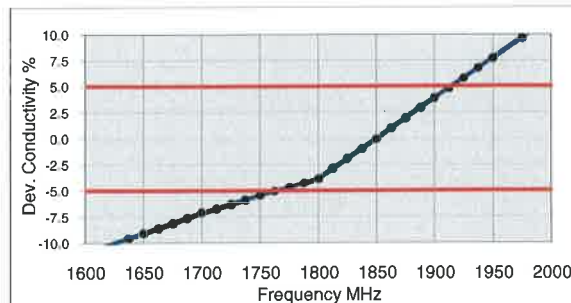
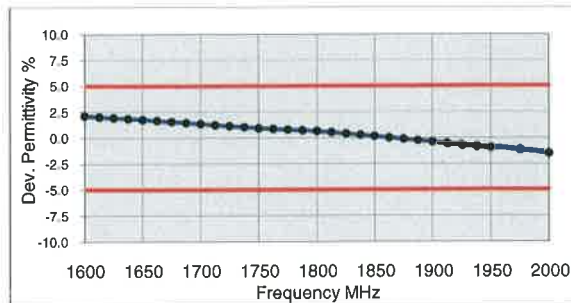
Ambient Condition 22°C ; 30% humidity
 TSL Temperature 22°C
 Test Date 18-Jan-12

Additional Information

TSL Density 0.985 g/cm³
 TSL Heat-capacity 3.710 kJ/(kg*K)

Results

f [MHz]	Measured			Target		Diff.to Target [%]	
	HP-ε'	HP-ε''	sigma	eps	sigma	Δ-eps	Δ-sigma
1600	41.2	12.84	1.14	40.3	1.28	2.1	-11.0
1613	41.1	12.88	1.16	40.3	1.29	2.0	-10.5
1625	41.1	12.93	1.17	40.3	1.30	1.9	-10.0
1638	41.0	12.97	1.18	40.3	1.31	1.8	-9.5
1650	40.9	13.01	1.19	40.2	1.31	1.8	-9.1
1663	40.9	13.05	1.21	40.2	1.32	1.7	-8.6
1675	40.8	13.10	1.22	40.2	1.33	1.6	-8.1
1688	40.8	13.14	1.23	40.2	1.33	1.4	-7.6
1700	40.7	13.18	1.25	40.2	1.34	1.3	-7.1
1713	40.6	13.22	1.26	40.1	1.35	1.2	-6.7
1725	40.6	13.25	1.27	40.1	1.36	1.1	-6.3
1738	40.5	13.28	1.28	40.1	1.36	1.0	-5.9
1750	40.5	13.31	1.30	40.1	1.37	0.9	-5.5
1763	40.4	13.35	1.31	40.1	1.38	0.9	-5.1
1775	40.4	13.38	1.32	40.0	1.39	0.8	-4.7
1788	40.3	13.41	1.33	40.0	1.39	0.7	-4.3
1800	40.3	13.44	1.35	40.0	1.40	0.6	-3.9
1813	40.2	13.48	1.36	40.0	1.40	0.5	-2.9
1825	40.2	13.52	1.37	40.0	1.40	0.4	-2.0
1838	40.1	13.55	1.39	40.0	1.40	0.3	-1.0
1850	40.1	13.59	1.40	40.0	1.40	0.1	-0.1
1863	40.0	13.63	1.41	40.0	1.40	0.0	0.9
1875	39.9	13.67	1.43	40.0	1.40	-0.1	1.9
1888	39.9	13.71	1.44	40.0	1.40	-0.3	2.9
1900	39.8	13.75	1.45	40.0	1.40	-0.4	3.8
1913	39.8	13.79	1.47	40.0	1.40	-0.5	4.8
1925	39.7	13.83	1.48	40.0	1.40	-0.7	5.8
1938	39.7	13.86	1.49	40.0	1.40	-0.8	6.7
1950	39.6	13.90	1.51	40.0	1.40	-0.9	7.7
1975	39.5	13.97	1.53	40.0	1.40	-1.2	9.6
2000	39.4	14.04	1.56	40.0	1.40	-1.5	11.6



Zeughausstrasse 43, 8004 Zurich, Switzerland
 Phone +41 44 245 9700, Fax +41 44 245 9779
 info@speag.com, http://www.speag.com

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.

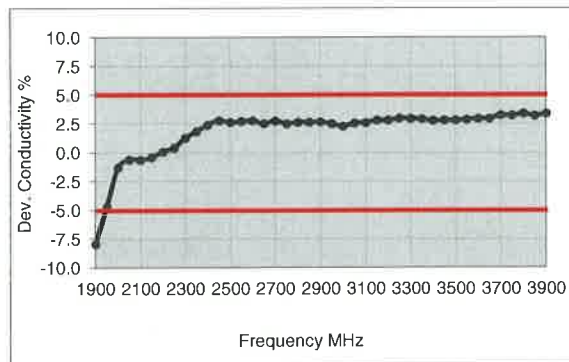
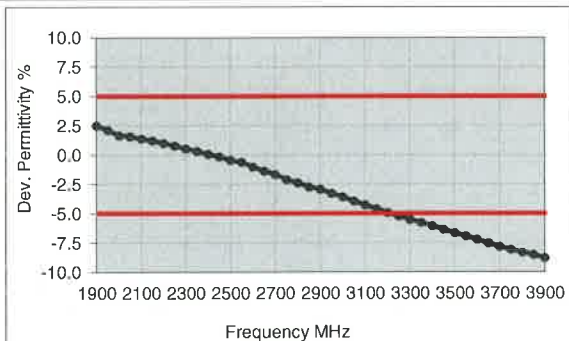
Test Condition

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



Zeughausstrasse 43, 8004 Zurich, Switzerland
 Phone +41 44 245 9700, Fax +41 44 245 9779
 info@speag.com, http://www.speag.com

Measurement Certificate / Material Test

Item Name **Body Tissue Simulating Liquid (MBBL3500-5800V5)**
 Product No. SL AAM 501 EA (Charge: 140114-1)
 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 15-Jan-14
 Operator IEN

Additional Information

TSL Density 0.996 g/cm³
 TSL Heat-capacity 3.765 kJ/(kg*K)

f [MHz]	Measured			Target		Diff.to Target [%]	
	HP-e'	HP-e''	sigma	eps	sigma	Δ-eps	Δ-sigma
3400	52.2	16.63	3.14	51.5	3.20	1.4	-1.8
3500	52.0	16.67	3.25	51.3	3.31	1.3	-1.9
3600	51.9	16.74	3.35	51.2	3.43	1.4	-2.4
3700	51.7	16.81	3.46	51.1	3.55	1.3	-2.5
3800	51.6	16.90	3.57	50.9	3.66	1.3	-2.6
3900	51.5	16.99	3.69	50.8	3.78	1.4	-2.4
4000	51.3	17.08	3.80	50.6	3.90	1.3	-2.5
4100	51.2	17.18	3.92	50.5	4.01	1.4	-2.4
4200	51.1	17.32	4.05	50.4	4.13	1.4	-2.0
4300	50.9	17.47	4.18	50.2	4.25	1.3	-1.6
4400	50.8	17.61	4.31	50.1	4.37	1.4	-1.3
4500	50.6	17.73	4.44	50.0	4.48	1.3	-0.9
4600	50.4	17.86	4.57	49.8	4.60	1.1	-0.6
4700	50.3	18.00	4.71	49.7	4.72	1.2	-0.1
4800	50.1	18.14	4.84	49.6	4.83	1.1	0.2
4850	50.0	18.20	4.91	49.5	4.89	1.0	0.4
4900	49.9	18.28	4.98	49.4	4.95	1.0	0.6
4950	49.8	18.31	5.04	49.4	5.01	0.9	0.7
5000	49.7	18.38	5.11	49.3	5.07	0.8	0.9
5050	49.6	18.44	5.18	49.2	5.12	0.8	1.1
5100	49.5	18.50	5.25	49.2	5.18	0.7	1.3
5150	49.4	18.57	5.32	49.1	5.24	0.6	1.5
5200	49.4	18.63	5.39	49.0	5.30	0.8	1.7
5250	49.3	18.68	5.46	48.9	5.36	0.7	1.9
5300	49.2	18.75	5.53	48.9	5.42	0.7	2.1
5350	49.1	18.79	5.59	48.8	5.47	0.6	2.1
5400	49.0	18.86	5.66	48.7	5.53	0.5	2.3
5450	48.9	18.90	5.73	48.7	5.59	0.5	2.5
5500	48.8	18.94	5.80	48.6	5.65	0.4	2.7
5550	48.7	19.01	5.87	48.5	5.71	0.3	2.8
5600	48.7	19.06	5.94	48.5	5.77	0.5	3.0
5650	48.6	19.13	6.01	48.4	5.82	0.4	3.2
5700	48.5	19.18	6.08	48.3	5.88	0.3	3.3
5750	48.4	19.26	6.16	48.3	5.94	0.3	3.7
5800	48.3	19.30	6.23	48.2	6.00	0.2	3.8
5850	48.2	19.37	6.30	48.1	6.06	0.1	4.0
5900	48.1	19.43	6.38	48.1	6.12	0.1	4.3

