Appendix B: Tissue Stimulating Liquids, System Checks and System Validation

B.1. SAR System Check

Prior to SAR assessment, the system is verified to ±10% of the SAR measurement on the reference dipole at the time of calibration by the calibration facility. Full system validation status and result summary can be found in Section B.3.

Table 1 System Check Results (SAR)

stem	Frequency (MHz)	Tissue Type	Date	Amb. Temp. (°C)	Tissue Temp (°C)	Input Power (dBm)	Verification Source SN	Probe SN	DAE SN	Measured 1g SAR (W/kg)	1W Target 1g SAR (W/kg)	1W Normalized 1g SAR (W/kg)	1g SAR Deviation	Measured 10g SAR (W/kg)	1W Target 10g SAR (W/kg)	1W Normalized 10g SAR (W/kg)	10g SAR Deviation (%)
Gamma	835	Head	9/20/2024	22.9	22.4	23	4d311	7859	1844	2.02	9.82	10.124	3.10%	1.31	6.37	6.566	3.07%

stem	Frequency (MHz)	Tissue Type	Date	Amb. Temp. (°C)	Tissue Temp (°C)	Input Power (dBm)	Verification Source SN	Probe SN	DAE SN	wbSAR (W/kg)	Target wbSAR (W/kg)	1W Normalized wbSAR (W/kg)	wbSAR Deviation [%]
Gamma	835	Head	9/20/2024	22.9	22.4	23	4d311	7859	1844	0.015	0.068	0.074	8.71%

Note: wbSAR Target per IEC 62232:2022

B.2. Dielectric Parameters of the TSL

Table 2 SAR Tissue Dielectric Parameters

Date	Type	Liquid Temp (°C)	Frequency (MHz)	Conductivity Measured (σ)	Conductivity Target (σ)	Deviation	Permittivity Measured (εr)	Permittivity Target (εr)	Deviation
9/20/2024	Head	22.6	835	0.95	0.90	5.58%	41.17	41.50	-0.79%
9/20/2024	Head	22.6	850	0.95	0.92	4.14%	41.13	41.50	-0.89%
9/20/2024	Head	22.6	875	0.96	0.94	2.47%	41.03	41.50	-1.13%
9/20/2024	Head	22.6	900	0.97	0.97	0.42%	40.95	41.50	-1.33%
9/20/2024	Head	22.6	935	0.99	0.99	-0.31%	40.89	41.46	-1.37%

The above measured tissue parameters were used in the DASY software. The DASY software was used to perform interpolation to determine the dielectric parameters at the SAR test device frequencies (per KDB Publication 865664 D01v01r04 and IEEE 1528-2013 6.6.1.2). The tissue parameters listed in the SAR test plots may slightly differ from the table above due to significant digit rounding in the software.

The SAR values were compensated for deviations between the measured and required tissue dielectric properties, as described in IEEE 1528-2013. The SAR values were applied to only scale up the measured SAR values, and not downward, per KDB Publication 865664 D01v04r04.

B.3. System Validation

Per FCC KDB Publication 865664 D02 Section 2.3 a) states “SAR system validation status and system verification results should be documented in a separate section of the SAR report, or as an attachment, to confirm measurement accuracy.”

The SAR systems used for evaluating this device were validated against its performance specifications prior to the SAR measurements.

Reference dipoles were used with the required tissue-equivalent media for system validation, according to the procedures outlined in FCC KDB Publication 865664 D01 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point was validated at a frequency within the valid frequency range of the probe calibration point.

Per FCC KDB 865664 D02, “the validation status should be documented according to the validation date(s), measurement frequencies, SAR probes, calibrated signal type(s) and tissue dielectric parameters.” A tabulated summary of the system validation status is provided accordingly:

Table 3 System Validation

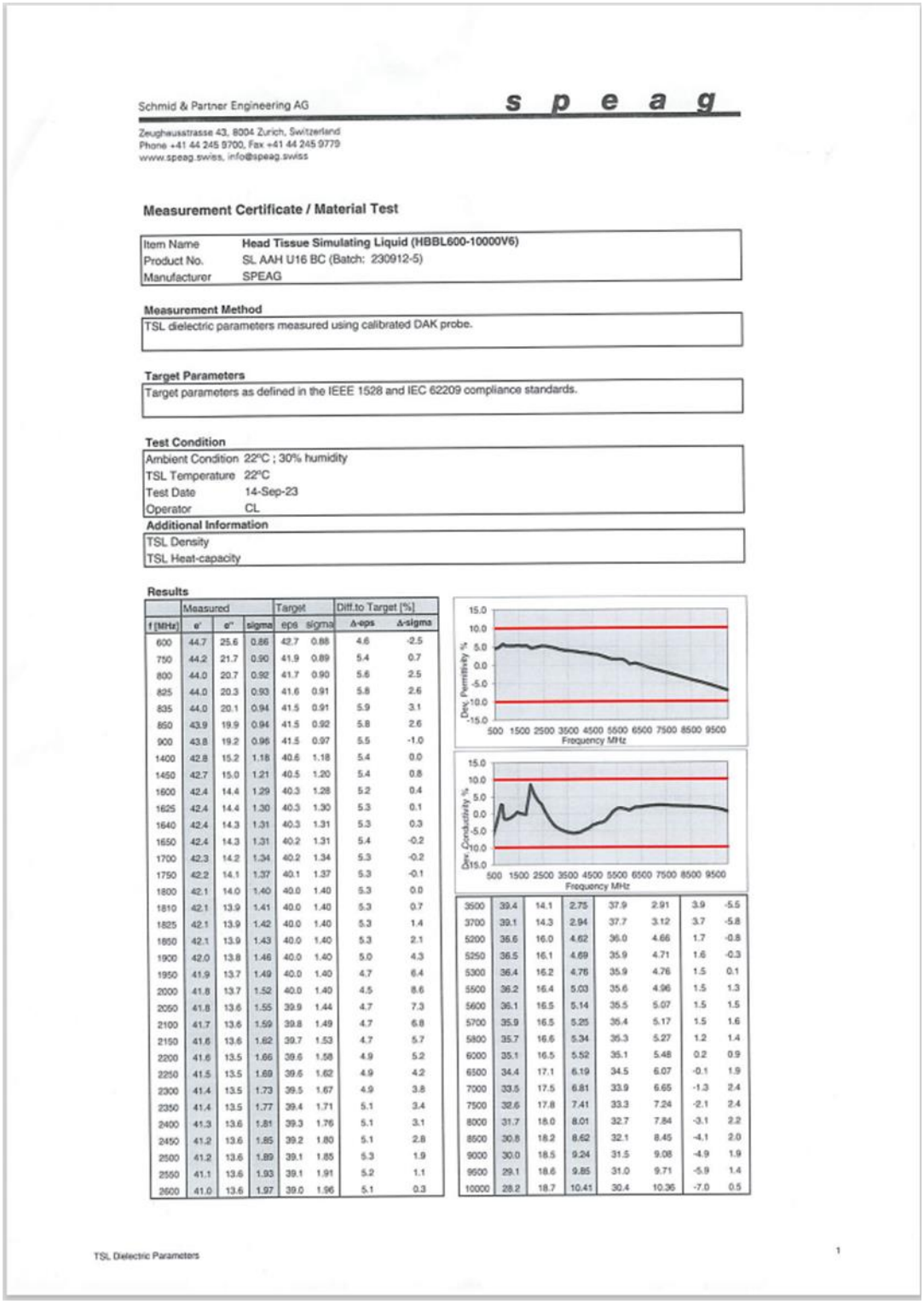
System	Frequency (MHz)	Date	Probe	DAE	Probe CalF		Cond. (σ)	Perm (εr)	CW Validation			Mod Validation		
					Freq (MHz)	Tissue Type			Sensitivity	Probe Linearity	Probe Isotropy	Mod Type	Duty Factor	PAR
Gamma	835	1/29/2024	7859	1844	835	Head	0.921	41.6	PASS	PASS	PASS	GMSK	PASS	N/A

NOTE: The probes have been calibrated for both CW and modulated signals. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664 D01 for scenarios when CW probe calibrations are used with other signal types.

SAR systems were additionally validated for modulated signals with a periodic duty cycle or with a high PAR (peak to average ratio) >5 dB, such as OFDM according to FCC KDB Publication 865664 D01 v01r04.

B.4. Sample TSL Compositions

TSL recipes are proprietary to SPEAG. Since the composition is approximate to the actual liquids utilized, the manufacturer data sheets are provided below.



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Measurement Certificate / Material Test

Item Name	**Head Tissue Simulating Liquid (HBBL600-10000V6)**
Product No.	SL AAH U16 BC (Batch: 230912-5)
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	14-Sep-23
Operator	CL

Additional Information

TSL Density
TSL Heat-capacity

Results

	Measured			Target		Diff.to Target [%]	
f [MHz]	ε'	ε''	sigma	eps	sigma	Δ-eps	Δ-sigma
600	44.7	25.6	0.86	42.7	0.88	4.6	-2.5
750	44.2	21.7	0.90	41.9	0.89	5.4	0.7
800	44.0	20.7	0.92	41.7	0.90	5.6	2.5
825	44.0	20.3	0.93	41.6	0.91	5.8	2.6
835	44.0	20.1	0.94	41.5	0.91	5.9	3.1
850	43.9	19.9	0.94	41.5	0.92	5.8	2.6
900	43.8	19.2	0.96	41.5	0.97	5.5	-1.0
1400	42.8	15.2	1.18	40.6	1.18	5.4	0.0
1450	42.7	15.0	1.21	40.5	1.20	5.4	0.8
1600	42.4	14.4	1.29	40.3	1.28	5.2	0.4
1625	42.4	14.4	1.30	40.3	1.30	5.3	0.1
1640	42.4	14.3	1.31	40.3	1.31	5.3	0.3
1650	42.4	14.3	1.31	40.2	1.31	5.4	-0.2
1700	42.3	14.2	1.34	40.2	1.34	5.3	-0.2
1750	42.2	14.1	1.37	40.1	1.37	5.3	-0.1
1800	42.1	14.0	1.40	40.0	1.40	5.3	0.0
1810	42.1	13.9	1.41	40.0	1.40	5.3	0.7
1825	42.1	13.9	1.42	40.0	1.40	5.3	1.4
1850	42.1	13.9	1.43	40.0	1.40	5.3	2.1
1900	42.0	13.8	1.46	40.0	1.40	5.0	4.3
1950	41.9	13.7	1.49	40.0	1.40	4.7	6.4
2000	41.8	13.7	1.52	40.0	1.40	4.5	8.6
2050	41.8	13.6	1.55	39.9	1.44	4.7	7.3
2100	41.7	13.6	1.59	39.8	1.49	4.7	6.8
2150	41.6	13.6	1.62	39.7	1.53	4.7	5.7
2200	41.6	13.5	1.66	39.6	1.58	4.9	5.2
2250	41.5	13.5	1.69	39.6	1.62	4.9	4.2
2300	41.4	13.5	1.73	39.5	1.67	4.9	3.8
2350	41.4	13.5	1.77	39.4	1.71	5.1	3.4
2400	41.3	13.6	1.81	39.3	1.76	5.1	3.1
2450	41.2	13.6	1.85	39.2	1.80	5.1	2.8
2500	41.2	13.6	1.89	39.1	1.85	5.3	1.9
2550	41.1	13.6	1.93	39.1	1.91	5.2	1.1
2600	41.0	13.6	1.97	39.0	1.96	5.1	0.3
3500	39.4	14.1	2.75	37.9	2.91	3.9	-5.5
3700	39.1	14.3	2.94	37.7	3.12	3.7	-5.8
5200	36.6	16.0	4.62	36.0	4.66	1.7	-0.8
5250	36.5	16.1	4.69	35.9	4.71	1.6	-0.3
5300	36.4	16.2	4.76	35.9	4.76	1.5	0.1
5500	36.2	16.4	5.03	35.6	4.96	1.5	1.3
5600	36.1	16.5	5.14	35.5	5.07	1.5	1.5
5700	35.9	16.5	5.25	35.4	5.17	1.5	1.6
5800	35.7	16.6	5.34	35.3	5.27	1.2	1.4
6000	35.1	16.5	5.52	35.1	5.48	0.2	0.9
6500	34.4	17.1	6.19	34.5	6.07	-0.1	1.9
7000	33.5	17.5	6.81	33.9	6.65	-1.3	2.4
7500	32.6	17.8	7.41	33.3	7.24	-2.1	2.4
8000	31.7	18.0	8.01	32.7	7.84	-3.1	2.2
8500	30.8	18.2	8.62	32.1	8.45	-4.1	2.0
9000	30.0	18.5	9.24	31.5	9.08	-4.9	1.9
9500	29.1	18.6	9.85	31.0	9.71	-5.9	1.4
10000	28.2	18.7	10.41	30.4	10.36	-7.0	0.5

TSL Dielectric Parameters

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Figure 1 - Head TSL Calibration Certificate Example