



## Head Tissue Simulating Liquids

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## Tissue Simulating Liquids

Verkotan offers tissue simulating liquids for various applications. The dielectric parameters of these liquids are tuned to match to real tissue parameters over a certain frequency range in a certain temperature. Based on Maxwell's equations the dielectric parameters capture the behaviour of electromagnetic field in a medium. Thus, they can be used to study how electromagnetic radiation propagates thru tissue.

The ingredients of the tissue simulants are selected among non-hazardous substances as far as applicable.

The dielectric parameters are measured with dielectric assessment kit, DAK-3.5 or DAK-12 Dielectric Probe manufactured by SPEAG. The dielectric measurement system is covering the 4 MHz – 20 GHz frequency range with an open-ended coaxial dielectric probe. With DAK, reference liquids are evaluated in accordance with IEC 62209, IEEE 1528, and several federal regulations.

Measurement report of the liquid will be included to the shipment.

### Application

Store the tissue simulant in closed container, stir the liquid thoroughly before the use and during the use if needed. Avoid making bubbles while mixing the liquid. Avoid evaporation of water while heating. Conductivity of the simulant can be adjusted by adding salt and relative permittivity by adding deionized water.



## Narrowband Head Tissue Simulating Liquids

### 150 MHz

150 MHz tissue simulant meets the target parameters of IEC/IEEE 62209-1528 with a tolerance of  $\pm 5\%$ .

#### Ingredients

- Deionized water
- Tween
- Salt

Target data: Head		
f (MHz)	$\epsilon'$	$\sigma$ (S/m)
<b>150</b>	52.3	0.76

### 450 MHz

450 MHz tissue simulant meets the target parameters of IEC/IEEE 62209-1528 with a tolerance of  $\pm 5\%$ .

#### Ingredients

- Deionized water
- Tween
- Salt

Target data: Head		
f (MHz)	$\epsilon'$	$\sigma$ (S/m)
<b>450</b>	43.5	0.87

## 700 - 935 MHz

700 - 935 MHz tissue simulant meets the target parameters of IEC/IEEE 62209-1528 with a tolerance of  $\pm 5\%$ .

### Ingredients

- Deionized water
- Tween
- Salt

Target data: Head		
f (MHz)	$\epsilon'$	$\sigma$ (S/m)
<b>700</b>	42.2	0.89
<b>750</b>	41.9	0.89
<b>800</b>	41.7	0.90
<b>850</b>	41.5	0.90
<b>900</b>	41.5	0.97
<b>935</b>	41.5	0.99

## 1 700 – 1 900 MHz

1 700 – 1 900 MHz tissue simulant meets the target parameters of IEC/IEEE 62209-1528 with a tolerance of  $\pm 5\%$ .

### Ingredients

- Deionized water
- Tween
- Salt

Target data: Head		
f (MHz)	$\epsilon'$	$\sigma$ (S/m)
<b>1700</b>	40.1	1.34
<b>1750</b>	40.1	1.37
<b>1800</b>	40.0	1.40
<b>1850</b>	40.0	1.40
<b>1900</b>	40.0	1.40

## 2 000 – 2 700 MHz

2 000 – 2 700 MHz tissue simulant meets the target parameters of IEC/IEEE 62209-1528 with a tolerance of  $\pm 5\%$ .

### Ingredients

- Deionized water
- Tween
- Salt

Target data: Head		
f (MHz)	$\epsilon'$	$\sigma$ (S/m)
<b>2000</b>	40.0	1.40
<b>2100</b>	39.8	1.49
<b>2200</b>	39.6	1.58
<b>2300</b>	39.5	1.67
<b>2400</b>	39.3	1.76
<b>2450</b>	39.2	1.80
<b>2500</b>	39.1	1.85
<b>2600</b>	39.0	1.96
<b>2700</b>	38.88	2.07

## Broadband Head Tissue Simulating Liquids

### LBH 10 – 450 MHz

LBH 10 – 450 MHz tissue simulant meets the target parameters of IEC/IEEE 62209-1528 with a tolerance of  $\pm 10\%$ .

#### Ingredients

- Deionized water
- Tween
- Salt

Target data: Head		
f (MHz)	$\epsilon'$	$\sigma$ (S/m)
<b>10</b>	55.0	0.75
<b>20</b>	55.0	0.75
<b>30</b>	55.0	0.75
<b>40</b>	54.8	0.75
<b>50</b>	54.6	0.75
<b>60</b>	54.3	0.75
<b>70</b>	54.1	0.75
<b>80</b>	53.9	0.75
<b>90</b>	53.7	0.76
<b>100</b>	53.4	0.76
<b>200</b>	50.0	0.80
<b>300</b>	45.3	0.87
<b>400</b>	44.1	0.87
<b>450</b>	43.5	0.87

## LBH 450 – 700 MHz

LBH 450 – 700 MHz tissue simulant meets the target parameters of IEC/IEEE 62209-1528 with a tolerance of  $\pm 10\%$ .

### Ingredients

- Deionized water
- Tween
- Salt

Target data: Head		
f (MHz)	$\epsilon'$	$\sigma$ (S/m)
<b>450</b>	43.5	0.87
<b>500</b>	43.2	0.87
<b>550</b>	43.0	0.88
<b>600</b>	42.7	0.88
<b>650</b>	42.4	0.88
<b>700</b>	42.2	0.89

## WBH 700 – 3000 MHz

WBH 700 – 3000 MHz tissue simulant meets the target parameters of IEC/IEEE 62209-1528 with a tolerance of  $\pm 10\%$ .

### Ingredients

- Deionized water
- Tween
- Salt

Target data: Head		
f (MHz)	$\epsilon'$	$\sigma$ (S/m)
<b>700</b>	42.2	0.89
<b>800</b>	41.7	0.90
<b>900</b>	41.5	0.97
<b>1000</b>	41.3	1.02
<b>1100</b>	41.1	1.05
<b>1200</b>	41.0	1.10
<b>1300</b>	40.8	1.14
<b>1400</b>	40.6	1.18
<b>1500</b>	40.4	1.23
<b>1600</b>	40.3	1.29
<b>1700</b>	40.1	1.34
<b>1800</b>	40.0	1.40
<b>1900</b>	40.0	1.40
<b>2000</b>	40.0	1.40
<b>2100</b>	39.8	1.49
<b>2200</b>	39.6	1.58
<b>2300</b>	39.5	1.67
<b>2400</b>	39.3	1.76
<b>2500</b>	39.1	1.86
<b>2600</b>	39.0	1.96
<b>2700</b>	38.9	2.07
<b>2800</b>	38.8	2.18
<b>2900</b>	38.6	2.29
<b>3000</b>	38.5	2.40



## HBH 3300 – 8000 MHz

HBH 3300 – 8 000 MHz tissue simulant meets the target parameters of IEC/IEEE 62209 -1528 with a tolerance of  $\pm 10\%$ .

### Ingredients

- Deionized water
- Tween
- Salt

Target data:Head		
f (MHz)	$\epsilon'$	$\sigma$ (S/m)
<b>3300</b>	38.1	2.71
<b>3400</b>	38.0	2.81
<b>3500</b>	37.9	2.91
<b>3600</b>	37.8	3.01
<b>3700</b>	37.7	3.12
<b>3800</b>	37.6	3.22
<b>3900</b>	37.5	3.33
<b>4000</b>	37.4	3.43
<b>4500</b>	36.8	3.94
<b>5000</b>	36.2	4.45
<b>5500</b>	35.7	4.97
<b>6000</b>	35.1	5.48
<b>6500</b>	34.5	6.07
<b>7000</b>	33.9	6.65
<b>7500</b>	33.3	7.24
<b>8000</b>	32.7	7.84