

## Head Tissue Simulating Liquids

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

## Body Tissue Simulating Liquids

| Body Tissue (Muscle)                         | Parameters according to FCC KDB 865664 D01 |                             |                         |
|--|--|-----------------------------|-------------------------|
| <b>Narrow-Band Solutions (±5% tolerance)</b> | <b>Product</b>                             | <b>Test Frequency (MHz)</b> | <b>Main Ingredients</b> |
|  | MSL300V2                                   | 300                         | Water, Sugar            |
|  | MSL450V2                                   | 400, 450                    | Water, Sugar            |
|  | MSL750V2                                   | 750                         | Water, Sugar            |
|  | MSL900V2                                   | 835, 900                    | Water, Sugar            |
|  | MSL1450V2                                  | 1450, 1500, 1640            | Water, DGBE             |
|  | MSL1750V2                                  | 1750                        | Water, DGBE             |
|  | MSL1800V2                                  | 1800, 1900                  | Water, DGBE             |
|  | MSL1900V2                                  | 1900                        | Water, DGBE             |
|  | MSL1950V2                                  | 1950, 2100                  | Water, DGBE             |
| MSL2450V2                                    | 2450, 2600                                 | Water, DGBE                 |                         |
| <b>Broad-Band Solutions (±5% tolerance)</b>  | <b>Product</b>                             | <b>Test Frequency (MHz)</b> | <b>Main Ingredients</b> |
|  | MBBL130-250V3                              | 130-250                     | Water, Tween            |
|  | MBBL1350-1850V3                            | 1350-1800                   | Water, Tween            |
|  | MBBL1550-1950V3                            | 1550-1850                   | Water, Tween            |
|  | MBBL1900-3800V3                            | 1950-3800                   | Water, Tween            |
| MBBL3500-5800V5                              | 3500-5800                                  | 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    | <b>Head Tissue Simulating Liquid (HSL750V2)</b> |
| Product No.  | SL AAH 075 AA (Charge: 140210-5)                |
| 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.

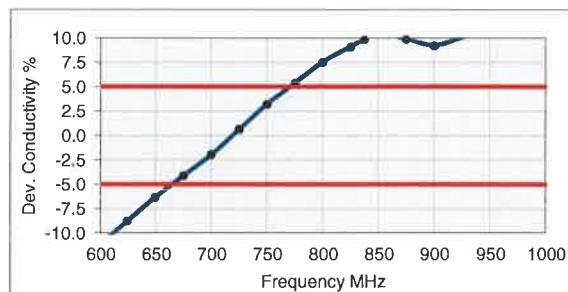
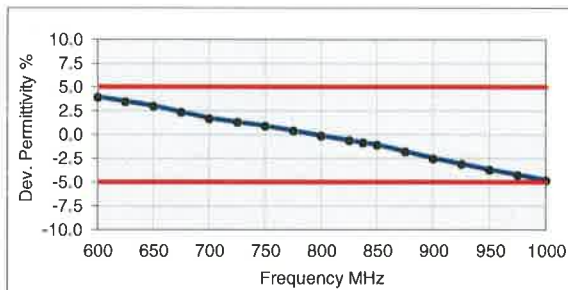
### Test Condition

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

### Additional Information

|                   |                         |
|-------------------|-------------------------|
| TSL Density       | 1.284 g/cm <sup>3</sup> |
| TSL Heat-capacity | 2.701 kJ/(kg*K)         |

| f [MHz]    | Measured    |              |             | Target      |             | Diff.to Target [%] |                 |
|------------|-------------|--------------|-------------|-------------|-------------|--------------------|-----------------|
|            | HP-e'       | HP-e''       | sigma       | eps         | sigma       | $\Delta$ -eps      | $\Delta$ -sigma |
| 600        | 44.4        | 23.49        | 0.78        | 42.7        | 0.88        | 3.9                | -11.1           |
| 625        | 44.1        | 23.23        | 0.81        | 42.6        | 0.88        | 3.5                | -8.6            |
| 650        | 43.7        | 22.96        | 0.83        | 42.5        | 0.89        | 3.0                | -6.2            |
| 675        | 43.3        | 22.68        | 0.85        | 42.3        | 0.89        | 2.4                | -4.1            |
| 700        | 42.9        | 22.40        | 0.87        | 42.2        | 0.89        | 1.7                | -1.9            |
| 725        | 42.6        | 22.25        | 0.90        | 42.1        | 0.89        | 1.3                | 0.7             |
| <b>750</b> | <b>42.3</b> | <b>22.10</b> | <b>0.92</b> | <b>41.9</b> | <b>0.89</b> | <b>0.9</b>         | <b>3.2</b>      |
| 775        | 42.0        | 21.89        | 0.94        | 41.8        | 0.90        | 0.4                | 5.4             |
| 800        | 41.6        | 21.67        | 0.96        | 41.7        | 0.90        | -0.1               | 7.5             |
| 825        | 41.3        | 21.55        | 0.99        | 41.6        | 0.91        | -0.6               | 9.0             |
| 838        | 41.2        | 21.49        | 1.00        | 41.5        | 0.91        | -0.8               | 9.8             |
| 850        | 41.1        | 21.42        | 1.01        | 41.5        | 0.92        | -1.1               | 10.6            |
| 875        | 40.8        | 21.29        | 1.04        | 41.5        | 0.94        | -1.8               | 9.9             |
| 900        | 40.5        | 21.15        | 1.06        | 41.5        | 0.97        | -2.5               | 9.2             |
| 925        | 40.2        | 21.01        | 1.08        | 41.5        | 0.98        | -3.1               | 10.0            |
| 950        | 39.9        | 20.87        | 1.10        | 41.4        | 0.99        | -3.7               | 10.9            |
| 975        | 39.6        | 20.79        | 1.13        | 41.4        | 1.00        | -4.3               | 12.2            |
| 1000       | 39.4        | 20.71        | 1.15        | 41.3        | 1.01        | -4.8               | 13.5            |



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    | <b>Head Tissue Simulating Liquid (HSL900V2)</b> |
| 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.

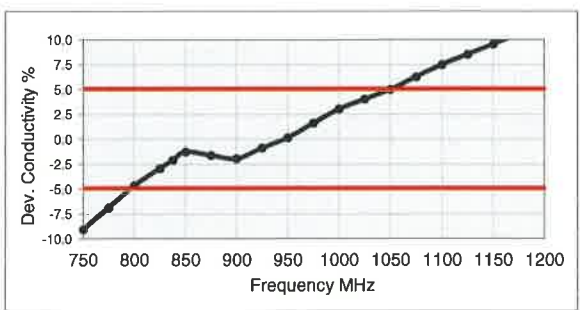
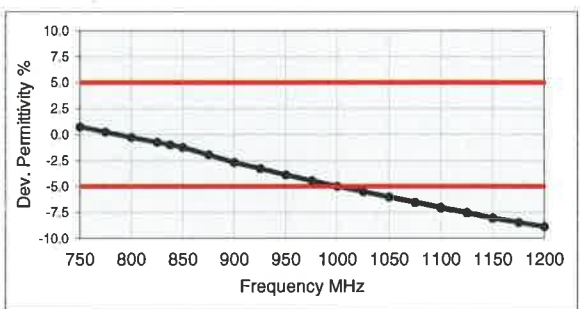
**Test Condition**

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

**Additional Information**

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

| f [MHz]    | Measured    |              |             | Target      |             | Diff.to Target [%] |                 |
|------------|-------------|--------------|-------------|-------------|-------------|--------------------|-----------------|
|            | HP-e'       | HP-e''       | sigma       | eps         | sigma       | $\Delta$ -eps      | $\Delta$ -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            |
| <b>838</b> | <b>41.1</b> | <b>19.16</b> | <b>0.89</b> | <b>41.5</b> | <b>0.91</b> | <b>-1.0</b>        | <b>-2.1</b>     |
| 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            |
| <b>900</b> | <b>40.4</b> | <b>19.00</b> | <b>0.95</b> | <b>41.5</b> | <b>0.97</b> | <b>-2.7</b>        | <b>-1.9</b>     |
| 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            |



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 (HSL1750V2)**  
 Product No. SL AAH 175 (Charge: 120907-2)  
 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.

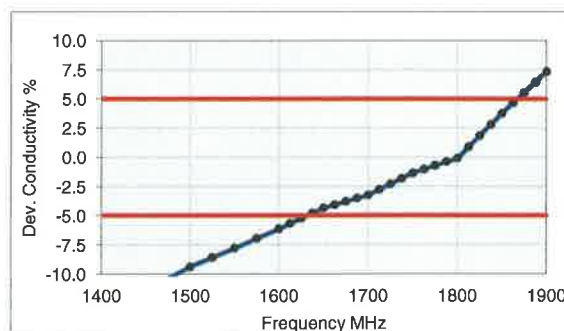
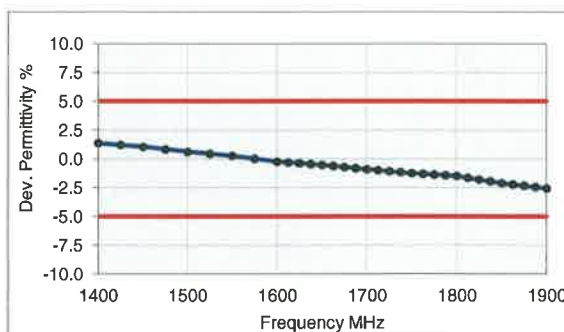
### Test Condition

Ambient Environment temperatur ( $22 \pm 3$ )°C and humidity < 70%.  
 TSL Temperature 22°C  
 Test Date 13-Sep-12  
 Operator CL

### Additional Information

TSL Density 0.998 g/cm<sup>3</sup>  
 TSL Heat-capacity 3.572 kJ/(kg\*K)

| f [MHz] | Measured |        |       | Target |       | Diff.to Target [%] |                 |
|---------|----------|--------|-------|--------|-------|--------------------|-----------------|
|         | HP-e'    | HP-e'' | sigma | eps    | sigma | $\Delta$ -eps      | $\Delta$ -sigma |
| 1400    | 41.2     | 13.09  | 1.02  | 40.6   | 1.18  | 1.4                | -13.6           |
| 1425    | 41.0     | 13.14  | 1.04  | 40.5   | 1.19  | 1.2                | -12.4           |
| 1450    | 40.9     | 13.19  | 1.06  | 40.5   | 1.20  | 1.1                | -11.3           |
| 1475    | 40.8     | 13.26  | 1.09  | 40.5   | 1.21  | 0.8                | -10.3           |
| 1500    | 40.7     | 13.34  | 1.11  | 40.4   | 1.23  | 0.6                | -9.4            |
| 1525    | 40.6     | 13.39  | 1.14  | 40.4   | 1.24  | 0.4                | -8.6            |
| 1550    | 40.5     | 13.44  | 1.16  | 40.4   | 1.26  | 0.3                | -7.8            |
| 1575    | 40.3     | 13.49  | 1.18  | 40.3   | 1.27  | 0.0                | -6.9            |
| 1600    | 40.2     | 13.55  | 1.21  | 40.3   | 1.28  | -0.2               | -6.1            |
| 1613    | 40.2     | 13.58  | 1.22  | 40.3   | 1.29  | -0.3               | -5.7            |
| 1625    | 40.1     | 13.62  | 1.23  | 40.3   | 1.30  | -0.4               | -5.2            |
| 1638    | 40.1     | 13.65  | 1.24  | 40.3   | 1.31  | -0.5               | -4.8            |
| 1650    | 40.0     | 13.68  | 1.26  | 40.2   | 1.31  | -0.5               | -4.3            |
| 1663    | 40.0     | 13.70  | 1.27  | 40.2   | 1.32  | -0.6               | -4.1            |
| 1675    | 39.9     | 13.71  | 1.28  | 40.2   | 1.33  | -0.7               | -3.8            |
| 1688    | 39.8     | 13.72  | 1.29  | 40.2   | 1.33  | -0.8               | -3.5            |
| 1700    | 39.8     | 13.73  | 1.30  | 40.2   | 1.34  | -0.9               | -3.2            |
| 1713    | 39.7     | 13.77  | 1.31  | 40.1   | 1.35  | -1.0               | -2.7            |
| 1725    | 39.7     | 13.81  | 1.33  | 40.1   | 1.36  | -1.1               | -2.3            |
| 1738    | 39.6     | 13.85  | 1.34  | 40.1   | 1.36  | -1.2               | -1.8            |
| 1750    | 39.6     | 13.89  | 1.35  | 40.1   | 1.37  | -1.3               | -1.4            |
| 1763    | 39.5     | 13.91  | 1.36  | 40.1   | 1.38  | -1.3               | -1.0            |
| 1775    | 39.5     | 13.93  | 1.38  | 40.0   | 1.39  | -1.4               | -0.7            |
| 1788    | 39.4     | 13.95  | 1.39  | 40.0   | 1.39  | -1.4               | -0.4            |
| 1800    | 39.4     | 13.97  | 1.40  | 40.0   | 1.40  | -1.5               | -0.1            |
| 1813    | 39.3     | 14.01  | 1.41  | 40.0   | 1.40  | -1.7               | 0.9             |
| 1825    | 39.3     | 14.04  | 1.43  | 40.0   | 1.40  | -1.8               | 1.8             |
| 1838    | 39.2     | 14.08  | 1.44  | 40.0   | 1.40  | -2.0               | 2.8             |
| 1850    | 39.2     | 14.11  | 1.45  | 40.0   | 1.40  | -2.1               | 3.8             |
| 1863    | 39.1     | 14.14  | 1.47  | 40.0   | 1.40  | -2.2               | 4.7             |
| 1875    | 39.1     | 14.17  | 1.48  | 40.0   | 1.40  | -2.3               | 5.6             |
| 1888    | 39.0     | 14.19  | 1.49  | 40.0   | 1.40  | -2.5               | 6.5             |
| 1900    | 39.0     | 14.22  | 1.50  | 40.0   | 1.40  | -2.6               | 7.4             |



## 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

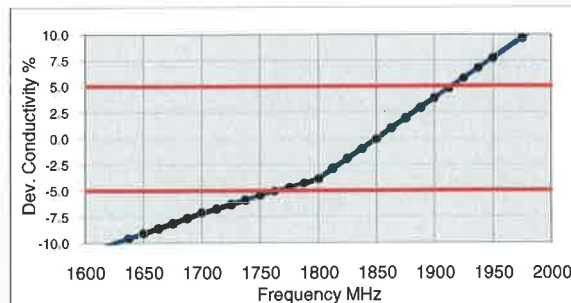
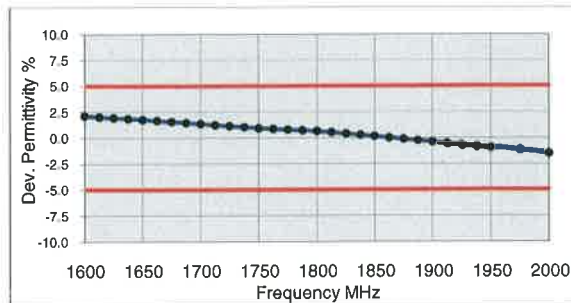
Ambient Condition 22°C ; 30% humidity  
 TSL Temperature 22°C  
 Test Date 18-Jan-12

### Additional Information

TSL Density 0.985 g/cm<sup>3</sup>  
 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        |
| <b>1800</b> | <b>40.3</b> | <b>13.44</b> | <b>1.35</b> | <b>40.0</b> | <b>1.40</b> | <b>0.6</b>         | <b>-3.9</b> |
| 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         |
| <b>1900</b> | <b>39.8</b> | <b>13.75</b> | <b>1.45</b> | <b>40.0</b> | <b>1.40</b> | <b>-0.4</b>        | <b>3.8</b>  |
| 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 (HSL1950V2)**  
 Product No. SL AAH 195 CA (Charge: 120717-3)  
 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

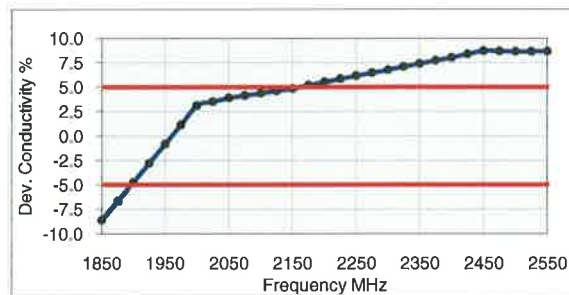
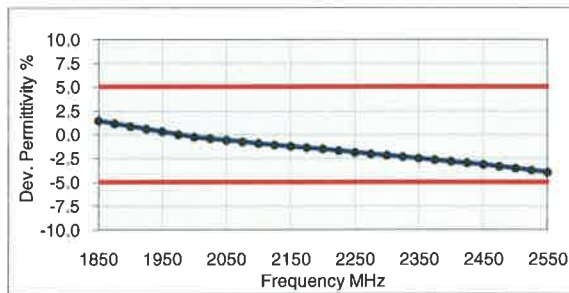
Target parameters as defined in the IEEE 1528 and IEC 62209 compliance standards.

### Test Condition

Ambient Environment temperatur ( $22 \pm 3$ )°C and humidity < 70%.  
 TSL Temperature 22°C  
 Test Date 18-Jul-12  
 Operator DI

TSL Density 0.995 g/cm<sup>3</sup>  
 TSL Heat-capacity 3.720 kJ/(kg\*K)

| f [MHz] | Measured |        |       | Target |       | Diff.to Target [%] |         |
|---------|----------|--------|-------|--------|-------|--------------------|---------|
|         | HP-e'    | HP-e'' | sigma | eps    | sigma | Δ-eps              | Δ-sigma |
| 1850    | 40.6     | 12.43  | 1.28  | 40.0   | 1.40  | 1.5                | -8.6    |
| 1875    | 40.5     | 12.53  | 1.31  | 40.0   | 1.40  | 1.2                | -6.7    |
| 1900    | 40.3     | 12.62  | 1.33  | 40.0   | 1.40  | 0.9                | -4.7    |
| 1925    | 40.2     | 12.71  | 1.36  | 40.0   | 1.40  | 0.6                | -2.8    |
| 1950    | 40.1     | 12.80  | 1.39  | 40.0   | 1.40  | 0.3                | -0.8    |
| 1975    | 40.0     | 12.89  | 1.42  | 40.0   | 1.40  | 0.0                | 1.1     |
| 2000    | 39.9     | 12.98  | 1.44  | 40.0   | 1.40  | -0.3               | 3.1     |
| 2025    | 39.8     | 13.07  | 1.47  | 40.0   | 1.42  | -0.4               | 3.5     |
| 2050    | 39.7     | 13.16  | 1.50  | 39.9   | 1.44  | -0.6               | 3.9     |
| 2075    | 39.6     | 13.23  | 1.53  | 39.9   | 1.47  | -0.8               | 4.2     |
| 2100    | 39.5     | 13.30  | 1.55  | 39.8   | 1.49  | -0.9               | 4.4     |
| 2125    | 39.3     | 13.37  | 1.58  | 39.8   | 1.51  | -1.1               | 4.6     |
| 2150    | 39.2     | 13.44  | 1.61  | 39.7   | 1.53  | -1.2               | 4.9     |
| 2175    | 39.1     | 13.52  | 1.64  | 39.7   | 1.56  | -1.4               | 5.2     |
| 2200    | 39.1     | 13.61  | 1.67  | 39.6   | 1.58  | -1.5               | 5.5     |
| 2225    | 38.9     | 13.68  | 1.69  | 39.6   | 1.60  | -1.7               | 5.9     |
| 2250    | 38.8     | 13.76  | 1.72  | 39.6   | 1.62  | -1.9               | 6.2     |
| 2275    | 38.7     | 13.83  | 1.75  | 39.5   | 1.64  | -2.0               | 6.5     |
| 2300    | 38.6     | 13.91  | 1.78  | 39.5   | 1.67  | -2.2               | 6.8     |
| 2325    | 38.5     | 13.98  | 1.81  | 39.4   | 1.69  | -2.3               | 7.1     |
| 2350    | 38.4     | 14.06  | 1.84  | 39.4   | 1.71  | -2.5               | 7.4     |
| 2375    | 38.3     | 14.13  | 1.87  | 39.3   | 1.73  | -2.7               | 7.7     |
| 2400    | 38.2     | 14.21  | 1.90  | 39.3   | 1.76  | -2.8               | 8.0     |
| 2425    | 38.1     | 14.28  | 1.93  | 39.2   | 1.78  | -3.0               | 8.4     |
| 2450    | 38.0     | 14.36  | 1.96  | 39.2   | 1.80  | -3.1               | 8.7     |
| 2475    | 37.9     | 14.42  | 1.99  | 39.2   | 1.83  | -3.3               | 8.7     |
| 2500    | 37.8     | 14.49  | 2.02  | 39.1   | 1.85  | -3.5               | 8.7     |
| 2525    | 37.6     | 14.56  | 2.04  | 39.1   | 1.88  | -3.7               | 8.7     |
| 2550    | 37.5     | 14.62  | 2.07  | 39.1   | 1.91  | -3.9               | 8.7     |
| 2575    | 37.4     | 14.69  | 2.10  | 39.0   | 1.94  | -4.1               | 8.7     |
| 2600    | 37.3     | 14.76  | 2.13  | 39.0   | 1.96  | -4.3               | 8.7     |



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    | <b>Head Tissue Simulating Liquid (HSL2450V2)</b> |
| Product No.  | SL AAH 245 BA (Charge: 130430-3)                 |
| 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.

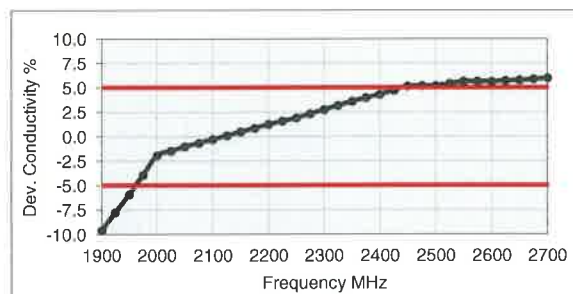
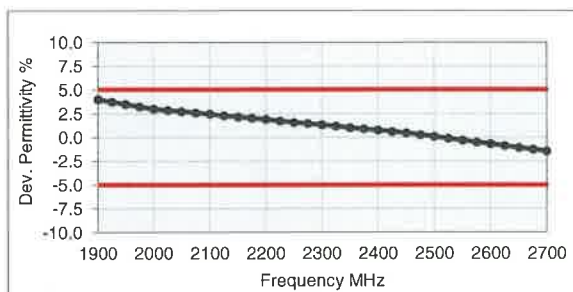
### Test Condition

|                 |   |
|-----------------|---|
| Ambient         | Environment temperatur ( $22 \pm 3$ )°C and humidity < 70%. |
| TSL Temperature | <b>23°C</b>   |
| Test Date       | 2-May-13  |
| Operator        | CL  |

### Additional Information

|                   |                         |
|-------------------|-------------------------|
| TSL Density       | 0.988 g/cm <sup>3</sup> |
| TSL Heat-capacity | 3.680 kJ/(kg*K)         |

| f [MHz]     | Measured    |              |             | Target      |             | Diff.to Target [%] |                 |
|-------------|-------------|--------------|-------------|-------------|-------------|--------------------|-----------------|
|             | HP-e'       | HP-e''       | sigma       | eps         | sigma       | $\Delta$ -eps      | $\Delta$ -sigma |
| 1900        | 41.6        | 11.98        | 1.27        | 40.0        | 1.40        | 4.0                | -9.6            |
| 1925        | 41.5        | 12.06        | 1.29        | 40.0        | 1.40        | 3.8                | -7.7            |
| 1950        | 41.4        | 12.15        | 1.32        | 40.0        | 1.40        | 3.5                | -5.9            |
| 1975        | 41.3        | 12.24        | 1.35        | 40.0        | 1.40        | 3.3                | -3.9            |
| 2000        | 41.2        | 12.34        | 1.37        | 40.0        | 1.40        | 3.0                | -1.9            |
| 2025        | 41.1        | 12.44        | 1.40        | 40.0        | 1.42        | 2.9                | -1.5            |
| 2050        | 41.0        | 12.54        | 1.43        | 39.9        | 1.44        | 2.8                | -1.0            |
| 2075        | 40.9        | 12.62        | 1.46        | 39.9        | 1.47        | 2.6                | -0.6            |
| 2100        | 40.8        | 12.71        | 1.48        | 39.8        | 1.49        | 2.5                | -0.3            |
| 2125        | 40.7        | 12.80        | 1.51        | 39.8        | 1.51        | 2.3                | 0.1             |
| 2150        | 40.6        | 12.88        | 1.54        | 39.7        | 1.53        | 2.2                | 0.5             |
| 2175        | 40.5        | 12.97        | 1.57        | 39.7        | 1.56        | 2.0                | 0.9             |
| 2200        | 40.4        | 13.05        | 1.60        | 39.6        | 1.58        | 1.9                | 1.3             |
| 2225        | 40.3        | 13.13        | 1.63        | 39.6        | 1.60        | 1.7                | 1.6             |
| 2250        | 40.2        | 13.21        | 1.65        | 39.6        | 1.62        | 1.6                | 1.9             |
| 2275        | 40.1        | 13.30        | 1.68        | 39.5        | 1.64        | 1.5                | 2.4             |
| <b>2300</b> | <b>40.0</b> | <b>13.39</b> | <b>1.71</b> | <b>39.5</b> | <b>1.67</b> | <b>1.3</b>         | <b>2.8</b>      |
| 2325        | 39.9        | 13.48        | 1.74        | 39.4        | 1.69        | 1.2                | 3.2             |
| 2350        | 39.8        | 13.56        | 1.77        | 39.4        | 1.71        | 1.0                | 3.6             |
| 2375        | 39.7        | 13.64        | 1.80        | 39.3        | 1.73        | 0.9                | 4.0             |
| 2400        | 39.6        | 13.72        | 1.83        | 39.3        | 1.76        | 0.8                | 4.3             |
| 2425        | 39.5        | 13.80        | 1.86        | 39.2        | 1.78        | 0.6                | 4.8             |
| <b>2450</b> | <b>39.4</b> | <b>13.89</b> | <b>1.89</b> | <b>39.2</b> | <b>1.80</b> | <b>0.5</b>         | <b>5.2</b>      |
| 2475        | 39.3        | 13.96        | 1.92        | 39.2        | 1.83        | 0.3                | 5.2             |
| 2500        | 39.2        | 14.03        | 1.95        | 39.1        | 1.85        | 0.1                | 5.2             |
| 2525        | 39.1        | 14.12        | 1.98        | 39.1        | 1.88        | -0.1               | 5.4             |
| 2550        | 39.0        | 14.22        | 2.02        | 39.1        | 1.91        | -0.3               | 5.6             |
| 2575        | 38.9        | 14.28        | 2.05        | 39.0        | 1.94        | -0.5               | 5.6             |
| <b>2600</b> | <b>38.7</b> | <b>14.34</b> | <b>2.07</b> | <b>39.0</b> | <b>1.96</b> | <b>-0.7</b>        | <b>5.6</b>      |
| 2625        | 38.6        | 14.41        | 2.10        | 39.0        | 1.99        | -0.9               | 5.7             |
| 2650        | 38.5        | 14.48        | 2.13        | 38.9        | 2.02        | -1.1               | 5.8             |
| 2675        | 38.4        | 14.55        | 2.17        | 38.9        | 2.05        | -1.3               | 5.9             |
| 2700        | 38.3        | 14.62        | 2.20        | 38.9        | 2.07        | -1.4               | 6.0             |



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 (HBBL1550-1950V3)**  
 Product No. SL AAH 181 AA (Charge: 140206-3)  
 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.

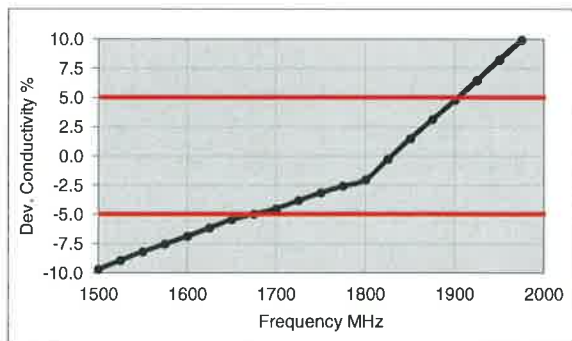
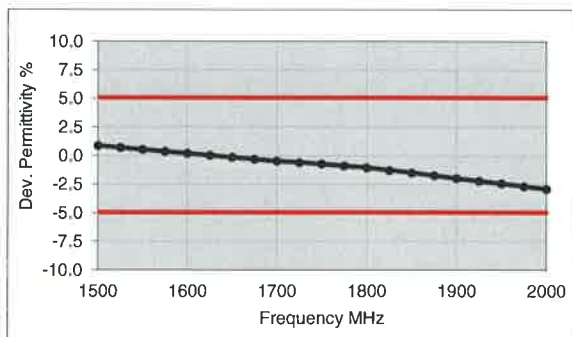
### Test Condition

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

### Additional Information

TSL Density 1.052 g/cm<sup>3</sup>  
 TSL Heat-capacity 3.322 kJ/(kg\*K)

| f [MHz] | Measured |        |       | Target |       | Diff.to Target [%] |                 |
|---------|----------|--------|-------|--------|-------|--------------------|-----------------|
|         | HP-e'    | HP-e'' | sigma | eps    | sigma | $\Delta$ -eps      | $\Delta$ -sigma |
| 1500    | 40.8     | 13.29  | 1.11  | 40.4   | 1.23  | 0.9                | -9.7            |
| 1525    | 40.7     | 13.34  | 1.13  | 40.4   | 1.24  | 0.7                | -8.9            |
| 1550    | 40.6     | 13.38  | 1.15  | 40.4   | 1.26  | 0.6                | -8.2            |
| 1575    | 40.5     | 13.41  | 1.17  | 40.3   | 1.27  | 0.4                | -7.5            |
| 1600    | 40.4     | 13.44  | 1.20  | 40.3   | 1.28  | 0.2                | -6.9            |
| 1625    | 40.3     | 13.48  | 1.22  | 40.3   | 1.30  | 0.1                | -6.2            |
| 1650    | 40.2     | 13.53  | 1.24  | 40.2   | 1.31  | -0.1               | -5.4            |
| 1675    | 40.1     | 13.54  | 1.26  | 40.2   | 1.33  | -0.3               | -5.0            |
| 1700    | 40.0     | 13.55  | 1.28  | 40.2   | 1.34  | -0.4               | -4.5            |
| 1725    | 39.9     | 13.60  | 1.30  | 40.1   | 1.36  | -0.6               | -3.8            |
| 1750    | 39.8     | 13.64  | 1.33  | 40.1   | 1.37  | -0.7               | -3.1            |
| 1775    | 39.7     | 13.67  | 1.35  | 40.0   | 1.39  | -0.9               | -2.6            |
| 1800    | 39.6     | 13.70  | 1.37  | 40.0   | 1.40  | -1.0               | -2.0            |
| 1825    | 39.5     | 13.75  | 1.40  | 40.0   | 1.40  | -1.2               | -0.3            |
| 1850    | 39.4     | 13.81  | 1.42  | 40.0   | 1.40  | -1.5               | 1.5             |
| 1875    | 39.3     | 13.84  | 1.44  | 40.0   | 1.40  | -1.7               | 3.1             |
| 1900    | 39.2     | 13.88  | 1.47  | 40.0   | 1.40  | -2.0               | 4.8             |
| 1925    | 39.1     | 13.92  | 1.49  | 40.0   | 1.40  | -2.2               | 6.5             |
| 1950    | 39.0     | 13.97  | 1.52  | 40.0   | 1.40  | -2.4               | 8.3             |
| 1975    | 38.9     | 14.01  | 1.54  | 40.0   | 1.40  | -2.6               | 10.0            |
| 2000    | 38.8     | 14.05  | 1.56  | 40.0   | 1.40  | -2.9               | 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    | <b>Head Tissue Simulating Liquid (HBBL1900-3800V3)</b> |
| 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 ± 2.5% towards the target values of Methanol.

**Target Parameters**

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

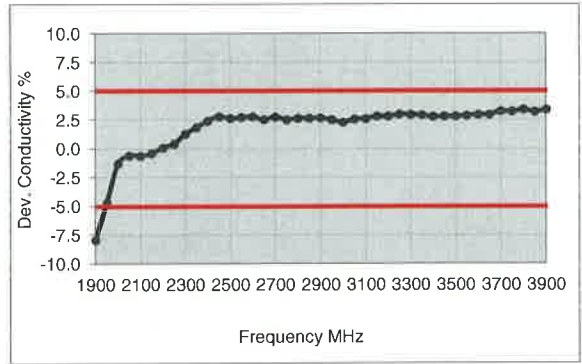
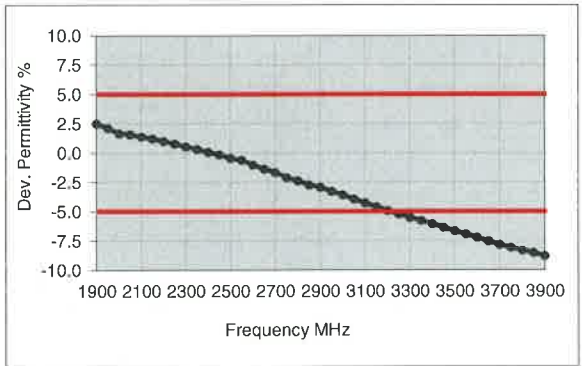
**Test Condition**

|                 |   |
|-----------------|---|
| 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/cm <sup>3</sup> |
| 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 (HBBL3500-5800V5) |
| Product No.  | SL AAH 502 AB (Charge: 130123-1)                |
| 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 ( $22 \pm 3$ )°C and humidity < 70%.  
 TSL Temperature 22°C  
 Test Date 23-Jan-13  
 Operator DI

### Additional Information

TSL Density 0.985 g/cm<sup>3</sup>  
 TSL Heat-capacity 3.383 kJ/(kg\*K)

| f [MHz]     | Measured    |              |             | Target      |             | Diff.to Target [%] |                 |
|-------------|-------------|--------------|-------------|-------------|-------------|--------------------|-----------------|
|             | HP-e'       | HP-e''       | sigma       | eps         | sigma       | $\Delta$ -eps      | $\Delta$ -sigma |
| 3400        | 38.8        | 15.03        | 2.84        | 38.0        | 2.81        | 1.9                | 1.2             |
| <b>3500</b> | <b>38.6</b> | <b>15.00</b> | <b>2.92</b> | <b>37.9</b> | <b>2.91</b> | <b>1.8</b>         | <b>0.3</b>      |
| 3600        | 38.5        | 14.98        | 3.00        | 37.8        | 3.02        | 1.7                | -0.5            |
| <b>3700</b> | <b>38.4</b> | <b>14.97</b> | <b>3.08</b> | <b>37.7</b> | <b>3.12</b> | <b>1.7</b>         | <b>-1.2</b>     |
| 3800        | 38.2        | 14.95        | 3.16        | 37.6        | 3.22        | 1.7                | -1.8            |
| 3900        | 38.1        | 14.96        | 3.25        | 37.5        | 3.32        | 1.7                | -2.3            |
| 4000        | 38.0        | 14.99        | 3.34        | 37.4        | 3.43        | 1.8                | -2.6            |
| 4100        | 37.9        | 15.03        | 3.43        | 37.2        | 3.53        | 1.8                | -2.8            |
| 4200        | 37.8        | 15.06        | 3.52        | 37.1        | 3.63        | 1.8                | -3.0            |
| 4300        | 37.7        | 15.13        | 3.62        | 37.0        | 3.73        | 1.8                | -3.1            |
| 4400        | 37.6        | 15.20        | 3.72        | 36.9        | 3.84        | 1.8                | -3.0            |
| 4500        | 37.4        | 15.23        | 3.81        | 36.8        | 3.94        | 1.7                | -3.2            |
| 4600        | 37.3        | 15.30        | 3.92        | 36.7        | 4.04        | 1.6                | -3.1            |
| 4700        | 37.1        | 15.35        | 4.01        | 36.6        | 4.14        | 1.5                | -3.1            |
| 4800        | 37.0        | 15.41        | 4.11        | 36.4        | 4.25        | 1.5                | -3.1            |
| 4850        | 36.9        | 15.45        | 4.17        | 36.4        | 4.30        | 1.5                | -3.0            |
| 4900        | 36.8        | 15.49        | 4.22        | 36.3        | 4.35        | 1.4                | -2.9            |
| 4950        | 36.8        | 15.51        | 4.27        | 36.3        | 4.40        | 1.4                | -2.9            |
| 5000        | 36.7        | 15.54        | 4.32        | 36.2        | 4.45        | 1.4                | -2.9            |
| 5050        | 36.6        | 15.57        | 4.37        | 36.2        | 4.50        | 1.3                | -2.8            |
| 5100        | 36.6        | 15.60        | 4.42        | 36.1        | 4.55        | 1.3                | -2.8            |
| 5150        | 36.5        | 15.63        | 4.48        | 36.0        | 4.60        | 1.2                | -2.7            |
| <b>5200</b> | <b>36.4</b> | <b>15.67</b> | <b>4.53</b> | <b>36.0</b> | <b>4.66</b> | <b>1.2</b>         | <b>-2.6</b>     |
| 5250        | 36.3        | 15.68        | 4.58        | 35.9        | 4.71        | 1.1                | -2.7            |
| 5300        | 36.2        | 15.71        | 4.63        | 35.9        | 4.76        | 1.0                | -2.6            |
| 5350        | 36.2        | 15.74        | 4.68        | 35.8        | 4.81        | 1.0                | -2.6            |
| 5400        | 36.1        | 15.78        | 4.74        | 35.8        | 4.86        | 0.9                | -2.5            |
| 5450        | 36.0        | 15.78        | 4.78        | 35.7        | 4.91        | 0.9                | -2.6            |
| <b>5500</b> | <b>36.0</b> | <b>15.79</b> | <b>4.83</b> | <b>35.6</b> | <b>4.96</b> | <b>0.9</b>         | <b>-2.6</b>     |
| 5550        | 35.9        | 15.84        | 4.89        | 35.6        | 5.01        | 0.9                | -2.5            |
| 5600        | 35.8        | 15.86        | 4.94        | 35.5        | 5.07        | 0.8                | -2.5            |
| 5650        | 35.8        | 15.91        | 5.00        | 35.5        | 5.12        | 0.8                | -2.2            |
| 5700        | 35.7        | 15.91        | 5.05        | 35.4        | 5.17        | 0.8                | -2.4            |
| 5750        | 35.6        | 15.97        | 5.11        | 35.4        | 5.22        | 0.7                | -2.1            |
| <b>5800</b> | <b>35.5</b> | <b>15.98</b> | <b>5.16</b> | <b>35.3</b> | <b>5.27</b> | <b>0.7</b>         | <b>-2.1</b>     |
| 5850        | 35.5        | 16.01        | 5.21        | 35.3        | 5.34        | 0.5                | -2.4            |
| 5900        | 35.4        | 16.05        | 5.27        | 35.3        | 5.40        | 0.3                | -2.4            |

