

## 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 **Head Tissue Simulating Liquid (HSL900V2)**  
 Product No. SL AAH 090 BB (Charge: 140818-1)  
 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.

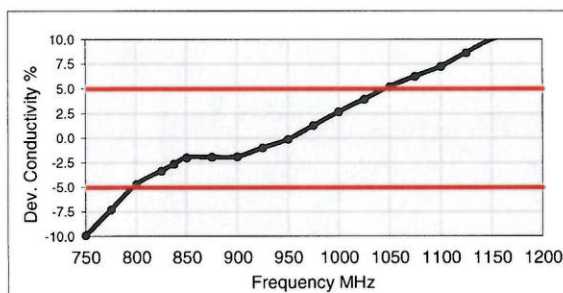
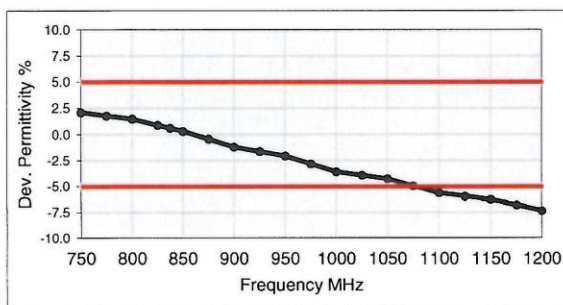
### Test Condition

Ambient Environment temperatur ( $22 \pm 3$ )°C and humidity < 70%.  
 TSL Temperature 22°C  
 Test Date 20-Aug-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     | 43.7     | 19.64  | 0.76  | 42.2   | 0.89  | 3.5                | -14.0           |
| 725     | 43.3     | 19.47  | 0.78  | 42.1   | 0.89  | 2.8                | -11.9           |
| 750     | 42.8     | 19.30  | 0.81  | 41.9   | 0.89  | 2.1                | -9.9            |
| 775     | 42.6     | 19.26  | 0.83  | 41.8   | 0.90  | 1.8                | -7.3            |
| 800     | 42.3     | 19.21  | 0.86  | 41.7   | 0.90  | 1.5                | -4.7            |
| 825     | 42.0     | 19.10  | 0.88  | 41.6   | 0.91  | 0.9                | -3.3            |
| 838     | 41.8     | 19.05  | 0.89  | 41.5   | 0.91  | 0.6                | -2.6            |
| 850     | 41.6     | 18.99  | 0.90  | 41.5   | 0.92  | 0.3                | -2.0            |
| 875     | 41.3     | 19.00  | 0.92  | 41.5   | 0.94  | -0.4               | -1.9            |
| 900     | 41.0     | 19.01  | 0.95  | 41.5   | 0.97  | -1.2               | -1.9            |
| 925     | 40.8     | 18.90  | 0.97  | 41.5   | 0.98  | -1.6               | -1.0            |
| 950     | 40.6     | 18.79  | 0.99  | 41.4   | 0.99  | -2.1               | -0.1            |
| 975     | 40.2     | 18.76  | 1.02  | 41.4   | 1.00  | -2.8               | 1.3             |
| 1000    | 39.9     | 18.74  | 1.04  | 41.3   | 1.01  | -3.6               | 2.7             |
| 1025    | 39.7     | 18.69  | 1.07  | 41.3   | 1.03  | -3.9               | 4.0             |
| 1050    | 39.5     | 18.65  | 1.09  | 41.2   | 1.04  | -4.3               | 5.2             |
| 1075    | 39.2     | 18.58  | 1.11  | 41.2   | 1.05  | -4.9               | 6.2             |
| 1100    | 38.8     | 18.51  | 1.13  | 41.2   | 1.06  | -5.6               | 7.3             |
| 1125    | 38.7     | 18.51  | 1.16  | 41.1   | 1.07  | -5.9               | 8.6             |
| 1150    | 38.5     | 18.51  | 1.18  | 41.1   | 1.08  | -6.3               | 10.0            |
| 1175    | 38.2     | 18.40  | 1.20  | 41.0   | 1.09  | -6.8               | 10.7            |
| 1200    | 38.0     | 18.29  | 1.22  | 41.0   | 1.10  | -7.3               | 11.3            |



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: 140729-2)  
 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.

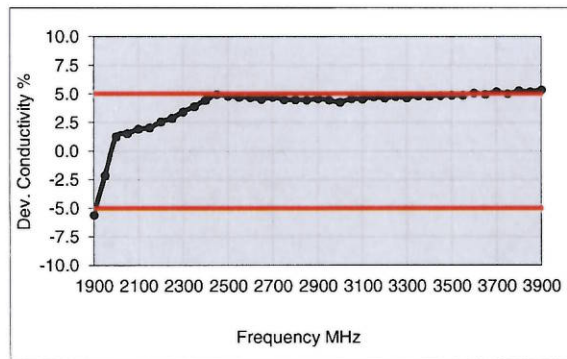
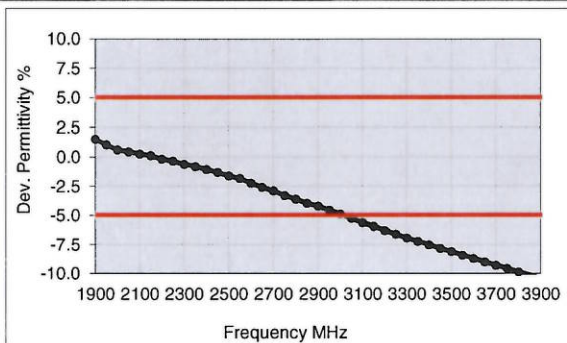
### Test Condition

Ambient Environment temperatur ( $22 \pm 3$ )°C and humidity < 70%.  
 TSL Temperature 22°C  
 Test Date 30-Jul-14  
 Operator CL

### 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    | 40.6     | 12.5   | 1.3   | 40.0   | 1.4   | 1.5                | -5.6    |
| 1950    | 40.4     | 12.6   | 1.4   | 40.0   | 1.4   | 1.1                | -2.1    |
| 2000    | 40.3     | 12.7   | 1.4   | 40.0   | 1.4   | 0.6                | 1.3     |
| 2050    | 40.1     | 12.9   | 1.5   | 39.9   | 1.4   | 0.5                | 1.6     |
| 2100    | 39.9     | 13.0   | 1.5   | 39.8   | 1.5   | 0.3                | 1.9     |
| 2150    | 39.8     | 13.1   | 1.6   | 39.7   | 1.5   | 0.1                | 2.0     |
| 2200    | 39.6     | 13.2   | 1.6   | 39.6   | 1.6   | -0.2               | 2.6     |
| 2250    | 39.4     | 13.3   | 1.7   | 39.6   | 1.6   | -0.3               | 2.9     |
| 2300    | 39.2     | 13.5   | 1.7   | 39.5   | 1.7   | -0.6               | 3.4     |
| 2350    | 39.1     | 13.6   | 1.8   | 39.4   | 1.7   | -0.8               | 3.9     |
| 2400    | 38.9     | 13.7   | 1.8   | 39.3   | 1.8   | -1.0               | 4.5     |
| 2450    | 38.7     | 13.9   | 1.9   | 39.2   | 1.8   | -1.3               | 4.9     |
| 2500    | 38.5     | 14.0   | 1.9   | 39.1   | 1.9   | -1.6               | 4.8     |
| 2550    | 38.4     | 14.1   | 2.0   | 39.1   | 1.9   | -1.8               | 4.8     |
| 2600    | 38.1     | 14.2   | 2.1   | 39.0   | 2.0   | -2.2               | 4.7     |
| 2650    | 37.9     | 14.3   | 2.1   | 38.9   | 2.0   | -2.6               | 4.6     |
| 2700    | 37.8     | 14.5   | 2.2   | 38.9   | 2.1   | -2.9               | 4.7     |
| 2750    | 37.5     | 14.5   | 2.2   | 38.8   | 2.1   | -3.3               | 4.5     |
| 2800    | 37.4     | 14.6   | 2.3   | 38.8   | 2.2   | -3.6               | 4.5     |
| 2850    | 37.2     | 14.7   | 2.3   | 38.7   | 2.2   | -3.9               | 4.5     |
| 2900    | 37.0     | 14.9   | 2.4   | 38.6   | 2.3   | -4.2               | 4.6     |
| 2950    | 36.8     | 14.9   | 2.5   | 38.6   | 2.3   | -4.5               | 4.5     |
| 3000    | 36.6     | 15.0   | 2.5   | 38.5   | 2.4   | -4.9               | 4.3     |
| 3050    | 36.4     | 15.1   | 2.6   | 38.4   | 2.5   | -5.2               | 4.6     |
| 3100    | 36.2     | 15.2   | 2.6   | 38.4   | 2.5   | -5.6               | 4.6     |
| 3150    | 36.1     | 15.3   | 2.7   | 38.3   | 2.6   | -5.9               | 4.8     |
| 3200    | 35.9     | 15.3   | 2.7   | 38.3   | 2.6   | -6.3               | 4.7     |
| 3250    | 35.7     | 15.4   | 2.8   | 38.2   | 2.7   | -6.6               | 4.8     |
| 3300    | 35.5     | 15.4   | 2.8   | 38.2   | 2.7   | -6.9               | 4.7     |
| 3350    | 35.4     | 15.5   | 2.9   | 38.1   | 2.8   | -7.2               | 4.9     |
| 3400    | 35.2     | 15.6   | 2.9   | 38.0   | 2.8   | -7.5               | 4.8     |
| 3450    | 35.0     | 15.6   | 3.0   | 38.0   | 2.9   | -7.8               | 4.9     |
| 3500    | 34.9     | 15.7   | 3.1   | 37.9   | 2.9   | -8.1               | 4.9     |
| 3550    | 34.7     | 15.7   | 3.1   | 37.9   | 3.0   | -8.4               | 4.9     |
| 3600    | 34.5     | 15.8   | 3.2   | 37.8   | 3.0   | -8.7               | 5.1     |
| 3650    | 34.4     | 15.9   | 3.2   | 37.8   | 3.1   | -9.0               | 5.0     |
| 3700    | 34.2     | 15.9   | 3.3   | 37.7   | 3.1   | -9.3               | 5.2     |
| 3750    | 34.0     | 16.0   | 3.3   | 37.6   | 3.2   | -9.6               | 5.0     |
| 3800    | 33.9     | 16.0   | 3.4   | 37.6   | 3.2   | -9.9               | 5.3     |
| 3850    | 33.7     | 16.1   | 3.4   | 37.5   | 3.3   | -10.1              | 5.2     |



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 (MSL900V2)**  
 Product No. SL AAM 090 CA (Charge: 140710-1)  
 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.

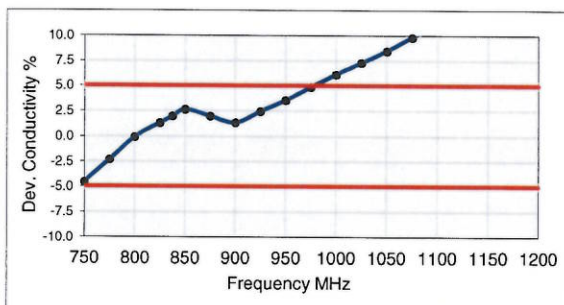
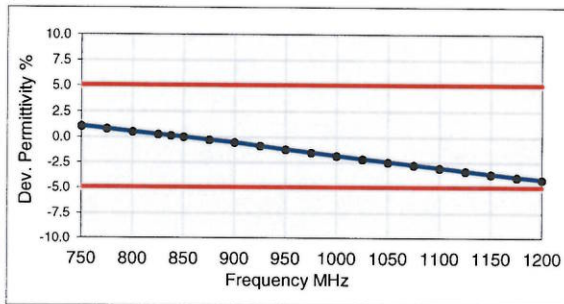
### Test Condition

Ambient Environment temperatur ( $22 \pm 3$ )°C and humidity < 70%.  
 TSL Temperature 22°C  
 Test Date 16-Jul-14  
 Operator IEN

### Additional Information

TSL Density 1.208 g/cm<sup>3</sup>  
 TSL Heat-capacity 3.113 kJ/(kg·K)

| f [MHz] | Measured |        |       | Target |       | Diff.to Target [%] |         |
|---------|----------|--------|-------|--------|-------|--------------------|---------|
|         | HP-e'    | HP-e'' | sigma | eps    | sigma | Δ-eps              | Δ-sigma |
| 700     | 56.6     | 22.41  | 0.87  | 55.7   | 0.96  | 1.6                | -9.0    |
| 725     | 56.4     | 22.23  | 0.90  | 55.6   | 0.96  | 1.3                | -6.8    |
| 750     | 56.1     | 22.04  | 0.92  | 55.5   | 0.96  | 1.1                | -4.5    |
| 775     | 55.9     | 21.88  | 0.94  | 55.4   | 0.97  | 0.8                | -2.3    |
| 800     | 55.6     | 21.72  | 0.97  | 55.3   | 0.97  | 0.5                | -0.1    |
| 825     | 55.4     | 21.59  | 0.99  | 55.2   | 0.98  | 0.3                | 1.3     |
| 838     | 55.3     | 21.52  | 1.00  | 55.2   | 0.98  | 0.2                | 2.0     |
| 850     | 55.2     | 21.46  | 1.01  | 55.2   | 0.99  | 0.0                | 2.6     |
| 875     | 54.9     | 21.35  | 1.04  | 55.1   | 1.02  | -0.2               | 2.0     |
| 900     | 54.7     | 21.25  | 1.06  | 55.0   | 1.05  | -0.5               | 1.3     |
| 925     | 54.5     | 21.17  | 1.09  | 55.0   | 1.06  | -0.9               | 2.5     |
| 950     | 54.3     | 21.08  | 1.11  | 54.9   | 1.08  | -1.2               | 3.6     |
| 975     | 54.1     | 21.01  | 1.14  | 54.9   | 1.09  | -1.5               | 4.9     |
| 1000    | 53.8     | 20.95  | 1.17  | 54.8   | 1.10  | -1.8               | 6.1     |
| 1025    | 53.6     | 20.88  | 1.19  | 54.8   | 1.11  | -2.1               | 7.3     |
| 1050    | 53.4     | 20.81  | 1.22  | 54.7   | 1.12  | -2.4               | 8.5     |
| 1075    | 53.2     | 20.79  | 1.24  | 54.7   | 1.13  | -2.7               | 9.8     |
| 1100    | 53.0     | 20.76  | 1.27  | 54.7   | 1.14  | -3.0               | 11.2    |
| 1125    | 52.8     | 20.71  | 1.30  | 54.6   | 1.15  | -3.3               | 12.3    |
| 1150    | 52.6     | 20.66  | 1.32  | 54.6   | 1.17  | -3.7               | 13.4    |
| 1175    | 52.4     | 20.64  | 1.35  | 54.5   | 1.18  | -3.9               | 14.7    |
| 1200    | 52.2     | 20.63  | 1.38  | 54.5   | 1.19  | -4.2               | 15.9    |



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 (MBBL1900-3800V3) |
| Product No.  | SL AAM 196 AB (Charge: 140903-2)                |
| 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 3-Sep-14  
 Operator CL

### Additional Information

TSL Density 1.036 g/cm<sup>3</sup>  
 TSL Heat-capacity 3.508 kJ/(kg\*K)

|         | Measured |        |       | Target |       | Diff.to Target [%] |                 |
|---------|----------|--------|-------|--------|-------|--------------------|-----------------|
| f [MHz] | HP-e'    | HP-e'' | sigma | eps    | sigma | $\Delta$ -eps      | $\Delta$ -sigma |
| 1900    | 53.7     | 13.5   | 1.43  | 53.3   | 1.52  | 0.8                | -5.8            |
| 1950    | 53.6     | 13.7   | 1.48  | 53.3   | 1.52  | 0.5                | -2.5            |
| 2000    | 53.4     | 13.8   | 1.53  | 53.3   | 1.52  | 0.3                | 0.7             |
| 2050    | 53.3     | 13.9   | 1.58  | 53.2   | 1.57  | 0.2                | 0.9             |
| 2100    | 53.2     | 14.0   | 1.63  | 53.2   | 1.62  | 0.1                | 1.1             |
| 2150    | 53.1     | 14.1   | 1.68  | 53.1   | 1.66  | 0.0                | 1.2             |
| 2200    | 52.9     | 14.2   | 1.74  | 53.0   | 1.71  | -0.2               | 1.5             |
| 2250    | 52.8     | 14.3   | 1.79  | 53.0   | 1.76  | -0.2               | 1.8             |
| 2300    | 52.7     | 14.5   | 1.85  | 52.9   | 1.81  | -0.4               | 2.4             |
| 2350    | 52.6     | 14.6   | 1.91  | 52.8   | 1.85  | -0.5               | 2.8             |
| 2400    | 52.4     | 14.7   | 1.97  | 52.8   | 1.90  | -0.7               | 3.3             |
| 2450    | 52.3     | 14.8   | 2.02  | 52.7   | 1.95  | -0.8               | 3.6             |
| 2500    | 52.1     | 15.0   | 2.08  | 52.6   | 2.02  | -1.0               | 2.9             |
| 2550    | 52.0     | 15.1   | 2.14  | 52.6   | 2.09  | -1.0               | 2.4             |
| 2600    | 51.9     | 15.2   | 2.20  | 52.5   | 2.16  | -1.3               | 1.8             |
| 2650    | 51.7     | 15.3   | 2.26  | 52.4   | 2.23  | -1.4               | 1.2             |
| 2700    | 51.5     | 15.5   | 2.33  | 52.4   | 2.30  | -1.6               | 0.9             |
| 2750    | 51.4     | 15.6   | 2.38  | 52.3   | 2.38  | -1.8               | 0.3             |
| 2800    | 51.2     | 15.7   | 2.44  | 52.3   | 2.45  | -2.0               | -0.1            |
| 2850    | 51.1     | 15.8   | 2.51  | 52.2   | 2.52  | -2.2               | -0.4            |
| 2900    | 50.9     | 16.0   | 2.57  | 52.1   | 2.59  | -2.3               | -0.6            |
| 2950    | 50.8     | 16.1   | 2.64  | 52.1   | 2.66  | -2.5               | -0.9            |
| 3000    | 50.6     | 16.1   | 2.69  | 52.0   | 2.73  | -2.7               | -1.3            |
| 3050    | 50.4     | 16.3   | 2.76  | 51.9   | 2.79  | -2.9               | -1.0            |
| 3100    | 50.3     | 16.4   | 2.82  | 51.9   | 2.85  | -3.0               | -0.9            |
| 3150    | 50.1     | 16.5   | 2.89  | 51.8   | 2.91  | -3.2               | -0.5            |
| 3200    | 50.0     | 16.6   | 2.95  | 51.7   | 2.96  | -3.4               | -0.5            |
| 3250    | 49.8     | 16.7   | 3.01  | 51.7   | 3.02  | -3.5               | -0.3            |
| 3300    | 49.7     | 16.7   | 3.07  | 51.6   | 3.08  | -3.7               | -0.2            |
| 3350    | 49.5     | 16.9   | 3.14  | 51.5   | 3.14  | -3.9               | 0.1             |
| 3400    | 49.4     | 16.9   | 3.20  | 51.5   | 3.20  | -4.0               | 0.2             |
| 3450    | 49.2     | 17.0   | 3.27  | 51.4   | 3.26  | -4.2               | 0.4             |
| 3500    | 49.1     | 17.1   | 3.33  | 51.3   | 3.31  | -4.3               | 0.6             |
| 3550    | 49.0     | 17.2   | 3.40  | 51.3   | 3.37  | -4.5               | 0.7             |
| 3600    | 48.8     | 17.3   | 3.47  | 51.2   | 3.43  | -4.6               | 1.0             |
| 3650    | 48.7     | 17.4   | 3.53  | 51.1   | 3.49  | -4.7               | 1.1             |
| 3700    | 48.6     | 17.5   | 3.60  | 51.1   | 3.55  | -4.9               | 1.5             |
| 3750    | 48.4     | 17.6   | 3.66  | 51.0   | 3.61  | -5.0               | 1.6             |
| 3800    | 48.3     | 17.7   | 3.73  | 50.9   | 3.66  | -5.2               | 1.9             |
| 3850    | 48.2     | 17.7   | 3.80  | 50.8   | 3.72  | -5.3               | 2.1             |

