



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005  
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid until: January 31, 2018

Certificate Number: 2117.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1</sup>:

I. Dimensional

| Parameter/Equipment                                     | Range                      | CMC <sup>2,5</sup> (±)    | Comments                              |
|---|----------------------------|---------------------------|---------------------------------------|
| Micrometers <sup>3</sup> –<br>Inside & Outside<br>Depth | Up to 1 in<br>(1 to 18) in | 66 μin<br>(66 + 4L) μin   | Grade 1 gage blocks                   |
| Calipers <sup>3</sup> –<br>Inside & Outside<br>Depth    | Up to 1 in<br>(1 to 18) in | 160 μin<br>(160 + 4L) μin | Grade 1 gage blocks                   |
| Pin & Plain Plug<br>Gages                               | Up to 1 in                 | 40 μin                    | Trimos THV UMM<br>Grade 1 gage blocks |

II. Electrical – DC/Low Frequency

| Parameter/Equipment                | Range  | CMC <sup>2,4,6,7</sup> ( $\pm$ )   | Comments   |
|------------------------------------|--|--|--|
| DC Voltage – Measure <sup>3</sup>  | Up to 100 mV<br>100 mV to 1 V<br>(1 to 10) V<br>(10 to 100) V<br>(100 to 1000) V<br><br>(1 to 70) kV   | 9.3 $\mu$ V/V + 0.3 $\mu$ V<br>5.5 $\mu$ V/V + 0.3 $\mu$ V<br>5.6 $\mu$ V/V + 0.5 $\mu$ V<br>8.7 $\mu$ V/V + 30 $\mu$ V<br>11 $\mu$ V/V + 100 $\mu$ V<br><br>0.10 %  | HP 3458A opt 002<br><br><i>Above 100 V add<br/>12 ppm x (Vin/1000)<sup>2</sup></i><br><br>Vitrek 4700 w/ 4710 Divider            |
| DC Voltage – Generate <sup>3</sup> | 10 V Reference<br>(1.0, 1.018) V<br><br>Up to 220 mV<br>220 mV to 2.2 V<br>(2.2 to 11) V<br>(11 to 22) V<br>(22 to 220) V<br>(220 to 1100) V<br><br>(1.1 to 25) kV   | 0.61 $\mu$ V/V<br>14 $\mu$ V/V<br><br>8.7 $\mu$ V/V + 0.4 $\mu$ V<br>5.9 $\mu$ V/V + 0.7 $\mu$ V<br>4.2 $\mu$ V/V + 2.5 $\mu$ V<br>4.2 $\mu$ V/V + 4 $\mu$ V<br>6 $\mu$ V/V + 40 $\mu$ V<br>7.7 $\mu$ V/V + 400 $\mu$ V<br><br>0.028 %                             | Fluke 732B<br>Fluke 732A<br><br>Fluke 5720A<br><br><br>DC source w/ HP 3458A and<br>Fluke 80D                                    |
| DC Current – Measure <sup>3</sup>  | Up to 1 $\mu$ A<br>(1 to 10) $\mu$ A<br>(10 to 100) $\mu$ A<br>100 $\mu$ A to 1 mA<br>(1 to 10) mA<br>(10 to 100) mA<br>100 mA to 1 A<br><br>(0.2 to 2) A<br>(2 to 20) A<br><br>(1 to 20) A<br>(2.2 to 100) A<br>(50 to 300) A | 24 $\mu$ A/A + 0.04 nA<br>24 $\mu$ A/A + 0.1 nA<br>24 $\mu$ A/A + 5 nA<br>24 $\mu$ A/A + 7 nA<br>24 $\mu$ A/A + 70 nA<br>41 $\mu$ A/A + 0.5 $\mu$ A<br>0.013 % + 10 $\mu$ A<br><br>0.026 % + 8 $\mu$ A<br>0.058 % + 20 $\mu$ A<br><br>0.02 %<br>0.069 %<br>0.052 % | HP 3458A<br><br><br><br><br><br><br>Fluke 8508A<br><br>HP 3458A w/ Fluke Y5020<br>HP 3458A w/ L&N shunt<br>HP 3458A w/ L&N shunt |

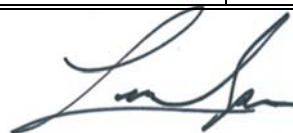


| Parameter/Equipment                   | Range  | CMC <sup>2, 4, 6, 7</sup> ( $\pm$ )   | Comments   |
|---------------------------------------|--|---|--|
| DC Current –<br>Generate <sup>3</sup> | (2 to 20) pA<br>(20 to 200) pA<br>(0.2 to 2) nA<br>(2 to 20) nA<br>(20 to 200) nA                | 0.44 % + 0.01 pA<br>0.29 % + 0.03 pA<br>0.076 % + 0.1 pA<br>0.076 % + 1 pA<br>0.042 % + 10 pA                                 | Keithley 263   |
|                                       | 0.2 nA to 200 $\mu$ A<br>(0.22 to 2.2) mA<br>(2.2 to 22) mA<br>(22 to 220) mA<br>(0.22 to 2.2) A | 72 $\mu$ A/A + 6 nA<br>42 $\mu$ A/A + 7 nA<br>42 $\mu$ A/A + 40 nA<br>54 $\mu$ A/A + 0.7 $\mu$ A<br>94 $\mu$ A/A + 12 $\mu$ A | Fluke 5720A  |
| Clamp-On                              | (0 to 1000) A  | 0.33 % + 0.75 mA  | Fluke 5522A w/ 5500A coil                                  |
| Resistance – Measure <sup>3</sup>     | (0.1 to 100) $\Omega$<br>(0.1 to 100) k $\Omega$   | 15 $\mu\Omega/\Omega$ + 500 $\mu\Omega$<br>12 $\mu\Omega/\Omega$ + 50 m $\Omega$  | HP 3458A   |
|                                       | (0.1 to 1) M $\Omega$<br>(1 to 10) M $\Omega$  | 20 $\mu\Omega/\Omega$ + 2 $\Omega$<br>58 $\mu\Omega/\Omega$ + 100 $\Omega$  |  |
|                                       | (10 to 100) M $\Omega$<br>(0.1 to 1) G $\Omega$<br>(1 to 10) G $\Omega$                          | 0.012 %<br>0.014 %<br>0.034 %   |  |
|                                       | (10 to 200) G $\Omega$<br>(0.2 to 2) T $\Omega$  | 0.041 %<br>0.041 %  |  |
| Resistance – Generate <sup>3</sup>    |  |   |  |
| Fixed Points                          | 0.001 $\Omega$<br>0.01 $\Omega$<br>0.1 $\Omega$<br>1 $\Omega$<br>10 k $\Omega$                   | 64 $\mu\Omega/\Omega$<br>55 $\mu\Omega/\Omega$<br>55 $\mu\Omega/\Omega$<br>7.6 $\mu\Omega/\Omega$<br>1.2 $\mu\Omega/\Omega$   | L&N 4223<br>L&N 4222<br>L&N 4221<br>L&N 4210<br>ESI SR-104 |



| Parameter/Equipment                          | Range  | CMC <sup>2,6,7</sup> (±) | Comments                        |
|--|--------|--------------------------|---------------------------------|
| Resistance –<br>Generate <sup>3</sup> (cont) |        |                          |                                 |
| Fixed Points                                 | 1.9 Ω  | 0.012 %                  | Fluke 5720A                     |
|  | 10 Ω   | 35 μΩ/Ω                  |                                 |
|  | 19 Ω   | 33 μΩ/Ω                  |                                 |
|  | 100 Ω  | 21 μΩ/Ω                  |                                 |
|  | 190 Ω  | 22 μΩ/Ω                  |                                 |
|  | 1 kΩ   | 17 μΩ/Ω                  |                                 |
|  | 1.9 kΩ | 17 μΩ/Ω                  |                                 |
|  | 10 kΩ  | 16 μΩ/Ω                  |                                 |
|  | 19 kΩ  | 15 μΩ/Ω                  |                                 |
|  | 100 kΩ | 17 μΩ/Ω                  |                                 |
|  | 190 kΩ | 20 μΩ/Ω                  |                                 |
|  | 1 MΩ   | 26 μΩ/Ω                  |                                 |
|  | 1.9 MΩ | 26 μΩ/Ω                  |                                 |
|  | 10 MΩ  | 47 μΩ/Ω                  |                                 |
|  | 19 MΩ  | 61 μΩ/Ω                  |                                 |
|  | 1 kΩ   | 17 μΩ/Ω                  | Fluke 742A                      |
|  | 10 kΩ  | 5.5 μΩ/Ω                 |                                 |
|  | 100 kΩ | 8.1 μΩ/Ω                 |                                 |
|  | 1 MΩ   | 11 μΩ/Ω                  |                                 |
|  | 10 MΩ  | 13 μΩ/Ω                  |                                 |
|  | 100 MΩ | 28 μΩ/Ω                  | IET SRX<br>Fluke 8508A – 7000 K |
|  | 1 GΩ   | 0.012 %                  |                                 |
|  | 1 GΩ   | 0.13 %                   | Keithley 263                    |
|  | 10 GΩ  | 0.27 %                   |                                 |
|  | 100 GΩ | 0.45 %                   |                                 |

| Parameter/Range                        | Frequency | CMC <sup>2,7</sup> (±) | Comments              |
|--|-----------|------------------------|-----------------------|
| Inductance – Generate,<br>Fixed Points |           |                        |                       |
| 100 μH to 10 H                         | 1 kHz     | 0.13 %                 | GenRad 1482 inductors |
| Inductance – Measure                   |           |                        |                       |
| 1 μH to 10 H                           | 1 kHz     | 0.059 %                | HP 4284A              |



| Parameter/Range                    | Frequency  | CMC <sup>2,6</sup> (±)  | Comments    |
|------------------------------------|--|---|-------------|
| AC Voltage – Generate <sup>3</sup> |  |   |             |
| 1 nV to 2.2 mV                     | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>(0.5 to 1) MHz | 0.028 % + 4 μV<br>0.011 % + 4 μV<br>94 μV/V + 4 μV<br>0.024 % + 4 μV<br>0.058 % + 5 μV<br>0.13 % + 10 μV<br>0.17 % + 20 μV<br>0.32 % + 20 μV      | Fluke 5720A |
| (2.2 to 22) mV                     | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>(0.5 to 1) MHz | 0.028 % + 4 μV<br>0.011 % + 4 μV<br>94 μV/V + 4 μV<br>0.024 % + 4 μV<br>0.058 % + 5 μV<br>0.13 % + 10 μV<br>0.17 % + 20 μV<br>0.32 % + 20 μV      |             |
| (22 to 220) mV                     | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>(0.5 to 1) MHz | 0.029 % + 12 μV<br>0.012 % + 7 μV<br>0.011 % + 7 μV<br>0.025 % + 7 μV<br>0.056 % + 17 μV<br>0.11 % + 20 μV<br>0.17 % + 25 μV<br>0.32 % + 45 μV    |             |
| (0.22 to 2.2) V                    | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>(0.5 to 1) MHz | 0.028 % + 40 μV<br>0.011 % + 15 μV<br>53 μV/V + 8 μV<br>88 μV/V + 10 μV<br>0.13 % + 30 μV<br>0.049 % + 80 μV<br>0.12 % + 200 μV<br>0.2 % + 300 μV |             |



| Parameter/Range                              | Frequency   | CMC <sup>2,6,7</sup> (±)  | Comments   |
|--|---|---|--|
| AC Voltage – Generate <sup>3</sup><br>(cont) |   |   |  |
| (2.2 to 22) V                                | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>(0.5 to 1) MHz  | 0.028 % + 0.4 mV<br>0.011 % + 0.15 mV<br>53 μV/V + 0.05 mV<br>88 μV/V + 0.1 mV<br>0.012 % + 0.2 mV<br>0.033 % + 0.6 mV<br>0.12 % + 2 mV<br>0.18 % + 3.2 mV  | Fluke 5720A  |
| (22 to 220) V                                | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz   | 0.028 % + 4 mV<br>0.011 % + 1.5 mV<br>61 μV/V + 0.6 mV<br>94 μV/V + 1 mV  |  |
| (220 to 1100) V                              | (15 to 50) Hz<br>50 Hz to 1 kHz   | 0.035 % + 16 mV<br>87 μV/V + 3.5 mV   |  |
| (1 to 15) kV                                 | 60 Hz   | 0.13 %  | Hipotronics 140 HV<br>power supply w/ Vitrek<br>4700 w/ 4710 divider |
| AC Voltage – Measure <sup>3</sup>            |   |   |  |
| Up to 2.2 mV                                 | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>500 kHz to 1 MHz<br>(1 to 2) MHz<br>(2 to 10) MHz<br>(10 to 20) MHz<br>(20 to 30) MHz | 0.27 % + 1.3 μV<br>0.11 % + 1.3 μV<br>0.058 % + 1.3 μV<br>0.1 % + 2 μV<br>0.17 % + 2.5 μV<br>0.33 % + 4 μV<br>0.35 % + 8 μV<br>0.61 % + 8 μV<br>0.091 % (Flatness)<br>0.24 % (Flatness)<br>0.38 % (Flatness)<br>0.85 % (Flatness) | Fluke 5790A/03   |



| Parameter/Range                             | Frequency   | CMC <sup>2,6,7</sup> ( $\pm$ )  | Comments       |
|---|---|---|----------------|
| AC Voltage –<br>Measure <sup>3</sup> (cont) |   |   |                |
| (2.2 to 7) mV                               | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>500 kHz to 1 MHz<br>(1 to 2) MHz<br>(2 to 10) MHz<br>(10 to 20) MHz<br>(20 to 30) MHz | 0.13 % + 1.3 $\mu$ V<br>0.064 % + 1.3 $\mu$ V<br>0.048 % + 1.3 $\mu$ V<br>0.081 % + 2 $\mu$ V<br>0.12 % + 2.5 $\mu$ V<br>0.19 % + 4 $\mu$ V<br>0.25 % + 8 $\mu$ V<br>0.46 % + 8 $\mu$ V<br>0.089 % (Flatness)<br>0.15 % (Flatness)<br>0.25 % (Flatness)<br>0.47 % (Flatness)          | Fluke 5790A/03 |
| (7 to 22) mV                                | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>500 kHz to 1 MHz<br>(1 to 2) MHz<br>(2 to 10) MHz<br>(10 to 20) MHz<br>(20 to 30) MHz | 0.041 % + 1.3 $\mu$ V<br>0.029 % + 1.3 $\mu$ V<br>0.02 % + 1.3 $\mu$ V<br>0.035 % + 2 $\mu$ V<br>0.044 % + 2.5 $\mu$ V<br>0.091 % + 4 $\mu$ V<br>0.12 % + 8 $\mu$ V<br>0.18 % + 8 $\mu$ V<br>0.097 % (Flatness)<br>0.15 % (Flatness)<br>0.24 % (Flatness)<br>0.47 % (Flatness)        |                |
| (22 to 70) mV                               | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>500 kHz to 1 MHz<br>(1 to 2) MHz<br>(2 to 10) MHz<br>(10 to 20) MHz<br>(20 to 30) MHz | 0.032 % + 1.5 $\mu$ V<br>0.018 % + 1.5 $\mu$ V<br>99 $\mu$ V/V + 1.5 $\mu$ V<br>0.018 % + 2 $\mu$ V<br>0.036 % + 2.5 $\mu$ V<br>0.071 % + 4 $\mu$ V<br>0.091 % + 8 $\mu$ V<br>0.16 % + 8 $\mu$ V<br>0.071 % (Flatness)<br>0.15 % (Flatness)<br>0.22 % (Flatness)<br>0.44 % (Flatness) |                |



| Parameter/Range                             | Frequency   | CMC <sup>2,6,7</sup> ( $\pm$ )  | Comments       |
|---|---|---|----------------|
| AC Voltage –<br>Measure <sup>3</sup> (cont) |   |   |                |
| (70 to 220) mV                              | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>500 kHz to 1 MHz<br>(1 to 2) MHz<br>(2 to 10) MHz<br>(10 to 20) MHz<br>(20 to 30) MHz | 0.028 % + 1.5 $\mu$ V<br>0.012 % + 1.5 $\mu$ V<br>56 $\mu$ V/V + 1.5 $\mu$ V<br>97 $\mu$ V/V + 2 $\mu$ V<br>0.022 % + 2.5 $\mu$ V<br>0.047 % + 4 $\mu$ V<br>0.062 % + 8 $\mu$ V<br>0.15 % + 8 $\mu$ V<br>0.074 % (Flatness)<br>0.15 % (Flatness)<br>0.24 % (Flatness)<br>0.44 % (Flatness)      | Fluke 5790A/03 |
| (220 to 700) mV                             | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>500 kHz to 1 MHz<br>(1 to 2) MHz<br>(2 to 10) MHz<br>(10 to 20) MHz<br>(20 to 30) MHz | 0.025 % + 1.5 $\mu$ V<br>93 $\mu$ V/V + 1.5 $\mu$ V<br>49 $\mu$ V/V + 1.5 $\mu$ V<br>69 $\mu$ V/V + 2 $\mu$ V<br>0.011 % + 2.5 $\mu$ V<br>0.027 % + 4 $\mu$ V<br>0.043 % + 8 $\mu$ V<br>0.14 % + 8 $\mu$ V<br>0.074 % (Flatness)<br>0.15 % (Flatness)<br>0.26 % (Flatness)<br>0.45 % (Flatness) |                |
| 700 mV to 2.2 V                             | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>500 kHz to 1 MHz<br>(1 to 2) MHz<br>(2 to 10) MHz<br>(10 to 20) MHz<br>(20 to 30) MHz | 0.024 %<br>83 $\mu$ V/V<br>40 $\mu$ V/V<br>62 $\mu$ V/V<br>93 $\mu$ V/V<br>0.023 %<br>0.041 %<br>0.15 %<br>0.074 % (Flatness)<br>0.15 % (Flatness)<br>0.22 % (Flatness)<br>0.44 % (Flatness)  |                |





| Parameter/Range                             | Frequency   | CMC <sup>2,6,7</sup> (±)   | Comments       |
|---|---|--|----------------|
| AC Voltage – Measure <sup>3</sup><br>(cont) |   |  |                |
| (2.2 to 7) V                                | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>500 kHz to 1 MHz<br>(1 to 2) MHz<br>(2 to 10) MHz<br>(10 to 20) MHz<br>(20 to 30) MHz | 0.024 %<br>83 μV/V<br>35 μV/V<br>63 μV/V<br>0.011 %<br>0.028 %<br>0.058 %<br>0.18 %<br>0.074 % (Flatness)<br>0.15 % (Flatness)<br>0.22 % (Flatness)<br>0.44 % (Flatness) | Fluke 5790A/03 |
| (7 to 22) V                                 | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>500 kHz to 1 MHz  | 0.028 %<br>84 μV/V<br>40 μV/V<br>74 μV/V<br>0.012 %<br>0.031 %<br>0.059 %<br>0.18 %  |                |
| (22 to 70) V                                | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz<br>500 kHz to 1 MHz  | 0.028 %<br>86 μV/V<br>49 μV/V<br>84 μV/V<br>0.014 %<br>0.031 %<br>0.063 %<br>0.18 %  |                |
| (70 to 220) V                               | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz<br>(100 to 300) kHz<br>(300 to 500) kHz  | 0.024 %<br>86 μV/V<br>51 μV/V<br>0.011 %<br>0.015 %<br>0.033 %<br>0.084 %  |                |
| (220 to 700) V                              | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz  | 0.024 %<br>0.013 %<br>64 μV/V<br>0.019 %<br>0.099 %  |                |



| Parameter/Range                             | Frequency  | CMC <sup>2,6,7</sup> (±)   | Comments                         |
|---|--|--|----------------------------------|
| AC Voltage – Measure <sup>3</sup><br>(cont) |  |  |                                  |
| (700 to 1100) V                             | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 20 kHz<br>(20 to 50) kHz<br>(50 to 100) kHz | 0.024 %<br>0.013 %<br>58 μV/V<br>0.021 %<br>0.11 %   | Fluke 5790A/03                   |
| (1 to 70) kV                                | 60 Hz  | 0.13 %   | Vitretek 4700 w/ 4710<br>Divider |
| AC Current – Generate <sup>3</sup>          |  |  |                                  |
| (9 to 220) μA                               | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 1 kHz<br>(1 to 5) kHz<br>(5 to 10) kHz      | 0.029 % + 16 nA<br>0.019 % + 10 nA<br>0.015 % + 8 nA<br>0.035 % + 12 nA<br>0.14 % + 65 nA    | Fluke 5720A                      |
| (0.22 to 2.2) mA                            | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 1 kHz<br>(1 to 5) kHz<br>(5 to 10) kHz      | 0.029 % + 40 nA<br>0.019 % + 35 nA<br>0.015 % + 35 nA<br>0.026 % + 110 nA<br>0.13 % + 650 nA |                                  |
| (2.2 to 22) mA                              | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 1 kHz<br>(1 to 5) kHz<br>(5 to 10) kHz      | 0.03 % + 400 nA<br>0.019 % + 350 nA<br>0.015 % + 350 nA<br>0.026 % + 550 nA<br>0.14 % + 5 μA |                                  |
| (22 to 220) mA                              | (10 to 20) Hz<br>(20 to 40) Hz<br>40 Hz to 1 kHz<br>(1 to 5) kHz<br>(5 to 10) kHz      | 0.03 % + 4 μA<br>0.019 % + 3.5 μA<br>0.015 % + 3.5 μA<br>0.024 % + 3.5 μA<br>0.13 % + 10 μA  |                                  |
| (0.22 to 2.2) A                             | 20 Hz to 1 kHz<br>(1 to 5) kHz<br>(5 to 10) kHz  | 0.034 % + 35 μA<br>0.055 % + 80 μA<br>0.82 % + 160 μA  |                                  |



| Parameter/Range                              | Frequency   | CMC <sup>2, 4, 6, 7</sup> ( $\pm$ )                                   | Comments                           |
|--|---|---|------------------------------------|
| AC Current – Generate <sup>3</sup><br>(cont) |   |   |                                    |
| (2.2 to 20) A                                | 30 Hz to 5 kHz                                    | 0.042 %   | Fluke Y5020 shunt                  |
| (20 to 300) A                                | 60 Hz   | 0.069 %   | EIL current source w/<br>L&N shunt |
| Clamp-On<br>(10 to 1000) A                   | (45 to 65) Hz                                     | 0.87 %  | Fluke 5522A w/ 5500A<br>coil       |
| AC Current – Measure <sup>3</sup>            |   |   |                                    |
| (0 to 100) $\mu$ A                           | 45 Hz to 5 kHz                                    | 0.06 % + 30 nA  | HP 3458A                           |
| (0.1 to 100) mA                              | 45 Hz to 5 kHz                                    | 0.07 % + 20 nA  |                                    |
| (0.1 to 1) A                                 | 45 Hz to 5 kHz                                    | 0.13 % + 200 $\mu$ A  |                                    |
| (0.2 to 2) A                                 | 10 Hz to 2 kHz<br>(2 to 10) kHz<br>(10 to 30) kHz | 0.085 % + 240 $\mu$ A<br>0.10 % + 240 $\mu$ A<br>0.35 % + 240 $\mu$ A | Fluke 8508A                        |
| (2 to 20) A                                  | 10 Hz to 2 kHz<br>(2 to 10) kHz                   | 0.11 % + 2.4 mA<br>0.29 % + 2.4 mA                                    |                                    |
| (1 to 20) A                                  | 60 Hz to 5 kHz                                    | 0.042 %   | HP 3458A w/ Fluke<br>Y5020         |
| (20 to 300) A                                | 60 Hz   | 0.070 %   | HP 3458A w/ L&N<br>shunt           |
| Capacitance – Measure                        |   |   |                                    |
| 1 pF to 1 $\mu$ F                            | 50 Hz to 1 kHz                                    | 0.013 %   | GenRad 1620A                       |
| 1 pF to 1 nF                                 | 1 kHz to 1 MHz                                    | 0.059 %   | HP 4284A                           |
| 1 nF to 1 $\mu$ F                            | (1 to 100) kHz                                    | 0.059 %   |                                    |
| 1 $\mu$ F to 1 mF                            | 50 Hz to 1 kHz                                    | 0.12 %  |                                    |
| (1 to 10) mF                                 | (50 to 120) Hz                                    | 0.12 %  |                                    |



| Parameter/Range                     | Frequency       | CMC <sup>2, 6, 7</sup> (±) | Comments           |
|-------------------------------------|-----------------|----------------------------|--------------------|
| Capacitance – Generate <sup>3</sup> |                 |                            |                    |
| (0.19 to 3.3) nF                    | 10 Hz to 3 kHz  | 0.6 % + 0.01 nF            | Fluke 5522A        |
| (3.3 to 11) nF                      | 10 Hz to 1 kHz  | 0.33 % + 0.1 nF            |                    |
| (11 to 330) nF                      | 10 Hz to 1 kHz  | 0.32 % + 0.3 nF            |                    |
| (0.33 to 3.3) μF                    | (10 to 300) Hz  | 0.29 % + 3 nF              |                    |
| (3.3 to 11) μF                      | (10 to 150) Hz  | 0.31 % + 10 nF             |                    |
| (11 to 33) μF                       | (10 to 120) Hz  | 0.47 % + 30 nF             |                    |
| (33 to 110) μF                      | (10 to 80) Hz   | 0.54 % + 100 nF            |                    |
| (110 to 330) μF                     | Up to 50 Hz     | 0.53 % + 300 nF            |                    |
| (0.33 to 1.1) mF                    | Up to 20 Hz     | 0.53 % + 1 μF              |                    |
| (1.1 to 3.3) mF                     | Up to 6 Hz      | 0.54 % + 3 μF              |                    |
| (3.3 to 11) mF                      | Up to 2 Hz      | 0.53 % + 10 μF             |                    |
| (11 to 33) mF                       | Up to 0.6 Hz    | 0.88 % + 30 μF             |                    |
| (33 to 110) mF                      | Up to 0.2 Hz    | 1.4 % + 100 μF             |                    |
| Fixed Points:                       |                 |                            |                    |
| 1000 pF                             | 1 kHz           | 29 μF/F                    | GenRad 1404        |
| (10, 100) pF                        | 100 Hz to 1 MHz | 0.035 %                    | GenRad 1409 Series |
| (0.001, 0.01, 0.1, 1) μF            | (50 to 1000) Hz | 0.068 %                    |                    |

| Parameter/Range  | Frequency         | CMC <sup>2</sup> (±) | Comments    |
|--|-------------------|----------------------|-------------|
| Electrical Calibration of Thermocouple Indicators <sup>3</sup> – |                   |                      |             |
| Type E   | (-250 to -100) °C | 0.59 °C              | Fluke 5522A |
|  | (-100 to 650) °C  | 0.2 °C               |             |
|  | (650 to 1000) °C  | 0.25 °C              |             |
| Type J   | (-210 to -100) °C | 0.32 °C              |             |
|  | (-100 to 760) °C  | 0.21 °C              |             |
|  | (760 to 1200) °C  | 0.28 °C              |             |
| Type K   | (-200 to -100) °C | 0.39 °C              |             |
|  | (-100 to 120) °C  | 0.22 °C              |             |
|  | (120 to 1000) °C  | 0.27 °C              |             |
|  | (1000 to 1372) °C | 0.5 °C               |             |



| Parameter/Equipment   | Range  | CMC <sup>2</sup> (±)                                  | Comments    |
|---|--|---|-------------|
| Electrical Calibration of Thermocouple Indicators <sup>3</sup> – (cont) |  |   |             |
| Type S  | (0 to 250) °C<br>(250 to 1400) °C<br>(1400 to 1767) °C                                     | 0.55 °C<br>0.46 °C<br>0.56 °C                         | Fluke 5522A |
| Type T  | (-250 to -150) °C<br>(-150 to 0) °C<br>(0 to 400) °C                                       | 0.73 °C<br>0.29 °C<br>0.18 °C                         |             |
| Electrical Calibration of RTD Indicators <sup>3</sup>                   |  |   |             |
| Pt 385, 100 Ω   | (-200 to 0) °C<br>(0 to 100) °C<br>(100 to 400) °C<br>(400 to 630) °C<br>(630 to 800) °C   | 0.06 °C<br>0.083 °C<br>0.12 °C<br>0.14 °C<br>0.27 °C  | Fluke 5522A |
| Pt 3926, 100 Ω  | (-200 to 0) °C<br>(0 to 100) °C<br>(100 to 400) °C<br>(400 to 630) °C                      | 0.061 °C<br>0.083 °C<br>0.12 °C<br>0.14 °C            |             |
| Pt 3916, 100 Ω  | (-200 to -190) °C<br>(-190 to 0) °C<br>(0 to 300) °C<br>(300 to 600) °C<br>(600 to 630) °C | 0.29 °C<br>0.061 °C<br>0.094 °C<br>0.12 °C<br>0.27 °C |             |
| Pt 385, 200 Ω   | (-200 to 100) °C<br>(100 to 260) °C<br>(260 to 600) °C<br>(600 to 630) °C                  | 0.049 °C<br>0.06 °C<br>0.17 °C<br>0.19 °C             |             |



| Parameter/Equipment   | Range   | CMC <sup>2</sup> (±)                        | Comments    |
|---|---|---|-------------|
| Electrical Calibration of<br>RTD Indicators <sup>3</sup> (cont) |   |   |             |
| Pt 385, 500 Ω   | (-200 to 100) °C<br>(100 to 260) °C<br>(260 to 600) °C<br>(600 to 630) °C | 0.061 °C<br>0.072 °C<br>0.11 °C<br>0.13 °C  | Fluke 5522A |
| Pt 385, 1 kΩ  | (-200 to 0) °C<br>(0 to 260) °C<br>(260 to 600) °C<br>(600 to 630) °C     | 0.039 °C<br>0.061 °C<br>0.083 °C<br>0.27 °C |             |
| PtNi 385, 120 Ω   | (-80 to 100) °C<br>(100 to 260) °C  | 0.094 °C<br>0.17 °C                         |             |
| Cu 427, 10 Ω  | (-100 to 260) °C  | 0.35 °C                                     |             |

| Parameter/Equipment                              | Range  | CMC <sup>2,6</sup> (±)   | Comments                  |
|--|--|--|---------------------------|
| Oscilloscopes <sup>3</sup> –                     |  |  |                           |
| Square Wave Signal<br>50 Ω, 1 kHz<br>1 MΩ, 1 kHz | 1 mV to 6.6 V<br>1 mV to 130 V   | 0.46 % + 40 μV<br>0.37 % + 40 μV   | Fluke 5522A w/<br>SC 1100 |
| Leveled Sine Wave<br>Amplitude                   | 50 kHz reference<br>50 kHz to 100 MHz<br>(100 to 300) MHz<br>(300 to 600) MHz<br>(600 to 1100) MHz | 2.4 % + 300 μV<br>4.2 % + 300 μV<br>4.8 % + 300 μV<br>7.1 % + 300 μV<br>8.2 % + 300 μV |                           |
| Flatness<br>(Up to 50 kHz)                       | 50 kHz to 100 MHz<br>(100 to 300) MHz<br>(300 to 600) MHz<br>(600 to 1100) MHz                     | 2 % + 100 μV<br>2.6 % + 100 μV<br>4.8 % + 100 μV<br>6 % + 100 μV                       |                           |
| Time Marker<br>(Into 50 Ω)                       | 1 ns to 20 ms<br>50 ms to 5 s  | 24 μs/s<br>27 μs/s   |                           |
| Rise Time  | < 300 ps   | (+0 / -120) ps   |                           |



III. Electrical – RF/ Microwave

| Parameter/Range                         | Frequency      | CMC <sup>2</sup> (±) | Comments                           |
|---|----------------|----------------------|------------------------------------|
| RF Power – Measure                      |                |                      |                                    |
| Power Reference 1 mW,<br>Type-N(f) 50 Ω | 50 MHz         | 0.026 dB (5.8 μW)    | HP 432A w/478A-H76<br>power sensor |
| 1 μW to 1 mW                            | 5 MHz to 1 GHz | 0.027 dB             |                                    |
| 500 W                                   | Up to 500 MHz  | 0.22 dB              | Bird 8322<br>VSWR<1.1:1            |

| Parameter/Range                         | Frequency          | CMC <sup>2, 7</sup> (±) | Comments                          |
|---|--------------------|-------------------------|-----------------------------------|
| RF Power – Measure (cont)               |                    |                         |                                   |
| (+20 to -70) dBm                        | 0.1 MHz to 6 GHz   | 0.18 dB                 | HP 4418B, E9304A,<br>VSWR <1.18:1 |
|   | (6 to 26.5) GHz    | 0.23 dB                 | HP E4413A VSWR<br><1.27:1         |
|   | (26.5 to 50) GHz   | 0.25 dB                 | HP 8487A VSWR<br><1.30:1          |
| Tuned RF Power,<br>Relative – Measure   | 2.5 MHz to 1.3 GHz |                         |                                   |
|   | (0 to -30) dB      | 0.24 dB                 | HP 8902A w/ HP<br>11722A & 11792A |
|   | (-30 to -70) dB    | 0.24 dB                 |                                   |
|   | (-70 to -120) dB   | 0.5 dB                  |                                   |
| Phase Modulation –<br>Measure           |                    |                         |                                   |
| Carrier Frequency:<br>10 MHz to 1.3 GHz | 200 Hz to 20 kHz   | 3.7 %                   | HP 8902A w/ HP<br>11793A          |



| Parameter/Range  | Frequency         | CMC <sup>2,7</sup> (±) | Comments                                 |
|--|-------------------|------------------------|--|
| RF Attenuation/ Insertion Loss – Measure<br><br>(0 to 120) dB                      | 5 Hz to 3 GHz     | 0.48 dB                | HP E5061B<br>w/ HP 85032B                |
| (0 to 70) dB<br>Dynamic Range  | 0.1 MHz to 6 GHz  | 0.18 dB                | HP 4418B, 8482A<br>VSWR <1.18:1,         |
|  | (6 to 26.5) GHz   | 0.24 dB                | HP 4418B, E4413A<br>VSWR <1.27:1         |
|  | (26.5 to 40) GHz  | 0.27 dB                | HP 4418B w/ HP<br>8487A/D SWR <1.30:1    |
| Amplitude Modulation – Measure<br><br>Rate: 50 Hz to 10 kHz<br>Depths: 5 % to 99 % | 150 kHz to 10 MHz | 2.4 %                  | HP 8902A w/ HP<br>11722A or<br>HP 11793A |
| Rate: 20 Hz to 10 kHz<br>Depths: 5 % to 99 %                                       | 150 kHz to 10 MHz | 3.5 %                  |  |
| Rate: 50 Hz to 50 kHz<br>Depths: 5 % to 99 %                                       | 10 MHz to 18 GHz  | 1.3 %                  |  |
| Rate: 20 Hz to 100 kHz<br>Depths: 5 % to 99 %                                      | 10 MHz to 18 GHz  | 3.5 %                  |  |
| Frequency Modulation – Measure<br><br>Rate: 20 Hz to 10 kHz<br>Dev: 5 % to 99 %    | 250 kHz to 10 MHz | 2.4 %                  | HP 8902A w/ HP<br>11722A or<br>HP 11793A |
| Rate: 50 Hz to 100 kHz<br>Dev: 5 % to 99 %   | 10 MHz to 18 GHz  | 1.2 %                  |  |
| Phase – Measure  | 5 Hz to 3 GHz     | 0.87°                  | HP E5061B<br>w/ HP 85032B                |





| Parameter/Range | Frequency     | CMC <sup>2,7</sup> (±) | Comments                  |
|-----------------|---------------|------------------------|---------------------------|
| LISN            |               |                        |                           |
| Insertion Loss  | 5 Hz to 3 GHz | 0.48 dB                | HP E5061B<br>w/ HP 85032B |
| Impedance       | 5 Hz to 3 GHz | 3.7 %                  |                           |
| Phase           | 5 Hz to 3 GHz | 0.87°                  |                           |
| Isolation       | 5 Hz to 3 GHz | 0.54 dB                |                           |

| Parameter/Range      | Frequency                          | CMC <sup>2,5,7</sup> (±)     | Comments |
|----------------------|------------------------------------|------------------------------|----------|
| Impedance – Measure  |                                    |                              |          |
| 1 Ω to 1 kΩ          | 5 Hz to 1 MHz<br>(1 to 13) MHz     | 0.15 %<br>0.41 %             | HP 4192A |
| (1 to 100) kΩ        | 5 Hz to 1 MHz<br>(1 to 13) MHz     | 0.48 %<br>0.83 %             |          |
| 100 kΩ to 1 MΩ       | 5 Hz to 1 MHz                      | 1.8 %                        |          |
| (10 to 100) Ω        | (10 to 110) MHz                    | 3.1 % + 0.037 <i>F</i> (MHz) | HP 4193A |
| 100 Ω to 1 kΩ        | (10 to 110) MHz                    | 3.2 % + 0.11 <i>F</i> (MHz)  |          |
| (1 to 10) kΩ         | (10 to 40) MHz                     | 1.3 % + 0.53 <i>F</i> (MHz)  |          |
| Distortion – Measure |                                    |                              |          |
| 20 Hz to 100 kHz     | 20 Hz to 20 kHz<br>(20 to 100) kHz | 0.2 %<br>0.28 %              | HP 8903B |



IV. Mechanical

| Parameter/Equipment              | Range                       | CMC <sup>2, 7</sup> (±)    | Comments   |
|----------------------------------|-----------------------------|----------------------------|--|
| Pressure Gages <sup>3</sup>      | (-14 to 15) psi             | 0.0035 psi                 | Druck DPI150   |
|                                  | (750 to 1150) mbar          | 0.37 mbar                  | Druck DPI150   |
|                                  | (0 to 2) inH <sub>2</sub> O | 0.00087 inH <sub>2</sub> O | Ashcroft AQS-1   |
|                                  | (-1 to 1) psi               | 0.00075 psi                | Druck DPI800/UPM-P<br>Fluke 2700G-BG200K<br>Fluke 2700G-BG2M<br>Fluke 2700G-BG7M |
|                                  | (-15 to 30) psi             | 0.012 psi                  |  |
|                                  | (-12 to 300) psi            | 0.082 psi                  |  |
|                                  | (-12 to 1000) psi           | 0.26 psi                   |  |
| (0 to 5000) psi                  | 3.1 psi                     | Druck DPI104               |  |
| (15 to 10 000) psi               | 0.079 %                     | Ashcroft 1305B             |  |
| Scales and Balances <sup>3</sup> | 0.5 lb (0.23 kg)            | 0.052 g                    | Class F weights  |
|                                  | 1 lb (0.46 kg)              | 0.12 g                     |  |
|                                  | 2 lb (0.91 kg)              | 0.16 g                     |  |
|                                  | 5 lb (2.3 kg)               | 0.38 g                     |  |
|                                  | 10 lb (4.6 kg)              | 0.75 g                     |  |
|                                  | 20 lb (9.1 kg)              | 1.6 g                      |  |
|                                  | 50 lb (23 kg)               | 3.1 g                      |  |
|                                  | (1 to 5) g                  | 0.044 mg                   | Class 1 weights  |
|                                  | 10 g                        | 0.17 mg                    |  |
|                                  | 20 g                        | 0.16 mg                    |  |
|                                  | 50 g                        | 0.21 mg                    |  |
|                                  | 100 g                       | 0.33 mg                    |  |
|                                  | 200 g                       | 0.62 mg                    |  |
|                                  | 500 g                       | 1.4 mg                     |  |
|                                  | 1000 g                      | 3.2 mg                     |  |
|                                  | 2000 g                      | 6 mg                       |  |
|                                  | Mass – Measure              | 1 to 500) g                |  |
| (500 to 1000) g                  |                             | 0.39 g                     |  |
| (1000 to 5000) g                 |                             | 1.2 g                      |  |
| (5000 to 12 000) g               |                             | 2.8 g                      |  |



| Parameter/Equipment                      | Range   | CMC <sup>2,7</sup> (±)                                | Comments   |
|--|---|---|--|
| Torque <sup>3</sup>                      | (2.5 to 25) in·lbf<br>(10 to 100) in·lbf<br>(50 to 500) in·lbf<br><br>(10 to 100) ft·lbf                      | 0.33 %<br>0.26 %<br>0.23 %<br><br>0.34 %              | Ref weights/torque arm   |
| Torque Wrenches and Drivers <sup>3</sup> | (10 to 100) in·lb<br>(2.5 to 25) in·lb<br>(16 to 160) in·oz<br><br>(50 to 500) in·lb<br><br>(10 to 100) ft·lb | 0.6 %<br>0.68 %<br>0.62 %<br><br>0.64 %<br><br>0.63 % | Mountz M100<br>Mountz TL25i<br>Mountz TL25i w/<br>LPX160Z<br>Mountz TL25i w/<br>BMX500i<br>Mountz BT100F-V |

#### V. Thermodynamics

| Parameter/Equipment                | Range   | CMC <sup>2</sup> (±)                             | Comments  |
|------------------------------------|---|--|---|
| Thermocouples –<br>Type T, J, K, E | (-40 to 120) °C<br><br>(100 to 425) °C<br>(425 to 600) °C                   | 0.27 °C<br><br>0.31 °C<br>0.32 °C                | Liquid bath & Hart<br>5626 PRT & Fluke<br>5520A<br><br>Metrology well & Hart<br>5626 PRT & Fluke<br>5520A |
| Thermometers                       | (-40 to 120) °C<br><br>(50 to 100) °C<br>(100 to 425) °C<br>(425 to 600) °C | 0.023 °C<br><br>0.024 °C<br>0.044 °C<br>0.073 °C | Liquid bath & Hart 5626<br>PRT<br><br>Metrology well<br>calibrator & Hart 5626<br>PRT                     |



| Parameter/Equipment                      | Range  | CMC <sup>2</sup> (±)            | Comments                          |
|--|--|---------------------------------|-----------------------------------|
| Temperature – Measure <sup>3</sup>       | (-100 to 0) °C<br>(0 to 425) °C<br>(425 to 600) °C | 0.015 °C<br>0.03 °C<br>0.033 °C | Hart 5626 PRT/9173                |
| Relative Humidity – Measure <sup>3</sup> | (5 to 95) % RH                                     | 1.4 % RH                        | Rotronic HP21/22                  |
| Measuring Equipment                      | (11, 33, 75) % RH<br>(23 ± 5) °C                   | 1.4 % RH                        | Rotronic HP21/22 humidity chamber |

## VI. Time & Frequency

| Parameter/Equipment             | Range  | CMC <sup>2</sup> (±)   | Comments   |
|---------------------------------|--|--|--|
| Frequency – Measuring Equipment | 10 MHz<br>0.01 Hz to 20 MHz<br>10 MHz to 40 GHz          | 2.2 parts in 10 <sup>12</sup><br>0.013 Hz<br>1.3 Hz                            | Symmetricom XLi<br>3325A<br>83640L & Symmetricom XLi |
| Frequency – Measure             | (1, 5, 10) MHz<br>0.01 Hz to 500 MHz<br>10 MHz to 40 GHz | 2.5 parts in 10 <sup>12</sup> Hz<br>5.3 parts in 10 <sup>10</sup> Hz<br>1.7 Hz | Symmetricom XLi<br>5345A<br>5352B & Symmetricom XLi  |

<sup>1</sup> This laboratory offers commercial calibration service and field calibration service.

<sup>2</sup> Calibration and Measurement Capability Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. CMC's represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of  $k = 2$ . The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

- <sup>3</sup> Field calibration service is available for this calibration and this laboratory meets A2LA R104 – *General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for these calibrations. Please note the actual measurement uncertainties achievable on a customer's site can normally be expected to be larger than the CMC found on the A2LA Scope. Allowance must be made for aspects such as the environment at the place of calibration and for other possible adverse effects such as those caused by transportation of the calibration equipment. The usual allowance for the actual uncertainty introduced by the item being calibrated, (e.g. resolution) must also be considered and this, on its own, could result in the actual measurement uncertainty achievable on a customer's site being larger than the CMC.
- <sup>4</sup> The measurands stated are measured with the HP 3458A. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a fraction/percentage of the reading plus a fixed floor specification.
- <sup>5</sup> In the statement of CMC's,  $L$  is the numerical value of the nominal length of the device measured in inches,  $F$  is the frequency.
- <sup>6</sup> The measurands stated are generated with the Fluke 732A and 5520A, 5720A, 5790A, & 5790A/03 series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a fraction/percentage of the reading plus a fixed floor specification.
- <sup>7</sup> In the statement of CMCs, percentages are to be read as percent of reading unless otherwise noted.

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## Accredited Laboratory

A2LA has accredited

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This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and R205 – Specific Requirements: Calibration Laboratory Accreditation Program. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 29<sup>th</sup> day of January 2016.

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President and CEO  
For the Accreditation Council  
Certificate Number 2117.01  
Valid to January 31, 2018  
Revised April 27, 2017

*For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.*