



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

TRU CAL INTERNATIONAL, INC.  
401 Country Club Drive  
Bensenville, IL 60106  
Scott Miller Phone: 630 238 8100

CALIBRATION

Valid until: December 31, 2019

Certificate Number: 1278.01

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. Acoustical

Parameter/Frequency	Range	CMC <sup>2,4</sup> (±)	Comments
Sound Level Meters — Measure @ 1000 Hz	94 dB 114 dB	0.40 dB 0.40 dB	Larson Davis CAL200

II. Dimensional

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Dial Indicators <sup>3</sup>	Up to 1 in	76 µin	Dial indicator calibrator
Dial Indicators	Up to 1 in	47 µin	Gage blocks w/MuMeter
Micrometers <sup>3</sup> – Heads, Inside, Outside	Up to 8 in (6 to 18) in	(22 + 18L) µin (68 + 20L) µin	Gage blocks Reference bar
Calipers <sup>3</sup>	Up to 8 in (8 to 18) in	(280 + 13L) µin (280 + 9.8L) µin	Gage blocks Reference bar

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Height Gages <sup>3</sup> , Dual Column – MTI	Up to 18 in	(52 + 17L) μin	Reference bar w/ MuMeter
Pin Gages <sup>3</sup>	Up to 1 in	47 μin	Bench mic w/gage blocks
Plain Plug Gages	Up to 6 in	(13 + 16L) μin	Pratt & Whitney Supermicrocrometer <sup>6</sup> w/ gage blocks
Steel Rules			
1/16	Up to 12"	0.036"	Grade 3 gage blocks
1/32	Up to 12"	0.018"	
Tape Measures	Up to 50'	0.02 in + 0.000 047 in/in	Steel rule
Thickness Gages <sup>3</sup> –			
Blade	Up to 1 in	47 μin	Bench mic Gage blocks
Dial	Up to 1 in	(280 + 13L) μin	
Bore Gages <sup>3</sup>	Up to 1 in	76 μin	Dial indicator calibrator
Thread Plugs <sup>3</sup> –			
Major Diameter	Non-Tapered: (4 to 80) TPI	(39 + 14L) μin	Bench mic w/ thread wires
Pitch Diameter	Up to 2 in	(82 + 8L) μin	
Thread Plugs –			
Major Diameter	Non-Tapered: (4 to 80) TPI	(13 + 11L) μin	Pratt & Whitney B w/ thread wires
Pitch Diameter	Up to 6 in	(70 + 5.7L) μin	

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,5,7</sup> (±)	Comments
DC Voltage – Measure <sup>3</sup>	Up to 200 mV 200 mV to 2 V (1 to 20) V (20 to 200) V (200 to 1000) V	0.0001 mV + 0.000 005 mV/mV 0.000 000 41 V + 0.000 003 5 V/V 0.000 004 1 V + 0.000 003 5 V/V 0.000 042 V + 0.000 005 5 V/V 0.000 52 V + 0.000 005 5 V/V	Fluke 8508
DC High Voltage – Measure <sup>3</sup>	(0 to 30) kV (31 to 120) kV	0.018 % 0.14 %	Ross VD30 Ross VD120
DC Voltage – Generate <sup>3</sup>	(0 to 220) mV 220 mV to 2.2V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1100) V	9.1 μV/V + 0.4 μV 4.4 μV/V + 0.7 μV 3 μV/V + 2.5 μV 3 μV/V + 4 μV 4.3 μV/V + 40 μV 5 μV/V + 0.4 mV	Fluke 5720A (using artifact calibrations)
DC Voltage – Generate, Fixed Points	100 mV 1 V 10 V 100 V 1000 V	3.6 μV/V 2.4 μV/V 1.8 μV/V 2 μV/V 2.4 μV/V	Fluke 732B w/ Fluke 752A
DC Current – Measure <sup>3</sup>	Up to 100 nA 100 nA to 1 μA (1 to 10) μA (10 to 200) μA 200 μA to 2 mA (2 to 20) mA (20 to 200) mA 200 mA to 2 A  (1 to 2) A  (2 to 10) A  (10 to 20) A  (20 to 100) A	43 μA/A + 0.04 nA 28 μA/A + 0.04 nA 24 μA/A + 0.1 nA 0.000 41 μA + 0.000 012 μA/A 0.000 004 mA + 0.000 012 mA/mA 0.000 041 mA + 0.000 14 mA/mA 0.0008 mA + 0.000 048 mA/mA 0.000 016 A + 0.000 190 A/A  59 μA/A  75 μA/A  0.015 %  0.077 %	HP 3458A opt 002  Fluke 8508A   HP 3458A w/ L&N 4221B current shunt  HP 3458A w/ L&N 4222B  HP 3458A w/ Fluke Y5020  Valhalla 2575A

Parameter/Equipment	Range	CMC <sup>2,5,7</sup> ( $\pm$ )	Comments
DC Current – Generate <sup>3</sup>	(0 to 220) $\mu$ A 220 $\mu$ A to 2.2 mA (2.2 to 22) mA	39 $\mu$ A/A + 6 nA 33 $\mu$ A/A + 7 nA 36 $\mu$ A/A + 40 nA	Fluke 5720A (using artifact calibrations)
	(22 to 220) mA	44 $\mu$ A/A + 0.7 $\mu$ A*	*Add (200 x I <sup>2</sup> ) $\mu$ A/A for I > 100 mA
	220 mA to 2.2 A	66 $\mu$ A/A + 12 $\mu$ A*	*Add (10 x I <sup>2</sup> ) $\mu$ A/A for I > 1 A
	(2.2 to 10.9999) A	0.039 % + 0.5 mA	Fluke 5522A
	(11 to 20) A (20 to 100) A	0.042 % + 0.03 % RNG 0.068 % + 0.03 % RNG	Fluke 5500A Valhalla 2555A
Clamp-On Only Toroidal	(20 to 1000) A	0.47 % + 0.05 A	Fluke 5522A w/ Fluke 5500 coil
Non-Toroidal	(20 to 1000) A	0.58 % + 0.5 A	
Resistance – Measure <sup>3</sup>	Up to 2 $\Omega$ (2 to 20) $\Omega$ 20 $\Omega$ to 2 k $\Omega$	0.000 004 2 $\Omega$ + 0.000 017 $\Omega/\Omega$ 0.000 014 $\Omega$ + 0.000 097 $\Omega/\Omega$ 0.000 000 53 k $\Omega$ + 0.000 008 2 k $\Omega/k\Omega$	Fluke 8508
	(2 to 20) k $\Omega$	0.000 005 8 k $\Omega$ + 0.000 008 14 k $\Omega/k\Omega$	
	(20 to 200) k $\Omega$	0.000 056 k $\Omega$ + 0.000 082 k $\Omega/k\Omega$	
	200 k $\Omega$ to 2 M $\Omega$	0.000 001 1 M $\Omega$ + 0.0000 092 M $\Omega/M\Omega$	
	(2 to 20) M $\Omega$ (20 to 200) M $\Omega$ 200 M $\Omega$ to 2 G $\Omega$ (2 to 20) G $\Omega$	0.0001 M $\Omega$ + 0.000 020 M $\Omega/M\Omega$ 0.0095 M $\Omega$ + 0.0013 M $\Omega/M\Omega$ 0.0001 G $\Omega$ + 0.000 18 G $\Omega/ G\Omega$ 0.01 G $\Omega$ + 0.0015 G $\Omega/ G\Omega$	

Parameter/Equipment	Range	CMC <sup>2, 5, 7</sup> ( $\pm$ )	Comments
Resistance – Generate, Fixed Values <sup>3</sup>	1 $\Omega$ 1.9 $\Omega$ 10 $\Omega$ 19 $\Omega$ 100 $\Omega$ 190 $\Omega$ (1, 1.9) k $\Omega$ 10 k $\Omega$ 19 k $\Omega$ 100 k $\Omega$ 190 k $\Omega$ 1 M $\Omega$ 1.9 M $\Omega$ 10 M $\Omega$ 19 M $\Omega$ 100 M $\Omega$	93 $\mu\Omega/\Omega$ 86 $\mu\Omega/\Omega$ 26 $\mu\Omega/\Omega$ 27 $\mu\Omega/\Omega$ 12 $\mu\Omega/\Omega$ 11 $\mu\Omega/\Omega$ 8.8 $\mu\Omega/\Omega$ 8.6 $\mu\Omega/\Omega$ 8.7 $\mu\Omega/\Omega$ 10 $\mu\Omega/\Omega$ 11 $\mu\Omega/\Omega$ 18 $\mu\Omega/\Omega$ 19 $\mu\Omega/\Omega$ 35 $\mu\Omega/\Omega$ 44 $\mu\Omega/\Omega$ 0.013 %	Fluke 5720A (using artifact calibrations)
Resistance – Generate	(0 to 10.999) $\Omega$ (11 to 32.999) $\Omega$ (33 to 109.999) $\Omega$ (110 to 329.999) $\Omega$ 330 $\Omega$ to 1.0999 k $\Omega$ (1.1 to 3.299) k $\Omega$ (3.3 to 10.999) k $\Omega$ (11 to 32.999) k $\Omega$ (33 to 109.99) k $\Omega$ (110 to 329.999) k $\Omega$ 330 k $\Omega$ to 1.0999 M $\Omega$ (1.1 to 3.299) M $\Omega$ (3.3 to 10.999) M $\Omega$ (11 to 32.999) M $\Omega$ (33 to 109.999) M $\Omega$ (110 to 329.999) M $\Omega$ (330 to 1100) M $\Omega$	46 $\mu\Omega/\Omega$ + 0.001 $\Omega$ 27 $\mu\Omega/\Omega$ + 0.0015 $\Omega$ 24 $\mu\Omega/\Omega$ + 0.0014 $\Omega$ 24 $\mu\Omega/\Omega$ + 0.002 $\Omega$ 23 $\mu\Omega/\Omega$ + 0.002 $\Omega$ 23 $\mu\Omega/\Omega$ + 0.02 $\Omega$ 24 $\mu\Omega/\Omega$ + 0.02 $\Omega$ 24 $\mu\Omega/\Omega$ + 0.2 $\Omega$ 24 $\mu\Omega/\Omega$ + 0.2 $\Omega$ 26 $\mu\Omega/\Omega$ + 2 $\Omega$ 26 $\mu\Omega/\Omega$ + 2 $\Omega$ 54 $\mu\Omega/\Omega$ + 30 $\Omega$ 0.011 % + 50 $\Omega$ 0.022 % + 2.5 k $\Omega$ 0.039 % + 3 k $\Omega$ 0.24 % + 0.1 M $\Omega$ 1.2 % + 0.5 M $\Omega$	Fluke 5522A

Parameter/Range	Frequency	CMC <sup>2</sup> (±)	Comments
AC Voltage – Measure <sup>3</sup>			
200 mV	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz	0.014 mV + 0.000 17 mV / mV 0.0035 mV + 0.000 3 mV / mV 0.004 mV + 0.000 12 mV / mV 0.002 mV + 0.000 11 mV / mV 0.002 mV + 0.000 11 mV / mV 0.008 mV + 0.000 34 mV / mV 0.02 mV + 0.000 77 mV / mV	Fluke 8508
2V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.000 12 V + 0.000 15 V / V 0.000 021 V + 0.000 12 V / V 0.000 02 V + 0.000 093 V / V 0.000 021 V + 0.000 077 V / V 0.000 021 V + 0.000 11 V / V 0.000 04 V + 0.000 22 V / V 0.0002 V + 0.000 57 V / V 0.002 V + 0.003 V / V 0.02 V + 0.01 V / V	
20V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.0012 V + 0.001 52 V / V 0.000 18 V + 0.001 16 V / V 0.000 18 V + 0.000 91 V / V 0.0002 V + 0.000 075 V / V 0.0002 V + 0.000 11 V / V 0.0004 V + 0.000 22 V / V 0.002 V + 0.000 57 V / V 0.02 V + 0.003 V / V 0.2 V + 0.01 V / V	
200 V	(1 to 10) Hz (10 to 40) Hz (40 to 100) Hz 100 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.012 V + 0.000 15 V / V 0.002 V + 0.000 12 V / V 0.002 V + 0.000 091 V / V 0.002 V + 0.000 076 V / V 0.002 V + 0.000 11 V / V 0.0068 V + 0.000 085 V / V 0.02 V + 0.000 57 V / V 0.2 V + 0.003 V / V 0.2 V + 0.003 V / V	
1000 V	(1 to 10) Hz (10 to 40) Hz 40 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.07 V + 0.000 15 V / V 0.021 V + 0.000 11 V / V 0.02 V + 0.000 12 V / V 0.04 V + 0.000 23 V / V 0.2 V + 0.000 58 V / V	

Parameter/Range	Frequency	CMC <sup>2, 5, 7</sup> ( $\pm$ )	Comments
AC Voltage – Generate <sup>3</sup>			
Up to 2.2 mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.033 % + 4 $\mu$ V 0.016 % + 4 $\mu$ V 0.015 % + 4 $\mu$ V 0.028 % + 4 $\mu$ V 0.067 % + 5 $\mu$ V 0.13 % + 10 $\mu$ V 0.17 % + 20 $\mu$ V 0.36 % + 20 $\mu$ V	Fluke 5720A
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.026 % + 4 $\mu$ V 0.015 % + 4 $\mu$ V 0.015 % + 4 $\mu$ V 0.027 % + 4 $\mu$ V 0.055 % + 5 $\mu$ V 0.099 % + 10 $\mu$ V 0.14 % + 20 $\mu$ V 0.27 % + 20 $\mu$ V	
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.025 % + 12 $\mu$ V 0.013 % + 7 $\mu$ V 0.012 % + 7 $\mu$ V 0.021 % + 7 $\mu$ V 0.045 % + 17 $\mu$ V 0.078 % + 20 $\mu$ V 0.12 % + 25 $\mu$ V 0.26 % + 450 $\mu$ V	
220 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.023 % + 40 $\mu$ V 95 $\mu$ V/V + 15 $\mu$ V 62 $\mu$ V/V + 8 $\mu$ V 89 $\mu$ V/V + 10 $\mu$ V 0.012 % + 30 $\mu$ V 0.036 % + 80 $\mu$ V 0.093 % + 0.2 mV 0.15 % + 0.3 mV	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.023 % + 0.4 mV 84 $\mu$ V/V + 0.15 mV 46 $\mu$ V/V + 50 $\mu$ V 78 $\mu$ V/V + 0.1 mV 0.011 % + 0.2 mV 0.028 % + 0.6 mV 0.093 % + 2 mV 0.14 % + 3.2 mV	

Parameter/Range	Frequency	CMC <sup>2,5,7</sup> ( $\pm$ )	Comments
AC Voltage – Generate <sup>3</sup> (cont)			
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	0.023 % + 4 mV 0.010 % + 1.5 mV 76 $\mu$ V/V + 0.6 mV 0.01 % + 1 mV 0.015 % + 2.5 mV 0.082 % + 16 mV 0.43 % + 40 mV 0.71 % + 80 mV	Fluke 5720A
(220 to 330) V	45 Hz to 1kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.016 % + 2 mV 0.017 % + 6 mV 0.021 % + 6 mV 0.026 % + 6 mV 0.16 % + 50 mV	Fluke 5522A
(220 to 1100) V	50 Hz to 1 kHz	75 $\mu$ V/V + 3.5 mV	Fluke 5720A
(330 to 1020) V	(1 to 5) kHz (5 to 10) kHz	0.021 % + 10 mV 0.025 % + 10 mV	Fluke 5522A
AC Current – Measure <sup>3</sup>			
Up to 200 $\mu$ A	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.021 $\mu$ A + 0.000 50 $\mu$ A/ $\mu$ A 0.022 $\mu$ A + 0.000 50 $\mu$ A/ $\mu$ A 0.022 $\mu$ A + 0.000 71 $\mu$ A/ $\mu$ A	Fluke 8508
200 $\mu$ A to 2 mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz 30 kHz to 100 kHz	0.0002 mA + 0.000 31 mA/mA 0.0002 mA + 0.000 31 mA/mA 0.0002 mA + 0.000 71 mA/mA 0.0002 mA + 0.004 mA/mA	
(2 to 20) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz	0.0019 mA + 0.000 32 mA/mA 0.002 mA + 0.000 31 mA/mA 0.002 mA + 0.000 71 mA/mA 0.002 mA + 0.004 mA/mA	



Parameter/Range	Frequency	CMC <sup>2,5,7</sup> (±)	Comments
AC Current – Measure <sup>3</sup> (cont)			
(20 to 200) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.02 mA + 0.000 31 mA/mA 0.02 mA + 0.000 29 mA/mA 0.02 mA + 0.000 63 mA/mA	Fluke 8508
100 mA to 1 A	(20 to 50) kHz 10 Hz to 2 kHz	1.2 % + 0.4 mA 0.0002 A + 0.000 62 A/A	HP 3458A opt 002
200 mA to 2 A	(2 to 10) kHz (10 to 30) kHz	0.0002 A + 0.000 74 A/A 0.0002 A + 0.003 A/A	
(1 to 2) A	10 Hz to 5 kHz  (5 to 10) kHz	0.03 %  0.12 %	Fluke 8508 w/ Fluke Y5020A Fluke 8508 w/ Valhalla 2575A
(2 to 20) A	10 Hz to 5 kHz (5 to 10) kHz	0.09 % 0.58 %	Fluke 8508 Fluke Y5020A Valhalla 2575A
(20 to 100) A	10 Hz to 1 kHz	0.12 %	Fluke 8508 w/ Valhalla 2575A
AC Current – Generate <sup>3</sup>			
(0 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 16 nA 0.015 % + 10 nA 0.012 % + 8 nA 0.03 % + 12 nA 0.095 % + 65 nA	Fluke 5720A
220 µA to 2.2 mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 40 nA 0.017 % + 35 nA 0.015 % + 35 nA 0.021 % + 0.11 µA 0.093 % + 0.65 µA	

Parameter/Range	Frequency	CMC <sup>2, 5, 7</sup> (±)	Comments
AC Current – Generate <sup>3</sup> (cont)			
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 0.4 µA 0.016 % + 0.35 µA 0.013 % + 0.35 µA 0.02 % + 0.55 µA 0.092 % + 5 µA	Fluke 5720A
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.025 % + 4 µA 0.016 % + 3.5 µA 0.013 % + 2.5 µA 0.02 % + 3.5 µA 0.095 % + 10 µA	
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.027 % + 35 µA 0.041 % + 80 µA 0.61 % + 0.16 mA	
(2.2 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.055 % + 2 mA 0.084 % + 2 mA 2.4 % + 5 mA	Fluke 5522A
(11 to 20) A	(45 to 100) Hz 100 Hz to 1 kHz  (1 to 10) kHz	0.097 % + 5 mA 0.12 % + 5 mA  0.58 % of rng	Fluke 5522A  Vallhalla 2555A w/ Vallhalla 2575A
(11 to 100) A	20 Hz to 1 kHz	0.12 % of rng	Vallhalla 2555A w/ Vallhalla 2575A
Clamp-On Only Toroidal			
(20 to 1000) A	(45 to 65) Hz	0.97 % + 0.09 A	Fluke 5522A w/
(20 to 1000) A	(65 to 440) Hz	1.4 % + 0.1 A	Fluke 5500 coil
Non-Toroidal			
(20 to 1000) A	(45 to 65) Hz	1.3 % + 0.25 A	Fluke 5522A w/
(20 to 1000) A	(65 to 440) Hz	1.5 % + 0.9 A	Fluke 5500 coil

Parameter/Range	Frequency	CMC <sup>2, 5, 7</sup> ( $\pm$ )	Comments
Capacitance			
Generate <sup>3</sup> –			
(220.0 to 399.9) pF	10 Hz to 10 kHz	0.64 % + 0.01 nF	Fluke 5522A
(0.4 to 1.0999) nF	10 Hz to 10 kHz	0.42 % + 0.01 nF	
(1.1 to 3.2999) nF	10 Hz to 3 kHz	0.42 % + 0.01 nF	
(3.3 to 10.2999) nF	10 Hz to 1 kHz	0.42 % + 0.01 nF	
(11 to 32.999) nF	10 Hz to 1 kHz	0.23 % + 0.1 nF	
(33 to 109.99) nF	10 Hz to 1 kHz	0.22 % + 0.1 nF	
(110 to 329.99) nF	10 Hz to 1 kHz	0.27 % + 0.3 nF	
(0.33 to 1.0999) $\mu$ F	(10 to 600) Hz	0.21 % + 1 nF	
(1.1 to 3.2999) $\mu$ F	(10 to 300) Hz	0.25 % + 3 nF	
(3.3 to 10.999) $\mu$ F	(10 to 150) Hz	0.22 % + 10 nF	
(11 to 32.999) $\mu$ F	(10 to 120) Hz	0.34 % + 30 nF	
(33 to 109.99) $\mu$ F	(10 to 80) Hz	0.38 % + 100 nF	
(110 to 329.99) $\mu$ F	(0 to 50) Hz	0.38 % + 300 nF	
(0.33 to 1.099) mF	(0 to 20) Hz	0.37 % + 1 $\mu$ F	
(1.1 to 3.29) mF	(0 to 6) Hz	0.37 % + 3 $\mu$ F	
(3.3 to 10.99) mF	(0 to 2) Hz	0.37 % + 10 $\mu$ F	
(11 to 32.99) mF	(0 to 0.6) Hz	0.56 % + 30 $\mu$ F	
(33 to 110) mF	(0 to 0.2) Hz	0.88 % + 100 $\mu$ F	
Fixed Points <sup>3</sup> –			
1 pF	100 Hz to 1 kHz	0.038 %	HP 16381A
	1 kHz to 1 MHz	0.039 %	
	(1 to 2) MHz	0.058 %	
	(2 to 3) MHz	0.12 %	
	(3 to 4) MHz	0.2 %	
	(4 to 5) MHz	0.31 %	
	(5 to 10) MHz	1.2 %	
	(10 to 13) MHz	2.2 %	
10 pF	100 Hz to 1 kHz	0.037 %	HP 16382A, 16383A
	1 kHz to 1 MHz	0.037 %	
	(1 to 2) MHz	0.037 %	
	(2 to 3) MHz	0.037 %	
	(3 to 4) MHz	0.038 %	
	(4 to 5) MHz	0.041 %	
	(5 to 10) MHz	0.079 %	
	(10 to 13) MHz	0.15 %	
100 pF	100 Hz to 1 kHz	0.038 %	HP 16382A, 16383A
	1 kHz to 1 MHz	0.046 %	
	(1 to 2) MHz	0.046 %	
	(2 to 3) MHz	0.05 %	
	(3 to 4) MHz	0.059 %	
	(4 to 5) MHz	0.078 %	
	(5 to 10) MHz	0.18 %	
	(10 to 13) MHz	0.24 %	

Parameter/Range	Frequency	CMC <sup>2, 5</sup> (±)	Comments	
Capacitance – Generate, Fixed Points <sup>3</sup> (cont)	1000 pF	100 Hz to 1 kHz	0.037 %	HP 16384A
		1 kHz to 1 MHz	0.068 %	
		(1 to 2) MHz	0.079 %	
		(2 to 3) MHz	0.15 %	
		(3 to 4) MHz	0.19 %	
		(4 to 5) MHz	0.25 %	
		(5 to 10) MHz	0.61 %	
	(10 to 13) MHz	0.86 %		
0.01 μF	(0.12 to 100) kHz	0.13 %	HP 16385A	
0.1 μF	(0.12 to 100) kHz	0.13 %	HP 16386A	
1 μF	(0.12 to 100) kHz	0.13 %	HP 16386A	
Inductance – Generate, Fixed Points <sup>3</sup>	100 μH	2.3 %	Gen Rad 1490F	
	1 mH	2.4 %		
	10 mH	2.4 %		
	100 mH	1.2 %		

Parameter/Range	Frequency	CMC <sup>2, 5</sup> (±)	Comments
AC 4 Terminal Resistance –			
1 mΩ	DC	0.23 %	Agilent 42030A
10 mΩ	DC	0.23 %	
100 mΩ	DC	0.23 %	
1 Ω	DC	0.23 %	
10 Ω	DC	0.12 %	
	1 MHz	0.12 %	
	2 MHz	0.13 %	
	3 MHz	0.14 %	
	4 MHz	0.14 %	
	5 MHz	0.16 %	
	10 MHz	0.42 %	
	13 MHz	0.62 %	
100 Ω	DC	0.12 %	
	1 MHz	0.12 %	
	2 MHz	0.13 %	
	3 MHz	0.13 %	
	4 MHz	0.13 %	
	5 MHz	0.13 %	
	10 MHz	0.24 %	
	13 MHz	0.33 %	
1 kΩ	DC	0.12 %	
	100 kHz	0.12 %	
	1 MHz	0.12 %	
	2 MHz	0.12 %	
	3 MHz	0.12 %	
	4 MHz	0.13 %	
	5 MHz	0.13 %	
	10 MHz	0.24 %	
	13 MHz	0.33 %	
10 kΩ	DC	0.12 %	
	100 kHz	0.12 %	
	1 MHz	0.12 %	
100 kΩ	DC	0.12 %	
	100 kHz	0.13 %	
	1 MHz	0.13 %	

Parameter/Equipment	Range	CMC <sup>2, 5, 7</sup> ( $\pm$ )	Comments
Oscilloscope – Generate <sup>3</sup>			
DC Signal 50 $\Omega$ Load 1 M $\Omega$ Load	1 mV to 6.6 V (0 to 130) V	0.19 % + 40 $\mu$ V 0.039 % + 40 $\mu$ V	Fluke 5500A SC600
Squarewave Signal 50 $\Omega$ Load 1 M $\Omega$ Load	1.0 mV to 6.6 V <sub>pk-pk</sub> 1.0 mV to 130 V <sub>pk-pk</sub>	0.19 % + 40 $\mu$ V 0.078 % + 40 $\mu$ V*	* > 1 kHz, uncertainty is 0.25 % + 40 $\mu$ V
Edge Characteristics (50 $\Omega$ Load)	5 mV to 2.5 V	1.6 % + 0.2 mV	
Risetime (50 $\Omega$ Load)	$\leq$ 300 ps	(+ 0 / - 78) ps	
Level Sine Wave, into 50 $\Omega$ Load 5 mV <sub>pk-pk</sub> to 5.5 V <sub>pk-pk</sub>	50 kHz reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	1.9 % + 0.3 mV 2.9 % + 0.3 mV 3.3 % + 0.3 mV 4.8 % + 0.3 mV	Fluke 5500A SC600
Time Marker, 50 $\Omega$	5 s to 50 ms 20 ms to 2 ns	(25 + 1000t) $\mu$ s/s 25 $\mu$ s/s	t = time in seconds
DC High Voltage – Generate <sup>3</sup>	Up to 10 kV	0.33 % RNG	Fluke 410B
Electrical Calibration of Thermocouple Indicating Devices <sup>3</sup> –			
Type J	(-210 to -100) $^{\circ}$ C (-100 to 760) $^{\circ}$ C (760 to 1200) $^{\circ}$ C	0.21 $^{\circ}$ C 0.14 $^{\circ}$ C 0.18 $^{\circ}$ C	Fluke 5500A
Type K	(-200 to -100) $^{\circ}$ C (-100 to 120) $^{\circ}$ C (120 to 1000) $^{\circ}$ C (1000 to 1372) $^{\circ}$ C	0.2 $^{\circ}$ C 0.11 $^{\circ}$ C 0.15 $^{\circ}$ C 0.24 $^{\circ}$ C	
Type T	(-250 to -150) $^{\circ}$ C (-150 to 0) $^{\circ}$ C (0 to 120) $^{\circ}$ C (120 to 400) $^{\circ}$ C	0.2 $^{\circ}$ C 0.11 $^{\circ}$ C 0.1 $^{\circ}$ C 0.15 $^{\circ}$ C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Calibration of Thermocouple Indicating Devices <sup>3</sup> – (cont)  Type E	(-250 to -100) °C (-100 to 650) °C (650 to 1000) °C	0.39 °C 0.14 °C 0.17 °C	Fluke 5500A
Electrical Calibration of RTD Devices <sup>3</sup>  PT 385, 100 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.04 °C 0.04 °C 0.05 °C 0.08 °C 0.08 °C 0.1 °C 0.19 °C	Fluke 5522A

IV. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC <sup>2</sup> (±)	Comments
Attenuation <sup>3</sup> –  (1 to 2) dB (3 to 4) dB (5 to 6) dB (7 to 10) dB 11 dB  (1 to 6) dB (6 to 9) dB (10 to 11) dB	DC to 12.4 GHz       (12.4 to 18) GHz	0.77 dB 0.83 dB 0.9 dB 0.98 dB 1.1 dB  1.3 dB 1.4 dB 1.5 dB	HP 8494H 1 dB step attenuator

Parameter/Range	Frequency	CMC <sup>2</sup> (±)	Comments
Attenuation <sup>3</sup> – (cont)			
10 dB 20 dB 30 dB 40 dB 50 dB 60 dB 70 dB 80 dB 90 dB 100 dB 110 dB	DC to 12.4 GHz	0.91 dB 1.1 dB 1.3 dB 1.6 dB 1.9 dB 2.2 dB 2.6 dB 2.9 dB 3.2 dB 3.6 dB 3.9 dB	HP 8496H 10 dB step attenuator
10 dB 20 dB 30 dB 40 dB 50 dB 60 dB 70 dB 80 dB 90 dB 100 dB 110 dB	(12.4 to 18) GHz	1.2 dB 1.4 dB 1.7 dB 2.1 dB 2.5 dB 3 dB 3.4 dB 3.9 dB 4.3 dB 4.8 dB 5.2 dB	
RF Power (Tuned)– Measure <sup>3</sup>			
(10 to -100) dBm (-100 to -120) dBm (-120 to -127) dBm	(0.1 to 1.3) GHz	0.18 dB 0.22 dB 0.37 dB	HP 8902A w/ opt 050 and HP 11722A power sensor
(10 to -100) dBm (-100 to -120) dBm	(1.3 to 26) GHz	0.29 dB 0.31 dB	HP 8902A w/ 11793A down converter and HP 11792A power sensor
RF Absolute Power – Measure			
10 MHz to 18 GHz 100 kHz to 26 GHz	(-70 to -20) dB (-20 to 10) dB	0.16 dB 0.16 dB	HP 438A w/8481A/8482A/8484A



Parameter/Range	Frequency	CMC <sup>2</sup> (±)	Comments
RF Power – Generate  +25 dB	(0.1 to 1300) MHz	2.4 dB	HP 8447F opt H64 w/ HP8340B
RF Power – Generate <sup>3</sup>  (+13 to -56) dBm  (-13 to -16) dBm (-16 to -56) dBm  (0 to -18) dBm (-20 to -58) dBm (-60 to -98) dBm  (+16 to -119.9) dBm (-120 to -129.9) dBm  (+10 to -9.95) dBm (-10 to -19.95) dBm (-20 to -49.95) dBm (-50 to -79.95) dBm (-80 to -100) dbm (-100 to -110) dBm  (+18 to +10) dBm (+10 to -9.95) dBm (-10 to -19.95) dBm (-20 to -49.95) dBm (-50 to -79.95) dBm (-80 to -100) dbm (-100 to -110) dBm  (+18 to +10) dBm (+10 to -9.95) dBm (-10 to -19.95) dBm (-20 to -49.95) dBm (-50 to -79.95) dBm (-80 to -100) dbm (-100 to -110) dBm	0.001 Hz to 10 MHz  10 MHz to 20 MHz  200 Hz to 81 MHz 200 Hz to 81 MHz 200 Hz to 81 MHz  100 kHz to 2.56 GHz 100 kHz to 2.56 GHz  (0.05 to 2.3) GHz  (2.3 to 20) GHz  (20 to 26.5) GHz	0.24 dB  0.69 dB 1 dB  0.05 dB 0.11 dB 0.23 dB  1.4 dB 3.6 dB  1 dB 1.4 dB 1.7 dB 2.1 dB 2.4 dB 3.4 dB  2.1 dB 1.8 dB 2.3 dB 2.7 dB 3 dB 3.4 dB 4.3 dB  2.7 dB 2.3 dB 2.9 dB 3.2 dB 3.6 dB 4 dB 4.3 dB	Agilent 3325B    HP 3335A  HP 8663A  HP 8340B  HP 8340B



Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
Amplitude Modulation – Measure <sup>3</sup>			
Rate: 50 Hz to 10 kHz Depths: (5 to 99) %	150 kHz to 10 MHz	2.8 % + 1 digit	HP 8902A w/ HP 11722A power sensor
Rate: 20 Hz to 10 kHz Depths: Up to 99 %	150 kHz to 10 MHz	3.8 % + 1 digit	
Rate: 50 Hz to 50 kHz Depths: (5 to 99) %	10 MHz to 1.3 GHz	1.7 % + 1 digit	
Rate: 20 Hz to 100 kHz Depths: (5 to 99) %	10 MHz to 1.3 GHz	3.7 % + 1 digit	
Rate: 50 Hz to 50 kHz Depths: (5 to 99) %	(1.3 to 18) GHz	3.2 % + 1 digit	HP 8902A w/ HP 11792A power sensor
Rate: 20 Hz to 100 kHz Depths: Up to 99 %	10 MHz to 26.5 GHz	4.7 % + 1 digit	
Frequency Modulation – Measure <sup>3</sup>			
Rate: 20 Hz to 10 kHz Dev: ≤ 40 kHz pk	250 kHz to 10 MHz	2.9 % + 1 digit	HP 8902A w/ HP 11722A power sensor

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
Frequency Modulation – Measure <sup>3</sup> (cont)  Rate: 50 Hz to 100 kHz Dev: ≤ 400 kHz pk  Rate: 20 Hz to 200 kHz Dev: ≤ 400 kHz pk  Rate: 50 Hz to 100 kHz Dev: ≤ 400 kHz pk  Rate: 20 Hz to 200 kHz Dev: ≤ 400 kHz pk	10 MHz to 1.3 GHz  10 MHz to 1.3 GHz  10 MHz to 26.5 GHz  10 MHz to 1.3 GHz	1.9 % + 1 digit  6 % + 1 digit  3.5 % + 1 digit  6.6 % + 1 digit	HP 8902A w/ HP 11792A power sensor      
Phase Modulation – Measure <sup>3</sup>  Rate: 200 Hz to 10 kHz  Rate: 200 Hz to 20 kHz  Rate: 200 Hz to 20 kHz	150 kHz ≤ $f_c$ < 10 MHz  10 MHz ≤ $f_c$ ≤ 1.3 GHz  10 MHz ≤ $f_c$ ≤ 26.5 GHz	5.3 % + 1 digit  4.3 % + 1 digit  5.2 % + 1 digit	HP 8902A w/ HP 11722A power sensor    HP 8902A w/ HP 11792A power sensor  $f_c$ represents the frequency carrier
Power Meters, Fixed Points <sup>3</sup> –  Instrument Accuracy	(3, 10, 30, 100, 300) μW (1, 3, 10, 30, 100) mW	0.32 % 0.32 %	Range calibrator, Agilent 11683A

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
Pulse – Generate Transition Time  Width	(10 to 90) %  500 ps to 89 ms	6.1 %  230 ps	HP 8131A
Distortion – Measure Total Harmonic Distortion  ≥140 dB	10 Hz to 15.99 kHz 16 Hz to 110 kHz	1.5 dB 3.7 dB	Panasonic VP-7722A
Harmonic Distortion – Measure	30 Hz to 26.5 GHz 20 Hz to 20 kHz (20 to 100) kHz	3.0 dB 1.3 dB 2.3 dB	HP 8563E HP 8903B
ESD Guns	Contact & Air Discharge Voltage: (1 to 16) kV  Amplitude Rise Time	6 % 0.24 nS	Tektronix TDS 794D and SR -ESH
Surge Generator <sup>3</sup> –  Open Circuit Front Time Open Circuit Time to Half Value  Open Circuit Front Time Open Circuit Time to Half Value  Short Circuit Front Time Short Circuit Time to Half Value  Short Circuit Front Time Short Circuit Time to Half Time  Open Circuit Voltage Short Circuit Current	(1.2 to 50) μs (1.2 to 50) μs  (10 to 700) μs (10 to 700) μs  (8 to 20) μs (8 to 20) μs  (5 to 320) μs (5 to 320) μs  10 V to 6 kV (0.125 to 3) kA	0.06 μs 1.3 μs  0.06 μs 2.4 μs  0.24 μs 0.24 μs  0.17 μs 5.1 μs  4.6 % 6.2 %	Tektronix TDS 460 and P 6015A, Pearson 110s

Parameter/Range	Frequency	CMC <sup>2,5</sup> (±)	Comments
EFT/Burst Generator <sup>3</sup> – Voltage (±)			
Rise Time	10 V to 6 kV	5 %	Tektronix TDS 460 and P 6015A
Impulse Duration	5 ns ± 30 %	14 ns	
Burst Duration	50 ns ± 30 %	14 ns	
Burst Period	15 ms ± 20 %	0.19 ms	
Repetition Rate	300 ms ± 20 %	3.6 ms	

#### V. Mechanical

Parameter/Equipment	Range	CMC <sup>2,4,5</sup> (±)	Comments
Torque Wrench <sup>3</sup>	Up to 100 in·lb Up to 240 in·lb (20 to 650) ft·lb	0.13 % + 0.6R 0.13 % + 0.6R 0.13 % + 0.6R	AKO TSD 1200 torque calibrator
Pressure – Hydraulic <sup>3</sup>	(1 to 30) psi (30 to 100) psi (100 to 1000) psi (1000 to 10 000) psi	0.01 psi 0.03 psi 0.25 psi 2.2 psi	Pressure calibrator; Fluke 525B w/750 sensors
RPM – Measure <sup>3</sup> (Non-Contact)	(6 to 599.9) rpm (600 to 9999) rpm (10 000 to 99 999) rpm	1.2 rpm 0.6 rpm + 0.000 075 rpm/rpm 1.7 rpm + 0.000 073 rpm/rpm	Shimpo MT-200 optical tachometer
Vacuum	(-14 to 0) psi	0.0099 psi	Pressure calibrator Fluke 525B w/750 sensors
Scales <sup>3</sup>	(1 to 500) g (0.5 to 5) kg (50 to 300) lb	0.082 g 5.8 g 0.017 lb	Class 6 weights
Balances	(50 to 500) mg (5 to 100) g	0.029 mg 0.31 mg	Class S weights

Parameter/Equipment	Range	CMC <sup>2,4,5</sup> (±)	Comments
Torque Cells / Standards	(1 to 100) in/lbf (1 to 650) ft/lbf	0.014 % + 0.6R 0.08 % + 0.6R	Torque arm and class 6 weights
Force Gages	Up to 300 lbs	0.034 lb + 0.000 46 lb/lb	Class F weights

## VI. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2,5</sup> (±)	Comments
Temperature – Measure <sup>3</sup>	(-170 to 660) °C	0.023 °C	Hart 5626 PRT probe w/ Azonix 1011 T9 display
Temperature – Measuring Equipment <sup>3</sup>	(35 to 200) °C	0.024 °C	Hart 5626 PRT w/ Azonix 1011 display, Hart 6102 bath
Relative Humidity – Measuring Equipment <sup>3</sup>	11.5 % 33 % 75 %	1.4 % 1.4 % 1.4 %	Vaisala HMT-337
Relative Humidity – Measure <sup>3</sup>	(10 to 90) % RH	1.4 % RH	Vaisala HMT-337

## VII. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Timers and Stopwatches <sup>3</sup>	Per day/month	0.1 s/day	T-9 Timometer TM- 4500 from Helmut Klein
Frequency – Measuring Equipment, Fixed Point	10 MHz reference	4.1 parts in 10 <sup>11</sup> Hz/Hz	GPS w/ Symmetricon Xli

Parameter/Equipment	Range	CMC <sup>2,4</sup> ( $\pm$ )	Comments
Frequency – Measuring Equipment	1 mHz to 100 Hz 100 Hz to 100 kHz 100 kHz to 100 MHz 100 MHz to 26.5 GHz	8.2 parts in 10 <sup>8</sup> Hz/Hz 9.3 parts in 10 <sup>8</sup> Hz/Hz 9 parts in 10 <sup>9</sup> Hz/Hz 2.1 parts in 10 <sup>9</sup> Hz/Hz	GPS w/ Symmetricon Xli w/HP 3325B HP8904A HP8648C HP8340A
Frequency – Measure	1 mHz to 100 Hz 100 Hz to 100 kHz 100 kHz to 100 MHz 100 MHz to 26.5 GHz	8.2 parts in 10 <sup>8</sup> Hz/Hz 9.3 parts in 10 <sup>8</sup> Hz/Hz 7.4 parts in 10 <sup>9</sup> Hz/Hz 2.1 parts in 10 <sup>9</sup> Hz/Hz	GPS w/ Symmetricon Xli w/HP53131A HP 5352B
Optical Tachometers	(10 to 100 000) rpm	0.0037 % + 6R	HP 3325B

<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. CMCs 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> In the statement of CMC,  $L$  is the numerical value of the nominal length of the device measured in inches; and  $R$  is the resolution of the device.

<sup>5</sup> In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.

<sup>6</sup> “Supermicrometer” is a trademark owned by Pratt & Whitney Measurement Systems, Inc. of Broomfield, CT.

<sup>7</sup> The stated measured values are determined using indicated instruments (see comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMCs are expressed as either a specific value that covers the full range or as a percent or fraction of the reading plus fixed floor specification.

SATELLITE FACILITY

TRU CAL INTERNATIONAL, INC.  
 333 Pfingsten Rd  
 Northbrook, IL 60062  
 Scott Miller Phone: 630 238 8100

I. Mechanical

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Mass	5 g	2.5 mg	Mettler XP5003SDR Ohaus EX10202 AND GP-61K ASTM Class 1/2
	10 g	2.5 mg	
	20 g	2.5 mg	
	50 g	2.6 mg	
	100 g	2.6 mg	
	200 g	2.7 mg	
	300 g	2.8 mg	
	400 g	3 mg	
	500 g	3.1 mg	
	1 kg	26 mg	
	1.5 kg	27 mg	
	2 kg	28 mg	
	5 kg	38 mg	
	10 kg	0.11 g	
	20 kg	0.98 g	
	30 kg	1.1 g	
	40 kg	1.3 g	
	50 kg	1.4 g	
60 kg	1.5 g		

<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. CMCs 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.







## *Accredited Laboratory*

A2LA has accredited

**TRU CAL INTERNATIONAL INC.**

*Bensenville, IL*

for technical competence in the field of

**Calibration**

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/NCCL 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 April 2017).



Presented this 26<sup>th</sup> day of June 2018.

A handwritten signature in black ink, written over a horizontal line.

President and CEO  
For the Accreditation Council  
Certificate Number 1278.01  
Valid to December 31, 2019  
Revised July 6, 2018

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



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