



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid To: March 31, 2023

Certificate Number: 3441.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 7}:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 4, 9} (±)	Comments
DC Voltage – Measure	(0 to 120) mV (0 to 1.2) V (0 to 12) V (0 to 120) V (0 to 1050) V	530 nV + 6.3 nV/mV 0.53 μV + 5.2 μV/V 1.4 μV + 5.2 μV/V 53 μV + 7.4 μV/V 200 μV + 9.1 μV/V	Keysight 3458A (option 002)
DC Voltage – Generate	(0 to 330) mV (0.33 to 3.3) V (3.3 to 33) V (33 to 330) V (100 to 1020) V	0.0016 % + 0.000 81 mV 0.000 89 % + 0.000 0016 V 0.000 98 % + 0.000 016 V 0.0014 % + 0.000 13 V 0.0014 % + 0.0014 V	Fluke 5522A
DC Current – Measure	(0 to 120) nA (0 to 1.2) μA (0 to 12) μA (0 to 120) μA (0 to 1.2) mA (0 to 12) mA (0 to 120) mA (0 to 1.05) A	0.0035 % + 52 pA 0.0024 % + 52 pA 0.0026 % + 87 pA 0.0027 % + 760 pA 0.0025 % + 5.3 nA 0.0026 % + 53 nA 0.0045 % + 530 nA 0.013 % + 12 μA	Keysight 3458A



Parameter/Equipment	Range	CMC ^{2,4,9} (±)	Comments
DC Current – Generate	(0 to 329.999) μ A (0 to 3.299 99) mA (0 to 32.9999) mA (0 to 329.999) mA (0 to 1.099 99) A (1.1 to 2.999 99) A (0 to 10.9999) A (11 to 20.5) A	0.012 % + 0.016 μ A 0.0077 % + 0.000 042 mA 0.0077 % + 0.000 22 mA 0.008 % + 0.002 mA 0.016 % + 0.000 031 A 0.03 % + 0.000 021 A 0.039 % + 0.000 41 A 0.078 % + 0.000 52 A	Fluke 5522A
DC Resistance – Measure	(0 to 12) Ω (0 to 120) Ω (0 to 1.2) k Ω (0 to 12) k Ω (0 to 120) k Ω (0 to 1.2) M Ω (0 to 12) M Ω (0 to 120) M Ω * (0 to 1.2) G Ω *	0.0019 % + 0.07 m Ω 0.0016 % + 0.66 m Ω 0.0014 % + 0.0007 Ω 0.0014 % + 0.007 Ω 0.0014 % + 0.07 Ω 0.0019 % + 0.0024 k Ω 0.0061 % + 0.12 k Ω 0.06 % + 2.1 k Ω 0.58 % + 0.11 M Ω	Keysight 3458A 4-wire measurement * = 2-wire measurement
DC Resistance – Generate	(0 to 10.9999) Ω (11 to 32.9999) Ω (33 to 109.9999) Ω (110 to 329.9999) Ω (0.33 to 1.099 999) k Ω (1.1 to 3.299 999) k Ω (3.3 to 10.999 99) k Ω (11 to 32.999 99) k Ω (33 to 109.9999) k Ω (110 to 329.9999) k Ω (0.33 to 1.099 999) M Ω (1.1 to 3.299 999) M Ω (3.3 to 10.999 99) M Ω (11 to 32.999 99) M Ω (33 to 109.9999) M Ω (110 to 329.9999) M Ω (330 to 1100) M Ω	0.0046 % + 0.000 78 Ω 0.0017 % + 0.0014 Ω 0.0022 % + 0.0011 Ω 0.0022 % + 0.0016 Ω 0.0022 % + 0.000 0016 k Ω 0.0022 % + 0.000 016 k Ω 0.0022 % + 0.000 016 k Ω 0.0022 % + 0.000 16 k Ω 0.0022 % + 0.000 16 k Ω 0.0025 % + 0.0016 k Ω 0.0025 % + 0.000 0016 M Ω 0.0047 % + 0.000 023 M Ω 0.01 % + 0.000 039 M Ω 0.019 % + 0.0019 M Ω 0.039 % + 0.0023 M Ω 0.23 % + 0.078 M Ω 1.2 % + 0.39 M Ω	Fluke 5522A
Capacitance – Generate	(220 to 399.9) pF (0.4 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.9999) nF (11 to 32.9999) nF (33 to 109.999) nF	0.37 % + 8 pF 0.39 % + 0.0079 nF 0.4 % + 0.0078 nF 0.2 % + 0.008 nF 0.2 % + 0.077 nF 0.2 % + 0.076 nF	Fluke 5522A

Parameter/Equipment	Range	CMC ^{2,4,9} (±)	Comments
Capacitance – Generate (cont)	(110 to 329.999) nF (0.33 to 1.099 99) μF (1.1 to 3.299 99) μF (3.3 to 10.9999) μF (11 to 32.9999) μF (33 to 109.999) μF (110 to 329.999) μF (0.33 to 1.099 99) mF (1.1 to 3.2999) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 110) mF	0.2 % + 0.23 nF 0.2 % + 0.000 77 μF 0.2 % + 0.0023 μF 0.21 % + 0.0074 μF 0.32 % + 0.023 μF 0.37 % + 0.073 μF 0.36 % + 0.23 μF 0.35 % + 0.0008 mF 0.35 % + 0.0024 mF 0.35 % + 0.0077 mF 0.58 % + 0.023 mF 0.85 % + 0.078 mF	Fluke 5522A

Parameter/Range	Frequency	CMC ^{2,4,9} (±)	Comments
AC Voltage – Measure (1.2 to 12) mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.029 % + 0.0042 mV 0.012 % + 0.0027 mV 0.025 % + 0.0026 mV 0.11 % + 0.0022 mV 0.58 % + 0.0016 mV 4.6 % + 0.0025 mV	Keysight 3458A (synchronously sub-sampled computed true rms technique.)
(12 to 120) mV	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	0.009 % + 0.0046 mV 0.0088 % + 0.0023 mV 0.017 % + 0.0023 mV 0.036 % + 0.0023 mV 0.097 % + 0.0024 mV 0.35 % + 0.012 mV 1.2 % + 0.012 mV 1.7 % + 0.012 mV	
(0.12 to 1.2) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	0.009 % + 0.000 046 V 0.0086 % + 0.000 023 V 0.054 % + 0.000 022 V 0.036 % + 0.000 023 V 0.094 % + 0.000 024 V 0.35 % + 0.000 12 V 1.2 % + 0.000 12 V 1.7 % + 0.000 12 V	
(1.2 to 12) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz	0.009 % + 0.000 46 V 0.0086 % + 0.000 23 V 0.017 % + 0.000 23 V 0.036 % + 0.000 23 V	

Parameter/Range	Frequency	CMC ^{2, 4, 9} (±)	Comments
AC Voltage – Measure (cont)			
(1.2 to 12) V	(50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	0.093 % + 0.000 23 V 0.35 % + 0.0012 V 1.2 % + 0.0012 V 1.7 % + 0.0012 V	Keysight 3458A (synchronously sub-sampled computed true rms technique.)
(12 to 120) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.023 % + 0.0046 V 0.023 % + 0.0023 V 0.024 % + 0.0023 V 0.041 % + 0.0023 V 0.14 % + 0.0024 V 0.46 % + 0.012 V 1.7 % + 0.012 V	
(70 to 700) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.046 % + 0.046 V 0.047 % + 0.023 V 0.07 % + 0.023 V 0.14 % + 0.023 V 0.35 % + 0.023 V	
AC Voltage – Generate			
(1 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.064 % + 0.0049 mV 0.0096 % + 0.0075 mV 0.0076 % + 0.011 mV 0.061 % + 0.013 mV 0.27 % + 0.01 mV 0.14 % + 0.33 mV	Fluke 5522A (sine wave)
(33 to 330) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.023 % + 0.0067 mV 0.011 % + 0.0068 mV 0.013 % + 0.0067 mV 0.027 % + 0.0075 mV 0.062 % + 0.026 mV 0.16 % + 0.057 mV	
(0.33 to 3.3) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.028 % + 0.000 027 V 0.012 % + 0.000 046 V 0.015 % + 0.000 047 V 0.023 % + 0.000 04 V 0.055 % + 0.000 098 V 0.19 % + 0.000 47 V	

Parameter/Range	Frequency	CMC ^{2,4,9} (±)	Comments
AC Voltage – Generate (cont)			
(3.3 to 33) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.027 % + 0.000 37 V 0.012 % + 0.000 47 V 0.019 % + 0.000 48 V 0.027 % + 0.000 47 V 0.07 % + 0.0013 V	Fluke 5522A (sine wave)
(33 to 330) V	(45 to 1000) Hz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.015 % + 0.0018 V 0.016 % + 0.0048 V 0.02 % + 0.0046 V 0.025 % + 0.0041 V 0.16 % + 0.039 V	
(330 to 1020) V	(45 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	0.023 % + 0.0083 V 0.019 % + 0.013 V 0.023 % + 0.013 V	
AC Current – Measure			
(6 to 120) µA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.47 % + 0.035 µA 0.18 % + 0.035 µA 0.07 % + 0.035 µA 0.07 % + 0.035 µA	Keysight 3458A
(0.06 to 1.2) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.47 % + 0.000 23 mA 0.18 % + 0.000 23 mA 0.071 % + 0.000 23 mA 0.035 % + 0.000 23 mA 0.071 % + 0.000 23 mA 0.47 % + 0.000 47 mA 0.65 % + 0.0018 mA	
(0.6 to 12) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.47 % + 0.0023 mA 0.18 % + 0.0023 mA 0.071 % + 0.0023 mA 0.035 % + 0.0023 mA 0.071 % + 0.0023 mA 0.47 % + 0.0047 mA 0.65 % + 0.018 mA	
(6 to 120) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.47 % + 0.023 mA 0.18 % + 0.023 mA 0.071 % + 0.023 mA 0.035 % + 0.023 mA	

Parameter/Range	Frequency	CMC ^{2,4,9} (±)	Comments
AC Current – Measure (cont)			
(6 to 120) mA	(5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.071 % + 0.023 mA 0.47 % + 0.047 mA 0.65 % + 0.18 mA	Keysight 3458A
(0.05 to 1.05) A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.47 % + 0.000 24 A 0.19 % + 0.000 23 A 0.093 % + 0.000 23 A 0.12 % + 0.000 23 A 0.35 % + 0.000 24 A 1.2 % + 0.000 47 A	
AC Current – Generate			
(29 to 329.99) µA	(10 to 20) Hz (20 to 45) Hz (45 to 1000) Hz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.16 % + 0.078 µA 0.12 % + 0.078 µA 0.098 % + 0.078 µA 0.23 % + 0.12 µA 0.62 % + 0.16 µA 1.2 % + 0.31 µA	Fluke 5522A (sine wave)
(0.33 to 3.2999) mA	(10 to 20) Hz (20 to 45) Hz (45 to 1000) Hz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.16 % + 0.000 12 mA 0.098 % + 0.000 12 mA 0.078 % + 0.000 12 mA 0.16 % + 0.000 16 mA 0.4 % + 0.0002 mA 0.78 % + 0.000 46 mA	
(3.3 to 32.999) mA	(10 to 20) Hz (20 to 45) Hz (45 to 1000) Hz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.14 % + 0.0016 mA 0.071 % + 0.0016 mA 0.034 % + 0.0015 mA 0.064 % + 0.0015 mA 0.16 % + 0.0029 mA 0.32 % + 0.0031 mA	
(33 to 329.99) mA	(10 to 20) Hz (20 to 45) Hz (45 to 1000) Hz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.14 % + 0.015 mA 0.071 % + 0.015 mA 0.033 % + 0.015 mA 0.079 % + 0.039 mA 0.16 % + 0.077 mA 0.32 % + 0.15 mA	
(0.33 to 1.099 99) A	(10 to 45) Hz (45 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	0.14 % + 0.000 068 A 0.04 % + 0.000 077 A 0.47 % + 0.000 78 A 1.9 % + 0.0039 A	

Parameter/Range	Frequency	CMC ^{2,3,4,9} (±)	Comments
AC Current – Generate (cont)			
(1.1 to 2.999 99) A	(10 to 45) Hz (45 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	0.14 % + 0.000 061 A 0.059 % + 0.000 044 A 0.47 % + 0.000 76 A 1.9 % + 0.0039 A	Fluke 5522A (sine wave)
(3 to 10.9999) A	(10 to 45) Hz (45 to 1000) Hz (1 to 5) kHz	0.051 % + 0.0016 A 0.081 % + 0.0016 A 2.3 % + 0.0016 A	
(11 to 20.5) A	(10 to 45) Hz (45 to 1000) Hz (1 to 5) kHz	0.095 % + 0.0039 A 0.12 % + 0.0039A 2.3 % + 0.0039 A	
AC Power – Generate			
(45 to 65) Hz	(0.1 to 3) mW (0.3 to 10.9) mW (1.09 to 30) mW (3 to 109) mW (10.9 to 300) mW (30 to 726) mW (0.072 to 1.49) W (0.148 to 6.77) W (0.001 to 9.18) W (0.003 to 33.7) W (0.01 to 91.8) W (0.03 to 337) W (0.1 to 918) W (0.3 to 2244) W (0.72 to 4590) W (1.49 to 20 910) W	0.11 % 0.079 % 0.11 % 0.079 % 0.1 % 0.095 % 0.1 % 0.088 % 0.094 % 0.063 % 0.094 % 0.063 % 0.086 % 0.081 % 0.097 % 0.081 %	Fluke 5522A (sine wave)

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Electrical Calibration of Thermocouple Indicating Devices – Measure & Generate			
Type B	(600 to 800) °C (800 to 1000) °C	0.37 °C 0.3 °C	Fluke 5522A

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Electrical Calibration of Thermocouple Indicating Devices – Measure & Generate (cont)			
Type B	(1000 to 1550) °C (1550 to 1820) °C	0.29 °C 0.3 °C	Fluke 5522A
Type C	(0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.26 °C 0.25 °C 0.28 °C 0.41 °C 0.67 °C	
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.41 °C 0.18 °C 0.16 °C 0.18 °C 0.21 °C	
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.24 °C 0.18 °C 0.16 °C 0.18 °C 0.22 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.28 °C 0.19 °C 0.18 °C 0.24 °C 0.34 °C	
Type L	(-200 to -100) °C (-100 to 800) °C (800 to 900) °C	0.31 °C 0.24 °C 0.18 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.34 °C 0.21 °C 0.19 °C 0.19 °C 0.25 °C	
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.46 °C 0.3 °C 0.3 °C 0.35 °C	

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Electrical Calibration of Thermocouple Indicating Devices – Measure & Generate (cont)			Fluke 5522A
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.39 °C 0.31 °C 0.33 °C 0.39 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.51 °C 0.22 °C 0.18 °C 0.17 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.45 °C 0.24 °C	

II. Electrical – RF/Microwave

Parameter/Equipment	Frequency	CMC ^{2,4,5,8} (±)	Comments
Absolute Power – Measure			
(-30 to 10) dBm (10 to 20) dBm	100 kHz to 4.2 GHz	0.082 dB 0.17 dB	Agilent E4418B with Agilent HP 8482A
(-30 to 10) dBm (10 to 20) dBm	50 MHz to 26.5 GHz	0.098 dB 0.18 dB	Agilent E4418B with Agilent HP 8485A
(-30 to 10) dBm (10 to 20) dBm	50 MHz to 50 GHz	0.19 dB 0.24 dB	Agilent E4418B with Agilent HP 8487A

III. Time & Frequency

Parameter/Equipment	Frequency	CMC ^{2,8} (±)	Comments
Frequency – Measure	10 MHz	13 pHz/Hz	Keysight 53132A counter, Keysight 58503A

Parameter/Equipment	Frequency	CMC ^{2, 8} (\pm)	Comments
Frequency – Generate	10 MHz	1.5 pHz/Hz	Keysight 58503A

- ¹ This laboratory offers commercial calibration service.
- ² 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.
- ³ In the statement of CMC, percentages are percent of reading, unless otherwise indicated.
- ⁴ The contributions from the "best existing device" are not included in the CMC claim for this parameter.
- ⁵ CMC does not include mismatch between the power sensor and device under test.
- ⁶ After 24 hours of GPS lock and interrupted tracking of 4 or more satellites
- ⁷ This scope meets A2LA's P112 Flexible Scope Policy.
- ⁸ The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.
- ⁹ The stated measured values are determined using the indicated instrument (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 fraction/percentage of the reading plus a fixed floor specification.



Accredited Laboratory

A2LA has accredited

CALRIGHT INSTRUMENTS, INC

San Diego, CA

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *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 April 2017*).



Presented this 23rd day of April 2021.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3441.01
Valid to March 31, 2023

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