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

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CALIBRATION

Valid To: September 30, 2024 Certificate Number: 1395.20

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations[1, 9]:

I. Dimensional

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Calipers	Up to 72 in	(310 + 7.5*L*) µin	Gage blocks
Cylindrical Ring Gages	(0.04 to 1) in (>1 to 4) in (>4 to 12) in	7.5 µin (5.9 + 1.6*L*) µin (8.8 + 1.4*L*) µin	Pratt &Whitney LabMaster™, gage blocks
Linear Indicators – Digital & Analog	Up to 1 in: 20 µin resolution 50 µin resolution 100 µin resolution 0.001 in resolution	 (4.4 + 2.1*L*) µin (6.7 + 2.1*L*) µin (49 + 7.4*L*) µin (150 + 7.4*L*) µin	Pratt & Whitney Labmaster™
Gage Blocks	(0.05 to 1) in (>1 to 4) in (>4 to 12) in	2.7 µin (1.7 + 1.4*L*) µin (8.9 + 1.0*L*) µin	Master short gage block set, federal 130B-24 comparator Master long gage block set, Pratt & Whitney LabMaster™

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Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Height Masters & Height Gages	Up to 24 in	(30 + 1.3*L*) µin	Gage blocks, amplifier, surface plate
End Standards, Micrometer Standards, End Rods	Up to 12 in	(5.9 + 1.8*L*) µin	Pratt & Whitney LabMaster™, gage blocks
Cylindrical Plug Gages & Master Discs	Up to 12 in	(3.9 + 1.8*L*) µin	Pratt & Whitney LabMaster™, gage blocks
Micrometers –	Up to 36 in: 100 µin resolution 50 µin resolution	 (100 + 11*L*) µin (50 + 11*L*) µin	Gage blocks
Flatness	Up to 1 in Diameter	7.3 µin	Optical flat
Parallelism	Up to 0.001 in	16 µin	Optical parallel
Optical Flats	Up to 3 in Diameter	4.7 µin	3 in Van Keuren master optical flat
Thread Plugs –			Pratt & Whitney Supermicrometer™ with:
UN (60° threads)	Pitch Diameter: Up to 12 in, Pitch: (4 to 80) TPI	(70 + 4.2*L*) µin	thread wires (english)
	Pitch Diameter: (1 to 300) mm, Pitch: (0.3 to 4) mm	(1.8 + 0.043*L*) µm	Thread wires (metric)
UN	Major Diameter: Up to 12 in	(27 + 4.2*L*) µin	Sine fixture & thread wires (english)
National Pipe (NPT)	Pitch Diameter: Up to 3 in Diameter, Pitch: (8 to 27) TPI	(99 + 3.6*L*) µin	Surface plate, gage blocks, electronic indicator
	Notch Height: Up to 1.5 in	160 µin	

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Granite Surface Plates[3] –			
Repeat Reading	TIR ± 0.002 in	29 µin	Repeat-O-Meter
Flatness	Up to 30 in D^6 (>0 to 160) in D^6	(25 + 0.41L) µin (43 + 0.41L) µin	Federal 832 (moody method)
Optical Comparators[3] –			
Linear Travel	Up to 6 in	(86 + 8.1L) µin	Stage micrometer
Angle[8]	± 45 degrees	38 arc seconds + 0.6R	Angle blocks
Angle – Measuring Equipment	(-180 to 180)°	45 arc seconds	Starrett optical comparator
Glass Scales	Up to 8 in	(77 + 2.8L) µin	Pratt & Whitney LabMaster™ with gage blocks
Adjustable Thread Rings –			
(UN)	Up to 1.5 in (>1.5 to 7.8) in	(210 + 5.8L) µin (310 + 5.8L) µin	Class W thread setting plugs
Thread Wires (Constant) –			Pratt & Whitney LabMaster™[, 6] with master thread wires:
60° Thread Wire Size – Wire Set	(4 to 80) TPI Constant	5.5 µin (17 µin)	English set
	(0.3 to 6) mm Constant	0.14 µm (0.42 µm)	Metric set

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Rulers & Tape Measures	Up to 40 in	(0.0014 in + 43L) µin	Denmark designs linear encoder

	Up to 7 in	(96 + 10*L*) µin	Starrett optical comparator

II. Electrical – DC/Low Frequency

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Current[3] – Generate			
(22 to 220) µA	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.026 % + 16 nA 0.017 % + 10 nA 0.013 % + 8 nA 0.032 % + 12 nA 0.11 % + 8.4 µA	Fluke 57XXA/EP calibrator
(0.22 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	0.026 % + 54 nA 0.017 % + 51 nA 0.013 % + 51 nA 0.021 % + 0.12 µA 0.11 % + 0.65 µA	
(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	0.028 % + 0.40 µA 0.017 % + 0.35 µA 0.013 % + 0.35 µA 0.021 % + 0.55 µA 0.11 % + 5.0 µA	
(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	0.028 % + 4.0 µA 0.017 % + 3.5 µA 0.013 % + 2.5 µA 0.021 % + 3.5 µA 0.11 % + 10 µA	
(0.22 to 2.2) A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.027 % + 35 µA 0.046 % + 80 µA 0.70 % + 0.16 mA	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Current[3] – Generate (cont)			
(2.2 to 3) A	45 Hz to 1 kHz (1 to 5) kHz	0.047 % + 0.084 mA 0.47 % + 0.78 mA	Fluke 57XXA/EP calibrator
(3 to 11) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.047 % + 1.6 mA 0.081 % + 1.6 mA 2.3 % + 1.6 mA	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.11 % + 1.6 mA 0.11 % + 3.9 mA 2.3 % + 3.9 mA	Fluke 552XA calibrator, LComp on
AC Current[3] – Measure			
(5 to 100) µA	45 Hz to 1 kHz	0.072 % + 0.035 µA	HP 3458A multimeter
(0.1 to 1) mA	(45 to 100) Hz 100 Hz to 5 kHz	0.070 % + 0.23 µA 0.037 % + 0.23 µA	
(1 to 10) mA	(45 to 100) Hz 100 Hz to 5 kHz	0.070 % + 2.3 µA 0.037 % + 2.3 µA	
(10 to 100) mA	(45 to 100) Hz 100 Hz to 5 kHz	0.070 % + 23 µA 0.037 % + 23 µA	
(0.1 to 1) A	(45 to 100) Hz 100 Hz to 5 kHz	0.093 % + 0.23 mA 0.12 % + 0.23 mA	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage[3] – Generate			
(0.22 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 (0.5 to 1) MHz	0.19 % + 4.0 µV 0.11 % + 4.0 µV 0.085 % + 4.0 µV 0.15 % + 4.0 µV 0.20 % + 5.0 µV 0.36 % + 10 µV 0.52 % + 20 µV 0.66 % + 20 µV	Fluke 57XXA/EP
(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 (0.5 to 1) MHz	0.026 % + 4.0 µV 0.012 % + 4.0 µV 0.011 % + 4.0 µV 0.026 % + 4.0 µV 0.057 % + 5.0 µV 0.11 % + 10 µV 0.15 % + 20 µV 0.29 % + 20 µV	
(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 (0.5 to 1) MHz	0.024 % + 12 µV 99 µV/V + 7.5 µV 83 µV/V + 7.5 µV 0.020 % + 7.5 µV 0.047 % + 17 µV 0.091 % + 20 µV 0.14 % + 25 µV 0.28 % + 45 µV	
(0.22 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 (0.5 to 1) MHz	0.026 % + 0.26 mV 97 µV/V + 0.26 mV 50 µV/V + 0.26 mV 81 µV/V + 0.26 mV 0.012 % + 0.26 mV 0.043 % + 0.27 mV 0.10 % + 0.33 mV 0.17 % + 0.40 mV	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage[3] (cont) – Generate			
(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 (0.5 to 1) MHz	0.024 % + 0.40 mV 92 µV/V + 0.15 mV 49 µV/V + 62 µV 81 µV/V + 0.11 mV 0.011 % + 0.20 mV 0.029 % + 0.60 mV 0.10 % + 2.0 mV 0.15 % + 3.2 mV	Fluke 57XXA/EP
(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 (0.5 to 1) MHz	0.024 % + 4.8 mV 92 µV/V + 3.0 mV 56 µV/V + 2.6 mV 90 µV/V + 2.8 mV 0.016 % + 3.6 mV 0.090 % + 16 mV 0.44 % + 40 mV 0.80 % + 80 mV	
(220 to 1100) V	(15 to 50) Hz 50 Hz to 1 kHz	0.030 % + 16 mV 76 µV/V + 4.3 mV	
(330 to 1020) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.024 % + 9.4 mV 0.02 % + 8.6 mV 0.024 % + 9.0 mV	Fluke 552XA calibrator
AC Voltage[3] – Measure			
(1 to 10) 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	0.035 % + 3.5 µV 0.023 % + 1.3 µV 0.035 % + 1.3 µV 0.012 % + 1.3 µV 0.6 % + 1.3 µV 4.6 % + 2.3 µV	HP 3458A
(10 to 100) 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 (0.3 to 1) MHz	89 µV/V + 4.6 µV 89 µV/V + 2.3 µV 0.017 % + 2.3 µV 0.035 % + 2.3 µV 0.093 % + 2.3 µV 0.35 % + 12 µV 1.2 % + 12 µV	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage[3] – Measure (cont)			
(0.1 to 1) 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 (0.3 to 1) MHz	89 µV/V + 46 µV 89 µV/V + 23 µV 0.017 % + 23 µV 0.035 % + 23 µV 0.093 % + 23 µV 0.35 % + 0.12 mV 1.2 % + 0.12 mV	HP 3458A
(1 to 10) 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 (0.3 to 1) MHz	89 µV/V + 0.47 mV 89 µV/V + 0.23 mV 0.017 % + 0.23 mV 0.035 % + 0.23 mV 0.093 % + 0.23 mV 0.35 % + 1.2 mV 1.2 % + 1.2 mV	
(10 to 100) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.023 % + 4.6 mV 0.023 % + 2.3 mV 0.023 % + 2.3 mV 0.041 % + 2.3 mV 0.14 % + 2.3 mV	
(100 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 % + 47 mV 0.046 % + 24 mV 0.069 % + 23 mV 0.14 % + 23 mV 0.35 % + 23 mV	

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
AC Current – Clamp Meters[3]	(0 to 500) A, (45 to 400) Hz (500 to 1000) A, (45 to 400) Hz	0.37 % + 0.097 A 0.38 % + 0.2 A	Fluke 552XA & 5500A/COIL

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
DC Current[3] – Generate	0 µA (0 to 220) µA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (1.1 to 3.0) A (3.0 to 11) A (11 to 20.5) A	0.4 nA 42 µA/A + 6.2 nA 36 µA/A + 7.2 nA 37 µA/A + 40 nA 46 µA/A + 0.75 µA 82 µA/A + 12 µA* 0.03 % + 34 µA 0.04 % + 0.39 mA 0.079 % + 0.65 mA	Reference open Fluke 57XXA/EP *add (±200 × I²) µA/A for (>100 to 220) mA & (±10 × I²) µA/A for (>1 to 2.2) A Fluke 552XA
DC Current – Clamp Meters[3]	(0 to 1000) A	0.37 % + 0.065 A	Fluke 552XA & 5500A/COIL
DC Current[3] – Measure	0 A (0 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	0.4 nA 28 µA/A + 1.1 nA 28 µA/A + 7.5 nA 28 µA/A + 75 nA 44 µA/A + 0.75 µA 0.013 % + 16 µA	Reference open HP 3458A opt 002
DC Voltage[3] – Generate	0 V (0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1000) V	27 nV 8.6 µV/V + 1.3 µV 5.2 µV/V + 1.4 µV 3.7 µV/V + 3.1 µV 3.7 µV/V + 4.9 µV 5.2 µV/V + 47 µV 6.9 µV/V + 0.43 mV	Reference short Fluke 57XXA/EP
DC Voltage[3] – Measure	0 V (0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	27 nV 6.9 µV/V + 0.45 µV 5.4 µV/V + 0.46 µV 5.4 µV/V + 0.94 µV 8 µV/V + 45 µV 8 µV/V + 0.23 mV*	Reference short HP 3458A opt 002 *Add 12 µV/V $(V_{in}/1000)^2$ for inputs >100 V

Parameter/Equipment	Range	CMC[2, 4, 7] (±)	Comments
Resistance[3] – Generate			
Fixed Values	0 Ω 1.0 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1.0 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1.0 MΩ 1.9 MΩ 100 MΩ 19 MΩ 100 MΩ	1.2 μΩ + 0.6*R* 98 μΩ/Ω 96 μΩ/Ω 26 μΩ/Ω 27 μΩ/Ω 11 μΩ/Ω 13 μΩ/Ω 9.2 μΩ/Ω 9.8 μΩ/Ω 9.0 μΩ/Ω 9.5 μΩ/Ω 12 μΩ/Ω 13 μΩ/Ω 21 μΩ/Ω 23 μΩ/Ω 45 μΩ/Ω 52 μΩ/Ω 0.011 %	Reference short Fluke 57XXA/EP
Variable	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ (0.33 to 1.1) MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (0.33 to 1.1) GΩ	32 μΩ/Ω + 0.78 mΩ 24 μΩ/Ω + 1.2 mΩ 22 μΩ/Ω + 1.1 mΩ 22 μΩ/Ω + 1.6 mΩ 22 μΩ/Ω + 1.6 mΩ 22 μΩ/Ω + 16 mΩ 22 μΩ/Ω + 16 mΩ 22 μΩ/Ω + 0.16 Ω 22 μΩ/Ω + 0.16 Ω 28 μΩ/Ω + 1.6 Ω 28 μΩ/Ω + 1.6 Ω 52 μΩ/Ω + 24 Ω 0.011 % + 40 Ω 0.021 % + 2 kΩ 0.041 % + 2.7 kΩ 0.24 % + 80 kΩ 1.2 % + 0.39 MΩ	Fluke 552XA

Parameter/Range	Frequency	CMC[2, 4, 7] (±)	Comments
Resistance[3] – Measure	0 Ω (0 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1.0) GΩ	1.2 μΩ + 0.6*R* 19 μΩ/Ω + 85 μΩ 16 μΩ/Ω + 0.82 mΩ 14 μΩ/Ω + 0.82 mΩ 14 μΩ/Ω + 8.2 mΩ 14 μΩ/Ω + 83 mΩ 20 μΩ/Ω + 2.7 Ω 62 μΩ/Ω + 0.12 kΩ 0.059 % + 3.7 kΩ 0.6 % + 0.26 MΩ	Reference short HP 3458A
Capacitance – Generate	(0.19 to 0.3999) nF (0.4 to 1.039 99) nF (1.1 to 3.2999) nF (3.3 to 10.9999) nF (11 to 32.9999) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.09999) μF (1.1 to 3.29999) 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	0.44 % + 8.1 pF 0.39 % + 8.1 pF 0.39 % + 8.1 pF 0.20 % + 8.1 pF 0.20 % + 78 pF 0.20 % + 80 pF 0.20 % + 0.23 nF 0.20 % + 0.78 nF 0.20 % + 2.3 nF 0.20 % + 23 nF 0.31 % + 23 nF 0.35 % + 78 nF 0.35 % + 0.23 μF 0.35 % + 0.78 μF 0.35 % + 2.3 μF 0.35 % + 7.8 μF 0.60 % + 23 μF 0.85 % + 78 μF	Fluke 552XA

Parameter/Equipment	Range	CMC[2] (±)	Comments
Electrical Simulation of Thermocouples[3] –			
Type E	(-270 to -200) °C (-200 to 0) °C (0 to 600) °C (600 to 1000) °C	0.091 °C 0.049 °C 0.041 °C 0.044 °C	Fluke 552XA Vdc output mode with external thermocouple reference probe
Type J	(-210 to -100) °C (-100 to 900) °C (900 to 1200) °C	0.056 °C 0.050 °C 0.054 °C	
Type K	(-270 to -200) °C (-200 to -100) °C (-100 to 600) °C (600 to 1000) °C (1000 to 1372) °C	0.15 °C 0.068 °C 0.053 °C 0.060 °C 0.069 °C	
Type N	(-270 to -200) °C (-200 to 0) °C (0 to 1300) °C	0.23 °C 0.094 °C 0.070 °C	
Type R/S	(-50 to 0 °C (0 to 500) °C (500 to 1768) °C	0.35 °C 0.29 °C 0.28 °C	
Type T	(-270 to -200) °C (-200 to 0) °C (0 to 400) °C	0.13 °C 0.068 °C 0.049 °C	

Parameter/Equipment	Range	CMC[2, 5, 7] (±)	Comments
Oscilloscopes[3] –			
DC Signal	± 1 mV to ± 200 V_{dc} (into 50 Ω) ± 1 mV to ± 50 V_{dc} (into 1 MΩ)	0.061 % + 25 µV	Fluke 9500B Oscilloscope calibrator with 9530/9560 active heads
Square Wave	40 µV to <1 mV_{pk-pk} 1 mV to 200 V_{pk-pk}	0.83 % + 10 µV 0.16 % + 10 µV	
Leveled Sine Wave:	50 kHz Reference Amplitude	1.2 %	
5 mV to 5 V	0.1 Hz to 300 MHz (>300 to 550) MHz (>0.55 to 2.5) GHz	2.2 % 2.5 % 2.8 %	
5 mV to 2 V	(>2.5 to 3.0) GHz (>3.0 to 6.5) GHz	2.8 % 3.5 %	
Edge Transition	500 ps, (10 Hz to 2 MHz rate) 150 ps, (10 Hz to 2 MHz rate) 70 ps, (10 Hz to 1 MHz rate)	33 ps 14 ps 8 ps	
Timing Marker Functions	9.0091 ns to <83 µs ≥83 µs to 55 s	0.2 µs/s 2.3 µs/s	
Pulse Width	(1 to 100) ns	4.1 % + 200 ps	

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2, 5, 7] (±)	Comments
Amplitude Modulation – Measure			
Rate: 50 Hz to 10 kHz Depth: (5 to 99) %	150 kHz to 10 MHz	2.1 % + 1 digit	HP 8902A measuring receiver with 11722/92A sensors & 11793A mixer
Rate: 20 Hz to 10 kHz Depth: to 99 %	150 kHz to 10 MHz	3 % + 1 digit	
Rate: 50 Hz to 50 kHz Depth: (5 to 99) %	>10 MHz to 1.3 GHz	1.1 % + 1 digit	
Rate: 20 Hz to 100 kHz Depth: to 99 %	>10 MHz to 1.3 GHz	3 % + 1 digit	
Rate: 50 Hz to 50 kHz Depth: (5 to 99) %	(>1.3 to 26.5) GHz	1.6 % + 1 digit	
Rate: 20 Hz to 100 kHz Depth: to 99 %	(>1.3 to 26.5) GHz	3 % + 1 digit	
Frequency Modulation – Measure			
Rate: 20 Hz to 10 kHz Dev: <40 kHz/pk	250 kHz, 10 MHz	2 % + 1 digit	HP 8902A measuring receiver
Rate: 50 Hz to 100 kHz Dev: <400 kHz/pk	10 MHz to 26.5 GHz	1.1 % + 1 digit	
Rate: 20 Hz to 200 kHz Dev: <400 kHz/pk	10 MHz to 26.5 GHz	5 % + 1 digit	
Frequency Response (Flatness)	(0.1 to 20) MHz @ 1 Vrms (>20 to 50) MHz @ 1 Vrms (>50 to 100) MHz @ 1 Vrms (0.1 to 20) MHz @ 3 Vrms (>20 to 50) MHz @ 3 Vrms (>50 to 100) MHz @ 3 Vrms	0.16 % 0.61 % 1.8 % 0.48 % 0.75 % 1.4 %	Thermal converters & DMM

Parameter/Range	Frequency	CMC[2, 5, 7] (±)	Comments
RF Attenuation – Measure			
(0 to 10) dB	0.1 MHz to 1.3 GHz	0.064 dB	HP 8902A measuring receiver with 11722A sensor
(>10 to 20) dB		0.068 dB	
(>20 to 30) dB		0.079 dB	
(>30 to 40) dB		0.079 dB	
(>40 to 50) dB		0.095 dB	
(>50 to 60) dB		0.12 dB	
(>60 to 70) dB		0.14 dB	
(>70 to 80) dB		0.16 dB	
(>80 to 90) dB		0.20 dB	
(>90 to 100) dB		0.22 dB	
(>100 to 110) dB		0.33 dB	
(0 to 10) dB	(>1.3 to 18) GHz	0.078 dB	HP 8902A measuring receiver with 11792A sensor
(>10 to 20) dB		0.083 dB	
(>20 to 30) dB		0.093 dB	
(>30 to 40) dB		0.1 dB	
(>40 to 50) dB		0.13 dB	
(>50 to 60) dB		0.15 dB	
(>60 to 70) dB		0.17 dB	
(>70 to 80) dB		0.2 dB	
(>80 to 90) dB		0.23 dB	
(>90 to 100) dB		0.33 dB	
(>100 to 110) dB		0.34 dB	
(0 to 10) dB	(>18 to 26.5) GHz	0.095 dB	
(>10 to 20) dB		0.097 dB	
(>20 to 30) dB		0.1 dB	
(>30 to 40) dB		0.12 dB	
(>40 to 50) dB		0.14 dB	
(>50 to 60) dB		0.16 dB	
(>60 to 70) dB		0.17 dB	
(>70 to 80) dB		0.21 dB	
(>80 to 90) dB		0.23 dB	
(>90 to 100) dB		0.32 dB	
(>100 to 110) dB		0.34 dB	

Parameter/Range	Frequency	CMC[2, 5, 7] (±)	Comments
Absolute RF Power – Measure	0 dBm at 50 MHz	0.6 %	Power meter & thermistor with DC substitution
1 µW to 100 mW* (-30 to +20 dBm)	(100 to 300) kHz >300 kHz to 1 MHz >1 MHz to 2 GHz (>2 to 12.4) GHz (>12.4 to 18) GHz (>18 to 26.5) GHz (>26.5 to 40) GHz (>40 to 50) GHz	1.7 % + 140 nW 1.2 % + 140 nW 1.2 % + 140 nW 1.6 % + 140 nW 2.3 % + 140 nW 2.4 % + 140 nW 2.8 % + 140 nW 4.1 % + 140 nW	8480-series power sensors & EPM-series meter, *add 1.9 % to CMC for sensor linearity at levels greater than 10 mW (+10 dBm)
100 pW to 1.0 µW (-70 to -30 dBm)	(0.05 to 0.1) GHz (0.1 to 2) GHz (>2 to 12.4) GHz (>12.4 to 18) GHz (>18 to 34) GHz (>34 to 40) GHz (>40 to 50) GHz	2.5 % + 57 pW 1.9 % + 57 pW 1.8 % + 57 pW 2.1 % + 57 pW 2.9 % + 57 pW 3.4 % + 57 pW 5.4 % + 57 pW	8487D power sensor & EPM-series meter

Parameter/Range	Frequency	CMC[2, 5, 7] (±)	Comments
Tuned RF Power – Measure			
100 kHz to 1.3 GHz	(+10 to 0) dBm (<0 to -10) dBm (<-10 to -20) dBm (<-20 to -30) dBm (<-30 to -40) dBm (<-40 to -50) dBm (<-50 to -60) dBm (<-60 to -70) dBm (<-70 to -80) dBm (<-80 to -90) dBm (<-90 to -100) dBm (<-100 to -110) dBm (<-110 to -120) dBm	2.5 % 2.5 % 2.7 % 3.2 % 3.5 % 3.8 % 4.2 % 5 % 5.4 % 5.9 % 6.4 % 6.9 % 13 %	HP 8902A measuring receiver with 11722A sensor
(>1.3 to 18) GHz	(+10 to 0) dBm (<0 to -10) dBm (<-10 to -20) dBm (<-20 to -30) dBm (<-30 to -40) dBm (<-40 to -50) dBm (<-50 to -60) dBm (<-60 to -70) dBm (<-70 to -80) dBm (<-80 to -90) dBm (<-90 to -100) dBm (<-100 to -110) dBm (<-110 to -120) dBm	2.5 % 2.6 % 2.7 % 3 % 3.4 % 3.8 % 4.2 % 5 % 5.4 % 5.9 % 6.4 % 6.9 % 13 %	HP 8902A measuring receiver with 11792A sensor
(>18 to 26.5) GHz	(+10 to 0) dBm (<0 to -10) dBm (<-10 to -20) dBm (<-20 to -30) dBm (<-30 to -40) dBm (<-40 to -50) dBm (<-50 to -60) dBm (<-60 to -70) dBm (<-70 to -80) dBm (<-80 to -90) dBm (<-90 to -100) dBm (<-100 to -110) dBm (<-110 to -120) dBm	2.5 % 2.5 % 2.7 % 2.9 % 3.4 % 3.8 % 4.2 % 5 % 5.4 % 5.9 % 6.3 % 6.9 % 13 %	

Parameter/Range	Frequency	CMC[2, 5, 7] (±)	Comments
Phase Modulation – Measure			
Rate: 200 Hz to 10 kHz	150 kHz to 10 MHz	4 % + 0.015 rad	HP 8902A measuring receiver w/ HP 11792A sensor
Rate: 20 Hz to 200 kHz	10 MHz to 26.5 GHz	5 % + 0.019 rad	
Harmonic Distortion – Measure			
Level ≥ 90 dBc	20 Hz to 20 kHz	1.0 dB	HP 8903A audio analyzer
	(20 to 100) kHz	2.0 dB	
	100 kHz to 1.3 GHz	3.1 dB	HP 8565E spectrum analyzer
	(1.3 to 22) GHz	3.5 dB	
	(>22 to 50) GHz	3.9 dB	

IV. Mechanical

Parameter/Equipment	Range	CMC[2, 4] (±)	Comments
Durometers –			
Indenter Geometry:			
Diameter	Up to 0.010 in (0.010 to 0.50) in	(150 + 21*L*) µin (110 + 21*L*) µin	Starrett optical comparator
Angle[8]	(29 to 36) degrees	290 arc sec	
Extension	Up to 0.1 in	(140 + 30*L*) µin	
Force Calibration:			
Type A, B, E, O	(56 to 821) gf	1.9 gf	Mettler-Toledo precision balance
Type C, D, DO	(0 to 4.6) kgf	11 gf	

Parameter/Equipment	Range	CMC[2, 4, 5, 10] (±)	Comments
Mass	1 mg to 40 g (>40 to 200) g >200 g to 6 kg (>6 to 32) kg	0.048 mg 0.16 mg 12 mg 0.12 g	Class S weights, analytical balances
Scales & Balances[3]	(1 to 50) mg (>50 to 500) mg >500 mg to 5 g (>5 to 20) g >20 g to 30 kg (5 to 700) lb	0.025 mg + 0.6*R* 0.033 mg + 0.6*R* 0.058 mg + 0.6*R* 0.078 mg + 0.6*R* 3.1 µg/g + 0.6*R* 0.01 % + 0.6*R*	Class S weights Class F weights
Force – Measuring Equipment Compression & Tension	 10 gf to 320 kgf (0.002 to 700) lbf	 0.05 % + 0.6*R* 0.05 % + 0.6*R*	 Class F weights
Pneumatic Pressure – Measuring Equipment Dry Nitrogen Gas	 (0 to 90) psi(a) (90 to 300) psi(a) (0 to 90) psi(g) (90 to 300 psi(g) (300 to 1000) psi(a)	 0.0021 % + 0.009 psi + 0.6*R* 0.01% + 0.00064 psi + 0.6*R* 0.0021 % + 0.009 psi + 0.6*R* 0.01% + 0.00064 psi + 0.6*R* 0.01 % of IV + 0.6*R*	 Additel 780S Controller, ADT160A-RD-AP300Q Module Additel 780S Controller, ADT160A-RD-AP1KQ Module

Parameter/Equipment	Range	CMC[2, 4, 5, 10] (±)	Comments
Vacuum	(-12.5 to 0) psi(g)	0.0021 % + 0.009 psig + 0.6*R*	Additel 780S controller, ADT160A-RD-AP300Q Module
Torque Handtools – Measuring Equipment[3]	10 ozf·in to 1000 lbf·ft	1.0 % + 0.6*R*	Digital torque load cells
Torque Measurement Devices – Generate	10 ozf·in to 1000 lbf·ft	0.06 %	Calibration arms & weights

V. Thermodynamics

Parameter/Equipment	Range	CMC[2, 4, 10] (±)	Comments
Temperature[3] – Measure	(-180 to 650) °C	0.014 °C + 0.6*R*	SPRT, super thermometer
	(650 to 1000) °C	0.63 °C + 0.6*R*	Type S thermocouple
Temperature[3] – Measuring Equipment			SPRT super thermometer with:
	(-40 to 200) °C	0.014 °C + 0.6*R*	Bath
	(220 to 650) °C	0.22 °C + 0.6*R*	Drywell
	(650 to 1000) °C	0.70 °C + 0.6*R*	Type S thermocouple & Fluke Blackstack

VI. Time & Frequency

Parameter/Equipment	Range	CMC[2, 4, 10] (±)	Comments
Frequency Reference	10 MHz Reference Signal	1.8×10^{-12} Hz/Hz	Fluke 910R GPS receiver
Frequency – Measuring Equipment			GPS receiver with:
	1 µHz to 20 MHz	1.7×10^{-11} Hz/Hz	3325 synthesized generator
	10 MHz to 50 GHz	1.7×10^{-11} Hz/Hz	83650B synthesized generator
Frequency – Measure, Fixed Frequency			GPS receiver with:
	DC to 225 MHz	1.5×10^{-9} Hz/Hz	53131 counter
	225 MHz to 26.5 GHz	1.8×10^{-12} Hz/Hz + 1.3 Hz	5343A counter
Timers & Stopwatches[3]	Up to 24 hr	26 ms + 0.6*R*	NIST SP 960-12 digital photo method
	Up to 19.99 s/day	0.037 s/day	4500 Timometer
Non-Contact Tachometers[3]	(6 to 199 999) rpm	0.6 nrpm/rpm + 0.6*R*	Agilent 33250A, LED, & Fluke 910 GPS receiver
Rotational Speed – Measure[3]	(6 to 99 999) rpm	0.023 % + 0.02 rpm	Non-contact Tachometer

[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. Calibration and Measurement Capability Uncertainties 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 Uncertainty due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

[3] Field calibration service is available for this calibration. 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.

[4] Unless otherwise noted, in the statement of CMC Uncertainty, *L* is the numerical value of the nominal length of the device measured in inches. In the statement of CMC Uncertainty, *R* is the numerical value of the resolution of the device in microinches. In the statement of CMC Uncertainty, IV represents indicated value.

[5] In the statement of CMC, the value is defined as the percentage of reading unless otherwise noted.

[6] *D* = Largest Diameter or Diagonal, as applicable to Surface Plate shape.

[7] 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 percent or fraction of the reading plus a fixed floor specification.

[8] Angular measurements using geometric construction of 2-lines measured by motion.

[9] This scope meets A2LA's *P112 Flexible Scope Policy*.

[10] 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.

Accredited Laboratory

A2LA has accredited

SIMCO ELECTRONICS, INC.

Draper, UT

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 28th of July 2022.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1395.20
Valid to September 30, 2024

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