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

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CALIBRATION

Valid To: September 30, 2026 Certificate Number: 1395.05

In recognition of the successful completion of the A2LA evaluation process (including an assessment of the organization's compliance with A2LA's Calibration Program Requirements), accreditation is granted to this laboratory to perform the following calibrations and dimensional inspections[1, 9]:

I. Dimensional

Parameter/Equipment	Range[4]	CMC[2, 5] (±)	Comments
Gage Blocks	(0.005 to 0.09) in (0.1 to 4) in (0.5 to 100) mm	3.0 µin (2.5 + 0.21*L*) µin (0.083 + 0.000 87*L*) µm	Federal 130B-24 gage block comparator
Angle –			
Sine Bars/Plates: Center-to-Center Distance	Up to 15 in	(17 + 4.8*L*) µin	Gage blocks, MU-checker, surface plate
Angle Blocks	Up to 45°	5.0 arcsec	Gage blocks, MU-checker, angle gage blocks, sine base
Protractors & Inclinometers	Up to 180°	0°, 00', 1.5" + 0.58*R*	Angle block set
	Up to 90°	0°, 00', 19" + 0.58*R*	Gage blocks, sine base, surface plate, square

Parameter/Equipment	Range[4]	CMC[2, 5, 8] (±)	Comments
Optical Flats/Parallels –			
Flatness	Up to 4 in	3.6 µin	Van Keuren optical flat, gage blocks
Parallelism	Up to 4 in	2.4 µin	Federal 130B-4 gage block comparator
Thickness	Up to 1 in	4.8 µin	Federal 130B-4 gage block comparator, gage blocks
Length Standards	Up to 60 in	0.000 05 % + 22 µin	SIP MUL 4000, Renishaw XL-80 laser system, gage blocks
Micrometers[3] –	Up to 48 in	(11 + 4.8*L*) µin	Gage blocks
Flatness[3]	Up to 48 in	5.6 µin	Optical flats
Parallelism[3]	Up to 48 in	9.6 µin	Optical parallels
Height Gages[3]	Up to 40 in	(69 + 1.5*L*) µin	Gage blocks, surface plate
Depth Gages[3]	Up to 12 in	(38 + 0.63*L*) µin	Gage blocks, surface plate
Calipers[3]	Up to 5 in (5 to 48) in (48 to 72) in	(290 + 10*L*) µin (540 + 6.4*L*) µin (600 + 6.4*L*) µin	Gage blocks
Indicators[3]	Up to 6 in	(37 + 0.67*L*) µin	Gage blocks, surface plate
Tapes & Rules	Up to 60 in	(36 + 4.9*L*) µin	SIP MUL 4000, Renishaw XL-80 laser system
Glass Scales	Up to 24 in	0.000 05 % + 32 µin	SIP MUL 4000, gage blocks, Renishaw XL-80 laser system

Parameter/Equipment	Range[4]	CMC[2, 5, 8] (±)	Comments
Plain Ring Gages	(0.25 to 4) in	(15 + 2.2*L*) µin	Gage blocks, Pratt & Whitney universal Supermic™
Pin Gages	(0.005 to 4) in	(15 + 4.8*L*) µin (0.38 + 0.0048*L*) µm	Pratt & Whitney universal Supermic™, gage blocks
Thread Plug Gages –			
Major Diameter	Up to 12 in	(36 + 4.8*L*) µin (0.92 + 0.0048*L*) µm	Pratt & Whitney universal Supermic™ w/ gage blocks & thread wires
Pitch Diameter	Up to 12 in	(73 + 4.8*L*) µin (1.8 + 0.0048*L*) µm	
Crimper Tools	Up to 2 in	0.000 32 in	Optical comparator
Levels	Up to 0.015 in	11 µin/ft	Sine plate & gage blocks
Linear Indicators, Comparators	Up to 4 in	(5.5 + 6.1*L*) µin	Gage blocks, Renishaw XL-80 laser system
V Blocks –			
Parallelism	(0 to 0.1) in	15 µin	Gage blocks, MU-checker, cylindrical square
Squareness	(0 to 0.1) in	83 µin	
Surface Plates[3] –			
Flatness	Up to 12 in	9.9 µin	Gage blocks, MU-checker
	Up to 180 in *DL*	(42 + 0.41*DL*) µin	Mahr leveling system *DL* = diagonal length measured in inches
Repeatability	Up to 0.001 in	36 µin	Repeat-o-meter

Parameter/Equipment	Range[4]	CMC[2, 5, 8] (±)	Comments
Precision Balls	Up to 2 in (2 to 4) in	24 µin 17 µin	MU checker, universal supermic & gage blocks Renishaw XL-80 laser system
Parallels	Up to 24 in	27 µin	MU checker, granite parallels & gage blocks
Precision Squares	Up to 24 in	26 µin	Master square, MU checker, true square

II. Dimensional Testing/Calibration[1]

Parameter/Equipment	Range	CMC[2] (±)	Comments
Length – 3 Dimensional[6] X, Y, & Z	Up to 56 in	350 µin	Mitutoyo B231 CMM

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
DC Voltage – Generate[3]	± (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 1100) V (1000 to 60 000) V	0.0008 % + 0.68 µV 0.0007 % + 1.6 µV 0.0007 % + 12 µV 0.0007 % + 14 µV 0.0008 % + 140 µV 0.0009 % + 1400 µV 0.12 % + 710 µV	Fluke 5700A-03 Ross VD60-6.2-B-K-AC, DMM, high voltage source

Parameter/Equipment	Range	CMC[2, 7, 8] (±)	Comments
DC Voltage – Measure[3]	± (0 to 100) mV ± (0.1 to 1) V ± (1 to 10) V ± (10 to 100) V ± (100 to 1000) V* (1000 to 60 000) V	0.000 58 % + 0.056 µV 0.0004 % + 0.12 µV 0.0004 % + 0.74 µV 0.0006 % + 16 µV 0.0006 % + 0.57 mV* 0.12 %	HP 3458A OPT-2 *add $12(V_{in}/1000)^2$ 1xE-6 to all $V_{in} > 100$ Ross VD60-6.2-B-K-AC
DC Current – Generate[3]	± (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 ± (2.2 to 11) A (11 to 20.5) A (11 to 20) A (20 to 100) A (> 20.5 to < 150) A (150 to 1025) A	0.005 % + 8.2 nA 0.005 % + 43 nA 0.005 % + 410 nA 0.006 % + 4.4 µA 0.008 % + 74 µA 0.036 % + 530 µA 0.078 % + 1300 µA 0.069 % + 3 mA 0.053 % + 3 mA 0.6 % + 0.17 A 0.6 % + 0.88 A	Fluke 5700A-03/5725A Fluke 5520A/SC600 Valhalla 2555A Fluke 5500A/coil & 5520A/SC600
DC Current – Measure[3]	(0 to 100) nA (0.1 to 1) µA (1 to 10) µA (10 to 100) µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 2) A (2 to 20) A (20 to 100) A	0.04 % + 3 pA 0.0045 % + 0.018 nA 0.0022 % + 0.58 nA 0.0022 % + 0.072 nA 0.0021 % + 0.62 nA 0.0021 % + 3.1 nA 0.0035 % + 0.075 µA 0.011 % + 1.8 µA 0.000 78 A 0.0041 A 0.071A	HP 3458A OPT-2 Valhalla 2575A

Parameter/Equipment	Range	CMC[2, 7, 8] (±)	Comments
Resistance – Generate[3]	(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 99) kΩ (1.1 to 3.299 999) kΩ (3.3 to 10.999 99) kΩ (11 to 32.999 99) kΩ (33 to 109.9999) kΩ (110 to 329.999 99) kΩ (0.33 to 1.099 999) MΩ (1.1 to 3.299 99) MΩ (3.3 to 10.999 99) MΩ (11 to 32.999 99) MΩ (33 to 109.9999) MΩ (110 to 329.9999) MΩ (0.33 to 1.1) GΩ	31 μΩ/Ω + 0.077 Ω 23 μΩ/Ω + 1.9 mΩ 22 μΩ/Ω + 2.2 mΩ 22 μΩ/Ω + 4.4 mΩ 22 μΩ/Ω + 18 mΩ 22 μΩ/Ω + 44 mΩ 22 μΩ/Ω + 140 mΩ 22 μΩ/Ω + 0.43 Ω 22 μΩ/Ω + 1.3 Ω 25 μΩ/Ω + 7.7 Ω 25 μΩ/Ω + 22 Ω 47 μΩ/Ω + 34 Ω 0.01 % + 770 Ω 0.019 % + 3.7 kΩ 0.039 % + 35 kΩ 0.23 % + 80 kΩ 1.2 % + 2.6 MΩ	Fluke 5522A/SC1100
Fixed Points	0.001 Ω 0.01 Ω 0.1 Ω 1 Ω	0.0058 % 0.012 % + 0.029 μΩ 0.012 % + 0.37 μΩ 0.012 % + 2.8 μΩ	Standard resistors Guildline, L&N
	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	54 μΩ 95 μΩ/Ω + 18 μΩ 95 μΩ/Ω + 31 μΩ 28 μΩ/Ω + 46 μΩ 27 μΩ/Ω + 82 μΩ 17 μΩ/Ω + 290 μΩ 17 μΩ/Ω + 560 μΩ 13 μΩ/Ω + 2.3 mΩ 13 μΩ/Ω + 6 mΩ 12 μΩ/Ω + 37 mΩ 12 μΩ/Ω + 51 mΩ 14 μΩ/Ω + 640 mΩ 14 μΩ/Ω + 1200 mΩ 20 μΩ/Ω + 6.2 Ω 21 μΩ/Ω + 12 Ω 40 μΩ/Ω + 190 Ω 47 μΩ/Ω + 360 Ω 110 μΩ/Ω + 2.7 kΩ	Fluke 5700A-03
	100 MΩ 1 GΩ	0.26 % + 0.081 MΩ 0.26 % + 0.72 MΩ	Keithley 5155

Parameter/Equipment	Range	CMC[2, 7] (±)	Comments
Resistance – Measure[3]	(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 (100 to 1000) MΩ	25 µΩ/Ω + 50 µΩ 21 µΩ/Ω + 0.5 mΩ 12 µΩ/Ω + 0.5 mΩ 12 µΩ/Ω + 5 mΩ 12 µΩ/Ω + 50 mΩ 20 µΩ/Ω + 2 Ω 59 µΩ/Ω + 100 Ω 0.060 MΩ + 1 kΩ 0.079 MΩ + 10 kΩ	HP 3458A OPT-002
Capacitance – Generate[3]	(0.220 to < 1.1) nF (1.1 to < 3.3) nF (3.3 to < 11) nF (11 to < 33) nF (33 to < 110) nF (110 to < 330) nF (0.33 to < 1.1) µF (1.1 to < 3.3) µF (3.3 to < 11) µF (11 to < 33) µF (33 to < 110) µF (110 to < 330) µF (0.33 to < 1.1) mF (1.1 to < 3.3) mF (3.3 to < 11) mF (11 to < 33) mF (33 to < 110) mF	0.39 % + 7.8 pF 0.39 % + 7.9 pF 0.19 % + 9.7 pF 0.19 % + 81 pF 0.19 % + 120 pF 0.19 % + 250 pF 0.19 % + 0.86 nF 0.19 % + 2.7 nF 0.19 % + 9.7 nF 0.31 % + 33 nF 0.35 % + 100 nF 0.35 % + 240 nF 0.35 % + 0.80 µF 0.35 % + 2.4 µF 0.35 % + 8.3 µF 0.58 % + 26 µF 0.85 % + 81 µF	Fluke 5522A-SC1100
Electrical Simulation of Thermocouples Indicating Devices – Generate & Measure[3]			
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.42 °C 0.23 °C 0.17 °C 0.21 °C 0.23 °C	Fluke 5520A
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.25 °C 0.21 °C 0.17 °C 0.19 °C 0.26 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.31 °C 0.2 °C 0.19 °C 0.26 °C 0.36 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.53 °C 0.23 °C 0.18 °C 0.17 °C	

Parameter/Equipment	Range[4]	CMC[2, 7] (±)	Comments
Oscilloscopes[3] –			
DC Signal:			
Into 50 Ω	(1 to 24.999) mV (25 to 109.99) mV 110 mV to 2.1999 V (2.2 to 6.599) V	0.012 mV + 40 µV 0.014 mV + 40 µV 0.000 16 V + 40 µV 0.002 V + 40 µV	Fluke 5522A/SC1100
Into 1 MΩ	(1 to 24.999) mV (25 to 109.99) mV 110 mV to 2.1999 V (2.2 to 10.999) V (11 to 130) V	0.013 mV + 40 µV 0.019 mV + 40 µV 0.000 27 V + 40 µV 0.002 V + 40 µV 0.014 V + 40 µV	
Level Sine Wave :			
50 kHz Reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	5 mV to 5.5 V 5 mV to 5.5 V 5 mV to 5.5 V 5 mV to 5.5 V 4 mV to 3.5 V	1.5 % + 0.3 mV 2.2 % + 0.4 mV 2.7 % + 0.4 mV 4.8 % + 0.4 mV 4.8 % + 0.4 mV	
Square Wave:			
50 Ω, 10 Hz to 10 kHz	(1 to 24.999) mV (25 to 109.99) mV 110 mV to 2.1999 V (2.2 to 6.599) V	0.19 % + 40 µV 0.19 % + 40 µV 0.19 % + 40 µV 0.19 % + 40 µV	
1 MΩ, 10 Hz to 1 kHz	(1 to 24.999) mV (25 to 109.99) mV 110 mV to 2.199 V (2.2 to 10.999) V (11 to 130) V	0.078 % + 40 µV 0.078 % + 40 µV 0.078 % + 40 µV 0.078 % + 40 µV 0.078 % + 40 µV	
1 MΩ, (1 to 10) kHz	(1 to 24.999) mV (25 to 109.99) mV 110 mV to 2.1999 V (2.2 to 10.999) V (11 to 130) V	0.078 % + 40 µV 0.078 % + 40 µV 0.078 % + 40 µV 0.078 % + 40 µV 0.078 % + 40 µV	
Time Marker Output: Into 50 Ω	(2 to 5) ns 10 ns (20 to 50) ns 100 ns to 20 ms	16 parts in 10^6 s 6.3 parts in 10^6 s 5.5 parts in 10^6 s 11 parts in 10^6 s	
Pulse Rise Time	1 kHz to 2 MHz (200 to 300) ps (2 to 10) MHz (200 to 350) ps	240 ps 270 ps	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage – Generate[3]			
(0.22 to 2.2) mV	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.055 % + 5 µV 0.021 % + 5 µV 0.011 % + 5 µV 0.037 % + 5.4 µV 0.085 % + 8 µV 0.11 % + 15 µV 0.17 % + 27 µV 0.34 % + 28 µV	Fluke 5700A-03 & 5725A
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.055 % + 8 µV 0.021 % + 7 µV 0.011 % + 12 µV 0.037 % + 12 µV 0.085 % + 11 µV 0.11 % + 20 µV 0.17 % + 32 µV 0.34 % + 42 µV	
(22 to 220) mV	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.055 % + 41 µV 0.021 % + 18 µV 0.011 % + 11 µV 0.032 % + 17 µV 0.085 % + 41 µV 0.11 % + 55 µV 0.17 % + 78 µV 0.34 % + 190 µV	
(0.22 to 2.2) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.05 % + 140 µV 0.016 % + 49 µV 0.0075 % + 43 µV 0.012 % + 78 µV 0.025 % + 170 µV 0.043 % + 330 µV 0.11 % + 560 µV 0.22 % + 1700 µV	
(2.2 to 22) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.05 % + 1400 µV 0.016 % + 540 µV 0.0075 % + 480 µV 0.012 % + 910 µV 0.025 % + 1600 µV 0.05 % + 3800 µV 0.13 % + 7700 µV 0.27 % + 21 000 µV	
(22 to 220) V	(10 to 20) Hz (20 to 40) Hz (0.04 to 20) kHz (20 to 50) kHz	0.05 % + 48 mV 0.016 % + 6.5 mV 0.008 % + 6.1 mV 0.022 % + 12 mV	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage – Generate[3] (cont)			
(22 to 220) V	(50 to 100) kHz	0.05 % + 18 mV	Fluke 5700A-03 & 5725A
(220 to 250) V	(15 to 50) Hz	0.04 % + 42 mV	
(220 to 1000) V	(0.04 to 1) kHz (≥ 4 to 20) kHz (20 to 30) kHz	0.008 % + 44 mV 0.017 % + 110 mV 0.06 % + 110 mV	
(220 to 750) V	(30 to 50) kHz (50 to 100) kHz	0.06 % + 79 mV 0.23 % + 300 mV	
(1000 to 40 000) V	(50 to 60) Hz	0.59 % + 2.2 mV	Ross VD60-6.2-B-K-AC, DMM, high voltage source
Wideband AC Voltage – Generate[3]			
Amplitude:			
(0.3 to 1.1) mV (1.1 to 3) mV (3 to 11) mV (11 to 33) mV (33 to 110) mV (110 to 330) mV (0.3 to 1.1) V (1.1 to 3.5) V	(0.03 to 500) kHz	0.8 % + 2.4 µV 0.7 % + 9.8 µV 0.7 % + 15 µV 0.6 % + 23 µV 0.6 % + 55 µV 0.5 % + 130 µV 0.5 % + 460 µV 0.4 % + 680 µV	Fluke 5700A-03
Flatness Relative to 1 kHz Reference:			
0.3 mV to 3.5 V	(10 to 30) Hz (30 to 120) Hz (0.12 to 1.2) kHz (1.2 to 12) kHz (12 to 120) kHz (0.12 to 1.2) MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.31 % + 5.8 µV 0.11 % + 5.8 µV 0.1 % + 5.8 µV 0.11 % + 5.8 µV 0.1 % + 5.8 µV 0.11 % + 6.7 µV 0.11 % + 6.7 µV 0.22 % + 6.7 µV 0.42 % + 6.7 µV 1 % + 6.7 µV	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Voltage – Measure[3]			
(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	0.048 % + 3 µV 0.037 % + 1.1 µV 0.048 % + 1.1 µV 0.12 % + 1.1 µV 0.61 % + 1.1 µV 4.7 % + 2 µV	HP 3458A OPT-002
(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 300 kHz to 1 MHz	0.011 % + 4 µV 0.0091 % + 2 µV 0.017 % + 2 µV 0.036 % + 2 µV 0.096 % + 2 µV 0.76 % + 10 µV 1.2 % + 10 µV	
(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 300 kHz to 1 MHz	0.0083 % + 40 µV 0.0083 % + 20 µV 0.016 % + 20 µV 0.035 % + 20 µV 0.093 % + 20 µV 0.35 % + 0.1 mV 1.2 % + 0.1 mV	
(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 300 kHz to 1 MHz	0.0085 % + 0.4 mV 0.0084 % + 0.2 mV 0.016 % + 0.2 mV 0.035 % + 0.2 mV 0.093 % + 0.2 mV 0.35 % + 1.0 mV 1.2 % + 1.0 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 mV 0.023 % + 2 mV 0.023 % + 2 mV 0.041 % + 2 mV 0.14 % + 2 mV	
(100 to 1000) V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.046 % + 40 mV 0.046 % + 20 mV 0.069 % + 20 mV 0.14 % + 20 mV 0.35 % + 20 mV	
(1000 to 40 000) V	(50 to 60) Hz	0.59 % + 3.9 mV	Ross VD60-6.2-B-K-AC

Parameter/Range	Frequency	CMC[2, 7, 8] (±)	Comments
AC Voltage Flatness – Measure[3]			
Relative to 1 kHz Reference:			
3 V	(10 to 100) Hz (0.1 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 8) MHz (8 to 20) MHz (20 to 30) MHz (30 to 50) MHz (50 to 70) MHz (70 to 80) MHz (80 to 100) MHz	0.21 % 0.092 % 0.13 % 0.13 % 0.22 % 0.23 % 0.24 % 0.30 % 0.67 % 0.43 % 0.49 %	Thermal converters & HP 3458A
AC Current[3] – Generate			
(9 to 220) µA	(10 to 20) Hz (20 to 40) Hz (0.04 to 1) kHz (1 to 5) kHz (5 to 10) kHz	0.07 % + 25 nA 0.035 % + 20 nA 0.014 % + 17 nA 0.06 % + 40 nA 0.16 % + 80 nA	Fluke 5700A-03/ 5725A
(0.22 to 2.2) mA	(10 to 20) Hz (20 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	0.07 % + 53 nA 0.035 % + 54 nA 0.014 % + 54 nA 0.06 % + 400 nA 0.16 % + 800 nA	
(2.2 to 22) mA	(10 to 20) Hz (20 to 40) Hz (0.04 to 1) kHz (1 to 5) kHz (5 to 10) kHz	0.07 % + 0.98 µA 0.035 % + 0.82 µA 0.014 % + 0.81 µA 0.06 % + 4.1 µA 0.16 % + 8 µA	
(22 to 220) mA	(10 to 20) Hz (20 to 40) Hz (40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	0.07 % + 11 µA 0.035 % + 7.9 µA 0.014 % + 7.9 µA 0.06 % + 41 µA 0.16 % + 80 µA	
(0.22 to 2.2) A	(20 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	0.065 % + 87 µA 0.075 % + 110 µA 0.85 % + 190 µA	

Parameter/Range	Frequency	CMC[2, 7] (±)	Comments
AC Current[3] – Generate (cont)			
(2.2 to 11) A	(40 to 1000) Hz (1 to 5) kHz (5 to 10) kHz	0.046 % + 710 µA 0.095 % + 780 µA 0.36 % + 1000 µA	Fluke 5700A-03/ 5725A
(2 to 20) A	60 Hz	0.71 % + 0.6 A	Valhalla 2555A
Clamp Meters:			
(> 20.5 to < 150) A (150 to 1025) A	(45 to 65) Hz	0.68 % + 0.3 A 0.67 % + 1.2 A	Fluke 5500A/coil & 5520A/SC600 LCOMP ON
(> 20.5 to < 150) A (150 to 1025) A	(> 65 to 440) Hz	1.2 % + 0.3 A 1.2 % + 1.2 A	
AC Current – Measure[3]			
10 µA (> 10 to 100) µA	(0.045 to 1) kHz	0.067 % + 0.58 nA 0.067 % + 3.6 nA	HP 3458A OPT-002
(> 0.1 to 1) mA (> 1 to 10) mA (> 10 to 100) mA (> 0.1 to 1) A	(0.045 to 5) kHz	0.063 % + 2.3 nA 0.063 % + 660 nA 0.063 % + 170 nA 0.1 % + 67 µA	
(> 1 to 2) A (> 2 to 20) A (> 20 to 100) A	(45 to 1000) Hz	0.12 % + 0.2 mA 0.13 % + 2 mA 0.12 % + 2 mA	Valhalla 2575A

IV. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC[2, 10] (±)	Comments
RF Power – Generate			
(13 to -5) dB (-20 to -58) dB (-50 to -80) dB	200 Hz to 80 MHz	0.054 dB 0.12 dB 0.26 dB	HP 3335A
(26 to > 20) dBm (20 to -10) dBm (-10 to -90) dBm	250 kHz to 40 GHz	1.2 dB 0.95 dB 1.2 dB	Agilent E8257D

Parameter/Range	Frequency	CMC[2, 8, 10] (±)	Comments
RF Power – Generate (cont)			
(10 to -10) dBm (-10 to > -60) dBm (-60 to -110) dBm	(2 to 26.5) GHz	1.1 dB 1.4 dB 2 dB	HP 83630B
(10 to -20) dBm	(2 to 50) GHz	2.3 dB	HP 83650B
RF Power – Measure[3]			
0 dBm	50 MHz	0.4 %	HP 432A, 478A-H76, 3458[a]
(-50 to 0) dBm (0 to +30) dBm	9 kHz to 18 GHz	0.092 dB 0.089 dB	Agilent E4419A & E9304A-H19
(-70 to +20) dBm	(0.01 to 18) GHz	0.085 dB	Agilent E4419A & E4412A
(-30 to +20) dBm	(0.05 to 50) GHz	0.15 dB	Agilent E4419A & 8487A
Displayed Average Noise Level (-150 to 0) dBm	3 Hz to 3 GHz 100 kHz to 3 GHz (> 3 to 6.6) GHz (> 6.6 to 22) GHz (> 22 to 26.8) GHz (> 26.8 to 31.15) GHz (> 31.15 to 50) GHz	0.62 dB 0.91 dB 1.7 dB 2.2 dB 2.7 dB 2.2 dB 2.8 dB	50 Ω Terminal
Tuned RF Level – Measure[3]			
(+16 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 kHz to 50 GHz	0.026 dB 0.024 dB 0.029 dB 0.04 dB 0.053 dB 0.056 dB 0.063 dB 0.074 dB 0.078 dB 0.096 dB	Agilent N5531S

Parameter/Range	Frequency	CMC[2, 8, 10] (±)	Comments
Tuned RF Level – Measure[3] (cont)			
(< -100 to -140) dBm	100 kHz to 3.05 GHz	0.096 dB	Agilent N5531S
(< -103 to -133) dBm	(> 3.05 to 6.6) GHz	0.29 dB	
(< -100 to -130) dBm	(> 6.6 to 13.2) GHz	0.30 dB	
(< -98 to -128) dBm	(> 13.2 to 19.2) GHz	0.12 dB	
(< -86 to -116) dBm	(> 19.2 to 26.5) GHz	0.36 dB	
(< -87 to -117) dBm	(> 26.5 to 31.15) GHz	0.21 dB	
(< -76 to -106) dBm	(> 31.15 to 41) GHz	0.15 dB	
(< -70 to -100) dBm	(> 41 to 45) GHz	0.15 dB	
(< -58 to -88) dBm	(> 45 to 50) GHz	0.15 dB	
RF Attenuation – Generate			
(0 to -10) dB	@ 50 MHz	0.0046 dB	Agilent 8494G & 8496G
(-10 to -20) dB		0.0049 dB	
(-20 to -30) dB		0.0075 dB	
(-30 to -40) dB		0.0076 dB	
(-40 to -50) dB		0.0094 dB	
(-50 to -60) dB		0.010 dB	
(-60 to -70) dB		0.015 dB	
(-70 to -80) dB		0.018 dB	
(-80 to -90) dB		0.021 dB	
(-90 to -100) dB		0.030 dB	
(-100 to -110) dB		0.037 dB	
(-110 to -121) dB		0.046 dB	
(0 to -10) dB	@ 1.195 GHz	0.011 dB	Agilent 8494G & 8496G, Agilent E4448A
(-10 to -20) dB		0.013 dB	
(-20 to -30) dB		0.019 dB	
(-30 to -40) dB		0.019 dB	
(-40 to -50) dB		0.024 dB	
(-50 to -60) dB		0.028 dB	
(-60 to -70) dB		0.040 dB	
(-70 to -80) dB		0.050 dB	
(-80 to -90) dB		0.058 dB	
(-90 to -100) dB		0.080 dB	
(-100 to -110) dB		0.10 dB	
(-110 to -121) dB		0.11 dB	
(0 to -10) dB	@ 4 GHz	0.020 dB	Agilent 8494G & 8496G, Agilent E4448A
(-10 to -20) dB		0.025 dB	
(-20 to -30) dB		0.029 dB	
(-30 to -40) dB		0.035 dB	
(-40 to -50) dB		0.042 dB	
(-50 to -60) dB		0.046 dB	
(-60 to -70) dB		0.053 dB	

Parameter/Range	Frequency	CMC[2, 8, 10] (±)	Comments
RF Attenuation – Generate (cont)			
(-70 to -80) dB (-80 to -90) dB (-90 to -100) dB (-100 to -110) dB (-110 to -121) dB	@ 4 GHz	0.057 dB 0.063 dB 0.070 dB 0.098 dB 0.29 dB	Agilent 8494G & 8496G, Agilent E4448A
Amplitude Modulation – Generate			
50 Hz to 50 kHz < 95 % 50 Hz to 50 kHz < 99 % 20 Hz to 100 kHz < 95 % 20 Hz to 100 kHz < 99 %	(11 to 13.5) MHz	0.27 % AM 0.33 % AM 0.38 % AM 0.43 % AM	HP 11715A
Amplitude Modulation – Measure			
Rate: 50 Hz to 10 kHz Depth: (5 to 99) %	(0.1 to 10) MHz	0.87 % of rdg + 0.0005 % AM	Agilent N5531S
Rate: 50 Hz to 100 kHz Depth: (5 to 20) %	(0.01 to 3) GHz	2.9 % of rdg + 0.0005 % AM	
Depth: (20 to 99) %		0.58 % of rdg + 0.0005 % AM	
Depth: (5 to 20) %	(3 to 26.5) GHz	5.2 % of rdg + 0.0005 % AM	
Depth: (20 to 99) %		1.7 % of rdg + 0.0005 % AM	
Depth: (5 to 20) %	(26.5 to 31.15) GHz	7.9 % of rdg + 0.0005 % AM	
Depth: (20 to 99) %		2.3 % of rdg + 0.0005 % AM	
Depth: (5 to 20) %	(31.15 to 50) GHz	30 % of rdg + 0.0005 % AM	
Depth: (20 to 99) %		6.9 % of rdg + 0.0005 % AM	

Parameter/Range	Frequency	CMC[2, 8, 10] (±)	Comments
Frequency Modulation – Generate			
DC to 100 kHz Rate	(11 to 432) MHz	0.15 % + 0.005 lsd	HP 11715A
DC to 200 kHz Rate	(11 to 432) MHz	0.31 % + 0.005 lsd	
DC to 10 MHz Rate	(11 to 432) MHz	2.9 % + 0.005 lsd	
Frequency Modulation – Measure			
Rate: 20 Hz to 10 kHz Deviation: 200 Hz to 40 kHz	(0.25 to 10) MHz		Agilent N5531S ß is the ratio of frequency deviation to modulation rate
	> 0.2 ß	1.7 % + 0.68 Hz	
	> 1.2 ß	1.2 % + 0.87 Hz	
Rate: 50 Hz to 200 kHz Deviation: 250 Hz to 400 kHz	(0.01 to 6.6) GHz		
	> 0.2 ß	1.7 % + 2.4 Hz	
	> 0.45 ß	1.2 % + 27 Hz	
	(6.6 to 13.2) GHz		
	> 0.2 ß	2.9 % + 19 Hz	
	> 8 ß	1.2 % + 19 Hz	
	(13.2 to 31.15) GHz		
	> 0.2 ß	4.4 % + 27 Hz	
	> 16 ß	1.2 % + 25 Hz	
	(31.15 to 50) GHz		
	> 0.2 ß	9.8 % + 5.8 Hz	
	> 32 ß	1.2 % + 5.8 Hz	
Phase Modulation – Measure			
> 0.7 rad	100 kHz to 6.6 GHz	1.2 % + 0.0051 rad	Agilent N5531S
> 0.3 rad		3.5 % + 0.0058 rad	
> 2 rad	(6.6 to 13.2) GHz	1.2 % + 0.011 rad	
> 0.6 rad		3.5 % + 0.01 rad	
> 4 rad	(13.2 to 26.5) GHz	1.2 % + 0.021 rad	
> 1.2 rad		3.5 % + 0.021 rad	
> 4 rad	(26.5 to 31.5) GHz	1.2 % + 0.0016 rad	
> 1.3 rad		3.5 % + 0.000 95 rad	
> 8 rad	(31.5 to 50) GHz	1.2 % + 0.05 rad	
> 2.4 rad		3.5 % + 0.0011 rad	

Parameter/Range	Frequency	CMC[2, 8, 10] (±)	Comments
Phase Noise – Measure			
(0.25 to 1.6) GHz	Offsets from CW:		
	1 Hz	2.6 dB	Agilent E8257D & N5500A
	10 Hz	2.6 dB	
	100 Hz	2.5 dB	
	1 kHz	2.4 dB	
	10 kHz	2.4 dB	
	100 kHz	2.3 dB	
(1.2 to 26.5) GHz	Offsets from CW:		
	1 Hz	2.8 dB	
	10 Hz	2.5 dB	
	100 Hz	2.4 dB	
	1 kHz	2.4 dB	
	10 kHz	2.4 dB	
	100 kHz	2.3 dB	
1 MHz to 50 GHz	Offsets from CW:		Agilent E4448A
	10 Hz	4.4 dB	
	100 Hz	2.1 dB	
	1 kHz	1.1 dB	
	10 kHz	0.91 dB	
	100 kHz	0.89 dB	
	1 MHz	0.99 dB	
	10 MHz	1.4 dB	
Phase Noise – Generate[3]			
(0.25 to 40) GHz	Offsets from CW:		
	1 Hz	3.1 dB	Agilent E8257D
	10 Hz	3.1 dB	
	100 Hz	2.7 dB	
	1 kHz	2.4 dB	
	10 kHz	2.4 dB	
	100 kHz	2.3 dB	
	10 Hz	2.3 dB	Wenzel 500-13438C
	100 Hz	2.3 dB	
	1 kHz	2.3 dB	
	10 kHz	2.3 dB	
	30 kHz	2.3 dB	
	100 kHz	2.3 dB	
	1 MHz	2.3 dB	
	6 MHz	2.3 dB	
	10 MHz	2.3 dB	

Parameter/Range	Frequency	CMC[2, 8, 10] (±)	Comments
Audio Distortion – Measure[3]			
(-80 to 0) dB (-65 to 0) dB	20 Hz to 20 kHz (> 20 to 100) kHz	1.3 dB 2.3 dB	HP 8903B
Modulation Distortion – Measure			
(0 to 100) %	100 kHz to 50 GHz (0.02 to 250) kHz	1.3 dB	Agilent E4448A
Audio Distortion – Generate			
(-80 to 0) dB (-65 to 0) dB	20 Hz to 20 kHz (> 20 to 100) kHz	1.3 dB 2.3 dB	HP 8903B
Reflection S_{11}/S_{22} – Measure			
(0.6 to 1) lin	(30 to 300) kHz > 300 kHz to 1.3 GHz	0.0057 lin 0.0063 lin	HP 8753ES, HP 85029B, HP 85050A-10
(0.2 to 0.5) lin	(> 1.3 to 3.0) GHz (> 3.0 to 6.0) GHz	0.0086 lin 0.014 lin	
(0.0 to 0.1) lin	45 MHz to 18 GHz	(0.012 to + 0.018) lin (0.83 to + 0.94)°	H-P 8510C, 85054A type-N (sliding load cal)
(0.6 to 1) lin		(0.0064 to + 0.011) lin (1.1 to + 1.8)°	
(0.2 to 0.5) lin		(0.0051 to + 0.0056) lin (3.3 to + 180)°	
(0.0 to 0.1) lin	45 MHz to 18 GHz	(0.0093 to + 0.015) lin (0.63 to + 0.72)°	H-P 8510C, 85050A 7 mm (sliding load cal)
		(0.0048 to + 0.0081) lin (0.77 to + 1.4)°	
		(0.0035 to + 0.004) lin (2.3 to + 180)°	

Parameter/Range	Frequency	CMC[2, 8, 10] (±)	Comments
Reflection S_{11}/S_{22} – Measure			
(0.6 to 1) lin	45 MHz to 26.5 GHz	(0.014 to + 0.023) lin (1.2 to + 1.2)°	H-P 8510C, 85052B 3.5 mm (sliding load cal)
(0.2 to 0.5) lin		(0.0073 to + 0.012) lin (1.3 to + 2.1)°	
(0.0 to 0.1) lin		(0.0059 to + 0.0064) lin (3.3 to + 180)°	
(0 to 0.1) lin	40 MHz to 2 GHz (> 2 to 20) GHz (> 20 to 40) GHz (> 40 to 50) GHz (> 50 to 65) GHz	0.011 lin 0.011 lin 0.017 lin 0.019 lin 0.023 lin	Anritsu 37397D, Anritsu 3654B
(0.1 to 1.0) lin	40 MHz to 2 GHz (> 2 to 20) GHz (> 20 to 40) GHz (> 40 to 50) GHz (> 50 to 65) GHz	0.014 lin 0.015 lin 0.024 lin 0.034 lin 0.040 lin	
Reflection S_{21}/S_{12} – Measure			
(+10 to 0) dB (0 to -30) dB (-30 to -50) dB (-50 to -60) dB	(0.04 to 2) GHz	0.13 dB 0.10 dB 0.15 dB 0.35 dB	Anritsu 37397D, Anritsu 3654B
(+10 to 0) dB (0 to -30) dB (-30 to -50) dB (-50 to -60) dB	(> 2 to 20) GHz	0.16 dB 0.13 dB 0.21 dB 0.55 dB	
(+10 to 0) dB (0 to -30) dB (-30 to -50) dB (-50 to -60) dB	(> 20 to 40) GHz	0.23 dB 0.20 dB 0.51 dB 1.3 dB	
(+10 to 0) dB (0 to -30) dB (-30 to -50) dB (-50 to -60) dB	(> 40 to 50) GHz	0.42 dB 0.39 dB 0.77 dB 2 dB	

Parameter/Range	Frequency	CMC[2, 8, 10] (±)	Comments
Reflection S_{21}/S_{12} – Measure (cont)			
(+10 to 0) dB (0 to -30) dB (-30 to -50) dB (-50 to -60) dB	(> 50 to 65) GHz	0.45 dB 0.48 dB 2.1 dB 5.4 dB	Anritsu 37397D, Anritsu 3654B
Transmission S_{12}/S_{21}– Measure			
(0 to 0.1) lin	(30 to 50) kHz (> 50 to 300) kHz (> 0.3 to 1.3) GHz (> 1.3 to 3.0) GHz (> 3.0 to 6.0) GHz	0.042 lin 0.042 lin 0.042 lin 0.045 lin 0.068 lin	HP 8753ES, HP 85029B, HP 85050A
10 dB	45 MHz to 18 GHz	(0.13 to + 0.22) dB (1.3 to + 4.2)°	HP 8510C, 85054A type-N (sliding load cal)
0 dB		(0.051 to + 0.093) dB (0.21 to + 3.9)°	
-10 dB		(0.066 to + 0.093) dB (0.33 to + 4)°	
-20 dB		(0.067 to + 0.094) dB (0.34 to + 4)°	
-30 dB	45 MHz to 18 GHz	(0.07 to + 0.097) dB (0.37 to + 4)°	
-40 dB		(0.076 to + 0.12) dB (0.45 to + 4.2)°	
-50 dB		(0.11 to + 0.2) dB (0.73 to + 4.8)°	
-60 dB		(0.24 to + 0.49) dB (1.7 to + 6.7)°	
10 dB		(0.068 to + 0.22) dB (1.3 to + 3.8)°	
0 dB		(0.046 to + 0.049) dB (0.18 to + 3.6)°	
-10 dB		(0.05 to + 0.065) dB (0.3 to + 3.7)°	

Parameter/Range	Frequency	CMC[2, 8, 10] (±)	Comments
Transmission S_{12}/S_{21}– Measure (cont)			
-20 dB	45 MHz to 18 GHz	(0.051 to + 0.067) dB (0.31 to + 3.7)°	HP 8510C, 85050A 7 mm (sliding load cal)
-30 dB		(0.054 to + 0.068) dB (0.34 to + 3.7)°	
-40 dB		(0.063 to + 0.073) dB (0.43 to + 3.9)°	
-50 dB		(0.11 to + 0.15) dB (0.72 to + 4.5)°	
-60 dB		(0.24 to + 0.45) dB (1.7 to + 6.4)°	
10 dB		(0.13 to + 0.22) dB (1.3 to + 5.8)°	
0 dB		(0.054 to + 0.11) dB (0.21 to + 5.7)°	
-10 dB		(0.069 to + 0.11) dB (0.31 to + 5.7)°	
-20 dB	45 MHz to 26.5 GHz	(0.07 to + 0.11) dB (0.34 to + 5.7)°	HP 8510C, 85052B 3.5 mm (sliding load cal)
-30 dB		(0.073 to + 0.13) dB (0.38 to + 5.9)°	
-40 dB		(0.076 to + 0.2) dB (0.46 to + 6.4)°	
-50 dB		(0.11 to + 0.46) dB (0.75 to + 8.1)°	
-60 dB		(0.24 to + 1.4) dB (1.7 to + 14)°	
(0 to 1) lin	40 MHz to 2 GHz (> 2 to 20) GHz (> 20 to 40) GHz (> 40 to 50) GHz (> 50 to 65) GHz	0.042 lin 0.043 lin 0.046 lin 0.061 lin 0.063 lin	Anritsu 37397D, Anritsu 3654B

V. Mechanical

Parameter/Equipment	Range[4]	CMC[2, 5, 8, 10] (±)	Comments
Mass – Measure	(0.5 to 2) kg 5 kg	58 mg 110 mg	Reference weights & electronic balance
Scales & Balances[3]	(1 to 500) mg 1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg 30 kg (0 to 500) lb	6.1 µg + 0.58*R* 20 µg + 0.58*R* 20 µg + 0.58*R* 21 µg + 0.58*R* 33 µg + 0.58*R* 50 µg + 0.58*R* 0.14 mg + 0.58*R* 0.21 mg + 0.58*R* 0.38 mg + 0.58*R* 0.90 mg + 0.58*R* 1.9 mg + 0.58*R* 3.7 mg + 0.58*R* 9.0 mg + 0.58*R* 19 mg + 0.58*R* 37 mg + 0.58*R* 56 mg + 0.58*R* 0.012 % + 0.58*R*	Troemner Ultra-Class weight set Class F weights
Torque Transducers	(1 to 10) ozf·in (> 10 to 50) ozf·in > 50 ozf·in to 8 lbf·in (> 8 to 100) lbf·in (10 to 100) lbf·ft (> 100 to 1000) lbf·ft	0.15 % 0.15 % 0.03 % 0.036 % 0.053 % 0.23 %	Torque wheels & torque arms with Ultra Class & Class F weights
Torque[3] – Wrenches & Drivers	(1 to 10) ozf·in (> 10 to 50) ozf·in (1 to 10) lbf·in (10 to 100) lbf·in (8 to 100) lbf·ft (100 to 1000) lbf·ft	1.2 % 0.61 % 0.58 % 0.59 % 0.76 % 0.56 %	AWS ITIO-10 AWS ITIO-50 AWS ITO-10 AWS ITI-100 AKO TSD 2050 torque system
Vacuum – Measure[3]	(0.01 to 10) Torr (10 to 1000) Torr	0.087 % 0.089 %	MKS reference transducers

Parameter/Equipment	Range[4]	CMC[2, 5, 8, 10] (±)	Comments
Pressure Measure & Measuring Equipment[3]–			
Nitrogen Gas	(0.01 to 10) Torr > 10 to 1000 Torr	0.12 Torr + 0.58*R* 0.14 Torr + 0.58*R*	Mensor 2101
	(1.45 to 60) psig (> 60 to 300) psig (1.45 to 200) psig (> 200 to 1000) psig	0.011 psi + 0.58*R* 0.035 psi + 0.58*R* 0.035 psi + 0.58*R* 0.12 psi + 0.58*R*	Additel 780S with ADT160A AP3000Q, AP1KQ
Oil	(100 to 2000) psig (> 2000 to 5000) psig (> 5000 to 10 000) psig (> 10 000 to 20 000) psig (> 20 000 to 30 000) psig	0.27 psi 0.59 psi 1.2 psi 10 psi 15 psi	Ruska 2450
Air Velocity – Measuring Equipment	(30 to 250) FPM (250 to 1500) FPM (1500 to 9000) FPM	2.4 % + 0.58*R* 2.4 % + 0.58*R* 1.3 % + 0.58*R*	TSI 8390 wind tunnel
Force Gages – Tension & Compression[3]	(0 to 1) lbf (> 1 to 10 lbf) (> 10 to 100) lbf (> 100 to 500) lbf	0.0023 lbf + 0.58*R* 0.0026 lbf + 0.58*R* 0.054 lbf + 0.58*R* 0.15 lbf + 0.58*R*	Weights, weight hangers

VI. Thermodynamics

Parameter/Equipment	Range	CMC[2, 10] (±)	Comments
Temperature – Measure[3]	(-196 to 0) °C (> 0 to 420) °C (> 420 to 660) °C	0.018 °C 0.062 °C 0.087 °C	Fluke probe w/ display

Parameter/Equipment	Range	CMC[2, 10] (±)	Comments
Temperature – Measuring Equipment[3]	(-75 to 175) °C (0 to 100) °C (-20 to 350) °C	0.068 °C 0.045 °C 0.063 °C	Fluke 1523 with baths, chambers, dry block calibrators
Relative Humidity – Measure[3]	(5 to 15) % RH (> 15 to 35) % RH (> 35 to 55) % RH (> 55 to 77) % RH (> 77 to 95) % RH	0.15 % RH 0.35 % RH 0.5 % RH 0.69 % RH 0.83 % RH	RH Systems 973
Frost & Dew Point – Measure	(-50 to < 0) °C (0 to 20) °C	0.16 °C 0.12 °C	RH Systems 973

VII. Time & Frequency

Parameter/Equipment	Range[4]	CMC[2, 5, 10] (±)	Comments
Frequency – Measuring Equipment[3]			
GPS Reference	10 MHz 1 PPS	(7×10^{-12}) Hz (8.3×10^{-12}) PPS	Fluke 910 GPS frequency standard
	0.001 Hz to 10 MHz (> 0.01 to 12) GHz (> 12 to 50) GHz	(6×10^{-12}) Hz + 0.58*R* (6.4×10^{-12}) Hz + 0.58*R* (310×10^{-12}) Hz + 0.58*R*	Fluke 910 GPS standard HP 3325A & 83650B
Frequency – Measure[3]	0.001 Hz to 10 MHz (> 0.01 to 12) GHz (> 12 to 50) GHz	(6.8×10^{-12}) Hz + 0.58*R* (6.4×10^{-12}) Hz + 0.58*R* (520×10^{-12}) Hz + 0.58*R*	Fluke 910 GPS frequency standard, Agilent 53132A-124 & N5531S
	100 kHz to 50 GHz	0.12 Hz	Agilent E4448A, Fluke 910 GPS frequency standard
Period – Measure	80.6 ps to 4.44 ns 4.44 ns to 5 µs 5 µs to to 10 ms > 10 ms	3.2×10^{-8} ps 7.9×10^{-11} µs 2.4×10^{-9} µs 3.8×10^{-7} ms	Agilent E4438C, Fluke 910 GPS, Agilent 53132A, Agilent 3325B

Parameter/Equipment	Range[4]	CMC[2, 8, 10] (±)	Comments
Timers & Stopwatches[3]	Totalize – Up to 24 hours	46 ms	Fluke 910 GPS standard, HP 53132A & 3325B
	Stopwatch to Stopwatch	510 ms	Stopwatch comparison
	(0 to 19.99) s/day	0.064 s/day	Timometer
Pulse Characterization			
Time Interval, Pulse Width, Transition Time & Jitter – Measure[3]	DC to 50 GHz 7 ps to 1 ms	9.2 ps + 0.12 %	HP 54750A & 54752A
Time Interval, Pulse Width, Transition Time	1 ns to 100 000 s	1.3 ns	HP 53132A, Fluke 910 GPS frequency standard, HP 81130A

[1] This laboratory offers commercial dimensional testing/calibration, and field 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] 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] Where ranges are not specified, the CMC stated is for the cardinal points only.

[5] In the statement of CMC, L is the numerical value of the nominal length of the device measured in inches or millimeters. In the statement of CMC, R is the numerical value of the resolution of the device.

[6] This laboratory meets R205 – *Specific Requirements: Calibration Laboratory Accreditation Program* for the types of dimensional tests listed above and is considered equivalent to that of a calibration.

[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 fraction/percentage of the reading plus a fixed floor specification.

[8] In the statement of CMC, a % is defined as the percentage of reading unless otherwise noted.

[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

Panorama City, 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 1st day of August 2024.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1395.05
Valid to September 30, 2026

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