



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

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CALIBRATION

Valid To: March 31, 2018

Certificate Number: 2147.01

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 Quantities

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Sound Pressure <sup>3</sup>	(94 to 114) dB 114 dB	0.19 dB 0.24 dB	Sound calibrator

II. Chemical

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
pH – Measuring Equipment, Fixed Points	4 pH 7 pH 10 pH	0.017 pH 0.012 pH 0.019 pH	Buffer solution
Conductivity – Measuring Equipment, Fixed Points	10 µS/cm 1413 µS/cm 10.000 mS/cm 100.900 mS/cm	4.6 µS/cm 11 µS/cm 0.15 mS/cm 2.2 mS/cm	Conductivity solutions

III. Dimensional

Parameter/Equipment	Range	CMC <sup>2,6</sup> (±)	Comments
Bore Gauges	Up to 4 in (4 to 8) in	85 µin 140 µin	Master ring gauges
Calipers <sup>3</sup> – Dial, Digital, Vernier	(6 to 12) in (12 to 48) in	380 µin 410 µin	Gage blocks
Depth Gage <sup>3</sup> – Dial, Digital, Vernier	(0.001 to 6) in	72 µin	Gage blocks
Gage Blocks	Up to 1.0 in (1 to 12) in	4.1 µin (4.1 + 1.3L) µin	P&W Labmaster™, gage blocks
Height Gages <sup>3</sup>	(0.05 to 12) in (12 to 24) in	790 µin 900 µin	Gage blocks
I.D. Micrometer <sup>3</sup>	Up to 12 in	960 µin	Gage blocks
Indicator <sup>3</sup>	(0.00001 to 1) in	37 µin	Gage blocks, surface plate
Length Standards <sup>3</sup>	Up to 4 in (4 to 24) in (24 to 48) in	41 µin 62 µin 120 µin	Labmaster™, gage blocks
Length Standards	(48 to 96) in	110 µin	Gage blocks
Optical Comparators <sup>3</sup>			
Linearity Displacement Accuracy	Up to 12"	0.0002"	Glass Scales
Magnification	Up to 50X	0.0007"	Magnification Scale

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Micrometers <sup>3</sup> – Outside Depth	Up to 6 in (6 to 12) in Up to 6 in	71 μin 79 μin 210 μin	Gage blocks
Pin & Plug Gage	(0.01 to 4) in	7.1 μin	P&W Labmaster™, gage blocks
Thread Rings	Up to 4 in	280 μin	Set plugs
Threaded Plugs Major Diameter Pitch Diameter	Up to 1 in (80 to 6) TPI	79 μin 49 μin	P&W Labmaster™, gage blocks
Protractor	(1 to 180)°	0.026°	Surface plate, sine bar
Plain Ring Gage	Up to 1 in (1 to 4) in (4 to 8) in	8.4 μin 18 μin 26 μin	P&W Labmaster™, master ring gages
Measuring Rule <sup>3</sup>	Up to 36 in (76.2 to 1000) mm	0.0019 in 62 μm	Master rule
Sine Bar	(5 to 10) in	48 μin	Surface plate, gage blocks
Surface Plate <sup>3</sup> Flatness	Up to 48 in (49 to 72) in	75 μin 150 μin	Electronic level

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Thread Wires	(80 to 6) TPI	15 µin	P&W Labmaster™, gage blocks
Thickness Gage – Hard	(0.0010 to 8.0000) in	87 µin	P&W Labmaster™, gage blocks
Ultrasonic	(0.001 to 8.000) in	170 µin	Gage blocks

#### IV. Electrical DC/Low Frequency

Parameter/Equipment	Range	CMC <sup>2,7,9</sup> (±)	Comments
DC Voltage <sup>3</sup> – Generate/Measure	100 µV to 1 mV	0.63 µV	Calibrator
	(1 to 10) mV	0.75 µV	
	(10 to 100) mV	0.70 µV	
	100 mV to 1 V	1.4 µV	
	(1 to 10) V	6.3 µV	
	(10 to 100) V	4.7 µV	
	(100 to 1000) V	560 µV	High volt DMM
	1000 V	7.6 µV/V	
	100 V to 10 kV	0.50 % + 3.0 V	
	300 V to 40 kV	2.0 %	DMM w/ high volt probe
	(1 to 3) µV	0.17 µV	
	(3 to 10) µV	0.20 µV	
	10 µV	0.37 µV	
DC Voltage – Solid State	10 V	1.4 µV/V	DC reference standard
	1.018 V	2.1 µV/V	
	1.0 V	1.3 µV/V	
	10.0 V	1.3 µV/V	
	100.0 V	1.3 µV/V	
	1000.0 V	1.4 µV/V	Null detector, DC reference standard, reference divider

Parameter/Equipment	Range	CMC <sup>2,9</sup> (±)	Comments	
DC Voltage – Solid State	10 V	1.4 μV/V	DC reference standard	
	1.018 V	2.1 μV/V		
	1.0 V	1.3 μV/V	Null detector, DC reference standard, reference divider	
	10.0 V	1.3 μV/V		
	100.0 V	1.3 μV/V		
1000.0 V	1.4 μV/V			
DC Current <sup>3</sup> – Generate/Measure	100 μA to 1.0 mA	0.041 μA	Calibrator/DMM	
	(1.0 to 10.0) mA	0.068 μA		
	(10.0 to 100.0) mA	0.56 μA		
DC Clamp-On Meter	100.0 mA to 1 A	5.6 μA	Current shunt	
	1.000 A	0.13 mA		
DC Resistance <sup>3</sup> – Generate/Measure, Fixed Points	(0 to 20) A	0.02 %	Calibrator w/ coil	
	(0 to 1000) A	1.1 %		
	(10 to 100) Ω	0.34 mΩ		Calibrator/DMM
	100 Ω to 1 kΩ	1.6 mΩ		
	(1 to 10) kΩ	1.7 mΩ		
	(10 to 100) kΩ	0.017 Ω		
	100 kΩ to 1 MΩ	0.20 Ω		
	(1 to 10) MΩ	30 Ω		
	(10 to 100) MΩ	300 Ω		
	100 MΩ	2.5 kΩ		
(100 to 300) MΩ	1.4 MΩ	Calibrator/DMM		
300 MΩ to 1.1 GΩ	18 MΩ			
	(1 to 10) Ω	3.8 μΩ/Ω	Lab resistor	
	10 kΩ	1.4 μΩ/Ω		
	0.01 mΩ to 99.9999 MΩ	0.052 %	Precision LCR meter	

Parameter/Range	Frequency	CMC <sup>2,9</sup> (±)	Comments
AC Voltage <sup>3</sup> – Measure			
3 mV	(10 to 100) Hz 100 Hz to 30 kHz (30 to 200) kHz (200 to 500) kHz 500 kHz to 1 MHz	0.11 % 0.093 % 0.13 % 0.25 % 0.50 %	Datron 4920A
10 mV	(10 to 100) Hz 100 Hz to 30 kHz (30 to 200) kHz (200 to 500) kHz 500 kHz to 1 MHz	0.034 % 0.021 % 0.052 % 0.14 % 0.35 %	
30 mV	(10 to 100) Hz 100 Hz to 30 kHz (30 to 200) kHz (200 to 500) kHz 500 kHz to 1 MHz	0.027 % 0.017 % 0.039 % 0.11 % 0.27 %	
100 mV	(10 to 100) Hz 100 Hz to 30 kHz (30 to 200) kHz (200 to 500) kHz 500 kHz to 1 MHz	0.020 % 0.010 % 0.019 % 0.058 % 0.16 %	
300 mV	(1 to 2) Hz (2 to 10) Hz (10 to 40) Hz 40 Hz to 30 kHz (30 to 200) kHz (200 to 500) kHz 500 kHz to 1 MHz	0.029 % 0.013 % 30 μV/V 33 μV/V 0.018 % 0.029 % 0.079 %	
1 V	(1 to 2) Hz (2 to 10) Hz (10 to 40) Hz 40 Hz to 30 kHz (30 to 200) kHz (200 to 500) kHz 500 kHz to 1 MHz	0.029 % 0.013 % 30 μV/V 32 μV/V 77 μV/V 0.029 % 0.078 %	
3 V	(1 to 2) Hz (2 to 10) Hz (10 to 40) Hz 40 Hz to 30 kHz (30 to 200) kHz (200 to 500) kHz 500 kHz to 1 MHz	0.029 % 0.013 % 30 μV/V 32 μV/V 80 μV/V 0.029 % 0.078 %	

Parameter/Range	Frequency	CMC <sup>2, 7, 9</sup> (±)	Comments
AC Voltage <sup>3</sup> – Measure (cont)			
10 V	(1 to 2) Hz	0.029 %	Datron 4920A
	(2 to 10) Hz	0.013 %	
	(10 to 40) Hz	30 µV/V	
	40 Hz to 30 kHz	30 µV/V	
	(30 to 200) kHz	68 µV/V	
	(200 to 500) kHz	0.029 %	
	500 kHz to 1 MHz	0.078 %	
30 V	(1 to 2) Hz	0.029 %	Datron 4920A
	(2 to 10) Hz	0.013 %	
	(10 to 40) Hz	37 µV/V	
	40 Hz to 30 kHz	30 µV/V	
	(30 to 200) kHz	68 µV/V	
	(200 to 500) kHz	0.029 %	
	500 kHz to 1 MHz	0.078 %	
100 V	(1 to 2) Hz	0.029 %	Datron 4920A
	(2 to 10) Hz	0.013 %	
	(10 to 40) Hz	37 µV/V	
	40 Hz to 30 kHz	31 µV/V	
	(30 to 200) kHz	83 µV/V	
300 V	(1 to 2) Hz	0.031 %	Datron 4920A
	(2 to 10) Hz	0.016 %	
	(10 to 40) Hz	46 µV/V	
	40 Hz to 20 kHz	46 µV/V	
	(20 to 100) kHz	0.011 %	
1000 V	(1 to 2) Hz	0.032 %	Datron 4920A
	(2 to 10) Hz	0.016 %	
	(10 to 40) Hz	46 µV/V	
	40 Hz to 20 kHz	52 µV/V	
	(20 to 100) kHz	0.011 %	

Parameter/Range	Frequency	CMC <sup>2, 7, 9</sup> (±)	Comments
AC Voltage <sup>3</sup> – Generate			
1 mV	(10 to 31) Hz	7.9 μV	Datron 4808 multifunction calibrator
	(32 to 320) Hz	7.9 μV	
	300 Hz to 10 kHz	7.2 μV	
	(10 to 33) kHz	7.2 μV	
	(30 to 100) kHz	7.4 μV	
	(100 to 330) kHz	7.2 μV	
	(0.3 to 1.0) MHz	17 μV	
10 mV	(10 to 31) Hz	8.7 μV	
	(32 to 320) Hz	8.6 μV	
	300 Hz to 10kHz	8.0 μV	
	(10 to 33) kHz	8.0 μV	
	(30 to 100) kHz	8.2 μV	
	(100 to 330) kHz	15 μV	
	(0.3 to 1.0) MHz	18 μV	
100 mV	(10 to 31) Hz	18 μV	
	(32 to 320) Hz	18 μV	
	300 Hz 10 kHz	18 μV	
	(10 to 33) kHz	18 μV	
	(30 to 100) kHz	18 μV	
	(100 to 330) kHz	24 μV	
	(0.3 to 1.0) MHz	190 μV	
1 V	(10 to 31) Hz	170 μV	
	(32 to 330) Hz	140 μV	
	300 Hz to 33 kHz	120 μV	
	(30 to 100) kHz	150 μV	
	(100 to 330) kHz	530 μV	
	(0.3 to 1.0) MHz	2.9 mV	
10 V	(10 to 31) Hz	420 μV	
	(32 to 330) Hz	290 μV	
	300 Hz to 33 kHz	190 μV	
	(30 to 100) kHz	310 μV	
	(100 to 330) kHz	1.3 mV	
	(0.3 to 1.0) MHz	2.1 mV	
100 V	(10 to 31) Hz	4.2 mV	
	(32 to 330) Hz	3.6 mV	
	300 Hz to 33 kHz	7.0 mV	
	(30 to 100) kHz	7.0 mV	
	(100 to 330) kHz	17 mV	



Parameter/Range	Frequency	CMC <sup>2, 7, 9</sup> (±)	Comments
AC Voltage <sup>3</sup> – Generate (cont)			
1000 V	(10 to 31) Hz (32 to 330) Hz 300 Hz to 3.3 kHz (3 to 10) kHz (10 to 33) kHz	190 mV 190 mV 140 mV 180 mV 180 mV	Datron 4808 multifunction calibrator
100 V to 10 kV	(10 to 400) Hz	1.0 % + 5 V(NF)	High volt meter
300 V to 40 kV	(50 to 400) Hz	5.0 %	DMM w/ high volt probe
AC Current <sup>3</sup> – Measure/ Generate			
(0 to 20) A	Up to 1 kHz  (1 to 5) kHz	0.025 %  0.035 %	Calibrator/DMM/ shunt
Clamp-On Meter  (0 to 1000) A	  (45 to 445) Hz	  1.1 %	  Calibrator w/ coil
Phase Angle – Measure/ Generate			
(0 to 360)° (0.01 to 120) Vrms	10 Hz to 5 kHz (5 to 20) kHz (20 to 100) kHz (100 to 200) kHz (200 to 500) kHz (0.500 to 1) MHz (1 to 3) MHz (3 to 5) MHz	0.050° 0.10° 0.70° 1.4° 3.5° 7.0° 21° 35°	Phase meter

Parameter/Equipment	Range	CMC <sup>2,7</sup> (±)	Comments
Capacitance <sup>3</sup> – Generate	(0 to 0.3) nF (0 to 1) nF (1 to 3) nF (3 to 10) nF (10 to 30) nF (30 to 100) nF (100 to 300) nF (0.3 to 1) μF (1 to 3) μF (3 to 10) μF (10 to 30) μF (30 to 100) μF (100 to 300) μF (0.3 to 1) mF (1 to 3) mF (3 to 10) mF (10 to 30) mF (30 to 110) mF	0.012 nF 0.015 nF 0.025 nF 0.035 nF 0.18 nF 0.35 nF 1.1 nF 3.5 nF 11 nF 35 nF 150 nF 550 nF 1.7 μF 5.5 μF 17 μF 55 μF 260 μF 1.4 mF	Fluke 5520A

Parameter/Equipment	Range	CMC <sup>2,7,9</sup> (±)	Comments
Capacitance – Measure  10 Hz to 1 MHz	(0.01 to 9.999999) F	0.050 %	Precision LCR meter



Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Thermocouple Simulation <sup>3</sup> –			
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.44 °C 0.34 °C 0.30 °C 0.33 °C	Fluke 5520A
Type C	(0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.30 °C 0.26 °C 0.31 °C 0.50 °C 0.84 °C	
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.50 °C 0.16 °C 0.14 °C 0.16 °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	0.27 °C 0.16 °C 0.14 °C 0.17 °C 0.23 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1000) °C (1000 to 1372) °C	0.33 °C 0.18 °C 0.16 °C 0.26 °C 0.33 °C 0.40 °C	
Type L	(-200 to -100) °C (-100 to -25) °C (-25 to 800) °C (800 to 900) °C	0.37 °C 0.26 °C 0.33 °C 0.22 °C	



Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Thermocouple Simulation <sup>3</sup> – (cont)			
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.40 °C 0.22 °C 0.19 °C 0.18 °C 0.27 °C	Fluke 5520A
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.57 °C 0.35 °C 0.33 °C 0.40 °C	
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.47 °C 0.36 °C 0.37 °C 0.46 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.63 °C 0.24 °C 0.16 °C 0.14 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.56 °C 0.27 °C	
RTD Simulation <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	0.050 °C 0.050 °C 0.070 °C 0.090 °C 0.10 °C 0.12 °C 0.23 °C	Fluke 5520A
Pt 3926, 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	0.050 °C 0.050 °C 0.070 °C 0.090 °C 0.10 °C 0.12 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
RTD Simulation <sup>3</sup> – (cont)			
Pt 3916, 100 Ω	(-200 to -190) °C (-190 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.25 °C 0.040 °C 0.050 °C 0.060 °C 0.070 °C 0.080 °C 0.090 °C 0.10 °C 0.23 °C	Fluke 5520A
Pt 385, 200 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.040 °C 0.040 °C 0.040 °C 0.050 °C 0.12 °C 0.13 °C 0.14 °C 0.16 °C	
Pt 385, 500 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.040 °C 0.050 °C 0.050 °C 0.060 °C 0.080 °C 0.080 °C 0.090 °C 0.11 °C	
Pt 385, 1000 Ω	(-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.030 °C 0.030 °C 0.040 °C 0.050 °C 0.060 °C 0.070 °C 0.070 °C 0.23 °C	
Ni 120, 120 Ω	(-80 to 0) °C (0 to 100) °C	0.080 °C 0.14 °C	
Cu 427, 10 Ω	(100 to 260) °C	0.30 °C	

Parameter/Equipment	Range	CMC <sup>2,9</sup> (±)	Comments
Inductance <sup>3</sup> – Generate, Fixed Points	100 μH 1 mH (1 to 10) mH (10 to 100) mH 100 mH to 1 H 1H	2.1 % 2.1 % 1.2 % 0.60 % 0.60 %	General radio 1490D
Measure 10 Hz to 1 MHz	0.01 nH to 99.999 kH	0.050 %	Precision LCR meter

#### IV. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC <sup>2</sup> (±)	Comments
Leveled Sine Wave <sup>3</sup> – Absolute Accuracy 50 Ω			
(-48 to 24) dBm (-74 to -48) dBm (-94 to -74) dBm (-130 to -94) dBm	100 kHz to 125 MHz	0.050 dB 0.20 dB 0.50 dB 1.5 dB	Fluke 9640A
(-17 to 24) dBm (-74 to -17) dBm (-94 to -74) dBm (-130 to -94) dBm	1 GHz	0.25 dB 0.50 dB 1.0 dB 1.5 dB	
(-74 to 14) dBm (-84 to -74) dBm	4 GHz	0.50 dB 1.0 dB	

Parameter/Range	Frequency	CMC <sup>2</sup> (±)	Comments
Absolute Amplitude <sup>3</sup> – Amplitude @ 50 Ω			
(20 to 24) dBm	9 Hz to 125 MHz	0.050 dB	Fluke 9640A
(14 to 20) dBm	9 Hz to 125 MHz (125 to 300) MHz 300 MHz to 1.4 GHz	0.050 dB 0.10 dB 0.25 dB	
(-17 to 14) dBm	9 Hz to 125 MHz (125 to 300) MHz 300 MHz to 1.4 GHz (1.4 to 3) GHz (3 to 4.024) GHz	0.050 dB 0.10 dB 0.25 dB 0.30 dB 0.50 dB	
(-48 to -17) dBm	9 Hz to 125 MHz (125 to 300) MHz 300 MHz to 4.024 GHz	0.050 dB 0.10 dB 0.50 dB	
(-74 to -48) dBm	100 kHz to 300 MHz 300 MHz to 4.024 GHz	0.20 dB 0.20 dB	
(-84 to -74) dBm	100 kHz to 300 MHz 300 MHz to 4.024 GHz	0.50 dB 1.0 dB	
(-94 to -84) dBm	100 kHz to 300 MHz 300 MHz to 3 GHz	0.50 dB 1.0 dB	
(-130 to -94) dBm	100 kHz to 3 GHz	1.5 dB	
Frequency Modulation <sup>3</sup> – Generate			
Carrier:	20 Hz to 1 kHz	0.012 %	Fluke 9640A
9 MHz to 4 GHz	(1 to 10) kHz	0.10 %	
	(10 to 100) kHz	1.0 %	
	(100 to 300) kHz	10 %	

Parameter/Range	Frequency	CMC <sup>2,9</sup> (±)	Comments
Attenuation <sup>3,4,5</sup> – (0 to 33) dB (33 to 64) dB (64 to 100) dB	100 kHz to 100 MHz	0.035 dB 0.040 dB 0.10 dB	Fluke 9640A
Frequency Modulation <sup>3</sup> – Measure  50 kHz to 10 MHz Mod: 20 Hz to 10 kHz  10 MHz to 1.3 GHz Mod: 50 Hz to 100 kHz  10 MHz to 1.3 GHz Mod: 20 Hz to 50 Hz	10 Hz to 1300 MHz	2.2 %  1.2 %  5.9 %	HP 8901A
Amplitude Modulation <sup>3</sup> – Measure  150 kHz to 10 MHz Rate: 50 Hz to 10 kHz 5% depth  150 kHz to 10 MHz Rate: 20 Hz to 10 kHz  (10 to 1300) MHz Rate: 50 Hz to 50 kHz 5% depth  (10 to 1300) MHz Rate: 20 Hz to 100 kHz  10 Hz to 1300 MHz Rate: 20 Hz to 20 kHz	10 Hz to 1300 MHz	2.2 %  3.2 %  1.1 %  3.2 %  3.2 %	HP 8901A



Parameter/Range	Frequency	CMC <sup>2, 7, 9</sup> ( $\pm$ )	Comments
Phase Modulation <sup>3</sup> – Measure Rate: 20 Hz to 20 kHz	10 Hz to 1300 MHz	3.1 %	HP 8901A
Amplitude Modulation <sup>3</sup> – Sine Depth (Internal) 2.0 % to 99 %	50 kHz to 4.024 GHz	3.2 %	Fluke 9640A
Amplitude Modulation <sup>3</sup> – Sine Distortion 10.0 % to 89.0 %	50 kHz to 125 MHz	-40 dBc	Fluke 9640A
Frequency Modulation <sup>3</sup> – Sine Deviation 10 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz 100 kHz to 1 MHz (1 to 4.8) MHz	50 kHz to 4.024 GHz	3.0 % 3.0 % 3.0 % 3.0 % 3.0 %	Fluke 9640A
Phase Modulation <sup>3</sup> – Sine Depth (0.0001 to 10) rad (10 to 100) rad (100 to 1000) rad	50 kHz to 4.024 GHz	3.3 % 3.2 % 3.1 %	Fluke 9640A
RF Power <sup>3</sup> – Measure (-70 to -30) dB	(10 to 50) MHz (50 to 500) MHz (500 to 1000) MHz (1000 to 2000) MHz (2000 to 3000) MHz (3000 to 4000) MHz 4000 MHz	2.5 % + 0.020 dB 2.5 % + 0.020 dB 2.6 % + 0.020 dB 2.6 % + 0.020 dB 2.6 % + 0.020 dB 2.6 % + 0.020 dB 2.6 % + 0.020 dB	HP 8484A w/ HP 436A



V. Fluid Quantities

Parameter/Equipment	Range	CMC <sup>2,7</sup> (±)	Comments
Mass Flow	Up to 50 LPM	0.83 % + 0.20 % FS	Mass flow meters

VI. Mechanical

Parameter/Equipment	Range	CMC <sup>2,9</sup> (±)	Comments
Accelerometers <sup>3</sup>	7 Hz to 10 kHz	3.1 %	9100D Vibration standard
Tachometers <sup>3</sup>	6 rpm 60 rpm 600 rpm 6000 rpm 60 000 rpm 100 000 rpm	0.0020 rpm 0.020 rpm 0.20 rpm 1.7 rpm 8.5 rpm 52 rpm	Master tachometer
Pressure/Vacuum <sup>3</sup>	(-15 to 25) PSI -22 in·Hg to 100 PSI (100 to 500) PSI (0 to 1500) PSI (1500 to 3000) PSI (3000 to 5000) PSI (5000 to 10 000) PSI (0 to 1) inH <sub>2</sub> O	0.021 % 0.030 PSI 0.050 PSI 0.15 PSI 0.011% 0.25 PSI 0.011 % 0.0010 psi	Fluke PPC4EX Pressure calibrator Pressure module DPG 2500 Pressure sensor
Torque <sup>3</sup>	(0 to150) in·lbf (0 to150) ft·lbf	1.2 % 1.2 %	Torque analyzer
Force <sup>3</sup>	(0 to1000) lb	0.21 %	Load cell

Parameter/Equipment	Range	CMC <sup>2, 6</sup> ( $\pm$ )	Comments
Balances	(1 to 50) mg (50 to 500) mg 500 mg to 1 g (1 to 5) g (5 to 50) g (50 to 100) g (100 to 200) g (200 to 2000) g (2000 to 6000) g	0.014 mg + 0.6R 0.025 mg + 0.6R 0.034 mg + 0.6R 0.054 mg + 0.6R 0.12 mg + 0.6R 0.25 mg + 0.6R 0.51 mg + 0.6R 24 mg + 0.6R 85 mg + 0.6R	Class S1, Class1, Class F weights

#### V. Thermodynamics

Parameter/Equipment	Range	CMC <sup>2</sup> ( $\pm$ )	Comments
Infrared Thermometry <sup>3</sup>	(15 to 315) °C	1.3 °C	Black body
Thermocouples, RTDs, and Liquid Thermometers <sup>3</sup>	(0 to 100) °C (100 to 375) °C	0.070 °C 0.40 °C	Dry well, PRTD
Humidity – Measuring Equipment	(0 to 99) % RH	1.4 % RH	Humidity generator w/ humidity probe
Humidity – Measure	(0 to 99) % RH	1.4 % RH	Humidity probe

#### VI. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2</sup> ( $\pm$ )	Comments
Timers/Stopwatches <sup>3</sup>	0 s to 60 hr	0.11 s	Master tachometer

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Frequency <sup>3</sup> – Measuring Equipment	(0.1 to 110) Hz 110 Hz to 1.1 kHz (1.1 to 10) kHz	310 µHz 3.0 mHz 28 mHz	Fluke 5520A
Frequency Out	9 Hz to 100 MHz 100 MHz to 4.024 GHz  (1 to 10) MHz	0.27 µHz/Hz  0.044 µHz/Hz 0.044 µHz/Hz	Fluke 9640A
Frequency – Measure <sup>3</sup>	(0.1 to 18) GHz	1 Count + 20 µHz	HP 5342A

<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> Specifications are typical below 10 MHz.

<sup>5</sup> Relative to +16 dBm output.

<sup>6</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 unit under test.

<sup>7</sup> The measurands stated are generated using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure the measurand in the ranges indicated. CMC are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

<sup>8</sup> "Labmaster" is a registered trade mark with a last listed owner of Pratt & Whitney Measurement Systems, Inc., Connecticut U.S.A.

<sup>9</sup> In the statement of CMC, percentages are percentage of reading, unless otherwise indicated.



## Accredited Laboratory

A2LA has accredited

**ENI LABS**

*Fort Wayne, IN*

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/NCSLI Z540-1-1994 and A2LA R205 – *Specific Requirements – Calibration Laboratory Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).



Presented this 30<sup>th</sup> day of August 2016.

A handwritten signature in blue ink, appearing to read "J. C. Bunt".

Senior Director of Quality and Communications  
For the Accreditation Council  
Certificate Number 2147.01  
Valid to March 31, 2018

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