



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005,
ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3-2006

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CALIBRATION

Valid To: April 30, 2019

Certificate Number: 2737.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Dimensional

Parameter/Equipment	Range	CMC ^{2,6} (\pm)	Comments
Calipers and Micrometers ³	Up to 12 in	(4 + 550L) μ in	Gage blocks
Pin Gages	(0.011 to 1) in	(6.6 + 9.5L) μ in	Pratt & Whitney labmaster plus gage block set

II. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,5} (\pm)	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	7.5 μ V/V + 0.6 μ V 5.7 μ V/V + 1.0 μ V 3.4 μ V/V + 3.5 μ V 3.9 μ V/V + 6.5 μ V 2.1 μ V/V + 80 μ V 3.6 μ V/V + 500 μ V	Fluke 5720A

Parameter/Equipment	Range	CMC ^{2, 5} (\pm)	Comments
DC Resistance – Generate ³ (cont)	(33 to 109.999) Ω (110 to 329.999) Ω 330 Ω to 1.0999 k Ω (1.1 to 3.2999) k Ω (3.3 to 10.9999) k Ω (11 to 32.9999) k Ω (33 to 109.999) k Ω (110 to 329.999) k Ω (330 to 1099.9) k Ω (1.1 to 3.2999) M Ω (3.3 to 10.999) M Ω (11 to 32.999) M Ω (33 to 109.999) M Ω (110 to 329.999) M Ω (330 to 1100) M Ω	24 $\mu\Omega/\Omega$ + 1.4 m Ω 12 $\mu\Omega/\Omega$ + 2.0 m Ω 16 $\mu\Omega/\Omega$ + 2.0 m Ω 17 $\mu\Omega/\Omega$ + 20 m Ω 21 $\mu\Omega/\Omega$ + 20 m Ω 37 $\mu\Omega/\Omega$ + 200 m Ω 18 $\mu\Omega/\Omega$ + 200 m Ω 15 $\mu\Omega/\Omega$ + 200 m Ω 13 $\mu\Omega/\Omega$ + 200 m Ω 24 $\mu\Omega/\Omega$ + 2 Ω 40 $\mu\Omega/\Omega$ + 2 Ω 13 $\mu\Omega/\Omega$ + 30 Ω 20 $\mu\Omega/\Omega$ + 50 Ω 53 $\mu\Omega/\Omega$ + 2.5 k Ω 0.28 m Ω/Ω + 3 k Ω	Fluke 5522A
DC Resistance – Measure ³	(0 to 2) Ω (2 to 20) Ω (20 to 200) Ω (200 to 2000) Ω (2 to 20) k Ω (20 to 200) k Ω (0.2 to 2) M Ω (2 to 20) M Ω (20 to 200) M Ω (0.2 to 2) G Ω	25 $\mu\Omega/\Omega$ + 4.0 $\mu\Omega$ 12 $\mu\Omega/\Omega$ + 14 $\mu\Omega$ 9.4 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 9.4 $\mu\Omega/\Omega$ + 0.5 m Ω 9.4 $\mu\Omega/\Omega$ + 5.0 m Ω 9.5 $\mu\Omega/\Omega$ + 50 m Ω 14 $\mu\Omega/\Omega$ + 1.0 Ω 57 $\mu\Omega/\Omega$ + 0.10 k Ω 0.046 % + 10 k Ω 0.18 % + 0.10 M Ω	Fluke 8508A

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Electrical Calibration of Thermocouple Indicators ^{3, 4} –			
Type B	(600 to 800) °C (800 to 1000) °C (1000 to 1550) °C (1550 to 1820) °C	0.35 °C 0.27 °C 0.24 °C 0.26 °C	Fluke 5520A
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.39 °C 0.14 °C 0.12 °C 0.14 °C 0.17 °C	
Type J	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.22 °C 0.14 °C 0.12 °C 0.14 °C 0.19 °C	
Type K	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.26 °C 0.15 °C 0.14 °C 0.21 °C 0.33 °C	
Type N	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 410) °C (410 to 1300) °C	0.31 °C 0.18 °C 0.16 °C 0.15 °C 0.22 °C	

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Electrical Calibration of Thermocouple Indicators ^{3, 4} – (cont)			
Type R	(0 to 250) °C (250 to 400) °C (400 to 1000) °C (1000 to 1767) °C	0.45 °C 0.28 °C 0.26 °C 0.31 °C	Fluke 5520A
Type S	(0 to 250) °C (250 to 1000) °C (1000 to 1400) °C (1400 to 1767) °C	0.37 °C 0.28 °C 0.29 °C 0.36 °C	
Type T	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.49 °C 0.19 °C 0.14 °C 0.15 °C	
Type U	(-200 to 0) °C (0 to 600) °C	0.44 °C 0.22 °C	
Electrical Calibration of RTD Indicators ^{3, 4} –			
Pt 385, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.039 °C 0.055 °C 0.070 °C 0.078 °C 0.093 °C 0.18 °C	Fluke 5520A
Pt 3926, 100 Ω	(-200 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C	0.039 °C 0.055 °C 0.070 °C 0.078 °C 0.093 °C	

Parameter/Equipment	Range	CMC ^{2, 5} (±)	Comments
Electrical Calibration of RTD Indicators ^{3,4} – (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	0.19 °C 0.032 °C 0.039 °C 0.047 °C 0.055 °C 0.062 °C 0.070 °C 0.078 °C 0.18 °C	Fluke 5520A
Pt 385, 200 Ω	(-200 to -80) °C (-80 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.017 °C 0.032 °C 0.089 °C 0.93 °C 0.10 °C 0.11 °C 0.12 °C	
Pt 385, 500 Ω	(-200 to -80) °C (-80 to 100) °C (100 to 260) °C (260 to 400) °C (400 to 600) °C (600 to 630) °C	0.031 °C 0.039 °C 0.047 °C 0.062 °C 0.070 °C 0.086 °C	
Pt 385, 1000 Ω	(-200 to 0) °C (0 to 100) °C (100 to 260) °C	0.025 °C 0.032 °C 0.092 °C	
PtNi 385, 120 Ω	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.069 °C 0.062 °C 0.11 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.23 °C	

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
Oscilloscope ^{3,4} –			
50 Ω Load	(1 to 24.999) mV 25 mV to 2.1999 V (2.2 to 130) V	1.3 % of output + 40 μV 0.23 % of output + 40 μV 2.1 % of output + 40 μV	Fluke 5520A/SC1100
1 MΩ Load	(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	0.12 % of output + 40 μV 0.09 % of output + 40 μV 0.31 % of output + 40 μV 0.27 % of output + 40 μV 2.0 % of output + 40 μV	
Level Sine Wave			
Amplitude (50 kHz Reference)	50 kHz 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	1.6 % + 300 μV 2.8 % + 300 μV 3.2 % + 300 μV 4.7 % + 300 μV 5.7 % + 300 μV	
Flatness (50 kHz Reference)	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	1.4 % + 100 μV 1.6 % + 100 μV 3.2 % + 100 μV 3.9 % + 100 μV	
Time Markers: Source and Period into a 50 Ω Load	5 s to 50 ms 20 ms to 2 ns	160 μs + <i>t</i> parts in 10 ⁶ s 64 μs + <i>t</i> parts in 10 ⁶ s	<i>t</i> = time in seconds
Amplitude 1 MΩ 50 Ω	1.8 mV to 55 V _(pk-pk) 1.8 mV to 2.5 V _(pk-pk)	2.4 % + 100 μV 2.4 % + 100 μV	
Frequency	10 Hz to 100 kHz	34 parts in 10 ⁶ Hz + 15 mHz	

Parameter/Equipment	Range	CMC ^{2,5} (±)	Comments
AC Power ^{3,4} @ (45 to 65) Hz – PF=1			
(3.3 to 9) mA	(33 to 330) mV (0.33 to 1020) V	0.11 % 0.09 %	Fluke 5520A
(9 to 33) mA	(33 to 330) mV (0.33 to 1020) V	0.08 % 0.06 %	
(33 to 90) mA	(33 to 330) mV (0.33 to 1020) V	0.11 % 0.09 %	
(90 to 330) mA	(33 to 330) mV (0.33 to 1020) V	0.08 % 0.06 %	
(0.33 to 0.9) A	(33 to 330) mV (0.33 to 1020) V	0.10 % 0.09 %	
(0.9 to 2.2) A	(33 to 330) mV (0.33 to 1020) V	0.07 % 0.10 %	
(2.2 to 4.5) A	(33 to 330) mV (0.33 to 1020) V	0.10 % 0.09 %	
(4.5 to 20.5) A	(33 to 330) mV (0.33 to 1020) V	0.09 % 0.08 %	

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
AC Voltage – Generate ³			
Up to 2.2 mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.27 mV/V + 4.5 μV 0.13 mV/V + 4.5 μV 0.11 mV/V + 4.5 μV 0.21 mV/V + 4.5 μV 0.51 mV/V + 7 μV 1.1 mV/V + 13 μV 1.4 mV/V + 25 μV 2.7 mV/V + 25 μV	Fluke 5720A
(2.2 to 22) mV	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.25 mV/V + 5 μV 0.10 mV/V + 5 μV 0.10 mV/V + 5 μV 0.21 mV/V + 5 μV 0.50 mV/V + 7 μV 1.1 mV/V + 12 μV 1.4 mV/V + 25 μV 1.6 mV/V + 25 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	0.24 mV/V + 13 μV 0.10 mV/V + 8 μV 0.08 mV/V + 8 μV 0.20 mV/V + 8 μV 0.46 mV/V + 25 μV 0.90 mV/V + 25 μV 0.04 mV/V + 35 μV 0.11 mV/V + 80 μV	
220 mV to 2.2 V	(10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz (0.5 to 1) MHz	0.12 mV/V + 80 μV 0.27 mV/V + 25 μV 0.26 mV/V + 6 μV 0.05 mV/V + 16 μV 0.06 mV/V + 70 μV 0.21 mV/V + 130 μV 0.47 mV/V + 350 μV 0.85 mV/V + 850 μV	
(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	39 μV/V + 800 μV 27 μV/V + 250 μV 0.27 mV/V + 60 μV 0.27 mV/V + 160 μV 0.27 mV/V + 350 μV 0.28 mV/V + 1.5 mV 0.28 mV/V + 4.3 mV 0.57 mV/V + 8.5 mV	

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
AC Voltage – Generate ^{3,4} (cont)			
(3.3 to 32.9999) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.054 % + 650 μV 0.026 % + 600 μV 0.11 % + 600 μV 0.16 % + 600 μV 0.17 % + 1.6 mV	Fluke 5520A
(33 to 329.999) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.024 % + 2.0 mV 0.24 % + 6.0 mV 0.25 % + 6.0 mV 0.40 % + 6.0 mV 0.43 % + 50 mV	
(330 to 1000) V	45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.41 % + 10 mV 0.41 % + 10 mV 0.40 % + 10 mV	
AC Voltage – Measure ^{3,4}			
Up to 10 mV	(10 to 40) Hz (40 to 1000) Hz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.034 % + 3.0 μV 0.023 % + 1.1 μV 0.034 % + 1.1 μV 0.12 % + 1.1 μV 0.57 % + 1.1 μV 4.6 % + 2.0 μV	Agilent 3458A
(10 to 100) mV	(10 to 40) Hz (40 to 1000) Hz (1 to 30) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz	0.01 % + 4 μV 0.01 % + 2 μV 0.02 % + 2 μV 0.034 % + 2 μV 0.091 % + 2 μV 0.34 % + 10 μV 1.2 % + 10 μV 1.5 % + 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 (0.3 to 1) MHz (1 to 2) MHz	0.007 % + 40 μV 0.007 % + 20 μV 0.014 % + 20 μV 0.03 % + 20 μV 0.08 % + 20 μV 0.3 % + 100 μV 1.0 % + 100 μV 1.5 % + 100 μV	

Parameter/Range	Frequency	CMC ^{2, 5} (\pm)	Comments
AC Voltage – Measure ^{3, 4} (cont)			
(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 (1 to 2) MHz	0.01 % + 400 μ V 0.01 % + 200 μ V 0.02 % + 200 μ V 0.035 % + 200 μ V 0.091 % + 200 μ V 0.34 % + 1 mV 1.3 % + 1 mV 1.7 % + 1 mV	Agilent 3458A
(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 (100 to 300) kHz 300 kHz to 1 MHz	0.063 % + 4 mV 0.035 % + 2 mV 0.023 % + 2 mV 0.06 % + 2 mV 0.14 % + 2 mV 0.46 % + 10 mV 1.7 % + 10 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	0.07 % + 40 mV 1.9 % + 20 mV 2.6 % + 20 mV 0.14 % + 20 mV 0.36 % + 20 mV	
AC Current – Generate ³			
Up to 220 μ A	(10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.26 mA/A + 25 nA 0.16 mA/A + 20 nA 0.12 mA/A + 16 nA 0.28 mA/A + 40 nA 1.1 mA/A + 80 nA	Fluke 5720A
220 μ A 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	0.25 mA/A + 40 nA 0.16 mA/A + 35 nA 0.12 mA/A + 35 nA 0.20 mA/A + 400 nA 1.1 mA/A + 800 nA	
(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	0.25 mA/A + 400 nA 0.16 mA/A + 350 nA 0.12 mA/A + 350 nA 0.20 mA/A + 4 μ A 1.1 mA/A + 8 μ A	

Parameter/Range	Frequency	CMC ^{2,5} (±)	Comments
AC Current – Generate ^{3,4} (cont)			
(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	0.25 mA/A + 4 µA 0.16 mA/A + 3.5 µA 0.12 mA/A + 3.5 µA 0.20 mA/A + 40 µA 1.1 mA/A + 80 µA	Fluke 5720A
220 mA to 2.2 A	20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.30 mA/A + 35 µA 0.51 mA/A + 380 µA 7.3 mA/A + 0.75 mA	
(1.1 to 2.99999) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.18 % + 100 µA 0.13 % + 100 µA 0.14 % + 1000 µA 2.0 % + 5000 µA	Fluke 5520A
(3 to 10.9999) A	(45 to 100) Hz (0.1 to 1) kHz (1 to 5) kHz	0.12 % + 2 mA 0.14 % + 2 mA 2.4 % + 2 mA	
(11 to 20.5) A	(45 to 100) Hz (0.1 to 1) kHz (1 to 5) kHz	0.42 % + 5 mA 0.33 % + 5 mA 2.4 % + 5 mA	
(20 to 1000) A	(45 to 440) Hz	1.0 %	Fluke 5500A/coil
AC Current – Measure ³			
Up to 200 µA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.034 % + 20 nA 0.030 % + 20 nA 0.030 % + 20 nA	Fluke 8508A
200 µA to 2 mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.040 % + 0.2 µA 0.030 % + 0.2 µA 0.030 % + 0.2 µA	
(2 to 20) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.040 % + 2 µA 0.040 % + 2 µA 0.040 % + 2 µA	
(20 to 200) mA	(1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz	0.040 % + 20 µA 0.030 % + 20 µA 0.070 % + 20 µA	

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
AC Current – Measure ³ (cont)			
200 mA to 2 A	10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz	0.070 % + 0.2 mA 0.080 % + 0.2 mA 0.68 % + 0.2 mA	Fluke 8508A
(2 to 20) A	10 Hz to 2 kHz (2 to 10) kHz	0.090 % + 0.2 mA 0.57 % + 0.2 mA	
Capacitance – Generate ^{3, 4}			
(0.19 to 1.09) nF	10 Hz to 10 kHz	0.55 % + 0.01 nF	Fluke 5520A
(1.1 to 3.29) nF	10 Hz to 3 kHz	0.43 % + 0.01 nF	
(3.3 to 10.9) nF	10 Hz to 1 kHz	0.19 % + 0.01 nF	
(11 to 109.9) nF	10 Hz to 1 kHz	0.19 % + 0.1 nF	
(110 to 329.9) nF	10 Hz to 1 kHz	0.19 % + 0.3 nF	
(0.33 to 1.09) μF	(10 to 600) Hz	0.19 % + 1 nF	
(1.1 to 3.29) μF	(10 to 300) Hz	0.19 % + 3 nF	
(3.29 to 10.9) μF	(10 to 150) Hz	0.19 % + 10 nF	
(11 to 32.9) μF	(10 to 120) Hz	0.31 % + 30 nF	
(33 to 109.9) μF	(10 to 80) Hz	0.35 % + 100 nF	
(11 to 329.9) μF	(10 to 50) Hz	0.35 % + 300 nF	
(0.33 to 1.09) mF	(10 to 20) Hz	0.35 % + 1 μF	

III. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ² (±)	Comments
Amplitude Modulation – Measure ^{3, 4}			
Rate: 50 Hz to 10 kHz, Depth: 5 % to 99 %	(0.15 to 10) MHz	4.1 % of rdg + 1 digit	Agilent 8902A measuring receiver plus Agilent 11722A power sensor
Rate: 20 Hz to 10 kHz, Depth: 5 % to 99 %	(0.15 to 10) MHz	5.0 % of rdg + 1 digit	
Rate: 50 Hz to 50 kHz, Depth: 5 % to 99 %	(10 to 1300) MHz	3.6 % of rdg + 1 digit	

Parameter/Range	Frequency	CMC ² (±)	Comments
Amplitude Modulation – Measure ^{3,4} (cont)			
Rate: 20 Hz to 100 kHz, Depth: to 99 %	(10 to 1300) MHz	4.6 % of rdg + 1 digit	Agilent 8902A measuring receiver plus Agilent 11792A power sensor
Rate: 50 Hz to 50 kHz, Depth: 5 % to 99 %	(1.3 to 26.5) GHz	4.0 % of rdg + 1 digit	
Rate: 20 Hz to 100 kHz, Depth: to 99 %	(0.01 to 26.5) GHz	5.3 % of rdg + 1 digit	
Frequency Modulation – Measure ^{3,4}			
Rate: 20 Hz to 10 kHz, ≤ 40 kHz Peak	(0.25 to 10) MHz	4.1 % of rdg + 1 digit	Agilent 8902A measuring receiver plus Agilent 11722A power sensor
Rate: 50 Hz to 100 kHz, ≤ 400 kHz Peak	(10 to 1300) MHz	3.4 % of rdg + 1 digit	
Rate: 20 Hz to 200 kHz, ≤ 400 kHz Peak	(10 to 1300) MHz	7.3 % of rdg + 1 digit	
Rate: 50 Hz to 100 kHz, ≤ 400 kHz Peak	(0.01 to 26.5) GHz	2.7 % of rdg + 1 digit	Agilent 8902A measuring receiver plus Agilent 11792A power sensor
Rate: 20 Hz to 200 kHz, ≤ 400 kHz Peak	(0.01 to 26.5) GHz	7 % of rdg + 1 digit	
Phase Modulation – Measure ^{3,4}			
Rate: 200 Hz to 10 kHz	(0.15 to 10) MHz	6.2 % of rdg + 1 digit	Agilent 8902A measuring power receiver plus Agilent 11722A powers sensor
Rate: 200 Hz to 20 kHz	(10 to 1300) MHz	5.5 % of rdg + 1 digit	
Rate: 200 Hz to 20 kHz	10 MHz to 26.5 GHz	5.1 % of rdg + 1 digit	Agilent 8902A measuring receiver plus Agilent 11792A power sensor

Parameter/Range	Frequency	CMC ^{2, 5} (±)	Comments
RF Absolute Power – Measure			
Power Reference ³			
1 mW, Type-N(f), 50 Ω	50 MHz	1.2 %	HP 432A power meter w/ 478A-H76 power sensor
Coaxial Power Sensors ³			
(+20 to -30) dBm, 50 Ω	10 MHz to 4.2 GHz	1.6 %	Tegam 1806, Tegam F1135 RF transfer standard
(+20 to -30) dBm, 50 Ω	10 MHz to 18 GHz	2.6 %	
(+20 to -30) dBm, 50 Ω	50 MHz to 26.5 GHz	2.6 %	
Direct Measure ^{3, 4}			
(+20 to -30) dBm, 50 Ω	(50 to < 100) MHz	0.13 dB	HP 8902A measuring receiver with 8487A power sensor
	100 MHz to 2 GHz	0.13 dB	
	(2 to 12.4) GHz	0.15 dB	
	(12.4 to 18) GHz	0.19 dB	
	(18 to 26.5) GHz	0.24 dB	
	(26.5 to 40) GHz	0.31 dB	
	(40 to 50) GHz	0.40 dB	
(+20 to -70) dBm, 50 Ω	10 MHz to 18 GHz	0.22 dB	w/ E4412A power sensor
	30 MHz to < 2 GHz	0.17 dB	
	(2 to < 6) GHz	0.19 dB	
	(6 to < 11) GHz	0.21 dB	
	(11 to 18) GHz	0.27 dB	
(+20 to -70) dBm, 50 Ω	(50 to < 100) MHz	0.21 dB	w/ E4413A power sensor
	100 MHz to < 8 GHz	0.20 dB	
	(8 to < 18) GHz	0.24 dB	
	(18 to 26.5) GHz	0.27 dB	
Relative Power – Measure ^{3, 4}			
0 dB, Reference	10 MHz to 26.5 GHz	0.2 dB	HP 8902A measuring receiver with 11722A, 11792A power sensors
(-0.0 to -10) dB		0.2 dB	
(-10 to -20) dB		0.21 dB	
(-20 to -30) dB		0.21 dB	
(-30 to -40) dB		0.21 dB	
(-40 to -50) dB		0.21 dB	
(-50 to -60) dB		0.21 dB	
(-60 to -70) dB		0.21 dB	
(-70 to -80) dB		0.22 dB	

IV. Mechanical

Parameter/Equipment	Range	CMC ^{2, 7, 8} (\pm)	Comments
Scales and Balances ^{3, 4}	Up to 20 g (20 to 100) g	320 $\mu\text{g/g} + 0.6R$ 67 $\mu\text{g/g} + 0.6R$	Class 2 weights
	2 oz to 1 lb (1 to 50) lb (50 to 300) lb	180 $\mu\text{g/g} + 0.6R$ 120 $\mu\text{g/g} + 0.6R$ 0.060 g/g + 0.6R	Class F weights
Pressure Gauges, Transducers & Calibrators – Measure and Measuring Equipment ^{3, 4}	(0 to 100) psi (0 to 500) psi (0 to 10 000) psi (1 to 15) psia	0.05 psi 0.26 psi 8.1 psi 0.012 psia	Fluke 700P06 Fluke 700P07 Fluke 700P31 Fluke 700PA4
Torque Wrench ^{3, 4}	(5 to 50) in·lbf (40 to 400) in·lbf (100 to 1000) in·lbf (25 to 250) ft·lbf	0.30 in·lbf 2.4 in·lbf 5.9 in·lbf 1.5 ft·lbf	CDI 4 in 1 suretest
Vibration – Measure			
Voltage Sensitivity – 100 Hz	10 mV/g	3.4 %	PCB ICP accelerometer 301A4
Frequency Response	5 Hz to 10 kHz	3.4 %	

V. Time & Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Stopwatches ^{3,4}	Up to 86 400 s	0.033 s	Agilent 53132A counter with option 030
Time Interval ^{3,4}	10 ms to 10 s	830 ps	Agilent 53132A counter with option 030
Frequency – Measure ^{3,4}	(10 to 100) kHz 100 kHz to 1 MHz (10 to 100) MHz 100 MHz to 1 GHz (1 to 3) GHz 50 MHz to 26.5 GHz	370 μHz 580 μHz 6 mHz 60 mHz 580 mHz 30 Hz	Agilent 53132A counter with option 030 Agilent 53151A
Frequency – Measuring Equipment ^{3,4}	10 MHz	1.1 parts in 10 ⁹ Hz	Spectracom rubidium

VI. Thermodynamics

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Hygrometers	(20 to 70) % RH (16 to 24) °C	1.3 % RH + 0.6R 0.11 °C + 0.6R	Fluke 2626-H Thermo-hygrometer probe

¹ This laboratory offers commercial calibration service 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 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.
- ⁴ This laboratory meets A2LA *R104 – General Requirements: Accreditation of Field Testing and Field Calibration Laboratories* for their Mobile Laboratory to perform the noted calibrations.
- ⁵ 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. CMC are expressed as either a specific value that covers the full range or as a fraction/percent of the reading plus a fixed floor specification.
- ⁶ In the statement of CMC, the value is defined as the percentage of reading unless otherwise indicated. *L* represents the length of displacement in inches. *R* represents the resolution of the unit under test.



Accredited Laboratory

A2LA has accredited

ACUCAL, INC.

Manassas, VA

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 the requirements of ANSI/NCSLI Z540.3-2006 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 8 January 2009*).



Presented this 24th day of August 2017.

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

President and CEO
For the Accreditation Council
Certificate Number 2737.01
Valid to April 30, 2019

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