



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: September 30, 2020

Certificate Number: 2737.03

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations<sup>1,6</sup>:

I. Dimensional

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Hand Tools <sup>3</sup> – Calipers Micrometers Height Gages Drop Micrometers Depth Micrometers	Up to 72 in Up to 48 in Up to 48 in Up to 2 in Up to 12 in	2.2 µin/in + 12 µin	Gage blocks
Diameter, External – Cylindrical Plug Gages, Thread Wires	Up to 3.0 in	9.5 µin/in + 11 µin	Laser micrometer
Precision Levels	Up to 90°	8.7”	Surface plate, sine bar, gage blocks

## II. Dimensional Testing/Calibration<sup>1</sup>

Parameter/Equipment	Range	CMC <sup>2, 7, 8</sup> (±)	Comments
1D Length – Measure	Up to 1 in	58 µin	Micrometer
	Up to 6 in	0.0012 in	Caliper
Diameter – Measure	Up to 1 in	58 µin	Micrometer
	Up to 6 in	0.0012 in	Caliper

## III. Electrical – DC/ Low Frequency

Parameter/Equipment	Range	CMC <sup>2, 4</sup> (±)	Comments
DC Voltage <sup>3</sup> – Generate	(0 to 330) mV (0.33 to 3.3) V (3.3 to 33) V (33 to 330) V (330 to 1000) V	23 µV/V + 1 µV 14 µV/V + 2 µV 14 µV/V + 20 µV 22 µV/V + 0.15 mV 22 µV/V + 1.5 mV	Fluke 5520A
DC Voltage <sup>3</sup> – Measure	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1000) V	12 µV/V + 0.3 µV 11 µV/V + 3 µV 11 µV/V + 0.5 µV 13 µV/V + 30 µV 13 µV/V + 100 µV	3458A
	(1000 to 6000) V	1.2 %	34401A w/ 80K6
DC Current <sup>3</sup> – Generate	(0 to 3.3) mA (3.3 to 330) mA (0.33 to 3.3) A (3.3 to 20.5) A (20.5 to 150) A (150 to 1000) A  (20.5 to 100) A	0.17 mA/A + 50 nA 0.12 mA/A + 2.5 µA 4.6 mA/A + 40 µA 9.3 mA/A + 1.5 mA 0.30 % + 0.018 A 0.33 % + 0.082 A  33 µA/A	Fluke 5520A  w/ 5500A/coil  Power supply, L&N shunt & 3458A

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
DC Current <sup>3</sup> – Measure	(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 (1.0 to 100) A	0.21 mA/A + 0.04 nA 59 μA/A + 0.04 nA 27 μA/A + 0.1 nA 26 μA/A + 0.8 nA 26 μA/A + 5 pA 26 μA/A + 50 pA 46 μA/A + 0.5 μA 0.18 μA/A + 10 μA 33 μA/A	3458A  3458A w/ L&N shunts
DC Resistance <sup>3</sup> – Generate	(0 to 10.999) Ω (11 to 32.999) Ω (33 to 109.999) Ω (110 to 329.999) Ω (0.33 to 1.0999) kΩ (1.1 to 3.2999) kΩ (3.3 to 109.999) kΩ (110 to 329.999) kΩ (0.33 to 1.0999) MΩ (1.1 to 3.2999) MΩ (3.3 to 10.999) MΩ (11 to 32.999) MΩ (33 to 109.999) MΩ (110 to 329.999) MΩ (330 to 1100) MΩ	55 μΩ/Ω + 1 mΩ 42 μΩ/Ω + 1.5 mΩ 94 μΩ/Ω + 1.4 mΩ 34 μΩ/Ω + 2 mΩ 34 μΩ/Ω + 2 mΩ 37 μΩ/Ω + 20 mΩ 19 μΩ/Ω + 20 mΩ 37 μΩ/Ω + 200 mΩ 37 μΩ/Ω + 200 mΩ 40 μΩ/Ω + 2 Ω 39 μΩ/Ω + 2 Ω 73 μΩ/Ω + 30 Ω 51 μΩ/Ω + 50 Ω 0.32 mΩ/Ω + 2.5 kΩ 0.57 mΩ/Ω + 3 kΩ	Fluke 5520A
DC Resistance <sup>3</sup> – Measure	(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) GΩ	49 μΩ/Ω + 50 μΩ 17 μΩ/Ω + 500 μΩ 15 μΩ/Ω + 500 μΩ 14 μΩ/Ω + 500 μΩ 14 μΩ/Ω + 5.0 μΩ 20 μΩ/Ω + 50 μΩ 66 μΩ/Ω + 1.0 Ω 3.4 mΩ/Ω + 100 Ω 6.5 μΩ/Ω + 10 kΩ	HP 3458A

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Calibration of Thermocouples and Indicators <sup>3</sup> –			
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 C	(0 to 150) °C (150 to 650) °C (650 to 1000) °C (1000 to 1800) °C (1800 to 2316) °C	0.24 °C 0.21 °C 0.25 °C 0.39 °C 0.65 °C	
Type E	(-250 to -100) °C (-100 to -25) °C (-25 to 350) °C (350 to 650) °C (650 to 1000) °C	0.53 °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 0.13 °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 <sup>2</sup> (±)	Comments
Electrical Calibration of Thermocouples and Indicators <sup>3</sup> – (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 <sup>3</sup> –			
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	0.068 °C 0.055 °C 0.07 °C 0.098 °C 0.11 °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 0.07 °C 0.078 °C 0.093 °C	
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	0.2 °C 0.032 °C 0.039 °C 0.076 °C 0.073 °C 0.084 °C 0.09 °C 0.096 °C 0.18 °C	

Parameter/Equipment	Range	CMC <sup>2</sup> (±)	Comments
Electrical Calibration of RTD Indicators <sup>3</sup> – (cont)			
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	0.032 °C 0.032 °C 0.039 °C 0.093 °C 0.11 °C 0.11 °C 0.12 °C	Fluke 5520A
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	0.032 °C 0.039 °C 0.047 °C 0.062 °C 0.07 °C 0.086 °C	
Pt 385, 1000 Ω	(-200 to 0) °C (0 to 100) °C (100 to 260) °C	0.024 °C 0.032 °C 0.039 °C	
PtNi 385, 120 Ω	(-80 to 0) °C (0 to 100) °C (100 to 260) °C	0.062 °C 0.062 °C 0.11 °C	
Cu 427, 10 Ω	(-100 to 260) °C	0.23 °C	
Oscilloscope <sup>3</sup> –			
50 Ω Load	(1 to 24.999) mV (0.025 to 2.1999) V (2.2 to 130) V	0.25 % of output + 40 μV 0.24 % of output + 40 μV 0.27 % of output + 40 μV	Fluke 5520A- SC1100
1 MΩ Load	(1 to 24.999) mV (25 to 109.999) mV (0.11 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 0.21 % of output + 40 μV 0.14 % of output + 40 μV	

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
Oscilloscope <sup>3</sup> – (cont)			
Level Sine Wave:			
Amplitude (50kHz Reference)	50 kHz 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	1.6 % + 0.3 mV 2.8 % + 0.3 mV 3.2 % + 0.3 mV 4.7 % + 0.3 mV 5.7 % + 0.3 mV	Fluke 5520A- SC1100
Flatness (50kHz Reference)	50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz (600 to 1100) MHz	1.4 % + 0.1 mV 1.6 % + 0.1 mV 3.2 % + 0.1 mV 3.9 % + 0.1 mV	
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 <sup>6</sup> s 64 μs + <i>t</i> parts in 10 <sup>6</sup> s	<i>t</i> = time in seconds
Amplitude 1 MΩ 50 Ω	1.8 mV to 55 V <sub>(pk-pk)</sub> 1.8 mV to 2.5 V <sub>(pk-pk)</sub>	2.4 % + 0.1 mV 2.4 % + 0.1 mV	
Frequency	10 Hz to 100 kHz	34 parts in 10 <sup>6</sup> Hz +15 mHz	
Phase <sup>3</sup> – Measure, Fixed Points	101 Hz 1 kHz 101 kHz 1 MHz 13 MHz	0.01° 0.0061° 0.068° + 4.9 μ°/° 0.65° + 60 μ°/° 8.4° + 0.67 m°/°	Agilent 53131A

Parameter/Equipment	Range	CMC <sup>2,4</sup> (±)	Comments
AC Power <sup>3</sup> – @ (45 to 65) Hz – (PF =1)			
(3.3 to 9) mA	(33 to 330) mV (0.33 to 1020) V	0.11 % 0.1 %	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	0.1 % 0.1 %	
(0.9 to 2.2) A	(33 to 330) mV (0.33 to 1020) V	0.09 % 0.07 %	
(2.2 to 4.5) A	(33 to 330) mV (0.33 to 1020) V	0.1 % 0.1 %	
(4.5 to 20.5) A	(33 to 330) mV (0.33 to 1020) V	0.09 % 0.31 %	



Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage <sup>3</sup> – Generate			
(1 to 33) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.064 % + 6 μV 0.012 % + 6 μV 0.016 % + 6 μV 0.078 % + 6 μV 0.27 % + 6 μV 0.62 % + 6 μV	Fluke 5520A
(33 to 330) mV	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.023 % + 8 μV 0.011 % + 8 μV 0.012 % + 8 μV 0.027 % + 8 μV 0.062 % + 32 μV 0.16 % + 70 μV	
(0.33 to 3.3) V	(10 to 45) Hz 45 Hz to 10 kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 500) kHz	0.023 % + 50 μV 0.012 % + 60 μV 0.018 % + 60 μV 0.027 % + 50 μV 0.059 % + 130 μV 0.22 % + 600 μV	
(3.3 to 33) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.54 % + 0.65mV 0.026 % + 0.6 mV 0.11 % + 0.6 mV 0.15 % + 0.6 mV 0.17 % + 1.6 mV	
(33 to 330) V	45 Hz to 1 kHz (1 to 10) kHz (10 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.23 % + 2 mV 0.23 % + 6 mV 0.24 % + 6 mV 0.40 % + 6 mV 0.43 % + 6 mV	
(330 to 1020) 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	

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Voltage – Measure			
(0 to 10) mV	(1 to 40) Hz (40 to 1000) Hz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.039 % + 3 μV 0.023 % + 1.1 μV 0.034 % + 1.1 μV 0.11 % + 1.1 μV 0.57 % + 1.1 μV 4.5 % + 2 μV	Agilent 3458A-002
(10 to 100) 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	0.049 % + 4 μV 0.12 % + 2 μV 0.045 % + 2 μV 0.091% + 2 μV 0.12 % + 2 μV 0.35 % + 10 μV	
(0.1 to 1) V	(1 to 40) Hz (40 to 1000) Hz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.008 % + 40 μV 0.008 % + 20 μV 0.016 % + 20 μV 0.034 % + 20 μV 0.091 % + 20 μV 0.34 % + 100 μV	
(1 to 10) V	(1 to 40) Hz (40 to 1000) Hz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.043 % + 400 μV 0.027 % + 200 μV 0.023 % + 200 μV 0.041 % + 200 μV 0.094 % + 200 μV 0.34 % + 1 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	0.21 % + 4 mV 0.21 % + 2 mV 0.21 % + 2 mV 0.28 % + 2 mV 0.31 % + 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	1.6 % + 40 mV 1.7 % + 20 mV 2.3 % + 20 mV 2.3 % + 20 mV 0.36 % + 20 mV	
(1000 to 5000) V	DC to 500 Hz	1.2 %	34401A w/ 80K

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
Capacitance <sup>3</sup> – Generate  (0.19 to 0.3999) nF (0.4 to 1.0999) nF (1.1 to 3.2999) nF (3.3 to 10.9999) nF (11 to 32.9999) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.0999) 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 1.09999) mF (1.1 to 3.2999) mF (3.3 to 10.9999) mF (11 to 32.9999) mF (33 to 110) mF	10 Hz to 10 kHz 10 Hz to 10 kHz 10 Hz to 3 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz 10 Hz to 1 kHz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (10 to 50) Hz (10 to 20) Hz (0 to 6) Hz (0 to 2) Hz (0 to 0.6) Hz (0 to 0.2) Hz	0.55 % + 0.01 nF 0.42 % + 0.01 nF 0.43 % + 0.01 nF 0.19 % + 0.01 nF 0.19 % + 0.1 nF 0.19 % + 0.1 nF 0.19 % + 0.3 nF 0.19 % + 1 nF 0.19 % + 3 nF 0.19 % + 10 nF 0.31 % + 30 nF 0.36 % + 100 nF 0.35 % + 300 nF 0.35 % + 1 μF 0.35 % + 3 μF 0.35 % + 10 μF 0.58 % + 30 μF 0.85 % + 100 μF	Fluke 5520A
AC Current <sup>3</sup> – Generate  (29 to 329.99) μA           (0.33 to 3.2999) mA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz           (10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.16 % + 100 nA 0.097 % + 100 nA 0.23 % + 150 nA 0.62 % + 200 nA 1.2 % + 400 nA           0.16 % + 150 nA 0.078 % + 150 nA 0.16 % + 200 nA 0.39 % + 300 nA 0.78 % + 600 nA	Fluke 5520A

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
AC Current <sup>3</sup> – Generate (cont)			
(3.3 to 32.999) mA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.14 % + 2 µA 0.10 % + 2 µA 0.062 % + 2 µA 0.16 % + 3 µA 1.1 % + 4 µA	Fluke 5520A
(33 to 329.99) mA	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.14 % + 20 µA 0.032 % + 20 µA 0.078 % + 50 µA 0.16 % + 100 µA 0.31 % + 200 µA	
(0.33 to 1.09999) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.14 % + 100 µA 0.04 % + 100 µA 0.47 % + 1 mA 1.9 % + 5 mA	
(1.1 to 2.99999) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.21 % + 100 µA 0.13 % + 100 µA 0.14 % + 1 mA 2 % + 5 mA	
(3 to 10.9999) A	(45 to 100) Hz (0.100 to 1) kHz (1 to 5) kHz	0.31 % + 2 mA 0.31 % + 2 mA 2.4 % + 2 mA	
(11 to 20.5) A	(45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.12 % + 5 mA 0.15 % + 5 mA 3 % + 5 mA	
(16.5 to 150) A (16.5 to 150) A (150 to 1025) A (150 to 1025) A	(45 to 65) Hz (65 to 440) Hz (45 to 65) Hz (65 to 440) Hz	0.38 % + 0.029 A 1.0 % + 0.031 A 0.54 % + 0.10 A 1.0 % + 0.12 A	5520A w/ 5500A/Coil
AC Current <sup>3</sup> – Measure			
Up to 100 µA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	40 Hz to 5 kHz	0.071 % + 31 nA 0.036 % + 0.21 µA 0.036 % + 2.1 µA 0.036 % + 21 µA 0.12 % + 0.21 mA	3458A-002

Parameter/Range	Frequency	CMC <sup>2,4</sup> (±)	Comments
Distortion – Measure <sup>3</sup> (0 to -80) dB (0 to -65) dB	20 Hz to 20 kHz (20 to 100) kHz	1.2 dB 2.3 dB	8903B

IV. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC <sup>2,5,7</sup> (±)	Comments
RF Microwave – Power <sup>3</sup> Power Reference at 1 mW Calibration Factor	50 MHz 10 MHz to 18 GHz	0.62 % 1.1 %	Weinschel 1805/1807
RF Microwave – Absolute Power, Measure <sup>3</sup> (-70 to 20) dBm (-30 to 20) dBm	9 kHz to 6 GHz 100 kHz to 4.2 GHz (4.2 to 18) GHz (18 to 30) GHz (30 to 40) GHz (40 to 50) GHz	0.18 dBm 0.21 dBm 0.26 dBm 0.23 dBm 0.29 dBm 0.31 dBm	Power meter w/ power sensors

Parameter/Equipment	Range	CMC <sup>2,4,7</sup> (±)	Comments
Attenuation <sup>3</sup> – Measure and Generate  (0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -70) dB (-70 to -80) dB (-80 to -90) dB (-90 to -100) dB (-100 to -110) dB (-110 to -120) dB	10 MHz to 26.5 GHz	0.046 dB 0.053 dB 0.080 dB 0.098 dB 0.11 dB 0.11 dB 0.12 dB 0.17 dB 0.17 dB 0.18 dB 0.19 dB 0.20 db	8902A
Amplitude Modulation – Measure  Rate: 50 Hz to 10 kHz Depths: 5 % to 99 %  Rate: 20 Hz to 10 kHz Depths: to 99 %  Rate: 50 Hz to 50 kHz Depths: 5 % to 99 %  Rate: 20 Hz to 100 kHz Depths: to 99 %	150 kHz to 10 MHz  150 kHz to 10 MHz  (0.01 to 26.5) GHz  (0.01 to 26.5) GHz	0.14% rdg + 0.023 % rng  0.13 % rdg + 0.034% rng  0.18 % rdg + 0.012% rng  0.15 % rdg + 0.035 % rng	8902A w/ 11793A
Frequency Modulation – Measure  Rate: 20 Hz to 10 kHz Dev.: ≤ 40 kHz Peak  Rate: 50 Hz to 100 kHz Dev.: ≤ 400 kHz Peak  Rate: 20 Hz to 200 kHz Dev.: ≤ 400 kHz Peak	250 kHz to 10 MHz  (0.01 to 26.5) GHz  (0.01 to 26.5) GHz	0.018 kHz + 0.023 kHz/kHz  0.37 kHz + 0.011 kHz/kHz  0.33 kHz + 0.057 kHz/kHz	8902A w 11793A

Parameter/Equipment	Range	CMC <sup>2, 4, 5, 7</sup> ( $\pm$ )	Comments
Phase Modulation – Measure  Rate: 200 Hz to 10 kHz (0 to 100) rad  Rate: 200 Hz to 20 kHz (0 to 100) rad	Carrier: 150 kHz $\leq f_c <$ 10MHz  10 MHz $\leq f_c <$ 26.5GHz	0.12R + 0.047R/R  0.12R + 0.035R/R	8902A w/ 11793A
Reflection S <sub>11</sub> /S <sub>22</sub> – Measure  (0.0001 to 1.0) lin	45 MHz 45 MHz to 2 GHz (2 to 8) GHz (8 to 20) GHz (20 to 26.5) GHz	0.0076 lin 0.007 lin 0.013 lin 0.013 lin 0.014 lin	8510C and cal kits
Transmission S <sub>12</sub> /S <sub>21</sub> – Measure  (0 to 20) dB (20 to 40) dB (40 to 60) dB  (0 to 20) dB (20 to 40) dB (40 to 60) dB  (0 to 20) dB (20 to 40) dB (40 to 60) dB  (0 to 20) dB (20 to 40) dB (40 to 60) dB  (0 to 20) dB (20 to 40) dB (40 to 60) dB	45 MHz  45 MHz to 2 GHz  (2 to 8) GHz  (8 to 20) GHz  (20 to 26.5) GHz	0.038 dB 0.16 dB 0.10 dB  0.056 dB 0.15 dB 0.23 dB  0.051 dB 0.19 dB 0.11 dB  0.074 dB 0.21 dB 0.38 dB  0.091 dB 0.25 dB 0.71 dB	8510C and cal kits

V. Mechanical

Parameter/Equipment	Range	CMC <sup>2, 5, 7</sup> (±)	Comments
Acceleration –  Sensitivity (mV/g, pC/g)  Frequency Response	100 Hz  (10 to 99) Hz (100 to 2500) Hz (2.5 to 10) kHz	3.4 %  4.3 % 3.4 % 3.8 %	Dytran 3120B reference accelerometer
Torque Tools	(4 to 50) in·lbf (40 to 400) in·lbf (100 to 1000) in·lbf (25 to 250) ft·lbf (60 to 600) ft·lbf	0.29 % 0.29 % 0.29 % 0.29 % 0.29 %	CDI 4-in-1 Suretest system
Scales and Balances <sup>3</sup>	Up to 20 g (20 to 100) g  2 oz to 1 lb (1 to 50) lb (50 to 300) lb	320 µg/g + 0.6R 67 µg/g + 0.6R  180 µg/g + 0.6R 120 µg/g + 0.6R 48 µg/g + 0.6R	Class 2 weights  Class F weights
Pressure Gages, Transducers and Calibrators – Measure and Measuring Equipment <sup>3</sup>	(0 to 100) psig (0 to 500) psig (0 to 1000) psig (0 to 10 000) psig (1 to 15) psia	0.08 psi 0.06 psi 0.83 psi 9.3 psi 0.06 psia	Fluke 700P06 Fluke 700P07 Fluke 700P Fluke 700P31 Fluke 700PA4

VI. Time & Frequency

Parameter/Equipment	Range	CMC <sup>2, 7</sup> (±)	Comments
Time Interval	Up to 86 400 s	30 ms	Counter phase locked to GPS
Frequency – Measure	1 mHz to 40 GHz	$1.2 \times 10^{-9} \times f + 5 \mu\text{Hz}$	Counter phase locked to GPS ( <i>f</i> is the frequency)



Parameter/Equipment	Range	CMC <sup>2,7</sup> (±)	Comments
Frequency – Measuring Equipment	10 MHz	$1.2 \times 10^{-9} \times f$	Datum GPS receiver
	1 mHz to 50 GHz	$1.2 \times 10^{-9} \times f + 5 \mu\text{Hz}$	Signal generators Phase locked to GPS ( $f$ is the frequency)

<sup>1</sup> This laboratory offers commercial dimensional testing, calibration 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> 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's 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.

<sup>5</sup> In the statement of CMC uncertainty, 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.

<sup>6</sup> This scope meets A2LA's P112 *Flexible Scope Policy*.

<sup>7</sup> 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.

<sup>8</sup> 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.



## *Accredited Laboratory*

A2LA has accredited

**ACUCAL INC.**

*Chandler, AZ*

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 April 2017*).



Presented this 12<sup>th</sup> day of March 2019.

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

Vice President, Accreditation Services  
For the Accreditation Council  
Certificate Number 2737.03  
Valid to September 30, 2020

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