



The American Association for Laboratory Accreditation

World Class Accreditation

Accredited Laboratory

A2LA has accredited

J.A. KING & COMPANY, LLC

Cary, NC

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/NCSL Z540-1-1994 and any additional program requirements in the field of calibration. 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 28th day of April 2009.





Peter Meyer

President & CEO
For the Accreditation Council
Certificate Number 1741.05
Valid to May 31, 2011
Revised: January 21, 2010

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

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

J. A. KING & COMPANY, LLC
 100-A CENTRE WEST COURT
 Cary, NC 27513
 Connie Foster Phone: 800 327 7727

CALIBRATION

Valid To: May 31, 2011

Certificate Number: 1741.05

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

I. Dimensional

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Pin Gage ³ – Class Z & Class ZZ	Up to 1.0 in	75 µin	Laser Micrometer
Calipers ³	Up to 36 in	(0.6R + 1.5 + 3L) µin	Gage blocks
Micrometers ³ – Outside	Up to 36 in	(0.6R + 1.5 + 3L) µin	Gage blocks
Linear Indicators ³ – Dial and Test	(0.5 to 4) in	(0.6R + 1.5 + 3L) µin	Gage blocks
Height Gages ³	Up to 20 in (20 to 40) in	120 µin 200 µin	Gage blocks
Steel Rules	Up to 72 in	(4.6 + 69L + 0.6R) µin	Gage blocks
Tape Measures	(Up to 25) ft	(4.6 + 69L + 0.6R) µin	Gage blocks
Angle Indicators and Protractors ³	15°, 30°, 45°, 60°, 75°, 90°	0.03°	Angle block set

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Thickness/Snap Gages	Up to 12 in (12 to 24) in	(0.6R + 1.5 + 3L) μin	Gage blocks
Feeler/Thickness Gages	Up to 1 in	75 μin	Laser Micrometer
Optical Comparators ³			
X-Y Linearity	Up to 6 in	150 μin	Glass master and scale
Magnification	10× to 250×	460 μin	
Angle	0° to 90°	0.1°	Angle block set
Vision Systems ³			
X-Y Linearity	Up to 6 in	150 μin	Glass master and scale
Surface Plates ³ (Repeatability Only)	-----	33 μin	Repeat-o-meter

II. Dimensional Testing

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
Length –			
X Axis	(0 to 20) in (500mm)	(230 + 3.4L) μin	DCC CMM
Y Axis	(0 to 24) in (600mm)		
Z Axis	(0 to 18) in (450mm)		
Volumetric Performance	10 in	(270 + 4.2L) μin	
Volumetric Length	(0 to 6) in (150 mm) (0 to 10) ft (3.0 m)	0.0025 in	Romer PCMM 10' Infinite
X-Y Measurements		430 μin	Vision system CNC
X Axis			
Y Axis			

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 4, 5, 7} (±)	Comments
DC Voltage – Measure ³	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V (1 to 6) kV (6 to 20) kV (20 to 35) kV (35 to 40) kV	11 μV/V + 3 μV 10 μV/V + 0.3 μV 10 μV/V + 0.05 μV 12 μV/V + 0.3 μV 27 μV/V + 0.1 μV 1.2 % 2.4 % 1.2 % 2.4 %	HP 3458A Fluke 80K-6 & DMM Fluke 80K-40 & DMM
DC Voltage – Generate ³	(0 to 330) mV 330 mV to 3.3 V (3.3 to 33) V (33 to 330) V (100 to 1020) V	21 μV /V + 1 μV 12 μV /V + 2 μV 13 μV /V + 15 μV 19 μV /V + 150 μV 19 μV /V + 1.5 mV	Fluke 5520A
DC Current – Measure ³	(0 to 100) nA 100 nA to 1 μA (1 to 10) μA (10 to 100) μA 100 μA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 20) A (20 to 100) A	35 μA/A + 0.04 nA 25 μA/A + 0.04 nA 25 μA/A + 0.1 nA 25 μA/A + 0.8 nA 25 μA/A + 5 nA 25 μA/A + 50 nA 40 μA/A + 0.5 μA 0.012 % + 10 μA 0.017 % 0.25 %	HP 3458A Fluke Y5020 w/ HP 3458A Empro shunt w/ HP 3458A

Parameter/Equipment	Range	CMC ^{2,4,5,7} (±)	Comments
DC Current – Generate ³	(0 to 330) μ A (0 to 3.3) mA (0 to 33) mA (0 to 330) mA (0 to 1.1) A (1.1 to 3) A (0 to 11) A (11 to 21) A	0.015 % + 0.02 μ A 0.01 % + 0.05 μ A 0.01 % + 0.25 μ A 0.01 % + 2.5 μ A 0.02 % + 40 μ A 0.038 % + 40 μ A 0.05 % + 500 μ A 0.1 % + 750 μ A	Fluke 5520A
Resistance – Measure ³	(0 to 10) Ω (10 to 100) Ω 100 Ω to 1k Ω (1 to 10) k Ω (10 to 100) k Ω 100 k Ω to 1M Ω (1 to 10) M Ω (10 to 100) M Ω 100 M Ω to 1 G Ω	18 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 15 $\mu\Omega/\Omega$ + 0.5 m Ω 14 $\mu\Omega/\Omega$ + 0.5 m Ω 13 $\mu\Omega/\Omega$ + 5 m Ω 13 $\mu\Omega/\Omega$ + 50 m Ω 18 $\mu\Omega/\Omega$ + 2 Ω 53 $\mu\Omega/\Omega$ + 100 Ω 0.051 % + 1 k Ω 0.5 % + 10 k Ω	HP 3458A
Resistance – Generate ³	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω 110 Ω to 1.1 k Ω 1.1 k Ω to 11 k Ω 11 k Ω to 110 k Ω 110 k Ω to 1.1 M Ω (1.1 to 3.3) M Ω (3.3 to 11) M Ω (11 to 33) M Ω (33 to 110) M Ω (110 to 330) M Ω (330 to 1100) M Ω	41 $\mu\Omega/\Omega$ + 0.001 Ω 31 $\mu\Omega/\Omega$ + 0.0015 Ω 29 $\mu\Omega/\Omega$ + 0.0014 Ω 29 $\mu\Omega/\Omega$ + 0.002 Ω 29 $\mu\Omega/\Omega$ + 0.02 Ω 29 $\mu\Omega/\Omega$ + 0.2 Ω 33 $\mu\Omega/\Omega$ + 2 Ω 61 $\mu\Omega/\Omega$ + 30 Ω 0.013 % + 50 Ω 0.025 % + 2.5 k Ω 0.05 % + 3 k Ω 0.3 % + 100 k Ω 1.5 % + 500 k Ω	Fluke 5520A

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
Capacitance – Generate ³ (0.19 to 10.9999) nF (11 to 109.999) nF (110 to 329.999) nF (0.33 to 1.09999) μF (1.1 to 3.29999) μF (3.3 to 10.9999) μF (11 to 32.9999) μF (33 to 109.999) μF (110 to 329.999) μF 330 μF to 10.9999 mF (11 to 110) mF	(10 to 1000) Hz (10 to 1000) Hz (10 to 1000) Hz (10 to 600) Hz (10 to 300) Hz (10 to 150) Hz (10 to 120) Hz (10 to 80) Hz (0 to 50) Hz (0 to 2) Hz (0 to 0.20) Hz	0.51 % + 0.01 nF 0.26 % + 0.1 nF 0.26 % + 0.3 nF 0.26 % + 1 nF 0.26 % + 3 nF 0.26 % + 10 nF 0.42 % + 30 nF 0.46 % + 100 nF 0.47 % + 300 nF 0.47 % + 10 μF 1.1 % + 100 μF	Fluke 5520A
AC Voltage – Generate ³ (1 to 33) mV (33 to 330) mV 330 mV to 3.3 V (3.3 to 33) 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 (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 (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	0.08 % + 6 μV 0.015 % + 6 μV 0.02 % + 6 μV 0.1 % + 6 μV 0.35 % + 12 μV 0.8 % + 50 μV 0.03 % + 8 μV 0.015 % + 8 μV 0.016 % + 8 μV 0.035 % + 8 μV 0.08 % + 32 μV 0.2 % + 70 μV 0.03 % + 50 μV 0.015 % + 60 μV 0.019 % + 60 μV 0.03 % + 50 μV 0.07 % + 130 μV 0.24 % + 600 μV 0.03 % + 650 μV 0.015 % + 600 μV 0.024 % + 600 μV 0.035 % + 600 μV 0.09 % + 1.6 mV	Fluke 5520A

Parameter/Range	Frequency	CMC ^{2,4,5,7} (±)	Comments
AC Voltage – Generate (cont) ³			
(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	0.019 % + 2 mV 0.02 % + 6 mV 0.025 % + 6 mV 0.03 % + 6 mV 0.2 % + 50 mV	Fluke 5520A
(330 to 1020) V	45 Hz to 10 kHz	0.03 % + 10 mV	
AC Voltage – Measure ³			
Up 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	0.031 % + 0.03 % 0.021 % + 0.01 % 0.031 % + 0.01 % 0.11 % + 0.01 % 0.51 % + 0.01 % 4.1 % + 0.02 %	HP 3458A
10 mV to 10 V	(1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.008 % + 0.004 % 0.008 % + 0.002 % 0.015 % + 0.002 % 0.031 % + 0.002 % 0.081 % + 0.002 % 0.31 % + 0.01 %	
(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	0.021 % + 0.004 % 0.021 % + 0.002 % 0.021 % + 0.002 % 0.036 % + 0.002 % 0.13 % + 0.002 % 0.41 % + 0.01 %	
(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	0.041 % + 0.004 % 0.041 % + 0.002 % 0.061 % + 0.002 % 0.013 % + 0.002 % 0.31 % + 0.002 %	
	(1 to 6) kV (6 to 40) kV	1.2 % 6 %	Fluke 80K-6 & DMM Fluke 80K-40 & DMM

Parameter/Range	Frequency	CMC ^{2,4} (±)	Comments
AC Current – Generate ³			
(0 to 0.33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.2 % + 0.1 μA 0.15 % + 0.1 μA 0.13 % + 0.1 μA 0.3 % + 0.15 μA 0.8 % + 0.2 μA 1.6 % + 0.4 μA	Fluke 5520A
(0.33 to 3.3) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.21 % + 0.15 μA 0.14 % + 0.15 μA 0.11 % + 0.15 μA 0.21 % + 0.2 μA 0.5 % + 0.3 μA 1 % + 0.6 μA	
(3.3 to 33) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.18 % + 2 μA 0.09 % + 2 μA 0.04 % + 2 μA 0.08 % + 2 μA 0.2 % + 3 μA 0.4 % + 4 μA	
(33 to 330) mA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.18 % + 20 μA 0.09 % + 20 μA 0.04 % + 20 μA 0.1 % + 50 μA 0.2 % + 100 μA 0.4 % + 200 μA	
(0.33 to 1.1) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.18 % + 100 μA 0.05 % + 100 μA 0.6 % + 1 mA 2.5 % + 5 mA	
(1.1 to 3.0) A	(10 to 45) Hz 45 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.18 % + 100 μA 0.06 % + 100 μA 0.6 % + 1 mA 2.5 % + 5 mA	
(3.0 to 11) A	45 Hz to 1 kHz (1 to 5) kHz	0.1 % + 2 mA 3. % + 2 mA	
(11 to 20.5) A	45 Hz to 1 kHz (1 to 5) kHz	0.16 % + 5 mA 3 % + 5 mA	

Parameter/Range	Frequency	CMC ^{2, 5, 7} (±)	Comments
AC Current – Measure ³			
(0 to 100) μA	(10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz 100 Hz to 5 kHz	0.41 % + 0.03 % 0.16 % + 0.03 % 0.07 % + 0.03 % 0.07 % + 0.03 %	HP 3458A
(1 to 100) mA	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.41 % + 0.02 % 0.16 % + 0.02 % 0.07 % + 0.02 % 0.04 % + 0.02 % 0.07 % + 0.02 % 0.41 % + 0.04 % 0.56 % + 0.15 %	
100 mA to 1 A	(10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (5 to 20) kHz (20 to 50) kHz	0.41 % + 0.02 % 0.17 % + 0.02 % 0.09 % + 0.02 % 0.11 % + 0.02 % 0.31 % + 0.02 % 1.1 % + 0.04 %	
	(1 to 20) A	0.022 %	Fluke Y5020 w/ HP 3458A
	(20 to 100) A	0.27 %	Empro shunt w/ HP 3458A

Parameter/Range	Frequency	CMC ^{2,4,7} (±)	Comments
Distortion – Measure			
(0.3 to 100) % Range < 30 V	10 Hz to 1 MHz (1 to 3) MHz	3.6 % 7.2 %	HP334A
(30 to 300) V	10 Hz to 300 kHz (300 to 500) kHz (0.5 to 3) MHz	3.6 % 7.2 % 14 %	
0.1 % Range < 30 V	(10 to 20) Hz (20 to 30) Hz 30 Hz to 300 kHz (300 to 500) kHz (0.5 to 1.2) MHz	14 % 7.2 % 3.6 % 7.2 % 14 %	
0.1% Range > 30 V	(20 to 30) Hz 30 Hz to 300 kHz (300 to 500) kHz (0.5 to 1.2) MHz	14 % 3.6 % 7.2 % 14 %	
Oscilloscopes ³ –			
Square Wave Signal:			Fluke 5520A w/ SC600
50 Ω Load @ 1 kHz	1.0 mV to 6.6 V _{pk - pk}	0.26 % + 40 μV	
1 MΩ Load @ 1 kHz	1.0 mV to 130 V _{pk - pk}	0.12 % + 40 μV	
DC Volt Amplitude:			
50 Ω Load	0 to 6.6 V	0.25 % + 40 μV	
1 MΩ Load	0 to 130V	0.05 % + 40 μV	
Level Sine Wave:			
Frequency	(0 to 600) MHz	3.1 μHz/Hz	
Amplitude	50 kHz Reference 50 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	2 % + 300 μV 3.5 % + 300 μV 4 % + 300 μV 6 % + 300 μV	
Flatness (Bandwidth)	0 kHz to 100 MHz (100 to 300) MHz (300 to 600) MHz	1.5 % + 100 μV 2 % + 100 μV 4 % + 100 μV	

Parameter/Range	Frequency	CMC ^{2,4,7} (±)	Comments
Oscilloscopes ³ – (cont)			
Time Markers: Into a 50 Ω load	5 s to 50 ms 20 ms to 2 ns	(25 + 1000 <i>t</i>) μs/s 2.5 μs/s	Fluke 5520A w/ SC600 <i>t</i> = time in seconds
Rise Time: 1 kHz to 2 MHz (2 to 10) MHz	≤ 300 ps ≤ 350 ps	(+ 0 ps / -110 ps)	

IV. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2,7} (±)	Comments
RF Power- Measure (-20 to 30) dBm 1 μW to 100 nW	100 kHz to 4.2 GHz	2 %	HP437B/8482A

V. Mechanical

Parameter/Equipment	Range	CMC ^{2,6,7} (±)	Comments
Torque Testers –	Up to 1000 ft·lb	0.077 %	Class F weights & torque arms
Force ³	Up to 10 lb Up to 20 lb Up to 50 lb Up to 100 lb	0.001 lb + 0.6 <i>R</i> 0.002 lb + 0.6 <i>R</i> 0.005 lb + 0.6 <i>R</i> 0.01 lb + 0.6 <i>R</i>	ASTM class F weights
	(100 to 5000) lb	0.038 %	ASTM class F weights
Compression Only ³	Up to 10 000 lb (10 000 to 100 000) lb (100 000 to 200 000) lb	0.09 % of full scale 360 lb 630 lb	Load cell w/ indicator

Parameter/Equipment	Range	CMC ^{2,6,7} (±)	Comments
Torque Wrenches ³	40 in·oz to 250 ft·lb	0.65 %	CDI Suretest 5000-ST
Scales ³	(1 to 20 000) g (Above 20 000) g	0.017 % + 0.6R 0.017 % per 20 000 g + 0.6R	Class F weights (applied load)
	Up to 1000 lbs (1000 to 120 000) lbs	0.017 % + 0.6R 0.017 % per 20 000 lb + 0.6R	Class F weights (applied load)
Balances ³	(1 to 500) mg	0.006 mg + 0.6R	ASTM class 0 weights (applied load)
	500 mg to 5 g	0.02 mg + 0.6R	
	(5 to 10) g	0.03 mg + 0.6R	
	(10 to 20) g	0.045 mg + 0.6R	
	(20 to 50) g	0.073 mg + 0.6R	
	(50 to 100) g	0.16 mg + 0.6R	
	(100 to 200) g	0.3 mg + 0.6R	ASTM class 1 weights (applied load)
	(Above 200) g	0.3 mg per 200 g + 0.6R	
	(1 to 5) g	0.041 mg + 0.6R	
	(Up to 10) g	0.06 mg + 0.6R	
	(Up to 30) g	0.089 mg + 0.6R	
	(Up to 50) g	0.14 mg + 0.6R	
	(Up to 100) g	0.3 mg + 0.6R	
	(Up to 200) g	0.6 mg + 0.6R	
(Up to 300) g	0.9 mg + 0.6R		
(Up to 500) g	1.4 mg + 0.6R		
(Up to 1000) g	3 mg + 0.6R		
(Above 1000) g	3 mg per 1000 g + 0.6R		
Pressure ³	(0.01 to 100) psig	0.07 % of full scale	Fluke 744 w/ 700 Series modules
	(0.1 to 1000) psig	0.07 % of full scale	Fluke 744 w/ 700 Series modules
	(5 to 10 000) psig	0.13 % of reading	Ametek DM-T-100
Vacuum ³	(0.01 to 30) inHg	0.07 % of full scale	Fluke 744 w/ 700PD6

Parameter/Equipment	Range	CMC ^{2,7} (±)	Comments
Indirect Verification of Rockwell Hardness Testers ³	HRC: Low Middle High HRB W: Low Middle High HR30N: Low Middle High	0.81 HRC 0.62 HRC 0.62 HRC 0.92 HRBW 0.68 HRBW 0.68 HRBW 0.90 HR30N 0.66 HR30N 0.66 HR30N	Indirect verification per ASTM E18
Verification of Durometer Spring	All durometer types	3.2 g	The durometer spring is verified with an electronic balance
Indenter Extension at Zero Reading	-----	70 µin	Gage block
Speed ³ – Optic/Non-contact: RPM Totalizer/Rate Meters Contact: RPM Totalizer/Rate Meters Speed/RPM/Rate Simulation	 (6 to 100 000) rpm (2 to 3300) fpm (6 to 20 000) rpm (2 to 3300) fpm (6 to 100 000) rpm	 0.035 % 0.035 % 0.35 % 0.35 % 0.003 %	 Ametek 1726 Ametek 1726 Agilent 33220A frequency synthesizer

VI. Thermodynamics

Parameter/Equipment	Range	CMC ² (±)	Comments
Temperature – Direct Method ³	50 °C to 600 °C	0.65 °C	Hart Scientific 9140

Peter Blayze

Parameter/Equipment	Range	CMC ² (±)	Comments
Plate Temperature – Infrared Devices ³	Ambient to 100 °C 100 °C to 250 °C 250 °C to 400 °C	0.65 °C 0.81 °C 1.1 °C	Hart Scientific 9132
Relative Humidity ³	(10 to 90) % RH	1.4 % RH	Vaisala MI-70 w/ MP77 probe
Thermocouple Simulation ³ –			
Type B	600 °C to 800 °C 800 °C to 1820 °C	0.46 °C 0.36 °C	Fluke 5520A
Type E	-250 °C to -100 °C -100 °C to 650 °C 650 °C to 1000 °C	0.51 °C 0.18 °C 0.22 °C	
Type J	-210 °C to -100 °C -100 °C to 760 °C 760 °C to 1200 °C	0.28 °C 0.19 °C 0.24 °C	
Type K	-200 °C to -100 °C -100 °C to 1000 °C 1000 °C to 1372 °C	0.34 °C 0.27 °C 0.41 °C	
Type R	0 °C to 250 °C 250 °C to 1000 °C 1000 °C to 1767 °C	0.59 °C 0.37 °C 0.42 °C	
Type S	0 °C to 250 °C 250 °C to 1400 °C 1400 °C to 1767 °C	0.49 °C 0.39 °C 0.48 °C	
Type T	-250 °C to -150 °C -150 °C to 0 °C 0 °C to 400 °C	0.64 °C 0.25 °C 0.18 °C	

Parameter/Equipment	Range	CMC ² (±)	Comments
RTD – Generate ³	-200 °C to 0 °C 0 °C to 400 °C 400 °C to 800 °C	0.13 °C 0.25 °C 0.49 °C	Fluke 744
RTD – Measure ³	-200 °C to 0 °C 0 °C to 400 °C 400 °C to 800 °C	0.37 °C 0.61 °C 0.97 °C	Fluke 744
Temperature – Measure ³	-196 °C to 420 °C	0.18 °C	HP3458A w/ SPRT

VII. Time and Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency – Generate	9 kHz to 3.0 GHz	2.7 µHz/Hz	Agilent N9310A
Frequency – Measure	(0 to 200) MHz	2.5 µHz/Hz	HP/Agilent 5335A
Timers & Stopwatches ³	(1 to 3600) s	0.2 s	Monarch tachometer and timer

¹ This laboratory offers commercial calibration and field calibration services, where noted.

² Calibration and Measurement Capability (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. Calibration and Measurement Capabilities 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 The measurands stated are generated with the Fluke 5520A series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. Calibration and Measurement Capability is expressed as either a specific value that covers the full range or as a fraction or percentage of the reading plus a fixed floor specification.
- ⁵ The measurands stated are measured with the HP 3458A. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. Calibration and Measurement Capability is expressed as either a specific value that covers the full range or as a combination of the fraction or percentage of the reading/output plus a range specification or as a combination of the fraction or percentage of the reading/output plus a fraction or percentage of the range.
- ⁶ In the statement of Calibration and Measurement Capability, L is the numerical value of the nominal length of the device measured in inches. In the Calibration and Measurement Capability, R is the numerical value of the resolution of the device in microinches.
- ⁷ Unless otherwise noted, percentage refers to percent of reading.