

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

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CALIBRATION

Valid To: September 30, 2010

Certificate Number: 2192.01


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

I. Acoustical Quantities

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Sound – Measure Microphone Sensitivity	250 Hz	0.10 dB	Bruel & Kjaer model 9699 reciprocity system with 4160 1 inch microphones

II. Dimensional

Parameter/Equipment	Range	Best Uncertainty ^{2,3} (±)	Comments
Angle Blocks – Measure, Fixed Points	45°, 30°, 15°, 5°, 3°, 1° (30, 20, 5, 3, 1) min (30, 20, 5, 3, 1) s	0.75 "	Autocollimator



Parameter/Equipment	Range	Best Uncertainty ^{2,3} (\pm)	Comments
Laser Frequency – Measure Laser Heads HP 5518A ML10	Nominal 4.74×10^8 MHz	3 MHz (3.3×10^{-6}) nm 12 MHz (1.6×10^{-5}) nm	Iodine stabilized laser
Gage Blocks – Measure Thin Blocks Fixed Point Short Blocks Long Blocks, Fixed Points	(0.01 to 0.09375) in 0.5 mm (0.1 to 1) in (2 to 4) in (1 to 25) mm (30 to 100) mm (5, 6, 7, 8, 10, 12, 16, 20) in (125, 150, 175, 200, 250, 300, 400, 500) mm	3 μ m 75 nm 2 μ m ($1.2 + 0.7L$) μ m 50 nm ($46 + 0.6L$) nm ($2.4 + 0.4L$) μ m ($60 + 0.4L$) nm	Chrome carbide and steel blocks (English) Chrome carbide and steel blocks (Metric) Chrome carbide and steel blocks (English) Chrome carbide and steel blocks (Metric) Steel blocks (English) Steel blocks (Metric)
Plug Gages – Measure Outside Diameter	(0.1 to < 0.825) in (0.825 to < 5.0) in (5.0 to 11.0) in (2.54 to < 20.955) mm (20.955 to < 127) mm (127 to 279.4) mm	5.0 μ m ($4.4 + 1.4L$) μ m ($12 + 1.4L$) μ m 130 nm ($120 + 1.4L$) nm ($310 + 1.4L$) nm	Federal comparators, models 136B-3, 130B-24

Parameter/Equipment	Range	Best Uncertainty ^{2,3} (±)	Comments
Ring Gages – Measure Inside Diameter	(0.125 to < 0.825) in (0.825 to < 1.51) in (1.51 to < 2.51) in (2.51 to < 5.0) in (5.0 to 11.0) in (3.175 to < 20.955) mm (20.955 to < 38.354) mm (38.354 to < 63.754) mm (63.754 to < 127) mm (127 to 279.4) mm	6.5 μin 7.5 μin 10 μin (7.8 + 1.2L) μin (14 + 1.3L) μin 170 nm 200 nm 260 nm (200 + 1.2L) nm (360 + 1.3L) nm	Federal comparator, model 136B-3
Angle – Measure Polygons Indexing Tables	0 ° to 360 ° 0 ° to 360 ° (30 ° and 15 ° increments)	0.25 " 0.35 "	Dual closure with: Autocollimator, indexing tables Autocollimator, polygon, indexing tables

III. Electrical – DC/Low Frequency

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
DC Voltage – Measure Fixed Points	10.0 V 10.0 V	0.16 μV/V 0.54 μV/V	Solid state reference standards (Zener) with Array Josephson junction Zeners compared against Zeners

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
DC Current – Measure, Shunts ⁴	10 kΩ, 10 μA	36 μΩ/Ω	Measurement International resistance bridge, Guildline 9211A DC shunt
	1 kΩ, 100 μA	51 μΩ/Ω	
	100 Ω, 1 mA	25 μΩ/Ω	
	10 Ω, 10 mA	17 μΩ/Ω	
	1 Ω, 100 mA	19 μΩ/Ω	
	0.1 Ω, 1 A	8.0 μΩ/Ω	
	0.01 Ω, 10 A/2 A	37 μΩ/Ω	
	0.01 Ω, 10 A/10 A	45 μΩ/Ω	
	0.001 Ω, 10 A/20 A	54 μΩ/Ω	
	0.0003333 Ω, 100 A/100 A	120 μΩ/Ω	
0.0003333 Ω, 300 A/100 A	120 μΩ/Ω		

Parameter/Range	Frequency	Best Uncertainty ² (±)	Comments	
AC Current – Measure, Shunts ⁴	40 Hz, (1, 5, 10, 20) kHz 20 kHz	0.06 % 0.07 %	Fluke AC current shunts A45	
				(0.02, 0.2, 0.5) A
				2.0 A
				5.0 A
				20 A
AC–DC Voltage Difference – Measure ⁴	1 MHz 10 MHz 20 MHz 30 MHz 40 MHz 50 MHz 60 MHz 70 MHz	0.13 % 0.18 % 0.22 % 0.25 % 0.4 % 0.52 % 0.69 % 0.81 %	Precision measurement model EL 2400	
				Thermal Voltage Converters
				0.5 V, 50 Ω

Peter Mlynar

Parameter/Range	Frequency	Best Uncertainty ² (±)	Comments
AC-DC Voltage Difference – Measure ⁴ (cont.)			
Thermal Voltage Converters			
0.5 V, 50 Ω	80 MHz	0.8 %	Precision measurement model EL 2400
	90 MHz	0.9 %	
	100 MHz	1.1 %	
0.5 V, 75 Ω	1 MHz	0.13 %	
	10 MHz	0.18 %	
	20 MHz	0.22 %	
	30 MHz	0.25 %	
	40 MHz	0.4 %	
	50 MHz	0.52 %	
	60 MHz	0.69 %	
	70 MHz	0.81 %	
	80 MHz	0.8 %	
	90 MHz	0.9 %	
100 MHz	1.1 %		
1.0 V, 50 Ω	1 MHz	0.14 %	
	10 MHz	0.16 %	
	20 MHz	0.22 %	
	30 MHz	0.27 %	
	40 MHz	0.37 %	
	50 MHz	0.52 %	
	60 MHz	0.66 %	
	70 MHz	0.82 %	
	80 MHz	0.98 %	
	90 MHz	1.0 %	
100 MHz	1.1 %		
1.0 V, 75 Ω	1 MHz	0.14 %	
	10 MHz	0.16 %	
	20 MHz	0.22 %	
	30 MHz	0.27 %	
	40 MHz	0.37 %	
	50 MHz	0.52 %	
	60 MHz	0.66 %	
	70 MHz	0.82 %	
	80 MHz	0.98 %	
	90 MHz	1.0 %	
100 MHz	1.1 %		

Parameter/Range	Frequency	Best Uncertainty ² (±)	Comments
AC-DC Voltage Difference – Measure ⁴ (cont)			
Thermal Voltage Converters			
1.0 V, 135 Ω	1 MHz	0.14 %	Precision Measurement model EL 2400
	10 MHz	0.16 %	
	20 MHz	0.22 %	
	30 MHz	0.27 %	
	40 MHz	0.37 %	
	50 MHz	0.52 %	
	60 MHz	0.66 %	
	70 MHz	0.82 %	
	80 MHz	0.98 %	
	90 MHz	1.0 %	
	100 MHz	1.1 %	
1.0 V, 150 Ω	1 MHz	0.14 %	
	10 MHz	0.16 %	
	20 MHz	0.22 %	
	30 MHz	0.27 %	
	40 MHz	0.37 %	
	50 MHz	0.52 %	
	60 MHz	0.66 %	
	70 MHz	0.82 %	
	80 MHz	0.98 %	
	90 MHz	1.0 %	
	100 MHz	1.1 %	
3.0 V, 50 Ω	1 MHz	0.13 %	
	10 MHz	0.16 %	
	20 MHz	0.2 %	
	30 MHz	0.23 %	
	40 MHz	0.52 %	
	50 MHz	0.55 %	
	60 MHz	0.65 %	
	70 MHz	0.74 %	
	80 MHz	0.82 %	
	90 MHz	0.88 %	
	100 MHz	0.94 %	

Parameter/Range	Frequency	Best Uncertainty ² (±)	Comments
AC-DC Voltage Difference – Measure ⁴ (cont.) Thermal Voltage Converters 3.0 V, 600 Ω	1 MHz 10 MHz 20 MHz 30 MHz 40 MHz 50 MHz 60 MHz 70 MHz 80 MHz 90 MHz 100 MHz	0.13 % 0.15 % 0.2 % 0.21 % 0.33 % 0.44 % 0.56 % 0.64 % 0.78 % 0.92 % 0.92 %	Precision Measurement Model EL 2400

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
DC Resistance – Measure, Fixed Points	1 Ω 10 Ω 100 Ω 1000 Ω 10 kΩ 100 kΩ 1 MΩ 10 MΩ	5.4 μΩ/Ω 3.2 μΩ/Ω 2.9 μΩ/Ω 2.9 μΩ/Ω 0.98 μΩ/Ω 2.6 μΩ/Ω 7.1 μΩ/Ω 15 μΩ/Ω	Fluke 742-X w/Measurement International 6010C ESI model SR-104 w/Measurement International 6000B Fluke 742-X w/Measurement International 6000B
Inductance – Measure ⁴	100 mH	0.064 %	General Radio model 1689M Digibridge
DC Voltage, High – Measure ⁴ 0.5 V Tap	10 kV 20 kV 30 kV	0.0070 % 0.0073 % 0.0066 %	Julie Research, model HVA 50

Peter Meyer

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
DC Voltage, High – Measure ⁴ (cont.)			
0.5 V Tap	40 kV 50 kV	0.0068 % 0.0067 %	Julie Research, model HVA 50
1 V Tap	10 kV 50 kV 75 kV 100 kV	0.0069 % 0.0072 % 0.0078 % 0.0075 %	Julie Research, model HVA 100
10 V Tap	10 kV 50 kV 75 kV 100 kV	0.0063 % 0.0078 % 0.011 % 0.015 %	
AC Voltage, High – Measure ⁴			
60 Hz only			
0.5 V Tap	2 kV 5 kV 10 kV 20 kV 30 kV 40 kV 50 kV	0.064 % 0.06 % 0.049 % 0.048 % 0.068 % 0.071 % 0.078 %	Julie Research, model HVA 50
5 V Tap	2 kV 5 kV 10 kV 20 kV 30 kV 40 kV 50 kV	0.052 % 0.053 % 0.054 % 0.057 % 0.075 % 0.079 % 0.083 %	Julie Research model HVA 50
1 V Tap	2 kV 5 kV 10 kV 15 kV (50, 75, 100) kV	0.067 % 0.054 % 0.052 % 0.053 % 0.13 %	Julie Research model HVA 100
10 V Tap	2 kV 5 kV 10 kV 15 kV (50, 75, 100) kV	0.046 % 0.058 % 0.067 % 0.042 % 0.13 %	

Peter Abney

Parameter/Range	Frequency	Best Uncertainty ² (±)	Comments
Capacitance – Measure Fixed Points			
1 pF	400 Hz 1000 Hz	10 μF/F 3.2 μF/F	Andeen Hagerling 2700A
10 pF	400 Hz 1000 Hz	3.0 μF/F 0.93 μF/F	
100 pF	400 Hz 1000 Hz	2.8 μF/F 0.87 μF/F	
Peak to Peak – Measure ⁴ , Fixed Points			
(mV/V, 067-0625-00 Detector)	0.1 MHz (0.3, 1.0) MHz 10 MHz 30 MHz 50 MHz 100 MHz 200 MHz 300 MHz 400 MHz 500 MHz	0.18 % 0.20 % 0.24 % 0.35 % 0.69 % 1.3 % 1.4 % 1.5 % 1.6 % 2.6 %	Tektronix 067-0625-00
AC Current, High – Measure ⁴ , Fixed Points			
10 A	(1, 10, 20) kHz 30 kHz 50 kHz 100 kHz	0.09 % 0.1 % 0.23 % 0.37 %	PMI EL9800, current shunts
20 A	1 kHz (10, 20) kHz 30 kHz 50 kHz 100 kHz	0.1 % 0.09 % 0.11 % 0.13 % 0.33 %	
30 A	1 kHz 10 kHz 20 kHz 30 kHz	0.09 % 0.1 % 0.12 % 0.19 %	
50 A	1 kHz (10, 20) kHz 30 kHz	0.09 % 0.14 % 0.26 %	

Peter Abney

Parameter/Range	Frequency	Best Uncertainty ² (±)	Comments
AC Current, High – Measure ⁴ , Fixed Points			
80 A	1 kHz 10 kHz 20 kHz	0.11 % 0.12 % 0.17 %	PMI EL9800, current shunts
100 A	1 kHz 10 kHz	0.11 % 0.25 %	

IV. Electrical – RF & Microwave

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
RF Power – Measure ⁴ , Fixed Points			
(Coaxial) Calibration Factors of Thermistor Mounts	0.1 MHz	1.4 %	Weinschel Engineering F1116 thermistor mount against M1111
	0.2 MHz	1.2 %	
	0.4 MHz	1.2 %	
	0.5 MHz	0.92 %	
	1.0 MHz	0.75 %	
	(2.0, 4.0, 6.0, 8.0) MHz	0.82 %	
	10 MHz	0.8 %	Weinschel Engineering F1109 thermistor mount against M1111
	10 MHz	0.86 %	
	(0.05, 0.1) GHz	1.0 %	Weinschel Engineering F1109 thermistor mount against M1110
	(0.5, 1.0) GHz	1.1 %	
	1.5 GHz	1.2 %	
	2.0 GHz	1.1 %	
	(2.5, 3.0) GHz	1.2 %	
	3.5 GHz	1.3 %	
	4.0 GHz	1.3 %	
5.0 GHz	1.4 %		
6.0 GHz	1.3 %		
7.0 GHz	1.4 %		
8.0 GHz	1.3 %		
9.0 GHz	1.9 %		

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
RF Power – Measure ⁴ (Waveguide) Calibration Factors for Thermistor Mounts	(8.2 to 12.4) GHz (12.4 to 18.0) GHz (18.0 to 26.5) GHz (26.5 to 40) GHz	2.0 % 2.6 % 4.1 % 3.7 %	Comparison of 486A/DBG-675-3 against 486A X-band P-band K-band R-band
Reflection Measurements – S11/S22, Magnitude & Phase Coaxial Type N	(0 to 0.10) lin; (0.045 to 2.0) GHz (0 to 0.10) lin; (2.0 to 8.0) GHz (0 to 0.10) lin; (8.0 to 18.0) GHz (0.10 to 0.30) lin; (0.045 to 2.0) GHz (0.10 to 0.30) lin; (2.0 to 8.0) GHz (0.10 to 0.30) lin; (8.0 to 18.0) GHz (0.30 to 0.70) lin; (0.045 to 2.0) GHz (0.30 to 0.70) lin; (2.0 to 8.0) GHz (0.30 to 0.70) lin; (8.0 to 18.0) GHz	0.0051 to 0.0056 (3.2 to 180) ° 0.0091 to 0.0096 (7.0 to 180) ° 0.0094 to 0.01 (9.2 to 180) ° 0.0056 to 0.0076 (1.3 to 2.95) ° 0.0097 to 0.013 (3.7 to 6.5) ° 0.01 to 0.014 (5.9 to 8.7) ° 0.0076 to 0.013 (0.9 to 3.7) ° 0.013 to 0.022 (3.1 to 3.7) ° 0.014 to 0.027 (5.5 to 5.8) °	HP 8510C, test set 8515A, source 8340B, cables 85132F, cal kit 85054B

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments	
Reflection Measurements (cont) – S11/S22, Magnitude & Phase	Coaxial Type N	(0.70 to 1.0) lin; (0.045 to 2.0) GHz	0.013 to 0.018 (0.83 to 0.89) °	HP 8510C, test set 8515A, source 8340B, cables 85132F, cal kit 85054B
		(0.70 to 1.0) lin; (2.0 to 8.0) GHz	0.022 to 0.031 (3.1 to 3.1) °	
		(0.70 to 1.0) lin; (8.0 to 18.0) GHz	0.027 to 0.042 (5.7 to 5.5) °	
	Coaxial 7 mm	(0 to 0.10) lin; (0.045 to 2.0) GHz	0.0035 to 0.004 (2.3 to 180) °	HP8510C, test set 8515A, source 8340B, cables 85132F, cal kit 85050B
		(0 to 0.10) lin; (2.0 to 8.0) GHz	0.0036 to 0.0041 (3.9 to 180) °	
		(0 to 0.10) lin; (8.0 to 18.0) GHz	0.0048 to 0.0054 (6.0 to 180) °	
		(0.10 to 0.30) lin; (0.045 to 2.0) GHz	0.004 to 0.0059 (1.0 to 2.1) °	
		(0.10 to 0.30) lin; (2.0 to 8.0) GHz	0.0041 to 0.0063 (2.6 to 3.7) °	
		(0.10 to 0.30) lin; (8.0 to 18.0) GHz	0.0052 to 0.0079 (4.7 to 5.8) °	
		(0.30 to 0.70) lin; (0.045 to 2.0) GHz	0.006 to 0.011 (0.68 to 0.98) °	
		(0.30 to 0.70) lin; (2.0 to 8.0) GHz	0.0063 to 0.0124 (2.4 to 2.6) °	
		(0.30 to 0.70) lin; (8.0 to 18.0) GHz	0.0079 to 0.017 (4.6 to 4.7) °	
		(0.70 to 1.0) lin; (0.045 to 2.0) GHz	0.011 to 0.015 (0.62 to 0.68) °	

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Reflection Measurements (cont) – S11/S22, Magnitude & Phase			
Coaxial 7 mm	(0.70 to 1.0) lin; (2.0 to 8.0) GHz	0.013 to 0.018 (2.4 to 2.4) °	HP8510C, test set 8515A, source 8340B, cables 85132F, cal kit 85050B
	(0.70 to 1.0) lin; (8.0 to 18.0) GHz	0.017 to 0.025 (4.6 to 4.6) °	
Coaxial 3.5 mm	(0 to 0.10) lin; (0.045 to 2.0) GHz	0.006 to 0.0065 (3.7 to 180) °	HP 8510 C, test set 8515A, source 8340B, cables 85131F, cal kit 85052B
	(0 to 0.10) lin; (2.0 to 8.0) GHz	0.0083 to 0.0088 (6.6 to 180) °	
	(0 to 0.10) lin; (8.0 to 20.0) GHz	0.0084 to 0.0089 (8.9 to 180) °	
	(0 to 0.10) lin; (20.0 to 26.5) GHz	0.0087 to 0.0091 (10.3 to 180) °	
	(0.10 to 0.30) lin; (0.045 to 2.0) GHz	0.0065 to 0.0086 (1.6 to 3.4) °	
	(0.10 to 0.30) lin; (2.0 to 8.0) GHz	0.0088 to 0.012 (3.7 to 6.2) °	
	(0.10 to 0.30) lin; (8.0 to 20.0) GHz	0.0089 to 0.013 (6.1 to 8.5) °	
	(0.10 to 0.30) lin; (20.0 to 26.5) GHz	0.0091 to 0.013 (7.4 to 9.8) °	
	(0.30 to 0.70) lin; (0.045 to 2.0) GHz	0.0086 to 0.016 (1.2 to 1.6) °	
	(0.30 to 0.70) lin; (2.0 to 8.0) GHz	0.012 to 0.024 (3.3 to 3.7) °	
	(0.30 to 0.70) lin; (8.0 to 20.0) GHz	0.013 to 0.027 (5.9 to 6.1) °	
	(0.30 to 0.70) lin; (20.0 to 26.5) GHz	0.013 to 0.027 (7.1 to 7.3) °	

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Reflection Measurements (cont) – S11/S22, Magnitude & Phase Coaxial 3.5 mm	(0.70 to 1.0) lin; (0.045 to 2.0) GHz	0.016 to 0.023 (1.2 to 1.6) °	HP 8510 C, test set 8515A, source 8340B, cables 85131F, cal kit 85052B
	(0.70 to 1.0) lin; (2.0 to 8.0) GHz	0.024 to 0.038 (3.5 to 3.3) °	
	(0.70 to 1.0) lin; (8.0 to 20.0) GHz	0.027 to 0.044 (6.2 to 5.9) °	
	(0.70 to 1.0) lin; (20.0 to 26.5) GHz	0.027 to 0.044 (7.4 to 7.1) °	

V. Fluid Quantities

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Gas Flow ⁴	(2 to 10) sccm (10 to 100) sccm (0.1 to 1) slm (1 to 10) slm (4 to 40) slm	0.25 % + 0.02 % fs 0.27 % + 0.02 % fs 0.25 % + 0.02 % fs 0.19 % + 0.02 % fs 0.3 % + 0.02 % fs	DH Instruments Molbloc set
Calibration of Air and Gas Flow Meters	(1 to 30) cfm 10 ccpm to 10 L/min (10 to 30) L/min (30 to 60) L/min	1 % 0.35 % 0.45 % 0.55 %	Bell Prover (air) Mobloc/Molbox calibration system

VI. Ionizing Radiation and Radioactivity

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Gamma Radiation – Measure ⁴ Gamma Radiation Sources	20 µR/hr to 10 000 R/hr	4.5 %	Shonka-Wycoff ionization chambers with Cs ¹³⁷ and Co ⁶⁰ sources

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Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Pressure – Hydraulic, Absolute ⁴			DHI 7302
Measuring Equipment	(72.5 to 5800) psi, or (0.5 to 40) Mpa	0.004 % + 50 Pa	Using NIST calibrated pistons
	(290 to 23 206) psi, or (2 to 160) Mpa	0.0037 % + 56 Pa	
	(725 to 40 000) psi, or (5 to 275) Mpa	0.0041 % + 82 Pa	
	(40 to 58) kpsi, or (275 to 400) MPa	0.0062 % + 82 Pa	
(Cross Float), Measure, Calibration of Piston Areas	(72.5 to 3264) psi, or (0.5 to 22.5) MPa	0.0054 %	Calibration of UUT pistons with NIST calibrated pistons
	(290 to 13 053) psi, or (2 to 90) Mpa	0.0047 %	
	(290 to 32 634) psi, or (5 to 225) MPa	0.005 %	
Calibration of Pressure Systems, Measure	(72.5 to 3264) psi, or (0.5 to 22.5) MPa	0.0056 % + 50 Pa	Calibration of UUTs (dead weight systems using piston uncertainties determined from crossfloats)
	(290 to 13 053) psi, or (2 to 90) MPa	0.0051 % + 56 Pa	
	(290 to 32 634) psi, or (5 to 225) MPa	0.0055 % + 82 Pa	
Differential Pressure – Measure ⁴			
Differential Pressure Gages	(0 to 15) kPa	0.0063 % + 0.40 Pa	DH Instruments force balanced piston gage, model FPG8601

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Pneumatic High Pressure ⁴ –			
Measuring Equipment – Gage and Absolute	(2 to 110) MPa	0.0038 % + 69 Pa	DH Instruments PC-7202-2 using a NIST calibrated piston
Measure – Cross-Float, Calibration of Piston Areas	(2 to 110) MPa	0.0048 %	DH Instruments PC-7202-2
Measure Pressure Systems – Gage and Absolute	(2 to 110) MPa	0.0052 % + 85 Pa	DH Instruments PC-7202-2
Mass – Measure, Weights and Weight Sets, Fixed Points	(1, 2, 3, 5) mg (10, 20, 30) mg 50 mg 100 mg (200, 300) mg 500 mg 1 g 2 g 3 g 5 g 10 g 20 g 30 g 50 g 100 g 200 g 300 g 500 g 1 kg 2 kg 3 kg 5 kg 10 kg 20 kg 50 lb	1.5 µg 1.7 µg 1.9 µg 2.6 µg 2.4 µg 2.9 µg 4.3 µg 4.2 µg 4.9 µg 6.4 µg 11 µg 15 µg 20 µg 32 µg 61 µg 95 µg 130 µg 210 µg 62 µg 0.48 mg 1.3 mg 1.7 mg 4.2 mg 11 mg 11 µlb	Mettler comparator balance

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Vacuum – Measure ⁴	(0.001 to 0.01) Torr (0.01 to 0.1) Torr (0.1 to 1.0) Torr (1.0 to 10) Torr (10 to 100) Torr	0.37 % + 0.35 mTorr 0.37 % + 1.1 mTorr 0.69 % + 0.21 mTorr 0.55 % + 4 mTorr 0.59 % + 49 mTorr	Capacitance manometers

VIII. Optical Quantities

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Spectral Transmittance – Measure (250 to 2500) nm			Varian Cary spectrophotometer model 500 scan with:
Transmittance	(0.001 to 0.1) T Up to 0.9 T	0.013 T 0.026 T	neutral density filters; T is transmittance
Wavelength	(240 to 650) nm	0.28 nm	Polystyrene film, SRM 1921a
Wavenumber	(906.69 to 30 812.25) cm ⁻¹	2.3 cm ⁻¹	Perkin Elmer 2000 FTIR scan with polystyrene film, SRM 1921a
Wavelength	3267.94 nm	0.37 nm	Varian Cary spectrophotometer model 500 scan with polystyrene film, SRM 1921a

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Fiber Optics – Measure ⁴ Linearity 850 nm 1310 nm 1550 nm Power (Collimated) 850 nm 1310 nm 1550 nm Power (Connectorized) 850 nm 1310 nm 1550 nm	(+3 to -60) dbm (2.5 mW to 1 μW) @ 100 μW @ 100 μW	0.016 db (0.18 %) 0.015 db (0.17 %) 0.016 db (0.18 %) 1.5 % 1.9 % 2.1 % 2.1 % 2.1 % 2.1 %	NIST triplet superposition system as method to calibrate fiber optic power meter linearity Judson IR fiber optic germanium detectors w/Anritsu model MS 9030A spectrum analyzer Agilent power meter model 8153A w/ Anritsu model MS 9030A spectrum analyzer
Lasers – Measure ⁴ Calibration of Laser Power Meters High Energy	(50 to 1400) W (8 to 600) kJ	3.9 % 3.9 %	NIST designed calorimeter
UV Radiation – Measure ⁴ Irradiance, at 365 nm	(0.5 to 2.5) mW/cm ²	7.3 %	Jerry Bachur Associates light source, LS90-NAFB

IX. Thermodynamics

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Dew Point – Measure, Calibration of Hygrometers	(-70 to 10) °C	0.6 °C	Thunder Scientific 3900
Relative Humidity – Measure, Calibration of RH Meters	(5 to 95) % RH	1.0 % RH	Thunder Scientific 9000
Temperature – Measure			
SPRTs at Fixed Points	-189.3442 °C -38.8344 °C 0.01 °C 29.7646 °C	0.0021 °C 0.0007 °C 0.00047 °C 0.001 °C	Pond K38 cell (Ar TP) Pond K18 cell (HG TP) Jarrett TP cell (H ₂ O TP) Isotech 17402A cell (Ga MP)
	231.928 °C	0.0016 °C	Isotech ITL-N-17669 cell (Sn FP)
	419.527 °C	0.0027 °C	Isotech ITL-M-17671 cell (Zn FP)
SPRTs over Temperature Ranges	(-200 to -40) °C (-40 to 0) °C (0 to 450) °C (450 to 661) °C	0.0024 °C 0.001 °C 0.0037 °C 0.013 °C	Fixed point cells, bridge, SPRTs

X. Time and Frequency

Parameter/Equipment	Range	Best Uncertainty ² (±)	Comments
Frequency – Measure Frequency Standards and Meters – Fixed Points	10 MHz	2.5 parts in 10 ¹³	Automated frequency system from NIST with HP 5071A cesium beam
	10 MHz	1.5 parts in 10 ¹¹	Using HP 5071A cesium beam for typical Rubidium standard
	10 MHz	3.5 parts in 10 ⁹	Distributed signal Agilent 53132, opt 12 counter

¹ This laboratory offers commercial calibration service.

² “Best Uncertainty” 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 of nearly ideal measuring equipment. Best uncertainties represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The best uncertainty of a specific calibration performed by the laboratory may be greater than the best uncertainty due to the behavior of the customer’s device and to influences from the circumstances of the specific calibration.

³ In the statement of best uncertainty, L is the numerical value of the nominal length of the unit under test measured in inches or millimeters.

⁴ In the statement of best uncertainty, percentages are percentage of reading, unless otherwise indicated; “fs” stands for “full scale”.



World Class Accreditation

The American Association for Laboratory Accreditation

Accredited Laboratory

A2LA has accredited

USAF PRIMARY STANDARDS LABORATORY - THE BIONETICS CORPORATION

Heath, OH

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 8th day of January 2009.



Peter Meyer

President & CEO
For the Accreditation Council
Certificate Number 2192.01
Valid to September 30, 2010
Revised September 1, 2010

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