National Voluntary Laboratory Accreditation Program

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

ESSCO CALIBRATION LABORATORY 27 Industrial Avenue, Unit #9 Chelmsford, MA 01824-3618 Mr. Kevin Pistey Phone: 800-325-2201 x115 Fax 978-256-1331 E-mail: kpistey@esscolab.com URL: http://www.esscolab.com	**Parameter(s) of Accreditation** Dimensional Electromagnetics – DC/Low Frequency Time and Frequency Mechanical Electromagnetics – RF/Microwave Thermodynamic This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (NVLAP Code: 20/A01)

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (k=2) [Note 3,5]	Remarks
DIMENSIONAL			
NVLAP Code: 20/D03 **GAGE BLOCKS**	0.01 in to 0.049 in 0.05 in to 0.15 in 0.15 in to 1 in 1 in to 2 in 2 in to 3 in 3 in to 4 in 4 in to 5 in 5 in to 6 in 6 in to 8 in 8 in to 10 in 10 in to 12 in 12 in to 16 in 16 in to 20 in	2.5 µin 2.4 µin 2.7 µin 4.1 µin 5.2 µin 7.4 µin 8.5 µin 9.6 µin 10 µin 12 µin 12 µin 16 µin 19 µin	Comparison to Master Blocks (Note: Uncertainties are for steel DUT; uncertainty will increase for different DUT Material)
NVLAP Code: 20/D05 **LENGTH & DIAMETER** Length Standards, Rods Calipers	 0.1 in to 20 in 0 in to 72 in	 1.1 µin/in + 18 µin 2.9 µin/in + 560 µin	 Comparison to Length Standards

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
Thickness Setting Discs	0.01 in to 0.24 in	21 µin	
Micrometer	0 in to 40 in	1.9 µin/in + 29 µin	Comparison to gage blocks
Supermicrometer	0 in to 1 in	12 µin	Comparison to gage blocks
Anvil Parallelism	0 µin nominal	13 µin	Optical flat
Anvil Flatness	0 µin nominal	5.0 µin	Optical flat
Optical Flats	0 µin nominal	2.5 µin	Comparison to standard flat
Parallelism	0 µin nominal	3.4 µin	Gage block comparator
Bore Micrometers and Gages	0.0625 in to 8 in	15 µin/in + 50 µin	Comparison to master rings
Dial/Test Indicator	0.01 in to 0.2 in 0.2 in to 1 in 1 in to 12 in	10 µin 20 µin/in + 6 µin 24 µin/in + 2 µin	Gage blocks or Micrometer head
Height Gages	0 in to 40 in	1.4 µin/in + 15 µin	Comparison to gage blocks
Depth Gages	0 in to 12 in	23 µin/in + 11 µin	
Durometer (Indicator Length) (Note: Spring force component listed in mechanical section)	0.05 in 0.10 in 0.20 in	180 µin 180 µin 210 µin	
Electronic Gage Amplifier	0 in to 1 in	8 µin	
Crimp Tools Crimp Height	0.011 to 1 in	0.0014 in	Indirect comparison to crimp micrometer

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
NVLAP Code: 20/D07 MEASURING WIRES			
Thread Wires	4 threads/in to 120 threads/in	8.3 µin	Labmaster, gage blocks
NVLAP Code: 20/D11 SPHERICAL DIAMETER PLAIN PLUG/RINGS			
Pin Gages	0.011 in to 1 in	60 µin	Supermicrometer
Plain Plugs	0 in to 12 in	5 µin/in + 4 µin	Labmaster
Plain Ring Gages			Note: The laboratory masters from the fixed points shown where the best uncertainties exist. Uncertainties are higher at other points within the variable range shown. Expect a near linear relation of range to uncertainty.
Fixed Points	0.04 in	5.9 µin	
	0.125 in	4.8 µin	
	0.25 in	4.7 µin	
	1.0 in	4.9 µin	
	4.0 in	7.5 µin	
Endpoints of Variable Range	0.02 in	7.9 µin	
	11 in	26 µin	
Crimp Tools			
Die Dimension	0.011 in to 0.5 in	0.0012 in	Pin Gages
NVLAP Code: 20/D14 THREADED PLUG/RINGS			
Thread Plugs			Thread wires and Supermicrometer
Pitch Diameter			
6 TPI to 80 TPI	0.01 in to 5 in	96 µin	
0.25 mm to 10 mm (Pitch)	0.1 mm to 127 mm	2.4 µm	
ELECTROMAGNETICS – DC/LOW FREQUENCY			
NVLAP Code: 20/E02 AC RESISTANCE and CURRENT			
Alternating Current– Generate			
0 µA to 220 µA	10 Hz to 20 Hz	2.4 mA/A + 22 nA	Fluke 5700A EP
	20 Hz to 40 Hz	140 µA/A + 15 nA	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	40 Hz to 1 kHz	100 µA/A + 14 nA	
	1 kHz to 5 kHz	200 µA/A + 35 nA	
	5 kHz to 10 kHz	0.90 mA/A + 91 nA	
220 µA to 2.2 mA	10 Hz to 20 Hz	3.2 mA/A + 630 nA	
	20 Hz to 40 Hz	140 µA/A + 91 nA	
	40 Hz to 1 kHz	110 µA/A + 92 nA	
	1 kHz to 5 kHz	190 µA/A + 190 nA	
	5 kHz to 10 kHz	1 mA/A + 820 nA	
2.2 mA to 22 mA	10 Hz to 20 Hz	240 µA/A + 1 µA	
	20 Hz to 40 Hz	150 µA/A + 850 nA	
	40 Hz to 1 kHz	110 µA/A + 880 nA	
	1 kHz to 5 kHz	190 µA/A + 1.3 µA	
	5 kHz to 10 kHz	1.0 mA/A + 6 µA	
22 mA to 220 mA	10 Hz to 20 Hz	240 µA/A + 10 µA	
	20 Hz to 40 Hz	150 µA/A + 8.5 µA	
	40 Hz to 1 kHz	110 µA/A + 8.1 µA	
	1 kHz to 5 kHz	180 µA/A + 11 µA	
	5 kHz to 10 kHz	950 µA/A + 36 µA	
220 mA to 2.2 A	40 Hz to 1 kHz	250 µA/A + 120 µA	
	1 kHz to 5 kHz	430 µA/A + 140 µA	
	5 kHz to 10 kHz	690 µA/A + 400 µA	
2.2 A to 11 A	40 Hz to 1 kHz	0.54 mA/A + 0.19 mA	Fluke 5700A/EP w/5725A
	1 kHz to 5 kHz	1.1 mA/A + 0.48 mA	
	5 kHz to 10 kHz	4.2 mA/A + 0.89 mA	
11 A to 20.5 A	45 Hz to 100 Hz	1.5 mA/A + 6 mA	Fluke 5520A
	100 Hz to 1 kHz	1.8 mA/A + 6 mA	
	1 kHz to 5 kHz	35 mA/A + 6 mA	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
Current Clamp, Non-Toroidal			
20 A to 1000 A	45 Hz to 65 Hz	7.2 mA/A + 270 mA	Fluke 5500A Coil
	65 Hz to 440 Hz	12.3 mA/A + 270 mA	
Current Clamp, Toroidal			
20 A to 1000 A	45 Hz to 65 Hz	3.3 mA/A + 27 mA	
	65 Hz to 440 Hz	9.3 mA/A + 29 mA	
1 nA to 200 µA	1 Hz to 10 Hz	370 µA/A + 0.023 µA	Fluke 8508A
	10 Hz to 10 kHz	400 µA/A + 0.023 µA	
	10 kHz to 30 kHz	850 µA/A + 0.023 µA	
	30 kHz to 100 kHz	4.7 mA/A + 0.023 µA	
200 µA to 2 mA	1 Hz to 10 Hz	360 µA/A + 0.23 µA	
	10 Hz to 10 kHz	360 µA/A + 0.23 µA	
	10 kHz to 30 kHz	830 µA/A + 0.23 µA	
	30 kHz to 100 kHz	4.7 mA/A + 0.23 µA	
2 mA to 20 mA	1 Hz to 10 Hz	370 µA/A + 2.3 µA	
	10 Hz to 10 kHz	370 µA/A + 2.3 µA	
	10 kHz to 30 kHz	830 µA/A + 2.3 µA	
	30 kHz to 100 kHz	4.7 mA/A + 2.3 µA	
20 mA to 200 mA	1 Hz to 10 Hz	370 µA/A + 23 µA	
	10 Hz to 10 kHz	350 µA/A + 23 µA	
	10 k Hz to 30 kHz	730 µA/A + 23 µA	
200 mA to 2 A	10 Hz to 2 kHz	730 µA/A + 230 µA	
	2 kHz to 10 kHz	850 µA/A + 23 µA	
	10 kHz to 30 kHz	3.5 mA/A + 23 µA	
2 A to 20 A	10 Hz to 2 kHz	0.96 mA/A + 2.8 mA	
	2 kHz to 10 kHz	3.0 mA/A + 2.3 mA	
10 mA to 20 mA	10 Hz to 20 Hz	230 µA/A	5790A/A40 Shunts

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	20 Hz to 40 Hz	110 µA/A	
	40 Hz to 20 kHz	80 µA	
	20 kHz to 50 kHz	90 µA/A	
	50 kHz to 100 kHz	110 µA/A	
20 mA to 30 mA	10 Hz to 20 Hz	230 µA/A	
	20 Hz to 40 Hz	110 µA/A	
	40 Hz to 20 kHz	78 µA/A	
	20 kHz to 50 kHz	91 µA/A	
	50 kHz to 100 kHz	110 µA/A	
100 mA to 200 mA	10 Hz to 20 Hz	230 µA/A	
	20 Hz to 40 Hz	110 µA/A	
	40 Hz to 20 kHz	78 µA/A	
	20 kHz to 50 kHz	90 µA/A	
	50 kHz to 100 kHz	110 µA/A	
200 mA to 300 mA	10 Hz to 20 Hz	230 µA/A	
	20 Hz to 40 Hz	110 µA/A	
	40 Hz to 20 kHz	81 µA/A	
	20 kHz to 50 kHz	92 µA/A	
	50 kHz to 100 kHz	110 µA/A	
1 A to 2 A	10 Hz to 20 Hz	230 µA/A	
	20 Hz to 40 Hz	110 µA/A	
	40 Hz to 20 kHz	79 µA/A	
	20 kHz to 50 kHz	90 µA/A	
	50 kHz to 100 kHz	110 µA/A	
2 A to 3 A	10 Hz to 20 Hz	230 µA/A	
	20 Hz to 40 Hz	110 µA/A	
	40 Hz to 20 kHz	79 µA/A	
	20 kHz to 50 kHz	90 µA/A	
	50 kHz to 100 kHz	110 µA/A	
3 A to 5 A	10 Hz to 20 Hz	230 µA/A	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	20 Hz to 40 Hz	110 µA/A	
	40 Hz to 20 kHz	80 µA/A	
5 A to 10 A	10 Hz to 20 Hz	230 µA/A	
	20 Hz to 40 Hz	110 µA/A	
	40 Hz to 20 kHz	80 µA/A	
	20 kHz to 50 kHz	91 µA/A	
10 A to 20 A	10 Hz to 20 Hz	230 µA/A	
	20 Hz to 40 Hz	110 µA/A	
	40 Hz to 20 kHz	79 µA/A	
	20 kHz to 50 kHz	90 µA/A	
NVLAP Code: 20/E05 DC RESISTANCE and CURRENT			
Direct Current – Generate	0 pA to 2 pA	4.9 fA/pA + 12 fA	Keithley 263
	2 pA to 20 pA	4.1 fA/pA + 17 fA	
	20 pA to 200 pA	2.9 fA/pA + 42 fA	
	0.2 nA to 2 nA	0.76 pA/nA + 0.12 pA	
	2 nA to 20 nA	0.76 pA/nA + 1.2 pA	
	20 nA to 200 nA	0.41 pA/nA + 12 pA	
	0.2 µA to 2 µA	0.29 nA/µA + 0.12 nA	
	2 µA to 20 µA	0.27 nA/µA + 1.7 nA	
	20 µA to 200 µA	0.30 nA/µA + 12 nA	
	2 µA to 220 µA	23 µA/A + 1.7 nA	Fluke 5700A EP/5725A
	220 µA to 2.2 mA	23 µA/A + 5.6 nA	
	2.2 mA to 20 mA	23 µA/A + 55 nA	
	22 mA to 220 mA	40 µA/A + 0.88 µA	
	220 mA to 2.2 A	32 µA/A + 31 µA	
	2.2 A to 11 A	110 µA/A + 260 µA	
	3 A to 11 A	580 µA/A + 1.2 mA	
	11 A to 20 A	1.2 mA/A + 0.87 mA	Fluke 5520A

2012-06-28 through 2013-06-30
Effective dates

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CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
Current Clamps			
Non – Toroidal	20 A to 1000 A	5.8 mA/A + 0.58 A	Fluke 5520A w/5500 coil
Toroidal	20 A to 1000 A	3.0 mA/A + 0.058 A	
Direct Current – Measure	0 A to 100 nA	35 µA/A + 47 pA	HP 3458A/002
	100 nA to 1 µA	22 µA/A	
	1 µA to 200 µA	7.7 µA/A + 0.45 nA	Fluke 8508A
	200 µA to 2 mA	8 µA/A + 3.8 nA	
	2 mA to20 mA	8.8 µA/A + 39 nA	
	20 mA to 200 mA	35 µA/A + 0.78 µA	
	0.2 A to 2 A	170 µA/A + 16 µA	
	2 A to 20 A	400 µA/A + 420 µA	
	20 A to 100 A	230 µA/A	Guildline 9230-0.01 With Fluke 8508A
Resistance – Variable Generate	0 Ω to 11 Ω	48 µΩ/Ω + 1.2 mΩ	Fluke 5520A
	11 Ω to 33 Ω	41 µΩ/Ω + 1.7 mΩ	
	33 Ω to 110 Ω	35 µΩ/Ω + 1.8 mΩ	
	110 Ω to 330 Ω	34 µΩ/Ω + 2.4 mΩ	
	330 Ω to 1.1 kΩ	34 µΩ/Ω + 2.4 mΩ	
	1.1 kΩ to 3.3 kΩ	35 µΩ/Ω + 22 mΩ	
	3.3 kΩ to 11 kΩ	35 µΩ/Ω + 23 mΩ	
	11 kΩ to 33 kΩ	35 µΩ/Ω + 22 mΩ	
	33 kΩ to 110 kΩ	34 µΩ/Ω + 24 mΩ	
	110 kΩ to 330 kΩ	44 µΩ/Ω + 1.6 Ω	
	330 kΩ to 1.1 MΩ	40 µΩ/Ω + 3 Ω	
	1.1 MΩ to 3.3 MΩ	120 µΩ/Ω	
	3.3 MΩ to 11 MΩ	160 µΩ/Ω	
	11 MΩ to 33 MΩ	700 µΩ/Ω - 1.6 kΩ	
	33 MΩ to 110 MΩ	760 µΩ/Ω + 3.5 kΩ	
	110 MΩ to 330 MΩ	0.65 % - 210 kΩ	
	330 MΩ to 1100 MΩ	1.5 % + 730 kΩ	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
Resistance – Fixed Generate (Instrument-Based)	1 Ω	40 μΩ	Fluke 5700A EP
	1.9 Ω	60 μΩ	
	10 Ω	0.13 mΩ	
	19 Ω	0.22 mΩ	
	100 Ω	0.87 mΩ	
	190 Ω	1.6 mΩ	
	1 kΩ	8.4 mΩ	
	1.9 kΩ	16 mΩ	
	10 kΩ	84 mΩ	
	19 kΩ	160 mΩ	
	100 kΩ	0.84 Ω	
	190 kΩ	1.6 Ω	
	1 MΩ	10 Ω	
	1.9 MΩ	19 Ω	
	10 MΩ	280 Ω	
	19 MΩ	540 Ω	
	100 MΩ	17 kΩ	
	10 GΩ	350 MΩ	Keithley 263
	100 GΩ	3.6 GΩ	
Resistance – Fixed Generate (Standard Resistor-Based)	0.001 Ω	0.2 μΩ	L & N 4333
	0.01 Ω	0.31 μΩ	Guildline 9230/100
	0.1 Ω	3.1 μΩ	Guildline 9230/15
	1 Ω	9.3 μΩ	Fluke 742A-1
	1.9 Ω	18 μΩ	Fluke 742A-1.9
	10 Ω	52 μΩ	Guildline 9334-10
	100 Ω	520 μΩ	Guildline 9334-100
	1 kΩ	6.9 mΩ	Fluke 742A-1K
	10 kΩ	4.6 mΩ	Fluke 742A-10K
	19 kΩ	88 mΩ	Fluke 742A-19K
	100 kΩ	460 mΩ	Fluke 742A-100K
	1 MΩ	9.4 Ω	Fluke 742A-1M
	10 MΩ	320 Ω	Guildline 9334-10M
	19 MΩ	260 Ω	Fluke 742A-19M

2012-06-28 through 2013-06-30
Effective dates

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CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

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Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	100 MΩ	3.8 kΩ	Guildline 9334-100M
	1 GΩ	38 kΩ	Guildline 9334-1G
Resistance – Measure	0 Ω to 2 Ω	2.2 μΩ/Ω + 4.6 μΩ	Fluke 8508 transfer accuracy
	2 Ω to 20 Ω	0.77 μΩ/Ω + 15 μΩ	
	20 Ω to 200 Ω	0.13 μΩ/Ω + 70 μΩ	
	200 Ω to 2 kΩ	1.8 μΩ/Ω + 0.99 mΩ	
	2 kΩ to 20 kΩ	0.17 μΩ/Ω + 13 mΩ	
	20 kΩ to 200 kΩ	0.49 Ω	Guildline 6530
	200 kΩ to 2 MΩ	0.29 μΩ/Ω + 3.2 Ω	
	2 MΩ to 20 MΩ	85 Ω	
	20 MΩ to 200 MΩ	0.23 μΩ/Ω + 3.8 kΩ	
	0.2 MΩ to 2 GΩ	25 mΩ/Ω + 110 kΩ	
	2 GΩ to 20 GΩ	0.24 mΩ/Ω + 12 MΩ	
	20 GΩ to 200 GΩ	0.93 mΩ/Ω	
	200 GΩ to 2 TΩ	1.4 mΩ/Ω	
	2 TΩ to 20 TΩ	4.0 mΩ/Ω	
	20 TΩ to 200 TΩ	6.9 mΩ/Ω	
NVLAP Code: 20/E06			
DC VOLTAGE			
DC Voltage – Variable Generate	0 V to 220 mV	2.2 μV/V + 0.56 μV	Fluke 5700A EP
	0.22 V to 2.2 V	2.3 μV/V + 0.67 μV	
	2.2 V to 11 V	1.5 μV/V + 3.3 μV	
	11 V to 22 V	1.6 μV/V + 3.5 μV	
	22 V to 220 V	2.3 μV/V + 40 μV	
	220 V to 1.1 kV	2.7 μV/V + 0.45 mV	
	1.0 kV to 20 kV	960 μV/V + 3.8 V	Hipotronics R50B with Vitrek 4670A
	20 kV to 50 kV	360 μV/V + 20 V	
DC Voltage – Fixed Generate	10 V	3.8 μV	Fluke 732A
DC Voltage – Measure	0 V to 200 mV	0.43 μV/V + 0.22 μV	Fluke 8508A
	200 mV to 2 V	0.63 μV/V + 0.17 μV	Fluke 8508A w/732A,752A

2012-06-28 through 2013-06-30
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	2 V to 20 V	0.60 µV/V + 1.5 µV	
	20 V to 200 V	0.76 µV/V + 16 µV	
	200 V to 1000 V	0.86 µV/V + 250 µV	
	1 kV to 20 kV	960 µV/V + 3.8 V	Vitrek 4670A
	20 kV to 50 kV	360 µV/V + 20 V	
	50 kV to 70 kV	540 µV/V + 12 V	
NVLAP Code: 20/E09			
AC VOLTAGE			
AC Voltage – Generate			
0 V to 2.2 mV	10 Hz to 20 Hz	1.3 mV/V + 3.9 µV	Fluke 5700AEP
	20 Hz to 40 Hz	0.32 mV/V + 4.1 µV	
	40 Hz to 20 kHz	0.17 mV/V + 4.1 µV	
	20 kHz to 50 kHz	0.4 mV/V + 4.2 µV	
	50 kHz to 100 kHz	0.66 mV/V + 5.3 µV	
	100 kHz to 300 kHz	1.2 mV/V + 10 µV	
	300 kHz to 500 kHz	1.5 mV/V + 21 µV	
	500 kHz to 1 MHz	3.3 mV/V + 21 µV	
2.2 mV to 22 mV	10 Hz to 20 Hz	300 µV/V + 4.0 µV	
	20 Hz to 40 Hz	150 µV/V + 4.0 µV	
	40 Hz to 20 kHz	86 µV/V + 4.1 µV	
	20 kHz to 50 kHz	160 µV/V + 4.2 µV	
	50 kHz to 100 kHz	290 µV/V + 5.3 µV	
	100 kHz to 300 kHz	0.64 mV/V + 10 µV	
	300 kHz to 500 kHz	1.0 mV/V + 21 µV	
	500 kHz to 1 MHz	2.7 mV/V + 21 µV	
22 mV to 220 mV	10 Hz to 20 Hz	300 µV/V + 11 µV	
	20 Hz to 40 Hz	100 µV/V + 6.9 µV	
	40 Hz to 20 kHz	63 µV/V + 7.1 µV	
	20 kHz to 50 kHz	95 µV/V + 7.1 µV	
	50 kHz to 100 kHz	210 µV/V + 17 µV	
	100 kHz to 300 kHz	370 µV/V + 20 µV	

2012-06-28 through 2013-06-30
Effective dates

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	300 kHz to 500 kHz	850 µV/V + 26 µV	
	500 kHz to 1 MHz	2.6 mV/V + 45 µV	
220 mV to 2.2 V	10 Hz to 20 Hz	270 µV/V + 36 µV	
	20 Hz to 40 Hz	95 µV/V + 14 µV	
	40 Hz to 20 kHz	40 µV/V + 8.6 µV	
	20 kHz to 50 kHz	70 µV/V + 9.9 µV	
	50 kHz to 100 kHz	100 µV/V + 29 µV	
	100 kHz to 300 kHz	270 µV/V + 77 µV	
	300 kHz to 500 kHz	820 µ/V + 0.20 mV	
	500 kHz to 1 MHz	1.3 mV/V + 0.28 mV	
2.2 V to 22 V	10 Hz to 20 Hz	270 µV/V + 0.36 mV	
	20 Hz to 40 Hz	95 µV/V + 0.14 mV	
	40 Hz to 20 kHz	41 µV/V + 46 µV	
	20 kHz to 50 kHz	71 µV/V + 91 µV	
	50 kHz to 100 kHz	100 µV/V + 0.18 mV	
	100 kHz to 300 kHz	310 µV/V + 0.56 mV	
	300 kHz to 500 kHz	0.86 mV/V + 1.9 mV	
	500 kHz to 1 MHz	1.5 mV/V + 0.3 mV	
22 V to 220 V	10 Hz to 20 Hz	270 µV/V + 3.6 mV	
	20 Hz to 40 Hz	96 µV/V + 1.4 mV	
	40 Hz to 20 kHz	47 µV/V + 0.55 mV	
	20 kHz to 50 kHz	84 µV/V + 0.87 mV	
	50 kHz to 100 kHz	140 µV/V + 2.3 mV	
	100 kHz to 300 kHz	72 µV/V + 18 mV	
	300 kHz to 500 kHz	3.9 mV/V + 40 mV	
	500 kHz to 1 MHz	7.0 mV/V + 80 mV	
220 V to 750 V	15 Hz to 50 Hz	270 µV/V + 16 mV	Fluke 5700A/5725A Booster
	50 Hz to 1 kHz	54 µV/V + 32 mV	
	1 kHz to 20 kHz	110 µV/V + 5.8 mV	
	20 kHz to 30 kHz	340 µV/V + 11 mV	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
	30 kHz to 50 kHz	330 µV/V + 11 mV	
	50 kHz to 100 kHz	1.3 mV/V + 43 mV	
750 V to 1100 V	15 Hz to 50 Hz	270 µV/V + 16 mV	
	50 Hz to 1 kHz	54 µV/V + 32 mV	
	1 kHz to 20 kHz	110 µV/V + 5.8 mV	
	20 kHz to 30 kHz	340 µV/V + 11 mV	
1.1 kV to 5 kV	50 Hz to 60 Hz	2.4 mV/V + 23 V	Quadtech Sentry 20 with Vitrek 4670
AC Voltage – Measure			
0 V to 2.2 mV	10 Hz to 20 Hz	130 µV/V + 0.98 µV	Fluke 5790A/03
	20 Hz to 40 Hz	100 µV/V + 0.98 µV	
	40 Hz to 20 kHz	99 µV/V + 0.98 µV	
	20 kHz to 50 kHz	89 µV/V + 1.5 µV	
	50 kHz to 100 kHz	100 µV/V + 1.9 µV	
	100 kHz to 300 kHz	220 µV/V + 3.1 µV	
	300 kHz to 500 kHz	590 µV/V + 6.2 µV	
	500 kHz to 1 MHz	2.2 mV/V + 6.1 µV	
2.2 mV to 7 mV	10 Hz to 20 Hz	83 µV/V + 1.0 µV	
	20 Hz to 40 Hz	53 µV/V + 1.0 µV	
	40 Hz to 20 kHz	51 µV/V + 1.0 µV	
	20 kHz to 50 kHz	21 µV/V + 1.6 µV	
	50 kHz to 100 kHz	61 µV/V + 1.9 µV	
	100 kHz to 300 kHz	10 µV/V + 3.0 µV	
	300 kHz to 500 kHz	380 µV/V + 6.2 µV	
	500 kHz to 1 MHz	1.6 mV/V + 6.1 µV	
7 mV to 22 mV	10 Hz to 20 Hz	81 µV/V + 0.83 µV	
	20 Hz to 40 Hz	57 µV/V + 0.91 µV	
	40 Hz to 20 kHz	41 µV/V +0.95 µV	
	20 kHz to 50 kHz	50 µV/V + 1.5 µV	
	50 kHz to 100 kHz	76 µV/V + 1.8 µV	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	100 kHz to 300 kHz	180 µV/V + 2.7 µV	
	300 kHz to 500 kHz	360 µV/V + 5.9 µV	
	500 kHz to 1 MHz	1.2 mV/V + 6.1 µV	
22 mV to 70 mV	10 Hz to 20 Hz	110 µV/V + 0.82 µV	
	20 Hz to 40 Hz	68 µV/V + 0.74 µV	
	40 Hz to 20 kHz	38 µV/V + 1.1 µV	
	20 kHz to 50 kHz	73 µV/V + 1.1 µV	
	50 kHz to 100 kHz	140 µV/V + 1.1 µV	
	100 kHz to 300 kHz	280 µV/V + 1.7 µV	
	300 kHz to 500 kHz	400 µV/V + 4.1 µV	
	500 kHz to 1 MHz	850 µV/V + 5.7 µV	
70 mV to 220 mV	10 Hz to 20 Hz	53 µV/V + 1.2 µV	
	20 Hz to 40 Hz	32 µV/V + 1.0 µV	
	40 Hz to 20 kHz	21 µV/V + 2.4 µV	
	20 kHz to 50 kHz	44 µV/V + 0.97 µV	
	50 kHz to 100 kHz	90 µV/V + 0.63 µV	
	100 kHz to 300 kHz	160 µV/V + 2.1 µV	
	300 kHz to 500 kHz	250 µV/V + 5.8 µV	
	500 kHz to 1 MHz	770 µV/V + 6.1 µV	
220 mV to 700 mV	10 Hz to 20 Hz	55 µV/V + 1.1 µV	
	20 Hz to 40 Hz	44 µV/V + 0.69 µV	
	40 Hz to 20 kHz	22 µV/V + 1.1 µV	
	20 kHz to 50 kHz	29 µV/V + 1.2 µV	
	50 kHz to 100 kHz	42 µV/V + 2.0 µV	
	100 kHz to 300 kHz	130 µV/V + 2.8 µV	
	300 kHz to 500 kHz	220 µV/V + 6.0 µV	
	500 kHz to 1 MHz	750 µV/V + 7.8 µV	
700 mV to 2.2 V	10 Hz to 20 Hz	54 µV/V + 1.1 µV	
	20 Hz to 40 Hz	42 µV/V + 0.2 µV	
	40 Hz to 20 kHz	21 µV/V + 0.06 µV	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	20 kHz to 50 kHz	30 µV/V + 0.06 µV	
	50 kHz to 100 kHz	41 µV/V + 0.11 µV	
	100 kHz to 300 kHz	130 µV/V + 0.46 µV	
	300 kHz to 500 kHz	190 µV/V +1.4 µV	
	500 kHz to 1 MHz	700 µV/V + 7.8 µV	
2.2 V to 7 V	10 Hz to 20 Hz	54 µV/V + 1.6 µV	
	20 Hz to 40 Hz	31 µV/V + 2.1 µV	
	40 Hz to 20 kHz	190 µV/V + 0.85 µV	
	20 kHz to 50 kHz	26 µV/V + 0.21 µV	
	50 kHz to 100 kHz	51 µV/V + 0.03 µV	
	100 kHz to 300 kHz	150 µV/V + 3.5 µV	
	300 kHz to 500 kHz	320 µV/V - 15 µV	
	500 kHz to 1 MHz	950 µV/V + 45 µV	
7 V to 22 V	10 Hz to 20 Hz	54 µV/V + 8.3 µV	
	20 Hz to 40 Hz	57 µV/V + 0.55 µV	
	40 Hz to 20 kHz	20 µV/V + 1.7 µV	
	20 kHz to 50 kHz	23 µV/V + 1.2 µV	
	50 kHz to 100 kHz	53 µV/V + 1.6 µV	
	100 kHz to 300 kHz	140 µV/v + 4.3 µV	
	300 kHz to 500 kHz	310 µV/V + 18 µV	
	500 kHz to 1 MHz	960 µV/V + 51 µV	
22 V to 70 V	10 Hz to 20 Hz	55 µV/V + 5.9 µV	
	20 Hz to 40 Hz	33 µV/V + 19 µV	
	40 Hz to 20 kHz	23 µV/V + 5.3 µV	
	20 kHz to 50 kHz	37 µV/V + 45 µV	
	50 kHz to 100 kHz	54 µV/V + 110 µV	
	100 kHz to 300 kHz	136 µV/V + 44 µV	
	300 kHz to 500 kHz	311 µV/V + 20 µV	
	500 kHz to 1 MHz	934 µV/V + 6.5 µV	
70 V to 220 V	10 Hz to 20 Hz	60 µV/V + 23 µV	
	20 Hz to 40 Hz	34 µV/V + 40 µV	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	40 Hz to 20 kHz	24 µV/V + 7.9 µV	
	20 kHz to 50 kHz	31 µV/V + 23 µV	
	50 kHz to 100 kHz	59 µV/V + 55 µV	
	100 kHz to 300 kHz	134 µV/V + 24 µV	
	300 kHz to 500 kHz	389 µV/V + 8.4 µV	
220 V to 700 V	10 Hz to 20 Hz	35 µV/V + 22 mV	
	20 Hz to 40 Hz	16.5 µV/V + 24 mV	
	40 Hz to 20 kHz	26 µV/V + 200 µV	
	20 kHz to 50 kHz	93 µV/V + 410 µV	
	50 kHz to 100 kHz	392 µV/V + 200 µV	
700 V to 1100 V	10 Hz to 20 Hz	54 µV/V + 51 µV	
	20 Hz to 40 Hz	34 µV/V + 80 µV	
	40 Hz to 20 kHz	26 µV/V + 2.2 mV	
	20 kHz to 50 kHz	95 µV/V + 630 µV	
	50 kHz to 100 kHz	392 µV/V + 150 µV	
1.1 kV to 5 kV	50 Hz to 60 Hz	2.4 mV/V + 23 V	Vitrek 4670
5 kV to 20 kV	50 Hz to 60 Hz	2.5 mV/V + 23 V	
20 kV to 35 kV	50 Hz to 60 Hz	4.7 V/kV + 120 V	
AC Voltage – Wideband Generate			
0.3 mV to 1.1 mV	10 Hz to 30 Hz	0.35 %	Fluke 5700A EP
	30 Hz to 120 kHz	0.12 %	
	120 kHz to 2 MHz	0.58 %	
	2 MHz to 10 MHz	0.81 %	
	10 MHz to 20 MHz	1.0 %	
	20 MHz to 30 MHz	3.5 %	
1.1 mV to 3.3 mV	10 Hz to 30 Hz	0.35 %	
	30 Hz to 120 kHz	0.12 %	
	120 kHz to 2 MHz	0.23 %	
	2 MHz to 10 MHz	0.46 %	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	10 MHz to 20 MHz	0.70 %	
	20 MHz to 30 MHz	1.9 %	
3.3 mV to 11 mV	10 Hz to 30 Hz	0.35 %	
	30 Hz to 120 kHz	0.12 %	
	120 kHz to 2 MHz	0.15 %	
	2 MHz to 10 MHz	0.27 %	
	10 MHz to 20 MHz	0.5 %	
	20 MHz to 30 MHz	1.2 %	
11 mV to 33 mV	10 Hz to 30 Hz	0.35 %	
	30 Hz to 120 kHz	0.12 %	
	120 kHz to 2 MHz	0.13 %	
	2 MHz to 10 MHz	0.25 %	
	10 MHz to 20 MHz	0.48 %	
	20 MHz to 30 MHz	1.2 %	
33 mV to 110 mV	10 Hz to 30 Hz	0.35 %	
	30 Hz to 2 MHz	0.12 %	
	2 MHz to 10 MHz	0.24 %	
	10 MHz to 20 MHz	0.47 %	
	20 MHz to 30 MHz	1.2 %	
110 mV to 330 mV	10 Hz to 30 Hz	0.35 %	
	30 Hz to 2 MHz	0.12 %	
	2 MHz to 10 MHz	0.24 %	
	10 MHz to 20 MHz	0.47 %	
	20 MHz to 30 MHz	1.2 %	
0.33 V to 1.1 V	10 Hz to 30 Hz	0.35 %	
	30 Hz to 2 MHz	0.12 %	
	2 MHz to 10 MHz	0.24 %	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	10 MHz to 20 MHz	0.47 %	
	20 MHz to 30 MHz	1.2 %	
1.1 V to 3.5 V	10 Hz to 30 Hz	0.35 %	
	30 Hz to 2 MHz	0.12 %	
	2 MHz to 10 MHz	0.24 %	
	10 MHz to 20 MHz	0.47 %	
	20 MHz to 30 MHz	1.2 %	
AC Voltage – Wideband Measure			Fluke 5790A
0.1 mV to 2.2 mV	10 Hz to 30 Hz	0.12 %	
	30 Hz to 120 kHz	0.059 %	
	120 kHz to 2 MHz	0.2 %	
	2 MHz to 10 MHz	0.33 %	
	10 MHz to 20 MHz	0.49 %	
	20 MHz to 30 MHz	1.1 %	
2.2 mV to 7 mV	10 Hz to 30 Hz	0.12 %	
	30 Hz to 120 kHz	0.059 %	
	120 kHz to 500 kHz	0.12 %	
	500 kHz to 2 MHz	0.13 %	
	2 MHz to 10 MHz	0.18 %	
	10 MHz to 20 MHz	0.28 %	
	20 MHz to 30 MHz	0.51 %	
7 mV to 22 mV	10 Hz to 30 Hz	0.12 %	
	30 Hz to 120 kHz	0.059 %	
	120 kHz to 500 kHz	0.084 %	
	500 kHz to 2 MHz	0.096 %	
	2 MHz to 10 MHz	0.15 %	
	10 MHz to 20 MHz	0.25 %	
	20 MHz to 30 MHz	0.48 %	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
22 mV to 70 mV	10 Hz to 30 Hz	0.12 %	
	30 Hz to 120 kHz	0.059 %	
	120 kHz to 500 kHz	0.061 %	
	500 kHz to 2 MHz	0.077 %	
	2 MHz to 10 MHz	0.15 %	
	10 MHz to 20 MHz	0.24 %	
	20 MHz to 30 MHz	0.46 %	
70 mV to 220 mV	10 Hz to 30 Hz	0.12 %	
	30 Hz to 120 kHz	0.047 %	
	120 kHz to 500 kHz	0.051 %	
	500 kHz to 2 MHz	0.077 %	
	2 MHz to 10 MHz	0.15 %	
	10 MHz to 20 MHz	0.23 %	
	20 MHz to 30 MHz	0.46 %	
220 mV to 700 mV	10 Hz to 30 Hz	0.12 %	
	30 Hz to 120 kHz	0.036 %	
	120 kHz to 500 kHz	0.037 %	
	500 kHz to 1.2 MHz	0.076 %	
	1.2 MHz to 2 MHz	0.077 %	
	2 MHz to 10 MHz	0.15 %	
	10 MHz to 20 MHz	0.23 %	
	20 MHz to 30 MHz	0.46 %	
0.7 V to 2.2 V	10 Hz to 30 Hz	0.12 %	
	30 Hz to 120 kHz	0.036 %	
	120 kHz to 500 kHz	0.041 %	
	500 kHz to 2 MHz	0.076 %	
	2 MHz to 10 MHz	0.15 %	
	10 MHz to 20 MHz	0.23 %	
	20 MHz to 30 MHz	0.45 %	
2.2 V to 7 V	10 Hz to 30 Hz	0.12 %	
	30 Hz to 120 kHz	0.035 %	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	120 kHz to 500 kHz	0.04 %	
	500 kHz to 2 MHz	0.076 %	
	2 MHz to 10 MHz	0.15 %	
	10 MHz to 20 MHz	0.23 %	
	20 MHz to 30 MHz	0.45 %	
NVLAP Code: 20/E10			
CAPACITANCE			
Capacitance – Measure	0.1 nF to 120 nF	0.12 pF/nF + 0.07 pF	ESI 701B
	120 nF to 1.2 µF	0.24 pF/nF	
	1.2 µF to 800 µF	1.3 pF/µF	Hewlett Packard 4284A
	800 µF to 100 mF	1.7 µF/mF + 0.02 nF	
	100 mF to 1000 mF	3.2 µF/mF	
Capacitance – Generate	0.19 nF to 0.39 nF	6 pF/nF + 12 pF	Fluke 5520A
	0.4 nF to 1.1 nF	5.7 pF/nF + 12 pF	
	1.1 nF to 3.3 nF	5.7 pF/nF + 12 pF	
	3.3 nF to 11 nF	2.9 pF/nF + 120 pF	
	11 nF to 33 nF	2.9 pF/nF + 120 pF	
	33 nF to 110 nF	2.9 pF/nF + 120 pF	
	110 nF to 330 nF	2.9 pF/nF + 350 pF	
	0.33 µF to 1.1 µF	2.9 nF/µF + 1.2 nF	
	1.1 µF to 3.3 µF	3 nF/µF + 3.5 nF	
	3.3 µF to 11 µF	3 nF/µF + 11 nF	
	11 µF to 33 µF	4.7 nF/µF + 35 nF	
	33 µF to 110 µF	5.3 nF/µF + 110 nF	
	110 µF to 330 µF	5.2 nF/µF + 350 nF	
	0.33 mF to 1.1 mF	5.3 µF/mF + 1.2 µF	
	1.1 mF to 3.3 mF	5.3 µF/mF + 3.5 µF	
	3.3 mF to 11 mF	5.3 µF/mF + 12 µF	
	11 mF to 33 mF	8.7 µF/mF + 35 µF	
	33 mF to 110 mF	13 µF/mF + 120 µF	
Capacitance – Generate (Fixed Points)	1 pF	3.9 fF	GenRad 1404, 874 connectors
	10 pF	12 fF	
	100 pF	6.1 fF	GenRad 1409

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	1000 pF	24 fF	5-way binding posts
	0.001 µF	0.60 pF	
	0.002 µF	1.2 pF	Hewlett Packard 16380A
	0.005 µF	3 pF	Hewlett Packard 16380C
	0.01 µF	6 pF	
	0.1 µF	60 pF	
	1 µF	600 pF	
NVLAP Code: 20/E11			
INDUCTANCE			
Inductance – Measure			
100 Hz or 1 KHz	0 H to 10 H	1.5 mH/H + 15 nH	HP 4284A
	0.1 mH to 0.5 mH	49 µH/H + 0.49 µH	ESI LCR Bridge System
	0.5 mH to 2 mH	145 µH/H + 0.44 µH	
	2 mH to 10 mH	240 µH/H + 0.24 µH	
	10 mH to 50 mH	0.26 mH/H + 69 nH	
	50 mH to 200 mH	0.26 mH/H + 1.8 nH	
	200 mH to 1 H	0.27 mH/H - 1.2 µH	
	1 H to 5 H	0.38 mH/H - 0.11 mH	
	5 H to 10 H	0.59 mH/H - 0.62 mH	
Inductance – Generate	50 µH	0.17 µH	GenRad 1482 Inductors
	100 µH	0.12 µH	
	200 µH	0.21 µH	
	500 µH	0.43 µH	
	1 mH	0.46 µH	
	2 mH	1.2 µH	
	5 mH	1.9 µH	
	10 mH	1.7 µH	
	20 mH	5.3 µH	
	50 mH	12 µH	
	100 mH	26 µH	
	200 mH	75 µH	
	500 mH	0.21 mH	
	1 H	0.99 mH	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
	2 H 5 H 10 H	2.3 mH 20 mH 19 mH	
NVLAP Code: 20/E12 **LF POWER & ENERGY** DC Power – Generate 0.33 mA to 330 mA	11 µW to 1.1 mW 1.1 mW to 110 mW 0.11W to 110 W 110 W to 330 W	0.024 % 0.027 % 0.024 % 0.018 %	Fluke 5520A
0.33 A to 3 A	11 W to 110 mW 0.11 W to 990 W 1 W to 3 kW	0.044 % 0.053 % 0.0096 %	
3 A to 20.5 A	0.099 W to 0.99 W 0.99 W to 6.8 kW 6.8 W to 20.5 kW	0.088 % 0.07 % 0.04 %	
AC Power – Generate Note 8 (PF = 1, Φ = 0º at 10 Hz - 65 Hz)			
3.3 mA to 9 mA	0.11 mW to 3.0 mW 3.0 mW to 9 W	0.13% 0.077 %	Fluke 5520A
9 mA to 33 mA	0.3 mW to 10 mW 10 mW to 33 W	0.089 % 0.077 %	
33 mA to 90 mA	1 mW to 30 mW 30 mW to 90 W	0.071 % 0.057 %	
90 mA to 330 mA	3.0 mW to 100 mW 100 mW to 300 W	0.089 % 0.078 %	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
DC Power – Generate			
0.33 A to 0.9 A	11 mW to 300 mW	0.071 %	
	300 mW to 900 W	0.081 %	
0.9 A to 2.2 A	30 mW to 720 mW	0.089 %	
	720 mW to 2 kW	0.079 %	
2.2 A to 4.5 A	80 mW to 1.4 W	0.088 %	
	1.4 W to 4.5 kW	0.18 %	
4.5 A to 20.5 A	150 mW to 6.7 W	0.17%	
	6.7 W to 20 kW	0.17%	
NVLAP Code: 20/E15			
PHASE			
Phase – Measure			
At 10 mV to 630 V			
	5 Hz to 2 kHz	0.032º	Clark Hess 6000A
	2 kHz to 5 kHz	0.042º	
	5 kHz to 10 kHz	0.058º	
	10 kHz to 50 kHz	0.068º	
	50 kHz to 1 MHz	0.0012º/kHz + 0.015º	
Phase – Generate	10 Hz to 65 Hz	0.14º	
	65 Hz to 500 Hz	0.30º	
	500 Hz to 1 kHz	0.58º	
	1 kHz to 5 kHz	2.9º	
	5 kHz to 10 kHz	5.8º	
	10 kHz to 30 kHz	12º	
NVLAP Code: 20/E20			
OSCILLOSCOPES			
Leveled Sine Amplitude	50 kHz reference	8.2 mV/V + 120 µV	Fluke 5820A/2.1 GHz
	50 kHz to 100 MHz	40 mV/V + 3.5 µV	
	100 MHz to 300 MHz	47 mV/V + 3.5 µV	
	300 MHz to 500 MHz	64 mV/V + 3.5 µV	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	500 MHz to 600 MHz	70 mV/V + 3.5 µV	
	600 MHz to 1.1 GHz	81 mV/V + 3.5 µV	
	1.1 GHz to 1.6 GHz	81 mV/V + 3.5 µV	
	1.6 GHz to 2.1 GHz	93 mV/V + 3.5 µV	
Leveled Sine Flatness	50 kHz to 70 MHz	0.18 dB	
	70 MHz to 360 MHz	0.22 dB	
	160 MHz to 600 MHz	0.41 dB	
	600 MHz to 1.6 GHz	0.50 dB	
	1.6 GHz to 2.1 GHz	0.56 dB	
Square Wave Amplitude			
1 MΩ @ 1kHz	0 V to 30 V	2.9 mV/V + 0.047 mV	
	30 V to 130 V	0.58 mV/V + 7.1 µV	
50 Ω @ 1 kHz	0 V to 6.6 V	2.9 mV/V + 0.046 mV	
Time Marker, 50 Ω	500 ps to 20 ms	0.5 µs/s	
	50 ms to 5 s	58 µs/s	
NVLAP Code: 20/E21			
CONDUCTANCE			
Conductivity	10 µS/cm	0.65 µS/cm	Conductivity solutions
	100 µS/cm	1.3 µS/cm	
	1000 µS/cm	4.2 µS/cm	
	10 000 µS/cm	36 µS/cm	
	100 000 µS/cm	330 µS/cm	
TIME and FREQUENCY			
NVLAP Code: 20/F01			
FREQUENCY DISSEMINATION			
Frequency – Measure	1µHz to 3 GHz	7.7 pHz/Hz	HP 58503A/53132A
	3 GHz to 26.5 GHz	7.7 pHz/Hz	HP 58503A/53151A
	26.5 GHz to 110 GHz	5.2 pHz/Hz	HP 58503A/EIP 578/EIP 590
Frequency – Generate	1µHz to 20 MHz	5.2 pHz/Hz	HP 3325A

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
NVLAP Code: 20/F03 OSCILLATOR CHARACTERIZATION			
Pulse - Measure Jitter, Delay, Period, Width	> 3.6 ps	7.3 ps	
Harmonics			
0 dBc to 80 dBc	20 Hz to 20 kHz	1.1 dBc	R & S FSQ26
	20 kHz to 100 kHz	2.1 dBc	
	100 kHz to 10 MHz	2.0 dBc	
	3.6 GHz to 8 GHz	2.1 dBc	
	8 GHz to 22 GHz	3.2 dBc	
	22 GHz to 26.5 GHz	3.8 dBc	
Amplitude Modulation – Measure		(where *AM* is measured depth in %)	HP 8902A
150 kHz to 10 MHz			
Rate: 20 Hz to 50 Hz	5 % to 40 %	3.5 %	
	40 % to 99 %	3.6 %	
Rate: 50 Hz to 10 kHz	5 % to 10 %	0.033*AM* + 1 %	
	10 % to 99 %	0.02*AM* + 0.41 %	
10 MHz to 1.3 GHz			
Rate: 20 Hz to 50 Hz	5 % to 10 %	3.5 %	
	40 % to 99 %	3.5 %	
Rate: 50 Hz to 10 kHz	5 % to 10 %	1.2 %	
	10 % to 99 %	1.2 %	
1.3 GHz to 26.5 GHz			
Rate: 20 Hz to 50 Hz	5 % to 10 %	3.8 %	
	40 % to 99 %	3.8 %	
Rate: 50 Hz to 10 kHz	5 % to 10 %	2.0 %	
	10 % to 99 %	2.0 %	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
Frequency Modulation – Measure		(where *FM* is measured peak in Hz)	
250 kHz to 10 MHz			
Rate: 20 Hz to 10 kHz	0 Hz to 4 kHz	0.023*FM* + 2.6 Hz	
	4 kHz to 40 kHz	0.023*FM*	
10 MHz to 1300 MHz			
Rate: 50 Hz to 100 kHz	0 Hz to 4 kHz	0.012*FM* + 2.9 Hz	
	4 kHz to 40 kHz	0.012*FM*	
	40 kHz to 400 kHz	0.012*FM*	
Rate: 20 Hz to 50 Hz or 100 kHz to 200 kHz	0 Hz to 4 kHz	0.058*FM* + 2.9 Hz	
	4 kHz to 40 kHz	0.058*FM*	
	40 kHz to 400 kHz	0.058*FM*	
1.3 GHz to 26.5 GHz			
Rate: 50 Hz to100 kHz	0 Hz to 4 kHz	0.012*FM* + 2.9 Hz	
	4 kHz to 40 kHz	0.012*FM*	
	40 kHz to 400 kHz	0.012*FM*	
Rate: 20 Hz to 50 Hz or 100 kHz to 200 kHz	0 Hz to 4 kHz	0.058*FM* + 2.9 Hz	
	4 kHz to 40 kHz	0.058*FM*	
	40 kHz to 400 kHz	0.058*FM*	
NVLAP Code: 20/F05 STOPWATCHES & TIMERS	15 s to 24 hr	0.059 s/day	Vibrograf 4500 Timometer
MECHANICAL			
NVLAP Code: 20/M05 FLOW RATE			
Gas Flow	0.5 SCCM to 100 SLPM	0.61 %	DHI Molbloc System
NVLAP Code: 20/M06 FORCE			
Crimp Tool – Pull Force	0 lbf to 100 lbf	40 %	Crimp pull tester

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
Durometer – Spring Force	78 gf	3.1 gf	Electronic balance
	113 gf	0.84 gf	
	821 gf	4.8 gf	
	4533 gf	13 gf	
Supermike Gaging Force	2 ozf	0.058 ozf	Gram gage
	4 ozf	0.12 ozf	
	8 ozf	0.14 ozf	
	16 ozf	0.94 ozf	Force gage
	40 ozf	1.5 ozf	
Force Gages	0.03125 ozf to 8 ozf	0.054 % + 0.000066 ozf	Class 6 Weights
	0.5 lbf to 500 lbf	0.055 % + 0.000022 lbf	Class 7 Weights
	3.2 lbf to 300 lbf	0.010 % + 0.0064 lbf	Morehouse M4215A-300LBF
	300 lbf to 1000 lbf	0.012 % + 0.0012 lbf	Morehouse M4215A
	1000 lbf to 10 000 lbf	0.010 % + 0.15 lbf	Morehouse M4215A
NVLAP Code: 20/M08			
MASS			
Mass – Measure	1 mg to 10 g	0.15 mg	Weights, RC210S Balance
	10 g to 30 g	0.18 mg	Weights, RC210S Balance
	30 g to 100 g	0.21 mg	Weights, RC210S Balance
	100 g to 210 g	0.24 mg	Weights, RC210S Balance
	210 g to 300 g	0.34 mg	Weights, 1773MP8 Balance
	300 g to 5000 g	27 mg	Weights, 5000L Balance
	5000 g to 34 000 g	370 mg	Weights, BP34000P Balance
Scales & Balances	1 mg to 500 mg	0.0064 mg	Class 1 Weights
	500 mg to 5 g	0.0095 mg	Class 1 Weights
	5 g to 10 g	0.020 mg	Class 1 Weights
	10 g to 20 g	0.055 mg	Class 1 Weights
	20 g to 50 g	0.13 mg	Class 1 Weights
	50 g to 300 g	0.18 mg	Class 1 Weights
	300 g to 500 g	0.22 mg	Class 1 Weights
	500 g to 1 kg	0.72 mg	Class 1 Weights

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) Note 3,5	Remarks
	1 kg to 2 kg	0.78 mg	Class 1 Weights
	2 kg to 5 kg	3.5 mg	Class 1 Weights
	5 kg to 10 kg	5.4 mg	Class 1 Weights
	10 kg to 30 kg	54 mg	Class 1 Weights
	30 kg to 50 kg	75 mg	Class 1 Weights
	50 kg to 250 kg	3.4 g	Class F Weights
NVLAP Code: 20/M12 VOLUME & DENSITY			
Viscosity	50 cps	0.28 %	Viscosity solutions
	100 cps	0.54 %	
	1000 cps	0.50 %	
	5000 cps	0.45 %	
	12 500 cps	0.50 %	
	100 000 cps	0.74 %	
NVLAP Code: 20/M14 SPEED INDICATORS			
Photo	1 rpm to 99 999 rpm	8.1E-6 rpm/rpm + 0.0058 rpm	Signal generator
Contact	10 rpm to 50 000 rpm	58E-6 rpm/rpm + 0.012 rpm	Ideal Aerosmith
NVLAP Code: 20/M15 TORQUE			
Torque – Generate	0.5 ozf-in to 215 ozf-in	0.25 %	Waters 6500T4 watch calibrator
	1 lbf-in to 1000 lbf-ft	0.25 %	Wheels, arms and weights
ELECTROMAGNETICS – RF/MICROWAVE			
NVLAP Code: 20/R02 COAXIAL/WAVEGUIDE TERMINATIONS			
S_{11}, S_{22} Parameters			
Reflection Coefficient (0 to 1)	At return loss of:		
10 MHz to 8.4 GHz	1 dB	0.067	HP 8757A w/85027B
	2 dB	0.054	
	3 dB	0.045	
	4 dB	0.037	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	5 dB	0.031	
	6 dB	0.027	
	7 dB	0.024	
	8 dB	0.022	
	9 dB	0.02	
	10 dB	0.019	
	11 dB	0.018	
	12 dB	0.018	
	20 dB	0.017	
	30 dB	0.017	
	40 dB	0.017	
8.4 GHz to 12 GHz	1 dB	0.16	
	2 dB	0.14	
	3 dB	0.11	
	4 dB	0.085	
	5 dB	0.069	
	6 dB	0.056	
	7 dB	0.046	
	8 dB	0.039	
	9 dB	0.033	
	10 dB	0.029	
	11 dB	0.027	
	12 dB	0.025	
	20 dB	0.021	
	30 dB	0.021	
	40 dB	0.021	
12 GHz to 20 GHz	1 dB	0.068	
	2 dB	0.056	
	3 dB	0.046	
	4 dB	0.039	
	5 dB	0.034	
	6 dB	0.03	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	7 dB	0.027	
	8 dB	0.025	
	9 dB	0.023	
	10 dB	0.022	
	11 dB	0.022	
	12 dB	0.022	
	20 dB	0.021	
	30 dB	0.021	
	40 dB	0.021	
20 GHz to 26.5 GHz	1 dB	0.26	
	2 dB	0.21	
	3 dB	0.17	
	4 dB	0.14	
	5 dB	0.11	
	6 dB	0.092	
	7 dB	0.078	
	8 dB	0.067	
	9 dB	0.06	
	10 dB	0.054	
	11 dB	0.05	
	12 dB	0.048	
	20 dB	0.043	
	30 dB	0.043	
	40 dB	0.043	
NVLAP Code: 20/R05			
HF CAPACITANCE			
HF Capacitance – Generate			
1 nF	120 Hz to 100 kHz	3.5 pF	HP 16385A
10 nF		35 pF	HP 16386A
100 nF		0.36 nF	HP 16387A
1 µF		3.6 nF	HP 16388A

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
1 pF	1kHz	0.083 fF	HP 16381A
	1 MHz	0.11 fF	
	2 MHz	0.24 fF	
	3 MHz	0.42 fF	
	4 MHz	0.64 fF	
	5 MHz	0.88 fF	
	10 MHz	2.5 fF	
	13 MHz	3.7 fF	
10 pF	1 kHz	0.70 fF	HP 16382A
	1 MHz	0.70 fF	
	2 MHz	0.71 fF	
	3 MHz	0.72 fF	
	4 MHz	0.75 fF	
	5 MHz	0.79 fF	
	10 MHz	1.3 fF	
	13 MHz	1.7 fF	
100 pF	1 kHz	7.1 fF	HP 16383A
	1 MHz	7.1 fF	
	2 MHz	7.6 fF	
	3 MHz	9.0 fF	
	4 MHz	11 fF	
	5 MHz	14 fF	
	10 MHz	35 fF	
	13 MHz	44 fF	
1000 pF	1 kHz	4 nF	HP 16384A
	1 MHz	86 nF	
	2 MHz	0.16 pF	
	3 MHz	0.29 pF	
	4 MHz	0.44 pF	
	5 MHz	0.62 pF	
	10 MHz	1.9 pF	
	13 MHz	2.8 pF	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
NVLAP Code: 20/R13			
RF/MICROWAVE ATTENUATORS			
S12, S21 Parameters			
Attenuation – Generate (50 Ω)			
200 Hz to 80 MHz	0 dB to 38 dB	0.26 dB	HP 3335A (BNC F)
	40 dB to 58 dB	0.32 dB	
	60 dB to 98 dB	0.51 dB	
Attenuation – Generate (75 Ω)			
200 Hz to 25 MHz	0 dB to 18 dB	0.28 dB	
25 MHz to 80 MHz		0.40 dB	
200 Hz to 25 MHz	20 dB to 58 dB	0.39 dB	
25 MHz to 80 MHz		0.52 dB	
200 Hz to 25 MHz	60 dB to 98 dB	0.47 dB	
25 MHz to 80 MHz		0.81 dB	
DC to 18 GHz (Fixed Value)	3 dB	0.46 dB	Weinschel 44 Series
	6 dB	0.46 dB	
	10 dB	0.65 dB	
	20 dB	0.65 dB	
Attenuation – Measure	0 dB to 2 dB	0.081 dB	HP8902 with 11722A
2.5 MHz to 26.5 GHz	2 dB to -12 dB	0.070 dB	or 11792A sensor
	-12 dB to -22 dB	0.081 dB	
	-22 dB to -31 dB	0.081 dB	
	-31 dB to -40 dB	0.093 dB	
	-40 dB to -50 dB	0.10 dB	
	-50 dB to -61 dB	0.11 dB	
	-61 dB to -71 dB	0.12 dB	
	-71 dB to -80 dB	0.15 dB	
	-80 dB to -90 dB	0.16 dB	
	-90 dB to -100 dB	0.16 dB	
	-100 dB to -110 dB	0.20 dB	
	-110 dB to -120 dB	0.22 dB	
	-120 dB to -127 dB	0.34 dB	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
NVLAP Code: 20/R17			
RF POWER			
RF Absolute Power – Measure			
100 kHz to 2.6 GHz	-20 dBm to 30 dBm	0.15 dBm	HP 8902A w/ 11722A
50 MHz to 1.3 GHz	-20 dBm to 30 dBm	0.15 dBm	
1.3 GHz to 18 GHz		0.25 dBm	
18 GHz to 26.5 GHz		0.31 dBm	
30 MHz to 4 GHz	-30 dBm to 20 dBm	0.086 dBm	HP E4419B w/ HP 8482A
4 GHz to 10 GHz		0.12 dBm	
10 GHz to 15 GHz		0.18 dBm	
15 GHz to 18 GHz		0.30 dBm	
50 MHz to 100 MHz	-30 dBm to 20 dBm	0.14 dBm	HP E4419B w/ HP 8487A
100 MHz to 2 GHz		0.12 dBm	
2 GHz to 12.4 GHz		0.14 dBm	
12.4 GHz to 18 GHz		0.15 dBm	
18 GHz to 26.5 GHz		0.18 dBm	
26.5 GHz to 40 GHz		0.22 dBm	
40 GHz to 50 GHz		0.31 dBm	
50 MHz to 100 MHz	-70 dBm to -20 dBm	0.15 dBm	HP E4419B w/ HP 8487D
100 MHz to 2 GHz		0.16 dBm	
2 GHz to 12.4 GHz		0.17 dBm	
12.4 GHz to 18 GHz		0.20 dBm	
18 GHz to 34 GHz		0.23 dBm	
34 GHz to 40 GHz		0.29 dBm	
40 GHz to 50 GHz		0.37 dBm	
30 MHz to 4 GHz	-70 dBm to -20 dBm	0.15 dBm	HP E4419B w/ HP 8481D
4 GHz to 10 GHz		0.16 dBm	
10 GHz to 15 GHz		0.19 dBm	
15 GHz to 18 GHz		0.21 dBm	
18 GHz to 30 GHz		0.22 dBm	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
RF Absolute Power – Measure			
9 kHz to 2 GHz	-60 dBm to 20 dBm	0.15 dBm	HP E4419B w/ HP E9304A
2 GHz to 6 GHz		0.16 dBm	
50 MHz to 100 MHz	-70 dBm to 20 dBm	0.21 dBm	HP E4419B w/ HP E4413A
100 MHz to 8 GHz		0.21 dBm	
8 GHz to 18 GHz		0.22 dBm	
18 GHz to 26.5 GHz		0.23 dBm	
50 MHz	1 mW	0.017 dB	HP 432A w/ 478A-H76
Tuned RF Power – Measure	-10 dBm to -22 dBm	0.14 dBm	Hewlett Packard 8902 with 11722A or 11792A
	-22 dBm to -42 dBm	0.15 dBm	
	-42 dBm to -50 dBm	0.17 dBm	
	-50 dBm to -60 dBm	0.17 dBm	
	-60 dBm to -72 dBm	0.19 dBm	
	-72 dBm to -80 dBm	0.20 dBm	
	-80 dBm to -92 dBm	0.21 dBm	
	-92 dBm to -102 dBm	0.27 dBm	
	-102 dBm to -110 dBm	0.32 dBm	
	-110 dBm to -120 dBm	0.37 dBm	
	-120 dBm to -127 dBm	0.43 dBm	
THERMODYNAMIC			
NVLAP Code: 20/T02 HUMIDITY		(where *RH* is measured value in %)	
Relative Humidity	10 % to 95 % RH	0.002*RH* + 0.58 % RH	Humidity probe/indicator Thunder Scientific
NVLAP Code: 20/T03 LABORATORY THERMOMETERS			
	0.01 °C to 660 °C	4.2E-04 °C /°C + 0.01 °C	Hart 1502A w/Fluke 5628 PRT, Fluke 8508
	-200 °C to 0.01 °C	0.012 °C	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
NVLAP Code: 20/T05 PRESSURE			
Pressure – Generate & Measure	0 Pa to 130 Pa	0.094 % + 0.07 Pa	Dwyer 1430 micro manometer
	130 Pa to 249 Pa	0.19 Pa	Heise HQS-1 0-1 INH2O
	249 Pa to 1245 Pa	0.96 Pa	Heise HQS-1 0-5 INH2O
	1245 Pa to 10 kPa	1.2 Pa	Pressurements T3500/3
Pressure – Generate & Measure	10 kPa to 63 kPa	0.012 %	Pressurements T3500/3
	63 kPa to 689 kPa	0.0094 % + 1.2 Pa	DHI RPM4-A700K
	689 kPa to 6.890 MPa	0.0095 % + 13 Pa	DHI RPM4-A7M
	6.89 MPa to 20 MPa	0.015 %	DHI RPM4-A20M
	20 MPa to 68.9 MPa	0.015 %	DHI RPM4-A70M
	69 MPa to 207 MPa	0.17 MPa	Heise 901A-30000PSI
NVLAP Code: 20/T06 RADIATION THERMOMETRY			
Source	-15 °C to 120 °C	0.0013 °C /°C + 0.54 °C	Hart 9132 infrared source
	50 °C to 500 °C	7.3E-04 °C/°C + 0.57 °C	
NVLAP Code: 20/T08 TEMPERATURE INDICATORS			
Thermocouple Simulation			
Type B	600 °C to 800 °C	0.50 °C	Fluke 5520A
	800 °C to 1000 °C	0.41 °C	
	1000 °C to 1550 °C	0.36 °C	
	1550 °C to 1820 °C	0.40 °C	
Type C	0 °C to 150 °C	0.36 °C	
	150 °C to 650 °C	0.32 °C	
	650 °C to 1000 °C	0.37 °C	
	1000 °C to 1800 °C	0.59 °C	
	1800 °C to 2316 °C	0.98 °C	
Type E	-250 °C to -100 °C	0.59 °C	
	-100 °C to -25 °C	0.22 °C	
	-25 °C to 350 °C	0.20 °C	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	350 °C to 650 °C	0.22 °C	
	650 °C to 1000 °C	0.27 °C	
Type J	-210 °C to -100 °C	0.33 °C	
	-100 °C to -30 °C	0.22 °C	
	-30 °C to 150 °C	0.20 °C	
	150 °C to 760 °C	0.23 °C	
	760 °C to 1200 °C	0.29 °C	
Type K	-210 °C to -100 °C	0.40 °C	
	-100 °C to -25 °C	0.24 °C	
	-25 °C to 120 °C	0.22 °C	
	120 °C to 1000 °C	0.22 °C	
	1000 °C to 1372 °C	0.47 °C	
Type L	-200 °C to -100 °C	0.44 °C	
	-100 °C to 800 °C	0.32 °C	
	800 °C to 900 °C	0.23 °C	
Type N	-200 °C to -100 °C	0.47 °C	
	-100 °C to -25 °C	0.28 °C	
	-25 °C to 120 °C	0.25 °C	
	120 °C to 410 °C	0.24 °C	
	410 °C to 1300 °C	0.33 °C	
Type R	0 °C to 250 °C	0.67 °C	
	250 °C to 400 °C	0.42 °C	
	400 °C to 1000°C	0.40 °C	
	100 °C to 1767 °C	0.47 °C	
Type S	0 °C to 250 °C	0.55 °C	
	250 °C to 1000 °C	0.43 °C	
	1000 °C to 1400 °C	0.44 °C	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	1400 °C to 1767 °C	0.54 °C	
Type T	-250 °C to -150 °C	0.74 °C	
	-150 °C to 0 °C	0.30 °C	
	0 °C to 120 °C	0.22 °C	
	120 °C to 400 °C	0.20 °C	
Type U	-200 °C to 0 °C	0.66 °C	
	0 °C to 600 °C	0.33 °C	
RTD Simulation			
Pt 395, 100 Ω	-200 °C to -80 °C	0.058 °C	
	-80 °C to 0 °C	0.058 °C	
	0 °C to 100 °C	0.081 °C	
	100 °C to 300 °C	0.10 °C	
	300 °C to 400 °C	0.12 °C	
	400 °C to 630 °C	0.14 °C	
	630 °C to 800 °C	0.27 °C	
Pt 2926, 100 Ω	-200 °C to -80 °C	0.058 °C	
	-80 °C to 0 °C	0.058 °C	
	0 °C to 100 °C	0.081 °C	
	100 °C to 300 °C	0.1 °C	
	300 °C to 400 °C	0.12 °C	
	400 °C to 630 °C	0.14 °C	
Pt 3916, 100 Ω	-200 °C to -190 °C	0.29 °C	
	-190 °C to -80 °C	0.046 °C	
	-80 °C to 0 °C	0.058 °C	
	0 °C to 100 °C	0.069 °C	
	100 °C to 260 °C	0.081 °C	
	260 °C to 300 °C	0.092 °C	
	300 °C to 400 °C	0.1 °C	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
	400 °C to 600 °C	0.12 °C	
	600 °C to 630 °C	0.27 °C	
Pt 385, 200 Ω	-200 °C to -80 °C	0.046 °C	
	-80 °C to 0 °C	0.046 °C	
	0 °C to 100 °C	0.046 °C	
	100 °C to 260 °C	0.058 °C	
	260 °C to 300 °C	0.14 °C	
Pt 385, 200 Ω	300 °C to 400 °C	0.15 °C	
	400 °C to 600 °C	0.16 °C	
	600 °C to 630 °C	0.18 °C	
Pt 385, 500 Ω	-200 °C to -80 °C	0.058 °C	
	-80 °C to 0 °C	0.046 °C	
	0 °C to 100 °C	0.058 °C	
	100 °C to 260 °C	0.069 °C	
	260 °C to 300 °C	0.092 °C	
	300 °C to 400 °C	0.092 °C	
	400 °C to 600 °C	0.1 °C	
	600 °C to 630 °C	0.13 °C	
Pt 385, 1000 Ω	-200 °C to -80 °C	0.035 °C	
	-80 °C to 0 °C	0.035 °C	
	0 °C to 100 °C	0.046 °C	
	100 °C to 260 °C	0.058 °C	
	260 °C to 300 °C	0.069 °C	
	300 °C to 400 °C	0.081 °C	
	400 °C to 600 °C	0.081 °C	
	600 °C to 630 °C	0.27 °C	
PtNi, 120 Ω	-80 °C to 0 °C	0.092 °C	
	0 °C to 100 °C	0.092 °C	

2012-06-28 through 2013-06-30
Effective dates

For the National Institute of Standards and Technology

CALIBRATION LABORATORIES

NVLAP LAB CODE 200972-0
Scope Revised 2012-11-13

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) [Notes 1,2]

Measured Parameter or Device Calibrated	Range	Uncertainty (*k*=2) [Note 3,5]	Remarks
Cu 427, 10 Ω	100 °C to 260 °C -100 °C to 260 °C	0.16 °C 0.35 °C	
NVLAP Code: 20/T09 **VACUUM & LOW PRESSURE GAGES**	0.8 Pa to 133 Pa 133 Pa to 1.333 kPa	0.11 Pa + 1.2 % 0.043 Pa + 1.3 %	Hastings VT-5AB Edwards 1575/600AB
END			

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Notes
Note 1: A Calibration and Measurement Capability (CMC) is a description of the best result of a calibration or measurement (result with the smallest uncertainty of measurement) that is available to the laboratory's customers under normal conditions, when performing more or less routine calibrations of nearly ideal measurement standards or instruments. The CMC is described in the laboratory's scope of accreditation by: the measurement parameter/device being calibrated, the measurement range, the uncertainty associated with that range (see note 3), and remarks on additional parameters, if applicable.
Note 2: Calibration and Measurement Capabilities are traceable to the national measurement standards of the U.S. or to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit.
Note 3: The uncertainty associated with a measurement in a CMC is an expanded uncertainty using a coverage factor, $k = 2$, with a level of confidence of approximately 95 %. Units for the measurand and its uncertainty are to match. Exceptions to this occur when marketplace practice employs mixed units, such as when the artifact to be measured is labeled in non-SI units and the uncertainty is given in SI units (Example: 5 lb weight with uncertainty given in mg). **Note 3a:** The uncertainty of a specific calibration by the laboratory may be greater than the uncertainty in the CMC due to the condition and behavior of the customer's device and specific circumstances of the calibration. The uncertainties quoted do not include possible effects on the calibrated device of transportation, long term stability, or intended use. **Note 3b:** As the CMC represents the best measurement results achievable under normal conditions, the accredited calibration laboratory shall not report smaller uncertainty of measurement than that given in a CMC for calibrations or measurements covered by that CMC. **Note 3c:** As described in Note 1, CMCs cover calibrations and measurements that are available to the laboratory's customers under *normal conditions.* However, the laboratory may have the capability to offer special tests, employing special conditions, which yield calibration or measurement results with lower uncertainties. Such special tests are not covered by the CMCs and are outside the laboratory's scope of accreditation. In this case, NVLAP requirements for the labeling, on calibration reports, of results outside the laboratory's scope of accreditation apply. These requirements are set out in Annex A.1.h. of NIST Handbook 150, Procedures and General Requirements.
Note 4: Uncertainties associated with field service calibration may be greater as they incorporate on-site environmental contributions, transportation effects, or other factors that affect the measurements. (This note applies only if marked in the body of the scope.)
Note 5: Values listed with percent (%) are percent of reading or generated value unless otherwise noted.
Note 6: NVLAP accreditation is the formal recognition of specific calibration capabilities. Neither NVLAP nor NIST guarantee the accuracy of individual calibrations made by accredited laboratories.
Note 7: See NIST Handbook 150 for further explanation of these notes.
Note 8: Uncertainties are listed at optimal conditions (PF = 1, Φ = 0º at 10 Hz - 65 Hz). At other frequencies, the uncertainty of the power measurement will vary based on the laboratory's AC voltage and current measurement uncertainties. Also, due to the functional relationship between power factors (PF) and phase, PFs of less than one will increase the uncertainty of the power measurement, an effect that ramps up as PF approaches zero. The laboratory may also report reactive power, apparent power, and power factor under this accreditation. Information regarding uncertainties at frequency and PF pairs not listed can be obtained by contacting the laboratory.

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