CALIBRATION LABORATORIES **NVLAP LAB CODE 200972-0**

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

ESSCO CALIBRATION LABORATORY	Fields of Calibration
27 Industrial Avenue, Unit #9 Chelmsford, MA 01824-3618 Mr. James Murphy Phone: 800-325-2201 Ext:156 Fax 978-256-1331 E-mail: jmurphy@esscolab.com URL: http://www.esscolab.com	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	Expanded Uncertainty (k=2) Note 3	Remarks
DIMENSIONAL			
GAGE BLOCKS (20/D03)			
Gage Block Calibration	0.01 in to 0.049 in 0.05 in to 0.5 in > 0.5 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	2.8 µin 2.4 µin 2.9 µin 4.3 µin 5.1 µin 6.4 µin 8.8 µin 9.5 µin 11 µin 13 µin 15 µin 17 µin 22 µin	Comparison to master blocks
LENGTH & DIAMETER (20/D05)			
Length Standards, Rods	0.1 in to 40 in	1.9 µin/in + 9.6 µin	Comparison to gage blocks
Calipers Note 4	0 in to 120 in	9.6 µin/in + 290 µin	Comparison to gage blocks
Thickness Setting Discs	0.01 in to 0.24 in	21 µin	Comparison to gage blocks

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Note 3]	Remarks
Micrometer [Note 4]	0 in to 40 in	2.1 µin/in + 28 µin	Comparison to gage blocks
Supermicrometer	0 in to 1 in	12 µin	Comparison to gage blocks
Anvil Parallelism [Note 4]	0 µin nominal	13 µin	Optical flat
Anvil Flatness [Note 4]	0 µin nominal	5.4 µin	Optical flat
Optical Flats & Parallels			
Flatness	0 µin nominal	2.3 µin	Comparison to standard flat
Parallelism	0 µin nominal	2.7 µin	Gage block comparator
Bore Micrometers and Gages	0.0625 in to 8 in	7.8 µin/in + 47 µin	Comparison to master rings
Dial/Test Indicator [Note 4]	0 in to 12 in	1.7 µin/in + 6.7 µin	Gage blocks or Micrometer head
Height Gages [Note 4]	0 in to 40 in	1.3 µin/in + 17 µin	Comparison to gage blocks
Depth Gages [Note 4]	0 in to 12 in	1.8 µin/in + 29 µin	Comparison to gage blocks
Durometer (Indentor Length)	0.05 in 0.10 in 0.20 in	0.00019 in 0.00019 in 0.00022 in	Comparison to gage blocks (Note: Spring force component listed in mechanical section)
Electronic Gage Amplifier	0 in to 1 in	8.2 µin	Comparison to gage blocks
Crimp Tools – Crimp Height	0.011 to 1 in	0.00046 in	Indirect comparison to crimp micrometer
MEASURING WIRES (20/D07)			
Thread Wires	4 threads/in to 120 threads/in	9.2 µin	Labmaster, gage blocks
OPTICAL REFERENCE PLANES (20/D08)			
Glass Reticules, Stage Micrometers	0 in to 1 in 1 in to 2 in	0.00021 in 0.00043 in	Microscope w/micrometer head

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) Note 3	Remarks
SPHERICAL DIAMETER, PLAIN PLUG/RINGS (20/D11)			
Pin Gages Note 4	0.004 in to 1 in	60 µin	Supermicrometer
Plain Plugs	0 in to 12 in	2.9 µin/in + 3.1 µin	Labmaster
Plain Ring Gages			
Discrete sizes	0.04 in 0.125 in 0.25 in 1.0 in 4.0 in	6.4 µin 5.7 µin 4.7 µin 5.1 µin 8.8 µin	Comparison to master gages
Variable Range	0.02 in to 0.04 in > 0.04 in to 1.0 in > 1.0 in to 12 in	8.2 µin 15 µin 1.5 µin/in + 15 µin	Comparison to master gages
Crimp Tools – Die Dimension	0.011 in to 0.5 in	0.00062 in	Pin gages
SURVEYING RODS and TAPES (20/D13)			
Rules	0 in to 40 in > 40 in to 80 in > 80 in to 120 in > 120 in to 160 in	4.9 µin/in + 170 µin 4.9 µin/in + 340 µin 4.9 µin/in + 500 µin 4.9 µin/in + 670 µin	P & W LMU1000A with digital microscope
Tape Measures	0 ft to 100 ft	0.0063 in + 0.00025 in/ft	Tape-to-tape method
THREADED PLUG/RINGS (20/D14)			
Thread Plugs – Pitch Diameter			Thread wires/ Supermicrometer
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	
Thread Rings, Straight Thread – Pitch Diameter			
6 TPI to 80 TPI	0.01 in to 5 in	96 µin	Ring is sized to a setting plug with plug's uncert. given
0.25 mm to 10 mm Pitch		2.4 µm	

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

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) [Note 3]	Remarks
ELECTROMAGNETICS – DC/LOW FREQUENCY				
AC RESISTANCE and CURRENT (20/E02)				
Alternating Current–Generate [Note 4]	0 µA to 220 µA	10 Hz to 20 Hz	283 µA/A + 19 nA	Fluke 5730A
		> 20 Hz to 40 Hz	0.16 mA/A + 10 nA	
		> 40 Hz to 1 kHz	0.12 mA/A + 10 nA	
		> 1 kHz to 5 kHz	0.25 mA/A + 12 nA	
		> 5 kHz to 10 kHz	0.83 mA/A + 65 nA	
	>220 µA to 2.2 mA	10 Hz to 20 Hz	0.20 mA/A + 0.14 µA	
		> 20 Hz to 40 Hz	0.16 mA/A + 32 nA	
		> 40 Hz to 1 kHz	0.15 mA/A + 44 nA	
		> 1 kHz to 5 kHz	0.23 mA/A + 130 nA	
		> 5 kHz to 10 kHz	1.2 mA/A + 0.94 µA	
	> 2.2 mA to 22 mA	10 Hz to 20 Hz	0.25 mA/A + 1.2 µA	
		> 20 Hz to 40 Hz	0.11 mA/A + 1.0 µA	
		> 40 Hz to 1 kHz	0.10 mA/A + 0.35 µA	
		> 1 kHz to 5 kHz	0.18 mA/A + 0.55 µA	
		> 5 kHz to 10 kHz	0.80 mA/A + 5.0 µA	
	> 22 mA to 220 mA	10 Hz to 20 Hz	0.24 mA/A + 3.9 µA	
		> 20 Hz to 40 Hz	0.14 mA/A + 3.4 µA	
		> 40 Hz to 1 kHz	0.099 mA/A + 2.5 µA	
		> 1 kHz to 5 kHz	0.17 mA/A + 3.5 µA	
		> 5 kHz to 10 kHz	0.79 mA/A + 12 µA	
	> 220 mA to 2.2 A	40 Hz to 1 kHz	0.24 mA/A + 34 µA	
		> 1 kHz to 5 kHz	0.35 mA/A + 79 µA	
		> 5 kHz to 10 kHz	6.0 mA/A + 160 µA	

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

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) [Note 3]	Remarks
				Fluke 5730A w/5725A
	> 2.2 A to 11 A	40 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz	0.54 mA/A + 0.19 mA 1.1 mA/A + 0.48 mA 4.2 mA/A + 0.89 mA	
	> 11 A to 20.5 A	45 Hz to 100 Hz > 100 Hz to 1 kHz > 1 kHz to 5 kHz	1.4 mA/A + 5.7 mA 1.8 mA/A + 5.7 mA 35 mA/A + 5.8 mA	Fluke 5522A
(no field capability)	20 A to 120 A	10 Hz to 65 Hz > 65 Hz to 300 Hz > 0.3 kHz to 1 kHz > 1 kHz to 3 kHz > 3 kHz to 6 kHz > 6 kHz to 10 kHz	1.3 mA/A 2.0 mA/A 6.3 mA/A 16 mA/A 33 mA/A 76 mA/A	Fluke 52120A/Fluke 5700A
Current Clamp, Non-Toroidal [Note 4]	20 A to 1000 A	45 Hz to 65 Hz > 65 Hz to 440 Hz	7.2 mA/A + 0.27 A 12 mA/A + 0.27 A	Fluke 5500A Coil
Current Clamp, Toroidal [Note 4]	20 A to 1000 A	45 Hz to 65 Hz > 65 Hz to 440 Hz	3.3 mA/A + 27 mA 9.2 mA/A + 29 mA	
Current Clamp	0 A to 300 A 120 A to 1000 A 120 A to 3000 A	1 kHz to 3 kHz 0.3 kHz to 1 kHz 10 Hz to 300 Hz	6.7 mA/A 5.6 mA/A 5.6 mA/A	Fluke 5210A/3 kA Coil
AC Current – Measure [Note 4]	1 nA to 200 µA	1 Hz to 10 Hz > 10 Hz to 10 kHz > 10 kHz to 30 kHz > 30 kHz to 100 kHz	0.37 mA/A + 0.023 µA 0.39 mA/A + 0.023 µA 0.84 mA/A + 0.023 µA 4.6 mA/A + 0.023 µA	Fluke 8508A DMM

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

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) [Note 3]	Remarks
	> 200 µA to 2 mA	1 Hz to 10 Hz	0.36 mA/A + 0.23 µA	
		> 10 Hz to 10 kHz	0.35 mA/A + 0.23 µA	
		> 10 kHz to 30 kHz	0.82 mA/A + 0.23 µA	
		> 30 kHz to 100 kHz	4.6 mA/A + 0.23 µA	
	> 2 mA to 20 mA	1 Hz to 10 Hz	0.37 mA/A + 2.3 µA	
		> 10 Hz to 10 kHz	0.36 mA/A + 2.3 µA	
		> 10 kHz to 30 kHz	0.83 mA/A + 2.3 µA	
		> 30 kHz to 100 kHz	4.6 mA/A + 2.3 µA	
	> 20 mA to 200 mA	1 Hz to 10 Hz	0.37 mA/A + 23 µA	
		> 10 Hz to 10 kHz	0.34 mA/A + 23 µA	
		> 10 k Hz to 30 kHz	0.73 mA/A + 23 µA	
	> 200 mA to 2 A	10 Hz to 2 kHz	0.72 mA/A + 0.23 mA	
		> 2 kHz to 10 kHz	0.85 mA/A + 0.23 mA	
		> 10 kHz to 30 kHz	3.5 mA/A + 0.23 mA	
	> 2 A to 20 A	10 Hz to 2 kHz	0.95 mA/A + 2.8 mA	
		> 2 kHz to 10 kHz	2.9 mA/A + 2.3 mA	
	100 nA to 1 mA	10 Hz to 20 Hz	160 µA/A	Fluke 5790B and A40B Shunts
		> 20 Hz to 40 Hz	66 µA/A	
		> 40 Hz to 20 kHz	53 µA/A	
		> 20 kHz to 50 kHz	61 µA/A	

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

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) [Note 3]	Remarks
		> 50 kHz to 100 kHz	110 µA/A	
	> 1 mA to 10 mA	10 Hz to 20 Hz	160 µA/A	
		> 20 Hz to 40 Hz	57 µA/A	
		> 40 Hz to 20 kHz	27 µA/A	
		> 20 kHz to 50 kHz	41 µA/A	
		> 50 kHz to 100 kHz	61 µA/A	
	> 10 mA to 20 mA	10 Hz to 20 Hz	160 µA/A	
		> 20 Hz to 40 Hz	57 µA/A	
		> 40 Hz to 20 kHz	27 µA/A	
		> 20 kHz to 50 kHz	41 µA/A	
		> 50 kHz to 100 kHz	61 µA/A	
	> 20 mA to 50 mA	10 Hz to 20 Hz	160 µA/A	
		> 20 Hz to 40 Hz	57 µA/A	
		> 40 Hz to 20 kHz	28 µA/A	
		> 20 kHz to 50 kHz	44 µA/A	
		> 50 kHz to 100 kHz	62 µA/A	
	> 50 mA to 100 mA	10 Hz to 20 Hz	160 µA/A	
		> 20 Hz to 40 Hz	57 µA/A	
		> 40 Hz to 20 kHz	27 µA/A	
		> 20 kHz to 50 kHz	42 µA/A	
		> 50 kHz to 100 kHz	59 µA/A	

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

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) [Note 3]	Remarks
	> 100 mA to 200 mA	10 Hz to 20 Hz	160 µA/A	
		> 20 Hz to 40 Hz	57 µA/A	
		> 40 Hz to 20 kHz	28 µA/A	
		> 20 kHz to 50 kHz	42 µA/A	
		> 50 kHz to 100 kHz	59 µA/A	
	> 200 mA to 500 mA	10 Hz to 20 Hz	160 µA/A	
		> 20 Hz to 40 Hz	58 µA/A	
		> 40 Hz to 20 kHz	28 µA/A	
		> 20 kHz to 50 kHz	42 µA/A	
		> 50 kHz to 100 kHz	60 µA/A	
	> 0.5 A to 1 A	10 Hz to 20 Hz	160 µA/A	
		> 20 Hz to 40 Hz	58 µA/A	
		> 40 Hz to 20 kHz	29 µA/A	
		> 20 kHz to 50 kHz	44 µA/A	
		> 50 kHz to 100 kHz	62 µA/A	
	> 1 A to 2 A	10 Hz to 20 Hz	160 µA/A	
		> 20 Hz to 40 Hz	58 µA/A	
		> 40 Hz to 20 kHz	29 µA/A	
		> 20 kHz to 50 kHz	47 µA/A	
		> 50 kHz to 100 kHz	77 µA/A	
	> 2 A to 5 A	10 Hz to 20 Hz	160 µA/A	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) [Note 3]	Remarks
		> 20 Hz to 40 Hz	60 µA/A	
		> 40 Hz to 20 kHz	34 µA/A	
		> 20 kHz to 50 kHz	53 µA/A	
		> 50 kHz to 100 kHz	95 µA/A	
	> 5 A to 10 A	10 Hz to 20 Hz	160 µA/A	
		> 20 Hz to 40 Hz	70 µA/A	
		> 40 Hz to 20 kHz	48 µA/A	
		> 20 kHz to 50 kHz	74 µA/A	
		> 50 kHz to 100 kHz	110 µA/A	
	> 10 A to 20 A	10 Hz to 20 Hz	160 µA/A	
		> 20 Hz to 40 Hz	67 µA/A	
		> 40 Hz to 20 kHz	59 µA/A	
		> 20 kHz to 50 kHz	86 µA/A	
		> 50 kHz to 100 kHz	140 µA/A	
	> 20 A to 50 A	10 Hz to 20 Hz	160 µA/A	
		> 20 Hz to 40 Hz	75 µA/A	
		> 40 Hz to 20 kHz	74 µA/A	
		> 20 kHz to 50 kHz	96 µA/A	
		> 50 kHz to 100 kHz	170 µA/A	
	> 50 A to 100 A	10 Hz to 20 Hz	170 µA/A	
		> 20 Hz to 40 Hz	82 µA/A	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) [Note 3]	Remarks
		> 40 Hz to 20 kHz	93 µA/A	
		> 20 kHz to 50 kHz	110 µA/A	
		> 50 kHz to 100 kHz	200 µA/A	
AC Resistance – Generate	0.1 Ω	> 0.1 Hz to 1 MHz	0.18 %	Agilent 16074A
		> 1 MHz to 13 MHz	0.27 %	
	1 Ω	> 0.1 Hz to 1 MHz	0.12 %	
		> 1 MHz to 13 MHz	0.12 %	
	10 Ω	> 0.1 Hz to 1 MHz	0.036 %	
		> 1 MHz to 13 MHz	0.036 %	
	100 Ω	> 0.1 Hz to 1 MHz	0.035 %	
		> 1 MHz to 13 MHz	0.036 %	
	1 kΩ	> 0.1 Hz to 1 MHz	0.035 %	
		> 1 MHz to 13 MHz	0.035 %	
	10 kΩ	> 0.1 Hz to 1 MHz	0.040 %	
		> 1 MHz to 13 MHz	0.14 %	
	100 kΩ	> 0.1 Hz to 1 MHz	0.099 %	
		> 1 MHz to 13 MHz	0.62 %	
AC Resistance – Measure	0 Ω to 15 Ω	50 Hz to 1 MHz	0.14 %	Agilent 4284A
	15 Ω to 320 kΩ	100 Hz to 100 kHz	0.08 %	
	> 320 kΩ to 10 MΩ	100 Hz to 100 kHz	0.26 %	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
DC RESISTANCE and CURRENT (20/E05)			
Direct Current – Generate [Note 4]	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	0.29 nA/µA + 12 nA	
	2 µA to 220 µA	23 µA/A + 1.6 nA	Fluke 5730A
	> 220 µA to 2.2 mA	23 µA/A + 4.0 nA	
	> 2.2 mA to 22 mA	27 µA/A + 38 nA	
	> 22 mA to 220 mA	33 µA/A + 0.25 µA	
	> 220 mA to 2.2 A	40 µA/A + 7.7 µA	
	> 2.2 A to 11 A	0.11 mA/A + 0.26 mA	Fluke 5730A with 5725A
	> 11 A to 20 A	0.77 mA/A + 0.77 mA	Fluke 5522A
	> 20 A to 100 A	0.43 mA/A	Fluke 52120A
Current Clamp – Non-Toroidal [Note 4]	20 A to 1000 A	5.8 mA/A + 0.58 A	Fluke 5522A w/5500 coil
Current Clamp, Toroidal [Note 4]	20 A to 1000 A	3.0 mA/A + 0.058 A	
Current Clamp	1000 A to 2500 A	4.9 mA/A	Fluke 52120A / 3 kA Coil
Direct Current – Measure [Note 4]	0 pA to 2 pA	16 fA/A + 13 fA	Keithley 617
	> 2 pA to 20 pA	14 fA/A + 110 fA	
	> 20 pA to 200 pA	18 fA/A + 110 fA	
	> 200 pA to 2 nA	2.6 pA/A + 1.3 pA	
	> 2 nA to 20 nA	2.8 pA/A + 5.3 pA	

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	> 20 nA to 100 nA	34 µA/A + 47 pA	HP 3458A/002
	> 100 nA to 1 µA	17 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 to 20 mA	8.8 µA/A + 39 nA	
	> 20 mA to 200 mA	35 µA/A + 0.78 µA	
	> 0.2 A to 2 A	0.17 mA/A + 16 µA	
	> 2 A to 20 A	0.39 mA/A + 0.42 mA	
	> 20 A to 100 A	0.23 mA/A	Guildline 9230/ Fluke 8508A
Resistance – Variable Generate [Note 4]	0 Ω to 11 Ω	47 µΩ/Ω + 1.2 mΩ	Fluke 5522A
	> 11 Ω to 33 Ω	40 µΩ/Ω + 1.7 mΩ	
	> 33 Ω to 110 Ω	34 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	34 µΩ/Ω + 22 mΩ	
	> 3.3 kΩ to 11 kΩ	34 µΩ/Ω + 23 mΩ	
	> 11 kΩ to 33 kΩ	34 µΩ/Ω + 0.22 Ω	
	> 33 kΩ to 110 kΩ	34 µΩ/Ω + 0.24 Ω	
	> 110 kΩ to 330 kΩ	44 µΩ/Ω + 1.6 Ω	
	> 330 kΩ to 1.1 MΩ	40 µΩ/Ω + 3.0 Ω	
	> 1.1 MΩ to 3.3 MΩ	0.12 mΩ/Ω	
	> 3.3 MΩ to 11 MΩ	0.16 mΩ/Ω + 86 Ω	
	> 11 MΩ to 33 MΩ	0.70 mΩ/Ω + 2.5 kΩ	
	> 33 MΩ to 110 MΩ	0.76 mΩ/Ω + 3.5 kΩ	
	> 110 MΩ to 330 MΩ	0.65 mΩ/Ω	
	> 330 MΩ to 1100 MΩ	15 mΩ/Ω + 730 kΩ	
Resistance – Fixed Generate Instrument-Based [Note 4]	1 Ω	37 µΩ	Fluke 5730A
	1.9 Ω	54 µΩ	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
	10 Ω	0.11 mΩ	
	19 Ω	0.13 mΩ	
	100 Ω	0.55 mΩ	
	190 Ω	0.90 mΩ	
	1 kΩ	5.9 mΩ	
	1.9 kΩ	7.4 mΩ	
	10 kΩ	44 mΩ	
	19 kΩ	0.074 Ω	
	100 kΩ	0.71 Ω	
	190 kΩ	0.75 Ω	
	1 MΩ	10 Ω	
	1.9 MΩ	13 Ω	
	10 MΩ	0.22 kΩ	
	19 MΩ	0.49 kΩ	
	100 MΩ	6.4 kΩ	
	10 GΩ	0.35 GΩ	Keithley 263
	100 GΩ	3.6 GΩ	
Fixed Resistor-Based	0.001 Ω	0.12 μΩ	L & N 4333
	0.01 Ω	0.14 μΩ	Guildline 9230/100
	0.1 Ω	0.78 μΩ	Guildline 9230/15
	1 Ω	2.1 μΩ	Fluke 742A-1
	1.9 Ω	1.8 μΩ	Fluke 742A-1.9
	10 Ω	11 μΩ	Guildline 9334-10
	100 Ω	0.18 mΩ	Guildline 9334-100
	1 kΩ	3.5 mΩ	Fluke 742A-1K
	10 kΩ	25 mΩ	Fluke 742A-10K
	19 kΩ	49 mΩ	Fluke 742A-19K
	100 kΩ	0.28 Ω	Fluke 742A-100K
	1 MΩ	2.3 Ω	Fluke 742A-1M
	10 MΩ	110 Ω	Guildline 9334-10M
	19 MΩ	0.38 kΩ	Fluke 742A-19M
	100 MΩ	8.4 kΩ	Guildline 9334-100M
	1 GΩ	38 kΩ	Guildline 9334-1G
	10 GΩ	21 MΩ	IET VRS-100-10-1K-BP

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
	100 GΩ	99 MΩ	
	1 TΩ	5.0 GΩ	
Resistance – Measure [Note 4]	0 Ω to 2 Ω	3.5 μΩ/Ω + 1.1 μΩ	Fluke 8508 transfer accuracy
	> 2 Ω to 20 Ω	2.2 μΩ/Ω + 11 μΩ	
	> 20 Ω to 200 Ω	1.6 μΩ/Ω + 14 μΩ	
	> 200 Ω to 2 kΩ	3.6 μΩ/Ω + 69 μΩ	
	> 2 kΩ to 20 kΩ	2.0 μΩ/Ω +1.1 mΩ	
	> 20 kΩ to 200 kΩ	2.3 μΩ/Ω + 10 mΩ	
	> 200 kΩ to 2 MΩ	2.6 μΩ/Ω + 0.67 Ω	
	> 2 MΩ to 20 MΩ	20 μΩ/Ω + 70 Ω	
	> 20 MΩ to 200 MΩ	41 μΩ/Ω + 14 kΩ	
	> 0.2 MΩ to 2 GΩ	0.11 mΩ/Ω + 97 kΩ	
	> 2 GΩ to 20 GΩ	0.69 mΩ/Ω + 9.5 MΩ	
(No field capability above 20 GΩ)	> 20 GΩ to 200 GΩ	0.93 mΩ/Ω	Guildline 6530B
	> 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	
DC VOLTAGE (20/E06)			
DC Voltage – Variable Generate [Note 4]	0 V to 220 mV	2.2 μV/V + 0.39 μV	Fluke 5730A
	> 0.22 V to 2.2 V	2.0 μV/V + 0.62 μV	
	> 2.2 V to 11 V	1.2 μV/V + 2.3 μV	
	> 11 V to 22 V	1.3 μV/V + 3.2 μV	
	> 22 V to 220 V	2.0 μV/V + 38 μV	
	> 220 V to 1.1 kV	2.4 μV/V + 0.31 mV	
	1.0 kV to 50 kV	0.49 mV/V + 0.21 V	Hipotronics Source and Vitrek 4700 w/HLV70
DC Voltage – Fixed Generate	10 V	3.8 μV	Fluke 732A

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
DC Voltage – Measure Note 4	0 V to 200 mV	1.3 µV/V + 23 nV	Fluke 8508A w/732A,752A
	> 200 mV to 2 V	0.56 µV/V + 0.15 µV	
	> 2 V to 20 V	0.80 µV/V + 1.3 µV	
	> 20 V to 200 V	0.49 µV/V + 1.9 µV	
	> 200 V to 1000 V	0.71 µV/V + 13 µV	
	1 kV to 50 kV	0.49 mV/V + 0.21 V	Vitrek 4700 w/HLV70
	> 50 kV to 70 kV	0.47 mV/V + 1.4 V	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
AC VOLTAGE (20/E09)				
AC Voltage – Generate Note 4	0 V to 2.2 mV	10 Hz to 20 Hz	0.24 mV/V + 4.3 µV	Fluke 5730A
		> 20 Hz to 40 Hz	0.11 mV/V + 4.3 µV	
		> 40 Hz to 20 kHz	0.051 mV/V + 4.3 µV	
		> 20 kHz to 50 kHz	0.068 mV/V + 4.7 µV	
		> 50 kHz to 100 kHz	0.16 mV/V + 5.9 µV	
		> 100 kHz to 300 kHz	0.29 mV/V + 11 µV	
		> 300 kHz to 500 kHz	0.71 mV/V + 23 µV	
		> 500 kHz to 1 MHz	2.0 mV/V + 25 µV	
	> 2.2 mV to 22 mV	10 Hz to 20 Hz	0.20 mV/V + 4.8 µV	
		20 Hz to 40 Hz	0.077 mV/V + 4.7 µV	
		40 Hz to 20 kHz	51 µV/V + 4.4 µV	
		20 kHz to 50 kHz	0.065 mV/V + 5.3 µV	
		50 kHz to 100 kHz	0.15 mV/V + 6.7 µV	
		100 kHz to 300 kHz	0.29 mV/V + 12 µV	

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

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
		> 300 kHz to 500 kHz	0.68 mV/V + 27 µV	
		> 500 kHz to 1 MHz	1.8 mV/V + 46 µV	
	> 22 mV to 220 mV	10 Hz to 20 Hz	0.21 mV/V + 15 µV	
		> 20 Hz to 40 Hz	0.076 mV/V + 10 µV	
		> 40 Hz to 20 kHz	48 µV/V + 11 µV	
		> 20 kHz to 50 kHz	89 µV/V + 7.5 µV	
		> 50 kHz to 100 kHz	0.20 mV/V + 17 µV	
		> 100 kHz to 300 kHz	0.36 mV/V + 20 µV	
		> 300 kHz to 500 kHz	0.89 mV/V + 27 µV	
		> 500 kHz to 1 MHz	2.6 mV/V + 51 µV	
	> 220 mV to 2.2 V	10 Hz to 20 Hz	0.22 mV/V + 40 µV	
		> 20 Hz to 40 Hz	85 µV/V + 15 µV	
		> 40 Hz to 20 kHz	41 µV/V + 9.6 µV	
		> 20 kHz to 50 kHz	65 µV/V + 12 µV	
		> 50 kHz to 100 kHz	0.098 mV/V + 32 µV	
		> 100 kHz to 300 kHz	0.28 mV/V + 79 µV	
		> 300 kHz to 500 kHz	0.83 mV/V + 0.20 mV	
		> 500 kHz to 1 MHz	1.4 mV/V + 0.27 mV	
	> 2.2 V to 22 V	10 Hz to 20 Hz	0.22 mV/V + 0.40 mV	
		> 20 Hz to 40 Hz	83 µV/V + 0.15 mV	
		> 40 Hz to 20 kHz	40 µV/V + 46 µV	

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

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
		> 20 kHz to 50 kHz	67 µV/V + 93 µV	
		> 50 kHz to 100 kHz	0.11 mV/V + 0.16 mV	
		> 100 kHz to 300 kHz	0.32 mV/V + 0.53 mV	
		> 300 kHz to 500 kHz	0.90 mV/V + 1.8 mV	
		> 500 kHz to 1 MHz	1.7 mV/V + 0.29 mV	
	> 22 V to 220 V	10 Hz to 20 Hz	0.22 mV/V + 4 mV	
		> 20 Hz to 40 Hz	87 µV/V + 1.4 mV	
		> 40 Hz to 20 kHz	51 µV/V + 0.52 mV	
		> 20 kHz to 50 kHz	77 µV/V + 0.94 mV	
		> 50 kHz to 100 kHz	0.15 mV/V + 2.3 mV	
		> 100 kHz to 300 kHz	0.63 mV/V + 16 mV	limits on voltage
		> 300 kHz to 500 kHz	3.8 mV/V + 38 mV	versus frequency
		> 500 kHz to 1 MHz	7.1 mV/V + 79 mV	
	> 220 V to 750 V	15 Hz to 50 Hz	0.26 mV/V + 16 mV	
		> 50 Hz to 1 kHz	58 µV/V + 3.0 mV	
		> 30 kHz to 50 kHz	0.34 mV/V + 11 mV	Fluke 5730A w/5725A
		> 50 kHz to 100 kHz	1.3 mV/V + 43 mV	
	220 V to 1100 V	40 Hz to 1 kHz	0.070 mV/V + 4.3 mV	
		> 1 kHz to 20 kHz	0.11 mV/V + 5.8 mV	
		> 20 kHz to 30 kHz	0.34 mV/V + 11 mV	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
	1.1 kV to 5 kV > 5 kV to 44 kV	50 Hz to 60 Hz 50 Hz to 60 Hz	2.5 mV/V + 1.5 V 1.4 mV/V + 27 V	Quadtech Sentry 20 w/Vitrek 4700 & HLV70

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

LF AC VOLTAGE 20 (/E09)

792A Source & Measure AC Voltage	Expanded uncertainties are in µV/V for the level shown at left at indicated frequencies below											
	10 Hz	20 Hz	40 Hz	100 Hz	1k Hz	10 kHz	20 kHz	50 kHz	100 kHz	300 kHz	500 kHz	1 MHz
2 mV	630	580	570	570	570	570	570	880	1100	1800	2900	4100
6 mV	270	220	220	220	220	220	220	320	400	650	1100	2000
20 mV	130	92	88	88	84	82	82	120	160	270	520	990
60 mV	72	49	48	48	40	35	35	43	83	140	210	310
200 mV	39	30	28	32	21	22	23	32	49	78	110	190
600 mV	32	20	14	15	16	16	15	16	18	25	28	60
0.6 V	29	20	14	14	14	14	14	15	17	25	29	42
1 V	29	20	15	14	14	14	14	15	17	24	28	42
2 V	30	22	18	17	16	16	16	17	18	25	30	44
6 V	29	21	16	16	15	15	15	16	16	25	29	43
20 V	32	22	15	15	15	15	15	16	17	25	30	54
60 V	30	22	16	16	17	16	17	17	18	29		
200 V	43	21	17	17	16	16	16	18	21			
600 V			26	26	26	26	26	28	48			
1000 V			16	17	16	16	17					

Additional point: 1000 V at 30 kHz, expanded uncertainty = 16 µV/V

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
AC Voltage – Measure Note 4	0 V to 2.2 mV	10 Hz to 20 Hz > 20 Hz to 40 Hz > 40 Hz to 20 kHz	0.13 mV/V + 0.98 µV 0.10 mV/V + 0.98 µV 99 µV/V + 0.98 µV	Fluke 5790B/05

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
		> 20 kHz to 50 kHz	89 µV/V + 1.5 µV	
		> 50 kHz to 100 kHz	0.10 mV/V + 1.9 µV	
		> 100 kHz to 300 kHz	0.21 mV/V + 3.1 µV	
		> 300 kHz to 500 kHz	0.60 mV/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	84 µV/V + 0.99 µV	
		> 20 Hz to 40 Hz	53 µV/V + 0.98 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	60 µV/V + 1.9 µV	
		> 100 kHz to 300 kHz	0.15 mV/V + 3.0 µV	
		> 300 kHz to 500 kHz	0.38 mV/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 + 0.82 µV	
		> 20 Hz to 40 Hz	49 µV/V + 0.93 µV	
		> 40 Hz to 20 kHz	41 µV/V +0.95 µV	
		> 20 kHz to 50 kHz	49 µV/V + 1.5 µV	
		> 50 kHz to 100 kHz	76 µV/V + 1.8 µV	
		> 100 kHz to 300 kHz	0.18 mV/V + 2.7 µV	
		> 300 kHz to 500 kHz	0.37 mV/V + 5.9 µV	

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

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
		> 500 kHz to 1 MHz	0.80 mV/V + 6.1 µV	
	> 22 mV to 70 mV	10 Hz to 20 Hz	63 µV/V + 1.1 µV	
		> 20 Hz to 40 Hz	40 µV/V + 0.97 µV	
		> 40 Hz to 20 kHz	32 µV/V + 1.2 µV	
		> 20 kHz to 50 kHz	48 µV/V + 1.3 µV	
		> 50 kHz to 100 kHz	90 µV/V + 1.4 µV	
		> 100 kHz to 300 kHz	0.19 mV/V + 2.2 µV	
		> 300 kHz to 500 kHz	0.33 mV/V + 5.3 µV	
		> 500 kHz to 1 MHz	0.81 mV/V + 5.9 µV	
	> 70 mV to 220 mV	10 Hz to 20 Hz	12 µV/V + 38 µV	
		> 20 Hz to 40 Hz	24 µV/V + 1.9 µV	
		> 40 Hz to 20 kHz	2.8 µV/V + 36 µV	
		> 20 kHz to 50 kHz	30 µV/V + 1.3 µV	
		> 50 kHz to 100 kHz	62 µV/V + 0.85 µV	
		> 100 kHz to 300 kHz	125 µV/V + 2.6 µV	
		> 300 kHz to 500 kHz	259 µV/V + 5.7 µV	
		> 500 kHz to 1 MHz	772 µV/V + 6.1 µV	
	> 220 mV to 700 mV	10 Hz to 20 Hz	54 µV/V + 1.2 µV	
		> 20 Hz to 40 Hz	24 µV/V + 1.2 µV	
		> 40 Hz to 20 kHz	22 µV/V + 1.0 µV	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
		> 20 kHz to 50 kHz	21 µV/V + 1.5 µV	
		> 50 kHz to 100 kHz	47 µV/V + 1.8 µV	
		> 100 kHz to 300 kHz	105 µV/V + 3.4 µV	
		> 300 kHz to 500 kHz	214 µV/V + 6.2 µV	
		> 500 kHz to 1 MHz	749 µV/V + 7.9 µV	
	> 700 mV to 2.2 V	10 Hz to 20 Hz	50 µV/V + 1.1 µV	
		> 20 Hz to 40 Hz	23 µV/V + 0.36 µV	
		> 40 Hz to 20 kHz	18 µV/V + 0.06 µV	
		> 20 kHz to 50 kHz	19 µV/V + 0.08 µV	
		> 50 kHz to 100 kHz	42 µV/V + 0.10 µV	
		> 100 kHz to 300 kHz	90 µV/V + 0.66 µV	
		> 300 kHz to 500 kHz	183 µV/V + 1.5 µV	
		> 500 kHz to 1 MHz	729 µV/V + 7.5 µV	
	> 2.2 V to 7 V	10 Hz to 20 Hz	50 µV/V + 1.8 µV	
		> 20 Hz to 40 Hz	23 µV/V + 2.8 µV	
		> 40 Hz to 20 kHz	18 mV/V + 0.87 µV	
		> 20 kHz to 50 kHz	21 µV/V + 0.25 µV	
		> 50 kHz to 100 kHz	50 µV/V + 28 nV	
		> 100 kHz to 300 kHz	119 µV/V + 4.3 µV	
		> 300 kHz to 500 kHz	304 µV/V - 15 µV	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
		> 500 kHz to 1 MHz	958 µV/V + 44 µV	
	> 7 V to 22 V	10 Hz to 20 Hz	50 µV/V + 8.7 µV	
		> 20 Hz to 40 Hz	53 µV/V + 0.58 µV	
		> 40 Hz to 20 kHz	19 µV/V + 1.8 µV	
		> 20 kHz to 50 kHz	22 µV/V + 1.3 µV	
		> 50 kHz to 100 kHz	51 µV/V + 1.6 µV	
		> 100 kHz to 300 kHz	119 µV/v + 5.2 µV	
		> 300 kHz to 500 kHz	296 µV/V + 18 µV	
		> 500 kHz to 1 MHz	960 µV/V + 51 µV	
	> 22 V to 70 V	10 Hz to 20 Hz	51 µV/V + 6.3 µV	
		> 20 Hz to 40 Hz	25 µV/V + 24 µV	
		> 40 Hz to 20 kHz	21 µV/V + 5.8 µV	
		> 20 kHz to 50 kHz	22 µV/V + 71 µV	
		> 50 kHz to 100 kHz	53 µV/V + 110 µV	
		> 100 kHz to 300 kHz	120 µV/V + 50 µV	
		> 300 kHz to 500 kHz	304 µV/V + 20 µV	
		> 500 kHz to 1 MHz	962 µV/V + 6.3 µV	
	> 70 V to 220 V	10 Hz to 20 Hz	51 µV/V + 27 µV	
		> 20 Hz to 40 Hz	27 µV/V + 51 µV	
		> 40 Hz to 20 kHz	22 µV/V + 8.8 µV	
		> 20 kHz to 50 kHz	29 µV/V + 24 µV	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
		> 50 kHz to 100 kHz	57 µV/V + 57 µV	
		> 100 kHz to 300 kHz	136 µV/V + 24 µV	
		> 300 kHz to 500 kHz	390 µV/V + 8.4 µV	
	> 220 V to 700 V	10 Hz to 20 Hz	38 µV/V + 21 mV	
		> 20 Hz to 40 Hz	13 µV/V + 25 mV	
		> 40 Hz to 20 kHz	25 µV/V + 0.20 mV	
		> 20 kHz to 50 kHz	88 µV/V + 0.43 mV	
		> 50 kHz to 100 kHz	391 µV/V + 0.20 mV	
	> 700 V to 1100 V	10 Hz to 20 Hz	57 µV/V + 47 µV	
		> 20 Hz to 40 Hz	29 µV/V + 93 µV	
		> 40 Hz to 20 kHz	24 µV/V + 2.3 mV	
		> 20 kHz to 50 kHz	87 µV/V + 0.69 mV	
		> 50 kHz to 100 kHz	390 µV/V + 0.16 mV	
	1 mV to 10 mV	1 MHz to 4 MHz	54 mV/V + 11 µV	HP 3458A
		> 4 MHz to 8 MHz	155 mV/V + 8.2 µV	
	> 10 mV to 100 mV	1 MHz to 2 MHz	11.5 mV/V + 19 µV	
		> 2 MHz to 4 MHz	30.4 mV/V + 130 µV	
		> 4 MHz to 8 MHz	30 mV/V + 220 µV	
		> 8 MHz to 10 MHz	116 mV/V + 160 µV	
	> 0.1 V to 1 V	1 MHz to 2 MHz	11.6 mV/V + 110 µV	
		> 2 MHz to 4 MHz	30.4 mV/V + 1.3 mV	
		> 4 MHz to 8 MHz	30 mV/V + 2.2 mV	
		> 8 MHz to 10 MHz	116 mV/V + 1.6 mV	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
AC Voltage – Wideband Generate Note 4	> 1 V to 10 V	1 MHz to 2 MHz	11.6 mV/V + 1.2 mV	
		> 2 MHz to 4 MHz	31 mV/V + 6.2 mV	
		> 4 MHz to 8 MHz	31 mV/V +7.9 mV	
		> 8 MHz to 10 MHz	116 mV/V + 8.5 mV	
	1.1 kV to 5 kV	50 Hz to 60 Hz	2.5 mV/V + 1.5 V	Vitrek 4700 w/HLV70
	> 5 kV to 50 kV	50 Hz to 60 Hz	1.4 mV/V + 27 V	
	0.3 mV to 1.1 mV	10 Hz to 30 Hz	0.24 %	Fluke 5730A / 05
		> 30 Hz to 120 kHz	0.085 %	
		> 120 kHz to 2 MHz	0.39 %	
		> 2 MHz to 10 MHz	0.55 %	
		> 10 MHz to 20 MHz	0.71 %	
		> 20 MHz to 30 MHz	2.3 %	
		> 30 MHz to 50 MHz	3.6 %	
	> 1.1 mV to 3.3 mV	10 Hz to 30 Hz	0.24 %	
		> 30 Hz to 120 kHz	0.08 %	
		> 120 kHz to 2 MHz	0.16 %	
		> 2 MHz to 10 MHz	0.31 %	
		> 10 MHz to 20 MHz	0.47 %	
		> 20 MHz to 30 MHz	1.3 %	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
		> 30 MHz to 50 MHz	2.5 %	
	> 3.3 mV to 11 mV	10 Hz to 30 Hz	0.23 %	
		> 30 Hz to 120 kHz	0.079 %	
		> 120 kHz to 2 MHz	0.10 %	
		> 2 MHz to 10 MHz	0.18 %	
		> 10 MHz to 20 MHz	0.35 %	
		> 20 MHz to 30 MHz	0.82 %	
		> 30 MHz to 50 MHz	1.7 %	
	11 mV to 33 mV	10 Hz to 30 Hz	0.30 %	
		> 30 Hz to 120 kHz	0.079 %	
		> 120 kHz to 2 MHz	0.089 %	
		> 2 MHz to 10 MHz	0.17 %	
		> 10 MHz to 20 MHz	0.33 %	
		> 20 MHz to 30 MHz	0.80 %	
		> 30 MHz to 50 MHz	1.7 %	
	> 33 mV to 110 mV	10 Hz to 30 Hz	0.23 %	
		> 30 Hz to 2 MHz	0.083 %	
		> 2 MHz to 10 MHz	0.16 %	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
		> 10 MHz to 20 MHz	0.33 %	
		> 20 MHz to 30 MHz	0.80 %	
		> 30 MHz to 50 MHz	1.7 %	
	> 110 mV to 330 mV	10 Hz to 30 Hz	0.23 %	
		> 30 Hz to 2 MHz	0.082 %	
		> 2 MHz to 10 MHz	0.16 %	
		> 10 MHz to 20 MHz	0.32 %	
		> 20 MHz to 30 MHz	0.79 %	
		> 30 MHz to 50 MHz	1.7 %	
	> 0.33 V to 1.1 V	10 Hz to 30 Hz	0.23 %	
		> 30 Hz to 2 MHz	0.081 %	
		> 2 MHz to 10 MHz	0.16 %	
		> 10 MHz to 20 MHz	0.32 %	
		> 20 MHz to 30 MHz	0.79 %	
		> 30 MHz to 50 MHz	1.7 %	
	> 1.1 V to 3.5 V	10 Hz to 30 Hz	0.23 %	
		> 30 Hz to 2 MHz	0.081 %	
		> 2 MHz to 10 MHz	0.16 %	
		> 10 MHz to 20 MHz	0.32 %	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
		> 20 MHz to 30 MHz	0.79 %	
		> 30 MHz to 50 MHz	1.7 %	
AC Voltage – Wideband Measure	0.1 mV to 2.2 mV	10 Hz to 30 Hz	0.088 %	Fluke 5790B/05
		> 30 Hz to 120 kHz	0.050 %	
		> 120 kHz to 2 MHz	0.13 %	
		> 2 MHz to 10 MHz	0.21 %	
		> 10 MHz to 20 MHz	0.32 %	
		> 20 MHz to 30 MHz	0.71 %	
		> 30 MHz to 50 MHz	0.88 %	
	> 2.2 mV to 7 mV	10 Hz to 30 Hz	0.082 %	
		> 30 Hz to 120 kHz	0.051 %	
		> 120 kHz to 500 kHz	0.079 %	
		> 500 kHz to 2 MHz	0.080 %	
		> 2 MHz to 10 MHz	0.11 %	
		> 10 MHz to 20 MHz	0.17 %	
		> 20 MHz to 30 MHz	0.42 %	
		> 30 MHz to 50 MHz	0.46 %	
	> 7 mV to 22 mV	10 Hz to 30 Hz	0.081 %	
		> 30 Hz to 120 kHz	0.040 %	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
		> 120 kHz to 500 kHz	0.055 %	
		> 500 kHz to 2 MHz	0.056 %	
		> 2 MHz to 10 MHz	0.084 %	
		> 10 MHz to 20 MHz	0.15 %	
		> 20 MHz to 30 MHz	0.32 %	
		> 30 MHz to 50 MHz	0.52 %	
	> 22 mV to 70 mV	10 Hz to 30 Hz	0.10 %	
		> 30 Hz to 120 kHz	0.040 %	
		> 120 kHz to 500 kHz	0.040 %	
		> 500 kHz to 2 MHz	0.042 %	
		> 2 MHz to 10 MHz	0.084 %	
		> 10 MHz to 20 MHz	0.12 %	
		> 20 MHz to 30 MHz	0.31 %	
		> 30 MHz to 50 MHz	0.51 %	
	> 70 mV to 220 mV	10 Hz to 30 Hz	0.080 %	
		> 30 Hz to 120 kHz	0.032 %	
		> 120 kHz to 500 kHz	0.032 %	
		> 500 kHz to 2 MHz	0.041 %	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
		> 2 MHz to 10 MHz	0.083 %	
		> 10 MHz to 20 MHz	0.13 %	
		> 20 MHz to 30 MHz	0.28 %	
		> 30 MHz to 50 MHz	0.51 %	
	> 220 mV to 700 mV	10 Hz to 30 Hz	0.079 %	
		> 30 Hz to 120 kHz	0.025 %	
		> 120 kHz to 500 kHz	0.025 %	
		> 500 kHz to 1.2 MHz	0.041 %	
		> 1.2 MHz to 2 MHz	0.041 %	
		> 2 MHz to 10 MHz	0.083 %	
		> 10 MHz to 20 MHz	0.13 %	
		> 20 MHz to 30 MHz	0.30 %	
		> 30 MHz to 50 MHz	0.51 %	
	> 0.7 V to 2.2 V	10 Hz to 30 Hz	0.080 %	
		> 30 Hz to 120 kHz	0.025 %	
		> 120 kHz to 500 kHz	0.025 %	
		> 500 kHz to 2 MHz	0.041 %	
		> 2 MHz to 10 MHz	0.10 %	
		> 10 MHz to 20 MHz	0.13 %	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
		> 20 MHz to 30 MHz	0.30 %	
		> 30 MHz to 50 MHz	0.50 %	
	> 2.2 V to 7 V	10 Hz to 30 Hz	0.080 %	
		> 30 Hz to 120 kHz	0.024 %	
		> 120 kHz to 500 kHz	0.024 %	
		> 500 kHz to 2 MHz	0.041 %	
		> 2 MHz to 10 MHz	0.083 %	
		> 10 MHz to 20 MHz	0.13 %	
		> 20 MHz to 30 MHz	0.30 %	
		> 30 MHz to 50 MHz	0.50 %	
CAPACITANCE (20/E10)				
Capacitance – Measure	0.001 nF to 1.2 µF	100 Hz to 10 kHz	8 µF/F	ESI 701B
	1.2 µF to 800 µF		1.3 nF/µF	HP 4284A
	> 800 µF to 100 mF		1.7 µF/mF + 4.3 nF	
	> 100 mF to 1000 mF		3.1 µF/mF + 57 µF	
	0.01 fF to 10 pF	20 Hz to 12.5 kH	3.8 fF/pF + 3.1 aF	HP 4284A
		> 12.5 kHz to 48 kHz	3.0 fF/pf + 3.5 aF	
		> 48 kHz to 96 kH	3.4 fF/pF + 3.3 aF	
		> 96 kHz to 1 MHz	3.1 fF/pF +3.5 aF	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
	> 10 pF to 100 pF	20 Hz to 500 Hz	3.5 fF/pF + 38 fF	
		> 500 Hz to 1 kHz	3.4 fF/pF + 38 fF	
		> 1 kHz to 12.5 kHz	1.7 fF/pF + 19 fF	
		>12.5 kHz to 48 kHz	2.0 fF/pF + 22 fF	
		> 48 kHz to 96 kHz	1.6 fF/pF + 18 fF	
		> 96 kHz to 1 MHz	1.5 fF/pF + 16 fF	
	> 100 pF to 1000 pF	20 Hz to 50 Hz	33 fF/pF + 3.7 pF	
		> 50 Hz to 500 Hz	3.3 fF/pF + 0.37 pF	
		> 500 Hz to 1 kHz	1.5 fF/pF + 0.17 pF	
		> 1 kHz to 12.5 kHz	1.6 fF/pF + 0.18 pF	
		> 12.5 kHz to 48 kHz	1.6 fF/pF + 0.18 pF	
		> 48 kHz to 96 kHz	1.7 fF/pF + 0.19 pF	
		> 96 kHz to 1 MHz	1.9 fF/pF + 0.21 pF	
	1 fF to 110 pF	50 Hz to 0.5 kHz	3.9 aF/pF + 2.0 aF	AH2700A
		> 0.5 kHz to 1.5 kHz	3.7 aF/pF + 1.3 aF	
		> 1.5 kHz to 10 kHz	4.8 aF/pF +7.1 aF	
		> 10 kHz to 20 kHz	14 aF/pF + 0.21 fF	
	> 110 pF to 1 nF	50 Hz to 0.5 kHz	3.9 aF/pF + 4.2 aF	
		> 0.5 kHz to 1.5 kHz	3.9 aF/pF – 4.0 aF	
		> 1.5 kHz to 10 kHz	8.2 aF/pF – 0.33 fF	
		> 10 kHz to 20 kHz	7.8 aF/pF + 0.13 fF	
	> 1 nF to 10 nF	50 Hz to 0.5 kHz	3.7 fF/nF + 1.5 fF	
		> 0.5 kHz to 1.5 kHz	4.8 fF/nF + 0.16 fF	
		> 1.5 kHz to 10 kHz	5.7 fF/nF – 51 aF	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
		> 10 kHz to 20 kHz	70 fF/nF – 0.71 fF	
	> 10 nF to 100 nF	50 Hz to 0.5 kHz	7.8 fF/nF – 0.64 fF	
		> 0.5 kHz to 1.5 kHz	9.6 fF/nF – 7.4 fF	
		> 1.5 kHz to 10 kHz	9.9 fF/nF – 7.5 fF	
		> 10 kHz to 20 kHz	0.22 pF/nF – 0.32 pF	
	> 100 nF to 1.2 µF	50 Hz to 0.5 kHz	13 fF/nF – 0.56 pF	
		> 0.5 kHz to 1.5 kHz	15 fF/nF – 0.38 pF	
		> 1.5 kHz to 10 kHz	23 fF/nF – 0.79 pF	
		> 10 kHz to 20 kHz	0.74 pF/nF – 34 pF	
Capacitance – Generate, Variable Note 4	0.19 nF to 0.39 nF	10 Hz to 10 kHz	5.8 pF/nF + 12 pF	Fluke 5522A
	0.4 nF to 1.1 nF	10 Hz to 10 kHz	5.8 pF/nF + 12 pF	
	> 1.1 nF to 3.3 nF	10 Hz to 3 kHz	5.8 pF/nF + 12 pF	
	> 3.3 nF to 11 nF	10 Hz to 1 kHz	2.9 pF/nF + 12 pF	
	> 11 nF to 33 nF	10 Hz to 1 kHz	2.9 pF/nF + 120 pF	
	> 33 nF to 110 nF	10 Hz to 1 kHz	2.9 pF/nF + 120 pF	
	> 110 nF to 330 nF	10 Hz to 1 kHz	2.9 pF/nF + 350 pF	
	> 0.33 µF to 1.1 µF	10 Hz to 600 Hz	2.9 nF/µF + 1.2 nF	
	> 1.1 µF to 3.3 µF	10 Hz to 300 Hz	2.9 nF/µF + 3.5 nF	
	> 3.3 µF to 11 µF	10 Hz to 150 Hz	2.9 nF/µF + 11 nF	
	> 11 µF to 33 µF	10 Hz to 120 Hz	4.7 nF/µF + 35 nF	
	> 33 µF to 110 µF	10 Hz to 80 Hz	5.2 nF/µF + 110 nF	
	> 110 µF to 330 µF	DC to 50 Hz	5.2 nF/µF + 350 nF	
	> 0.33 mF to 1.1 mF	DC to 20 Hz	5.2 µF/mF + 1.2 µF	
	> 1.1 mF to 3.3 mF	DC to 6 Hz	5.2 µF/mF + 3.5 µF	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
	> 3.3 mF to 11 mF	DC to 2 Hz	5.2 µF/mF + 12 µF	
	> 11 mF to 33 mF	DC to 0.6 Hz	8.7 µF/mF + 35 µF	
	> 33 mF to 110 mF	DC to 0.2 Hz	13 µF/mF + 120 µF	
Capacitance – Generate, Fixed Note 4	1 pF	1 kHz or 1.6 kHz	2.0 aF	AH1100
	10 pF		16 aF	
	100 pF		0.15 fF	
	1 pF	100 Hz, 120 Hz, or 1 kHz	3.9 fF	GenRad 1404 & 1409
	10 pF		12 fF	
	100 pF		6.1 fF	
	1000 pF		24 fF	
	0.001 µF		0.60 pF	
	0.002 µF		1.2 pF	
	0.005 µF		3.0 pF	
	0.01 µF		6.0 pF	
	0.1 µF		410 pF	
	1 µF		600 pF	
	10 µF	100 Hz, 120 Hz, or 1 kHz	0.034 µF	GenRad 1417
	100 µF		0.34 µF	
	1 mF		3.6 µF	
	10 mF		52 µF	
	100 mF	100 Hz, 120 Hz	0.41 mF	
	1 F		5.8 mF	
	10 nF	120 Hz to 100 kHz	3.5 pF	HP 16385A
	100 nF		35 pF	HP 16386A
	1 µF		0.36 nF	HP 16387A
	1 pF	1 kHz	0.083 fF	HP 16381A

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
		1 MHz	0.11 fF	
		2 MHz	0.24 fF	
		3 MHz	0.42 fF	
		4 MHz	0.63 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	0.70 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	7.0 fF	HP 16383A
		1 MHz	7.1 fF	
		2 MHz	7.6 fF	
		3 MHz	8.9 fF	
		4 MHz	11 fF	
		5 MHz	14 fF	
		10 MHz	34 fF	
		13 MHz	49 fF	
	1000 pF	1 kHz	4.0 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	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Frequency Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
INDUCTANCE (20/E11)				
Inductance – Measure	10 nH to 10 H	12 Hz to 100 kHz	2.2 mH/H + 4.8 nH	GenRad 1693
	10 µH to 10 H	100 Hz or 1 kHz	1.5 mH/H + 0.12 µH	HP 4284A
	0.1 mH to 0.5 mH	100 Hz to 1 kHz	49 µH/H + 0.49 µH	ESI LCR Bridge w/ DT72A Transformer
	> 0.5 mH to 2 mH		0.14 mH/H + 0.44 µH	
	> 2 mH to 10 mH		0.24 mH/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		0.37 mH/H - 0.11 mH	
	5 H to 10 H		0.59 mH/H - 0.62 mH	
Inductance – Generate Note 4	50 µH	100 Hz or 1 kHz	0.17 µH	GenRad 1482 Set
	100 µH		0.12 µH	
	1 mH		0.46 µH	
	10 mH		1.7 µH	
	100 mH		26 µH	
	1 H		0.99 mH	
	10 H		19 mH	

CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
LF POWER & ENERGY (20/E12)			
DC Power – Generate Note 4			
0.33 mA to 330 mA	11 µW to 1.1 mW	0.024 %	Fluke 5522A
	> 1.1 mW to 110 mW	0.027 %	
	> 0.11W to 110 W	0.024 %	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
	> 110 W to 330 W	0.018 %	
> 0.33 A to 3 A	11 W to 110 mW	0.044 %	
	> 0.11 W to 990 W	0.053 %	
	> 0.99 kW to 3 kW	0.0096 %	
> 3 A to 20.5 A	0.099 W to 0.99 W	0.088 %	
	> 0.99 W to 6.8 kW	0.070 %	
	> 6.8 kW to 20.5 kW	0.040 %	
AC Power – Generate [Notes 4,7] (PF = 1, Φ = 0º at 10 Hz to 65 Hz)			
3.3 mA to 9 mA	0.11 mW to 3.0 mW	0.13%	Fluke 5522A
	> 3.0 mW to 9 W	0.077 %	
> 9 mA to 33 mA	0.3 mW to 10 mW	0.089 %	
	> 10 mW to 33 W	0.077 %	
> 33 mA to 90 mA	1 mW to 30 mW	0.071 %	
	> 30 mW to 90 W	0.057 %	
> 90 mA to 330 mA	3.0 mW to 100 mW	0.089 %	
	> 100 mW to 300 W	0.078 %	
> 0.33 A to 0.9 A	11 mW to 300 mW	0.071 %	
	> 300 mW to 900 W	0.058 %	
> 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	0.05 %	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
> 4.5 A to 20.5 A	150 mW to 6.7 W > 6.7 W to 20 kW	0.17 % 0.17 %	
PHASE (20/E15)			
Phase – Measure (10 mV to 630 V)	5 Hz to 2 kHz > 2 kHz to 5 kHz > 5 kHz to 10 kHz > 10 kHz to 50 kHz > 50 kHz to 1 MHz	0.032º 0.042º 0.058º 0.068º 0.0012º/kHz + 0.015º	Clark Hess 6000A
Phase – Generate [Note 4]	10 Hz to 65 Hz > 65 Hz to 500 Hz > 500 Hz to 1 kHz > 1 kHz to 5 kHz > 5 kHz to 10 kHz > 10 kHz to 30 kHz	0.14º 0.30º 0.58º 2.9º 5.8º 12º	Fluke 5522A
OSCILLOSCOPES (20/E20)			
Leveled Sine Amplitude	50 kHz reference 0.1 Hz to 6.4 GHz	17.3 µV/mV + 1.9 nV 17.3 µV/mV + 1.9 nV	Fluke 9500B / 9560
Leveled Sine Flatness [Note 4] 50 kHz – 10 MHz Reference	0.1 Hz to 300 MHz > 300 MHz to 550 MHz > 550 MHz to 3 GHz > 3 GHz to 6 GHz	0.20 dB 0.25 dB 0.30 dB 0.40 dB	Fluke 9500B/9560
Time Marker, 50 Ω [Note 4]	180.19 ps to 9.009 ns 9.0091 ns to 55 s	0.29 as/ns + 1.1 as 0.29 ns/ms – 1.7 as	Fluke 9500B /9560
CONDUCTANCE (20/E21)			
Conductivity [Note 4]	10 µS/cm 100 µS/cm 1000 µS/cm	0.65 µS/cm 1.3 µS/cm 4.2 µS/cm	Conductivity solutions

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
	10 000 µS/cm 100 000 µS/cm	36 µS/cm 0.33 mS/cm	
TIME and FREQUENCY			
FREQUENCY DISSEMINATION (20/F01)			
Frequency – Measure [Note 4]	100 µHz to 10 Hz > 10 Hz to 3 GHz > 3 GHz to 26.5 GHz > 26.5 GHz to 110 GHz	50 µHz 7.7 pHz/Hz 7.7 pHz/Hz 5.2 pHz/Hz	HP 58503A/53132A HP 58503A/53132A HP 58503A/53151A HP 58503A/EIP 578/EIP 590
Frequency – Generate [Note 4]	100 µHz to 10 Hz > 10 Hz to 50 GHz	6.5 pHz/Hz 6.5 pHz/Hz	HP 58503A/HP3325B & Agilent 83650B
OSCILLATOR CHARACTERIZATION (20/F03)			
Harmonics [Note 4]			
0 dBc to 80 dBc	20 Hz to 50 kHz > 50 kHz to 10 MHz > 10 MHz to 3.6 GHz > 3.6 GHz to 26.5 GHz	0.50 dB 0.45 dB 0.39 dB 1.7 dB	R & S FSQ26
Amplitude Modulation -- Measure & Generate [Note 4]			
100 kHz to 3.6 GHz	1 % to 99 %	0.12 %	Keysight N5531X
> 3.6 GHz to 13.6 GHz	5 % to 99 %	0.15 %	
> 13.6 GHz to 17.1 GHz	5 % to 99 %	0.17 %	
> 17.1 GHz to 26.5 GHz	5 % to 99 %	0.19 %	
> 26.5 GHz to 34.5 GHz	5 % to 99 %	0.24 %	
> 34.5 GHz to 50 GHz	5 % to 99 %	0.46 %	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
Frequency Modulation -- Generate and measure [Notes 4,8]			
100 kHz to 3.6 GHz	0.2 < β ≤ 100 β > 100	0.004 *FM* 0.0092 *FM*	Keysight N5531X
> 3.6 GHz to 8.4 GHz	0.2 < β ≤ 100 β > 100	0.0081 *FM* 0.023 *FM*	
> 8.4 GHz to 17.1 GHz	0.2 < β ≤ 100 β > 100	0.0081 *FM* 0.029 *FM*	
> 17.1 GHz to 34.5 GHz	0.2 < β ≤ 100 β > 100	0.0092 *FM* 0.035 *FM*	
> 34.5 GHz to 50 GHz	0.2 < β ≤ 100 β > 100	0.016 *FM* 0.046 *FM*	
Phase Modulation – Measure & Generate [Note 4]			
	100 kHz to 3.6 GHz	0.014 rad	Keysight N5531X
	> 3.6 GHz to 13.6 GHz	0.015 rad	
	> 13.6 GHz to 17.1 GHz	0.018 rad	
	> 17.1 GHz to 26.5 GHz	0.021 rad	
	> 26.5 GHz to 34.5 GHz	0.025 rad	
	> 34.5 GHz to 50 GHz	0.027 rad	
PULSE WAVEFORM (20/F04)			
Rise Time – Generate	30 ps 500 ps 150 ps 70 ps	18 ps 49 ps 20 ps 16 ps	Tek 067-1338-00 Fluke 9500A/9530 Fluke 9500A/9560

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
Rise Time – Measure	> 10 ps	24 ps	HP 54750A/54751A
STOPWATCHES & TIMERS (20/F05)			
Time – Measure Note 4	15 s to 24 hr	0.059 s/day	Vibrograf 4500 Timometer
MECHANICAL			
AIRSPEED (20/M03)			
Air Velocity – Measure	0 ft/min 400 ft/min to 800 ft/min 800 ft/min to 9000 ft/min	1.3 ft/min 24ft/min - 1.4 % of reading 5.7 ft/min + 0.94 % of reading	Comparison of Pitot tube with UUT using wind tunnel
FLOW RATE (20/M05)			
Gas Flow	0 SCCM to 50 SCCM 50 SCCM to 500 SCCM 500 SCCM to 5 SLPM 5 SLPM to 50 SLPM 50 SLPM to 100 SLPM	0.26 % + 0.012 SCCM 0.26 % + 0.12 SCCM 0.26 % + 1.2 SCCM 0.26 % + 12 SCCM 0.52 % + 140 SCCM	Molbox1 & 5E1 Molbloc Molbox1 & 5E2 Molbloc Molbox1 & 5E3 Molbloc Molbox1 & 5E4 Molbloc Molbox1 & 1E5Molbloc
FORCE (20/M06)			
Crimp Tool – Pull Force	0 lbf to 100 lbf	7.8 % of rdg. + 2.6 lbf	Crimp pull tester
Durometer – Spring Force	78 gf 113 gf 821 gf 4533 gf	3.1 gf 0.84 gf 4.8 gf 13 gf	Electronic balance
Gaging Force	2 ozf 4 ozf 8 ozf 16 ozf 40 ozf	0.090 ozf 0.22 ozf 0.22 ozf 0.97 ozf 2.5 ozf	Gram gage Force gage
Force Gages	0.03125 ozf to 8 ozf	0.056 % + 0.000024 ozf	Class 6 Weights

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
	0.5 lbf to 500 lbf 3.2 lbf to 300 lbf > 300 lbf to 1000 lbf > 1000 lbf to 10 000 lbf	0.055 % + 0.000022 lbf 0.010 % + 0.0064 lbf 0.012 % + 0.0012 lbf 0.010 % + 0.16 lbf	Class 7 Weights Morehouse HADI 300LBF Morehouse M4215A- 1000LBF Morehouse M4215A-10000LBF
MASS DISSEMINATION (20/M08)			
Mass – Measure	1 mg to 2 g > 2 g to 10 g > 10 g to 31 g > 31 g to 210 g > 210 g to 300 g > 300 g to 5 kg > 5 kg to 34 kg	3.0 µg + 2.2 µg/g 4.7 µg + 1.4 µg/g 12 µg + 0.63 µg/g 55 µg + 0.56 µg/g 0.34 mg 0.75 mg + 0.43 µg/g 270 mg	Weights, MCM36 Balance Weights, MCM36 Balance Weights, MCM36 Balance Weights, RC210S Balance Weights, 1773MP8 Balance Weights, CCE5004 Balance Weights, CPA34001S Balance
VIBRATION (20/M11)			
Accelerometers			
Voltage sensitivity	5 Hz – 10 Hz 10 Hz – 100 Hz 100 Hz – 2 kHz 2 kHz – 8 kHz 8 kHz – 10 kHz	3.3 % 2.2 % 1.9 % 3.1 % 3.3 %	Vibration Research VR9500
Charge sensitivity	5 Hz – 10 Hz 10 Hz – 100 Hz 100 Hz – 2 kHz 2 kHz – 8 kHz 8 kHz – 10 kHz	3.5 % 2.5 % 2.2 % 3.3 % 3.5 %	
VOLUME & DENSITY (20/M12)			
Viscosity	100 cps 1000 cps 5000 cps 100 000 cps	0.33 % 0.50 % 0.45 % 0.60 %	Viscosity solutions

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
SPEED INDICATORS (20/M14)			
Photo Note 4	1 rpm to 100 000 rpm	8.6E-6 rpm/rpm + 0.0058 rpm	Signal generator
Contact	10 rpm to 50 000 rpm	5.9 E-5 rpm/rpm + 0.012 rpm	Ideal Aerosmith 1921
TORQUE (20/M15)			
Torque – Generate	0.25 ozf-in to 40 ozf-in	0.13 %	Torque wheel or arm with Class 6 weights
	> 40 ozf-in to 20 lbf-in	0.073 %	
	0.035 Nm to 0.45 Nm	0.077 %	
	0.45 Nm to 3.3 Nm	0.070 %	
	3.3 Nm to 339 Nm	0.065 %	
	339 Nm to 2712 Nm	0.070 %	
Torque – Measure	0.5 ozf-in to 2.5 ozf-in	0.51 % + 0.0022 ozf-in	Waters 6500T4
	> 2.5 ozf-in to 10 ozf-in	0.51 % + 0.0086 ozf-in	Waters 6500T4
	> 10 ozf-in to 15 ozf-in	0.58 % + 0.0032 lbf-in	CDI 2000-4-02
	> 15 ozf-in to 200 ozf-in	0.29 % + 0.035 lbf-in	CDI 2000-5-02
	> 200 ozf-in to 50 lbf-in	0.30 % + 0.0031 lbf-in	CDI 2000-6-02
	> 50 lbf-in to 150 lbf-in	0.30 % + 0.0057 lbf-in	CDI 2000-65-02
	> 150 lbf-in to 400 lbf-in	0.30 % + 0.017 lbf-in	CDI 2000-7-02
	> 400 lbf-in to 1000 lbf-in	0.30 % + 0.038 lbf-in	CDI 2000-8-02
	> 1000 lbf-in to 125 lbf-ft	0.27 % + 0.037 lbf-ft	CDI 2000-10-02
	> 125 lbf-ft to 250 lbf-ft	0.30 % + 0.0084 lbf-ft	CDI 2000-11-02
	> 250 lbf-ft to 600 lbf-ft	0.30 % + 0.031 lbf-ft	CDI 2000-12-02
	> 600 lbf-ft to 1000 lbf-ft	0.30 % + 0.083 lbf-ft	CDI 2000-13-02
	> 1000 lbf-ft to 2000 lbf-ft	0.30 % + 0.042 lbf-ft	CDI 2000-14-02
WEIGHING INSTRUMENTS (20/M16)			
Scales & Balances Note 4	1 mg to 500 mg	0.0064 mg	Class 1 Weights
	> 500 mg to 5 g	0.0095 mg	
	> 5 g to 10 g	0.020 mg	
	> 10 g to 20 g	0.031 mg	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
	> 20 g to 50 g	0.13 mg	
	> 50 g to 300 g	0.21 mg	
	> 300 g to 500 g	0.31 mg	
	> 500 g to 1 kg	0.85 mg	
	> 1 kg to 2 kg	1.1 mg	
	> 2 kg to 5 kg	3.7 mg	
	> 5 kg to 10 kg	5.9 mg	
	> 10 kg to 30 kg	22 mg	
	> 30 kg to 50 kg	28 mg	
	> 50 kg to 250 kg	3.8 µg/g + 400 mg	Class F Weights
ELECTROMAGNETICS – RF/MICROWAVE			
RF/MICROWAVE POWER (20/R17)			
RF Absolute Power – Measure Note 4			
100 kHz to 2.6 GHz	-20 dBm to 30 dBm	0.15 dB	HP 8902A w/ 11722A
50 MHz to 1.3 GHz	-20 dBm to 30 dBm	0.15 dB	HP 8902A w/ 11792A
1.3 GHz to 18 GHz		0.25 dB	
18 GHz to 26.5 GHz		0.31 dB	
50 MHz to 100 MHz	-30 dBm to 20 dBm	0.14 dB	HP E4419B w/ HP N8487A
100 MHz to 2 GHz		0.12 dB	
2 GHz to 12.4 GHz		0.14 dB	
12.4 GHz to 18 GHz		0.15 dB	
18 GHz to 26.5 GHz		0.18 dB	
26.5 GHz to 40 GHz		0.22 dB	
40 GHz to 50 GHz		0.31 dB	
50 MHz to 100 MHz	-70 dBm to -20 dBm	0.15 dB	HP E4419B w/ HP 8487D
100 MHz to 2 GHz		0.16 dB	
2 GHz to 12.4 GHz		0.17 dB	
12.4 GHz to 18 GHz		0.20 dB	
18 GHz to 34 GHz		0.23 dB	
34 GHz to 40 GHz		0.29 dB	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
40 GHz to 50 GHz		0.37 dB	
30 MHz to 4 GHz	-70 dBm to -20 dBm	0.15 dB	HP E4419B w/ HP 8481D
4 GHz to 10 GHz		0.16 dB	
10 GHz to 15 GHz		0.19 dB	
15 GHz to 18 GHz		0.21 dB	
18 GHz to 30 GHz		0.22 dB	
RF Absolute Power – Measure [Note 4]			
9 kHz to 2 GHz	-60 dBm to 20 dBm	0.15 dB	HP E4419B w/ HP E9304A
2 GHz to 6 GHz		0.16 dB	
50 MHz to 100 MHz	-70 dBm to 20 dBm	0.21 dB	HP E4419B w/ HP E4413A
100 MHz to 8 GHz		0.21 dB	
8 GHz to 18 GHz		0.22 dB	
18 GHz to 26.5 GHz		0.23 dB	
50 MHz	1 mW	0.0033 mW	Tegam 1830A w/HP 478A-H76
Tuned RF Power – Absolute Measure [Note 4]	10 dBm to -22 dBm	0.14 dB	HP 8902 w/11722A or 11792A sensor
	-22 dBm to -42 dBm	0.15 dB	
	-42 dBm to -50 dBm	0.17 dB	
	-50 dBm to -60 dBm	0.17 dB	
	-60 dBm to -72 dBm	0.19 dB	
	-72 dBm to -80 dBm	0.20 dB	
	-80 dBm to -92 dBm	0.21 dB	
	-92 dBm to -102 dBm	0.27 dB	
	-102 dBm to -110 dBm	0.32 dB	
	-110 dBm to -120 dBm	0.37 dB	
	-120 dBm to -127 dBm	0.43 dB	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
Tuned RF Power – Relative Measure [Note 4]			HP 8902
2.5 MHz to 26.5 GHz	10 dB to 2 dB	0.087 dB	w/11722A or 11792A sensor
	2 dB to -12 dB	0.099 dB	
	-12 dB to -22 dB	0.11 dB	
	-22 dB to -31 dB	0.11 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	
SCATTERING PARAMETERS (20/R18)			
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	0.044	
	4 dB	0.037	
	5 dB	0.031	
	6 dB	0.027	
	7 dB	0.026	
	8 dB	0.022	
	9 dB	0.022	
	10 dB	0.022	
	11 dB	0.021	
	12 dB	0.021	
	20 dB	0.022	
	30 dB	0.017	
	40 dB	0.091	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
> 8.4 GHz to 12 GHz	1 dB	0.16	
	2 dB	0.13	
	3 dB	0.10	
	4 dB	0.084	
	5 dB	0.068	
	6 dB	0.055	
	7 dB	0.047	
	8 dB	0.039	
	9 dB	0.034	
	10 dB	0.030	
	11 dB	0.028	
	12 dB	0.026	
	20 dB	0.045	
	30 dB	0.068	
	40 dB	0.11	
> 12 GHz to 20 GHz	1 dB	0.069	
	2 dB	0.056	
	3 dB	0.047	
	4 dB	0.039	
	5 dB	0.034	
	6 dB	0.030	
	7 dB	0.032	
	8 dB	0.031	
	9 dB	0.030	
	10 dB	0.029	
	11 dB	0.029	
	12 dB	0.028	
	20 dB	0.042	
	30 dB	0.10	
	40 dB	0.037	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
> 20 GHz to 26.5 GHz	1 dB	0.027	
	2 dB	0.022	
	3 dB	0.018	
	4 dB	0.015	
	5 dB	0.12	
	6 dB	0.11	
	7 dB	0.11	
	8 dB	0.097	
	9 dB	0.092	
	10 dB	0.089	
	11 dB	0.086	
	12 dB	0.085	
	20 dB	0.16	
	30 dB	0.44	
	40 dB	0.31	
Attenuation – Generate Note 4 (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 Note 4 (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	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
	20 dB	0.65 dB	
Attenuation – Generate Note 4			
30 MHz	0 dB	0.0040 dB	Agilent 11812A
	10 dB	0.0083 dB	
	20 dB	0.019 dB	
	30 dB	0.020 dB	
	40 dB	0.033 dB	
	50 dB	0.022 dB	
Attenuation – Measure Note 4			HP8902 with 11722A or
2.5 MHz to 26.5 GHz	0 dB to 2 dB	0.081 dB	11792A sensor
	> 2 dB to -12 dB	0.070 dB	
	> -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	
THERMODYNAMIC			
HUMIDITY (20/T02)			
Relative Humidity Note 4	10 % RH to 95 % RH	0.15 % RH + 0.29 % rdg.	Humidity probe/indicator Thunder Scientific
LABORATORY THERMOMETERS (20/T03)			
Temperature – Generate & Measure	-197 °C	6.4 mK	Additel ADT286 w/AccuMac 1960A or Fixed Point
	-95 °C to -80 °C	13 mK	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
	≥ -80 °C to 0 °C	7.2 mK+ 0.014 mK/°C	
	0.01 °C	4.4 mK	TPW
	> 0 °C to 100 °C	7.6 mK+ 0.018 mK/°C	
	≥ 100 °C to 250 °C	6.3 mK+ 0.029 mK/°C	
	> 250 °C to 660 °C	20 mK+ 0.079 mK/°C	
	> 660 °C to 700 °C	0.47 °C + 1.2 E-04 °C/°C	
			Fluke 9118A w/AccuMac
	> 700 °C to 1000 °C	1.2 °C	AM1210-20
	> 1000 °C to 1200 °C	0.85 °C + 7.6 E-04 °C/°C	
		5.5 E-03 °C +	Fluke 5644S w/Additel
Thermistor	0 °C to 100 °C	4.5 E-05 °C/°C	ADT286
PRESSURE (20/T05)			
Pressure – Generate & Measure [Note 4]			
	0 Pa to 746 Pa	0.0048 % + 0.045 Pa	Fluke 7250 LP
	> 746 Pa to 7460 Pa	0.011 % - 0.00015 Pa	
	1245 Pa to 10 kPa	1.2 Pa	Pressurements T3500/3
	> 10 kPa to 62 kPa	0.012 %	
	> 62 kPa to 689 kPa	0.0098 % + 0.64 Pa	DHI RPM4-A700kp
	> 689 kPa to 6.89 MPa	0.0098 % + 1.8 Pa	DHI RPM4-A7mp
	> 6.89 MPa to 20 MPa	0.016 % + 1.4 Pa	DHI RPM4-A2Ms
	> 20 MPa to 68.9 MPa	0.017 % + 3.0 Pa	DHI RPM4-A70Ms
			Fluke/DHI E-DWT-H-
	69 MPa to 207 MPa	0.025 % + 17 Pa	A200Me-L
RADIATION THERMOMETRY (20/T06)			
Source [Note 4]	-15 °C to 120 °C	0.0012 °C /°C + 0.33 °C	Fluke 4180 infrared source
	120 °C to 200 °C	0.0023 °C /°C + 0.17 °C	Fluke 4181 infrared source
	200 °C to 500 °C	0.0028 °C /°C + 0.065 °C	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
RESISTANCE THERMOMETRY (20/T07)			
Comparison - RTDs	-197 °C	6.4 mK	Additel ADT286 w/AccuMac 1960A or Fixed Point
	-95 °C to -80 °C	13 mK	
	≥ -80 °C to 0 °C	7.2 mK+ 0.014 mK/°C	
	0.01 °C	4.4 mK	TPW
	> 0 °C to 100 °C	7.6 mK+ 0.018 mK/°C	
	≥ 100 °C to 250 °C	6.3 mK+ 0.029 mK/°C	
	> 250 °C to 660 °C	20 mK+ 0.079 mK/°C	
	> 660 °C to 700 °C	0.47 °C + 1.2 E-04 °C/°C	
	> 700 °C to 1000 °C	1.2 °C	Fluke 9118A w/AccuMac AM1210-20
	> 1000 °C to 1200 °C	0.85 °C + 7.6 E-04 °C/°C	
TEMPERATURE INDICATORS (20/T08)			
Thermocouple Simulation [Note 4]			
Type B	600 °C to 800 °C	0.34 °C	Fluke 5522A
	> 800 °C to 1000 °C	0.27 °C	
	> 1000 °C to 1550 °C	0.23 °C	
	> 1550 °C to 1820 °C	0.26 °C	
Type C	0 °C to 150 °C	0.23 °C	
	> 150 °C to 650 °C	0.20 °C	
	> 650 °C to 1000 °C	0.24 °C	
	> 1000 °C to 1800 °C	0.39 °C	
	> 1800 °C to 2316 °C	0.65 °C	
Type E	-250 °C to -100 °C	0.39 °C	
	> -100 °C to -25 °C	0.13 °C	
	> -25 °C to 350 °C	0.11 °C	
	> 350 °C to 650 °C	0.13 °C	
	> 650 °C to 1000 °C	0.16 °C	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
Type J	-210 °C to -100 °C	0.21 °C	
	> -100 °C to -30 °C	0.13 °C	
	> -30 °C to 150 °C	0.11 °C	
	> 150 °C to 760 °C	0.13 °C	
	> 760 °C to 1200 °C	0.18 °C	
Type K	-210 °C to -100 °C	0.26 °C	
	> -100 °C to -25 °C	0.14 °C	
	> -25 °C to 120 °C	0.13 °C	
	> 120 °C to 1000 °C	0.20 °C	
	> 1000 °C to 1372 °C	0.31 °C	
Type L	-200 °C to -100 °C	0.29 °C	
	> -100 °C to 800 °C	0.20 °C	
	> 800 °C to 900 °C	0.13 °C	
Type N	-200 °C to -100 °C	0.31 °C	
	> -100 °C to -25 °C	0.17 °C	
	> -25 °C to 120 °C	0.15 °C	
	> 120 °C to 410 °C	0.14 °C	
	> 410 °C to 1300 °C	0.21 °C	
Type R	0 °C to 250 °C	0.44 °C	
	> 250 °C to 400 °C	0.27 °C	
	> 400 °C to 1000°C	0.26 °C	
	> 1000 °C to 1767 °C	0.31 °C	
Type S	0 °C to 250 °C	0.37 °C	
	> 250 °C to 1000 °C	0.28 °C	
	> 1000 °C to 1400 °C	0.29 °C	
	> 1400 °C to 1767 °C	0.36 °C	

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

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) [Notes 3,5]	Remarks
Type T	-250 °C to -150 °C	0.49 °C	
	> -150 °C to 0 °C	0.19 °C	
	> 0 °C to 120 °C	0.13 °C	
	> 120 °C to 400 °C	0.11 °C	
Type U	-200 °C to 0 °C	0.44 °C	
	> 0 °C to 600 °C	0.22 °C	
Half Junction Simulation			
Type E	-200 °C to 1000 °C	0.074 °C	
Type J	-210 °C to 1200 °C	0.14 °C	
Type K	-270 °C to 1373 °C	0.14 °C	
Type N	-270 °C to 1260 °C	0.12 °C	
Type S	-50 °C to 1480 °C	0.15 °C	
Type T	-200 °C to 400 °C	0.11 °C	
RTD Simulation [Note 4]			
Pt 385, 100 Ω	-200 °C to -80 °C	0.039 °C	
	> -80 °C to 0 °C	0.039 °C	
	> 0 °C to 100 °C	0.054 °C	
	> 100 °C to 300 °C	0.070 °C	
	> 300 °C to 400 °C	0.078 °C	
	> 400 °C to 630 °C	0.093 °C	
	> 630 °C to 800 °C	0.18 °C	
Pt 3926, 100 Ω	-200 °C to -80 °C	0.039 °C	
	> -80 °C to 0 °C	0.039 °C	
	> 0 °C to 100 °C	0.054 °C	
	> 100 °C to 300 °C	0.070 °C	

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Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
	> 300 °C to 400 °C	0.078 °C	
	> 400 °C to 630 °C	0.093 °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	0.10 °C	
	> 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	0.031 °C	
	> -80 °C to 0 °C	0.031 °C	
	> 0 °C to 100 °C	0.031 °C	
	> 100 °C to 260 °C	0.039 °C	
	> 260 °C to 300 °C	0.093 °C	
	> 300 °C to 400 °C	0.10 °C	
	> 400 °C to 600 °C	0.11 °C	
	> 600 °C to 630 °C	0.12 °C	
Pt 385, 500 Ω	-200 °C to -80 °C	0.039 °C	
	> -80 °C to 0 °C	0.031 °C	
	> 0 °C to 100 °C	0.039 °C	
	> 100 °C to 260 °C	0.047 °C	
	> 260 °C to 300 °C	0.062 °C	
	> 300 °C to 400 °C	0.062 °C	
	> 400 °C to 600 °C	0.070 °C	
	> 600 °C to 630 °C	0.085 °C	
Pt 385, 1000 Ω	-200 °C to -80 °C	0.023 °C	
	> -80 °C to 0 °C	0.023 °C	

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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) Notes 1,2

Measured Parameter or Device Calibrated	Range	Expanded Uncertainty (k=2) Notes 3,5	Remarks
	> 0 °C to 100 °C	0.031 °C	
	> 100 °C to 260 °C	0.039 °C	
	> 260 °C to 300 °C	0.047 °C	
	> 300 °C to 400 °C	0.054 °C	
	> 400 °C to 600 °C	0.055 °C	
	> 600 °C to 630 °C	0.18 °C	
PtNi, 120 Ω	-80 °C to 0 °C	0.062 °C	
	> 0 °C to 100 °C	0.062 °C	
	> 100 °C to 260 °C	0.11 °C	
Cu 427, 10 Ω	-100 °C to 260 °C	0.23 °C	
VACUUM & LOW PRESSURE GAGES (20/T09)			
Measure Note 4	0 mTorr to 1000 mTorr	0.14 mTorr + 1.3 %	MKS 390411-0-YE-T with:
	> 1 Torr to 10 Torr	0.0013 Torr + 1.3 %	MKS 660B20/626C01TDE
			MKS660B10/626C11TQD
THERMOCOUPLES (20/T11)			
Type K	-200 °C to 0.01 °C	0.14 °C – 3.5E-04 °C/°C	Comparison to Fluke SPRT
	> 0.01 °C to 660 °C	0.14 °C + 1.3E-04 °C/°C	
Type J	-200 °C to 0.01 °C	0.14 °C – 3.0E-04 °C/°C	
	> 0.01 °C to 660 °C	0.14 °C + 1.3E-04 °C/°C	
Type T	-200 °C to 0.01 °C	0.14 °C – 3.4E-04 °C/°C	
	> 0.01 °C to 420 °C	0.14 °C + 1.1E-04 °C/°C	
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 with a level of confidence of approximately 95 %, typically using a coverage factor of $k = 2$. However, laboratories may report a coverage factor different than $k = 2$ to achieve the 95 % level of confidence. 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.5 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.

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Notes
Note 7: Uncertainties are listed at optimal conditions (PF = 1, Φ = 0º at 10 Hz - 65 Hz). Under different conditions, the uncertainty of the power measurement will vary based on the laboratory's AC voltage and current measurement uncertainties. PFs of less than one will increase the uncertainty of the power measurement, ramping up as PF approaches zero. Essco may also report reactive power, apparent power, and power factor under this accreditation. Uncertainties at other conditions can be obtained from the laboratory. **Note 8:** Where *FM* is measured peak expressed in Hertz.

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