CERTIFICATE OF ACCREDITATION

This is to attest that

FIELD CALIBRATIONS, INC

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PHOENIX, ARIZONA 85044-5668, U.S.A.

Calibration Laboratory CL-112

has met the requirements of AC204, *IAS Accreditation Criteria for Calibration Laboratories*, and has demonstrated compliance with ISO/IEC Standard 17025:2017, *General requirements for the competence of testing and calibration laboratories.* This organization is accredited to provide the services specified in the scope of accreditation.

Effective Date April 27, 2020

Expiration Date March 1, 2023

President

Visit www.iasonline.org for current accreditation information.

FIELD CALIBRATIONS, INC

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Accredited to ISO/IEC 17025:2017 *Effective Date April 27, 2020*

CALIBRATION AND MEASUREMENT CAPABILITY (CMC)*

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Dimensional			
Micrometers	0.0625 in to 60 in	(20 + 7L) µin (where L = length in inches)	Gage blocks, and micrometer standards
Calipers	Up to 60 in	(35 + 10L) µin (where L = length in inches)	Gage blocks, and micrometer standards
	Internal Diameter: 1 in 2.8 in	 80 µin 80 µin	Ring Gage
Mechanical			
Totalizers (Contact)	0.01 ft to 100 000 ft 0.02 m to 100 000 m 1 in to 100 000 in	1.0 %	Electromatic CDT2000
Speed – Generate[3] (Contact)	55 rpm to 5000 rpm 5000 rpm to 7000 rpm 7000 rpm to 46 000 rpm	0.001 rpm 0.0012 rpm 0.000018 %	Quantum N-11-ECS/3A w/HP 53132A
Speed – Generate[3] (Non-contact)	1 rpm to 100 000 rpm	1×10^{-12}	HP 3325B w/Fluke 910R
Speed – Measure[4] (Non-contact)	1 rpm to 99 999 rpm 0.3 ft/min to 6500 ft/min 4 in/min to 78 000 in/min 0.1 m/min to 1999 m/min	0.03 % 0.03 % 0.03 % 0.03 %	Electromatic CDT2000
Speed – Measure[4] (Contact)	1 rpm to 99 999 rpm 0.3 ft/min to 6500 ft/min 4 in/min to 78 000 in/min 0.1 m/min to 1999 m/min	1.0 % 1.0 % 1.0 % 1.0 %	Electromatic CDT2000
	0.1 ft/min to 999.99 ft/min 1000 ft/min to 9999.9 ft/min 10 000 ft/min to 25 000 ft/min	0.13% + 0.06 ft/min 0.13% + 0.6 ft/min 0.13% + 1 ft/min	Shimpo DT-107A

** If information in this CMC is presented in non-SI units, the conversion factors stated in NIST Special Publication 811 "Guide for the Use of the International System of Units (SI)" apply.*

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Acceleration/ Vibration – Measure[4] (at 1 g)[5]	1 Hz to 10 Hz 10 Hz to 100 Hz 100 Hz to 10 kHz	2.9 % 2.4 % 2.3 %	Dytran 3120BK w/ Keithley 2002
Scales and Balances - Class 1 and Class 3 (200 mg to 20 kg) (Linearity Test Only)	200 mg 1 g 2 g 5 g	0.060 mg 0.10 mg 0.13 mg 0.18 mg	Class 3 Weights
	10 g 30 g 50 g 100 g 400 g 1 kg 3 kg 5 kg	0.051 mg 0.076 mg 0.13 mg 0.26 mg 0.77 mg 2.6 mg 7.8 mg 13 mg	Class 1 Weights
	10 kg	100 mg	Class 3 Weights
Scales and Balances - Class 7 and Class F (0.5 lb to 400 lb) (Linearity Test Only)	0.5 lb 1 lb 2 lb 5 lb 10 lb	0.0005 lb 0.0007 lb 0.0010 lb 0.0022 lb 0.0031 lb	Class 7 Weights
	50 lb	0.0051 lb	Class F Weights
Vacuum – Generate[3] and Measure[4]	-24.432 inHg to 61.080 inHg	0.031 inHg	Fluke 717-30G
	-25 inHg to 204 inHg	0.072 inHg	Fluke 719-100G
	-12 psi to 0 psi	0.035 psi	Fluke 719-100G
Pressure − Generate[3] and Measure[4]	0 inH_20 to 10 inH_20	0.03 inH_2O	Fluke 700P01 w/718
	0 inH_20 to 12 inH_20	0.0025 inH_2O	Dwyer 1425-12
	-12 psi to 30 psi	0.015 psi	Fluke 717-30G
	-12 psi to 100 psi	0.035 psi	Fluke 719-100G
	0 psia to 30 psia	0.021 psi	Fluke 700PA5 w/718
	-12 psi to 300 psi	0.11 psi	Fluke 719 Pro 300G
	0 psi to 500 psi	0.25 psi	Fluke 700P07 w/718
	0 psi to 1000 psi	0.5 psi	Fluke 700P08
	0 psi to 3000 psi	1.5 psi	Ametek XP2i 3000
	0 psi to 5000 psi	2.5 psi	Druck DPI104 5k
	0 psi to 7000 psi	4 psi	Ashcroft 7000
	0 psi to 10 000 psi	8 psi	Fluke 700P31
Force Gages (0.5 lb to 100 lb)	0.5 lb 1 lb 2 lb 5 lb 10 lb	0.0005 lb 0.0007 lb 0.0010 lb 0.0022 lb 0.0031 lb	Class 7 Weights

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Force – Measure[4]	0 lbf to 10 000 lbf	0.005 % + 10 lbf	Interface 1211NE w/Newport Infinity INFS
	0 lbf to 100 000 lbf	200 lbf	Transcell TI-500E w/VMC VLC-120
	0 lbf to 275 000 lbf	0.55 % + 100 lbf	Omega PX105 w/Analogic AN2559
Thermal			
Simulated Temperature - Thermocouples Generate			Fluke 7526A
Type B	600 °C to 800 °C	0.35 °C	
	800 °C to 1550 °C	0.28 °C	
	1550 °C to 1820 °C	0.22 °C	
Type C	0 °C to 1000 °C	0.16 °C	
	1000 °C to 1800 °C	0.23 °C	
	1800 °C to 2000 °C	0.26 °C	
	2000 °C to 2316 °C	0.35 °C	
Type E	-250 °C to -200 °C	0.25 °C	
	-200 °C to -100 °C	0.12 °C	
	-100 °C to 0 °C	0.09 °C	
	0 °C to 600 °C	0.08 °C	
	600 °C to 1000 °C	0.10 °C	
Type J	-210 °C to -100 °C	0.14 °C	
	-100 °C to 800 °C	0.09 °C	
	800 °C to 1200 °C	0.10 °C	
Type K	-250 °C to -200 °C	0.46 °C	
	-200 °C to -100 °C	0.16 °C	
	-100 °C to 500 °C	0.10 °C	
	500 °C to 800 °C	0.10 °C	
	800 °C to 1372 °C	0.13 °C	
Type L	-200 °C to -100 °C	0.10 °C	
	-100 °C to 900 °C	0.09 °C	
Type N	-250 °C to -200 °C	0.73 °C	
	-200 °C to -100 °C	0.23 °C	
	-100 °C to 0 °C	0.12 °C	
	0 °C to 100 °C	0.11 °C	
	100 °C to 800 °C	0.10 °C	
	800 °C to 1300 °C	0.12 °C	
Type R	-50 °C to -25 °C	0.55 °C	
	-25 °C to 0 °C	0.45 °C	
	0 °C to 100 °C	0.39 °C	

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Simulated Temperature Thermocouples Generate			Fluke 7526A
Type R continued	100 °C to 400 °C	0.28 °C	
	400 °C to 600 °C	0.22 °C	
	600 °C to 1000 °C	0.21 °C	
	1000 °C to 1600 °C	0.19 °C	
	1600 °C to 1767 °C	0.23 °C	
Type S	-50 °C to -25 °C	0.51 °C	
	-25 °C to 0 °C	0.43 °C	
	0 °C to 100 °C	0.38 °C	
	100 °C to 400 °C	0.29 °C	
	400 °C to 600 °C	0.23 °C	
	600 °C to 1000 °C	0.22 °C	
	1000 °C to 1600 °C	0.22 °C	
	1600 °C to 1767 °C	0.26 °C	
Type T	-250 °C to -200 °C	0.35 °C	
	-200 °C to -100 °C	0.16 °C	
	-100 °C to 0 °C	0.11 °C	
	0 °C to 200 °C	0.09 °C	
	200 °C to 400 °C	0.09 °C	
Type U	-200 °C to 0 °C	0.16 °C	
	0 °C to 200 °C	0.10 °C	
	200 °C to 600 °C	0.10 °C	
Simulated Temperature RTD Generate			Fluke 7526A
Pt 385, 100 Ω	-200 °C to 800 °C	0.05 °C	
Pt 3926, 100 Ω	-200 °C to 630 °C	0.05 °C	
Pt 3916, 100 Ω	-200 °C to 630 °C	0.05 °C	
Ni 120, 120 Ω	-80 °C to 260 °C	0.02 °C	
Simulated Temperature RTD Generate			Fluke 5520A
Pt 385, 200 Ω	200 °C to 100 °C	0.04 °C	
	100 °C to 260 °C	0.05 °C	
	260 °C to 300 °C	0.12 °C	
	300 °C to 400 °C	0.13 °C	
	400 °C to 600 °C	0.14 °C	
	600 °C to 630 °C	0.16 °C	

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Simulated Temperature RTD Generate continued			Fluke 5520A
Pt 385, 500 Ω	-200 °C to -80 °C -80 °C to 100 °C 100 °C to 260 °C 260 °C to 400 °C	0.04 °C 0.05 °C 0.06 °C 0.08 °C	
Pt 385, 500 Ω	400 °C to 600 °C 600 °C to 630 °C	0.09 °C 0.11 °C	
Pt 385, 1000 Ω	-200 °C to 0 °C 0 °C to 100 °C 100 °C to 260 °C 260 °C to 300 °C 300 °C to 600 °C 600 °C to 630 °C	0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.07 °C 0.23 °C	
Cu 427, 10 Ω	-100 °C to 260 °C	0.3 °C	
Simulated Temperature Thermistor Generate YSI 400	15 °C to 50 °C	0.007 °C	Fluke 7526A
Temperature - Generate[3]	10 °C to 60 °C	0.08 °C	Thunder Scientific 1200
Simulated Temperature RTD − Measure	-100 °C to 100 °C -200 °C to 630 °C -148 °F to 212 °F -328 °F to 1166 °F	0.021 °C 0.068 °C 0.036 °F 0.12 °F	Keithley 2002, 4-wire
Temperature – Generate[3]/ Measure[4]	-200 °C to 660 °C -200 °C to 500 °C	0.030 °C 0.027 °C	Hart 1502A w/5628 Hart 1521 w/5612
Infrared Temperature – Measure[4]	20 °C to 100 °C 100 °C to 250 °C	2 °C 2 %	Fluke VT02
Dew Point – Generate[3]	-20 °C to 0 °C 0 °C to 50 °C	0.17 °C 0.14 °C	Thunder Scientific 1200
Dewpoint –Measure[4]	-40 °C (10 %RH) (80 %RH) -20 °C (10 %RH) (80 %RH) 0 °C (10 %RH) (80 %RH)	 1.9 °C 0.43 °C 2.2 °C 0.48 °C 2.5 °C 0.48 °C	Vaisala HMP233/HMP235

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Dewpoint –Measure[4] continued	20 °C (10 %RH) (80 %RH) 40 °C (10 %RH) (80 %RH) 60 °C (10 %RH) (80 %RH) 80 °C (10 %RH) (80 %RH) 100 °C (10 %RH) (80 %RH) 120 °C (10 %RH) (80 %RH) 140 °C (10 %RH) (80 %RH) 160 °C (10 %RH) (80 %RH)	 2.9 °C 0.53 °C 3.2 °C 0.58 °C 3.6 °C 0.64 °C 4 °C 0.7 °C 4.4 °C 0.76 °C 4.9 °C 0.84 °C 5.3 °C 0.91 °C 5.8 °C 0.99 °C	Vaisala HMP233/HMP235
Relative Humidity – Generate[3]	10 %RH to 30 %RH 30 %RH to 80 %RH 80 %RH to 95 %RH	0.52 %RH 0.58 %RH 0.69 %RH	Thunder Scientific 1200
Relative Humidity − Measure[4]	0 %RH to 90 %RH 90 %RH to 100 %RH	1 %RH 1.7 %RH	Vaisala HM70
Electrical – DC/LF			
DC Voltage − Generate[3] and Measure[4]	0 mV to 200 mV 200 mV to 2 V 2 V to 20 V 20 V to 200 V 200 V to 1050 V	5.0 µV/V + 100 nV 3.5 µV/V + 400 nV 3.5 µV/V + 4 µV 5.5 µV/V + 40 µV 5.5 µV/V + 500 µV	Fluke 5720A w/Fluke 8508A
DC Voltage – Generate[3]	1050 V to 1100 V	6.5 µV/V + 400 µV	Fluke 5720A
DC Voltage − Generate[3] and Measure[4]	0 kV to 2 kV 2 kV to 20 kV	0.04 % + 0.4 V 0.04 % + 4 V	Glassman LG40, Vitrek 4620B

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
DC Voltage – Measure[4]	1050 V to 1100 V	22 µV/V + 700 µV	Keithley 2002
	20 kV to 100 kV	0.0035 % + 0.10 kV	Spellman HVD-100-1 w/HP 34401A
DC Current Generate[3]	50 aA to 2 pA 2 pA to 20 pA 20 pA to 200 pA 200 pA to 2 nA	0.43 % + 10 fA 0.38 % + 10 fA 0.25 % + 30 fA 0.065 % + 100 fA	Keithley 263
	0.1 A to 1 A 10 µA to 100 µA 0.1 mA to 1 mA 1 mA to 10 mA 10 mA to 100 mA	120 µA/A + 10 µA 25 µA/A + 0.8 nA 25 µA/A + 5 nA 25 µA/A + 50 nA 40 µA/A + 0.5 µA	Fluke 5720A w/HP 3458A
	0.022 A to 0.220 A 0.22 A to 2.2 A	45 µA/A + 0.7 µA 80 µA/A + 12 µA	Fluke 5720A
	2.2 A to 11 A	360 µA/A + 480 µA	Fluke 5720A w/5725A
	11 A to 20.5 A	0.1 % + 750 µA	Fluke 5520A
	20 A to 150 A 150 A to 550 A 550 A to 1000 A	0.26 % + 0.05 A 0.25 % + 0.06 A 0.27 % + 0.06 A	Fluke 5520A w/50 Turn Coil
	0 A to 100 A	0.11 % + 0.3 mA	EMS 5.5-150-1-D w/HP 3458A & LAB100-100
	100 A to 120 A	0.12 % + 3 mA	EMS 5.5-150-1-D w/HP 3458A & LAB1000-100
DC Current – Measure[4]	10 fA to 2 nA 2 nA to 20 nA 20 nA to 200 nA 200 nA to 2 µA 2 µA to 20 µA 20 µA to 200 µA 200 µA to 2 mA	0.3 % + 500 fA 0.2 % + 3 pA 0.15 % + 20 pA 0.15 % + 200 pA 0.1 % + 2 nA 0.1 % + 20 nA 0.1 % + 200 nA	Keithley 487
	0 nA to 100 nA 0.1 µA to 1 µA 1 µA to 10 µA	35 µA/A + 40 pA 25 µA/A + 40 pA 25 µA/A + 100 pA	HP 3458A
	10 µA to 200 µA 200 µA to 2 mA 2 mA to 20 mA 20 mA to 200 mA	12 µA/A + 400 pA 12 µA/A + 4 nA 14 µA/A + 40 nA 48 µA/A + 800 nA	Fluke 8508A
	10 mA to 100 mA 0.1 A to 1 A	40 µA/A + 500 nA 120 µA/A + 10 µA	HP 3458A
	0.2 A to 2 A 2 A to 20 A	190 µA/A + 16 µA 400 µA/A + 400 µA	Fluke 8508A
	1 A to 30 A	0.13 % + 0.3 mA	HP 3458A w/HP 34330A
	10 A to 100 A	0.11 % + 0.3 mA	HP 3458A w/LAB100-100
	100 A to 1000 A	0.12 % + 3 mA	HP 3458A w/LAB1000-100

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
DC Resistance – Generate[3]	1 mΩ 10 mΩ 100 mΩ 1 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 100 kΩ	0.22 % 0.22 % 0.22 % 0.22 % 0.12 % 0.12 % 0.12 % 0.12 % 0.12 %	HP 4203x series
	0 Ω to 2 Ω 2 Ω to 20 Ω 20 Ω to 200 Ω	17 µΩ/Ω + 4 µΩ 9.5 µΩ/Ω + 14 µΩ 8.0 µΩ/Ω + 50 µΩ	Fluke 5500A w/Fluke 8508A
	190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	10 µΩ/Ω 8.5 µΩ/Ω 8.5 µΩ/Ω 8.5 µΩ/Ω 8.5 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 20 µΩ/Ω 21 µΩ/Ω 40 µΩ/Ω 47 µΩ/Ω 100 µΩ/Ω	Fluke 5720A
	11 MΩ to 32.99999 MΩ 33 MΩ to 109.9999 MΩ 110 MΩ to 329.9999 MΩ 330 MΩ to 1100 MΩ	250 µΩ/Ω + 2.5 kΩ 500 µΩ/Ω + 3 kΩ 0.3 % + 100 kΩ 1.5 % + 500 kΩ	Fluke 5520A
	0.1 GΩ to 1 GΩ	0.1 %	PPM R3-1, 110
	1 GΩ to 10 GΩ 10 GΩ to 100 GΩ	0.5 % 1.0 %	Biddle Megadek 72-6345-1
	1 kΩ 10 kΩ 100 kΩ 1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ	0.04 % 0.02 % 0.02 % 0.025 % 0.037 % 0.07 % 0.1 % 0.23 % 0.4 %	Keithley 263
	1 TΩ	0.57 %	Rohde & Schwarz CR504
DC Resistance − Measure[4]	0 Ω to 2 Ω 2 Ω to 20 Ω 20 Ω to 200 Ω 200 Ω to 2 kΩ 2 kΩ to 20 kΩ	17 µΩ/Ω + 4 µΩ 9.5 µΩ/Ω + 14 µΩ 8.0 µΩ/Ω + 50 µΩ 8.0 µΩ/Ω + 500 µΩ 8.0 µΩ/Ω + 5 mΩ	Fluke 8508A (Normal Mode)

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
DC Resistance − Measure[4] continued	20 kΩ to 200 kΩ 200 kΩ to 2 MΩ 2 MΩ to 20 MΩ 20 MΩ to 200 MΩ 200 MΩ to 2 GΩ	8.0 μΩ/Ω + 50 mΩ 9.0 μΩ/Ω + 1 Ω 20 μΩ/Ω + 100 Ω 120 μΩ/Ω + 10 kΩ 1500 μΩ/Ω + 1 MΩ	Fluke 8508A (Normal Mode)
	2 MΩ to 20 MΩ 20 MΩ to 200 MΩ 200 MΩ to 2 GΩ 2 GΩ to 20 GΩ	17 μΩ/Ω + 10 Ω 65 μΩ/Ω + 1 kΩ 180 μΩ/Ω + 100 kΩ 1500 μΩ/Ω +10 MΩ	Fluke 8508A (High Voltage Mode)
	10 MΩ 100 MΩ 1 GΩ 10 GΩ	0.0050 % 0.0064 % 0.015 % 0.12 %	HP 3458A; Fluke 5720A
	100 GΩ 1 TΩ	0.29 % 0.57 %	Keithley 487; Fluke 5720A
DC Power − Generate[3]	 (33 mV to 1020 V) 330 μA to 329.99 mA 330 mA to 2.999 A 3 A to 20.5 A	(% of output in Watts) 0.023 % 0.022 % 0.07 %	Fluke 5520A
AC Voltage – Generate[3]	1 nV to 2.2 mV (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 500 kHz) (500 kHz to 1 MHz) 2.2 mV to 22 mV (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 500 kHz) (500 kHz to 1 MHz) 22 mV to 220 mV (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz)	 240 μV/V + 4 μV 90 μV/V + 4 μV 80 μV/V + 4 μV 200 μV/V + 4 μV 500 μV/V + 5 μV 1100 μV/V + 10 μV 1400 μV/V + 20 μV 2700 μV/V + 20 μV 240 μV/V + 4 μV 90 μV/V + 4 μV 80 μV/V + 4 μV 200 μV/V + 4 μV 500 μV/V + 5 μV 1100 μV/V + 10 μV 1400 μV/V + 20 μV 2700 μV/V + 20 μV 240 μV/V + 12 μV 90 μV/V + 7 μV 80 μV/V + 7 μV 200 μV/V + 7 μV 460 μV/V + 17 μV 900 μV/V + 20 μV	Fluke 5520A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
AC Voltage – Generate[3] continued	22 mV to 220 mV		Fluke 5520A
	(300 kHz to 500 kHz)	1400 µV/V + 25 µV	
	(500 kHz to 1 MHz)	2700 µV/V + 45 µV	
	220 mV to 2.2 V		
	(10 Hz to 20 Hz)	240 µV/V + 40 µV	
	(20 Hz to 40 Hz)	90 µV/V + 15 µV	
	(40 Hz to 20 kHz)	45 µV/V + 8 µV	
	(20 kHz to 50 kHz)	75 µV/V + 10 µV	
	(50 kHz to 100 kHz)	110 µV/V + 30 µV	
	(100 kHz to 300 kHz)	420 µV/V + 8 µV	
	(300 kHz to 500 kHz)	1000 µV/V + 200 µV	
	(500 kHz to 1 MHz)	1700 µV/V + 300 µV	
	2.2 V to 22 V		
	(10 Hz to 20 Hz)	240 µV/V + 400 µV	
	(20 Hz to 40 Hz)	90 µV/V + 150 µV	
	(40 Hz to 20 kHz)	45 µV/V + 50 µV	
	(20 kHz to 50 kHz)	75 µV/V + 100 µV	
	(50 kHz to 100 kHz)	100 µV/V + 200 µV	
	(100 kHz to 300 kHz)	275 µV/V + 600 µV	
	(300 kHz to 500 kHz)	1000 µV/V + 2 mV	
	(500 kHz to 1 MHz)	1500 µV/V + 3.2 mV	
	22 V to 220 V		
	(10 Hz to 20 Hz)	240 µV/V + 4 mV	
	(20 Hz to 40 Hz)	90 µV/V + 1.5 mV	
	(40 Hz to 20 kHz)	52 µV/V + 0.6 mV	
	(20 kHz to 50 kHz)	80 µV/V + 1 mV	
	(50 kHz to 100 kHz)	150 µV/V + 2.5 mV	
	(100 kHz to 300 kHz)	900 µV/V + 16 mV	
	(300 kHz to 500 kHz)	4400 µV/V + 40 mV	
	(500 kHz to 1 MHz)	8000 µV/V + 80 mV	
	220 V to 1100 V		
	(15 Hz to 50 Hz)	300 µV/V + 16 mV	
	(50 Hz to 1 kHz)	70 µV/V + 3.5 mV	
	220 V to 750 V		
	(30 kHz to 50 kHz)	600 µV/V + 11 mV	
	(50 kHz to 500 kHz)	2300 µV/V + 45 mV	
	220 V to 1100 V		Fluke 5720A w/5725A
	(40 Hz to 1 kHz)	90 µV/V + 4 mV	
	(1 kHz to 20 kHz)	165 µV/V + 6 mV	
	(20 kHz to 30 kHz)	600 µV/V + 11 mV	

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
AC Voltage − Measure[4]	0 mV to 10 mV (1 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz)	 0.03 % + 3 µV 0.02 % + 1.1 µV 0.03 % + 1.1 µV 0.1 % + 1.1 µV 0.5 % + 1.1 µV 4 % + 2 µV	HP 3458A
	0 mV to 200 mV (1 Hz to 10 Hz) (10 Hz to 40 Hz) (40 Hz to 100 Hz) (100 Hz to 2 kHz) (2 kHz to 10 kHz) (10 kHz to 30 kHz) (30 kHz to 100 kHz)	 165 µV/V + 14 µV 140 µV/V + 4 µV 120 µV/V + 4 µV 110 µV/V + 2 µV 140 µV/V + 4 µV 340 µV/V + 8 µV 770 µV/V + 20 µV	Fluke 8508A
	10 mV to 100 mV (1 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz) (1 MHz to 2 MHz)	 0.007 % + 4 µV 0.007 % + 2 µV 0.014 % + 2 µV 0.03 % + 2 µV 0.08 % + 2 µV 0.3 % + 10 µV 1 % + 10 µV 1.5 % + 10 µV	HP 3458A
	100 mV to 1 V (1 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz) (1 MHz to 2 MHz)	 0.007 % + 40 µV 0.007 % + 20 µV 0.014 % + 20 µV 0.03 % + 20 µV 0.08 % + 20 µV 0.3 % + 100 µV 1 % + 100 µV 1.5 % + 100 µV	HP 3458A
	1 V to 10 V (1 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz) (1 MHz to 2 MHz)	 0.007 % + 400 µV 0.007 % + 200 µV 0.014 % + 200 µV 0.03 % + 200 µV 0.08 % + 200 µV 0.3 % + 1 mV 1 % + 1 mV 1.5 % + 1 mV	HP 3458A
	200 mV to 2 V (1 Hz to 10 Hz) (10 Hz to 40 Hz) (40 Hz to 100 Hz) (100 Hz to 2 kHz)	 150 µV/V + 120 µV 120 µV/V + 20 µV 90 µV/V + 20 µV 75 µV/V + 20 µV	Fluke 8508A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
AC Voltage – Measure[4] continued	200 mV to 2 V (2 kHz to 10 kHz) (10 kHz to 30 kHz) (30 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz)	 110 µV/V + 20 µV 220 µV/V + 40 µV 570 µV/V + 200 µV 0.3 % + 2 mV 1 % + 20 mV	Fluke 8508A
	2 V to 20 V (1 Hz to 10 Hz) (10 Hz to 40 Hz) (40 Hz to 100 Hz) (100 Hz to 2 kHz) (2 kHz to 10 kHz) (10 kHz to 30 kHz) (30 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz)	 150 µV/V + 1.2 mV 120 µV/V + 200 µV 90 µV/V + 200 µV 75 µV/V + 200 µV 110 µV/V + 200 µV 220 µV/V + 400 µV 570 µV/V + 2 mV 0.3 % + 20 mV % + 200 mV	Fluke 8508A
	20 V to 200 V (1 Hz to 10 Hz) (10 Hz to 40 Hz) (40 Hz to 100 Hz) (100 Hz to 2 kHz) (2 kHz to 10 kHz) (10 kHz to 30 kHz) (30 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz)	 150 µV/V + 12 mV 120 µV/V + 2 mV 90 µV/V + 2 mV 75 µV/V + 2 mV 110 µV/V + 2 mV 220 µV/V + 4 mV 570 µV/V + 20 mV 0.3 % + 200 mV % + 2 V	Fluke 8508A
	10 V to 100 V (1 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz) (100 kHz to 300 kHz) (300 kHz to 1 MHz)	 0.02 % + 4 mV 0.02 % + 2 mV 0.02 % + 2 mV 0.035 % + 2 mV 0.12 % + 2 mV 0.4 % + 10 mV 1.5 % + 10 mV	HP 3458A
	100 V to 700 V (1 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 20 kHz) (20 kHz to 50 kHz) (50 kHz to 100 kHz)	 0.04 % + 28 mV 0.04 % + 14 mV 0.06 % + 14 mV 0.12 % + 14 mV 0.3 % + 14 mV	HP 3458A
	200 V to 1050 V (1 Hz to 10 Hz) (10 Hz to 40 Hz) (40 Hz to 10 kHz) (10 kHz to 30 kHz) (30 kHz to 100 kHz)	 150 µV/V + 70 mV 120 µV/V + 20 mV 115 µV/V + 20 mV 225 µV/V + 40 mV 580 µV/V + 200 mV	Fluke 8508A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
AC Voltage – Measure[4] continued	0 kV to 2 kV (20 Hz to 100 Hz) (100 Hz to 400 Hz) (2 kV to 20 kV) 20 Hz to 100 Hz	 0.07 % + 2 V 0.4 % + 4 V 0.2 % + 20 V	Vitrek 4620B
AC Voltage – Measure[4] (AC Band >2 MHz)	0 to 10 mV (45 Hz to 100 kHz) (100 kHz to 1 MHz) (1 MHz to 4 MHz) (4 MHz to 8 MHz) 10 mV to 100 mV (45 Hz to 100 kHz) (100 kHz to 1 MHz) (1 MHz to 4 MHz) (4 MHz to 8 MHz) (8 MHz to 10 MHz) 100 mV to 1 V (45 Hz to 100 kHz) (100 kHz to 1 MHz) (1 MHz to 4 MHz) (4 MHz to 8 MHz) (8 MHz to 10 MHz) 1 V to 10 V (45 Hz to 100 kHz) (100 kHz to 1 MHz) (1 MHz to 4 MHz) (4 MHz to 8 MHz) (8 MHz to 10 MHz) 10 to 100 V (45 Hz to 100 kHz) 100 to 700 V (45 Hz to 100 kHz)	 0.09 % + 6 µV 1.2 % + 5 µV 7 % + 7 µV 20 % + 8 µV 0.09 % + 60 µV 2 % + 50 µV 4 % + 70 µV 4 % + 80 µV 15 % + 100 µV 0.09 % + 600 µV 2 % + 500 µV 4 % + 700 µV 4 % + 800 µV 15 % + 1 mV 0.09 % + 6 mV 2 % + 5 mV 4 % + 7 mV 4 % + 8 mV 15 % + 10 mV 0.12 % + 2 mV 0.3 % + 70 mV	HP 3458A
AC Voltage − Amplitude Flatness, Measure[4]	1 V to 2 V (10 Hz to 10 MHz) (10 MHz to 30 MHz) (30 MHz to 50 MHz) (50 MHz to 100 MHz)	 0.08 % 0.16 % 0.4 % 0.8 %	HP 3458A w/Fluke A55
AC Current – Generate[3]	1 nA to 220 µA (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz)	 250 µA/A + 16 nA 160 µA/A + 10 nA 120 µA/A + 8 nA 280 µA/A + 12 nA 1100 µA/A + 65 nA	Fluke 5720A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
AC Current – Generate[3] continued	220 µA to 2.2 mA (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz) 2.2 mA to 22 mA (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz) 22 mA to 220 mA (10 Hz to 20 Hz) (20 Hz to 40 Hz) (40 Hz to 1 kHz) (kHz 1 to 5 kHz) (5 kHz to 10 kHz) 220 mA to 2.2 A (20 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz) 2.2 A to 11 A (40 Hz to 1 kHz) (1 kHz to 5 kHz) (5 kHz to 10 kHz)	 250 µA/A + 40 nA 160 µA/A + 35 nA 120 µA/A + 35 nA 200 µA/A + 110 nA 1100 µA/A + 650 nA 250 µA/A + 400 nA 160 µA/A + 350 nA 120 µA/A + 350 nA 200 µA/A + 550 nA 1100 µA/A + 5 µA 250 µA/A + 4 µA 160 µA/A + 3.5 µA 120 µA/A + 2.5 µA 200 µA/A + 3.5 µA 1100 µA/A + 10 µA 260 µA/A + 35 µA 450 µA/A + 80 µA 7000 µA/A + 160 µA 460 µA/A + 170 µA 950 µA/A + 380 µA 3600 µA/A + 750 µA	Fluke 5720A Fluke 5720A w/5725A
	1 A to 20 A) (0 Hz to 5 kHz)	 0.025 % + (0.012 %*F) of RDG (F is frequency in kHz)	Shepherd Scientific 100 w/Fluke Y5020
	20 A to 100 A (0 Hz to 1 kHz)	 0.1 A	Shepherd Scientific 100 w/Valhalla 2575A
	11 A to 20.5 A (45 Hz to 100 Hz) (100 Hz to 1 kHz) (1 kHz to 5 kHz)	 0.12 % + 5 mA 0.15 % + 5 mA 3 % + 5 mA	Fluke 5520A
	0 A to 1000 A (45 Hz to 440 Hz)	 0.28 % + 0.11 A	Fluke 5520A w/50 turn coil

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
AC Current – Measure[4]	0 µA to 100 µA		HP 3458A
	(10 Hz to 20 Hz)	0.4 % + 30 nA	
	(20 Hz to 45 Hz)	0.15 % + 30 nA	
	(45 Hz to 5 kHz)	0.06 % + 30 nA	
	100 µA to 1 mA		
	(10 Hz to 20 Hz)	0.4 % + 200 nA	
	(20 Hz to 45 Hz)	0.15 % + 200 nA	
	(45 Hz to 100 Hz)	0.06 % + 200 nA	
	(100 Hz to 5 kHz)	0.03 % + 200 nA	
	(5 kHz to 20 kHz)	0.06 % + 200 nA	
	(20 kHz to 50 kHz)	0.4 % + 400 nA	
	(50 kHz to 100 kHz)	0.55 % + 1.5 µA	
	1 mA to 10 mA		
	(10 Hz to 20 Hz)	0.4 % + 2 µA	
	(20 Hz to 45 Hz)	0.15 % + 2 µA	
	(45 Hz to 100 Hz)	0.06 % + 2 µA	
	(100 Hz to 5 kHz)	0.03 % + 2 µA	
	(5 kHz to 20 kHz)	0.06 % + 2 µA	
	(20 kHz to 50 kHz)	0.4 % + 4 µA	
	(50 kHz to 100 kHz)	0.55 % + 15 µA	
	10 mA to 100 mA		
	(10 Hz to 20 Hz)	0.4 % + 20 µA	
	(20 Hz to 45 Hz)	0.15 % + 20 µA	
	(45 Hz to 100 Hz)	0.06 % + 20 µA	
	(100 Hz to 5 kHz)	0.03 % + 20 µA	
	(5 kHz to 20 kHz)	0.06 % + 20 µA	
	(20 kHz to 50 kHz)	0.4 % + 40 µA	
	(50 kHz to 100 kHz)	0.55 % + 150 µA	
	0 µA to 200 µA		Fluke 8508A
	(1 Hz to 10 Hz)	310 µA/A + 20 nA	
	(10 Hz to 10 kHz)	300 µA/A + 20 nA	
	(10 kHz to 30 kHz)	710 µA/A + 20 nA	
	(30 kHz to 100 kHz)	0.4 % + 20 nA	
	200 µA to 2 mA		
	(1 Hz to 10 Hz)	310 µA/A + 200 nA	
	(10 Hz to 10 kHz)	300 µA/A + 200 nA	
	(10 kHz to 30 kHz)	710 µA/A + 200 nA	
	(30 kHz to 100 kHz)	0.4 % + 200 nA	
	2 mA to 20 mA		
	(1 Hz to 10 Hz)	310 µA/A + 2 µA	
	(10 Hz to 10 kHz)	300 µA/A + 2 µA	
	(10 kHz to 30 kHz)	710 µA/A + 2 µA	
	(30 kHz to 100 kHz)	0.4 % + 2 µA	

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
AC Current – Measure[4] continued	20 mA to 200 mA (1 Hz to 10 Hz) (10 Hz to 10 kHz) (10 kHz to 30 kHz)	 310 µA/A + 20 µA 290 µA/A + 20 µA 630 µA/A + 20 µA	Fluke 8508A
	100 mA to 1 A (10 Hz to 20 Hz) (20 Hz to 45 Hz) (45 Hz to 100 Hz) (100 Hz to 5 kHz) (5 kHz to 20 kHz) (20 kHz to 50 kHz)	 0.4 % + 200 µA 0.16 % + 200 µA 0.08 % + 200 µA 0.1 % + 200 µA 0.3 % + 200 µA 1 % + 400 µA	HP 3458A
	200 mA to 2 A (10 Hz to 2 kHz) (2 kHz to 10 kHz) (10 kHz to 30 kHz) 2 A to 20 A (10 Hz to 2 kHz) (2 kHz to 10 kHz)	 620 µA/A + 200 µA 725 µA/A + 200 µA 0.3 % + 200 µA 820 µA/A + 2 mA 0.25 % + 2 mA	Fluke 8508A
	1 A to 20 A (DC to 5 kHz)	 0.025 % + (0.012 %*F) of RDG where F is frequency in kHz	Fluke Y5020
	20 A to 100 A (DC to 1 kHz)	 0.1 A	Valhalla 2575A
AC Resistance – Generate[3]	10 Ω (DC to 1 MHz) (1 MHz to 2 MHz) (2 MHz to 3 MHz) (3 MHz to 4 MHz) (4 MHz to 5 MHz) (5 MHz to 10 MHz) (10 MHz to 13 MHz) 100 Ω (DC to 1 MHz) (1 MHz to 2 MHz) (2 MHz to 3 MHz) (3 MHz to 4 MHz) (4 MHz to 5 MHz) 100 Ω (5 MHz to 10 MHz) (10 MHz to 13 MHz)	 0.13 % 0.14 % 0.16 % 0.17 % 0.2 % 0.5 % 0.7 % 0.13 % 0.14 % 0.15 % 0.15 % 0.15 % 0.3 % 0.4 %	HP 42030 resistor set

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
AC Resistance – Generate[3] continued	1 kΩ (DC to 100 kHz) (100 kHz to 1 MHz) (1 MHz to 2 MHz) (2 MHz to 3 MHz) (3 MHz to 4 MHz) (4 MHz to 5 MHz) (5 MHz to 10 MHz) (10 MHz to 13 MHz) 10 kΩ (DC to 100 kHz) (100 kHz to 1 MHz) 100 kΩ (DC to 100 kHz) (100 kHz to 1 MHz)	 0.13 % + 0.2 Ω 0.13 % + 0.2 Ω 0.13 % + 0.2 Ω 0.13 % + 0.2 Ω 0.14 % + 0.2 Ω 0.15 % + 0.2 Ω 0.3 % + 0.2 Ω 0.4 % + 0.2 Ω 0.12 % + 2 Ω 0.13 % + 2 Ω 0.13 % + 20 Ω 0.13 % + 20 Ω	HP 42030 resistor set
AC Resistance – Measure[4]	10 mΩ to 100 MΩ (20 Hz to 1 MHz)	 0.05 %	HP 4284A
AC Power – Generate[3] (45 Hz to 65 Hz)	 33 mV to 330 mV (3.3 mA to 8.999 mA) (9 mA to 32.999 mA) (33 mA to 89.99 mA) (90 mA to 329.99 mA) (330 mA to 0.8999 A) (0.9 A to 2.1999 A) (2.2 A to 4.4999 A) (4.5 A to 20.5 A) 330 mV to 1020 V (3.3 mA to 8.999 mA) (9 mA to 32.999 mA) (33 mA to 89.99 mA) (90 mA to 329.99 mA) (330 mA to 0.8999 A) (0.9 A to 2.1999 A) (2.2 A to 4.4999 A) (4.5 A to 20.5 A)	(% of output in Watts) 0.14 % 0.1 % 0.14 % 0.1 % 0.13 % 0.11 % 0.13 % 0.11 % 0.12 % 0.08 % 0.12 % 0.08 % 0.11 % 0.09 % 0.12 % 0.1 %	Fluke 5520A
Capacitance – Generate[3]	0.19 nF to 1.0999 nF (10 Hz to 10 kHz) 1.1 nF to 3.2999 nF (10 Hz to 3 kHz) 3.3 nF to 10.9999 nF (10 Hz to 1 kHz)	 0.5 % + 0.01 nF 0.5 % + 0.01 nF 0.25 % + 0.01 nF	Fluke 5520A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Capacitance – Generate[3] continued	11 nF to 109.999 nF (10 Hz to 1 kHz)	0.25 % + 0.1 nF	Fluke 5520A
	110 nF to 329.999 nF (10 Hz to 1 kHz)	0.25 % + 0.3 nF	
	330 nF to 1.09999 µF (10 Hz to 600 Hz)	0.25 % + 1 nF	
	1.1 µF to 3.29999 µF (10 Hz to 300 Hz)	0.25 % + 3 nF	
	3.3 µF to 10.9999 µF (10 Hz to 150 Hz)	0.25 % + 10 nF	
	11 µF to 32.9999 µF (10 Hz to 120 Hz)	0.4 % + 30 nF	
	33 µF to 109.999 µF (10 Hz to 80 Hz)	0.45 % + 100 nF	
	110 µF to 329.999 µF (0 Hz to 50 Hz)	0.45 % + 300 nF	
	330 µF to 1.09999 mF (0 Hz to 20 Hz)	0.45 % + 1 µF	
	1.1 mF to 3.2999 mF @ 0 Hz to 6 Hz	0.45 % + 3 µF	
	3.3 mF to 10.9999 mF (0 Hz to 2 Hz)	0.45 % + 10 µF	
	11 mF to 32.9999 mF (0 Hz to 0.6 Hz)	0.75 % + 30 µF	
	33 mF to 110 mF (0 Hz to 0.2 Hz)	1.1 % + 100 µF	
Capacitance – Generate[3], Fixed Points	1 pF, 10 pF, 100 pF, 1000 pF (20 Hz to 1 MHz)	0.05 %	HP 1638x series
	100 pF to 1 µF (100 Hz to 100 kHz)	0.05 %	Arco SS32 set
	1 µF to 1 F (100 Hz to 1 kHz)	0.25 %	GenRad 1417
Capacitance – Measure[4]	0.1 pF to 10 F (20 Hz to 1 MHz)	0.05 %	HP 4284A

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Inductance – Generate[3], Fixed Values	100 µH to 10 H (100 Hz to 10 kHz)	0.05 %	GenRad 1482x series
Inductance − Measure[4]	0.01 nH to 100 kH (20 Hz to 1 MHz)	0.05 %	HP 4284A
Oscilloscopes Voltage Function - DC Signal (50 Ω)	±1 mV to ±5 V	0.025 % + 25 µV	Fluke 9500B w/9530
Oscilloscopes Voltage Function - DC Signal (1 MΩ)	±1 mV to ±200 V	0.025 % + 25 µV	
Square Wave Signal (<10 kHz) (50 Ω)	40 µVp-p to 5 Vp-p ≥1 mV ≤1 mV	 0.1 % + 10 µV 1.0 % + 10 µV	
Square Wave Signal (<10 kHz) (1 MΩ)	40 µV p-p to 200 Vp-p ≥1 mV ≤1 mV	 0.1 % + 10 µV 1.0 % + 10 µV	
Square Wave Frequency	10 Hz to 100 kHz	0.25 µHz/Hz	
Edge Function - Rise/Fall Time	150 ps (Fast Edge) 500 ps (Edge)	15 ps 40 ps	
Edge Amplitude	5 mVp-p to 3 Vp-p	2 %	
HV Edge Amplitude	1 Vp-p to 5 Vp-p (50 Ω) 1 Vp-p to 200 Vp-p (1 MΩ)	2 % 2 %	
Edge Frequency	10 kHz to 2 MHz	0.25 µHz/Hz	
HV Edge Frequency	10 Hz to 100 kHz	0.25 µHz/Hz	
Leveled Sine Function - Leveled Sine Amplitude (Single Ref Frequency 50 kHz to 10 MHz)	 5 mVp-p to 5 Vp-p (0.1 Hz to 550 MHz 5 mVp-p to 3 Vp-p (550 MHz to 2.5 GHz) 5 mVp-p to 2 Vp-p (2.5 GHz to 3.2 GHz)	(@ single reference frequency) 1.5 % 1.5 % 1.5 %	

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Leveled Sine Flatness with reference to frequency	(into VSWR of 1.6:1) 0.1 Hz to 300 MHz 300 MHz to 550 MHz 550 MHz to 1.1 GHz 1.1 GHz to 3.2 GHz (into VSWR of 1.2:1) 0.1 Hz to 300 MHz 300 MHz to 550 MHz 550 MHz to 1.1 GHz 1.1 GHz to 3.2 GHz	 4 % 4 % 5 % 5 % 2 % 2.5 % 3.5 % 4 %	Fluke 9500B w/9530
Timing Marker Function - Square Pulse and Narrow Triangle Sine	 9.0091 ns to 55 s 900.91 ns to 55 s 450.5 ps to 9.009 ns	 0.25 µs/s 0.25 µs/s 0.25 µs/s	
Input Impedance Function -Resistance Measurement	10 Ω to 40 Ω 40 Ω to 90 Ω 90 Ω to 150 Ω 50 k Ω to 800 kΩ 800 kΩ to 1.2 MΩ 1.2 MΩ to 12 MΩ	0.5 % 0.1 % 0.5 % 0.5 % 0.1 % 0.5 %	
Input Impedance Function – Capacitance Measurement	1 pF to 35 pF 35 pF to 95 pF	2 % + 0.25 pF 3 % + 0.25 pF	
Pulse Width Function	1 ns to 100 ns	5 % + 200 ps	
Current Output Function DC Signal Square Wave Signal @ 1 kHz	 ±100 µA to ±100 mA ±100 µAp-p to ±100 mAp-p	 0.25 % + 0.5 µA 0.25 % + 0.5 µA	
Time and Frequency			
Timers/Stop Watches	0.001 s to 99999.999 s	0.001 %	VWR 62344-880
	5 mHz to 500 MHz	5×10^{-12}	HP 5345A, Fluke 910R as external time base
Frequency – Generate[3]	0.1 MHz, 1 MHz, 5 MHz, 10 MHz	1×10^{-12}	Fluke 910R
	1 Hz to 20 MHz	5×10^{-12}	HP 3325B, Fluke 910R as external time base
	10 MHz to 26.5 GHz	5×10^{-12}	HP 8340B, Fluke 910R as external time base

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Frequency − Measure[4]	5 mHz to 500 MHz (100 s to 10 s Gate Time)	5×10^{-12}	HP 5345A, Fluke 910R as external time base
	0.4 GHz to 1.5 GHz	5×10^{-12}	HP 5345A, HP 5355A, Fluke 910R as external time base
	1.5 GHz to 26.5 GHz	5×10^{-12}	HP 5345A, HP 5355A, HP 5356B, Fluke 910R as external time base
RF/Microwave and Electromagnetics			
Amplitude Modulation – Measure[4]			HP 8902A w/HP 11793A (using peak detector)
(150 kHz to 10 MHz)	Rate: 50 Hz to 10 kHz Depth: 5 % to 99 %	2 % + 1 digit	
	Rate: 20 Hz to 10 kHz Depth: 5 % to 99 %	3 % + 1 digit	
(10 MHz to 1300 MHz)	Rate: 50 Hz to 50 kHz Depth: 5 % to 99 %	1 % + 1 digit	
	Rate: 20 Hz to 20 kHz Depth: 5 % to 99 %	3 % + 1 digit	
(1.3 GHz to 26.5 GHz)	Rate: 50 Hz to 50 kHz Depth: 5 % to 99 %	1.5 % + 1 digit	
	Rate: 20 Hz to 100 kHz Depth: 5 % to 99 %	3 % + 1 digit	
Frequency Modulation – Measure[4]			
(250 kHz to 10 MHz)	Rate: 20 Hz to 10 kHz Deviation: 40 kHz peak	2 % + 1 digit	
(10 MHz to 1.3 GHz)	Rate: 50 Hz to 100 kHz Deviation: 400 kHz peak	1 % + 1 digit	
	Rate: 20 Hz to 200 kHz Deviation: 400 kHz peak	5 % + 1 digit	
(1.3 GHz to 26.5 GHz)	Rate: 50 Hz to 100 kHz Deviation: 400 kHz peak	1 % + 1 digit	
	Rate: 20 Hz to 200 kHz Deviation: 40 kHz peak	5 % + 1 digit	
Amplitude Modulation − Flatness Measure[4] 10 MHz to 1.3 GHz Carrier Frequency	Rate: 90 Hz to 10 kHz Depth: 20 % to 80 %	0.3 % + 1 digit	HP 8902A w/HP 11793A (using peak detector)

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Modulation Residual AM – Measure[4] 50 Hz to 3 kHz BW	0 % rms to 100 % rms	0.01 % rms	HP 8902A
Modulation Residual FM – Measure[4] 50 Hz to 3 kHz BW	≤100 MHz	1 Hz_{rms}	
	1300 MHz	0.58 Hz_{rms} + 0.0058 Hz_{rms}/MHz	
Phase Modulation – Measure[4]	(150 kHz to 10 MHz) 200 Hz to 10 kHz (10 MHz to 1.3 GHz) 200 Hz to 20 kHz (1.3 GHz to 26.5 GHz) 200 Hz to 20 kHz	 4 % + 1 digit 3 % + 1 digit 3 % + 1 digit	HP 8902A w/HP 11793A (using peak detector)
Noise Measurement[4] (Distortion Harmonics <330 kHz)	20 Hz to 20 kHz 20 kHz to 100 kHz	1 dB 2 dB	HP 8903B
Single Side Band Phase Noise (SSB)	10 MHz to 1300 MHz	1 dB	HP 8902A-030, 037
Frequency – Generate[3]	10 MHz to 26.5 GHz	5 X 10^{-12}	HP 8340B, Fluke 910R as external time base
Attenuators – Generate[3]	(200 Hz to 80 MHz) 0 dB to 18 dB 20 dB to 58 dB 60 dB to 98 dB	 0.04 dB 0.09 dB 0.20 dB	HP 3335A
	(DC to 18 GHz) 1 dB 2 dB 3 dB to 6 dB 7 dB to 8 dB 9 dB 10 dB 11 dB (18 GHz to 26.5 GHz) 1 dB 2 dB 3 dB to 6 dB 7 dB to 8 dB 9 dB 10 dB 11 dB	 0.35 dB 0.45 dB 0.55 dB 0.60 dB 0.65 dB 0.70 dB 0.80 dB 0.40 dB 0.50 dB 0.70 dB 0.80 dB 0.85 dB 0.90 dB 1.10 dB	Agilent 84904K, APC 3.5 mm connector

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Attenuators – Generate[3] continued	(DC to 6 GHz)		HP 8497K, APC 3.5 mm connector
	10 dB	0.3 dB	
	20 dB	0.5 dB	
	30 dB	0.6 dB	
	40 dB	0.7 dB	
	50 dB	0.8 dB	
	60 dB	1.0 dB	
	70 dB to 80 dB	1.1 dB	
	90 dB	1.2 dB	
	(6 GHz to 12.4 GHz)		
	10 dB	0.4 dB	
	20 dB	0.5 dB	
	30 dB	0.7 dB	
	40 dB	0.9 dB	
	50 dB	1.0 dB	
	60 dB	1.3 dB	
	70 dB	1.5 dB	
	80 dB	1.6 dB	
	90 dB	1.7 dB	
	20 dB	0.6 dB	
	30 dB	0.8 dB	
	40 dB	1.1 dB	
	50 dB	1.2 dB	
	60 dB	1.4 dB	
	70 dB	1.7 dB	
	80 dB	1.8 dB	
	90 dB	2.1 dB	
	(18 GHz to 26.5 GHz)		
	10 dB	0.7 dB	
	20 dB	0.8 dB	
	30 dB	1.0 dB	
	40 dB	1.5 dB	
	50 dB	1.6 dB	
	60 dB	1.9 dB	
	70 dB	2.3 dB	
	80 dB	2.5 dB	
	90 dB	2.8 dB	

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Attenuators − Measure[4]	(100 kHz to 26.5 GHz) 0 dB to -20 dB -20 dB to -40 dB -40 dB to -60 dB -60 dB to -80 dB -80 dB to -100 dB -100 dB to -127 dB	 0.05 dB + M 0.18 dB + M 0.20 dB + M 0.24 dB + M 0.28 dB + M 0.35 dB + M Where M is the mismatch uncertainty, which has the following best-case values: 100 kHz to 6 GHz—0.02 dB, 6 GHz to 26.5 GHz--0.07 dB	HP 8902A w/11722A and 11793A
Power − Generate[3] (into 50 Ω)	(0.001 Hz to 100 kHz) -56.02 dBm to 13.52 dBm 13.52 dBm to 23.98 dBm (100 kHz to 10 MHz) -56.02 dBm to +13.52 dBm (10 MHz to 20 MHz) -56.02 dBm to -16.02 dBm -16.02 dBm to +13.52 dBm (100 kHz to 20 MHz) 13.52 dBm to 23.98 dBm	 0.2 dB 0.1 dB 0.6 dB 0.9 dB 0.6 dB 0.4 dB	HP 3325B (sinewave 0 dB attenuation, BNC connector)
	(0.01 GHz to 3 GHz) +10 dBm to -9.95 dBm -10 dBm to -19.95 dBm -20 dBm to -49.95 dBm -50 dBm to -79.95 dBm -80 dBm to -100 dBm (2.3 GHz to 20 GHz) +18 dBm to +10 dBm +10 dBm to -9.95 dBm -10 dBm to -19.95 dBm -20 dBm to -49.95 dBm -50 dBm to -79.95 dBm -80 dBm to -100 dBm (20 GHz to 26.5 GHz) +18 dBm to +10 dBm +10 dBm to -9.95 dBm	 0.9 dBm 1.2 dBm 1.5 dBm 1.8 dBm 2.1 dBm 1.8 dBm 1.5 dBm 2.0 dBm 2.3 dBm 2.6 dBm 2.9 dBm 2.3 dBm 2.0 dBm	HP 8340B, internally leveled Type N connector

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
Power − Generate[3] (into 50 Ω) continued	(20 GHz to 26.5 GHz) -10 dBm to -19.95 dBm -20 dBm to -49.95 dBm -50 dBm to -79.95 dBm -80 dBm to -100 dBm	 2.5 dBm 2.8 dBm 3.1 dBm 3.4 dBm	HP 8340B, internally leveled Type N connector
Power − Measure[3]	(100 kHz to 4.2 GHz) +10 dBm to +20 dBm -30 dBm to +10 dBm	 0.02 dB 0.02 dB	HP 437B, assuming VSWR of calibration item of 1:1 with 8482A
	(50 MHz to 26.5 GHz) -30 dBm to +20 dBm	 0.02 dB	HP 437B with 8485A
Return Loss – Measure[4] (into 50 Ω)	(10 MHz to 8.4 GHz) 10 dB 20 dB 30 dB 40 dB (8.4 GHz to 12.4 GHz) 10 dB 20 dB 30 dB 40 dB (12.4 GHz to 20 GHz) 10 dB 20 dB 30 dB 40 dB (20 GHz to 26.5 GHz) 10 dB 20 dB 30 dB 40 dB	 1.3 dB 1.5 dB 1.5 dB 1.5 dB 1.3 dB 1.5 dB 1.5 dB 1.5 dB 1.3 dB 1.5 dB 1.6 dB 1.6 dB 1.5 dB 1.6 dB 1.7 dB 1.7 dB	HP 85021B w/8755C and 8340B
Harmonic and Non-Harmonic Amplitude Measure[4] 0.02 Hz to 25.5 kHz	+30 dBV to -120 dBV	0.6 dB	HP 3582A
Harmonic and Non-Harmonic Amplitude Measure[4] (9 kHz to 25 GHz)	0 dB to 60 dB Reference Level (Log Scale) (Linear Scale) -60 dB to -70 dB Reference Level (Log Scale) (Linear Scale)	 0.75 dB 3% 1 dB 3%	HP 8592B
Chemical/Gas			

MEASURED QUANTITY or DEVICE TYPE CALIBRATED	RANGE	UNCERTAINTY[1,2] (±)	CALIBRATION PROCEDURE AND/OR STANDARD EQUIPMENT USED
pH - Generate[3]	4 units 7 units 10 units	0.002 units 0.002 units 0.005 units	Solutions

[1]The uncertainty covered by the Calibration and Measurement Capability (CMC) is expressed as the expanded uncertainty having a coverage probability of approximately 95 %. It is the smallest measurement uncertainty that a laboratory can achieve within its scope of accreditation when performing calibrations of a best existing device. The measurement uncertainty reported on a calibration certificate may be greater than that provided in the CMC due to the behavior of the calibration item and other factors that may contribute to the uncertainty of a specific calibration.

[2]When uncertainty is stated in relative terms (such as percent, a multiplier expressed as a decimal fraction or in scientific notation), it is in relation to instrument reading or instrument output, as appropriate, unless otherwise indicated.

[3]Capability is suitable for the calibration of measuring devices in the stated ranges.

[4]Capability is suitable for the calibration of devices intended to generate the indicated quantity in the stated ranges.

[5]g = acceleration due to gravity

RDG = reading
BW = bandwidth
p-p = peak to peak
HV = high voltage
VSWR = voltage standing wave ratio