



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Technical Maintenance, Inc.
12530 Telecom Drive
Temple Terrace, FL 33637
(and satellite sites as shown on the scope)

Fulfills the requirements of

ISO/IEC 17025:2017

and national standards

ANSI/NCSL Z540-1-1994 (R2002) and
ANSI/NCSL Z540.3-2006 (R2013)

In the field (s) of

CALIBRATION and DIMENSIONAL MEASUREMENT

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

Jason Stine, Vice President

Expiry Date: 20 September 2025

Certificate Number: AC-2080



This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory
quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).



ASCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

AND

ANSI/NCSL Z540-1-1994 (R2002)

ANSI/NCSL Z540.3-2006 (R2013)

Technical Maintenance, Inc.

12530 Telecom Drive

Temple Terrace, FL 33637

Wally Gynn (Branch Manager) Phone: 813-978-3054

Scott Chamberlain (Quality Manager) Phone: 321-242-0890

CALIBRATION AND DIMENSIONAL MEASUREMENT

Valid to: **September 20, 2025**

Certificate Number: **AC-2080**

Satellite locations in:

[Peachtree Corners, GA](#)

[Madison, AL](#)

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CALIBRATION AND DIMENSIONAL MEASUREMENT

CALIBRATION

Acoustics and Vibration

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometers – Acceleration (7 < 10) Hz (10 < 30) Hz (30 < 2000) Hz (2 to 10) kHz	(0.01 to 10) g	2 % of reading 1.5 % of reading 1 % of reading 2.5 % of reading	Comparison to Accelerometer Calibrator

Chemical Quantities

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH meters ^{1,5}	4 pH 7 pH 10 pH	0.018 pH 0.036 pH 0.069 pH	Comparison to pH buffer solutions
Conductivity Meters ^{1,5}	2 µS/cm 100 µS/cm 1 000 µS/cm 10 000 µS/cm 100 000 µS/cm 150 000 µS/cm	0.2 µS/cm 0.74 µS/cm 3.6 µS/cm 35 µS/cm 350 µS/cm 580 µS/cm	Comparison to Conductivity solutions

Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Phase Angle – Generate 5 V Equal Amplitude	(0 to 360)° 1 Hz to 1 kHz (1 to 6.25) kHz (6.25 to 50) kHz (50 to 200) kHz	0.005° 0.01° 0.015° 0.04°	Comparison to Clarke-Hess 5600 Phase Standard
Phase Angle – Generate 50 mV to 120 V– Unequal Amplitude	(0 to 360)° 1 Hz to 1 kHz (1 to 6.25) kHz (6.25 to 50) kHz (50 to 200) kHz	0.005° 0.01° 0.015° 0.04°	Comparison to Clarke-Hess 5600 Phase Standard
Phase Angle – Measure 10 mV to 630 V	(0 to 360)° 5 Hz to 2 kHz (2 to 5) kHz (5 to 10) kHz (10 to 50) kHz (50 to 100) kHz (100 to 200) kHz	0.02° 0.03° 0.04° 0.05° 0.1° 0.2°	Comparison to Clarke-Hess 6000A Phase Meter
Phase Angle – Measure 50 mV to 120 V	(0 to 360) ° 1 Hz to 1 kHz (1 to 50) kHz	0.001° 0.002°	Comparison to Clarke-Hess 5002A Phase Meter
	(1 to 50) kHz (50 to 200) kHz	0.002° 0.008°	Clarke-Hess 5002B Phase Meter
	(5 to 50) kHz (50 to 200) kHz	0.002° 0.008°	Clarke-Hess 5002C Phase Meter
	(5 to 50) kHz (50 to 200) kHz	0.002° 0.008°	Clarke-Hess 5002D Phase Meter
DC Current – Generate ¹	(1 to 1.2) nA (1.2 to 12) nA (12 to 120) nA (0.12 to 1.2) µA (1.2 to 10) µA	92 µA/A + 0.007 nA 92 µA/A + 0.007 nA 92 µA/A + 0.01 nA 36 µA/A + 0.1 nA 13 µA/A + 1 nA	Comparison to Fluke 5730A Multifunction Calibrator & Fluke 5560A Multiproduct Calibrator
DC Current – Generate ¹	(10 to 220) µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA (0.22 to 1) A (1 to 2.2) A	38 µA/A + 5 nA 30 µA/A + 7 nA 30 µA/A + 44 nA 38 µA/A + 0.7 µA 45 µA/A + 0.7 µA 68 µA/A + 12 µA 105 µA/A + 12 µA	Comparison to Fluke 5730A Multifunction Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Generate ¹	(2.2 to 3.1) A (3.1 to 12) A	228 μ A/A + 115 μ A 228 μ A/A + 191 μ A	Comparison to Fluke 5560A Multiproduct Calibrator
DC Current – Generate ¹	(12 to 20) A (20 to 100) A	76 μ A/A + 0.76 mA 76 μ A/A + 4.6 mA	Comparison to Fluke 5560A Multiproduct Calibrator /52120A Transconductance Amplifier
DC Current Clamp Meters Toroidal-Wound	(0.6 to 600) A (600 to 1 000) A	0.19 % of output + 0.04A 0.2 % of output + 0.04A	Comparison to Fluke 5560A Multiproduct Calibrator /Coil5500A x50
DC Current Clamp Meters Other	(0.6 to 600) A (600 to 1 000) A	0.38 % of output + 0.38A 0.39 % of output + 0.38A	Comparison to Fluke 5560A Multiproduct Calibrator /Coil5500A x50
DC Current – Measure ¹	(1 to 10) nA (10 to 100) nA (0.1 to 1) μ A (1 to 10) μ A (10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA	18.3 μ A/A + 0.15 pA 6 μ A/A + 1.5 pA 4.8 μ A/A + 0.015 nA 4.4 μ A/A + 0.015 nA 4.4 μ A/A + 0.15 nA 4.4 μ A/A + 0.0015 μ A 4.4 μ A/A + 0.015 μ A 9.9 μ A/A + 0.15 μ A	Comparison to Agilent 3458A Multimeter Option 002, 5450A Resistance Calibrator
DC Current – Measure ¹	(10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	13 μ A/A + 0.5 nA 13 μ A/A + 3 nA 13 μ A/A + 0.03 μ A 23 μ A/A + 0.3 μ A 72 μ A/A + 6.6 μ A	Comparison to Agilent 3458A Multimeter
DC Current – Measure ¹	(1 to 10) A (10 to 100) A (100 to 300) A	7.3 μ A/A + 3.4 μ A 7.3 μ A/A + 34 μ A 7.3 μ A/A + 344 μ A	Comparison to Agilent 3458A Multimeter Option 002, MI 6311A Current Divider
DC Current – Measure ¹	(300 to 1 000) A	0.25 % of reading + 8 mA	Comparison to Agilent 3458A Multimeter Option 002, Empro 1000A Current Shunt
DC Voltage – Generate ¹	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	6.8 μ V/V + 0.8 μ V 4.6 μ V/V + 0.9 μ V 3 μ V/V + 2.5 μ V 3 μ V/V + 3.9 μ V 4.6 μ V/V + 38 μ V 6.1 μ V/V + 385 μ V	Comparison to Fluke 5730A Multifunction Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure ¹	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1 000) V	3.3 μ V/V + 1 μ V 2.6 μ V/V + 1 μ V 2.6 μ V/V + 1.5 μ V 3.9 μ V/V + 20 μ V 3.9 μ V/V + 66 μ V + 12 μ V/V x (Vin/1 000) ^2	Comparison to Agilent 3458A Option 002 Multimeter
DC Voltage – Measure ¹	(1 to 60) kV	0.035 % of reading	Comparison to Ross VD60 High Voltage Divider, Agilent 3458A Multimeter
DC Voltage – Measure ¹	(12 to 120) kV	0.018 % of reading	Comparison to Ross VD120 High Voltage Divider, Agilent 3458A Multimeter
DC Voltage – Measure ¹ Fixed Points	100 mV 1 V 10 V 100 V 1 000 V	3.1 μ V/V 0.46 μ V/V 0.3 μ V/V 0.34 μ V/V 0.48 μ V/V	Comparison to Fluke 732B Reference Standard, 752A Divider
AC Voltage – Generate ¹	(0.22 to 2.2) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (2.2 to 22) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	228 μ V/V + 3.9 μ V 88 μ V/V + 3.9 μ V 76 μ V/V + 3.9 μ V 190 μ V/V + 3.9 μ V 457 μ V/V + 4.6 μ V 989 μ V/V + 9.2 μ V 1.3 mV/V + 19 μ V 2.6 mV/V + 19 μ V 228 μ V/V + 3.9 μ V 88 μ V/V + 3.9 μ V 76 μ V/V + 3.9 μ V 190 μ V/V + 3.9 μ V 457 μ V/V + 4.6 μ V 989 μ V/V + 9.2 μ V 1.3 mV/V + 19 μ V 2.6 mV/V + 19 μ V	Comparison to Fluke 5730A Multifunction Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(22 to 220) mV		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	228 $\mu\text{V/V} + 11.4 \mu\text{V}$	
	(20 to 40) Hz	88 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	40 Hz to 20 kHz	53 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	(20 to 50) kHz	114 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	(50 to 100) kHz	304 $\mu\text{V/V} + 15.2 \mu\text{V}$	
	(100 to 300) kHz	609 $\mu\text{V/V} + 19 \mu\text{V}$	
	(300 to 500) kHz	1.3 mV/V + 23 μV	
	500 kHz to 1 MHz	2.5 mV/V + 46 μV	
	220 mV to 2.2 V		
	(10 to 20) Hz	228 $\mu\text{V/V} + 38 \mu\text{V}$	
	(20 to 40) Hz	84 $\mu\text{V/V} + 15 \mu\text{V}$	
	40 Hz to 20 kHz	37 $\mu\text{V/V} + 8 \mu\text{V}$	
	(20 to 50) kHz	61 $\mu\text{V/V} + 9 \mu\text{V}$	
	(50 to 100) kHz	76 $\mu\text{V/V} + 30 \mu\text{V}$	
	(100 to 300) kHz	304 $\mu\text{V/V} + 76 \mu\text{V}$	
	(300 to 500) kHz	913 $\mu\text{V/V} + 190 \mu\text{V}$	
	500 kHz to 1 MHz	1.5 mV/V + 304 μV	
	(2.2 to 22) V		
	(10 to 20) Hz	228 $\mu\text{V/V} + 380 \mu\text{V}$	
	(20 to 40) Hz	84 $\mu\text{V/V} + 152 \mu\text{V}$	
	40 Hz to 20 kHz	37 $\mu\text{V/V} + 54 \mu\text{V}$	
	(20 to 50) kHz	61 $\mu\text{V/V} + 91 \mu\text{V}$	
	(50 to 100) kHz	76 $\mu\text{V/V} + 190 \mu\text{V}$	
	(100 to 300) kHz	228 $\mu\text{V/V} + 609 \mu\text{V}$	
	(300 to 500) kHz	913 $\mu\text{V/V} + 1.9 \text{ mV}$	
	500 kHz to 1 MHz	1.4 mV/V + 3 mV	
(22 to 220) V			
(10 to 20) Hz	228 $\mu\text{V/V} + 3.8 \text{ mV}$		
(20 to 40) Hz	84 $\mu\text{V/V} + 1.5 \text{ mV}$		
40 Hz to 20 kHz	49 $\mu\text{V/V} + 0.6 \text{ mV}$		
(20 to 50) kHz	76 $\mu\text{V/V} + 0.9 \text{ mV}$		
(50 to 100) kHz	137 $\mu\text{V/V} + 2.3 \text{ mV}$		
(220 to 750) V			
40 Hz to 1 kHz	68 $\mu\text{V/V} + 3 \text{ mV}$		
(1 to 20) kHz	126 $\mu\text{V/V} + 5 \text{ mV}$		
(20 to 50) kHz	457 $\mu\text{V/V} + 8 \text{ mV}$		
(50 to 100) kHz	1.8 mV/V + 34 mV		



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Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(750 to 1 000) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	68 μ V/V + 3 mV 126 μ V/V + 5 mV 457 μ V/V + 8 mV	Comparison to Fluke 5730A Multifunction Calibrator /5725A Amplifier
AC Voltage – Generate ¹ Wideband Absolute	(0.3 to 1.1) mV (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (1.1 to 3.3) mV (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (3.3 to 11) mV (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (11 to 33) mV (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz	0.65 % of output + 1.5 μ V 0.61 % of output + 1.5 μ V 0.63 % of output + 3.8 μ V 0.63 % of output + 3.8 μ V 0.68 % of output + 3.8 μ V 0.76 % of output + 3.8 μ V 1.3 % of output + 13 μ V 0.58 % of output + 2.3 μ V 0.53 % of output + 2.3 μ V 0.54 % of output + 4.6 μ V 0.54 % of output + 4.6 μ V 0.58 % of output + 4.6 μ V 0.65 % of output + 4.6 μ V 1.3 % of output + 4.6 μ V 0.58 % of output + 6.1 μ V 0.53 % of output + 6.1 μ V 0.54 % of output + 8.4 μ V 0.54 % of output + 8.4 μ V 0.55 % of output + 8.4 μ V 0.61 % of output + 8.4 μ V 0.93 % of output + 8.4 μ V 0.52 % of output + 12 μ V 0.46 % of output + 12 μ V 0.47 % of output + 14 μ V 0.47 % of output + 14 μ V 0.49 % of output + 14 μ V 0.55 % of output + 14 μ V 0.89 % of output + 14 μ V	Comparison to Fluke 5730A Multifunction Calibrator /5725A Amplifier

Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(33 to 110) mV (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (110 to 330) mV (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (0.33 to 1.1) V (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (1.1 to 3.5) V (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz	0.52 % of output + 30 μV 0.46 % of output + 30 μV 0.4 % of output + 33 μV 0.4 % of output + 33 μV 0.42 % of output + 33 μV 0.55 % of output + 33 μV 0.89 % of output + 33 μV 0.45 % of output + 0.1 mV 0.38 % of output + 0.1 mV 0.4 % of output + 0.1 mV 0.4 % of output + 0.1 mV 0.42 % of output + 0.1 mV 0.49 % of output + 0.1 mV 0.85 % of output + 0.1 mV 0.45 % of output + 0.3 mV 0.38 % of output + 0.3 mV 0.4 % of output + 0.3 mV 0.4 % of output + 0.3 mV 0.42 % of output + 0.3 mV 0.49 % of output + 0.3 mV 0.85 % of output + 0.3 mV 0.39 % of output + 0.4 mV 0.3 % of output + 0.4 mV 0.32 % of output + 0.4 mV 0.32 % of output + 0.4 mV 0.35 % of output + 0.4 mV 0.44 % of output + 0.4 mV 0.82 % of output + 0.4 mV	Comparison to Fluke 5730A Multifunction Calibrator
AC Voltage – Measure ¹	Up to 2.2 mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	1.3 mV/V + 1.2 μV 563 μV/V + 1.2 μV 320 μV/V + 1.2 μV 616 μV/V + 1.7 μV 913 μV/V + 2 μV 1.8 mV/V + 3.1 μV 1.8 mV/V + 6.1 μV 2.7 mV/V + 6.1 μV	Comparison to Fluke 5790B AC/DC Transfer Standard



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(2.2 to 7) mV		Comparison to Fluke 5790B AC/DC Transfer Standard
	(10 to 20) Hz	647 $\mu\text{V/V} + 1.2 \mu\text{V}$	
	(20 to 40) Hz	282 $\mu\text{V/V} + 1.2 \mu\text{V}$	
	40 Hz to 20 kHz	160 $\mu\text{V/V} + 1.2 \mu\text{V}$	
	(20 to 50) kHz	304 $\mu\text{V/V} + 1.7 \mu\text{V}$	
	(50 to 100) kHz	457 $\mu\text{V/V} + 2 \mu\text{V}$	
	(100 to 300) kHz	913 $\mu\text{V/V} + 3.1 \mu\text{V}$	
	(300 to 500) kHz	989 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	500 kHz to 1 MHz	1.8 mV/V + 6.1 μV	
	(7 to 22) mV		
	(10 to 20) Hz	221 $\mu\text{V/V} + 1.2 \mu\text{V}$	
	(20 to 40) Hz	145 $\mu\text{V/V} + 1.2 \mu\text{V}$	
	40 Hz to 20 kHz	84 $\mu\text{V/V} + 1.2 \mu\text{V}$	
	(20 to 50) kHz	160 $\mu\text{V/V} + 1.7 \mu\text{V}$	
	(50 to 100) kHz	236 $\mu\text{V/V} + 2 \mu\text{V}$	
	(100 to 300) kHz	616 $\mu\text{V/V} + 3.1 \mu\text{V}$	
	(300 to 500) kHz	677 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	500 kHz to 1 MHz	1.3 mV/V + 6.1 μV	
	(22 to 70) mV		
	(10 to 20) Hz	183 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	(20 to 40) Hz	91 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	40 Hz to 20 kHz	49 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	(20 to 50) kHz	99 $\mu\text{V/V} + 1.7 \mu\text{V}$	
	(50 to 100) kHz	198 $\mu\text{V/V} + 2 \mu\text{V}$	
	(100 to 300) kHz	388 $\mu\text{V/V} + 3.1 \mu\text{V}$	
	(300 to 500) kHz	510 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	500 kHz to 1 MHz	837 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	(70 to 220) mV		
(10 to 20) Hz	160 $\mu\text{V/V} + 1.3 \mu\text{V}$		
(20 to 40) Hz	65 $\mu\text{V/V} + 1.3 \mu\text{V}$		
40 Hz to 20 kHz	29 $\mu\text{V/V} + 1.3 \mu\text{V}$		
(20 to 50) kHz	53 $\mu\text{V/V} + 1.7 \mu\text{V}$		
(50 to 100) kHz	122 $\mu\text{V/V} + 2 \mu\text{V}$		
(100 to 300) kHz	190 $\mu\text{V/V} + 3.1 \mu\text{V}$		
(300 to 500) kHz	289 $\mu\text{V/V} + 6.1 \mu\text{V}$		
500 kHz to 1 MHz	761 $\mu\text{V/V} + 6.1 \mu\text{V}$		



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(220 to 700) mV		Comparison to Fluke 5790B AC/DC Transfer Standard
	(10 to 20) Hz	160 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	(20 to 40) Hz	58 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	40 Hz to 20 kHz	25 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	(20 to 50) kHz	39 $\mu\text{V/V} + 1.7 \mu\text{V}$	
	(50 to 100) kHz	60 $\mu\text{V/V} + 2 \mu\text{V}$	
	(100 to 300) kHz	137 $\mu\text{V/V} + 3.1 \mu\text{V}$	
	(300 to 500) kHz	228 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	500 kHz to 1 MHz	730 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	700 mV to 2.2 V		
	(10 to 20) Hz	152 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	(20 to 40) Hz	50 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	40 Hz to 20 kHz	18 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	(20 to 50) kHz	35 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	(50 to 100) kHz	54 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	(100 to 300) kHz	122 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	(300 to 500) kHz	198 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	500 kHz to 1 MHz	685 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	(2.2 to 7) V		
	(10 to 20) Hz	152 $\mu\text{V/V} + 0.9 \mu\text{V}$	
	(20 to 40) Hz	51 $\mu\text{V/V} + 0.9 \mu\text{V}$	
	40 Hz to 20 kHz	18 $\mu\text{V/V} + 0.9 \mu\text{V}$	
	(20 to 50) kHz	37 $\mu\text{V/V} + 0.9 \mu\text{V}$	
	(50 to 100) kHz	62 $\mu\text{V/V} + 0.9 \mu\text{V}$	
(100 to 300) kHz	145 $\mu\text{V/V} + 0.9 \mu\text{V}$		
(300 to 500) kHz	304 $\mu\text{V/V} + 0.9 \mu\text{V}$		
500 kHz to 1 MHz	913 $\mu\text{V/V} + 0.9 \mu\text{V}$		
(7 to 22) V			
(10 to 20) Hz	152 $\mu\text{V/V} + 0.9 \mu\text{V}$		
(20 to 40) Hz	51 $\mu\text{V/V} + 0.9 \mu\text{V}$		
40 Hz to 20 kHz	21 $\mu\text{V/V} + 0.9 \mu\text{V}$		
(20 to 50) kHz	37 $\mu\text{V/V} + 0.9 \mu\text{V}$		
(50 to 100) kHz	62 $\mu\text{V/V} + 0.9 \mu\text{V}$		
(100 to 300) kHz	145 $\mu\text{V/V} + 0.9 \mu\text{V}$		
(300 to 500) kHz	304 $\mu\text{V/V} + 0.9 \mu\text{V}$		
500 kHz to 1 MHz	913 $\mu\text{V/V} + 0.9 \mu\text{V}$		



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(22 to 70) V		Comparison to Fluke 5790B AC/DC Transfer Standard
	(10 to 40) Hz	152 $\mu\text{V/V} + 5.7 \mu\text{V}$	
	40 Hz to 20 kHz	52 $\mu\text{V/V} + 5.7 \mu\text{V}$	
	(20 to 50) kHz	24 $\mu\text{V/V} + 5.7 \mu\text{V}$	
	(50 to 100) kHz	43 $\mu\text{V/V} + 5.7 \mu\text{V}$	
	(100 to 300) kHz	72 $\mu\text{V/V} + 5.7 \mu\text{V}$	
	(300 to 500) kHz	152 $\mu\text{V/V} + 5.7 \mu\text{V}$	
	(70 to 220) V		
	(10 to 20) Hz	152 $\mu\text{V/V} + 5.7 \mu\text{V}$	
	(20 to 40) Hz	52 $\mu\text{V/V} + 5.7 \mu\text{V}$	
	40 Hz to 20 kHz	24 $\mu\text{V/V} + 5.7 \mu\text{V}$	
	(20 to 50) kHz	53 $\mu\text{V/V} + 5.7 \mu\text{V}$	
	(50 to 100) kHz	75 $\mu\text{V/V} + 5.7 \mu\text{V}$	
	(220 to 700) V		
40 Hz to 20 kHz	31 $\mu\text{V/V} + 57 \mu\text{V}$		
(20 to 50) kHz	99 $\mu\text{V/V} + 57 \mu\text{V}$		
(50 to 100) kHz	380 $\mu\text{V/V} + 57 \mu\text{V}$		
(700 to 1 000) V			
40 Hz to 20 kHz	29 $\mu\text{V/V} + 57 \mu\text{V}$		
(20 to 30) kHz	99 $\mu\text{V/V} + 57 \mu\text{V}$		
AC Voltage – Measure ¹	60 Hz (1 to 10) kV (10 to 42) kV	0.5 % of reading + 0.002 kV 0.5 % of reading + 0.02 kV	Comparison to Ross VD60 High Voltage Divider, Agilent 34401A Multimeter
AC Voltage – Measure ¹	60 Hz (1 to 10) kV (10 to 85) kV	0.5 % of reading + 0.002 kV 0.5 % of reading + 0.02 kV	Comparison to Ross VD120 High Voltage Divider, Agilent 34401A Multimeter
AC Current – Generate ¹	(9 to 220) μA		Comparison to Fluke 5730A/03 Multifunction Calibrator
	(10 to 20) Hz	228 $\mu\text{A/A} + 15 \text{ nA}$	
	(20 to 40) Hz	152 $\mu\text{A/A} + 10 \text{ nA}$	
	40 Hz to 1 kHz	91 $\mu\text{A/A} + 8 \text{ nA}$	
	(1 to 5) kHz	266 $\mu\text{A/A} + 12 \text{ nA}$	
	(5 to 10) kHz	989 $\mu\text{A/A} + 61 \text{ nA}$	
	(0.22 to 2.2) mA		
	(10 to 20) Hz	228 $\mu\text{A/A} + 39 \text{ nA}$	
	(20 to 40) Hz	152 $\mu\text{A/A} + 31 \text{ nA}$	
	40 Hz to 1 kHz	91 $\mu\text{A/A} + 31 \text{ nA}$	
	(1 to 5) kHz	183 $\mu\text{A/A} + 99 \text{ nA}$	
	(5 to 10) kHz	989 $\mu\text{A/A} + 609 \text{ nA}$	



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Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate ¹	(2.2 to 22) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (22 to 220) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	228 μ A/A + 385 nA 152 μ A/A + 310 nA 91 μ A/A + 310 nA 183 μ A/A + 536 nA 989 μ A/A + 4.6 μ A 228 μ A/A + 4 μ A 152 μ A/A + 3 μ A 91 μ A/A + 2 μ A 183 μ A/A + 3 μ A 989 μ A/A + 9 μ A	Comparison to Fluke 5730A/03 Multifunction Calibrator
AC Current – Generate ¹	(0.22 to 1.2) A (3 to 45) Hz 45 to 1000 Hz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (1.2 to 3.1) A (3 to 45) Hz 45 to 1000 Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (3 to 45) Hz 45 to 1000 Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (3 to 45) Hz 45 to 1000 Hz (1 to 5) kHz	0.019 % of output + 0.08 mA 0.019 % of output + 0.04 mA 0.019 % of output + 0.06 mA 0.19 % of output + 0.23 mA 0.38 % of output + 0.23 mA 0.029 % of output + 0.4 mA 0.023 % of output + 0.27 mA 0.029 % of output + 0.27 mA 0.19 % of output + 0.40 mA 0.029 % of output + 0.8 mA 0.023 % of output + 0.4 mA 0.029 % of output + 0.6 mA 0.19 % of output + 0.8 mA 0.076 % of output + 7.7 mA 0.053 % of output + 6.2 mA 0.038 % of output + 6.2 mA	Comparison to Fluke 5560A Multiproduct Calibrator
AC Current – Generate ¹	(30.2 to 120) A (10 to 65) Hz (65 to 300) Hz 300 Hz to 1 kHz (1 to 3) kHz (3 to 6) kHz (6 to 10) kHz	156 μ A/A + 19 mA 252 μ A/A + 28 mA 768 μ A/A + 92 mA 0.23 % of output + 228 mA 0.76 % of output + 411 mA 3 % of output + 685 mA	Comparison to Fluke 5560A Multiproduct Calibrator / 52120A Transconductance Amplifier

Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
AC Current Clamps – Toroidal-Wound	(0.6 to 600) A (45 to 65) Hz	0.21 % of output + 71 mA	Comparison to Fluke 5560A Multiproduct Calibrator /x50 Coil		
	(600 to 1 000) A (45 to 65) Hz	0.22 % of output + 0.311 A			
	(0.6 to 155) A (65 to 440) Hz	0.6 % of output + 77 mA			
AC Current Clamps – Other	(0.6 to 600) A (45 to 65) Hz	0.43 % of output +0.53 A	Comparison to Fluke 5560A Multiproduct Calibrator /x50 Coil		
	(600 to 1 000) A (45 to 65) Hz	0.43 % of output +0.61 A			
	(0.6 to 155) A (65 to 440) Hz	0.76 % of output +0.69 A			
AC Current Clamps – Rogowski	(10 to 100) A (10 to 1 000) Hz (1 to 3) kHz	0.53 % of output +0.011 A 0.61 % of output +0.015 A	Comparison to Fluke 5560A Multiproduct Calibrator, Fluke 52120A Transconductance Amplifier, Coil 6KA Current Coil		
	(100 to 1000) A (10 to 1 000) Hz (1 to 3) kHz	0.53 % of output +0.11 A 0.61 % of output +0.15 A			
	(1 000 to 6 000) A (10 to 1 000) Hz	0.53 % of output + 0.68 A			
	(1 000 to 3 500) A (1 to 3) kHz	0.61 % of output + 0.91 A			
	AC Current – Measure ¹	(2 to 200) μA 10 Hz to 10 kHz		0.047 % of reading + 0.018 μA	Comparison to Fluke 8508A Multimeter
		200 μA to 2 mA 10 Hz to 10 kHz		0.028 % of reading + 0.18 μA	
AC Current – Measure ¹	(0.19 to 1) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz	201 μA/A 201 μA/A 171 μA/A 275 μA/A	Comparison to Agilent 3458A Multimeter / Fluke A40 Current Shunts		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(1 to 10) mA		Comparison to Fluke 5790B AC/DC Transfer Standard / Holt HCS-1 Current Shunts
	(10 to 20) Hz	163 μ A/A	
	(20 to 40) Hz	70 μ A/A	
	40 Hz to 20 kHz	40 μ A/A	
	(20 to 50) kHz	65 μ A/A	
	(10 to 50) mA		
	(10 to 20) Hz	165 μ A/A	
	(20 to 40) Hz	69 μ A/A	
	40 Hz to 20 kHz	39 μ A/A	
	(20 to 50) kHz	66 μ A/A	
	(50 to 500) mA		
	(10 to 20) Hz	167 μ A/A	
	(20 to 40) Hz	70 μ A/A	
	40 Hz to 20 kHz	40 μ A/A	
(20 to 50) kHz	72 μ A/A		
AC Current – Measure ¹	(0.5 to 2) A		Comparison to Fluke 5790B AC/DC Transfer Standard / Holt HCS-1 Current Shunts
	(10 to 20) Hz	170 μ A/A	
	(20 to 40) Hz	77 μ A/A	
	40 Hz to 20 kHz	62 μ A/A	
AC Current – Measure ¹	(2 to 10) A		Comparison to Fluke 5790B AC/DC Transfer Standard / Holt HCS-1 Current Shunts
	(10 to 20) Hz	181 μ A/A	
	(20 to 40) Hz	94 μ A/A	
	40 Hz to 20 kHz	79 μ A/A	
AC Current – Measure ¹	(20 to 50) kHz	130 μ A/A	Comparison to Agilent 3458A Multimeter / Fluke Y5020 Current Shunt
	(10 to 20) A		
	(10 to 20) Hz	306 μ A/A	
	(20 to 40) Hz	306 μ A/A	
AC Current – Measure ¹	40 Hz to 1 kHz	274 μ A/A	Comparison to Agilent 3458A Multimeter, MI 6311A Current Divider
	(1 to 5) kHz	384 μ A/A	
	(1 to 10) A		
	(10 to 1000) Hz	50 μ A/A + 131 μ A	
AC Current – Measure ¹	(10 to 100) A		Comparison to Agilent 3458A Multimeter, MI 6311A Current Divider
	(10 to 1000) Hz	50 μ A/A + 1.3 mA	
	(100 to 300) A		
AC Current – Measure ¹	(10 to 1 000) Hz		Comparison to Fluke 376 Clamp Meter
	(100 to 1 000) A		
	(10 to 100) Hz	1.6 % of reading + 0.5A	
AC Current – Measure ¹	(100 to 500) Hz		Comparison to Fluke 376 Clamp Meter
	(100 to 500) Hz	1.9 % of reading+ 0.5A	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(200 to 600) A (10 to 500) Hz	2.3 % of reading + 0.5A	Comparison to Fluke 376 Clamp Meter W/i2500 flex probe
	(600 to 2 500) A (10 to 500) Hz	2.3 % of reading + 5A	
Resistance – Generate ¹ Fixed Points	0.001 Ω	10 μΩ/Ω	Comparison to LN 422x Resistance Standards
	0.01 Ω	6.6 μΩ/Ω	
	0.1 Ω	25.3 μΩ/Ω	
Resistance – Generate ¹ Fixed Points	1 Ω	1 μΩ/Ω	Comparison to Fluke 742A, IET SRL Resistance Standards
	10 Ω	2 μΩ/Ω	
	100 Ω	0.44 μΩ/Ω	
	1 kΩ	0.67 μΩ/Ω	
	10 kΩ	0.86 μΩ/Ω	
	100 kΩ	1.2 μΩ/Ω	
	1 MΩ	2 μΩ/Ω	
	10 MΩ	2.5 μΩ/Ω	
	100 MΩ	19 μΩ/Ω	
1 GΩ	84 μΩ/Ω		
Resistance – Generate ¹ Fixed Points	(1, 1.9) Ω	84 μΩ/Ω + 0.1 μΩ	Comparison to Fluke 5730A Multifunction Calibrator
	(10, 19) Ω	21 μΩ/Ω + 1 μΩ	
	(100, 190) Ω	9.1 μΩ/Ω + 6 μΩ	
	(1, 1.9) kΩ	6.1 μΩ/Ω + 60 μΩ	
	(10, 19) kΩ	6.1 μΩ/Ω + 0.6 mΩ	
	100 kΩ	7.6 μΩ/Ω + 6 mΩ	
	190 kΩ	9.1 μΩ/Ω + 6 mΩ	
	1 MΩ	11 μΩ/Ω + 60 mΩ	
	1.9 MΩ	16 μΩ/Ω + 60 mΩ	
	10 MΩ	35 μΩ/Ω + 0.6 Ω	
	19 MΩ	42 μΩ/Ω + 0.6 Ω	
	100 MΩ	91 μΩ/Ω + 6 Ω	
Resistance – Generate ¹	Up to 12 Ω	19 μΩ/Ω + 0.001 Ω	Comparison to Fluke 5560A Multiproduct Calibrator
	(12 to 120) Ω	19 μΩ/Ω + 0.001 Ω	
	(0.12 to 1.20) kΩ	19 μΩ/Ω + 0.002 Ω	
	(1.2 to 12.0) kΩ	19 μΩ/Ω + 0.02 Ω	
	(12 to 120) kΩ	19 μΩ/Ω + 0.2 Ω	
	(0.12 to 1.2) MΩ	19 μΩ/Ω + 2 Ω	
	(1.2 to 12) MΩ	27 μΩ/Ω + 24 Ω	
	(12 to 120) MΩ	327 μΩ/Ω + 2 kΩ	
	(120 to 1 200) MΩ	3 mΩ/Ω + 76 Ω	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Generate ¹ Fixed Points	100 V		Comparison to TMI RB Resistance Standard
	100 kΩ	1 % of output	
	(100 to 1 000) V		
	1 MΩ	1 % of output	
	10 MΩ	1 % of output	
	100 MΩ	1 % of output	
	1 GΩ	1 % of output	
Resistance – Measure ¹ Fixed Points	10 GΩ	1.2 % of output	Comparison to Fluke 8508A Multimeter, Fluke 742A, IET SRL Resistance Standards
	100 GΩ	3.2 % of output	
	(1, 1.9) Ω	4.8 μΩ/Ω	
	(10, 19) Ω	2.6 μΩ/Ω	
	(100, 190) Ω	0.7 μΩ/Ω	
	(1, 1.9) kΩ	0.9 μΩ/Ω	
	(10, 19) kΩ	1 μΩ/Ω	
	(100, 190) kΩ	1.3 μΩ/Ω	
Resistance – Measure ¹	(1, 1.9) MΩ	2.3 μΩ/Ω	Comparison to Fluke 8508A Multimeter
	(10, 19) MΩ	2.9 μΩ/Ω	
	100 MΩ	22 μΩ/Ω	
	1 GΩ	123 μΩ/Ω	
	Up to 2 Ω	15 μΩ/Ω + 3.8 μΩ	
	(2 to 20) Ω	8.8 μΩ/Ω + 14 μΩ	
	(20 to 200) Ω	7.2 μΩ/Ω + 46 μΩ	
	200 Ω to 2 kΩ	7.2 μΩ/Ω + 457 μΩ	
	(2 to 20) kΩ	7.2 μΩ/Ω + 4.6 mΩ	
	(20 to 200) kΩ	7.2 μΩ/Ω + 46 mΩ	
	200 kΩ to 2 MΩ	8 μΩ/Ω + 0.9 Ω	
(2 to 20) MΩ	15 μΩ/Ω + 9 Ω		
(20 to 200) MΩ	57 μΩ/Ω + 0.9 kΩ		
200 MΩ to 2 GΩ	148 μΩ/Ω + 91 kΩ		
(2 to 20) GΩ	514 μΩ/Ω + 9.1 MΩ		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure ¹	100 V		Comparison to Quadtech 1865 Megohmmeter
	100 kΩ	0.53 % of reading	
	(100, 1 000) V		
	1 MΩ	0.5 % of reading	
	10 MΩ	0.5 % of reading	
	100 MΩ	0.5 % of reading	
	1 GΩ	0.5 % of reading	
	10 GΩ	0.52 % of reading	
	(500, 1 000) V		
	100 GΩ	0.59 % of reading	
1 000 V			
	1 TΩ	0.7 % of reading	
	10 TΩ	2.5 % of reading	
Resistance – Measure ¹	50 Hz		Comparison to IET 1693 RLC Meter
	(1 to 10) Ω	0.17 % of reading + 0.003 Ω	
	(10 to 100) Ω	0.062 % of reading + 0.006 Ω	
	(100 to 1000) Ω	0.051 % of reading + 0.06 Ω	
	(1 to 10) kΩ	0.05 % of reading + 0.000 6 kΩ	
	(10 to 100) kΩ	0.054 % of reading + 0.006 kΩ	
	(0.1 to 1) MΩ	0.09 % of reading + 0.000 06 MΩ	
	(1 to 10) MΩ	0.45% of reading + 0.000 6 MΩ	
	100/120 Hz		
	(1 to 10) Ω	0.13 % of reading + 0.003 Ω	
	(10 to 100) Ω	0.049 % of reading + 0.006 Ω	
	(100 to 1000) Ω	0.041 % of reading + 0.06 Ω	
	(1 to 10) kΩ	0.04 % of reading + 0.000 6 kΩ	
	(10 to 100) kΩ	0.043 % of reading + 0.006 kΩ	
	(0.1 to 1) MΩ	0.07 % of reading + 0.000 06 MΩ	
	(1 to 10) MΩ	0.34 % of reading + 0.000 6 MΩ	
	1 000 Hz		
	(1 to 10) Ω	0.05 % of reading + 0.003 Ω	
	(10 to 100) Ω	0.023 % of reading + 0.006 Ω	
	(100 to 1000) Ω	0.02 % of reading + 0.06 Ω	
	(1 to 10) kΩ	0.02 % of reading + 0.000 6 kΩ	
	(10 to 100) kΩ	0.021 % of reading + 0.006 kΩ	
	(0.1 to 1) MΩ	0.03 % of reading + 0.000 06 MΩ	
	(1 to 10) MΩ	0.12 % of reading + 0.000 6 MΩ	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure ¹	10 kHz		Comparison to IET 1693 RLC Meter
	(1 to 10) Ω	0.17 % of reading + 0.003 Ω	
	(10 to 100) Ω	0.062 % of reading + 0.006 Ω	
	(100 to 1000) Ω	0.051 % of reading + 0.06 Ω	
	(1 to 10) kΩ	0.05 % of reading + 0.000 6 KΩ	
	(10 to 25.6) kΩ	0.051 % of reading + 0.006 KΩ	
	(25.6 to 100) kΩ	0.186 % of reading + 0.006 KΩ	
	(0.1 to 1) MΩ	0.33 % of reading + 0.000 06 MΩ	
	(1 to 10) MΩ	1.8 % of reading + 0.0006 MΩ	
	100 kHz		
	(1 to 10) Ω	0.77 % of reading + 0.003 Ω	
	(10 to 100) Ω	0.257 % of reading + 0.006 Ω	
	(100 to 1000) Ω	0.21 % of reading + 0.06 Ω	
	(1 to 10) kΩ	0.23 % of reading + 0.000 6 kΩ	
(10 to 100) kΩ	0.52 % of reading + 0.006 kΩ		
(0.1 to 1) MΩ	3.4 % of reading + 0.000 06 MΩ		
Capacitance – Generate ¹	(0.2 to 1.2) nF	0.09% of output + 1.5 pF	Comparison to Fluke 5560A Multiproduct Calibrator
	(1.2 to 12.0) nF	0.09 % of output + 0.004 nF	
	(12 to 120.0) nF	0.10 % of output + 0.023 nF	
	(0.12 to 1.2) μF	0.10 % of output + 0.23 nF	
	(1.2 to 12.0) μF	0.10 % of output + 2.3 nF	
	(12 to 120.0) μF	0.11 % of output + 19 nF	
	(0.12 to 1.2) mF	0.19 % of output + 190 nF	
	(1.2 to 12.0) mF	0.19 % of output + 2.3 μF	
(12 to 120.0) mF	0.38 % of output + 23 μF		
Inductance – Generate ¹	(13 to 120.0) μH	0.15% of output + 0.15 μH	Comparison to Fluke 5560A Multiproduct Calibrator
	(0.12 to 1.2) mH	0.09 % of output + 0.76 μH	
	(1.2 to 12.0) mH	0.09 % of output + 7.6 μH	
	(12 to 120.0) mH	0.09 % of output + 76 μH	
	(0.12 to 1.2) H	0.11 % of output + 0.76 mH	
	(1.2 to 12.0) H	0.15 % of output + 7.6 mH	
(12 to 120.0) H	0.19 % of output + 76 mH		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure 12 Hz to 200 kHz	50 Hz		Comparison to IET 1693 LCR Meter
	(50 to 100) pF	2.6 % of reading + 0.015 pF	
	(100 to 400) pF	1.3 % of reading + 0.06 pF	
	(400 to 1 000) pF	0.37 % of reading + 0.06 pF	
	(1 to 10) nF	0.18 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.063 % of reading + 0.006 nF	
	(100 to 1000) nF	0.051 % of reading + 0.06 nF	
	(0.1 to 1) μF	0.051 % of reading + 0.000 06 μF	
	(1 to 10) μF	0.05% of reading + 0.000 6 μF	
	(10 to 100) μF	0.054 % of reading + 0.006 μF	
	(100 to 1 000) μF	0.09 % of reading + 0.06 μF	
	100 Hz		
	(20 to 100) pF	2.4 % of reading + 0.015 pF	
	(100 to 400) pF	0.52 % of reading + 0.06 pF	
	(400 to 1 000) pF	0.16 % of reading + 0.06 pF	
	(1 to 10) nF	0.088 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.045 % of reading + 0.006 nF	
	(100 to 1000) nF	0.041 % of reading + 0.06 nF	
	(0.1 to 1) μF	0.041 % of reading + 0.000 06 μF	
	(10 to 100) μF	0.046 % of reading + 0.006 μF	
	(100 to 1 000) μF	0.1 % of reading + 0.06 μF	
	120 Hz		
	(20 to 100) pF	2 % of reading + 0.01 5pF	
	(100 to 400) pF	0.44 % of reading + 0.06 pF	
	(400 to 1 000) pF	0.14 % of reading + 0.06 pF	
	(1 to 10) nF	0.08 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.044 % of reading + 0.006 nF	
(100 to 1000) nF	0.04 % of reading + 0.06 nF		
(0.1 to 1) μF	0.04 % of reading + 0.000 06 μF		
(1 to 10) μF	0.041 % of reading + 0.000 6 μF		
(10 to 100) μF	0.047 % of reading + 0.006 μF		
(100 to 1 000) μF	0.11 % of reading + 0.06 μF		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure 12 Hz to 200 kHz	1 000 Hz		Comparison to IET 1693 LCR Meter
	(1 to 10) pF	1.6 % of reading + 0.014 pF	
	(10 to 20) pF	0.18 % of reading + 0.015 pF	
	(20 to 100) pF	0.1 % of reading + 0.015 pF	
	(100 to 400) pF	0.036 % of reading + 0.06 pF	
	(400 to 1 000) pF	0.024 % of reading + 0.06 pF	
	(1 to 10) nF	0.022 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.02 % of reading + 0.006 nF	
	(100 to 1 000) nF	0.02 % of reading + 0.06 nF	
	(0.1 to 1) μF	0.02 % of reading + 0.000 06 μF	
	(1 to 10) μF	0.02 % of reading + 0.000 6 μF	
	(10 to 100) μF	0.04 % of reading + 0.006 μF	
	(100 to 1 000) μF	0.22 % of reading + 0.06 μF	
	10 kHz		
	(20 to 100) pF	0.3 % of reading + 0.015 pF	
	(100 to 622) pF	0.2 % of reading + 0.06 pF	
	(622 to 1 000) pF	0.051 % of reading + 0.06 pF	
	(1 to 10) nF	0.051 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.051 % of reading + 0.006 nF	
	(100 to 1 000) nF	0.058 % of reading + 0.06 nF	
	(0.1 to 1) μF	0.058 % of reading + 0.000 06 μF	
	(1 to 10) μF	0.13 % of reading + 0.000 6 μF	
	(10 to 100) μF	0.85 % of reading + 0.006 μF	
	(100 to 500) μF	4.1 % of reading + 0.06 μF	
	100 kHz		
	(20 to 100) pF	0.49 % of reading + 0.015 pF	
	(100 to 400) pF	0.26 % of reading + 0.06 pF	
	(400 to 1 000) pF	0.21 % of reading + 0.06 pF	
	(1 to 10) nF	0.21 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.24 % of reading + 0.006 nF	
(100 to 1 000) nF	0.58 % of reading + 0.06 nF		
(0.1 to 1) μF	0.58 % of reading + 0.000 06 μF		
(1 to 10) μF	4 % of reading + 0.000 6 μF		



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Generate ¹ Fixed Points	1 pF		Comparison to Agilent 16381A Capacitor Set
	1 kHz	0.028 % of output	
	1 MHz	0.028 % of output	
	2 MHz	0.034 % of output	
	3 MHz	0.047 % of output	
	4 MHz	0.069 % of output	
	5 MHz	0.096 % of output	
	10 MHz	0.31 % of output	
Capacitance – Generate ¹ Fixed Points	10 pF		Comparison to Agilent 16382A Standard Air Capacitor
	1 kHz	0.019 % of output	
	1 MHz	0.019 % of output	
	2 MHz	0.019 % of output	
	3 MHz	0.019 % of output	
	4 MHz	0.019 % of output	
	5 MHz	0.019 % of output	
	10 MHz	0.022 % of output	
Capacitance – Generate ¹ Fixed Points	100 pF		Comparison to Agilent 16383A Standard Air Capacitor
	1 kHz	0.017 % of output	
	1 MHz	0.017 % of output	
	2 MHz	0.018 % of output	
	3 MHz	0.018 % of output	
	4 MHz	0.02 % of output	
	5 MHz	0.024 % of output	
	10 MHz	0.053 % of output	
Capacitance – Generate ¹ Fixed Points	1 000 pF		Comparison to Agilent 16384A Standard Air Capacitor
	1 kHz	0.018 % of output	
	1 MHz	0.019 % of output	
	2 MHz	0.024 % of output	
	3 MHz	0.035 % of output	
	4 MHz	0.051 % of output	
	5 MHz	0.069 % of output	
	10 MHz	0.22 % of output	
13 MHz	0.32 % of output		



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Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ¹ 12 Hz to 200 kHz	100 Hz		Comparison to IET 1693 LCR Meter
	(40 to 100) μH	3.8 % of reading + 0.006 μH	
	(0.1 to 0.4) mH	1.6 % of reading + 0.000 06 mH	
	(0.4 to 1) mH	0.42 % of reading + 0.000 06 mH	
	(1 to 10) mH	0.19 % of reading + 0.000 6 mH	
	(10 to 100) mH	0.056 % of reading + 0.006 mH	
	(0.1 to 1) H	0.042 % of reading + 0.000 06 H	
	(1 to 10) H	0.041 % of reading + 0.000 6 H	
	(10 to 100) H	0.042 % of reading + 0.006 H	
	1 000 Hz		
	(4 to 10) μH	1.3 % of reading + 0.003 μH	
	(10 to 40) μH	0.53 % of reading + 0.006 μH	
	(40 to 100) μH	0.15 % of reading + 0.006 μH	
	(0.1 to 0.4) mH	0.071 % of reading + 0.000 06 mH	
	(0.4 to 1) mH	0.033 % of reading + 0.000 06 mH	
	(1 to 10) mH	0.025 % of reading + 0.000 6 mH	
	(10 to 100) mH	0.021 % of reading + 0.006 mH	
	(0.1 to 1) H	0.02 % of reading + 0.000 06 H	
	(1 to 10) H	0.021 % of reading + 0.000 6 H	
	(10 to 100) H	0.026 % of reading + 0.006 H	
	10 kHz		
	(1 to 4) μH	2.1 % of reading + 0.003 μH	
	(4 to 10) μH	0.56 % of reading + 0.003 μH	
	(10 to 40) μH	0.25 % of reading + 0.006 μH	
	(40 to 100) μH	0.1 % of reading + 0.006 μH	
	(0.1 to 0.4) mH	0.071 % of reading + 0.000 06 mH	
	(0.4 to 1) mH	0.056 % of reading + 0.000 06 mH	
	(1 to 10) mH	0.052 % of reading + 0.000 6 mH	
(10 to 100) mH	0.051 % of reading + 0.006 mH		
(0.1 to 0.407) H	0.051 % of reading + 0.000 06 H		
(0.407 to 1) H	0.18 % of reading + 0.000 6 H		
(1 to 10) H	0.27 % of reading + 0.000 6 H		
(10 to 100) H	1.2 % of reading + 0.006 H		



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Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ¹ 12 Hz to 200 kHz	100 kHz (1 to 4) μ H (4 to 10) μ H (10 to 40) μ H (40 to 100) μ H (0.1 to 0.4) mH (0.4 to 1) mH (1 to 10) mH (10 to 100) mH (0.1 to 1) H	1.2 % of reading + 0.003 μ H 0.44 % of reading + 0.003 μ H 0.3 % of reading + 0.006 μ H 0.23 % of reading + 0.006 μ H 0.21 % of reading + 0.000 06 mH 0.21 % of reading + 0.000 06 mH 0.22 % of reading + 0.000 6 mH 0.39 % of reading + 0.006 mH 2.1 % of reading + 0.000 06 H	Comparison to IET 1693 LCR Meter
Inductance – Generate ¹ Fixed Point	50 mH 100 Hz 1 kHz	0.028 mH 0.021 mH	Comparison to GR 1482-K Standard Inductor
	100 mH 100 Hz 1 kHz	0.069 mH 0.063 mH	Comparison to GR 1481-G Standard Inductor
	200 mH 100 Hz 1 kHz	0.09 mH 0.06 mH	Comparison to GR 1482-M Standard Inductor
	500 mH 100 Hz 1 kHz	0.23 mH 0.15 mH	Comparison to GR 1482-N Standard Inductor
	5 H 100 Hz 1 kHz	0.021 H 0.021 H	Comparison to GR 1482-R Standard Inductor
Oscilloscopes Calibration ¹ Generate Voltage DC - 50 Ω	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 6.6) V	0.19 % of Output + 31 μ V 0.19 % of Output + 36 μ V 0.19 % of Output + 87 μ V 0.19 % of Output + 0.6 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
DC - 1M Ω	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.019 % of reading + 20 μ V 0.019 % of reading + 25 μ V 0.019 % of reading + 76 μ V 0.019 % of reading + 0.6 mV 0.019 % of reading + 6 mV	
Square Wave 10Hz to 10kHz - 50 Ω	(1 to 24.999) mVpp (25 to 109.99) mVpp (110mV to 2.1999) Vpp (2.2 to 6.6) Vpp	0.19 % of Output + 31 μ V 0.19 % of Output + 36 μ V 0.19 % of Output + 87 μ V 0.19 % of Output + 0.6 mV	



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Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration ¹ Generate Square Wave 10 Hz to 1 kHz – 1 MΩ Square Wave 1 to 10 kHz - 1MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.199 9) V (2.2 to 10.999) V (11 to 130) V (1 to 24.999) mV (25 to 109.99) mV (110mV to 2.199 9) V (2.2 to 10.999) V (11 to 130) V	0.038 % of reading + 4 μV 0.038 % of reading + 9 μV 0.038 % of reading + 60 μV 0.038 % of reading + 0.6 mV 0.038 % of reading + 6 mV 0.19 % of reading + 31 μV 0.19 % of reading + 36 μV 0.19 % of reading + 87 μV 0.19 % of reading + 0.6 mV 0.19 % of reading + 6 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration– Generate ¹ Leveled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth (5 to 50 mV) Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 16 00) MHz (1 600 to 2 100) MHz	0.34 dB 0.36 dB 0.42 dB 0.46 dB 0.5 dB 0.56 dB	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration Generate ¹ Leveled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth 50 mVpp to 3.5 Vpp 50 kHz to 100) MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 16 00) MHz (1 600 to 2 100) MHz (3.5 to 5) Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz	0.24 dB 0.24 dB 0.32 dB 0.34 dB 0.4 dB 0.44 dB 0.24 dB 0.24 dB 0.32 dB 0.34 dB	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration Generate ¹ Leveled Sine Flatness	3 dB Bandwidth 50 mV to 3.5Vpp (1 100 to 4 000) MHz (4 000 to 8 000) MHz (8 000 to 18 000) MHz	0.3 dB 0.38 dB 0.48 dB	Comparison to EPM Power Meter w/ E Series Power Sensors

Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration Generate ¹ Time Marker	500 ps to 20 ms 50 ms to 5 s	0.25 μs/s 1.9 μs/s + 3.8 μHz	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Rise Time	< 150 ps	+0 / -50 ps	
Input Impedance	(40 to 60) Ω	0.08 % of reading	
Resistance	500 kΩ to 1.5MΩ	0.08 % of reading	
Leakage	(0 to 5.99) V	0.038 % of reading + 0.8 mV	
Oscilloscopes Calibration ¹ Generate Voltage DC - 50Ω DC - 1MΩ	(1mV to 5V) (1mV to 200V)	0.025 % of output + 25 μV 0.025 % of output + 25 μV	Comparison to Fluke 9500B with 9510 Active Head
Square Wave 10Hz to 10kHz – 1MΩ	(1mV to 200Vpp)	0.1 % of output + 10 μV	
Oscilloscopes Calibration ¹ Generate	5 mV to 5 Vpp (0.1 Hz to 300) MHz (300 to 550) MHz	0.18 dB 0.22 dB	Comparison to Fluke 9500B with 9510 Active Head
Leveled Sine Flatness 50 kHz to 10 MHz Reference	(5 mV to 3Vpp) (550 to 1 100) MHz	0.3 dB	
Oscilloscopes Calibration ¹ Generate Time Marker	9 ns to 55 s	0.25 μs/s	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration ¹ Measure	(10 to 40) Ω (40 to 90) Ω (90 to 150) Ω (50 to 800) KΩ (0.8 to 1.2) MΩ (1.2 to 12) MΩ	0.5 % of reading 0.1 % of reading 0.5 % of reading 0.5 % of reading 0.1 % of reading 0.5 % of reading	Comparison to Fluke 9500B with 9510 Active Head
Input Impedance Resistance			



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Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ 12 to 120mV Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 0.1 μ W	
	(40 to 1 000) Hz	0.022 % of Output + 0.1 μ W	
	(1 to 5) kHz	0.022 % of Output + 0.1 μ W	
	(5 to 10) kHz	0.12 % of Output + 0.1 μ W	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 1.1 μ W	
	(40 to 1 000) Hz	0.016 % of Output + 0.7 μ W	
	(1 to 5) kHz	0.022 % of Output + 0.9 μ W	
	(5 to 10) kHz	0.12 % of Output + 1.1 μ W	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 11 μ W	
	(40 to 1 000) Hz	0.022 % of Output + 7.2 μ W	
	(1 to 5) kHz	0.022 % of Output + 9.2 μ W	
	(5 to 10) kHz	0.19 % of Output + 28 μ W	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 48 μ W	
	(40 to 1 000) Hz	0.025 % of Output + 31 μ W	
	(1 to 5) kHz	0.03 % of Output + 31 μ W	
	(5 to 10) kHz	0.19 % of Output + 48 μ W	
(3.1 to 12) A			
(10 to 40) Hz	0.03 % of Output + 107 μ W		
(40 to 1 000) Hz	0.025 % of Output + 72 μ W		
(1 to 5) kHz	0.03 % of Output + 92 μ W		
(5 to 10) kHz	0.19 % of Output + 107 μ W		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 0.92 mW		
(40 to 1 000) Hz	0.054 % of Output + 0.74 mW		
(1 to 5) kHz	0.38 % of Output + 0.74 mW		



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Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ 0.12 to 1.2 V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 0.9 μW	
	(40 to 1 000) Hz	0.022 % of Output + 0.9 μW	
	(1 to 5) kHz	0.022 % of Output + 0.9 μW	
	(5 to 10) kHz	0.12 % of Output + 0.9 μW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 9.2 μW	
	(40 to 1 000) Hz	0.016 % of Output + 4.7 μW	
	(1 to 5) kHz	0.022 % of Output + 7.4 μW	
	(5 to 10) kHz	0.12 % of Output + 9.2 μW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 92 μW	
	(40 to 1 000) Hz	0.022 % of Output + 47 μW	
	(1 to 5) kHz	0.022 % of Output + 74 μW	
	(5 to 10) kHz	0.19 % of Output + 0.27 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 0.46 mW	
	(40 to 1 000) Hz	0.025 % of Output + 0.27 mW	
	(1 to 5) kHz	0.03 % of Output + 0.27 mW	
	(5 to 10) kHz	0.19 % of Output + 0.46 mW	
	(3.1 to 12) A		
(10 to 40) Hz	0.03 % of Output + 0.92 mW		
(40 to 1 000) Hz	0.025 % of Output + 0.47 mW		
(1 to 5) kHz	0.030 % of Output + 0.74 mW		
(5 to 10) kHz	0.19 % of Output + 0.92 mW		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 9.1 mW		
(40 to 1 000) Hz	0.054 % of Output + 7.3 mW		
(1 to 5) kHz	0.38 % of Output + 7.3 mW		



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Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ 1.2 to 12 V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 9.2 μW	
	(40 to 1 000) Hz	0.022 % of Output + 9.2 μW	
	(1 to 5) kHz	0.022 % of Output + 9.2 μW	
	(5 to 10) kHz	0.12 % of Output + 9.2 μW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 92 μW	
	(40 to 1 000) Hz	0.016 % of Output + 46 μW	
	(1 to 5) kHz	0.022 % of Output + 74 μW	
	(5 to 10) kHz	0.11% of Output + 92 μW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 0.92 mW	
	(40 to 1 000) Hz	0.022 % of Output + 0.46 mW	
	(1 to 5) kHz	0.022 % of Output + 0.74 mW	
	(5 to 10) kHz	0.19 % of Output + 2.7 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 4.6 mW	
	(40 to 1 000) Hz	0.025 % of Output + 2.7 mW	
	(1 to 5) kHz	0.03 % of Output + 2.7 mW	
	(5 to 10) kHz	0.19 % of Output + 4.6 mW	
	(3.1 to 12) A		
(10 to 40) Hz	0.03 % of Output + 9.2 mW		
(40 to 1 000) Hz	0.025 % of Output + 4.6 mW		
(1 to 5) kHz	0.03 % of Output + 7.4 mW		
(5 to 10) kHz	0.19 % of Output + 9.2 mW		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 91 mW		
(40 to 1 000) Hz	0.054 % of Output + 73 mW		
(1 to 5) kHz	0.38 % of Output + 73 mW		



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Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ 12 to 120 V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 92 μW	
	(40 to 1 000) Hz	0.022 % of Output + 92 μW	
	(1 to 5) kHz	0.022 % of Output + 92 μW	
	(5 to 10) kHz	0.12 % of Output + 92 μW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 0.92 mW	
	(40 to 1 000) Hz	0.016 % of Output + 0.46 mW	
	(1 to 5) kHz	0.022 % of Output + 0.74 mW	
	(5 to 10) kHz	0.12 % of Output + 0.92 mW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 9.2 mW	
	(40 to 1 000) Hz	0.022 % of Output + 4.6 mW	
	(1 to 5) kHz	0.022 % of Output + 7.4 mW	
	(5 to 10) kHz	0.19 % of Output + 27 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 46 mW	
	(40 to 1 000) Hz	0.025 % of Output + 27 mW	
	(1 to 5) kHz	0.03 % of Output + 27 mW	
	(5 to 10) kHz	0.19% of Output + 46 mW	
	(3.1 to 12) A		
(10 to 40) Hz	0.03 % of Output + 92 mW		
(40 to 1 000) Hz	0.025 % of Output + 46 mW		
(1 to 5) kHz	0.03 % of Output + 74 mW		
(5 to 10) kHz	0.19 % of Output + 92 mW		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 0.91 W		
(40 to 1 000) Hz	0.054 % of Output + 0.73 W		
(1 to 5) kHz	0.38 % of Output + 0.73 W		



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Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ 120 to 330 V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 0.26 mW	
	(40 to 1 000) Hz	0.022 % of Output + 0.26 mW	
	(1 to 5) kHz	0.022 % of Output + 0.26 mW	
	(5 to 10) kHz	0.12 % of Output + 0.26 mW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 2.6 mW	
	(40 to 1 000) Hz	0.016 % of Output + 1.5 mW	
	(1 to 5) kHz	0.022 % of Output + 2.1 mW	
	(5 to 10) kHz	0.12 % of Output + 2.6 mW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 26 mW	
	(40 to 1 000) Hz	0.022 % of Output + 15 mW	
	(1 to 5) kHz	0.022 % of Output + 21 mW	
	(5 to 10) kHz	0.19 % of Output + 76 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 0.13 W	
	(40 to 1 000) Hz	0.025 % of Output + 0.08 W	
	(1 to 5) kHz	0.030 % of Output + 0.08 W	
	(5 to 10) kHz	0.19 % of Output + 0.13 W	
	(3.1 to 12) A		
(10 to 40) Hz	0.03 % of Output + 0.26 W		
(40 to 1 000) Hz	0.025 % of Output + 0.15 W		
(1 to 5) kHz	0.03 % of Output + 0.21 W		
(5 to 10) kHz	0.19 % of Output + 0.26 W		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 2.5 W		
(40 to 1 000) Hz	0.054 % of Output + 2.0 W		
(1 to 5) kHz	0.38 % of Output + 2.0 W		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ 330 to 1020 V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 1.1 mW	
	(40 to 1 000) Hz	0.022 % of Output + 1.1 mW	
	(1 to 5) kHz	0.022 % of Output + 1.1 mW	
	(5 to 10) kHz	0.12 % of Output + 1.1 mW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 11 mW	
	(40 to 1 000) Hz	0.016 % of Output + 8.3 mW	
	(1 to 5) kHz	0.022 % of Output + 9.6 mW	
	(5 to 10) kHz	0.12 % of Output + 11 mW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 107 mW	
	(40 to 1 000) Hz	0.022 % of Output + 83 mW	
	(1 to 5) kHz	0.022 % of Output + 96 mW	
	(5 to 10) kHz	0.19 % of Output + 244 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 0.43 W	
	(40 to 1 000) Hz	0.025 % of Output + 0.30 W	
	(1 to 5) kHz	0.03 % of Output + 0.30 W	
	(5 to 10) kHz	0.19 % of Output + 0.43 W	
(3.1 to 12) A			
(10 to 40) Hz	0.03 % of Output + 1.1 W		
(40 to 1 000) Hz	0.025 % of Output + 0.8 W		
(1 to 5) kHz	0.03 % of Output + 1.0 W		
(5 to 10) kHz	0.19 % of Output + 1.1 W		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 8.0 W		
(40 to 1 000) Hz	0.054 % of Output + 6.5 W		
(1 to 5) kHz	0.38 % of Output + 6.5 W		
Phase Angle - Generate	(-180 to 180) °		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 65) Hz	0.08°	
	(65 to 500) Hz	0.19°	
	500 Hz to 1 kHz	0.38°	
	(1 to 5) kHz	1.9°	
	(5 to 10) kHz	3.8°	
(10 to 30) kHz	7.6°		



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Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicating Devices ¹	Type B		Comparison to Fluke 7526A Process Calibrator
	(600 to 800) °C	0.27 °C	
	(800 to 1 550) °C	0.21 °C	
	(1 550 to 1 820) °C	0.17 °C	
	Type C		
	(0 to 1000) °C	0.12 °C	
	(1 000 to 1 800) °C	0.18 °C	
	(1 800 to 2 000) °C	0.2 °C	
	(2 000 to 2 316) °C	0.27 °C	
	Type E		
	(-250 to -200) °C	0.19 °C	
	(-200 to -100) °C	0.09 °C	
	(-100 to 0) °C	0.07 °C	
	(0 to 600) °C	0.06 °C	
	(600 to 1 000) °C	0.08 °C	
	Type J		
	(-210 to -100) °C	0.11 °C	
	(-100 to 800) °C	0.07 °C	
	(800 to 1 200) °C	0.08 °C	
	Type K		
	(-250 to -200) °C	0.35 °C	
(-200 to -100) °C	0.12 °C		
(-100 to 800) °C	0.08 °C		
(800 to 1 372) °C	0.1 °C		
Type L			
(-200 to -100) °C	0.08 °C		
(-100 to 900) °C	0.07 °C		
Type N			
(-250 to -200) °C	0.56 °C		
(-200 to -100) °C	0.18 °C		
(-100 to 0) °C	0.09 °C		
(0 to 100) °C	0.08 °C		
(100 to 800) °C	0.08 °C		
(800 to 1 300) °C	0.09 °C		



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Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
Electrical Calibration of Thermocouple Indicating Devices ¹	Type R		Comparison to Fluke 7526A Process Calibrator	
		(-50 to -25) °C		0.42 °C
		(-25 to 0) °C		0.34 °C
		(0 to 100) °C		0.3 °C
		(100 to 400) °C		0.21 °C
		(400 to 600) °C		0.17 °C
		(600 to 1 000) °C		0.16 °C
		(1 000 to 1 600) °C		0.14 °C
		(1 600 to 1 767) °C		0.18 °C
		Type S		
		(50 to -25) °C		0.39 °C
		(-25 to 0) °C		0.33 °C
		(0 to 100) °C		0.29 °C
		(100 to 400) °C		0.22 °C
		(400 to 600) °C		0.18 °C
		(600 to 1 600) °C		0.17 °C
		(1 600 to 1 767) °C		0.2 °C
		Type T		
		(-250 to -200) °C		0.27 °C
	(-200 to -100) °C	0.12 °C		
	(-100 to 0) °C	0.08 °C		
	(0 to 400) °C	0.07 °C		
	Type U			
	(-200 to 0) °C	0.13 °C		
	(0 to 600) °C	0.08 °C		
Electrical Calibration of RTD Indicating Devices ¹	Pt 100 (385)		Comparison to Fluke 7526A Process Calibrator	
		(-200 to 800) °C		0.04 °C
	Pt 100 (3916)			0.04 °C
		(-200 to 630) °C		0.04 °C
	Pt 100 (3926)			0.04 °C
		(-200 to 630) °C		0.04 °C
	Pt 200 (385)			0.30 °C
		(-200 to 400) °C		0.38 °C
	(400 to 630) °C	0.38 °C		
Pt 500 (385)		0.13 °C		
	(-200 to 630) °C	0.13 °C		
Pt 1 000 (385)		0.07 °C		
	(-200 to 630) °C	0.07 °C		



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Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicating Devices ¹	Cu 10 (427) (100 °C to 260) °C	0.29 °C	Comparison to Fluke 7526A Process Calibrator
	Ni 120 (672) (-80 to 260) °C	0.02 °C	
AC Voltage – Measure Wideband Flatness Relative to 1 kHz	(0.6 to 2.2) mV (10 to 30) Hz	0.08 % of reading + 0.1 µV	Comparison to Fluke 5790B AC/DC Measurement Standard
	30 Hz to 120 kHz	0.04 % of reading + 0.1 µV	
	120 kHz 2 MHz	0.05 % of reading + 0.8 µV	
	(2 to 10) MHz	0.13 % of reading + 0.8 µV	
	(10 to 20) MHz	0.23 % of reading + 0.8 µV	
	(20 to 30) MHz	0.53 % of reading + 1.6 µV	
	(2.2 to 7) mV (10 to 30) Hz	0.08 % of reading + 0.1 µV	
	30 Hz to 120 kHz	0.04 % of reading + 0.1 µV	
	120 kHz 2 MHz	0.05 % of reading + 0.8 µV	
	(2 to 10) MHz	0.08 % of reading + 0.8 µV	
	(10 to 20) MHz	0.13 % of reading + 0.8 µV	
	(20 to 30) MHz	0.28 % of reading + 0.8 µV	
	(7 to 22) mV (10 to 30) Hz	0.08 % of reading + 0.1 µV	
	30 Hz to 120 kHz	0.04 % of reading + 0.1 µV	
	120 kHz 2 MHz	0.05 % of reading + 0.1 µV	
	(2 to 10) MHz	0.08 % of reading + 0.1 µV	
	(10 to 20) MHz	0.13 % of reading + 0.1 µV	
	(20 to 30) MHz	0.28 % of reading + 0.1 µV	
	(22 to 70) mV (10 to 30) Hz	0.08 % of reading + 0.6 µV	
	30 Hz to 2 MHz	0.04 % of reading + 0.6 µV	
(2 to 10) MHz	0.08 % of reading + 0.6 µV		
(10 to 20) MHz	0.11 % of reading + 0.6 µV		
(20 to 30) MHz	0.27 % of reading + 0.6 µV		
(70 to 220) mV (10 to 30) Hz	0.08 % of reading		
30 Hz to 500 kHz	0.03 % of reading		
500 kHz to 2 MHz	0.04 % of reading		
(2 to 10) MHz	0.08 % of reading		
(10 to 20) MHz	0.11 % of reading		
(20 to 30) MHz	0.27 % of reading		



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Electrical – DC/Low Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure Wideband Flatness Relative to 1 kHz	(220 to 700) mV		Comparison to Fluke 5790B AC/DC Measurement Standard
	(10 to 30) Hz	0.08 % of reading	
	30 Hz to 500 kHz	0.02 % of reading	
	500 kHz to 2 MHz	0.04 % of reading	
	(2 to 10) MHz	0.08 % of reading	
	(10 to 20) MHz	0.11 % of reading	
	(20 to 30 MHz)	0.27 % of reading	
	(0.7 to 2) V		
	(10 to 30) Hz	0.08 % of reading	
	30 Hz to 500 kHz	0.02 % of reading	
	500 kHz to 2 MHz	0.04 % of reading	
	(2 to 10) MHz	0.08 % of reading	
	(10 to 20) MHz	0.11 % of reading	
	(20 to 30) MHz	0.27 % of reading	
	(2.2 to 7) V		
(10 to 30) Hz	0.08 % of reading		
30 Hz to 500 kHz	0.02 % of reading		
500 kHz to 2 MHz	0.04 % of reading		
(2 to 10) MHz	0.08 % of reading		
(10 to 20) MHz	0.11 % of reading		
(20 to 30) MHz	0.27 % of reading		
Power Meter Range Calibration ¹	3 μ W to 100 mW	0.25 % of reading	Comparison to HP 11683A Power Meter Calibrator

Electrical – RF/Microwave

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness – Measure	9 kHz to 2 000 MHz		Comparison to Agilent EPN Series Power Meter w/E9304A H18 Power Sensor
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.1 dB	
	(-30 to -40) dBm	0.11 dB	
	(-40 to -42) dBm	0.12 dB	
	(2 to 14) GHz		
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.09 dB	
	(-30 to -40) dBm	0.1 dB	
	(-40 to -42) dBm	0.11 dB	



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Electrical – RF/Microwave

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness – Measure	(14 to 18) GHz (20 to -10) dBm (-10 to -30) dBm (-30 to -40) dBm (-40 to -42) dBm	0.11 dB 0.12 dB 0.12 dB 0.13 dB	Comparison to Agilent EPN Series Power Meter w/E9304A H18 Power Sensor
Thermal Noise – Measure ENR	5 dB, 15 dB, or 21 dB 0.1 GHz 1 GHz 2 GHz 3 GHz 4 GHz 5 GHz 6 GHz 7 GHz 8 GHz 9 GHz 10 GHz 11 GHz 12 GHz 13 GHz 14 GHz 15 GHz 16 GHz	0.21 dB 0.21 dB 0.22 dB 0.23 dB 0.24 dB 0.25 dB 0.26 dB 0.27 dB 0.28 dB 0.29 dB 0.3 dB 0.31 dB 0.32 dB 0.33 dB 0.34 dB 0.35 dB 0.36 dB	Comparison to Agilent 3460 Noise Source - Option H13
Thermal Noise – Measure ENR	5 dB, 15 dB, or 21 dB 17 GHz 18 GHz 19 GHz 20 GHz 21 GHz 22 GHz 23 GHz 24 GHz 25 GHz 26 GHz 26.5 GHz	0.37 dB 0.38 dB 0.39 dB 0.4 dB 0.41 dB 0.42 dB 0.43 dB 0.44 dB 0.45 dB 0.46 dB 0.47 dB	Comparison to Agilent 3460 Noise Source - Option H13



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Electrical – RF/Microwave

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(30 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.13 dB	
	(3 050 to 6 600) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.19 dB	
	(6 600 to 13 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.12 dB		
(80 to 90) dB	0.12 dB		
(90 to 100) dB	0.13 dB		
(100 to 110) dB	0.25 dB		



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Electrical – RF/Microwave

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(13 200 to 19 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.31 dB	
	(19 200 to 26 500) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.14 dB	
	(90 to 100) dB	0.36 dB	
	(100 to 110) dB	0.82 dB	
	(26 500 to 31 150) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.12 dB		
(80 to 90) dB	0.13 dB		
(90 to 100) dB	0.33 dB		
(100 to 110) dB	0.77 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(31 150 to 41 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.14 dB	
	(80 to 90) dB	0.36 dB	
	(41 000 to 45 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.11 dB	
	(70 to 80) dB	0.24 dB	
	(80 to 90) dB	0.6 dB	
	(45 000 to 50 000) MHz		
(0 to 10) dB	0.02 dB		
(10 to 20) dB	0.025 dB		
(20 to 30) dB	0.03 dB		
(30 to 40) dB	0.035 dB		
(40 to 50) dB	0.04 dB		
(50 to 60) dB	0.11 dB		
(60 to 70) dB	0.29 dB		
(70 to 80) dB	0.7 dB		
(80 to 90) dB	1.4 dB		
RF Power – Measure ¹	9 kHz to 14 000 MHz		Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(20 to 0) dB	0.13 dB	
	(0 to -40) dB	0.15 dB	
	(-40 to -50) dB	0.35 dB	
	(-50 to -55) dB	0.93 dB	
	(14 000 to 18 000) MHz		
	(20 to 0) dB	0.12 dB	
	(0 to -40) dB	0.16 dB	
	(-40 to -50) dB	0.35 dB	
	(-50 to -55) dB	0.93 dB	



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Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(50 to 100) MHz		Comparison to Agilent EPM Series Power Meter RF Power / Keysight N8487A Power Sensor
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.07 dB	
	(0 to -10) dB	0.07 dB	
	(-10 to -20) dB	0.07 dB	
	(-20 to -25) dB	0.11 dB	
	(100 to 6 000) MHz		
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.07 dB	
	(0 to -10) dB	0.07 dB	
	(-10 to -20) dB	0.08 dB	
	(-20 to -25) dB	0.11 dB	
	(6 000 to 12 400) MHz		
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.08 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.08 dB	
	(-20 to -25) dB	0.12 dB	
	(12 400 to 18 000) MHz		
	(20 to 10) dB	0.09 dB	
	(10 to 0) dB	0.09 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.09 dB	
	(-20 to -25) dB	0.12 dB	
	(18 000 to 26 500) MHz		
	(20 to 10) dB	0.11 dB	
	(10 to 0) dB	0.11 dB	
	(0 to -10) dB	0.10 dB	
(-10 to -20) dB	0.11 dB		
(-20 to -25) dB	0.14 dB		
(26 500 to 33 000) MHz			
(20 to 10) dB	0.12 dB		
(10 to 0) dB	0.12 dB		
(0 to -10) dB	0.12 dB		
(-10 to -20) dB	0.12 dB		
(-20 to -25) dB	0.14 dB		

Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(33 000 to 40 000) MHz		Comparison to Agilent EPM Series Power Meter RF Power / Keysight N8487A Power Sensor
	(20 to 10) dB	0.13 dB	
	(10 to 0) dB	0.13 dB	
	(0 to -10) dB	0.12 dB	
	(-10 to -20) dB	0.13 dB	
	(-20 to -25) dB	0.15 dB	
	(40 000 to 50 000) MHz		
	(20 to 10) dB	0.19 dB	
	(10 to 0) dB	0.18 dB	
	(0 to -10) dB	0.18 dB	
RF Power – Measure ¹	100 kHz to 2 000 MHz		Comparison to Agilent EPM Series Power Meter RF Power / HP 8482B Power Sensor
	(44 to 35) dB	0.18 dB	
	(35 to 30) dB	0.07 dB	
	(30 to 20) dB	0.07 dB	
	(20 to 10) dB	0.08 dB	
	(10 to 5) dB	0.15 dB	
	(2 000 to 4 200) MHz		
	(44 to 35) dB	0.18 dB	
	(35 to 30) dB	0.07 dB	
	(30 to 20) dB	0.07 dB	
RF Power – Measure ¹	(30 to 2 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.36 dB	
	(20 to 0) dB	0.2 dB	
	(0 to -58) dB	0.22 dB	
	(-58 to -78) dB	0.23 dB	
	(-78 to -110) dB	0.25 dB	
	(-110 to -115) dB	0.27 dB	
	(-115 to -120) dB	0.33 dB	
(-120 to -125) dB	0.46 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(2 000 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.26 dB	
	(-110 to -115) dB	0.28 dB	
	(-115 to -120) dB	0.34 dB	
	(-120 to -125) dB	0.7 dB	
	(3 050 to 6 600) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.29 dB	
	(-110 to -115) dB	0.38 dB	
	(-115 to -120) dB	0.53 dB	
	(6 600 to 13 200) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.34 dB	
	(-110 to -115) dB	0.46 dB	
	(-115 to -120) dB	0.65 dB	
	(13 200 to 18 000) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
(-78 to -90) dB	0.26 dB		
(-90 to -95) dB	0.26 dB		
(-95 to -100) dB	0.26 dB		
(-100 to -105) dB	0.29 dB		
(-105 to -110) dB	0.38 dB		
(-110 to -115) dB	0.53 dB		
(-115 to -120) dB	0.75 dB		



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Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(18 000 to 19 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.27 dB	
	(-90 to -95) dB	0.27 dB	
	(-95 to -100) dB	0.27 dB	
	(-100 to -105) dB	0.3 dB	
	(-105 to -110) dB	0.38 dB	
	(-110 to -115) dB	0.53 dB	
	(-115 to -120) dB	0.75 dB	
	(19 200 to 26 500) MHz		
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.28 dB	
	(-90 to -95) dB	0.33 dB	
	(-95 to -100) dB	0.43 dB	
	(-100 to -105) dB	0.61 dB	
	(-105 to -110) dB	0.85 dB	
	(-110 to -115) dB	1.2 dB	
	(-115 to -120) dB	1.5 dB	
	(26 500 to 31 150) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
(0 to -58) dB	0.34 dB		
(-58 to -78) dB	0.34 dB		
(-78 to -90) dB	0.36 dB		
(-90 to -95) dB	0.39 dB		
(-95 to -100) dB	0.46 dB		
(-100 to -105) dB	0.61 dB		
(-105 to -110) dB	0.82 dB		
(-110 to -115) dB	1.1 dB		



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Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(31 150 to 41 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.35 dB	
	(-78 to -90) dB	0.48 dB	
	(-90 to -95) dB	0.64 dB	
	(-95 to -100) dB	0.87 dB	
	(-100 to -105) dB	1.2 dB	
	(-105 to -110) dB	1.5 dB	
	(41 000 to 45 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.38 dB	
	(-78 to -90) dB	0.68 dB	
	(-90 to -95) dB	0.93 dB	
	(-95 to -100) dB	1.2 dB	
(-100 to -105) dB	1.6 dB		
(45 000 to 50 000) MHz			
(30 to 20) dB	0.42 dB		
(20 to 0) dB	0.3 dB		
(0 to -58) dB	0.34 dB		
(-58 to -78) dB	0.67 dB		
(-78 to -90) dB	1.4 dB		
Amplitude Modulation – Measure ¹	100 kHz to 10 MHz Rate 50 Hz to 10 kHz (5 to 99) % Depth	0.75 % of reading + 0.3 digits	Comparison to Agilent N5531S Measuring Receiver
	10 MHz to 3 GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth	2.5 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.5 % of reading + 0.4 digits	
	(3 to 26.5) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth	4.5 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.5 % of reading + 0.4 digits	
	(26.5 to 31.15) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth	6.8 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.9 % of reading + 0.4 digits	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – Measure ¹	(31.15 to 50) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth	26 % of reading + 0.4 digits 6 % of reading + 0.4 digits	Comparison to Agilent N5531S Measuring Receiver
Frequency Modulation – Measure ¹ β = deviation / rate	250 kHz to 10 MHz Rates 20 Hz to 10 kHz Peak Dev 200 to 40 kHz 10 MHz to 6.6 GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (6.6 to 13.2) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (13.2 to 26.5) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (13.2 to 31.15) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (31.15 to 50) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz	$\beta > 0.2$ - 1.5 % of reading + 2 Hz $\beta > 1.2$ - 1 % of reading + 2 Hz $\beta > 0.20$ - 1.5 % of reading + 2 Hz $\beta > 0.45$ - 1 % of reading + 2 Hz $\beta > 0.2$ - 2.5 % of reading + 4 Hz $\beta > 8.0$ - 1 % of reading + 4 Hz $\beta > 0.2$ - 3.8 % of reading + 9 Hz $\beta > 16$ - 1 % of reading + 9 Hz $\beta > 0.2$ - 3.8 % of reading + 9 Hz $\beta > 16$ - 1 % of reading + 9 Hz $\beta > 0.2$ - 8.5 % of reading + 17 Hz $\beta > 16$ - 1 % of reading + 17 Hz	Comparison to Agilent N5531S Measuring Receiver
Phase Modulation – Measure ¹	100 kHz to 6.6 GHz Deviations > 0.3 rad Deviations > 0.7 rad (6.6 to 13.2) GHz Deviations > 0.6 rad Deviations > 2.0 rad (13.2 to 26.5) GHz Deviations: > 1.2 rad Deviations > 4.0 rad (26.5 to 31.15) GHz Deviations: > 1.3 rad Deviations > 4.0 rad (31.15 to 50) GHz Deviations: > 2.4 rad Deviations > 8.0 rad	3 % of reading + 0.002 rad 1 % of reading + 0.002 rad 3 % of reading + 0.005 rad 1 % of reading + 0.005 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad 3 % of reading + 0.018 rad 1 % of reading + 0.018 rad	Comparison to Agilent N5531S Measuring Receiver



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Electrical – RF/Microwave

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
AM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(0.1 to 10) MHz		Comparison to Agilent N5531S Measuring Receiver	
	AM Depth > 1 %			
	(0 to -20) dB	1.2 dB		
	(-20 to -30) dB	2.2 dB		
	AM Depth > 3 %			
	(0 to -20) dB	1 dB		
	(-20 to -30) dB	1.3 dB		
	(-30 to -40) dB	2.4 dB		
	10 MHz to 26.5 GHz			
	AM Depth > 1 %			
	(0 to -20) dB	1.3 dB		
	(-20 to -30) dB	2.5 dB		
	AM Depth > 3 %			
	(0 to -20) dB	1.1 dB		
(-20 to -30) dB	1.4 dB			
(-30 to -40) dB	3 dB			
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(26.5 MHz to 50.0 GHz)		Comparison to Agilent N5531S Measuring Receiver	
	AM Depth > 3 %			
	(0 to -20) dB	1.8 dB		
	AM Depth > 5%			
	(0 to -20) dB	1.5 dB		
	(-20 to -30) dB	3.5 dB		
	(1 to 6 600) MHz			Comparison to Agilent N5531S Measuring Receiver
	Dev 500 Hz to 2 kHz			
	(0 to -20) dB	0.26 dB		
	(-20 to -30) dB	0.79 dB		
	(-30 to -40) dB	2.3 dB		
	Dev > 2 kHz			
	(0 to -20) dB	0.09 dB		
	(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB			
(-40 to -50) dB	2.4 dB			
(6.6 to 13.2) GHz				
Dev > 2.3 kHz				
(0 to -20) dB	0.26 dB			
(-20 to -30) dB	0.79 dB			
(-30 to -40) dB	2.3 dB			



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(6.6 to 13.2) GHz Dev > 4.5 K kHz Hz		Comparison to Agilent N5531S Measuring Receiver
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.4 dB	
	(13.2 to 31.15) GHz Dev > 2.7 kHz		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 6.0 kHz		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.4 dB	
	(31.15 to 50.0) GHz Dev > 4 kHz		
	(0 to -20) dB	0.26 dB	
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
(31.15 to 50.0) GHz Dev > 12.0 kHz			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.4 dB		
PM Distortion Measure ¹	(1 to 6 600) MHz Rate (20 to 500) Hz Dev > 0.8 rad		Comparison to Agilent N5531S Measuring Receiver
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 2.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
(-40 to -50) dB	2.3 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(1 to 6 600) MHz		Comparison to Agilent N5531S Measuring Receiver
	Rate (500 to 1 000) Hz		
	Dev > 0.4 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 1.0 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	(6.6 to 13.2) GHz		
	Rate (20 to 500) Hz		
	Dev > 1.8 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 5.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	(6.6 to 13.2) GHz		
	Rate (500 to 1 000) Hz		
Dev > 0.8 rad	0.26 dB		
(0 to -20) dB	0.79 dB		
(-20 to -30) dB	2.3 dB		
(-30 to -40) dB			
Dev > 2.5 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(13.2 to 31.15) GHz		Comparison to Agilent N5531S Measuring Receiver
	Rate (20 to 500) Hz		
	Dev > 3.5 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 10.0 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	Rate (500 to 1 000) Hz		
	Dev > 1.2 rad		
	(0 to -20) dB	0.26 dB	
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 4.0 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		
Harmonics Measure ¹	(-10 to -80) dB		Comparison to Agilent E4448A Measuring Receiver
	2 nd through 5 th Harmonic		
	1kHz to 600MHz	0.37 dB	
	(600 to 1 320) MHz	1.1 dB	
	(1 320 to 2 200) MHz	1.4 dB	
	(2 200 to 3 000) MHz	1.4 dB	
	(3 000 to 4 400) MHz	1.7 dB	
	(4 400 to 5 300) MHz	1.9 dB	
	(5 300 to 10 000) MHz	2.1 dB	
	2 nd through 4 th Harmonic		
	(10 000 to 12 500) MHz	2.1 dB	
2 nd through 3 rd Harmonic			
(12 500 to 16 667) MHz	2.1 dB		
2 nd Harmonic			
(16 667 to 25 000) MHz	2.3 dB		
Attenuation Generate @ 30 MHz	10 dB	5.6 mdB	Comparison to HP 11812A Calibration Kit
	20 dB	7.6 mdB	
	30 dB	6.4 mdB	
	40 dB	7.4 mdB	
	50 dB	8.6 mdB	

Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹ 50 MHz	1.0 mW	0.37 % of reading	Comparison to HP 478A/Opt H76 Power Meter
RF Power – Generate	10 Hz to 100 kHz (24 to -48) dBm 100 kHz to 9.99 MHz (-48 to 24) dBm (-48 to -74) dBm (-74 to -94) dBm (10 MHz to 128) MHz (24 to -48) dBm (-48 to -84) dBm (-84 to -94) dBm (-94 to -124) dBm (128 to 300) MHz (20 to -48) dBm (-48 to -74) dBm (-74 to -84) dBm (-84 to -94) dBm (-94 to -124) dBm (300 to 1 400) MHz (20 to -48) dBm (-48 to -74) dBm (-74 to -84) dBm (-84 to -94) dBm (-94 to -124) dBm (1.4 to 3.0) GHz (14 to -48) dBm (-48 to -74) dBm (-74 to -94) dBm (-94 to -124) dBm	0.06 dB 0.07 dB 0.16 dB 0.39 dB 0.07 dB 0.09 dB 0.24 dB 0.54 dB 0.08 dB 0.09 dB 0.24 dB 0.39 dB 1.2 dB 0.16 dB 0.31 dB 0.39 dB 0.77 dB 1.2 dB 0.24 dB 0.39 dB 0.77 dB 1.2 dB	Comparison to Fluke 9640A-LPNX RF Reference Source
RF Power – Generate ¹	(30 to 2 000) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB	0.29 dB 0.3 dB 0.31 dB 0.32 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, E8257D Signal Generator

Electrical – RF/Microwave

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Generate ¹	(2 000 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, E8257D Signal Generator
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.39 dB	
	(3 050 to 6 600) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.39 dB	
	(6 600 to 13 200) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.42 dB	
	(13 200 to 18 000) MHz		
	(15 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.46 dB	
	(18 000 to 19 200) MHz		
	(15 to 0) dB	0.41 dB	
	(0 to -58) dB	0.41 dB	
	(-58 to -78) dB	0.42 dB	
(-78 to -110) dB	0.5 dB		
(19 200 to 26 500) MHz			
(15 to 0) dB	0.41 dB		
(0 to -58) dB	0.41 dB		
(-58 to -78) dB	0.42 dB		
(-78 to -110) dB	0.9 dB		
(26 500 to 31 150) MHz			
(15 to 0) dB	0.62 dB		
(0 to -58) dB	0.63 dB		
(-58 to -78) dB	0.64 dB		
(-78 to -110) dB	0.96 dB		
(31 150 to 41 000) MHz			
(10 to 0) dB	0.82 dB		
(0 to -58) dB	0.83 dB		
(-58 to -78) dB	0.84 dB		
(-78 to -100) dB	1.1 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Generate ¹	(41 000 to 45 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, E8257D Signal Generator
	(10 to 0) dB	0.82 dB	
	(0 to -58) dB	0.83 dB	
	(-58 to -78) dB	0.85 dB	
	(-78 to -100) dB	1.4 dB	
	(45 000 to 50 000) MHz		
RF Power – Power Sensor (Cal Factor)	(10 to 0) dB	0.82 dB	M is the mismatch Uncertainty Comparison to Agilent EPM Series Power Meter RF Power / Keysight 8482A H84 Power Sensor
	(0 to -58) dB	0.83 dB	
	(-58 to -78) dB	1 dB	
	(-78 to -90) dB	1.5 dB	
	Type-N (50 Ω)		
	0.1 MHz	1.1 % of reading + M	
	0.3 MHz	0.94 % of reading + M	
	0.5 MHz	0.93 % of reading + M	
	1 MHz	0.93 % of reading + M	
	3 MHz	0.9 % of reading + M	
	5 MHz	0.9 % of reading + M	
	10 MHz	0.89 % of reading + M	
	30 MHz	0.89 % of reading + M	
	50 MHz	0.91 % of reading + M	
	100 MHz	0.89 % of reading + M	
	300 MHz	0.94 % of reading + M	
	500 MHz	0.94 % of reading + M	
	1 000 MHz	0.96 % of reading + M	
	1 500 MHz	0.96 % of reading + M	
	2 000 MHz	0.96 % of reading + M	
2 500 MHz	1.1 % of reading + M		
3 000 MHz	1.2 % of reading + M		
3 500 MHz	1.2 % of reading + M		
3 700 MHz	1.2 % of reading + M		
4 000 MHz	1.4 % of reading + M		
4 200 MHz	1.4 % of reading + M		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Power Sensor (Cal Factor)	Type-N (50 Ω)		<p>M is the mismatch Uncertainty</p> <p>Comparison to Agilent EPM Series Power Meter RF Power / Keysight 8481A H84 Power Sensor</p>
	100 MHz	1.2 % of reading + M	
	500 MHz	1.2 % of reading + M	
	1 000 MHz	1.2 % of reading + M	
	2 000 MHz	1.2 % of reading + M	
	3 000 MHz	1.3 % of reading + M	
	4 000 MHz	1.3 % of reading + M	
	5 000 MHz	1.4 % of reading + M	
	6 000 MHz	1.4 % of reading + M	
	7 000 MHz	1.4 % of reading + M	
	8 000 MHz	1.4 % of reading + M	
	9 000 MHz	1.5 % of reading + M	
	10 000 MHz	1.5 % of reading + M	
	11 000 MHz	1.5 % of reading + M	
	12 000 MHz	1.5 % of reading + M	
	13 000 MHz	1.7 % of reading + M	
	14 000 MHz	1.7 % of reading + M	
	15 000 MHz	1.7 % of reading + M	
16 000 MHz	1.8 % of reading + M		
17 000 MHz	1.8 % of reading + M		
18 000 MHz	1.9 % of reading + M		
RF Power – Power Sensor (Cal Factor)	3.5 mm (50Ω)		<p>M is the mismatch Uncertainty</p> <p>Comparison to Agilent EPM Series Power Meter RF Power / Keysight 8485A H84 Power Sensor</p>
	50 MHz	1.3 % of reading + M	
	100 MHz	1.2 % of reading + M	
	300 MHz	1.2 % of reading + M	
	500 MHz	1.3 % of reading + M	
	1 000 MHz	1.3 % of reading + M	
	1 500 MHz	1.3 % of reading + M	
	2 000 MHz	1.2 % of reading + M	
	3 000 MHz	1.3 % of reading + M	
	4 000 MHz	1.3 % of reading + M	
	5 000 MHz	1.3 % of reading + M	
	6 000 MHz	1.4 % of reading + M	
	7 000 MHz	1.4 % of reading + M	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Power Sensor (Cal Factor)	3.5 mm (50Ω)		<p>M is the mismatch Uncertainty</p> <p>Comparison to Agilent EPM Series Power Meter RF Power / Keysight 8485A H84 Power Sensor</p>
	8 000 MHz	1.5 % of reading + M	
	9 000 MHz	1.6 % of reading + M	
	10 000 MHz	1.6 % of reading + M	
	11 000 MHz	1.5 % of reading + M	
	12 000 MHz	1.5 % of reading + M	
	12 400 MHz	1.6 % of reading + M	
	13 000 MHz	1.6 % of reading + M	
	14 000 MHz	1.9 % of reading + M	
	15 000 MHz	1.7 % of reading + M	
	16 000 MHz	1.6 % of reading + M	
	17 000 MHz	1.8 % of reading + M	
	18 000 MHz	1.7 % of reading + M	
	19 000 MHz	2 % of reading + M	
	20 000 MHz	2.2 % of reading + M	
	21 000 MHz	2.1 % of reading + M	
	22 000 MHz	2.5 % of reading + M	
	23 000 MHz	2.7 % of reading + M	
24 000 MHz	2.3 % of reading + M		
25 000 MHz	2 % of reading + M		
26 000 MHz	2 % of reading + M		
26 500 MHz	2.3 % of reading + M		
RF Power – Power Sensor (Cal Factor)	2.4 mm (50 Ω)		<p>M is the mismatch Uncertainty</p> <p>Comparison to Agilent EPM Series Power Meter RF Power / Keysight N8487A H84 Power Sensor</p>
	50 MHz	1.1 % of reading + M	
	100 MHz	1.1 % of reading + M	
	300 MHz	1.1 % of reading + M	
	500 MHz	1.2 % of reading + M	
	1 000 MHz	1.2 % of reading + M	
	2 000 MHz	1.2 % of reading + M	
	3 000 MHz	1.2 % of reading + M	
	4 000 MHz	1.2 % of reading + M	
	5 000 MHz	1.3 % of reading + M	
	6 000 MHz	1.3 % of reading + M	
	7 000 MHz	1.3 % of reading + M	
	8 000 MHz	1.4 % of reading + M	
	9 000 MHz	1.5 % of reading + M	
	10 000 MHz	1.5 % of reading + M	
	11 000 MHz	1.5 % of reading + M	
12 000 MHz	1.5 % of reading + M		
13 000 MHz	1.5 % of reading + M		
14 000 MHz	1.6 % of reading + M		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Power Sensor (Cal Factor)	2.4 mm (50 Ω)		<p>M is the mismatch Uncertainty</p> <p>Comparison to Agilent EPM Series Power Meter RF Power / Keysight N8487A H84 Power Sensor</p>
	15 000 MHz	1.6 % of reading + M	
	16 000 MHz	1.7 % of reading + M	
	17 000 MHz	1.7 % of reading + M	
	18 000 MHz	1.7 % of reading + M	
	19 000 MHz	1.9 % of reading + M	
	20 000 MHz	1.9 % of reading + M	
	21 000 MHz	1.9 % of reading + M	
	22 000 MHz	1.9 % of reading + M	
	23 000 MHz	1.9 % of reading + M	
	24 000 MHz	1.9 % of reading + M	
	25 000 MHz	1.9 % of reading + M	
	26 000 MHz	1.9 % of reading + M	
	27 000 MHz	2.4 % of reading + M	
	28 000 MHz	2.4 % of reading + M	
	29 000 MHz	2.4 % of reading + M	
	30 000 MHz	2.4 % of reading + M	
	31 000 MHz	2.4 % of reading + M	
	32 000 MHz	2.4 % of reading + M	
	33 000 MHz	2.4 % of reading + M	
	34 000 MHz	2.5 % of reading + M	
	34 500 MHz	2.5 % of reading + M	
	35 000 MHz	2.5 % of reading + M	
	36 000 MHz	2.6 % of reading + M	
	37 000 MHz	2.6 % of reading + M	
	38 000 MHz	2.6 % of reading + M	
	39 000 MHz	2.9 % of reading + M	
	40 000 MHz	3 % of reading + M	
	41 000 MHz	3.2 % of reading + M	
	42 000 MHz	3.2 % of reading + M	
43 000 MHz	3.2 % of reading + M		
44 000 MHz	3.2 % of reading + M		
45 000 MHz	3.2 % of reading + M		
46 000 MHz	3.2 % of reading + M		
47 000 MHz	3.2 % of reading + M		
48 000 MHz	3.3 % of reading + M		
49 000 MHz	3.4 % of reading + M		
50 000 MHz	3.4 % of reading + M		
Phase Noise ¹			Comparison to HP 3048A Phase Noise System with 866XA Source
Offset Frequency	≤ 100 kHz	2.3 dB	
5 MHz < f ≤ 18 GHz	100 kHz to 40 MHz	4.6 dB	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
Total Harmonic Distortion (THD)	(0 to -60) dB		Comparison to HP 8903B Audio Analyzer	
	20 Hz to 20 kHz			
	(0 to -40) dB	1 dB		
	(-40 to -50) dB	1 dB		
	(-50 to -60) dB	1.3 dB		
	(-60 to -65) dB	1.7 dB		
	(20 to 50) kHz			
	(0 to -40) dB	2 dB		
	(-40 to -50) dB	2.1 dB		
	(-50 to -60) dB	3 dB		
	(50 to 100) kHz			
	(0 to -40) dB	2 dB		
	(-40 to -50) dB	2.4 dB		
Return Loss (VSWR)	(0 to 120) dB	5 Hz to 45 MHz	1.1 dB	
		45 MHz to 50 GHz	0.41 dB	
ISN – Relative Amplitude (dB) Insertion Loss	(0 to 120) dB		CISPR 22, CISPR 32, CISPR 16-1-2 HP 8751A Network Analyzer & HP 87512A Transmission/Reflection Test Set, 85032B Calibration Kit	
	150 kHz to 80 MHz	0.59 dB		
Impedance Magnitude (Ω)	(0 to 1) k Ω			
	150 kHz to 80 MHz	2 % of reading		
Impedance Phase ($^{\circ}$)	(-180 to 180) $^{\circ}$			
	150 kHz to 80 MHz	1.8 $^{\circ}$		
CDN's & Adapters – (50 to 150) Ω	(0 to 120) dB	10 kHz to 230 MHz	1.3 dB	
				Relative Amplitude (dB) Adapter Insertion Loss
	(0 to 120) dB	10 kHz to 230 MHz	1.3 dB	IEC/EN 61000-4-6 CISPR 16-1-2 HP 8751A Network Analyzer & HP 87512A Transmission/Reflection Test Set, 85032B Calibration Kit
	(0 to 1) k Ω			
	Impedance Magnitude (Ω)	10 kHz to 230 MHz	2 % reading	
Relative Amplitude (dB)	(0 to 120) dB			
Voltage Division Factor	10 kHz to 230 MHz	0.59 dB		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
LISN – Relative Amplitude (dB) Insertion Loss	(0 to 120) dB 9 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz	0.59 dB 1.3 dB 1.8 dB	ANSI C63.4, CISPR 25, CISPR 16-1-2 HP 8751A Network Analyzer & HP 87512A Transmission/Reflection Test Set, 85032B Calibration Kit
Impedance Magnitude (Ω)	(0 to 1) k Ω	2 % of reading	
Impedance – Phase ($^{\circ}$)	9 kHz to 500 MHz (-180 to 180) $^{\circ}$	1.8 $^{\circ}$	
Relative Amplitude (dB) Isolation	(0 to 120) dB 9 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz	0.59 dB 1.3 dB 1.8 dB	
Current Probes and Bulk Current Injection Probes Insertion Loss and Transfer Impedance	(0 to 120) dB 20 Hz to 100 MHz (100 to 300) MHz (300 to 500) MHz	0.59 dB 1.3 dB 1.8 dB	
Relative Amplitude (dB)	(300 to 500) MHz	1.8 dB	

Length – Dimensional Metrology

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks ²	Up to 20 in	$(3.2 + 1.2L) \mu\text{in}$	Comparison to Master gage blocks, P&W universal measuring machine
Micrometers ^{1,2}	Up to 40 in	$(30 + 4.8L) \mu\text{in}$	Comparison to Gage blocks (grade 2)
Micrometer Standards Length Rods	Up to 40 in	$(4.3 + 3.8L) \mu\text{in}$	Comparison to Gage blocks (grade 2), P&W universal measuring machine
Calipers ^{1,2}	Up to 40 in	$(280 + 2L) \mu\text{in}$	Comparison to Gage blocks (grade 2)
Dial Indicators ^{1,2} Resolution: $\geq 50\mu\text{in}$ $< 50\mu\text{in}$	Up to 10 in Up to 0.1 in	$(26 + 3.3L) \mu\text{in}$ 7.7 μin	Comparison to Gage blocks (grade 2)

Length – Dimensional Metrology

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Height Gages ^{1,2}	Up to 40 in	$(114 + 3.3L) \mu\text{in}$	Comparison to Gage blocks (grade 2)
Protractors ¹	$(0 \text{ to } 360)^\circ$	0.0086°	Comparison to Angle blocks
Rulers ¹	Up to 46 in	0.009 in	Comparison to Gage blocks (grade 2)
Radius Gages	$(0.016 \text{ to } 1) \text{ in}$	220 μin	Comparison to Optical Comparator
Tape Measures ²	Up to 100 ft	$(0.00026F + 0.025) \text{ in}$	Comparison to Standard rule
Bore Micrometers ² 2 point 3 point	Up to 12 in	$(22 + 3.6L) \mu\text{in}$ $(8.8 + 42L) \mu\text{in}$	Comparison to Master gage blocks, P&W universal measuring machine, Master Ring
Feeler Gage ¹	Up to 1 in	30 μin	Comparison to Pratt & Whitney Supermicrometer C
Cylindrical Gages ^{1,2} – Plain Pin, Plugs, Rings	$(0.04 \text{ to } 13) \text{ in}$	$(5.3 + 2.3D) \mu\text{in}$	Comparison to Master gage blocks, P&W universal measuring machine
Cylindrical Gages ^{1,2} – Plain Rings	$(0 \text{ to } 14) \text{ in}$	$(8.1 + 2.9D) \mu\text{in}$	
Thread Plugs ¹ – Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	36 μin 92 μin	Comparison to B & S 599-246-00, Van Keuren thread wire set, Gage blocks, Pratt & Whitney Labmaster
Solid Thread Rings Pitch Diameter	Up to 12 in	107 μin	Comparison to Pratt & Whitney Labmaster Measuring Machine
Adjustable Thread Rings ^{2,3} Pitch Diameter (Tactile Fit)	Up to 12 in	$(350 + 47D) \mu\text{in}$	Comparison to Thread setting plug gages
NPT Thread Plugs Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	85 μin 120 μin	Comparison to P&W Model C Bench Micrometer, Van Keuren Thread Wire Set, Alameda Pipe Taper Sine Block
Thread Wires ²	Up to 0.5D	10 μin	Comparison to Master gage blocks, P&W universal measuring machine

Length – Dimensional Metrology

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Surface Plates ¹ – Overall Flatness Local Area Flatness	Up to 6 ft × 6 ft (-0.001 to 0.001) in	125 μin 68 μin	Comparison to Planekator Repeat-O-Meter
Optical Comparators ¹ – Angle Linearity Magnification	Up to 360 ° Up to 20 in (20 to 40) in (10 to 100) x	0.008 7 ° 210 μin 450 μin 340 μin	Comparison to Gage blocks, Angle Blocks, SI Industries glass scales
Coating Thickness Gages ^{1,2} Eddy Current & Magnetic Induction	(0.737 to 100) mils (100 to 243) mils	26 μin 240 μin	Comparison to Coating thickness standards
Ultrasonic Thickness Gauges ¹	Up to 10 in	110 μin	Comparison to Gage blocks
Coating Thickness Shims ²	(0 to 243) mils	56 μin	Comparison to Pratt & Whitney Supermicrometer Model C
Crimp Tools ¹	(0.011 to 1) in (0.011 to 0.5) in	150 μin 240 μin	Comparison to Micrometer, Pin Gages

Mass and Mass Related

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales & Balances ^{1,2,4}	1 mg to 5 000 g (0.001 to 100) lb	(0.049 + 0.003X) mg (3.2 E ⁻⁶ + 3.1 E ⁻⁶ W) lb	Comparison to Class 1 weights
	Up to 1 000 lb	(0.000 2 + 0.000 12W) lb	Comparison to Class F weights
Force ¹ Tension and Compression	(0.5 to 750) lbf	0.09 % of reading	Comparison to Class F weights
	(20 to 1 000) lbf (200 to 10 000) lbf (10 000 to 25 000) lbf (25 000 to 50 000) lbf	The greater of: 0.012 % of reading or 0.023 lbf 0.012 % of reading or 0.24 lbf 0.012 % of reading or 0.5 lbf 0.012 % of reading or 0.77 lbf	Comparison to Morehouse Press with Load Cells
Pressure ¹	(0 to 24) inH ₂ O	0.001 5 inH ₂ O	Comparison to Dwyer 1425-25 Hook Gage

Mass and Mass Related

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure ¹	(60 to 110) kPa (8.7 to 16) psia	0.027 kPa 0.004 psi	Comparison to ADT783 Pressure Controller with ADT151-BP module
Pressure ¹	(-15 to 15) psi (>15 to 30) psi	0.001 8 psi 0.012 % of reading	Comparison to ADT783 Pressure Controller with ADT151-01RD-CP30M module
Pressure ¹	(-15 to 150) psi (>150 to 300) psi	0.018 psi 0.012 % of reading	Comparison to ADT783 Pressure Controller with ADT151-01RD-CP300M module
Pressure ¹	(-15 to 500) psi (>500 to 1 000) psi	0.059 psi 0.012 % of reading	Comparison to ADT783 Pressure Controller with ADT151-01RD-CP1KM module
Pressure ¹	(10 to 16 000) psi	0.019 % of reading	Comparison to Fluke P3125-PSI Dead Weight Tester
Pressure ¹	(16 000 to 40 000) psi	25 psi	Comparison to Additel ADT672-10-GP40K Pressure Calibrator
Gas Flow	(1 to 10 000) sccm (10 to 1 000) slpm	0.2 % of reading 0.26 % of reading	Comparison to Molbloc flow standards
Pipette ²	(10 to 100) μL (100 to 1 000) μL (1 to 10) mL	(0.58 + 0.004 <i>V</i>) μL (0.6 + 0.001 <i>V</i>) μL (2.6 + 0.001 2 <i>V</i>) μL	Comparison to Mass Balance
Torque Tools ¹	(10 to 100) ozf-in	0.59 % of reading	Comparison to CDI 1001 Torque Tester
	64 ozf-in to 1 000 lbf-ft	0.32 % of reading	Comparison to Analyzer / CDI 5000 ST Torque Analyzer
Torque Analyzers ¹	1 lbf-in to 1 000 lbf-ft	0.075 % of reading	Comparison to Torque Arm, Class F Weights



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Mass and Mass Related

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness Testers ¹	(< 60) HRBW (≥ 60 to < 80) HRBW (≥ 80) HRBW (< 35) HRC (≥ 35 to < 60) HRC (≥ 60) HRC (< 84) HREW (≥ 84 to < 93) HREW (≥ 93) HREW (< 81) HR15TW (≥ 81 to < 87) HR15TW (> 87) HR15TW	3 HRBW 3 HRBW 1.3 HRBW 1.3 HRC 1.2 HRC 0.7 HRC 1.3 HREW 1.3 HREW 1.3 HREW 1.8 HR15TW 1.3 HR15TW 1.3 HR15TW	Indirect verification per ASTM E18
Durometers Scale (Force) Accuracy Types A, B, C, D, DO, O Type M Types O, OO Indenter Geometry Length Diameter Angle	(0 to 100) duros 0.1 in 0.05 in (30 to 35)°	0.06 duros 0.07 duros 0.08 duros 130 μin 130 μin 0.12°	Direct Verification Master balance Optical comparator
Mass - Fixed Points Metric	(1, 2, 5, 10) mg (20, 50, 100, 500) mg (1, 2, 5) g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 5 kg	0.027 mg 0.027 mg 0.08 mg 0.13 mg 0.11 mg 0.22 mg 0.36 mg 0.64 mg 29 mg 30 mg 31 mg	Comparison to ASTM E617 Class 1 weights



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Mass and Mass Related

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass - Fixed Points Avoirdupois	(0.001, 0.002) lb	0.18 mg	Comparison to ASTM E617 Class 1 weights
	(0.005, 0.01, 0.02) lb	0.19 mg	
	0.05 lb	0.24 mg	
	0.1 lb	0.29 mg	
	0.2 lb	0.39 mg	
	(0.5, 1, 2) lb	27 mg	
	5 lb	28 mg	
	10 lb	28 mg	
	25 lb	0.23 g	
	50 lb	0.23 g	

Thermodynamic

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity Generate	(10 to 95) %RH	0.5 %RH	Comparison to Thunder Scientific 2500 Humidity Chamber
Relative Humidity Measure	(0 to 90) %RH (90 to 100) %RH	1.2 %RH 2 %RH	Comparison to Vaisala MI70/HMP76 Humidity Indicator and Probe
Temperature – Measure ¹	(-196 to 230) °C (-321 to 446) °F (230 to 420) °C (446 to 788) °F (420 to 660) °C (788 to 1 220) °F	0.023 °C 0.042 °F 0.04 °C 0.072 °F 0.056 °C 0.1 °F	Comparison to Hart 1502A Indicator with 5616 & 5609 PRT
	(800 to 1 550) °C	2 °C	Comparison to Type B Thermocouple
Temperature Uniformity Surveys ¹	Type J (100 to 900) °F Type K (100 to 1 000) °F (1 000 to 2 000) °F (2 000 to 2 200) °F	1.8 °F 2 °F 2.1 °F 2.7 °F	Comparison to Datalogger and Thermocouples
Infrared (IR) Thermometry ¹	(20 to 100) °C (100 to 300) °C (300 to 420) °C (420 to 500) °C	1.5 °C 4.3 °C 6 °C 7.7 °C	Comparison to Fluke 9132 Infrared Calibrator $\lambda = (8 \text{ to } 14) \mu\text{m}$, $\epsilon = 0.95$

Time and Frequency

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Measure	10 MHz	1×10^{-12} Hz/Hz	Comparison to 58503A/B GPS Receiver
Frequency – Generate ¹	1 to 10 Hz 10 to 100 Hz 100 to 1 000 Hz 1 to 10 kHz 10 to 100 kHz 0.1 to 1 MHz 1 to 10 MHz	1×10^{-12} Hz/Hz + 0.57 μ Hz 1×10^{-12} Hz/Hz + 5.7 μ Hz 1×10^{-12} Hz/Hz + 57 μ Hz 1×10^{-12} Hz/Hz + 0.57 mHz 1×10^{-12} Hz/Hz + 5.7 mHz 1×10^{-12} Hz/Hz + 57 mHz 1×10^{-12} Hz/Hz + 0.57 Hz	Comparison to Agilent 33250A Function Generator / HP 58503A GPS Receiver
Frequency – Generate ¹	10 to 50 000 MHz	1×10^{-12} Hz/Hz + 0.57mHz	Comparison to Agilent E8257D Opt 550 Signal Generator / HP 58503A GPS Receiver
Frequency – Measure ¹	1 to 10 Hz 10 to 100 Hz 100 to 1 000 Hz 1 to 10 kHz 10 to 100 kHz 100 to 200 kHz 0.2 to 3 000 MHz	1.82×10^{-9} Hz/Hz 0.59×10^{-9} Hz/Hz 0.20×10^{-9} Hz/Hz 74×10^{-10} Hz/Hz 35×10^{-10} Hz/Hz 23×10^{-10} Hz/Hz 20×10^{-10} Hz/Hz	Comparison to Agilent 53132A Opt 030 Frequency Counter / HP 58503A GPS Receiver
	50 to 46 000 MHz	1×10^{-12} Hz/Hz + 1.6 Hz	Comparison to Agilent 53152A Frequency Counter / HP 58503A GPS Receiver
	10 to 50 000 MHz	1×10^{-12} Hz/Hz + 0.1 Hz	Comparison to Agilent E4448A Spectrum Analyzer / HP 58503A GPS Receiver
Time – Generate	1 pps	1×10^{-12} s/s + 750 ps	Comparison to HP 58503A GPS Receiver
Type I (digital) Timers	(0 to 19.99) sec/day (0 to 599) sec/month	0.031 sec/day 1.1 sec/month	Comparison to Helmut Klein Timometer 4500
Type II (mechanical) Timers	(0 to 320) sec/day	0.6 sec/day	
Tachometers – RPM ^{1,2}	Up to 100 000 RPM	0.001 % of reading + 0.6R	Comparison to HP 33250A Signal Generator & LED

DIMENSIONAL MEASUREMENT

1 Dimensional

Temple Terrace, FL

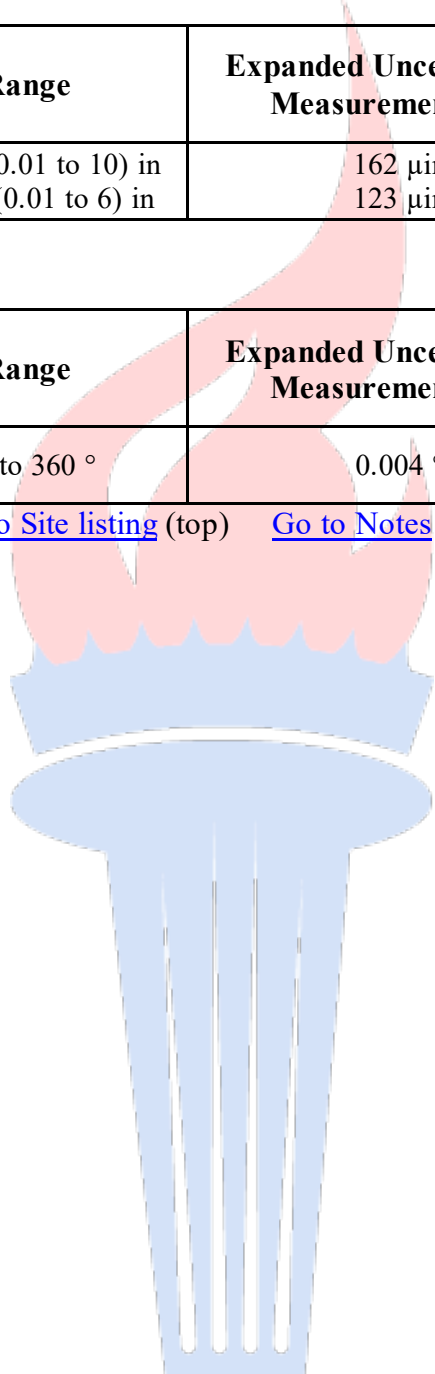
Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Length	X Axis (0.01 to 10) in Y Axis (0.01 to 6) in	162 μ m 123 μ m	Comparison to Optical comparator

2 Dimensional

Temple Terrace, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Angle	Up to 360 °	0.004 °	Comparison to Optical comparator

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Services performed at satellite laboratory

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CALIBRATION AND DIMENSIONAL MEASUREMENT

CALIBRATION

Acoustics and Vibration

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometers – Acceleration ¹	(0.01 to 10) g (7 < 10) Hz (10 < 30) Hz (30 < 2 000) Hz (2 to 10) kHz	4 % of reading 3 % of reading 1.5 % of reading 4 % of reading	Comparison to Modal Shop 9100D Portable Vibration Calibrator
Sound Pressure Level – Generate ¹	114dB @ 251.2 Hz	0.26 dB	Comparison to Larson Davis CAL250 Sound Level Calibrator

Chemical Quantities

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters ^{1,5}	4 pH 7 pH 10 pH	0.039 pH 0.02 pH 0.035 pH	Comparison to Standard pH buffers
Conductivity Meters ^{1,5}	100 µS/cm 1 419 µS/cm 10 000 µS/cm	0.74 µS/cm 5.7 µS/cm 35 µS/cm	Comparison to Conductivity Solutions

Electrical – DC/Low Frequency

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Generate ¹	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	6.8 $\mu\text{V/V} + 0.8 \mu\text{V}$ 4.6 $\mu\text{V/V} + 0.9 \mu\text{V}$ 3 $\mu\text{V/V} + 2.5 \mu\text{V}$ 3 $\mu\text{V/V} + 3.9 \mu\text{V}$ 4.6 $\mu\text{V/V} + 38 \mu\text{V}$ 6.1 $\mu\text{V/V} + 385 \mu\text{V}$	Comparison to Fluke 5720A Multifunction Calibrator
DC Voltage – Measure ¹	Up to 100 mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	3.3 $\mu\text{V/V} + 1 \mu\text{V}$ 2.6 $\mu\text{V/V} + 1 \mu\text{V}$ 2.6 $\mu\text{V/V} + 1.5 \mu\text{V}$ 3.9 $\mu\text{V/V} + 20 \mu\text{V}$ 3.9 $\mu\text{V/V} + 66 \mu\text{V} + 12 \mu\text{V/V} \times (\text{Vin}/1\ 000)^2$	Comparison to Agilent 3458A Opt 002 Multimeter
DC Voltage – Measure ¹	(0 to 220) mV (0.202 to 2.02) V (2.02 to 20.2) V (20.2 to 202) V (202 to 1 000) V	7.3 $\mu\text{V/V} + 0.7 \mu\text{V}$ 2.8 $\mu\text{V/V} + 0.8 \mu\text{V}$ 2.8 $\mu\text{V/V} + 0.8 \mu\text{V}$ 4.2 $\mu\text{V/V} + 30 \mu\text{V}$ 4.3 $\mu\text{V/V} + 0.99 \text{ mV}$	Comparison to Fluke 8588A Multimeter
DC Voltage – Measure ¹	(1 to 60) kV	0.1 % of reading	Comparison to Ross VD60 High Voltage Divider, Agilent 34401A Multimeter
DC Current – Generate ¹	(1 to 1.2) nA (1.2 to 12) nA (12 to 120) nA (0.12 to 1.2) μA (1.2 to 10) μA	92 $\mu\text{A/A} + 0.007 \text{ nA}$ 92 $\mu\text{A/A} + 0.007 \text{ nA}$ 92 $\mu\text{A/A} + 0.01 \text{ nA}$ 36 $\mu\text{A/A} + 0.1 \text{ nA}$ 18.5 $\mu\text{A/A} + 1 \text{ nA}$	Comparison to Fluke 5720A Multifunction Calibrator & Fluke 5560A Multifunction Calibrator
DC Current – Generate ¹	(10 to 220) μA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA (0.22 to 1) A (1 to 2.2) A	38 $\mu\text{A/A} + 5 \text{ nA}$ 30 $\mu\text{A/A} + 7 \text{ nA}$ 30 $\mu\text{A/A} + 44 \text{ nA}$ 38 $\mu\text{A/A} + 0.7 \mu\text{A}$ 45 $\mu\text{A/A} + 0.7 \mu\text{A}$ 68 $\mu\text{A/A} + 12 \mu\text{A}$ 105 $\mu\text{A/A} + 12 \mu\text{A}$	Comparison to Fluke 5720A Multifunction Calibrator
DC Current – Generate ¹	(2.2 to 11) A	274 $\mu\text{A/A} + 365 \mu\text{A}$	Comparison to Fluke 5720A Multifunction Calibrator, 5725A Amplifier
DC Current – Generate ¹	(11 to 20.5) A	761 $\mu\text{A/A} + 578 \mu\text{A}$	Comparison to Fluke 5560A Multifunction Calibrator



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Electrical – DC/Low Frequency

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Generate ¹	(2.2 to 3.1) A (3.1 to 12) A (12 to 30) A	228 μ A/A + 115 μ A 228 μ A/A + 191 μ A 761 μ A/A + 392 μ A	Comparison to Fluke 5560A Multiproduct Calibrator
DC Current Clamp Meters ¹ Toroidal-Wound	(0.6 to 600) A (600 to 1 000) A	0.19 % of output + 0.04A 0.2 % of output + 0.04A	Comparison to Fluke 5560A Multiproduct Calibrator / Coil x50
DC Current Clamp Meters ¹ Other	(0.6 to 600) A (600 to 1 000) A	0.38 % of output + 0.38A 0.39 % of output + 0.38A	Comparison to Fluke 5560A Multiproduct Calibrator / Coil x50
DC Current – Measure ¹	(1 to 10) nA (10 to 100) nA (0.1 to 1) μ A (1 to 10) μ A	35.2 μ A/A + 0.1 pA 18 μ A/A + 1 pA 10 μ A/A + 0.01 nA 8.3 μ A/A + 0.1 nA	Comparison to Fluke 5720A Multifunction Calibrator, Agilent 3458A Multimeter Option 002
DC Current – Measure ¹	(10 to 100) μ A (0.1 to 1) mA 1 to 10 mA (10 to 100) mA (0.1 to 1) A	13 μ A/A + 0.5 nA 13 μ A/A + 3 nA 13 μ A/A + 0.03 μ A 23 μ A/A + 0.3 μ A 72 μ A/A + 6.6 μ A	Comparison to Agilent 3458A Multimeter
DC Current – Measure ¹	(0.1 to 20.2) μ A (20.2 to 202) μ A (0.202 to 2.02) mA (2.02 to 20.2) mA (20.2 to 202) mA (0.202 to 2.02) A (2.02 to 20.2) A (20.2 to 30.2) A	27 μ A/A + 0.4 nA 9.9 μ A/A + 0.4 nA 9.1 μ A/A + 4 nA 14 μ A/A + 0.04 μ A 56 μ A/A + 1.0 μ A 130 μ A/A + 0.2mA 230 μ A/A + 0.5mA 541 μ A/A + 4.3mA	Comparison to Fluke 8588A Multimeter
DC Current – Measure ¹	(1 to 10) A (10 to 100) A	46 μ A/A + 90 μ A 47 μ A/A + 0.09 mA	Comparison to Agilent 3458A Option 002 Precision Multimeter Standard Resistor L&N 4361 Current Shunt
DC Current – Measure ¹	(1 to 500) A	0.27 % of reading	Comparison to Current shunts
Resistance – Fixed Points ¹	(0.01, 0.1, 1.0) Ω	34 $\mu\Omega/\Omega$	Comparison to Leeds & Northrup Resistor Set

Electrical – DC/Low Frequency

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Fixed Points ¹	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9) kΩ (10, 19) kΩ (100, 190) kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	84 μΩ/Ω + 0.1 μΩ 21 μΩ/Ω + 1 μΩ 9.1 μΩ/Ω + 6 μΩ 7.6 μΩ/Ω + 60 μΩ 7.6 μΩ/Ω + 0.6 mΩ 9.9 μΩ/Ω + 6 mΩ 17.5 μΩ/Ω + 60 mΩ 18.3 μΩ/Ω + 60 mΩ 35 μΩ/Ω + 0.6 Ω 42 μΩ/Ω + 0.6 Ω 91 μΩ/Ω + 6 Ω	Comparison to Fluke 5720A Multifunction Calibrator
Resistance – Generate ¹	Up to 12 Ω (12 to 120) Ω (0.12 to 1.20) kΩ (1.2 to 12.0) kΩ (12 to 120) kΩ (0.12 to 1.2) MΩ (1.2 to 12) MΩ (12 to 120) MΩ (120 to 1 200) MΩ	19 μΩ/Ω + 0.001 Ω 19 μΩ/Ω + 0.001 Ω 19 μΩ/Ω + 0.002 Ω 19 μΩ/Ω + 0.02 Ω 19 μΩ/Ω + 0.2 Ω 19 μΩ/Ω + 2 Ω 27 μΩ/Ω + 24 Ω 327 μΩ/Ω + 2 kΩ 3 mΩ/Ω + 76 Ω	Comparison to Fluke 5560A Multiproduct Calibrator
Resistance – Measure ¹	Up to 12 Ω (10 to 120) Ω (0.1 to 1.2 kΩ 1 to 12 kΩ (10 to 120) kΩ (0.1 to 1.2) MΩ (1 to 12) MΩ (10 to 120) MΩ (0.1 to 1.2) GΩ	9.8 μΩ/Ω + 38 μΩ 7.8 μΩ/Ω + 0.3 mΩ 6.5 μΩ/Ω + 0.4 mΩ 6.5 μΩ/Ω + 3.8 mΩ 6.5 μΩ/Ω + 38 mΩ 9.8 μΩ/Ω + 1.5 Ω 33 μΩ/Ω + 100 Ω 327 μΩ/Ω + 1 kΩ 0.33 % of reading + 70 kΩ	Comparison to HP 3458A Multimeter
Resistance – Measure ¹	Up to 2.02 Ω 2.02 to 20.2 Ω (20.2 to 202) Ω (0.202 to 2.02) kΩ (2.02 to 20.2) kΩ (20.2 to 202) kΩ (0.202 to 2.02) MΩ (2.02 to 20.2) MΩ (20.2 to 202) MΩ (0.202 to 2.02) GΩ (2.02 to 20.2) GΩ	16.3 μΩ/Ω + 4 μΩ 9.6 μΩ/Ω + 14 μΩ 9.0 μΩ/Ω + 48 μΩ 8.9 μΩ/Ω + 0.46 mΩ 9.0 μΩ/Ω + 4.6 mΩ 9.1 μΩ/Ω + 46 mΩ 10.4 μΩ/Ω + 1 Ω 16.7 μΩ/Ω + 9.8 Ω 67 μΩ/Ω + 0.98 kΩ 226 μΩ/Ω + 98 kΩ 1.3 mΩ/Ω + 9.8 MΩ	Comparison to Fluke 8588A Multimeter



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Electrical – DC/Low Frequency

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Generate ¹	(0.2 to 1.2) nF (1.2 to 12.0) nF (12 to 120.0) nF (0.12 to 1.2) μF (1.2 to 12.0) μF (12 to 120.0) μF (0.12 to 1.2) mF (1.2 to 12.0) mF (12 to 120.0) mF	0.09% of output + 1.5 pF 0.09 % of output + 0.004 nF 0.1 % of output + 0.023 nF 0.1 % of output + 0.23 nF 0.1 % of output + 2.3 nF 0.11 % of output + 19 nF 0.19 % of output + 190 nF 0.19 % of output + 2.3 μF 0.38 % of output + 23 μF	Comparison to Fluke 5560A Multiproduct Calibrator
Inductance – Generate ¹	(13 to 120.0) μH (0.12 to 1.2) mH (1.2 to 12.0) mH (12 to 120.0) mH (0.12 to 1.2) H (1.2 to 12.0) H (12 to 120.0) H	0.15% of output + 0.15 μH 0.09 % of output + 0.76 μH 0.09 % of output + 7.6 μH 0.09 % of output + 76 μH 0.11 % of output + 0.76 mH 0.15 % of output + 7.6 mH 0.19 % of output + 76 mH	Comparison to Fluke 5560A Multiproduct Calibrator
Capacitance – Generate ¹ Fixed Points	1 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.028 % of output 0.028 % of output 0.034 % of output 0.047 % of output 0.069 % of output 0.096 % of output 0.31 % of output 0.5 % of output	Comparison to Agilent 16381A Standard Air Capacitor
Capacitance – Generate ¹ Fixed Points	10 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.019 % of output 0.019 % of output 0.019 % of output 0.019 % of output 0.019 % of output 0.019 % of output 0.022 % of output 0.024 % of output	Comparison to Agilent 16382A Standard Air Capacitor



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Electrical – DC/Low Frequency

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Generate ¹ Fixed Points	100 pF		Comparison to Agilent 16383A Standard Air Capacitor
	1 kHz	0.017 % of output	
	1 MHz	0.017 % of output	
	2 MHz	0.018 % of output	
	3 MHz	0.018 % of output	
	4 MHz	0.02 % of output	
	5 MHz	0.024 % of output	
	10 MHz	0.053 % of output	
13 MHz	0.083 % of output		
Capacitance – Generate ¹ Fixed Points	1 000 pF		Comparison to Agilent 16384A Standard Air Capacitor
	1 kHz	0.018 % of output	
	1 MHz	0.019 % of output	
	2 MHz	0.024 % of output	
	3 MHz	0.035 % of output	
	4 MHz	0.051 % of output	
	5 MHz	0.069 % of output	
	10 MHz	0.22 % of output	
13 MHz	0.32 % of output		
Inductance – Generate ¹ Fixed Point	500 μ H		Comparison to GR 1482-D Standard Inductor
	1 kHz	0.35 μ H	
	20 mH		Comparison to GR 1482-J Standard Inductor
	1 kHz	0.008 mH	
200 mH		Comparison to GR 1482-M Standard Inductor	
100 Hz	0.11 mH		
2 H		Comparison to GR 1482-Q Standard Inductor	
100 Hz	0.8 mH		
AC Voltage – Generate ¹	Up to 22 mV		Comparison to Fluke 5720A Multifunction Calibrator
	(10 to 20) Hz	228 μ V/V + 3.9 μ V	
	(20 to 40) Hz	88 μ V/V + 3.9 μ V	
	40 Hz to 20 kHz	76 μ V/V + 3.9 μ V	
	(20 to 50) kHz	190 μ V/V + 3.9 μ V	
	(50 to 100) kHz	457 μ V/V + 4.6 μ V	
	(100 to 300) kHz	989 μ V/V + 9.2 μ V	
	(300 to 500) kHz	1.3 mV/V + 19 μ V	
500 kHz to 1 MHz	2.6 mV/V + 19 μ V		



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Electrical – DC/Low Frequency

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(22 to 220) mV		Comparison to Fluke 5720A Multifunction Calibrator
	(10 to 20) Hz	228 $\mu\text{V/V} + 11.4 \mu\text{V}$	
	(20 to 40) Hz	88 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	40 Hz to 20 kHz	76 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	(20 to 50) kHz	190 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	(50 to 100) kHz	457 $\mu\text{V/V} + 15.2 \mu\text{V}$	
	(100 to 300) kHz	837 $\mu\text{V/V} + 19 \mu\text{V}$	
	(300 to 500) kHz	1.3 mV/V + 23 μV	
	500 kHz to 1 MHz	2.5 mV/V + 46 μV	
	(0.22 to 2.2) V		
	(10 to 20) Hz	228 $\mu\text{V/V} + 38 \mu\text{V}$	
	(20 to 40) Hz	84 $\mu\text{V/V} + 15 \mu\text{V}$	
	40 Hz to 20 kHz	40 $\mu\text{V/V} + 8 \mu\text{V}$	
	(20 to 50) kHz	68 $\mu\text{V/V} + 9 \mu\text{V}$	
	(50 to 100) kHz	99 $\mu\text{V/V} + 30 \mu\text{V}$	
	(100 to 300) kHz	380 $\mu\text{V/V} + 76 \mu\text{V}$	
	(300 to 500) kHz	913 $\mu\text{V/V} + 190 \mu\text{V}$	
	500 kHz to 1 MHz	1.5 mV/V + 304 μV	
	(2.2 to 22) V		
	(10 to 20) Hz	228 $\mu\text{V/V} + 380 \mu\text{V}$	
	(20 to 40) Hz	84 $\mu\text{V/V} + 152 \mu\text{V}$	
	40 Hz to 20 kHz	37 $\mu\text{V/V} + 54 \mu\text{V}$	
	(20 to 50) kHz	61 $\mu\text{V/V} + 91 \mu\text{V}$	
	(50 to 100) kHz	76 $\mu\text{V/V} + 190 \mu\text{V}$	
(100 to 300) kHz	228 $\mu\text{V/V} + 609 \mu\text{V}$		
(300 to 500) kHz	913 $\mu\text{V/V} + 1.9 \text{ mV}$		
500 kHz to 1 MHz	1.4 mV/V + 3 mV		
(22 to 220) V			
(10 to 20) Hz	228 $\mu\text{V/V} + 3.8 \text{ mV}$		
(20 to 40) Hz	84 $\mu\text{V/V} + 1.5 \text{ mV}$		
40 Hz to 20 kHz	49 $\mu\text{V/V} + 0.6 \text{ mV}$		
(20 to 50) kHz	76 $\mu\text{V/V} + 0.9 \text{ mV}$		
(50 to 100) kHz	137 $\mu\text{V/V} + 2.3 \text{ mV}$		
AC Voltage – Generate ¹	(220 to 750) V		Comparison to Fluke 5720A Multifunction Calibrator /5725A Amplifier
	40 Hz to 1 kHz	68 $\mu\text{V/V} + 3 \text{ mV}$	
	(1 to 20) kHz	126 $\mu\text{V/V} + 5 \text{ mV}$	
	(20 to 50) kHz	457 $\mu\text{V/V} + 8 \text{ mV}$	
	(50 to 100) kHz	1.8 mV/V + 34 mV	
	(750 to 1 000) V		
	40 Hz to 1 kHz	68 $\mu\text{V/V} + 3 \text{ mV}$	
	(1 to 20) kHz	126 $\mu\text{V/V} + 5 \text{ mV}$	
	(20 to 30) kHz	457 $\mu\text{V/V} + 8 \text{ mV}$	



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(0.3 to 1.1) mV		Comparison to Fluke 5720A Multifunction Calibrator
	(10 to 30) Hz	0.65 % of output + 1.5 μ V	
	30 Hz to 500 kHz	0.61 % of output + 1.5 μ V	
	(0.5 to 1.2) MHz	0.63 % of output + 3.8 μ V	
	(1.2 to 2) MHz	0.63 % of output + 3.8 μ V	
	(2 to 12) MHz	0.68 % of output + 3.8 μ V	
	(12 to 20) MHz	0.76 % of output + 3.8 μ V	
	(20 to 30) MHz	1.3 % of output + 12.9 μ V	
	(1.1 to 3.3) mV		
	(10 to 30) Hz	0.58 % of output + 2.3 μ V	
	30 Hz to 500 kHz	0.53 % of output + 2.3 μ V	
	(0.5 to 1.2) MHz	0.54 % of output + 4.6 μ V	
	(1.2 to 2) MHz	0.54 % of output + 4.6 μ V	
	(2 to 12) MHz	0.58 % of output + 4.6 μ V	
	(12 to 20) MHz	0.65 % of output + 4.6 μ V	
	(20 to 30) MHz	1.3 % of output + 4.6 μ V	
	(3.3 to 11) mV		
	(10 to 30) Hz	0.58 % of output + 6.1 μ V	
	30 Hz to 500 kHz	0.53 % of output + 6.1 μ V	
	(0.5 to 1.2) MHz	0.54 % of output + 8.4 μ V	
	(1.2 to 2) MHz	0.54 % of output + 8.4 μ V	
	(2 to 12) MHz	0.55 % of output + 8.4 μ V	
	(12 to 20) MHz	0.61 % of output + 8.4 μ V	
	(20 to 30) MHz	0.93 % of output + 8.4 μ V	
(11 to 33) mV			
(10 to 30) Hz	0.52 % of output + 12 μ V		
30 Hz to 500 kHz	0.46 % of output + 12 μ V		
(0.5 to 1.2) MHz	0.47 % of output + 14 μ V		
(1.2 to 2) MHz	0.47 % of output + 14 μ V		
(2 to 12) MHz	0.49 % of output + 14 μ V		
(12 to 20) MHz	0.55 % of output + 14 μ V		
(20 to 30) MHz	0.89 % of output + 14 μ V		



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Electrical – DC/Low Frequency

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(33 to 110) mV		Comparison to Fluke 5720A Multifunction Calibrator
	(10 to 30) Hz	0.52 % of output + 30 μV	
	30 Hz to 500 kHz	0.46 % of output + 30 μV	
	(0.5 to 1.2) MHz	0.47 % of output + 33 μV	
	(1.2 to 2) MHz	0.47 % of output + 33 μV	
	(2 to 12) MHz	0.49 % of output + 33 μV	
	(12 to 20) MHz	0.55 % of output + 33 μV	
	(20 to 30) MHz	0.89 % of output + 33 μV	
	(110 to 330) mV		
	(10 to 30) Hz	0.45 % of output + 0.1 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.1 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.1 mV	
	(1.2 to 2) MHz	0.4 % of output + 0.1 mV	
	(2 to 12) MHz	0.42 % of output + 0.1 mV	
	(12 to 20) MHz	0.49 % of output + 0.1 mV	
	(20 to 30) MHz	0.85 % of output + 0.1 mV	
	0.33 to 1.1 V		
	(10 to 30) Hz	0.45 % of output + 0.3 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.3 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.3 mV	
	(1.2 to 2) MHz	0.4 % of output + 0.3 mV	
(2 to 12) MHz	0.42 % of output + 0.3 mV		
(12 to 20) MHz	0.49 % of output + 0.3 mV		
(20 to 30) MHz	0.85 % of output + 0.3 mV		
(1.1 to 3.5) V			
(10 to 30) Hz	0.39 % of output + 0.4 mV		
30 Hz to 500 kHz	0.3 % of output + 0.4 mV		
(0.5 to 1.2) MHz	0.32 % of output + 0.4 mV		
(1.2 to 2) MHz	0.32 % of output + 0.4 mV		
(2 to 12) MHz	0.35 % of output + 0.4 mV		
(12 to 20) MHz	0.44 % of output + 0.4 mV		
(20 to 30) MHz	0.82 % of output + 0.4 mV		
AC Voltage – Measure ¹	(1 to 10) mV		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.02 % of reading + 2.0 μV	
	40 Hz to 1 kHz	0.013 % of reading + 0.7 μV	
	(1 to 20) kHz	0.02 % of reading + 0.7 μV	
	(20 to 50) kHz	0.065 % of reading + 0.7 μV	
	(50 to 100) kHz	0.33 % of reading + 0.7 μV	
	100 kHz to 1 MHz	0.78 % of reading + 3.3 μV	
	(1 to 4) MHz	4.6 % of reading + 4.6 μV	
(4 to 8) MHz	13 % of reading + 5.3 μV		



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	10 mV to 100 mV		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.005 % of reading + 2.6 μV	
	40 Hz to 1 kHz	0.005 % of reading + 1.3 μV	
	(1 to 20) kHz	0.009 % of reading + 1.3 μV	
	(20 to 50) kHz	0.02 % of reading + 1.3 μV	
	(50 to 100) kHz	0.052 % of reading + 1.3 μV	
	(100 to 300) kHz	0.20 % of reading + 6.5 μV	
	300 kHz to 1 MHz	0.70 % of reading + 6.5 μV	
	(1 to 2) MHz	0.98 % of reading + 46 μV	
	(2 to 4) MHz	2.6 % of reading + 46 μV	
	(4 to 8) MHz	2.6 % of reading + 52 μV	
	(8 to 10) MHz	9.8 % of reading + 65 μV	
	(0.1 to 1) V		
	(1 to 40) Hz	0.005 % of reading + 26 μV	
	40 Hz to 1 kHz	0.005 % of reading + 13 μV	
	(1 to 20) kHz	0.009 % of reading + 13 μV	
	(20 to 50) kHz	0.02 % of reading + 13 μV	
	(50 to 100) kHz	0.052 % of reading + 13 μV	
	(100 to 300) kHz	0.2 % of reading + 65 μV	
	300 kHz to 1 MHz	0.65 % of reading + 65 μV	
	(1 to 2) MHz	0.98 % of reading + 0.5 mV	
	(2 to 4) MHz	2.6 % of reading + 0.5 mV	
	(4 to 8) MHz	2.6 % of reading + 0.5 mV	
	(8 to 10) MHz	9.8 % of reading + 0.7 mV	
	(1 to 10) V		
	(1 to 40) Hz	0.005 % of reading + 0.3 mV	
	40 Hz to 1 kHz	0.005 % of reading + 0.1 mV	
	(1 to 20) kHz	0.009 % of reading + 0.1 mV	
(20 to 50) kHz	0.02 % of reading + 0.1 mV		
(50 to 100) kHz	0.052 % of reading + 0.1 mV		
(100 to 300) kHz	0.2 % of reading + 0.7 mV		
300 kHz to 1 MHz	0.65 % of reading + 0.7 mV		
(1 to 2) MHz	0.98 % of reading + 4.6 mV		
(2 to 4) MHz	2.6 % of reading + 4.6 mV		
(4 to 8) MHz	2.6 % of reading + 5.2 mV		
(8 to 10) MHz	9.8 % of reading + 6.5 mV		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(10 to 100) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (100 to 700) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	0.013 % of reading + 2.6 mV 0.013 % of reading + 1.3 mV 0.013 % of reading + 1.3 mV 0.023 % of reading + 1.3 mV 0.08 % of reading + 1.3 mV 0.26 % of reading + 6.5 mV 0.98 % of reading + 6.5 mV 0.026 % of reading + 26 mV 0.026 % of reading + 13 mV 0.039 % of reading + 13 mV 0.078 % of reading + 13 mV 0.2 % of reading + 13 mV	Comparison to HP 3458A Multimeter
AC Voltage – Measure ¹	(1.2 to 12.12) mV (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (12.12 to 121.2) mV (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1 MHz) (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.028 % of reading + 1.2 μV 0.036 % of reading + 1.2 μV 0.037 % of reading + 1.2 μV 0.297 % of reading + 0.9 μV 0.99 % of reading + 3.9 μV 2 % of reading + 3.9 μV 0.009 % of reading + 0.6 μV 0.013 % of reading + 0.6 μV 0.023 % of reading + 1.1 μV 0.052 % of reading + 5.1 μV 0.21 % of reading + 30.6 μV 0.99 % of reading + 0.1 mV 1.5 % of reading + 0.5 mV 43 % of reading + 1.0 mV 8.2 % of reading + 1.0 mV 16 % of reading + 1.0 mV	Comparison to Fluke 8588A Multimeter

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(0.1212 to 1.212) V		Comparison to Fluke 8588A Multimeter
	(1 to 2 000) Hz	0.007 % of reading + 0.006 mV	
	(2 to 10) kHz	0.012 % of reading + 0.006 mV	
	(10 to 30) kHz	0.023 % of reading + 0.011 mV	
	(30 to 100) kHz	0.052 % of reading + 0.05 mV	
	(100 to 300) kHz	0.21 % of reading + 0.31 mV	
	(0.3 to 1) MHz	0.99 % of reading + 0.99 mV	
	(1 to 2) MHz	1.5 % of reading + 4.9 mV	
	(2 to 4) MHz	4 % of reading + 9.8 mV	
	(4 to 8) MHz	8.1 % of reading + 9.8 mV	
	(8 to 10) MHz	15 % of reading + 9.8 mV	
	(1.212 to 12.12) V		
	(1 to 2 000) Hz	0.007 % of reading + 0.06mV	
	(2 to 10) kHz	0.012 % of reading + 0.06 mV	
	(10 to 30) kHz	0.023 % of reading + 0.11 mV	
	(30 to 100) kHz	0.052 % of reading + 0.52 mV	
	(100 to 300) kHz	0.21 % of reading + 3.1 mV	
	(0.3 to 1) MHz	0.99 % of reading + 9.9 mV	
	(1 to 2) MHz	1.5 % of reading + 49 mV	
	(2 to 4) MHz	4 % of reading + 98 mV	
(4 to 8) MHz	8.1 % of reading + 98 mV		
(8 to 10) MHz	15 % of reading + 98 mV		
(12.12 to 121.2) V			
(1 to 2 000) Hz	0.009 % of reading + 0.6 mV		
(2 to 10) kHz	0.011 % of reading + 0.6 mV		
(10 to 30) kHz	0.023 % of reading + 1.1 mV		
(30 to 100) kHz	0.058 % of reading + 5.1 mV		
(100 to 200) kHz	0.37 % of reading + 46 mV		
(121.2 to 1050) V			
(1 to 2 000) Hz	0.011 % of reading + 26 mV		
(2 to 10) kHz	0.011 % of reading + 26 mV		
(10 to 30) kHz	0.023 % of reading + 26 mV		
AC Voltage – Measure ¹	(1 to 10) kV		Comparison to Ross VD60 High Voltage Divider, Agilent 34401A Multimeter
	60 Hz	0.5 % of reading + 0.002 kV	
	(10 to 42) kV		
	60 Hz	0.5 % of reading + 0.02 kV	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate ¹	(9 to 220) μ A		Comparison to Fluke 5720A Multifunction Calibrator
	(10 to 20) Hz	228 μ A/A + 15 nA	
	(20 to 40) Hz	152 μ A/A + 10 nA	
	40 Hz to 1 kHz	91 μ A/A + 8 nA	
	(1 to 5) kHz	266 μ A/A + 12 nA	
	(5 to 10) kHz	989 μ A/A + 61 nA	
	(0.22 to 2.2) mA		
	(10 to 20) Hz	228 μ A/A + 39 nA	
	(20 to 40) Hz	152 μ A/A + 31 nA	
	40 Hz to 1 kHz	107 μ A/A + 31 nA	
	(1 to 5) kHz	183 μ A/A + 99 nA	
	(5 to 10) kHz	989 μ A/A + 609 nA	
	(2.2 to 22) mA		
	(10 to 20) Hz	228 μ A/A + 385 nA	
	(20 to 40) Hz	152 μ A/A + 310 nA	
40 Hz to 1 kHz	107 μ A/A + 310 nA		
(1 to 5) kHz	183 μ A/A + 536 nA		
(5 to 10) kHz	989 μ A/A + 4.6 μ A		
AC Current – Generate ¹	(22 to 220) mA		Comparison to Fluke 5720A Multifunction Calibrator
	(10 to 20) Hz	228 μ A/A + 4 μ A	
	(20 to 40) Hz	152 μ A/A + 3 μ A	
	40 Hz to 1 kHz	107 μ A/A + 2 μ A	
	(1 to 5) kHz	183 μ A/A + 3 μ A	
	(5 to 10) kHz	989 μ A/A + 9 μ A	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate ¹	(0.22 to 1.2) A		Comparison to Fluke 5560A Multiproduct Calibrator
	(3 to 45) Hz	0.019 % of output + 0.08 mA	
	(45 to 1 000) Hz	0.019 % of output + 0.04 mA	
	(1 to 5) kHz	0.019 % of output + 0.06 mA	
	(5 to 10) kHz	0.19 % of output + 0.23 mA	
	(10 to 30) kHz	0.38 % of output + 0.23 mA	
	(1.2 to 3.1) A		
	(3 to 45) Hz	0.029 % of output + 0.4 mA	
	(45 to 1 000) Hz	0.023 % of output + 0.27 mA	
	(1 to 5) kHz	0.029 % of output + 0.27 mA	
	(5 to 10) kHz	0.19 % of output + 0.4 mA	
	(3.1 to 12) A		
(3 to 45) Hz	0.029 % of output + 0.8 mA		
(45 to 1 000) Hz	0.023 % of output + 0.4 mA		
(1 to 5) kHz	0.029 % of output + 0.6 mA		
(5 to 10) kHz	0.19 % of output + 0.8 mA		
(12 to 30.2) A			
(3 to 45) Hz	0.076 % of output + 7.7 mA		
(45 to 1 000) Hz	0.053 % of output + 6.2 mA		
(1 to 5) kHz	0.038 % of output + 6.2 mA		
AC Current Clamps – Toroidal-Wound	(0.6 to 600) A		Comparison to Fluke 5560A Multiproduct Calibrator, 5500A/Coil x50
	(45 to 65) Hz	0.21 % of output + 71 mA	
	(600 to 1 000) A		
	(45 to 65) Hz	0.22 % of output + 0.311 A	
AC Current Clamps – Other	(0.6 to 155) A		Comparison to Fluke 5560A Multiproduct Calibrator, 5500A/Coil x50
	(65 to 440) Hz	0.6 % of output + 77 mA	
AC Current Clamps – Other	(0.6 to 600) A		Comparison to Fluke 5560A Multiproduct Calibrator, 5500A/Coil x50
	(45 to 65) Hz	0.43 % of output +0.53 A	
	(600 to 1 000) A		
	(45 to 65) Hz	0.43 % of output +0.61 A	
AC Current Clamps – Other	(0.6 to 155) A		Comparison to Fluke 5560A Multiproduct Calibrator, 5500A/Coil x50
	(65 to 440) Hz	0.76 % of output +0.69 A	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(5 to 100) μ A		Comparison to Agilent 3458A Multimeter
	(10 to 20) Hz	0.26 % of reading + 0.02 μ A	
	(20 to 45) Hz	0.1 % of reading + 0.02 μ A	
	45 Hz to 1 kHz	0.04 % of reading + 0.02 μ A	
	(0.1 to 1) mA		
	(10 to 20) Hz	0.26 % of reading + 0.13 μ A	
	(20 to 45) Hz	0.1 % of reading + 0.13 μ A	
	(45 to 100) Hz	0.04 % of reading + 0.13 μ A	
	100 Hz to 5 kHz	0.02 % of reading + 0.13 μ A	
	(1 to 10) mA		
	(10 to 20) Hz	0.26 % of reading + 1.3 μ A	
	(20 to 45) Hz	0.1 % of reading + 1.3 μ A	
	(45 to 100) Hz	0.04 % of reading + 1.3 μ A	
	100 Hz to 5 kHz	0.02 % of reading + 1.3 μ A	
(10 to 100) mA			
(10 to 20) Hz	0.26 % of reading + 13 μ A		
(20 to 45) Hz	0.1 % of reading + 13 μ A		
(45 to 100) Hz	0.04 % of reading + 13 μ A		
100 Hz to 5 kHz	0.02 % of reading + 13 μ A		
(0.1 to 1) A			
(10 to 20) Hz	0.26 % of reading + 0.13 mA		
(20 to 45) Hz	0.1 % of reading + 0.13 mA		
(45 to 100) Hz	0.04 % of reading + 0.13 mA		
100 Hz to 5 kHz	0.02 % of reading + 0.13 mA		
AC Current – Measure ¹	(2.02 to 20.2) μ A		Comparison to Fluke 8588A Multimeter
	(1 to 2 000) Hz	0.2 % of reading + 2.5 nA	
	(2 to 10) kHz	0.2 % of reading + 2.5 nA	
	(10 to 30) kHz	0.2 % of reading + 2.5 nA	
	(2.02 to 20.2) μ A		
	(1 to 2 000) Hz	0.027 % of reading + 4.9 nA	
	(2 to 10) kHz	0.052 % of reading + 4.9 nA	
	(10 to 30) kHz	0.073 % of reading + 4.9 nA	
	(0.202 to 2.02) mA		
	(1 to 2 000) Hz	0.027 % of reading + 49 nA	
	(2 to 10) kHz	0.052 % of reading + 49 nA	
	(10 to 30) kHz	0.073 % of reading + 49 nA	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment			
AC Current – Measure ¹	(2.02 to 20.2) mA (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz	0.027 % of reading + 0.49 μA 0.052 % of reading + 0.49 μA 0.073 % of reading + 0.49 μA	Comparison to Fluke 8588A Multimeter			
	(20.2 to 202) mA (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz	0.027 % of reading + 4.9 μA 0.051 % of reading + 4.9 μA 0.073 % of reading + 4.9 μA				
	(0.202 to 2.02) A (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz	0.029 % of reading + 98 μA 0.054 % of reading + 98 μA 0.078 % of reading + 98 μA				
	(2.02 to 20.2) A (10 to 2 000) Hz (2 to 10) kHz	0.082 % of reading + 0.49 mA 0.082 % of reading + 0.49 mA				
	(20.2 to 30.2) A (10 to 2 000) Hz (2 to 10) kHz	0.082 % of reading + 11.8 mA 0.12 % of reading + 11.8 mA				
	AC Current – Measure ¹	(50 to 500) mA (10 to 40) Hz (40 to 1) kHz (1 to 20) kHz (20 to 50) kHz		164 μA/A 118 μA/A 187 μA/A 348 μA/A	Comparison to Agilent 3458A Multimeter / Fluke A40 Current Shunts	
		AC Current – Measure ¹		(0.5 to 1) A (10 to 40) Hz (40 to 1) kHz (1 to 20) kHz (20 to 50) kHz		115 μA/A 82 μA/A 133 μA/A 231 μA/A
				AC Current – Measure ¹		(1 to 3) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz
AC Current – Measure ¹			(1 to 20) A (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz			306 μA/A 306 μA/A 274 μA/A 384 μA/A
	AC Current – Measure ¹	(3 to 30) A 40 Hz to 1 kHz (1 to 5) kHz	0.3 % of reading + 0.07 A 5 % of reading + 0.14 A	Comparison to Agilent 3458A Multimeter Keysight 34330A Current Shunt		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(10 to 100) A (50 to 1000) Hz	2 % of reading + 0.02 A	Comparison to Fluke 80i-600 Clamp Meter / Agilent 3458A Multimeter
	(100 to 600) A (50 to 1000) Hz	2 % of reading + 0.2 A	
AC Current – Measure ¹	(100 to 2 000) A 55 to 65 Hz	1 % of reading + 0.5A	Comparison to PEM CWT600B Rogowski Coil / Agilent 34401A Multimeter
	(2 000 to 6 000) A 55 to 65 Hz	1 % of reading + 3.9 A	
AC Power – Generate ¹ (12 to 120) mV Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz	0.022 % of Output + 0.1 μW	Comparison to Fluke 5560A Multiproduct Calibrator
	40 to 1 000 Hz (1 to 5) kHz	0.022 % of Output + 0.1 μW	
	(5 to 10) kHz	0.022 % of Output + 0.1 μW	
	(12 to 120) mA (10 to 40) Hz	0.12 % of Output + 0.1 μW	
	40 to 1 000 Hz (1 to 5) kHz	0.022 % of Output + 1.1 μW	
	(5 to 10) kHz	0.016 % of Output + 0.7 μW	
	(0.12 to 1.2) A (10 to 40) Hz	0.022 % of Output + 0.9 μW	
	40 to 1 000 Hz (1 to 5) kHz	0.12 % of Output + 1.1 μW	
	(5 to 10) kHz	0.022 % of Output + 11 μW	
	(1.2 to 3.1) A (10 to 40) Hz	0.022 % of Output + 7.2 μW	
	40 to 1 000 Hz (1 to 5) kHz	0.022 % of Output + 9.2 μW	
	(5 to 10) kHz	0.19 % of Output + 28 μW	
AC Power – Generate ¹ (12 to 120) mV Power Factor = 1	(3.1 to 12) A (10 to 40) Hz	0.03 % of Output + 48 μW	Comparison to Fluke 5560A Multiproduct Calibrator
	40 to 1 000 Hz (1 to 5) kHz	0.025 % of Output + 31 μW	
	(5 to 10) kHz	0.03 % of Output + 31 μW	
	(12 to 30.2) A (10 to 40) Hz	0.19 % of Output + 48 μW	
	40 to 1 000 Hz	0. % of Output + 107 μW	
	(1 to 5) kHz	0.025 % of Output + 72 μW	
AC Power – Generate ¹ (12 to 120) mV Power Factor = 1	(5 to 10) kHz	0.03 % of Output + 92 μW	Comparison to Fluke 5560A Multiproduct Calibrator
	(12 to 30.2) A (10 to 40) Hz	0.19 % of Output + 107 μW	
	40 to 1 000 Hz	0.077 % of Output + 0.92 mW	
	(1 to 5) kHz	0.054 % of Output + 0.74 mW	
	(1 to 5) kHz	0.38 % of Output + 0.74 mW	
	(1 to 5) kHz		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (0.12 to 1.2) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 0.9 μW	
	40 to 1 000 Hz	0.022 % of Output + 0.9 μW	
	(1 to 5) kHz	0.022 % of Output + 0.9 μW	
	(5 to 10) kHz	0.12 % of Output + 0.9 μW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 9.2 μW	
	(40 to 1 000) Hz	0.016 % of Output + 4.7 μW	
	(1 to 5) kHz	0.022 % of Output + 7.4 μW	
	(5 to 10) kHz	0.12 % of Output + 9.2 μW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 92 μW	
	(40 to 1 000) Hz	0.022 % of Output + 47 μW	
	(1 to 5) kHz	0.022 % of Output + 74 μW	
	(5 to 10) kHz	0.19 % of Output + 0.27 mW	
	(1.2 to 3.1) A		
(10 to 40) Hz	0.03 % of Output + 0.46 mW		
(40 to 1 000) Hz	0.025 % of Output + 0.27 mW		
(1 to 5) kHz	0.03 % of Output + 0.27 mW		
(5 to 10) kHz	0.19 % of Output + 0.46 mW		
(3.1 to 12) A			
(10 to 40) Hz	0.03 % of Output + 0.92 mW		
(40 to 1 000) Hz	0.025 % of Output + 0.47 mW		
(1 to 5) kHz	0.03 % of Output + 0.74 mW		
(5 to 10) kHz	0.19 % of Output + 0.92 mW		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 9.1 mW		
(40 to 1 000) Hz	0.054 % of Output + 7.3 mW		
(1 to 5) kHz	0.38 % of Output + 7.3 mW		
AC Power – Generate ¹ (1.2 to 12) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 9.2 μW	
	(40 to 1 000) Hz	0.022 % of Output + 9.2 μW	
	(1 to 5) kHz	0.022 % of Output + 9.2 μW	
	(5 to 10) kHz	0.12 % of Output + 9.2 μW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 92 μW	
	(40 to 1 000) Hz	0.016 % of Output + 46 μW	
	(1 to 5) kHz	0.022 % of Output + 74 μW	
	(5 to 10) kHz	0.12 % of Output + 92 μW	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (1.2 to 12) V Power Factor = 1	(0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.022 % of Output + 0.92 mW 0.022 % of Output + 0.46 mW 0.022 % of Output + 0.74 mW 0.19 % of Output + 2.7 mW 0.03 % of Output + 4.6 mW 0.025 % of Output + 2.7 mW 0.03 % of Output + 2.7 mW 0.19 % of Output + 4.6 mW 0.03 % of Output + 9.2 mW 0.025 % of Output + 4.6 mW 0.03 % of Output + 7.4 mW 0.19 % of Output + 9.2 mW 0.077 % of Output + 91 mW 0.054 % of Output + 73 mW 0.38 % of Output + 73 mW	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (12 to 120) V Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz	0.022 % of Output + 92 μW 0.022 % of Output + 92 μW 0.022 % of Output + 92 μW 0.12 % of Output + 92 μW 0.022 % of Output + 0.92 mW 0.016 % of Output + 0.46 mW 0.022 % of Output + 0.74 mW 0.12 % of Output + 0.92 mW 0.022 % of Output + 9.2 mW 0.022 % of Output + 4.6 mW 0.022 % of Output + 7.4 mW 0.191 % of Output + 27 mW 0.03 % of Output + 46 mW 0.025 % of Output + 27 mW 0.03 % of Output + 27 mW 0.19% of Output + 46 mW	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (12 to 120) V Power Factor = 1	(3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.03 % of Output + 92 mW 0.025 % of Output + 46 mW 0.03 % of Output + 74 mW 0.19 % of Output + 92 mW 0.077 % of Output + 0.91 W 0.054 % of Output + 0.73 W 0.38 % of Output + 0.73 W	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (120 to 330) V Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.022 % of Output + 0.26 mW 0.022 % of Output + 0.26 mW 0.022 % of Output + 0.26 mW 0.12 % of Output + 0.26 mW 0.022 % of Output + 2.6 mW 0.016 % of Output + 1.5 mW 0.022 % of Output + 2.1 mW 0.12 % of Output + 2.6 mW 0.022 % of Output + 26 mW 0.022 % of Output + 15 mW 0.022 % of Output + 21 mW 0.19 % of Output + 76 mW 0.03 % of Output + 0.13 W 0.025 % of Output + 0.08 W 0.03 % of Output + 0.08 W 0.19 % of Output + 0.13 W 0.03 % of Output + 0.26 W 0.025 % of Output + 0.15 W 0.03 % of Output + 0.21 W 0.19 % of Output + 0.26 W 0.077 % of Output + 2.5 W 0.054 % of Output + 2 W 0.38 % of Output + 2 W	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (330 to 1020) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 1.1 mW	
	(40 to 1 000) Hz	0.022 % of Output + 1.1 mW	
	(1 to 5) kHz	0.022 % of Output + 1.1 mW	
	(5 to 10) kHz	0.12 % of Output + 1.1 mW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 11 mW	
	(40 to 1 000) Hz	0.016 % of Output + 8.3 mW	
	(1 to 5) kHz	0.022 % of Output + 9.6 mW	
	(5 to 10) kHz	0.12 % of Output + 11 mW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 107 mW	
	(40 to 1 000) Hz	0.022 % of Output + 83 mW	
	(1 to 5) kHz	0.022 % of Output + 96 mW	
	(5 to 10) kHz	0.19 % of Output + 244 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 0.43 W	
	(40 to 1 000) Hz	0.025 % of Output + 0.30 W	
	(1 to 5) kHz	0.03 % of Output + 0.30 W	
	(5 to 10) kHz	0.19 % of Output + 0.43 W	
(3.1 to 12) A			
(10 to 40) Hz	0.03 % of Output + 1.1 W		
(40 to 1 000) Hz	0.025 % of Output + 0.8 W		
(1 to 5) kHz	0.03 % of Output + 1.0 W		
(5 to 10) kHz	0.19 % of Output + 1.1 W		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 8.0 W		
(40 to 1 000) Hz	0.054 % of Output + 6.5 W		
(1 to 5) kHz	0.38 % of Output + 6.5 W		
Phase Angle - Generate ¹	(-180 to 180)°		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 65) Hz	0.08°	
	(65 to 500) Hz	0.19°	
	500 Hz to 1 kHz	0.38°	
	(1 to 5) kHz	1.9°	
	(5 to 10) kHz	3.8°	
(10 to 30) kHz	7.6°		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicators ¹	Type B		Comparison to Fluke 5560A Multiproduct Calibrator
	(600 to 800) °C	0.33 °C	
	(800 to 1 000) °C	0.26 °C	
	(1 000 to 1 550) °C	0.23 °C	
	(1 550 to 1 820) °C	0.25 °C	
	Type C		
	(0 to 150) °C	0.19 °C	
	(150 to 650) °C	0.16 °C	
	(650 to 1 000) °C	0.2 °C	
	(1 000 to 1 800) °C	0.34 °C	
	(1 800 to 2 315) °C	0.6 °C	
	Type D		
	(0 to 150) °C	0.19 °C	
	(150 to 650) °C	0.16 °C	
	(650 to 1 000) °C	0.2 °C	
	(1 000 to 1 800) °C	0.33 °C	
	(1 800 to 2 315) °C	0.59 °C	
	Type E		
	(-250 to -150) °C	0.3 °C	
	(-150 to -25) °C	0.11 °C	
	(-25 to 350) °C	0.08 °C	
	(350 to 650) °C	0.12 °C	
	(650 to 1 000) °C	0.16 °C	
	Type G		
(0 to 150) °C	0.38 °C		
(150 to 650) °C	0.25 °C		
(650 to 1 000) °C	0.2 °C		
(1 000 to 1 800) °C	0.33 °C		
(1 800 to 2 315) °C	0.59 °C		
Type J			
(-210 to -100) °C	0.18 °C		
(-100 to -30) °C	0.1 °C		
(-30 to 150) °C	0.08 °C		
(150 to 760) °C	0.11 °C		
(760 to 1 200) °C	0.15 °C		
Type K			
(-200 to -100) °C	0.21 °C		
(-100 to -25) °C	0.1 °C		
(-25 to 120) °C	0.08 °C		
(120 to 1 000) °C	0.16 °C		
(1 000 to 1 372) °C	0.27 °C		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicators ¹	Type L		Comparison to Fluke 5560A Multiproduct Calibrator
	(-200 to -100) °C	0.24 °C	
	(-100 to 800) °C	0.15 °C	
	(800 to 900) °C	0.08 °C	
	Type N		
	(-200 to -100) °C	0.25 °C	
	(-100 to -25) °C	0.11 °C	
	(-25 to 120) °C	0.09 °C	
	(120 to 410) °C	0.08 °C	
	(410 to 1 300) °C	0.15 °C	
	Type R		
	(0 to 250) °C	0.39 °C	
	(250 to 400) °C	0.22 °C	
	(400 to 1 000) °C	0.21 °C	
	(1 000 to 1 767) °C	0.26 °C	
	Type S		
	(0 to 250) °C	0.32 °C	
	(250 to 1 000) °C	0.24 °C	
	(1 000 to 1 400) °C	0.24 °C	
	(1 400 to 1 767) °C	0.31 °C	
	Type T		
	(-250 to -150) °C	0.46 °C	
	(-150 to 0) °C	0.16 °C	
	(0 to 120) °C	0.1 °C	
(120 to 400) °C	0.08 °C		
Type U			
(-200 to 0) °C	0.30 °C		
(0 to 600) °C	0.08 °C		
Type BP			
(0 to 1000) °C	0.3 °C		
(1 000 to 2 000) °C	0.46 °C		
(2 000 to 2 500) °C	0.61 °C		
Type XK			
(-200 to 300) °C	0.15 °C		
(300 to 800) °C	0.23 °C		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicators ¹	Cu 10 (427) (-80 to 260) °C	0.23 °C	Comparison to Fluke 5560A Multiproduct Calibrator
	Cu 50 (428) (-180 to 200) °C	0.3 °C	
	Cu 100 (428) (-180 to -40) °C	0.3 °C	
	Cu 100 (428) (-40 to 200) °C	0.49 °C	
	Ni 120 (672) (-80 to 0) °C	0.06 °C	
	Ni 120 (672) (0 to 100) °C	0.06 °C	
	Ni 120 (672) (100 to 260) °C	0.11 °C	
	Pt 100 (385) (-200 to -80) °C	0.04 °C	
	Pt 100 (385) (-80 to 0) °C	0.04 °C	
	Pt 100 (385) (0 to 100) °C	0.05 °C	
	Pt 100 (385) (100 to 300) °C	0.07 °C	
	Pt 100 (385) (300 to 400) °C	0.08 °C	
	Pt 100 (385) (400 to 630) °C	0.09 °C	
	Pt 100 (385) (630 to 800) °C	0.18 °C	
	Pt 100 (3916) (-200 to -190) °C	0.19 °C	
	Pt 100 (3916) (-190 to -80) °C	0.03 °C	
	Pt 100 (3916) (-80 to 0) °C	0.04 °C	
	Pt 100 (3916) (0 to 100) °C	0.05 °C	
	Pt 100 (3916) (100 to 260) °C	0.05 °C	
	Pt 100 (3916) (260 to 300) °C	0.06 °C	
	Pt 100 (3916) (300 to 400) °C	0.07 °C	
	Pt 100 (3916) (400 to 600) °C	0.08 °C	
	Pt 100 (3916) (600 to 630) °C	0.18 °C	
	Pt 100 (3926) (-200 to -80) °C	0.04 °C	
Pt 100 (3926) (-80 to 0) °C	0.04 °C		
Pt 100 (3926) (0 to 100) °C	0.05 °C		
Pt 100 (3926) (100 to 300) °C	0.07 °C		
Pt 100 (3926) (300 to 400) °C	0.08 °C		
Pt 100 (3926) (400 to 630) °C	0.09 °C		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicators ¹	Pt 200 (385)		Comparison to Fluke 5560A Multiproduct Calibrator
	(-200 to -80) °C	0.03 °C	
	(-80 to 0) °C	0.03 °C	
	(0 to 100) °C	0.03 °C	
	(100 to 260) °C	0.04 °C	
	(260 to 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 600) °C	0.11 °C	
	(600 to 630) °C	0.12 °C	
	Pt 500 (385)		
	(-200 to -80) °C	0.03 °C	
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.04 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.06 °C	
	(300 to 400) °C	0.06 °C	
	(400 to 600) °C	0.07 °C	
	(600 to 630) °C	0.08 °C	
Pt 1000 (385)			
(-200 to -80) °C	0.02 °C		
(-80 to 0) °C	0.02 °C		
(0 to 100) °C	0.03 °C		
(100 to 260) °C	0.04 °C		
(260 to 300) °C	0.05 °C		
(300 to 400) °C	0.05 °C		
(400 to 600) °C	0.05 °C		
(600 to 630) °C	0.18 °C		
Oscilloscopes Calibration – Generate ¹ Voltage DC - 50Ω	(1 to 24.999) mV	0.19 % of Output + 31 μV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
	(25 to 109.99) mV	0.19 % of Output + 36 μV	
	(110mV to 2.199 9) V	0.19 % of Output + 87 μV	
	(2.2 to 6.6) V	0.19 % of Output + 0.6 mV	
	(1 to 24.999) mV	0.019 % of reading + 20 μV	
	(25 to 109.99) mV	0.019 % of reading + 25 μV	
	(110mV to 2.199 9) V	0.019 % of reading + 76 μV	
	(2.2 to 10.999) V	0.019 % of reading + 0.6 mV	
DC - 1MΩ	(11 to 130) V	0.019 % of reading + 6 mV	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration – Generate ¹ Square Wave 10 Hz to 10 kHz - 50Ω Square Wave 10 Hz to 1 kHz - 1MΩ Square Wave (1 to 10) kHz - 1MΩ	(1 to 24.999) mVpp (25 to 109.99) mVpp (110mV to 2.199 9) Vpp (2.2 to 6.6) Vpp (1 to 24.999) mV (25 to 109.99) mV (110mV to 2.199 9) V (2.2 to 10.999) V (11 to 130) V (1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.19 % of Output + 31 μV 0.19 % of Output + 36 μV 0.19 % of Output + 87 μV 0.19 % of Output + 0.6 mV 0.038 % of reading + 4 μV 0.038 % of reading + 9 μV 0.038 % of reading + 60 μV 0.038 % of reading + 0.6 mV 0.038 % of reading + 6 mV 0.19 % of reading + 31 μV 0.19 % of reading + 36 μV 0.19 % of reading + 87 μV 0.19 % of reading + 0.6 mV 0.19 % of reading + 6 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth (5 to 50) mVpp 50 kHz to 100) MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 16 00) MHz (1 600 to 2 100) MHz 50 mV to 3.5 Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 1 600) MHz (1 600 to 2 100) MHz	0.34 dB 0.36 dB 0.42 dB 0.46 dB 0.5 dB 0.56 dB 0.24 dB 0.24 dB 0.32 dB 0.34 dB 0.4 dB 0.44 dB	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness	3 dB Bandwidth 50 mV to 3.5Vpp (1 100 to 4 000) MHz (4 000 to 8 000) MHz (8 000 to 18 000) MHz	0.3 dB 0.38 dB 0.48 dB	Comparison to EPM Power Meter w/ E Series Power Sensors
Oscilloscopes Calibration – Generate ¹ Time Marker	500 ps to 20 ms 50 ms to 5 s	0.25 μs/s 1.9 μs/s + 3.8 μHz	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration Measure ¹ Input Impedance Resistance Leakage	(40 to 60) Ω 500 kΩ to 1.5MΩ (0 to 5.99) V	0.08 % of reading 0.08 % of reading 0.038 % of reading + 0.8 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Generate ¹ Voltage DC – 50 Ω DC – 1 MΩ Square Wave 10 Hz to 10 kHz – 1 MΩ	1 mV to 5 V 1 mV to 200 V 1 mV to 200 Vpp	0.025 % of output + 25 μV 0.025 % of output + 25 μV 0.1 % of output + 10 μV	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness 50 kHz to 10 MHz Reference	5 mV to 5 Vpp (0.1 Hz to 300) MHz (300 to 550) MHz 5 mV to 3 Vpp (550 to 1 100) MHz	 0.18 dB 0.22 dB 0.3 dB	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration – Generate ¹ Time Marker	9 ns to 55 s	0.25 μs/s	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration – Measure ¹ Input Impedance Resistance	(10 to 40) Ω (40 to 90) Ω (90 to 150) Ω (50 to 800) KΩ (0.8 to 1.2) MΩ (1.2 to 12) MΩ	0.5 % of reading 0.1 % of reading 0.5 % of reading 0.5 % of reading 0.1 % of reading 0.5 % of reading	Comparison to Fluke 9500B with 9510 Active Head
Power Meters ¹	3 μW to 100 mW	0.3 % of reading	Comparison to HP 11683A Range Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(30 to 3050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.13 dB	
	(3 050 to 6 600) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.19 dB	
	(6 600 to 13 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.12 dB		
(80 to 90) dB	0.12 dB		
(90 to 100) dB	0.13 dB		
(100 to 110) dB	0.25 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(13 200 to 19 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.31 dB	
	(19 200 to 26 500) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.14 dB	
	(90 to 100) dB	0.36 dB	
	(100 to 110) dB	0.82 dB	
	(26 500 to 31 150) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.12 dB		
(80 to 90) dB	0.13 dB		
(90 to 100) dB	0.33 dB		
(100 to 110) dB	0.77 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(31 150 to 41 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.14 dB	
	(80 to 90) dB	0.36 dB	
	(41 000 to 45 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.11 dB	
	(70 to 80) dB	0.24 dB	
	(80 to 90) dB	0.6 dB	
	(45 000 to 50 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
(30 to 40) dB	0.035 dB		
(40 to 50) dB	0.04 dB		
(50 to 60) dB	0.11 dB		
(60 to 70) dB	0.29 dB		
(70 to 80) dB	0.7 dB		
(80 to 90) dB	1.4 dB		
RF Flatness – Measure ¹	9 kHz to 2 000 MHz		Comparison to Agilent EPM Series Power Meter w/E9304A Power Sensor
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.1 dB	
	(-30 to -40) dBm	0.11 dB	
	(-40 to -42) dBm	0.12 dB	
	(2 000 to 6 000) MHz		
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.09 dB	
	(-30 to -40) dBm	0.1 dB	
	(-40 to -42) dBm	0.11 dB	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	9 kHz to 14 000 MHz (20 to 0) dB (0 to -40) dB (-40 to -50) dB (-50 to -55) dB	0.13 dB 0.15 dB 0.35 dB 0.93 dB	Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(14 000 to 18 000) MHz (20 to 0) dB (0 to -40) dB (-40 to -50) dB (-50 to -55) dB	0.12 dB 0.16 dB 0.35 dB 0.93 dB	
RF Power – Measure ¹	(100 to 2 000) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	0.14 dB 0.06 dB 0.07 dB 0.08 dB 0.15 dB	Comparison to Agilent EPM Series Power Meter 8487A Power Sensor
RF Power Measure ¹	(10 to 100) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (100 to 2 000) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (2 000 to 12 400) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (12 400 to 18 000) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	0.07 dB 0.06 dB 0.06 dB 0.06 dB 0.11 dB 0.07 dB 0.07 dB 0.06 dB 0.07 dB 0.11 dB 0.08 dB 0.08 dB 0.08 dB 0.08 dB 0.08 dB 0.12 dB 0.09 dB 0.08 dB 0.08 dB 0.09 dB 0.12 dB	Comparison to Agilent EPM Series Power Meter RF Power / Keysight N8485A Power Sensor



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	(18 000 to 26 500) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	0.12 dB 0.12 dB 0.12 dB 0.12 dB 0.15 dB	Comparison to Agilent EPM Series Power Meter RF Power / Keysight N8485A Power Sensor
RF Power – Measure ¹	(2 000 to 12 400) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (12 400 to 18 000) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (18 000 to 26 500) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (26 5000 to 40 000) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	0.15 dB 0.07 dB 0.07 dB 0.08 dB 0.15 dB 0.15 dB 0.08 dB 0.08 dB 0.09 dB 0.15 dB 0.16 dB 0.1 dB 0.1 dB 0.11 dB 0.16 dB 0.17 dB 0.12 dB 0.12 dB 0.13 dB 0.18 dB	Comparison to Agilent EPM Series Power Meter 8487A Power Sensor
RF Power – Measure ¹	(40 000 to 50 000) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	0.22 dB 0.19 dB 0.19 dB 0.19 dB 0.23 dB	Comparison to Agilent EPM Series Power Meter 8487A Power Sensor



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(30 to 2 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.36 dB	
	(20 to 0) dB	0.2 dB	
	(0 to -58) dB	0.22 dB	
	(-58 to -78) dB	0.23 dB	
	(-78 to -110) dB	0.25 dB	
	(-110 to -115) dB	0.27 dB	
	(-115 to -120) dB	0.33 dB	
	(-120 to -125) dB	0.46 dB	
	(2 000 to 3 050) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.26 dB	
	(-110 to -115) dB	0.28 dB	
	(-115 to -120) dB	0.34 dB	
	(-120 to -125) dB	0.7 dB	
	(3 050 to 6 600) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.29 dB	
	(-110 to -115) dB	0.38 dB	
	(-115 to -120) dB	0.53 dB	
	(6 600 to 13 200) MHz		
	(30 to 20) dB	0.37 dB	
(20 to 0) dB	0.21 dB		
(0 to -58) dB	0.23 dB		
(-58 to -78) dB	0.24 dB		
(-78 to -110) dB	0.34 dB		
(-110 to -115) dB	0.46 dB		
(-115 to -120) dB	0.65 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(13 200 to 18 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -90) dB	0.26 dB	
	(-90 to -95) dB	0.26 dB	
	(-95 to -100) dB	0.26 dB	
	(-100 to -105) dB	0.29 dB	
	(-105 to -110) dB	0.38 dB	
	(-110 to -115) dB	0.53 dB	
	(-115 to -120) dB	0.75 dB	
	(18 000 to 19 200) MHz		
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.27 dB	
	(-90 to -95) dB	0.27 dB	
	(-95 to -100) dB	0.27 dB	
	(-100 to -105) dB	0.3 dB	
	(-105 to -110) dB	0.38 dB	
	(-110 to -115) dB	0.53 dB	
	(-115 to -120) dB	0.75 dB	
	(19 200 to 26 500) MHz		
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.28 dB	
(-90 to -95) dB	0.33 dB		
(-95 to -100) dB	0.43 dB		
(-100 to -105) dB	0.61 dB		
(-105 to -110) dB	0.85 dB		
(-110 to -115) dB	1.2 dB		
(-115 to -120) dB	1.5 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(26 500 to 31 150) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.34 dB	
	(-78 to -90) dB	0.36 dB	
	(-90 to -95) dB	0.39 dB	
	(-95 to -100) dB	0.46 dB	
	(-100 to -105) dB	0.61 dB	
	(-105 to -110) dB	0.82 dB	
	(-110 to -115) dB	1.1 dB	
	(31 150 to 41 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.35 dB	
	(-78 to -90) dB	0.48 dB	
	(-90 to -95) dB	0.64 dB	
	(-95 to -100) dB	0.87 dB	
	(-100 to -105) dB	1.2 dB	
	(-105 to -110) dB	1.5 dB	
	(41 000 to 45 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.38 dB	
	(-78 to -90) dB	0.68 dB	
	(-90 to -95) dB	0.93 dB	
	(-95 to -100) dB	1.2 dB	
	(-100 to -105) dB	1.6 dB	
(45 000 to 50 000) MHz			
(30 to 20) dB	0.42 dB		
(20 to 0) dB	0.3 dB		
(0 to -58) dB	0.34 dB		
(-58 to -78) dB	0.67 dB		
(-78 to -90) dB	1.4 dB		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Generate ¹	(30 to 2 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, E8257D Signal Generator
	(20 to 0) dB	0.29 dB	
	(0 to -58) dB	0.3 dB	
	(-58 to -78) dB	0.31 dB	
	(-78 to -110) dB	0.32 dB	
	(2 000 to 3 050) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.39 dB	
	(3 050 to 6 600) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.39 dB	
	(6 600 to 13 200) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.42 dB	
	(13 200 to 18 000) MHz		
	(15 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.46 dB	
	(18 000 to 19 200) MHz		
	(15 to 0) dB	0.41 dB	
	(0 to -58) dB	0.41 dB	
(-58 to -78) dB	0.42 dB		
(-78 to -110) dB	0.5 dB		
(19 200 to 26 500) MHz			
(15 to 0) dB	0.41 dB		
(0 to -58) dB	0.41 dB		
(-58 to -78) dB	0.42 dB		
(-78 to -110) dB	0.9 dB		
(26 500 to 31 150) MHz			
(15 to 0) dB	0.62 dB		
(0 to -58) dB	0.63 dB		
(-58 to -78) dB	0.64 dB		
(-78 to -110) dB	0.96 dB		



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RF Power – Generate ¹	(31 150 to 41 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, E8257D Signal Generator
	(10 to 0) dB	0.82 dB	
	(0 to -58) dB	0.83 dB	
	(-58 to -78) dB	0.84 dB	
	(-78 to -100) dB	1.1 dB	
	(41 000 to 45 000) MHz		
	(10 to 0) dB	0.82 dB	
	(0 to -58) dB	0.83 dB	
	(-58 to -78) dB	0.85 dB	
	(-78 to -100) dB	1.4 dB	
	(45 000 to 50 000) MHz		
	(10 to 0) dB	0.82 dB	
(0 to -58) dB	0.83 dB		
(-58 to -78) dB	1 dB		
(-78 to -90) dB	1.5 dB		
Amplitude Modulation – Measure ¹	100 kHz to 10 MHz		Comparison to Agilent N5531S Measuring Receiver
	Rate 50 Hz to 10 kHz		
	(5 to 99) % Depth	0.75 % of reading + 0.3 digits	
	10 MHz to 3 GHz		
	Rate 50 Hz to 100 kHz		
	(5 to 20) % Depth	2.5 % of reading + 0.4 digits	
	(20 to 99) % Depth	0.5 % of reading + 0.4 digits	
	(3 to 26.5) GHz		
	Rate 50 Hz to 100 kHz		
	(5 to 20) % Depth	4.5 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.5 % of reading + 0.4 digits	
	(26.5 to 31.15) GHz		
Rate 50 Hz to 100 kHz			
(5 to 20) % Depth	6.8 % of reading + 0.4 digits		
(20 to 99) % Depth	1.9 % of reading + 0.4 digits		
(31.15 to 50) GHz			
Rate 50 Hz to 100 kHz			
(5 to 20) % Depth	26 % of reading + 0.4 digits		
(20 to 99) % Depth	6 % of reading + 0.4 digits		



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Frequency Modulation – Measure ¹ $\beta = \text{deviation} / \text{rate}$	250 kHz to 10 MHz Rates 20 Hz to 10 kHz Peak Dev 200 to 40 kHz 10 MHz to 6.6 GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (6.6 to 13.2) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (13.2 to 31.15) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (31.15 to 50.0) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz	$\beta > 0.2 - 1.5 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 1.2 - 1 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.20 - 1.5 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.45 - 1 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.2 - 2.5 \% \text{ of reading} + 4 \text{ Hz}$ $\beta > 8.0 - 1 \% \text{ of reading} + 4 \text{ Hz}$ $\beta > 0.2 - 3.8 \% \text{ of reading} + 9 \text{ Hz}$ $\beta > 16 - 1 \% \text{ of reading} + 9 \text{ Hz}$ $\beta > 0.2 - 8.5 \% \text{ of reading} + 17 \text{ Hz}$ $\beta > 32 - 1 \% \text{ of reading} + 17 \text{ Hz}$	Comparison to Agilent N5531S Measuring Receiver
Phase Modulation – Measure ¹	100 kHz to 6.6 GHz Deviations > 0.3 rad Deviations > 0.7 rad (6.6 to 13.2) GHz Deviations > 0.6 rad Deviations > 2.0 rad (13.2 to 26.5) GHz Deviations: > 1.2 rad Deviations > 4.0 rad (26.5 to 31.15) GHz Deviations: > 1.3 rad Deviations > 4.0 rad (31.15 to 50) GHz Deviations: > 2.4 rad Deviations > 8.0 rad	3 % of reading + 0.002 rad 1 % of reading + 0.002 rad 3 % of reading + 0.005 rad 1 % of reading + 0.005 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad 3 % of reading + 0.018 rad 1 % of reading + 0.018 rad	Comparison to Agilent N5531S Measuring Receiver
Audio Distortion	(-80 to 0) dB 400 Hz and 1 kHz	5.8 % of reading	Comparison to HP 8902A Measuring Receiver



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AM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(0.1 to 10) MHz		Comparison to Agilent N5531S Measuring Receiver
	AM Depth > 1%		
	(0 to -20) dB	1.2 dB	
	(-20 to -30) dB	2.2 dB	
	AM Depth > 3%		
	(0 to -20) dB	1 dB	
	(-20 to -30) dB	1.3 dB	
	(-30 to -40) dB	2.4 dB	
	10 MHz to 26.5 GHz		
	AM Depth > 1%		
	(0 to -20) dB	1.3 dB	
	(-20 to -30) dB	2.5 dB	
	AM Depth > 3%		
(0 to -20) dB	1.1 dB		
(-20 to -30) dB	1.4 dB		
(-30 to -40) dB	3 dB		
(26.5 MHz to 50.0 GHz)			
AM Depth > 3%			
(0 to -20) dB	1.8 dB		
AM Depth > 5%			
(0 to -20) dB	1.5 dB		
(-20 to -30) dB	3.5 dB		
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(1 to 6 600) MHz		Comparison to Agilent N5531S Measuring Receiver
	Dev 500 Hz to 2KHz		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 2 kHz		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
(-40 to -50) dB	2.4 dB		



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FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(6.6 to 13.2) GHz		Comparison to Agilent N5531S Measuring Receiver
	Dev > 2.3 kHz		
	(0 to -20) dB		
	(-20 to -30) dB	0.26 dB	
	(-30 to -40) dB	0.79 dB	
	Dev > 4.5 kHz	2.3 dB	
	(0 to -20) dB		
	(-20 to -30) dB	0.09 dB	
	(-30 to -40) dB	0.27 dB	
	(-40 to -50) dB	0.83 dB	
	(13.2 to 31.15) GHz	2.4 dB	
	Dev > 2.7 kHz		
	(0 to -20) dB		
	(-20 to -30) dB	0.26 dB	
	(-30 to -40) dB	0.79 dB	
	Dev > 6.0 kHz	2.3 dB	
	(0 to -20) dB		
	(-20 to -30) dB	0.09 dB	
	(-30 to -40) dB	0.27 dB	
	(-40 to -50) dB	0.83 dB	
(31.15 to 50.0) GHz	2.4 dB		
Dev > 4 kHz			
(0 to -20) dB			
(-20 to -30) dB	0.26 dB		
(-30 to -40) dB	0.79 dB		
(31.15 to 50.0) GHz	2.3 dB		
Dev > 12.0 kHz			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		

Electrical – RF/Microwave

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(1 to 6 600) MHz		Comparison to Agilent N5531S Measuring Receiver
	Rate 20 to 500 Hz		
	Dev > 0.8 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 2.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	Rate (500 to 1 000) Hz		
	Dev > 0.4 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 1.0 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	(6.6 to 13.2) GHz		
	Rate (20 to 500) Hz		
	Dev > 1.8 rad		
(0 to -20) dB	0.26 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 5.5 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		
Rate (500 to 1 000) Hz			
Dev > 0.8 rad			
(0 to -20) dB	0.26 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		



ANSI National Accreditation Board

Electrical – RF/Microwave

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(6.6 to 13.2) GHz		Comparison to Agilent N5531S Measuring Receiver
	Rate (500 to 1 000) Hz		
	Dev > 2.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	(13.2 to 31.15) GHz		
	Rate (20 to 500) Hz		
	Dev > 3.5 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 10.0 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	Rate (500 to 1 000) Hz		
	Dev > 1.2 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 4.0 rad		
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		
(31.15 to 50.0) GHz			
Rate 20 to 500 Hz			
Dev > 7.5 rad			
(0 to -20) dB	0.26 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 19.0 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		



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Electrical – RF/Microwave

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(31.15 to 50.0) GHz		Comparison to Agilent N5531S Measuring Receiver
	Rate (500 to 1 000) Hz		
	Dev > 3.0 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 8.0 rad	0.09 dB	
	(0 to -20) dB	0.27 dB	
Total Harmonic Distortion (THD)	(-30 to -40) dB	0.83 dB	Comparison to HP 8903B Audio Analyzer
	(-40 to -50) dB	2.3 dB	
	(0 to -60) dB		
	20 Hz to 20 kHz		
	(0 to -40) dB	1 dB	
	(-40 to -50) dB	1 dB	
	(-50 to -60) dB	1.3 dB	
	(-60 to -65) dB	1.7 dB	
	(20 to 50) kHz		
	(0 to -40) dB	2 dB	
	(-40 to -50) dB	2.1 dB	
	(-50 to -60) dB	3 dB	
Harmonics Measure ¹	(50 to 100) kHz		Comparison to Agilent E4448A Measuring Receiver
	(0 to -40) dB	2 dB	
	(-40 to -50) dB	2.4 dB	
	(-10 to -80) dB		
	2 nd through 5 th Harmonic		
	1kHz to 600MHz	0.37 dB	
	(600 to 1 320) MHz	1.1 dB	
	(1 320 to 2 200) MHz	1.4 dB	
	(2 200 to 3 000) MHz	1.4 dB	
	(3 000 to 4 400) MHz	1.7 dB	
	(4 400 to 5 300) MHz	1.9 dB	
	(5 300 to 10 000) MHz	2.1 dB	
2 nd through 4 th Harmonic			
(10 000 to 12 500) MHz	2.1 dB		
2 nd through 3 rd Harmonic			
(12 500 to 16 667) MHz	2.1 dB		
2 nd Harmonic			
(16 667 to 25 000) MHz	2.3 dB		

Length – Dimensional Metrology

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers ^{1,2}	Up to 46 in	$(76 + 7L) \mu\text{in}$	Comparison to Grade 2 gage blocks
Micrometers ^{1,2}	Up to 46 in	$(31 + 4.3L) \mu\text{in}$	Comparison to Grade 2 gage blocks
Micrometers Standards	(1 to 12) in	$(2.5 + 6.7L) \mu\text{in}$	Comparison to Universal measuring machine, master gage block set
Bore Micrometers ² 2 point 3 point	Up to 12 in (0.125 to 3.5) in	$(22 + 4L) \mu\text{in}$ $(29 + 5.9L) \mu\text{in}$	Comparison to Master gage blocks, P&W universal measuring machine, Master Ring
Dial Indicators ^{1,2} Resolution: $\geq 50\mu\text{in}$ $< 50\mu\text{in}$	Up to 10 in Up to 0.1 in	$(26 + 3.9L) \mu\text{in}$ 8.3 μin	Comparison to Grade 2 gage blocks
Height Gages ^{1,2}	Up to 46 in	$(106 + 1.6L) \mu\text{in}$	Comparison to Grade 2 gage blocks
Scales – Rulers ¹	Up to 46 in	0.009 in	Comparison to Grade 2 gage blocks
Feeler Gages ¹	Up to 1 in	31 μin	Comparison to P&W Supermicrometer
Surface Plates ¹ – Overall Flatness Local Area Flatness	(18 x 18) in to (6x6) ft (-0.001 to 0.001) in	79 μin 68 μin	Comparison to Mahr Leveling system Repeat-o-meter
Gage Blocks ²	Up to 12 in	$(4.2 + 2L) \mu\text{in}$	Comparison to Universal measuring machine, master gage block set
Protractors ¹	(0 to 360) °	0.013°	Comparison to Angle blocks
Radius Gages	(0.01 to 1) in	240 μin	Comparison to Optical comparator
Cylindrical Gages ^{1,2} – Plain Pin, Plugs Rings	(0 to 12) in (0.04 to 14) in	$(8.1 + 2.1D) \mu\text{in}$ $(14 + 2D) \mu\text{in}$	Comparison to Master gage blocks, P&W universal measuring machine
Thread Plugs – Major Pitch Diameter (6 to 80) TPI	Up to 12 in Up to 12 in	50 μin 97 μin	Comparison to Gage blocks, P & W Supermicrometer, Van Keuren thread wire set

Length – Dimensional Metrology

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Rings ^{2,3} Pitch Diameter (tactile fit)	Up to 12 in	(350 + 47D) μin	Comparison to Thread setting plug gages

Mass and Mass Related

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales & Balances ^{1,2,4}	1 g to 40 kg	(0.042 + 0.0045X) mg	Comparison to Class 1 weights
	Up to 1 100 lb Up to 500 kg	(0.0003 + 0.00012W) lb (0.13 + 0.00012X) g	Comparison to Class F weights
Pressure ¹ – Measure	(0 to 30) inH ₂ O	0.0073 % of reading or 0.000 55 inH ₂ O whichever is greater	Comparison to Low Pressure Controller/ Calibrator Ruska 7250LP
	(-150 to 150) inH ₂ O (0 to 30) psig	0.07 inH ₂ O 0.007 psi	Comparison to Pressure Gage Additel ADT686-DP150 Additel ADT686-GP30
	(0 to 23) psia (0 to 30) inHg	0.005 psi 0.01 inHg	Comparison to High Accuracy Pressure Standard Paroscientific 760-23A Paroscientific 760-23A
	(0 to 5 000) psig (0 to 10 000) psig	1.2 psi 2.3 psi	Comparison to Pressure Gage Additel ADT686-GP5K Additel ADT686-GP10K
Pressure ¹ – Generate	(-15 to 300) psig (-15 to 1 000) psig	0.07 psi 0.24 psi	Comparison to Additel Pressure Calibrator ADT761A-1K
Pressure ¹ – Generate	(10 to 16 000) psi	0.019 % of reading or 0.007 5 psi whichever is greater	Comparison to Fluke P3125-PSI Deadweight Tester
Vacuum Gages	(100 to 1000) torr (10 to 100) torr (1 to 10) torr (10 to 100) mtorr	(0.084 % of reading + 0.25) torr (0.093 % of reading + 0.025) torr (0.094 % of reading + 0.0025) torr (0.29 % of reading + 0.025) mtorr	Comparison to MKS 960AVacuum Transducers
Torque Tools ¹	(4 to 1 000) lbf·in (25 to 1 000) lbf·ft	0.4 % of reading 0.49 % of reading	Comparison to CDI torque system



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Mass and Mass Related

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque Analyzers	1 ozf·in to 250 lbf·ft	0.11 % of reading	Comparison to Weights and arm
Force Gages Tension & Compression ¹	10 mgf to 540 lbf	0.061 % of reading	Comparison to Class 1 and Class F weights
Mass – Class F	(5 to 225) g (1 to 10) lb (220 to 50) lb	1.2 mg 0.034 g 0.33 g	Comparison to Master balances
Rockwell Hardness Testers ¹	HRA (20 to 69) HRA (70 to 79) HRA (80 to 86) HRA HRBW (0 to 59) HRBW (60 to 79) HRBW (80 to 100) HRBW HRC (20 to 39) HRC (40 to 59) HRC (60 to 70) HRC	0.62 HRA 0.52 HRA 0.33 HRA 0.9 HRBW 0.62 HRBW 0.42 HRBW 0.36 HRC 0.33 HRC 0.21 HRC	Indirect Verification using Hardness blocks
Durometers – Scale Accuracy (force) Types A, B, C, D, DO, O Type M, Types OO, OOO Indenter Geometry Length Diameter Angle	(0 to 100) duros 0.1 in 0.05 in (30 to 35)°	0.06 duros 0.09 duros 0.07 duros 180 μin 180 μin 0.006°	Direct Verification Master balance Optical comparator
Mass - Fixed Points Metric	(1,2,5) g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg	0.07 mg 0.15 mg 0.19 mg 0.23 mg 0.45 mg 0.99 mg 6.5 mg 10 mg 14 mg 31 mg 82 mg 114 mg	Comparison to ASTM E617 Class 1 weights



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Thermodynamic

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure ¹	(-196 to 230) °C (230 to 420) °C	0.03 °C 0.041 °C	Comparison to Hart 1502 Indicator with Fluke 5615 PRT
Temperature – Measuring Equipment ¹	(-40 to 160) °C (160 to 420) °C	0.056 °C 0.067 °C	Comparison to Hart 1502 Indicator with Fluke 5615 PRT and Additel Dry Well
	(420 to 660) °C	0.31 °C	Comparison to Additel Dry Well
Humidity – Measure ¹	(0 to 90) % RH	1.7 % RH	Comparison to Vaisala HM141/HMP46 Humidity Indicator and Probe
	(0 to 90) % RH (90 to 100) % RH Non-condensing	1.2 % RH 2 % RH	Comparison to Vaisala MI70/HMP77B Humidity Indicator and Probe
Humidity - Generate	(10 to 95) %RH	0.5 % RH	Comparison to Thunder Scientific 2500
Infrared (IR) Thermometry ¹	(20 to 100) °C (100 to 300) °C (300 to 420) °C (420 to 500) °C	1.5 °C 4.3 °C 6 °C 7.7 °C	Comparison to Fluke 9132 Infrared Calibrator $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$

Time and Frequency

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Generate ¹	10 MHz	1×10^{-12} Hz/Hz	Comparison to HP 58503A GPS Receiver
	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 10) MHz	1×10^{-12} Hz/Hz + 0.57 μ Hz 1×10^{-12} Hz/Hz + 5.7 μ Hz 1×10^{-12} Hz/Hz + 57 μ Hz 1×10^{-12} Hz/Hz + 0.57 mHz 1×10^{-12} Hz/Hz + 5.7 mHz 1×10^{-12} Hz/Hz + 57 mHz 1×10^{-12} Hz/Hz + 0.57 Hz	Comparison to Agilent 33250A Function Generator / HP 58503A GPS Receiver
	(10 to 50 000) MHz	1×10^{-12} Hz/Hz + 0.57 mHz	Comparison to Agilent E8257D Opt 550 Signal Generator / HP 58503A GPS Receiver



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Time and Frequency

Peachtree Corners, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Time – Generate	1 pps	1×10^{-12} s/s + 750 ps	Comparison to HP 58503A GPS Receiver
Frequency – Measure	1 to 10 Hz 10 to 100 Hz 100 to 1 000 Hz 1 to 10 kHz 10 to 100 kHz 100 to 200 kHz 0.2 to 3 000 MHz	4.20×10^{-9} Hz/Hz 1.47×10^{-9} Hz/Hz 0.60×10^{-9} Hz/Hz 0.33×10^{-9} Hz/Hz 0.24×10^{-9} Hz/Hz 0.21×10^{-9} Hz/Hz 0.21×10^{-9} Hz/Hz	Comparison to Agilent 53131A Opt 030 Frequency Counter / HP 58503A GPS Receiver
Frequency – Measure ¹	50 to 46 000 MHz	1×10^{-12} Hz/Hz + 1.6 Hz	Comparison to Agilent 53152A Frequency Counter / HP 58503A GPS Receiver
Frequency – Measure ¹	10 to 50 000 MHz	1×10^{-12} Hz/Hz + 0.1 Hz	Comparison to Agilent E4448A Spectrum Analyzer / HP 58503A GPS Receiver
Tachometers – RPM ^{1,2}	Up to 100 000 RPM	0.000 7 of reading + 0.6R	Comparison to HP 33250A Signal Generator & LED

DIMENSIONAL MEASUREMENT

1 Dimensional

Peachtree Corners, GA

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Length (distance)	X Axis (0.01 to 8) in Y Axis (0.01 to 4) in	160 μin 120 μin	Comparison to Optical comparator

2 Dimensional

Peachtree Corners, GA

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Angle	Up to 360°	0.006°	Comparison to Optical comparator

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Services performed at satellite laboratory

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Scott Chamberlain (Quality Manager) Phone: 321-242-0890

CALIBRATION AND DIMENSIONAL MEASUREMENT

CALIBRATION

Acoustics and Vibration

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometers – Acceleration ¹	(0.01 to 10) g (7 to 100) Hz (100 to 2 500) Hz (2.5 to 10) kHz	1.5 % of reading 1.2 % of reading 2.5 % of reading	Comparison to Accelerometer Calibrator
Sound Pressure Level – Generate ¹	94 dB @ 1 kHz 114 dB @ 1 kHz	0.65 dB 0.97 dB	Comparison to Extech 407766 Sound Level Calibrator

Chemical Quantities

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters ^{1,5}	4 pH 7 pH 10 pH	0.016 pH 0.025 pH 0.061 pH	Comparison to pH buffer solutions
Conductivity Meters ^{1,5}	100 µS/cm 1 410 µS/cm 10 000 µS/cm	0.83 µS/cm 5.3 µS/cm 44 µS/cm	Comparison to Conductivity solutions



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Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Generate ¹	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	6.8 $\mu\text{V/V} + 0.8 \mu\text{V}$ 4.6 $\mu\text{V/V} + 0.9 \mu\text{V}$ 3 $\mu\text{V/V} + 2.5 \mu\text{V}$ 3 $\mu\text{V/V} + 3.9 \mu\text{V}$ 4.6 $\mu\text{V/V} + 38 \mu\text{V}$ 6.1 $\mu\text{V/V} + 385 \mu\text{V}$	Comparison to Fluke 5730A Multifunction Calibrator
DC Voltage – Measure ¹	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	3.3 $\mu\text{V/V} + 1 \mu\text{V}$ 2.6 $\mu\text{V/V} + 1 \mu\text{V}$ 2.6 $\mu\text{V/V} + 1.5 \mu\text{V}$ 3.9 $\mu\text{V/V} + 20 \mu\text{V}$ 3.9 $\mu\text{V/V} + 66 \mu\text{V} + 12\mu\text{V/V} \times (\text{Vin}/1\ 000) ^2$	Comparison to Agilent 3458A Option 002 Multimeter
DC Voltage – Measure ¹	(1 to 30) kV	0.1 % of reading	Comparison to Ross VD30 High Voltage Divider, Fluke 89 IV Multimeter
DC Voltage – Measure ¹	(1 to 150) kV	0.1 % of reading	Comparison to Ross VD150 High Voltage Divider, HP 34401A Multimeter
DC Current – Generate ¹	(1 to 2.2) nA (2.2 to 22) nA (22 to 220) nA (0.22 to 2.2) μA (2.2 to 10) μA	93 $\mu\text{A/A} + 0.007 \text{ nA}$ 92 $\mu\text{A/A} + 0.007 \text{ nA}$ 92 $\mu\text{A/A} + 0.01 \text{ nA}$ 36 $\mu\text{A/A} + 0.1 \text{ nA}$ 15 $\mu\text{A/A} + 1 \text{ nA}$	Comparison to Fluke 5730A & 5522A Multifunction Calibrator
	(10 to 220) μA 220 μA to 2.2 mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA (0.22 to 1) A (1 to 2.2) A	38 $\mu\text{A/A} + 5 \text{ nA}$ 30 $\mu\text{A/A} + 7 \text{ nA}$ 30 $\mu\text{A/A} + 44 \text{ nA}$ 38 $\mu\text{A/A} + 0.7 \mu\text{A}$ 45 $\mu\text{A/A} + 0.7 \mu\text{A}$ 68 $\mu\text{A/A} + 12 \mu\text{A}$ 105 $\mu\text{A/A} + 12 \mu\text{A}$	Comparison to Fluke 5730A Multifunction Calibrator
	(2.2 to 11) A	274 $\mu\text{A/A} + 365 \mu\text{A}$	Comparison to Fluke 5730A/03 Multifunction Calibrator 5725A Amplifier
	(11 to 20.5) A	761 $\mu\text{A/A} + 578 \mu\text{A}$	Comparison to Fluke 5522A Multiproduct Calibrator
	DC Current Clamp Meters ¹ Toroidal-Wound	(0 to 1 025) A	0.2 % of output + 0.05A



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current Clamp Meters ¹ Other	(0 to 1 025) A	0.39 % of output + 0.38A	Comparison to Fluke 5522A Multiproduct Calibrator/5500A/Coil x50
DC Current – Measure ¹	(1 to 10) nA (10 to 100) nA (0.1 to 1) μ A (1 to 10) μ A	35 μ A/A + 0.1 pA 12 μ A/A + 1 pA 8.3 μ A/A + 0.01 nA 6.9 μ A/A + 0.1 nA	Comparison to Fluke 5730A Multifunction Calibrator Agilent 3458A Option 002 Multimeter
DC Current – Measure ¹	(10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	13 μ A/A + 0.5 nA 13 μ A/A + 3 nA 13 μ A/A + 0.03 μ A 23 μ A/A + 0.3 μ A 72 μ A/A + 6.6 μ A	Comparison to Agilent 3458A Multimeter
DC Current – Measure ¹	(1 to 3) A (3 to 10) A	761 μ A/A + 462 μ A 1.1 mA/A + 614 μ A	Comparison to Fluke 8845A Multimeter
	(1 to 600) A	0.27 % of reading	Comparison to Current Shunts
AC Voltage – Generate ¹	(0.22 to 2.2) mV		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	228 μ V/V + 3.9 μ V	
	(20 to 40) Hz	88 μ V/V + 3.9 μ V	
	40 Hz to 20 kHz	76 μ V/V + 3.9 μ V	
	(20 to 50) kHz	190 μ V/V + 3.9 μ V	
	(50 to 100) kHz	457 μ V/V + 4.6 μ V	
	(100 to 300) kHz	989 μ V/V + 9.2 μ V	
	(300 to 500) kHz	1.3 mV/V + 19 μ V	
	500 kHz to 1 MHz	2.6 mV/V + 19 μ V	
	(2.2 to 22) mV		
	(10 to 20) Hz	228 μ V/V + 3.9 μ V	
	(20 to 40) Hz	88 μ V/V + 3.9 μ V	
	40 Hz to 20 kHz	76 μ V/V + 3.9 μ V	
	(20 to 50) kHz	190 μ V/V + 3.9 μ V	
(50 to 100) kHz	457 μ V/V + 4.6 μ V		
(100 to 300) kHz	989 μ V/V + 9.2 μ V		
(300 to 500) kHz	1.3 mV/V + 19 μ V		
500 kHz to 1 MHz	2.6 mV/V + 19 μ V		



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(22 to 220) mV		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	228 $\mu\text{V/V}$ + 11.4 μV	
	(20 to 40) Hz	88 $\mu\text{V/V}$ + 6.1 μV	
	40 Hz to 20 kHz	53 $\mu\text{V/V}$ + 6.1 μV	
	(20 to 50) kHz	114 $\mu\text{V/V}$ + 6.1 μV	
	(50 to 100) kHz	304 $\mu\text{V/V}$ + 15.2 μV	
	(100 to 300) kHz	609 $\mu\text{V/V}$ + 19 μV	
	(300 to 500) kHz	1.3 mV /V + 22.8 μV	
	500 kHz to 1 MHz	2.5 mV /V + 45.7 μV	
	(0.22 to 2.2) V		
	(10 to 20) Hz	228 $\mu\text{V/V}$ + 38 μV	
	(20 to 40) Hz	84 $\mu\text{V/V}$ + 15 μV	
	40 Hz to 20 kHz	37 $\mu\text{V/V}$ + 8 μV	
	(20 to 50) kHz	61 $\mu\text{V/V}$ + 9 μV	
	(50 to 100) kHz	76 $\mu\text{V/V}$ + 30 μV	
	(100 to 300) kHz	304 $\mu\text{V/V}$ + 76 μV	
	(300 to 500) kHz	913 $\mu\text{V/V}$ + 190 μV	
	500 kHz to 1 MHz	1.5 mV/V + 304 μV	
	(2.2 to 22) V		
	(10 to 20) Hz	228 $\mu\text{V/V}$ + 380 μV	
	(20 to 40) Hz	84 $\mu\text{V/V}$ + 152 μV	
	40 Hz to 20 kHz	37 $\mu\text{V/V}$ + 54 μV	
	(20 to 50) kHz	61 $\mu\text{V/V}$ + 91 μV	
	(50 to 100) kHz	76 $\mu\text{V/V}$ + 190 μV	
(100 to 300) kHz	228 $\mu\text{V/V}$ + 609 μV		
(300 to 500) kHz	913 $\mu\text{V/V}$ + 1.9 mV		
500 kHz to 1 MHz	1.4 mV/V + 3 mV		
(22 to 220) V			
(10 to 20) Hz	228 $\mu\text{V/V}$ + 3.8 mV		
(20 to 40) Hz	84 $\mu\text{V/V}$ + 1.5 mV		
40 Hz to 20 kHz	49 $\mu\text{V/V}$ + 0.6 mV		
(20 to 50) kHz	76 $\mu\text{V/V}$ + 0.9 mV		
(50 to 100) kHz	137 $\mu\text{V/V}$ + 2.3 mV		



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Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(220 to 750) V 40 Hz to 1 kHz (1 to 20) kHz (30 to 50) kHz (50 to 100) kHz	68 μ V/V + 3 mV 126 μ V/V + 5 mV 457 μ V/V + 8 mV 1.8 mV/V + 34 mV	Comparison to Fluke 5730A Multifunction Calibrator /5725A Amplifier
	(750 to 1 000) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	68 μ V/V + 3 mV 126 μ V/V + 5 mV 457 μ V/V + 8 mV	
AC Voltage – Generate ¹ Wideband Absolute	(0.3 to 1.1) mV (10 to 30 Hz)	0.65 % of output + 1.5 μ V	Comparison to Fluke 5730A Multifunction Calibrator
	30 Hz to 500 kHz	0.61 % of output + 1.5 μ V	
	(0.5 to 1.2) MHz	0.63 % of output + 3.8 μ V	
	(1.2 to 2) MHz	0.63 % of output + 3.8 μ V	
	(2 to 12) MHz	0.68 % of output + 3.8 μ V	
	(12 to 20) MHz	0.76 % of output + 3.8 μ V	
	(20 to 30) MHz	1.3 % of output + 12.9 μ V	
	(1.1 to 3.3) mV (10 to 30 Hz)	0.58 % of output + 2.3 μ V	
	30 Hz to 500 kHz	0.53 % of output + 2.3 μ V	
	(0.5 to 1.2) MHz	0.54% of output + 4.6 μ V	
	(1.2 to 2) MHz	0.54 % of output + 4.6 μ V	
	(2 to 12) MHz	0.58 % of output + 4.6 μ V	
	(12 to 20) MHz	0.65 % of output + 4.6 μ V	
	(20 to 30) MHz	1.3 % of output + 4.6 μ V	
	(3.3 to 11) mV (10 to 30 Hz)	0.58 % of output + 6.1 μ V	
30 Hz to 500 kHz	0.53 % of output + 6.1 μ V		
(0.5 to 1.2) MHz	0.54 % of output + 8.4 μ V		
(1.2 to 2) MHz	0.54 % of output + 8.4 μ V		
(2 to 12) MHz	0.55 % of output + 8.4 μ V		
(12 to 20) MHz	0.61 % of output + 8.4 μ V		
(20 to 30) MHz	0.93 % of output + 8.4 μ V		



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Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(11 to 33) mV		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 30 Hz)	0.52 % of output + 12 μV	
	30 Hz to 500 kHz	0.46 % of output + 12 μV	
	(0.5 to 1.2) MHz	0.47 % of output + 14 μV	
	(1.2 to 2) MHz	0.47 % of output + 14 μV	
	(2 to 12) MHz	0.49 % of output + 14 μV	
	(12 to 20) MHz	0.55 % of output + 14 μV	
	(20 to 30) MHz	0.89 % of output + 14 μV	
	(33 to 110) mV		
	(10 to 30 Hz)	0.52 % of output + 30 μV	
	30 Hz to 500 kHz	0.46 % of output + 30 μV	
	(0.5 to 1.2) MHz	0.47 % of output + 33 μV	
	(1.2 to 2) MHz	0.47 % of output + 33 μV	
	(2 to 12) MHz	0.49 % of output + 33 μV	
	(12 to 20) MHz	0.55 % of output + 33 μV	
	(20 to 30) MHz	0.89 % of output + 33 μV	
	(110 to 330) mV		
	(10 to 30 Hz)	0.45 % of output + 0.1 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.1 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.1 mV	
	(1.2 to 2) MHz	0.4 % of output + 0.1 mV	
	(2 to 12) MHz	0.42 % of output + 0.1 mV	
	(12 to 20) MHz	0.49 % of output + 0.1 mV	
	(20 to 30) MHz	0.85 % of output + 0.1 mV	
	(0.33 to 1.1) V		
	(10 to 30 Hz)	0.45 % of output + 0.3 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.3 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.3 mV	
	(1.2 to 2) MHz	0.4 % of output + 0.3 mV	
	(2 to 12) MHz	0.42 % of output + 0.3 mV	
(12 to 20) MHz	0.49 % of output + 0.3 mV		
(20 to 30) MHz	0.85 % of output + 0.3 mV		
(1.1 to 3.5) V			
(10 to 30 Hz)	0.39 % of output + 0.4 mV		
30 Hz to 500 kHz	0.3 % of output + 0.4 mV		
(0.5 to 1.2) MHz	0.32 % of output + 0.4 mV		
(1.2 to 2) MHz	0.32 % of output + 0.4 mV		
(2 to 12) MHz	0.35 % of output + 0.4 mV		
(12 to 20) MHz	0.44 % of output + 0.4 mV		
(20 to 30) MHz	0.82 % of output + 0.4 mV		



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(1 to 10) mV		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.02 % of reading + 2.0 μ V	
	40 Hz to 1 kHz	0.013 % of reading + 0.7 μ V	
	(1 to 20) kHz	0.02 % of reading + 0.7 μ V	
	(20 to 50) kHz	0.065 % of reading + 0.7 μ V	
	(50 to 100) kHz	0.33 % of reading + 0.7 μ V	
	100 kHz to 1 MHz	0.78 % of reading + 3.3 μ V	
	(1 to 4) MHz	4.6 % of reading + 4.6 μ V	
	(4 to 8) MHz	13 % of reading + 5.3 μ V	
	(10 to 100) mV		
	(1 to 40) Hz	0.005 % of reading + 2.6 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 1.3 μ V	
	(1 to 20) kHz	0.009 % of reading + 1.3 μ V	
	(20 to 50) kHz	0.02 % of reading + 1.3 μ V	
	(50 to 100) kHz	0.052 % of reading + 1.3 μ V	
	(100 to 300) kHz	0.2 % of reading + 6.5 μ V	
	300 kHz to 1 MHz	0.7 % of reading + 6.5 μ V	
	(1 to 2) MHz	0.98 % of reading + 46 μ V	
	(2 to 4) MHz	2.6 % of reading + 46 μ V	
	(4 to 8) MHz	2.6 % of reading + 52 μ V	
	(8 to 10) MHz	9.8 % of reading + 65 μ V	
	(0.1 to 1) V		
	(1 to 40) Hz	0.005 % of reading + 26 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 13 μ V	
(1 to 20) kHz	0.009 % of reading + 13 μ V		
(20 to 50) kHz	0.02 % of reading + 13 μ V		
(50 to 100) kHz	0.052 % of reading + 13 μ V		
(100 to 300) kHz	0.2 % of reading + 65 μ V		
300 kHz to 1 MHz	0.65 % of reading + 65 μ V		
(1 to 2) MHz	0.98 % of reading + 0.5 mV		
(2 to 4) MHz	2.6 % of reading + 0.5 mV		
(4 to 8) MHz	2.6 % of reading + 0.5 mV		
(8 to 10) MHz	9.8 % of reading + 0.7 mV		



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Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(1 to 10) V		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.005 % of reading + 0.3 mV	
	40 Hz to 1 kHz	0.005 % of reading + 0.1 mV	
	(1 to 20) kHz	0.009 % of reading + 0.1 mV	
	(20 to 50) kHz	0.02 % of reading + 0.1 mV	
	(50 to 100) kHz	0.052 % of reading + 0.1 mV	
	(100 to 300) kHz	0.2 % of reading + 0.7 mV	
	300 kHz to 1 MHz	0.65 % of reading + 0.7 mV	
	(1 to 2) MHz	0.98 % of reading + 4.6 mV	
	(2 to 4) MHz	2.6 % of reading + 4.6 mV	
	(4 to 8) MHz	2.6 % of reading + 5.2 mV	
	(8 to 10) MHz	9.8 % of reading + 6.5 mV	
	(10 to 100) V		
	(1 to 40) Hz	0.013 % of reading + 2.6 mV	
	40 Hz to 1 kHz	0.013 % of reading + 1.3 mV	
(1 to 20) kHz	0.013 % of reading + 1.3 mV		
(20 to 50) kHz	0.023 % of reading + 1.3 mV		
(50 to 100) kHz	0.08 % of reading + 1.3 mV		
(100 to 300) kHz	0.26 % of reading + 6.5 mV		
300 kHz to 1 MHz	0.98 % of reading + 6.5 mV		
(100 to 700) V			
(1 to 40) Hz	0.026 % of reading + 26 mV		
40 Hz to 1 kHz	0.026 % of reading + 13 mV		
(1 to 20) kHz	0.039 % of reading + 13 mV		
(20 to 50) kHz	0.078 % of reading + 13 mV		
(50 to 100) kHz	0.2 % of reading + 13 mV		
AC Voltage – Measure ¹	(1 to 21) kV 60 Hz	0.57 % of reading + 0.002 kV	Comparison to Ross VD30 High Voltage Divider, Fluke 89IV Multimeter
AC Voltage – Measure ¹	(1 to 100) kV 60 Hz	0.5 % of reading + 0.02 kV	Comparison to Ross VD150 High Voltage Divider, Agilent 34401A Multimeter



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Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate ¹	(9 to 220) μ A		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	228 μ A/A + 15 nA	
	(20 to 40) Hz	152 μ A/A + 10 nA	
	40 Hz to 1 kHz	91 μ A/A + 8 nA	
	(1 to 5) kHz	266 μ A/A + 12 nA	
	(5 to 10) kHz	989 μ A/A + 61 nA	
	(0.22 to 2.2) mA		
	(10 to 20) Hz	228 μ A/A + 39 nA	
	(20 to 40) Hz	152 μ A/A + 31 nA	
	40 Hz to 1 kHz	91 μ A/A + 31 nA	
	(1 to 5) kHz	183 μ A/A + 99 nA	
	(5 to 10) kHz	989 μ A/A + 609 nA	
	(2.2 to 22) mA		
	(10 to 20) Hz	228 μ A/A + 385 nA	
	(20 to 40) Hz	152 μ A/A + 310 nA	
	40 Hz to 1 kHz	91 μ A/A + 310 nA	
	(1 to 5) kHz	183 μ A/A + 536 nA	
	(5 to 10) kHz	989 μ A/A + 4.6 nA	
	(22 to 220) mA		
	(10 to 20) Hz	228 μ A/A + 4 μ A	
(20 to 40) Hz	152 μ A/A + 3 μ A		
40 Hz to 1 kHz	91 μ A/A + 2 μ A		
(1 to 5) kHz	183 μ A/A + 3 μ A		
(5 to 10) kHz	989 μ A/A + 9 μ A		
(0.22 to 2.2) A			
20 Hz to 1 kHz	228 μ A/A + 31 μ A		
(1 to 5) kHz	380 μ A/A + 76 μ A		
(5 to 10) kHz	6.1 mA/A + 152 μ A		
AC Current – Generate ¹	(2.2 to 11) A 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	350 μ A /A + 141 μ A 723 μ A /A + 295 μ A 2.7 mA /A + 573 μ A	Comparison to Fluke 5730A Multifunction Calibrator /5725A Amplifier
AC Current – Generate ¹	(11 to 20.5) A 45 Hz to 100 Hz 100 Hz to 1 kHz (1 to 5) kHz	0.09 % of output + 5 mA 0.11 % of output + 5 mA 2.3 % of output + 5 mA	Comparison to Fluke 5522A Multiproduct Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment				
AC Current – Generate ¹ Clamps – Toroidal-Wound	(16.5 to 150) A (45 to 65) Hz	0.22 % of output + 69 mA	Comparison to Fluke 5522A Multiproduct Calibrator, 5500A/Coil x50				
	(150 to 1 000) A (45 to 65) Hz	0.23 % of output + 0.2 A					
	(16.5 to 150) A (65 to 440) Hz	0.6 % of output + 0.077 A					
AC Current – Generate ¹ Clamps – Other	(16.5 to 1 025) A (45 to 65) Hz	0.44 % of output +0.57 A	Comparison to Fluke 5522A Multiproduct Calibrator, 5500A/Coil x50				
	(16.5 to 150) A (65 to 440) Hz	0.76 % of output +0.69 A					
AC Current – Measure ¹	(5 to 100) μ A (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz	0.26 % of reading + 0.02 μ A 0.1 % of reading + 0.02 μ A 0.04 % of reading + 0.02 μ A	Comparison to Agilent 3458A/002 Precision Multimeter				
	100 μ A to 1 mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 0.13 μ A 0.1 % of reading + 0.13 μ A 0.04 % of reading + 0.13 μ A 0.02 % of reading + 0.13 μ A					
	(1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 1.3 μ A 0.1 % of reading + 1.3 μ A 0.04 % of reading + 1.3 μ A 0.02 % of reading + 1.3 μ A					
	AC Current – Measure ¹	(10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz		0.26 % of reading + 13 μ A 0.1 % of reading + 13 μ A 0.04 % of reading + 13 μ A 0.02 % of reading + 13 μ A	Comparison to Agilent 3458A Precision Multimeter		
		100 mA to 1 A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz		0.26 % of reading + 0.13 mA 0.1 % of reading + 0.13 mA 0.04 % of reading + 0.13 mA 0.02 % of reading + 0.13 mA			
		AC Current – Measure ¹		(1 to 3) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz		0.72 % of reading + 1.2 mA 0.23 % of reading + 1.2 mA 0.1 % of reading + 1.2 mA	Comparison to Agilent 34401A Multimeter



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Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(3 to 30) A 40 Hz to 1 kHz (1 to 5) kHz	0.3 % of reading + 0.07 A 5 % of reading + 0.14 A	Comparison to Agilent 3458A/002 Precision Multimeter Keysight 34330A Current Shunt
AC Current – Measure ¹	(10 to 1 000) A (10 to 100) Hz (100 to 500) Hz	1.5 % of reading + 1 A 1.9 % of reading + 1 A	Comparison to Fluke 376 Clamp Meter
AC Current – Measure ¹	(100 to 2 500) A (10 to 500) Hz	2.3 % of reading + 5 A	Comparison to Fluke 376 Clamp Meter w/i2500 flex probe
Resistance – Generate ¹ Fixed Points	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9) kΩ (10, 19) kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	84 μΩ/Ω + 0.1 μΩ 21 μΩ/Ω + 1 μΩ 9.1 μΩ/Ω + 6 μΩ 6.1 μΩ/Ω + 60 μΩ 6.1 μΩ/Ω + 0.6 mΩ 7.6 μΩ/Ω + 6 mΩ 9.1 μΩ/Ω + 6 mΩ 11.4 μΩ/Ω + 60 mΩ 16 μΩ/Ω + 60 mΩ 35 μΩ/Ω + 0.6Ω 42 mΩ/Ω + 0.6Ω 91 mΩ/Ω + 6Ω	Comparison to Fluke 5730A Multifunction Calibrator
Resistance – Generate ¹	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω 330 Ω to 1.1 kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ (0.33 to 1.1) MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ 330 MΩ to 1.1 GΩ	30 μΩ/Ω + 0.001 Ω 23 μΩ/Ω + 0.001 Ω 21 μΩ/Ω + 0.001 Ω 21 μΩ/Ω + 0.002 Ω 21 μΩ/Ω + 0.002 Ω 21 μΩ/Ω + 0.02 Ω 21 μΩ/Ω + 0.02 Ω 21 μΩ/Ω + 0.2 Ω 21 μΩ/Ω + 0.2 Ω 24 μΩ/Ω + 2 Ω 24 μΩ/Ω + 2 Ω 46 μΩ/Ω + 23 Ω 99 μΩ/Ω + 38 Ω 190 μΩ/Ω + 1.9 kΩ 380 μΩ/Ω + 2.3 kΩ 0.23 % of setting + 76 kΩ 1.1 % of reading + 380 kΩ	Comparison to Fluke 5520A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure ¹	Up to 12 Ω (10 to 120) Ω 100 Ω to 1.2 kΩ (1 to 12) kΩ (10 to 120) kΩ 100 kΩ to 1.2 MΩ (1 to 12) MΩ (10 to 120) MΩ 100 MΩ to 1.2 GΩ	9.8 μΩ/Ω + 38 μΩ 7.8 μΩ/Ω + 0.3 mΩ 6.5 μΩ/Ω + 0.4 mΩ 6.5 μΩ/Ω + 3.8 mΩ 6.5 μΩ/Ω + 38 mΩ 9.8 μΩ/Ω + 1.5 Ω 33 μΩ/Ω + 100 Ω 327 μΩ/Ω + 1 kΩ 0.33 % of reading + 70 kΩ	Comparison to Agilent 3458A Multimeter
Resistance – Generate ¹ Fixed Points	100 V 100 kΩ (100 to 1 000) V 1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ	1 % of output 1 % of output 1 % of output 1 % of output 1 % of output 1.2 % of output 3.2 % of output	Comparison to TMI RB Resistance Standard
Capacitance – Generate ¹	(220 to 400) pF (0.4 to 3.299 9) nF (3.3 to 10.999 9) nF (11 to 32.999 9) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.099 99) μF (1.1 to 3.299 99) μF (3.3 to 10.999 9) μF (11 to 32.999 9) μF (33 to 109.999) μF (110 to 329.999) μF (0.33 to 1.099 99) mF (1.1 to 3.299 99) mF (3.3 to 10.999 9) mF (11 to 32.999 9) mF (33 to 110) mF	0.38% of output + 7.6 pF 0.38 % of output + 0.01 nF 0.19 % of output + 0.01 nF 0.19 % of output + 0.08 nF 0.19 % of output + 0.08 nF 0.19 % of output + 0.23 nF 0.19 % of output + 0.76 nF 0.19 % of output + 2.3 nF 0.19 % of output + 7.6 nF 0.3 % of output + 23 nF 0.34 % of output + 76 nF 0.34 % of output + 228 nF 0.34 % of output + 0.76 μF 0.34 % of output + 2.3 μF 0.34 % of output + 7.6 μF 0.57 % of output + 23 μF 0.84 % of output + 76 μF	Comparison to Fluke 5522A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure ¹	100 Hz /120 Hz		Comparison to Agilent 4263B LCR Meter
	(16 to 400) pF	2 % of reading + 0.3 pF	
	(0.4 to 1) nF	0.17 % of reading	
	(1 to 100) nF	0.13 % of reading	
	(0.1 to 1) μF	0.12 % of reading	
	(1 to 100) μF	0.18 % of reading	
	(0.1 to 1) mF	0.2 % of reading	
	1 000 Hz		
	(16 to 400) pF	0.43 % of reading + 0.3pF	
	(0.4 to 1) nF	0.1 % of reading	
	(1 to 100) nF	0.08 % of reading	
	(0.1 to 1) μF	0.07 % of reading	
	(1 to 100) μF	0.13 % of reading	
	(0.1 to 1) mF	0.45 % of reading	
	10 kHz		
	(16 to 400) pF	0.56 % of reading + 0.3pF	
	(0.4 to 1) nF	0.15 % of reading	
	(1 to 100) nF	0.12 % of reading	
	(0.1 to 1) μF	0.17 % of reading	
	(1 to 100) μF	0.69 % of reading	
	(0.1 to 1) mF	3.5 % of reading	
	20 kHz		
	(16 to 400) pF	2.1 % of reading + 0.3pF	
	(0.4 to 1) nF	0.62 % of reading	
(1 to 100) nF	0.62 % of reading		
(0.1 to 1) μF	0.43 % of reading		
(1 to 100) μF	1.7 % of reading		
100 kHz			
(16 to 400) pF	1.6 % of reading + 0.3 pF		
(0.4 to 1) nF	1 % of reading		
(1 to 100) nF	0.98 % of reading		
(0.1 to 1) μF	1.4 % of reading		
(1 to 10) μF	4.1 % of reading		



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Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ¹	100 Hz /120 Hz		Comparison to Agilent 4263B LCR Meter
	(4 to 10) μ H	5.2 % of reading + 0.03 μ H	
	(10 to 40) μ H	2.3 % of reading + 0.03 μ H	
	(40 to 100) μ H	0.57 % of reading + 0.03 μ H	
	(0.1 to 0.4) mH	0.4 % of reading	
	(0.4 to 1) mH	0.32 % of reading	
	(1 to 10) mH	0.28 % of reading	
	(10 to 100) mH	0.23 % of reading	
	(0.1 to 1) H	0.18 % of reading	
	(1 to 10) H	0.22 % of reading	
	1 000 Hz		
	(1 to 4) μ H	1 % of reading + 0.03 μ H	
	(4 to 10) μ H	0.46 % of reading + 0.03 μ H	
	(10 to 40) μ H	0.74 % of reading + 0.03 μ H	
	(40 to 100) μ H	0.35 % of reading + 0.03 μ H	
	(0.01 to 0.4) mH	0.3 % of reading	
	(0.4 to 1) mH	0.11 % of reading	
	(1 to 10) mH	0.12 % of reading	
	(10 to 100) mH	0.1 % of reading	
	(0.1 to 1) H	0.1 % of reading	
	(1 to 10) H	0.12 % of reading	
	10 kHz		
	(1 to 4) μ H	0.62 % of reading + 0.03 μ H	
	(4 to 10) μ H	0.4 % of reading + 0.03 μ H	
	(10 to 40) μ H	0.32 % of reading + 0.03 μ H	
	(40 to 100) μ H	0.18 % of reading + 0.03 μ H	
	(0.1 to 0.4) mH	0.2 % of reading	
	(0.4 to 1) mH	0.14 % of reading	
	(1 to 10) mH	0.17 % of reading	
	(10 to 100) mH	0.2 % of reading	
(0.1 to 1) H	0.2 % of reading		
(1 to 10) H	0.44 % of reading		



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Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ¹	20 kHz (1 to 4) μ H (4 to 10) μ H (10 to 40) μ H (40 to 100) μ H (0.1 to 0.4) mH (0.4 to 1) mH (1 to 10) mH (10 to 100) mH (0.1 to 1) H (1 to 10) H	1.3 % of reading + 0.03 μ H 0.68 % of reading + 0.03 μ H 0.63 % of reading + 0.03 μ H 0.53 % of reading + 0.03 μ H 0.49 % of reading 0.48 % of reading 0.65 % of reading 0.66 % of reading 1.2 % of reading 3.3 % of reading	Comparison to Agilent 4263B LCR Meter
	100 kHz (1 to 4) μ H (4 to 10) μ H (10 to 40) μ H (40 to 100) μ H (0.1 to 0.4) mH (0.4 to 1) mH (1 to 10) mH (10 to 100) mH (0.1 to 1) H	2.7 % of reading + 0.03 μ H 0.86 % of reading + 0.03 μ H 1.2 % of reading + 0.03 μ H 0.68 % of reading + 0.03 μ H 0.9 % of reading 1.1 % of reading 1.4 % of reading 1.4 % of reading 6.3 % of reading	
Electrical Calibration of Thermocouple Indicating Devices ¹	Type B (600 to 800) $^{\circ}$ C (800 to 1 550) $^{\circ}$ C (1 550 $^{\circ}$ C to 1 820) $^{\circ}$ C Type C (0 to 1000) $^{\circ}$ C (1 000 to 1 800) $^{\circ}$ C (1 800 to 2 000) $^{\circ}$ C (2 000 to 2 316) $^{\circ}$ C Type E (-250 to -200) $^{\circ}$ C (-200 to -100) $^{\circ}$ C (-100 to 0) $^{\circ}$ C (0 to 600) $^{\circ}$ C (600 to 1 000) $^{\circ}$ C Type J (-210 to -100) $^{\circ}$ C (-100 to 800) $^{\circ}$ C (800 to 1 200) $^{\circ}$ C	0.27 $^{\circ}$ C 0.21 $^{\circ}$ C 0.17 $^{\circ}$ C 0.12 $^{\circ}$ C 0.18 $^{\circ}$ C 0.2 $^{\circ}$ C 0.27 $^{\circ}$ C 0.19 $^{\circ}$ C 0.09 $^{\circ}$ C 0.07 $^{\circ}$ C 0.06 $^{\circ}$ C 0.08 $^{\circ}$ C 0.11 $^{\circ}$ C 0.07 $^{\circ}$ C 0.08 $^{\circ}$ C	Comparison to Fluke 7526A Process Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicating Devices ¹	Type K		Comparison to Fluke 7526A Process Calibrator
	(-250 to -200) °C	0.35 °C	
	(-200 to -100) °C	0.12 °C	
	(-100 to 800) °C	0.08 °C	
	(800 to 1 372) °C	0.1 °C	
	Type L		
	(-200 to -100) °C	0.08 °C	
	(-100 to 900) °C	0.07 °C	
	Type N		
	(-250 to -200) °C	0.56 °C	
	(-200 to -100) °C	0.18 °C	
	(-100 to 0) °C	0.09 °C	
	(0 to 100) °C	0.08 °C	
	(100 to 800) °C	0.08 °C	
	(800 to 1 300) °C	0.09 °C	
	Type R		
	(-50 to -25) °C	0.42 °C	
	(-25 to 0) °C	0.34 °C	
	(0 to 100) °C	0.3 °C	
	(100 to 400) °C	0.21 °C	
	(400 to 600) °C	0.17 °C	
	(600 to 1 000) °C	0.16 °C	
	(1 000 to 1 600) °C	0.14 °C	
	(1 600 to 1 767) °C	0.18 °C	
	Type S		
	(50 to -25) °C	0.39 °C	
	(-25 to 0) °C	0.33 °C	
	(0 to 100) °C	0.29 °C	
(100 to 400) °C	0.22 °C		
(400 to 600) °C	0.18 °C		
(600 to 1 600) °C	0.17 °C		
(1 600 to 1 767) °C	0.2 °C		
Type T			
(-250 to -200) °C	0.27 °C		
(-200 to -100) °C	0.12 °C		
(-100 to 0) °C	0.08 °C		
(0 to 400) °C	0.07 °C		
Type U			
(-200 to 0) °C	0.13 °C		
(0 to 600) °C	0.08 °C		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicating Devices ¹	Pt 100 (385) (-200 to 800) °C	0.04 °C	Comparison to Fluke 7526A Process Calibrator
	Pt 100 (3916) (-200 to 630) °C	0.04 °C	
	Pt 100 (3926) (-200 to 630) °C	0.04 °C	
	Pt 200 (385) (-200 to 400) °C	0.3 °C	
	(400 to 630) °C	0.38 °C	
	Pt 500 (385) (-200 to 630) °C	0.13 °C	
	Pt 1000 (385) (-200 to 630) °C	0.07 °C	
	Cu 10 (427) (100 °C to 260) °C	0.29 °C	
	Ni 120 (672) (-80 to 260) °C	0.02 °C	
Oscilloscopes Calibration ¹ – Generate Voltage DC - 50Ω	(1 to 24.999) mV	0.19 % of Output + 31 μV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
	(25 to 109.99) mV	0.19 % of Output + 36 μV	
	(110mV to 2.1999) V	0.19 % of Output + 87 μV	
	(2.2 to 6.6) V	0.19 % of Output + 0.6 mV	
DC - 1MΩ	(1 to 24.999) mV	0.019 % of reading + 20 μV	
	(25 to 109.99) mV	0.019 % of reading + 25 μV	
	(110mV to 2.1999) V	0.019 % of reading + 76 μV	
	(2.2 to 10.999) V (11 to 130) V	0.019 % of reading + 0.6 mV 0.019 % of reading + 6 mV	
Square Wave 10 Hz to 10 kHz - 50Ω	(1 to 24.999) mVpp	0.19 % of Output + 31 μV	
	(25 to 109.99) mVpp	0.19 % of Output + 36 μV	
	(110mV to 2.1999) Vpp	0.19 % of Output + 87 μV	
	(2.2 to 6.6) Vpp	0.19 % of Output + 0.6 mV	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration – Generate ¹ Square Wave 10 Hz to 1 kHz – 1 MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.038 % of reading + 4 μV 0.038 % of reading + 9 μV 0.038 % of reading + 60 μV 0.038 % of reading + 0.6 mV 0.038 % of reading + 6 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Square Wave 1 to 10 kHz – 1 MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.19 % of reading + 31 μV 0.19 % of reading + 36 μV 0.19 % of reading + 87 μV 0.19 % of reading + 0.6 mV 0.19 % of reading + 6 mV	
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth (5 to 50) mVpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 1 600) MHz (1 600 to 2 100) MHz 50 mV to 3.5 Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 1 600) MHz (1 600 to 2 100) MHz (3.5 to 5) Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz	0.34 dB 0.36 dB 0.42 dB 0.46 dB 0.5 dB 0.56 dB 0.24 dB 0.24 dB 0.32 dB 0.34 dB 0.4 dB 0.44 dB 0.24 dB 0.24 dB 0.32 dB 0.34 dB	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness	3 dB Bandwidth 50 mV to 3.5Vpp (1 100 to 4 000) MHz (4 000 to 8 000) MHz (8 000 to 18 000) MHz	0.3 dB 0.38 dB 0.48 dB	
Oscilloscopes Calibration – Generate ¹ Time Marker	500 ps to 20 ms 50 ms to 5 s	0.25 μs/s 1.9 μs/s + 3.8 μHz	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration ¹ – Generate Voltage DC - 50Ω DC - 1MΩ Square Wave 10Hz to 10kHz – 1MΩ	1mV to 5V 1mV to 200V 1mV to 200Vpp	0.025 % of output + 25 μV 0.025 % of output + 25 μV 0.1 % of output + 10uV	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration ¹ – Generate Time Marker	9 ns to 55 s	0.25 μs/s	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration ¹ – Measure Input Impedance Resistance	(10 to 40) Ω (40 to 90) Ω (90 to 150) Ω (50 to 800) KΩ (0.8 to 1.2) MΩ (1.2 to 12) MΩ	0.5 % of reading 0.1 % of reading 0.5 % of reading 0.5 % of reading 0.1 % of reading 0.5 % of reading	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration ¹ – Generate Leveled Sine Flatness 50 kHz to 10 MHz Reference	5mV to 5Vpp (0.1 Hz to 300) MHz (300 to 550) MHz 5 mV to 3Vpp (550 to 1 100) MHz	0.18 dB 0.22 dB 0.3 dB	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration – Measure ¹ Input Impedance Resistance Leakage	(40 to 60) Ω 500 kΩ to 1.5MΩ (0 to 5.99) V	0.08 % of reading 0.08 % of reading 0.038 % of reading + 0.8 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
AC Power – Generate ¹ (33 to 329.999) mV Power Factor = 1	(3.3 to 32.9999) mA (20 to 45) Hz (45 to 1 000) Hz (33 to 329.999) mA (20 to 45) Hz (45 to 1 000) Hz (0.33 to 1.099 99) A (10 to 45) Hz (45 to 1 000) Hz	0.072 % of Output + 0.5 μW 0.032 % of Output + 0.5 μW 0.072 % of Output + 5.4 μW 0.032 % of Output + 5.4 μW 0.139 % of Output + 26 μW 0.04 % of Output + 26 μW	Comparison to Fluke 5522A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (33 to 329.999) mV Power Factor = 1	(1.1 to 2.999 99) A (10 to 45) Hz (45 to 1 000) Hz (3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.14 % of Output + 31 μW 0.047 % of Output + 31 μW 0.047 % of Output + 0.5mW 0.077 % of Output + 0.5mW 0.092 % of Output + 1.3mW 0.12 % of Output + 1.3mW	Comparison to Fluke 5522A Multiproduct Calibrator
AC Power – Generate ¹ (0.33 to 3.299 99) V Power Factor = 1	(3.3 to 32.9999) mA (20 to 45) Hz (45 to 1 000) Hz (33 to 329.999) mA (20 to 45) Hz (45 to 1 000) Hz (0.33 to 1.099 99) A (10 to 45) Hz (45 to 1 000) Hz (1.1 to 2.999 99) A (10 to 45) Hz (45 to 1 000) Hz (3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.072 % of Output + 5.2μW 0.033 % of Output + 5.2μW 0.072 % of Output + 52 μW 0.033 % of Output + 52 μW 0.14 % of Output + 26μW 0.04 % of Output + 26μW 0.14 % of Output + 0.28 mW 0.047 % of Output + 0.29 mW 0.047 % of Output + 5.1mW 0.077 % of Output + 5.1mW 0.092 % of Output + 13mW 0.12 % of Output + 13mW	Comparison to Fluke 5522A Multiproduct Calibrator
AC Power – Generate ¹ (3.3 to 32.999 9) V Power Factor = 1	(3.3 to 32.9999) mA (20 to 45) Hz (45 to 1 000) Hz (33 to 329.999) mA (20 to 45) Hz (45 to 1 000) Hz (0.33 to 1.099 99) A (10 to 45) Hz (45 to 1 000) Hz (1.1 to 2.999 99) A (10 to 45) Hz (45 to 1 000) Hz	0.072 % of Output + 53μW 0.033 % of Output + 53μW 0.072 % of Output + 0.5 mW 0.033 % of Output + 0.5 mW 0.14 % of Output + 2.6 mW 0.04 % of Output + 2.6 mW 0.14 % of Output + 2.9 mW 0.047 % of Output + 2.9 mW	Comparison to Fluke 5522A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (3.3 to 32.999 9) V Power Factor = 1	(3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.047 % of Output + 51mW 0.077 % of Output + 51mW 0.092 % of Output + 0.13 W 0.12 % of Output + 0.13 W	Comparison to Fluke 5522A Multiproduct Calibrator
AC Power – Generate ¹ (33 to 329.999) V Power Factor = 1	(3.3 to 32.999 9) mA (45 to 1 000) Hz (33 to 329.999) mA (45 to 1 000) Hz (0.33 to 1.099 99) A (45 to 1 000) Hz (1.1 to 2.999 99) A (45 to 1 000) Hz (3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.034 % of Output + 0.5 mW 0.034 % of Output + 5.1 mW 0.041 % of Output + 25 mW 0.048 % of Output + 26 mW 0.048 % of Output + 0.5 W 0.077 % of Output + 0.5 W 0.092 % of Output + 1.3 W 0.12 % of Output + 1.3W	Comparison to Fluke 5522A Multiproduct Calibrator
AC Power – Generate ¹ (330 to 1 020) V Power Factor = 1	(3.3 to 32.999 9) mA (45 to 1 000) Hz (33 to 329.999) mA (45 to 1 000) Hz (0.33 to 1.099 99) A (45 to 1 000) Hz (1.1 to 2.999 99) A (45 to 1 000) Hz (3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.036 % of Output + 1.6 mW 0.036 % of Output + 16 mW 0.043 % of Output + 78 mW 0.049 % of Output + 81 mW 0.051 % of Output + 1.6 W 0.078 % of Output + 1.6 W 0.094 % of Output + 3.9 W 0.12 % of Output + 3.9W	Comparison to Fluke 5522A Multiproduct Calibrator
Phase Angle - Generate ¹	(-180 to 180) ° (10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.08° 0.19° 0.38° 1.9° 3.8° 7.6°	Comparison to Fluke 5522A Multiproduct Calibrator

Electrical – DC/Low Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Power Meters ¹	3 μ W to 100 mW	0.25 % of reading	Comparison to HP 11683A Range Calibrator

Electrical – RF/Microwave

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Flatness – Measure ¹	9 kHz to 2 000 MHz		Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.1 dB	
	(-30 to -40) dBm	0.11 dB	
	(-40 to -42) dBm	0.12 dB	
	(2 000 to 14 000) MHz		
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.09 dB	
	(-30 to -40) dBm	0.1 dB	
	(-40 to -42) dBm	0.11 dB	
	(14 000 to 18 000) MHz		
	(20 to -10) dBm	0.11 dB	
(-10 to -30) dBm	0.12 dB		
(-30 to -40) dBm	0.12 dB		
(-40 to -42) dBm	0.13 dB		
RF Attenuation – Measure ¹	(30 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
(100 to 110) dB	0.13 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(3 050 to 6 600) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.19 dB	
	(6 600 to 13 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.25 dB	
	(13 200 to 19 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.12 dB		
(80 to 90) dB	0.12 dB		
(90 to 100) dB	0.13 dB		
(100 to 110) dB	0.31 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(19 200 to 26 500) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.14 dB	
	(90 to 100) dB	0.36 dB	
	(100 to 110) dB	0.82 dB	
	(26 500 to 31 150) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.13 dB	
	(90 to 100) dB	0.33 dB	
	(100 to 110) dB	0.77 dB	
	(31 150 to 41 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.14 dB		
(80 to 90) dB	0.36 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(41 000 to 45 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.11 dB	
	(70 to 80) dB	0.24 dB	
	(80 to 90) dB	0.6 dB	
	(45 000 to 50 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
(50 to 60) dB	0.11 dB		
(60 to 70) dB	0.29 dB		
(70 to 80) dB	0.7 dB		
(80 to 90) dB	1.4 dB		
RF Power – Measure ¹	9 kHz to 14 000 MHz		Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(20 to 0) dB	0.13 dB	
	(0 to -40) dB	0.15 dB	
	(-40 to -50) dB	0.35 dB	
	(-50 to -55) dB	0.93 dB	
	(14 000 to 18 000) MHz		
	(20 to 0) dB	0.12 dB	
	(0 to -40) dB	0.16 dB	
	(-40 to -50) dB	0.35 dB	
	(-50 to -55) dB	0.93 dB	
RF Power – Measure ¹	(50 to 100) MHz		Comparison to Agilent EPM Series Power Meter N8487A Power Sensor
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.07 dB	
	(0 to -10) dB	0.07 dB	
	(-10 to -20) dB	0.07 dB	
	(-20 to -25) dB	0.11 dB	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(100 to 6 000) MHz		Comparison to Agilent EPM Series Power Meter N8487A Power Sensor
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.07 dB	
	(0 to -10) dB	0.07 dB	
	(-10 to -20) dB	0.08 dB	
	(-20 to -25) dB	0.11 dB	
	(6 000 to 12 400) MHz		
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.08 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.08 dB	
	(-20 to -25) dB	0.12 dB	
	(12 400 to 18 000) MHz		
	(20 to 10) dB	0.09 dB	
	(10 to 0) dB	0.09 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.09 dB	
	(-20 to -25) dB	0.12 dB	
	(18 000 to 26 500) MHz		
	(20 to 10) dB	0.11 dB	
	(10 to 0) dB	0.11 dB	
	(0 to -10) dB	0.1 dB	
	(-10 to -20) dB	0.11 dB	
	(-20 to -25) dB	0.14 dB	
	(26 500 to 33 000) MHz		
	(20 to 10) dB	0.12 dB	
	(10 to 0) dB	0.12 dB	
	(0 to -10) dB	0.12 dB	
(-10 to -20) dB	0.12 dB		
(-20 to -25) dB	0.15 dB		
(33 000 to 40 000) MHz			
(20 to 10) dB	0.13 dB		
(10 to 0) dB	0.13 dB		
(0 to -10) dB	0.12 dB		
(-10 to -20) dB	0.13 dB		
(-20 to -25) dB	0.15 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(40 000 to 50 000) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	0.19 dB 0.18 dB 0.18 dB 0.19 dB 0.2 dB	Comparison to Agilent EPM Series Power Meter N8487A Power Sensor
RF Power – Measure ¹	(30 to 2 000) MHz (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB (2 000 to 3 050) MHz (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB (3 050 to 6 600) MHz (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (6 600 to 13 200) MHz (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB	0.36 dB 0.2 dB 0.22 dB 0.23 dB 0.25 dB 0.27 dB 0.33 dB 0.46 dB 0.37 dB 0.21 dB 0.23 dB 0.24 dB 0.26 dB 0.28 dB 0.34 dB 0.7 dB 0.37 dB 0.21 dB 0.23 dB 0.24 dB 0.29 dB 0.38 dB 0.53 dB 0.37 dB 0.21 dB 0.23 dB 0.24 dB 0.34 dB 0.46 dB 0.65 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor



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Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(13 200 to 18 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -90) dB	0.26 dB	
	(-90 to -95) dB	0.26 dB	
	(-95 to -100) dB	0.26 dB	
	(-100 to -105) dB	0.29 dB	
	(-105 to -110) dB	0.38 dB	
	(-110 to -115) dB	0.53 dB	
	(-115 to -120) dB	0.75 dB	
	(18 000 to 19 200) MHz		
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.27 dB	
	(-90 to -95) dB	0.27 dB	
	(-95 to -100) dB	0.27 dB	
	(-100 to -105) dB	0.3 dB	
	(-105 to -110) dB	0.38 dB	
	(-110 to -115) dB	0.53 dB	
	(-115 to -120) dB	0.75 dB	
	(19 200 to 26 500) MHz		
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.28 dB	
(-90 to -95) dB	0.33 dB		
(-95 to -100) dB	0.43 dB		
(-100 to -105) dB	0.61 dB		
(-105 to -110) dB	0.85 dB		
(-110 to -115) dB	1.2 dB		
(-115 to -120) dB	1.5 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(26 500 to 31 150) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.34 dB	
	(-78 to -90) dB	0.36 dB	
	(-90 to -95) dB	0.39 dB	
	(-95 to -100) dB	0.46 dB	
	(-100 to -105) dB	0.61 dB	
	(-105 to -110) dB	0.82 dB	
	(-110 to -115) dB	1.1 dB	
	(31 150 to 41 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.35 dB	
	(-78 to -90) dB	0.48 dB	
	(-90 to -95) dB	0.64 dB	
	(-95 to -100) dB	0.87 dB	
	(-100 to -105) dB	1.2 dB	
	(-105 to -110) dB	1.5 dB	
	(41 000 to 45 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
(0 to -58) dB	0.34 dB		
(-58 to -78) dB	0.38 dB		
(-78 to -90) dB	0.68 dB		
(-90 to -95) dB	0.93 dB		
(-95 to -100) dB	1.2 dB		
(-100 to -105) dB	1.6 dB		
(45 000 to 50 000) MHz			
(30 to 20) dB	0.42 dB		
(20 to 0) dB	0.3 dB		
(0 to -58) dB	0.34 dB		
(-58 to -78) dB	0.67 dB		
(-78 to -90) dB	1.4 dB		
RF Power – Measure ¹ 50 MHz	1 mW	0.003 2 mW	Comparison to HP 432A Power Meter & 8478B Power Sensor

Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Generate ¹	(30 to 2 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, E8257D Signal Generator
	(20 to 0) dB	0.29 dB	
	(0 to -58) dB	0.3 dB	
	(-58 to -78) dB	0.31 dB	
	(-78 to -110) dB	0.32 dB	
	(2 000 to 3 050) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.39 dB	
	(3 050 to 6 600) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.39 dB	
	(6 600 to 13 200) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.42 dB	
	(13 200 to 18 000) MHz		
	(15 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.46 dB	
	(18 000 to 19 200) MHz		
	(15 to 0) dB	0.41 dB	
	(0 to -58) dB	0.41 dB	
(-58 to -78) dB	0.42 dB		
(-78 to -110) dB	0.5 dB		
(19 200 to 26 500) MHz			
(15 to 0) dB	0.41 dB		
(0 to -58) dB	0.41 dB		
(-58 to -78) dB	0.42 dB		
(-78 to -110) dB	0.9 dB		
(26 500 to 31 150) MHz			
(15 to 0) dB	0.62 dB		
(0 to -58) dB	0.63 dB		
(-58 to -78) dB	0.64 dB		
(-78 to -110) dB	0.96 dB		



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Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Generate ¹	(31 150 to 41 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, E8257D Signal Generator
	(10 to 0) dB	0.82 dB	
	(0 to -58) dB	0.83 dB	
	(-58 to -78) dB	0.84 dB	
	(-78 to -100) dB	1.1 dB	
	(41 000 to 45 000) MHz		
	(10 to 0) dB	0.82 dB	
	(0 to -58) dB	0.83 dB	
	(-58 to -78) dB	0.85 dB	
	(-78 to -100) dB	1.4 dB	
	(45 000 to 50 000) MHz		
	(0 to 10) dB	0.82 dB	
(-58 to 0) dB	0.83 dB		
(-78 to -58) dB	1 dB		
(-90 to -78) dB	1.5 dB		
Amplitude Modulation – Measure ¹	100 kHz to 10 MHz		Comparison to Agilent N5531S Measuring Receiver
	Rate 50 Hz to 10 kHz		
	(5 to 99) % Depth	0.75 % of reading + 0.3 digits	
	10 MHz to 3 GHz		
	Rate 50 Hz to 100 kHz		
	(5 to 20) % Depth	2.5 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.5 % of reading + 0.4 digits	
	(3 to 26.5) GHz		
	Rate 50 Hz to 100 kHz		
	(5 to 20) % Depth	4.5 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.5 % of reading + 0.4 digits	
	(26.5 to 31.15) GHz		
Rate 50 Hz to 100 kHz			
(5 to 20) % Depth	6.8 % of reading + 0.4 digits		
(20 to 99) % Depth	1.9 % of reading + 0.4 digits		
(31.15 to 50) GHz			
Rate 50 Hz to 100 kHz			
(5 to 20) % Depth	26 % of reading + 0.4 digits		
(20 to 99) % Depth	6 % of reading + 0.4 digits		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency Modulation – Measure ¹ β = deviation / rate	250 kHz to 10 MHz Rates 20 Hz to 10 kHz Peak Dev 200 to 40 kHz 10 MHz to 6.6 GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (6.6 to 13.2) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (13.2 to 31.15) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (31.15 to 50.0) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz	$\beta > 0.2 - 1.5\%$ of reading + 2 Hz $\beta > 1.2 - 1\%$ of reading + 2 Hz $\beta > 0.20 - 1.5\%$ of reading + 2 Hz $\beta > 0.45 - 1\%$ of reading + 2 Hz $\beta > 0.2 - 2.5\%$ of reading + 4 Hz $\beta > 8.0 - 1\%$ of reading + 4 Hz $\beta > 0.2 - 3.8\%$ of reading + 9 Hz $\beta > 16 - 1\%$ of reading + 9 Hz $\beta > 0.2 - 8.5\%$ of reading + 17 Hz $\beta > 32 - 1\%$ of reading + 17 Hz	Comparison to Agilent N5531S Measuring Receiver
Phase Modulation ¹ – Measure	100 kHz to 6.6 GHz Deviations > 0.3 rad Deviations > 0.7 rad (6.6 to 13.2) GHz Deviations > 0.6 rad Deviations > 2.0 rad (13.2 to 26.5) GHz Deviations: > 1.2 rad Deviations > 4.0 rad (26.5 to 31.15) GHz Deviations: > 1.3 rad Deviations > 4.0 rad (31.15 to 50) GHz Deviations: > 2.4 rad Deviations > 8.0 rad	3 % of reading + 0.002 rad 1 % of reading + 0.002 rad 3 % of reading + 0.005 rad 1 % of reading + 0.005 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad 3 % of reading + 0.018 rad 1 % of reading + 0.018 rad	Comparison to Agilent N5531S Measuring Receiver
AM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(0.1 to 10) MHz AM Depth > 1 % (0 to -20) dB (-20 to -30) dB AM Depth > 3 % (0 to -20) dB (-20 to -30) dB (-30 to -40) dB	1.2 dB 2.2 dB 1 dB 1.3 dB 2.4 dB	Comparison to Agilent N5531S Measuring Receiver



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AM Distortion Measure ¹ Rate 20 Hz to 1 kHz	10 MHz to 26.5 GHz AM Depth > 1 % (0 to -20) dB (-20 to -30) dB AM Depth > 3 % (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (26.5 MHz to 50.0 GHz) AM Depth > 3 % (0 to -20) dB AM Depth > 5% (0 to -20) dB (-20 to -30) dB	1.3 dB 2.5 dB 1.1 dB 1.4 dB 3 dB 1.8 dB 1.5 dB 3.5 dB	Comparison to Agilent N5531S Measuring Receiver
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(1 to 6 600) MHz Dev 500 Hz to 2 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 2 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB	Comparison to Agilent N5531S Measuring Receiver
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(6.6 to 13.2) GHz Dev > 2.3 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 4.5 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB	Comparison to Agilent N5531S Measuring Receiver



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(13.2 to 31.15) GHz		Comparison to Agilent N5531S Measuring Receiver
	Dev > 2.7 kHz		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 6.0 kHz		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.4 dB	
	(31.15 to 50.0) GHz		
	Dev > 4 kHz		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 12.0 kHz		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	(1 to 6 600) MHz		
	Rate (20 to 500) Hz		
	Dev > 0.8 rad		
	(0 to -20) dB	0.26 dB	
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 2.5 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		
Rate (500 to 1 000) Hz			
Dev > 0.4 rad			
(0 to -20) dB	0.26 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 1.0 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		

Electrical – RF/Microwave

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(6.6 to 13.2) GHz		Comparison to Agilent N5531S Measuring Receiver
	Rate (20 to 500) Hz		
	Dev > 1.8 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 5.5 rad	0.09 dB	
	(0 to -20) dB	0.27 dB	
	(-20 to -30) dB	0.83 dB	
	(-30 to -40) dB	2.3 dB	
	(-40 to -50) dB		
	(6.6 to 13.2) GHz		
	Rate (500 to 1 000) Hz		
	Dev > 0.8 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 2.5 rad	0.09 dB	
	(0 to -20) dB	0.27 dB	
	(-20 to -30) dB	0.83 dB	
	(-30 to -40) dB	2.3 dB	
(-40 to -50) dB			
(13.2 to 31.15) GHz			
Rate (20 to 500) Hz			
Dev > 3.5 rad	0.26 dB		
(0 to -20) dB	0.79 dB		
(-20 to -30) dB	2.3 dB		
(-30 to -40) dB			
Dev > 10.0 rad	0.09 dB		
(0 to -20) dB	0.27 dB		
(-20 to -30) dB	0.83 dB		
(-30 to -40) dB	2.3 dB		
(-40 to -50) dB			



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Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(13.2 to 31.15) GHz		
	Rate (500 to 1 000) Hz		
	Dev > 1.2 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 4.0 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	(31.15 to 50.0) GHz		
	Rate 20 to 500 Hz		
	Dev > 7.5 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 19.0 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		
Rate (500 to 1 000) Hz			
Dev > 3.0 rad			
(0 to -20) dB	0.26 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 8.0 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		

Comparison to Agilent N5531S Measuring Receiver

Electrical – RF/Microwave

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Total Harmonic Distortion (THD)	(0 to 60) dB		Comparison to HP 8903B Audio Analyzer
	20 Hz to 20 kHz	1 dB	
	(-40 to 0) dB	1 dB	
	(-50 to -40) dB	1.3 dB	
	(-60 to -50) dB	1.7 dB	
	(-65 to -60) dB		
	(20 to 50) kHz	2 dB	
	(-40 to 0) dB	2.1 dB	
	(-50 to -40) dB	3 dB	
	(-60 to -50) dB		
Harmonics Measure ¹	(50 to 100) kHz	2 dB	Comparison to Agilent E4448A Measuring Receiver
	(-40 to 0) dB	2.4 dB	
	(-50 to -40) dB		
	(-80 to -10) dB		
	2 nd through 5 th Harmonic		
	1 kHz to 600 MHz	0.37 dB	
	(600 to 1 320) MHz	1.1 dB	
	(1 320 to 2 200) MHz	1.4 dB	
	(2 200 to 3 000) MHz	1.4 dB	
	(3 000 to 4 400) MHz	1.7 dB	
	(4 400 to 5 300) MHz	1.9 dB	
	(5 300 to 10 000) MHz	2.1 dB	
	2 nd through 4 th Harmonic		
(10 000 to 12 500) MHz	2.1 dB		
2 nd through 3 rd Harmonic			
(12 500 to 16 667) MHz	2.1 dB		
2 nd Harmonic			
(16 667 to 25 000) MHz	2.3 dB		

Length – Dimensional Metrology

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers ^{1,2}	Up to 80 in	(280 + 3.4L) μin	Comparison to Gage blocks (Grade 2)
Micrometers ^{1,2}	Up to 46 in	(9.3 + 7L) μin	
Height Gages ^{1,2}	Up to 46 in	(78 + 5.3L) μin	

Length – Dimensional Metrology

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dial Indicators ^{1,2} Resolution ≥ 50µin Resolution < 50µin	Up to 10 in Up to 0.1 in	(26 + 3.7L) µin 9.6 µin	Comparison to Gage blocks (Grade 2)
Rulers ¹	Up to 46 in	0.009 1 in	
Bore Micrometers ² 2 point 3 point	Up to 12 in Up to 12 in	(56 + 3.2L) µin (64 + 3.1L) µin	Comparison to Master gage blocks, P&W universal measuring machine, Master Ring
Spheres	Up to 2 in	30 µin	Comparison to P&W Model C Measuring Machine
Metal Tapes and Rules ^{1,2}	Up to 100 ft	(0.000 27F + 0.024) in	Comparison to Standard rule
Feeler Gages ¹	Up to 1 in	36 µin	Comparison to P&W Model C Measuring Machine
Cylindrical gages ^{1,2} – Plain Pins, Plugs Rings	Up to 10 in Up to 14 in	(10 + 2.9D) µin (9.8 + 3D) µin	Comparison to P&W LabMaster gage blocks (grade 1)
Surface Plates ¹ – Overall Flatness Local Area Flatness	(18 × 18) in to (6 × 6) ft (-0.001 to 0.001) in	77 µin 68 µin	Comparison to Rahn Planekator Repeat-o-meter
Gage Blocks ²	Up to 12 in	(4.1 + 2.3L) µin	Comparison to Universal measuring machine, master gage block set
Micrometer Standards Length Rods	Up to 46 in	(1 + 7.8L) µin	Comparison to Gage blocks (grade 2), P&W universal measuring Machine, MAHR Supramess Dial Comparator
Thread Plugs – Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	40 µin 92 µin	Comparison to Gage blocks, P&W universal measuring machine, Van Keuren thread wire set

Length – Dimensional Metrology

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Wires	Up to 0.5 in	11 μ m	Comparison to Master gage blocks, P&W universal measuring machine
Optical Comparators ¹ – Angle Linearity	Up to 360 ° Up to 20 in (20 to 40) in	0.008 7 ° 320 μ m 630 μ m	Comparison to Precision balls, Angle Blocks, Gage Blocks, SI Industries glass scales
Magnification	10x to 100x	420 μ m	
Protractors ¹	(0 to 360)°	0.008°	Comparison to Angle blocks
Coating Thickness Gages ¹ Eddy Current & Magnetic Induction, Fixed Point	(0.48 to 38.9) mils	69 μ m	Comparison to Calibration foils, P&W Supermicrometer
Coating Thickness Shims ¹	(0 to 243) mils	57 μ m	Comparison to P&W Supermicrometer
Crimp Tools ¹	(0.011 to 1) in (0.011 to 0.5) in	150 μ m 240 μ m	Comparison to Micrometer, Pin Gages

Mass and Mass Related

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales & Balances ^{1,2,4}	1 mg to 600 g	(0.014 + 0.001 5X) mg	Comparison to Class 0 weights
	10 mg to 40 kg (0.022 to 2 000) lb	(7.7 + 0.12X) mg (0.000 08 + 0.000 12W) lb	Comparison to Class F weights
Pressure ¹	(0 to 30) psia (0 to 61) inHg	0.018 psi 0.037 inHg	Comparison to Fluke 700GA5 Pressure Gage
Comparison to	(0 to 30) psi	0.009 psi	Comparison to Additel 681-GP30 Pressure Gage
Comparison to	(-15 to 100) psi	0.027 psi	Comparison to Additel 681- CP100 Pressure Gage
Comparison to	(0 to 300) psi	0.08 psi	Comparison to Additel 681- GP300 Pressure Gage

Mass and Mass Related

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Comparison to	(0 to 1 000) psi	0.24 psi	Comparison to Additel 681- GP1K Pressure Gage
Comparison to	(0 to 3 000) psi	0.7 psi	Comparison to Additel 681- GP3K Pressure Gage
Comparison to	(0 to 10 000) psi	2.5 psi	Comparison to Additel 681- GP10K Pressure Gage
Pressure ¹	(-150 to 150) inH ₂ O	0.094 inH ₂ O	Comparison to Additel 681-DP150 Pressure Gage
Pressure ¹	(-20 to 20) inH ₂ O	0.001 3 inH ₂ O	Comparison to Additel 681-DP20 Pressure Gage
Torque Tools ¹	(10 to 100) ozf·in (5 to 1 000) lbf·in (25 to 250) lbf·ft (250 to 2 000) lbf·ft	0.59 % of reading 0.35 % of reading 0.35 % of reading 0.6 % of reading	Comparison to CDI torque system
Torque Analyzers	(5 to 80) ozf·in (5 to 600) lbf·in (50 to 2 000) lbf·ft	0.16 % of reading 0.15 % of reading 0.14 % of reading	Comparison to Weights and Wheel
Force ¹ Tension	(10 to 200) mgf (0.2 to 1) gf (1 to 10) gf (10 to 500) gf (1 to 540) lbf	0.45 mgf 1.2 mgf 0.037 % of reading 0.024 % of reading 0.017 % of reading	Comparison to Class F weights
Force ¹ Tension	(1 000 to 50 000) lbf	0.021 % of reading	Comparison to Morehouse Load Cells
Force ¹ Compression	(200 to 10 000) lbf (500 to 25 000) lbf (1 000 to 50 000) lbf	0.014 % of reading 0.018 % of reading 0.034 % of reading	Comparison to Morehouse Load Cells
Rockwell Hardness Testers ¹	(< 60) HRBW (≥ 60 to < 80) HRBW (≥ 35 to < 60) HRC (≥ 60) HRC < 70 HA > 80 HA	3.1 HRBW 3 HRBW 1.2 HRC 0.7 HRC 1.4 HRA 0.7 HRA	Indirect verification per ASTM E18

Mass and Mass Related

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Durometers Scale (Force) Accuracy Types A, B, C, D, DO, E, O	(0 to 100) duros	0.06 duros	Direct Verification Master balance
Indenter Geometry Length Diameter Angle	0.1 in 0.05 in (30 to 35)°	140 μin 140 μin 0.13°	Optical comparator
Roughness Testers ¹	117 μin Ra 370 μin Rmax	1.3 μin	Comparison to Roughness Specimen
Mass - Class F	(0.5 to 10) lb (10 to 50) lb	0.03 g, (0.000 066) lb 0.27 g, (0.000 6) lb	Comparison to Master balance

Thermodynamic

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measuring Equipment ¹	(50 to 600) °C	0.17 °C	Comparison to Secondary PRT w/ Additel Reference Thermometer Readout and dry block
Temperature – Measure ¹	(-200 to 200) °C (200 to 400) °C (400 to 660) °C	0.018 °C 0.03 °C 0.043 °C	Comparison to Secondary PRT w/ Additel Reference Thermometer Readout
Temperature Uniformity ¹ Surveys	Type K (100 to 1 000) °F (1 000 to 2 000) °F (2 000 to 2 200) °F Type T (32 to 400) °F	2 °F 2.1 °F 2.7 °F 1.6 °F	Comparison to Datalogger and Thermocouples
Relative Humidity – Measure ¹	(0 to 90) % RH	1.2 %RH	Comparison to Vaisala HM141/HMP46 Humidity Indicator and Probe
Infrared (IR) Thermometry ¹	(20 to 100) °C (100 to 300) °C (300 to 420) °C (420 to 500) °C	1.5 °C 4.3 °C 6 °C 7.7 °C	Comparison to Fluke 9132 Infrared Calibrator ε= 0.95, λ = (8 to 14) μm



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Time and Frequency

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Generate ¹	10 MHz	1×10^{-9} Hz/Hz	Comparison to HP Z3801A GPS Receiver
Frequency – Generate ¹	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 10) MHz	1×10^{-9} Hz/Hz + 0.57 μ Hz 1×10^{-9} Hz/Hz + 5.7 μ Hz 1×10^{-9} Hz/Hz + 57 μ Hz 1×10^{-9} Hz/Hz + 0.57 mHz 1×10^{-9} Hz/Hz + 5.7 mHz 1×10^{-9} Hz/Hz + 57 mHz 1×10^{-9} Hz/Hz + 0.57 Hz	Comparison to Agilent 33250A Function Generator / HP Z3801A GPS Receiver
	(10 to 5 000) MHz	1×10^{-9} Hz/Hz + 0.57 mHz	Comparison to Agilent E8257D Opt 550 Signal Generator / HP Z3801A GPS Receiver
Frequency – Measure ¹	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (100 to 200) kHz (0.2 to 3 000) MHz	5.2×10^{-9} Hz/Hz 2.5×10^{-9} Hz/Hz 1.6×10^{-9} Hz/Hz 1.3×10^{-9} Hz/Hz 1.2×10^{-9} Hz/Hz 1.2×10^{-9} Hz/Hz 1.2×10^{-9} Hz/Hz	Comparison to Agilent 53131A Frequency Counter / HP Z3801A GPS Receiver
	(500 to 46 000) MHz	1×10^{-9} Hz/Hz + 1.0 Hz	Comparison to Agilent 5352B Frequency Counter / HP Z3801A GPS Receiver
	(10 to 50 000) MHz	1×10^{-9} Hz/Hz + 0.1 Hz	Comparison to Agilent E4448A Spectrum Analyzer / HP Z3801A GPS Receiver
Type I (digital) Timers	(0 to 19.99) s/day (0 to 599) s/month	0.031 s/day 1.1 s/month	Comparison to Helmut Klein Timometer 4500
Type II (mechanical) Timers	(0 to 320) s/day	0.6 s/day	Comparison to Helmut Klein Timometer 4500
Tachometers – RPM ^{1,2}	Up to 100 000 RPM	0.001 % of reading + 0.6R	Comparison to HP 33250A Signal Generator & LED

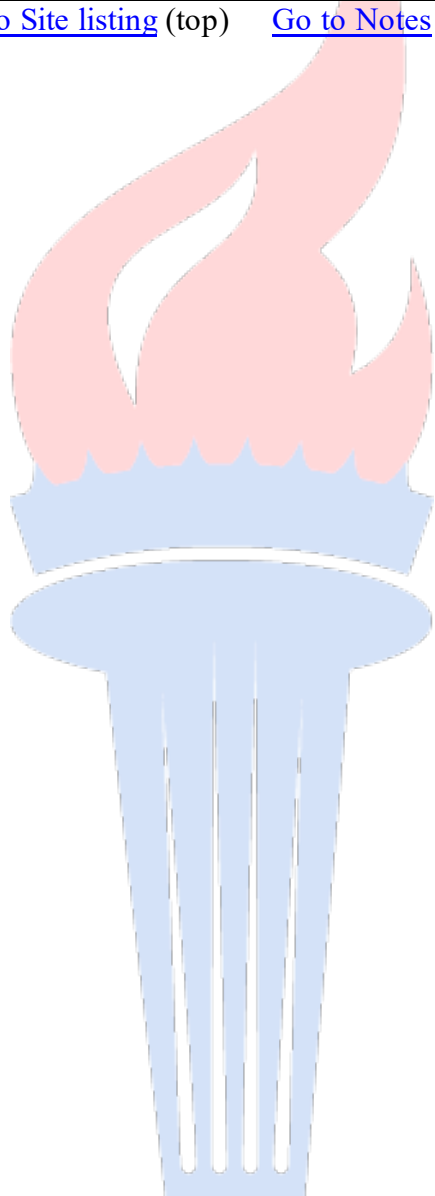
DIMENSIONAL MEASUREMENT

1 Dimensional

Madison, AL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Length	X Axis (0.01 to 5.0) in Y Axis (0.01 to 3.0) in	340 μ m	Comparison to Optical comparator

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Services performed at satellite laboratory

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CALIBRATION AND DIMENSIONAL MEASUREMENT

CALIBRATION

Acoustics and Vibration

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometers – Acceleration ¹	(0.01 to 10) g (7 < 10) Hz (10 < 100) Hz (100 to 920) Hz (>920 to 5000) Hz (>5 to 10) kHz	1.7 % of reading 1.2 % of reading 1 % of reading 1.4 % of reading 1.9 % of reading	Comparison to Accelerometer Calibrator
Sound Pressure Level – Generate / Measure	Up to 150 dB (19 to 16 000) Hz (16 000 to 20 000) Hz	0.25 dB 0.32 dB	Comparison to TMS 9350C Acoustic Calibrator

Chemical Quantities

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters ^{1,5}	4 pH 7 pH 10 pH	0.035 pH 0.025 pH 0.069 pH	Comparison to Buffer Solutions
Conductivity Meters ^{1,5}	2 µS/cm 10 µS/cm 100 µS/cm 1 000 µS/cm 1 413 µS/cm 10 000 µS/cm	0.19 µS/cm 0.17 µS/cm 0.74 µS/cm 3.6 µS/cm 5.7 µS/cm 36 µS/cm	Comparison to Conductivity Solutions

Electrical – DC/Low Frequency

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Generate ¹	(1 to 1.2) nA (1.2 to 12) nA (12 to 120) nA (0.12 to 1.2) μ A (1.2 to 10) μ A	92 μ A/A + 0.007 nA 92 μ A/A + 0.007 nA 92 μ A/A + 0.01 nA 36 μ A/A + 0.1 nA 13 μ A/A + 1 nA	Comparison to Fluke 5730A, Multifunction Calibrator, Fluke 5560A Multiproduct Calibrator
DC Current – Generate ¹	(10 to 220) μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA (0.22 to 1) A (1 to 2.2) A	38 μ A/A + 5 nA 30 μ A/A + 7 nA 30 μ A/A + 44 nA 38 μ A/A + 0.7 μ A 45 μ A/A + 0.7 μ A 68 μ A/A + 12 μ A 105 μ A/A + 12 μ A	Comparison to Fluke 5730A/03 Multifunction Calibrator
DC Current – Generate ¹	(2.2 to 3.1) A (3.1 to 12) A	228 μ A/A + 115 μ A 228 μ A/A + 191 μ A	Comparison to Fluke 5560A Multiproduct Calibrator
DC Current – Generate ¹	(12 to 20) A (20 to 100) A	76 μ A/A + 0.76 mA 76 μ A/A + 4.6 mA	Comparison to Fluke 5560A Multiproduct Calibrator, 52120A Transconductance Amplifier
DC Current Clamp Meters ¹ Toroidal-Wound	(0.6 to 600) A (600 to 1 000) A	0.19 % of output + 0.04A 0.2 % of output + 0.04A	Comparison to Fluke 5560A Multiproduct Calibrator/Coil 5500A x50
DC Current Clamp Meters ¹ Other	(0.6 to 600) A (600 to 1 000) A	0.38 % of output + 0.38A 0.39 % of output + 0.38A	Comparison to Fluke 5560A Multiproduct Calibrator/Coil 5500A x50
DC Current – Measure ¹	(1 to 10 nA) (10 to 100 nA) (0.1 to 1 μ A) (1 to 10 μ A) (10 to 100 μ A) 0.1 to 1 mA (1 to 10) mA (10 to 100) mA	18.3 μ A/A + 0.15 pA 6 μ A/A + 1.5 pA 4.8 μ A/A + 0.015 nA 4.4 μ A/A + 0.015 nA 4.4 μ A/A + 0.15 nA 4.4 μ A/A + 0.0015 μ A 4.4 μ A/A + 0.015 μ A 9.9 μ A/A + 0.15 μ A	Comparison to Agilent 3458A Option 002 Multimeter, 5450A Resistance Calibrator
DC Current – Measure ¹	(10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	13 μ A/A + 0.5 nA 13 μ A/A + 3 nA 13 μ A/A + 0.03 μ A 23 μ A/A + 0.3 μ A 72 μ A/A + 6.6 μ A	Comparison to Agilent 3458A Multimeter



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Electrical – DC/Low Frequency

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measure ¹	(0.1 to 20.2) μ A (20.2 to 202) μ A (0.202 to 2.02) mA (2.02 to 20.2) mA (20.2 to 202) mA (0.202 to 2.02) A (2.02 to 20.2) A (20.2 to 30.2) A	27 μ A/A + 0.4 nA 9.9 μ A/A + 0.4 nA 9.1 μ A/A + 4 nA 14 μ A/A + 0.04 μ A 56.3 μ A/A + 1.0 μ A 130 μ A/A + 0.2mA 230 μ A/A + 0.5mA 541 μ A/A + 4.3mA	Comparison to Fluke 8588A Multimeter
DC Current – Measure ¹	(1 to 10) A (10 to 100) A	35 μ A/A + 85 μ A 44 μ A/A + 0.09 mA	Comparison to Agilent 3458A Option 002 Precision Multimeter Standard Resistor L&N 4361 Current Shunt
DC Current – Measure ¹	(1 to 1 000) A	0.25 % of reading	Comparison to Agilent 3458A Multimeter, Empro Current Shunt
DC Voltage – Generate ¹	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	6.8 μ V/V + 0.8 μ V 4.6 μ V/V + 0.9 μ V 3 μ V/V + 2.5 μ V 3 μ V/V + 3.9 μ V 4.6 μ V/V + 38 μ V 6.1 μ V/V + 385 μ V	Comparison to Fluke 5730A Multifunction Calibrator
DC Voltage – Measure ¹	(0 to 100) mV 100 mV to 1V (1 to 10) V (10 to 100) V (100 to 1 000) V	3.3 μ V/V + 1 μ V 2.6 μ V/V + 1 μ V 2.6 μ V/V + 1.5 μ V 3.9 μ V/V + 20 μ V 3.9 μ V/V + 66 μ V + 12 μ V/V x (Vin/1 000) ^2	Comparison to Agilent 3458A Option 002 Multimeter
DC Voltage – Measure ¹	(0 to 220) mV (0.202 to 2.02) V (2.02 to 20.2) V (20.2 to 202) V (202 to 1 000) V	7.3 μ V/V + 0.7 μ V 2.8 μ V/V + 0.8 μ V 2.8 μ V/V + 0.8 μ V 4.2 μ V/V + 30 μ V 4.3 μ V/V + 0.99 mV	Comparison to Fluke 8588A Multimeter
DC Voltage – Measure ¹	(0 to 1) kV (1 to 10) kV	0.03 % of reading + 0.000 032 kV 0.03 % of reading + 0.000 12 kV + 1.5 μ V/V x (Vin/1 000) ^2	Comparison to Vitrek 4700 Digital HV Meter
DC Voltage – Measure ¹	(1 to 60) kV (1 to 120) kV	0.1 % of reading 0.1 % of reading	Comparison to Ross VD60, VD120 High Voltage Divider, Agilent 34401A Multimeter



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Electrical – DC/Low Frequency

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure ¹ Fixed Points	100 mV 1 V 10 V 100 V 1 000 V	3.1 μV/V 0.61 μV/V 0.5 μV/V 0.52 μV/V 0.63 μV/V	Comparison to Fluke 732B Reference Standard, 752A Divider
Phase Angle – Generate 5 V Equal Amplitude	(0 to 360) ° 1 Hz to 1 kHz (1 to 6.25) kHz (6.25 to 50) kHz (50 to 200) kHz	0.005° 0.01° 0.015° 0.04°	Comparison to Clarke- Hess 5500-2 Phase Standard
Phase Angle – Generate 50 mV to 120 V– Unequal Amplitude	(0 to 360)° 1 Hz to 1 kHz (1 to 6.25) kHz (6.25 to 50) kHz (50 to 200) kHz	0.005° 0.01° 0.015° 0.04°	Comparison to Clarke- Hess 5500-2 Phase Standard
Phase Angle – Measure 10 mV to 350 V	(0 to 360)° 5 Hz to 2 kHz (2 to 5) kHz (5 to 10) kHz (10 to 50) kHz (50 to 100) kHz (100 to 200) kHz	0.02° 0.03° 0.04° 0.05° 0.1° 0.2°	Comparison to Clarke- Hess 6000A Phase Meter
AC Voltage – Generate ¹	(0.22 to 2.2) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	228 μV/V + 3.9 μV 88 μV/V + 3.9 μV 76 μV/V + 3.9 μV 190 μV/V + 3.9 μV 457 μV/V + 4.6 μV 989 μV/V + 9.2 μV 1.3 mV/V + 19 μV 2.6 mV/V + 19 μV	Comparison to Fluke 5730A Multifunction Calibrator
AC Voltage – Generate ¹	(2.2 to 22) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	228 μV/V + 3.9 μV 88 μV/V + 3.9 μV 76 μV/V + 3.9 μV 190 μV/V + 3.9 μV 457 μV/V + 4.6 μV 989 μV/V + 9.2 μV 1.3 mV/V + 19 μV 2.6 mV/V + 19 μV	Comparison to Fluke 5730A Multifunction Calibrator



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Electrical – DC/Low Frequency

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(22 to 220) mV		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	228 μ V/V + 11.4 μ V	
	(20 to 40) Hz	88 μ V/V + 6.1 μ V	
	40 Hz to 20 kHz	53 μ V/V + 6.1 μ V	
	(20 to 50) kHz	114 μ V/V + 6.1 μ V	
	(50 to 100) kHz	304 μ V/V + 15.2 μ V	
	(100 to 300) kHz	609 μ V/V + 19 μ V	
	(300 to 500) kHz	1.3 mV /V + 22.8 μ V	
	500 kHz to 1 MHz	2.5 mV /V + 45.7 μ V	
	220 mV to 2.2 V		
	(10 to 20) Hz	228 μ V/V + 38 μ V	
	(20 to 40) Hz	84 μ V/V + 15 μ V	
	40 Hz to 20 kHz	37 μ V/V + 8 μ V	
	(20 to 50) kHz	61 μ V/V + 9 μ V	
	(50 to 100) kHz	76 μ V/V + 30 μ V	
	(100 to 300) kHz	304 μ V/V + 76 μ V	
	(300 to 500) kHz	913 μ V /V + 190 μ V	
	500 kHz to 1 MHz	1.5 mV/V + 304 μ V	
	(2.2 to 22) V		
	(10 to 20) Hz	228 μ V/V + 380 μ V	
(20 to 40) Hz	84 μ V/V + 152 μ V		
40 Hz to 20 kHz	37 μ V/V + 54 μ V		
(20 to 50) kHz	61 μ V/V + 91 μ V		
(50 to 100) kHz	76 μ V/V + 190 μ V		
(100 to 300) kHz	228 μ V/V + 609 μ V		
(300 to 500) kHz	913 μ V/V + 1.9 mV		
500 kHz to 1 MHz	1.4 mV/V + 3 mV		
AC Voltage – Generate ¹	(22 to 220) V		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	228 μ V/V + 3.8 mV	
	(20 to 40) Hz	84 μ V/V + 1.5 mV	
	40 Hz to 20 kHz	49 μ V/V + 0.6 mV	
	(20 to 50) kHz	76 μ V/V + 0.9 mV	
	(50 to 100) kHz	137 μ V/V + 2.3 mV	
	(220 to 750) V		
	40 Hz to 1 kHz	68 μ V/V + 3 mV	
	(1 to 20) kHz	126 μ V/V + 5 mV	
	(20 to 50) kHz	457 μ V/V + 8 mV	
(50 to 100) kHz	1.8 mV/V + 34 mV		



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Electrical – DC/Low Frequency

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(750 to 1 000) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	68 μ V/V + 3 mV 126 μ V/V + 5 mV 457 μ V/V + 8 mV	Comparison to Fluke 5730A Multifunction Calibrator /5725A Amplifier
AC Voltage – Generate ¹ Wideband Absolute	(0.3 to 1.1) mV (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (1.1 to 3.3) mV (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (3.3 to 11) mV (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz (11 to 33) mV (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz	0.65 % of output + 1.5 μ V 0.61 % of output + 1.5 μ V 0.63 % of output + 3.8 μ V 0.63 % of output + 3.8 μ V 0.68 % of output + 3.8 μ V 0.76 % of output + 3.8 μ V 1.3 % of output + 13 μ V 0.58 % of output + 2.3 μ V 0.53 % of output + 2.3 μ V 0.54 % of output + 4.6 μ V 0.54 % of output + 4.6 μ V 0.58 % of output + 4.6 μ V 0.65 % of output + 4.6 μ V 1.3 % of output + 4.6 μ V 0.58 % of output + 6.1 μ V 0.53 % of output + 6.1 μ V 0.54 % of output + 8.4 μ V 0.54 % of output + 8.4 μ V 0.55 % of output + 8.4 μ V 0.61 % of output + 8.4 μ V 0.93 % of output + 8.4 μ V 0.52 % of output + 12 μ V 0.46 % of output + 12 μ V 0.47 % of output + 14 μ V 0.47 % of output + 14 μ V 0.49 % of output + 14 μ V 0.55 % of output + 14 μ V 0.89 % of output + 14 μ V	Comparison to Fluke 5730A Multifunction Calibrator



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Electrical – DC/Low Frequency

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(33 to 110) mV		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 30 Hz)	0.52 % of output + 30 μV	
	30 Hz to 500 kHz	0.46 % of output + 30 μV	
	(0.5 to 1.2) MHz	0.47 % of output + 33 μV	
	(1.2 to 2) MHz	0.47 % of output + 33 μV	
	(2 to 12) MHz	0.49 % of output + 33 μV	
	(12 to 20) MHz	0.55 % of output + 33 μV	
	(20 to 30) MHz	0.89 % of output + 33 μV	
	(110 to 330) mV		
	(10 to 30 Hz)	0.45 % of output + 0.1 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.1 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.1 mV	
	(1.2 to 2) MHz	0.4 % of output + 0.1 mV	
	(2 to 12) MHz	0.42 % of output + 0.1 mV	
	(12 to 20) MHz	0.49 % of output + 0.1 mV	
	(20 to 30) MHz	0.85 % of output + 0.1 mV	
	(0.33 to 1.1) V		
	(10 to 30 Hz)	0.45 % of output + 0.3 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.3 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.3 mV	
(1.2 to 2) MHz	0.4 % of output + 0.3 mV		
(2 to 12) MHz	0.42 % of output + 0.3 mV		
(12 to 20) MHz	0.49 % of output + 0.3 mV		
(20 to 30) MHz	0.85 % of output + 0.3 mV		
(1.1 to 3.5) V			
(10 to 30 Hz)	0.39 % of output + 0.4 mV		
30 Hz to 500 kHz	0.3 % of output + 0.4 mV		
(0.5 to 1.2) MHz	0.32 % of output + 0.4 mV		
(1.2 to 2) MHz	0.32 % of output + 0.4 mV		
(2 to 12) MHz	0.35 % of output + 0.4 mV		
(12 to 20) MHz	0.44 % of output + 0.4 mV		
(20 to 30) MHz	0.82 % of output + 0.4 mV		
AC Voltage – Measure ¹	(1 to 10) mV		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.02 % of reading + 2.0 μV	
	40 Hz to 1 kHz	0.013 % of reading + 0.7 μV	
	(1 to 20) kHz	0.02 % of reading + 0.7 μV	
	(20 to 50) kHz	0.065 % of reading + 0.7 μV	
	(50 to 100) kHz	0.33 % of reading + 0.7 μV	
	100 kHz to 1 MHz	0.78 % of reading + 3.3 μV	
	(1 to 4) MHz	4.6 % of reading + 4.6 μV	
(4 to 8) MHz	13 % of reading + 5.3 μV		



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(10 to 100) mV		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.005 % of reading + 2.6 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 1.3 μ V	
	(1 to 20) kHz	0.009 % of reading + 1.3 μ V	
	(20 to 50) kHz	0.02 % of reading + 1.3 μ V	
	(50 to 100) kHz	0.052 % of reading + 1.3 μ V	
	(100 to 300) kHz	0.2 % of reading + 6.5 μ V	
	300 kHz to 1 MHz	0.7 % of reading + 6.5 μ V	
	(1 to 2) MHz	0.98 % of reading + 46 μ V	
	(2 to 4) MHz	2.6 % of reading + 46 μ V	
	(4 to 8) MHz	2.6 % of reading + 52 μ V	
	(8 to 10) MHz	9.8 % of reading + 65 μ V	
	(0.1 to 1) V		
	(1 to 40) Hz	0.005 % of reading + 26 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 13 μ V	
	(1 to 20) kHz	0.009 % of reading + 13 μ V	
	(20 to 50) kHz	0.02 % of reading + 13 μ V	
	(50 to 100) kHz	0.052 % of reading + 13 μ V	
	(100 to 300) kHz	0.2 % of reading + 65 μ V	
	300 kHz to 1 MHz	0.65 % of reading + 65 μ V	
	(1 to 2) MHz	0.98 % of reading + 0.5 mV	
	(2 to 4) MHz	2.6 % of reading + 0.5 mV	
	(4 to 8) MHz	2.6 % of reading + 0.5 mV	
	(8 to 10) MHz	9.8 % of reading + 0.7 mV	
	(1 to 10) V		
	(1 to 40) Hz	0.005 % of reading + 0.3 mV	
	40 Hz to 1 kHz	0.005 % of reading + 0.1 mV	
	(1 to 20) kHz	0.009 % of reading + 0.1 mV	
	(20 to 50) kHz	0.02 % of reading + 0.1 mV	
	(50 to 100) kHz	0.052 % of reading + 0.1 mV	
(100 to 300) kHz	0.2 % of reading + 0.7 mV		
300 kHz to 1 MHz	0.65 % of reading + 0.7 mV		
(1 to 2) MHz	0.98 % of reading + 4.6 mV		
(2 to 4) MHz	2.6 % of reading + 4.6 mV		
(4 to 8) MHz	2.6 % of reading + 5.2 mV		
(8 to 10) MHz	9.8 % of reading + 6.5 mV		



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Electrical – DC/Low Frequency

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(10 to 100) V		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.013 % of reading + 2.6 mV	
	40 Hz to 1 kHz	0.013 % of reading + 1.3 mV	
	(1 to 20) kHz	0.013 % of reading + 1.3 mV	
	(20 to 50) kHz	0.023 % of reading + 1.3 mV	
	(50 to 100) kHz	0.08 % of reading + 1.3 mV	
	(100 to 300) kHz	0.26 % of reading + 6.5 mV	
	300 kHz to 1 MHz	0.98 % of reading + 6.5 mV	
	(100 to 700) V		
	(1 to 40) Hz	0.026 % of reading + 26 mV	
	40 Hz to 1 kHz	0.026 % of reading + 13 mV	
	(1 to 20) kHz	0.039 % of reading + 13 mV	
	(20 to 50) kHz	0.078 % of reading + 13 mV	
	(50 to 100) kHz	0.2 % of reading + 13 mV	
AC Voltage – Measure ¹	(1.2 to 12.12) mV		Comparison to Fluke 8588A Multimeter
	(1 to 2000) Hz	0.028 % of reading + 1.2 μV	
	(2 to 10) kHz	0.036 % of reading + 1.2 μV	
	(10 to 30) kHz	0.037 % of reading + 1.2 μV	
	(30 to 100) kHz	0.3 % of reading + 0.9 μV	
	(100 to 300) kHz	0.99 % of reading + 3.9 μV	
	(0.3 to 1) MHz	2 % of reading + 3.9 μV	
	(12.12 to 121.2) mV		
	(1 to 2000) Hz	0.009 % of reading + 0.6 μV	
	(2 to 10) kHz	0.013 % of reading + 0.6 μV	
	(10 to 30) kHz	0.023 % of reading + 1.1 μV	
	(30 to 100) kHz	0.052 % of reading + 5.1 μV	
	(100 to 300) kHz	0.21 % of reading + 31 μV	
	(0.3 to 1 MHz)	0.99 % of reading + 0.1 mV	
	(1 to 2) MHz	1.5 % of reading + 0.5 mV	
	(2 to 4) MHz	4 % of reading + 1 mV	
	(4 to 8) MHz	8.2 % of reading + 1 mV	
	(8 to 10) MHz	16 % of reading + 1 mV	



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(0.1212 to 1.212) V		Comparison to Fluke 8588A Multimeter
	1 to 2000 Hz	0.007 % of reading + 0.006 mV	
	(2 to 10) kHz	0.012 % of reading + 0.006 mV	
	(10 to 30) kHz	0.023 % of reading + 0.011 mV	
	(30 to 100) kHz	0.052 % of reading + 0.05 mV	
	(100 to 300) kHz	0.21 % of reading + 0.31 mV	
	(0.3 to 1) MHz	0.99 % of reading + 0.99 mV	
	(1 to 2) MHz	1.5 % of reading + 4.9 mV	
	(2 to 4) MHz	4 % of reading + 9.8 mV	
	(4 to 8) MHz	8.1 % of reading + 9.8 mV	
	(8 to 10) MHz	11 % of reading + 9.8 mV	
	(1.212 to 12.12) V		
	1 to 2000 Hz	0.007 % of reading + 0.06mV	
	(2 to 10) kHz	0.012 % of reading + 0.06 mV	
	(10 to 30) kHz	0.023 % of reading + 0.11 mV	
	(30 to 100) kHz	0.052 % of reading + 0.52 mV	
	(100 to 300) kHz	0.21 % of reading + 3.1 mV	
	(0.3 to 1) MHz	0.99 % of reading + 9.9 mV	
	(1 to 2) MHz	1.5 % of reading + 49 mV	
	(2 to 4) MHz	4 % of reading + 98 mV	
(4 to 8) MHz	8.1 % of reading + 98 mV		
(8 to 10) MHz	15 % of reading + 98 mV		
(12.12 to 121.2) V			
1 to 2000 Hz	0.009 % of reading + 0.6 mV		
(2 to 10) kHz	0.011 % of reading + 0.6 mV		
(10 to 30) kHz	0.023 % of reading + 1.1 mV		
(30 to 100) kHz	0.058 % of reading + 5.1 mV		
(100 to 200) kHz	0.37 % of reading + 46 mV		
(121.2 to 1 050) V			
1 to 1000 Hz	0.011 % of reading + 26 mV		
(2 to 10) kHz	0.011 % of reading + 26 mV		
(10 to 30) kHz	0.023 % of reading + 26 mV		
AC Voltage – Measure ¹	Up to 2.2 mV		Comparison to Fluke 5790A AC/DC Transfer Standard
	(10 to 20) Hz	1.3 mV/V + 1.2 μV	
	(20 to 40) Hz	563 μV/V + 1.2 μV	
	40 Hz to 20 kHz	320 μV/V + 1.2 μV	
	(20 to 50) kHz	616 μV/V + 1.7 μV	
	(50 to 100) kHz	913 μV/V + 2 μV	
	(100 to 300) kHz	1.8 mV/V + 3.1 μV	
	(300 to 500) kHz	1.8 mV/V + 6.1 μV	
500 to 1 MHz	2.7 mV/V + 6.1 μV		



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(2.2 to 7) mV		Comparison to Fluke 5790A AC/DC Transfer Standard
	(10 to 20) Hz	647 $\mu\text{V/V} + 1.2 \mu\text{V}$	
	(20 to 40) Hz	282 $\mu\text{V/V} + 1.2 \mu\text{V}$	
	40 Hz to 20 kHz	160 $\mu\text{V/V} + 1.2 \mu\text{V}$	
	(20 to 50) kHz	304 $\mu\text{V/V} + 1.7 \mu\text{V}$	
	(50 to 100) kHz	457 $\mu\text{V/V} + 2 \mu\text{V}$	
	(100 to 300) kHz	913 $\mu\text{V/V} + 3.1 \mu\text{V}$	
	(300 to 500) kHz	989 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	500 kHz to 1 MHz	1.8 mV/V + 6.1 μV	
	(7 to 22) mV		
	(10 to 20) Hz	221 $\mu\text{V/V} + 1.2 \mu\text{V}$	
	(20 to 40) Hz	145 $\mu\text{V/V} + 1.2 \mu\text{V}$	
	40 Hz to 20 kHz	84 $\mu\text{V/V} + 1.2 \mu\text{V}$	
	(20 to 50) kHz	160 $\mu\text{V/V} + 1.7 \mu\text{V}$	
	(50 to 100) kHz	236 $\mu\text{V/V} + 2 \mu\text{V}$	
	(100 to 300) kHz	616 $\mu\text{V/V} + 3.1 \mu\text{V}$	
	(300 to 500) kHz	677 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	500 kHz to 1 MHz	1.3 mV/V + 6.1 μV	
	(22 to 70) mV		
	(10 to 20) Hz	183 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	(20 to 40) Hz	91 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	40 Hz to 20 kHz	49 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	(20 to 50) kHz	99 $\mu\text{V/V} + 1.7 \mu\text{V}$	
	(50 to 100) kHz	198 $\mu\text{V/V} + 2 \mu\text{V}$	
	(100 to 300) kHz	388 $\mu\text{V/V} + 3.1 \mu\text{V}$	
	(300 to 500) kHz	510 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	500 kHz to 1 MHz	837 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	(70 to 220) mV		
	(10 to 20) Hz	160 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	(20 to 40) Hz	65 $\mu\text{V/V} + 1.3 \mu\text{V}$	
40 Hz to 20 kHz	29 $\mu\text{V/V} + 1.3 \mu\text{V}$		
(20 to 50) kHz	53 $\mu\text{V/V} + 1.7 \mu\text{V}$		
(50 to 100) kHz	122 $\mu\text{V/V} + 2 \mu\text{V}$		
(100 to 300) kHz	190 $\mu\text{V/V} + 3.1 \mu\text{V}$		
(300 to 500) kHz	289 $\mu\text{V/V} + 6.1 \mu\text{V}$		
500 kHz to 1 MHz	761 $\mu\text{V/V} + 6.1 \mu\text{V}$		



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Electrical – DC/Low Frequency

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(220 to 700) mV		Comparison to Fluke 5790A AC/DC Transfer Standard
	(10 to 20) Hz	160 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	(20 to 40) Hz	58 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	40 Hz to 20 kHz	25 $\mu\text{V/V} + 1.3 \mu\text{V}$	
	(20 to 50) kHz	39 $\mu\text{V/V} + 1.7 \mu\text{V}$	
	(50 to 100) kHz	60 $\mu\text{V/V} + 2 \mu\text{V}$	
	(100 to 300) kHz	137 $\mu\text{V/V} + 3.1 \mu\text{V}$	
	(300 to 500) kHz	228 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	500 kHz to 1 MHz	730 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	700 mV to 2.2 V		
	(10 to 20) Hz	152 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	(20 to 40) Hz	50 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	40 Hz to 20 kHz	18 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	(20 to 50) kHz	35 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	(50 to 100) kHz	54 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	(100 to 300) kHz	122 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	(300 to 500) kHz	198 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	500 kHz to 1 MHz	685 $\mu\text{V/V} + 0.7 \mu\text{V}$	
	(2.2 to 7) V		
	(10 to 20) Hz	152 $\mu\text{V/V} + 0.89 \mu\text{V}$	
	(20 to 40) Hz	51 $\mu\text{V/V} + 0.89 \mu\text{V}$	
	40 Hz to 20 kHz	18 $\mu\text{V/V} + 0.89 \mu\text{V}$	
	(20 to 50) kHz	37 $\mu\text{V/V} + 0.89 \mu\text{V}$	
	(50 to 100) kHz	62 $\mu\text{V/V} + 0.89 \mu\text{V}$	
	(100 to 300) kHz	145 $\mu\text{V/V} + 0.89 \mu\text{V}$	
	(300 to 500) kHz	304 $\mu\text{V/V} + 0.89 \mu\text{V}$	
	500 kHz to 1 MHz	913 $\mu\text{V/V} + 0.89 \mu\text{V}$	
	(7 to 22) V		
(10 to 20) Hz	152 $\mu\text{V/V} + 0.89 \mu\text{V}$		
(20 to 40) Hz	51 $\mu\text{V/V} + 0.89 \mu\text{V}$		
40 Hz to 20 kHz	21 $\mu\text{V/V} + 0.89 \mu\text{V}$		
(20 to 50) kHz	37 $\mu\text{V/V} + 0.89 \mu\text{V}$		
(50 to 100) kHz	62 $\mu\text{V/V} + 0.89 \mu\text{V}$		
(100 to 300) kHz	145 $\mu\text{V/V} + 0.89 \mu\text{V}$		
(200 to 500) kHz	304 $\mu\text{V/V} + 0.89 \mu\text{V}$		
500 kHz to 1 MHz	913 $\mu\text{V/V} + 0.89 \mu\text{V}$		



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(22 to 70) V		Comparison to Fluke 5790A AC/DC Transfer Standard
	(10 to 40) Hz	152 μ V/V + 5.7 μ V	
	40 Hz to 20 kHz	52 μ V/V + 5.7 μ V	
	(20 to 50) kHz	24 μ V/V + 5.7 μ V	
	(50 to 100) kHz	43 μ V/V + 5.7 μ V	
	(100 to 300) kHz	72 μ V/V + 5.7 μ V	
	(300 to 500) kHz	152 μ V/V + 5.7 μ V	
	(70 to 220) V		
	(10 to 20) Hz	152 μ V/V + 5.7 μ V	
	(20 to 40) Hz	52 μ V/V + 5.7 μ V	
	40 Hz to 20 kHz	24 μ V/V + 5.7 μ V	
	(20 to 50) kHz	53 μ V/V + 5.7 μ V	
(50 to 100) kHz	75 μ V/V + 5.7 μ V		
AC Voltage – Measure ¹	(220 to 700) V		Comparison to Vitrek 4700 Digital HV Meter
	40 to 20 kHz	31 μ V/V + 57 μ V	
	(20 to 50) kHz	99 μ V/V + 57 μ V	
	(50 to 100) kHz	380 μ V/V + 57 μ V	
	(700 to 1 000) V		
	40 Hz to 20 kHz	29 μ V/V + 57 μ V	
(20 to 30) kHz	99 μ V/V + 57 μ V		
AC Voltage – Measure ¹	(0 to 1) kV		Comparison to Ross VD60, VD120 High Voltage Divider, Agilent 34401A Multimeter
	30 to 200 Hz	0.12 % of reading + 0.000 1 kV	
	200 to 450 Hz	0.12 % of reading + 0.000 15 kV + 1.5 μ V/V x (Vin/1 000) ^2	
	(1 to 10) kV		
AC Voltage – Measure ¹	30 to 200 Hz	0.4 % of reading + 0.000 1 kV	Comparison to Ross VD60, VD120 High Voltage Divider, Agilent 34401A Multimeter
	200 to 450 Hz	0.4 % of reading + 0.000 15 kV + 1.5 μ V/V x (Vin/1 000) ^2	
AC Voltage – Measure ¹	60 Hz		Comparison to Fluke 5790A Option 003 AC/DC Transfer Standard
AC Voltage – Measure ¹	(1 to 10) kV	0.5 % of reading + 0.002 kV	
	(1 to 85) kV	0.5 % of reading + 0.02 kV	
AC Voltage – Measure Wideband Flatness Relative to 1 kHz	(0.6 to 2.2) mV		Comparison to Fluke 5790A Option 003 AC/DC Transfer Standard
	(10 to 30) Hz	0.08 % of reading + 0.1 μ V	
	30 Hz to 120 kHz	0.04 % of reading + 0.1 μ V	
	120 kHz 2 MHz	0.05 % of reading + 0.8 μ V	
	(2 to 10) MHz	0.13 % of reading + 0.8 μ V	
	(10 to 20) MHz	0.23 % of reading + 0.8 μ V	
(20 to 30) MHz	0.53 % of reading + 1.6 μ V		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure Wideband Flatness Relative to 1 kHz	(2.2 to 7) mV		Comparison to Fluke 5790A Option 003 AC/DC Transfer Standard
	(10 to 30) Hz	0.08 % of reading + 0.1 μV	
	30 Hz to 120 kHz	0.04 % of reading + 0.1 μV	
	120 kHz to 2 MHz	0.05 % of reading + 0.8 μV	
	(2 to 10) MHz	0.08 % of reading + 0.8 μV	
	(10 to 20) MHz	0.13 % of reading + 0.8 μV	
	(20 to 30) MHz	0.28 % of reading + 0.8 μV	
	(7 to 22) mV		
	(10 to 30) Hz	0.08 % of reading + 0.1 μV	
	30 Hz to 120 kHz	0.04 % of reading + 0.1 μV	
	120 kHz to 2 MHz	0.05 % of reading + 0.1 μV	
	(2 to 10) MHz	0.08 % of reading + 0.1 μV	
	(10 to 20) MHz	0.13 % of reading + 0.1 μV	
	(20 to 30) MHz	0.28 % of reading + 0.1 μV	
	(22 to 70) mV		
	(10 to 30) Hz	0.08 % of reading + 0.6 μV	
	30 Hz to 2 MHz	0.04 % of reading + 0.6 μV	
	(2 to 10) MHz	0.08 % of reading + 0.6 μV	
	(10 to 20) MHz	0.11 % of reading + 0.6 μV	
	(20 to 30) MHz	0.27 % of reading + 0.6 μV	
	(70 to 220) mV		
	(10 to 30) Hz	0.08 % of reading	
	30 Hz to 500 kHz	0.03 % of reading	
	500 kHz to 2 MHz	0.04 % of reading	
	(2 to 10) MHz	0.08 % of reading	
	(10 to 20) MHz	0.11 % of reading	
	(20 to 30) MHz	0.27 % of reading	
	(220 to 700) mV		
(10 to 30) Hz	0.08 % of reading		
30 Hz to 500 kHz	0.02 % of reading		
500 kHz to 2 MHz	0.04 % of reading		
(2 to 10) MHz	0.08 % of reading		
(10 to 20) MHz	0.11 % of reading		
(20 to 30) MHz	0.27 % of reading		
(0.7 to 2) V			
(10 to 30) Hz	0.08 % of reading		
30 Hz to 500 kHz	0.02 % of reading		
500 kHz to 2 MHz	0.04 % of reading		
(2 to 10) MHz	0.08 % of reading		
(10 to 20) MHz	0.11 % of reading		
(20 to 30) MHz	0.27 % of reading		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure Wideband Flatness Relative to 1 kHz	(2 to 7) V (10 to 30) Hz 30 Hz to 500 kHz 500 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	0.08 % of reading 0.02 % of reading 0.04 % of reading 0.08 % of reading 0.11 % of reading 0.27 % of reading	Comparison to Fluke 5790A Option 003 AC/DC Transfer Standard
AC Current – Generate ¹	(9 to 220) μ A (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (0.22 to 2.2) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (2.2 to 22) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (22 to 220) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	228 μ A/A + 15 nA 152 μ A/A + 10 nA 91 μ A/A + 8 nA 266 μ A/A + 12 nA 989 μ A/A + 61 nA 228 μ A/A + 39 nA 152 μ A/A + 31 nA 91 μ A/A + 31 nA 183 μ A/A + 99 nA 989 μ A/A + 609 nA 228 μ A/A + 385 nA 152 μ A/A + 310 nA 91 μ A/A + 310 nA 183 μ A/A + 536 nA 989 μ A/A + 4.6 μ A 228 μ A/A + 4 μ A 152 μ A/A + 3 μ A 91 μ A/A + 2 μ A 183 μ A/A + 3 μ A 989 μ A/A + 9 μ A	Comparison to Fluke 5730A Multifunction Calibrator
AC Current – Generate ¹	(0.22 to 1.2) A (3 to 45) Hz (45 to 1000) Hz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.019 % of output + 0.08 mA 0.019 % of output + 0.04 mA 0.019 % of output + 0.06 mA 0.19 % of output + 0.23 mA 0.38 % of output + 0.23 mA	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate ¹	(1.2 to 3.1) A (3 to 45) Hz (45 to 1000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (3 to 45) Hz (45 to 1000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (3 to 45) Hz (45 to 1000) Hz (1 to 5) kHz	0.029 % of output + 0.4 mA 0.023 % of output + 0.27 mA 0.029 % of output + 0.27 mA 0.19 % of output + 0.4 mA 0.029 % of output + 0.8 mA 0.023 % of output + 0.4 mA 0.029 % of output + 0.6 mA 0.19 % of output + 0.8 mA 0.076 % of output + 7.7 mA 0.053 % of output + 6.2 mA 0.038 % of output + 6.2 mA	Comparison to Fluke 5560A Multiproduct Calibrator
AC Current – Generate ¹	(20 to 120) A (10 to 65) Hz (65 to 300) Hz 300 Hz to 1 kHz (1 to 3) kHz (3 to 6) kHz (6 to 10) kHz	156 μ A/A + 19 mA 252 μ A/A + 28 mA 768 μ A/A + 92 mA 0.23 % of output + 228 mA 0.76 % of output + 411 mA 3 % of output + 685 mA	Comparison to Fluke 5560A Multiproduct Calibrator, Fluke 52120A Transconductance Amplifier
AC Current Clamps ¹ Toroidal – Wound	(0.6 to 600) A (45 to 65) Hz (600 to 1 000) A (45 to 65) Hz (0.6 to 155) A (65 to 440) Hz	0.21 % of output + 71 mA 0.22 % of output + 0.311 A 0.60 % of output + 77 mA	Comparison to Fluke 5560A Multiproduct Calibrator /Coil x50
AC Current Clamps ¹ Other	(0.6 to 600) A (45 to 65) Hz (600 to 1 000) A (45 to 65) Hz (0.6 to 155) A (65 to 440) Hz	0.43 % of output +0.53 A 0.43 % of output +0.61 A 0.76 % of output +0.69 A	Comparison to Fluke 5560A Multiproduct Calibrator /Coil x50



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current Clamps - Rogowski	(10 to 100) A (10 to 1000) Hz (1 to 3) kHz (100 to 1 000) A (10 to 1000) Hz (1 to 3) kHz (1 000 to 6 000) A (10 to 1000) Hz (1 000 to 3 500) A (1 to 3) kHz	0.53 % of reading +0.011 A 0.61 % of reading +0.015 A 0.53 % of reading +0.11 A 0.61 % of reading +0.15 A 0.53 % of reading +0.69 A 0.61 % of reading +0.95 A	Comparison to Fluke 5560A Multiproduct Calibrator, Fluke 52120 Transconductance Amplifier, Coil6KA Current Coil
AC Current – Measure ¹	(5 to 100) μ A (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz	0.26 % of reading + 0.02 μ A 0.1 % of reading + 0.02 μ A 0.04 % of reading + 0.02 μ A	Comparison to Agilent 3458A/002 Multimeter
AC Current – Measure ¹	(0.1 to 1) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (0.1 to 1) A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 0.13 μ A 0.1 % of reading + 0.13 μ A 0.04 % of reading + 0.13 μ A 0.02 % of reading + 0.13 μ A 0.26 % of reading + 1.3 μ A 0.1 % of reading + 1.3 μ A 0.04 % of reading + 1.3 μ A 0.02 % of reading + 1.3 μ A 0.26 % of reading + 13 μ A 0.1 % of reading + 13 μ A 0.04 % of reading + 13 μ A 0.02 % of reading + 13 μ A 0.26 % of reading + 0.13 mA 0.1 % of reading + 0.13 mA 0.04 % of reading + 0.13 mA 0.02 % of reading + 0.13 mA	Comparison to Agilent 3458A/002 Multimeter
AC Current – Measure ¹	(2.02 to 20.2) μ A (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz	0.20 % of reading + 2.5 nA 0.20 % of reading + 2.5 nA 0.20 % of reading + 2.5 nA	Comparison to Fluke 8588A Multimeter



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
AC Current – Measure ¹	(2.02 to 20.2) μ A (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz	0.027 % of reading + 4.9 nA 0.052 % of reading + 4.9 nA 0.073 % of reading + 4.9 nA	Comparison to Fluke 8588A Multimeter		
	(0.202 to 2.02) mA (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz	0.027 % of reading + 49 nA 0.052 % of reading + 49 nA 0.073 % of reading + 49 nA			
	(2.02 to 20.2) mA (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz	0.027 % of reading + 0.49 μ A 0.052 % of reading + 0.49 μ A 0.073 % of reading + 0.49 μ A			
	(20.2 to 202) mA (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz	0.027 % of reading + 4.9 μ A 0.051 % of reading + 4.9 μ A 0.073 % of reading + 4.9 μ A			
	(0.202 to 2.02) A (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz	0.029 % of reading + 98 μ A 0.054 % of reading + 98 μ A 0.078 % of reading + 98 μ A			
	(2.02 to 20.2) A (10 to 2 000) Hz (2 to 10) kHz	0.082 % of reading + 0.49 mA 0.082 % of reading + 0.49 mA			
	(20.2 to 30.2) A (10 to 2 000) Hz (2 to 10) kHz	0.082 % of reading + 11.8 mA 0.122 % of reading + 11.8 mA			
	AC Current – Measure ¹	(0.22 to 10) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz		189 μ A/A + 0.002 μ A 90 μ A/A + 0.002 μ A 44 μ A/A + 0.002 μ A 76 μ A/A + 0.002 μ A	Comparison to Fluke 5790A AC/DC Transfer Standard / Holt HCS-1 Current Shunts
		(10 to 50) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz		190 μ A/A 87 μ A/A 42 μ A/A 71 μ A/A	
		(50 to 100) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz		190 μ A/A 88 μ A/A 45 μ A/A 77 μ A/A	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(100 to 250) mA		Comparison to Fluke 5790A AC/DC Transfer Standard / Holt HCS-1 Current Shunts
	(10 to 20) Hz	191 μ A/A	
	(20 to 40) Hz	91 μ A/A	
	40 Hz to 20 kHz	42 μ A/A	
	(20 to 50) kHz	78 μ A/A	
	(250 to 500) mA		
	(10 to 20) Hz	190 μ A/A	
	(20 to 40) Hz	91 μ A/A	
	40 Hz to 20 kHz	42 μ A/A	
	(20 to 50) kHz	82 μ A/A	
	(0.5 to 1) A		
	(10 to 20) Hz	190 μ A/A	
	(20 to 40) Hz	92 μ A/A	
	(0.5 to 1) A		
	40 Hz to 20 kHz	59 μ A/A	
	(20 to 50) kHz	117 μ A/A	
	(1 to 2.5) A		
	(10 to 20) Hz	196 μ A/A	
	(20 to 40) Hz	107 μ A/A	
	40 Hz to 20 kHz	78 μ A/A	
	(20 to 50) kHz	129 μ A/A	
	(2.5 to 5) A		
	(10 to 20) Hz	199 μ A/A	
	(20 to 40) Hz	110 μ A/A	
	40 Hz to 20 kHz	85 μ A/A	
	(20 to 50) kHz	177 μ A/A	
	(5 to 10) A		
	(10 to 20) Hz	205 μ A/A	
(20 to 40) Hz	132 μ A/A		
40 Hz to 20 kHz	103 μ A/A		
(20 to 50) kHz	149 μ A/A		
(10 to 20) A			
(10 to 20) Hz	217 μ A/A		
(20 to 40) Hz	149 μ A/A		
40 Hz to 20 kHz	127 μ A/A		
(20 to 50) kHz	184 μ A/A		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(1 to 3) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz (5 to 10) kHz	0.84 % of reading + 1.4 mA 0.27 % of reading + 1.4 mA 0.11 % of reading + 1.4 mA 0.27 % of reading + 16 mA	Comparison to Fluke 8845A Multimeter
	(3 to 10) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz (5 to 10) kHz	0.84 % of reading + 4.6 mA 0.27 % of reading + 4.6 mA 0.11 % of reading + 4.6 mA 0.27 % of reading + 53 mA	
AC Current – Measure ¹	(10 to 20) A (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz	306 μA/A 306 μA/A 274 μA/A 384 μA/A	Comparison to Agilent 3458A Multimeter / Fluke Y5020 Current Shunt
AC Current – Measure ¹	(3 to 30) A 40 Hz to 1 kHz (1 to 5) kHz	0.3 % of reading + 0.07 A 5 % of reading + 0.14 A	Comparison to Agilent 3458A Multimeter, Keysight 34330A Current Shunt
AC Current – Measure ¹	(10 to 1 000) A (10 to 100) Hz (100 to 500) Hz	1.5 % of reading + 1A 1.9 % of reading + 1A	Comparison to Fluke 376 Clamp Meter
Resistance – Generate ¹ Fixed Points	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9) kΩ (10, 19) kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	84 μΩ/Ω + 0.1 μΩ 21 μΩ/Ω + 1 μΩ 9.1 μΩ/Ω + 6 μΩ 6.1 μΩ/Ω + 60 μΩ 6.1 μΩ/Ω + 0.6 mΩ 7.6 μΩ/Ω + 6 mΩ 9.1 μΩ/Ω + 6 mΩ 11 μΩ/Ω + 60 mΩ 16 μΩ/Ω + 60 mΩ 35 μΩ/Ω + 0.6 Ω 42 μΩ/Ω + 0.6 Ω 91 μΩ/Ω + 6 Ω	Comparison to Fluke 5730A Multifunction Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Generate ¹ Fixed Points	1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 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	13 μΩ/Ω + 0.6 μΩ 8.7 μΩ/Ω + 0.6 μΩ 5.6 μΩ/Ω + 6 μΩ 6.7 μΩ/Ω + 6 μΩ 4.7 μΩ/Ω + 60 μΩ 4.5 μΩ/Ω + 60 μΩ 1.2 μΩ/Ω + 0.6 mΩ 1.1 μΩ/Ω + 0.6 mΩ 3 μΩ/Ω + 0.6 mΩ 2 μΩ/Ω + 6 mΩ 1.9 μΩ/Ω + 60 mΩ 1.7 μΩ/Ω + 60 mΩ 3.4 μΩ/Ω + 0.6 Ω 2.8 μΩ/Ω + 0.6 Ω 7.3 μΩ/Ω + 6 Ω 11 μΩ/Ω + 6 Ω 49 μΩ/Ω + 60 Ω	Comparison to Fluke 5450A Resistance Calibrator
Resistance – Generate ¹ Fixed Points	1 Ω 10 kΩ	2.6 μΩ/Ω 0.93 μΩ/Ω	Comparison to Fluke 742A Resistance Standards
Resistance – Generate ¹	Up to 12 Ω (12 to 120) Ω (0.12 to 1.20) kΩ (1.2 to 12.0) kΩ (12 to 120) kΩ (0.12 to 1.2) MΩ (1.2 to 12) MΩ (12 to 120) MΩ (120 to 1 200) MΩ	19 μΩ/Ω + 0.001 Ω 19 μΩ/Ω + 0.001 Ω 19 μΩ/Ω + 0.002 Ω 19 μΩ/Ω + 0.02 Ω 19 μΩ/Ω + 0.2 Ω 19 μΩ/Ω + 2.0Ω 27 μΩ/Ω + 24 Ω 327 μΩ/Ω + 2 kΩ 3 mΩ/Ω + 76 Ω	Comparison to Fluke 5560A Multiproduct Calibrator
Resistance – Measure ¹	Up to 12 Ω (10 to 120) Ω 100 Ω to 1.2 kΩ (1 to 12) kΩ (10 to 120) kΩ 100 kΩ to 1.2 MΩ (1 to 12) MΩ (10 to 120) MΩ 100 MΩ to 1.2 GΩ	9.8 μΩ/Ω + 38 μΩ 7.8 μΩ/Ω + 0.3 mΩ 6.5 μΩ/Ω + 0.4 mΩ 6.5 μΩ/Ω + 3.8 mΩ 6.5 μΩ/Ω + 38 mΩ 9.8 μΩ/Ω + 1.5 Ω 33 μΩ/Ω + 100 Ω 327 μΩ/Ω + 1 kΩ 0.33 % of reading + 70 kΩ	Comparison to Agilent 3458A-Multimeter



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure ¹	Up to 2.02 Ω (2.02 to 20.2) Ω (20.2 to 202) Ω (0.202 to 2.02) kΩ (2.02 to 20.2) kΩ (20.2 to 202) kΩ (0.202 to 2.02) MΩ (2.02 to 20.2) MΩ (20.2 to 202) MΩ (0.202 to 2.02) GΩ (2.02 to 20.2) GΩ	16 μΩ/Ω + 4 μΩ 9.6 μΩ/Ω + 14 μΩ 9.0 μΩ/Ω + 48 μΩ 8.9 μΩ/Ω + 0.46 mΩ 9 μΩ/Ω + 4.6 mΩ 9.1 μΩ/Ω + 46 mΩ 10 μΩ/Ω + 1 Ω 16.7 μΩ/Ω + 9.8 Ω 67 μΩ/Ω + 0.98 kΩ 0.23 mΩ/Ω + 98 kΩ 1.3 mΩ/Ω + 9.8 MΩ	Comparison to Fluke 8588A Multimeter
Resistance – Measure ¹	50 Hz (1 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ 100/120 Hz (1 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ 1 000 Hz (1 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ	0.17 % of reading + 0.003 Ω 0.062 % of reading + 0.006 Ω 0.051 % of reading + 0.06 Ω 0.05 % of reading + 0.000 6 kΩ 0.054 % of reading + 0.006 kΩ 0.09 % of reading + 0.000 06 MΩ 0.45% of reading + 0.000 6 MΩ 0.13 % of reading + 0.003 Ω 0.049 % of reading + 0.006 Ω 0.041 % of reading + 0.06 Ω 0.04 % of reading + 0.000 6 kΩ 0.043 % of reading + 0.006 kΩ 0.07 % of reading + 0.000 06 MΩ 0.34 % of reading + 0.000 6 MΩ 0.05 % of reading + 0.003 Ω 0.023 % of reading + 0.006 Ω 0.02 % of reading + 0.06 Ω 0.02 % of reading + 0.000 6 kΩ 0.021 % of reading + 0.006 kΩ 0.03 % of reading + 0.000 06 MΩ 0.12 % of reading + 0.000 6 MΩ	Comparison to IET 1693 RLC Meter



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure ¹	10 kHz (1 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 25.6) kΩ (25.6 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ	0.17 % of reading + 0.003 Ω 0.062 % of reading + 0.006 Ω 0.051 % of reading + 0.06 Ω 0.05 % of reading + 0.000 6 KΩ 0.051 % of reading + 0.006 KΩ 0.19 % of reading + 0.006 KΩ 0.33 % of reading + 0.000 06 MΩ 1.8 % of reading + 0.000 6 MΩ	Comparison to IET 1693 RLC Meter
	100 kHz (1 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ	0.77 % of reading + 0.003 Ω 0.257 % of reading + 0.006 Ω 0.206 % of reading + 0.06 Ω 0.23 % of reading + 0.000 6 kΩ 0.52 % of reading + 0.006 kΩ 3.4 % of reading + 0.000 06 MΩ	
Capacitance – Generate ¹ Fixed Points	1 pF 10 pF 100 pF 1 000 pF	0.17 % of reading 0.17 % of reading 0.17 % of reading 0.17 % of reading	Comparison to Agilent 16380A Capacitor Set
Capacitance – Generate ¹ Fixed Points	1 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.038 % of output 0.038 % of output 0.044 % of output 0.055 % of output 0.073 % of output 0.096 % of output 0.25 % of output 0.37 % of output	Comparison to Agilent 16381A Capacitor Fixed
Capacitance – Generate ¹ Fixed Points	10 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.036 % of output 0.038 % of output	Comparison to Agilent 16382A Capacitor Fixed



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Generate ¹ Fixed Points	100 pF		Comparison to Agilent 16383A Capacitor Fixed
	1 kHz	0.035 % of output	
	1 MHz	0.035 % of output	
	2 MHz	0.035 % of output	
	3 MHz	0.035 % of output	
	4 MHz	0.035 % of output	
	5 MHz	0.037 % of output	
	10 MHz	0.048 % of output	
13 MHz	0.06 % of output		
Capacitance – Generate ¹ Fixed Points	1 000 pF		Comparison to Agilent 16384A Capacitor Fixed
	1 kHz	0.035 % of output	
	1 MHz	0.035 % of output	
	2 MHz	0.037 % of output	
	3 MHz	0.044 % of output	
	4 MHz	0.056 % of output	
	5 MHz	0.071 % of output	
	10 MHz	0.19 % of output	
13 MHz	0.28 % of output		
Capacitance – Generate ¹ Fixed Points	0.01 μF		Comparison to Agilent 16385A Capacitor Fixed
	0.12 kHz	0.02 % of output	
	1 kHz	0.02 % of output	
	10 kHz	0.02 % of output	
Capacitance – Generate ¹ Fixed Points	0.1 μF		Comparison to Agilent 16386A Capacitor Fixed
	0.12 kHz	0.02 % of output	
	1 kHz	0.02 % of output	
	10 kHz	0.02 % of output	
Capacitance – Generate ¹ Fixed Points	1 μF		Comparison to Agilent 16387A Capacitor Fixed
	0.12 kHz	0.021 % of output	
	1 kHz	0.02 % of output	
	10 kHz	0.02 % of output	
Capacitance – Generate ¹ Fixed Points	100 kHz	0.021 % of output	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Generate ¹	(0.2 to 1.2) nF (1.2 to 12.0) nF (12 to 120.0) nF (0.12 to 1.2) μF (1.2 to 12.0) μF (12 to 120.0) μF (0.12 to 1.2) mF (1.2 to 12.0) mF (12 to 120.0) mF	0.09% of output + 1.5 pF 0.09 % of output + 0.004 nF 0.1 % of output + 0.023 nF 0.1 % of output + 0.23 nF 0.1 % of output + 2.3 nF 0.11 % of output + 19 nF 0.19 % of output + 190 nF 0.19 % of output + 2.3 μF 0.38 % of output + 23 μF	Comparison to Fluke 5560A Multiproduct Calibrator
Inductance – Generate ¹	(13 to 120.0) μH (0.12 to 1.2) mH (1.2 to 12.0) mH (12 to 120.0) mH (0.12 to 1.2) H (1.2 to 12.0) H (12 to 120.0) H	0.15% of output + 0.15 μH 0.09 % of output + 0.76 μH 0.09 % of output + 7.6 μH 0.09 % of output + 76 μH 0.11 % of output + 0.76 mH 0.15 % of output + 7.6 mH 0.19 % of output + 76 mH	Comparison to Fluke 5560A Multiproduct Calibrator
Capacitance – Measure ¹	50 Hz (50 to 100) pF (100 to 400) pF (400 to 1 000) pF (1 to 10) nF (10 to 100) nF (100 to 1 000) nF (0.1 to 1) μF (1 to 10) μF (10 to 100) μF (100 to 1 000) μF 100 Hz (20 to 100) pF (100 to 400) pF (400 to 1 000) pF (1 to 10) nF (10 to 100) nF (100 to 1 000) nF (0.1 to 1) μF (10 to 100) μF (100 to 1 000) μF	2.6 % of reading + 0.015 pF 1.3 % of reading + 0.06 pF 0.37 % of reading + 0.06 pF 0.18 % of reading + 0.000 6 nF 0.063 % of reading + 0.006 nF 0.051 % of reading + 0.06 nF 0.051 % of reading + 0.000 06 μF 0.05% of reading + 0.000 6 μF 0.054 % of reading + 0.006 μF 0.09 % of reading + 0.06 μF 2.4 % of reading + 0.015 pF 0.52 % of reading + 0.06 pF 0.16 % of reading + 0.06 pF 0.088 % of reading + 0.000 6 nF 0.045 % of reading + 0.006 nF 0.041 % of reading + 0.06 nF 0.041 % of reading + 0.000 06 μF 0.046 % of reading + 0.006 μF 0.1 % of reading + 0.06 μF	Comparison to IET 1693 LCR Meter



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure ¹	120 Hz		Comparison to IET 1693 LCR Meter
	(20 to 100) pF	2 % of reading + 0.015 pF	
	(100 to 400) pF	0.44 % of reading + 0.06 pF	
	(400 to 1 000) pF	0.14 % of reading + 0.06 pF	
	(1 to 10) nF	0.08 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.044 % of reading + 0.006 nF	
	(100 to 1 000) nF	0.04 % of reading + 0.06 nF	
	(0.1 to 1) μF	0.04 % of reading + 0.000 06 μF	
	(1 to 10) μF	0.041 % of reading + 0.000 6 μF	
	(10 to 100) μF	0.047 % of reading + 0.006 μF	
	(100 to 1 000) μF	0.11 % of reading + 0.06 μF	
	1 000 Hz		
	(1 to 10) pF	1.6 % of reading + 0.014 pF	
	(10 to 20) pF	0.18 % of reading + 0.015 pF	
	(20 to 100) pF	0.1 % of reading + 0.015 pF	
	(100 to 400) pF	0.036 % of reading + 0.06 pF	
	(400 to 1 000) pF	0.024 % of reading + 0.06 pF	
	(1 to 10) nF	0.022 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.02 % of reading + 0.006 nF	
	(100 to 1 000) nF	0.02 % of reading + 0.06 nF	
	(0.1 to 1) μF	0.02 % of reading + 0.000 06 μF	
	(1 to 10) μF	0.022 % of reading + 0.000 6 μF	
	(10 to 100) μF	0.04 % of reading + 0.006 μF	
	(100 to 1 000) μF	0.22 % of reading + 0.06 μF	
	10 kHz		
	(20 to 100) pF	0.3 % of reading + 0.015 pF	
	(100 to 622) pF	0.2 % of reading + 0.06 pF	
	(622 to 1 000) pF	0.051 % of reading + 0.06 pF	
	(1 to 10) nF	0.051 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.051 % of reading + 0.006 nF	
	(100 to 1 000) nF	0.058 % of reading + 0.06 nF	
	(0.1 to 1) μF	0.058 % of reading + 0.000 06 μF	
	(1 to 10) μF	0.13 % of reading + 0.000 6 μF	
	(10 to 100) μF	0.85 % of reading + 0.006 μF	
	(100 to 500) μF	4.1 % of reading + 0.06 μF	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure ¹	100 kHz (20 to 100) pF (100 to 400) pF (400 to 1 000) pF (1 to 10) nF (10 to 100) nF (100 to 1 000) nF (0.1 to 1) μF (1 to 10) μF	0.49 % of reading + 0.015 pF 0.26 % of reading + 0.06 pF 0.21 % of reading + 0.06 pF 0.21 % of reading + 0.000 6 nF 0.24 % of reading + 0.006 nF 0.58 % of reading + 0.06 nF 0.58 % of reading + 0.000 06 μF 4 % of reading + 0.000 6 μF	Comparison to IET 1693 LCR Meter
Inductance – Measure ¹	100 Hz (40 to 100) μH (0.1 to 0.4) mH (0.4 to 1) mH (1 to 10) mH (10 to 100) mH (0.1 to 1) H (1 to 10) H (10 to 100) H 1 000 Hz (4 to 10) μH (10 to 40) μH (40 to 100) μH (0.1 to 0.4) mH (0.4 to 1) mH (1 to 10) mH (10 to 100) mH (0.1 to 1) H (1 to 10) H (10 to 100) H 10 kHz (1 to 4) μH (4 to 10) μH (10 to 40) μH (40 to 100) μH (0.1 to 0.4) mH (0.4 to 1) mH (1 to 10) mH (10 to 100) mH (0.1 to 0.407) H (0.407 to 1) H (1 to 10) H (10 to 100) H	3.8 % of reading + 0.006 μH 1.6 % of reading + 0.000 06 mH 0.42 % of reading + 0.000 06 mH 0.19 % of reading + 0.0006 mH 0.056 % of reading + 0.006 mH 0.042 % of reading + 0.000 06 H 0.041 % of reading + 0.000 6 H 0.042 % of reading + 0.006 H 1.3 % of reading + 0.003 μH 0.53 % of reading + 0.006 μH 0.15 % of reading + 0.006 μH 0.071 % of reading + 0.000 06 mH 0.033 % of reading + 0.000 06 mH 0.025 % of reading + 0.000 6 mH 0.02 % of reading + 0.006 mH 0.02% of reading + 0.000 06 H 0.02 % of reading + 0.000 6 H 0.026 % of reading + 0.006 H 2.1 % of reading + 0.003 μH 0.56 % of reading + 0.003 μH 0.25 % of reading + 0.006 μH 0.1 % of reading + 0.006 μH 0.071 % of reading + 0.000 06 mH 0.056 % of reading + 0.000 06 mH 0.052 % of reading + 0.000 6 mH 0.051 % of reading + 0.006 mH 0.051 % of reading + 0.006 mH 0.18 % of reading + 0.000 06 H 0.27 % of reading + 0.000 6 H 1.2 % of reading + 0.006 H	Comparison to IET 1693 LCR Meter



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ¹	100 kHz (1 to 4) μ H (4 to 10) μ H (10 to 40) μ H (40 to 100) μ H (0.1 to 0.4) mH (0.4 to 1) mH (1 to 10) mH (10 to 100) mH (0.1 to 1) H	1.16 % of reading + 0.003 μ H 0.44 % of reading + 0.003 μ H 0.3 % of reading + 0.006 μ H 0.23 % of reading + 0.006 μ H 0.21 % of reading + 0.000 06 mH 0.21 % of reading + 0.000 06 mH 0.22 % of reading + 0.000 6 mH 0.39 % of reading + 0.006 mH 2.1 % of reading + 0.000 06 H	Comparison to IET 1693 LCR Meter
Inductance – Generate ¹ Fixed Point	100 μ H 10 kHz	0.25 μ H	Comparison to GR 1482-B Standard Inductor
Inductance – Generate ¹ Fixed Point	100 mH 100 Hz	0.047mH	Comparison to GR 1482-L Standard Inductor
AC Power – Generate ¹ (12 to 120) mV Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz	0.022 % of Output + 0.1 μ W 0.022 % of Output + 0.1 μ W 0.022 % of Output + 0.1 μ W 0.12 % of Output + 0.1 μ W 0.022 % of Output + 1.1 μ W 0.016 % of Output + 0.7 μ W 0.022 % of Output + 0.9 μ W 0.12 % of Output + 1.1 μ W 0.022 % of Output + 11 μ W 0.022 % of Output + 7.2 μ W 0.022 % of Output + 9.2 μ W 0.19 % of Output + 28 μ W 0.030 % of Output + 48 μ W 0.025 % of Output + 31 μ W 0.03 % of Output + 31 μ W 0.19 % of Output + 48 μ W 0.03 % of Output + 107 μ W 0.025 % of Output + 72 μ W 0.03 % of Output + 92 μ W 0.19 % of Output + 107 μ W	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (12 to 120) mV Power Factor = 1	(12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.077 % of Output + 0.92 mW 0.054 % of Output + 0.74 mW 0.38 % of Output + 0.74 mW	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (0.12 to 1.2) V Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.022 % of Output + 0.9 μW 0.022 % of Output + 0.9 μW 0.022 % of Output + 0.9 μW 0.12 % of Output + 0.9 μW 0.022 % of Output + 9.2 μW 0.016 % of Output + 4.7 μW 0.022 % of Output + 7.4 μW 0.12 % of Output + 9.2 μW 0.022 % of Output + 92 μW 0.022 % of Output + 47 μW 0.022 % of Output + 74 μW 0.19 % of Output + 0.27 mW 0.03 % of Output + 0.46 mW 0.025 % of Output + 0.27 mW 0.03 % of Output + 0.27 mW 0.19 % of Output + 0.46 mW 0.03 % of Output + 0.92 mW 0.025 % of Output + 0.47 mW 0.03 % of Output + 0.74 mW 0.19 % of Output + 0.92 mW 0.077 % of Output + 9.1 mW 0.054 % of Output + 7.3 mW 0.38 % of Output + 7.3 mW	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (1.2 to 12) V Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz	0.022 % of Output + 9.2 μW 0.022 % of Output + 9.2 μW 0.022 % of Output + 9.2 μW 0.12 % of Output + 9.2 μW	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (1.2 to 12) V Power Factor = 1	(12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.022 % of Output + 92 μW 0.016 % of Output + 46 μW 0.022 % of Output + 74 μW 0.12 % of Output + 92 μW 0.022 % of Output + 0.92 mW 0.022 % of Output + 0.46 mW 0.022 % of Output + 0.74 mW 0.19 % of Output + 2.7 mW 0.03 % of Output + 4.6 mW 0.025 % of Output + 2.7 mW 0.03 % of Output + 2.7 mW 0.19 % of Output + 4.6 mW 0.03 % of Output + 9.2 mW 0.025 % of Output + 4.6 mW 0.03 % of Output + 7.4 mW 0.19 % of Output + 9.2 mW 0.077 % of Output + 91 mW 0.054 % of Output + 73 mW 0.38 % of Output + 73 mW	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (12 to 120) V Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz	0.022 % of Output + 92 μW 0.022 % of Output + 92 μW 0.022 % of Output + 92 μW 0.12 % of Output + 92 μW 0.022 % of Output + 0.92 mW 0.016 % of Output + 0.46 mW 0.022 % of Output + 0.74 mW 0.12 % of Output + 0.92 mW	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (12 to 120) V Power Factor = 1	(0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.022 % of Output + 9.2 mW 0.022 % of Output + 4.6 mW 0.022 % of Output + 7.4 mW 0.19 % of Output + 27 mW 0.03 % of Output + 46 mW 0.025 % of Output + 27 mW 0.03 % of Output + 27 mW 0.19% of Output + 46 mW 0.03 % of Output + 92 mW 0.025 % of Output + 46 mW 0.03 % of Output + 74 mW 0.19 % of Output + 92 mW 0.077 % of Output + 0.91 W 0.054 % of Output + 0.73 W 0.38 % of Output + 0.73 W	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (120 to 330) V Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz	0.022 % of Output + 0.26 mW 0.022 % of Output + 0.26 mW 0.022 % of Output + 0.26 mW 0.12 % of Output + 0.26 mW 0.022 % of Output + 2.6 mW 0.016 % of Output + 1.5 mW 0.022 % of Output + 2.1 mW 0.12 % of Output + 2.6 mW 0.022 % of Output + 26 mW 0.022 % of Output + 15 mW 0.022 % of Output + 21 mW 0.19 % of Output + 76 mW 0.03 % of Output + 0.13 W 0.025 % of Output + 0.08 W 0.03 % of Output + 0.08 W 0.19 % of Output + 0.13 W	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (120 to 330) V Power Factor = 1	(3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.03 % of Output + 0.26 W 0.025 % of Output + 0.15 W 0.03 % of Output + 0.21 W 0.19 % of Output + 0.26 W 0.077 % of Output + 2.5 W 0.054 % of Output + 2 W 0.38 % of Output + 2 W	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (330 to 1020) V Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.022 % of Output + 1.1 mW 0.022 % of Output + 1.1 mW 0.022 % of Output + 1.1 mW 0.12 % of Output + 1.1 mW 0.022 % of Output + 11 mW 0.016 % of Output + 8.3 mW 0.022 % of Output + 9.6 mW 0.12 % of Output + 11 mW 0.022 % of Output + 107 mW 0.022 % of Output + 83 mW 0.022 % of Output + 96 mW 0.19 % of Output + 244 mW 0.03 % of Output + 0.43 W 0.025 % of Output + 0.3 W 0.03 % of Output + 0.3 W 0.19 % of Output + 0.43 W 0.03 % of Output + 1.1 W 0.025 % of Output + 0.8 W 0.03 % of Output + 1 W 0.19 % of Output + 1.1 W 0.077 % of Output + 8 W 0.054 % of Output + 6.5 W 0.38 % of Output + 6.5 W	Comparison to Fluke 5560A Multiproduct Calibrator



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Phase Angle – Generate ¹	(-180 to 180) °		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 65) Hz	0.08°	
	(65 to 500) Hz	0.19°	
	500 Hz to 1 kHz	0.38°	
	(1 to 5) kHz	1.9°	
	(5 to 10) kHz	3.8°	
Electrical Calibration of Thermocouple Indicating Devices ¹	Type B		Comparison to Fluke 7526A Process Calibrator
	(600 to 800) °C	0.27 °C	
	(800 to 1 550) °C	0.21 °C	
	(1 550 to 1 820) °C	0.17 °C	
	Type C		
	(0 to 1 000) °C	0.12 °C	
	(1 000 to 1 800) °C	0.18 °C	
	(1 800 to 2 000) °C	0.2 °C	
	(2 000 to 2 316) °C	0.27 °C	
	Type E		
	(-250 to -200) °C	0.19 °C	
	(-200 to -100) °C	0.09 °C	
	(-100 to 0) °C	0.07 °C	
	(0 to 600) °C	0.06 °C	
	(600 to 1 000) °C	0.08 °C	
	Type J		
	(-210 to -100) °C	0.11 °C	
	(-100 to 800) °C	0.07 °C	
	(800 to 1 200) °C	0.08 °C	
	Type K		
	(-250 to -200) °C	0.35 °C	
	(-200 to -100) °C	0.12 °C	
	(-100 to 800) °C	0.08 °C	
	(800 to 1 372) °C	0.1 °C	
	Type L		
	(-200°C to -100) °C	0.08 °C	
	(-100 to 900) °C	0.07 °C	
Type N			
(-250 to -200) °C	0.56 °C		
(-200 to -100) °C	0.18 °C		
(-100 to 0) °C	0.09 °C		
(0 to 100) °C	0.08 °C		
(100 to 800) °C	0.08 °C		
(800 to 1 300) °C	0.09 °C		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicating Devices ¹	Type R (-50 to -25) °C (-25 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 600) °C (600 to 1 000) °C (1 000 to 1 600) °C (1 600 to 1 767) °C Type S (-50 to -25) °C (-25 to 0) °C (0 to 100) °C (100 to 400) °C (400 to 600) °C (600 to 1 600) °C (1 600 to 1 767) °C Type T (-250 to -200) °C (-200 to -100) °C (-100 to 0) °C (0 to 400) °C Type U (-200 to 0) °C (0 to 600) °C	0.42 °C 0.34 °C 0.3 °C 0.21 °C 0.17 °C 0.16 °C 0.14 °C 0.18 °C 0.39 °C 0.33 °C 0.29 °C 0.22 °C 0.18 °C 0.17 °C 0.2 °C 0.27 °C 0.12 °C 0.08 °C 0.07 °C 0.13 °C 0.08 °C	Comparison to Fluke 7526A Process Calibrator
Electrical Calibration of RTD Indicators ¹	Pt 100 (385) (-200 to 800) °C Pt 100 (3916) (-200 to 630) °C Pt 100 (3926) (-200 to 630) °C Pt 200 (385) (-200 to 400) °C (400 to 630) °C Pt 500 (385) (-200 to 630) °C Pt 1 000 (385) (-200 to 630) °C	0.04 °C 0.04 °C 0.04 °C 0.3 °C 0.38 °C 0.13 °C 0.07 °C	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicators ¹	Cu 10 (427) (100 °C to 260) °C	0.29 °C	Comparison to Fluke 7526A Process Calibrator
	Ni 120 (672) (-80 to 260) °C	0.02 °C	
Oscilloscopes Calibration – Generate ¹ Voltage DC – 50 Ω	(1 to 24.999) mV	0.19 % of Output + 31 μV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
	(25 to 109.99) mV	0.19 % of Output + 36 μV	
	(110mV to 2.1999) V	0.19 % of Output + 87 μV	
	(2.2 to 6.6) V	0.19 % of Output + 0.6 mV	
DC – 1 MΩ	(1 to 24.999) mV	0.019 % of reading + 20 μV	
	(25 to 109.99) mV	0.019 % of reading + 25 μV	
	(110mV to 2.1999) V	0.019 % of reading + 76 μV	
	(2.2 to 10.999) V	0.019 % of reading + 0.6 mV	
	(11 to 130) V	0.019 % of reading + 6.0 mV	
Square Wave 10 Hz to 10 kHz – 50 Ω	(1 to 24.999) mVpp	0.19 % of Output + 31 μV	
	(25 to 109.99) mVpp	0.19 % of Output + 36 μV	
	(110mV to 2.1999) Vpp	0.19 % of Output + 87 μV	
	(2.2 to 6.6) Vpp	0.19 % of Output + 0.6 mV	
Square Wave 10 Hz to 1 kHz – 1 MΩ	(1 to 24.999) mV	0.038 % of reading + 4 μV	
	(25 to 109.99) mV	0.038 % of reading + 9 μV	
	(110mV to 2.1999) V	0.038 % of reading + 60 μV	
	(2.2 to 10.999) V	0.038 % of reading + 0.6 mV	
	(11 to 130) V	0.038 % of reading + 6 mV	
Square Wave 1 to 10 kHz - 1MΩ	(1 to 24.999) mV	0.19 % of reading + 31 μV	
	(25 to 109.99) mV	0.19 % of reading + 36 μV	
	(110mV to 2.1999) V	0.19 % of reading + 87 μV	
	(2.2 to 10.999) V	0.19 % of reading + 0.6 mV	
	(11 to 130) V	0.19 % of reading + 6 mV	



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Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth (5 to 50) mVpp		Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
	50 kHz to 100 MHz	0.34 dB	
	(100 to 300) MHz	0.36 dB	
	(300 to 500) MHz	0.42 dB	
	(500 to 600) MHz	0.46 dB	
	(600 to 1 600) MHz	0.5 dB	
	(1 600 to 2 100) MHz	0.56 dB	
	50 mV to 3.5 Vpp		
	50 kHz to 100 MHz	0.24 dB	
	(100 to 300) MHz	0.24 dB	
	(300 to 500) MHz	0.32 dB	
	(500 to 600) MHz	0.34 dB	
(600 to 1 600) MHz	0.4 dB		
(1 600 to 2 100) MHz	0.44 dB		
3.5 to 5 Vpp			
50 kHz to 100 MHz	0.24 dB		
(100 to 300) MHz	0.24 dB		
(300 to 500) MHz	0.32 dB		
(500 to 600) MHz	0.34 dB		
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness	3 dB Bandwidth 50 mV to 3.5Vpp (1 100 to 4 000) MHz (4 000 to 8 000) MHz (8 000 to 18 000) MHz	0.3 dB 0.38 dB 0.48 dB	Comparison to EPM Power Meter w/ E Series Power Sensors
Oscilloscopes Calibration – Generate Time Marker	500 ps to 20 ms 50 ms to 5 s	0.25 μs/s 1.9 μs/s + 3.8 μHz	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Measure ¹			Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Input Impedance	(40 to 60) Ω	0.08 % of reading	
Resistance	500 kΩ to 1.5MΩ	0.08 % of reading	
Leakage	(0 to 5.99) V	0.038 % of reading + 0.8 mV	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration ¹ – Generate Voltage DC - 50Ω DC - 1MΩ Square Wave 10Hz to 10kHz – 1MΩ	1 mV to 5 V 1 mV to 200 V 1 mV to 200 Vpp)	0.025 % of output + 25uV 0.025 % of output + 25uV 0.1 % of output + 10uV	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration ¹ – Generate Time Marker	9 ns to 55 s	0.25 μs/s	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration ¹ – Measure Input Impedance Resistance	(10 to 40) Ω (40 to 90) Ω (90 to 150) Ω (50 to 800) KΩ (0.8 to 1.2) MΩ (1.2 to 12) MΩ	0.5 % of reading 0.1 % of reading 0.5 % of reading 0.5 % of reading 0.1 % of reading 0.5 % of reading	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration ¹ – Generate Leveled Sine Flatness 50 kHz to 10 MHz Reference	(5mV to 5Vpp) (0.1 Hz to 300) MHz (300 to 550) MHz (5 mV to 3Vpp) (550 to 1100) MHz	0.18 dB 0.22 dB 0.3 dB	Comparison to Fluke 9500B with 9510 Active Head
Power Meter Range Calibration ¹	3 μW to 100 mW	0.3 % of reading	Comparison to HP 11683A Range Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency Modulation – Measure ¹ β = deviation / rate	250 kHz to 10 MHz Rates 20 Hz to 10 kHz Peak Dev 200 Hz to 40 kHz 10 MHz to 6.6 GHz Rates 50 Hz to 200 kHz Peak Dev 250 Hz to 400 kHz (6.6 to 13.2) GHz Rates 50 Hz to 200 kHz Peak Dev 250 Hz to 400 kHz (13.2 to 26.5) GHz Rates 50 Hz to 200 kHz Peak Dev 250 Hz to 400 kHz (31.15 to 50.0) GHz Rates 50 Hz to 200 kHz Peak Dev 250 Hz to 400 kHz	$\beta > 0.2 - 1.5$ % of reading + 2 Hz $\beta > 1.2 - 1$ % of reading + 2 Hz $\beta > 0.2 - 1.5$ % of reading + 2 Hz $\beta > 0.45 - 1$ % of reading + 2 Hz $\beta > 0.2 - 2.5$ % of reading + 4 Hz $\beta > 8.0 - 1$ % of reading + 4 Hz $\beta > 0.2 - 3.8$ % of reading + 9 Hz $\beta > 16 - 1$ % of reading + 9 Hz $\beta > 0.2 - 8.5$ % of reading + 17 Hz $\beta > 32 - 1$ % of reading + 17 Hz	Comparison to Agilent N5531S Measuring Receiver System
Amplitude Modulation – Measure ¹	100 kHz to 10 MHz Rate 50 Hz to 10 kHz (5 to 99) % Depth 10 MHz to 3 GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth (3 to 26.5) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth (26.5 to 31.15) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth (31.15 to 50) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth	0.75 % of reading + 0.3 digits 2.5 % of reading + 0.4 digits 1.5 % of reading + 0.4 digits 4.5 % of reading + 0.4 digits 1.5 % of reading + 0.4 digits 6.8 % of reading + 0.4 digits 1.9 % of reading + 0.4 digits 26 % of reading + 0.4 digits 6 % of reading + 0.4 digits	Comparison to Agilent N5531S Measuring Receiver System



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Phase Modulation – Measure ¹	100 kHz to 6.6 GHz Deviations > 0.3 rad Deviations > 0.7 rad (6.6 to 13.2) GHz Deviations > 0.6 rad Deviations > 2.0 rad (13.2 to 26.5) GHz Deviations: > 1.2 rad Deviations > 4.0 rad (26.5 to 31.15) GHz Deviations: > 1.3 rad Deviations > 4.0 rad (31.15 to 50) GHz Deviations: > 2.4 rad Deviations > 8.0 rad	3 % of reading + 0.002 rad 1 % of reading + 0.002 rad 3 % of reading + 0.005 rad 1 % of reading + 0.005 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad 3 % of reading + 0.018 rad 1 % of reading + 0.018 rad	Comparison to Agilent N5531S Measuring Receiver System
RF Flatness – Measure ¹	9 kHz to 2 000MHz (20 to -10) dBm (-10 to -30) dBm (-30 to -40) dBm (-40 to -42) dBm (2 to 14) GHz (20 to -10) dBm (-10 to -30) dBm (-30 to -40) dBm (-40 to -42) dBm (14 to 18) GHz (20 to -10) dBm (-10 to -30) dBm (-30 to -40) dBm (-40 to -42) dBm	0.1 dB 0.1 dB 0.11 dB 0.12 dB 0.10 dB 0.09 dB 0.1 dB 0.11 dB 0.11 dB 0.12 dB 0.12 dB 0.13 dB	Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
RF Attenuation – Measure ¹	(30 to 3 050) MHz (0 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 70) dB (70 to 80) dB (80 to 90) dB (90 to 100) dB (100 to 110) dB	0.02 dB 0.025 dB 0.03 dB 0.035 dB 0.04 dB 0.076 dB 0.081 dB 0.12 dB 0.12 dB 0.13 dB 0.13 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532B Opt 550 Power Sensor



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RF Attenuation – Measure ¹	(3 050 to 6 600) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532B Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.19 dB	
	(6 600 to 13 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.25 dB	
	(13 200 to 19 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.12 dB		
(80 to 90) dB	0.12 dB		
(90 to 100) dB	0.13 dB		
(100 to 110) dB	0.31 dB		



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RF Attenuation – Measure 1	(19 200 to 26 500) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532B Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.14 dB	
	(90 to 100) dB	0.36 dB	
	(100 to 110) dB	0.82 dB	
	(26 500 to 31 150) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.13 dB	
	(90 to 100) dB	0.33 dB	
	(100 to 110) dB	0.77 dB	
	(31 150 to 41 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.14 dB		
(80 to 90) dB	0.36 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(41 000 to 45 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532B Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.11 dB	
	(70 to 80) dB	0.24 dB	
	(80 to 90) dB	0.6 dB	
	(45 000 to 50 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.11 dB	
	(60 to 70) dB	0.29 dB	
(70 to 80) dB	0.7 dB		
(80 to 90) dB	1.4 dB		
RF Power – Measure ¹	9 kHz to 14 000 MHz		Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(20 to 0) dB	0.13 dB	
	(0 to -40) dB	0.15 dB	
	(-40 to -50) dB	0.35 dB	
	(-50 to -55) dB	0.93 dB	
	(14 000 to 18 000) MHz		
	(20 to 0) dB	0.12 dB	
	(0 to -40) dB	0.16 dB	
	(-40 to -50) dB	0.35 dB	
	(-50 to -55) dB	0.93 dB	
RF Power Measure ¹	(10 to 100) MHz		Comparison to Agilent EPM Series Power Meter RF Power / Keysight N8485A Power Sensor
	(20 to 10) dB	0.07 dB	
	(10 to 0) dB	0.06 dB	
	(0 to -10) dB	0.06 dB	
	(-10 to -20) dB	0.06 dB	
	(-20 to -25) dB	0.11 dB	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	(100 to 2 000) MHz		Comparison to Agilent EPM Series Power Meter RF Power / Keysight N8485A Power Sensor
	(20 to 10) dB	0.07 dB	
	(10 to 0) dB	0.07 dB	
	(0 to -10) dB	0.06 dB	
	(-10 to -20) dB	0.07 dB	
	(-20 to -25) dB	0.11 dB	
	(2 000 to 12 400) MHz		
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.08 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.08 dB	
	(-20 to -25) dB	0.12 dB	
	(12 400 to 18 000) MHz		
	(20 to 10) dB	0.09 dB	
	(10 to 0) dB	0.08 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.09 dB	
	(-20 to -25) dB	0.12 dB	
(18 000 to 26 500) MHz			
(20 to 10) dB	0.12 dB		
(10 to 0) dB	0.12 dB		
(0 to -10) dB	0.12 dB		
(-10 to -20) dB	0.12 dB		
(-20 to -25) dB	0.15 dB		
RF Power Measure ¹	(50 to 100) MHz		Comparison to Agilent EPM Series Power Meter N8487A Power Sensor
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.07 dB	
	(0 to -10) dB	0.07 dB	
	(-10 to -20) dB	0.07 dB	
	(-20 to -25) dB	0.11 dB	
	(100 to 6 000) MHz		
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.07 dB	
	(0 to -10) dB	0.07 dB	
	(-10 to -20) dB	0.08 dB	
	(-20 to -25) dB	0.11 dB	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	(6 000 to 12 400) MHz		Comparison to Agilent EPM Series Power Meter N8487A Power Sensor
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.08 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.08 dB	
	(-20 to -25) dB	0.12 dB	
	(12 400 to 18 000) MHz		
	(20 to 10) dB	0.09 dB	
	(10 to 0) dB	0.09 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.09 dB	
	(-20 to -25) dB	0.12 dB	
	(18 000 to 26 500) MHz		
	(20 to 10) dB	0.11 dB	
	(10 to 0) dB	0.11 dB	
	(0 to -10) dB	0.10 dB	
	(-10 to -20) dB	0.11 dB	
	(-20 to -25) dB	0.14 dB	
	(26 5000 to 33 000) MHz		
	(20 to 10) dB	0.12 dB	
	(10 to 0) dB	0.12 dB	
	(0 to -10) dB	0.12 dB	
	(-10 to -20) dB	0.12 dB	
	(-20 to -25) dB	0.15 dB	
(33 000 to 40 000) MHz			
(20 to 10) dB	0.13 dB		
(10 to 0) dB	0.13 dB		
(0 to -10) dB	0.12 dB		
(-10 to -20) dB	0.13 dB		
(-20 to -25) dB	0.15 dB		
(40 000 to 50 000) MHz			
(20 to 10) dB	0.19 dB		
(10 to 0) dB	0.18 dB		
(0 to -10) dB	0.18 dB		
(-10 to -20) dB	0.19 dB		
(-20 to -25) dB	0.2 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	100 kHz to 30 MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB	0.12 dB 0.13 dB 0.14 dB 0.18 dB 0.2 dB 0.28 dB 0.43 dB	Comparison to Agilent N5531S Measuring Receiver, N1912A w/E9304A Power Sensor
RF Power – Measure ¹	(30 to 2 000) MHz (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB (2 000 to 3 050) MHz (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB (3 050 to 6 600) MHz (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB	0.36 dB 0.2 dB 0.22 dB 0.23 dB 0.25 dB 0.27 dB 0.33 dB 0.46 dB 0.37 dB 0.21 dB 0.23 dB 0.24 dB 0.26 dB 0.28 dB 0.34 dB 0.7 dB 0.37 dB 0.21 dB 0.23 dB 0.24 dB 0.29 dB 0.38 dB 0.53 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532B Opt 550 Power Sensor

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(6 600 to 13 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532B Opt 550 Power Sensor
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.34 dB	
	(-110 to -115) dB	0.46 dB	
	(-115 to -120) dB	0.65 dB	
	(13 200 to 18 000) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -90) dB	0.26 dB	
	(-90 to -95) dB	0.26 dB	
	(-95 to -100) dB	0.26 dB	
	(-100 to -105) dB	0.29 dB	
	(-105 to -110) dB	0.38 dB	
	(-110 to -115) dB	0.53 dB	
	(-115 to -120) dB	0.75 dB	
	(18 000 to 19 200) MHz		
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.27 dB	
	(-90 to -95) dB	0.27 dB	
	(-95 to -100) dB	0.27 dB	
	(-100 to -105) dB	0.3 dB	
	(-105 to -110) dB	0.38 dB	
(-110 to -115) dB	0.53 dB		
(-115 to -120) dB	0.75 dB		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(19 200 to 26 500) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532B Opt 550 Power Sensor
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.28 dB	
	(-90 to -95) dB	0.33 dB	
	(-95 to -100) dB	0.43 dB	
	(-100 to -105) dB	0.61 dB	
	(-105 to -110) dB	0.85 dB	
	(-110 to -115) dB	1.2 dB	
	(-115 to -120) dB	1.5 dB	
	(26 500 to 31 150) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.34 dB	
	(-78 to -90) dB	0.36 dB	
	(-90 to -95) dB	0.39 dB	
	(-95 to -100) dB	0.46 dB	
	(-100 to -105) dB	0.61 dB	
	(-105 to -110) dB	0.82 dB	
	(-110 to -115) dB	1.1 dB	
	(31 150 to 41 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
(-58 to -78) dB	0.35 dB		
(-78 to -90) dB	0.48 dB		
(-90 to -95) dB	0.64 dB		
(-95 to -100) dB	0.87 dB		
(-100 to -105) dB	1.2 dB		
(-105 to -110) dB	1.5 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(41 000 to 45 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532B Opt 550 Power Sensor
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.38 dB	
	(-78 to -90) dB	0.68 dB	
	(-90 to -95) dB	0.93 dB	
	(-95 to -100) dB	1.2 dB	
	(-100 to -105) dB	1.6 dB	
	(45 000 to 50 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.67 dB	
(-78 to -90) dB	1.4 dB		
RF Power – Generate ¹	10 Hz to 100 kHz		Comparison to Fluke 9640A RF Reference Source
	(24 to -48) dBm	0.06 dB	
	100 kHz to 10 MHz		
	(24 to -48) dBm	0.07 dB	
	(-48 to -74) dBm	0.16 dB	
	(-74 to -94) dBm	0.39 dB	
	(10 to 128) MHz		
	(24 to -48) dBm	0.07 dB	
	(-48 to -84) dBm	0.09 dB	
	(-84 to -94) dBm	0.24 dB	
	(-94 to -124) dBm	0.54 dB	
	(128 to 300) MHz		
	(20 to -48) dBm	0.08 dB	
	(-48 to -74) dBm	0.09 dB	
	(-74 to -84) dBm	0.24 dB	
	(-84 to -94) dBm	0.39 dB	
	(-94 to -124) dBm	1.2 dB	
	(300 to 1.4) GHz		
(20 to -48) dBm	0.16 dB		
(-48 to -74) dBm	0.31 dB		
(-74 to -84) dBm	0.39 dB		
(-84 to -94) dBm	0.77 dB		
(-94 to -124) dBm	1.2 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Generate ¹	(1.4 to 3) GHz (14 to -48) dBm (-48 to -74) dBm (-74 to -94) dBm (-94 to -124) dBm	0.24 dB 0.39 dB 0.77 dB 1.2 dB	Comparison to Fluke 9640A RF Reference Source
RF Power – Generate ¹	(30 to 2 000) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (2 000 to 3 050) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (3 050 to 6 600) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (6 600 to 13 200) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (13 200 to 18 000) MHz (15 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (18 000 to 19 200) MHz (15 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (19 200 to 26 500) MHz (15 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB	0.29 dB 0.3 dB 0.31 dB 0.32 dB 0.34 dB 0.35 dB 0.36 dB 0.39 dB 0.34 dB 0.35 dB 0.36 dB 0.39 dB 0.34 dB 0.35 dB 0.36 dB 0.39 dB 0.34 dB 0.35 dB 0.36 dB 0.42 dB 0.34 dB 0.35 dB 0.36 dB 0.46 dB 0.41 dB 0.41 dB 0.42 dB 0.5 dB 0.41 dB 0.41 dB 0.42 dB 0.9 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532B Opt 550 Power Sensor, 83650B Signal Generator

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Generate ¹	(26 500 to 31 150) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532B Opt 550 Power Sensor, 83650B Signal Generator
	(15 to 0) dB	0.62 dB	
	(0 to -58) dB	0.63 dB	
	(-58 to -78) dB	0.64 dB	
	(-78 to -110) dB	0.96 dB	
	(31 150 to 41 000) MHz		
	(10 to 0) dB	0.82 dB	
	(0 to -58) dB	0.83 dB	
	(-58 to -78) dB	0.84 dB	
	(-78 to -100) dB	1.1 dB	
	(41 000 to 45 000) MHz		
	(10 to 0) dB	0.82 dB	
	(0 to -58) dB	0.83 dB	
	(-58 to -78) dB	0.85 dB	
	(-78 to -100) dB	1.4 dB	
	(45 000 to 50 000) MHz		
(10 to 0) dB	0.82 dB		
(0 to -58) dB	0.83 dB		
(-58 to -78) dB	1 dB		
(-78 to -90) dB	1.5 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Power Sensor (Cal Factor)	Type-N (50 Ω)		<p>M is the mismatch Uncertainty</p> <p>Comparison to Agilent EPM Series Power Meter RF Power / Keysight N8482A H84 Power Sensor</p>
	0.1 MHz	1.2 % of reading + M	
	0.3 MHz	1 % of reading + M	
	0.5 MHz	1 % of reading + M	
	1 MHz	1 % of reading + M	
	3 MHz	1 % of reading + M	
	5 MHz	1 % of reading + M	
	10 MHz	0.97 % of reading + M	
	30 MHz	0.95 % of reading + M	
	50 MHz	0.85 % of reading + M	
	100 MHz	0.85 % of reading + M	
	300 MHz	0.89 % of reading + M	
	500 MHz	0.89 % of reading + M	
	1 000 MHz	0.89 % of reading + M	
	1 500 MHz	0.89 % of reading + M	
	2 000 MHz	0.89 % of reading + M	
	2 500 MHz	0.88 % of reading + M	
	3 000 MHz	0.88 % of reading + M	
3 500 MHz	0.9 % of reading + M		
3 700 MHz	0.9 % of reading + M		
4 000 MHz	0.92 % of reading + M		
4 200 MHz	0.93 % of reading + M		
5 000 MHz	0.93 % of reading + M		
6 000 MHz	0.93 % of reading + M		
RF Power – Power Sensor (Cal Factor)	Type-N (50 Ω)		<p>M is the mismatch Uncertainty</p> <p>Comparison to Agilent EPM Series Power Meter RF Power / Keysight N8481A H84 Power Sensor</p>
	10 MHz	1.3 % of reading + M	
	30 MHz	1.3 % of reading + M	
	50 MHz	1.2 % of reading + M	
	100 MHz	1.2 % of reading + M	
	300 MHz	1.2 % of reading + M	
	500 MHz	1.2 % of reading + M	
	800 MHz	1.2 % of reading + M	
	1 000 MHz	1.2 % of reading + M	
	1 200 MHz	1.2 % of reading + M	
	1 500 MHz	1.2 % of reading + M	
	2 000 MHz	1.2 % of reading + M	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Power Sensor (Cal Factor)	Type-N (50 Ω)		M is the mismatch Uncertainty Comparison to Agilent EPM Series Power Meter RF Power / Keysight N8481A H84 Power Sensor
	3 000 MHz	1.2 % of reading + M	
	4 000 MHz	1.2 % of reading + M	
	5 000 MHz	1.3 % of reading + M	
	6 000 MHz	1.3 % of reading + M	
	7 000 MHz	1.3 % of reading + M	
	8 000 MHz	1.3 % of reading + M	
	9 000 MHz	1.4 % of reading + M	
	10 000 MHz	1.4 % of reading + M	
	11 000 MHz	1.4 % of reading + M	
	12 000 MHz	1.4 % of reading + M	
	12 400 MHz	1.4 % of reading + M	
	13 000 MHz	1.5 % of reading + M	
	14 000 MHz	1.5 % of reading + M	
	15 000 MHz	1.5 % of reading + M	
	16 000 MHz	1.6 % of reading + M	
	17 000 MHz	1.6 % of reading + M	
18 000 MHz	1.6 % of reading + M		
AM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(0.1 to 10) MHz		Comparison to Agilent N5531S Measuring Receiver
	AM Depth > 1%		
	(0 to -20) dB	1.2 dB	
	(-20 to -30) dB	2.2 dB	
	AM Depth > 3%		
	(0 to -20) dB	1 dB	
	(-20 to -30) dB	1.3 dB	
	(-30 to -40) dB	2.4 dB	
	10 MHz to 26.5 GHz		
	AM Depth > 1%		
	(0 to -20) dB	1.3 dB	
	(-20 to -30) dB	2.5 dB	
	AM Depth > 3%		
	(0 to -20) dB	1.1 dB	
	(-20 to -30) dB	1.4 dB	
(-30 to -40) dB	3 dB		
26.5 MHz to 50.0 GHz			
AM Depth > 3%			
(0 to -20) dB	1.8 dB		
AM Depth > 5%			
(0 to -20) dB	1.5 dB		
(-20 to -30) dB	3.5 dB		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(1 to 6 600) MHz Dev 500 Hz to 2 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 2 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.28 dB 0.09 dB 0.27 dB 0.83 dB 2.39 dB	Comparison to Agilent N5531S Measuring Receiver
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(6.6 to 13.2) GHz Dev > 2.3 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 4.5 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (13.2 to 31.15) GHz Dev > 2.7 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 6.0 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (31.15 to 50.0) GHz Dev > 4 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 12.0 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.3 dB	Comparison to Agilent N5531S Measuring Receiver



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(1 to 6 600) MHz		Comparison to Agilent N5531S Measuring Receiver
	Rate 20 to 500 Hz		
	Dev > 0.8 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 2.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
(-40 to -50) dB	2.3 dB		
PM Distortion Measure ¹	(1 to 6 600) MHz		Comparison to Agilent N5531S Measuring Receiver
	Rate (500 to 1 000) Hz		
	Dev > 0.4 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 1.0 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	(6.6 to 13.2) GHz		
	Rate (20 to 500) Hz		
	Dev > 1.8 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 5.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(6.6 to 13.2) GHz		
	Rate 500 to 1 000 Hz		
	Dev > 0.8 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.28 dB	
	Dev > 2.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	(13.2 to 31.15) GHz		
	Rate 20 to 500 Hz		
	Dev > 3.5 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 10.0 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
(-40 to -50) dB	2.3 dB		
Rate 500 Hz to 1000 Hz			
Dev > 1.2 rad			
(0 to -20) dB	0.26 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 4.0 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		

Comparison to Agilent N5531S Measuring Receiver



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(31.15 to 50.0) GHz Rate 20 to 500 Hz Dev > 7.5 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 19.0 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB Rate 500 Hz to 1000 Hz Dev > 3.0 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 8.0 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.3 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.3 dB	Comparison to Agilent N5531S Measuring Receiver
Total Harmonic Distortion (THD)	(0 to -60) dB 20 Hz to 20 kHz (0 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -65) dB (20 to 50) kHz (0 to -40) dB (-40 to -50) dB (-50 to -60) dB (50 to 100) kHz (0 to -40) dB (-40 to -50) dB	1 dB 1 dB 1.3 dB 1.7 dB 2 dB 2.1 dB 3 dB 2 dB 2.4 dB	Comparison to HP 8903B Audio Analyzer



ANSI National Accreditation Board

Electrical – RF/Microwave

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Harmonics Measure ¹	(-80 to -10) dB 2 nd through 5 th Harmonic 1 kHz to 600 MHz (600 to 1 320) MHz (1 320 to 2 200) MHz (2 200 to 3 000) MHz (3 000 to 4 400) MHz (4 400 to 5 300) MHz (5 300 to 10 000) MHz 2 nd through 4 th Harmonic (10 000 to 12 500) MHz 2 nd through 3 rd Harmonic (12 500 to 16 667) MHz 2 nd Harmonic (16 667 to 25 000) MHz	0.37 dB 1.1 dB 1.4 dB 1.4 dB 1.7 dB 1.9 dB 2.1 dB 2.1 dB 2.1 dB 2.3 dB	Comparison to Agilent E4440A Measuring Receiver
Phase Noise – SSB Measure ¹	1 MHz to 26.5 GHz	0.45 dB	Comparison to Agilent E4440A Spectrum Analyzer

Length – Dimensional Metrology

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Micrometers ^{2,3}	Up to 46 in	(29 + 4.5L) μin	Comparison to Gage blocks (Grade 0)
Gage Blocks ²	Up to 13 in	(1.2+ 2.5L) μin	Comparison to Master gage blocks, P&W universal measuring machine
Bore Micrometers ² 2 point 3 point	Up to 8 in	(7 + 2L) μin (42 + 1.4L) μin	Comparison to Master gage blocks, P&W universal measuring machine, Master Ring
Calipers ^{1,2}	Up to 46 in	(280 + 1.7L) μin	Comparison to Gage blocks (Grade 0)
Dial Indicators ^{1,2} Resolution ≥ 50μin Resolution < 50μin	Up to 10 in Up to 0.1 in	(25 + 3.6L) μin 7 μin	Comparison to 716 Starrett Calibrator, gage blocks (Grade 0)
Micrometer Rods	Up to 40 in	(1.1 + 5.7L) μin	Comparison to Gage blocks (grade 0)

Length – Dimensional Metrology

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Height Gages ^{1,2}	Up to 40 in	$(95 + 3L) \mu\text{in}$	Comparison to Gage blocks (grade 0)
Roughness Measure	123 $\mu\text{in Ra}$ 117 $\mu\text{in Ra}$ 116 $\mu\text{in Ra}$ 3 $\mu\text{m Ra}$	3.2 μin 2.5 μin 2.9 μin 0.06 μm	Comparison to Mitutoyo SV-3200H4 Surface Measuring System and Roughness Specimens
Cylindrical Gages ²			
Ring Gages	(0.04 to 14) in	$(9.6 + 2.1D) \mu\text{in}$	Comparison to Master gage blocks, P&W universal measuring machine
Plain Plugs/Pins	Up to 13 in	$(4.2 + 3.4D) \mu\text{in}$	
Thread Wires	Up to 0.5D	10 μin	Comparison to Master gage blocks, P&W universal measuring machine
Thread Plugs –			
Major Diameter	Up to 12 in	44 μin	Comparison to P & W Model C Bench Micrometer, Van Keuren thread wire set
Pitch Diameter	Up to 12 in	79 μin	
Solid Thread Rings	(0.625 to 12) in	106 μin	Comparison to Master gage blocks, P&W universal measuring machine
Adjustable Thread Rings ^{2,3} Pitch Diameter (Tactile Fit)	Up to 12 in	$(350 + 47D) \mu\text{in}$	Comparison to Thread setting plug gages
NPT Thread Plugs			
Major Diameter	Up to 12 in	85 μin	Comparison to P&W Model C Bench Micrometer, Van Keuren Thread Wire Set, Alameda Pipe Taper Sine Block
Pitch Diameter	Up to 12 in	120 μin	
Surface Plates ^{1,2}			
Overall Flatness	Up to 6 ft × 6 ft	77 μin	Comparison to Planekator
Local Area Flatness	± 0.001 in	68 μin	Repeat-O-Meter
Parallelism & Straightness	(0 to 0.01) in	13 μin	Comparison to Gage Amplifier, Surface Plate
Protractors ¹	(0 to 360)°	0.006° (22 s)	Comparison to Angle Blocks
Radius Gages	(0.016 to 1.00) in	240 μin	Comparison to Optical Comparator



ANSI National Accreditation Board

Length – Dimensional Metrology

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rulers ¹	Up to 72 in	0.009 in	Comparison to Gage blocks (grade 0)
Tape Measures ¹	Up to 100 ft	(0.000 27 <i>F</i> + 0.024) in	Comparison to Standard rule
Feeler Gage ¹	Up to 1 in	31 μin	Comparison to Pratt & Whitney Model C Bench Micrometer
Optical Comparators ¹ Angle Linearity	(0 to 360) ° Up to 20 in (20 to 40) in	0.042 ° 320 μin 630 μin	Comparison to Gage blocks, Angle blocks, SI Industries glass scales
Magnification	(10 to 100) x	420 μin	

Mass and Mass Related

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales & Balances ^{1,2,4}	1 mg to 5 000 g (0.001 to 100) lb	(0.049 + 0.003 <i>X</i>) mg (3.2 E ⁻⁶ + 3.1 E ⁻⁶ <i>W</i>) lb	Comparison to Class 1 weights
Scales & Balances ^{1,2,4}	Up to 1 000 lb	(0.00 02 + 0.000 12 <i>W</i>) lb	Comparison to Class F weights
Mass - Measure	(1 to 200) g (200 to 2 500) g (1 to 34) kg	0.69 mg 0.026 g 0.25 g	Comparison to Precision Balance
Mass - Fixed Points Metric	200 g 500 g 1 kg 5 kg	0.73 mg 29 mg 30 mg 30 mg	Comparison to ASTM E617 Class 1 weights
Pressure – Generate ¹	(10 to 16 000) psi	0.019 % of reading	Comparison to Dead Weight Tester Fluke P3125

Mass and Mass Related

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure – Measure ¹	(-1 to 1) inH ₂ O	0.001 5 inH ₂ O	Comparison to Pressure Gauges ADT681-05-DP1-inH ₂ O ADT681-05-DP5-inH ₂ O ADT681-05-DP50-inH ₂ O Fluke 2700G-BG100K Fluke 2700G-BG100K Additel ADT681-GP30 Fluke 2700G-BG700K Fluke 2700G-BG2M Fluke 2700G-BG7M Additel ADT681-GP3K Additel ADT681-GP10K
	(-5 to 5) inH ₂ O	0.008 inH ₂ O	
	(-50 to 50) inH ₂ O	0.061 inH ₂ O	
	(-15 to 0) psi	0.008 9 psi	
	(0 to 15) psi	0.004 psi	
	(0 to 30) psi	0.007 8 psi	
	(0 to 100) psi	0.028 psi	
	(0 to 300) psi	0.064 psi	
	(0 to 1 000) psi	0.23 psi	
	(0 to 3 000) psi	0.97 psi	
(0 to 10 000) psi	3.3 psi		
Force ¹ Tension and Compression	(0.01 to 500) lbf	0.063 % of reading	Comparison to Class F weights
Force ¹ Tension and Compression	(50 to 2 000) lbf	0.068 % of reading	Comparison to Morehouse Press with Load Cells
	(200 to 10 000) lbf	0.044 % of reading	
	(500 to 25 000) lbf	0.087 % of reading	
Torque Tools ¹	(10 to 100) ozf-in	0.59 % of reading	Comparison to CDI 1001 Torque Tester CDI 5000 ST torque tester
	4 lbf-in to 1 000 lbf-ft	0.32 % of reading	
Torque Tools ¹	(0.5 to 2.5) ozf-in	0.18 % of reading	Comparison to Waters Torque Analyzer
	(2 to 10) ozf-in	0.18 % of reading	
	(6 to 43) ozf-in	0.18 % of reading	
	(30 to 215) ozf-in	0.18 % of reading	
Torque Analyzers	0.4 ozf-in to 1 000 lbf-ft	0.065 % of reading	Comparison to Class F weights and arm
Durometers Scale (Force) Accuracy Types A, B, E, O,C, D, DO Type M Types OO, OOO Types CF & SL Indenter Geometry Length Diameter Angle	(0 to 100) duros	0.06 duros	Direct Verification Master balance Optical comparator
		0.07 duros	
		0.08 duros	
		0.06 duros	
		0.06 duros	
0.1 in	130 μin	Optical comparator	
0.05 in	130 μin		
(30 to 35) °	0.085 °		

Mass and Mass Related

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Rockwell Hardness Testers ¹	(< 60) HRBW (≥ 60 to < 80) HRBW (≥ 80) HRBW	3 HRBW 3 HRBW 1.4 HRBW	Indirect verification per ASTM E18
	(< 35) HRC (≥ 35 to < 60) HRC (≥ 60) HRC	1.3 HRC 1.3 HRC 0.73 HRC	
	(< 81) HR15TW (≥ 81 to < 87) HR15TW (> 87) HR15TW	1.8 HR15TW 1.3 HR15TW 1.3 HR15TW	

Thermodynamic

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity – Generate	(10 to 95) %RH	0.5 %RH	Comparison to Thunder Scientific 1200 Humidity Chamber
Relative Humidity – Measure	(0 to 90) %RH (90 to 100) %RH	1.2 %RH 2 %RH	Comparison to Vaisala MI70/HMP76 Humidity Indicator and Probe
Temperature – Measuring Equipment ¹	(-25 to 350) °C	0.087 °C	Comparison to Hart 1502A Indicator with Burnes Engineering 12005 PRT and dry block
Temperature – Measure ¹	(-200 to 420) °C	0.036 °C	Comparison to Hart 1502A Indicator with Burnes Engineering 12005 PRT
Infrared (IR) Thermometers	(20 to 100) °C (100 to 300) °C (300 to 420) °C (420 to 500) °C	1.5 °C 4.3 °C 6 °C 7.7 °C	Comparison to Fluke 9132 IR Calibrator $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$



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Time and Frequency

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Generate ¹	1 to 10 Hz 10 to 100 Hz 100 to 1 000 Hz 1 to 10 kHz 10 to 100 kHz 0.1 to 1 MHz 1 to 10 MHz	1×10^{-12} Hz/Hz + 0.57 μ Hz 1×10^{-12} Hz/Hz + 5.7 μ Hz 1×10^{-12} Hz/Hz + 57 μ Hz 1×10^{-12} Hz/Hz + 0.57 mHz 1×10^{-12} Hz/Hz + 5.7 mHz 1×10^{-12} Hz/Hz + 57 mHz 1×10^{-12} Hz/Hz + 0.57 Hz	Comparison to Agilent 33250A Function Generator / HP 58503A GPS Receiver
Frequency – Generate ¹	10 to 40 000 MHz	1×10^{-12} Hz/Hz + 0.57 mHz	Comparison to Agilent E8257D Opt 540 Signal Generator / HP 58503A GPS Receiver
Frequency – Generate ¹	10 to 50 000 MHz	1×10^{-12} Hz/Hz + 0.57 kHz	Comparison to HP 83650B Signal Generator / HP 58503A GPS Receiver
Frequency – Measure ¹	1 to 10 Hz 10 to 100 Hz 100 to 1 000 Hz 1 to 10 kHz 10 to 100 kHz 100 to 200 kHz 0.2 to 3 000 MHz	4.20×10^{-9} Hz/Hz 1.47×10^{-9} Hz/Hz 0.60×10^{-9} Hz/Hz 0.33×10^{-9} Hz/Hz 0.24×10^{-9} Hz/Hz 0.21×10^{-9} Hz/Hz 0.21×10^{-9} Hz/Hz	Comparison to Agilent 53131A Opt 030 Frequency Counter / HP 58503A GPS Receiver
Frequency – Measure ¹	10 to 50 000 MHz	1×10^{-12} Hz/Hz + 0.1 Hz	Comparison to Agilent E4448A Spectrum Analyzer / HP 58503A GPS Receiver
Time – Generate	1 pps	1×10^{-12} s/s + 750 ps	Comparison to HP 58503A GPS Receiver
Type I (digital) Timers	(0 to 19.99) sec/day (0 to 599) sec/month	0.031 sec/day 1.1 sec/month	Comparison to Helmut Klein Timometer 4500
Type II (mechanical) Timers	(0 to 320) sec/day	0.6 sec/day	Comparison to Helmut Klein Timometer 4500
Timer, Stopwatch	10 s to 24 hr	34 ms	Totalize method with counter
Tachometers – RPM ¹	Up to 100 000 RPM	0.001 % of reading + 0.6R	Comparison to HP 33250A Signal Generator & LED

DIMENSIONAL MEASUREMENT

1 Dimensional

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Length	X Axis (0.01 to 10) in Y Axis (0.01 to 6) in	162 μ m 123 μ m	Comparison to Optical comparator

2 Dimensional

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Angle	Up to 360°	0.004°	Comparison to Optical comparator

3 Dimensional

Rockford, IL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
General Inspection	X axis (0 to 33) in (0 to 838) mm Y axis (0 to 60) in (0 to 1 524) mm Z axis (0 to 20) in (0 to 508) mm	(80+ 3.6L) μ m (2.1 + 0.003 6L) μ m (200 + 0.13L) μ m (5.1 + 0.000 13L) μ m (200 + 0.13L) μ m (5.1 + 0.000 13L) μ m	Comparison to CMM

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Services performed at satellite laboratory

Technical Maintenance, Inc.

425 Hayden Station Road, Suite B
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Matt Nicewicz (Branch Manager) Phone: 860-219-0046
Scott Chamberlain (Quality Manager) Phone: 321-242-0890

CALIBRATION

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometers – Acceleration	(0.01 to 10) g (7 < 10) Hz (10 < 30) Hz (30 < 2 000) Hz (2 to 10) kHz	4 % of reading 3 % of reading 1.5 % of reading 4 % of reading	Comparison to Accelerometer Calibrator

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters ^{1,5}	4 pH 7 pH 10 pH	0.035 pH 0.025 pH 0.069 pH	Comparison to pH buffer solutions

Electrical – DC/Low Frequency

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Generate ¹	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 000) V	6.8 μV/V + 0.9 μV 6.1 μV/V + 0.9 μV 6.1 μV/V + 3.2 μV 6.1 μV/V + 6.2 μV 6.8 μV/V + 76 μV 8.4 μV/V + 460 μV	Comparison to Fluke 5700A Multifunction Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure ¹	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1 000) V	3.3 $\mu\text{V/V} + 1 \mu\text{V}$ 2.6 $\mu\text{V/V} + 1 \mu\text{V}$ 2.6 $\mu\text{V/V} + 1.5 \mu\text{V}$ 3.9 $\mu\text{V/V} + 20 \mu\text{V}$ 3.9 $\mu\text{V/V} + 66 \mu\text{V} + 12\mu\text{V/V} \times$ ($V_{in}/1\ 000$) ²	Comparison to Agilent 3458A Option 002 Multimeter
DC Voltage – Measure ¹	(1 to 60) kV	0.1 % of reading	Comparison to Ross VD60 High Voltage Divider, Agilent 34401A Multimeter
DC Current – Generate ¹	(1 to 1.2) nA (1.2 to 12) nA (12 to 120) nA (0.12 to 1.2) μA (1.2 to 10) μA	99 $\mu\text{A/A} + 0.007 \text{ nA}$ 99 $\mu\text{A/A} + 0.007 \text{ nA}$ 99 $\mu\text{A/A} + 0.01 \text{ nA}$ 36 $\mu\text{A/A} + 0.1 \text{ nA}$ 19 $\mu\text{A/A} + 1 \text{ nA}$	Comparison to Fluke 5700A Multifunction Calibrator, Fluke 5560A Multiproduct Calibrator
DC Current – Generate ¹	(10 to 220) μA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA (0.22 to 1) A (1 to 2.2) A	46 $\mu\text{A/A} + 8 \text{ nA}$ 46 $\mu\text{A/A} + 8 \text{ nA}$ 46 $\mu\text{A/A} + 82 \text{ nA}$ 53 $\mu\text{A/A} + 0.9 \mu\text{A}$ 61 $\mu\text{A/A} + 0.9 \mu\text{A}$ 72 $\mu\text{A/A} + 23 \mu\text{A}$ 109 $\mu\text{A/A} + 23 \mu\text{A}$	Comparison to Fluke 5700A Multifunction Calibrator
DC Current – Generate ¹	(2.2 to 3.1) A (3.1 to 12) A (12 to 30) A	228 $\mu\text{A/A} + 115 \mu\text{A}$ 228 $\mu\text{A/A} + 191 \mu\text{A}$ 761 $\mu\text{A/A} + 392 \mu\text{A}$	Comparison to Fluke 5560A Multiproduct Calibrator
DC Current – Generate ¹ Clamp Meters	(1.2 to 200) A	0.21 % of output + 0.008 A	Comparison to Fluke 5560A Multiproduct Calibrator / 9100-200 x10 Coil
DC Current – Generate ¹ Clamp Meters	(6 to 1 000) A	0.21 % of output + 0.024 A	Comparison to Fluke 5560A Multiproduct Calibrator / 9100-200 x50 Coil
DC Current – Measure	(1 to 10) nA (10 to 100) nA (0.1 to 1) μA (1 to 10) μA	35 $\mu\text{A/A} + 0.12 \text{ pA}$ 18 $\mu\text{A/A} + 1.2 \text{ pA}$ 13 $\mu\text{A/A} + 0.01 \text{ nA}$ 12 $\mu\text{A/A} + 0.12 \text{ nA}$	Comparison to Fluke 5700A/03 Multifunction Calibrator Agilent 3458A Option 002 Multimeter



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measure	(10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	13 μ A/A + 0.5 nA 13 μ A/A + 3 nA 13 μ A/A + 0.03 μ A 23 μ A/A + 0.3 μ A 72 μ A/A + 6.6 μ A	Comparison to Agilent 3458A Multimeter
DC Current – Measure	(1 to 3) A (3 to 10) A	761 μ A/A + 462 μ A 1.1 mA/A + 614 μ A	Comparison to Fluke 8845A Multimeter
DC Current – Measure	(10 to 100) A	0.25 % of reading	Comparison to Agilent 3458A Option 002 Multimeter Empro Current Shunt
AC Voltage – Generate ¹	(0.22 to 2.2) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (2.2 to 22) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (22 to 220) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	457 μ V/V + 3.9 μ V 183 μ V/V + 3.9 μ V 91 μ V/V + 3.9 μ V 312 μ V/V + 3.9 μ V 723 μ V/V + 6.1 μ V 989 μ V/V + 11.4 μ V 1.4 mV/V + 23 μ V 3.7 mV/V + 30 μ V 457 μ V/V + 4.6 μ V 183 μ V/V + 4.6 μ V 91 μ V/V + 4.6 μ V 312 μ V/V + 4.6 μ V 723 μ V/V + 6.1 μ V 989 μ V/V + 11.4 μ V 1.4 mV/V + 23 μ V 3.7 mV/V + 30 μ V 457 μ V/V + 12 μ V 183 μ V/V + 7.6 μ V 84 μ V/V + 7.6 μ V 274 μ V/V + 7.6 μ V 685 μ V/V + 23 μ V 837 μ V/V + 23 μ V 1.4 mV/V + 30 μ V 2.7 mV/V + 76 μ V	Comparison to Fluke 5700A/03 Multifunction Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	220 mV to 2.2 V		Comparison to Fluke 5700A/03 Multifunction Calibrator
	(10 to 20) Hz	457 μ V/V + 8 μ V	
	(20 to 40) Hz	137 μ V/V + 23 μ V	
	40 Hz to 20 kHz	65 μ V/V + 5 μ V	
	(20 to 50) kHz	107 μ V/V + 15 μ V	
	(50 to 100) kHz	213 μ V/V + 61 μ V	
	(100 to 300) kHz	365 μ V/V + 114 μ V	
	(300 to 500) kHz	913 μ V /V + 304 μ V	
	500 kHz to 1 MHz	1.8 mV/V + 761 μ V	
	(2.2 to 22) V		
	(10 to 20) Hz	457 μ V/V + 761 μ V	
	(20 to 40) Hz	137 μ V/V + 228 μ V	
	40 Hz to 20 kHz	65 μ V/V + 54 μ V	
	(20 to 50) kHz	107 μ V/V + 152 μ V	
	(50 to 100) kHz	213 μ V/V + 304 μ V	
(100 to 300) kHz	457 μ V/V + 1294 μ V		
(300 to 500) kHz	1.1 mV/V + 3805 μ V		
500 kHz to 1 MHz	2.3 mV/V + 6848 μ V		
AC Voltage – Generate ¹	(22 to 220) V		Comparison to Fluke 5700A/03 Multifunction Calibrator, 5725A Amplifier
	(10 to 20) Hz	457 μ V/V + 7.6 mV	
	(20 to 40) Hz	137 μ V/V + 2.4 mV	
	40 Hz to 20 kHz	68 μ V/V + 1.0 mV	
	(20 to 50) kHz	190 μ V/V + 3.1 mV	
	(50 to 100) kHz	457 μ V/V + 7.6 mV	
	(220 to 750) V		
40 Hz to 1 kHz	68 μ V/V + 3 mV		
(1 to 20) kHz	126 μ V/V + 5 mV		
(20 to 50) kHz	457 μ V/V + 9 mV		
(50 to 100) kHz	1.8 mV/V + 34 mV		
AC Voltage – Generate ¹	(750 to 1 000) V		Comparison to Fluke 5700A Option 003 Multifunction Calibrator
	40 Hz to 1 kHz	68 μ V/V + 3 mV	
	(1 to 20) kHz	126 μ V/V + 5 mV	
	(20 to 30) kHz	457 μ V/V + 8 mV	
AC Voltage – Generate ¹ Wideband Absolute	(0.3 to 1.1) mV		Comparison to Fluke 5700A Option 003 Multifunction Calibrator
	(10 to 30 Hz)	0.65 % of output + 1.5 μ V	
	30 to 500 kHz	0.61% of output + 1.5 μ V	
	(0.5 to 1.2) MHz	0.63 % of output + 3.8 μ V	
	(1.2 to 2) MHz	0.63 % of output + 3.8 μ V	
	(2 to 12) MHz	0.68 % of output + 3.8 μ V	
	(12 to 20) MHz	0.76 % of output + 3.8 μ V	
(20 to 30) MHz	1.3 % of output + 13 μ V		



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(1.1 to 3.3) mV		Comparison to Fluke 5700A Option 003 Multifunction Calibrator
	(10 to 30 Hz)	0.58 % of output + 2.3 μV	
	30 Hz to 500 kHz	0.53 % of output + 2.3 μV	
	(0.5 to 1.2) MHz	0.54 % of output + 4.6 μV	
	(1.2 to 2) MHz	0.54 % of output + 4.6 μV	
	(2 to 12) MHz	0.58 % of output + 4.6 μV	
	(12 to 20) MHz	0.65 % of output + 4.6 μV	
	(20 to 30) MHz	1.3 % of output + 4.6 μV	
	(3.3 to 11) mV		
	(10 to 30 Hz)	0.58 % of output + 6.1 μV	
	30 Hz to 500 kHz	0.53 % of output + 6.1 μV	
	(0.5 to 1.2) MHz	0.54 % of output + 8.4 μV	
	(1.2 to 2) MHz	0.54 % of output + 8.4 μV	
	(2 to 12) MHz	0.55 % of output + 8.4 μV	
	(12 to 20) MHz	0.61 % of output + 8.4 μV	
	(20 to 30) MHz	0.93 % of output + 8.4 μV	
	(11 to 33) mV		
	(10 to 30 Hz)	0.52 % of output + 12 μV	
	30 Hz to 500 kHz	0.46 % of output + 12 μV	
	(0.5 to 1.2) MHz	0.47 % of output + 14 μV	
	(1.2 to 2) MHz	0.47 % of output + 14 μV	
	(2 to 12) MHz	0.49 % of output + 14 μV	
	(12 to 20) MHz	0.55 % of output + 14 μV	
	(20 to 30) MHz	0.89 % of output + 14 μV	
	(33 to 110) mV		
	(10 to 30 Hz)	0.52 % of output + 30 μV	
	30 Hz to 500 kHz	0.46 % of output + 30 μV	
	(0.5 to 1.2) MHz	0.47 % of output + 33 μV	
	(1.2 to 2) MHz	0.47 % of output + 33 μV	
	(2 to 12) MHz	0.49 % of output + 33 μV	
(12 to 20) MHz	0.55 % of output + 33 μV		
(20 to 30) MHz	0.89 % of output + 33 μV		
(110 to 330) mV			
(10 to 30 Hz)	0.45 % of output + 0.1 mV		
30 Hz to 500 kHz	0.38 % of output + 0.1 mV		
(0.5 to 1.2) MHz	0.4 % of output + 0.1 mV		
(1.2 to 2) MHz	0.4 % of output + 0.1 mV		
(2 to 12) MHz	0.42 % of output + 0.1 mV		
(12 to 20) MHz	0.49 % of output + 0.1 mV		
(20 to 30) MHz	0.85 % of output + 0.1 mV		



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Electrical – DC/Low Frequency

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(0.33 to 1.1) V		Comparison to Fluke 5700A Multifunction Calibrator Option 003
	(10 to 30 Hz)	0.45 % of output + 0.3 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.3 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.3 mV	
	(1.2 to 2) MHz	0.4 % of output + 0.3 mV	
	(2 to 12) MHz	0.42 % of output + 0.3 mV	
	(12 to 20) MHz	0.49 % of output + 0.3 mV	
	(20 to 30) MHz	0.85 % of output + 0.3 mV	
	(1.1 to 3.5) V		
	(10 to 30 Hz)	0.39 % of output + 0.4 mV	
	30 Hz to 500 kHz	0.3 % of output + 0.4 mV	
	(0.5 to 1.2) MHz	0.32 % of output + 0.4 mV	
	(1.2 to 2) MHz	0.32 % of output + 0.4 mV	
	(2 to 12) MHz	0.35 % of output + 0.4 mV	
(12 to 20) MHz	0.44 % of output + 0.4 mV		
(20 to 30) MHz	0.82 % of output + 0.4 mV		
AC Voltage – Measure ¹	(1 to 10) mV		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.02 % of reading + 2.0 μV	
	40 Hz to 1 kHz	0.013 % of reading + 0.7 μV	
	(1 to 20) kHz	0.02 % of reading + 0.7 μV	
	(20 to 50) kHz	0.065 % of reading + 0.7 μV	
	(50 to 100) kHz	0.33 % of reading + 0.7 μV	
	100 kHz to 1 MHz	0.78 % of reading + 3.3 μV	
	(1 to 4) MHz	4.6 % of reading + 4.6 μV	
	(4 to 8) MHz	13 % of reading + 5.3 μV	
	(10 to 100) mV		
	(1 to 40) Hz	0.005 % of reading + 2.6 μV	
	40 Hz to 1 kHz	0.005 % of reading + 1.3 μV	
	(1 to 20) kHz	0.009 % of reading + 1.3 μV	
	(20 to 50) kHz	0.02 % of reading + 1.3 μV	
	(50 to 100) kHz	0.052 % of reading + 1.3 μV	
	(100 to 300) kHz	0.2 % of reading + 6.5 μV	
	300 kHz to 1 MHz	0.7 % of reading + 6.5 μV	
	(1 to 2) MHz	0.98 % of reading + 46 μV	
(2 to 4) MHz	2.6 % of reading + 46 μV		
(4 to 8) MHz	2.6 % of reading + 52 μV		
(8 to 10) MHz	9.8 % of reading + 65 μV		



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Electrical – DC/Low Frequency

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	100 mV to 1 V		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.005 % of reading + 26 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 13 μ V	
	(1 to 20) kHz	0.009 % of reading + 13 μ V	
	(20 to 50) kHz	0.02 % of reading + 13 μ V	
	(50 to 100) kHz	0.052 % of reading + 13 μ V	
	(100 to 300) kHz	0.2 % of reading + 65 μ V	
	300 kHz to 1 MHz	0.65 % of reading + 65 μ V	
	(1 to 2) MHz	0.98 % of reading + 0.5 mV	
	(2 to 4) MHz	2.6 % of reading + 0.5 mV	
	(4 to 8) MHz	2.6 % of reading + 0.5 mV	
	(8 to 10) MHz	9.8 % of reading + 0.7 mV	
	(1 to 10) V		
	(1 to 40) Hz	0.005 % of reading + 0.3 mV	
	40 Hz to 1 kHz	0.005 % of reading + 0.1 mV	
	(1 to 20) kHz	0.009 % of reading + 0.1 mV	
	(20 to 50) kHz	0.02 % of reading + 0.1 mV	
	(50 to 100) kHz	0.052 % of reading + 0.1 mV	
	(100 to 300) kHz	0.2 % of reading + 0.7 mV	
	300 kHz to 1 MHz	0.65 % of reading + 0.7 mV	
	(1 to 2) MHz	0.98 % of reading + 4.6 mV	
	(2 to 4) MHz	2.6 % of reading + 4.6 mV	
	(4 to 8) MHz	2.6 % of reading + 5.2 mV	
	(8 to 10) MHz	9.8 % of reading + 6.5 mV	
	(10 to 100) V		
	(1 to 40) Hz	0.013 % of reading + 2.6 mV	
	40 Hz to 1 kHz	0.013 % of reading + 1.3 mV	
(1 to 20) kHz	0.013 % of reading + 1.3 mV		
(20 to 50) kHz	0.023 % of reading + 1.3 mV		
(50 to 100) kHz	0.08 % of reading + 1.3 mV		
(100 to 300) kHz	0.26 % of reading + 6.5 mV		
300 kHz to 1 MHz	0.98 % of reading + 6.5 mV		
(100 to 700) V			
(1 to 40) Hz	0.026 % of reading + 26 mV		
40 Hz to 1 kHz	0.026 % of reading + 13 mV		
(1 to 20) kHz	0.039 % of reading + 13 mV		
(20 to 50) kHz	0.078 % of reading + 13 mV		
(50 to 100) kHz	0.2 % of reading + 13 mV		
AC Voltage – Measure ¹	(60) Hz		Comparison to Ross VD60 High Voltage Divider
	(1 to 10) kV	0.5 % of reading + 0.002 kV	
	(10 to 42) kV	0.5 % of reading + 0.02 kV	

Electrical – DC/Low Frequency

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate ¹	(9 to 220) μ A (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (0.22 to 2.2) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (2.2 to 22) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (22 to 220) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz	228 μ A/A + 15 nA 152 μ A/A + 10 nA 107 μ A/A + 8 nA 266 μ A/A + 12 nA 989 μ A/A + 61 nA 228 μ A/A + 39 nA 152 μ A/A + 31 nA 107 μ A/A + 31 nA 183 μ A/A + 99 nA 989 μ A/A + 609 nA 228 μ A/A + 385 nA 152 μ A/A + 310 nA 107 μ A/A + 310 nA 183 μ A/A + 536 nA 989 μ A/A + 4.6 μ A 228 μ A/A + 4 μ A 152 μ A/A + 3 μ A 107 μ A/A + 2 μ A 183 μ A/A + 3 μ A	Comparison to Fluke 5700A/03 Multifunction Calibrator
AC Current – Generate ¹	(22 to 220) mA (5 to 10) kHz (0.22 to 2.2) A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	989 μ A/A + 9 μ A 243 μ A/A + 31 μ A 380 μ A/A + 76 μ A 6.1 mA/A + 152 μ A	Comparison to Fluke 5700A/03 Multifunction Calibrator
AC Current – Generate ¹	(0.22 to 1.2) A (3 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (1.2 to 3.1) A (3 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz	0.019 % of output + 0.08 mA 0.019 % of output + 0.04 mA 0.019 % of output + 0.06 mA 0.19 % of output + 0.23 mA 0.38 % of output + 0.23 mA 0.029 % of output + 0.4 mA 0.023 % of output + 0.27 mA 0.029 % of output + 0.27 mA 0.19 % of output + 0.4 mA	Comparison to Fluke 5522A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate ¹	(3.1 to 12) A (3 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (3 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz	0.029 % of output + 0.8 mA 0.023 % of output + 0.4 mA 0.029 % of output + 0.6 mA 0.19 % of output + 0.8 mA 0.076 % of output + 7.7 mA 0.053 % of output + 6.2 mA 0.038 % of output + 6.2 mA	Comparison to Fluke 5522A Multiproduct Calibrator
AC Current – Generate ¹ Clamp Meters	(1.2 to 30) A (10 to 440) Hz (30 to 120) A (10 to 440) Hz (120 to 200) A 10 to 440 Hz	0.2 % of output + 0.005 A 0.20 % of output + 0.008 A 0.21 % of output + 0.076 A	Comparison to Fluke 5560A Multiproduct Calibrator / 9100-200 x10 Coil
AC Current – Generate ¹ Clamp Meters	(6 to 150) A (10 to 100) Hz (150 to 600) A (10 to 100) Hz (600 to 1 000) A (10 to 100) Hz	0.2 % of output + 0.02 A 0.2 % of output + 0.04 A 0.21 % of output + 0.31 A	Comparison to Fluke 5560A Multiproduct Calibrator / 9100-200 x50 Coil
AC Current – Measure ¹	(5 to 100) μ A (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz (0.1 to 1) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 0.02 μ A 0.1 % of reading + 0.02 μ A 0.04 % of reading + 0.02 μ A 0.26 % of reading + 0.13 μ A 0.1 % of reading + 0.13 μ A 0.04 % of reading + 0.13 μ A 0.02 % of reading + 0.13 μ A 0.26 % of reading + 1.3 μ A 0.1 % of reading + 1.3 μ A 0.04 % of reading + 1.3 μ A 0.02 % of reading + 1.3 μ A 0.26 % of reading + 13 μ A 0.1 % of reading + 13 μ A 0.04 % of reading + 13 μ A 0.02 % of reading + 13 μ A	Comparison to Agilent 3458A Multimeter

Electrical – DC/Low Frequency

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(0.1 to 1) A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 0.13 mA 0.1 % of reading + 0.13 mA 0.04 % of reading + 0.13 mA 0.02 % of reading + 0.13 mA	Comparison to Agilent 3458A Multimeter
AC Current – Measure ¹	(1 to 3) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz (5 to 10) kHz (3 to 10) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz (5 to 10) kHz	0.84 % of reading + 1.4 mA 0.27 % of reading + 1.4 mA 0.11 % of reading + 1.4 mA 0.27 % of reading + 16 mA 0.84 % of reading + 4.6 mA 0.27 % of reading + 4.6 mA 0.11 % of reading + 4.6 mA 0.27 % of reading + 53 mA	Comparison to Fluke 8845A Multimeter
AC Current – Measure ¹	(10 to 1 000) A (10 to 100) Hz (100 to 500) Hz	1.5 % of reading + 1A 1.9 % of reading + 1A	Comparison to Fluke 376 Clamp Meter
AC Current – Measure ¹	(100 to 2 500) A (10 to 500) Hz	2.3 % of reading + 5A	Comparison to Fluke 376 Clamp Meter W/i2500 flex probe
Resistance – Generate ¹	Up to 12 Ω (12 to 120) Ω (0.12 to 1.20) kΩ (1.2 to 12.0) kΩ (12 to 120) kΩ (0.12 to 1.2) MΩ (1.2 to 12) MΩ (12 to 120) MΩ (120 to 1 200) MΩ	19 μΩ/Ω + 0.001 Ω 19 μΩ/Ω + 0.001 Ω 19 μΩ/Ω + 0.002 Ω 19 μΩ/Ω + 0.02 Ω 19 μΩ/Ω + 0.2 Ω 19 μΩ/Ω + 2.0Ω 27 μΩ/Ω + 24 Ω 0.33 mΩ/Ω + 2 kΩ 3 mΩ/Ω + 76 Ω	Comparison to Fluke 5560A Multiproduct Calibrator
Resistance – Generate ¹ Fixed Points	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9) kΩ (10, 19) kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ	84 μΩ/Ω + 0.1 μΩ 25 μΩ/Ω + 1 μΩ 15 μΩ/Ω + 6 μΩ 11 μΩ/Ω + 60 μΩ 11 μΩ/Ω + 0.6 mΩ 12 μΩ/Ω + 6 mΩ 12 μΩ/Ω + 6 mΩ 18 μΩ/Ω + 60 mΩ 18 μΩ/Ω + 60 mΩ	Comparison to Fluke 5700A Multifunction Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Generate ¹ Fixed Points	10 MΩ 19 MΩ 100 MΩ	35 μΩ/Ω + 0.6Ω 42 μΩ/Ω + 0.6Ω 99 μΩ/Ω + 6Ω	Comparison to Fluke 5700A Multifunction Calibrator
Resistance – Generate ¹ Fixed Points	100 V 100 kΩ (100 to 1 000) V 1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ	1 % of output 1 % of output 1 % of output 1 % of output 1 % of output 1.2 % of output	Comparison to TMI RB Resistance Standard
Resistance – Measure	Up to 12 Ω (10 to 120) Ω (0.1 to 1.2) kΩ (1 to 12) kΩ (10 to 120) kΩ (0.1 to 1.2) MΩ (1 to 12) MΩ (10 to 120) MΩ (0.1 to 1.2) GΩ	9.8 μΩ/Ω + 38 μΩ 7.8 μΩ/Ω + 0.3 mΩ 6.5 μΩ/Ω + 0.4 mΩ 6.5 μΩ/Ω + 3.8 mΩ 6.5 μΩ/Ω + 38 mΩ 9.8 μΩ/Ω + 1.5 Ω 33 μΩ/Ω + 100 Ω 327 μΩ/Ω + 1 kΩ 0.33 % of reading + 70 kΩ	Comparison to Agilent 3458A Multimeter
Electrical Calibration of Thermocouple Indicating Devices ¹	Type B (600 to 800) °C (800 to 1 000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C Type C (0 to 150) °C (150 to 650) °C (650 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 315) °C Type D (0 to 150) °C (150 to 650) °C (650 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 315) °C	0.33 °C 0.26 °C 0.23 °C 0.25 °C 0.19 °C 0.16 °C 0.2 °C 0.34 °C 0.60 °C 0.19 °C 0.16 °C 0.2 °C 0.33 °C 0.59 °C	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicating Devices ¹	Type E		Comparison to Fluke 5560A Multiproduct Calibrator
	(-250 to -150) °C	0.3 °C	
	(-150 to -25) °C	0.11 °C	
	(-25 to 350) °C	0.08 °C	
	(350 to 650) °C	0.12 °C	
	(650 to 1 000) °C	0.16 °C	
	Type G		
	(0 to 150) °C	0.38 °C	
	(150 to 650) °C	0.25 °C	
	(650 to 1 000) °C	0.2 °C	
	(1 000 to 1 800) °C	0.33 °C	
	(1 800 to 2 315) °C	0.59 °C	
	Type J		
	(-210 to -100) °C	0.18 °C	
	(-100 to -30) °C	0.1 °C	
	(-30 to 150) °C	0.08 °C	
	(150 to 760) °C	0.11 °C	
	(760 to 1 200) °C	0.15 °C	
	Type K		
	(-200 to -100) °C	0.21 °C	
	(-100 to -25) °C	0.1 °C	
	(-25 to 120) °C	0.08 °C	
	(120 to 1 000) °C	0.16 °C	
	(1 000 to 1 372) °C	0.27 °C	
Type L			
(-200 to -100) °C	0.24 °C		
(-100 to 800) °C	0.15 °C		
(800 to 900) °C	0.08 °C		
Type N			
(-200 to -100) °C	0.25 °C		
(-100 to -25) °C	0.11 °C		
(-25 to 120) °C	0.09 °C		
(120 to 410) °C	0.08 °C		
(410 to 1 300) °C	0.15 °C		
Type R			
(0 to 250) °C	0.39 °C		
(250 to 400) °C	0.22 °C		
(400 to 1 000) °C	0.21 °C		
(1 000 to 1 767) °C	0.26 °C		

Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicating Devices ¹	Type S (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600) °C Type BP (0 to 1000) °C (1 000 to 2 000) °C (2 000 to 2 500) °C Type XK (-200 to 300) °C (300 to 800) °C	0.32 °C 0.24 °C 0.24 °C 0.31 °C 0.46 °C 0.16 °C 0.1 °C 0.08 °C 0.3 °C 0.08 °C 0.3 °C 0.46 °C 0.61 °C 0.15 °C 0.23 °C	Comparison to Fluke 5560A Multiproduct Calibrator
Electrical Calibration of RTD Indicators ¹	Cu 10 (427) (-80 to 260) °C Cu 50 (428) (-180 to 200) °C Cu 100 (428) (-180 to -40) °C (-40 to 200) °C Ni 120 (672) (-80 to 0) °C (0 to 100) °C (100 to 260) °C Pt 100 (385) (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.23 °C 0.3 °C 0.3 °C 0.49 °C 0.06 °C 0.06 °C 0.11 °C 0.04 °C 0.04 °C 0.05 °C 0.07 °C 0.08 °C 0.09 °C 0.18 °C	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicators ¹	Pt 100 (3916)		Comparison to Fluke 5560A Multiproduct Calibrator
	(-200 to -190) °C	0.19 °C	
	(-190 to -80) °C	0.03 °C	
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 260) °C	0.05 °C	
	(260 to 300) °C	0.06 °C	
	(300 to 400) °C	0.07 °C	
	(400 to 600) °C	0.08 °C	
	(600 to 630) °C	0.18 °C	
	Pt 100 (3926)		
	(-200 to -80) °C	0.04 °C	
	(-80 to 0) °C	0.04 °C	
	(0 to 100) °C	0.05 °C	
	(100 to 300) °C	0.07 °C	
	(300 to 400) °C	0.08 °C	
	(400 to 630) °C	0.09 °C	
	Pt 200 (385)		
	(-200 to -80) °C	0.03 °C	
	(-80 to 0) °C	0.03 °C	
	(0 to 100) °C	0.03 °C	
	(100 to 260) °C	0.04 °C	
	(260 to 300) °C	0.09 °C	
	(300 to 400) °C	0.1 °C	
	(400 to 600) °C	0.11 °C	
	(600 to 630) °C	0.12 °C	
	Pt 500 (385)		
	(-200 to -80) °C	0.03 °C	
(-80 to 0) °C	0.04 °C		
(0 to 100) °C	0.04 °C		
(100 to 260) °C	0.05 °C		
(260 to 300) °C	0.06 °C		
(300 to 400) °C	0.06 °C		
(400 to 600) °C	0.07 °C		
(600 to 630) °C	0.08 °C		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicators ¹	Pt 1000 (385) (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	0.02 °C 0.02 °C 0.03 °C 0.04 °C 0.05 °C 0.05 °C 0.05 °C 0.18 °C	Comparison to Fluke 5560A Multiproduct Calibrator
Capacitance – Generate ¹	(0.2 to 1.2) nF (1.2 to 12.0) nF (12 to 120.0) nF (0.12 to 1.2) µF (1.2 to 12.0) µF (12 to 120.0) µF (0.12 to 1.2) mF (1.2 to 12.0) mF (12 to 120.0) mF	0.09 % of output + 1.5 pF 0.09 % of output + 0.004 nF 0.10 % of output + 0.023 nF 0.10 % of output + 0.23 nF 0.10 % of output + 2.3 nF 0.11 % of output + 19 nF 0.19 % of output + 190 nF 0.19 % of output + 2.3 µF 0.38 % of output + 23 µF	Comparison to Fluke 5560A Multiproduct Calibrator
Inductance – Generate ¹	(13 to 120.0) µH (0.12 to 1.2) mH (1.2 to 12.0) mH (12 to 120.0) mH (0.12 to 1.2) H (1.2 to 12.0) H (12 to 120.0) H	0.15 % of output + 0.15 µH 0.09 % of output + 0.76 µH 0.09 % of output + 7.6 µH 0.09 % of output + 76 µH 0.11 % of output + 0.76 mH 0.15 % of output + 7.6 mH 0.19 % of output + 76 mH	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (12 to 120) mV Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz	0.022 % of Output + 0.1 µW 0.022 % of Output + 0.1 µW 0.022 % of Output + 0.1 µW 0.12 % of Output + 0.1 µW 0.022 % of Output + 1.1 µW 0.016 % of Output + 0.7 µW 0.022 % of Output + 0.9 µW 0.12 % of Output + 1.1 µW 0.022 % of Output + 11 µW 0.022 % of Output + 7.2 µW 0.022 % of Output + 9.2 µW 0.19 % of Output + 28 µW	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (12 to 120) mV Power Factor = 1	(1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.03 % of Output + 48 μW 0.025 % of Output + 31 μW 0.03 % of Output + 31 μW 0.19 % of Output + 48 μW 0.03 % of Output + 107 μW 0.025 % of Output + 72 μW 0.030 % of Output + 92 μW 0.19 % of Output + 107 μW 0.077 % of Output + 0.92 mW 0.054 % of Output + 0.74 mW 0.38 % of Output + 0.74 mW	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (0.12 to 1.2) V Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz	0.022 % of Output + 0.9 μW 0.022 % of Output + 0.9 μW 0.022 % of Output + 0.9 μW 0.12 % of Output + 0.9 μW 0.022 % of Output + 9.2 μW 0.016 % of Output + 4.7 μW 0.022 % of Output + 7.4 μW 0.12 % of Output + 9.2 μW 0.022 % of Output + 92 μW 0.022 % of Output + 47 μW 0.022 % of Output + 74 μW 0.19 % of Output + 0.27 mW 0.03 % of Output + 0.46 mW 0.025 % of Output + 0.27 mW 0.03 % of Output + 0.27 mW 0.19 % of Output + 0.46 mW 0.03 % of Output + 0.92 mW 0.025 % of Output + 0.47 mW 0.03 % of Output + 0.74 mW 0.19 % of Output + 0.92 mW	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (0.12 to 1.2) V Power Factor = 1	(12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.077 % of Output + 9.1 mW 0.054 % of Output + 7.3 mW 0.38 % of Output + 7.3 mW	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (1.2 to 12) V Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.022 % of Output + 9.2 μW 0.022 % of Output + 9.2 μW 0.022 % of Output + 9.2 μW 0.12 % of Output + 9.2 μW 0.022 % of Output + 92 μW 0.016 % of Output + 46 μW 0.022 % of Output + 74 μW 0.12 % of Output + 92 μW 0.022 % of Output + 0.92 mW 0.022 % of Output + 0.46 mW 0.022 % of Output + 0.74 mW 0.19 % of Output + 2.7 mW 0.03 % of Output + 4.6 mW 0.025 % of Output + 2.7 mW 0.03 % of Output + 2.7 mW 0.19 % of Output + 4.6 mW 0.03 % of Output + 9.2 mW 0.025 % of Output + 4.6 mW 0.03 % of Output + 7.4 mW 0.19 % of Output + 9.2 mW 0.077 % of Output + 91 mW 0.054 % of Output + 73 mW 0.38 % of Output + 73 mW	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (12 to 120) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 92 μW	
	(40 to 1 000) Hz	0.022 % of Output + 92 μW	
	(1 to 5) kHz	0.022 % of Output + 92 μW	
	(5 to 10) kHz	0.12 % of Output + 92 μW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 0.92 mW	
	(40 to 1 000) Hz	0.016 % of Output + 0.46 mW	
	(1 to 5) kHz	0.022 % of Output + 0.74 mW	
	(5 to 10) kHz	0.12 % of Output + 0.92 mW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 9.2 mW	
	(40 to 1 000) Hz	0.022 % of Output + 4.6 mW	
	(1 to 5) kHz	0.022 % of Output + 7.4 mW	
	(5 to 10) kHz	0.19 % of Output + 27 mW	
	(1.2 to 3.1) A		
(10 to 40) Hz	0.03 % of Output + 46 mW		
(40 to 1 000) Hz	0.025 % of Output + 27 mW		
(1 to 5) kHz	0.03 % of Output + 27 mW		
(5 to 10) kHz	0.19% of Output + 46 mW		
(3.1 to 12) A			
(10 to 40) Hz	0.03 % of Output + 92 mW		
(40 to 1 000) Hz	0.025 % of Output + 46 mW		
(1 to 5) kHz	0.03 % of Output + 74 mW		
(5 to 10) kHz	0.19 % of Output + 92 mW		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 0.91 W		
(40 to 1 000) Hz	0.054 % of Output + 0.73 W		
(1 to 5) kHz	0.38 % of Output + 0.73 W		
AC Power – Generate ¹ (120 to 330) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 0.26 mW	
	(40 to 1 000) Hz	0.022 % of Output + 0.26 mW	
	(1 to 5) kHz	0.022 % of Output + 0.26 mW	
	(5 to 10) kHz	0.12 % of Output + 0.26 mW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 2.6 mW	
	(40 to 1 000) Hz	0.016 % of Output + 1.5 mW	
	(1 to 5) kHz	0.022 % of Output + 2.1 mW	
	(5 to 10) kHz	0.12 % of Output + 2.6 mW	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (120 to 330) V Power Factor = 1	(0.12 to 1.2) A (10 to 40) Hz (40 to 10 00) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.022 % of Output + 26 mW 0.022 % of Output + 15 mW 0.022 % of Output + 21 mW 0.19 % of Output + 76 mW 0.03 % of Output + 0.13 W 0.025 % of Output + 0.08 W 0.03 % of Output + 0.08 W 0.19 % of Output + 0.13 W 0.03 % of Output + 0.26 W 0.025 % of Output + 0.15 W 0.03 % of Output + 0.21 W 0.19 % of Output + 0.26 W 0.077 % of Output + 2.5 W 0.054 % of Output + 2.0 W 0.38 % of Output + 2.0 W	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (330 to 1020) V Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz	0.022 % of Output + 1.1 mW 0.022 % of Output + 1.1 mW 0.022 % of Output + 1.1 mW 0.12 % of Output + 1.1 mW 0.022 % of Output + 11 mW 0.016 % of Output + 8.3 mW 0.022 % of Output + 9.6 mW 0.12 % of Output + 11 mW 0.022 % of Output + 107 mW 0.022 % of Output + 83 mW 0.022 % of Output + 96 mW 0.19 % of Output + 244 mW 0.03 % of Output + 0.43 W 0.025 % of Output + 0.30 W 0.03 % of Output + 0.30 W 0.19 % of Output + 0.43 W	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (330 to 1020) V Power Factor = 1	(3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.03 % of Output + 1.1 W 0.025 % of Output + 0.8 W 0.03 % of Output + 1.0 W 0.19 % of Output + 1.1 W 0.077 % of Output + 8.0 W 0.054 % of Output + 6.5 W 0.38 % of Output + 6.5 W	Comparison to Fluke 5560A Multiproduct Calibrator
Phase Angle – Generate ¹	(-180 to 180)° (10 to 65) Hz (65 to 500) Hz 500 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz	0.08° 0.19° 0.38° 1.9° 3.8° 7.6°	Comparison to Fluke 5560A Multiproduct Calibrator
Oscilloscopes Calibration – Generate ¹ Voltage DC - 50Ω DC - 1MΩ Square Wave 10 Hz to 10 kHz - 50Ω Square Wave 10 Hz to 1 kHz – 1 MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 6.6) V (1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V (1 to 24.999) mVpp (25 to 109.99) mVpp (110mV to 2.199 9) Vpp (2.2 to 6.6) Vpp (1 to 24.999) mV (25 to 109.99) mV (110mV to 2.199 9) V (2.2 to 10.999) V (11 to 130) V	0.19 % of Output + 31 μV 0.19 % of Output + 36 μV 0.19 % of Output + 87 μV 0.19 % of Output + 0.6 mV 0.019 % of reading + 20 μV 0.019 % of reading + 25 μV 0.019 % of reading + 76 μV 0.019 % of reading + 0.6 mV 0.019 % of reading + 6 mV 0.19 % of Output + 31 μV 0.19 % of Output + 36 μV 0.19 % of Output + 87 μV 0.19 % of Output + 0.6 mV 0.038 % of reading + 4 μV 0.038 % of reading + 9 μV 0.038 % of reading + 60 μV 0.038 % of reading + 0.6 mV 0.038 % of reading + 6 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration – Generate ¹ Square Wave 1 to 10 kHz – 1 MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.199 9) V (2.2 to 10.999) V (11 to 130) V	0.19 % of reading + 31 μV 0.19 % of reading + 36 μV 0.19 % of reading + 87 μV 0.19 % of reading + 0.6 mV 0.19 % of reading + 6 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth (5 to 50) mVpp 50 kHz to 100) MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 16 00) MHz (1 600 to 2 100) MHz 50 mV to 3.5 Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 16 00) MHz (1 600 to 2 100) MHz (3.5 to 5) Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz	0.34 dB 0.36 dB 0.42 dB 0.46 dB 0.5 dB 0.56 dB 0.24 dB 0.24 dB 0.32 dB 0.34 dB 0.4 dB 0.44 dB 0.24 dB 0.24 dB 0.32 dB 0.34 dB	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness	3 dB Bandwidth 50 mV to 3.5Vpp (2 100 to 4 000) MHz (4 000 to 8 000) MHz (8 000 to 18 000) MHz	0.25 dB 0.35 dB 0.46 dB	Comparison to EPM Power Meter w/ E Series Power Sensors
Oscilloscopes Calibration – Generate ¹ Time Marker	500 ps to 20 ms 50 ms to 5 s	0.25 μs/s 1.9 μs/s + 3.8 μHz	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Measure ¹ Input Impedance Resistance Leakage	(40 to 60) Ω 500 kΩ to 1.5MΩ (0 to 5.99) V	0.08 % of reading 0.08 % of reading 0.038 % of reading + 0.8 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Flatness – Measure ¹	9 kHz to 2 000MHz		Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.1 dB	
	(-30 to -40) dBm	0.11 dB	
	(-40 to -42) dBm	0.12 dB	
	(2 to 14) GHz		
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.09 dB	
	(-30 to -40) dBm	0.1 dB	
	(-40 to -42) dBm	0.11 dB	
	(14 to 18) GHz		
	(20 to -10) dBm	0.11 dB	
(-10 to -30) dBm	0.12 dB		
(-30 to -40) dBm	0.12 dB		
(-40 to -42) dBm	0.13 dB		
RF Power – Measure ¹	9 kHz to 14 000 MHz		Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(20 to 0) dB	0.13 dB	
	(0 to -40) dB	0.15 dB	
	(-40 to -50) dB	0.34 dB	
	(-50 to -55) dB	0.93 dB	
	(14 000 to 18 000) MHz		
	(20 to 0) dB	0.12 dB	
	(0 to -40) dB	0.15 dB	
(-40 to -50) dB	0.34 dB		
(-50 to -55) dB	0.93 dB		
RF Power – Measure ¹	100 kHz to 30 MHz		Comparison to Agilent N5531S Measuring Receiver N1912A w/E9304A Power Sensor
	(20 to 0) dB	0.12 dB	
	(0 to -58) dB	0.13 dB	
	(-58 to -78) dB	0.15 dB	
	(-78 to -110) dB	0.18 dB	
	(-110 to -115) dB	0.21 dB	
	(-115 to -120) dB	0.28 dB	
	(-120 to -125) dB	0.43 dB	



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RF Power – Measure ¹	(30 to 2 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor
	(30 to 20) dB	0.36 dB	
	(20 to 0) dB	0.2 dB	
	(0 to -58) dB	0.22 dB	
	(-58 to -78) dB	0.23 dB	
	(-78 to -110) dB	0.25 dB	
	(-110 to -115) dB	0.27 dB	
	(-115 to -120) dB	0.33 dB	
	(-120 to -125) dB	0.46 dB	
	(2 000 to 3 050) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.31 dB	
	(-58 to -78) dB	0.32 dB	
	(-78 to -110) dB	0.34 dB	
	(-110 to -115) dB	0.35 dB	
	(-115 to -120) dB	0.4 dB	
	(-120 to -125) dB	0.51 dB	
	(3 050 to 6 600) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.31 dB	
	(-58 to -78) dB	0.32 dB	
	(-78 to -110) dB	0.34 dB	
	(-110 to -115) dB	0.38 dB	
	(-115 to -120) dB	0.48 dB	
	(-120 to -125) dB	0.64 dB	
	(6 600 to 13 200) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
(0 to -58) dB	0.31 dB		
(-58 to -78) dB	0.32 dB		
(-78 to -100) dB	0.34 dB		
(-100 to -105) dB	0.37 dB		
(-105 to -110) dB	0.45 dB		
(-110 to -115) dB	0.6 dB		
(-115 to -120) dB	0.82 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(13 200 to 18 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.31 dB	
	(-58 to -78) dB	0.32 dB	
	(-78 to -90) dB	0.33 dB	
	(-90 to -95) dB	0.35 dB	
	(-95 to -100) dB	0.41 dB	
	(-100 to -105) dB	0.53 dB	
	(-105 to -110) dB	0.72 dB	
	(18 000 to 19 200) MHz		
	(30 to 20) dB	0.48 dB	
	(20 to 0) dB	0.38 dB	
	(0 to -58) dB	0.39 dB	
	(-58 to -78) dB	0.4 dB	
	(-78 to -90) dB	0.41 dB	
	(-90 to -95) dB	0.42 dB	
	(-95 to -100) dB	0.47 dB	
	(-100 to -105) dB	0.58 dB	
	(-105 to -110) dB	0.75 dB	
	(19 200 to 26 500) MHz		
	(30 to 20) dB	0.48 dB	
	(20 to 0) dB	0.38 dB	
	(0 to -58) dB	0.39 dB	
	(-58 to -78) dB	0.4 dB	
	(-78 to -90) dB	0.43 dB	
	(-90 to -95) dB	0.50 dB	
(-95 to -100) dB	0.63 dB		
(-100 to -105) dB	0.84 dB		
(-105 to -110) dB	1.1 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Attenuation – Measure ¹	100 kHz to 3 050 MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.13 dB	
	(110 to 120) dB	0.26 dB	
	(3 050 to 6 600) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
(100 to 110) dB	0.15 dB		
(110 to 120) dB	0.37 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Attenuation – Measure ¹	(6 600 to 13 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.14 dB	
	(100 to 110) dB	0.34 dB	
	(110 to 120) dB	0.77 dB	
	(13 200 to 19 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.27 dB	
	(100 to 110) dB	0.66 dB	
	(19 200 to 26 500) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
(40 to 50) dB	0.04 dB		
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.12 dB		
(80 to 90) dB	0.2 dB		
(90 to 100) dB	0.5 dB		
(100 to 110) dB	1.1 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – Measure ¹	100 kHz to 10 MHz Rate 50 Hz to 10 kHz (5 to 99) % Depth 10 MHz to 3 GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth (3 to 26.5) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth	0.75 % of reading + 0.3 digits 2.5 % of reading + 0.4 digits 1.5 % of reading + 0.4 digits 4.5 % of reading + 0.4 digits 1.5 % of reading + 0.4 digits	Comparison to Agilent N5531S Measuring Receiver
Frequency Modulation – Measure ¹ β = deviation / rate	250 kHz to 10 MHz Rates 20 Hz to 10 kHz Peak Dev 200 to 40KHz 10 MHz to 6.6 GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400KHz (6.6 to 13.2) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400KHz (13.2 to 26.5) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400KHz	$\beta > 0.2$ - 1.5 % of reading + 2 Hz $\beta > 1.2$ - 1 % of reading + 2 Hz $\beta > 0.2$ - 1.5 % of reading + 2 Hz $\beta > 0.45$ - 1 % of reading + 2 Hz $\beta > 0.2$ - 2.5 % of reading + 4 Hz $\beta > 8.0$ - 1 % of reading + 4 Hz $\beta > 0.2$ - 3.8 % of reading + 9 Hz $\beta > 16$ - 1 % of reading + 9 Hz	Comparison to Agilent N5531S Measuring Receiver
Phase Modulation – Measure ¹	100 kHz to 6.6 GHz Deviations > 0.3 rad Deviations > 0.7 rad (6.6 to 13.2) GHz Deviations > 0.6 rad Deviations > 2.0 rad (13.2 to 26.5) GHz Deviations: > 1.2 rad Deviations > 4.0 rad	3 % of reading + 0.002 rad 1 % of reading + 0.002 rad 3 % of reading + 0.005 rad 1 % of reading + 0.005 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad	Comparison to Agilent N5531S Measuring Receiver
RF Power – Generate	(30 to 2 000) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB	0.26 dB 0.28 dB 0.29 dB 0.3 dB 0.37 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor, 83630B Signal Generator



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RF Power – Generate	(2 000 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor, 83630B Signal Generator
	(20 to 0) dB	0.37 dB	
	(0 to -58) dB	0.38 dB	
	(-58 to -78) dB	0.38 dB	
	(-78 to -110) dB	0.4 dB	
	(-110 to -120) dB	0.52 dB	
	(3 050 to 6 600) MHz		
	(20 to 0) dB	0.37 dB	
	(0 to -58) dB	0.38 dB	
	(-58 to -78) dB	0.38 dB	
	(-78 to -110) dB	0.4 dB	
	(-110 to -120) dB	0.52 dB	
	(6 600 to 13 200) MHz		
	(20 to 0) dB	0.37 dB	
	(0 to -58) dB	0.38 dB	
	(-58 to -78) dB	0.38 dB	
	(-78 to -110) dB	0.49 dB	
	(-110 to -120) dB	0.84 dB	
	(13 200 to 18 000) MHz		
	(20 to 0) dB	0.37 dB	
	(0 to -58) dB	0.38 dB	
	(-58 to -78) dB	0.38 dB	
	(-78 to -110) dB	0.75 dB	
	(-110 to -120) dB	1.3 dB	
	(18 000 to 19 200) MHz		
	(20 to 0) dB	0.49 dB	
	(0 to -58) dB	0.5 dB	
	(-58 to -78) dB	0.5 dB	
(-78 to -110) dB	0.81 dB		
(-110 to -120) dB	1.4 dB		
(19 200 to 26 500) MHz			
(20 to 0) dB	0.49 dB		
(0 to -58) dB	0.5 dB		
(-58 to -78) dB	0.5 dB		
(-78 to -110) dB	1.2 dB		
(-110 to -120) dB	1.9 dB		

Electrical – RF/Microwave

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
Total Harmonic Distortion (THD)	(0 to 60) dB		Comparison to HP 8903B Audio Analyzer	
	20 Hz to 20 kHz			
	(-40 to 0) dB	1 dB		
	(-50 to -40) dB	1 dB		
	(-60 to -50) dB	1.3 dB		
	(-65 to -60) dB	1.7 dB		
	20 to 50 kHz			
	(-40 to 0) dB	2 dB		
	(-50 to -40) dB	2.1 dB		
	(-60 to -50) dB	3 dB		
AM Distortion Measure ¹ Rate 20 Hz to 1 kHz	50 to 100 kHz		Comparison to Agilent N5531S Measuring Receiver	
	(-40 to 0) dB	2 dB		
	(-50 to -40) dB	2.4 dB		
	(0.1 to 10) MHz			
	AM Depth > 1%			
	(0 to -20) dB	1.2 dB		
	(-20 to -30) dB	2.2 dB		
	AM Depth > 3%			
	(0 to -20) dB	1 dB		
	(-20 to -30) dB	1.3 dB		
(-30 to -40) dB	2.4 dB			
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	10 MHz to 26.5 GHz		Comparison to Agilent N5531S Measuring Receiver	
	AM Depth > 1%			
	(0 to -20) dB	1.3 dB		
	(-20 to -30) dB	2.5 dB		
	AM Depth > 3%			
	(0 to -20) dB	1.1 dB		
	(-20 to -30) dB	1.4 dB		
	(-30 to -40) dB	3 dB		
	(1 to 6 600) MHz			Comparison to Agilent N5531S Measuring Receiver
	Dev 500 Hz to 2 kHz			
(0 to -20) dB	0.26 dB			
(-20 to -30) dB	0.79 dB			
(-30 to -40) dB	2.3 dB			
Dev > 2 kHz				
(0 to -20) dB	0.09 dB			
(-20 to -30) dB	0.27 dB			
(-30 to -40) dB	0.83 dB			
(-40 to -50) dB	2.4 dB			



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Electrical – RF/Microwave

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(6.6 to 13.2) GHz Dev > 2.3 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 4.5 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (13.2 to 26.5) GHz Dev > 2.7 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 6.0 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB	Comparison to Agilent N5531S Measuring Receiver
PM Distortion Measure ¹	(1 to 6 600) MHz Rate (20 to 500) Hz Dev > 0.8 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 2.5 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB Rate (500 to 1 000) Hz Dev > 0.4 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 1.0 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB	Comparison to Agilent N5531S Measuring Receiver



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Electrical – RF/Microwave

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(6.6 to 13.2) GHz		
	Rate (20 to 500) Hz		
	Dev > 1.8 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 5.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.4 dB	
	Rate (500 to 1 000) Hz		
	Dev > 0.8 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 2.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.4 dB	
	(13.2 to 26.5) GHz		
	Rate (20 to 500) Hz		
	Dev > 3.5 rad		
(0 to -20) dB	0.26 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 10.0 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.4 dB		

Comparison to Agilent N5531S Measuring Receiver



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Electrical – RF/Microwave

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(13.2 to 26.5) GHz	0.26 dB	Comparison to Agilent N5531S Measuring Receiver
	Rate (500 to 1 000) Hz	0.79 dB	
	Dev > 1.2 rad	2.3 dB	
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
Harmonics Measure ¹	Dev > 4.0 rad	2.4 dB	Comparison to Agilent E4440A Measuring Receiver
	(0 to -20) dB	0.37 dB	
	(-20 to -30) dB	1.1 dB	
	(-30 to -40) dB	1.4 dB	
	(-40 to -50) dB	1.4 dB	
		1.7 dB	
Harmonics Measure ¹	(-80 to -10) dB	1.9 dB	Comparison to Agilent E4440A Measuring Receiver
	2 nd through 5 th Harmonic	2.1 dB	
	1 kHz to 600 MHz	2.1 dB	
	(600 to 1 320) MHz	2.1 dB	
Harmonics Measure ¹	(1 320 to 2 200) MHz		Comparison to Agilent E4440A Measuring Receiver
	(2 200 to 3 000) MHz		
	(3 000 to 4 400) MHz		
	(4 400 to 5 300) MHz		

Length – Dimensional metrology

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks ²	Up to 12 in	$(3.7 + 2.4L) \mu\text{in}$	Comparison to Master gage blocks, P&W Universal Measuring Machine
Micrometers ^{1,2}	Up to 18 in	$(26 + 4.7L) \mu\text{in}$	Comparison to Gage blocks
Laser Micrometer ¹	(0.5 to 1.5) in	88 μin	Comparison to Pin Gages
Calipers ^{1,2}	Up to 40 in	$(281 + 1.9L) \mu\text{in}$	Comparison to Gage blocks

Length – Dimensional metrology

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dial Indicators ^{1,2} Resolution: $\geq 50\mu\text{in}$ $< 50\mu\text{in}$	Up to 10 in Up to 0.1 in	$(25 + 4L) \mu\text{in}$ $10 \mu\text{in}$	Comparison to Gage blocks
Height Gages ^{1,2}	Up to 40 in	$(94 + 3.1L) \mu\text{in}$	Comparison to Gage blocks
Cylindrical Gages ² – Rings Plain Pins, Plugs	(0.02 to 8) in (0 to 8) in	$(10 + 2.7D) \mu\text{in}$ $(10 + 3D) \mu\text{in}$	Comparison to Master gage blocks, P&W Universal Measuring Machine
Thread Plugs ¹ – Major Diameter Pitch Diameter	Up to 10 in Up to 10 in	$43 \mu\text{in}$ $94 \mu\text{in}$	Comparison to Fisher Machine Shop Model 1962 thread wire set, Gage blocks, Pratt & Whitney Model C
Surface Plates ¹ Overall Flatness Local Area Flatness	(18 x 18) in to (10 x 10) ft (-0.001 to 0.001) in	$66 \mu\text{in}$ $68 \mu\text{in}$	Comparison to Mahr Leveling System Repeat-O-Meter
Protractors ¹	(0 to 360) ^o	0.015^o	Comparison to Angle blocks
Linear Scales – Rulers ¹	Up to 36 in	0.009 1 in	Comparison to Gage blocks
Pi Tapes ¹	Up to 3 in	$450 \mu\text{in}$	Comparison to Plug Gages
Tape Measures ¹	Up to 150 ft	$(0.000 28F + 0.024) \text{ in}$	Comparison to Standard rule
Microscopes ¹	Up to 2 in	$100 \mu\text{in}$	Comparison to Stage Micrometer
Feeler Gage ¹	Up to 1 in	$45 \mu\text{in}$	Comparison to Pratt & Whitney Supermicrometer C
Crimp Tools ¹	(0.011 to 1) in (0.011 to 0.5) in	$150 \mu\text{in}$ $240 \mu\text{in}$	Comparison to Micrometer, Pin Gages

Mass and Mass Related

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales & Balances ^{1,4}	1 mg to 220 g	$(0.048 + 0.003 1X) \text{ mg}$	Comparison to ASTM E617 Class 1 weights

Mass and Mass Related

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
	Up to 1 000 lb Up to 454 kg	(0.000 12 <i>W</i>) lb (0.000 12 <i>X</i>) g	Comparison to NIST Class F weights
Pressure ¹	(-1 to 1) inH ₂ O -15 to 100 psig Up to 500 psig Up to 1 000 psig Up to 10 000 psig	0.004 inH ₂ O 0.027 psi 0.12 psi 0.26 psi 2.5 psi	Comparison to Pressure Gauge/Module Additel ADT155-DPI-760, ADT681-02-GP100-PSI, ADT681-02-GP500-PSI, ADT681-02-GP1K-PSI, ADT681-02-GP10K-PSI
Torque Tools ¹	(10 to 100) ozf·in 4 lbf·in to 250 lbf·ft	0.6 % of reading 0.32 % of reading	Comparison to CDI 1001-O-DDT CDI 5000 ST Torque Tester
Force ^{1,2} Tension and Compression	(0.5 to 500) lbf 220 gf to 23 kgf	(0.000 06 + 0.000 12 <i>W</i>) lbf ² (0.03 + 0.000 12 <i>M</i>) grams ²	Comparison to Class F weights

Thermodynamic

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity Generate	(10 to 95) %RH	0.5 %RH	Comparison to Thunder Scientific 2500 Humidity Chamber
Relative Humidity Measure	(0 to 90) %RH	1.6 %RH	Comparison to Vaisala M170/HMP75 Humidity Indicator and Probe
Temperature – Measure ¹	(-196 to 0.01) °C (0.01 to 660) °C	0.004 3 °C (0.004 3 + 0.000 001 <i>T</i>) °C	Comparison to Fluke 5699 SPRT & Fluke 1594A Super-Thermometer
Temperature – Source	(-196 to 300) °C (>300 to 500) °C	0.014 °C 0.02 °C	Comparison to Fluke 5699 SPRT, Fluke 1594A Super-Thermometer & Temperature Baths
Temperature – Source Fix Point	0.01 °C	0.002 6 °C	Comparison to Triple Point of Water



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Time and Frequency

Windsor, CT

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Generate	10 MHz	1×10^{-9} Hz/Hz	Comparison to HP Z3801A GPS Receiver
Frequency – Generate	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 10) MHz	1×10^{-9} Hz/Hz + 0.57 μ Hz 1×10^{-9} Hz/Hz + 5.7 μ Hz 1×10^{-9} Hz/Hz + 57 μ Hz 1×10^{-9} Hz/Hz + 0.57 mHz 1×10^{-9} Hz/Hz + 5.7 mHz 1×10^{-9} Hz/Hz + 57 mHz 1×10^{-9} Hz/Hz + 0.57 Hz	Comparison to Agilent 33250A Function Generator / HP Z3801A GPS Receiver
Frequency – Generate	(10 to 26 500) MHz	1×10^{-9} Hz/Hz + 0.57 kHz	Comparison to HP 83630B Signal Generator / HP Z3801A GPS Receiver
Frequency – Measure ¹	1 to 10 Hz 10 to 100 Hz 100 to 1000 Hz 1 to 10 kHz 10 to 100 kHz 100 to 200 kHz 0.2 to 3 000 MHz	5.20×10^{-9} Hz/Hz 2.46×10^{-9} Hz/Hz 1.60×10^{-9} Hz/Hz 1.33×10^{-9} Hz/Hz 1.24×10^{-9} Hz/Hz 1.21×10^{-9} Hz/Hz 1.21×10^{-9} Hz/Hz	Comparison to Agilent 53131A Frequency Counter / HP Z3801A GPS Receiver
	10 to 26 500 MHz	1×10^{-9} Hz/Hz + 0.1 Hz	Comparison to Agilent E4440A Spectrum Analyzer / HP Z3801A GPS Receiver
Timer, Stopwatch ¹	10 s to 24 hr	34 ms	Totalize method with counter
Tachometers – RPM ¹	Up to 100 000 RPM	$\pm (0.001\% + 0.6R)$	Comparison to HP 33250A Signal Generator & LED

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Services performed at satellite laboratory

Technical Maintenance, Inc.

4613 Northwest Parkway
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Scott Chamberlain (Quality Manager) Phone: 321-242-0890

CALIBRATION AND DIMENSIONAL MEASUREMENT

CALIBRATION

Acoustics and Vibration

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometers – Acceleration	(0.01 to 10) g (7 < 10) Hz (10 < 30) Hz (30 < 2 000) Hz (2 to 10) kHz	4 % of reading 3 % of reading 1.5 % of reading 4 % of reading	Comparison to Accelerometer Calibrator

Chemical Quantities

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters ^{1,5}	(4, 7) pH 10 pH	0.017 pH 0.023 pH	Comparison to Standard pH buffers
Conductivity Meters ^{1,5}	2 µS/cm 10 µS/cm 100 µS/cm 1 000 µS/cm 1 413 µS/cm 10 000 µS/cm	0.2 µS/cm 0.17 µS/cm 0.74 µS/cm 3.6 µS/cm 5.7 µS/cm 35 µS/cm	Comparison to Standard conductivity solutions

Electrical – DC/Low Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Generate ¹	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	6.8 $\mu\text{V/V} + 0.8 \mu\text{V}$ 4.6 $\mu\text{V/V} + 0.9 \mu\text{V}$ 3 $\mu\text{V/V} + 2.5 \mu\text{V}$ 3 $\mu\text{V/V} + 3.9 \mu\text{V}$ 4.6 $\mu\text{V/V} + 38 \mu\text{V}$ 6.1 $\mu\text{V/V} + 385 \mu\text{V}$	Comparison to Fluke 5720A Multifunction Calibrator
DC Voltage – Generate ¹	(1 to 6) kV	2.4 % of output + 10 V	Comparison to Associated Research 3565D Hypot
DC Voltage – Measure ¹	(0 to 100) mV 100 mV to 1V (1 to 10) V (10 to 100) V (100 to 1 000) V	3.3 $\mu\text{V/V} + 1 \mu\text{V}$ 2.6 $\mu\text{V/V} + 1 \mu\text{V}$ 2.6 $\mu\text{V/V} + 1.5 \mu\text{V}$ 3.9 $\mu\text{V/V} + 20 \mu\text{V}$ 3.9 $\mu\text{V/V} + 66 \mu\text{V} + 12\mu\text{V/V} \times (\text{Vin}/1\ 000) ^2$	Comparison to Agilent 3458A Multimeter
DC Voltage – Measure ¹	(1 to 60) kV	0.1 % of reading	Comparison to Ross VD60 High Voltage Divider, Agilent 34401A Multimeter
DC Current – Generate ¹	(1 to 2.2) nA (2.2 to 22) nA (22 to 220) nA (0.22 to 2.2) μA (2.2 to 10) μA	93 $\mu\text{A/A} + 0.007 \text{ nA}$ 92 $\mu\text{A/A} + 0.007 \text{ nA}$ 92 $\mu\text{A/A} + 0.01 \text{ nA}$ 36 $\mu\text{A/A} + 0.1 \text{ nA}$ 20 $\mu\text{A/A} + 1 \text{ nA}$	Comparison to Fluke 5720A Multifunction Calibrator & Fluke 5522A Multifunction Calibrator
DC Current – Generate ¹	(10 to 220) μA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA (0.22 to 1) A (1 to 2.2) A	38 $\mu\text{A/A} + 5 \text{ nA}$ 30 $\mu\text{A/A} + 7 \text{ nA}$ 30 $\mu\text{A/A} + 44 \text{ nA}$ 38 $\mu\text{A/A} + 0.7 \mu\text{A}$ 45 $\mu\text{A/A} + 0.7 \mu\text{A}$ 68 $\mu\text{A/A} + 12 \mu\text{A}$ 105 $\mu\text{A/A} + 12 \mu\text{A}$	Comparison to Fluke 5720A Multifunction Calibrator
DC Current – Generate ¹	(2.2 to 11) A	274 $\mu\text{A/A} + 365 \mu\text{A}$	Comparison to Fluke 5720A Multifunction Calibrator, 5725A Amplifier
DC Current – Generate ¹	(11 to 20.5) A	761 $\mu\text{A/A} + 578 \mu\text{A}$	Comparison to Fluke 5522A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Generate ¹ Clamp Meters	(0 to 200) A	0.21% of output + 0.028A	Comparison to Fluke 5522A Multiproduct Calibrator / 9100-200 x10 Coil
DC Current – Generate ¹ Clamp Meters	(0 to 1000) A	0.21% of output + 0.040A	Comparison to Fluke 5522A Multiproduct Calibrator / 9100-200 x50 Coil
High Voltage -Generate DC Voltage	(1 to 6) kV	2.4 % of reading + 10 V	Comparison to Associated Research 3565D High Voltage Tester
DC Current – Measure ¹	(1 to 10) nA (10 to 100) nA (0.1 to 1) μ A (1 to 10) μ A	35.2 μ A/A + 0.1 pA 17.8 μ A/A + 1 pA 10 μ A/A + 0.01 nA 8.3 μ A/A + 0.1 nA	Comparison to Fluke 5720A Multifunction Calibrator, Agilent 3458A Multimeter Option 002
DC Current – Measure ¹	(10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	13 μ A/A + 0.5 nA 13 μ A/A + 3 nA 13 μ A/A + 0.03 μ A 23 μ A/A + 0.3 μ A 72 μ A/A + 6.6 μ A	Comparison to Agilent 3458A Multimeter
DC Current – Measure ¹	(1 to 1 000) A	0.26 % of reading	Comparison to Current shunt
Resistance – Measure ¹	Up to 12 Ω (10 to 120) Ω (0.1 to 1.2 k Ω (1 to 12) k Ω (10 to 120) k Ω (0.1 to 1.2) M Ω (1 to 12) M Ω (10 to 120) M Ω (0.1 to 1.2) G Ω	9.8 $\mu\Omega/\Omega$ + 38 $\mu\Omega$ 7.8 $\mu\Omega/\Omega$ + 0.3 m Ω 6.5 $\mu\Omega/\Omega$ + 0.4 m Ω 6.5 $\mu\Omega/\Omega$ + 3.8 m Ω 6.5 $\mu\Omega/\Omega$ + 38 m Ω 9.8 $\mu\Omega/\Omega$ + 1.5 Ω 33 $\mu\Omega/\Omega$ + 100 Ω 327 $\mu\Omega/\Omega$ + 1 k Ω 0.33 % of reading + 70 k Ω	Comparison to Agilent 3458A Multimeter
Resistance ¹ Fixed Points	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9) k Ω (10, 19) k Ω (100, 190) k Ω 1 M Ω 1.9 M Ω 10 M Ω 19 M Ω 100 M Ω	84 $\mu\Omega/\Omega$ + 0.1 $\mu\Omega$ 21 $\mu\Omega/\Omega$ + 1 $\mu\Omega$ 9.1 $\mu\Omega/\Omega$ + 6 $\mu\Omega$ 7.6 $\mu\Omega/\Omega$ + 60 $\mu\Omega$ 7.6 $\mu\Omega/\Omega$ + 0.6 m Ω 9.9 $\mu\Omega/\Omega$ + 6 m Ω 18 $\mu\Omega/\Omega$ + 60 m Ω 18 $\mu\Omega/\Omega$ + 60 m Ω 35 $\mu\Omega/\Omega$ + 0.6 Ω 42 $\mu\Omega/\Omega$ + 0.6 Ω 91 $\mu\Omega/\Omega$ + 6 Ω	Comparison to Fluke 5720A Multifunction Calibrator



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Electrical – DC/Low Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Generate ¹	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ 0.33 kΩ to 1.1 MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ 330 MΩ to 1.1 GΩ	30 μΩ/Ω + 0.001 Ω 23 μΩ/Ω + 0.001 Ω 21 μΩ/Ω + 0.001 Ω 21 μΩ/Ω + 0.002 Ω 21 μΩ/Ω + 0.002 Ω 21 μΩ/Ω + 0.02 Ω 21 μΩ/Ω + 0.02 Ω 21 μΩ/Ω + 0.2 Ω 21 μΩ/Ω + 0.2 Ω 24 μΩ/Ω + 2 Ω 24 μΩ/Ω + 2 Ω 46 μΩ/Ω + 23 Ω 99 μΩ/Ω + 38 Ω 190 μΩ/Ω + 1.9 k Ω 380 μΩ/Ω + 2.3 k Ω 0.23 % of setting + 76 k Ω 1.1 % of reading + 380 k Ω	Comparison to Fluke 5522A Multiproduct Calibrator
Resistance – Generate ¹ Fixed Points	100 V 100 kΩ (100 to 1 000) V 1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ	1 % of output 1 % of output 1 % of output 1 % of output 1 % of output 1.2 % of output	Comparison to TMI RB Resistance Standard



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Electrical – DC/Low Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Generate ¹	(220 to 400) pF (0.4 to 3.299 9) nF (3.3 to 10.999 9) nF (11 to 32.999 9) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.099 99) μF (1.1 to 3.299 99) μF (3.3 to 10.999 9) μF (11 to 32.999 9) μF (33 to 109.999) μF (110 to 329.999) μF (0.33 to 1.099 99) mF (1.1 to 3.299 99) mF (3.3 to 10.999 9) mF (11 to 32.999 9) mF (33 to 110) mF	0.38 % of output + 7.6 pF 0.38 % of output + 0.01 nF 0.19 % of output + 0.01 nF 0.19 % of output + 0.08 nF 0.19 % of output + 0.08 nF 0.19 % of output + 0.23 nF 0.19 % of output + 0.76 nF 0.19 % of output + 2.3 nF 0.19 % of output + 7.6 nF 0.3 % of output + 23 nF 0.34 % of output + 76 nF 0.34 % of output + 228 nF 0.34 % of output + 0.76 μF 0.34 % of output + 2.3 μF 0.34 % of output + 7.6 μF 0.57 % of output + 23 μF 0.84 % of output + 76 μF	Comparison to Fluke 5522A Multiproduct Calibrator
AC Voltage – Generate ¹	(0.22 to 2.2) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (2.2 to 22) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	228 μV/V + 3.9 μV 88 μV/V + 3.9 μV 76 μV/V + 3.9 μV 190 μV/V + 3.9 μV 457 μV/V + 4.6 μV 989 μV/V + 9.2 μV 1.3 mV/V + 19 μV 2.6 mV/V + 19 μV 228 μV/V + 3.9 μV 88 μV/V + 3.9 μV 76 μV/V + 3.9 μV 190 μV/V + 3.9 μV 457 μV/V + 4.6 μV 989 μV/V + 9.2 μV 1.3 mV/V + 19 μV 2.6 mV/V + 19 μV	Comparison to Fluke 5720A Multifunction Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(22 to 220) mV		Comparison to Fluke 5720A Multifunction Calibrator
	(10 to 20) Hz	228 $\mu\text{V/V} + 11.4 \mu\text{V}$	
	(20 to 40) Hz	88 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	40 Hz to 20 kHz	76 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	(20 to 50) kHz	190 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	(50 to 100) kHz	457 $\mu\text{V/V} + 15.2 \mu\text{V}$	
	(100 to 300) kHz	837 $\mu\text{V/V} + 19 \mu\text{V}$	
	(300 to 500) kHz	1.3 mV/V + 23 μV	
	500 kHz to 1 MHz	2.5 mV/V + 46 μV	
	220 mV to 2.2 V		
	(10 to 20) Hz	228 $\mu\text{V/V} + 38 \mu\text{V}$	
	(20 to 40) Hz	84 $\mu\text{V/V} + 15 \mu\text{V}$	
	40 Hz to 20 kHz	40 $\mu\text{V/V} + 8 \mu\text{V}$	
	(20 to 50) kHz	68 $\mu\text{V/V} + 9 \mu\text{V}$	
	(50 to 100) kHz	99 $\mu\text{V/V} + 30 \mu\text{V}$	
	(100 to 300) kHz	380 $\mu\text{V/V} + 76 \mu\text{V}$	
	(300 to 500) kHz	913 $\mu\text{V/V} + 190 \mu\text{V}$	
	500 kHz to 1 MHz	1.5 mV/V + 304 μV	
	(2.2 to 22) V		
	(10 to 20) Hz	228 $\mu\text{V/V} + 380 \mu\text{V}$	
	(20 to 40) Hz	84 $\mu\text{V/V} + 152 \mu\text{V}$	
40 Hz to 20 kHz	37 $\mu\text{V/V} + 54 \mu\text{V}$		
(20 to 50) kHz	61 $\mu\text{V/V} + 91 \mu\text{V}$		
(50 to 100) kHz	76 $\mu\text{V/V} + 190 \mu\text{V}$		
(100 to 300) kHz	228 $\mu\text{V/V} + 609 \mu\text{V}$		
(300 to 500) kHz	913 $\mu\text{V/V} + 1.9 \text{ mV}$		
500 kHz to 1 MHz	1.4 mV/V + 3 mV		
(22 to 220) V			
(10 to 20) Hz	228 $\mu\text{V/V} + 3.8 \text{ mV}$		
(20 to 40) Hz	84 $\mu\text{V/V} + 1.5 \text{ mV}$		
40 Hz to 20 kHz	49 $\mu\text{V/V} + 0.6 \text{ mV}$		
(20 to 50) kHz	76 $\mu\text{V/V} + 0.9 \text{ mV}$		
(50 to 100) kHz	137 $\mu\text{V/V} + 2.3 \text{ mV}$		
AC Voltage – Generate ¹	(220 to 750) V		Comparison to Fluke 5720A Multifunction Calibrator / Fluke 5725A Amplifier
	40 Hz to 1 kHz	68 $\mu\text{V/V} + 3 \text{ mV}$	
	(1 to 20) kHz	126 $\mu\text{V/V} + 5 \text{ mV}$	
	(20 to 50) kHz	457 $\mu\text{V/V} + 8 \text{ mV}$	
	(50 to 100) kHz	1.8 mV/V + 34 mV	
	(750 to 1 000) V		
	40 Hz to 1 kHz	68 $\mu\text{V/V} + 3 \text{ mV}$	
	(1 to 20) kHz	126 $\mu\text{V/V} + 5 \text{ mV}$	
(20 to 30) kHz	457 $\mu\text{V/V} + 8 \text{ mV}$		



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Electrical – DC/Low Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(0.3 to 1.1) mV		Comparison to Fluke 5720A Option 003 Multifunction Calibrator
	(10 to 30 Hz)	0.65 % of output + 1.5 μ V	
	30 Hz to 500 kHz	0.61 % of output + 1.5 μ V	
	(0.5 to 1.2) MHz	0.63 % of output + 3.8 μ V	
	(1.2 to 2) MHz	0.63 % of output + 3.8 μ V	
	(2 to 12) MHz	0.68 % of output + 3.8 μ V	
	(12 to 20) MHz	0.76 % of output + 3.8 μ V	
	(20 to 30) MHz	1.3 % of output + 12.9 μ V	
	(1.1 to 3.3) mV		
	(10 to 30 Hz)	0.58 % of output + 2.3 μ V	
	30 Hz to 500 kHz	0.53 % of output + 2.3 μ V	
	(0.5 to 1.2) MHz	0.54 % of output + 4.6 μ V	
	(1.2 to 2) MHz	0.54 % of output + 4.6 μ V	
	(2 to 12) MHz	0.58 % of output + 4.6 μ V	
	(12 to 20) MHz	0.65 % of output + 4.6 μ V	
	(20 to 30) MHz	1.3 % of output + 4.6 μ V	
	(3.3 to 11) mV		
	(10 to 30 Hz)	0.58 % of output + 6.1 μ V	
	30 Hz to 500 kHz	0.53 % of output + 6.1 μ V	
	(0.5 to 1.2) MHz	0.54 % of output + 8.4 μ V	
	(1.2 to 2) MHz	0.54 % of output + 8.4 μ V	
	(2 to 12) MHz	0.55 % of output + 8.4 μ V	
	(12 to 20) MHz	0.61 % of output + 8.4 μ V	
	(20 to 30) MHz	0.93 % of output + 8.4 μ V	
	(11 to 33) mV		
	(10 to 30 Hz)	0.52 % of output + 12 μ V	
	30 Hz to 500 kHz	0.46 % of output + 12 μ V	
	(0.5 to 1.2) MHz	0.47 % of output + 14 μ V	
	(1.2 to 2) MHz	0.47 % of output + 14 μ V	
	(2 to 12) MHz	0.49 % of output + 14 μ V	
(12 to 20) MHz	0.55 % of output + 14 μ V		
(20 to 30) MHz	0.89% of output + 14 μ V		
(33 to 110) mV			
(10 to 30 Hz)	0.52 % of output + 30 μ V		
30 Hz to 500 kHz	0.46 % of output + 30 μ V		
(0.5 to 1.2) MHz	0.47 % of output + 33 μ V		
(1.2 to 2) MHz	0.47 % of output + 33 μ V		
(2 to 12) MHz	0.49 % of output + 33 μ V		
(12 to 20) MHz	0.55 % of output + 33 μ V		
(20 to 30) MHz	0.89 % of output + 33 μ V		



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Electrical – DC/Low Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(110 to 330) mV		Comparison to Fluke 5720A Option 003 Multifunction Calibrator
	(10 to 30 Hz)	0.45 % of output + 0.1 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.1 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.1 mV	
	(1.2 to 2) MHz	0.4 % of output + 0.1 mV	
	(2 to 12) MHz	0.42 % of output + 0.1 mV	
	(12 to 20) MHz	0.49 % of output + 0.1 mV	
	(20 to 30) MHz	0.85 % of output + 0.1 mV	
	0.33 to 1.1 V		
	(10 to 30 Hz)	0.45 % of output + 0.3 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.3 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.3 mV	
	(1.2 to 2) MHz	0.4 % of output + 0.3 mV	
	(2 to 12) MHz	0.42 % of output + 0.3 mV	
	(12 to 20) MHz	0.49 % of output + 0.3 mV	
	(20 to 30) MHz	0.85 % of output + 0.3 mV	
AC Voltage – Measure ¹	(1.1 to 3.5) V		Comparison to Agilent 3458A Multimeter
	(10 to 30 Hz)	0.39 % of output + 0.4 mV	
	30 Hz to 500 kHz	0.3 % of output + 0.4 mV	
	(0.5 to 1.2) MHz	0.32 % of output + 0.4 mV	
	(1.2 to 2) MHz	0.32 % of output + 0.4 mV	
	(2 to 12) MHz	0.35 % of output + 0.4 mV	
	(12 to 20) MHz	0.44 % of output + 0.4 mV	
	(20 to 30) MHz	0.82 % of output + 0.4 mV	
	(0 to 10) mV		
	(1 to 40) Hz	0.03 % of reading + 3 μV	
40 Hz to 1 kHz	0.02 % of reading + 1.1 μV		
(1 to 20) kHz	0.03 % of reading + 1.1 μV		
(20 to 50) kHz	0.1 % of reading + 1.1 μV		
(50 to 100) kHz	0.5 % of reading + 1.1 μV		
100 kHz to 1 MHz	1.2 % of reading + 5 μV		
(1 to 4) MHz	7 % of reading + 7 μV		
(4 to 8) MHz	20 % of reading + 8 μV		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(10 to 100) mV		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.005 % of reading + 2.6 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 1.3 μ V	
	(1 to 20) kHz	0.009 % of reading + 1.3 μ V	
	(20 to 50) kHz	0.02 % of reading + 1.3 μ V	
	(50 to 100) kHz	0.052 % of reading + 1.3 μ V	
	(100 to 300) kHz	0.20 % of reading + 6.5 μ V	
	300 kHz to 1 MHz	0.70 % of reading + 6.5 μ V	
	(1 to 2) MHz	0.98 % of reading + 46 μ V	
	(2 to 4) MHz	2.6 % of reading + 46 μ V	
	(4 to 8) MHz	2.6 % of reading + 52 μ V	
	(8 to 10) MHz	9.8 % of reading + 65 μ V	
	100 mV to 1 V		
	(1 to 40) Hz	0.005 % of reading + 26 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 13 μ V	
	(1 to 20) kHz	0.009 % of reading + 13 μ V	
	(20 to 50) kHz	0.02 % of reading + 13 μ V	
	(50 to 100) kHz	0.052 % of reading + 13 μ V	
	(100 to 300) kHz	0.2 % of reading + 65 μ V	
	300 kHz to 1 MHz	0.65 % of reading + 65 μ V	
	(1 to 2) MHz	0.98 % of reading + 0.5 mV	
	(2 to 4) MHz	2.6 % of reading + 0.5 mV	
	(4 to 8) MHz	2.6 % of reading + 0.5 mV	
	(8 to 10) MHz	9.8 % of reading + 0.7 mV	
	(1 to 10) V		
	(1 to 40) Hz	0.005 % of reading + 0.3 mV	
	40 Hz to 1 kHz	0.005 % of reading + 0.1 mV	
	(1 to 20) kHz	0.009 % of reading + 0.1 mV	
(20 to 50) kHz	0.02 % of reading + 0.1 mV		
(50 to 100) kHz	0.052 % of reading + 0.1 mV		
(100 to 300) kHz	0.2 % of reading + 0.7 mV		
300 kHz to 1 MHz	0.65 % of reading + 0.7 mV		
(1 to 2) MHz	0.98 % of reading + 4.6 mV		
(2 to 4) MHz	2.6 % of reading + 4.6 mV		
(4 to 8) MHz	2.6 % of reading + 5.2 mV		
(8 to 10) MHz	9.8 % of reading + 6.5 mV		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(10 to 100) V		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.013 % of reading + 2.6 mV	
	40 Hz to 1 kHz	0.013 % of reading + 1.3 mV	
	(1 to 20) kHz	0.013 % of reading + 1.3 mV	
	(20 to 50) kHz	0.023 % of reading + 1.3 mV	
	(50 to 100) kHz	0.08 % of reading + 1.3 mV	
	(100 to 300) kHz	0.26 % of reading + 6.5 mV	
	300 kHz to 1 MHz	0.98 % of reading + 6.5 mV	
	(100 to 700) V		
	(1 to 40) Hz	0.026 % of reading + 26 mV	
	40 Hz to 1 kHz	0.026 % of reading + 13 mV	
	(1 to 20) kHz	0.039 % of reading + 13 mV	
	(20 to 50) kHz	0.078 % of reading + 13 mV	
	(50 to 100) kHz	0.2 % of reading + 13 mV	
AC Voltage – Measure ¹	(1 to 10) kV	0.5 % of reading + 0.002 kV	Comparison to Ross VD60 High Voltage Divider, Agilent 34401A Multimeter
	(60) Hz		
	(10 to 42) kV	0.5 % of reading + 0.02 kV	
	(60) Hz		
AC Current – Generate ¹	(9 to 200) μ A		Comparison to Fluke 5720A Multifunction Calibrator
	(10 to 20) Hz	228 μ A/A + 15 nA	
	(20 to 40) Hz	152 μ A/A + 10 nA	
	40 Hz to 1 kHz	91 μ A/A + 8 nA	
	(1 to 5) kHz	266 μ A/A + 12 nA	
	(5 to 10) kHz	989 μ A/A + 61 nA	
	(0.22 to 2.2) mA		
	(10 to 20) Hz	228 μ A/A + 39 nA	
	(20 to 40) Hz	152 μ A/A + 31 nA	
	40 Hz to 1 kHz	107 μ A/A + 31 nA	
	(1 to 5) kHz	183 μ A/A + 99 nA	
	(5 to 10) kHz	989 μ A/A + 609 nA	
	(2.2 to 22) mA		
	(10 to 20) Hz	228 μ A/A + 385 nA	
	(20 to 40) Hz	152 μ A/A + 310 nA	
	40 Hz to 1 kHz	107 μ A/A + 310 nA	
	(1 to 5) kHz	183 μ A/A + 536 nA	
	(5 to 10) kHz	989 μ A/A + 4.6 μ A	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate ¹	(22 to 220) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	228 μ A/A + 4 μ A 152 μ A/A + 3 μ A 107 μ A/A + 2 μ A 183 μ A/A + 3 μ A 989 μ A/A + 9 μ A	Comparison to Fluke 5720A Multifunction Calibrator
	(0.22 to 2.2) A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	243 μ A/A + 31 μ A 380 μ A/A + 76 μ A 6.1 mA/A + 152 μ A	
AC Current – Generate ¹	(2.2 to 11) A 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	350 μ A/A + 141 μ A 723 μ A/A + 295 μ A 2.7 mA/A + 573 μ A	Comparison to Fluke 5720A Multifunction Calibrator / Fluke 5725A Amplifier
AC Current – Generate ¹	(11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 Hz to 5) kHz	0.09 % of output + 5 mA 0.11 % of output + 5 mA 2.3 % of output + 5 mA	Comparison to Fluke 5522A Multiproduct Calibrator
AC Current – Generate ¹ Clamp Meters	(3.3 to 30) A (10 to 100) Hz (100 to 440) Hz	0.22 % of output + 0.028 A 0.3 % of output + 0.07 A	Comparison to Fluke 5522A Multiproduct Calibrator / 9100-200 x10 Coil
	(30 to 200) A 10 to 100 Hz (100 to 440) Hz	0.22 % of output + 0.032 A 0.79 % of output + 0.08 A	
AC Current – Generate ¹ Clamp Meters	(16.5 to 150) A (10 to 100) Hz (100 to 440) Hz	0.22 % of output + 0.029 A 0.3 % of output + 0.08 A	Comparison to Fluke 5522A Multiproduct Calibrator / 9100-200 x50 Coil
	(150 to 1 000) A (10 to 100) Hz (100 to 440) Hz	0.22 % of output + 0.081 A 0.79 % of output + 0.20 A	
AC Current – Measure ¹	(5 to 100) μ A (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz	0.26 % of reading + 0.02 μ A 0.1 % of reading + 0.02 μ A 0.04 % of reading + 0.02 μ A	Comparison to Agilent 3458A Multimeter
	(0.1 to 1) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 0.13 μ A 0.1 % of reading + 0.13 μ A 0.04 % of reading + 0.13 μ A 0.02 % of reading + 0.13 μ A	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 1.3 μA 0.1 % of reading + 1.3 μA 0.04 % of reading + 1.3 μA 0.02 % of reading + 1.3 μA	Comparison to Agilent 3458A Multimeter
	(10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 13 μA 0.1 % of reading + 13 μA 0.04 % of reading + 13 μA 0.02 % of reading + 13 μA	
	(0.1 to 1 A) (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 0.13 mA 0.1 % of reading + 0.13 mA 0.04 % of reading + 0.13 mA 0.02 % of reading + 0.13 mA	
AC Current – Measure ¹	(1 to 3) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz (5 to 10) kHz	0.84 % of reading + 1.4 mA 0.27 % of reading + 1.4 mA 0.11 % of reading + 1.4 mA 0.27 % of reading + 16 mA	Comparison to Fluke 8845A Multimeter
	(3 to 10) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz (5 to 10) kHz	0.84 % of reading + 4.6 mA 0.27 % of reading + 4.6 mA 0.11 % of reading + 4.6 mA 0.27 % of reading + 53 mA	
AC Current – Measure ¹	(10 to 30) A 40 Hz to 1 kHz (1 to 5) kHz	0.3 % of reading + 0.07 A 5 % of reading + 0.14 A	Comparison to Agilent 3458A Multimeter, Keysight, 34330A Current Shunt
Electrical Calibration of Thermocouple Indicators ¹	Type B (600 to 800) °C (800 to 1 550) °C (1 550 to 1 820) °C	0.27 °C 0.21 °C 0.17 °C	Comparison to Fluke 7526A Process Calibrator
	Type C (0 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 000) °C (2 000 to 2 316) °C	0.12 °C 0.18 °C 0.2 °C 0.27 °C	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicators ¹	Type E		Comparison to Fluke 7526A Process Calibrator
	(-250 to -200) °C	0.19 °C	
	(-200 to -100) °C	0.09 °C	
	(-100 to 0) °C	0.07 °C	
	(0 to 600) °C	0.06 °C	
	(600 to 1 000) °C	0.08 °C	
	Type J		
	(-210 to -100) °C	0.11 °C	
	(-100 to 800) °C	0.07 °C	
	(800 to 1 200) °C	0.08 °C	
	Type K		
	(-250 to -200) °C	0.35 °C	
	(-200 to -100) °C	0.12 °C	
	(-100 to 800) °C	0.08 °C	
	(800 to 1 372) °C	0.1 °C	
	Type L		
	(-200 to -100) °C	0.08 °C	
	(-100 to 900) °C	0.07 °C	
	Type N		
	(-250 to -200) °C	0.56 °C	
	(-200 to -100) °C	0.18 °C	
	(-100 to 0) °C	0.09 °C	
	(0 to 100) °C	0.08 °C	
	(100 to 800) °C	0.08 °C	
	(800 to 1 300) °C	0.09 °C	
	Type R		
	(-50 to -25) °C	0.42 °C	
	(-25 to 0) °C	0.34 °C	
(0 to 100) °C	0.3 °C		
(100 to 400) °C	0.21 °C		
(400 to 600) °C	0.17 °C		
(600 to 1 000) °C	0.16 °C		
(1 000 to 1 600) °C	0.14 °C		
(1 600 to 1 767) °C	0.18 °C		
Type S			
(50 to -25) °C	0.39 °C		
(-25 to 0) °C	0.33 °C		
(0 to 100) °C	0.29 °C		
(100 to 400) °C	0.22 °C		
(400 to 600) °C	0.18 °C		
(600 to 1 600) °C	0.17 °C		
(1 600 to 1 767) °C	0.2 °C		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicators ¹	Type T (-250 to -200) °C (-200 to -100) °C (-100 to 0) °C (0 to 400) °C Type U (-200 to 0) °C (0 to 600) °C	0.27 °C 0.12 °C 0.08 °C 0.07 °C 0.13 °C 0.08 °C	Comparison to Fluke 7526A Process Calibrator
Electrical Calibration of RTD Indicating Devices ¹	Pt 100 (385) (-200 to 800) °C Pt 100 (3916) (-200 to 630) °C Pt 100 (3926) (-200 to 630) °C Pt 200 (385) (-200 to 400) °C (400 to 630) °C Pt 500 (385) (-200 to 630) °C Pt 1 000 (385) (-200 to 630) °C Cu 10 (427) (100 °C to 260) °C Ni 120 (672) (-80 to 260) °C	0.04 °C 0.04 °C 0.04 °C 0.30 °C 0.38 °C 0.13 °C 0.07 °C 0.29 °C 0.02 °C	Comparison to Fluke 7526A Process Calibrator
Oscilloscopes Calibration ¹ – Generate Voltage DC - 50Ω DC - 1MΩ Square Wave 10 Hz to 10 kHz - 50Ω	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 6.6) V (1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V (1 to 24.999) mVpp (25 to 109.99) mVpp (110mV to 2.1999) Vpp (2.2 to 6.6) Vpp	0.19 % of Output + 31 μV 0.19 % of Output + 36 μV 0.19 % of Output + 87 μV 0.19 % of Output + 0.6 mV 0.019 % of reading + 20 μV 0.019 % of reading + 25 μV 0.019 % of reading + 76 μV 0.019 % of reading + 0.6 mV 0.019 % of reading + 6 mV 0.19 % of Output + 31 μV 0.19 % of Output + 36 μV 0.19 % of Output + 87 μV 0.19 % of Output + 0.6 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option



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Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration ¹ – Generate Square Wave 10 Hz to 1 kHz – 1 MΩ Square Wave (1 to 10) kHz – 1 MΩ	(1 to 24.999) mV (25 to 109.99) mV 110 mV to 2.199 9 V (2.2 to 10.999) V (11 to 130) V (1 to 24.999) mV (25 to 109.99) mV 110mV to 2.199 9 V (2.2 to 10.999) V (11 to 130) V	0.038 % of reading + 4 μV 0.038 % of reading + 9 μV 0.038 % of reading + 60 μV 0.038 % of reading + 0.6 mV 0.038 % of reading + 6 mV 0.19 % of reading + 31 μV 0.19 % of reading + 36 μV 0.19 % of reading + 87 μV 0.19 % of reading + 0.6 mV 0.19 % of reading + 6 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth (5 to 50) mVpp 50 kHz to 100) MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 16 00) MHz (1 600 to 2 100) MHz	0.34 dB 0.36 dB 0.42 dB 0.46 dB 0.5 dB 0.56 dB	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth 50 mV to 3.5 Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 16 00) MHz (1 600 to 2 100) MHz (3.5 to 5) Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz	0.24 dB 0.24 dB 0.32 dB 0.34 dB 0.4 dB 0.44 dB 0.24 dB 0.24 dB 0.32 dB 0.34 dB	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness	3 dB Bandwidth 50 mV to 3.5Vpp (2 100 to 4 000) MHz (4 000 to 8 000) MHz (8 000 to 18 000) MHz	0.25 dB 0.35 dB 0.46 dB	Comparison to EPM Power Meter w/ E Series Power Sensors
Oscilloscopes Calibration – Generate ¹ Time Marker	500 ps to 20 ms 50 ms to 5 s	0.25 μs/s 1.9 μs/s + 3.8 μHz	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option

Electrical – DC/Low Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration – Measure ¹ Input Impedance Resistance Capacitance Leakage	(40 to 60) Ω 500 kΩ to 1.5MΩ (5 to 50) pF (0 to 5.99) V	0.08 % of reading 0.08 % of reading 3.8 % of reading + 0.4pF 0.038 % of reading + 0.8 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
AC Power – Generate ¹ (33 to 329.999) mV Power Factor = 1	(3.3 to 32.9999) mA (20 to 45) Hz (45 to 1 000) Hz (33 to 329.999) mA (20 to 45) Hz (45 to 1 000) Hz (0.33 to 1.099 99) A (10 to 45) Hz (45 to 1 000) Hz (1.1 to 2.999 99) A (10 to 45) Hz (45 to 1 000) Hz (3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.072 % of Output + 0.5 μW 0.032 % of Output + 0.5 μW 0.072 % of Output + 5.4 μW 0.032 % of Output + 5.4 μW 0.14 % of Output + 26 μW 0.04 % of Output + 26 μW 0.14 % of Output + 31 μW 0.047 % of Output + 31 μW 0.047 % of Output + 0.5mW 0.077 % of Output + 0.5mW 0.092 % of Output + 1.3mW 0.12 % of Output + 1.3mW	Comparison to Fluke 5522A Multiproduct Calibrator
AC Power – Generate ¹ (0.33 to 3.29999) V Power Factor = 1	(3.3 to 32.9999) mA (20 to 45) Hz (45 to 1 000) Hz (33 to 329.999) mA (20 to 45) Hz (45 to 1 000) Hz (0.33 to 1.099 99) A (10 to 45) Hz (45 to 1 000) Hz (1.1 to 2.999 99) A (10 to 45) Hz (45 to 1 000) Hz (3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.072 % of Output + 5.2μW 0.033 % of Output + 5.2μW 0.072 % of Output + 52 μW 0.033 % of Output + 52 μW 0.14 % of Output + 26μW 0.04 % of Output + 26μW 0.14 % of Output + 0.28 mW 0.047 % of Output + 0.29 mW 0.047 % of Output + 5.1mW 0.077 % of Output + 5.1mW 0.092 % of Output + 13mW 0.12 % of Output + 13mW	Comparison to Fluke 5522A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (3.3 to 32.9999) V Power Factor = 1	(3.3 to 32.9999) mA (20 to 45) Hz (45 to 1 000) Hz (33 to 329.999) mA (20 to 45) Hz (45 to 1 000) Hz (0.33 to 1.099 99) A (10 to 45) Hz (45 to 1 000) Hz (1.1 to 2.999 99) A (10 to 45) Hz (45 to 1 000) Hz (3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.072 % of Output + 53µW 0.033 % of Output + 53µW 0.072 % of Output + 0.5 mW 0.033 % of Output + 0.5 mW 0.14 % of Output + 2.6 mW 0.04 % of Output + 2.6 mW 0.14 % of Output + 2.9 mW 0.047 % of Output + 2.9 mW 0.047 % of Output + 51mW 0.077 % of Output + 51mW 0.092 % of Output + 0.13 W 0.12 % of Output + 0.13 W	Comparison to Fluke 5522A Multiproduct Calibrator
AC Power – Generate ¹ (33 to 329.999) V Power Factor = 1	(3.3 to 32.999 9) mA (45 to 1 000) Hz (33 to 329.999) mA (45 to 1 000) Hz (0.33 to 1.099 99) A (45 to 1 000) Hz (1.1 to 2.999 99) A (45 to 1 000) Hz (3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.034 % of Output + 0.5 mW 0.034 % of Output + 5.1 mW 0.041 % of Output + 25 mW 0.048 % of Output + 26 mW 0.048 % of Output + 0.5 W 0.077 % of Output + 0.5 W 0.092 % of Output + 1.3 W 0.12 % of Output + 1.3W	Comparison to Fluke 5522A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (330 to 1020) V Power Factor = 1	(3.3 to 32.999 9) mA (45 to 1 000) Hz	0.036 % of Output + 1.6 mW	Comparison to Fluke 5522A Multiproduct Calibrator
	(33 to 329.999) mA (45 to 1 000) Hz	0.036 % of Output + 16 mW	
	(0.33 to 1.099 99) A (45 to 1 000) Hz	0.043 % of Output + 78 mW	
	(1.1 to 2.999 99) A (45 to 1 000) Hz	0.049 % of Output + 81 mW	
	(3 to 10.999 9) A (45 to 100) Hz	0.051 % of Output + 1.6 W	
	(100 to 1 000) Hz	0.078 % of Output + 1.6 W	
	(11 to 20.5) A (45 to 100) Hz	0.094 % of Output + 3.9 W	
	(100 to 1 000) Hz	0.12 % of Output + 3.9W	
Phase Angle – Generate ¹	(-180 to 180) °		Comparison to Fluke 5522A Multiproduct Calibrator
	(10 to 65) Hz	0.08°	
	(65 to 500) Hz	0.19°	
	500 Hz to 1 kHz	0.38°	
	(1 to 5) kHz	1.9°	
	(5 to 10) kHz (10 to 30) kHz	3.8° 7.6°	
Fundamental AC Voltage – Generate ¹	(15 to 17) V (45 to 65) Hz	42 μV/V	Comparison to Fluke 6105A Power Quality Calibrator
	(0 to 23) V (45 to 65) Hz	42 μV/V + 0.2 mV	
	(16 to 850) Hz	60 μV/V + 0.2 mV	
	(28 to 32) V (45 to 65) Hz	42 μV/V	
	(23 to 45) V (45 to 65) Hz	42 μV/V + 0.4 mV	
	(16 to 850) Hz	60 μV/V + 0.4 mV	
	(56 to 64) V (45 to 65) Hz	42 μV/V	
	(45 to 90) V (45 to 65) Hz	42 μV/V + 0.8 mV	
	(16 to 850) Hz	60 μV/V + 0.8 mV	
	(110 to 128) V (45 to 65) Hz	44 μV/V	
	(90 to 180) V (45 to 65) Hz	44 μV/V + 1.6 mV	
	(16 to 850) Hz	60 μV/V + 1.6 mV	



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Electrical – DC/Low Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
Fundamental AC Voltage – Generate ¹	(215 to 246) V (45 to 65) Hz	44 μV/V	Comparison to Fluke 6105A Power Quality Calibrator		
	(180 to 360) V (45 to 65) Hz (16 to 850) Hz	60 μV/V + 3.2 mV 61 μV/V + 3.2 mV			
	(425 to 490) V (45 to 65) Hz	44 μV/V			
	(360 to 650) V (45 to 65) Hz (16 to 850) Hz	60 μV/V + 5.8 mV 61 μV/V + 5.8 mV			
	(740 to 850) V (45 to 65) Hz	44 μV/V			
	(650 to 1 008) V (45 to 65) Hz (16 to 850) Hz	60 μV/V + 10 mV 61 μV/V + 10 mV			
	Additive DC Offset Voltage – Generate ¹ Additive signal to the Fundamental AC Voltage, up to 50% of range	(0 to 11.5) V		91 μV/V + 2 mV	Comparison to Fluke 6105A Power Quality Calibrator
		(0 to 22.5) V		91 μV/V + 4 mV	
(0 to 45) V		91 μV/V + 8 mV			
(0 to 90) V		91 μV/V + 16 mV			
(0 to 180) V		91 μV/V + 32 mV			
(0 to 325) V		92 μV/V + 60 mV			
(0 to 504) V		92 μV/V + 100 mV			
Additive AC Voltage Harmonics – Generate ¹ Additive signal to the Fundamental AC Voltage, up to 30% of range	(0 to 6.9) V (16 to 850) Hz (850 to 6000) Hz	58 μV/V + 1 mV 451 μV/V + 1 mV	Comparison to Fluke 6105A Power Quality Calibrator		
	(0 to 13.5) V (16 to 850) Hz (850 to 6 000) Hz	58 μV/V + 2 mV 451 μV/V + 2 mV			
	(0 to 27) V (16 to 850) Hz (850 to 6 000) Hz	60 μV/V + 2.2 mV 451 μV/V + 2.2 mV			
	(0 to 54) V (16 to 850) Hz (850 to 6 000) Hz	60 μV/V + 4.4 mV 451 μV/V + 4.4 mV			
	(0 to 108) V (16 to 850) Hz (850 to 6 000) Hz	60 μV/V + 12 mV 451 μV/V + 12 mV			
	(0 to 195) V (16 to 850) Hz (850 to 6 000) Hz	61 μV/V + 22 mV 451 μV/V + 22 mV			

Electrical – DC/Low Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Additive AC Voltage Harmonics – Generate ¹ Additive signal to the Fundamental AC Voltage, up to 30% of range	(0 to 302) V (16 to 850) Hz (850 to 6 000) Hz	61 μ V/V + 33 mV 451 μ V/V + 33 mV	Comparison to Fluke 6105A Power Quality Calibrator
Fundamental AC Current – Generate ¹	Up to 0.25 A (45 to 65) Hz (16 to 850) Hz (0.25 to 0.5) A (45 to 65) Hz (16 to 850) Hz (0.5 to 1) A (45 to 65) Hz (16 to 850) Hz (1 to 2) A (45 to 65) Hz (16 to 850) Hz (2 to 5) A (45 to 65) Hz (16 to 850) Hz (5 to 10) A (45 to 65) Hz (16 to 850) Hz (10 to 21) A (45 to 65) Hz (16 to 850) Hz (21 to 50) A (45 to 65) Hz (40 to 850) Hz (50 to 80) A (40 to 450) Hz (450 to 850) Hz	46 μ A/A + 2.5 μ A 60 μ A/A + 5 μ A 46 μ A/A + 5 μ A 61 μ A/A + 10 μ A 47 μ A/A + 10 μ A 61 μ A/A + 20 μ A 46 μ A/A + 20 μ A 61 μ A/A + 40 μ A 49 μ A/A + 50 μ A 64 μ A/A + 100 μ A 49 μ A/A + 100 μ A 65 μ A/A + 200 μ A 49 μ A/A + 200 μ A 69 μ A/A + 400 μ A 49 μ A/A + 500 μ A 74 μ A/A + 1 mA 106 μ A/A + 2.8 mA 118 μ A/A + 2.8 mA	Comparison to Fluke 6105A Power Quality Calibrator
Additive DC Offset Current – Generate ¹ Additive signal to the Fundamental AC Current, up to 50% of range	(0 to 0.125) A (0 to 0.25) A (0 to 0.5) A (0 to 1) A (0 to 2.5) A (0 to 5) A (0 to 10) A	89 μ A/A + 25 μ A 89 μ A/A + 50 μ A 89 μ A/A + 100 μ A 89 μ A/A + 200 μ A 89 μ A/A + 500 μ A 89 μ A/A + 1 mA 90 μ A/A + 2 mA	Comparison to Fluke 6105A Power Quality Calibrator

Electrical – DC/Low Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
<p>Additive AC Current Harmonics – Generate ¹</p> <p>Additive signal to the Fundamental AC Current, up to 30% of range</p>	Up to 0.075 A (16 to 850) Hz (850 to 6 000) Hz	61 μ A/A + 5 μ A 400 μ A/A + 5 μ A	<p>Comparison to Fluke 6105A Power Quality Calibrator</p>		
	Up to 0.15 A (16 to 850) Hz (850 to 6 000) Hz	61 μ A/A + 10 μ A 400 μ A/A + 10 μ A			
	Up to 0.3 A (16 to 850) Hz (850 to 6 000) Hz	61 μ A/A + 20 μ A 400 μ A/A + 20 μ A			
	Up to 0.6 A (16 to 850) Hz (850 to 6 000) Hz	61 μ A/A + 40 μ A 400 μ A/A + 40 μ A			
	Up to 1.5 A (16 to 850) Hz (850 to 6 000) Hz	61 μ A/A + 100 μ A 400 μ A/A + 100 μ A			
	Up to 3 A (16 to 850) Hz (850 to 6 000) Hz	64 μ A/A + 200 μ A 400 μ A/A + 200 μ A			
	Up to 6 A (16 to 850) Hz (850 to 6 000) Hz	65 μ A/A + 400 μ A 400 μ A/A + 400 μ A			
	Up to 15 A (16 to 850) Hz (850 to 3000) Hz	69 μ A/A + 1 mA 400 μ A/A + 1 mA			
	Up to 24 A (16 to 850) Hz (850 to 3 000) Hz	112 μ A/A + 2 mA 400 μ A/A + 2 mA			
	<p>Current to Voltage Phase Offsets (regardless of voltage range)</p>	(-180 to +180) ^o or (0 to 360) ^o			<p>Comparison to Fluke 6105A Power Quality Calibrator</p>
		Up to 50 A		0.002 3 ^o	
		(45 to 65) Hz		0.003 ^o	
		(16 to 69) Hz		0.007 ^o	
(69 to 180) Hz		0.018 ^o			
(180 to 450) Hz		0.033 ^o			
(450 to 850) Hz		0.12 ^o			
(850 to 3 000) Hz	0.23 ^o				
(3 000 to 6 000) kHz					



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Current to Voltage Phase Offsets (regardless of voltage range)	(-180 to +180)° or (0 to 360)°		Comparison to Fluke 6105A Power Quality Calibrator
	Up to 80 A		
	(45 to 65) Hz	0.003°	
	(16 to 69) Hz	0.003°	
	(69 to 180) Hz	0.008°	
	(180 to 450) Hz	0.025°	
	(450 to 850) Hz	0.05°	
(850 to 3 000) Hz	0.25°		

Electrical – RF/Microwave

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure 1	(30 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.13 dB	
	(110 to 120) dB	0.26 dB	
	(3 050 to 6 600) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
(80 to 90) dB	0.12 dB		
(90 to 100) dB	0.13 dB		
(100 to 110) dB	0.15 dB		
(110 to 120) dB	0.37 dB		



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Electrical – RF/Microwave

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(6 600 to 13 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.14 dB	
	(100 to 110) dB	0.34 dB	
	(110 to 120) dB	0.77 dB	
	(13 200 to 19 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.27 dB	
	(100 to 110) dB	0.66 dB	
	(19 200 to 26 500) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
(60 to 70) dB	0.081 dB		
(19 200 to 26 500) MHz			
(70 to 80) dB	0.12 dB		
(80 to 90) dB	0.2 dB		
(90 to 100) dB	0.5 dB		
(100 to 110) dB	1.1 dB		



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Electrical – RF/Microwave

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Flatness – Measure ¹	9 kHz to 2 000 MHz		Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.1 dB	
	(-30 to -40) dBm	0.11 dB	
	(-40 to -42) dBm	0.12 dB	
	(2 to 14) GHz		
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.09 dB	
	(-30 to -40) dBm	0.1 dB	
	(-40 to -42) dBm	0.11 dB	
	(14 to 18) GHz		
	(20 to -10) dBm	0.11 dB	
	(-10 to -30) dBm	0.12 dB	
	(-30 to -40) dBm	0.12 dB	
(-40 to -42) dBm	0.13 dB		
RF Power – Measure ¹	100 kHz to 30 MHz		Comparison to Agilent N5531S Measuring Receiver N1912A w/E9304A Power Sensor
	(20 to 0) dB	0.12 dB	
	(0 to -58) dB	0.13 dB	
	(-58 to -78) dB	0.15 dB	
	(-78 to -110) dB	0.18 dB	
	(-110 to -115) dB	0.21 dB	
	(-115 to -120) dB	0.28 dB	
	(-120 to -125) dB	0.43 dB	
	(30 to 2 000) MHz		
	(30 to 20) dB	0.36 dB	
	(20 to 0) dB	0.2 dB	
	(0 to -58) dB	0.22 dB	
	(-58 to -78) dB	0.23 dB	
	(-78 to -110) dB	0.25 dB	
	(-110 to -115) dB	0.27 dB	
	(-115 to -120) dB	0.33 dB	
	(-120 to -125) dB	0.46 dB	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(2 000 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver N1912A w/E9304A Power Sensor
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.31 dB	
	(-58 to -78) dB	0.32 dB	
	(-78 to -110) dB	0.34 dB	
	(-110 to -115) dB	0.35 dB	
	(-115 to -120) dB	0.4 dB	
	(-120 to -125) dB	0.51 dB	
	(3 050 to 6 600) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.31 dB	
	(-58 to -78) dB	0.32 dB	
	(-78 to -110) dB	0.34 dB	
	(-110 to -115) dB	0.38 dB	
	(-115 to -120) dB	0.48 dB	
	(-120 to -125) dB	0.64 dB	
	(6 600 to 13 200) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.31 dB	
	(-58 to -78) dB	0.32 dB	
	(-78 to -100) dB	0.34 dB	
	(-100 to -105) dB	0.37 dB	
	(-105 to -110) dB	0.45 dB	
	(-110 to -115) dB	0.60 dB	
	(-115 to -120) dB	0.82 dB	
	(13 200 to 18 000) MHz		
	(30 to 20) dB	0.42 dB	
(20 to 0) dB	0.3 dB		
(0 to -58) dB	0.31 dB		
(-58 to -78) dB	0.32 dB		
(-78 to -90) dB	0.33 dB		
(-90 to -95) dB	0.35 dB		
(-95 to -100) dB	0.41 dB		
(-100 to -105) dB	0.53 dB		
(-105 to -110) dB	0.72 dB		



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Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(18 000 to 19 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor
	(30 to 20) dB	0.48 dB	
	(20 to 0) dB	0.38 dB	
	(0 to -58) dB	0.39 dB	
	(-58 to -78) dB	0.4 dB	
	(-78 to -90) dB	0.41 dB	
	(-90 to -95) dB	0.42 dB	
	(-95 to -100) dB	0.47 dB	
	(-100 to -105) dB	0.58 dB	
	(-105 to -110) dB	0.75 dB	
	(19 200 to 26 500) MHz		
	(30 to 20) dB	0.48 dB	
	(20 to 0) dB	0.38 dB	
	(0 to -58) dB	0.39 dB	
	(-58 to -78) dB	0.4 dB	
	(-78 to -90) dB	0.43 dB	
	(-90 to -95) dB	0.50 dB	
	(-95 to -100) dB	0.63 dB	
(-100 to -105) dB	0.84 dB		
(-105 to -110) dB	1.1 dB		
Amplitude Modulation – Measure ¹	100 kHz to 10 MHz Rate 50 Hz to 10 kHz (5 to 99) % Depth	0.75 % of reading + 0.3 digits	Comparison to Agilent N5531S Measuring Receiver
	10 MHz to 3 GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth	2.5 % of reading + 0.4 digits	
	(20 to 99) % Depth	0.5 % of reading + 0.4 digits	
	(3 to 26.5) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth	4.5 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.5 % of reading + 0.4 digits	



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Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency Modulation – Measure ¹ $\beta = \text{deviation} / \text{rate}$	250 kHz to 10 MHz Rates 20 Hz to 10 kHz Peak Dev 200 to 40 kHz 10 MHz to 6.6 GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (6.6 to 13.2) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (13.2 to 26.5) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz	$\beta > 0.2 - 1.5 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 1.2 - 1 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.20 - 1.5 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.45 - 1 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.2 - 2.5 \% \text{ of reading} + 4 \text{ Hz}$ $\beta > 8.0 - 1 \% \text{ of reading} + 4 \text{ Hz}$ $\beta > 0.2 - 3.8 \% \text{ of reading} + 9 \text{ Hz}$ $\beta > 16 - 1 \% \text{ of reading} + 9 \text{ Hz}$	Comparison to Agilent N5531S Measuring Receiver
Phase Modulation – Measure ¹	100 kHz to 6.6 GHz Deviations > 0.3 rad Deviations > 0.7 rad (6.6 to 13.2) GHz Deviations > 0.6 rad Deviations > 2.0 rad (13.2 to 26.5) GHz Deviations: > 1.2 rad Deviations > 4.0 rad	3 % of reading + 0.002 rad 1 % of reading + 0.002 rad 3 % of reading + 0.005 rad 1 % of reading + 0.005 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad	Comparison to Agilent N5531S Measuring Receiver
RF Power – Generate ¹	(30 to 2 000) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB (2 000 to 3 050) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB (3 050 to 6 600) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB	0.26 dB 0.28 dB 0.29 dB 0.3 dB 0.37 dB 0.37 dB 0.38 dB 0.38 dB 0.4 dB 0.52 dB 0.37 dB 0.38 dB 0.38 dB 0.4 dB 0.52 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor, 83630B Signal Generator

Electrical – RF/Microwave

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Generate ¹	(6 600 to 13 200) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (13 200 to 18 000) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (18 000 to 19 200) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (19 200 to 26 500) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB	0.37 dB 0.38 dB 0.38 dB 0.49 dB 0.37 dB 0.38 dB 0.38 dB 0.75 dB 0.49 dB 0.5 dB 0.5 dB 0.81 dB 0.49 dB 0.5 dB 0.5 dB 1.2 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor, 83630B Signal Generator
AM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(0.1 to 10) MHz AM Depth > 1% (0 to -20) dB (-20 to -30) dB AM Depth > 3% (0 to -20) dB (-20 to -30) dB (-30 to -40) dB 10 MHz to 26.5 GHz AM Depth > 1% (0 to -20) dB (-20 to -30) dB AM Depth > 3% (0 to -20) dB (-20 to -30) dB (-30 to -40) dB	1.2 dB 2.2 dB 1 dB 1.3 dB 2.4 dB 1.3 dB 2.5 dB 1.1 dB 1.4 dB 3 dB	Comparison to Agilent N5531S Measuring Receiver



ANSI National Accreditation Board

Electrical – RF/Microwave

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(1 to 6 600) MHz Dev 500 Hz to 2KHz		Comparison to Agilent N5531S Measuring Receiver
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 2 kHz		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.4 dB	
	(6.6 to 13.2) GHz		
	Dev > 2.3 kHz		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 4.5 kHz		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.4 dB	
	(13.2 to 26.5) GHz		
	Dev > 2.7 kHz		
(0 to -20) dB	0.26 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 6.0 kHz			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.4 dB		

Electrical – RF/Microwave

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(1 to 6 600) MHz		
	Rate (20 to 500) Hz		
	Dev > 0.8 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 2.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	Rate (500 to 1 000) Hz		
	Dev > 0.4 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 1.0 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	(6.6 to 13.2) GHz		
	Rate (20 to 500) Hz		
	Dev > 1.8 rad		
(0 to -20) dB	0.26 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 5.5 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		
Rate (500 to 1 000) Hz			
Dev > 0.8 rad			
(0 to -20) dB	0.26 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 2.5 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		

Comparison to Agilent
N5531S Measuring
Receiver



ANSI National Accreditation Board

Electrical – RF/Microwave

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(13.2 to 26.5) GHz Rate (20 to 500) Hz Dev > 3.5 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 10.0 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB Rate (500 to 1 000) Hz Dev > 3.0 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 8.0 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.3 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.3 dB	Comparison to Agilent N5531S Measuring Receiver
Total Harmonic Distortion (THD)	(0 to -60) dB 20 Hz to 20 kHz (0 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -65) dB (20 to 50) kHz (0 to -40) dB (-40 to -50) dB (-50 to -60) dB (50 to 100) kHz (0 to -40) dB (-40 to -50) dB	1 dB 1 dB 1.3 dB 1.7 dB 2 dB 2.1 dB 3 dB 2 dB 2.4 dB	Comparison to HP 8903B Audio Analyzer

Electrical – RF/Microwave

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Harmonics Measure ¹	(-80 to -10) dB		Comparison to Agilent E4440A Measuring Receiver
	2 nd through 5 th Harmonic		
	1 kHz to 600 MHz	0.37 dB	
	(600 to 1 320) MHz	1.1 dB	
	(1 320 to 2 200) MHz	1.4 dB	
	(2 200 to 3 000) MHz	1.4 dB	
	(3 000 to 4 400) MHz	1.7 dB	
	(4 400 to 5 300) MHz	1.9 dB	
(-80 to -10) dB			
2 nd through 4 th Harmonic			
(5 300 to 6 625) MHz	2.1 dB		
2 nd through 3 rd Harmonic			
(6 625 to 8 833) MHz	2.1 dB		
2 nd Harmonic			
(8 833 to 13 250) MHz	2.1 dB		

Length – Dimensional Metrology

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers ^{1,2}	Up to 24 in (24 to 80) in	(284 + 1.6L) μin (231 + 3.6L) μin	Comparison to Grade 2 gage blocks
Micrometers ^{1,2}	Up to 46 in	(29 + 4.7L) μin	
Dial Indicators ^{1,2} Resolution: ≥ 50μin < 50μin	Up to 10 in Up to 0.1 in	(25 + 3.8L) μin 9.4 μin	
Bore Micrometers/Gages ² 2 point 3 point	Up to 12 in (0.25 to 3.2) in	(22 + 3.7L) μin (23 + 26L) μin	Comparison to Master gage blocks, P&W universal measuring machine, Master Ring
Feeler Gages ¹	Up to 1 in	52 μin	Comparison to Pratt & Whitney Supermicrometer Model C
Height Gages ^{1,2}	Up to 46 in	(151 + 2.4L) μin	Comparison to Grade 2 gage blocks
Protractors ¹	(0 to 360)°	0.012° (43 s)	Comparison to Angle blocks

Length – Dimensional Metrology

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Surface Plates ¹ Overall Flatness Local Area Flatness	Up to 6 ft × 6 ft (-0.001 to 0.001) in	79 μin 68 μin	Comparison to Leveling system Repeat-o-Meter
Cylindrical Gages ^{1,2} – Plain Pin, Plug Gages Ring Gages	(0 to 13) in (0 to 14) in	(4.8 + 2.3 <i>D</i>) μin (9.3 + 1.5 <i>D</i>) μin	Comparison to Universal measuring machine, gage blocks (Grade 1)
Coating Thickness Gages ¹ Eddy Current & Magnetic Induction, Fixed Point	(14 to 202) mils	63 μin	Comparison to Coating thickness standards
Coating Thickness Shims ^{1,3}	Up to 243 mils	69 μin	Comparison to P&W Model C Bench Micrometer
Tape Measures ¹	Up to 100 ft	(0.025 + 0.000 26 <i>F</i>) in	Comparison to Standard rule
Rulers	Up to 46 in	0.009 in	Comparison to Gage blocks (grade 2)
Gage Blocks ²	(0 to 13) in	(3.2 + 1.9 <i>L</i>) μin	Comparison to Universal measuring machine, master gage block set
Thread Plugs – Major Diameter Pitch Diameter, (6 to 72) TPI	Up to 12 in Up to 12 in	65 μin 106 μin	Comparison to Gage Blocks, P&W Model C Bench Micrometer, Van Keuren thread wire set
Adjustable Thread Rings ^{2,3} Pitch Diameter (Tactile Fit)	Up to 12 in	(352 + 47 <i>D</i>) μin	Comparison to Thread Setting Plug Gages
Radius Gages	(0.01 to 1) in	290 μin	Comparison to Optical comparator
Micrometer Standards Length Rods ²	(1 to 10) in	(21 + 1.4 <i>L</i>) μin	Comparison to Gage blocks (grade 2), P&W Model C Bench Micrometer
Crimp Tools ¹	(0.011 to 1) in (0.011 to 1) in	150 μin 240 μin	Comparison to Micrometer, Pin Gages



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Mass and Mass Related

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales & Balances ^{1,4}	500 mg to 15 kg	(1 + 0.0042X) mg	Comparison to Class 1 and 2 weights
	Up to 28 kg	(8.5 + 0.12X) mg	Comparison to Class F weights & Class 2 weights
	Up to 1 600 lb	(0.005 + 0.00013W) lb	Comparison to Class F weights
Torque Tools ¹	(10 to 100) ozf·in 5 lbf·in to 1 000 lbf·ft	0.6 % of reading 0.31 % of reading	Comparison to CDI torque system
Torque Analyzers	5 lbf·in to 1 000 lbf·ft	0.06 % of reading	Comparison to Class F weights, torque arm
Pressure Gauges	(-14.75 to 1 015) psig (0.75 to 1 015) psia	0.002 % of reading	Comparison to Fluke PG7601 Piston Gauge w/ PC-7100/7600-1, PC-7200-2 and PC-7300-5 Piston-Cylinder
	(60 to 13 000) psig (72 to 13 000) psia	0.003 5 % of reading	
	(145 to 29 000) psig (160 to 29 000) psia	0.003 5 % of reading	
Pressure Gauges	(0 to 12) inH ₂ O	0.002 5 inH ₂ O	Comparison to Dwyer 1425-25 Hook Gage
Pressure Gauges ¹	(0 to 15) psi (-15 to 100) psi (0 to 500) psi (0 to 10 000) psi	0.004 psi 0.03 psi 1.2 psi 2.3 psi	Comparison to Digital gage Additel 681
Force Gages, Load Cells & Dynamometers Tension/Compression	10 g to 10 kg (0.5 to 500) lb	0.024 % of reading 0.031 % of reading	Comparison to Class F weights
Rockwell Hardness Testers ¹	HRA (20 to 65) HRA (70 to 78) HRA (80 to 84) HRA HRBW (40 to 59) HRBW (60 to 79) HRBW (80 to 100) HRBW HRC (20 to 30) HRC (35 to 55) HRC (56 to 65) HRC	0.53 HRA 0.36 HRA 0.29 HRA 0.57 HRBW 0.62 HRBW 0.4 HRBW 0.42 HRC 0.26 HRC 0.23 HRC	Indirect Verification per ASTM E18

Mass and Mass Related

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass - Fixed Points Metric	(1, 2, 3, 5, 10, 20, 30) mg	1.8 µg	Comparison to ASTM E617 Class 0 Weights OIML Class E2 Weights Precision Mass Comparators Balances
	(50, 100, 200) mg	1.8 µg	
	300 mg	2 µg	
	500 mg	1.8 µg	
	(1, 2, 5) g	5.2 µg	
	10 g	8.2 µg	
	20 g	10 µg	
	50 g	21 µg	
	100 g	41 µg	
	200 g	61 µg	
	500 g	0.16 mg	
	1 kg	0.31 mg	
	2 kg	0.61 mg	
	5 kg	2.1 mg	
	10 kg	3.1 mg	
20 kg	8.1 mg		
25 kg	8.1 mg		
Mass - Fixed Points Avoirdupois	(0.001, 0.002) lb	2.5 µg	Comparison to ASTM E617 Class 1 weights Precision Mass Comparators Balances
	0.005 lb	6.1 µg	
	0.01 lb	6.2 µg	
	0.02 lb	7.3 µg	
	0.05 lb	15 µg	
	0.1 lb	20 µg	
	0.2 lb	38 µg	
	(0.5, 1) lb	0.25 mg	
	2 lb	0.33 mg	
	5 lb	1.2 mg	
	10 lb	2.1 mg	
	20 lb	4.1 mg	
	25 lb	4.2 mg	
50 lb	14 mg		
Durometers Scale (Force) Accuracy Types A, B, C, D, E, DO Type M, Types O, OO Indenter Geometry Length Diameter Angle	(0 to 100) duros	0.06 duros	Direct Verification Master balance
		0.09 duros	
		0.07 duros	
	0.1 in 0.05 in (30 to 35)°	180 µin	Optical comparator
		180 µin	
		0.004°	

Photometry and Radiometry

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gloss Meters ¹	(20, 60, 85) ^o (0 to 100) GU	0.71 GU	Comparison to Gloss standards

Thermodynamic

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure	(-196 to 200) °C (200 to 420) °C	0.045 °C 0.59 °C	Comparison to Hart 1502 Indicator, ASL T100 PRT
Infrared (IR) Thermometry ¹	(20 to 100) °C (100 to 300) °C (300 to 420) °C (420 to 500) °C	1.5 °C 4.3 °C 6 °C 7.7 °C	Comparison to Fluke 9132 Infrared Calibrator $\lambda = (8 \text{ to } 14) \mu\text{m}$, $\epsilon = 0.95$
Humidity – Measure ¹	(10 to 90) %RH	1.3 %RH	Comparison to Vaisala MI70 Indicator and HMP77B Probe
Relative Humidity Measuring Equipment ¹	(10 to 95) %RH	0.5 %RH	Comparison to Thunder Scientific 2500 Humidity Chamber

Time and Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Generate ¹	10 MHz	1×10^{-9} Hz/Hz	Comparison to HP Z3801A GPS Receiver
Frequency – Generate ¹	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 10) MHz	1×10^{-9} Hz/Hz + 0.57 μ Hz 1×10^{-9} Hz/Hz + 5.7 μ Hz 1×10^{-9} Hz/Hz + 57 μ Hz 1×10^{-9} Hz/Hz + 0.57 mHz 1×10^{-9} Hz/Hz + 5.7 mHz 1×10^{-9} Hz/Hz + 57 mHz 1×10^{-9} Hz/Hz + 0.57 Hz	Comparison to Agilent 3325B Function Generator / HP Z3801A GPS Receiver
Frequency – Generate ¹	(10 to 26 500) MHz	1×10^{-9} Hz/Hz + 0.57 kHz	Comparison to HP 83630B Signal Generator / HP Z3801A GPS Receiver



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Time and Frequency

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Measure ¹	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (100 to 200) kHz (0.2 to 3 000) MHz	5.2 x 1 ^{e-9} Hz/Hz 2.5 x 1 ^{e-9} Hz/Hz 1.6 x 1 ^{e-9} Hz/Hz 1.3 x 1 ^{e-9} Hz/Hz 1.2 x 1 ^{e-9} Hz/Hz 1. x 1 ^{e-9} Hz/Hz 1.21 x 1 ^{e-9} Hz/Hz	Comparison to Agilent 53131A Frequency Counter / HP Z3801A GPS Receiver
	(10 to 26 500) MHz	1 x 1 ^{e-9} Hz/Hz + 0.1 Hz	Comparison to Agilent E4440A Spectrum Analyzer / HP Z3801A GPS Receiver
Timer, Stopwatch ¹	10 s to 24 hr	34 ms	Totalize method with counter
Tachometers – RPM ^{1,2}	Up to 100 000 RPM	0.001 % of reading + 0.6R	Comparison to HP 3325B Signal Generator & LED

DIMENSIONAL MEASUREMENT

1 Dimensional

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Length	X Axis (0.01 to 8) in Y Axis (0.01 to 4) in	180 μin 180 μin	Comparison to Optical comparator

2 Dimensional

Hilliard, OH

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Angle	Up to 360°	0.004°	Comparison to Optical comparator

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Services performed at satellite laboratory

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CALIBRATION

Acoustics and Vibration

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometers – Acceleration	(0.01 to 10) g (7 to < 10) Hz (10 to < 30) Hz (30 to < 2 000) Hz (2 to 10) kHz	4 % of reading 3 % of reading 1.5 % of reading 4 % of reading	Comparison to Accelerometer Calibrator

Chemical Quantities

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH meters ^{1,5}	4 pH 7 pH 10 pH	0.035 pH 0.03 pH 0.032 pH	Comparison to pH buffer solutions
Conductivity Meters ^{1,5}	2 µS/cm 5 µS/cm 10 µS/cm 100 µS/cm 500 µS/cm 1 000 µS/cm 10 000 µS/cm 100 000 µS/cm	0.2 µS/cm 0.2 µS/cm 0.17 µS/cm 0.74 µS/cm 2.3 µS/cm 3.6 µS/cm 36 µS/cm 350 µS/cm	Comparison to Conductivity solutions

Electrical – DC/Low Frequency

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Generate ¹	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	6.8 $\mu\text{V/V} + 0.8 \mu\text{V}$ 4.6 $\mu\text{V/V} + 0.9 \mu\text{V}$ 3 $\mu\text{V/V} + 2.5 \mu\text{V}$ 3 $\mu\text{V/V} + 3.9 \mu\text{V}$ 4.6 $\mu\text{V/V} + 38 \mu\text{V}$ 6.1 $\mu\text{V/V} + 385 \mu\text{V}$	Comparison to Fluke 5720A Multifunction Calibrator
DC Voltage – Measure ¹	Up to 100 mV 100 mV to 1V (1 to 10) V (10 to 100) V (100 to 1 000) V	3.3 $\mu\text{V/V} + 1 \mu\text{V}$ 2.6 $\mu\text{V/V} + 1 \mu\text{V}$ 2.6 $\mu\text{V/V} + 1.5 \mu\text{V}$ 3.9 $\mu\text{V/V} + 20 \mu\text{V}$ 3.9 $\mu\text{V/V} + 66 \mu\text{V} + 12\mu\text{V/V} \times (\text{Vin}/1\ 000) ^2$	Comparison to Agilent 3458A Multimeter
DC Voltage – Measure ¹	(1 to 40) kV	2.3 % of reading	Comparison to Agilent 34401A Multimeter, Fluke 80k-40 High Voltage Probe
DC Current – Generate ¹	(1 to 2.2) nA (2.2 to 22) nA (22 to 220) nA (0.22 to 2.2) μA (2.2 to 10) μA	93 $\mu\text{A/A} + 0.007 \text{ nA}$ 92 $\mu\text{A/A} + 0.007 \text{ nA}$ 92 $\mu\text{A/A} + 0.01 \text{ nA}$ 36 $\mu\text{A/A} + 0.1 \text{ nA}$ 20 $\mu\text{A/A} + 1 \text{ nA}$	Comparison to Fluke 5720A Multifunction Calibrator & Fluke 5522A Multifunction Calibrator
DC Current – Generate ¹	(10 to 220) μA 0.22 to 2.2 mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA (0.22 to 1) A (1 to 2.2) A	38 $\mu\text{A/A} + 5 \text{ nA}$ 30 $\mu\text{A/A} + 7 \text{ nA}$ 30 $\mu\text{A/A} + 44 \text{ nA}$ 38 $\mu\text{A/A} + 0.7 \mu\text{A}$ 45 $\mu\text{A/A} + 0.7 \mu\text{A}$ 68 $\mu\text{A/A} + 12 \mu\text{A}$ 105 $\mu\text{A/A} + 12 \mu\text{A}$	Comparison to Fluke 5720A Multifunction Calibrator
DC Current – Generate ¹	(2.2 to 11) A	274 $\mu\text{A/A} + 365 \mu\text{A}$	Comparison to Fluke 5720A Multifunction Calibrator, 5725A Amplifier
DC Current – Generate ¹	(11 to 20.5) A	761 $\mu\text{A/A} + 578 \mu\text{A}$	Comparison to Fluke 5522A Multiproduct Calibrator
DC Current – Generate ¹ Clamps Only	(0 to 200) A	0.21 % of output + 0.028 A	Comparison to Fluke 5522A Multiproduct Calibrator / 9100-200 x10 Coil



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Electrical – DC/Low Frequency

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Generate ¹ Clamps Only	(0 to 1 000) A	0.21 % of output + 0.04 A	Comparison to Fluke 5522A Multiproduct Calibrator / 9100-200 x50 Coil
DC Current – Measure ¹	(1 to 10) nA (10 to 100) nA (0.1 to 1) μ A (1 to 10) μ A	35 μ A/A + 0.1 pA 17.8 μ A/A + 1 pA 10 μ A/A + 0.01 nA 8.3 μ A/A + 0.1 nA	Comparison to Fluke 5720A Multifunction Calibrator, Agilent 3458A Multimeter Option 002
DC Current – Measure ¹	(10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	13 μ A/A + 0.5 nA 13 μ A/A + 3 nA 13 μ A/A + 0.03 μ A 23 μ A/A + 0.3 μ A 72 μ A/A + 6.6 μ A	Comparison to Agilent 3458A Multimeter
DC Current – Measure ¹	(1 to 500) A	0.26 % of reading	Comparison to Empro current shunts, Multimeter
Resistance – Generate ¹ Fixed Points	100 V 100 k Ω (100 to 1 000) V 1 M Ω 10 M Ω 100 M Ω 1 G Ω 10 G Ω	1 % of output 1 % of output 1 % of output 1 % of output 1 % of output 1.2 % of output	Comparison to TMI RB Resistance Standard
Resistance – Generate ¹	Up to 11 Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) k Ω (1.1 to 3.3) k Ω (3.3 to 11) k Ω (11 to 33) k Ω (33 to 110) k Ω (110 to 330) k Ω (0.33 to 1.1) M Ω (1.1 to 3.3) M Ω (3.3 to 11) M Ω (11 to 33) M Ω (33 to 110) M Ω (110 to 330) M Ω (0.33 to 1.1) G Ω	30 $\mu\Omega/\Omega$ + 0.001 Ω 23 $\mu\Omega/\Omega$ + 0.001 Ω 21 $\mu\Omega/\Omega$ + 0.001 Ω 21 $\mu\Omega/\Omega$ + 0.002 Ω 21 $\mu\Omega/\Omega$ + 0.002 Ω 21 $\mu\Omega/\Omega$ + 0.02 Ω 21 $\mu\Omega/\Omega$ + 0.02 Ω 21 $\mu\Omega/\Omega$ + 0.2 Ω 21 $\mu\Omega/\Omega$ + 0.2 Ω 24 $\mu\Omega/\Omega$ + 2 Ω 24 $\mu\Omega/\Omega$ + 2 Ω 46 $\mu\Omega/\Omega$ + 23 Ω 99 $\mu\Omega/\Omega$ + 38 Ω 190 $\mu\Omega/\Omega$ + 1.9 k Ω 380 $\mu\Omega/\Omega$ + 2.3 k Ω 0.23 % of setting + 76 k Ω 1.1 % of reading + 380 k Ω	Comparison to Fluke 5522A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Fixed Points	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9) kΩ (10, 19) kΩ (100, 190) kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	84 μΩ/Ω + 0.1 μΩ 21 μΩ/Ω + 1 μΩ 9.1 μΩ/Ω + 6 μΩ 7.6 μΩ/Ω + 60 μΩ 7.6 μΩ/Ω + 0.6 mΩ 9.9 μΩ/Ω + 6 mΩ 18 μΩ/Ω + 60 mΩ 18 μΩ/Ω + 60 mΩ 35 μΩ/Ω + 0.6 Ω 42 μΩ/Ω + 0.6 Ω 91 μΩ/Ω + 6 Ω	Comparison to Fluke 5720A Multifunction Calibrator
Resistance – Measure ¹	Up to 12 Ω (10 to 120) Ω (0.1 to 1.2 kΩ (1 to 12) kΩ (10 to 120) kΩ (0.1 to 1.2) MΩ (1 to 12) MΩ (10 to 120) MΩ (0.1 to 1.2) GΩ	9.8 μΩ/Ω + 38 μΩ 7.8 μΩ/Ω + 0.3 mΩ 6.5 μΩ/Ω + 0.4 mΩ 6.5 μΩ/Ω + 3.8 mΩ 6.5 μΩ/Ω + 38 mΩ 9.8 μΩ/Ω + 1.5 Ω 33 μΩ/Ω + 100 Ω 327 μΩ/Ω + 1 kΩ 0.33 % of reading + 70 kΩ	Comparison to Agilent 3458A Multimeter
Capacitance – Generate ¹	(220 to 400) pF (0.4 to 3.299 9) nF (3.3 to 10.999 9) nF (11 to 32.999 9) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.099 99) μF (1.1 to 3.299 99) μF (3.3 to 10.999 9) μF (11 to 32.999 9) μF (33 to 109.999) μF (110 to 329.999) μF (0.33 to 1.099 99) mF (1.1 to 3.299 99) mF (3.3 to 10.999 9) mF (11 to 32.999 9) mF (33 to 110) mF	0.38% of output + 7.6 pF 0.38 % of output + 0.01 nF 0.19 % of output + 0.01 nF 0.19 % of output + 0.08 nF 0.19 % of output + 0.08 nF 0.19 % of output + 0.23 nF 0.19 % of output + 0.76 nF 0.19 % of output + 2.3 nF 0.19 % of output + 7.6 nF 0.3 % of output + 23 nF 0.34 % of output + 76 nF 0.34 % of output + 228 nF 0.34 % of output + 0.76 μF 0.34 % of output + 2.3 μF 0.34 % of output + 7.6 μF 0.57 % of output + 23 μF 0.84 % of output + 76 μF	Comparison to Fluke 5522A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure ¹	100 Hz /120 Hz		Comparison to Agilent 4263B LCR Meter
	(16 to 400) pF	2 % of reading + 0.3 pF	
	(0.4 to 1) nF	0.17 % of reading	
	(1 to 100) nF	0.23 % of reading	
	(0.1 to 1) μF	0.23 % of reading	
	(1 to 100) μF	0.23 % of reading	
	(0.1 to 1) mF	0.23 % of reading	
	1 000 Hz		
	(16 to 400) pF	0.43 % of reading + 0.3 pF	
	(0.4 to 1) nF	0.1 % of reading	
	(1 to 100) nF	0.13 % of reading	
	(0.1 to 1) μF	0.12 % of reading	
	(1 to 100) μF	0.13 % of reading	
	(0.1 to 1) mF	0.45 % of reading	
	10 kHz		
	(16 to 400) pF	0.56 % of reading + 0.3 pF	
	(0.4 to 1) nF	0.15 % of reading	
	(1 to 100) nF	0.2 % of reading	
	(0.1 to 1) μF	0.17 % of reading	
	(1 to 100) μF	0.69 % of reading	
	(0.1 to 1) mF	3.5 % of reading	
20 kHz			
(16 to 400) pF	1.2 % of reading + 0.3 pF		
(0.4 to 1) nF	0.66 % of reading		
(1 to 100) nF	0.65 % of reading		
(0.1 to 1) μF	0.53 % of reading		
(1 to 100) μF	1.7 % of reading		
Inductance – Measure ¹	100 Hz /120 Hz		Comparison to Agilent 4263B LCR Meter
	(4 to 10) μH	5.2 % of reading + 0.03 μH	
	(10 to 40) μH	2.3 % of reading + 0.03 μH	
	(40 to 100) μH	0.57 % of reading + 0.03 μH	
	(0.1 to 0.4) mH	0.4 % of reading	
	(0.4 to 1) mH	0.32 % of reading	
	(1 to 10) mH	0.28 % of reading	
	(10 to 100) mH	0.23 % of reading	
	(0.1 to 1) H	0.18 % of reading	
	(1 to 10) H	0.22 % of reading	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ¹	1 000 Hz		Comparison to Agilent 4263B LCR Meter
	(1 to 4) μ H	1 % of reading + 0.03 μ H	
	(4 to 10) μ H	0.46 % of reading + 0.03 μ H	
	(10 to 40) μ H	0.74 % of reading + 0.03 μ H	
	(40 to 100) μ H	0.35 % of reading + 0.03 μ H	
	(0.01 to 0.4) mH	0.3 % of reading	
	(0.4 to 1) mH	0.11 % of reading	
	(1 to 10) mH	0.12 % of reading	
	(10 to 100) mH	0.1 % of reading	
	(0.1 to 1) H	0.1 % of reading	
	(1 to 10) H	0.12 % of reading	
	10 kHz		
	(1 to 4) μ H	0.62 % of reading + 0.03 μ H	
	(4 to 10) μ H	0.4 % of reading + 0.03 μ H	
	(10 to 40) μ H	0.32 % of reading + 0.03 μ H	
	(40 to 100) μ H	0.18 % of reading + 0.03 μ H	
	(0.1 to 0.4) mH	0.2 % of reading	
	(0.4 to 1) mH	0.14 % of reading	
	(1 to 10) mH	0.17 % of reading	
	(10 to 100) mH	0.2 % of reading	
	(0.1 to 1) H	0.2 % of reading	
	(1 to 10) H	0.44 % of reading	
	20 kHz		
	(1 to 4) μ H	1.3 % of reading + 0.03 μ H	
	(4 to 10) μ H	0.68 % of reading + 0.03 μ H	
	(10 to 40) μ H	0.63 % of reading + 0.03 μ H	
	(40 to 100) μ H	0.53 % of reading + 0.03 μ H	
	(0.1 to 0.4) mH	0.49 % of reading	
	(0.4 to 1) mH	0.48 % of reading	
	(1 to 10) mH	0.65 % of reading	
(10 to 100) mH	0.66 % of reading		
(0.1 to 1) H	1.2 % of reading		
(1 to 10) H	3.3 % of reading		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ¹	100 kHz (1 to 4) μ H (4 to 10) μ H (10 to 40) μ H (40 to 100) μ H (0.1 to 0.4) mH (0.4 to 1) mH (1 to 10) mH (10 to 100) mH (0.1 to 1) H	2.7 % of reading + 0.03 μ H 0.86 % of reading + 0.03 μ H 1.2 % of reading + 0.03 μ H 0.68 % of reading + 0.03 μ H 0.9 % of reading 1.1 % of reading 1.4 % of reading 1.4 % of reading 6.3 % of reading	Comparison to Agilent 4263B LCR Meter
AC Voltage – Generate ¹	(0.22 to 22) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (22 to 220) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (0.22 to 2.2) V (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	228 μ V/V + 3.9 μ V 88 μ V/V + 3.9 μ V 76 μ V/V + 3.9 μ V 190 μ V/V + 3.9 μ V 457 μ V/V + 4.6 μ V 989 μ V/V + 9.2 μ V 1.3 mV/V + 19 μ V 2.6 mV/V + 19 μ V 228 μ V/V + 11 μ V 88 μ V/V + 6.1 μ V 76 μ V/V + 6.1 μ V 190 μ V/V + 6.1 μ V 457 μ V/V + 15 μ V 837 μ V/V + 19 μ V 1.3 mV/V + 23 μ V 2.5 mV/V + 46 μ V 228 μ V/V + 38 μ V 84 μ V/V + 15 μ V 40 μ V/V + 8 μ V 68 μ V/V + 9 μ V 99 μ V/V + 30 μ V 380 μ V/V + 76 μ V 913 μ V/V + 190 μ V 1.5 mV/V + 304 μ V	Comparison to Fluke 5720A Multifunction Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(2.2 to 22) V		Comparison to Fluke 5720A Multifunction Calibrator
	(10 to 20) Hz	228 μ V/V + 380 μ V	
	(20 to 40) Hz	84 μ V/V + 152 μ V	
	40 Hz to 20 kHz	37 μ V/V + 54 μ V	
	(20 to 50) kHz	61 μ V/V + 91 μ V	
	(50 to 100) kHz	76 μ V/V + 190 μ V	
	(100 to 300) kHz	228 μ V/V + 609 μ V	
	(300 to 500) kHz	913 μ V/V + 1.9 mV	
	500 kHz to 1 MHz	1.4 mV/V + 3 mV	
	(22 to 220) V		
	(10 to 20) Hz	228 μ V/V + 3.8 mV	
	(20 to 40) Hz	84 μ V/V + 1.5 mV	
	40 Hz to 20 kHz	49 μ V/V + 0.6 mV	
	(20 to 50) kHz	76 μ V/V + 0.9 mV	
(50 to 100) kHz	137 μ V/V + 2.3 mV		
AC Voltage – Generate ¹	(220 to 750) V		Comparison to Fluke 5720A Multifunction Calibrator, 5725A Amplifier
	40 Hz to 1 kHz	68 μ V/V + 3 mV	
	(1 to 20) kHz	126 μ V/V + 5 mV	
	(20 to 50) kHz	457 μ V/V + 8 mV	
	(50 to 100) kHz	1.8 mV/V + 34 mV	
	(750 to 1 000) V		
	40 Hz to 1 kHz	68 μ V/V + 3 mV	
	(1 to 20) kHz	126 μ V/V + 5 mV	
(20 to 30) kHz	457 μ V/V + 8 mV		
AC Voltage – Generate ¹ Wideband Absolute	(0.3 to 1.1) mV		Comparison to Fluke 5720A Option 003 Multifunction Calibrator
	(10 to 30 Hz)	0.65 % of output + 1.5 μ V	
	30 Hz to 500 kHz	0.61 % of output + 1.5 μ V	
	(0.5 to 1.2) MHz	0.63 % of output + 3.8 μ V	
	(1.2 to 2) MHz	0.63 % of output + 3.8 μ V	
	(2 to 12) MHz	0.68 % of output + 3.8 μ V	
	(12 to 20) MHz	0.76 % of output + 3.8 μ V	
	(20 to 30) MHz	1.3 % of output + 13 μ V	
	(1.1 to 3.3) mV		
	(10 to 30 Hz)	0.58 % of output + 2.3 μ V	
	30 Hz to 500 kHz	0.53 % of output + 2.3 μ V	
	(0.5 to 1.2) MHz	0.54 % of output + 4.6 μ V	
	(1.2 to 2) MHz	0.54 % of output + 4.6 μ V	
	(2 to 12) MHz	0.58 % of output + 4.6 μ V	
	(12 to 20) MHz	0.65 % of output + 4.6 μ V	
	(20 to 30) MHz	1.3 % of output + 4.6 μ V	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(3.3 to 11) mV		Comparison to Fluke 5720A Option 003 Multifunction Calibrator
	(10 to 30 Hz)	0.58 % of output + 6.1 μ V	
	30 Hz to 500 kHz	0.53 % of output + 6.1 μ V	
	(0.5 to 1.2) MHz	0.54 % of output + 8.4 μ V	
	(1.2 to 2) MHz	0.54 % of output + 8.4 μ V	
	(2 to 12) MHz	0.55 % of output + 8.4 μ V	
	(12 to 20) MHz	0.61 % of output + 8.4 μ V	
	(20 to 30) MHz	0.93 % of output + 8.4 μ V	
	(11 to 33) mV		
	(10 to 30 Hz)	0.52 % of output + 12 μ V	
	30 Hz to 500 kHz	0.46 % of output + 12 μ V	
	(0.5 to 1.2) MHz	0.47 % of output + 14 μ V	
	(1.2 to 2) MHz	0.47 % of output + 14 μ V	
	(2 to 12) MHz	0.49 % of output + 14 μ V	
	(12 to 20) MHz	0.55 % of output + 14 μ V	
	(20 to 30) MHz	0.89 % of output + 14 μ V	
	(33 to 110) mV		
	(10 to 30 Hz)	0.52 % of output + 30 μ V	
	30 Hz to 500 kHz	0.46 % of output + 30 μ V	
	(0.5 to 1.2) MHz	0.47 % of output + 33 μ V	
	(1.2 to 2) MHz	0.47 % of output + 33 μ V	
	(2 to 12) MHz	0.49 % of output + 33 μ V	
	(12 to 20) MHz	0.55 % of output + 33 μ V	
	(20 to 30) MHz	0.89 % of output + 33 μ V	
	(110 to 330) mV		
	(10 to 30 Hz)	0.45 % of output + 0.1 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.1 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.1 mV	
(1.2 to 2) MHz	0.4 % of output + 0.1 mV		
(2 to 12) MHz	0.42 % of output + 0.1 mV		
(12 to 20) MHz	0.49 % of output + 0.1 mV		
(20 to 30) MHz	0.85 % of output + 0.1 mV		
0.33 to 1.1 V			
(10 to 30 Hz)	0.45% of output + 0.3 mV		
30 Hz to 500 kHz	0.38 % of output + 0.3 mV		
(0.5 to 1.2) MHz	0.4 % of output + 0.3 mV		
(1.2 to 2) MHz	0.4 % of output + 0.3 mV		
(2 to 12) MHz	0.42 % of output + 0.3 mV		
(12 to 20) MHz	0.49 % of output + 0.3 mV		
(20 to 30) MHz	0.85 % of output + 0.3 mV		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(1.1 to 3.5) V (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz	0.39 % of output + 0.4 mV 0.3 % of output + 0.4 mV 0.32 % of output + 0.4 mV 0.32 % of output + 0.4 mV 0.35 % of output + 0.4 mV 0.44 % of output + 0.4 mV 0.82 % of output + 0.4 mV	Comparison to Fluke 5720A Multifunction Calibrator Option 003
AC Voltage – Measure ¹	(0 to 10) mV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz (10 to 100) mV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz (0.1 to 1) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.02 % of reading + 2 μV 0.013 % of reading + 0.7 μV 0.02 % of reading + 0.7 μV 0.065 % of reading + 0.7 μV 0.33 % of reading + 0.7 μV 0.78 % of reading + 3.3 μV 4.6 % of reading + 4.6 μV 13 % of reading + 5.3 μV 0.005 % of reading + 2.6 μV 0.005 % of reading + 1.3 μV 0.009 % of reading + 1.3 μV 0.02 % of reading + 1.3 μV 0.052 % of reading + 1.3 μV 0.2 % of reading + 6.5 μV 0.7 % of reading + 6.5 μV 0.98 % of reading + 46 μV 2.6 % of reading + 46 μV 2.6 % of reading + 52 μV 9.8 % of reading + 65 μV 0.005 % of reading + 26 μV 0.005 % of reading + 13 μV 0.009 % of reading + 13 μV 0.02 % of reading + 13 μV 0.052 % of reading + 13 μV 0.2 % of reading + 65 μV 0.65 % of reading + 65 μV 0.98 % of reading + 0.5 mV 2.6 % of reading + 0.5 mV 2.6 % of reading + 0.5 mV 9.8 % of reading + 0.7 mV	Comparison to Agilent 3458A Multimeter



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(1 to 10) V		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.005 % of reading + 0.3 mV	
	40 Hz to 1 kHz	0.005 % of reading + 0.1 mV	
	(1 to 20) kHz	0.009 % of reading + 0.1 mV	
	(20 to 50) kHz	0.02 % of reading + 0.1 mV	
	(50 to 100) kHz	0.052 % of reading + 0.1 mV	
	(100 to 300) kHz	0.2 % of reading + 0.7 mV	
	300 kHz to 1 MHz	0.65 % of reading + 0.7 mV	
	(1 to 2) MHz	0.98 % of reading + 4.6 mV	
	(2 to 4) MHz	2.6 % of reading + 4.6 mV	
	(4 to 8) MHz	2.6 % of reading + 5.2 mV	
	(8 to 10) MHz	9.8 % of reading + 6.5 mV	
	(10 to 100) V		
	(1 to 40) Hz	0.013 % of reading + 2.6 mV	
	40 Hz to 1 kHz	0.013 % of reading + 1.3 mV	
(1 to 20) kHz	0.013 % of reading + 1.3 mV		
(20 to 50) kHz	0.023 % of reading + 1.3 mV		
(50 to 100) kHz	0.08 % of reading + 1.3 mV		
(100 to 300) kHz	0.26 % of reading + 6.5 mV		
300 kHz to 1 MHz	0.98 % of reading + 6.5 mV		
(100 to 700) V			
(1 to 40) Hz	0.026 % of reading + 26 mV		
40 Hz to 1 kHz	0.026 % of reading + 13 mV		
(1 to 20) kHz	0.039 % of reading + 13 mV		
(20 to 50) kHz	0.078 % of reading + 13 mV		
(50 to 100) kHz	0.2 % of reading + 13 mV		
AC Voltage – Measure ¹	(1 to 28) kV 60 Hz	5.8 % of reading	Comparison to Agilent 34401A Multimeter / Fluke 80k-40 High Voltage Probe
AC Current – Generate ¹	(9 to 220) μ A		Comparison to Fluke 5720A Multifunction Calibrator
	(10 to 20) Hz	228 μ A/A + 15 nA	
	(20 to 40) Hz	152 μ A/A + 10 nA	
	40 Hz to 1 kHz	91 μ A/A + 8 nA	
	(1 to 5) kHz	266 μ A/A + 12 nA	
	(5 to 10) kHz	989 μ A/A + 61 nA	
	(0.22 to 2.2) mA		
	(10 to 20) Hz	228 μ A/A + 39 nA	
	(20 to 40) Hz	152 μ A/A + 31 nA	
	40 Hz to 1 kHz	107 μ A/A + 31 nA	
	(1 to 5) kHz	183 μ A/A + 99 nA	
	(5 to 10) kHz	989 μ A/A + 609 nA	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate ¹	(2.2 to 22) mA		Comparison to Fluke 5720A Multifunction Calibrator
	(10 to 20) Hz	228 μ A/A + 385 nA	
	(20 to 40) Hz	152 μ A/A + 310 nA	
	40 Hz to 1 kHz	107 μ A/A + 310 nA	
	(1 to 5) kHz	183 μ A/A + 536 nA	
	(5 to 10) kHz	989 μ A/A + 4.6 μ A	
	(22 to 220) mA		
	(10 to 20) Hz	228 μ A/A + 4 μ A	
	(20 to 40) Hz	152 μ A/A + 3 μ A	
	40 Hz to 1 kHz	107 μ A/A + 2 μ A	
	(1 to 5) kHz	183 μ A/A + 3 μ A	
	(5 to 10) kHz	989 μ A/A + 9 μ A	
AC Current – Generate ¹	(0.22 to 2.2) A		Comparison to Fluke 5720A Multifunction Calibrator, 5725A Amplifier
	20 Hz to 1 kHz	243 μ A/A + 31 μ A	
	(1 to 5) kHz	380 μ A/A + 76 μ A	
	(5 to 10) kHz	6.1 mA/A + 152 μ A	
AC Current – Generate ¹	(2.2 to 11) A		Comparison to Fluke 5522A Multiproduct Calibrator
	40 Hz to 1 kHz	350 μ A/A + 141 μ A	
	(1 to 5) kHz	723 μ A/A + 295 μ A	
	(5 to 10) kHz	2.7 mA/A + 573 μ A	
AC Current – Generate ¹	(11 to 20.5) A		Comparison to Fluke 5522A Multiproduct Calibrator
	(45 to 100) Hz	0.09 % of output + 5 mA	
	100 Hz to 1 kHz	0.11 % of output + 5 mA	
	(1 to 5) kHz	2.28 % of output + 5 mA	
AC Current – Generate ¹ Clamp Meters Only	(3.3 to 30) A		Comparison to Fluke 5522A Multiproduct Calibrator / 9100-200 x10 Coil
	(10 to 100) Hz	0.22 % of output + 0.028 A	
	(100 to 440) Hz	0.3 % of output + 0.07 A	
	(30 to 200) A		
	10 to 100 Hz	0.22 % of output + 0.032 A	
AC Current – Generate ¹ Clamp Meters Only	(16.5 to 150) A		Comparison to Fluke 5522A Multiproduct Calibrator /9100-200 x50 Coil
	(10 to 100) Hz	0.22 % of output + 0.029 A	
	(100 to 440) Hz	0.3 % of output + 0.08 A	
	(150 to 1 000) A		
	(10 to 100) Hz	0.22 % of output + 0.081 A	
	(100 to 440) Hz	0.79 % of output + 0.2 A	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(5 to 100) μ A		Comparison to Agilent 3458A Multimeter
	(10 to 20) Hz	0.26 % of reading + 0.02 μ A	
	(20 to 45) Hz	0.1 % of reading + 0.02 μ A	
	45 Hz to 1 kHz	0.04 % of reading + 0.02 μ A	
	(0.1 to 1) mA		
	(10 to 20) Hz	0.26 % of reading + 0.13 μ A	
	(20 to 45) Hz	0.1 % of reading + 0.13 μ A	
	(45 to 100) Hz	0.04 % of reading + 0.13 μ A	
	100 Hz to 5 kHz	0.02 % of reading + 0.13 μ A	
	(1 to 10) mA		
	(10 to 20) Hz	0.26 % of reading + 1.3 μ A	
	(20 to 45) Hz	0.1 % of reading + 1.3 μ A	
	(45 to 100) Hz	0.04 % of reading + 1.3 μ A	
	100 Hz to 5 kHz	0.02 % of reading + 1.3 μ A	
	(10 to 100) mA		
	(10 to 20) Hz	0.26 % of reading + 13 μ A	
(20 to 45) Hz	0.1 % of reading + 13 μ A		
(45 to 100) Hz	0.04 % of reading + 13 μ A		
100 Hz to 5 kHz	0.02 % of reading + 13 μ A		
(0.1 to 1) A			
(10 to 20) Hz	0.26 % of reading + 0.13 mA		
(20 to 45) Hz	0.1 % of reading + 0.13 mA		
(45 to 100) Hz	0.04 % of reading + 0.13 mA		
100 Hz to 5 Hz	0.02 % of reading + 0.13 mA		
AC Current – Measure ¹	(1 to 3) A		Comparison to Agilent 34401A Multimeter
	(3 to 5) Hz	0.72 % of reading + 1.2 mA	
	(5 to 10) Hz	0.23 % of reading + 1.2 mA	
	10 Hz to 5 kHz	0.1 % of reading + 1.2 mA	
AC Current – Measure ¹	(3 to 30) A		Comparison to Agilent 3458A Multimeter, Keysight 34330A Current Shunt
	40 Hz to 1 kHz	0.3 % of reading + 0.07 A	
	(1 to 5) kHz	5 % of reading + 0.14 A	
AC Current – Measure ¹	(30 to 600) A		Comparison to Fluke 336 Clamp Meter
	(10 to 100) Hz	1.5 % of reading + 1.1 A	
	(100 to 400) Hz	4.6 % of reading + 1.1 A	



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Electrical – DC/Low Frequency

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration ¹ – Generate			
Voltage DC - 50Ω	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.199 9) V (2.2 to 6.6) V	0.19 % of Output + 31 μV 0.19 % of Output + 36 μV 0.19 % of Output + 87 μV 0.19 % of Output + 0.6 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
DC - 1MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.199 9) V (2.2 to 10.999) V (11 to 130) V	0.019 % of reading + 20 μV 0.019 % of reading + 25 μV 0.019 % of reading + 76 μV 0.019 % of reading + 0.6 mV 0.019 % of reading + 6 mV	
Square Wave 10 Hz to 10 kHz - 50Ω	(1 to 24.999) mVpp (25 to 109.99) mVpp (110mV to 2.199 9) Vpp (2.2 to 6.6) Vpp	0.19 % of Output + 31 μV 0.19 % of Output + 36 μV 0.19 % of Output + 87 μV 0.19 % of Output + 0.6 mV	
Square Wave 10 Hz to 1 kHz - 1MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.038 % of reading + 4 μV 0.038 % of reading + 9 μV 0.038 % of reading + 60 μV 0.038 % of reading + 0.6 mV 0.038 % of reading + 6 mV	
Square Wave 1 to 10 kHz - 1MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.199 9) V (2.2 to 10.999) V (11 to 130) V	0.19 % of reading + 31 μV 0.19 % of reading + 36 μV 0.19 % of reading + 87 μV 0.19 % of reading + 0.6 mV 0.19 % of reading + 6 mV	



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Electrical – DC/Low Frequency

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration – Generate ¹ Levelled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth (5 to 50) mVpp 50 kHz to 100) MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 16 00) MHz (1 600 to 2 100) MHz 50 mV to 3.5 Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 16 00) MHz (1 600 to 2 100) MHz (3.5 to 5) Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz	0.34 dB 0.36 dB 0.42 dB 0.46 dB 0.5 dB 0.56 dB 0.24 dB 0.24 dB 0.32 dB 0.34 dB 0.4 dB 0.44 dB 0.24 dB 0.24 dB 0.32 dB 0.34 dB	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Generate ¹ Levelled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth 50 mVpp to 3.5Vpp (2 100 to 4 000) MHz (4 000 to 8 000) MHz (8 000 to 18 000) MHz	0.25 dB 0.35 dB 0.46 dB	Comparison to EPM Power Meter w/ E Series Power Sensors
Oscilloscopes Calibration – Generate ¹ Time Marker Input Impedance Resistance Leakage	500 ps to 20 ms 50 ms to 5 s (40 to 60) Ω 500 kΩ to 1.5MΩ (0 to 5.99) V	0.25 μs/s 1.9 μs/s + 3.8 μHz 0.08 % of reading 0.08 % of reading 0.038 % of reading + 0.8 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option



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Electrical – DC/Low Frequency

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicators ¹	Type B		Comparison to Fluke 7526A Process Calibrator
	(600 to 800) °C	0.27 °C	
	(800 to 1 550) °C	0.21 °C	
	(1 550 to 1 820) °C	0.17 °C	
	Type C		
	(0 to 1 000) °C	0.12 °C	
	(1 000 to 1 800) °C	0.18 °C	
	(1 800 to 2 000) °C	0.2 °C	
	(2 000 to 2 316) °C	0.27 °C	
	Type E		
	(-250 to -200) °C	0.19 °C	
	(-200 to -100) °C	0.09 °C	
	(-100 to 0) °C	0.07 °C	
	(0 to 600) °C	0.06 °C	
	(600 to 1 000) °C	0.08 °C	
	Type J		
	(-210 to -100) °C	0.11 °C	
	(-100 to 800) °C	0.07 °C	
	(800 to 1 200) °C	0.08 °C	
	Type K		
	(-250 to -200) °C	0.35 °C	
(-200 to -100) °C	0.12 °C		
(-100 to 800) °C	0.08 °C		
(800 to 1 372) °C	0.1 °C		
Type L			
(-200 to -100) °C	0.08 °C		
(-100 to 900) °C	0.07 °C		
Type N			
(-250 to -200) °C	0.56 °C		
(-200 to -100) °C	0.18 °C		
(-100 to 0) °C	0.09 °C		
(0 to 100) °C	0.08 °C		
(100 to 800) °C	0.08 °C		
(800 to 1 300) °C	0.09 °C		



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Electrical – DC/Low Frequency

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicators ¹	Type R		Comparison to Fluke 7526A Process Calibrator
	(-50 to -25) °C	0.42 °C	
	(-25 to 0) °C	0.34 °C	
	(0 to 100) °C	0.3 °C	
	(100 to 400) °C	0.21 °C	
	(400 to 600) °C	0.17 °C	
	(600 to 1 000) °C	0.16 °C	
	(1 000 to 1 600) °C	0.14 °C	
	(1 600 to 1 767) °C	0.18 °C	
	Type S		
	(50 to -25) °C	0.39 °C	
	(-25 to 0) °C	0.33 °C	
	(0 to 100) °C	0.29 °C	
	(100 to 400) °C	0.22 °C	
	(400 to 600) °C	0.18 °C	
	(600 to 1 600) °C	0.17 °C	
	(1 600 to 1 767) °C	0.2 °C	
	Type T		
	(-250 to -200) °C	0.27 °C	
	(-200 to -100) °C	0.12 °C	
(-100 to 0) °C	0.08 °C		
(0 to 400) °C	0.07 °C		
Type U			
(-200 to 0) °C	0.13 °C		
(0 to 600) °C	0.08 °C		
Electrical Calibration of RTD Indicators ¹	Pt 100 (385)		Comparison to Fluke 7526A Process Calibrator
	(-200 to 800) °C	0.04 °C	
	Pt 100 (3916)		
	(-200 to 630) °C	0.04 °C	
	Pt 100 (3926)		
	(-200 to 630) °C	0.04 °C	
	Pt 200 (385)		
	(-200 to 400) °C	0.3 °C	
	(400 to 630) °C	0.38 °C	
	Pt 500 (385)		
(-200 to 630) °C	0.13 °C		
Pt 1 000 (385)			
(-200 to 630) °C	0.07 °C		



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Electrical – DC/Low Frequency

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicators ¹	Cu 10 (427) (100 °C to 260) °C	0.29 °C	Comparison to Fluke 5522A Multiproduct Calibrator
	Ni 120 (672) (-80 to 260) °C	0.02 °C	
AC Power – Generate ¹ (33 to 329.999) mV Power Factor = 1	(3.3 to 32.999 9) mA (20 to 45) Hz	0.072 % of Output + 0.5 µW	Comparison to Fluke 5522A Multiproduct Calibrator
	(45 to 1 000) Hz	0.032 % of Output + 0.5 µW	
	(33 to 329.999) mA (20 to 45) Hz	0.072 % of Output + 5.4 µW	
	(45 to 1 000) Hz	0.032 % of Output + 5.4 µW	
	(0.33 to 1.099 99) A (10 to 45) Hz	0.14 % of Output + 26 µW	
	(45 to 1 000) Hz	0.04 % of Output + 26 µW	
	(1.1 to 2.999 99) A (10 to 45) Hz	0.14 % of Output + 31 µW	
	(45 to 1 000) Hz	0.047 % of Output + 31 µW	
	(3 to 10.999 9) A (45 to 100) Hz	0.047 % of Output + 0.5 mW	
	(100 to 1 000) Hz	0.077 % of Output + 0.5 mW	
AC Power – Generate ¹ (0.33 to 3.29999) V Power Factor = 1	(11 to 20.5) A (45 to 100) Hz	0.092 % of Output + 1.3 mW	Comparison to Fluke 5522A Multiproduct Calibrator
	(100 to 1 000) Hz	0.12 % of Output + 1.3 mW	
	(3.3 to 32.9999) mA (20 to 45) Hz	0.072 % of Output + 5.2 µW	
	(45 to 1 000) Hz	0.033 % of Output + 5.2 µW	
	(33 to 329.999) mA (20 to 45) Hz	0.072 % of Output + 52 µW	
	(45 to 1 000) Hz	0.033 % of Output + 52 µW	
	(0.33 to 1.099 99) A (10 to 45) Hz	0.139 % of Output + 26 µW	
	(45 to 1 000) Hz	0.04 % of Output + 26 µW	
	(1.1 to 2.999 99) A (10 to 45) Hz	0.14 % of Output + 0.28 mW	
	(45 to 1 000) Hz	0.047 % of Output + 0.29 mW	
AC Power – Generate ¹ (3 to 10.999 9) A (45 to 100) Hz	(100 to 1 000) Hz	0.047 % of Output + 5.1 mW	Comparison to Fluke 5522A Multiproduct Calibrator
	(11 to 20.5) A (45 to 100) Hz	0.077 % of Output + 5.1 mW	
	(45 to 100) Hz	0.092 % of Output + 13 mW	
	(100 to 1 000) Hz	0.12 % of Output + 13 mW	



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Electrical – DC/Low Frequency

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (3.3 to 32.9999) V Power Factor = 1	(3.3 to 32.999 9) mA (20 to 45) Hz (45 to 1 000) Hz (33 to 329.999) mA (20 to 45) Hz (45 to 1 000) Hz (0.33 to 1.099 99) A (10 to 45) Hz (45 to 1 000) Hz (1.1 to 2.999 99) A (10 to 45) Hz (45 to 1 000) Hz (3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.072 % of Output + 53μW 0.033 % of Output + 53μW 0.072 % of Output + 0.5 mW 0.033 % of Output + 0.5 mW 0.14 % of Output + 2.6 mW 0.04 % of Output + 2.6 mW 0.14 % of Output + 2.9 mW 0.047 % of Output + 2.9 mW 0.047 % of Output + 51 mW 0.077 % of Output + 51 mW 0.092 % of Output + 0.13 W 0.12 % of Output + 0.13 W	Comparison to Fluke 5522A Multiproduct Calibrator
AC Power – Generate ¹ (33 to 329.999) V Power Factor = 1	(3.3 to 32.999 9) mA (45 to 1 000) Hz (33 to 329.999) mA (45 to 1 000) Hz (0.33 to 1.099 99) A (45 to 1 000) Hz (1.1 to 2.999 99) A (45 to 1 000) Hz (3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.034 % of Output + 0.5 mW 0.034 % of Output + 5.1 mW 0.041 % of Output + 25 mW 0.048 % of Output + 26 mW 0.048 % of Output + 0.5 W 0.077 % of Output + 0.5 W 0.092 % of Output + 1.3 W 0.12 % of Output + 1.3 W	Comparison to Fluke 5522A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (330 to 1020) V Power Factor = 1	(3.3 to 32.999 9) mA (45 to 1 000) Hz	0.036 % of Output + 1.6 mW	Comparison to Fluke 5522A Multiproduct Calibrator
	(33 to 329.999) mA (45 to 1 000) Hz	0.036 % of Output + 16 mW	
	(0.33 to 1.099 99) A (45 to 1 000) Hz	0.043 % of Output + 78 mW	
	(1.1 to 2.999 99) A (45 to 1 000) Hz	0.049 % of Output + 81 mW	
	(3 to 10.999 9) A (45 to 100) Hz	0.051 % of Output + 1.6 W	
	(100 to 1 000) Hz	0.078 % of Output + 1.6 W	
	(11 to 20.5) A (45 to 100) Hz	0.094 % of Output + 3.9 W	
	(100 to 1 000) Hz	0.12 % of Output + 3.9 W	
Phase Angle - Generate ¹	(-180 to 180) °		Comparison to Fluke 5522A Multiproduct Calibrator
	(10 to 65) Hz	0.08°	
	(65 to 500) Hz	0.19°	
	500 Hz to 1 kHz (1 to 5) kHz	0.38° 1.9°	
	(5 to 10) kHz (10 to 30) kHz	3.8° 7.6°	
Power Meters ¹	3 μW to 100 mW	0.32 % of reading	Comparison to HP 11683A Range Calibrator



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Electrical – RF/Microwave

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation –Measure ¹	(30 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.13 dB	
	(110 to 120) dB	0.26 dB	
	(3 050 to 6 600) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.15 dB	
	(110 to 120) dB	0.37 dB	
	(6 600 to 13 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
(90 to 100) dB	0.14 dB		
(100 to 110) dB	0.34 dB		
(110 to 120) dB	0.77 dB		



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Electrical – RF/Microwave

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(13 200 to 19 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.27 dB	
	(100 to 110) dB	0.66 dB	
	(19 200 to 26 500) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
(70 to 80) dB	0.12 dB		
(80 to 90) dB	0.2 dB		
(90 to 100) dB	0.52 dB		
(100 to 110) dB	1.1 dB		
RF Power – Measure ¹ 50 MHz	1.0 mW	0.0032 mW	Comparison to HP 478A, 432A Power Meter
RF Flatness – Measure ¹	9 kHz to 2 000 MHz		Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.1 dB	
	(-30 to -40) dBm	0.11 dB	
	(-40 to -42) dBm	0.12 dB	
	(2 to 14) GHz		
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.09 dB	
	(-30 to -40) dBm	0.1 dB	
	(-40 to -42) dBm	0.11 dB	
	(14 to 18) GHz		
	(20 to -10) dBm	0.11 dB	
	(-10 to -30) dBm	0.12 dB	
	(-30 to -40) dBm	0.12 dB	
(-40 to -42) dBm	0.13 dB		



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Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	9 kHz to 14 000 MHz		Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(20 to 0) dB	0.13 dB	
	(0 to -40) dB	0.15 dB	
	(-40 to -50) dB	0.35 dB	
	(-50 to -55) dB	0.93 dB	
	(14 000 to 18 000) MHz		
	(20 to 0) dB	0.12 dB	
	(0 to -40) dB	0.16 dB	
RF Power Measure ¹	100 kHz to 30 MHz		Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(20 to 0) dB	0.12 dB	
	(0 to -58) dB	0.13 dB	
	(-58 to -78) dB	0.15 dB	
	(-78 to -110) dB	0.19 dB	
	(-110 to -115) dB	0.26 dB	
	(-115 to -120) dB	0.39 dB	
	(-120 to -125) dB	0.59 dB	
RF Power Measure ¹	(30 to 2 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor
	(30 to 20) dB	0.36 dB	
	(20 to 0) dB	0.2 dB	
	(0 to -58) dB	0.22 dB	
	(-58 to -78) dB	0.23 dB	
	(-78 to -110) dB	0.25 dB	
	(-110 to -115) dB	0.27 dB	
	(-115 to -120) dB	0.33 dB	
	(-120 to -125) dB	0.46 dB	
	(2 000 to 3 050) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.31 dB	
	(-58 to -78) dB	0.32 dB	
	(-78 to -110) dB	0.34 dB	
	(-110 to -115) dB	0.35 dB	
	(-115 to -120) dB	0.4 dB	
	(-120 to -125) dB	0.51 dB	



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Electrical – RF/Microwave

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	(3 050 to 6 600) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.31 dB	
	(-58 to -78) dB	0.32 dB	
	(-78 to -110) dB	0.34 dB	
	(-110 to -115) dB	0.38 dB	
	(-115 to -120) dB	0.48 dB	
	(-120 to -125) dB	0.64 dB	
	(6 600 to 13 200) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.31 dB	
	(-58 to -78) dB	0.32 dB	
	(-78 to -100) dB	0.34 dB	
	(-100 to -105) dB	0.37 dB	
	(-105 to -110) dB	0.45 dB	
	(-110 to -115) dB	0.6 dB	
	(-115 to -120) dB	0.82 dB	
	(13 200 to 18 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.31 dB	
	(-58 to -78) dB	0.32 dB	
	(-78 to -90) dB	0.33 dB	
	(-90 to -95) dB	0.35 dB	
	(-95 to -100) dB	0.41 dB	
	(-100 to -105) dB	0.53 dB	
	(-105 to -110) dB	0.72 dB	
	(18 000 to 19 200) MHz		
(30 to 20) dB	0.48 dB		
(20 to 0) dB	0.38 dB		
(0 to -58) dB	0.39 dB		
(-58 to -78) dB	0.4 dB		
(-78 to -90) dB	0.41 dB		
(-90 to -95) dB	0.42 dB		
(-95 to -100) dB	0.47 dB		
(-100 to -105) dB	0.58 dB		
(-105 to -110) dB	0.75 dB		



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Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	(19 200 to 26 500) MHz (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -90) dB (-90 to -95) dB (-95 to -100) dB (-100 to -105) dB (-105 to -110) dB	0.48 dB 0.38 dB 0.39 dB 0.4 dB 0.43 dB 0.5 dB 0.63 dB 0.84 dB 1.1 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 526 Power Sensor
Amplitude Modulation – Measure ¹	100 kHz to 10 MHz Rate 50 Hz to 10 kHz (5 to 99) % Depth 10 MHz to 3 GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth (3 to 26.5) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth	0.75 % of reading + 0.3 digits 2.5 % of reading + 0.4 digits 0.5 % of reading + 0.4 digits 4.5 % of reading + 0.4 digits 1.5 % of reading + 0.4 digits	Comparison to Agilent N5531S Measuring Receiver
Frequency Modulation Measure ¹ β = deviation / rate	250 kHz to 10 MHz Rates 20 Hz to 10 kHz Peak Dev 200 to 40 kHz 10 MHz to 6.6 GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (6.6 to 13.2) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (13.2 to 26.5) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400kHz	$\beta > 0.2 - 1.5$ % of reading + 2 Hz $\beta > 1.2 - 1$ % of reading + 2 Hz $\beta > 0.2 - 1.5$ % of reading + 2 Hz $\beta > 0.45 - 1$ % of reading + 2 Hz $\beta > 0.2 - 2.5$ % of reading + 4 Hz $\beta > 8 - 1$ % of reading + 4 Hz $\beta > 0.2 - 3.8$ % of reading + 9 Hz $\beta > 16 - 1$ % of reading + 9 Hz	Comparison to Agilent N5531S Measuring Receiver



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Electrical – RF/Microwave

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(6.6 to 13.2) GHz		Comparison to Agilent N5531S Measuring Receiver
	Dev > 2.3 kHz		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 4.5 kHz		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.4 dB	
	(13.2 to 26.5) GHz		
	Dev > 2.7 kHz		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
(-30 to -40) kHz	2.3 dB		
Dev > 6.0 kHz			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.4 dB		
Total Harmonic Distortion (THD)	(0 to -60) dB		Comparison to HP 8903B Audio Analyzer
	20 Hz to 20 kHz		
	(0 to -40) dB	1 dB	
	(-40 to -50) dB	1 dB	
	(-50 to -60) dB	1.3 dB	
	(-60 to -65) dB	1.7 dB	
	(20 to 50) kHz		
	(0 to -40) dB	2 dB	
	(-40 to -50) dB	2.1 dB	
	(-50 to -60) dB	3 dB	
	(50 to 100) kHz		
	(0 to -40) dB	2 dB	
(-40 to -50) dB	2.4 dB		

Electrical – RF/Microwave

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Harmonics Measure ¹	(-80 to -10) dB		Comparison to Agilent E4440A Measuring Receiver
	2 nd through 5 th Harmonic		
	1 kHz to 600 MHz	0.37 dB	
	(600 to 1 320) MHz	1.1 dB	
	(1 320 to 2 200) MHz	1.4 dB	
	(2 200 to 3 000) MHz	1.4 dB	
	(3 000 to 4 400) MHz	1.7 dB	
	(4 400 to 5 300) MHz	1.9 dB	
2 nd through 4 th Harmonic			
(5 300 to 6 625) MHz	2.1 dB		
2 nd through 3 rd Harmonic			
(6 625 to 8 833) MHz	2.1 dB		
2 nd Harmonic			
(8 833 to 13 250) MHz	2.1 dB		

Length – Dimensional Metrology

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers ^{1,2}	Up to 46 in	$(282 + 1.2L) \mu\text{in}$	Comparison to Gage blocks (Grade 2)
Micrometers ^{1,2}	Up to 46 in	$(27 + 4.2L) \mu\text{in}$	
Dial Indicators ^{1,2} Resolution: $\geq 50\mu\text{in}$ $< 50\mu\text{in}$	Up to 10 in Up to 0.1 in	$(26 + 3.3L) \mu\text{in}$ $9 \mu\text{in}$	
Height Gages ^{1,2}	Up to 46 in	$(238 + 1.5L) \mu\text{in}$	
Scales – Rulers ¹	Up to 46 in	0.009 1 in	Comparison to Gage blocks (Grade 2)
Tape Measures	Up to 100 ft	$(0.024 + 0.000 022L) \text{in}$	Comparison to Standard rule
Protractors ¹	(0 to 360) ^o	0.013 ^o (47 s)	Comparison to Angle blocks
Feeler Gages ¹	Up to 1 in	31 μin	Comparison to P&W Model C Bench Micrometer

Length – Dimensional Metrology

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Cylindrical Gages ² – Inside Outside	Up to 10 in Up to 11 in	$(14 + 2D) \mu\text{in}$ $(5.2 + 2.1D) \mu\text{in}$	Comparison to Gage blocks, P&W universal measuring machine
Gage Blocks ² – Length Only	Up to 10 in	$(3.3 + 2.2L) \mu\text{in}$	Comparison to Comparison to Master gage blocks, P&W universal measuring machine
Thread Plugs – Major Diameter Pitch Diameter	Up to 10 in Up to 10 in	50 μin 97 μin	P & W Model C Bench Micrometer, Van Keuren thread wire set, gage blocks

Mass and Mass Related

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales & Balances ^{1,2,4}	0.001 g to 10 kg	$(0.15 + 0.003X) \text{ mg}$	Comparison to Class 1 weights
	Up to 400 lb Up to 181 kg	$(0.000 12W) \text{ lb}$ $(0.000 12X) \text{ g}$	Comparison to Class F weights
Torque Tools ¹	(10 to 100) ozf·in 5 lbf·in to 250 lbf·ft (250 to 1 000) lbf·ft	0.59 % of reading 0.32 % of reading 0.32 % of reading	Comparison to Torque Testers CDI 1001-0-DDT CDI 5000-ST CDI 2000-13-02
Pressure ¹	(0.2 to 1 000) psi	0.002 2 % of reading	Comparison to Ruska 2468A Deadweight Tester
Pressure ¹	(-15 to 100) psi	0.082 psi	Comparison to Fluke 74x Series Process Calibrator w/700PD6 Pressure Module
Pressure ¹	(0 to 500) psi	0.31 psi	Comparison to Fluke 700G07 Pressure Gauge
Pressure ¹	(-150 to 150) inH ₂ O (0 to 15) psi (0 to 100) psi (0 to 1 000) psi (0 to 10 000) psi	0.07 inH ₂ O 0.004 psi 0.02 psi 0.6 psi 5.9 psi	Comparison to Additel 681 Pressure Gage

Mass and Mass Related

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Force ¹ Tension and Compression	Up to 10 kgf (0.1 to 300) lbf	(6.1 + 0.002 9X) mg 0.086 % of reading	Comparison to Class 1 weights Class F weights

Thermodynamic

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Temperature – Measure ¹	(-200 to 300) °C	0.031 °C	Comparison to Hart 1502 Indicator with 5622 PRT
Temperature Measuring Equipment ¹	(-25 to 140) °C (140 to 300) °C	0.13 °C 0.42 °C	Comparison to Hart 1502 Indicator with 5622 PRT and dry block
Infrared (IR) Temperature ¹	(20 to 100) °C (100 to 300) °C (300 to 420) °C (420 to 500) °C	1.5 °C 4.3 °C 6 °C 7.7 °C	Comparison to Fluke 9132 Portable Infrared Calibrator ε= 0.95, λ = (8 to 14) μm
Relative Humidity Generate	(10 to 95) %RH	0.5 %RH	Comparison to Thunder Scientific 2500 Humidity Chamber
Relative Humidity – Measure ¹	Up to 90 %RH (90 to 97) %RH	1.3 %RH 2.1 %RH	Comparison to Vaisala MI70/HMP76 Indicator and Probe

Time and Frequency

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Generate ¹	10 MHz	1 x 1 ^{e-12} Hz/Hz	Comparison to HP 58503A GPS Receiver
Frequency – Generate ¹	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 10) MHz	1 x 1 ^{e-12} Hz/Hz + 0.57 μHz 1 x 1 ^{e-12} Hz/Hz + 5.7 μHz 1 x 1 ^{e-12} Hz/Hz + 57 μHz 1 x 1 ^{e-12} Hz/Hz + 0.57 mHz 1 x 1 ^{e-12} Hz/Hz + 5.7 mHz 1 x 1 ^{e-12} Hz/Hz + 57 mHz 1 x 1 ^{e-12} Hz/Hz + 0.57 Hz	Comparison to Agilent 33250A Function Generator / HP 58503A GPS Receiver



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Time and Frequency

Pompano Beach, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Generate ¹	(10 to 20 000) MHz	1×10^{-12} Hz/Hz + 0.57 mHz	Comparison to Agilent E8257D Opt 520 Signal Generator / HP 58503A GPS Receiver
Frequency – Generate ¹	(10 to 26 500) MHz	1×10^{-12} Hz/Hz + 0.57 kHz	Comparison to HP 83630B Signal Generator / HP 58503A GPS Receiver
Time – Generate	1 pps	1×10^{-12} s/s + 750 ps	Comparison to HP 58503A GPS Receiver
Frequency – Measure ¹	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (100 to 200) kHz (0.2 to 3 000) MHz	4.2×10^{-9} Hz/Hz 1.5×10^{-9} Hz/Hz 0.6×10^{-9} Hz/Hz 0.33×10^{-9} Hz/Hz 0.24×10^{-9} Hz/Hz 0.21×10^{-9} Hz/Hz 0.21×10^{-9} Hz/Hz	Comparison to Agilent 53131A Opt 030 Frequency Counter / HP 58503A GPS Receiver
Frequency – Measure ¹	(10 to 26 500) MHz	1×10^{-12} Hz/Hz + 0.1 Hz	Comparison to Agilent E4440A Spectrum Analyzer / HP 58503A GPS Receiver
Timers and Stopwatches ¹	Up to 24 hr	346 ms	Comparison to GPS Reference Frequency Counter
Tachometers – RPM	Up to 100 000 RPM	$\pm (0.001\% + 0.6R)$	Comparison to HP 33250A Signal Generator & LED

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CALIBRATION AND DIMENSIONAL MEASUREMENT

CALIBRATION

Acoustics and Vibration

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometers – Acceleration ¹	(0.01 to 10) g (7 < 10) Hz (10 < 30) Hz (30 < 2 000) Hz (2 to 10) kHz	4 % of reading 3 % of reading 1.5 % of reading 4 % of reading	Comparison to Modal Shop 9100D Portable Vibration Calibrator

Chemical Quantities

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters ^{1,5}	4 pH 7 pH 10 pH	0.018 pH 0.017 pH 0.03 pH	Comparison to pH buffer solutions
Conductivity Meters ^{1,5}	84 µS/cm 1 413 µS/cm 10 000 µS/cm	0.83 µS/cm 5.7 µS/cm 35 µS/cm	Comparison to Conductivity solutions

Electrical – DC/Low Frequency

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Generate ¹	(1 to 1.2) nA (1.2 to 12) nA (12 to 120) nA (0.12 to 1.2) µA (1.2 to 10) µA	92 µA/A + 0.007 nA 92 µA/A + 0.007 nA 92 µA/A + 0.01 nA 36 µA/A + 0.1 nA 13 µA/A + 1 nA	Comparison to Fluke 5730A Multifunction Calibrator, Fluke 5560A Multiproduct Calibrator

Electrical – DC/Low Frequency

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Generate ¹	(10 to 220) μ A (0.22 to 2.2) mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA (0.22 to 1) A (1 to 2.2) A	38 μ A/A + 5 nA 30 μ A/A + 7 nA 30 μ A/A + 44 nA 38 μ A/A + 0.7 μ A 45 μ A/A + 0.7 μ A 68 μ A/A + 12 μ A 105 μ A/A + 12 μ A	Comparison to Fluke 5730A/03 Multifunction Calibrator
DC Current – Generate ¹	(2.2 to 3.1) A (3.1 to 12) A (12 to 30) A	228 μ A/A + 115 μ A 228 μ A/A + 191 μ A 761 μ A/A + 392 μ A	Comparison to Fluke 5560A Multiproduct Calibrator
DC Current Clamp Meters Toroidal-Wound	(0.6 to 600) A (600 to 1 000) A	0.19 % of output + 0.04A 0.20 % of output + 0.04A	Comparison to Fluke 5560A Multiproduct Calibrator / Coil5500A x50
DC Current Clamp Meters Other	(0.6 to 600) A (600 to 1 000) A	0.38 % of output + 0.38A 0.39 % of output + 0.38A	Comparison to Fluke 5560A Multiproduct Calibrator / Coil5500A x50
DC Current – Measure ¹	(1 to 10) nA (10 to 100) nA (0.1 to 1) μ A (1 to 10) μ A	35.2 μ A/A + 0.1 pA 11.9 μ A/A + 1 pA 8.3 μ A/A + 0.01 nA 6.9 μ A/A + 0.1 nA	Comparison to Fluke 5730A Multifunction Calibrator Agilent 3458A Option 002 Precision Multimeter
DC Current – Measure ¹	(10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	13 μ A/A + 0.5 nA 13 μ A/A + 3 nA 13 μ A/A + 0.03 μ A 23 μ A/A + 0.3 μ A 72 μ A/A + 6.6 μ A	Comparison to Agilent 3458A Multimeter
DC Current – Measure ¹	(1 to 10) A (10 to 100) A	34 μ A/A + 90 μ A 39 μ A/A + 0.09 mA	Comparison to Agilent 3458A Option 002 Multimeter, Standard Resistor, L&N 4361 Current Shunt
DC Current – Measure ¹	(100 to 1 000) A	0.25% of reading	Comparison to Agilent 3458A Multimeter Empro Current Shunt
DC Voltage – Generate ¹	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	6.8 μ V/V + 0.8 μ V 4.6 μ V/V + 0.9 μ V 3.0 μ V/V + 2.5 μ V 3.0 μ V/V + 3.9 μ V 4.6 μ V/V + 38 μ V 6.1 μ V/V + 385 μ V	Comparison to Fluke 5730A Multifunction Calibrator



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Electrical – DC/Low Frequency

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Measure ¹	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	3.3 μV/V + 1 μV 2.6 μV/V + 1 μV 2.6 μV/V + 1.5 μV 3.9 μV/V + 20 μV 3.9 μV/V + 66 μV + 12μV/V x (Vin/1 000) ^2	Comparison to Agilent 3458A Option 002 Precision Multimeter
DC Voltage – Measure ¹	(1 to 60) kV	0.1 % of reading	Comparison to Ross VD60 High Voltage Divider, Agilent 34401A Precision Multimeter
AC Voltage – Generate ¹	(0.22 to 2.2) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (2.2 to 22) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (22 to 220) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	228 μV/V + 3.9 μV 88 μV/V + 3.9 μV 76 μV/V + 3.9 μV 190 μV/V + 3.9 μV 457 μV/V + 4.6 μV 989 μV/V + 9.2 μV 1.3 mV/V + 19 μV 2.6 mV/V + 19 μV 228 μV/V + 3.9 μV 88 μV/V + 3.9 μV 76 μV/V + 3.9 μV 190 μV/V + 3.9 μV 457 μV/V + 4.6 μV 989 μV/V + 9.2 μV 1.3 mV/V + 19 μV 2.6 mV/V + 19 μV 228 μV/V + 11.4 μV 88 μV/V + 6.1 μV 53 μV/V + 6.1 μV 114 μV/V + 6.1 μV 304 μV/V + 15 μV 609 μV/V + 19 μV 1.3 mV /V + 22.8 μV 2.5 mV /V + 46 μV	Comparison to Fluke 5730A Multifunction Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	220 mV to 2.2 V		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	228 μ V/V + 38 μ V	
	(20 to 40) Hz	84 μ V/V + 15 μ V	
	40 Hz to 20 kHz	37 μ V/V + 8 μ V	
	(20 to 50) kHz	61 μ V/V + 9 μ V	
	(50 to 100) kHz	76 μ V/V + 30 μ V	
	(100 to 300) kHz	304 μ V/V + 76 μ V	
	(300 to 500) kHz	913 μ V /V + 190 μ V	
	500 kHz to 1 MHz	1.5 mV/V + 304 μ V	
	(2.2 to 22) V		
	(10 to 20) Hz	228 μ V/V + 380 μ V	
	(20 to 40) Hz	84 μ V/V + 152 μ V	
	40 Hz to 20 kHz	37 μ V/V + 54 μ V	
	(20 to 50) kHz	61 μ V/V + 91 μ V	
	(50 to 100) kHz	76 μ V/V + 190 μ V	
	(100 to 300) kHz	228 μ V/V + 609 μ V	
(300 to 500) kHz	913 μ V/V + 1.9 mV		
500 kHz to 1 MHz	1.4 mV/V + 3 mV		
AC Voltage – Generate ¹	(22 to 220) V		Comparison to Fluke 5730A Multifunction Calibrator, 5725A Amplifier
	(10 to 20) Hz	228 μ V/V + 3.8 mV	
	(20 to 40) Hz	84 μ V/V + 1.5 mV	
	40 Hz to 20 kHz	49 μ V/V + 0.6 mV	
	(20 to 50) kHz	76 μ V/V + 0.9 mV	
	(50 to 100) kHz	137 μ V/V + 2.3 mV	
	(220 to 750) V		
	40 Hz to 1 kHz	68 μ V/V + 3 mV	
	(1 to 20) kHz	126 μ V/V + 5 mV	
	(20 to 50) kHz	457 μ V/V + 8 mV	
(50 to 100) kHz	1.8 mV/V + 34 mV		
AC Voltage – Generate ¹	(750 to 1 000) V		
	40 Hz to 1 kHz	68 μ V/V + 3 mV	
	(1 to 20) kHz	126 μ V/V + 5 mV	
	(20 to 30) kHz	457 μ V/V + 8 mV	



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(0.3 to 1.1) mV		Comparison to Fluke 5730A Option 003 Multifunction Calibrator
	(10 to 30 Hz)	0.65 % of output + 1.5 μ V	
	30 Hz to 500 kHz	0.61 % of output + 1.5 μ V	
	(0.5 to 1.2) MHz	0.63 % of output + 3.8 μ V	
	(1.2 to 2) MHz	0.63 % of output + 3.8 μ V	
	(2 to 12) MHz	0.68 % of output + 3.8 μ V	
	(12 to 20) MHz	0.76 % of output + 3.8 μ V	
	(20 to 30) MHz	1.3 % of output + 13 μ V	
	(1.1 to 3.3) mV		
	(10 to 30 Hz)	0.58 % of output + 2.3 μ V	
	30 Hz to 500 kHz	0.53 % of output + 2.3 μ V	
	(0.5 to 1.2) MHz	0.54 % of output + 4.6 μ V	
	(1.2 to 2) MHz	0.54 % of output + 4.6 μ V	
	(2 to 12) MHz	0.58 % of output + 4.6 μ V	
	(12 to 20) MHz	0.65 % of output + 4.6 μ V	
	(20 to 30) MHz	1.3 % of output + 4.6 μ V	
	(3.3 to 11) mV		
	(10 to 30 Hz)	0.58 % of output + 6.1 μ V	
	30 Hz to 500 kHz	0.53 % of output + 6.1 μ V	
	(0.5 to 1.2) MHz	0.54 % of output + 8.4 μ V	
	(1.2 to 2) MHz	0.54 % of output + 8.4 μ V	
	(2 to 12) MHz	0.55 % of output + 8.4 μ V	
	(12 to 20) MHz	0.61 % of output + 8.4 μ V	
	(20 to 30) MHz	0.93 % of output + 8.4 μ V	
	(11 to 33) mV		
	(10 to 30 Hz)	0.52 % of output + 12 μ V	
	30 Hz to 500 kHz	0.46 % of output + 12 μ V	
	(0.5 to 1.2) MHz	0.47 % of output + 14 μ V	
	(1.2 to 2) MHz	0.47 % of output + 14 μ V	
	(2 to 12) MHz	0.49 % of output + 14 μ V	
(12 to 20) MHz	0.55 % of output + 14 μ V		
(20 to 30) MHz	0.89 % of output + 14 μ V		
(33 to 110) mV			
(10 to 30 Hz)	0.52 % of output + 30 μ V		
30 Hz to 500 kHz	0.46 % of output + 30 μ V		
(0.5 to 1.2) MHz	0.47 % of output + 33 μ V		
(1.2 to 2) MHz	0.47 % of output + 33 μ V		
(2 to 12) MHz	0.49 % of output + 33 μ V		
(12 to 20) MHz	0.55 % of output + 33 μ V		
(20 to 30) MHz	0.89 % of output + 33 μ V		



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(110 to 330) mV (10 to 30 Hz)	0.45 % of output + 0.1 mV	Comparison to Fluke 5730A Option 003 Multifunction Calibrator
	30 Hz to 500 kHz (0.5 to 1.2) MHz	0.38 % of output + 0.1 mV	
	(1.2 to 2) MHz (2 to 12) MHz	0.4 % of output + 0.1 mV	
	(12 to 20) MHz (20 to 30) MHz	0.4 % of output + 0.1 mV	
	0.33 to 1.1 V (10 to 30 Hz)	0.42 % of output + 0.1 mV	
	30 Hz to 500 kHz (0.5 to 1.2) MHz	0.49 % of output + 0.1 mV	
	(1.2 to 2) MHz (2 to 12) MHz	0.85 % of output + 0.1 mV	
	(12 to 20) MHz (20 to 30) MHz	0.45 % of output + 0.3 mV	
	0.33 to 1.1 V (10 to 30 Hz)	0.38 % of output + 0.3 mV	
	30 Hz to 500 kHz (0.5 to 1.2) MHz	0.4 % of output + 0.3 mV	
	(1.2 to 2) MHz (2 to 12) MHz	0.4 % of output + 0.3 mV	
	(12 to 20) MHz (20 to 30) MHz	0.42 % of output + 0.3 mV	
	(1.1 to 3.5) V (10 to 30 Hz)	0.49 % of output + 0.3 mV	
	30 Hz to 500 kHz (0.5 to 1.2) MHz	0.85 % of output + 0.3 mV	
	(1.2 to 2) MHz (2 to 12) MHz	0.39 % of output + 0.4 mV	
	(12 to 20) MHz (20 to 30) MHz	0.3 % of output + 0.4 mV	
AC Voltage – Measure ¹	(1 to 10) mV (1 to 40) Hz	0.02 % of reading + 2.0 μ V	Comparison to Agilent 3458A Multimeter
	40 Hz to 1 kHz (1 to 20) kHz	0.013 % of reading + 0.7 μ V	
	(20 to 50) kHz (50 to 100) kHz	0.02 % of reading + 0.7 μ V	
	100 kHz to 1 MHz (1 to 4) MHz	0.065 % of reading + 0.7 μ V	
	(4 to 8) MHz	0.33 % of reading + 0.7 μ V	
		0.78 % of reading + 3.3 μ V	
		4.6 % of reading + 4.6 μ V	
		13 % of reading + 5.3 μ V	



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(10 to 100) mV		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.005 % of reading + 2.6 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 1.3 μ V	
	(1 to 20) kHz	0.009 % of reading + 1.3 μ V	
	(20 to 50) kHz	0.020 % of reading + 1.3 μ V	
	(50 to 100) kHz	0.052 % of reading + 1.3 μ V	
	(100 to 300) kHz	0.20 % of reading + 6.5 μ V	
	300 kHz to 1 MHz	0.70 % of reading + 6.5 μ V	
	(1 to 2) MHz	0.98 % of reading + 46 μ V	
	(2 to 4) MHz	2.6 % of reading + 46 μ V	
	(4 to 8) MHz	2.6 % of reading + 52 μ V	
	(8 to 10) MHz	9.8 % of reading + 65 μ V	
	(0.1 to 1) V		
	(1 to 40) Hz	0.005 % of reading + 26 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 13 μ V	
	(1 to 20) kHz	0.009 % of reading + 13 μ V	
	(20 to 50) kHz	0.02 % of reading + 13 μ V	
	(50 to 100) kHz	0.052 % of reading + 13 μ V	
	(100 to 300) kHz	0.2 % of reading + 65 μ V	
	300 kHz to 1 MHz	0.65 % of reading + 65 μ V	
	(1 to 2) MHz	0.98 % of reading + 0.5 mV	
	(2 to 4) MHz	2.6 % of reading + 0.5 mV	
	(4 to 8) MHz	2.6 % of reading + 0.5 mV	
	(8 to 10) MHz	9.8 % of reading + 0.7 mV	
	(1 to 10) V		
	(1 to 40) Hz	0.005 % of reading + 0.3 mV	
	40 Hz to 1 kHz	0.005 % of reading + 0.1 mV	
(1 to 20) kHz	0.009 % of reading + 0.1 mV		
(20 to 50) kHz	0.02 % of reading + 0.1 mV		
(50 to 100) kHz	0.052 % of reading + 0.1 mV		
(100 to 300) kHz	0.2 % of reading + 0.7 mV		
300 kHz to 1 MHz	0.65 % of reading + 0.7 mV		
(1 to 2) MHz	0.98 % of reading + 4.6 mV		
(2 to 4) MHz	2.6 % of reading + 4.6 mV		
(4 to 8) MHz	2.6 % of reading + 5.2 mV		
(8 to 10) MHz	9.8 % of reading + 6.5 mV		



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Electrical – DC/Low Frequency

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(10 to 100) V		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.013 % of reading + 2.6 mV	
	40 Hz to 1 kHz	0.013 % of reading + 1.3 mV	
	(1 to 20) kHz	0.013 % of reading + 1.3 mV	
	(20 to 50) kHz	0.023 % of reading + 1.3 mV	
	(50 to 100) kHz	0.08 % of reading + 1.3 mV	
	(100 to 300) kHz	0.26 % of reading + 6.5 mV	
	300 kHz to 1 MHz	0.98 % of reading + 6.5 mV	
	(100 to 700) V		
	(1 to 40) Hz	0.026 % of reading + 26 mV	
	40 Hz to 1 kHz	0.026 % of reading + 13 mV	
	(1 to 20) kHz	0.039 % of reading + 13 mV	
	(20 to 50) kHz	0.078 % of reading + 13 mV	
	(50 to 100) kHz	0.2 % of reading + 13 mV	
AC Voltage – Measure ¹	(1 to 10) kV	0.5 % of reading + 0.002 kV	Comparison to Ross VD60 High Voltage Divider, Agilent 34401A Multimeter
	60 Hz		
	(10 to 42) kV	0.5 % of reading + 0.02 kV	
	60 Hz		
AC Current – Generate ¹	(9 to 220) μ A	Comparison to Fluke 5730A Multifunction Calibrator	
	(10 to 20) Hz		228 μ A/A + 15 nA
	(20 to 40) Hz		152 μ A/A + 10 nA
	40 Hz to 1 kHz		91 μ A/A + 8 nA
	(1 to 5) kHz		266 μ A/A + 12 nA
	(5 to 10) kHz		989 μ A/A + 61 nA
	0.22 to 2.2 mA		
	(10 to 20) Hz		228 μ A/A + 39 nA
	(20 to 40) Hz		152 μ A/A + 31 nA
	40 Hz to 1 kHz		91 μ A/A + 31 nA
	(1 to 5) kHz		183 μ A/A + 99 nA
	(5 to 10) kHz		989 μ A/A + 609 nA
	2.2 to 22 mA		
	(10 to 20) Hz		228 μ A/A + 385 nA
	(20 to 40) Hz		152 μ A/A + 310 nA
	40 Hz to 1 kHz		91 μ A/A + 310 nA
	(1 to 5) kHz		183 μ A/A + 536 nA
	(5 to 10) kHz		989 μ A/A + 4566 nA

Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate ¹	22 to 220 mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	228 μ A/A + 4 μ A 152 μ A/A + 3 μ A 91 μ A/A + 2 μ A 183 μ A/A + 3 μ A 989 μ A/A + 9 μ A	Comparison to Fluke 5730A Multifunction Calibrator
AC Current – Generate ¹	(0.22 to 1.2) A (3 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (1.2 to 3.1) A (3 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (3 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (3 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz	0.019 % of output + 0.08 mA 0.019 % of output + 0.04 mA 0.019 % of output + 0.06 mA 0.19 % of output + 0.23 mA 0.38 % of output + 0.23 mA 0.029 % of output + 0.4 mA 0.023 % of output + 0.27 mA 0.029 % of output + 0.27 mA 0.19 % of output + 0.40 mA 0.029 % of output + 0.8 mA 0.023 % of output + 0.4 mA 0.029 % of output + 0.6 mA 0.19 % of output + 0.8 mA 0.076 % of output + 7.7 mA 0.053 % of output + 6.2 mA 0.038 % of output + 6.2 mA	Comparison to Fluke 5560A Multiproduct Calibrator
AC Current Clamps – Toroidal-Wound	(0.6 to 600) A (45 to 65) Hz (600 to 1 000) A (45 to 65) Hz (0.6 to 155) A (65 to 440) Hz	0.21 % of output + 71 mA 0.22 % of output + 0.311 A 0.6 % of output + 77 mA	Comparison to Fluke 5560A Multiproduct Calibrator /5500A/Coil x50
AC Current Clamps – Other	(0.6 to 600) A (45 to 65) Hz (600 to 1 000) A (45 to 65) Hz (0.6 to 155) A (65 to 440) Hz	0.43 % of output +0.53 A 0.43 % of output +0.61 A 0.76 % of output +0.69 A	Comparison to Fluke 5560A Multiproduct Calibrator /5500A/Coil x50

Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
AC Current – Measure ¹	Up to 100 μ A (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz	0.26 % of reading + 0.02 μ A 0.1 % of reading + 0.02 μ A 0.04 % of reading + 0.02 μ A	Comparison to Agilent 3458A Multimeter		
	100 μ A to 1 mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 0.13 μ A 0.1 % of reading + 0.13 μ A 0.04 % of reading + 0.13 μ A 0.02 % of reading + 0.13 μ A			
	(1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 1.3 μ A 0.1 % of reading + 1.3 μ A 0.04 % of reading + 1.3 μ A 0.02 % of reading + 1.3 μ A			
	(10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 13 μ A 0.1 % of reading + 13 μ A 0.04 % of reading + 13 μ A 0.02 % of reading + 13 μ A			
	100 mA to 1 A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 Hz	0.26 % of reading + 0.13 mA 0.1 % of reading + 0.13 mA 0.04 % of reading + 0.13 mA 0.02 % of reading + 0.13 mA			
	(1 to 3) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz	0.72 % of reading + 1.2 mA 0.23 % of reading + 1.2 mA 0.1 % of reading + 1.2 mA		Comparison to Agilent 34401A Multimeter	
	(3 to 30) A 40 Hz to 1 kHz (1 to 5) kHz	0.3 % of reading + 0.07 A 5 % of reading + 0.14 A		Comparison to Agilent 3458A Multimeter, Keysight 34330A Current Shunt	
	(100 to 1 000) A (10 to 100) Hz (100 to 500) Hz	1.5 % of reading + 1A 1.9 % of reading + 1A		Comparison to Fluke 376 Clamp Meter	
	(100 to 2 500) A (10 to 500) Hz	2.3 % of reading + 5A		Comparison to Fluke 376 Clamp Meter W/i2500 flex probe	
	Resistance – Generate ¹ Fixed Points	(0.001, 0.01, 0.1) Ω		100 $\mu\Omega/\Omega$	Comparison to Standard Resistors



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Generate ¹ Fixed Points	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9) kΩ (10, 19) kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	84 μΩ/Ω + 0.1 μΩ 21 μΩ/Ω + 1 μΩ 9.1 μΩ/Ω + 6 μΩ 6.1 μΩ/Ω + 60 μΩ 6.1 μΩ/Ω + 0.6 mΩ 7.6 μΩ/Ω + 6 mΩ 9.1 μΩ/Ω + 6 mΩ 11 μΩ/Ω + 60 mΩ 16 μΩ/Ω + 60 mΩ 35 μΩ/Ω + 0.6 Ω 42 μΩ/Ω + 0.6 Ω 91 μΩ/Ω + 6 Ω	Comparison to Fluke 5730A/03 Multifunction Calibrator
Resistance – Generate ¹	Up to 12 Ω (12 to 120) Ω (0.12 to 1.20) kΩ (1.2 to 12.0) kΩ (12 to 120) kΩ (0.12 to 1.2) MΩ (1.2 to 12) MΩ (12 to 120) MΩ (120 to 1 200) MΩ	19 μΩ/Ω + 0.001 Ω 19 μΩ/Ω + 0.001 Ω 19 μΩ/Ω + 0.002 Ω 19 μΩ/Ω + 0.02 Ω 19 μΩ/Ω + 0.2 Ω 19 μΩ/Ω + 2.0Ω 27 μΩ/Ω + 24 Ω 327 μΩ/Ω + 2 kΩ 3044 μΩ/Ω + 76 Ω	Comparison to Fluke 5560A Multifunction Calibrator
Resistance – Generate ¹ Fixed Points	100V 100 kΩ (100 to 1 000) V 1 MΩ 10 MΩ 100 MΩ 1 GΩ 10 GΩ 100 GΩ	1 % of reading 1 % of reading 1 % of reading 1 % of reading 1 % of reading 1.2 % of reading 3.2 % of reading	Comparison to Standard Resistors
Resistance – Generate ¹ Fixed Points	1 GΩ	217 μΩ/Ω	Comparison to IET SRL-1G Standard Resistor



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure ¹	Up to 12 Ω (10 to 120) Ω (0.1 to 1.2) kΩ (1 to 12) kΩ (10 to 120) kΩ (0.1 to 1.2) MΩ (1 to 12) MΩ (10 to 120) MΩ (0.1 to 1.2) GΩ	9.8 μΩ/Ω + 38 μΩ 7.8 μΩ/Ω + 0.3 mΩ 6.5 μΩ/Ω + 0.4 mΩ 6.5 μΩ/Ω + 3.8 mΩ 6.5 μΩ/Ω + 38 mΩ 9.8 μΩ/Ω + 1.5 Ω 33 μΩ/Ω + 100 Ω 327 μΩ/Ω + 1 kΩ 0.33 % of reading + 70 kΩ	Comparison to Agilent 3458A Multimeter
Capacitance – Generate ¹	(0.2 to 1.2) nF (1.2 to 12.0) nF (12 to 120.0) nF (0.12 to 1.2) μF (1.2 to 12.0) μF (12 to 120.0) μF (0.12 to 1.2) mF (1.2 to 12.0) mF (12 to 120.0) mF	0.09% of output + 1.5 pF 0.09 % of output + 0.004 nF 0.10 % of output + 0.023 nF 0.10 % of output + 0.23 nF 0.10 % of output + 2.3 nF 0.11 % of output + 19 nF 0.19 % of output + 190 nF 0.19 % of output + 2.3μF 0.38 % of output + 23 μF	Comparison to Fluke 5560A Multiproduct Calibrator
Capacitance – Generate ¹ 1 kHz	1 pF to 1.111 11 μF	0.05 % of output + 0.5 pF	Comparison to GR 1413 Decade Capacitor
Capacitance – Measure ¹ @1Vrms	(10 to 100) pF (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz (100 to 1 000) pF (20 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz (1 to 10) nF (20 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz	10 % of Reading 1 % of Reading 0.3 % of Reading 1 % of Reading 1 % of Reading 10 % of Reading 1.2 % of Reading 0.3 % of Reading 0.3 % of Reading 0.3 % of Reading 0.3 % of Reading 1.2 % of Reading 0.3 % of Reading 0.1 % of Reading 0.1 % of Reading 0.3 % of Reading 1 % of Reading	Comparison to Agilent E4980A LCR Meter



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure ¹ @1V _{rms}	(10 to 100) nF		Comparison to Agilent E4980A LCR Meter
	(20 to 100) Hz	0.3 % of Reading	
	(100 to 1 000) Hz	0.1 % of Reading	
	(1 to 10) kHz	0.1 % of Reading	
	(10 to 100) kHz	0.1 % of Reading	
	(0.1 to 1) MHz	0.3 % of Reading	
	(1 to 2) MHz	1 % of Reading	
	(100 to 1 000) nF		
	(20 to 100) Hz	0.3 % of Reading	
	(100 to 1 000) Hz	0.1 % of Reading	
	(1 to 10) kHz	0.3 % of Reading	
	(10 to 100) kHz	0.3 % of Reading	
	(0.1 to 1) MHz	1 % of Reading	
	(1 to 2) MHz	1 % of Reading	
	(1 to 10) μF		
	(20 to 100) Hz	0.3 % of Reading	
	(100 to 1 000) Hz	0.12 % of Reading	
	(1 to 10) kHz	0.3 % of Reading	
	(10 to 100) kHz	0.7 % of Reading	
	(0.1 to 1) MHz	5 % of Reading	
	(1 to 2) MHz	7 % of Reading	
	(10 to 100) μF		
	(20 to 100) Hz	0.3 % of Reading	
	(100 to 1 000) Hz	0.3 % of Reading	
(1 to 10) kHz	0.7 % of Reading		
(10 to 100) kHz	5 % of Reading		
(100 to 1000) μF			
(20 to 100) Hz	0.3 % of Reading		
(100 to 1 000) Hz	1 % of Reading		
(1 to 10) kHz	5 % of Reading		
(1 to 10) mF			
(20 to 100) Hz	1.2 % of Reading		
(100 to 1 000) Hz	10 % of Reading		
(10 to 100) mF			
(20 to 100) Hz	10 % of Reading		
Inductance – Generate ¹ 1 kHz	(1 to 10) mH	2 % of output	Comparison to Bundy Electronics BEC-700-032 Decade Inductor
	(1 to 100) mH	1 % of output	
	(100 to 1 000) mH	0.5 % of output	
	(1 to 10) H	0.25 % of output	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Generate ¹	(13 to 120.0) μ H (0.12 to 1.2) mH (1.2 to 12.0) mH (12 to 120.0) mH (0.12 to 1.2) H (1.2 to 12.0) H (12 to 120.0) H	0.15% of output + 0.15 μ H 0.09 % of output + 0.76 μ H 0.09 % of output + 7.6 μ H 0.09 % of output + 76 μ H 0.11 % of output + 0.76 mH 0.15 % of output + 7.6 mH 0.19 % of output + 76 mH	Comparison to Fluke 5560A Multiproduct Calibrator
Inductance – Measure ¹ @1Vrms	(100 to 1 000) nH (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz (1 to 10) μ H (2 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz (10 to 100) μ H (250 to 1 000) Hz (1 to 2) kHz (2 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz (100 to 1 000) μ H (50 to 100) Hz (100 to 250) Hz (250 to 1 000) Hz (1 to 2) kHz (2 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 2) MHz	10 % of Reading 1 % of Reading 1 % of Reading 10 % of Reading 1 % of Reading 0.3 % of Reading 1 % of Reading 10 % of Reading 10 % of Reading 1 % of Reading 1 % of Reading 0.3 % of Reading 0.3 % of Reading 1 % of Reading 10 % of Reading 10 % of Reading 1 % of Reading 1 % of Reading 0.3 % of Reading 0.3 % of Reading 0.3 % of Reading 0.3 % of Reading 1 % of Reading	Comparison to Agilent E4980A LCR Meter



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ¹ @1V _{rms}	(1 to 10) mH		Comparison to Agilent E4980A LCR Meter
	(20 to 50) Hz	10 % of Reading	
	(50 to 100) Hz	1 % of Reading	
	(100 to 250) Hz	1 % of Reading	
	(250 to 1 000) Hz	0.3 % of Reading	
	(1 to 2) kHz	0.3 % of Reading	
	(2 to 10) kHz	0.3 % of Reading	
	(10 to 100) kHz	0.1 % of Reading	
	(0.1 to 1) MHz	0.3 % of Reading	
	(1 to 2) MHz	1 % of Reading	
	(10 to 100) mH		
	(20 to 50) Hz	1 % of Reading	
	(50 to 100) Hz	0.3 % of Reading	
	(100 to 250) Hz	0.3 % of Reading	
	(250 to 1 000) Hz	0.3 % of Reading	
	(1 to 2) kHz	0.3 % of Reading	
	(2 to 10) kHz	0.1 % of Reading	
	(10 to 100) kHz	0.1 % of Reading	
	(0.1 to 1) MHz	1 % of Reading	
	(1 to 2) MHz	10 % of Reading	
	(100 to 1 000) mH		
	(20 to 50) Hz	0.3 % of Reading	
	(50 to 100) Hz	0.3 % of Reading	
	(100 to 250) Hz	0.1 % of Reading	
	(250 to 1 000) Hz	0.1 % of Reading	
	(1 to 2) kHz	0.1 % of Reading	
	(2 to 10) kHz	0.1 % of Reading	
	(10 to 100) kHz	0.3 % of Reading	
	(0.1 to 1) MHz	10 % of Reading	
	(1 to 10) H		
(20 to 50) Hz	0.3 % of Reading		
(50 to 100) Hz	0.3 % of Reading		
(100 to 250) Hz	0.1 % of Reading		
(250 to 1 000) Hz	0.1 % of Reading		
(1 to 2) kHz	0.1 % of Reading		
(2 to 10) kHz	0.3 % of Reading		
(10 to 100) kHz	1 % of Reading		



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration ¹ – Generate			
Voltage DC - 50Ω	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 6.6) V	0.19 % of Output + 31 μV 0.19 % of Output + 36 μV 0.19 % of Output + 87 μV 0.19 % of Output + 0.6 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
DC - 1MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.019 % of reading + 20 μV 0.019 % of reading + 25 μV 0.019 % of reading + 76 μV 0.019 % of reading + 0.6 mV 0.019 % of reading + 6.0 mV	
Square Wave 10 Hz to 10 kHz - 50Ω	(1 to 24.999) mVpp (25 to 109.99) mVpp (110mV to 2.1999) Vpp (2.2 to 6.6) Vpp	0.19 % of Output + 31 μV 0.19 % of Output + 36 μV 0.19 % of Output + 87 μV 0.19 % of Output + 0.6 mV	
Square Wave 10 Hz to 1 kHz – 1 MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.038 % of reading + 4 μV 0.038 % of reading + 9 μV 0.038 % of reading + 60 μV 0.038 % of reading + 0.6 mV 0.038 % of reading + 6.0 mV	
Square Wave (1 to 10) kHz – 1 MΩ	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.19 % of reading + 31 μV 0.19 % of reading + 36 μV 0.19 % of reading + 87 μV 0.19 % of reading + 0.6 mV 0.19 % of reading + 6.0 mV	
Leveled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth (5 to 50) mVpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 1 600) MHz (1 600 to 2 100) MHz	0.34 dB 0.36 dB 0.42 dB 0.46 dB 0.5 dB 0.56 dB	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Leveled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth 50 mV to 3.5 Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz (600 to 1 600) MHz (1 600 to 2 100) MHz (3.5 to 5) Vpp 50 kHz to 100 MHz (100 to 300) MHz (300 to 500) MHz (500 to 600) MHz	0.24 dB 0.24 dB 0.32 dB 0.34 dB 0.4 dB 0.44 dB 0.24 dB 0.24 dB 0.32 dB 0.34 dB	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscope Calibration Generate ¹ Leveled Sine Flatness	3 dB Bandwidth 50 mV to 3.5 Vpp (1 100 to 4 000) MHz (4 000 to 8 000) MHz (8 000 to 18 000) MHz	0.3 dB 0.38 dB 0.48 dB	Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
Oscilloscope Calibration Generate ¹ Time Marker	500 ps to 20 ms 50 ms to 5 s	0.25 μs/s 1.9 μs/s + 3.8 μHz	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscope Calibration Measure ¹ Resistance Leakage	(40 to 60) Ω 500 kΩ to 1.5 MΩ (0 to 5.99) V	0.08 % of reading 0.08 % of reading 0.038 % of reading + 0.8 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration ¹ – Generate Voltage DC - 50Ω DC - 1MΩ Square Wave 10Hz to 10kHz – 1MΩ	1 mV to 5 V 1 mV to 200 V 1 mV to 200 Vpp	0.025 % of output + 25uV 0.025 % of output + 25uV 0.1 % of output + 10uV	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration ¹ – Generate Time Marker	9 ns to 55 s	0.25 μs/s	Comparison to Fluke 9500B with 9510 Active Head



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration ¹ – Measure Input Impedance Resistance	(10 to 40) Ω (40 to 90) Ω (90 to 150) Ω (50 to 800) KΩ (0.8 to 1.2) MΩ (1.2 to 12) MΩ	0.5 % of reading 0.1 % of reading 0.5 % of reading 0.5 % of reading 0.1 % of reading 0.5 % of reading	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration ¹ – Generate Leveled Sine Flatness 50 kHz to 10 MHz Reference	(5mV to 5Vpp) (0.1 Hz to 300) MHz (300 to 550) MHz (5 mV to 3Vpp) (550 to 1100) MHz	 0.18 dB 0.22 dB 0.3 dB	Comparison to Fluke 9500B with 9510 Active Head
AC Power – Generate ¹ (12 to 120) mV Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.022 % of Output + 0.1 μW 0.022 % of Output + 0.1 μW 0.022 % of Output + 0.1 μW 0.12 % of Output + 0.1 μW 0.022 % of Output + 1.1 μW 0.016 % of Output + 0.7 μW 0.022 % of Output + 0.9 μW 0.12 % of Output + 1.1 μW 0.022 % of Output + 11 μW 0.022 % of Output + 7.2 μW 0.022 % of Output + 9.2 μW 0.19 % of Output + 28 μW 0.03 % of Output + 48 μW 0.025 % of Output + 31 μW 0.03 % of Output + 31 μW 0.19 % of Output + 48 μW 0.03 % of Output + 107 μW 0.025 % of Output + 72 μW 0.03 % of Output + 92 μW 0.19 % of Output + 107 μW 0.077 % of Output + 0.92 mW 0.054 % of Output + 0.74 mW 0.38 % of Output + 0.74 mW	Comparison to Fluke 5560A Multiproduct Calibrator



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (0.12 to 1.2) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 0.9 μW	
	(40 to 1 000) Hz	0.022 % of Output + 0.9 μW	
	(1 to 5) kHz	0.022 % of Output + 0.9 μW	
	(5 to 10) kHz	0.12 % of Output + 0.9 μW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 9.2 μW	
	(40 to 1 000) Hz	0.016 % of Output + 4.7 μW	
	(1 to 5) kHz	0.022 % of Output + 7.4 μW	
	(5 to 10) kHz	0.12 % of Output + 9.2 μW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 92 μW	
	(40 to 1 000) Hz	0.022 % of Output + 47 μW	
	(1 to 5) kHz	0.022 % of Output + 74 μW	
	(5 to 10) kHz	0.19 % of Output + 0.27 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 0.46 mW	
	(40 to 1 000) Hz	0.025 % of Output + 0.27 mW	
	(1 to 5) kHz	0.03 % of Output + 0.27 mW	
	(5 to 10) kHz	0.19 % of Output + 0.46 mW	
(3.1 to 12) A			
(10 to 40) Hz	0.00 % of Output + 0.92 mW		
(40 to 1 000) Hz	0.025 % of Output + 0.47 mW		
(1 to 5) kHz	0.03 % of Output + 0.74 mW		
(5 to 10) kHz	0.19 % of Output + 0.92 mW		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 9.1 mW		
(40 to 1 000) Hz	0.054 % of Output + 7.3 mW		
(1 to 5) kHz	0.38 % of Output + 7.3 mW		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (1.2 to 12) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 9.2 μW	
	(40 to 1 000) Hz	0.022 % of Output + 9.2 μW	
	(1 to 5) kHz	0.022 % of Output + 9.2 μW	
	(5 to 10) kHz	0.12 % of Output + 9.2 μW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 92 μW	
	(40 to 1 000) Hz	0.016 % of Output + 46 μW	
	(1 to 5) kHz	0.022 % of Output + 74 μW	
	(5 to 10) kHz	0.12 % of Output + 92 μW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 0.92 mW	
	(40 to 1 000) Hz	0.022 % of Output + 0.46 mW	
	(1 to 5) kHz	0.022 % of Output + 0.74 mW	
	(5 to 10) kHz	0.19 % of Output + 2.7 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 4.6 mW	
	(40 to 1 000) Hz	0.025 % of Output + 2.7 mW	
	(1 to 5) kHz	0.03 % of Output + 2.7 mW	
	(5 to 10) kHz	0.19 % of Output + 4.6 mW	
(3.1 to 12) A			
(10 to 40) Hz	0.03 % of Output + 9.2 mW		
(40 to 1 000) Hz	0.025 % of Output + 4.6 mW		
(1 to 5) kHz	0.03 % of Output + 7.4 mW		
(5 to 10) kHz	0.19 % of Output + 9.2 mW		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 91 mW		
(40 to 1 000) Hz	0.054 % of Output + 73 mW		
(1 to 5) kHz	0.38 % of Output + 73 mW		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (12 to 120) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 92 μ W	
	(40 to 1 000) Hz	0.022 % of Output + 92 μ W	
	(1 to 5) kHz	0.022 % of Output + 92 μ W	
	(5 to 10) kHz	0.12 % of Output + 92 μ W	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 0.92 mW	
	(40 to 1 000) Hz	0.016 % of Output + 0.46 mW	
	(1 to 5) kHz	0.022 % of Output + 0.74 mW	
	(5 to 10) kHz	0.12 % of Output + 0.92 mW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 9.2 mW	
	(40 to 1 000) Hz	0.022 % of Output + 4.6 mW	
	(1 to 5) kHz	0.022 % of Output + 7.4 mW	
	(5 to 10) kHz	0.19 % of Output + 27 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 46 mW	
	(40 to 1 000) Hz	0.025 % of Output + 27 mW	
	(1 to 5) kHz	0.03 % of Output + 27 mW	
	(5 to 10) kHz	0.19% of Output + 46 mW	
(3.1 to 12) A			
(10 to 40) Hz	0.03 % of Output + 92 mW		
(40 to 1 000) Hz	0.025 % of Output + 46 mW		
(1 to 5) kHz	0.03 % of Output + 74 mW		
(5 to 10) kHz	0.19 % of Output + 92 mW		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 0.91 W		
(40 to 1 000) Hz	0.054 % of Output + 0.73 W		
(1 to 5) kHz	0.38 % of Output + 0.73 W		



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (120 to 330) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 0.26 mW	
	(40 to 1 000) Hz	0.022 % of Output + 0.26 mW	
	(1 to 5) kHz	0.022 % of Output + 0.26 mW	
	(5 to 10) kHz	0.12 % of Output + 0.26 mW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 2.6 mW	
	(40 to 1 000) Hz	0.016 % of Output + 1.5 mW	
	(1 to 5) kHz	0.022 % of Output + 2.1 mW	
	(5 to 10) kHz	0.12 % of Output + 2.6 mW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 26 mW	
	(40 to 1 000) Hz	0.022 % of Output + 15 mW	
	(1 to 5) kHz	0.022 % of Output + 21 mW	
	(5 to 10) kHz	0.191 % of Output + 76 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 0.13 W	
	(40 to 1 000) Hz	0.025 % of Output + 0.08 W	
	(1 to 5) kHz	0.03 % of Output + 0.08 W	
	(5 to 10) kHz	0.19 % of Output + 0.13 W	
(3.1 to 12) A			
(10 to 40) Hz	0.03 % of Output + 0.26 W		
(40 to 1 000) Hz	0.025 % of Output + 0.15 W		
(1 to 5) kHz	0.03 % of Output + 0.21 W		
(5 to 10) kHz	0.19 % of Output + 0.26 W		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 2.5 W		
(40 to 1 000) Hz	0.054 % of Output + 2.0 W		
(1 to 5) kHz	0.38 % of Output + 2.0 W		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (330 to 1020) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 1.1 mW	
	(40 to 1 000) Hz	0.022 % of Output + 1.1 mW	
	(1 to 5) kHz	0.022 % of Output + 1.1 mW	
	(5 to 10) kHz	0.12 % of Output + 1.1 mW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 11 mW	
	(40 to 1 000) Hz	0.016 % of Output + 8.3 mW	
	(1 to 5) kHz	0.022 % of Output + 9.6 mW	
	(5 to 10) kHz	0.12 % of Output + 11 mW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 107 mW	
	(40 to 1 000) Hz	0.022 % of Output + 83 mW	
	(1 to 5) kHz	0.022 % of Output + 96 mW	
	(5 to 10) kHz	0.19 % of Output + 244 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 0.43 W	
	(40 to 1 000) Hz	0.025 % of Output + 0.30 W	
(1 to 5) kHz	0.03 % of Output + 0.30 W		
(5 to 10) kHz	0.19 % of Output + 0.43 W		
(3.1 to 12) A			
(10 to 40) Hz	0.00 % of Output + 1.1 W		
(40 to 1 000) Hz	0.025 % of Output + 0.8 W		
(1 to 5) kHz	0.03 % of Output + 1.0 W		
(5 to 10) kHz	0.19 % of Output + 1.1 W		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 8.0 W		
(40 to 1 000) Hz	0.054 % of Output + 6.5 W		
(1 to 5) kHz	0.38 % of Output + 6.5 W		
Phase Angle - Generate	(-180 to 180)°		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 65) Hz	0.08°	
	(65 to 500) Hz	0.19°	
	500 Hz to 1 kHz	0.38°	
	(1 to 5) kHz	1.9°	
	(5 to 10) kHz	3.8°	
(10 to 30) kHz	7.6°		
Power Meter Range Calibration ¹	3 μW to 100 mW	0.25 % of reading	Comparison to HP 11683A Power Meter Calibrator



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicating Devices ¹	Type B		Comparison to Fluke 7526A Process Calibrator
	(600 to 800) °C	0.27 °C	
	(800 to 1 550) °C	0.21 °C	
	(1 550 to 1 820) °C	0.17 °C	
	Type C		
	(0 to 1 000) °C	0.12 °C	
	(1 000 to 1 800) °C	0.18 °C	
	(1 800 to 2 000) °C	0.2 °C	
	(2 000 to 2 316) °C	0.27 °C	
	Type E		
	(-250 to -200) °	0.19 °C	
	(-200 to -11) °C	0.09 °C	
	(-100 to 0) °C	0.07 °C	
	(0 to 600) °C	0.06 °C	
	(600 to 1 000) °C	0.08 °C	
	Type J		
	(-210 to -100) °C	0.11 °C	
	(-100 to 800) °C	0.07 °C	
	(800 to 1 200) °C	0.08 °C	
	Type K		
	(-250 to -200) °C	0.35 °C	
-200 to -100) °C	0.12 °C		
(-100 to 800) °C	0.08 °C		
(800 to 1 372) °C	0.1 °C		
Type L			
(-200 to -100) °C	0.08 °C		
(-100 to 900) °C	0.07 °C		
Type N			
(-250 to -200) °C	0.56 °C		
(-200 to -100) °C	0.18 °C		
(-100 to 0) °C	0.09 °C		
(0 to 100) °C	0.08 °C		
(100 to 800) °C	0.08 °C		
(800 to 1 300) °C	0.09 °C		



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
Electrical Calibration of Thermocouple Indicating Devices ¹	Type R		Comparison to Fluke 7526A Process Calibrator	
		(-50 to -25) °C		0.42 °C
		(-25 to 0) °C		0.34 °C
		(0 to 100) °C		0.3 °C
		(100 to 400) °C		0.21 °C
		(400 to 600) °C		0.17 °C
		(600 to 1 000) °C		0.16 °C
		(1 000 to 1 600) °C		0.14 °C
		(1 600 to 1 767) °C		0.18 °C
		Type S		
		(-50 to -25) °C		0.39 °C
		(-25 to 0) °C		0.33 °C
		(0 to 100) °C		0.29 °C
		(100 to 400) °C		0.22 °C
		(400 to 600) °C		0.18 °C
		(600 to 1 600) °C		0.17 °C
		(1 600 to 1 767) °C		0.2 °C
		Type T		
		(-250 to -200) °C		0.27 °C
	(-200 to -100) °C	0.12 °C		
	(-100 to 0) °C	0.08 °C		
	(0 to 400) °C	0.07 °C		
	Type U			
	(-200 to 0) °C	0.13 °C		
	(0 to 600) °C	0.08 °C		
Electrical Calibration of RTD Indicating Devices ¹	Pt 100 (385)		Comparison to Fluke 7526A Process Calibrator	
		(-200 to 800) °C		0.04 °C
	Pt 100 (3916)			0.04 °C
		(-200 to 630) °C		0.04 °C
	Pt 100 (3926)			0.04 °C
		(-200 to 630) °C		0.04 °C
	Pt 200 (385)			0.30 °C
		(-200 to 400) °C		0.38 °C
	(400 to 630) °C	0.38 °C		
Pt 500 (385)		0.13 °C		
	(-200 to 630) °C	0.13 °C		
Pt 1 000 (385)		0.07 °C		
	(-200 to 630) °C	0.07 °C		

Electrical – DC/Low Frequency

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicating Devices ¹	Cu 10 (427) (100 °C to 260) °C	0.29 °C	Comparison to Fluke 7526A Process Calibrator
	Ni 120 (672) (-80 to 260) °C	0.02 °C	

Electrical – RF/Microwave

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(50 to 26 500) MHz (20 to 10) dB (10 to -50) dB (-50 to -60) dB (-60 to -65) dB	0.25 dB 0.22 dB 0.37 dB 0.94 dB	Comparison to Agilent EPM Series Power Meter w/E4413A Power Sensor
RF Flatness – Measure ¹	9 kHz to 2 000 MHz (20 to -10) dBm (-10 to -30) dBm (-30 to -40) dBm (-40 to -42) dBm	0.1 dB 0.1 dB 0.11 dB 0.12 dB	Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
RF Flatness – Measure ¹	(2 to 14) GHz (20 to -10) dBm (-10 to -30) dBm (-30 to -40) dBm (-40 to -42) dBm (14 to 18) GHz (20 to -10) dBm (-10 to -30) dBm (-30 to -40) dBm (-40 to -42) dBm	0.1 dB 0.09 dB 0.1 dB 0.11 dB 0.11 dB 0.12 dB 0.12 dB 0.13 dB	Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
RF Power – Measure ¹	9 kHz to 14 000 MHz (20 to 0) dB (0 to -40) dB (-40 to -50) dB (-50 to -55) dB (14 000 to 18 000) MHz (20 to 0) dB (0 to -40) dB (-40 to -50) dB (-50 to -55) dB	0.13 dB 0.15 dB 0.35 dB 0.93 dB 0.12 dB 0.16 dB 0.35 dB 0.93 dB	Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor



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Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(10 to 100) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	0.07 dB 0.06 dB 0.06 dB 0.06 dB 0.11 dB	Comparison to Agilent EPM Series Power Meter w/N8485A Power Sensor
RF Power – Measure ¹	(100 to 2 000) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (2 000 to 12 400) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	0.07 dB 0.07 dB 0.06 dB 0.07 dB 0.11 dB 0.08 dB 0.08 dB 0.08 dB 0.08 dB 0.12 dB	Comparison to Agilent EPM Series Power Meter w/N8485A Power Sensor
RF Power – Measure ¹	(12 400 to 18 000) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (18 000 to 26 500) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	0.09 dB 0.08 dB 0.08 dB 0.09 dB 0.12 dB 0.12 dB 0.12 dB 0.12 dB 0.12 dB 0.15 dB	Comparison to Agilent EPM Series Power Meter w/N8485A Power Sensor
Agilent EPM Series Power Meter w/N8487A Power Sensor	(50 to 100) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	0.08 dB 0.07 dB 0.07 dB 0.07 dB 0.11 dB	Comparison to Agilent EPM Series Power Meter w/N8487A Power Sensor



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(100 to 6 000) MHz		Comparison to Agilent EPM Series Power Meter w/N8487A Power Sensor
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.07 dB	
	(0 to -10) dB	0.07 dB	
	(-10 to -20) dB	0.08 dB	
	(-20 to -25) dB	0.11 dB	
	(6 000 to 12 400) MHz		
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.08 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.08 dB	
	(-20 to -25) dB	0.12 dB	
	(12 400 to 18 000) MHz		
	(20 to 10) dB	0.09 dB	
	(10 to 0) dB	0.09 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.09 dB	
	(-20 to -25) dB	0.12 dB	
	(18 000 to 26 500) MHz		
	(20 to 10) dB	0.11 dB	
	(10 to 0) dB	0.11 dB	
	(0 to -10) dB	0.10 dB	
	(-10 to -20) dB	0.11 dB	
	(-20 to -25) dB	0.14 dB	
	(26 500 to 33 000) MHz		
	(20 to 10) dB	0.12 dB	
	(10 to 0) dB	0.12 dB	
	(0 to -10) dB	0.12 dB	
(-10 to -20) dB	0.12 dB		
(-20 to -25) dB	0.14 dB		
(33 000 to 40 000) MHz			
(20 to 10) dB	0.13 dB		
(10 to 0) dB	0.13 dB		
(0 to -10) dB	0.12 dB		
(-10 to -20) dB	0.13 dB		
(-20 to -25) dB	0.15 dB		

Electrical – RF/Microwave

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(40 000 to 50 000) MHz		Comparison to Agilent EPM Series Power Meter w/N8487A Power Sensor
	(20 to 10) dB	0.19 dB	
	(10 to 0) dB	0.18 dB	
	(0 to -10) dB	0.18 dB	
	(-10 to -20) dB	0.19 dB	
	(-20 to -25) dB	0.2 dB	
RF Power – Measure ¹	100 kHz to 30 MHz		Comparison to Agilent N5531S Measuring Receiver N1912A w/E9304A Power Sensor
	(20 to 0) dB	0.12 dB	
	(0 to -58) dB	0.13 dB	
	(-58 to -78) dB	0.14 dB	
	(-78 to -110) dB	0.18 dB	
	(-110 to -115) dB	0.2 dB	
	(-115 to -120) dB	0.28 dB	
	(-120 to -125) dB	0.43 dB	
RF Power – Measure ¹	(30 to 2 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.36 dB	
	(20 to 0) dB	0.2 dB	
	(0 to -58) dB	0.22 dB	
	(-58 to -78) dB	0.23 dB	
	(-78 to -110) dB	0.25 dB	
	(-110 to -115) dB	0.27 dB	
	(-115 to -120) dB	0.33 dB	
	(-120 to -125) dB	0.46 dB	
	(2 000 to 3 050) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.26 dB	
	(-110 to -115) dB	0.28 dB	
	(-115 to -120) dB	0.34 dB	
	(-120 to -125) dB	0.7 dB	
	(3 050 to 6 600) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.29 dB	
(-110 to -115) dB	0.38 dB		
(-115 to -120) dB	0.53 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(6 600 to 13 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.34 dB	
	(-110 to -115) dB	0.46 dB	
	(-115 to -120) dB	0.65 dB	
	(13 200 to 18 000) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -90) dB	0.26 dB	
	(-90 to -95) dB	0.26 dB	
	(-95 to -100) dB	0.26 dB	
	(-100 to -105) dB	0.29 dB	
	(-105 to -110) dB	0.38 dB	
	(-110 to -115) dB	0.53 dB	
	(-115 to -120) dB	0.75 dB	
	(18 000 to 19 200) MHz		
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.27 dB	
	(-90 to -95) dB	0.27 dB	
(-95 to -100) dB	0.27 dB		
(-100 to -105) dB	0.30 dB		
(-105 to -110) dB	0.38 dB		
(-110 to -115) dB	0.53 dB		
(-115 to -120) dB	0.75 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(19 200 to 26 500) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.28 dB	
	(-90 to -95) dB	0.33 dB	
	(-95 to -100) dB	0.43 dB	
	(-100 to -105) dB	0.61 dB	
	(-105 to -110) dB	0.85 dB	
	(-110 to -115) dB	1.2 dB	
	(-115 to -120) dB	1.5 dB	
	(26 500 to 31 150) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.34 dB	
	(-78 to -90) dB	0.36 dB	
	(-90 to -95) dB	0.39 dB	
	(-95 to -100) dB	0.46 dB	
	(-100 to -105) dB	0.61 dB	
	(-105 to -110) dB	0.82 dB	
	(-110 to -115) dB	1.1 dB	
	(31 150 to 41 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
(-58 to -78) dB	0.35 dB		
(-78 to -90) dB	0.48 dB		
(-90 to -95) dB	0.64 dB		
(-95 to -100) dB	0.87 dB		
(-100 to -105) dB	1.2 dB		
(-105 to -110) dB	1.5 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(41 000 to 45 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.38 dB	
	(-78 to -90) dB	0.68 dB	
	(-90 to -95) dB	0.93 dB	
	(-95 to -100) dB	1.2 dB	
	(-100 to -105) dB	1.6 dB	
	(45 000 to 50 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.67 dB	
(-78 to -90) dB	1.4 dB		
Attenuation – Measure ¹	(30 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.13 dB	
	(3 050 to 6 600) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
(90 to 100) dB	0.13 dB		
(100 to 110) dB	0.15 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Attenuation – Measure ¹	(6 600 to 13 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.25 dB	
	(13 200 to 19 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.31 dB	
	(19 200 to 26 500) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.14 dB	
	(90 to 100) dB	0.36 dB	
	(100 to 110) dB	0.82 dB	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Attenuation – Measure ¹	(26 500 to 31 150) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.13 dB	
	(90 to 100) dB	0.33 dB	
	(100 to 110) dB	0.77 dB	
	(31 150 to 41 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.14 dB	
	(80 to 90) dB	0.36 dB	
	(41 000 to 45 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.11 dB	
(70 to 80) dB	0.24 dB		
(80 to 90) dB	0.6 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Attenuation – Measure ¹	(45 000 to 50 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.11 dB	
	(60 to 70) dB	0.29 dB	
Amplitude Modulation – Measure ¹	100 kHz to 10 MHz Rate 50 Hz to 10 kHz (5 to 99) % Depth	0.75 % of reading + 0.3 digits	Comparison to Agilent N5531S Measuring Receiver
	10 MHz to 3 GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth	2.5 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.5 % of reading + 0.4 digits	
	(3 to 26.5) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth	4.5 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.5 % of reading + 0.4 digits	
	(26.5 to 31.15) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth	6.8 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.9 % of reading + 0.4 digits	
	(31.15 to 50) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth	6.8 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.9 % of reading + 0.4 digits	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency Modulation – Measure ¹ $\beta = \text{deviation} / \text{rate}$	250 kHz to 10 MHz Rates 20 Hz to 10 kHz Peak Dev 200 to 40 kHz	$\beta > 0.2 - 1.5 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 1.2 - 1 \% \text{ of reading} + 2 \text{ Hz}$	Comparison to Agilent N5531S Measuring Receiver
	10 MHz to 6.6 GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz	$\beta > 0.20 - 1.5 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.45 - 1 \% \text{ of reading} + 2 \text{ Hz}$	
	(6.6 to 13.2) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz	$\beta > 0.2 - 2.5 \% \text{ of reading} + 4 \text{ Hz}$ $\beta > 8.0 - 1 \% \text{ of reading} + 4 \text{ Hz}$	
	(13.2 to 31.15) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz	$\beta > 0.2 - 3.8 \% \text{ of reading} + 9 \text{ Hz}$ $\beta > 16 - 1 \% \text{ of reading} + 9 \text{ Hz}$	
	(31.15 to 50) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz	$\beta > 0.2 - 8.5 \% \text{ of reading} + 17 \text{ Hz}$ $\beta > 16 - 1 \% \text{ of reading} + 17 \text{ Hz}$	
Phase Modulation – Measure ¹	100 kHz to 6.6 GHz Deviations > 0.3 rad Deviations > 0.7 rad (6.6 to 13.2) GHz Deviations > 0.6 rad Deviations > 2.0 rad (13.2 to 26.5) GHz Deviations: > 1.2 rad Deviations > 4.0 rad (26.5 to 31.15) GHz Deviations: > 1.3 rad Deviations > 4.0 rad (31.15 to 50) GHz Deviations: > 2.4 rad Deviations > 8.0 rad	$3 \% \text{ of reading} + 0.002 \text{ rad}$ $1 \% \text{ of reading} + 0.002 \text{ rad}$ $3 \% \text{ of reading} + 0.005 \text{ rad}$ $1 \% \text{ of reading} + 0.005 \text{ rad}$ $3 \% \text{ of reading} + 0.009 \text{ rad}$ $1 \% \text{ of reading} + 0.009 \text{ rad}$ $3 \% \text{ of reading} + 0.009 \text{ rad}$ $1 \% \text{ of reading} + 0.009 \text{ rad}$ $3 \% \text{ of reading} + 0.018 \text{ rad}$ $1 \% \text{ of reading} + 0.018 \text{ rad}$	Comparison to Agilent N5531S Measuring Receiver
Phase Noise for Signal Sources ¹ Offset Frequency, $\leq 100 \text{ kHz}$	$5 \text{ MHz} < f \leq 18 \text{ GHz}$	2.3 dB	Comparison to HP 3048A Phase Noise System with 866XA Source

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Generate ¹	(30 to 2 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, E8257D Signal Generator
	(20 to 0) dB	0.29 dB	
	(0 to -58) dB	0.3 dB	
	(-58 to -78) dB	0.31 dB	
	(-78 to -110) dB	0.32 dB	
	(2 000 to 3 050) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.39 dB	
	(3 050 to 6 600) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.39 dB	
	(6 600 to 13 200) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.42 dB	
	(13 200 to 18 000) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.46 dB	
	(18 000 to 19 200) MHz		
	(20 to 0) dB	0.41 dB	
	(0 to -58) dB	0.41 dB	
(-58 to -78) dB	0.42 dB		
(-78 to -110) dB	0.5 dB		
(19 200 to 26 500) MHz			
(20 to 0) dB	0.41 dB		
(0 to -58) dB	0.41 dB		
(-58 to -78) dB	0.42 dB		
(-78 to -110) dB	0.9 dB		
(26 500 to 31 150) MHz			
(15 to 0) dB	0.62 dB		
(0 to -58) dB	0.63 dB		
(-58 to -78) dB	0.64 dB		
(-78 to -110) dB	0.96 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Generate ¹	(31 150 to 41 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, E8257D Signal Generator
	(10 to 0) dB	0.82 dB	
	(0 to -58) dB	0.83 dB	
	(-58 to -78) dB	0.84 dB	
	(-78 to -100) dB	1.1 dB	
	(41 000 to 45 000) MHz		
	(10 to 0) dB	0.82 dB	
	(0 to -58) dB	0.83 dB	
	(-58 to -78) dB	0.85 dB	
	(-78 to -100) dB	1.4 dB	
	(45 000 to 50 000) MHz		
	(10 to 0) dB	0.82 dB	
(0 to -58) dB	0.83 dB		
(-58 to -78) dB	1 dB		
(-78 to -90) dB	1.5 dB		
AM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(0.1 to 10) MHz		Comparison to Agilent N5531S Measuring Receiver
	AM Depth > 1%		
	(0 to -20) dB	1.2 dB	
	(-20 to -30) dB	2.2 dB	
	AM Depth > 3%		
	(0 to -20) dB	1 dB	
	(-20 to -30) dB	1.3 dB	
	(-30 to -40) dB	2.4 dB	
	10 MHz to 26.5 GHz		
	AM Depth > 1%		
	(0 to -20) dB	1.3 dB	
	(-20 to -30) dB	2.5 dB	
	AM Depth > 3%		
	(0 to -20) dB	1.1 dB	
	(-20 to -30) dB	1.4 dB	
(-30 to -40) dB	3 dB		
(26.5 MHz to 50.0 GHz)			
AM Depth > 3 %			
(0 to -20) dB	1.8 dB		
AM Depth > 5%			
(0 to -20) dB	1.5 dB		
(-20 to -30) dB	3.5 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(1 to 6 600) MHz		Comparison to Agilent N5531S Measuring Receiver
	Dev 500 Hz to 2 kHz	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 2 kHz	0.09 dB	
	(0 to -20) dB	0.27 dB	
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(-20 to -30) dB	0.83 dB	Comparison to Agilent N5531S Measuring Receiver
	(-30 to -40) dB	2.4 dB	
	(6.6 to 13.2) GHz		
	Dev > 2.3 kHz	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 4.5 kHz	0.09 dB	
	(0 to -20) dB	0.27 dB	
	(-20 to -30) dB	0.83 dB	
	(-30 to -40) dB	2.4 dB	
	(-40 to -50) dB		
	(13.2 to 31.15) GHz		
	Dev > 2.7 kHz	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 6.0 kHz	0.09 dB	
	(0 to -20) dB	0.27 dB	
	(-20 to -30) dB	0.83 dB	
	(-30 to -40) dB	2.4 dB	
(-40 to -50) Db			
(31.15 to 50.0) GHz			
Dev > 4 kHz	0.26 dB		
(0 to -20) dB	0.79 dB		
(-20 to -30) dB	2.3 dB		
(-30 to -40) dB			
Dev > 12.0 kHz	0.09 dB		
(0 to -20) dB	0.27 dB		
(-20 to -30) dB	0.83 dB		
(-30 to -40) dB	2.4 dB		
(-40 to -50) dB			

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(1 to 6 600) MHz		
	Rate (20 to 500) Hz		
	Dev > 0.8 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 2.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	Rate (500 to 1 000) Hz		
	Dev > 0.4 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 1.0 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) Db	2.3 dB	
(6.6 to 13.2) GHz			
Rate (20 to 500) Hz			
Dev > 1.8 rad			
(0 to -20) dB	0.26 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 5.5 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		

Comparison to Agilent N5531S Measuring Receiver

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(6.6 to 13.2) GHz		Comparison to Agilent N5531S Measuring Receiver
	Rate (500 to 1 000) Hz		
	Dev > 0.8 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Rate (500 to 1 000) Hz		
	Dev > 2.5 rad	0.09 dB	
	(0 to -20) dB	0.27 dB	
	(-20 to -30) dB	0.83 dB	
	(-30 to -40) dB	2.3 dB	
	(-40 to -50) dB		
	(13.2 to 31.15) GHz		
	Rate 20 to 500 Hz		
	Dev > 3.5 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 10.0 rad	0.09 dB	
	(0 to -20) dB	0.27 dB	
	(-20 to -30) dB	0.83 dB	
	(-30 to -40) dB	2.3 dB	
	(-40 to -50) dB		
	Rate 500 Hz to 1000 Hz		
Dev > 1.2 rad	0.26 dB		
(0 to -20) dB	0.79 dB		
(-20 to -30) dB	2.3 dB		
(-30 to -40) dB			
Dev > 4 rad	0.09 dB		
(0 to -20) dB	0.27 dB		
(-20 to -30) dB	0.83 dB		
(-30 to -40) dB	2.3 dB		
(-40 to -50) dB			



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(31.15 to 50.0) GHz Rate 20 to 500 Hz Dev > 7.5 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 19.0 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB Rate (500 to 1 000) Hz Dev > 3.0 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 8.0 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.3 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.3 dB	Comparison to Agilent N5531S Measuring Receiver
Total Harmonic Distortion (THD)	(0 to -60) dB 20 Hz to 20 kHz (0 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -65) dB (20 to 50) kHz (0 to -40) dB (-40 to -50) dB (-50 to -60) dB (50 to 100) kHz (0 to -40) dB (-40 to -50) dB	1 dB 1 dB 1.3 dB 1.7 dB 2 dB 2.1 dB 3 dB 2 dB 2.4 dB	Comparison to HP 8903B Audio Analyzer



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Harmonics Measure ¹	(-80 to -10) dB		Comparison to Agilent E4440A Measuring Receiver
	2 nd through 5 th Harmonic		
	1kHz to 600MHz	0.37 dB	
	(600 to 1 320) MHz	1.1 dB	
	(1 320 to 2 200) MHz	1.4 dB	
	(2 200 to 3 000) MHz	1.4 dB	
	(3 000 to 4 400) MHz	1.7 dB	
	(4 400 to 5 300) MHz	1.9 dB	
	(5 300 to 10 000) MHz	2.1 dB	
	2 nd through 4 th Harmonic		
(10 000 to 12 500) MHz	2.1 dB		
2 nd through 3 rd Harmonic			
(12 500 to 16 667) MHz	2.1 dB		
2 nd Harmonic			
(16 667 to 25 000) MHz	2.3 dB		

Length – Dimensional Metrology

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks ²	Up to 13 in	$(4.3 + 2.3L) \mu\text{in}$	Comparison to Master gage blocks, P&W Labmaster Universal
Micrometer Standards Length Rods	Up to 13 in	$(1.2 + 6.9L) \mu\text{in}$	Comparison to Gage blocks (grade 2), P&W Labmaster Universal
Micrometers ^{1,2}	Up to 40 in	$(20 + 4.5L) \mu\text{in}$	Comparison to Gage blocks (grade 2)
Calipers ^{1,2}	Up to 40 in	$(280 + 1.9L) \mu\text{in}$	
Dial Indicators ^{1,2} Resolution $\geq 50\mu\text{in}$ Resolution $< 50\mu\text{in}$	Up to 10 in Up to 0.1 in	$(26 + 3.6L) \mu\text{in}$ 10 μin	Comparison to Gage blocks (grade 2)
Height Gages ^{1,2}	Up to 40 in	$(92 + 2.6L) \mu\text{in}$	
Rulers ¹	Up to 46 in	0.009 1 in	
Feeler Gage ¹	Up to 1 in	45 μin	Comparison to Pratt & Whitney Supermicrometer C

Length – Dimensional Metrology

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Radius Gages	(0.01 to 1) in	300 μin	Comparison to Optical comparator
Bore Micrometers/Gages ² 2 point 3 point	Up to 12 in (0.125 to 2) in	(22 + 3.9L) μin (15 + 8.8L) μin	Comparison to Master gage blocks, P&W universal measuring machine, Master Ring
Protractors ¹	(0 to 360) °	0.019 °	Comparison to Angle blocks, Sine Bar, Gage Blocks Grade 0
Parallelism & Straightness	(0 to 4) in	110 μin	Comparison to Gage Amplifier, Surface Plate
Cylindrical Gages ² Plain Pins, Plugs Rings	(0 to 13) in (0.04 to 14) in	(11 + 2.5D) μin (11 + 3.1D) μin	Comparison to Master gage blocks, P&W universal measuring machine
Thread Plugs ¹ Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	62 μin 99 μin	Comparison to B & S 599-246-00, Van Keuren thread wire set, Gage blocks, P & W Model C
Thread Rings ³ Pitch Diameter (tactile fit)	Up to 12 in	(350 + 47D) μin	Comparison to Thread setting plug gages
NPT Thread Plugs Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	85 μin 120 μin	Comparison to P&W Model C Bench Micrometer, Van Keuren Thread Wire Set, Alameda Pipe Taper Sine Block
Surface Plates ¹ – Overall Flatness Local Area Flatness	Up to 6 ft × 6 ft (-0.001 to 0.001) in	110 μin 68 μin	Comparison to Planekator Repeat-o-meter
Optical Comparators ¹ Linearity	Up to 20 in (20 to 40) in	190 μin 350 μin	Gage blocks, SI Industries glass scales, angle blocks
Magnification Angle	(10 to 100) X (0 to 360)°	250 μin 0.02°	
Tape Measures ²	Up to 100 ft	(0.000 26F + 0.026) in	Comparison to Standard rule

Length – Dimensional Metrology

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Coating Thickness Gages ^{1,2} Eddy Current & Magnetic Induction	(0.9 to 20) mils	62 μin	Comparison to Coating thickness Standards
Coating Thickness Shims ²	(0 to 243) mils	62 μin	Comparison to Pratt & Whitney Supermicrometer C
Ultrasonic Thickness Gauges ¹	Up to 10 in	590 μin	Comparison to Gage blocks
Crimp Tools ¹	(0.011 to 1) in (0.011 to 0.5) in	150 μin 240 μin	Comparison to Micrometer, Pin Gages

Mass and Mass Related

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Banding Tools	Up to 180 lbf	1.2 lbf	Comparison to Glenair Band-Master Calibration Fixture
Scales & Balances ^{1,2,4}	(1 to 400) g	(0.001 5X + 0.019) mg	Comparison to Class 0 Weights
Scales & Balances ^{1,2,4}	(1 to 1 000) g (1 000 to 40 000) g	(0.0031X + 0.04) mg (0.003 3X) mg	Comparison to Class 1 Weights
Scales & Balances ^{1,2,4}	(1 to 9 100) g	(0.12X + 9.3) mg	Comparison to Class F Weights
Scales & Balances ^{1,2,4}	(0.002 to 1 000) lb	(0.000 12W + 0.000 04) lb	Comparison to Class F Weights
Force ¹ Tension and Compression	(0.5 to 500) lbf	0.06 % of reading	Comparison to Class F weights
Mass – Class F	(1 to 220) g (220 to 6400) g (6 to 34) kg	0.42 mg 36 mg 0.31 g	Comparison to Master balances
Pressure - Generate	(10 to 500) psi (200 to 10 000) psi	0.008% of reading 0.01% of reading	Comparison to Fluke P3224-PSI Pressure Calibrator



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Mass and Mass Related

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure ¹	(-1 to 1) inH ₂ O (-50 to 50) inH ₂ O (-30 to 0) inHg (-15 to 30) psi (0 to 100) psi (0 to 300) psi (0 to 500) psi (0 to 1 000) psi (0 to 3 000) psi (0 to 5 000) psi (0 to 15 000) psi	0.001 7 inH ₂ O 0.058 inH ₂ O 0.022 inHg 0.011 psi 0.032 psi 0.07 psi 0.12 psi 0.3 psi 0.9 psi 1.5 psi 8.7 psi	Comparison to Digital Pressure Gages Additel ADT681-05-DP1 Additel ADT681-05-DP50 Additel ADT681-02-CP30 Additel ADT681-02-CP30 Additel ADT681-02-GP100 Additel ADT681-02-GP300 Additel ADT681-02-GP500 Additel ADT681-02-GP1K Additel ADT681-02-GP3K Additel ADT681-02-GP5K Additel ADT681-05-GP15K
Torque Tools ¹	(1 to 10) ozf·in (10 to 100) ozf·in 4 lbf·in to 1 000 lbf·ft	0.63 % of reading 0.6 % of reading 0.32 % of reading	Comparison to AWS QCMIO-10 CDI 1001-O-DDT CDI 5000 ST torque tester
Torque Analyzers	(1 to 20) ozf·in (20 to 100) ozf·in (4 to 150) lbf·in (12.5 to 250) lbf·ft	0.25 % of reading 0.12 % of reading 0.04 % of reading 0.16 % of reading	Comparison to Torque wheels & weights
Rockwell Hardness Testers ¹	HRBW (0 to 59) HRBW (60 to 79) HRBW (80 to 100) HRBW HRC (20 to 39) HRC (40 to 59) HRC (60 to 70) HRC HRA (20 to 65) HRA (70 to 78) HRA (80 to 84) HRA	0.82 HRBW 0.8 HRBW 0.55 HRBW 0.47 HRC 0.45 HRC 0.39 HRC 0.45 HRA 0.39 HRA 0.32 HRA	Indirect verification per ASTM E18



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Thermodynamic

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity Generate	(10 to 95) %RH	0.5 %RH	Comparison to Thunder Scientific 2500 Humidity Chamber
Relative Humidity – Measure	(0 to 90) %RH	1.3 %RH	Comparison to Vaisala MI70 / HMP75 Thermohygrometer
Temperature – Measuring Equipment ¹	(-25 to 140) °C (140 to 375) °C	0.08°C 0.19 °C	Comparison to Hart 1502A with 5615 PRT Fluke 9103 Dry Block Fluke 9100S Dry Block
Temperature – Measuring Equipment ¹	(-5 to 125) °C	0.051°C	Comparison to Hart 1502A with 5615 PRT Fluke 7102 Micro-Bath
Temperature – Measure ¹	(-196 to 232) °C (-321 to 450) °F (232 to 420) °C (450 to 788) °F	0.018 °C 0.032 °F 0.025 °C 0.044 °F	Comparison to Hart 1502A Indicator with 5615 PRT
Infrared (IR) Thermometry ¹	(20 to 100) °C (100 to 300) °C (300 to 420) °C (420 to 500) °C	1.5 °C 4.3 °C 6 °C 7.7 °C	Comparison to Fluke 9132 Blackbody $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$

Time and Frequency

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Generate ¹	10 MHz	1 x 1 ^{e-12} Hz/Hz	Comparison to HP 58503A GPS Receiver
Frequency – Generate ¹	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 10) MHz	1 x 1 ^{e-12} Hz/Hz + 0.57 μHz 1 x 1 ^{e-12} Hz/Hz + 5.7 μHz 1 x 1 ^{e-12} Hz/Hz + 57 μHz 1 x 1 ^{e-12} Hz/Hz + 0.57 mHz 1 x 1 ^{e-12} Hz/Hz + 5.7 mHz 1 x 1 ^{e-12} Hz/Hz + 57 mHz 1 x 1 ^{e-12} Hz/Hz + 0.57 Hz	Comparison to Agilent 33250A Function Generator / HP 58503A GPS Receiver
Frequency – Generate ¹	(10 to 50 000) MHz	1 x 1 ^{e-12} Hz/Hz + 0.57mHz	Comparison to Agilent E8257D Opt 550 Signal Generator / HP 58503A GPS Receiver

Time and Frequency

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Time – Generate	1 pulse per second	1×10^{-12} s/s + 750 ps	Comparison to HP 58503A GPS Receiver
Frequency – Measure ¹	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (100 to 200) kHz (0.2 to 3 000) MHz	1.82×10^{-9} Hz/Hz 0.59×10^{-9} Hz/Hz 0.20×10^{-9} Hz/Hz 74×10^{-10} Hz/Hz 35×10^{-10} Hz/Hz 23×10^{-10} Hz/Hz 20×10^{-10} Hz/Hz	Comparison to Agilent 53132A Opt 030 Frequency Counter / HP 58503A GPS Receiver
Frequency – Measure ¹	(10 to 50 000) MHz	1×10^{-12} Hz/Hz + 0.1 Hz	Comparison to Agilent E4448A Spectrum Analyzer / HP 58503A GPS Receiver
Type I (digital) Timers	(0 to 19.99) sec/day (0 to 599) sec/month	0.031 sec/day 1.1 sec/month	Comparison to Helmut Klein Timometer 4500
Type II (mechanical) Timers	(0 to 320) sec/day	0.6 sec/day	Comparison to Helmut Klein Timometer 4500
Tachometers – RPM ¹	Up to 100 000 RPM	0.001 % of reading + 0.6R	Comparison to HP 33250A Signal Generator & LED

DIMENSIONAL MEASUREMENT

1 Dimensional

Melbourne, FL

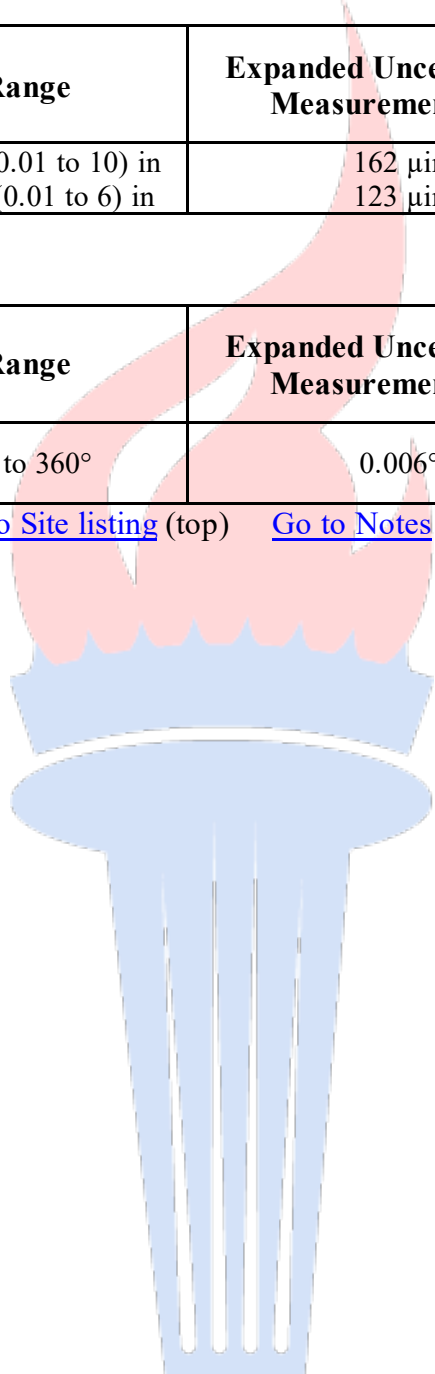
Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Length	X Axis (0.01 to 10) in Y Axis (0.01 to 6) in	162 μ in 123 μ in	Comparison to Optical comparator

2 Dimensional

Melbourne, FL

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Angle	Up to 360°	0.006°	Comparison to Optical comparator

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Services performed at satellite laboratory

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Toyo Tires

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CALIBRATION

Electrical – DC/Low Frequency

White, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Generate	(0 to 329.999) mV 330 mV to 3.299 99 V (3.3 to 32.999 9) V (33 to 329.999) V (330 to 1 020) V	0.028 % of reading + 10 μ V 0.013 % of reading + 15 μ V 0.016 % of reading + 150 μ V 0.015 % of reading + 1.5 mV 0.015 % of reading + 5.5 mV	Comparison to Fluke 5080A Multiproduct Calibrator
DC Voltage – Measure	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	0.007 6 % of reading + 3.5 μ V 0.005 8 % of reading + 7 μ V 0.005 1 % of reading + 50 μ V 0.006 4 % of reading + 600 μ V 0.005 6 % of reading + 10 mV	Comparison to Fluke 8845A Multimeter
DC Current – Generate	(0 to 329.99) μ A (.330 to 3.299 9) mA (3.3 to 32.999) mA (33 to 329.999) mA 330 mA to 1.099 9 A (1.1 to 2.999 9) A (3 to 10.999) A (11 to 20.5) A	0.1 % of reading + 0.1 μ A 0.095 % of reading + 0.25 μ A 0.083 % of reading + 1.25 μ A 0.1 % of reading + 16.5 μ A 0.18 % of reading + 220 μ A 0.19 % of reading + 220 μ A 0.29 % of reading + 2.5 mA 0.58 % of reading + 3.8 mA	Comparison to Fluke 5080A Multiproduct Calibrator
	(20.5 to 150) A (150 to 1 050) A	0.44 % of reading + 0.14 A 0.55 % of reading + 0.14 A	Comparison to Fluke 5080A Multiproduct Calibrator, 5500A/Coil x50
Resistance – Generate	0 Ω 100 Ω 1 000 Ω	0.014 Ω 0.049 % of reading 0.029 % of reading	Comparison to Fluke 5080A Multiproduct Calibrator
Resistance – Generate	10 k Ω 100 k Ω 1 M Ω 10 M Ω	0.029 % of reading 0.044 % of reading 0.11 % of reading 0.12 % of reading	Comparison to Fluke 5080A Multiproduct Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

White, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Generate	100 MΩ 1 000 MΩ	1 % of reading 1 % of reading	Comparison to Tsuruga 5804 Resistor
AC Voltage – Generate 45 Hz to 1 kHz	(1 to 32.99) mV (33 to 329.99) mV 330 mV to 3.299 9 V (3.3 to 32.999) V (33 to 101.99) V (102 to 329.99) V (330 to 1 020) V	0.42 % of reading + 60 μV 0.2 % of reading + 60 μV 0.15 % of reading + 180 μV 0.16 % of reading + 1.8 mV 0.19 % of reading + 18 mV 0.19 % of reading + 18 mV 0.2 % of reading + 180 mV	Comparison to Fluke 5080A Multiproduct Calibrator
AC Voltage – Measure	(0 to 100) mV 10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (0.1 to 1) V 10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (1 to 10) V 10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (10 to 100) V 10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (100 to 750) V 10 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz	0.12 % of reading + 0.04 mV 0.19 % of reading + 0.05 mV 0.79 % of reading + 0.08 mV 4.8 % of reading + 0.5 mV 0.13 % of reading + 0.3 mV 0.18 % of reading + 0.5 mV 0.74 % of reading + 0.8 mV 4.7 % of reading + 5 mV 0.12 % of reading + 3 mV 0.18 % of reading + 5 mV 0.74 % of reading + 8 mV 4.7 % of reading + 50 mV 0.12 % of reading + 30 mV 0.18 % of reading + 50 mV 0.74 % of reading + 80 mV 4.7 % of reading + 500 mV 0.12 % of reading + 0.3 V 0.18 % of reading + 0.5 V 0.74 % of reading + 0.8 V 4.7 % of reading + 5 V	Comparison to Fluke 8845A Multimeter



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Electrical – DC/Low Frequency

White, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate 45 Hz to 1 kHz	(29 to 329.9) μ A 330 μ A to 3.299 9 mA (3.3 to 32.999) mA (33 to 329.99) mA 330 mA to 1.099 9 A (1.1 to 2.999 9) A (3 to 10.999) A (11 to 20.5) A	0.31 % of reading + 0.75 μ A 0.27 % of reading + 0.9 μ A 0.23 % of reading + 12 μ A 0.32 % of reading + 120 μ A 0.28 % of reading + 1.2 mA 0.33 % of reading + 1.5 mA 0.47 % of reading + 6 mA 0.8 % of reading + 15 mA	Comparison to Fluke 5080A Multiproduct Calibrator
AC Current – Generate 45 Hz to 1 kHz	(20.5 to 1 000) A (45 to 65) Hz (65 to 440) Hz	0.57 % of reading + 1 A 0.86 % of reading + 0.98 A	Comparison to Fluke 5080A Multiproduct Calibrator, 5500A/Coil x50
Electrical Simulation of Thermocouple Indicators	Type J (-200 to -0) $^{\circ}$ C (0 to 1 200) $^{\circ}$ C	1.2 $^{\circ}$ C 0.83 $^{\circ}$ C	Comparison to Fluke 725 Process Calibrator
Electrical Simulation of RTD Indicators	Pt100-385 (0 to 200) $^{\circ}$ C Pt100-392 (0 to 200) $^{\circ}$ C	0.39 $^{\circ}$ C 0.36 $^{\circ}$ C	

Length – Dimensional Metrology

White, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers	Up to 300 mm	1.6 μ m	Comparison to Gage Blocks
Micrometers	Up to 25 mm	0.63 μ m	Comparison to Gage Blocks
Dial Indicators	Up to 50 mm	1 μ m	Comparison to Gage Blocks
Linear Scales – Rulers	Up to 300 mm	0.29 mm	Comparison to Gage Blocks
Tape Measures	Up to 300 cm	0.69 mm	Comparison to Steel Rule



ANSI National Accreditation Board

Mass and Mass Related

White, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales & Balances ^{2,4}	(0.1 to 250) kg	9 g + 0.6R	Comparison to F Class Weights
Pressure	Up to 100 psi Up to 689 kPa	0.09 psi 0.62 kPa	Comparison to Fluke 700P06 Pressure Module
	Up to 300 psi Up to 2 068 kPa	0.22 psi 1.5 kPa	Comparison to Fluke 700P27 Pressure Module
	Up to 1 000 psi Up to 6 895 kPa	0.72 psi 5 kPa	Comparison to Fluke 700P08 Pressure Module
	Up to 10 000 psi Up to 68 948 kPa	10 psi 69 kPa	Comparison to Fluke 700P31 Pressure Module

Thermodynamic

White, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RTD – Measure Pt100-385 Pt100-3926	(0 to 200) °C	0.39 °C	Comparison to Fluke 725 Process Calibrator
	(0 to 200) °C	0.36 °C	
Type J Thermocouples Measure	(50 to 105) °C	1.2 °C	Comparison to Fluke 725 Process Calibrator, Fluke 9140 Dry Block

Time and Frequency

White, GA

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency	(45 to 119.99) Hz (120 to 1 000) Hz	0.017 % of reading + 2 mHz 0.16 % of reading + 2 mHz	Comparison to Fluke 5080A Multiproduct Calibrator

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ANSI National Accreditation Board

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CALIBRATION AND DIMENSIONAL MEASUREMENT

CALIBRATION

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Accelerometers – Acceleration	(0.01 to 10) g (5 to < 10) Hz (10 to < 30) Hz (30 to < 2 000) Hz (2 to 10) kHz	4 % of reading 3 % of reading 1.5 % of reading 4 % of reading	Comparison to Accelerometer Calibrator

Chemical Quantities

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH meters ^{1,5}	4 pH 7 pH 10 pH	0.016 pH 0.025 pH 0.061 pH	Comparison to pH buffer solutions
Conductivity Meters ^{1,5}	0.65 µS/cm 10 µS/cm 100 µS/cm 1 000 µS/cm 10 000 µS/cm 100 000 µS/cm	0.33 µS/cm 0.64 µS/cm 2.1 µS/cm 5 µS/cm 44 µS/cm 400 µS/cm	Comparison to Conductivity solutions



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Generate ¹	(1 to 2.2) nA (2.2 to 22) nA (22 to 220) nA (0.22 to 2.2) μ A (2.2 to 10) μ A	93 μ A/A + 0.007 nA 92 μ A/A + 0.007 nA 92 μ A/A + 0.01 nA 36 μ A/A + 0.1 nA 15 μ A/A + 1 nA	Comparison to Fluke 5730A Multifunction Calibrator, Fluke 5522A Multiproduct Calibrator
DC Current – Generate ¹	(10 to 220) μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA (0.22 to 1) A (1 to 2.2) A	38 μ A/A + 5 nA 30 μ A/A + 6 nA 30 μ A/A + 44 nA 38 μ A/A + 0.7 μ A 45 μ A/A + 0.7 μ A 68 μ A/A + 12 μ A 105 μ A/A + 12 μ A	Comparison to Fluke 5730A Multifunction Calibrator
DC Current – Generate ¹	(2.2 to 11) A	274 μ A/A + 371 μ A	Comparison to Fluke 5730A Multifunction Calibrator 5725A Amplifier
DC Current – Generate ¹	(11 to 20.5) A	761 μ A/A + 631 μ A	Comparison to Fluke 5522A Multiproduct Calibrator
DC Current – Generate ¹ Clamp Meters	(0 to 200) A	0.21 % of output + 0.028 A	Comparison to Fluke 5522A Multiproduct Calibrator / 9100-200 x10 Coil
DC Current – Generate ¹ Clamp Meters	(0 to 1 000) A	0.21 % of output + 0.04 A	Comparison to Fluke 5522A Multiproduct Calibrator / 9100-200 x50 Coil
DC Current – Measure ¹	(1 to 10) nA (10 to 100) nA (0.1 to 1) μ A (1 to 10) μ A	35.2 μ A/A + 0.1 pA 12 μ A/A + 1 pA 8.3 μ A/A + 0.01 nA 6.9 μ A/A + 0.1 nA	Comparison to Fluke 5730A Multifunction Calibrator Agilent 3458A Option 002 Multimeter
DC Current – Measure ¹	(10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) A	13 μ A/A + 0.5 nA 13 μ A/A + 3 nA 13 μ A/A + 0.03 μ A 23 μ A/A + 0.3 μ A 72 μ A/A + 6.6 μ A	Comparison to Agilent 3458A Multimeter



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measure ¹	(1 to 10) A (10 to 100) A	45 μ A/A + 90 μ A 46 μ A/A + 0.09 mA	Comparison to Agilent 3458A Option 002 Multimeter, Standard Resistor, L&N 4361 Current Shunt
DC Current – Measure ¹	(1 to 1 000) A	0.25 % of reading	Comparison to Agilent 3458A Option 002 Multimeter, Empro Current Shunt
DC Voltage – Generate ¹	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	6.8 μ V/V + 0.8 μ V 4.6 μ V/V + 0.9 μ V 3 μ V/V + 2.5 μ V 3 μ V/V + 3.9 μ V 4.6 μ V/V + 38 μ V 6.1 μ V/V + 385 μ V	Comparison to Fluke 5730A Multifunction Calibrator
DC Voltage – Measure ¹	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	3.3 μ V/V + 1 μ V 2.6 μ V/V + 1 μ V 2.6 μ V/V + 1.5 μ V 3.9 μ V/V + 20 μ V 3.9 μ V/V + 66 μ V + 12 μ V/V x (Vin/1 000) ^2	Comparison to Agilent 3458A Option 002 Multimeter
DC Voltage – Measure ¹	(1 to 30) kV	0.1 % of reading	Comparison to Ross VD30 High Voltage Divider, Fluke 287 Multimeter
AC Voltage – Generate ¹	(0.22 to 2.2) mV (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz	228 μ V/V + 3.9 μ V 88 μ V/V + 3.9 μ V 76 μ V/V + 3.9 μ V 190 μ V/V + 3.9 μ V 457 μ V/V + 4.6 μ V 989 μ V/V + 9.2 μ V 1.3 mV/V + 19 μ V 2.6 mV/V + 19 μ V	Comparison to Fluke 5730A Multifunction Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(2.2 to 22) mV		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	228 $\mu\text{V}/\text{V}$ + 3.9 μV	
	(20 to 40) Hz	88 $\mu\text{V}/\text{V}$ + 3.9 μV	
	40 Hz to 20 kHz	76 $\mu\text{V}/\text{V}$ + 3.9 μV	
	(20 to 50) kHz	190 $\mu\text{V}/\text{V}$ + 3.9 μV	
	(50 to 100) kHz	457 $\mu\text{V}/\text{V}$ + 4.6 μV	
	(100 to 300) kHz	989 $\mu\text{V}/\text{V}$ + 9.2 μV	
	(300 to 500) kHz	1.3 mV/V + 19 μV	
	500 kHz to 1 MHz	2.6 mV/V + 19 μV	
	(22 to 220) mV		
	(10 to 20) Hz	228 $\mu\text{V}/\text{V}$ + 11.4 μV	
	(20 to 40) Hz	88 $\mu\text{V}/\text{V}$ + 6.1 μV	
	40 Hz to 20 kHz	53 $\mu\text{V}/\text{V}$ + 6.1 μV	
	(20 to 50) kHz	114 $\mu\text{V}/\text{V}$ + 6.1 μV	
	(50 to 100) kHz	304 $\mu\text{V}/\text{V}$ + 15.2 μV	
	(100 to 300) kHz	609 $\mu\text{V}/\text{V}$ + 19 μV	
	(300 to 500) kHz	1.3 mV /V + 23 μV	
	500 kHz to 1 MHz	2.5 mV /V + 46 μV	
	220 mV to 2.2 V		
	(10 to 20) Hz	228 $\mu\text{V}/\text{V}$ + 38 μV	
	(20 to 40) Hz	84 $\mu\text{V}/\text{V}$ + 15 μV	
	40 Hz to 20 kHz	37 $\mu\text{V}/\text{V}$ + 8 μV	
	(20 to 50) kHz	61 $\mu\text{V}/\text{V}$ + 9 μV	
	(50 to 100) kHz	76 $\mu\text{V}/\text{V}$ + 30 μV	
	(100 to 300) kHz	304 $\mu\text{V}/\text{V}$ + 76 μV	
	(300 to 500) kHz	913 $\mu\text{V} /\text{V}$ + 190 μV	
	500 kHz to 1 MHz	1.5 mV/V + 304 μV	
	(2.2 to 22) V		
	(10 to 20) Hz	228 $\mu\text{V}/\text{V}$ + 380 μV	
	(20 to 40) Hz	84 $\mu\text{V}/\text{V}$ + 152 μV	
40 Hz to 20 kHz	37 $\mu\text{V}/\text{V}$ + 54 μV		
(20 to 50) kHz	61 $\mu\text{V}/\text{V}$ + 91 μV		
(50 to 100) kHz	76 $\mu\text{V}/\text{V}$ + 190 μV		
(100 to 300) kHz	228 $\mu\text{V}/\text{V}$ + 609 μV		
(300 to 500) kHz	913 $\mu\text{V}/\text{V}$ + 1.9 mV		
500 kHz to 1 MHz	1.4 mV/V + 3 mV		
(22 to 220) V			
(10 to 20) Hz	228 $\mu\text{V}/\text{V}$ + 3.8 mV		
(20 to 40) Hz	84 $\mu\text{V}/\text{V}$ + 1.5 mV		
40 Hz to 20 kHz	49 $\mu\text{V}/\text{V}$ + 0.6 mV		
(20 to 50) kHz	76 $\mu\text{V}/\text{V}$ + 0.9 mV		
(50 to 100) kHz	137 $\mu\text{V}/\text{V}$ + 2.3 mV		



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Electrical – DC/Low Frequency

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(220 to 750) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	68 μ V/V + 3 mV 126 μ V/V + 5 mV 457 μ V/V + 8 mV 1.8 mV/V + 34 mV	Comparison to Fluke 5730A Multifunction Calibrator, 5725A Amplifier
	(750 to 1 000) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	68 μ V/V + 3 mV 126 μ V/V + 5 mV 457 μ V/V + 8 mV	
AC Voltage – Generate ¹ Wideband Absolute	(0.3 to 1.1) mV (10 to 30 Hz)	0.65 % of output + 1.5 μ V	Comparison to Fluke 5730A Option 003 Multifunction Calibrator
	30 Hz to 500 kHz	0.61 % of output + 1.5 μ V	
	(0.5 to 1.2) MHz	0.63 % of output + 3.8 μ V	
	(1.2 to 2) MHz	0.63 % of output + 3.8 μ V	
	(2 to 12) MHz	0.68 % of output + 3.8 μ V	
	(12 to 20) MHz	0.76 % of output + 3.8 μ V	
	(20 to 30) MHz	1.3 % of output + 13 μ V	
	(1.1 to 3.3) mV (10 to 30 Hz)	0.58 % of output + 2.3 μ V	
	30 Hz to 500 kHz	0.53 % of output + 2.3 μ V	
	(0.5 to 1.2) MHz	0.54 % of output + 4.6 μ V	
	(1.2 to 2) MHz	0.54 % of output + 4.6 μ V	
	(2 to 12) MHz	0.58 % of output + 4.6 μ V	
	(12 to 20) MHz	0.65 % of output + 4.6 μ V	
	(20 to 30) MHz	1.3 % of output + 4.6 μ V	
	(3.3 to 11) mV (10 to 30 Hz)	0.58 % of output + 6.1 μ V	
	30 Hz to 500 kHz	0.53 % of output + 6.1 μ V	
	(0.5 to 1.2) MHz	0.54 % of output + 8.4 μ V	
	(1.2 to 2) MHz	0.54 % of output + 8.4 μ V	
(2 to 12) MHz	0.55 % of output + 8.4 μ V		
(12 to 20) MHz	0.61 % of output + 8.4 μ V		
(20 to 30) MHz	0.93 % of output + 8.4 μ V		
(11 to 33) mV (10 to 30 Hz)	0.52 % of output + 12 μ V		
30 Hz to 500 kHz	0.46 % of output + 12 μ V		
(0.5 to 1.2) MHz	0.47 % of output + 14 μ V		
(1.2 to 2) MHz	0.47 % of output + 14 μ V		
(2 to 12) MHz	0.49 % of output + 14 μ V		
(12 to 20) MHz	0.55 % of output + 14 μ V		
(20 to 30) MHz	0.89 % of output + 14 μ V		



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Electrical – DC/Low Frequency

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(33 to 110) mV		Comparison to Fluke 5730A Option 003 Multifunction Calibrator
	(10 to 30 Hz)	0.52 % of output + 30 μV	
	30 Hz to 500 kHz	0.46 % of output + 30 μV	
	(0.5 to 1.2) MHz	0.47 % of output + 33 μV	
	(1.2 to 2) MHz	0.47 % of output + 33 μV	
	(2 to 12) MHz	0.49 % of output + 33 μV	
	(12 to 20) MHz	0.55 % of output + 33 μV	
	(20 to 30) MHz	0.89 % of output + 33 μV	
	(110 to 330) mV		
	(10 to 30 Hz)	0.45 % of output + 0.1 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.1 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.1 mV	
	(1.2 to 2) MHz	0.4 % of output + 0.1 mV	
	(2 to 12) MHz	0.42 % of output + 0.1 mV	
	(12 to 20) MHz	0.49 % of output + 0.1 mV	
	(20 to 30) MHz	0.85 % of output + 0.1 mV	
	(0.33 to 1.1) V		
	(10 to 30 Hz)	0.45 % of output + 0.3 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.3 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.3 mV	
(1.2 to 2) MHz	0.4 % of output + 0.3 mV		
(2 to 12) MHz	0.42 % of output + 0.3 mV		
(12 to 20) MHz	0.49 % of output + 0.3 mV		
(20 to 30) MHz	0.85 % of output + 0.3 mV		
(1.1 to 3.5) V			
(10 to 30 Hz)	0.39 % of output + 0.4 mV		
30 Hz to 500 kHz	0.3 % of output + 0.4 mV		
(0.5 to 1.2) MHz	0.32 % of output + 0.4 mV		
(1.2 to 2) MHz	0.32 % of output + 0.4 mV		
(2 to 12) MHz	0.35 % of output + 0.4 mV		
(12 to 20) MHz	0.44 % of output + 0.4 mV		
(20 to 30) MHz	0.82 % of output + 0.4 mV		
AC Voltage – Measure ¹	(1 to 10) mV		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.02 % of reading + 2 μV	
	40 Hz to 1 kHz	0.013 % of reading + 0.7 μV	
	(1 to 20) kHz	0.02 % of reading + 0.7 μV	
	(20 to 50) kHz	0.065 % of reading + 0.7 μV	
	(50 to 100) kHz	0.33 % of reading + 0.7 μV	
	100 kHz to 1 MHz	0.78 % of reading + 3.3 μV	
	(1 to 4) MHz	4.6 % of reading + 4.6 μV	
(4 to 8) MHz	13 % of reading + 5.3 μV		



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Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(10 to 100) mV		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.005 % of reading + 2.6 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 1.3 μ V	
	(1 to 20) kHz	0.009 % of reading + 1.3 μ V	
	(20 to 50) kHz	0.02 % of reading + 1.3 μ V	
	(50 to 100) kHz	0.052 % of reading + 1.3 μ V	
	(100 to 300) kHz	0.20 % of reading + 6.5 μ V	
	300 kHz to 1 MHz	0.70 % of reading + 6.5 μ V	
	(1 to 2) MHz	0.98 % of reading + 46 μ V	
	(2 to 4) MHz	2.6 % of reading + 46 μ V	
	(4 to 8) MHz	2.6 % of reading + 52 μ V	
	(8 to 10) MHz	9.8 % of reading + 65 μ V	
	(0.10 to 1) V		
	(1 to 40) Hz	0.005 % of reading + 26 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 13 μ V	
	(1 to 20) kHz	0.009 % of reading + 13 μ V	
	(20 to 50) kHz	0.02 % of reading + 13 μ V	
	(50 to 100) kHz	0.052 % of reading + 13 μ V	
	(100 to 300) kHz	0.2 % of reading + 65 μ V	
	300 kHz to 1 MHz	0.65 % of reading + 65 μ V	
	(1 to 2) MHz	0.98 % of reading + 0.5 mV	
	(2 to 4) MHz	2.6 % of reading + 0.5 mV	
	(4 to 8) MHz	2.6 % of reading + 0.5 mV	
	(8 to 10) MHz	9.8 % of reading + 0.7 mV	
	(1 to 10) V		
	(1 to 40) Hz	0.005 % of reading + 0.3 mV	
	40 Hz to 1 kHz	0.005 % of reading + 0.1 mV	
	(1 to 20) kHz	0.009 % of reading + 0.1 mV	
	(20 to 50) kHz	0.02 % of reading + 0.1 mV	
	(50 to 100) kHz	0.052 % of reading + 0.1 mV	
(100 to 300) kHz	0.2 % of reading + 0.7 mV		
300 kHz to 1 MHz	0.65 % of reading + 0.7 mV		
(1 to 2) MHz	0.98 % of reading + 4.6 mV		
(2 to 4) MHz	2.6 % of reading + 4.6 mV		
(4 to 8) MHz	2.6 % of reading + 5.2 mV		
(8 to 10) MHz	9.8 % of reading + 6.5 mV		



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Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(10 to 100) V		Comparison to Agilent 3458A/002 Precision Multimeter
	(1 to 40) Hz	0.013 % of reading + 2.6 mV	
	40 Hz to 1 kHz	0.013 % of reading + 1.3 mV	
	(1 to 20) kHz	0.013 % of reading + 1.3 mV	
	(20 to 50) kHz	0.023 % of reading + 1.3 mV	
	(50 to 100) kHz	0.08 % of reading + 1.3 mV	
	(100 to 300) kHz	0.26 % of reading + 6.5 mV	
	300 kHz to 1 MHz	0.98 % of reading + 6.5 mV	
	(100 to 700) V		
	(1 to 40) Hz	0.026 % of reading + 26 mV	
	40 Hz to 1 kHz	0.026 % of reading + 13 mV	
	(1 to 20) kHz	0.039 % of reading + 13 mV	
	(20 to 50) kHz	0.078 % of reading + 13 mV	
	(50 to 100) kHz	0.2 % of reading + 13 mV	
AC Voltage – Measure ¹	(1 to 5) kV	0.5 % of reading	Comparison to Ross VD30 Voltage Divider, Fluke 287 Multimeter
	60 Hz		
	(5 to 21) kV	0.5 % of reading	
	60 Hz		
AC Current – Generate ¹	(9 to 220) μ A		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	228 μ A/A + 15 nA	
	(20 to 40) Hz	152 μ A/A + 10 nA	
	40 Hz to 1 kHz	91 μ A/A + 8 nA	
	(1 to 5) kHz	266 μ A/A + 12 nA	
	(5 to 10) kHz	989 μ A/A + 61 nA	
	(0.22 to 2.2) mA		
	(10 to 20) Hz	228 μ A/A + 39 nA	
	(20 to 40) Hz	152 μ A/A + 31 nA	
	40 Hz to 1 kHz	91 μ A/A + 31 nA	
	(1 to 5) kHz	183 μ A/A + 99 nA	
	(5 to 10) kHz	989 μ A/A + 609 nA	
	(2.2 to 22) mA		
	(10 to 20) Hz	228 μ A/A + 385 nA	
	(20 to 40) Hz	152 μ A/A + 310 nA	
	40 Hz to 1 kHz	91 μ A/A + 310 nA	
	(1 to 5) kHz	183 μ A/A + 536 nA	
	(5 to 10) kHz	989 μ A/A + 4566 nA	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate ¹	(22 to 220) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz (0.22 to 2.2) A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	228 μ A/A + 4 μ A 152 μ A/A + 3 μ A 91 μ A/A + 2 μ A 183 μ A/A + 3 μ A 989 μ A/A + 9 μ A 228 μ A/A + 31 μ A 380 μ A/A + 76 μ A 0.61 % of reading + 152 μ A	Comparison to Fluke 5730A Multifunction Calibrator
AC Current – Generate ¹	(2.2 to 11) A 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	350 μ A /A + 141 μ A 723 μ A /A + 295 μ A 0.27 % of reading + 573 μ A	Comparison to Fluke 5730A Multifunction Calibrator, 5725 Amplifier
AC Current – Generate ¹	(11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.09 % of output + 5 mA 0.11 % of output + 5 mA 2.3 % of output + 5 mA	Comparison to Fluke 5522A Multiproduct Calibrator
AC Current – Generate ¹ Clamp Meters	(3.3 to 30) A (10 to 100) Hz (100 to 440) Hz (30 to 200) A 10 to 100 Hz (100 to 440) Hz	0.22 % of output + 0.028 A 0.3 % of output + 0.07 A 0.22 % of output + 0.032 A 0.79 % of output + 0.08 A	Comparison to Fluke 5522A Multiproduct Calibrator / 9100-200 x10 Coil
AC Current – Generate ¹ Clamp Meters	(16.5 to 150) A (10 to 100) Hz (100 to 440) Hz (150 to 1 000) A (10 to 100) Hz (100 to 440) Hz	0.22 % of output + 0.029 A 0.3 % of output + 0.08 A 0.22 % of output + 0.081 A 0.79 % of output + 0.20 A	Comparison to Fluke 5522A Multiproduct Calibrator / 9100-200 x50 Coil
AC Current – Measure ¹	(5 to 100) μ A (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz 100 μ A to 1 mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 0.02 μ A 0.1 % of reading + 0.02 μ A 0.04 % of reading + 0.02 μ A 0.26 % of reading + 0.13 μ A 0.1 % of reading + 0.13 μ A 0.04 % of reading + 0.13 μ A 0.02 % of reading + 0.13 μ A	Comparison to Agilent 3458A Multimeter

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Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(1 to 10) mA		Comparison to Agilent 3458A Multimeter
	(10 to 20) Hz	0.26 % of reading + 1.3 μA	
	(20 to 45) Hz	0.1 % of reading + 1.3 μA	
	(45 to 100) Hz	0.04 % of reading + 1.3 μA	
	100 Hz to 5 kHz	0.02 % of reading + 1.3 μA	
	(10 to 100) mA		
	(10 to 20) Hz	0.26 % of reading + 13 μA	
	(20 to 45) Hz	0.1 % of reading + 13 μA	
	(45 to 100) Hz	0.04 % of reading + 13 μA	
	100 Hz to 5 kHz	0.02 % of reading + 13 μA	
	100 mA to 1 A		
	(10 to 20) Hz	0.26 % of reading + 0.13 mA	
(20 to 45) Hz	0.1 % of reading + 0.13 mA		
(45 to 100) Hz	0.04 % of reading + 0.13 mA		
100 Hz to 5 kHz	0.02 % of reading + 0.13 mA		
AC Current – Measure ¹	(1 to 3) A		Comparison to Fluke 8846A Multimeter
	(3 to 5) Hz	0.84 % of reading + 1.4 mA	
	(5 to 10) Hz	0.27 % of reading + 1.4 mA	
	10 Hz to 5 kHz	0.11 % of reading + 1.4 mA	
	(5 to 10) kHz	0.27 % of reading + 16 mA	
	(3 to 10) A		
	(3 to 5) Hz	0.84 % of reading + 4.6 mA	
	(5 to 10) Hz	0.27 % of reading + 4.6 mA	
	10 Hz to 5 kHz	0.11 % of reading + 4.6 mA	
	(5 to 10) kHz	0.27 % of reading + 53 mA	
Resistance – Generate ¹ Fixed Points	(1, 1.9) Ω	84 μΩ/Ω + 0.1 μΩ	Comparison to Fluke 5730A Multifunction Calibrator
	(10, 19) Ω	21 μΩ/Ω + 1 μΩ	
	(100, 190) Ω	9.1 μΩ/Ω + 6 μΩ	
	(1, 1.9) kΩ	6.1 μΩ/Ω + 60 μΩ	
	(10, 19) kΩ	6.1 μΩ/Ω + 0.6 mΩ	
	100 kΩ	7.6 μΩ/Ω + 6 mΩ	
	190 kΩ	9.1 μΩ/Ω + 6 mΩ	
	1 MΩ	11.4 μΩ/Ω + 60 mΩ	
	1.9 MΩ	16 μΩ/Ω + 60 mΩ	
	10 MΩ	35 μΩ/Ω + 0.6 Ω	
	19 MΩ	42 mΩ/Ω + 0.6 Ω	
	100 MΩ	91 mΩ/Ω + 6 Ω	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Generate ¹ Fixed Points	100 V 100 kΩ (100 to 1 000) V (1, 10, 100) MΩ (1, 10) GΩ 100 GΩ	1 % of reading 1 % of reading 1 % of reading 2 % of reading	Comparison to TMI RB Resistance Standard
Resistance – Measure ¹	Up to 12 Ω (10 to 120) Ω (0.1 to 1.2) kΩ (1 to 12) kΩ (10 to 120) kΩ (0.1 to 1.2) MΩ (1 to 12) MΩ (10 to 120) MΩ (0.1 to 1.2) GΩ	9.8 μΩ/Ω + 38 μΩ 7.8 μΩ/Ω + 0.3 mΩ 6.5 μΩ/Ω + 0.4 mΩ 6.5 μΩ/Ω + 3.8 mΩ 6.5 μΩ/Ω + 38 mΩ 9.8 μΩ/Ω + 1.5 Ω 33 μΩ/Ω + 100 Ω 327 μΩ/Ω + 1 kΩ 0.33 % of reading + 70 kΩ	Comparison to Agilent 3458A Multimeter
Resistance – Measure ¹	50 Hz (1 to 10) Ω (10 to 100) Ω (100 to 1 000) Ω (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ 100/120 Hz (1 to 10) Ω (10 to 100) Ω (100 to 1 000) Ω (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ 1 000 Hz (1 to 10) Ω (10 to 100) Ω (100 to 1 000) Ω (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ	0.17 % of reading + 0.003 Ω 0.062 % of reading + 0.006 Ω 0.051 % of reading + 0.06 Ω 0.05 % of reading + 0.000 6 kΩ 0.054 % of reading + 0.006 kΩ 0.09 % of reading + 0.000 06 MΩ 0.45% of reading + 0.000 6 MΩ 0.13 % of reading + 0.003 Ω 0.049 % of reading + 0.006 Ω 0.041 % of reading + 0.06 Ω 0.04 % of reading + 0.000 6 kΩ 0.043 % of reading + 0.006 kΩ 0.07 % of reading + 0.000 06 MΩ 0.34 % of reading + 0.000 6 MΩ 0.05 % of reading + 0.003 Ω 0.023 % of reading + 0.006 Ω 0.02 % of reading + 0.06 Ω 0.02 % of reading + 0.000 6 kΩ 0.021 % of reading + 0.006 kΩ 0.03 % of reading + 0.000 06 MΩ 0.12 % of reading + 0.000 6 MΩ	Comparison to IET 1693 RLC Meter



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure ¹	10 kHz		Comparison to IET 1693 RLC Meter
	(1 to 10) Ω	0.17 % of reading + 0.003 Ω	
	(10 to 100) Ω	0.062 % of reading + 0.006 Ω	
	(100 to 1 000) Ω	0.051 % of reading + 0.06 Ω	
	(1 to 10) kΩ	0.05 % of reading + 0.000 6 KΩ	
	(10 to 25.6) kΩ	0.051 % of reading + 0.006 KΩ	
	(25.6 to 100) kΩ	0.186 % of reading + 0.006 KΩ	
	(0.1 to 1) MΩ	0.33 % of reading + 0.000 06 MΩ	
	(1 to 10) MΩ	1.8 % of reading + 0.0006 MΩ	
	100 kHz		
	(1 to 10) Ω	0.77 % of reading + 0.003 Ω	
	(10 to 100) Ω	0.257 % of reading + 0.006 Ω	
	(100 to 1 000) Ω	0.21 % of reading + 0.06 Ω	
	(1 to 10) kΩ	0.23 % of reading + 0.000 6 kΩ	
(10 to 100) kΩ	0.52 % of reading + 0.006 kΩ		
(0.1 to 1) MΩ	3.4 % of reading + 0.000 06 MΩ		
Resistance – Generate ¹	Up to 11 Ω	30 μΩ/Ω + 0.001 Ω	Comparison to Fluke 5522A Multiproduct Calibrator
	(11 to 33) Ω	23 μΩ/Ω + 0.001 Ω	
	(33 to 110) Ω	21 μΩ/Ω + 0.001 Ω	
	(110 to 330) Ω	21 μΩ/Ω + 0.002 Ω	
	(0.33 to 1.1) kΩ	21 μΩ/Ω + 0.002 Ω	
	(1.1 to 3.3) kΩ	21 μΩ/Ω + 0.02 Ω	
	(3.3 to 11) kΩ	21 μΩ/Ω + 0.02 Ω	
	(11 to 33) kΩ	21 μΩ/Ω + 0.2 Ω	
	(33 to 110) kΩ	21 μΩ/Ω + 0.2 Ω	
	(110 to 330) kΩ	24 μΩ/Ω + 2 Ω	
	(0.33 to 1.1) MΩ	24 μΩ/Ω + 2 Ω	
	(1.1 to 3.3) MΩ	46 μΩ/Ω + 23 Ω	
	(3.3 to 11) MΩ	99 μΩ/Ω + 38 Ω	
	(11 to 33) MΩ	190 μΩ/Ω + 1.9 kΩ	
	(33 to 110) MΩ	380 μΩ/Ω + 2.3 kΩ	
(110 to 330) MΩ	0.23 % of setting + 76 kΩ		
(0.33 to 1.1) GΩ	1.1 % of reading + 380 kΩ		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Generate ¹	(220 to 400) pF (0.4 to 3.299 9) nF (3.3 to 10.999 9) nF (11 to 32.999 9) nF (33 to 109.999) nF (110 to 329.999) nF (0.33 to 1.099 99) μF (1.1 to 3.299 99) μF (3.3 to 10.999 9) μF (11 to 32.999 9) μF (33 to 109.999) μF (110 to 329.999) μF (0.33 to 1.099 99) mF (1.1 to 3.299 99) mF (3.3 to 10.999 9) mF (11 to 32.999 9) mF (33 to 110) mF	0.38% of output + 7.6 pF 0.38 % of output + 0.01 nF 0.19 % of output + 0.01 nF 0.19 % of output + 0.08 nF 0.19 % of output + 0.08 nF 0.19 % of output + 0.23 nF 0.19 % of output + 0.76 nF 0.19 % of output + 2.3 nF 0.19 % of output + 7.6 nF 0.3 % of output + 23 nF 0.34 % of output + 76 nF 0.34 % of output + 228 nF 0.34 % of output + 0.76 μF 0.34 % of output + 2.3 μF 0.34 % of output + 7.6 μF 0.57 % of output + 23 μF 0.84 % of output + 76 μF	Comparison to Fluke 5522A Multiproduct Calibrator
Capacitance – Generate ¹ Fixed Points	1 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.038 % of output 0.038 % of output 0.044 % of output 0.055 % of output 0.073 % of output 0.096 % of output 0.25 % of output 0.37 % of output	Comparison to Agilent 16381A Capacitor Fixed
Capacitance – Generate ¹ Fixed Points	10 pF 1 kHz 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.035 % of output 0.036 % of output 0.038 % of output	Comparison to Agilent 16382A Capacitor Fixed



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Generate ¹ Fixed Points	100 pF		Comparison to Agilent 16383A Capacitor Fixed
	1 kHz	0.035 % of output	
	1 MHz	0.035 % of output	
	2 MHz	0.035 % of output	
	3 MHz	0.035 % of output	
	4 MHz	0.035 % of output	
	5 MHz	0.037 % of output	
	10 MHz	0.048 % of output	
13 MHz	0.06 % of output		
Capacitance – Generate ¹ Fixed Points	1 000 pF		Comparison to Agilent 16384A Capacitor Fixed
	1 kHz	0.035 % of output	
	1 MHz	0.035 % of output	
	2 MHz	0.037 % of output	
	3 MHz	0.044 % of output	
	4 MHz	0.056 % of output	
	5 MHz	0.071 % of output	
	10 MHz	0.19 % of output	
13 MHz	0.28 % of output		
Capacitance – Generate ¹ 1 kHz	1 pF to 1.111 11 μF	0.05% of output + 0.5 pF	Comparison to GR 1413 Decade Capacitor
Capacitance – Generate ¹	100 & 120 Hz		Comparison to GR 1417 Capacitance Standard
	10 μF	0.35 % of output	
	100 μF	0.35 % of output	
	1000 μF	0.35 % of output	
	10 mF	0.35 % of output	
	100 mF	0.36 % of output	
	1 F	0.43 % of output	
	1 kHz		
	10 μF	0.35 % of output	
	100 μF	0.35 % of output	
	1000 μF	0.36 % of output	
	10 mF	0.4 % of output	



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure	50 Hz		Comparison to IET 1693 LCR Meter
	(50 to 100) pF	2.6 % of reading + 0.015 pF	
	(100 to 400) pF	1.3 % of reading + 0.06 pF	
	(400 to 1 000) pF	0.37 % of reading + 0.06 pF	
	(1 to 10) nF	0.18 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.063 % of reading + 0.006 nF	
	(100 to 1000) nF	0.051 % of reading + 0.06 nF	
	(0.1 to 1) μF	0.051 % of reading + 0.000 06 μF	
	(1 to 10) μF	0.05% of reading + 0.000 6 μF	
	(10 to 100) μF	0.054 % of reading + 0.006 μF	
	(100 to 1 000) μF	0.09 % of reading + 0.06 μF	
	100 Hz		
	(20 to 100) pF	2.4 % of reading + 0.015 pF	
	(100 to 400) pF	0.52 % of reading + 0.06 pF	
	(400 to 1 000) pF	0.16 % of reading + 0.06 pF	
	(1 to 10) nF	0.088 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.045 % of reading + 0.006 nF	
	(100 to 1000) nF	0.041 % of reading + 0.06 nF	
	(0.1 to 1) μF	0.041 % of reading + 0.000 06 μF	
	(10 to 100) μF	0.046 % of reading + 0.006 μF	
	(100 to 1 000) μF	0.1 % of reading + 0.06 μF	
	120 Hz		
	(20 to 100) pF	2 % of reading + 0.01 5pF	
	(100 to 400) pF	0.44 % of reading + 0.06 pF	
	(400 to 1 000) pF	0.14 % of reading + 0.06 pF	
	(1 to 10) nF	0.08 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.044 % of reading + 0.006 nF	
(100 to 1000) nF	0.04 % of reading + 0.06 nF		
(0.1 to 1) μF	0.04 % of reading + 0.000 06 μF		
(1 to 10) μF	0.041 % of reading + 0.000 6 μF		
(10 to 100) μF	0.047 % of reading + 0.006 μF		
(100 to 1 000) μF	0.11 % of reading + 0.06 μF		



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Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure	1 000 Hz		Comparison to IET 1693 LCR Meter
	(1 to 10) pF	1.6 % of reading + 0.014 pF	
	(10 to 20) pF	0.18 % of reading + 0.015 pF	
	(20 to 100) pF	0.1 % of reading + 0.015 pF	
	(100 to 400) pF	0.036 % of reading + 0.06 pF	
	(400 to 1 000) pF	0.024 % of reading + 0.06 pF	
	(1 to 10) nF	0.022 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.02 % of reading + 0.006 nF	
	(100 to 1 000) nF	0.02 % of reading + 0.06 nF	
	(0.1 to 1) μF	0.02 % of reading + 0.000 06 μF	
	(1 to 10) μF	0.020 % of reading + 0.000 6 μF	
	(10 to 100) μF	0.04 % of reading + 0.006 μF	
	(100 to 1 000) μF	0.22 % of reading + 0.06 μF	
	10 kHz		
	(20 to 100) pF	0.3 % of reading + 0.015 pF	
	(100 to 622) pF	0.2 % of reading + 0.06 pF	
	(622 to 1 000) pF	0.051 % of reading + 0.06 pF	
	(1 to 10) nF	0.051 % of reading + 0.000 6 nF	
	(10 to 100) nF	0.051 % of reading + 0.006 nF	
	(100 to 1 000) nF	0.058 % of reading + 0.06 nF	
	(0.1 to 1) μF	0.058 % of reading + 0.000 06 μF	
	(1 to 10) μF	0.13 % of reading + 0.000 6 μF	
	(10 to 100) μF	0.85 % of reading + 0.006 μF	
	(100 to 500) μF	4.1 % of reading + 0.06 μF	
100 kHz			
(20 to 100) pF	0.49 % of reading + 0.015 pF		
(100 to 400) pF	0.26 % of reading + 0.06 pF		
(400 to 1 000) pF	0.21 % of reading + 0.06 pF		
(1 to 10) nF	0.21 % of reading + 0.000 6 nF		
(10 to 100) nF	0.24 % of reading + 0.006 nF		
(100 to 1 000) nF	0.58 % of reading + 0.06 nF		
(0.1 to 1) μF	0.58 % of reading + 0.000 06 μF		
(1 to 10) μF	4 % of reading + 0.000 6 μF		
Inductance – Generate ¹ Fixed Point	5 mH 1 000 Hz	0.0018mH	Comparison to GR 1482-G Standard Inductor
Inductance – Generate ¹ Fixed Point	100 mH (100 to 1 000) Hz	0.13mH	Comparison to GR LSB- 100mH Standard Inductor



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ¹	100 Hz		Comparison to IET 1693 LCR Meter
	(40 to 100) μ H	3.8 % of reading + 0.006 μ H	
	(0.1 to 0.4) mH	1.6 % of reading + 0.000 06 mH	
	(0.4 to 1) mH	0.42 % of reading + 0.000 06 mH	
	(1 to 10) mH	0.19 % of reading + 0.000 6 mH	
	(10 to 100) mH	0.056 % of reading + 0.006 mH	
	(0.1 to 1) H	0.042 % of reading + 0.000 06 H	
	(1 to 10) H	0.041 % of reading + 0.000 6 H	
	(10 to 100) H	0.042 % of reading + 0.006 H	
	1 000 Hz		
	(4 to 10) μ H	1.3 % of reading + 0.003 μ H	
	(10 to 40) μ H	0.53 % of reading + 0.006 μ H	
	(40 to 100) μ H	0.15 % of reading + 0.006 μ H	
	(0.1 to 0.4) mH	0.071 % of reading + 0.000 06 mH	
	(0.4 to 1) mH	0.033 % of reading + 0.000 06 mH	
	(1 to 10) mH	0.025 % of reading + 0.000 6 mH	
	(10 to 100) mH	0.021 % of reading + 0.006 mH	
	(0.1 to 1) H	0.02 % of reading + 0.000 06 H	
	(1 to 10) H	0.021 % of reading + 0.000 6 H	
	(10 to 100) H	0.026 % of reading + 0.006 H	
	10 kHz		
	(1 to 4) μ H	2.1 % of reading + 0.003 μ H	
	(4 to 10) μ H	0.56 % of reading + 0.003 μ H	
	(10 to 40) μ H	0.25 % of reading + 0.006 μ H	
	(40 to 100) μ H	0.1 % of reading + 0.006 μ H	
	(0.1 to 0.4) mH	0.071 % of reading + 0.000 06 mH	
	(0.4 to 1) mH	0.056 % of reading + 0.000 06 mH	
	(1 to 10) mH	0.052 % of reading + 0.000 6 mH	
(10 to 100) mH	0.051 % of reading + 0.006 mH		
(0.1 to 0.407) H	0.051 % of reading + 0.000 06 H		
(0.407 to 1) H	0.18 % of reading + 0.000 6 H		
(1 to 10) H	0.27 % of reading + 0.000 6 H		
(10 to 100) H	1.2 % of reading + 0.006 H		



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Electrical – DC/Low Frequency

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ¹	100 kHz (1 to 4) μ H (4 to 10) μ H (10 to 40) μ H (40 to 100) μ H (0.1 to 0.4) mH (0.4 to 1) mH (1 to 10) mH (10 to 100) mH (0.1 to 1) H	1.2 % of reading + 0.003 μ H 0.44 % of reading + 0.003 μ H 0.3 % of reading + 0.006 μ H 0.23 % of reading + 0.006 μ H 0.21 % of reading + 0.000 06 mH 0.21 % of reading + 0.000 06 mH 0.22 % of reading + 0.000 6 mH 0.39 % of reading + 0.006 mH 2.1 % of reading + 0.000 06 H	Comparison to IET 1693 LCR Meter
Oscilloscopes Calibration ¹ – Generate Voltage DC - 50 Ω	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 6.6) V	0.19 % of Output + 31 μ V 0.19 % of Output + 36 μ V 0.19 % of Output + 87 μ V 0.19 % of Output + 0.6 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
DC - 1M Ω	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.019 % of reading + 20 μ V 0.019 % of reading + 25 μ V 0.019 % of reading + 76 μ V 0.019 % of reading + 0.6 mV 0.019 % of reading + 6 mV	
Square Wave 10 Hz to 10 kHz - 50 Ω	(1 to 24.999) mVpp (25 to 109.99) mVpp (110mV to 2.1999) Vpp (2.2 to 6.6) Vpp	0.19 % of Output + 31 μ V 0.19 % of Output + 36 μ V 0.19 % of Output + 87 μ V 0.19 % of Output + 0.6 mV	
Square Wave 10 Hz to 1 kHz - 1M Ω	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.038 % of reading + 4 μ V 0.038 % of reading + 9 μ V 0.038 % of reading + 60 μ V 0.038 % of reading + 0.6 mV 0.038 % of reading + 6 mV	
Square Wave (1 to 10) kHz - 1M Ω	(1 to 24.999) mV (25 to 109.99) mV (110mV to 2.1999) V (2.2 to 10.999) V (11 to 130) V	0.19 % of reading + 31 μ V 0.19 % of reading + 36 μ V 0.19 % of reading + 87 μ V 0.19 % of reading + 0.6 mV 0.19 % of reading + 6 mV	



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness 50 kHz to 10 MHz Reference	3 dB Bandwidth (5 to 50) mVpp		Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
	50 kHz to 100 MHz	0.34 dB	
	(100 to 300) MHz	0.36 dB	
	(300 to 500) MHz	0.42 dB	
	(500 to 600) MHz	0.46 dB	
	(600 to 1 600) MHz	0.5 dB	
	(1 600 to 2 100) MHz	0.56 dB	
	50 mV to 3.5 Vpp		
	50 kHz to 100 MHz	0.24 dB	
	(100 to 300) MHz	0.24 dB	
	(300 to 500) MHz	0.32 dB	
	(500 to 600) MHz	0.34 dB	
(600 to 1 600) MHz	0.4 dB		
(1 600 to 2 100) MHz	0.44 dB		
(3.5 to 5) Vpp			
50 kHz to 100 MHz	0.24 dB		
(100 to 300) MHz	0.24 dB		
(300 to 500) MHz	0.32 dB		
(500 to 600) MHz	0.34 dB		
Oscilloscopes Calibration – Generate ¹ Leveled Sine Flatness	3 dB Bandwidth 50 mV to 3.5Vpp (2 100 to 4 000) MHz (4 000 to 8 000) MHz (8 000 to 18 000) MHz	0.25 dB 0.35 dB 0.46 dB	Comparison to EPM Power Meter w/ E Series Power Sensors
Oscilloscopes Calibration – Generate ¹ Time Marker	500 ps to 20 ms 50 ms to 5 s	0.25 μ s/s 1.9 μ s/s + 3.8 μ Hz	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option
Oscilloscopes Calibration – Measure ¹ Input Impedance Resistance Leakage	(40 to 60) Ω 500 k Ω to 1.5 M Ω (0 to 5.99) V	0.08 % of reading 0.08 % of reading 0.038 % of reading + 0.8 mV	Comparison to Fluke 5820A Oscilloscope Calibrator w/ GHz Option



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Electrical – DC/Low Frequency

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (33 to 329.999) mV Power Factor = 1	(3.3 to 32.999 9) mA (20 to 45) Hz (45 to 1 000 Hz (33 to 329.999) mA (20 to 45) Hz (45 to 1 000) Hz (0.33 to 1.099 99) A (10 to 45) Hz (45 to 1 000) Hz (1.1 to 2.999 99) A (10 to 45) Hz (45 to 1 000) Hz (3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.072 % of Output + 0.5 μW 0.032 % of Output + 0.5 μW 0.072 % of Output + 5.4 μW 0.032 % of Output + 5.4 μW 0.14 % of Output + 26 μW 0.04 % of Output + 26 μW 0.14 % of Output + 31 μW 0.044% of Output + 31 μW 0.047 % of Output + 0.5mW 0.077 % of Output + 0.5mW 0.092 % of Output + 1.3mW 0.12 % of Output + 1.3mW	Comparison to Fluke 5522A Multiproduct Calibrator
AC Power – Generate ¹ (0.33 to 3.299 99) V Power Factor = 1	(3.3 to 32.9999) mA (20 to 45) Hz (45 to 1 000 Hz (33 to 329.999) mA (20 to 45) Hz (45 to 1 000) Hz (0.33 to 1.09999) A (10 to 45) Hz (45 to 1 000) Hz (1.1 to 2.99999) A (10 to 45) Hz (45 to 1 000) Hz (3 to 10.999 9) A (45 to 100) Hz (100 to 1 000) Hz (11 to 20.5) A (45 to 100) Hz (100 to 1 000) Hz	0.072 % of Output + 5.2μW 0.033 % of Output + 5.2μW 0.072 % of Output + 52 μW 0.033 % of Output + 52 μW 0.14 % of Output + 26μW 0.04 % of Output + 26μW 0.14 % of Output + 0.28 mW 0.047 % of Output + 0.29 mW 0.047 % of Output + 5.1mW 0.077 % of Output + 5.1mW 0.092 % of Output + 13mW 0.12 % of Output + 13mW	Comparison to Fluke 5522A Multiproduct Calibrator



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Electrical – DC/Low Frequency

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (3.3 to 32.999 9) V Power Factor = 1	(3.3 to 32.999 9) mA	0.072 % of Output + 53μW	Comparison to Fluke 5522A Multiproduct Calibrator
	(20 to 45) Hz	0.033 % of Output + 53μW	
	(45 to 1 000) Hz		
	(33 to 329.999) mA	0.072 % of Output + 0.5 mW	
	(20 to 45) Hz	0.033 % of Output + 0.5 mW	
	(45 to 1 000) Hz		
	(0.33 to 1.099 99) A	0.14 % of Output + 2.6 mW	
	(10 to 45) Hz	0.04 % of Output + 2.6 mW	
	(45 to 1 000) Hz		
	(1.1 to 2.999 99) A	0.14 % of Output + 2.9 mW	
	(10 to 45) Hz	0.047 % of Output + 2.9 mW	
	(45 to 1 000) Hz		
AC Power – Generate ¹ (33 to 329.999) V Power Factor = 1	(3 to 10.999 9) A	0.047 % of Output + 51mW	Comparison to Fluke 5522A Multiproduct Calibrator
	(45 to 100) Hz	0.077 % of Output + 51mW	
	(100 to 1 000) Hz		
	(11 to 20.5) A	0.092 % of Output + 0.13 W	
	(45 to 100) Hz	0.12 % of Output + 0.13 W	
	(100 to 1 000) Hz		
	(3.3 to 32.999 9) mA	0.034 % of Output + 0.5 mW	
	(45 to 1 000) Hz		
	(33 to 329.999) mA	0.034 % of Output + 5.1 mW	
	(45 to 1 000) Hz		
	(0.33 to 1.099 99) A	0.041 % of Output + 25 mW	
	(45 to 1 000) Hz		
(1.1 to 2.999 99) A	0.048 % of Output + 26 mW		
(45 to 1 000) Hz			
(3 to 10.999 9) A	0.048 % of Output + 0.5 W		
(45 to 100) Hz	0.077 % of Output + 0.5 W		
(100 to 1 000) Hz			
(11 to 20.5) A	0.092 % of Output + 1.3 W		
(45 to 100) Hz	0.12 % of Output + 1.3W		
(100 to 1 000) Hz			



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (330 to 1 020) V Power Factor = 1	(3.3 to 32.999 9) mA (45 to 1 000) Hz	0.036 % of Output + 1.6 mW	Comparison to Fluke 5522A Multiproduct Calibrator
	(33 to 329.999) mA (45 to 1 000) Hz	0.036 % of Output + 16 mW	
	(0.33 to 1.099 99) A (45 to 1 000) Hz	0.043 % of Output + 78 mW	
	(1.1 to 2.999 99) A (45 to 1 000) Hz	0.049 % of Output + 81 mW	
	(3 to 10.999 9) A (45 to 100) Hz	0.051 % of Output + 1.6 W	
	(100 to 1 000) Hz	0.078 % of Output + 1.6 W	
	(11 to 20.5) A (45 to 100) Hz	0.094 % of Output + 3.9 W	
	(100 to 1 000) Hz	0.12 % of Output + 3.9W	
Phase Angle - Generate ¹	(-180 to 180) °		Comparison to Fluke 5522A Multiproduct Calibrator
	(10 to 65) Hz	0.08°	
	(65 to 500) Hz	0.19°	
	500 Hz to 1 kHz (1 to 5) kHz	0.38° 1.9°	
	(5 to 10) kHz	3.8°	
	(10 to 30) kHz	7.6°	
Electrical Calibration of Thermocouple Indicators ¹	Type B (600 to 800) °C	0.27 °C	Comparison to Fluke 7526A Process Calibrator
	(800 to 1 550) °C	0.21 °C	
	(1 550 to 1 820) °C	0.17 °C	
	Type C (0 to 1 000) °C	0.12 °C	
	(1 000 to 1 800) °C	0.18 °C	
	(1 800 to 2 000) °C	0.2 °C	
	(2 000 to 2 316) °C	0.27 °C	
	Type E (-250 to -200) °C	0.19 °C	
	(-200 to -100) °C	0.09 °C	
	(-100 to 0) °C	0.07 °C	
	(0 to 600) °C	0.06 °C	
	(600 to 1 000) °C	0.08 °C	
	Type J (-210 to -100) °C	0.11 °C	
	(-100 to 800) °C	0.07 °C	
	(800 to 1 200) °C	0.08 °C	



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicators ¹	Type K		Comparison to Fluke 7526A Process Calibrator
	(-250 to -200) °C	0.35 °C	
	(-200 to -100) °C	0.12 °C	
	(-100 to 800) °C	0.08 °C	
	(800 to 1 372) °C	0.1 °C	
	Type L		
	(-200 to -100) °C	0.08 °C	
	(-100 to 900) °C	0.07 °C	
	Type N		
	(-250 to -200) °C	0.56 °C	
	(-200 to -100) °C	0.18 °C	
	(-100 to 0) °C	0.09 °C	
	(0 to 100) °C	0.08 °C	
	(100 to 800) °C	0.08 °C	
	(800 to 1 300) °C	0.09 °C	
	Type R		
	(-50 to -25) °C	0.42 °C	
	(-25 to 0) °C	0.34 °C	
	(0 to 100) °C	0.3 °C	
	(100 to 400) °C	0.21 °C	
	(400 to 600) °C	0.17 °C	
	(600 to 1 000) °C	0.16 °C	
	(1 000 to 1 600) °C	0.14 °C	
	(600 to 1 767) °C	0.18 °C	
	Type S		
	(50 to -25) °C	0.39 °C	
	(-25 to 0) °C	0.33 °C	
	(0 to 100) °C	0.29 °C	
(100 to 400) °C	0.22 °C		
(400 to 600) °C	0.18 °C		
(600 to 1 600) °C	0.17 °C		
(1 600 to 1 767) °C	0.2 °C		
Type T			
(-250 to -200) °C	0.27 °C		
(-200 to -100) °C	0.12 °C		
(-100 to 0) °C	0.08 °C		
(0 to 400) °C	0.07 °C		
Type U			
(-200 to 0) °C	0.13 °C		
(0 to 600) °C	0.08 °C		



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Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicators ¹	Pt 100 (385) (-200 to 800) °C	0.04 °C	Comparison to Fluke 7526A Process Calibrator
	Pt 100 (3916) (-200 to 630) °C	0.04 °C	
	Pt 100 (3926) (-200 to 630) °C	0.04 °C	
	Pt 200 (385) (-200 to 400) °C	0.30 °C	
	(400 to 630) °C	0.38 °C	
	Pt 500 (385) (-200 to 630) °C	0.13 °C	
	Pt 1 000 (385) (-200 to 630) °C	0.07 °C	
	Cu 10 (427) (100 °C to 260) °C	0.29 °C	
	Ni 120 (672) (-80 to 260) °C	0.02 °C	
Power Meter Range Calibration ¹	3 μW to 100 mW	0.25 % of reading	Comparison to HP 11683A Power Meter Calibrator

Electrical – RF/Microwave

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Flatness – Measure ¹	9 kHz to 2 000 MHz (20 to -10) dBm	0.1 dB	Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(-10 to -30) dBm	0.1 dB	
	(-30 to -40) dBm	0.11 dB	
	(-40 to -42) dBm	0.12 dB	
	(2 to 14) GHz (20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.09 dB	
	(-30 to -40) dBm	0.1 dB	
	(-40 to -42) dBm	0.11 dB	
	(14 to 18) GHz (20 to -10) dBm	0.11 dB	
	(-10 to -30) dBm	0.12 dB	
	(-30 to -40) dBm	0.12 dB	
	(-40 to -42) dBm	0.13 dB	

Electrical – RF/Microwave

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	9 kHz to 14 000 MHz (20 to 0) dB (0 to -40) dB (-40 to -50) dB (-50 to -55) dB (14 000 to 18 000) MHz (20 to 0) dB (0 to -40) dB (-40 to -50) dB (-50 to -55) dB	0.13 dB 0.15 dB 0.35 dB 0.93 dB 0.12 dB 0.16 dB 0.35 dB 0.93 dB	Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
RF Power Measure ¹	(50 to 100) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (100 to 6 000) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB (6 000 to 12 400) MHz (20 to 10) dB (10 to 0) dB (0 to -10) dB (-10 to -20) dB (-20 to -25) dB	0.08 dB 0.07 dB 0.07 dB 0.07 dB 0.11 dB 0.08 dB 0.07 dB 0.07 dB 0.08 dB 0.11 dB 0.08 dB 0.08 dB 0.08 dB 0.08 dB 0.12 dB	Comparison to Agilent EPM Series Power Meter N8487A Power Sensor



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Electrical – RF/Microwave

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	(12 400 to 18 000) MHz		Comparison to Agilent EPM Series Power Meter N8487A Power Sensor
	(20 to 10) dB	0.09 dB	
	(10 to 0) dB	0.09 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.09 dB	
	(-20 to -25) dB	0.12 dB	
	(18 000 to 26 500) MHz		
	(20 to 10) dB	0.11 dB	
	(10 to 0) dB	0.11 dB	
	(0 to -10) dB	0.10 dB	
	(-10 to -20) dB	0.11 dB	
	(-20 to -25) dB	0.14 dB	
	(26 500 to 33 000) MHz		
	(20 to 10) dB	0.12 dB	
	(10 to 0) dB	0.12 dB	
	(0 to -10) dB	0.12 dB	
	(-10 to -20) dB	0.12 dB	
	(-20 to -25) dB	0.15 dB	
	(33 000 to 40 000) MHz		
	(20 to 10) dB	0.13 dB	
	(10 to 0) dB	0.13 dB	
	(0 to -10) dB	0.12 dB	
	(-10 to -20) dB	0.13 dB	
	(-20 to -25) dB	0.15 dB	
(40 000 to 50 000) MHz			
(20 to 10) dB	0.19 dB		
(10 to 0) dB	0.18 dB		
(0 to -10) dB	0.18 dB		
(-10 to -20) dB	0.19 dB		
(-20 to -25) dB	0.20 dB		



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RF Power Measure ¹	(10 to 100) MHz		Comparison to Agilent EPM Series Power Meter N8488A Power Sensor
	(20 to 10) dB	0.09 dB	
	(10 to 0) dB	0.08 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.09 dB	
	(-20 to -25) dB	0.12 dB	
	(-25 to -30) dB	0.29 dB	
	(-30 to -35) dB	0.82 dB	
	(100 to 2 400) MHz		
	(20 to 10) dB	0.10 dB	
	(10 to 0) dB	0.10 dB	
	(0 to -10) dB	0.09 dB	
	(-10 to -20) dB	0.10 dB	
	(-20 to -25) dB	0.13 dB	
	(-25 to -30) dB	0.29 dB	
	(-30 to -35) dB	0.83 dB	
	(2 400 to 12 400) MHz		
	(20 to 10) dB	0.10 dB	
	(10 to 0) dB	0.10 dB	
	(0 to -10) dB	0.09 dB	
	(-10 to -20) dB	0.10 dB	
	(-20 to -25) dB	0.13 dB	
	(-25 to -30) dB	0.29 dB	
	(-30 to -35) dB	0.83 dB	
	(12 400 to 18 000) MHz		
	(20 to 10) dB	0.10 dB	
	(10 to 0) dB	0.10 dB	
	(0 to -10) dB	0.10 dB	
	(-10 to -20) dB	0.10 dB	
	(-20 to -25) dB	0.13 dB	
(-25 to -30) dB	0.29 dB		
(-30 to -35) dB	0.83 dB		
(18 000 to 26 500) MHz			
(20 to 10) dB	0.12 dB		
(10 to 0) dB	0.12 dB		
(0 to -10) dB	0.12 dB		
(-10 to -20) dB	0.12 dB		
(-20 to -25) dB	0.15 dB		
(-25 to -30) dB	0.30 dB		
(-30 to -35) dB	0.83 dB		



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RF Power Measure ¹	(26 500 to 40 000) MHz		Comparison to Agilent EPM Series Power Meter N8488A Power Sensor
	(20 to 10) dB	0.15 dB	
	(10 to 0) dB	0.15 dB	
	(0 to -10) dB	0.15 dB	
	(-10 to -20) dB	0.15 dB	
	(-20 to -25) dB	0.17 dB	
	(-25 to -30) dB	0.31 dB	
	(-30 to -35) dB	0.83 dB	
	(40 000 to 67 000) MHz		
	(20 to 10) dB	0.22 dB	
	(10 to 0) dB	0.22 dB	
	(0 to -10) dB	0.22 dB	
	(-10 to -20) dB	0.22 dB	
	(-20 to -25) dB	0.24 dB	
	(-25 to -30) dB	0.35 dB	
	(-30 to -35) dB	0.85 dB	
	(67 000 to 70 000) MHz		
	(20 to 10) dB	0.25 dB	
(10 to 0) dB	0.25 dB		
(0 to -10) dB	0.25 dB		
(-10 to -20) dB	0.25 dB		
(-20 to -25) dB	0.26 dB		
(-25 to -30) dB	0.37 dB		
(-30 to -35) dB	0.85 dB		
RF Power Measure ¹	100 kHz to 30 MHz		Comparison to Agilent N5531S Measuring Receiver N1912A w/E9304A H18 Power Sensor
	(20 to 0) dB	0.12 dB	
	(0 to -58) dB	0.13 dB	
	(-58 to -78) dB	0.15 dB	
	(-78 to -110) dB	0.19 dB	
	(-110 to -115) dB	0.26 dB	
	(-115 to -120) dB	0.39 dB	
	(-120 to -125) dB	0.59 dB	
RF Power Measure ¹	(30 to 2 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.36 dB	
	(20 to 0) dB	0.2 dB	
	(0 to -58) dB	0.22 dB	
	(-58 to -78) dB	0.23 dB	
	(-78 to -110) dB	0.25 dB	
	(-110 to -115) dB	0.27 dB	
	(-115 to -120) dB	0.33 dB	
(-120 to -125) dB	0.46 dB		



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RF Power Measure ¹	(2 000 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.26 dB	
	(-110 to -115) dB	0.28 dB	
	(-115 to -120) dB	0.34 dB	
	(-120 to -125) dB	0.7 dB	
	(3 050 to 6 600) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.29 dB	
	(-110 to -115) dB	0.38 dB	
	(-115 to -120) dB	0.53 dB	
	(6 600 to 13 200) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.34 dB	
	(-110 to -115) dB	0.46 dB	
	(-115 to -120) dB	0.65 dB	
	(13 200 to 18 000) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
(-78 to -90) dB	0.26 dB		
(-90 to -95) dB	0.26 dB		
(-95 to -100) dB	0.26 dB		
(-100 to -105) dB	0.29 dB		
(-105 to -110) dB	0.38 dB		
(-110 to -115) dB	0.53 dB		
(-115 to -120) dB	0.75 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	(18 000 to 19 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.27 dB	
	(-90 to -95) dB	0.27 dB	
	(-95 to -100) dB	0.27 dB	
	(-100 to -105) dB	0.3 dB	
	(-105 to -110) dB	0.38 dB	
	(-110 to -115) dB	0.53 dB	
	(-115 to -120) dB	0.75 dB	
	(19 200 to 26 500) MHz		
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.28 dB	
	(-90 to -95) dB	0.33 dB	
	(-95 to -100) dB	0.43 dB	
	(-100 to -105) dB	0.61 dB	
	(-105 to -110) dB	0.85 dB	
	(-110 to -115) dB	1.2 dB	
	(-115 to -120) dB	1.5 dB	
	(26 500 to 31 150) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
(0 to -58) dB	0.34 dB		
(-58 to -78) dB	0.34 dB		
(-78 to -90) dB	0.36 dB		
(-90 to -95) dB	0.39 dB		
(-95 to -100) dB	0.46 dB		
(-100 to -105) dB	0.61 dB		
(-105 to -110) dB	0.82 dB		
(-110 to -115) dB	1.1 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	(31 150 to 41 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.35 dB	
	(-78 to -90) dB	0.48 dB	
	(-90 to -95) dB	0.64 dB	
	(-95 to -100) dB	0.87 dB	
	(-100 to -105) dB	1.2 dB	
	(-105 to -110) dB	1.5 dB	
	(41 000 to 45 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.38 dB	
	(-78 to -90) dB	0.68 dB	
	(-90 to -95) dB	0.93 dB	
	(-95 to -100) dB	1.2 dB	
(-100 to -105) dB	1.6 dB		
RF Attenuation – Measure ¹	(45 000 to 50 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.67 dB	
	(-78 to -90) dB	1.4 dB	
	(30 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
(30 to 40) dB	0.035 dB		
(40 to 50) dB	0.04 dB		
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.12 dB		
(80 to 90) dB	0.12 dB		
(90 to 100) dB	0.13 dB		
(100 to 110) dB	0.13 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(3 050 to 6 600) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.19 dB	
	(6 600 to 13 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.25 dB	
	(13 200 to 19 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.12 dB		
(80 to 90) dB	0.12 dB		
(90 to 100) dB	0.13 dB		
(100 to 110) dB	0.31 dB		



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RF Attenuation – Measure ¹	(19 200 to 26 500) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.14 dB	
	(90 to 100) dB	0.36 dB	
	(100 to 110) dB	0.82 dB	
	(26 500 to 31 150) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.13 dB	
	(90 to 100) dB	0.33 dB	
	(100 to 110) dB	0.77 dB	
	(31 150 to 41 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
(20 to 30) dB	0.03 dB		
(30 to 40) dB	0.035 dB		
(40 to 50) dB	0.04 dB		
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.14 dB		
(80 to 90) dB	0.36 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(41 000 to 45 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.11 dB	
	(70 to 80) dB	0.24 dB	
	(80 to 90) dB	0.6 dB	
	(45 000 to 50 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
(50 to 60) dB	0.11 dB		
(60 to 70) dB	0.29 dB		
(70 to 80) dB	0.7 dB		
(80 to 90) dB	1.4 dB		
Amplitude Modulation Measure ¹	100 kHz to 10 MHz		Comparison to Agilent N5531S Measuring Receiver
	Rate 50 Hz to 10 kHz		
	(5 to 99) % Depth	0.75 % of reading + 0.3 digits	
	10 MHz to 3 GHz		
	Rate 50 Hz to 100 kHz		
	(5 to 20) % Depth	2.5 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.5 % of reading + 0.4 digits	
	(3 to 26.5) GHz		
	Rate 50 Hz to 100 kHz		
	(5 to 20) % Depth	4.5 % of reading + 0.4 digits	
	(20 to 99) % Depth	1.5 % of reading + 0.4 digits	
	(26.5 to 31.15) GHz		
Rate 50 Hz to 100 kHz			
(5 to 20) % Depth	6.8 % of reading + 0.4 digits		
(20 to 99) % Depth	1.9 % of reading + 0.4 digits		
(31.15 to 50) GHz			
Rate 50 Hz to 100 kHz			
(5 to 20) % Depth	26 % of reading + 0.4 digits		
(20 to 99) % Depth	6 % of reading + 0.4 digits		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency Modulation Measure ¹ $\beta = \text{deviation} / \text{rate}$	250 kHz to 10 MHz Rates 20 Hz to 10 kHz Peak Dev 200 to 40 kHz 10 MHz to 6.6 GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (6.6 to 13.2) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (13.2 to 31.15) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (31.15 to 50) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz	$\beta > 0.2 - 1.5 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 1.2 - 1 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.2 - 1.5 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.45 - 1 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.2 - 2.5 \% \text{ of reading} + 4 \text{ Hz}$ $\beta > 8 - 1 \% \text{ of reading} + 4 \text{ Hz}$ $\beta > 0.2 - 3.8 \% \text{ of reading} + 9 \text{ Hz}$ $\beta > 16 - 1 \% \text{ of reading} + 9 \text{ Hz}$ $\beta > 0.2 - 8.5 \% \text{ of reading} + 17 \text{ Hz}$ $\beta > 16 - 1 \% \text{ of reading} + 17 \text{ Hz}$	Comparison to Agilent N5531S Measuring Receiver
Phase Modulation – Measure ¹	100 kHz to 6.6 GHz Deviations > 0.3 rad Deviations > 0.7 rad (6.6 to 13.2) GHz Deviations > 0.6 rad Deviations > 2.0 rad (13.2 to 26.5) GHz Deviations: > 1.2 rad Deviations > 4.0 rad (26.5 to 31.15) GHz Deviations: > 1.3 rad Deviations > 4.0 rad (31.15 to 50) GHz Deviations: > 2.4 rad Deviations > 8.0 rad	3 % of reading + 0.002 rad 1 % of reading + 0.002 rad 3 % of reading + 0.005 rad 1 % of reading + 0.005 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad 3 % of reading + 0.018 rad 1 % of reading + 0.018 rad	Comparison to Agilent N5531S Measuring Receiver
RF Power Generate ¹	0.25 to 30 MHz (10 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB (30 to 2 000) MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB	0.23 dB 0.23 dB 0.25 dB 0.27 dB 0.43 dB 0.29 dB 0.3 dB 0.31 dB 0.32 dB	Comparison to Agilent N5531S Measuring Receiver N1912A w/E9304A Power Sensor, E8257D Signal Generator

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RF Power Generate ¹	(2 000 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, E8257D Signal Generator
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.39 dB	
	(3 050 to 6 600) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.39 dB	
	(6 600 to 13 200) MHz		
	(20 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.42 dB	
	(13 200 to 18 000) MHz		
	(15 to 0) dB	0.34 dB	
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.46 dB	
	(18 000 to 19 200) MHz		
	(15 to 0) dB	0.41 dB	
	(0 to -58) dB	0.41 dB	
	(-58 to -78) dB	0.42 dB	
	(-78 to -110) dB	0.5 dB	
	(19 200 to 26 500) MHz		
	(15 to 0) dB	0.41 dB	
	(0 to -58) dB	0.41 dB	
(-58 to -78) dB	0.42 dB		
(-78 to -110) dB	0.9 dB		
(26 500 to 31 150) MHz			
(15 to 0) dB	0.62 dB		
(0 to -58) dB	0.63 dB		
(-58 to -78) dB	0.64 dB		
(-78 to -110) dB	0.96 dB		
(31 150 to 41 000) MHz			
(10 to 0) dB	0.82 dB		
(0 to -58) dB	0.83 dB		
(-58 to -78) dB	0.84 dB		
(-78 to -100) dB	1.1 dB		

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RF Power Generate ¹	(41 000 to 45 000) MHz (10 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -100) dB (45 000 to 50 000) MHz (10 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -90) dB	0.82 dB 0.83 dB 0.85 dB 1.4 dB 0.82 dB 0.83 dB 1 dB 1.5 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, E8257D Signal Generator
RF Power Generate ¹	(50 000 to 65 000) MHz (0 to -20) dB (-20 to -25) dB (-25 to -30) dB (-30 to -35) dB (65 000 to 67 000) MHz (-2 to -20) dB (-20 to -25) dB (-25 to -30) dB (-30 to -35) dB	0.86 dB 0.86 dB 0.89 dB 1.15 dB 0.88 dB 0.88 dB 0.91 dB 1.16 dB	Comparison to Agilent EPM Series Power Meter N8488A Power Sensor, E8257D Op 567 Signal Generator
AM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(0.1 to 10) MHz AM Depth > 1% (0 to -20) dB (-20 to -30) dB AM Depth > 3% (0 to -20) dB (-20 to -30) dB (-30 to -40) dB 10 MHz to 26.5 GHz AM Depth > 1% (0 to -20) dB (-20 to -30) dB AM Depth > 3% (0 to -20) dB (-20 to -30) dB (-30 to -40) dB	1.2 dB 2.2 dB 1 dB 1.3 dB 2.4 dB 1.3 dB 2.5 dB 1.1 dB 1.4 dB 3 dB	Comparison to Agilent N5531S Measuring Receiver



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AM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(26.5 MHz to 50.0 GHz) AM Depth > 3% (0 to -20) dB AM Depth > 5% (0 to -20) dB (-20 to -30) dB	1.8 dB 1.5 dB 3.5 dB	Comparison to Agilent N5531S Measuring Receiver
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(1 to 6 600) MHz Dev 500 Hz to 2 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 2 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (6.6 to 13.2) GHz Dev > 2.3 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 4.5 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (13.2 to 31.15) GHz Dev > 2.7 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 6.0 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB	Comparison to Agilent N5531S Measuring Receiver



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(31.15 to 50.0) GHz Dev > 4 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 12.0 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB	Comparison to Agilent N5531S Measuring Receiver
PM Distortion Measure ¹	(1 to 6 600) MHz Rate (20 to 500) Hz Dev > 0.8 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 2.5 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB Rate (500 to 1 000) Hz Dev > 0.4 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 1.0 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.3 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.3 dB	Comparison to Agilent N5531S Measuring Receiver

Electrical – RF/Microwave

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(6.6 to 13.2) GHz		
	Rate (20 to 500) Hz		
	Dev > 1.8 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 5.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.3 dB	
	Rate (500 to 1 000) Hz		
	Dev > 0.8 rad		
	(0 to -20) dB	0.26 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 2.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
(-40 to -50) dB	2.3 dB		
(13.2 to 31.15) GHz			
Rate (20 to 500) Hz			
Dev > 3.5 rad			
(0 to -20) dB	0.26 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 10.0 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		
Comparison to Agilent N5531S Measuring Receiver			



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Electrical – RF/Microwave

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(13.2 to 31.15) GHz		Comparison to Agilent N5531S Measuring Receiver
	Rate (500 to 1 000) Hz		
	Dev > 3.0 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 8.0 rad		
Total Harmonic Distortion (THD)	(0 to -60) dB		Comparison to HP 8903B Audio Analyzer
	20 Hz to 20 kHz		
	(0 to -40) dB	1 dB	
	(-40 to -50) dB	1 dB	
	(-50 to -60) dB	1.3 dB	
	(-60 to -65) dB	1.7 dB	
	(20 to 50) kHz		
	(0 to -40) dB	2 dB	
	(-40 to -50) dB	2.1 dB	
	(-50 to -60) dB	3 dB	
	(50 to 100) kHz		
	(0 to -40) dB	2 dB	
	(-40 to -50) dB	2.4 dB	
	Harmonics Measure ¹	(-80 to -10) dB	
2 nd through 5 th Harmonic			
1kHz to 600MHz		0.37 dB	
(600 to 1 320) MHz		1.1 dB	
(1 320 to 2 200) MHz		1.4 dB	
(2 200 to 3 000) MHz		1.4 dB	
(3 000 to 4 400) MHz		1.7 dB	
(4 400 to 5 300) MHz		1.9 dB	
(5 300 to 10 000) MHz		2.1 dB	
2 nd through 4 th Harmonic			
(10 000 to 12 500) MHz		2.1 dB	
2 nd through 3 rd Harmonic			
(12 500 to 16 667) MHz	2.1 dB		
2 nd Harmonic			
(16 667 to 25 000) MHz	2.3 dB		



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Electrical – RF/Microwave

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
EFT/Burst Generator – Voltage (+/-) Risetime Impulse Duration Burst Duration Burst Period	10 V to 8 kV 5 ns +/- 30 % 50 ns +/- 30 % 15 ms +/- 20 % 300 ms +/- 20 %	2.6 % of reading 0.003 % of reading 0.003 % of reading 0.003 % of reading 0.003 % of reading	IEC/EN 61000-4-4 Tektronix TDS784C Oscilloscope, EFT Attenuator Set
Surge Generator – Front Time (+/-) Risetime Open/Short Circuit (+/-) Time to Half Value (+/-) Open Circuit Voltage (+/-) Short Circuit Voltage (+/-) Ring Wave Voltage Ring Wave Risetime	(0.1 to 50) μ s (0.1 to 50) μ s (20 to 1 500) μ s 10 V to 8 kV (0.125 to 3) kA 1 kV +/- 10 % 1.5 μ s +/- 0.5 μ s	0.008 % of reading 0.008 % of reading 0.008 % of reading 2.9 % of reading 2.9 % of reading 2.9 % of reading 0.008 % of reading	IEC/EN 61000-4-5 IEC/EN 61000-4-8 IEC/EN 61000-4-9 IEC/EN 61000-4-10 IEC/EN 61000-4-11 IEC/EN 61000-4-12 Tektronix TDS784C Oscilloscope, Tektronix P5210 High Voltage Probe Pearson 411 Current Probe
Source Errors for CISPR Bands A, B, C and D for Impulse Spectral Amplitude Absolute Amplitude Pulse Response & Relative Ratio	Band A (0 to 120) dB (10 to 150) kHz Band B (0 to 120) dB (0.15 to 30) MHz	 0.82 dB 0.82 dB	IGUU 2918 Pulse Generator CISPR 16-1-1 Signal Generator, Agilent 33250A Waveform Generator
Source Errors for CISPR Bands A, B, C and D for Impulse Spectral Amplitude Absolute Amplitude Pulse Response & Relative Ratio	Band C and D (0 to 120) dB (30 to 1 000) MHz (0 to 120) dB Band E (1 to 18) GHz	 1.5 dB 0.77 dB	IGUU 2918 Pulse Generator CISPR 16-1-1 Signal Generator, Agilent 33250A Waveform Generator
Source Errors for Sinewave output for CISPR Checks (at 60 dB μ V) Absolute Amplitude	60 dB μ V Band A through D Band E	 0.58 dB 0.58 dB	CISPR 16-1-1 Agilent E8257D Signal Generator, Agilent 33250A Waveform Generator
QuasiPeak to Peak & Average Detector Response Relative Amplitude Ratio	(-60 to 60) dB Band A through D	 1.3 dB	IGUU 2918 Pulse Generator
Return Loss (VSWR) 30 kHz to 6 GHz 6 GHz to 18 GHz	(0 to 80) dB (0 to 50) dB	 2.4 dB 0.32 dB	Comparison to Agilent 8753ES Network Analyzers, Wiltron 87A50 VSWR Bridge

Electrical – RF/Microwave

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
ESD Simulators			IEC 61000-4-2 ISO 10605 MIL STD 331
Contact Voltage (Positive and Negative)	(0 to 20) kV (20 to 30) kV	1.2 % of reading + 2V 1.2 % of reading + 20V	ESVM
Risetime	(0 to 5) ns	31.5 ps	Agilent 54855A
Peak Current	(0 to 60) A	4.2 % of reading	Oscilloscope, IEC ESD
30 ns Current	(0 to 60) A	4.2 % of reading	Target
60 ns Current	(0 to 60) A	4.2 % of reading	

Length – Dimensional Metrology

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks ²	Up to 13 in	$(3.1 + 1.2L) \mu\text{in}$	Comparison to Master gage blocks, P&W Universal Measuring Machine
Micrometers ^{1,2}	Up to 40 in	$(28 + 4.6L) \mu\text{in}$	Comparison to Gage Blocks
Bore Micrometers ²			Comparison to Master gage blocks, P&W Labmaster Universal, Master Ring
2 point	Up to 12 in	$(56 + 3.3L) \mu\text{in}$	
3 point	Up to 3 in	$(57 + 2.8L) \mu\text{in}$	
Calipers ^{1,2}	Up to 40 in	$(280 + 1.8L) \mu\text{in}$	Comparison to Gage Blocks
Dial Indicators ^{1,2}			Comparison to Gage Blocks
Resolution $\geq 50\mu\text{in}$	Up to 10 in	$(26 + 3.8L) \mu\text{in}$	
Resolution $< 50\mu\text{in}$	Up to 0.1 in	8.1 μin	
Height Gages ^{1,2}	Up to 40 in	$(95 + 3L) \mu\text{in}$	Comparison to Gage Blocks
Rulers ¹	Up to 46 in	0.009 1 in	Comparison to Gage Blocks
Tape Measures ²	Up to 100 ft	$(0.000 26F + 0.025) \text{ in}$	Comparison to Standard rule
Protractors ¹	(0 to 360)°	0.013°	Comparison to Angle Blocks
Rotary Encoders - Angle ¹	(0 to 360)°	24 arc sec	Comparison to Rotary Encoder

Length – Dimensional Metrology

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Feeler Gage	Up to 1 in	31 μ in	Comparison to Pratt & Whitney Supermicrometer C
Cylindrical Gages ²			
Plain Pins, Plugs	(0 to 13) in	(10 + 3.1D) μ in	Comparison to Master gage blocks, P&W Universal Measuring Machine
Plain Rings	(0.04 to 14) in	(11 + 3.2D) μ in	
Solid Thread Rings Pitch Diameter	Up to 12 in	98 μ in	Comparison to Pratt & Whitney, Labmaster Measuring Machine
Thread Plugs Major Diameter Pitch Diameter	Up to 10 in Up to 10 in	44 μ in 79 μ in	Comparison to Thread Wires, Gage Blocks, Pratt & Whitney Supermicrometer C
Thread Rings ^{2,3} Pitch Diameter	Up to 12 in	(350 + 47D) μ in	Comparison to Thread Setting Plugs, Tactile Fit
NPT Thread Plugs Major Diameter Pitch Diameter	Up to 12 in Up to 12 in	85 μ in 120 μ in	Comparison to P&W Model C Bench Micrometer, Van Keuren Thread Wire Set, Alameda Pipe Taper Sine Block
Thread Wires	Up to 0.5 in	11 μ in	Comparison to Master gage blocks, P&W universal measuring machine
Surface Plates ¹			
Overall Flatness	(18 x 18) in to (6 x 6) ft	86 μ in	Comparison to Planekator Repeat-o-meter
Local Area Flatness	(-0.001 to 0.001) in	68 μ in	
Optical Comparators ¹ –			Comparison to Gage blocks, Angle blocks,
Angle	(0 to 360) °	0.016 °	
Linearity	Up to 20 in (20 to 40) in	320 μ in 630 μ in	
Magnification	10x to 100x	430 μ in	SI Industries glass scales
Crimp Tools ¹	(0.011 to 1) in (0.011 to 0.5) in	150 μ in 240 μ in	Comparison to Micrometer, Pin Gages



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Mass and Mass Related

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure ¹	(-150 to 150) inH ₂ O Up to 30 psia (-30 to 0) inHg (-15 to 30) psig Up to 100 psig (-15 to 300) psig Up to 1 000 psig Up to 5 000 psig Up to 10 000 psig Up to 15 000 psig	0.07 inH ₂ O 0.035 psi 0.023 inHg 0.011 psi 0.025 psi 0.077 psi 0.25 psi 1.5 psi 3.1 psi 3.6 psi	Comparison to Pressure Gages ADT681-02-DP150 ADT681-10AP30 ADT681-02-CP30 ADT681-02-CP30 ADT681-02-GP100 ADT681-02-CP300 ADT681-02-GP1K ADT681-02-GP5K ADT681-02-GP10K ADT681-05-GP15K
Pressure ¹	Up to 2 900 psig Up to 10 000 psig	0.37 psi 1.3 psi	Comparison to ADT 762 Automated Hydraulic Pressure Calibrator
Pressure	(5 to 15 000) psi	0.04 % of reading	Comparison to Ametek type T Deadweight Tester
Pipettes ^{1,2}	(10 to 100) μL (100 to 1000) μL (1 to 10) mL	(0.58 + 0.004V) μL (0.6 + 0.001V) μL (2.6 + 0.0012V) μL	Comparison to Mass Balance
Torque Tools ¹	(0.5 to 2.5) ozf-in (2 to 10) ozf-in (6 to 43) ozf-in (30 to 215) ozf-in	0.18 % of reading 0.18 % of reading 0.18 % of reading 0.18 % of reading	Comparison to Waters Torque Analyzer
Torque Tools ¹	(10 to 100) ozf-in 4 lbf-in to 1 000 lbf-ft	0.59 % of reading 0.3 % of reading	Comparison to Torque Testers CDI 1001-O-DDT CDI 5000 ST
Torque Analyzers ¹	Up to 100 ozf-in (4 to 150) lbf-in (12.5 to 1 000) lbf-ft	0.1 % of reading 0.064 % of reading 0.036 % of reading	Comparison to Torque Arms and Class F Weights
Force ¹ Tension and Compression	(0.5 to 500) lbf	0.02 % of reading	Comparison to Class F Weights
Force Tension and Compression	(200 to 25 000) lbf	0.017 % of reading	Comparison to Morehouse Load Cells
Scales and Balances ^{1,2,4}	1 mg to 420 g	(0.021 + 0.003 4X) mg	Comparison to Class 1 Weights
Scales and Balances ^{1,2,4}	500 g to 41 kg	(0.015 + 0.024X) mg	Comparison to Class 4 Weights



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Mass and Mass Related

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Scales and Balances ^{1,2,4}	Up to 100 kg Up to 1 000 lb	(0.001 7 + 0.000 12 <i>X</i>) g (0.002 1 + 0.000 12 <i>W</i>) lb	Comparison to Class F Weights
Mass - Fixed Points Metric	(1, 2, 3, 5, 10) mg (20, 30, 50, 100) mg (200, 300, 500) mg (1, 2, 3, 5) g (10, 20, 30) g 50 g 100 g 200 g	0.013 mg 0.013 mg 0.013 mg 0.049 mg 0.068 mg 0.072 mg 0.23 mg 0.38 mg	Comparison to ASTM E617 Class 1 weights
Mass - Fixed Points Metric	500 g (1, 2, 3) kg (5, 10, 20) kg	58 mg	Comparison to ASTM E617 Class 4 weights
Rockwell Hardness Testers ¹	(< 60) HRBW (≥ 60 to < 80) HRBW ≥ 80 HRBW < 35 HRC (≥ 35 to < 60) HRC ≥ 60 HRC < 70 HRA (≥ 70 and < 80) HRA ≥ 80 HRA	3 HRBW 3 HRBW 1.3 HRBW 1.3 HRC 1.2 HRC 0.7 HRC 1.3 HRA 1.2 HRA 0.7 HRA	Indirect verification per ASTM E18

Thermodynamic

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity Generate	(10 to 95) %RH	0.5 %RH	Comparison to Thunder Scientific 2500 Humidity Chamber
Relative Humidity Measure ¹	(0 to 90) %RH (90 to 100) %RH	1.2 %RH 2 %RH	Comparison to Vaisala MI70/HMP76 Humidity Indicator and Probe
Temperature Measuring Equipment ¹	(-40 to 660) °C	0.18 °C	Comparison to Dry Well Calibrators
Temperature Measure ¹	(-200 to 400) °C (400 to 660) °C	0.043 °C 0.13 °C	Comparison to Secondary PRT

Thermodynamic

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Infrared (IR) Thermometers ¹	(20 to 100) °C (100 to 300) °C (300 to 420) °C (420 to 500) °C	1.5 °C 4.3 °C 6 °C 7.7 °C	Comparison to Fluke 9132 IR Calibrator $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$

Time and Frequency

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Generate ¹	10 MHz	$1 \times 10^{-12} \text{ Hz/Hz}$	Comparison to HP 58503A GPS Receiver
Frequency – Generate ¹	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 10) MHz	$1 \times 10^{-12} \text{ Hz/Hz} + 0.57 \mu\text{Hz}$ $1 \times 10^{-12} \text{ Hz/Hz} + 5.7 \mu\text{Hz}$ $1 \times 10^{-12} \text{ Hz/Hz} + 57 \mu\text{Hz}$ $1 \times 10^{-12} \text{ Hz/Hz} + 0.57 \text{ mHz}$ $1 \times 10^{-12} \text{ Hz/Hz} + 5.7 \text{ mHz}$ $1 \times 10^{-12} \text{ Hz/Hz} + 57 \text{ mHz}$ $1 \times 10^{-12} \text{ Hz/Hz} + 0.57 \text{ Hz}$	Comparison to Agilent 33250A Function Generator / HP 58503A GPS Receiver
Frequency – Generate ¹	(10 to 67 000) MHz	$1 \times 10^{-12} \text{ Hz/Hz} + 0.57 \text{ mHz}$	Comparison to Agilent E8257D Opt 567 Signal Generator / HP 58503A GPS Receiver
Time – Generate	1 pps	$1 \times 10^{-12} \text{ s/s} + 750 \text{ ps}$	Comparison to HP 58503A GPS Receiver
Frequency – Measure ¹	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (100 to 200) kHz (0.2 to 3 000) MHz	$4.2 \times 10^{-9} \text{ Hz/Hz}$ $1.5 \times 10^{-9} \text{ Hz/Hz}$ $0.6 \times 10^{-9} \text{ Hz/Hz}$ $0.33 \times 10^{-9} \text{ Hz/Hz}$ $0.24 \times 10^{-9} \text{ Hz/Hz}$ $0.21 \times 10^{-9} \text{ Hz/Hz}$ $0.21 \times 10^{-9} \text{ Hz/Hz}$	Comparison to Agilent 53131A Opt 030 Frequency Counter / HP 58503A GPS Receiver
Frequency – Measure ¹	(10 to 50 000) MHz	$1 \times 10^{-12} \text{ Hz/Hz} + 0.1 \text{ Hz}$	Comparison to Agilent E4448A Spectrum Analyzer / HP 58503A GPS Receiver
Timer, Stopwatch ¹	10 s to 24 hr	34 ms	Totalize method with counter
Tachometers – RPM ¹	Up to 100 000 RPM	0.001 % of reading + 0.6R	Comparison to HP 33250A Signal Generator & LED

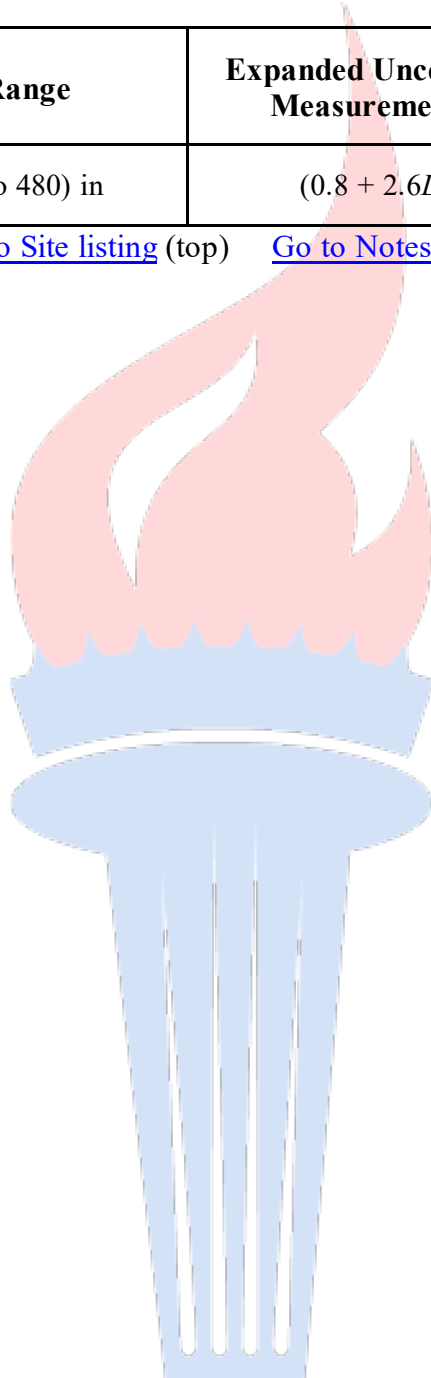
DIMENSIONAL MEASUREMENT

1 Dimensional

Colorado Springs, CO

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Length ^{1,2}	(0 to 480) in	$(0.8 + 2.6L) \mu\text{in}$	Comparison to Laser measurement system

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CALIBRATION

Chemical Quantities

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH meters ^{1,5}	4 pH 7 pH 10 pH	0.025 pH 0.027 pH 0.064 pH	Comparison to pH buffer solutions
Conductivity Meters ^{1,5}	10 µS/cm 500 µS/cm 1 000 µS/cm	0.17 µS/cm 2.2 µS/cm 3.6 µS/cm	Comparison to Conductivity solutions

Electrical – DC/Low Frequency

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Generate ¹	(1 to 1.2) nA (1.2 to 12) nA (12 to 120) nA (0.12 to 1.2) µA (1.2 to 10) µA	92 µA/A + 0.007 nA 92 µA/A + 0.007 nA 92 µA/A + 0.01 nA 36 µA/A + 0.1 nA 13 µA/A + 1 nA	Comparison to Fluke 5730A Multifunction Calibrator, Fluke 5560A Multiproduct Calibrator
DC Current – Generate ¹	(10 to 220) µA 220 µA to 2.2 mA (2.2 to 22) mA (22 to 100) mA (100 to 220) mA (0.22 to 1) A (1 to 2.2) A	38 µA/A + 5 nA 30 µA/A + 7 nA 30 µA/A + 44 nA 38 µA/A + 0.7 µA 45 µA/A + 0.7 µA 68 µA/A + 12 µA 105 µA/A + 12 µA	Comparison to Fluke 5730A Multifunction Calibrator
	(2.2 to 3.1) A (3.1 to 12) A (12 to 30) A	228 µA/A + 115 µA 228 µA/A + 191 µA 761 µA/A + 392 µA	Comparison to Fluke 5560A Multiproduct Calibrator



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Generate ¹ Clamp Meters	(3.1 to 300.2) A	0.65 % of output + 0.014 A	Comparison to Fluke 5560A Multiproduct Calibrator 55xxA x1/2/10 Coil
DC Current – Measure ¹	(1 to 10) nA (10 to 100) nA (0.1 to 1) μ A (1 to 10) μ A	35 μ A/A + 0.1 pA 12 μ A/A + 1 pA 8.3 μ A/A + 0.01 nA 6.9 μ A/A + 0.1 nA	Comparison to Fluke 5730A Multifunction Calibrator Agilent 3458A Option 002 Multimeter
	(0.1 to 20.2) μ A (20.2 to 202) μ A (0.202 to 2.02) mA (2.02 to 20.2) mA (20.2 to 202) mA (0.202 to 2.02) A	30.4 μ A/A + 0.4 nA 11.4 μ A/A + 0.5 nA 11.4 μ A/A + 5 nA 15.2 μ A/A + 0.05 μ A 58 μ A/A + 1.5 μ A 150 μ A/A + 0.2mA	Comparison to Fluke 8588A Multimeter
	(1 to 3) A (3 to 10) A	0.08 % of Reading + 0.46 mA 0.11 % of Reading + 0.61 mA	Comparison to Fluke 8845A Multimeter
	(10 to 250) A	0.25 % of Reading + 0.02A	Comparison to Fluke 8845A Multimeter, Empro Current Shunt
DC Voltage – Generate ¹	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	6.8 μ V/V + 0.8 μ V 4.6 μ V/V + 0.9 μ V 3 μ V/V + 2.5 μ V 3 μ V/V + 3.9 μ V 4.6 μ V/V + 38 μ V 6.1 μ V/V + 385 μ V	Comparison to Fluke 5730A Multifunction Calibrator
DC Voltage – Measure ¹	(0 to 220) mV (0.202 to 2.02) V (2.02 to 20.2) V (20.2 to 202) V (202 to 1 000) V	8.1 μ V/V + 0.7 μ V 5.2 μ V/V + 0.8 μ V 5.2 μ V/V + 0.9 μ V 8.3 μ V/V + 34 μ V 8.4 μ V/V + 1.3 mV	Comparison to Fluke 8558A Multimeter
DC Voltage – Measure ¹	(0 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 1 000) V	3.3 μ V/V + 1 μ V 2.6 μ V/V + 1 μ V 2.6 μ V/V + 1.5 μ V 3.9 μ V/V + 20 μ V 3.9 μ V/V + 66 μ V + 12 μ V/V x (Vin/1000) ^2	Comparison to Agilent 3458A Multimeter
DC Voltage – Measure ¹	(1 to 30) kV	0.1 % of reading	Comparison to Ross VD30 High Voltage Divider, HP 34401A Multimeter



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(0.22 to 2.2) mV		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	228 $\mu\text{V/V} + 3.9 \mu\text{V}$	
	(20 to 40) Hz	88 $\mu\text{V/V} + 3.9 \mu\text{V}$	
	40 Hz to 20 kHz	76 $\mu\text{V/V} + 3.9 \mu\text{V}$	
	(20 to 50) kHz	190 $\mu\text{V/V} + 3.9 \mu\text{V}$	
	(50 to 100) kHz	457 $\mu\text{V/V} + 4.6 \mu\text{V}$	
	(100 to 300) kHz	989 $\mu\text{V/V} + 9.2 \mu\text{V}$	
	(300 to 500) kHz	1.3 mV/V + 19 μV	
	500 kHz to 1 MHz	2.6 mV/V + 19 μV	
	(2.2 to 22) mV		
	(10 to 20) Hz	228 $\mu\text{V/V} + 3.9 \mu\text{V}$	
	(20 to 40) Hz	88 $\mu\text{V/V} + 3.9 \mu\text{V}$	
	40 Hz to 20 kHz	76 $\mu\text{V/V} + 3.9 \mu\text{V}$	
	(20 to 50) kHz	190 $\mu\text{V/V} + 3.9 \mu\text{V}$	
	(50 to 100) kHz	457 $\mu\text{V/V} + 4.6 \mu\text{V}$	
	(100 to 300) kHz	989 $\mu\text{V/V} + 9.2 \mu\text{V}$	
	(300 to 500) kHz	1.3 mV/V + 19 μV	
	500 kHz to 1 MHz	2.6 mV/V + 19 μV	
	(22 to 220) mV		
	(10 to 20) Hz	228 $\mu\text{V/V} + 11.4 \mu\text{V}$	
	(20 to 40) Hz	88 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	40 Hz to 20 kHz	53 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	(20 to 50) kHz	114 $\mu\text{V/V} + 6.1 \mu\text{V}$	
	(50 to 100) kHz	304 $\mu\text{V/V} + 15.2 \mu\text{V}$	
	(100 to 300) kHz	609 $\mu\text{V/V} + 19 \mu\text{V}$	
	(300 to 500) kHz	1.3 mV /V + 23 μV	
	500 kHz to 1 MHz	2.5 mV /V + 46 μV	
220 mV to 2.2 V			
(10 to 20) Hz	228 $\mu\text{V/V} + 38 \mu\text{V}$		
(20 to 40) Hz	84 $\mu\text{V/V} + 15 \mu\text{V}$		
40 Hz to 20 kHz	37 $\mu\text{V/V} + 8 \mu\text{V}$		
(20 to 50) kHz	61 $\mu\text{V/V} + 9 \mu\text{V}$		
(50 to 100) kHz	76 $\mu\text{V/V} + 30 \mu\text{V}$		
(100 to 300) kHz	304 $\mu\text{V/V} + 76 \mu\text{V}$		
(300 to 500) kHz	913 $\mu\text{V} /V + 190 \mu\text{V}$		
500 kHz to 1 MHz	1.5 mV/V + 304 μV		



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Electrical – DC/Low Frequency

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹	(2.2 to 22) V		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	228 μ V/V + 380 μ V	
	(20 to 40) Hz	84 μ V/V + 152 μ V	
	40 Hz to 20 kHz	37 μ V/V + 54 μ V	
	(20 to 50) kHz	61 μ V/V + 91 μ V	
	(50 to 100) kHz	76 μ V/V + 190 μ V	
	(100 to 300) kHz	228 μ V/V + 609 μ V	
	(300 to 500) kHz	913 μ V/V + 1.9 mV	
	500 kHz to 1 MHz	1.4 mV/V + 3 mV	
	(22 to 220) V		
	(10 to 20) Hz	228 μ V/V + 3.8 mV	
	(20 to 40) Hz	84 μ V/V + 1.5 mV	
	40 Hz to 20 kHz	49 μ V/V + 0.6 mV	
	(20 to 50) kHz	76 μ V/V + 0.9 mV	
(50 to 100) kHz	137 μ V/V + 2.3 mV		
AC Voltage – Generate ¹	(220 to 750) V		Comparison to Fluke 5730A Multifunction Calibrator, 5725A Amplifier
	40 Hz to 1 kHz	68 μ V/V + 3 mV	
	(1 to 20) kHz	126 μ V/V + 5 mV	
	(20 to 50) kHz	457 μ V/V + 8 mV	
	(50 to 100) kHz	1.8 mV/V + 34 mV	
	(750 to 1 000) V		
	40 Hz to 1 kHz	68 μ V/V + 3 mV	
	(1 to 20) kHz	126 μ V/V + 5 mV	
(20 to 30) kHz	457 μ V/V + 8 mV		
AC Voltage – Generate ¹ Wideband Absolute	(0.3 to 1.1) mV		Comparison to Fluke 5730A Option 003 Multifunction Calibrator
	(10 to 30 Hz)	0.65 % of output + 1.5 μ V	
	30 Hz to 500 kHz	0.61 % of output + 1.5 μ V	
	(0.5 to 1.2) MHz	0.63 % of output + 3.8 μ V	
	(1.2 to 2) MHz	0.63 % of output + 3.8 μ V	
	(2 to 12) MHz	0.68 % of output + 3.8 μ V	
	(12 to 20) MHz	0.76 % of output + 3.8 μ V	
	(20 to 30) MHz	1.3 % of output + 12.9 μ V	
	(1.1 to 3.3) mV		
	(10 to 30 Hz)	0.58 % of output + 2.3 μ V	
	30 Hz to 500 kHz	0.53 % of output + 2.3 μ V	
	(0.5 to 1.2) MHz	0.54 % of output + 4.6 μ V	
	(1.2 to 2) MHz	0.54 % of output + 4.6 μ V	
	(2 to 12) MHz	0.58 % of output + 4.6 μ V	
	(12 to 20) MHz	0.65 % of output + 4.6 μ V	
	(20 to 30) MHz	1.3 % of output + 4.6 μ V	



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Electrical – DC/Low Frequency

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(3.3 to 11) mV		Comparison to Fluke 5730A Option 003 Multifunction Calibrator
	(10 to 30 Hz)	0.58 % of output + 6.1 μV	
	30 Hz to 500 kHz	0.53 % of output + 6.1 μV	
	(0.5 to 1.2) MHz	0.54 % of output + 8.4 μV	
	(1.2 to 2) MHz	0.54 % of output + 8.4 μV	
	(2 to 12) MHz	0.55 % of output + 8.4 μV	
	(12 to 20) MHz	0.61 % of output + 8.4 μV	
	(20 to 30) MHz	0.93 % of output + 8.4 μV	
	(11 to 33) mV		
	(10 to 30 Hz)	0.52 % of output + 12 μV	
	30 Hz to 500 kHz	0.46 % of output + 12 μV	
	(0.5 to 1.2) MHz	0.47 % of output + 14 μV	
	(1.2 to 2) MHz	0.47 % of output + 14 μV	
	(2 to 12) MHz	0.49 % of output + 14 μV	
	(12 to 20) MHz	0.55 % of output + 14 μV	
	(20 to 30) MHz	0.89 % of output + 14 μV	
	(33 to 110) mV		
	(10 to 30 Hz)	0.52 % of output + 30 μV	
	30 Hz to 500 kHz	0.46 % of output + 30 μV	
	(0.5 to 1.2) MHz	0.47 % of output + 33 μV	
	(1.2 to 2) MHz	0.47 % of output + 33 μV	
	(2 to 12) MHz	0.49 % of output + 33 μV	
	(12 to 20) MHz	0.55 % of output + 33 μV	
	(20 to 30) MHz	0.89 % of output + 33 μV	
	(110 to 330) mV		
	(10 to 30 Hz)	0.45 % of output + 0.1 mV	
	30 Hz to 500 kHz	0.38 % of output + 0.1 mV	
	(0.5 to 1.2) MHz	0.4 % of output + 0.1 mV	
(1.2 to 2) MHz	0.4 % of output + 0.1 mV		
(2 to 12) MHz	0.42 % of output + 0.1 mV		
(12 to 20) MHz	0.49 % of output + 0.1 mV		
(20 to 30) MHz	0.85 % of output + 0.1 mV		
(0.33 to 1.1) V			
(10 to 30 Hz)	0.45 % of output + 0.3 mV		
30 Hz to 500 kHz	0.38 % of output + 0.3 mV		
(0.5 to 1.2) MHz	0.4 % of output + 0.3 mV		
(1.2 to 2) MHz	0.4 % of output + 0.3 mV		
(2 to 12) MHz	0.42 % of output + 0.3 mV		
(12 to 20) MHz	0.49 % of output + 0.3 mV		
(20 to 30) MHz	0.85 % of output + 0.3 mV		



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Electrical – DC/Low Frequency

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Generate ¹ Wideband Absolute	(1.1 to 3.5) V (10 to 30 Hz) 30 Hz to 500 kHz (0.5 to 1.2) MHz (1.2 to 2) MHz (2 to 12) MHz (12 to 20) MHz (20 to 30) MHz	0.39 % of output + 0.4 mV 0.3 % of output + 0.4 mV 0.32 % of output + 0.4 mV 0.32 % of output + 0.4 mV 0.35 % of output + 0.4 mV 0.44 % of output + 0.4 mV 0.82 % of output + 0.4 mV	Comparison to Fluke 5730A Option 003 Multifunction Calibrator
AC Voltage – Measure ¹	(1.2 to 12.12) mV 1 to 2000 Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (12.12 to 121.2) mV 1 to 2000 Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz (0.1212 to 1.212)V (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz	0.06 % of reading + 2.0 μV 0.045 % of reading + 2.0 μV 0.046 % of reading + 2.0 μV 0.42 % of reading + 2.0 μV 1.58 % of reading + 5.9 μV 2.47 % of reading + 5.9 μV 0.011 % of reading + 1 μV 0.015 % of reading + 1 μV 0.025 % of reading + 2 μV 0.057 % of reading + 20 μV 0.34 % of reading + 50 μV 1.38 % of reading + 0.2mV 1.6 % of reading + 0.7mV 4.6 % of reading + 1.2 mV 9.2 % of reading + 1.2 mV 18 % of reading + 1.2 mV 0.01 % of reading + 0.01mV 0.014 % of reading + 0.01 mV 0.025 % of reading + 0.02 mV 0.057 % of reading + 0.20 mV 0.26 % of reading + 0.5 mV 1.4 % of reading + 2mV 1.6 % of reading + 7mV 4.6 % of reading + 12 mV 9.1 % of reading + 12 mV 18 % of reading + 12 mV	Comparison to Fluke 8588A Multimeter



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Electrical – DC/Low Frequency

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(1.212 to 12.12)V 1 to 2000 Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 300) kHz (0.3 to 1) MHz (1 to 2) MHz (2 to 4) MHz (4 to 8) MHz (8 to 10) MHz (12.12 to 121.2)V (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz (30 to 100) kHz (100 to 200) kHz (121.2 to 1 050)V (1 to 1000 Hz (2 to 10) kHz (10 to 30) kHz	0.01 % of reading + 0.1mV 0.014 % of reading + 0.1 mV 0.025 % of reading + 0.2 mV 0.057 % of reading + 2 mV 0.26 % of reading + 5 mV 1.4 % of reading + 20mV 1.6 % of reading + 70mV 4.6 % of reading + 120 mV 9.1 % of reading + 120 mV 18 % of reading + 120 mV 0.011 % of reading + 1mV 0.015 % of reading + 1 mV 0.025 % of reading + 2 mV 0.063 % of reading + 20 mV 0.43 % of reading + 100 mV 0.016 % of reading + 30mV 0.018 % of reading + 30 mV 0.032 % of reading + 30 mV	Comparison to Fluke 8588A Multimeter
AC Voltage – Measure ¹	(1 to 10) mV (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz 100 kHz to 1 MHz (1 to 4) MHz (4 to 8) MHz	0.02 % of reading + 2 μV 0.013 % of reading + 0.7 μV 0.02 % of reading + 0.7 μV 0.065 % of reading + 0.7 μV 0.33 % of reading + 0.7 μV 0.78 % of reading + 3.3 μV 4.6 % of reading + 4.6 μV 13 % of reading + 5.3 μV	Comparison to Agilent 3458A Multimeter



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Electrical – DC/Low Frequency

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(10 to 100) mV		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.005 % of reading + 2.6 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 1.3 μ V	
	(1 to 20) kHz	0.009 % of reading + 1.3 μ V	
	(20 to 50) kHz	0.02 % of reading + 1.3 μ V	
	(50 to 100) kHz	0.052 % of reading + 1.3 μ V	
	(100 to 300) kHz	0.20 % of reading + 6.5 μ V	
	300 kHz to 1 MHz	0.70 % of reading + 6.5 μ V	
	(1 to 2) MHz	0.98 % of reading + 46 μ V	
	(2 to 4) MHz	2.6 % of reading + 46 μ V	
	(4 to 8) MHz	2.6 % of reading + 52 μ V	
	(8 to 10) MHz	9.8 % of reading + 65 μ V	
	(0.10 to 1) V		
	(1 to 40) Hz	0.005 % of reading + 26 μ V	
	40 Hz to 1 kHz	0.005 % of reading + 13 μ V	
	(1 to 20) kHz	0.009 % of reading + 13 μ V	
	(20 to 50) kHz	0.02 % of reading + 13 μ V	
	(50 to 100) kHz	0.052 % of reading + 13 μ V	
	(100 to 300) kHz	0.2 % of reading + 65 μ V	
	300 kHz to 1 MHz	0.65 % of reading + 65 μ V	
	(1 to 2) MHz	0.98 % of reading + 0.5 mV	
	(2 to 4) MHz	2.6 % of reading + 0.5 mV	
	(4 to 8) MHz	2.6 % of reading + 0.5 mV	
	(8 to 10) MHz	9.8 % of reading + 0.7 mV	
	(1 to 10) V		
	(1 to 40) Hz	0.005 % of reading + 0.3 mV	
	40 Hz to 1 kHz	0.005 % of reading + 0.1 mV	
(1 to 20) kHz	0.009 % of reading + 0.1 mV		
(20 to 50) kHz	0.02 % of reading + 0.1 mV		
(50 to 100) kHz	0.052 % of reading + 0.1 mV		
(100 to 300) kHz	0.2 % of reading + 0.7 mV		
300 kHz to 1 MHz	0.65 % of reading + 0.7 mV		
(1 to 2) MHz	0.98 % of reading + 4.6 mV		
(2 to 4) MHz	2.6 % of reading + 4.6 mV		
(4 to 8) MHz	2.6 % of reading + 5.2 mV		
(8 to 10) MHz	9.8 % of reading + 6.5 mV		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(10 to 100) V		Comparison to Agilent 3458A Multimeter
	(1 to 40) Hz	0.013 % of reading + 2.6 mV	
	40 Hz to 1 kHz	0.013 % of reading + 1.3 mV	
	(1 to 20) kHz	0.013 % of reading + 1.3 mV	
	(20 to 50) kHz	0.023 % of reading + 1.3 mV	
	(50 to 100) kHz	0.08 % of reading + 1.3 mV	
	(100 to 300) kHz	0.26 % of reading + 6.5 mV	
	300 kHz to 1 MHz	0.98 % of reading + 6.5 mV	
	(100 to 700) V		
	(1 to 40) Hz	0.026 % of reading + 26 mV	
	40 Hz to 1 kHz	0.026 % of reading + 13 mV	
	(1 to 20) kHz	0.039 % of reading + 13 mV	
	(20 to 50) kHz	0.078 % of reading + 13 mV	
	(50 to 100) kHz	0.2 % of reading + 13 mV	
AC Voltage – Measure ¹	(1 to 5) kV	0.5 % of reading	Comparison to Ross VD30 Voltage Divider, HP 34401A Multimeter
	60 Hz		
	(5 to 21) kV	0.5 % of reading	
	60 Hz		
AC Current – Generate ¹	(9 to 220) μ A		Comparison to Fluke 5730A Multifunction Calibrator
	(10 to 20) Hz	228 μ A/A + 15 nA	
	(20 to 40) Hz	152 μ A/A + 10 nA	
	40 Hz to 1 kHz	91 μ A/A + 8 nA	
	(1 to 5) kHz	266 μ A/A + 12 nA	
	(5 to 10) kHz	989 μ A/A + 61 nA	
	(0.22 to 2.2) mA		
	(10 to 20) Hz	228 μ A/A + 39 nA	
	(20 to 40) Hz	152 μ A/A + 31 nA	
	40 Hz to 1 kHz	91 μ A/A + 31 nA	
	(1 to 5) kHz	183 μ A/A + 99 nA	
	(5 to 10) kHz	989 μ A/A + 609 nA	
	(2.2 to 22) mA		
	(10 to 20) Hz	228 μ A/A + 385 nA	
	(20 to 40) Hz	152 μ A/A + 310 nA	
	40 Hz to 1 kHz	91 μ A/A + 310 nA	
	(1 to 5) kHz	183 μ A/A + 536 nA	
	(5 to 10) kHz	989 μ A/A + 4566 nA	

Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Generate ¹	(22 to 220) mA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	228 μ A/A + 4 μ A 152 μ A/A + 3 μ A 91 μ A/A + 2 μ A 183 μ A/A + 3 μ A 989 μ A/A + 9 μ A	Comparison to Fluke 5730A Multifunction Calibrator
AC Current – Generate ¹	(0.22 to 1.2) A (3 to 45) Hz (45 to 1000) Hz (1 to 5) kHz (5 to 10) kHz (10 to 30) kHz (1.2 to 3.1) A (3 to 45) Hz (45 to 1000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (3 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (3 to 45) Hz (45 to 1 000) Hz (1 to 5) kHz	0.019 % of output + 0.08 mA 0.019 % of output + 0.04 mA 0.019 % of output + 0.06 mA 0.19 % of output + 0.23 mA 0.38 % of output + 0.23 mA 0.029 % of output + 0.4 mA 0.023 % of output + 0.27 mA 0.029 % of output + 0.27 mA 0.19 % of output + 0.40 mA 0.029 % of output + 0.8 mA 0.023 % of output + 0.4 mA 0.029 % of output + 0.6 mA 0.19 % of output + 0.8 mA 0.076 % of output + 7.7 mA 0.053 % of output + 6.2 mA 0.38 % of output + 6.2 mA	Comparison to Fluke 5560A Multiproduct Calibrator
AC Current – Generate ¹ Clamp Meters	(3.1 to 300.2) A (3 to 440) Hz	0.65 % of output + 0.077 A	Fluke 5560A Multiproduct Comparison to Calibrator 55xxA x1/2/10 Coil
AC Current – Measure ¹	(2.02 to 20.2) μ A (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz (2.02 to 20.2) μ A (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz (0.202 to 2.02) mA (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz	0.38 % of reading + 2.9 nA 0.38 % of reading + 2.9 nA 0.38 % of reading + 2.9 nA 0.044 % of reading + 9.8 nA 0.087 % of reading + 9.8 nA 0.11 % of reading + 9.8 nA 0.044 % of reading + 98 nA 0.087 % of reading + 98 nA 0.11 % of reading + 98 nA	Comparison to Fluke 8588A Multimeter

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(2.02 to 20.2) mA (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz (20.2 to 202) mA (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz (0.202 to 2.02)A (1 to 2 000) Hz (2 to 10) kHz (10 to 30) kHz	0.044 % of reading + 0.98 μA 0.087 % of reading + 0.98 μA 0.11 % of reading + 0.98 μA 0.044 % of reading + 9.8 μA 0.087 % of reading + 9.8 μA 0.11 % of reading + 9.8 μA 0.044 % of reading + 148 μA 0.076 % of reading + 148 μA 0.12 % of reading + 148 μA	Comparison to Fluke 8588A Multimeter
AC Current – Measure ¹	(5 to 100) μA (10 to 20) Hz (20 to 45) Hz 45 Hz to 1 kHz 100 μA to 1 mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz (10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz 100 mA to 1 A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.26 % of reading + 0.02 μA 0.1 % of reading + 0.02 μA 0.04 % of reading + 0.02 μA 0.26 % of reading + 0.13 μA 0.1 % of reading + 0.13 μA 0.04 % of reading + 0.13 μA 0.02 % of reading + 0.13 μA 0.26 % of reading + 1.3 μA 0.1 % of reading + 1.3 μA 0.04 % of reading + 1.3 μA 0.02 % of reading + 1.3 μA 0.26 % of reading + 13 μA 0.1 % of reading + 13 μA 0.04 % of reading + 13 μA 0.02 % of reading + 13 μA 0.26 % of reading + 0.13 mA 0.1 % of reading + 0.13 mA 0.05 % of reading + 0.13 mA 0.07 % of reading + 0.13 mA	Comparison to Agilent 3458A Multimeter

Electrical – DC/Low Frequency

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure ¹	(1 to 3) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz (5 to 10) kHz (3 to 10) A (3 to 5) Hz (5 to 10) Hz 10 Hz to 5 kHz (5 to 10) kHz	0.84 % of reading + 1.4 mA 0.27 % of reading + 1.4 mA 0.11 % of reading + 1.4 mA 0.27 % of reading + 16 mA 0.84 % of reading + 4.6 mA 0.27 % of reading + 4.6 mA 0.11 % of reading + 4.6 mA 0.27 % of reading + 53 mA	Comparison to Fluke 8845A Multimeter
Resistance – Generate ¹ Fixed Points	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9) kΩ (10, 19) kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	84 μΩ/Ω + 0.1 μΩ 21 μΩ/Ω + 1 μΩ 9.1 μΩ/Ω + 6 μΩ 6.1 μΩ/Ω + 60 μΩ 6.1 μΩ/Ω + 0.6 mΩ 7.6 μΩ/Ω + 6 mΩ 9.1 μΩ/Ω + 6 mΩ 11.4 μΩ/Ω + 60 mΩ 16 μΩ/Ω + 60 mΩ 35 μΩ/Ω + 0.6 Ω 42 mΩ/Ω + 0.6 Ω 91 mΩ/Ω + 6 Ω	Comparison to Fluke 5730A Multifunction Calibrator
Resistance – Generate ¹	Up to 12 Ω (12 to 120) Ω (0.12 to 1.20) kΩ (1.2 to 12.0) kΩ (12 to 120) kΩ (0.12 to 1.2) MΩ (1.2 to 12) MΩ (12 to 120) MΩ (120 to 1 200) MΩ	19 μΩ/Ω + 0.001 Ω 19 μΩ/Ω + 0.001 Ω 19 μΩ/Ω + 0.002 Ω 19 μΩ/Ω + 0.02 Ω 19 μΩ/Ω + 0.2 Ω 19 μΩ/Ω + 2.0Ω 27 μΩ/Ω + 24 Ω 327 μΩ/Ω + 2 kΩ 3 mΩ/Ω + 76 Ω	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Resistance – Measure ¹	Up to 2.02 Ω 2.02 to 20.2 Ω (20.2 to 202) Ω (0.202 to 2.02) kΩ (2.02 to 20.2) kΩ (20.2 to 202) kΩ (0.202 to 2.02) MΩ (2.02 to 20.2) MΩ (20.2 to 202) MΩ (0.202 to 2.02) GΩ (2.02 to 20.2) GΩ	21 μΩ/Ω + 4.4 μΩ 15 μΩ/Ω + 20 μΩ 12 μΩ/Ω + 53 μΩ 12 μΩ/Ω + 0.53 mΩ 12 μΩ/Ω + 5.3 mΩ 12 μΩ/Ω + 53 mΩ 12.9 μΩ/Ω + 1.0 Ω 17 μΩ/Ω + 9.8 Ω 67 μΩ/Ω + 0.98 kΩ 228 μΩ/Ω + 98 kΩ 1.3 mΩ/Ω + 9.8 MΩ	Comparison to Fluke 8588A Multimeter
Resistance – Measure ¹	Up to 12 Ω (10 to 120) Ω (0.1 to 1.2) kΩ (1 to 12) kΩ (10 to 120) kΩ (0.1 to 1.2) MΩ (1 to 12) MΩ (10 to 120) MΩ (0.1 to 1.2) GΩ	9.8 μΩ/Ω + 38 μΩ 7.8 μΩ/Ω + 0.3 mΩ 6.5 μΩ/Ω + 0.4 mΩ 6.5 μΩ/Ω + 3.8 mΩ 6.5 μΩ/Ω + 38 mΩ 9.8 μΩ/Ω + 1.5 Ω 33 μΩ/Ω + 100 Ω 327 μΩ/Ω + 1 kΩ 0.33 % of reading + 70 kΩ	Comparison to Agilent 3458A Multimeter
Capacitance – Generate ¹	(0.2 to 1.2) nF (1.2 to 12.0) nF (12 to 120.0) nF (0.12 to 1.2) μF (1.2 to 12.0) μF (12 to 120.0) μF (0.12 to 1.2) mF (1.2 to 12.0) mF (12 to 120.0) mF	0.09% of output + 1.5 pF 0.09 % of output + 0.004 nF 0.1 % of output + 0.023 nF 0.1 % of output + 0.23 nF 0.1 % of output + 2.3 nF 0.11 % of output + 19 nF 0.19 % of output + 190 nF 0.19 % of output + 2.3 μF 0.38 % of output + 23 μF	Comparison to Fluke 5560A Multiproduct Calibrator
Inductance – Generate ¹	(13 to 120.0) μH (0.12 to 1.2) mH (1.2 to 12.0) mH (12 to 120.0) mH (0.12 to 1.2) H (1.2 to 12.0) H (12 to 120.0) H	0.15% of output + 0.15 μH 0.09 % of output + 0.76 μH 0.09 % of output + 7.6 μH 0.09 % of output + 76 μH 0.11 % of output + 0.76 mH 0.15 % of output + 7.6 mH 0.19 % of output + 76 mH	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes Calibration ¹ – Generate Voltage DC - 50Ω DC - 1MΩ Square Wave 10Hz to 10kHz – 1MΩ	1 mV to 5 V 1 mV to 200 V 1 mV to 200 Vpp	0.025 % of output + 25 μV 0.025 % of output + 2.5 μV 0.1 % of output + 10 μV	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration ¹ – Generate Leveled Sine Flatness 50 kHz to 10 MHz Reference	(5mV to 5Vpp) 0.1 Hz to 300 MHz (300 to 550) MHz 5 mV to 3 Vpp (550 to 1 100) MHz	0.18 dB 0.22 dB 0.3 dB	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration ¹ – Generate Time Marker	9 ns to 55 s	0.25 μs/s	Comparison to Fluke 9500B with 9510 Active Head
Oscilloscopes Calibration ¹ – Measure Input Impedance Resistance	(10 to 40) Ω (40 to 90) Ω (90 to 150) Ω (50 to 800) KΩ (0.8 to 1.2) MΩ (1.2 to 12) MΩ	0.5 % of reading 0.1 % of reading 0.5 % of reading 0.5 % of reading 0.1 % of reading 0.5 % of reading	Comparison to Fluke 9500B with 9510 Active Head
Electrical Calibration of Thermocouple Indicators/Sources ¹	Type B (600 to 800) °C (800 to 1000) °C (1 000 to 1 550) °C (1 550 to 1 820) °C Type C (0 to 150) °C (150 to 650) °C (650 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 315) °C Type D (0 to 150) °C (150 to 650) °C (650 to 1 000) °C (1 000 to 1 800) °C (1 800 to 2 315) °C	0.33 °C 0.26 °C 0.23 °C 0.25 °C 0.19 °C 0.16 °C 0.20 °C 0.34 °C 0.60 °C 0.19 °C 0.16 °C 0.2 °C 0.33 °C 0.59 °C	Comparison to Fluke 5560A Multiproduct Calibrator

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
Electrical Calibration of Thermocouple Indicators/Sources ¹	Type E		Comparison to Fluke 5560A Multiproduct Calibrator	
		(-250 to -150) °C		0.3 °C
		(-150 to -25) °C		0.11 °C
		(-25 to 350) °C		0.08 °C
		(350 to 650) °C		0.12 °C
		(650 to 1 000) °C		0.16 °C
	Type G			
		(0 to 150) °C		0.38 °C
		(150 to 650) °C		0.25 °C
		(650 to 1 000) °C		0.2 °C
		(1 000 to 1 800) °C		0.33 °C
		(1 800 to 2 315) °C		0.59 °C
	Type J			
		(-210 to -100) °C		0.18 °C
		(-100 to -30) °C		0.1 °C
		(-30 to 150) °C		0.08 °C
		(150 to 760) °C		0.11 °C
		(760 to 1 200) °C		0.15 °C
Type K				
	(-200 to -100) °C	0.21 °C		
	(-100 to -25) °C	0.1 °C		
	(-25 to 120) °C	0.08 °C		
	(120 to 1 000) °C	0.16 °C		
	(1 000 to 1 372) °C	0.27 °C		
Type L				
	(-200 to -100) °C	0.24 °C		
	(-100 to 800) °C	0.15 °C		
	(800 to 900) °C	0.08 °C		
Electrical Calibration of Thermocouple Indicators ¹	Type N		Comparison to Fluke 7526A Process Calibrator	
		(-200 to -100) °C		0.25 °C
		(-100 to -25) °C		0.11 °C
		(-25 to 120) °C		0.09 °C
		(120 to 410) °C		0.08 °C
		(410 to 1 300) °C		0.15 °C
	Type R			
		(0 to 250) °C		0.39 °C
		(250 to 400) °C		0.22 °C
		(400 to 1 000) °C		0.21 °C
	(1 000 to 1 767) °C	0.26 °C		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of Thermocouple Indicators ¹	Type S (0 to 250) °C (250 to 1 000) °C (1 000 to 1 400) °C (1 400 to 1 767) °C Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600) °C Type BP (0 to 1 000) °C (1 000 to 2 000) °C (2 000 to 2 500) °C Type XK (-200 to 300) °C (300 to 800) °C	0.32 °C 0.24 °C 0.24 °C 0.31 °C 0.46 °C 0.16 °C 0.1 °C 0.08 °C 0.3 °C 0.08 °C 0.3 °C 0.46 °C 0.61 °C 0.15 °C 0.23 °C	Comparison to Fluke 7526A Process Calibrator
Electrical Calibration of RTD Indicators ¹	Cu 10 (427) (-80 to 260) °C Cu 50 (428) (-180 to 200) °C Cu 100 (428) (-180 to -40) °C (-40 to 200) °C Ni 120 (672) (-80 to 0) °C (0 to 100) °C (100 to 260) °C Pt 100 (385) (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C	0.23 °C 0.30 °C 0.3 °C 0.49 °C 0.06 °C 0.06 °C 0.11 °C 0.04 °C 0.04 °C 0.05 °C 0.07 °C 0.08 °C 0.09 °C 0.18 °C	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicators ¹	Pt 100 (3916)		Comparison to Fluke 5560A Multiproduct Calibrator
	(-200 to -190)°C	0.19 °C	
	(-190 to -80)°C	0.03 °C	
	(-80 to 0)°C	0.04 °C	
	(0 to 100)°C	0.05 °C	
	(100 to 260)°C	0.05 °C	
	(260 to 300)°C	0.06 °C	
	(300 to 400)°C	0.07 °C	
	(400 to 600)°C	0.08 °C	
	(600 to 630)°C	0.18 °C	
	Pt 100 (3926)		
	(-200 to -80)°C	0.04 °C	
	(-80 to 0)°C	0.04 °C	
	(0 to 100)°C	0.05 °C	
	(100 to 300)°C	0.07 °C	
	(300 to 400)°C	0.08 °C	
	(400 to 630)°C	0.09 °C	
	Pt 200 (385)		
	(-200 to -80)°C	0.03 °C	
	(-80 to 0)°C	0.03 °C	
	(0 to 100)°C	0.03 °C	
	(100 to 260)°C	0.04 °C	
	(260 to 300)°C	0.09 °C	
	(300 to 400)°C	0.10 °C	
	(400 to 600)°C	0.11 °C	
	(600 to 630)°C	0.12 °C	
	Pt 500 (385)		
	(-200 to -80)°C	0.03 °C	
(-80 to 0)°C	0.04 °C		
(0 to 100)°C	0.04 °C		
(100 to 260)°C	0.05 °C		
(260 to 300)°C	0.06 °C		
(300 to 400)°C	0.06 °C		
(400 to 600)°C	0.07 °C		
(600 to 630)°C	0.08 °C		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Calibration of RTD Indicators ¹	Pt 1000 (385)		Comparison to Fluke 5560A Multiproduct Calibrator
	(-200 to -80)°C	0.02 °C	
	(-80 to 0)°C	0.02 °C	
	(0 to 100)°C	0.03 °C	
	(100 to 260)°C	0.04 °C	
	(260 to 300)°C	0.05 °C	
	(300 to 400)°C	0.05 °C	
AC Power – Generate ¹ (12 to 120) mV Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 0.9 μW	
	(40 to 1000) Hz	0.022 % of Output + 0.9 μW	
	(1 to 5) kHz	0.022 % of Output + 0.9 μW	
	(5 to 10) kHz	0.115 % of Output + 0.9 μW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 9.2 μW	
	(40 to 1000) Hz	0.016 % of Output + 4.7 μW	
	(1 to 5) kHz	0.022 % of Output + 7.4 μW	
	(5 to 10) kHz	0.115 % of Output + 9.2 μW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 92 μW	
	(40 to 1000) Hz	0.022 % of Output + 47 μW	
	(1 to 5) kHz	0.022 % of Output + 74 μW	
	(5 to 10) kHz	0.19 % of Output + 0.27 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 0.46 mW	
	(40 to 1000) Hz	0.025 % of Output + 0.27 mW	
	(1 to 5) kHz	0.03 % of Output + 0.27 mW	
	(5 to 10) kHz	0.19 % of Output + 0.46 mW	
	(3.1 to 12) A		
	(10 to 40) Hz	0.03 % of Output + 0.92 mW	
	(40 to 1000) Hz	0.025 % of Output + 0.47 mW	
	(1 to 5) kHz	0.03 % of Output + 0.74 mW	
(5 to 10) kHz	0.19 % of Output + 0.92 mW		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 9.1 mW		
(40 to 1000) Hz	0.054 % of Output + 7.3 mW		
(1 to 5) kHz	0.38 % of Output + 7.3 mW		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (0.12 to 1.2) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 0.9 μW	
	(40 to 1000) Hz	0.022 % of Output + 0.9 μW	
	(1 to 5) kHz	0.022 % of Output + 0.9 μW	
	(5 to 10) kHz	0.12 % of Output + 0.9 μW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 9.2 μW	
	(40 to 1000) Hz	0.016 % of Output + 4.7 μW	
	(1 to 5) kHz	0.022 % of Output + 7.4 μW	
	(5 to 10) kHz	0.12 % of Output + 9.2 μW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 92 μW	
	(40 to 1000) Hz	0.022 % of Output + 47 μW	
	(1 to 5) kHz	0.022 % of Output + 74 μW	
	(5 to 10) kHz	0.19 % of Output + 0.27 mW	
	(1.2 to 3.1) A		
(10 to 40) Hz	0.03 % of Output + 0.46 mW		
(40 to 1000) Hz	0.025 % of Output + 0.27 mW		
(1 to 5) kHz	0.03 % of Output + 0.27 mW		
(5 to 10) kHz	0.19 % of Output + 0.46 mW		
(3.1 to 12) A			
(10 to 40) Hz	0.03 % of Output + 0.92 mW		
(40 to 1000) Hz	0.025 % of Output + 0.47 mW		
(1 to 5) kHz	0.03 % of Output + 0.74 mW		
(5 to 10) kHz	0.19 % of Output + 0.92 mW		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 9.1 mW		
(40 to 1000) Hz	0.054 % of Output + 7.3 mW		
(1 to 5) kHz	0.38 % of Output + 7.3 mW		
AC Power – Generate ¹ (1.2 to 12) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 9.2 μW	
	(40 to 1 000) Hz	0.022 % of Output + 9.2 μW	
	(1 to 5) kHz	0.022 % of Output + 9.2 μW	
	(5 to 10) kHz	0.12 % of Output + 9.2 μW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 92 μW	
	(40 to 1 000) Hz	0.016 % of Output + 46 μW	
(1 to 5) kHz	0.022 % of Output + 74 μW		
(5 to 10) kHz	0.12 % of Output + 92 μW		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (1.2 to 12) V Power Factor = 1	(0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.022 % of Output + 0.92 mW 0.022 % of Output + 0.46 mW 0.022 % of Output + 0.74 mW 0.19 % of Output + 2.7 mW 0.03 % of Output + 4.6 mW 0.025 % of Output + 2.7 mW 0.03 % of Output + 2.7 mW 0.19 % of Output + 4.6 mW 0.03 % of Output + 9.2 mW 0.025 % of Output + 4.6 mW 0.03 % of Output + 7.4 mW 0.19 % of Output + 9.2 mW 0.077 % of Output + 91 mW 0.054 % of Output + 73 mW 0.38 % of Output + 73 mW	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (12 to 120) V Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz	0.022 % of Output + 92 μW 0.022 % of Output + 92 μW 0.022 % of Output + 92 μW 0.12 % of Output + 92 μW 0.022 % of Output + 0.92 mW 0.016 % of Output + 0.46 mW 0.022 % of Output + 0.74 mW 0.12 % of Output + 0.92 mW 0.022 % of Output + 9.2 mW 0.022 % of Output + 4.6 mW 0.022 % of Output + 7.4 mW 0.19 % of Output + 27 mW 0.03 % of Output + 46 mW 0.025 % of Output + 27 mW 0.03 % of Output + 27 mW 0.19% of Output + 46 mW	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (12 to 120) V Power Factor = 1	(3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.03 % of Output + 92 mW 0.025 % of Output + 46 mW 0.03 % of Output + 74 mW 0.19 % of Output + 92 mW 0.077 % of Output + 0.91 W 0.054 % of Output + 0.73 W 0.38 % of Output + 0.73 W	Comparison to Fluke 5560A Multiproduct Calibrator
AC Power – Generate ¹ (120 to 330) V Power Factor = 1	(1.2 to 12) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 120) mA (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (0.12 to 1.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (1.2 to 3.1) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (3.1 to 12) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz (5 to 10) kHz (12 to 30.2) A (10 to 40) Hz (40 to 1 000) Hz (1 to 5) kHz	0.022 % of Output + 0.26 mW 0.022 % of Output + 0.26 mW 0.022 % of Output + 0.26 mW 0.12 % of Output + 0.26 mW 0.022 % of Output + 2.6 mW 0.016 % of Output + 1.5 mW 0.022 % of Output + 2.1 mW 0.12 % of Output + 2.6 mW 0.022 % of Output + 26 mW 0.022 % of Output + 15 mW 0.022 % of Output + 21 mW 0.19 % of Output + 76 mW 0.03 % of Output + 0.13 W 0.025 % of Output + 0.08 W 0.03 % of Output + 0.08 W 0.19 % of Output + 0.13 W 0.03 % of Output + 0.26 W 0.025 % of Output + 0.15 W 0.03 % of Output + 0.21 W 0.19 % of Output + 0.26 W 0.077 % of Output + 2.5 W 0.054 % of Output + 2.0 W 0.38 % of Output + 2.0 W	Comparison to Fluke 5560A Multiproduct Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Generate ¹ (330 to 1 020) V Power Factor = 1	(1.2 to 12) mA		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 40) Hz	0.022 % of Output + 1.1 mW	
	(40 to 1 000) Hz	0.022 % of Output + 1.1 mW	
	(1 to 5) kHz	0.022 % of Output + 1.1 mW	
	(5 to 10) kHz	0.12 % of Output + 1.1 mW	
	(12 to 120) mA		
	(10 to 40) Hz	0.022 % of Output + 11 mW	
	(40 to 1 000) Hz	0.016 % of Output + 8.3 mW	
	(1 to 5) kHz	0.022 % of Output + 9.6 mW	
	(5 to 10) kHz	0.12 % of Output + 11 mW	
	(0.12 to 1.2) A		
	(10 to 40) Hz	0.022 % of Output + 107 mW	
	(40 to 1 000) Hz	0.022 % of Output + 83 mW	
	(1 to 5) kHz	0.022 % of Output + 96 mW	
	(5 to 10) kHz	0.19 % of Output + 244 mW	
	(1.2 to 3.1) A		
	(10 to 40) Hz	0.03 % of Output + 0.43 W	
	(40 to 1 000) Hz	0.025 % of Output + 0.3 W	
(1 to 5) kHz	0.03 % of Output + 0.3 W		
(5 to 10) kHz	0.19 % of Output + 0.43 W		
(3.1 to 12) A			
(10 to 40) Hz	0.03 % of Output + 1.1 W		
(40 to 1 000) Hz	0.025 % of Output + 0.8 W		
(1 to 5) kHz	0.03 % of Output + 1 W		
(5 to 10) kHz	0.19 % of Output + 1.1 W		
(12 to 30.2) A			
(10 to 40) Hz	0.077 % of Output + 8 W		
(40 to 1 000) Hz	0.054 % of Output + 6.5 W		
(1 to 5) kHz	0.38 % of Output + 6.5 W		
Phase Angle – Generate ¹	(-180 to 180)°		Comparison to Fluke 5560A Multiproduct Calibrator
	(10 to 65) Hz	0.08°	
	(65 to 500) Hz	0.19°	
	500 Hz to 1 kHz	0.38°	
	(1 to 5) kHz	1.9°	
	(5 to 10) kHz	3.8°	
(10 to 30) kHz	7.6°		
Power Meter Range Calibration ¹	3 μW to 100 mW	0.25 % of reading	Comparison to HP 11683A Power Meter Calibrator



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Flatness – Measure ¹	9 kHz to 2 000 MHz		Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.1 dB	
	(-30 to -40) dBm	0.11 dB	
	(-40 to -42) dBm	0.12 dB	
	(2 to 14) GHz		
	(20 to -10) dBm	0.1 dB	
	(-10 to -30) dBm	0.09 dB	
	(-30 to -40) dBm	0.1 dB	
	(-40 to -42) dBm	0.11 dB	
	(14 to 18) GHz		
	(20 to -10) dBm	0.11 dB	
	(-10 to -30) dBm	0.12 dB	
	(-30 to -40) dBm	0.12 dB	
(-40 to -42) dBm	0.13 dB		
RF Power Measure ¹	9 kHz to 14 000 MHz		Comparison to Agilent EPM Series Power Meter w/E9304A H18 Power Sensor
	(20 to 0) dB	0.13 dB	
	(0 to -40) dB	0.15 dB	
	(-40 to -50) dB	0.35 dB	
	(-50 to -55) dB	0.93 dB	
	(14 000 to 18 000) MHz		
	(20 to 0) dB	0.12 dB	
	(0 to -40) dB	0.16 dB	
	(-40 to -50) dB	0.35 dB	
	(-50 to -55) dB	0.93 dB	
RF Power Measure ¹	(50 to 100) MHz		Comparison to Agilent EPM Series Power Meter w/N8487A Power Sensor
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.07 dB	
	(0 to -10) dB	0.07 dB	
	(-10 to -20) dB	0.07 dB	
	(-20 to -25) dB	0.11 dB	
	(100 to 6 000) MHz		
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.07 dB	
	(0 to -10) dB	0.07 dB	
	(-10 to -20) dB	0.08 dB	
	(-20 to -25) dB	0.11 dB	



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	(6 000 to 12 400) MHz		Comparison to Agilent EPM Series Power Meter w/N8487A Power Sensor
	(20 to 10) dB	0.08 dB	
	(10 to 0) dB	0.08 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.08 dB	
	(-20 to -25) dB	0.12 dB	
	(12 400 to 18 000) MHz		
	(20 to 10) dB	0.09 dB	
	(10 to 0) dB	0.09 dB	
	(0 to -10) dB	0.08 dB	
	(-10 to -20) dB	0.09 dB	
	(-20 to -25) dB	0.12 dB	
	(18 000 to 26 500) MHz		
	(20 to 10) dB	0.11 dB	
	(10 to 0) dB	0.11 dB	
	(0 to -10) dB	0.1 dB	
	(-10 to -20) dB	0.11 dB	
	(-20 to -25) dB	0.14 dB	
	(26 500 to 33 000) MHz		
	(20 to 10) dB	0.12 dB	
	(10 to 0) dB	0.12 dB	
	(0 to -10) dB	0.12 dB	
	(-10 to -20) dB	0.12 dB	
	(-20 to -25) dB	0.15 dB	
	(33 000 to 40 000) MHz		
	(20 to 10) dB	0.13 dB	
	(10 to 0) dB	0.13 dB	
	(0 to -10) dB	0.12 dB	
(-10 to -20) dB	0.13 dB		
(-20 to -25) dB	0.15 dB		
(40 000 to 50 000) MHz			
(20 to 10) dB	0.19 dB		
(10 to 0) dB	0.18 dB		
(0 to -10) dB	0.18 dB		
(-10 to -20) dB	0.19 dB		
(-20 to -25) dB	0.20 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	100 kHz to 30 MHz (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB	0.12 dB 0.13 dB 0.15 dB 0.19 dB 0.26 dB 0.39 dB 0.59 dB	Comparison to Agilent N5531S Measuring Receiver N1912A w/E9304A H18 Power Sensor
RF Power Measure ¹	(30 to 2 000) MHz (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB (2 000 to 3 050) MHz (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB (-120 to -125) dB (3 050 to 6 600) MHz (30 to 20) dB (20 to 0) dB (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -115) dB (-115 to -120) dB	0.36 dB 0.2 dB 0.22 dB 0.23 dB 0.25 dB 0.27 dB 0.33 dB 0.7 dB 0.37 dB 0.21 dB 0.23 dB 0.24 dB 0.26 dB 0.28 dB 0.34 dB 0.7 dB 0.37 dB 0.21 dB 0.23 dB 0.24 dB 0.29 dB 0.38 dB 0.53 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	(6 600 to 13 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -110) dB	0.34 dB	
	(-110 to -115) dB	0.46 dB	
	(-115 to -120) dB	0.65 dB	
	(13 200 to 18 000) MHz		
	(30 to 20) dB	0.37 dB	
	(20 to 0) dB	0.21 dB	
	(0 to -58) dB	0.23 dB	
	(-58 to -78) dB	0.24 dB	
	(-78 to -90) dB	0.26 dB	
	(-90 to -95) dB	0.26 dB	
	(-95 to -100) dB	0.26 dB	
	(-100 to -105) dB	0.29 dB	
	(-105 to -110) dB	0.38 dB	
	(-110 to -115) dB	0.53 dB	
	(-115 to -120) dB	0.75 dB	
	(18 000 to 19 200) MHz		
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.27 dB	
	(-90 to -95) dB	0.27 dB	
	(-95 to -100) dB	0.27 dB	
	(-100 to -105) dB	0.3 dB	
	(-105 to -110) dB	0.38 dB	
(-110 to -115) dB	0.53 dB		
(-115 to -120) dB	0.75 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	(19 200 to 26 500) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.39 dB	
	(20 to 0) dB	0.25 dB	
	(0 to -58) dB	0.24 dB	
	(-58 to -78) dB	0.25 dB	
	(-78 to -90) dB	0.28 dB	
	(-90 to -95) dB	0.33 dB	
	(-95 to -100) dB	0.43 dB	
	(-100 to -105) dB	0.61 dB	
	(-105 to -110) dB	0.85 dB	
	(-110 to -115) dB	1.2 dB	
	(-115 to -120) dB	1.5 dB	
	(26 500 to 31 150) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.34 dB	
	(-78 to -90) dB	0.36 dB	
	(-90 to -95) dB	0.39 dB	
	(-95 to -100) dB	0.46 dB	
	(-100 to -105) dB	0.61 dB	
	(-105 to -110) dB	0.82 dB	
	(-110 to -115) dB	1.1 dB	
	(31 150 to 41 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
(-58 to -78) dB	0.35 dB		
(-78 to -90) dB	0.48 dB		
(-90 to -95) dB	0.64 dB		
(-95 to -100) dB	0.87 dB		
(-100 to -105) dB	1.2 dB		
(-105 to -110) dB	1.5 dB		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Measure ¹	(41 000 to 45 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.38 dB	
	(-78 to -90) dB	0.68 dB	
	(-90 to -95) dB	0.93 dB	
	(-95 to -100) dB	1.2 dB	
	(-100 to -105) dB	1.6 dB	
	(45 000 to 50 000) MHz		
	(30 to 20) dB	0.42 dB	
	(20 to 0) dB	0.3 dB	
	(0 to -58) dB	0.34 dB	
	(-58 to -78) dB	0.67 dB	
(-78 to -90) dB	1.4 dB		
RF Attenuation – Measure ¹	(30 to 3 050) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.13 dB	
	(3 050 to 6 600) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
(90 to 100) dB	0.13 dB		
(100 to 110) dB	0.19 dB		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(6 600 to 13 200) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.25 dB	
	(13 200 to 19 200) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.12 dB	
	(90 to 100) dB	0.13 dB	
	(100 to 110) dB	0.31 dB	
	(19 200 to 26 500) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.081 dB		
(70 to 80) dB	0.12 dB		
(80 to 90) dB	0.14 dB		
(90 to 100) dB	0.36 dB		
(100 to 110) dB	0.82 dB		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(26 500 to 31 150) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.12 dB	
	(80 to 90) dB	0.13 dB	
	(90 to 100) dB	0.33 dB	
	(100 to 110) dB	0.77 dB	
	(31 150 to 41 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
	(40 to 50) dB	0.04 dB	
	(50 to 60) dB	0.076 dB	
	(60 to 70) dB	0.081 dB	
	(70 to 80) dB	0.14 dB	
	(80 to 90) dB	0.36 dB	
	(41 000 to 45 000) MHz		
	(0 to 10) dB	0.02 dB	
	(10 to 20) dB	0.025 dB	
	(20 to 30) dB	0.03 dB	
	(30 to 40) dB	0.035 dB	
(40 to 50) dB	0.04 dB		
(50 to 60) dB	0.076 dB		
(60 to 70) dB	0.11 dB		
(70 to 80) dB	0.24 dB		
(80 to 90) dB	0.6 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Attenuation – Measure ¹	(45 000 to 50 000) MHz (0 to 10) dB (10 to 20) dB (20 to 30) dB (30 to 40) dB (40 to 50) dB (50 to 60) dB (60 to 70) dB (70 to 80) dB (80 to 90) dB	0.02 dB 0.025 dB 0.03 dB 0.035 dB 0.04 dB 0.11 dB 0.29 dB 0.7 dB 1.4 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor
Amplitude Modulation Measure ¹	100 kHz to 10 MHz Rate 50 Hz to 10 kHz (5 to 99) % Depth 10 MHz to 3 GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth (3 to 26.5) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth (26.5 to 31.15) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth (31.15 to 50) GHz Rate 50 Hz to 100 kHz (5 to 20) % Depth (20 to 99) % Depth	0.75 % of reading + 0.3 digits 2.5 % of reading + 0.4 digits 1.5 % of reading + 0.4 digits 4.5 % of reading + 0.4 digits 1.5 % of reading + 0.4 digits 6.8 % of reading + 0.4 digits 1.9 % of reading + 0.4 digits 2.6 % of reading + 0.4 digits 6 % of reading + 0.4 digits	Comparison to Agilent N5531S Measuring Receiver



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency Modulation Measure ¹ $\beta = \text{deviation} / \text{rate}$	250 kHz to 10 MHz Rates 20 Hz to 10 kHz Peak Dev 200 to 40 kHz 10 MHz to 6.6 GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (6.6 to 13.2) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (13.2 to 31.15) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz (31.15 to 50) GHz Rates 50 Hz to 200 kHz Peak Dev 250 to 400 kHz	$\beta > 0.2 - 1.5 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 1.2 - 1 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.2 - 1.5 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.45 - 1 \% \text{ of reading} + 2 \text{ Hz}$ $\beta > 0.2 - 2.5 \% \text{ of reading} + 4 \text{ Hz}$ $\beta > 8 - 1 \% \text{ of reading} + 4 \text{ Hz}$ $\beta > 0.2 - 3.8 \% \text{ of reading} + 9 \text{ Hz}$ $\beta > 16 - 1 \% \text{ of reading} + 9 \text{ Hz}$ $\beta > 0.2 - 8.5 \% \text{ of reading} + 17 \text{ Hz}$ $\beta > 16 - 1 \% \text{ of reading} + 17 \text{ Hz}$	Comparison to Agilent N5531S Measuring Receiver
Phase Modulation – Measure ¹	100 kHz to 6.6 GHz Deviations > 0.3 rad Deviations > 0.7 rad (6.6 to 13.2) GHz Deviations > 0.6 rad Deviations > 2.0 rad (13.2 to 26.5) GHz Deviations: > 1.2 rad Deviations > 4.0 rad (26.5 to 31.15) GHz Deviations: > 1.3 rad Deviations > 4.0 rad (31.15 to 50) GHz Deviations: > 2.4 rad Deviations > 8.0 rad	3 % of reading + 0.002 rad 1 % of reading + 0.002 rad 3 % of reading + 0.005 rad 1 % of reading + 0.005 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad 3 % of reading + 0.009 rad 1 % of reading + 0.009 rad 3 % of reading + 0.018 rad 1 % of reading + 0.018 rad	Comparison to Agilent N5531S Measuring Receiver
RF Power Generate ¹	10 to 30 MHz (0 to -58) dB (-58 to -78) dB (-78 to -110) dB (-110 to -120) dB	0.23 dB 0.25 dB 0.27 dB 0.43 dB	Comparison to Agilent N5531S Measuring Receiver N1912A w/E9304A Power Sensor, 83650B Signal Generator

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Generate ¹	(30 to 2 000) MHz		Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, 83650B Signal Generator
	(0 to -58) dB	0.3 dB	
	(-58 to -78) dB	0.31 dB	
	(-78 to -110) dB	0.32 dB	
	(2 000 to 3 050) MHz		
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.37 dB	
	(3 050 to 6 600) MHz		
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.39 dB	
	(6 600 to 13 200) MHz		
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.42 dB	
	(13 200 to 18 000) MHz		
	(0 to -58) dB	0.35 dB	
	(-58 to -78) dB	0.36 dB	
	(-78 to -110) dB	0.46 dB	
	(18 000 to 19 200) MHz		
	(0 to -58) dB	0.41 dB	
	(-58 to -78) dB	0.42 dB	
	(-78 to -110) dB	0.5 dB	
(19 200 to 26 500) MHz			
(0 to -58) dB	0.41 dB		
(-58 to -78) dB	0.42 dB		
(-78 to -110) dB	0.9 dB		
(26 500 to 31 150) MHz			
(-3 to -58) dB	0.63 dB		
(-58 to -78) dB	0.64 dB		
(-78 to -110) dB	0.96 dB		
(31 150 to 41 000) MHz			
(-6 to -58) dB	0.83 dB		
(-58 to -78) dB	0.84 dB		
(-78 to -100) dB	1.1 dB		
(41 000 to 45 000) MHz			
(-6 to -58) dB	0.83 dB		
(-58 to -78) dB	0.85 dB		
(-78 to -100) dB	1.4 dB		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Generate ¹	(45 000 to 50 000) MHz (-6 to -58) dB (-58 to -78) dB (-78 to -90) dB	0.83 dB 1 dB 1.5 dB	Comparison to Agilent N5531S Measuring Receiver w/N5532A Opt 550 Power Sensor, 83650B Signal Generator
AM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(0.1 to 10) MHz AM Depth > 1 % (0 to -20) dB (-20 to -30) dB AM Depth > 3 % (0 to -20) dB (-20 to -30) dB (-30 to -40) dB 10 MHz to 26.5 GHz AM Depth > 1 % (0 to -20) dB (-20 to -30) dB AM Depth > 3% (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (26.5 MHz to 50.0 GHz) AM Depth > 3 % (0 to -20) dB AM Depth > 5% (0 to -20) dB (-20 to -30) dB	1.2 dB 2.2 dB 1 dB 1.3 dB 2.4 dB 1.3 dB 2.5 dB 1.1 dB 1.4 dB 3 dB 1.8 dB 1.5 dB 3.5 dB	Comparison to Agilent N5531S Measuring Receiver
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(1 to 6 600) MHz Dev 500 Hz to 2 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 2 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB	Comparison to Agilent N5531S Measuring Receiver



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
FM Distortion Measure ¹ Rate 20 Hz to 1 kHz	(6.6 to 13.2) GHz Dev > 2.3 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 4.5 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (13.2 to 31.15) GHz Dev > 2.7 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 6.0 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (31.15 to 50.0) GHz Dev > 4 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 12.0 kHz (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB 0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.4 dB	Comparison to Agilent N5531S Measuring Receiver
PM Distortion Measure ¹	(1 to 6 600) MHz Rate (20 to 500) Hz Dev > 0.8 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB Dev > 2.5 rad (0 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB	0.26 dB 0.79 dB 2.3 dB 0.09 dB 0.27 dB 0.83 dB 2.3 dB	Comparison to Agilent N5531S Measuring Receiver

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(1 to 6 600) MHz Rate (500 to 1 000) Hz		Comparison to Agilent N5531S Measuring Receiver
	Dev > 0.4 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB	0.09 dB	
	Dev > 1.0 rad		
	(0 to -20) dB	0.27 dB	
	(-20 to -30) dB	0.83 dB	
	(-30 to -40) dB	2.3 dB	
	(-40 to -50) dB	2.3 dB	
	(6.6 to 13.2) GHz Rate (20 to 500) Hz		
	Dev > 1.8 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	0.79 dB	
	(-30 to -40) dB	2.3 dB	
	Dev > 5.5 rad		
	(0 to -20) dB	0.09 dB	
	(-20 to -30) dB	0.27 dB	
	(-30 to -40) dB	0.83 dB	
	(-40 to -50) dB	2.4 dB	
(6.6 to 13.2) GHz Rate (500 to 1 000) Hz			
Dev > 0.8 rad	0.26 dB		
(0 to -20) dB	0.79 dB		
(-20 to -30) dB	0.79 dB		
(-30 to -40) dB	2.3 dB		
Dev > 2.5 rad			
(0 to -20) dB	0.09 dB		
(-20 to -30) dB	0.27 dB		
(-30 to -40) dB	0.83 dB		
(-40 to -50) dB	2.3 dB		



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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
PM Distortion Measure ¹	(13.2 to 31.15) GHz		Comparison to Agilent N5531S Measuring Receiver
	Rate (20 to 500) Hz		
	Dev > 3.5 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
	(-30 to -40) dB		
	Dev > 10.0 rad	0.09 dB	
	(0 to -20) dB	0.27 dB	
	(-20 to -30) dB	0.83 dB	
	(-30 to -40) dB	2.3 dB	
	Rate (500 to 1 000) Hz		
	Dev > 3.0 rad	0.26 dB	
	(0 to -20) dB	0.79 dB	
	(-20 to -30) dB	2.3 dB	
(-30 to -40) dB			
Dev > 8.0 rad	0.09 dB		
(0 to -20) dB	0.27 dB		
(-20 to -30) dB	0.83 dB		
(-30 to -40) dB	2.3 dB		
(-40 to -50) dB			
Total Harmonic Distortion (THD)	(0 to -60) dB		Comparison to HP 8903B Audio Analyzer
	20 Hz to 20 kHz		
	(0 to -40) dB	1 dB	
	(-40 to -50) dB	1 dB	
	(-50 to -60) dB	1.3 dB	
	(-60 to -65) dB	1.7 dB	
	(20 to 50) kHz		
	(0 to -40) dB	2 dB	
	(-40 to -50) dB	2.1 dB	
	(-50 to -60) dB	3 dB	
	(50 to 100) kHz		
	(0 to -40) dB	2 dB	
(-40 to -50) dB	2.4 dB		

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Harmonics Measure ¹	(-80 to -10) dB		Comparison to Agilent E4448A Measuring Receiver
	2 nd through 5 th Harmonic		
	1kHz to 600MHz	0.37 dB	
	(600 to 1 320) MHz	1.1 dB	
	(1 320 to 2 200) MHz	1.4 dB	
	(2 200 to 3 000) MHz	1.4 dB	
	(3 000 to 4 400) MHz	1.7 dB	
	(4 400 to 5 300) MHz	1.9 dB	
	(5 300 to 10 000) MHz	2.1 dB	
	2 nd through 4 th Harmonic		
(10 000 to 12 500) MHz	2.1 dB		
2 nd through 3 rd Harmonic			
(12 500 to 16 667) MHz	2.1 dB		
2 nd Harmonic			
(16 667 to 25 000) MHz	2.3 dB		

Length – Dimensional Metrology

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gage Blocks ²	Up to 13 in	$(4 + 1.5L) \mu\text{in}$	Comparison to Master gage blocks, P&W Universal Measuring Machine
Micrometers ^{1,2}	Up to 40 in	$(28 + 4.4L) \mu\text{in}$	Comparison to Gage Blocks
Bore Micrometers ²			Comparison to Master gage blocks, P&W Labmaster Universal, Master Ring
2 point	Up to 12 in	$(57 + 2.8L) \mu\text{in}$	
3 point	Up to 3 in	$(52 + 14L) \mu\text{in}$	
Calipers ^{1,2}	Up to 40 in	$(280 + 1.7L) \mu\text{in}$	Comparison to Gage Blocks
Dial Indicators ^{1,2}			Comparison to Gage Blocks
Resolution $\geq 50\mu\text{in}$	Up to 10 in	$(26 + 3.8L) \mu\text{in}$	
Resolution $< 50\mu\text{in}$	Up to 0.1 in	8.2 μin	
Height Gages ^{1,2}	Up to 40 in	$(96 + 2.8L) \mu\text{in}$	Comparison to Gage Blocks
Rulers ¹	Up to 46 in	0.009 1 in	Comparison to Gage Blocks

Length – Dimensional Metrology

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Tape Measures ²	Up to 100 ft	$(0.00026F + 0.025)$ in	Comparison to Standard rule
Protractors ¹	$(0 \text{ to } 360)^\circ$	0.013°	Comparison to Angle Blocks
Feeler Gage	Up to 1 in	$31 \mu\text{in}$	Comparison to Pratt & Whitney Supermicrometer C
Cylindrical Gages ²			
Plain Pins, Plugs	$(0 \text{ to } 13)$ in	$(6.8 + 3.3D) \mu\text{in}$	Comparison to Master gage blocks, P&W Universal Measuring Machine
Plain Rings	$(0.04 \text{ to } 14)$ in	$(11 + 3.2D) \mu\text{in}$	
Solid Thread Rings Pitch Diameter	Up to 12 in	$120 \mu\text{in}$	Comparison to Pratt & Whitney Labmaster Measuring Machine
Thread Plugs Major Diameter Pitch Diameter	Up to 10 in Up to 10 in	$53 \mu\text{in}$ $98 \mu\text{in}$	Comparison to Thread Wires, Gage Blocks, Pratt & Whitney Supermicrometer C
Thread Rings ^{2,3} Pitch Diameter	Up to 12 in	$(350 + 47D) \mu\text{in}$	Comparison to Thread Setting Plugs Tactile Fit
Thread Wires	Up to 0.5 in	$11 \mu\text{in}$	Comparison to Master gage blocks, P&W universal measuring machine
Surface Plates ¹			
Overall Flatness	(18×18) in to (6×6) ft	$86 \mu\text{in}$	Comparison to Planekator Repeat-o-meter
Local Area Flatness	$(-0.001 \text{ to } 0.001)$ in	$72 \mu\text{in}$	
Optical Comparators ¹ – Angle Linearity	$(0 \text{ to } 360)^\circ$ Up to 20 in $(20 \text{ to } 40)$ in	0.016° $320 \mu\text{in}$ $630 \mu\text{in}$	Comparison to Gage blocks, Angle blocks,
Magnification	10x to 100x	$430 \mu\text{in}$	SI Industries glass scales

Mass and Mass Related

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure ¹	(0 to 6 000) psi (0 to 15 000) psi	0.72 psi 2 psi	Comparison to ADT783 Pressure Controller w/module ADT151-01-GP15K
Pressure ¹	(60 to 110) kPa (8.7 to 16) psia	0.027 kPa 0.004 psi	Comparison to ADT783 Pressure Controller with ADT151-BP module
Pressure ¹	(-15 to 15) psi (>15 to 100) psi	0.005 9 psi 0.012 % of reading	Comparison to ADT783 Pressure Controller with ADT151-01RD-CP100M module
Pressure ¹	(-15 to 150) psi (>150 to 300) psi	0.018 psi 0.012 % of reading	Comparison to ADT783 Pressure Controller with ADT151-01RD-CP300M module
Pressure ¹	(-15 to 500) psi (>500 to 1 000) psi	0.059 psi 0.012 % of reading	Comparison to ADT783 Pressure Controller with ADT151-01RD-CP1KM module
Pressure ¹	(-15 to 1 800) psi (>1 800 to 3 600) psi	0.059 psi 0.012 % of reading	Comparison to ADT783 Pressure Controller with ADT151-01RD-CP1KM module
Pipettes ^{1,2}	(10 to 100) μL (100 to 1 000) μL (1 to 10) mL	(0.58 + 0.004 <i>V</i>) μL (0.6 + 0.001 <i>V</i>) μL (2.6 + 0.00 12 <i>V</i>) μL	Comparison to Mass Balance
Torque Tools ¹	(10 to 100) ozf-in 4 lbf-in to 1 000 lbf-ft	0.59 % of reading 0.32 % of reading	Comparison to Torque Testers CDI 1001-O-DDT CDI 5000 ST
Torque Analyzers ¹	Up to 100 ozf-in (4 to 150) lbf-in (12.5 to 1 000) lbf-ft	0.1 % of reading 0.064 % of reading 0.036 % of reading	Comparison to Torque Arms and Class F Weights
Force ¹ Tension and Compression	(0.5 to 500) lbf	0.02% of reading	Comparison to Class F Weights
Scales and Balances ^{1,2,4}	1 g to 11 kg (0.001 to 71) lb	(0.16 + 0.003 <i>X</i>) mg (0.000 004 7 <i>W</i>) lb	Comparison to Class 1 Weights
Scales and Balances ^{1,2,4}	1 g to 11 kg (0.001 to 531) lb	(0.75 + 0.12 <i>X</i>) mg (0.000 12 <i>W</i>) lb	Comparison to Class 6 Weights



ANSI National Accreditation Board

Mass and Mass Related

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass - Fixed Points Metric	(1, 2, 5) g 10 g 20g 50 g 100 g 200 g 500 g (1, 2, 5) kg	0.14 mg 0.19 mg 0.18 mg 0.25 mg 0.45 mg 0.65 mg 29 mg 31 mg	Comparison to ASTM E617 Class 1 weights
Mass - Fixed Points Metric	(0.001, 0.002) lb (0.005, 0.01, 0.02) lb 0.05 lb 0.1 lb 0.2 lb (0.5, 1, 2) lb (5, 10) lb 50 lb	0.13 mg 0.14 mg 0.2 mg 0.3 mg 0.34 mg 27 mg 28 mg 230 mg	Comparison to ASTM E617 Class 1 weights
Rockwell Hardness Testers ¹	HRBW < 60 (≥ 60 to < 80) ≥ 80 HRC < 35 (≥ 35 to < 60) ≥ 60	0.8 HRBW 0.85 HRBW 0.69 HRBW 0.58 HRC 0.54 HRC 0.39 HRC	Indirect verification per ASTM E18

Thermodynamic

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Relative Humidity Generate	(10 to 95) %RH	0.5 %RH	Comparison to Thunder Scientific 2500 Humidity Chamber
Relative Humidity Measure ¹	(0 to 90) %RH (90 to 100) %RH	1.2 %RH 2 %RH	Comparison to Vaisala MI70/HMP76 Humidity Indicator and Probe
Temperature Measuring Equipment ¹	(-40 to 160) °C (33 to 700) °C	0.13 °C (0.21 + 0.00042T) °C	Comparison to Dry Well Calibrators
Temperature Measure ¹	(-200 to 200) °C (200 to 400) °C (400 to 660) °C	0.015 °C 0.023 °C 0.035 °C	Comparison to Secondary PRT w/ Additel Reference Thermometer Readout

Thermodynamic

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Infrared (IR) Thermometers ¹	(20 to 100) °C (100 to 300) °C (300 to 420) °C (420 to 500) °C	1.5 °C 4.3 °C 6 °C 7.7 °C	Comparison to Fluke 9132 IR Calibrator $\epsilon = 0.95, \lambda = (8 \text{ to } 14) \mu\text{m}$

Time and Frequency

Morrisville (Raleigh), NC

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Generate ¹	10 MHz	$1 \times 10^{-12} \text{ Hz/Hz}$	Comparison to HP Z3805A GPS Receiver
Frequency – Generate ¹	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (0.1 to 1) MHz (1 to 10) MHz	$1 \times 10^{-12} \text{ Hz/Hz} + 0.57 \mu\text{Hz}$ $1 \times 10^{-12} \text{ Hz/Hz} + 5.7 \mu\text{Hz}$ $1 \times 10^{-12} \text{ Hz/Hz} + 57 \mu\text{Hz}$ $1 \times 10^{-12} \text{ Hz/Hz} + 0.57 \text{ mHz}$ $1 \times 10^{-12} \text{ Hz/Hz} + 5.7 \text{ mHz}$ $1 \times 10^{-12} \text{ Hz/Hz} + 57 \text{ mHz}$ $1 \times 10^{-12} \text{ Hz/Hz} + 0.57 \text{ Hz}$	Comparison to Agilent 33250A Function Generator / HP Z3805A GPS Receiver
Frequency – Generate ¹	(10 to 50 000) MHz	$1 \times 10^{-12} \text{ Hz/Hz} + 0.57 \text{ mHz}$	Comparison to Agilent 83650B Signal Generator / HP Z3805A GPS Receiver
Time – Generate	1 pps	$1 \times 10^{-12} \text{ s/s} + 750 \text{ ps}$	Comparison to HP Z3805A GPS Receiver
Frequency – Measure ¹	(1 to 10) Hz (10 to 100) Hz (100 to 1 000) Hz (1 to 10) kHz (10 to 100) kHz (100 to 200) kHz (0.2 to 3 000) MHz	$4.2 \times 10^{-9} \text{ Hz/Hz}$ $1.5 \times 10^{-9} \text{ Hz/Hz}$ $0.6 \times 10^{-9} \text{ Hz/Hz}$ $0.33 \times 10^{-9} \text{ Hz/Hz}$ $0.24 \times 10^{-9} \text{ Hz/Hz}$ $0.21 \times 10^{-9} \text{ Hz/Hz}$ $0.21 \times 10^{-9} \text{ Hz/Hz}$	Comparison to Agilent 53131A Opt 030 Frequency Counter / HP Z3805A GPS Receiver
Frequency – Measure ¹	(10 to 50 000) MHz	$1 \times 10^{-12} \text{ Hz/Hz} + 0.1 \text{ Hz}$	Comparison to Agilent E4448A Spectrum Analyzer / HP Z3805A GPS Receiver
Timer, Stopwatch ¹	10 s to 24 hr	34 ms	Totalize method with counter
Tachometers – RPM ¹	Up to 100 000 RPM	0.001 % of reading + 0.6R	Comparison to HP 33250A Signal Generator & LED

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Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement multiplied by a coverage factor of 2 ($k=2$), corresponding to a confidence level of approximately 95%.

Notes:

1. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
2. D = diameter in inches, DL = diagonal length in inches, L = length in inches (or millimeters as indicated), F = length in feet, R = resolution of device under test, t = time in seconds, V = Volume in microliters, X = weight in grams, W = weight in pounds, 1 mil = 0.001 inch.
3. The tactile fit of an adjustable thread ring to a thread-setting plug is not a measurement of pitch diameter. The uncertainty for this pitch diameter setting is based on the contributors associated with the thread setting plug and environmental contributors only.
4. The CMC for scales and balances is highly dependent upon the resolution of the unit under test. The uncertainties presented here do not include the resolution of the unit under test. The resolution will be included in the reported measurement uncertainty at the time of calibration.
5. The nominal values listed are approximate.
6. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2080.



Jason Stine, Vice President

