



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Transcat-Pittsburgh

403 Georgian Place
Somerset, PA 15501

Fulfills the requirements of

ISO/IEC 17025:2017

and the national standards

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

In the field of

CALIBRATION

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.

A handwritten signature in black ink, appearing to read 'R. Douglas Leonard Jr.', is positioned above a horizontal line.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 07 September 2021
Certificate Number: AC-2489.15



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).

**SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017,
ANSI/NCSL Z540-1-1994 (R2002) AND ANSI/NCSL Z540.3 (R2013)**

Transcat-Pittsburgh

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Somerset, PA 15501
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CALIBRATION

Valid to: **September 7, 2021**

Certificate Number: **AC-2489.15**

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
DC Voltage – Source ¹	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V (11 to 22) V (22 to 220) V	8 μV/V + 0.4 μV 5.4 μV/V + 0.7 μV 4 μV/V + 2.5 μV 4 μV/V + 4 μV 6.2 μV/V + 40 μV	Fluke 5700A/EP Multiproduct Calibrator
	220 V to 1.1 kV	7.6 μV/V + 400 μV	Fluke 5700A/5725A Multiproduct Calibrator Amplifier
DC Voltage – Measure ¹	(0 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 500) V (500 to 800) V 800 V to 1 kV	7.1 μV/V + 0.6 μV 5.0 μV/V + 0.6 μV 5.1 μV/V + 0.6 μV 7.6 μV/V + 35 μV 11 μV/V + 120 μV 14 μV/V + 120 μV 21 μV/V + 120 μV	Agilent 3458A Opt 002 Digital Multimeter
	(1 to 10) kV	0.05 %	Vitrek 4700A High Voltage Meter
	(10 to 100) kV	0.15 %	Vitrek 4700A/HVP-35 Vitrek 4700A/HVL-70 Vitrek 4700A/ HVL-100 High Voltage Meter 35kV, 70kV, 100kV

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
DC Current – Source ¹	200 nA to 220 μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 220) mA 220 mA to 2.2 A	41 μ A/A + 6 nA 37 μ A/A + 7 nA 36 μ A/A + 40 nA 57 μ A/A + 0.7 μ A 20 μ A/A + 12 μ A	Fluke 5700A/EP Multiproduct Calibrator
	(2.2 to 11) A	0.04 % + 0.48 mA	5700A/EP w/5725A Multiproduct Calibrator Amplifier
	(11 to 20.5) A	0.082 % + 0.58 mA	Fluke 5520A SC1100 Multiproduct Calibrator
DC Current – Measure ¹	(10 to 100) μ A 100 μ A to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A	26 μ A/A + 0.92 nA 26 μ A/A + 5.8 nA 26 μ A/A + 58 nA 43 μ A/A + 0.58 μ A 0.013 % + 12 μ A	Guildline 9711A w/3458A (002) DC Precision Current Shunt
	(1 to 10) A (10 to 100) A (100 to 300) A	0.064 % 0.066 % 0.12 %	Guildline 9711A w/3458A (002) DC Precision Current Shunt
DC Current – Source ¹ Clamp-on Ammeter Non-Toroidal Type Hall Effect Sensor ¹	20 A to 150 A 150 A to 1 000 A	0.51 % + 0.14 A 0.51 % + 0.5 A	Fluke 5520A with 5500A/Coil Multiproduct Calibrator
AC Voltage – Source ¹	(0 to 2.2) mV		Fluke 5700A/EP Multiproduct Calibrator
	(10 to 20) Hz	0.16 % + 4 μ V	
	(20 to 40) Hz	0.16 % + 4 μ V	
	40 Hz to 20 kHz	0.1 % + 4 μ V	
	(20 to 50) kHz	0.13 % + 4 μ V	
	(50 to 100) kHz	0.17 % + 5 μ V	
	(100 to 300) kHz	0.33 % + 10 μ V	
	(300 to 500) kHz	0.47 % + 20 μ V	
500 kHz to 1 MHz	0.58 % + 20 μ V		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
AC Voltage – Source 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	0.043 % + 4 μV 0.035 % + 4 μV 0.015 % + 4 μV 0.031 % + 4 μV 0.059 % + 5 μV 0.12 % + 10 μV 0.16 % + 20 μV 0.3 % + 20 μV	Fluke 5700A/EP Multiproduct Calibrator
	(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	0.028 % + 12 μV 0.017 % + 7 μV 0.01 % + 7 μV 0.021 % + 7 μV 0.047 % + 17 μV 0.092 % + 20 μV 0.14 % + 25 μV 0.28 % + 45 μV	
	220 mV 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	0.028 % + 40 μV 0.016 % + 15 μV 0.006 3 % + 8 μV 0.008 % + 10 μV 0.012 % + 30 μV 0.043 % + 80 μV 0.1 % + 200 μV 0.18 % + 300 μV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(2.2 to 22) V		Fluke 5700A with 5725A Multiproduct Calibrator Amplifier
	(10 to 20) Hz	0.028 % + 0.4 mV	
	(20 to 40) Hz	0.016 % + 0.15 mV	
	40 Hz to 20 kHz	0.004 9 % + 50 μV	
	(20 to 50) kHz	0.008 3 % + 0.1 mV	
	(50 to 100) kHz	0.011 % + 0.2 mV	
	(100 to 300) kHz	0.03 % + 0.6 mV	
	(300 to 500) kHz	0.1 % + 2 mV	
	500 kHz to 1 MHz	0.17 % + 3.2 mV	
	(22 to 220) V		
(10 to 20) Hz	0.028 % + 4 mV		
(20 to 40) Hz	0.01 % + 1.5 mV		
40 Hz to 20 kHz	0.005 6 % + 0.6 mV		
(20 to 50) kHz	0.009 3 % + 1 mV		
(50 to 100) kHz	0.016 % + 2.5 mV		
(100 to 300) kHz	0.09 % + 16 mV		
(300 to 500) kHz	0.44 % + 40 mV		
500 kHz to 1 MHz	0.8 % + 80 mV		
(220 to 750) V			
(30 to 50) kHz	0.061 % + 11 mV		
(50 to 100) kHz	0.23 % + 45 mV		
(220 to 1 100) V			
40 Hz to 1 kHz	0.011 % + 4 mV		
(1 to 20) kHz	0.017 % + 6 mV		
(20 to 30) kHz	0.061 % + 11 mV		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	100 mV to 1 V		Agilent 3458A Opt 002 Digital Multimeter
	(1 to 40) Hz	0.009 8 % + 46 μV	
	40 Hz to 1 kHz	0.009 4 % + 23 μV	
	(1 to 20) kHz	0.017 % + 23 μV	
	(20 to 50) kHz	0.036 % + 23 μV	
	(50 to 100) kHz	0.093 % + 23 μV	
	(100 to 300) kHz	0.35 % + 120 μV	
	300 kHz to 1 MHz	1.2 % + 120 μV	
	(1 to 2) MHz	1.7 % + 120 μV	
	(1 to 10) mV		
	(1 to 40) Hz	0.039 % + 3 μV	
	40 Hz to 1 kHz	0.028 % + 1 μV	
	(1 to 20) kHz	0.038 % + 1 μV	
	(20 to 50) kHz	0.15 % + 1 μV	
	(50 to 100) kHz	0.59 % + 1 μV	
	(100 to 300) kHz	4.6 % + 2 μV	
	(10 to 100) mV		
	(1 to 40) Hz	0.013 % + 4 μV	
	40 Hz to 1 kHz	0.009 4 % + 2 μV	
	(1 to 20) kHz	0.017 % + 2 μV	
	(20 to 50) kHz	0.037 % + 2 μV	
	(50 to 100) kHz	0.093 % + 2 μV	
	(100 to 300) kHz	0.36 % + 11 μV	
	300 kHz to 1 MHz	1.2 % + 11 μV	
(1 to 2) MHz	1.7 % + 11 μV		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(1 to 10) 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	0.009 5 % + 46 μV 0.009 5 % + 230 μV 0.017 % + 230 μV 0.036 % + 230 μV 0.093 % + 230 μV 0.35 % + 1.2 mV 1.2 % + 1 mV 1.8 % + 1 mV	Agilent 3458A Opt 002 Digital Multimeter
	(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	0.024 % + 4 mV 0.024 % + 2 mV 0.024 % + 2 mV 0.041 % + 2 mV 0.14 % + 2 mV 0.46 % + 12 mV 1.7 % + 12 mV	
	(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	0.047 % + 46 mV 0.047 % + 23 mV 0.071 % + 23 mV 0.14 % + 23 mV 0.35 % + 23 mV	Vitrek 4700A High Voltage Meter
	700V to 100 kV 45 Hz to 70 Hz	0.15 %	Vitrek 4700A/ HVP-35, HVL-70, HVL- 100 High Voltage Meter 35kV, 70kV, 100kV
AC Current – Source ¹	(0 to 220) μA (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.030 % + 16 nA 0.019 % + 10 nA 0.015 % + 8 nA 0.03 % + 12 nA 0.11 % + 65 nA	Fluke 5520A SC1100 Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	220 µA to 2.2 mA		Fluke 5700A/EP Multiproduct Calibrator
	(10 to 20) Hz	0.03 % + 40 nA	
	(20 to 40) Hz	0.018 % + 35 nA	
	40 Hz to 1 kHz	0.013 % + 35 nA	
	(1 to 5) kHz	0.021 % + 110 nA	
	(5 to 10) kHz	0.11 % + 650 nA	
	(2.2 to 22) mA		
	(10 to 20) Hz	0.039 % + 400 nA	
	(20 to 40) Hz	0.019 % + 350 nA	
	40 Hz to 1 kHz	0.014 % + 350 nA	
	(1 to 5) kHz	0.021 % + 550 nA	
	(5 to 10) kHz	0.11 % + 5 µA	
	(22 to 220) mA		
	(10 to 20) Hz	0.033 % + 4 µA	
	(20 to 40) Hz	0.018 % + 3.5 µA	
	40 Hz to 1 kHz	0.014 % + 2.5 µA	
(1 to 5) kHz	0.021 % + 3.5 µA		
(5 to 10) kHz	0.11 % + 10 µA		
220 mA to 2.2 A			
20 Hz to 1 kHz	0.027 % + 35 µA		
(1 to 5) kHz	0.046 % + 80 µA		
(5 to 10) kHz	0.7 % + 160 µA		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(2.2 to 11) A (40 to 100) Hz (1 to 5) kHz (5 to 10) kHz	0.048 % + 170 μA 0.096 % + 380 μA 0.36 % + 750 μA	Fluke 5700A with 5725A
	(11 to 20) A 45 Hz to 1 kHz (1 to 5) kHz	0.095 % + 2 mA 2.3 % + 5 mA	Multiproduct Calibrator Amplifier
AC Current - Source Extended Frequency Ranges ¹	(29 to 330) μA (10 to 30) kHz	1.2 % + 0.3 μA	Fluke 5520A Multiproduct Calibrator
	(0.33 to 3.3) mA (10 to 30) kHz	0.78 % + 0.5 μA	
	(3.3 to 33) mA (10 to 30) kHz	0.31 % + 3 μA	
	(33 to 330) mA (10 to 30) kHz	0.31 % + 0.16 mA	
AC Current - Source Clamp On Ammeters Toroidal Type ¹	(20 to 150) A (45 to 65) Hz (65 to 440) Hz	0.34 % + 26 mA 0.95 % + 47 mA	Fluke 5520A - SC1100 With 5500 Coil Fluke 5520A Multiproduct Calibrator
	(150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	0.38 % + 0.12 A 1.2 % + 0.22 A	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment		
AC Current – Source Clamp On Ammeters Non-Toroidal Type ¹	(20 to 150) A (45z to 65) Hz (65 to 440) Hz	0.66 % + 0.25 A 1.2 % + 0.25 A	Fluke 5520A - SC1100 With 5500 Coil Fluke 5520A Multiproduct Calibrator		
	(150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	0.68 % + 0.90 A 1.4 % + 0.92 A			
AC Current – Measure 1	(0 to 100) μ A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 1 kHz	0.46 % + 35 nA 0.18 % + 35 nA 0.072 % + 35 nA 0.072 % + 35 nA	Agilent 3458A Opt 002 Digital Multimeter		
	100 μ A to 1 mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 230 nA 0.17 % + 230 nA 0.071 % + 230 nA 0.038 % + 230 nA			
	(1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 2.3 μ A 0.17 % + 2.3 μ A 0.71 mA/A + 2.3 μ A 0.38 mA/A + 2.3 μ A			
	(10 to 100) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 23 μ A 0.17 % + 23 μ A 0.07 % + 23 μ A 0.037 % + 23 μ A			
	100 mA to 1 A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % + 231 μ A 0.18 % + 231 μ A 0.097 % + 231 μ A 0.12 % + 231 μ A			
	AC Current – Measure ¹	(1 to 3) A 10 Hz to 5 kHz (5 to 10) kHz		0.24 % + 0.1 mA 1.3 % + 0.1 mA	Fluke 8846A Digital Multimeter
		(3 to 10) A 10 Hz to 5 kHz		0.81 % + 0.4 mA	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Resistance – Source ¹	Up to 11 Ω	0.12 mΩ/Ω + 1.2 mΩ	Fluke 5520A SC1100 Multiproduct Calibrator
	(11 to 33) Ω	0.12 mΩ/Ω + 1.7 mΩ	
	(33 to 111) Ω	27 μΩ/Ω + 1.6 mΩ	
	(110 to 330) Ω	24 μΩ/Ω + 2.3 mΩ	
Resistance – Source ¹	330 Ω to 1.1k Ω	25 μΩ/Ω + 2.3 mΩ	Fluke 5520A SC1100 Multiproduct Calibrator
	(1.1 to 3.3) kΩ	26 μΩ/Ω + 2.3 mΩ	
	(3.3 to 11) kΩ	25 μΩ/Ω + 2.3 mΩ	
	(11 to 33) kΩ	23 μΩ/Ω + 0.23 Ω	
	(33 to 110) kΩ	23 μΩ/Ω + 0.23 Ω	
	(110 to 330) kΩ	26 μΩ/Ω + 2.3 Ω	
	330 kΩ to 1.19 MΩ	35 μΩ/Ω + 2.3 Ω	
	(1.1 to 3.3) MΩ	48 μΩ/Ω + 35 Ω	
	(3.3 to 11) MΩ	0.12 mΩ/Ω + 58 Ω	
	(11 to 33) MΩ	0.28 mΩ/Ω + 2.9 kΩ	
	(33 to 110) MΩ	0.47 mΩ/Ω + 3.5 kΩ	
	(110 to 330) MΩ	2.3 μΩ/Ω + 0.12 MΩ	
	330 MΩ to 1.1 GΩ	12 μΩ/Ω + 0.5 MΩ	IET HRRS-B-7-100k -5kV High Resistance Decade Box
	(10 to 100) MΩ	0.082 %	
	100 MΩ to 1 GΩ	0.24 %	
	(1 to 10) GΩ	0.42 %	
	(10 to 100) GΩ	0.82 %	
	100 GΩ to 1 TΩ	2.4 %	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Resistance – Measure ¹	Up to 10 Ω	18 μΩ/Ω + 58 μΩ	Agilent 3458A Digital Multimeter
	(10 to 100) Ω	16 μΩ/Ω + 0.6 mΩ	
	100 Ω to 1 kΩ	12 μΩ/Ω + 0.6 mΩ	
	(1 to 10) kΩ	12 μΩ/Ω + 6 mΩ	
Resistance – Measure ¹	(10 to 100) kΩ	12 μΩ/Ω + 58 mΩ	Agilent 3458A Digital Multimeter
	100 kΩ to 1 MΩ	19 μΩ/Ω + 2.3 Ω	
	(1 to 10) MΩ	62 μΩ/Ω + 116 Ω	
	(10 to 100) MΩ	0.059 % + 12 kΩ	
	100 MΩ to 1 GΩ	0.58 % + 12 kΩ	
Electrical Simulation of Thermocouple Indicators - Source and Measure ¹	Type B		Fluke 5520A SC1100 Multiproduct Calibrator
	(600 to 800) °C	0.34 °C	
	(800 to 1 000) °C	0.26 °C	
	(1 000 to 1 550) °C	0.23 °C	
	(1 550 to 1 820) °C	0.27 °C	
	Type E		
	(-250 to -100) °C	0.39 °C	
	(-100 to -25) °C	0.12 °C	
	(-25 to 350) °C	0.11 °C	
	(350 to 650) °C	0.12 °C	
	(650 to 1 000) °C	0.16 °C	
	Type J		
	(-210 to -100) °C	0.21 °C	
	(-100 to -30) °C	0.13 °C	
	(-30 to 150) °C	0.11 °C	
(150 to 760) °C	0.13 °C		
(760 to 1 200) °C	0.18 °C		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicators - Source and Measure ¹	Type K		Fluke 5520A SC1100 Multiproduct Calibrator
	(-200 to -100) °C	0.26 °C	
	(-100 to -25) °C	0.14 °C	
	(-25 to 120) °C	0.13 °C	
	(120 to 1 000) °C	0.20 °C	
	(1 000 to 1 372) °C	0.31 °C	
	Type N		
	(-200 to -100) °C	0.31 °C	
	(-100 to -25) °C	0.17 °C	
	(-25 to 120) °C	0.15 °C	
	(120 to 410) °C	0.14 °C	
	(410 to 1 300) °C	0.21 °C	
	Type R		
	(0 to 250) °C	0.44 °C	
	(250 to 400) °C	0.27 °C	
	(400 to 1 000) °C	0.26 °C	
(1 000 to 1 767) °C	0.31 °C		
Type S			
(0 to 250) °C	0.44 °C		
(250 to 1 000) °C	0.28 °C		
(1 000 to 1 400) °C	0.29 °C		
(1 400 to 1 767) °C	0.36 °C		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicators - Source and Measure ¹	Type T		Fluke 5520A SC1100 Multiproduct Calibrator
	(-250 to -150) °C	0.49 °C	
	(-150 to 0) °C	0.19 °C	
	(0 to 120) °C	0.13 °C	
Electrical Simulation of RTDs ¹ Pt 385 (100 Ω)	(120 to 400) °C	0.11 °C	Fluke 5520A SC1100 Multiproduct Calibrator
	(-200 to 0) °C	0.04 °C	
	(0 to 100) °C	0.06 °C	
	(100 to 300) °C	0.07 °C	
	(300 to 400) °C	0.08 °C	
DC Power – Source 1 (1 to 1 000) V	(400 to 630) °C	0.10 °C	Fluke 5520A SC1100 Multiproduct Calibrator
	(630 to 800) °C	0.18 °C	
	(0.33 to 330) mA		
	11 μW to 1.1 mW	0.024 %	
	(1.1 to 110) mW	0.027 %	
	(0.11 to 110) W	0.024 %	
	(110 to 330) W	0.018 %	
	(0.33 to 3) A		
	(11 to 110) mW	0.044 %	
	(0.11 to 990) W	0.053 %	
	(1 to 3) kW	0.0096 %	
	(3 to 20.5) A		
	(0.099 to 0.99) W	0.088 %	
	0.99 W to 6.8 kW	0.07 %	
	6.8 W to 20.5 kW	0.04 %	
(3.3 to 9) mA			
(0.11 to 3) mW	0.13 %		
3 mW to 9 W	0.077 %		
(9 to 33) mA			
(0.3 to 10) mW	0.089 %		
10 mW to 33 W	0.077 %		
AC Power – Source ¹ (45 to 65) Hz P=1 (1 to 1 000) V	(33 to 90) mA		Fluke 5520A SC1100 Multiproduct Calibrator
	(1 to 30) mW	0.071 %	
	30 mW to 90 W	0.057 %	
	(90 to 330) mA		
	(3 to 100) mW	0.089 %	
100 mW to 300 W	0.078 %		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
AC Power – Source ¹ (45 to 65) Hz P=1 (1 to 1 000) V	(0.33 to 0.9) A (11 to 300) mW 300 mW to 900 W	0.071 % 0.081 %	Fluke 5520A SC1100 Multiproduct Calibrator
	(0.9 to 2.2) A (30 to 720) mW 720 mW to 2 kW	0.089 % 0.079 %	
	(2.2 to 4.5) A 80 mW to 1.4 W 1.4 W to 4.5 kW	0.088 % 0.18 %	
	(4.5 to 20.5) A 150 mW to 6.7 W 6.7 W to 20 kW	0.17 % 0.17 %	
Capacitance – Source ¹	(0.19 to 1.1) nF (10Hz to 10kHz)	0.39 % + 7.8 pF	Fluke 5520A SC1100 Multiproduct Calibrator
	(1.1 to 3.3) nF (10 Hz to 3 kHz)	0.39 % + 7.8 pF	
	(3.3 to 11) nF (10 Hz to 1kHz)	0.21 % + 7.8 pF	
	(11 to 110) nF (10 Hz to 1kHz)	0.21 % + 78 pF	
	(110 to 330) nF (10 Hz to 1kHz)	0.21 % + 0.23 nF	
	(0.33 to 1.1) μF (10 Hz to 600 Hz)	0.21 % + 0.78 nF	
	(1.1 to 3.3) μF (10 Hz to 300 Hz)	0.21 % + 2.3 nF	
	(3.3 to 11) μF (10 Hz to 150 Hz)	0.2 % + 7.8 nF	
	(11 to 33) μF (10 Hz to 120 Hz)	0.32 % + 23 nF	
	(33 to 110) μF (10 Hz to 180Hz)	0.35 % + 78 nF	
(110 to 330) μF (DC to 50 Hz)	0.37 % + 0.23 μF		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Capacitance – Source ¹	(0.33 to 1.1) mF (DC to 20Hz)	0.37 % + 0.78 μF	Fluke 5520A SC1100 Multiproduct Calibrator
	(1.1 to 3.3) mF (DC to 6 Hz)	0.35 % + 2.3 μF	
	(3.3 to 11) mF (DC to 2 Hz)	0.35 % + 7.8 μF	
	(11 to 33) mF (DC to 0.6 Hz)	0.58 % + 23 μF	
	(33 to 110) mF (DC to 0.2 Hz)	0.85 % + 78 μF	
Capacitance – Measure ¹	(0 to 10) pF 60 Hz to 1 kHz	0.47 % + 0.014 pF	GR 1689-9700 5 Precision Impedance Meter
	(10 to 100) pF 60 Hz to 1 kHz	0.062 % + 0.014 pF	
	100 pf to 1 μF 60 Hz to 1 kHz	0.027 % + 0.014 pF	
	1 μf to 100 μF 60 Hz to 1 kHz	0.035 % + 0.018 pF	
	100 μf to 1000 μF 60 Hz to 1 kHz	0.24 % + 0.018 pF	
Phase Meters ¹	(0 to 179.99)°		Fluke 5520A SC1100 Multiproduct Calibrator
	(10 to 65) Hz	0.11°	
	(65 to 500) Hz	0.2°	
	500 Hz to 1 kHz	0.4°	
	(1 to 5) kHz	1.9°	
	(5 to 10) kHz (10 to 30) kHz	3.9° 7.8°	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Oscilloscopes ¹ Amplitude DC ¹ into 50 Ω Load into 1 MΩ Load	(-6.6 to 6.6) V (-130 to 130) V	0.20 % + 31 μV 0.039 % + 31 μV	Fluke 5520A/SC1100 Multiproduct Calibrator
Amplitude Square Wave into 50 Ω Load Rate: 10 Hz to 10 kHz	1 mV(pk-pk) to 6.6 V(pk-pk)	0.19 % + 31 μV	
into 1 MΩ Load Rate: 10 Hz to 1 kHz Rate: 1 kHz to 10 kHz	1 mV(pk-pk) to 6.6 V(pk-pk) 1 mV(pk-pk) to 6.6 V(pk-pk)	0.078 % + 31 μV 0.19 % + 31 μV	
Timing – Generate ¹ 50 Ω Load	5 s 2 s 1 s 500 ms 200 ms 100 ms 50 ms 20 mS to 1 nS	0.30 % 0.12 % 0.062 % 0.032 % 0.014 % 0.007 6 % 0.004 6 % 0.000 22 %	
Rise Time – Generate ^{1,4} 50 Ω Load 5 mV(pk-pk) to 2.5 V(pk-pk) Rate: 1 kHz to 2 MHz Rate: 2 MHz to 10 MHz	250 ps (nominal) 250 ps (nominal)	51 ps 51 ps	Fluke 5520A/SC1100 Multiproduct Calibrator
Leveled Sine Wave Generate ¹ 50 Ω Load 5 mV(pk-pk) to 5.5 V(pk-pk)	50 kHz 50 kHz to 100 MHz 100 MHz to 300 MHz 300 MHz to 600 MHz	1.8 % + 230 μV 2.8 % + 230 μV 3.2 % + 230 μV 4.0 % + 230 μV	Fluke 5520A/SC1100 Multiproduct Calibrator
5 mV(pk-pk) to 3.5 V(pk-pk)	600 MHz to 1 GHz	5.5 % + 230 μV	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Bandwidth/Flatness Measure ¹ 50 Ω Load (50 kHz Reference) 5 mV(pk-pk) to 5.5 V(pk-pk)	50 kHz to 100 MHz 100 MHz to 300 MHz 300 MHz to 600 MHz	1.4 % + 78 μV 1.8 % + 78 μV 3.2 % + 78 μV	Fluke 5520A SC1100 Multiproduct Calibrator
5 mV(pk-pk) to 3.5 V(pk-pk)	600 MHz to 1.1 GHz	4.0 % + 78 μV	
Input Impedance Measure ¹ 50 Ω 1 MΩ	40 Ω to 60 Ω 500 kΩ to 1.5 MΩ	0.082 % 0.081 %	
Input Capacitance Measure ¹	5 pF to 50 pF	3.9 % + 0.39 pF	
Wave Generator – Source ¹ Amplitude (10 Hz to 10 kHz) Sine, Square, Triangle 50 Ω Load 1 MΩ Load	1.8 mV(pk-pk) to 2.5 V(pk-pk) 1.8 mV(pk-pk) to 55 V(pk-pk)	2.3 % + 78 μV(pk-pk) 2.3 % + 78 μV(pk-pk)	
Wave Generator – Source ¹ Frequency Sine, Square, Triangle	10 Hz to 100 kHz	0.001 9% + 0.012 Hz	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Sinewave Flatness	9 kHz to 6 GHz (-43 to 20) dB	0.07 dB	E441XX E4413A Power Meter Power Sensor

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power ¹ Absolute - Measure	9 kHz to 6 GHz (-40 to -20) dBm	0.18 dB	E441XX E4413A Power Meter Power Sensor
RF Power ¹ Absolute - Measure	50 MHz to 26.5 GHz (-20 to 30) dBm	0.16 dB	HP 8902A HP 11792A Measuring Receiver Power Sensor
	100 kHz to 2.6 GHz (-20 to 30) dBm	0.10 dB	HP 8902A 11722A Measuring Receiver Power Sensor
AM Depth – Measure ¹ 50 Hz to 10 kHz	5 % to 40 % 150 kHz to 10 MHz	(0.021AM + 0.014) %	HP 8902A with 11722A Measuring Receiver Power Sensor
	40 % to 99 % 150 kHz to 10 MHz	(0.021AM + 0.14) %	
20 Hz to <50 Hz	5 % to 40 % 150 kHz to 10 MHz	(0.031AM + 0.014) %	
	40 % to 99 % 150 kHz to 10 MHz	(0.031AM + 0.14) %	
50 Hz to 50 kHz	5 % to 40 % 10 MHz to 1.3 GHz	(0.011AM + 0.014) %	
	40 % to 99 % 10 MHz to 1.3 GHz	(0.011AM + 0.14) %	
50 Hz to 50 kHz	5 % to 40 % 1.3 GHz to 26.5 GHz	(0.016AM + 0.014) %	HP 8902A with 11722A, 11792A, and 11793A Measuring Receiver Power Sensor Microwave Converter
	40 % to 99 % 1.3 GHz to 26.5 GHz	(0.016AM + 0.14) %	
(20 Hz to 50 Hz) or (50 kHz to 100 kHz)	5 % to 40 % 10 MHz to 26.5 GHz	(0.031AM + 0.014) %	
	40 % to 99 % 10 MHz to 26.5 GHz	(0.031AM + 0.14) %	
FM Modulation – Measure ¹ 20 Hz to 10 kHz	0 kHz to 4 kHz	(0.021FM + 20) Hz	Agilent 8902A with 11722A Measuring Receiver Power Sensor
	250 kHz to 10 MHz	(0.021FM + 22) Hz	
	4 kHz to 40 kHz	(0.021FM + 100) Hz	
	40 kHz to 400 kHz		
50 Hz to 100 kHz	0 kHz to 4 kHz 100 MHz to 26.5 GHz	(0.011FM + 20) Hz	HP 8902A with 11722A, 11792A,



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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
	4 kHz to 40 kHz 100 MHz to 26.5 GHz	$(0.011FM + 22)$ Hz	and 11793A Measuring Receiver Power Sensor Microwave Converter
	40 kHz to 400 kHz 100 MHz to 26.5 GHz	$(0.011FM + 100)$ Hz	
20 Hz to <50 Hz	0 kHz to 4 kHz 100 MHz to 26.5 GHz	$(0.05FM + 20)$ Hz	HP 8902A with 11722A, 11792A, and 11793A Measuring Receiver Power Sensor Microwave Converter
	4 kHz to 40 kHz 100 MHz to 26.5 GHz	$(0.05FM + 22)$ Hz	
	40 kHz to 400 kHz 100 MHz to 26.5 GHz	$(0.05FM + 100)$ Hz	
>100 kHz to 200 kHz	0 kHz to 4 kHz 100 MHz to 26.5 GHz	$(0.05FM + 100)$ Hz	
	4 kHz to 40 kHz 100 MHz to 26.5 GHz	$(0.05FM + 100)$ Hz	
	40 kHz to 400 kHz 100 MHz to 26.5 GHz	$(0.05FM + 100)$ Hz	
Phase Modulation – Measure ¹ 200 Hz to 10 kHz	0 rad to < 4 rad 150 kHz to 10 MHz	$(0.042PM + 0.03)$ rad	HP 8902A with 11722A Measuring Receiver Power Sensor
	4 rad to < 40 rad 150 kHz to 10 MHz	$(0.042PM + 0.03)$ rad	
Phase Modulation – Measure ¹ 200 Hz to 10 kHz	40 rad to 400 rad 150 kHz to 10 MHz	$(0.042PM + 0.1)$ rad	HP 8902A with 11722A Measuring Receiver Power Sensor
200 Hz to 20 kHz	0 rad to < 4 rad 10 MHz to 26.5 GHz	$(0.036PM + 0.03)$ rad	HP 8902A with 11722A, 11792A, and 11793A Measuring Receiver Power Sensor Microwave Converter
	4 rad to < 40 rad 10 MHz to 26.5 GHz	$(0.036PM + 0.03)$ rad	
Harmonic Distortion ¹	40 rad to 400 rad 10 MHz to 26.5 GHz	$(0.036PM + 0.1)$ rad	Agilent 8563E Spectrum Analyzer
Harmonic Distortion	0 dBc to -80 dBc 30 Hz to 6.5 GHz 6.5 GHz to 22 GHz 22 GHz to 26.5 GHz	1.7 dB 2.6 dB 3.4 dB	Agilent 8563E Spectrum Analyzer
Total Harmonic Distortion ¹	0 dB to -80 dB 20 Hz to 20 kHz 20 kHz to 100 kHz	1.2 dB 2.3 dB	Agilent 8903B Audio Analyzer

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AM Total Harmonic Distortion ¹	0 dB to -80 dB 20 Hz to 100 kHz	2.7 dB	
Absolute RF Power ¹ 50 MHz	1 mW Reference	0.63 % (0.03 dB)	Agilent 478A- H75, 432A, and 3458A Power Meter Thermistor Mount Digital Multimeter
100 kHz to 2.6 GHz	30 dBm to 20 dBm	0.12 dB	HP 8902A with 11722A Measuring Receiver Power Sensor
	20 dBm to 10 dBm	0.12 dB	
	10 dBm to 0 dBm	0.12 dB	
	0 dBm to -10 dBm	0.12 dB	
	-10 dBm to -20 dBm	0.15 dB	
2.6 GHz to 12 GHz	30 dBm to 20 dBm	0.13 dB	HP 8902A w/ 11722A, 11792A & 11793A Measuring Receiver Power Sensor Microwave Converter
	20 dBm to 10 dBm	0.13 dB	
	10 dBm to 0 dBm	0.13 dB	
	0 dBm to -10 dBm	0.13 dB	
	-10 dBm to -20 dBm	0.14 dB	
12 GHz to 18 GHz	30 dBm to 20 dBm	0.13 dB	HP 8902A w/ 11722A, 11792A & 11793A Measuring Receiver Power Sensor Microwave Converter
	20 dBm to 10 dBm	0.13 dB	
	10 dBm to 0 dBm	0.13 dB	
	0 dBm to -10 dBm	0.13 dB	
	-10 dBm to -20 dBm	0.15 dB	
18 GHz to 26.5 GHz	5 dBm to 0 dBm	0.16 dB	HP 8902A w/ 11722A, 11792A & 11793A Measuring Receiver Power Sensor Microwave Converter
	0 dBm to -10 dBm	0.15 dB	
	-10 dBm to -20 dBm	0.15 dB	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Reflection (VSWR) 1 10 MHz to 18 GHz	(Rho) 0.022 to 0.1	(Rho) 0.022	VSWR Bridge
	0.1 to 0.2	0.027	
	0.2 to 0.3	0.033	
	0.3 to 0.4	0.042	
Relative Tuned RF Power ¹ 2.5 MHz to 26 GHz	0 dB to -20 dB	0.02 dB	Agilent 8902A with 11722A, 11793A Measuring Receiver Power Sensor Microwave Converter
	-20 dB to -40 dB	0.03 dB	
	-40 dB to -60 dB	0.04 dB	
	-60 dB to -80 dB	0.05 dB	
	-80 dB to -100 dB	0.06 dB	
	-100 dB to -120 dB	0.18 dB	
18 GHz to 26 GHz	0 dB to -20 dB	0.13 dB	
	-20 dB to -40 dB	0.15 dB	
	-40 dB to -60 dB	0.18 dB	
	-60 dB to -80 dB	0.22 dB	
Amplitude Modulation ^{1,2} Rate: 50 Hz to 10 kHz Depth: (5 to 99) % Rate: 20 Hz to 10 kHz Depth: (to 99) % Rate: 50 Hz to 50 kHz Depth: (5 to 99) % Amplitude Modulation ^{1,2} Rate: 20 Hz to 100 kHz Depth: (to 99) % Rate: 50 Hz to 50 kHz Depth: (5 to 99) % Rate: 20 Hz to 100 kHz Depth: (to 99) %	(0.15 to 10) MHz	2.4 % + 1 LSD	HP 8902A Measuring Receiver
	(0.15 to 10) MHz	3.5 % + 1 LSD	
	(0.01 to 1.3) GHz	1.3 % + 1 LSD	
	(0.01 to 1.3) GHz	3.5 % + 1 LSD	HP 8902A, HP 11793A Measuring Receiver Microwave Converter
	(1.3 to 26.5) GHz	1.8 % + 1 LSD	
	(1.3 to 26.5) GHz	3.5 % + 1 LSD	

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency Modulation ^{1,2} Rate: 20 Hz to 10 kHz Dev: ≤ 40 kHz peak Rate: 50 Hz to 100 kHz Dev: ≤ 400 kHz peak	(0.25 to 10) MHz (0.01 to 1.3) GHz	2.3 % + 1 LSD 1.2 % + 1 LSD	HP 8902A Measuring Receiver
Rate: 20 Hz to 200 kHz Dev: ≤ 4.0 kHz peak	(0.01 to 1.3) GHz	5.8 % + 1 LSD	HP 8902A, HP 11793A Measuring Receiver Microwave Converter
Rate: 50 Hz to 100 kHz Dev: ≤ 400 kHz peak	(1.3 to 26.5) GHz	1.2 % + 1 LSD	HP 8902A, HP 11793A Measuring Receiver Microwave Converter
Rate: 20 Hz to 200 kHz Dev: ≤ 400 kHz peak	(1.3 to 26.5) GHz	5.8 % + 1 LSD	
Phase Modulation – Measure ^{1,2} Rate: (0.2 to 10) kHz Rate: (0.2 to 20) kHz	(0.15 to 10) MHz (0.01 to 26.5) GHz	4.6 % + 1 LSD 3.5 % + 1 LSD	HP 8902A HP 8902A, HP 11793A Measuring Receiver Microwave Converter

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ³	Reference Standard, Method, and/or Equipment
Micrometers ¹	(0 to 0.45) in (0.45 to 1) in (1 to 4) in (4 to 40) in	(7 + 13L) μin (5 + 22L) μin (19 + 20L) μin (10 + 22L) μin	Grade 2 Gage Blocks
Anvil Flatness ¹	Up to 1in	6.3 μin	Optical Flats
Calipers ¹	(0 to 0.45) in (0.45 to 1) in (1 to 4) in (4 to 40) in	(7 + 13L) μin (5 + 22L) μin (19 + 20L) μin (10 + 22L) μin	Grade 2 Gage Blocks
Jaw Parallelism ¹	Up to 1 in	7.2 μin	Pin Gage
Height Gages	(0 to 0.45) in (0.45 to 1) in (1 to 4) in (4 to 40) in	(7 + 13L) μin (5 + 22L) μin (19 + 20L) μin (10 + 22L) μin	Grade 2 Gage Blocks
Length Single Axis	(0 to 10) in	(7 + 22L) μin	Supermicrometer

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ³	Reference Standard, Method, and/or Equipment
Plain Plug and Pin Gages	Up to 1 in	29 μin	P&W Model C Supermicrometer, Grade 2 Gage Blocks
Threaded Plug Gage Outer Pitch Diameter, 60°	(0 to 6) in	(60 + 20L) μin	Supermicrometer w/Wires
Major Diameter	(0 to 6) in	(7 + 22L) μin	Supermicrometer Grade 2 Gage Blocks
Rulers and Tapes	0 in to 100 ft	0.001 7 in	Magnified Glass Rule
Surface Plates ¹ (Local Area Flatness Only)	Up to 18 in	120 μin	Repeat-o-meter
Surface Parallelism ¹	Up to 18 in	120 μin	Gage Amplifier and Surface Plate
Surface Straightness	Up to 18 in	120 μin	Height Gage, Granite Square and Surface Plate

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Force - Source ¹	(0.1 to 1 000) lbf	0.024 % + 0.001 lbf	Class F Weights
Torque Wrenches ¹	(0.2 to 10) Nm (0.4 to 20) Nm (2 to 100) Nm	1 % 1 % 1 %	Stahlwille 7721 Stahlwille 7721-1 Stahlwille 7722
Torque Wrenches ¹	(4 to 200) Nm (8 to 400) Nm (25 to 1 100) Nm (900 to 2 000) lbf·ft	1 % 1 % 1 % 1.5 %	Stahlwille 7723-1 Stahlwille 7723-2 Stahlwille 7723-3 CDI 200-14-02
Torque Transducers ¹	0.156 lbf·in to 150 lbf·ft	0.17 %	Wheels /Arms / Class F masses
Absolute, Pneumatic Pressure - Source and Measure ¹	(0 to 15) psia	0.001 5 psia	Mensor CPC6000
	(15 to 30) psia	0.01 %	
	(30 to 50) psia	0.005 % + 0.006 1 psia	Fluke 6270A

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Absolute, Pneumatic Pressure - Source and Measure ¹	(50 to 300) psia	0.004 5 % + 0.006 4 psia	Fluke PPC4
	(300 to 1000) psia	0.005 2 % + 0.001 5 psia	
Gauge, Pneumatic Pressure - Source and Measure ¹	(-14.7 to 0) psi	0.006 2 % + 0.000 1 psi	Fluke PPC4
	(0 to 1) psi	0.000 1 psi	Mensor CPC6000
	(1 to 1 000) psi	0.006 2 % + 0.000 1 psi	Fluke PPC4
Gauge, Hydraulic Pressure - Source and Measure ¹	(10 to 800) psig	0.025 % + 0.005 psi	Fluke P3125-DWT
	(800 to 16 000) psig	0.02 % + 0.095 psi	
Scales and Balances ¹ Metric	5 kg 2 kg 1kg 500 g 200 g 100 g 50 g 20 g 10 g 5 g 2 g 1g	14 mg 6 mg 3.1 mg 1.4 mg 0.59 mg 0.31 mg 0.15 mg 93 µg 68 µg 42 µg 42 µg 42 µg	ASTM Class 1 Masses
Scales and Balances ¹ Avoirdupois	50 lb	5.9 mlb	ASTM Class 1 Masses
	20 lb	2.3 mlb	
Scales and Balances ¹ Avoirdupois	10 lb 5 lb 2 lb 1 lb 0.5 lb 0.2 lb 0.1 lb 0.05 lb 0.02 lb 0.01 lb 0.005 lb 0.002 lb 0.001 lb	1.2 mlb 590 µlb 230 µlb 180 µlb 120 µlb 46 µlb 23 µlb 12 µlb 4.6 µlb 3.8 µlb 3.1 µlb 2.2 µlb 1.8 µlb	ASTM Class 1 Masses

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-) ²	Reference Standard, Method, and/or Equipment
Temperature Source ¹	(-80 to 100) °C (100 to 200) °C (200 to 400) °C (400 to 600) °C	0.033 °C 0.052 °C 0.074 °C 0.12 °C	Microbath Fluke 7103 Drywell Fluke 9173 Monitored with Hart 5628
Temperature - Measure ¹	(-195 to 0) °C (0 to 420) °C (420 to 660) °C	0.011 °C + 0.001 % 0.026 °C + 0.001 % 0.036 °C + 0.001 %	Fluke 5626 with 1523
Humidity Measure ¹	(10 to 90) %RH	1.3 %RH	Vaisala MI70/HMP76B Datalogger
IR Temperature – Source ¹	(-15 to 0) °C (0 to 50) °C (50 to 100) °C (100 to 120) °C (120 to 200) °C (200 to 350) °C (350 to 500) °C	0.8 °C 0.65 °C 0.7 °C 0.76 °C 0.94 °C 1.6 °C 2.1 °C	Fluke 4180 Fluke 4181

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Reference ¹	10 MHz	640 pHz/Hz	Rubidium Oscillator
Frequency – Measure ¹	0.01 Hz to 100 kHz 100 kHz to 10 MHz (10 to 100) MHz (100 to 225) MHz 225 MHz to 1 GHz (1 to 10) GHz (10 to 50) GHz	0.0048 Hz 0.45 Hz 4.5 Hz 10 Hz 0.86 Hz 7.5 Hz 37 Hz	HP 53132A w/Rb Oscillator Agilent E4448A w/Rb Oscillator Counter Spectrum Analyzer
	0.01 Hz to 2 MHz	2 μHz/Hz + 8 μHz	Fluke 5520A SC1100 Multiproduct Calibrator
Frequency – Source ¹	0.01 Hz to 100 kHz 100 kHz to 20 MHz	0.002 Hz 0.18 Hz	HP 3325B w/Rb Oscillator Synthesized Function Generator
	250 kHz to 1 GHz (10 to 50) GHz	0.74 Hz 37 Hz	Agilent E8257D w/Rb Oscillator Signal Generator

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source ¹	0.01 Hz to 2 MHz	2 μ Hz/Hz + 8 μ Hz	Fluke 5520A SC1100 Multiproduct Calibrator
Stopwatches /Timers ¹	Up to 24 hours	5.8 ms	Fluke 5520A SC1100 with Keysight 53132 Opt 10 Multiproduct Calibrator Counter
Tachometers ¹	(60 to 99 999) rpm	0.58 rpm	Fluke 5520A SC1100 with Keysight 53132 Opt 10 Multiproduct Calibrator Counter

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. % = percent of reading unless indicated otherwise.
3. t = time in seconds, L = length in inches.
4. The stated uncertainty is the laboratory's ability to source a fast rise pulse that is approximately 250 ps. In the typical application of measuring rise time of an oscilloscope, this value is one of the contributing factors, but other factors are derived from the DUT. The known source rise time is mathematically removed from the total measured rise time measured on the DUT.
5. The CMC is only valid at the upper limit of the measurement range and at 1 kHz. The laboratory calculates uncertainties at other values in the range using the IET 1689 Limits of Error Calculation Tool
6. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2489.15.



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