



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Transcat - Houston
16115 Park Row
Houston, TX 77084

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 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-2489.02



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 Z540.3-2006 (R2013)**

Transcat - Houston
16115 Park Row
Houston, TX 77084
Scott Caine 713-465-4399

CALIBRATION

Valid to: **September 7, 2021**

Certificate Number: **AC-2489.02**

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Source/Measure	Up to 1 pA (1 to 10) pA (10 to 100) pA (0.1 to 1) nA (1 to 10) nA (10 to 100) nA (0.1 to 1) μ A (1 to 10) μ A	1.4 % of reading + 7 fA 0.53 % of reading + 7 fA 0.18 % of reading + 3 fA 0.059 % of reading + 0.2 pA 0.057 % of reading + 2 pA 0.056 % of reading + 20 pA 0.054 % of reading + 0.3 nA 0.05 % of reading + 2 nA	Keithley 6430 Sub-femtoamp Remote SourceMeter
DC Current – Source/Measure	Up 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 (0.1 to 1) A (1 to 10) A (10 to 20) A (20 to 30) A (30 to 100) A	1.5 pA 21 μ A/A 7.2 μ A/A 6.5 μ A/A 2.8 μ A/A 5.1 μ A/A 2 μ A/A 2.4 μ A/A 4.8 μ A/A 4 μ A/A 10 μ A/A 36 μ A/A	Standard Shunts, Current Source
DC Current – Source/Measure ¹	Up to 100 μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 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 0.13 mA/A + 12 μ A	HP 3458A opt 002 8.5 Digit Multimeter, Current Source

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measure ¹	(1 to 3) A (3 to 10) A	0.12 % of reading + 1.2 mA 0.18 % of reading + 1.3 mA	Fluke 8846A 6.5 Digit Multimeter
	(10 to 100) A	0.15 mA/A + 2 mA	Ohms Labs CS-100 Precision Shunt, Agilent 3458A 8.5 Digit Multimeter
DC Clamp-on Ammeters (Non-Toroidal Type) Transformer Type Sensor ¹	(20 to 150) A (150 to 1 000) A (1 000 to 5 000) A	0.51 % of reading + 0.14 A 0.51 % of reading + 0.5 A 0.58 % of reading	Fluke 5520A Multiproduct Calibrator, Fluke 5500A/COIL, Fluke 55120A Transconductance Amplifier, 1 kA and 6 kA Coils
AC Current – Source ¹	Up 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 (0.22 to 2.2) A 20 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.032 % of reading + 16 nA 0.019 % of reading + 10 nA 0.015 % of reading + 8 nA 0.03 % of reading + 12 nA 0.11 % of reading + 65 nA 0.03 % of reading + 40 nA 0.018 % of reading + 35 nA 0.014 % of reading + 35 nA 0.021 % of reading + 0.11 μ A 0.11 % of reading + 0.65 μ A 0.039 % of reading + 0.4 μ A 0.019 % of reading + 0.35 μ A 0.014 % of reading + 0.35 μ A 0.021 % of reading + 0.55 μ A 0.11 % of reading + 5 μ A 0.033 % of reading + 4 μ A 0.018 % of reading + 3.5 μ A 0.014 % of reading + 2.5 μ A 0.021 % of reading + 3.5 μ A 0.11 % of reading + 10 μ A 0.027 % of reading + 35 μ A 0.046 % of reading + 80 μ A 0.7 % of reading + 0.16 mA	Fluke 5720A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source ¹	(2.2 to 11) A 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	0.048 % of reading + 0.17 mA 0.096 % of reading + 0.38 mA 0.36 % of reading + 0.75 mA	Fluke 5720A Multiproduct Calibrator, Fluke 5725A Amplifier
	(11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	0.097 % of reading + 3.8 mA 0.12 % of reading + 3.8 mA 2.3 % of reading + 3.8 mA	Fluke 5520A Multiproduct Calibrator
AC Current – Source ¹ (Extended Frequency Ranges)	(29 to 330) μ A (10 to 30) kHz	1.2 % of reading + 0.31 μ A	Fluke 5520A Multiproduct Calibrator
	(0.33 to 3.3) mA (10 to 30) kHz	0.78 % of reading + 0.47 μ A	
	(3.3 to 33) mA (10 to 30) kHz	0.31 % of reading + 3.1 μ A	
	(29 to 330) mA (10 to 30) kHz	0.31 % of reading + 0.16 mA	
AC Clamp-on Ammeter (Toroidal Type) Transformer Type Sensor ¹	(20 to 150) A (45 to 65) Hz (65 to 440) Hz	0.3 % of reading + 26 mA 0.83 % of reading + 47 mA	Fluke 5520A Multiproduct Calibrator, 1 kA Coil
	(150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	0.35 % of reading + 0.12 A 1.1 % of reading + 0.22 A	
AC Clamp-on Ammeter (Non-Toroidal Type) Hall Effect Sensor ¹	(20 to 150) A (45 to 65) Hz (65 to 440) Hz	0.57 % of reading + 0.25 A 1 % of reading + 0.25 A	Fluke 5520A Multiproduct Calibrator, 1 kA Coil
	(150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	0.6 % of reading + 0.9 A 1.3 % of reading + 0.92 A	
	(1 to 6) kA (10 to 300) Hz	0.62 % of reading	Fluke 5520A Multiproduct Calibrator, Fluke 55120A Transconductance Amplifier, 6 kA Coil
	(1 to 2) kA (300 to 440) Hz (2 to 6) kA (300 to 440) Hz	0.8 % of reading 0.66 % of reading	

Electrical – DC/Low Frequency

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 to 100) Hz 100 Hz to 1 kHz	0.46 % of reading + 23 nA 0.17 % of reading + 23 nA 0.071 % of reading + 23 nA 0.037 % of reading + 23 nA	Agilent 3458A Opt 002 8.5 Digit Multimeter		
	(0.1 to 1) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % of reading + 0.23 μ A 0.17 % of reading + 0.23 μ A 0.071 % of reading + 0.23 μ A 0.038 % of reading + 0.23 μ A			
	(1 to 10) mA (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % of reading + 2.3 μ A 0.17 % of reading + 2.3 μ A 0.071 % of reading + 2.3 μ A 0.038 % of reading + 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	0.48 % of reading + 23 μ A 0.17 % of reading + 23 μ A 0.071 % of reading + 23 μ A 0.038 % of reading + 23 μ A			
	(0.1 to 1) A (10 to 20) Hz (20 to 45) Hz (45 to 100) Hz 100 Hz to 5 kHz	0.46 % of reading + 0.23 mA 0.19 % of reading + 0.23 mA 0.097 % of reading + 0.23 mA 0.12 % of reading + 0.23 mA			
	(1 to 3) A 10 Hz to 5 kHz (5 to 10) kHz	0.24 % of reading + 0.1 mA 1.2 % of reading + 0.1 mA		Fluke 8846A 6.5 Digit Multimeter	
	(3 to 10) A 10 Hz to 5 kHz	0.81 % of reading + 0.4 mA			
	10 A to 100 A (50 to 60) Hz 400 Hz 1 kHz	0.22 mA/A + 5 mA 0.26 mA/A + 5 mA 1.1 mA/A + 1.3 mA		Agilent 3458A opt 002 8.5 Digit Multimeter, Ohms Lab CS-100 Current Shunt	
	DC Voltage – Source/Measure (Fixed Points)	0 V (floor)		59 nV	Ratio Metric with Zener
		100 mV		0.8 μ V/V	
		1 V		0.29 μ V/V	
		10 V		0.2 μ V/V	
19 V		0.46 μ V/V			
100 V		0.28 μ V/V			
1 000 V	0.54 μ V/V				



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source/Measure (Fixed Points)	10 mV < V < 100 mV 100 mV < V ≤ 1 000V	8.6 μV/V 7.4 μV/V + 59 nV	Fluke 8508 8.5 Digit Multimeter, Ratio Metric with Zener
DC Voltage – Measure (Fixed Points)	1 mV ≤ V < 10 mV 10 mV	100 μV/V 13 μV/V	Fluke 8508 8.5 Digit Multimeter
DC Voltage – Source/Measure ¹ (Variable Points)	(0 to 100) mV (0.1 to 10) V (10 to 100) V (100 to 500) V (500 to 800) V (800 to 1 000) V	8.3 μV/V + 0.58 μV 5.3 μV/V + 0.58 μV 7.6 μV/V + 35 μV 14 μV/V + 0.12 mV 18 μV/V + 0.12 mV 21 μV/V + 0.12 mV	Agilent 3458A opt 002 8.5 Digit Multimeter, Fluke 5720A Multiproduct Calibrator
DC Voltage – Source	1 mV 10 mV 100 mV 1 V 10 V 100 V	2.6 % of reading 0.68 % of reading 0.052 % of reading 0.006 4 % of reading 0.027 % of reading 0.026 % of reading	Fluke 9500B Oscilloscope Calibrator, Fluke 9530 Active Head
DC High Voltage – Measure ¹	(1 to 10) kV	0.049 % of reading + 0.62 V	Vitrek 4700 High Voltage Meter
	(10 to 20) kV (20 to 35) kV	0.08 % of reading + 0.35 V 0.14 % of reading + 1 V	Vitrek 4700 High Voltage Meter, Vitrek HVP-35 High Voltage Probe
	(15 to 30) kV (30 to 45) kV (45 to 70) kV	0.065 % of reading + 1 V 0.09 % of reading + 3 V 0.17 % of reading + 1 V	Vitrek 4700 High Voltage Meter, Vitrek HVL-70 High Voltage Probe
	(25 to 100) kV	0.11 % of reading + 0.5 V	Vitrek 4700 High Voltage Meter, HVL-100 High Voltage Probe
AC Voltage – Source 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	0.16 % of reading + 4 μV 0.1 % of reading + 4 μV 0.078 % of reading + 4 μV 0.13 % of reading + 4 μV 0.17 % of reading + 5 μV 0.33 % of reading + 10 μV 0.47 % of reading + 20 μV 0.58 % of reading + 20 μV	Fluke 5720A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(2.2 to 22) mV		Fluke 5720A Multiproduct Calibrator
	(10 to 20) Hz	0.042 % of reading + 4 μV	
	(20 to 40) Hz	0.03 % of reading + 4 μV	
	40 Hz to 20 kHz	0.014 % of reading + 4 μV	
	(20 to 50) kHz	0.03 % of reading + 4 μV	
	(50 to 100) kHz	0.058 % of reading + 5 μV	
	(100 to 300) kHz	0.12 % of reading + 10 μV	
	(300 to 500) kHz	0.16 % of reading + 20 μV	
	500 kHz to 1 MHz	0.27 % of reading + 20 μV	
	(22 to 220) mV		
	(10 to 20) Hz	0.028 % of reading + 12 μV	
	(20 to 40) Hz	0.011 % of reading + 7 μV	
	40 Hz to 20 kHz	0.008 5 % of reading + 7 μV	
	(20 to 50) kHz	0.021 % of reading + 7 μV	
	(50 to 100) kHz	0.047 % of reading + 17 μV	
	(100 to 300) kHz	0.091 % of reading + 20 μV	
	(300 to 500) kHz	0.14 % of reading + 25 μV	
	500 kHz to 1 MHz	0.28 % of reading + 45 μV	
	(0.22 to 2.2) V		
	(10 to 20) Hz	0.027 % of reading + 40 μV	
	(20 to 40) Hz	0.01 % of reading + 15 μV	
	40 Hz to 20 kHz	0.004 8 % of reading + 8 μV	
	(20 to 50) kHz	0.008 % of reading + 10 μV	
	(50 to 100) kHz	0.012 % of reading + 30 μV	
	(100 to 300) kHz	0.043 % of reading + 80 μV	
	(300 to 500) kHz	0.1 % of reading + 0.2 mV	
	500 kHz to 1 MHz	0.18 % of reading + 0.3 mV	
	(2.2 to 22) V		
	(10 to 20) Hz	0.028 % of reading + 0.4 mV	
	(20 to 40) Hz	0.01 % of reading + 0.15 mV	
	40 Hz to 20 kHz	0.004 9 % of reading + 50 μV	
	(20 to 50) kHz	0.008 3 % of reading + 0.1 mV	
	(50 to 100) kHz	0.012 % of reading + 0.2 mV	
	(100 to 300) kHz	0.03 % of reading + 0.6 mV	
	(300 to 500) kHz	0.1 % of reading + 2 mV	
	500 kHz to 1 MHz	0.17 % of reading + 3.2 mV	
(22 to 220) V			
(10 to 20) Hz	0.028 % of reading + 4 mV		
(20 to 40) Hz	0.01 % of reading + 1.5 mV		
40 Hz to 20 kHz	0.005 6 % of reading + 0.6 mV		
(20 to 50) kHz	0.009 3 % of reading + 1 mV		
(50 to 100) kHz	0.016 % of reading + 2.5 mV		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source ¹	(22 to 220) V (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (220 to 750) V (30 to 50) kHz (50 to 100) kHz (220 to 1 100) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	0.09 % of reading + 16 mV 0.44 % of reading + 40 mV 0.8 % of reading + 40 mV 0.061 % of reading + 11 mV 0.23 % of reading + 45 mV 0.011 % of reading + 4 mV 0.017 % of reading + 6 mV 0.061 % of reading + 11 mV	Fluke 5720A Multiproduct Calibrator
AC Voltage – Measure ¹	Up 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 to 300) kHz (0.3 to 1) MHz (1 to 4) 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	0.04 % of reading + 3.5 μV 0.03 % of reading + 1.2 μV 0.04 % of reading + 1.2 μV 0.15 % of reading + 1.2 μV 0.59 % of reading + 1.2 μV 4.6 % of reading + 2.3 μV 1.5 % of reading + 5.8 μV 8.1 % of reading + 8.1 μV 0.013 % of reading + 4.6 μV 0.009 7 % of reading + 2.3 μV 0.017 % of reading + 2.3 μV 0.037 % of reading + 2.3 μV 0.093 % of reading + 2.3 μV 0.36 % of reading + 12 μV 1.2 % of reading + 12 μV 1.8 % of reading + 12 μV 4.7 % of reading + 81 μV 4.7 % of reading + 92 μV 17 % of reading + 0.12 mV 0.008 8 % of reading + 46 μV 0.008 3 % of reading + 23 μV 0.017 % of reading + 23 μV 0.036 % of reading + 23 μV 0.093 % of reading + 23 μV 0.35 % of reading + 0.12 mV 1.2 % of reading + 0.12 mV	Agilent 3458A opt 002 8.5 Digit Multimeter

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure ¹	(0.1 to 1) V		Agilent 3458A opt 002 8.5 Digit Multimeter
	(1 to 2) MHz	1.8 % of reading + 0.12 mV	
	(2 to 4) MHz	4.6 % of reading + 81 μV	
	(4 to 8) MHz	4.6 % of reading + 0.92 μV	
	(8 to 10) MHz	17 % of reading + 1.2 mV	
	(1 to 10) V		
	(1 to 40) Hz	0.009 5 % of reading + 0.46 mV	
	40 Hz to 1 kHz	0.023 % of reading + 0.23 mV	
	(1 to 20) kHz	0.017 % of reading + 0.23 mV	
	(20 to 50) kHz	0.036 % of reading + 0.23 mV	
	(50 to 100) kHz	0.093 % of reading + 0.23 mV	
	(100 to 300) kHz	0.35 % of reading + 1.2 mV	
	300 kHz to 1 MHz	1.2 % of reading + 1.2 mV	
	(1 to 2) MHz	1.8 % of reading + 1.2 mV	
	(2 to 4) MHz	4.6 % of reading + 8.1 mV	
	(4 to 8) MHz	4.6 % of reading + 9.2 mV	
	(8 to 10) MHz	17 % of reading + 12 mV	
	(10 to 100) V		
	(1 to 40) Hz	0.024 % of reading + 4.6 mV	
	40 Hz to 1 kHz	0.024 % of reading + 2.3 mV	
(1 to 20) kHz	0.024 % of reading + 2.3 mV		
(20 to 50) kHz	0.041 % of reading + 2.3 mV		
(50 to 100) kHz	0.14 % of reading + 2.3 mV		
(100 to 300) kHz	0.46 % of reading + 12 mV		
300 kHz to 1 MHz	1.7 % of reading + 12 mV		
(100 to 700) V			
(1 to 40) Hz	0.047 % of reading + 46 mV		
40 Hz to 1 kHz	0.047 % of reading + 23 mV		
(1 to 20) kHz	0.071 % of reading + 23 mV		
(20 to 50) kHz	0.19 % of reading + 23 mV		
(50 to 100) kHz	0.35 % of reading + 23 mV		
AC High Voltage – Measure ¹	(0.7 to 10) kV 60 Hz	0.17 % of reading + 0.16 V	Vitrek 4700 High Voltage Meter
	(10 to 20) kV 60 Hz	0.17 % of reading + 0.6 V	Vitrek 4700 High Voltage Meter,
	(20 to 35) kV 60 Hz	0.23 % of reading + 3.5 V	Vitrek HVP-35 High Voltage Probe
	(12.5 to 25) kV 60 Hz	0.15 % of reading + 1.4 V	Vitrek 4700 High Voltage Meter,
	(25 to 37.5) kV 60 Hz	0.16 % of reading + 2.8 V	Vitrek HVL-70 High Voltage Probe

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC High Voltage – Measure ¹	(37.5 to 50) kV 60 Hz	0.2 % of reading + 0.2 V	Vitrek 4700 High Voltage Meter, Vitrek HVL-70 High Voltage Probe
	(25 to 75) kV 60 Hz	0.19 % of reading + 3.5 V	Vitrek 4700 High Voltage Meter, HVL-100 High Voltage Probe
Capacitance – Source ¹ (Simulation)	10 Hz to 10 kHz (0.19 to 3.3) pF	0.39 % of reading + 7.8 pF	Fluke 5520A Multiproduct Calibrator
	10 Hz to 1 kHz (3.3 to 11) nF	0.21 % of reading + 7.8 pF	
	(11 to 110) nF	0.21 % of reading + 78 pF	
	(110 to 330) nF	0.21 % of reading + 0.23 nF	
	(10 to 600) Hz (0.33 to 1.1) μF	0.2 % of reading + 0.78 nF	
	(10 to 300) Hz (1.1 to 3.3) μF	0.2 % of reading + 2.3 nF	
	(10 to 150) Hz (3.3 to 11) μF	0.2 % of reading + 7.8 nF	
	(10 to 120) Hz (11 to 33) μF	0.31 % of reading + 23 nF	
	(10 to 80) Hz (33 to 110) μF	0.35 % of reading + 78 nF	
	DC to 50 Hz (110 to 330) μF	0.35 % of reading + 0.23 μF	
	DC to 20 Hz (0.33 to 1.1) mF	0.35 % of reading + 0.78 μF	
	DC to 6 Hz (1.1 to 3.3) mF	0.35 % of reading + 2.3 μF	
	DC to 2 Hz (3.3 to 11) mF	0.35 % of reading + 7.8 μF	
	DC to 0.6 Hz (11 to 33) mF	0.58 % of reading + 23 μF	
DC to 0.2 Hz (33 to 110) mF	0.85 % of reading + 78 μF		
Capacitance – Measure ¹ 10 Hz to 1 MHz (Fixed Points)	0.33 mF	0.048 % of reading	Time/Charge Method utilizing the HP 3458A 8.5 Digit Multimeter.
	0.8 mF	0.027 % of reading	
	1 mF	0.024 % of reading	
	1.2 mF	0.023 % of reading	
	3 mF	0.018 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure ¹ 10 Hz to 1 MHz (Fixed Points)	3.3 mF	0.017 % of reading	Time/Charge Method utilizing the HP 3458A 8.5 Digit Multimeter.
	8 mF	0.016 % of reading	
	10 mF	0.016 % of reading	
	12 mF	0.016 % of reading	
	30 mF	0.015 % of reading	
	80 mF	0.014 % of reading	
	100 mF	0.014 % of reading	
Capacitance – Measure 10 Hz to 1 MHz (Fixed Points)	0.1 pF		Agilent E4980A LCR Meter
	100 kHz	1.4 % of reading	
	1 MHz	1.8 % of reading	
	1 pF		
	10 kHz	1.4 % of reading	
	100 kHz	0.37 % of reading	
	1 MHz	0.44 % of reading	
	2 MHz	1.1 % of reading	
	10 pF		
	1 kHz	1.4 % of reading	
	10 kHz	0.28 % of reading	
	100 kHz	0.28 % of reading	
	1 MHz	0.3 % of reading	
	2 MHz	0.75 % of reading	
	100 pF		
	100 Hz	2.1 % of reading	
	1 kHz	0.23 % of reading	
	10 kHz	0.17 % of reading	
	100 kHz	0.21 % of reading	
	1 MHz	0.23 % of reading	
	2 MHz	0.3 % of reading	
	1 nF		
	20 Hz	1.8 % of reading	
	100 Hz	0.3 % of reading	
	1 kHz	0.1 % of reading	
	10 kHz	0.1 % of reading	
	100 kHz	0.1 % of reading	
	1 MHz	0.14 % of reading	
2 MHz	0.53 % of reading		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Capacitance – Measure 10 Hz to 1 MHz (Fixed Points)	10 nF		Agilent E4980A LCR Meter
	20 Hz	0.31 % of reading	
	100 Hz	0.12 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.092 % of reading	
	1 MHz	0.25 % of reading	
	2 MHz	0.67 % of reading	
	100 nF		
	20 Hz	0.16 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.18 % of reading	
	1 MHz	0.33 % of reading	
	2 MHz	0.97 % of reading	
	1 μF		
	20 Hz	0.15 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.18 % of reading	
	100 kHz	0.25 % of reading	
	1 MHz	0.79 % of reading	
	10 μF		
	20 Hz	0.15 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.16 % of reading	
	10 kHz	0.28 % of reading	
100 kHz	0.73 % of reading		
100 μF			
20 Hz	0.16 % of reading		
100 Hz	0.17 % of reading		
1 kHz	0.29 % of reading		
10 kHz	0.8 % of reading		
DC Resistance – Source/Measure	Up to 100 μΩ (0.1 Ω to 1) mΩ (1 to 10) mΩ (10 to 100) mΩ (0.1 to 1) Ω	0.63 nΩ 6.1 μΩ/Ω 7.2 μΩ/Ω 2.5 μΩ/Ω 4.4 μΩ/Ω	Standard Resistors, Current Source, Digital Multimeter



ANSI National Accreditation Board

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Resistance – Source/Measure	(1 to 10) Ω	0.41 $\mu\Omega/\Omega$	Standard Resistors, MI 6242B Resistance Bridge
	(10 to 100) Ω	0.67 $\mu\Omega/\Omega$	
	(0.1 to 1) k Ω	0.82 $\mu\Omega/\Omega$	
	(1 to 10) k Ω	2.4 $\mu\Omega/\Omega$	
	(10 to 100) k Ω	0.29 $\mu\Omega/\Omega$	
	(0.1 to 1) M Ω	1.4 $\mu\Omega/\Omega$	
	(1 to 10) M Ω	16 $\mu\Omega/\Omega$	
	(10 to 100) M Ω	19 $\mu\Omega/\Omega$	
Resistance Ratio	1 Ω to 1 k Ω	0.16 $\mu\Omega/\Omega$	MI 6242B Resistance Bridge
DC Resistance – Source/Measure ¹	Up to 10 Ω	18 $\mu\Omega/\Omega$ + 58 $\mu\Omega$	Agilent 3458A opt 002 8.5 Digit Multimeter, Decade Resistor
	(10 to 100) Ω	15 $\mu\Omega/\Omega$ + 0.58 m Ω	
	(0.1 to 1) k Ω	12 $\mu\Omega/\Omega$ + 0.58 m Ω	
	(1 to 10) k Ω	12 $\mu\Omega/\Omega$ + 5.8 m Ω	
	(10 to 100) k Ω	12 $\mu\Omega/\Omega$ + 58 m Ω	
	(0.1 to 1) M Ω	20 $\mu\Omega/\Omega$ + 2.3 Ω	
	(1 to 10) M Ω	62 $\mu\Omega/\Omega$ + 0.12 k Ω	
	(10 to 100) M Ω	0.59 m Ω/Ω + 1.2 k Ω	
	(0.1 to 1) G Ω	0.82 % of reading + 12 k Ω	
		(1 to 10) G Ω	
	(10 to 100) G Ω	0.074 % of reading + 0.1 M Ω	Keithley 6430 Sub-Femtoamp Remote Sourcemeter, Voltage Source
	(0.1 to 1) T Ω	0.075 % of reading + 1 M Ω	
	(1 to 10) T Ω	0.19 % of reading + 10 M Ω	
	(10 to 100) T Ω	0.59 % of reading + 0.1 G Ω	
DC Resistance – Source	10 M Ω	19 $\mu\Omega/\Omega$	Standard Resistors
	100 M Ω	30 $\mu\Omega/\Omega$	
	1 G Ω	53 $\mu\Omega/\Omega$	
DC Resistance – Source ¹	(10 to 100) M Ω	0.08 % of reading	IET HRRS-B-7-100k-5kV High Resistance Substituter
	(0.1 to 1) G Ω	0.25 % of reading	
	(1 to 10) G Ω	0.41 % of reading	
	(10 to 100) G Ω	0.84 % of reading	
	(0.1 to 1) T Ω	2.5 % of reading	
DC Resistance – Measure	(0.1 to 1) G Ω	32 $\mu\Omega/\Omega$	Double Substitution Method using Standard Resistors and Fluke 8508 8.5 Digit Multimeter.
	(1 to 20) G Ω	0.14 m Ω/Ω	
Inductance – Source ¹ (Artifacts)	100 mH	0.02 % of reading	Standard Inductor
	1 kHz		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Source ¹ (Artifacts)	1 μ H		Standard Inductors
	10 kHz	1.6 % of reading	
	100 kHz	0.36 % of reading	
	1 MHz	0.27 % of reading	
	2 MHz	0.66 % of reading	
	10 μ H		
	10 kHz	0.37 % of reading	
	100 kHz	0.2 % of reading	
Inductance – Measure ³	100 μ H		Agilent E4980A LCR Meter
	1 kHz	0.4 % of reading	
	10 kHz	0.2 % of reading	
	100 kHz	0.12 % of reading	
	1 MHz	0.14 % of reading	
	2 MHz	0.72 % of reading	
	1 mH		
	100 Hz	0.55 % of reading	
	1 kHz	0.18 % of reading	
	10 kHz	0.12 % of reading	
	100 kHz	0.092 % of reading	
	1 MHz	0.23 % of reading	
	2 MHz	0.88 % of reading	
	10 mH		
	20 Hz	0.85 % of reading	
	100 Hz	0.22 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.1 % of reading	
	1 MHz	0.35 % of reading	
	2 MHz	1.3 % of reading	
	100 mH		
	20 Hz	0.28 % of reading	
	100 Hz	0.1 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.21 % of reading	
	1 MHz	0.88 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ³	1 H		Agilent E4980A LCR Meter
	20 Hz	0.16 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.1 % of reading	
	100 kHz	0.31 % of reading	
	10 H		
	20 Hz	0.15 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.1 % of reading	
	10 kHz	0.21 % of reading	
	100 kHz	0.69 % of reading	
	100 H		
	20 Hz	0.15 % of reading	
	100 Hz	0.1 % of reading	
1 kHz	0.15 % of reading		
10 kHz	0.62 % of reading		
Impedance – Measure ³	0.1 Ω		Agilent E4980A LCR Meter
	1 kHz	1.8 % of reading	
	10 kHz	1.6 % of reading	
	100 kHz	1 % of reading	
	1 MHz	1.5 % of reading	
	1 Ω		
	20 Hz	0.67 % of reading	
	100 Hz	0.43 % of reading	
	1 kHz	0.33 % of reading	
	10 kHz	0.32 % of reading	
	100 kHz	0.31 % of reading	
	1 MHz	0.38 % of reading	
	2 MHz	0.92 % of reading	
	10 Ω		
	20 Hz	0.29 % of reading	
	100 Hz	0.2 % of reading	
	1 kHz	0.17 % of reading	
	10 kHz	0.19 % of reading	
	100 kHz	0.19 % of reading	
	1 MHz	0.27 % of reading	
	2 MHz	0.67 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Impedance – Measure ³	100 Ω		Agilent E4980A LCR Meter
	20 Hz	0.16 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.12 % of reading	
	100 kHz	0.12 % of reading	
	1 MHz	0.2 % of reading	
	2 MHz	0.53 % of reading	
	1 k Ω		
	20 Hz	0.15 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.092 % of reading	
	1 MHz	0.14 % of reading	
	2 MHz	0.3 % of reading	
	10 k Ω		
	20 Hz	0.15 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.1 % of reading	
	1 MHz	0.29 of reading	
	2 MHz	0.87 of reading	
	100 k Ω		
	20 Hz	0.17 % of reading	
	100 Hz	0.1 % of reading	
	1 kHz	0.1 % of reading	
10 kHz	0.17 % of reading		
100 kHz	0.28 % of reading		
1 MHz	0.38 % of reading		
2 MHz	1.3 % of reading		
Flatness Relative to 1 kHz 7 V / 3.2 V	10 Hz	0.009 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.008% of reading	
	50 Hz	0.006 % of reading	
	105 Hz	0.007 % of reading	
	200 Hz	0.006 % of reading	
	2 kHz	0.006 % of reading	
	10 kHz	0.006 % of reading	
	20 kHz	0.008 % of reading	
	50 kHz	0.007 % of reading	
	100 kHz	0.007 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 7 V / 3.2 V	200 kHz	0.007 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	500 kHz	0.009 % of reading	
	700 kHz	0.013 % of reading	
	1 MHz	0.016 % of reading	
	1.2 MHz	0.016 % of reading	
	2 MHz	0.021 % of reading	
	3 MHz	0.024 % of reading	
	4 MHz	0.028% of reading	
	6 MHz	0.031 % of reading	
	8 MHz	0.034 % of reading	
	9 MHz	0.034 % of reading	
	10 MHz	0.034 % of reading	
	12 MHz	0.042 % of reading	
	15 MHz	0.046 % of reading	
	17 MHz	0.052 % of reading	
	20 MHz	0.062 % of reading	
	23 MHz	0.087 % of reading	
	26 MHz	0.1 % of reading	
28 MHz	0.11 % of reading		
30 MHz	0.12 % of reading		
35 MHz	0.15 % of reading		
40 MHz	0.17 % of reading		
45 MHz	0.20 % of reading		
50 MHz	0.25 % of reading		
Flatness Relative to 1 kHz 2.2 V / 2 V	10 Hz	0.012 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.012 % of reading	
	50 Hz	0.007 % of reading	
	105 Hz	0.008 % of reading	
	200 Hz	0.006 % of reading	
	2 kHz	0.007 % of reading	
	10 kHz	0.007 % of reading	
	20 kHz	0.008 % of reading	
	50 kHz	0.007% of reading	
	100 kHz	0.007 % of reading	
	200 kHz	0.007 % of reading	
	500 kHz	0.009 % of reading	
	700 kHz	0.014 % of reading	
	1 MHz	0.017 % of reading	
	1.2 MHz	0.017 % of reading	
2 MHz	0.021 % of reading		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 2.2 V / 2 V	3 MHz	0.026 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	4 MHz	0.029 % of reading	
	6 MHz	0.033 % of reading	
	8 MHz	0.037 % of reading	
	9 MHz	0.036 % of reading	
	10 MHz	0.036 % of reading	
	12 MHz	0.045 % of reading	
	15 MHz	0.049 % of reading	
	17 MHz	0.054 % of reading	
	20 MHz	0.065 % of reading	
	23 MHz	0.045 % of reading	
	26 MHz	0.049 % of reading	
	28 MHz	0.054 % of reading	
	30 MHz	0.065 % of reading	
	35 MHz	0.089 % of reading	
	40 MHz	0.1 % of reading	
45 MHz	0.12 % of reading		
50 MHz	0.12 % of reading		
Flatness Relative to 1 kHz 2.2 V / 1 V	10 Hz	0.014 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.013 % of reading	
	50 Hz	0.008 % of reading	
	105 Hz	0.009 % of reading	
	200 Hz	0.007 % of reading	
	2 kHz	0.007 % of reading	
	10 kHz	0.007 % of reading	
	20 kHz	0.008 % of reading	
	50 kHz	0.007 % of reading	
	100 kHz	0.007 % of reading	
	200 kHz	0.007 % of reading	
	500 kHz	0.009 % of reading	
	700 kHz	0.014 % of reading	
	1 MHz	0.017 % of reading	
	1.2 MHz	0.017 % of reading	
	2 MHz	0.022 % of reading	
	3 MHz	0.027 % of reading	
	4 MHz	0.031 % of reading	
	6 MHz	0.035 % of reading	
8 MHz	0.039 % of reading		
9 MHz	0.04 % of reading		
10 MHz	0.04 % of reading		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 2.2 V / 1 V	12 MHz	0.049 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	15 MHz	0.052 % of reading	
	17 MHz	0.056 % of reading	
	20 MHz	0.066 % of reading	
	23 MHz	0.049 % of reading	
	26 MHz	0.052 % of reading	
	28 MHz	0.056 % of reading	
	30 MHz	0.066 % of reading	
	35 MHz	0.09 % of reading	
	40 MHz	0.11 % of reading	
	45 MHz	0.12 % of reading	
Flatness Relative to 1 kHz 0.7 V / 0.64 V	10 Hz	0.017 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.016 % of reading	
	50 Hz	0.009 % of reading	
	105 Hz	0.01 % of reading	
	200 Hz	0.008 % of reading	
	2 kHz	0.007 % of reading	
	10 kHz	0.007 % of reading	
	20 kHz	0.009 % of reading	
	50 kHz	0.008 % of reading	
	100 kHz	0.008 % of reading	
	200 kHz	0.008 % of reading	
	500 kHz	0.01 % of reading	
	700 kHz	0.015 % of reading	
	1 MHz	0.018 % of reading	
	1.2 MHz	0.018 % of reading	
	2 MHz	0.023 % of reading	
	3 MHz	0.028 % of reading	
	4 MHz	0.032 % of reading	
	6 MHz	0.037 % of reading	
	8 MHz	0.041 % of reading	
9 MHz	0.042 % of reading		
10 MHz	0.042 % of reading		
12 MHz	0.052 % of reading		
15 MHz	0.055 % of reading		
17 MHz	0.059 % of reading		
20 MHz	0.069 % of reading		
23 MHz	0.052 % of reading		
26 MHz	0.055 % of reading		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 0.7 V / 0.64 V	28 MHz 30 MHz 35 MHz 40 MHz 45 MHz 50 MHz	0.059 % of reading 0.069 % of reading 0.093 % of reading 0.11 % of reading 0.12 % of reading 0.13 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
Flatness Relative to 1 kHz 0.7 V / 0.32 V	10 Hz 20 Hz 50 Hz 105 Hz 200 Hz 2 kHz 10 kHz 20 kHz 50 kHz 100 kHz 200 kHz 500 kHz 700 kHz 1 MHz 1.2 MHz 2 MHz 3 MHz 4 MHz 6 MHz 8 MHz 9 MHz 10 MHz 12 MHz 15 MHz 17 MHz 20 MHz 23 MHz 26 MHz 28 MHz 30 MHz	0.014 % of reading 0.014 % of reading 0.008 % of reading 0.008 % of reading 0.007 % of reading 0.008 % of reading 0.007 % of reading 0.009 % of reading 0.008 % of reading 0.008 % of reading 0.008 % of reading 0.010 % of reading 0.015 % of reading 0.017 % of reading 0.018 % of reading 0.022 % of reading 0.028 % of reading 0.031 % of reading 0.034 % of reading 0.038 % of reading 0.038 % of reading 0.038 % of reading 0.049 % of reading 0.053 % of reading 0.060 % of reading 0.071 % of reading 0.049 % of reading 0.053 % of reading 0.06 % of reading 0.071 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 0.7 V / 0.32 V	35 MHz 40 MHz 45 MHz 50 MHz	0.094 % of reading 0.11 % of reading 0.12 % of reading 0.13 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
Flatness Relative to 1 kHz 0.22 V / 0.1 V	10 Hz 20 Hz 50 Hz 105 Hz 200 Hz 2 kHz 10 kHz 20 kHz 50 kHz 100 kHz 200 kHz 500 kHz 700 kHz 1 MHz 1.2 MHz 2 MHz 3 MHz 4 MHz 6 MHz 8 MHz 9 MHz 10 MHz 12 MHz 15 MHz 17 MHz 20 MHz 23 MHz 26 MHz 28 MHz 30 MHz	0.018 % of reading 0.017 % of reading 0.01 % of reading 0.01 % of reading 0.008 % of reading 0.008 % of reading 0.008 % of reading 0.009 % of reading 0.009 % of reading 0.009 % of reading 0.009 % of reading 0.009 % of reading 0.01 % of reading 0.016 % of reading 0.019 % of reading 0.019 % of reading 0.023 % of reading 0.03 % of reading 0.034 % of reading 0.038 % of reading 0.043 % of reading 0.043 % of reading 0.044 % of reading 0.055 % of reading 0.059 % of reading 0.064 % of reading 0.075 % of reading 0.055 % of reading 0.059 % of reading 0.064 % of reading 0.075 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 0.22 V / 0.1 V	35 MHz 40 MHz 45 MHz 50 MHz	0.098 % of reading 0.12 % of reading 0.13 % of reading 0.14 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
Flatness Relative to 1 kHz 0.07 V / 32 mV	10 Hz 20 Hz 50 Hz 105 Hz 200 Hz 2 kHz 10 kHz 20 kHz 50 kHz 100 kHz 200 kHz 500 kHz 700 kHz 1 MHz 1.2 MHz 2 MHz 3 MHz 4 MHz 6 MHz 8 MHz 9 MHz 10 MHz 12 MHz 15 MHz 17 MHz 20 MHz 23 MHz 26 MHz 28 MHz 30 MHz	0.019 % of reading 0.018 % of reading 0.009 % of reading 0.01 % of reading 0.008 % of reading 0.009 % of reading 0.009 % of reading 0.01 % of reading 0.009 % of reading 0.009 % of reading 0.01 % of reading 0.011 % of reading 0.016 % of reading 0.02 % of reading 0.02 % of reading 0.024 % of reading 0.031 % of reading 0.034 % of reading 0.039 % of reading 0.044 % of reading 0.044 % of reading 0.045 % of reading 0.057 % of reading 0.063 % of reading 0.07 % of reading 0.08 % of reading 0.057 % of reading 0.063 % of reading 0.07 % of reading 0.08 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 0.07 V / 32 mV	35 MHz	0.1 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	40 MHz	0.12 % of reading	
	45 MHz	0.13 % of reading	
	50 MHz	0.14 % of reading	
Flatness Relative to 1 kHz 22 mV / 10 mV	10 Hz	0.022 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.021 % of reading	
	50 Hz	0.011 % of reading	
	105 Hz	0.011 % of reading	
	200 Hz	0.009 % of reading	
	2 kHz	0.009 % of reading	
	10 kHz	0.009 % of reading	
	20 kHz	0.01 % of reading	
	50 kHz	0.01 % of reading	
	100 kHz	0.01 % of reading	
	200 kHz	0.01 % of reading	
	500 kHz	0.012 % of reading	
	700 kHz	0.017 % of reading	
	1 MHz	0.021 % of reading	
	1.2 MHz	0.021 % of reading	
	2 MHz	0.025 % of reading	
	3 MHz	0.033 % of reading	
	4 MHz	0.037 % of reading	
	6 MHz	0.043 % of reading	
	8 MHz	0.048 % of reading	
	9 MHz	0.049 % of reading	
	10 MHz	0.05 % of reading	
	12 MHz	0.063 % of reading	
	15 MHz	0.068 % of reading	
	17 MHz	0.073 % of reading	
	20 MHz	0.084 % of reading	
23 MHz	0.063 % of reading		
26 MHz	0.068 % of reading		
28 MHz	0.073 % of reading		
30 MHz	0.084 % of reading		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 22 mV / 10 mV	35 MHz	0.11 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	40 MHz	0.12 % of reading	
	45 MHz	0.14 % of reading	
	50 MHz	0.15 % of reading	
Flatness Relative to 1 kHz 7 mV / 3.2 mV	10 Hz	0.022 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.022 % of reading	
	50 Hz	0.01 % of reading	
	105 Hz	0.011 % of reading	
	200 Hz	0.009 % of reading	
	2 kHz	0.01 % of reading	
	10 kHz	0.01 % of reading	
	20 kHz	0.011 % of reading	
	50 kHz	0.01 % of reading	
	100 kHz	0.01 % of reading	
	200 kHz	0.01 % of reading	
	500 kHz	0.012 % of reading	
	700 kHz	0.018 % of reading	
	1 MHz	0.021 % of reading	
	1.2 MHz	0.021 % of reading	
	2 MHz	0.025 % of reading	
	3 MHz	0.034 % of reading	
	4 MHz	0.036 % of reading	
	6 MHz	0.042 % of reading	
	8 MHz	0.047 % of reading	
	9 MHz	0.048 % of reading	
	10 MHz	0.049 % of reading	
	12 MHz	0.063 % of reading	
	15 MHz	0.069 % of reading	
17 MHz	0.076 % of reading		
20 MHz	0.087 % of reading		
23 MHz	0.063 % of reading		
26 MHz	0.069 % of reading		
28 MHz	0.076 % of reading		
30 MHz	0.087 % of reading		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 7 mV / 3.2 mV	35 MHz	0.11 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	40 MHz	0.13 % of reading	
	45 MHz	0.14 % of reading	
	50 MHz	0.15 % of reading	
Flatness Relative to 1 kHz 2.2 mV / 1 mV	10 Hz	0.025 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
	20 Hz	0.024 % of reading	
	50 Hz	0.011 % of reading	
	105 Hz	0.012 % of reading	
	200 Hz	0.01 % of reading	
	2 kHz	0.01 % of reading	
	10 kHz	0.01 % of reading	
	20 kHz	0.011 % of reading	
	50 kHz	0.01 % of reading	
	100 kHz	0.011 % of reading	
	200 kHz	0.011 % of reading	
	500 kHz	0.013 % of reading	
	700 kHz	0.018 % of reading	
	1 MHz	0.022 % of reading	
	1.2 MHz	0.022 % of reading	
	2 MHz	0.026 % of reading	
	3 MHz	0.036 % of reading	
	4 MHz	0.039 % of reading	
	6 MHz	0.045 % of reading	
	8 MHz	0.051 % of reading	
	9 MHz	0.052 % of reading	
	10 MHz	0.053 % of reading	
	12 MHz	0.068 % of reading	
	15 MHz	0.073 % of reading	
	17 MHz	0.079 % of reading	
	20 MHz	0.09 % of reading	
23 MHz	0.068 % of reading		
26 MHz	0.073 % of reading		
28 MHz	0.079 % of reading		
30 MHz	0.09 % of reading		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Flatness Relative to 1 kHz 2.2 mV / 1 mV	35 MHz 40 MHz 45 MHz 50 MHz	0.11 % of reading 0.13 % of reading 0.14 % of reading 0.15 % of reading	Fluke 5790B AC Measurement Standard, EL1100 3 V Thermal converter, 4 dB attenuator, 10 dB attenuator, (3) 20 dB attenuators, Fluke 5730A Multiproduct Calibrator
Low Frequency – AC/DC Difference Measurement (Voltage)	2 mV 10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz 6 mV 10 Hz 20 Hz 40 Hz 100 Hz 1 kHz 10 kHz 20 kHz 50 kHz 100 kHz 300 kHz 500 kHz 800 kHz 1 MHz	0.56 V/V 0.35 mV/V 0.45 mV/V 0.39 mV/V 0.34 mV/V 0.32 mV/V 0.32 mV/V 0.35 mV/V 0.44 mV/V 0.51 mV/V 0.61 mV/V 0.75 mV/V 0.76 mV/V 0.23 mV/V 0.23 mV/V 0.23 mV/V 0.19 mV/V 0.18 mV/V 0.17 mV/V 0.2 mV/V 0.22 mV/V 0.3 mV/V 0.41 mV/V 0.49 mV/V 0.58 mV/V 0.63 mV/V	Fluke 792A AC/DC Transfer Standard

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Low Frequency – AC/DC Difference Measurement (Voltage)	10 mV		Fluke 792A AC/DC Transfer Standard
	10 Hz	0.11 mV/V	
	20 Hz	0.11 mV/V	
	40 Hz	89 μ V/V	
	100 Hz	0.14 mV/V	
	1 kHz	88 μ V/V	
	10 kHz	0.11 mV/V	
	20 kHz	83 μ V/V	
	50 kHz	0.1 mV/V	
	100 kHz	0.16 mV/V	
	300 kHz	0.22 mV/V	
	500 kHz	0.3 mV/V	
	800 kHz	0.33 mV/V	
	1 MHz	0.42 mV/V	
	20 mV		
	10 Hz	84 μ V/V	
	20 Hz	68 μ V/V	
	40 Hz	64 μ V/V	
	100 Hz	0.11 mV/V	
	1 kHz	67 μ V/V	
	10 kHz	81 μ V/V	
	20 kHz	62 μ V/V	
	50 kHz	0.11 mV/V	
	100 kHz	0.16 mV/V	
	300 kHz	0.22 mV/V	
	500 kHz	0.31 mV/V	
	800 kHz	0.38 mV/V	
	1 MHz	0.39 mV/V	
	60 mV		
	10 Hz	0.1 mV/V	
	20 Hz	45 μ V/V	
	40 Hz	35 μ V/V	
	100 Hz	33 μ V/V	
	1 kHz	32 μ V/V	
	10 kHz	37 μ V/V	
	20 kHz	35 μ V/V	
	50 kHz	40 μ V/V	
	100 kHz	77 μ V/V	
	300 kHz	0.15 mV/V	
	500 kHz	0.22 mV/V	
	800 kHz	0.29 mV/V	
	1 MHz	0.3 mV/V	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Low Frequency – AC/DC Difference Measurement (Voltage)	0.1 V		Fluke 792A AC/DC Transfer Standard
	10 Hz	46 μ V/V	
	20 Hz	29 μ V/V	
	40 Hz	21 μ V/V	
	100 Hz	15 μ V/V	
	1 kHz	14 μ V/V	
	10 kHz	26 μ V/V	
	20 kHz	29 μ V/V	
	50 kHz	30 μ V/V	
	100 kHz	45 μ V/V	
	300 kHz	90 μ V/V	
	500 kHz	0.13 mV/V	
	800 kHz	0.19 mV/V	
	1 MHz	0.2 mV/V	
	0.2 V		
	10 Hz	35 μ V/V	
	20 Hz	21 μ V/V	
	40 Hz	29 μ V/V	
	100 Hz	16 μ V/V	
	1 kHz	12 μ V/V	
	10 kHz	20 μ V/V	
	20 kHz	17 μ V/V	
	50 kHz	28 μ V/V	
	100 kHz	48 μ V/V	
	300 kHz	76 μ V/V	
	500 kHz	0.11 mV/V	
	800 kHz	0.16 mV/V	
	1 MHz	0.19 mV/V	
	0.6 V		
	10 Hz	28 μ V/V	
	20 Hz	24 μ V/V	
	40 Hz	7.6 μ V/V	
	100 Hz	8.7 μ V/V	
	1 kHz	9.2 μ V/V	
	10 kHz	7.8 μ V/V	
	20 kHz	9.7 μ V/V	
50 kHz	8.6 μ V/V		
100 kHz	30 μ V/V		
300 kHz	26 μ V/V		
500 kHz	47 μ V/V		
800 kHz	60 μ V/V		
1 MHz	81 μ V/V		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Low Frequency – AC/DC Difference Measurement (Voltage)	1V		Fluke 792A AC/DC Transfer Standard
	10 Hz	29 μ V/V	
	20 Hz	18 μ V/V	
	40 Hz	6.5 μ V/V	
	100 Hz	6.7 μ V/V	
	1 kHz	7 μ V/V	
	10 kHz	6 μ V/V	
	20 kHz	6 μ V/V	
	50 kHz	8.2 μ V/V	
	100 kHz	14 μ V/V	
	300 kHz	22 μ V/V	
	500 kHz	35 μ V/V	
	800 kHz	36 μ V/V	
	1 MHz	48 μ V/V	
	2 V		
	10 Hz	25 μ V/V	
	20 Hz	15 μ V/V	
	40 Hz	6.6 μ V/V	
	100 Hz	6.4 μ V/V	
	1 kHz	6.5 μ V/V	
	10 kHz	6.2 μ V/V	
	20 kHz	6.8 μ V/V	
	50 kHz	7.9 μ V/V	
	100 kHz	14 μ V/V	
	300 kHz	33 μ V/V	
	500 kHz	33 μ V/V	
	800 kHz	32 μ V/V	
	1 MHz	45 μ V/V	
	6 V		
	10 Hz	32 μ V/V	
	20 Hz	16 μ V/V	
	40 Hz	5.6 μ V/V	
	100 Hz	6.1 μ V/V	
	1 kHz	5.8 μ V/V	
	10 kHz	6.3 μ V/V	
	20 kHz	5.8 μ V/V	
	50 kHz	6.5 μ V/V	
	100 kHz	9.4 μ V/V	
	300 kHz	20 μ V/V	
	500 kHz	27 μ V/V	
	800 kHz	33 μ V/V	
	1 MHz	42 μ V/V	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
Low Frequency – AC/DC Difference Measurement (Voltage)	10 V		Fluke 792A AC/DC Transfer Standard	
	10 Hz	26 μ V/V		
	20 Hz	15 μ V/V		
	40 Hz	5.5 μ V/V		
	100 Hz	6.3 μ V/V		
	1 kHz	5.9 μ V/V		
	10 kHz	5.5 μ V/V		
	20 kHz	5.6 μ V/V		
	50 kHz	7.3 μ V/V		
	100 kHz	9.6 μ V/V		
	300 kHz	20 μ V/V		
	500 kHz	35 μ V/V		
	800 kHz	56 μ V/V		
	1 MHz	81 μ V/V		
	20 V			
	10 Hz	37 μ V/V		
	20 Hz	17 μ V/V		
	40 Hz	8 μ V/V		
	100 Hz	7.9 μ V/V		
	1 kHz	7.7 μ V/V		
	10 kHz	7.9 μ V/V		
	20 kHz	7.8 μ V/V		
	50 kHz	8.9 μ V/V		
	100 kHz	12 μ V/V		
	300 kHz	22 μ V/V		
	500 kHz	28 μ V/V		
	800 kHz	37 μ V/V		
	1 MHz	55 μ V/V		
	60 V			
	10 Hz	36 μ V/V		
	20 Hz	17 μ V/V		
	40 Hz	7.1 μ V/V		
	100 Hz	6.9 μ V/V		
	1 kHz	7.3 μ V/V		
	10 kHz	7.0 μ V/V		
	20 kHz	7.7 μ V/V		
50 kHz	15 μ V/V			
100 kHz	11 μ V/V			
300 kHz	33 μ V/V			

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Low Frequency – AC/DC Difference Measurement (Voltage)	100 V		Fluke 792A AC/DC Transfer Standard
	10 Hz	27 μ V/V	
	20 Hz	15 μ V/V	
	40 Hz	7.2 μ V/V	
	100 Hz	6.9 μ V/V	
	1 kHz	7 μ V/V	
	10 kHz	7.1 μ V/V	
	20 kHz	7.6 μ V/V	
	50 kHz	12 μ V/V	
	100 kHz	18 μ V/V	
	200 V		
	10 Hz	44 μ V/V	
	20 Hz	17 μ V/V	
	40 Hz	10 μ V/V	
	100 Hz	10 μ V/V	
	1 kHz	9.7 μ V/V	
	10 kHz	9.8 μ V/V	
	20 kHz	10.3 μ V/V	
	50 kHz	12 μ V/V	
	100 kHz	19 μ V/V	
	600 V		
	10 Hz	54 μ V/V	
	20 Hz	29 μ V/V	
	40 Hz	14 μ V/V	
	100 Hz	15 μ V/V	
	1 kHz	13 μ V/V	
	10 kHz	18 μ V/V	
	20 kHz	20 μ V/V	
	50 kHz	32 μ V/V	
	100 kHz	72 μ V/V	
	1 000 V		
	10 Hz	54 μ V/V	
	20 Hz	22 μ V/V	
	40 Hz	13 μ V/V	
	100 Hz	12 μ V/V	
	1 kHz	13 μ V/V	
	10 kHz	16 μ V/V	
	20 kHz	22 μ V/V	
	50 kHz	47 μ V/V	
	100 kHz	67 μ V/V	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure (Current w/ Voltage Output Reading)	0.1 mA		Fluke 792A AC/DC Transfer Standard, Fluke A40 Current Shunts
	10 Hz	75 μ V/V	
	20 Hz	70 μ V/V	
	40 Hz	61 μ V/V	
	400 Hz	59 μ V/V	
	1 kHz	56 μ V/V	
	5 kHz	73 μ V/V	
	10 kHz	83 μ V/V	
	20 kHz	0.12 mV/V	
	30 kHz	0.16 mV/V	
	0.2 mA		
	10 Hz	95 μ V/V	
	20 Hz	56 μ V/V	
	40 Hz	59 μ V/V	
	400 Hz	45 μ V/V	
	1 kHz	43 μ V/V	
	5 kHz	69 μ V/V	
	10 kHz	81 μ V/V	
	20 kHz	0.12 mV/V	
	30 kHz	0.19 mV/V	
	0.3 mA		
	10 Hz	71 μ V/V	
	20 Hz	70 μ V/V	
	40 Hz	49 μ V/V	
	400 Hz	47 μ V/V	
	1 kHz	47 μ V/V	
	5 kHz	47 μ V/V	
	10 kHz	49 μ V/V	
	20 kHz	68 μ V/V	
	30 kHz	0.12 mV/V	
	1 mA		
	10 Hz	56 μ V/V	
	20 Hz	47 μ V/V	
40 Hz	41 μ V/V		
400 Hz	34 μ V/V		
1 kHz	30 μ V/V		
5 kHz	34 μ V/V		
10 kHz	37 μ V/V		
20 kHz	43 μ V/V		
30 kHz	36 μ V/V		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
AC Current – Measure (Current w/ Voltage Output Reading)	2 mA		Fluke 792A AC/DC Transfer Standard, Fluke A40 Current Shunts	
	10 Hz	54 μ V/V		
	20 Hz	42 μ V/V		
	40 Hz	46 μ V/V		
	400 Hz	38 μ V/V		
	1 kHz	38 μ V/V		
	5 kHz	39 μ V/V		
	10 kHz	41 μ V/V		
	20 kHz	41 μ V/V		
	30 kHz	48 μ V/V		
	3 mA			
	10 Hz	51 μ V/V		
	20 Hz	40 μ V/V		
	40 Hz	35 μ V/V		
	400 Hz	33 μ V/V		
	1 kHz	33 μ V/V		
	5 kHz	32 μ V/V		
	10 kHz	32 μ V/V		
	20 kHz	38 μ V/V		
	30 kHz	44 μ V/V		
	10 mA			
	10 Hz	0.1 mV/V		
	20 Hz	53 μ V/V		
	40 Hz	38 μ V/V		
	400 Hz	37 μ V/V		
	1 kHz	32 μ V/V		
	5 kHz	31 μ V/V		
	10 kHz	32 μ V/V		
	20 kHz	42 μ V/V		
	30 kHz	63 μ V/V		
	20 mA			
	10 Hz	0.14 mV/V		
	20 Hz	84 μ V/V		
	40 Hz	78 μ V/V		
	400 Hz	77 μ V/V		
	1 kHz	76 μ V/V		
5 kHz	76 μ V/V			
10 kHz	76 μ V/V			
20 kHz	78 μ V/V			
30 kHz	93 μ V/V			

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
AC Current – Measure (Current w/ Voltage Output Reading)	30 mA		Fluke 792A AC/DC Transfer Standard, Fluke A40 Current Shunts	
	10 Hz	0.15 mV/V		
	20 Hz	92 μV/V		
	40 Hz	72 μV/V		
	400 Hz	66 μV/V		
	1 kHz	66 μV/V		
	5 kHz	67 μV/V		
	10 kHz	73 μV/V		
	20 kHz	85 μV/V		
	30 kHz	0.11 mV/V		
	0.1 A			
	10 Hz	0.14 mV/V		
	20 Hz	64 μV/V		
	40 Hz	53 μV/V		
	400 Hz	51 μV/V		
	1 kHz	48 μV/V		
	5 kHz	48 μV/V		
	10 kHz	49 μV/V		
	20 kHz	61 μV/V		
	30 kHz	78 μV/V		
	0.2 A			
	10 Hz	0.15 mV/V		
	20 Hz	58 μV/V		
	40 Hz	39 μV/V		
	400 Hz	37 μV/V		
	1 kHz	40 μV/V		
	5 kHz	34 μV/V		
	10 kHz	33 μV/V		
	20 kHz	49 μV/V		
	30 kHz	68 μV/V		
	0.3 A			
	10 Hz	0.12 mV/V		
	20 Hz	56 μV/V		
	40 Hz	43 μV/V		
	400 Hz	33 μV/V		
	1 kHz	32 μV/V		
5 kHz	31 μV/V			
10 kHz	36 μV/V			
20 kHz	43 μV/V			
30 kHz	72 μV/V			

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure (Current w/ Voltage Output Reading)	0.5 A		Fluke 792A AC/DC Transfer Standard, Fluke A40 Current Shunts
	10 Hz	0.26 mV/V	
	20 Hz	51 μ V/V	
	40 Hz	75 μ V/V	
	400 Hz	50 μ V/V	
	1 kHz	45 μ V/V	
	5 kHz	37 μ V/V	
	10 kHz	29 μ V/V	
	20 kHz	47 μ V/V	
	30 kHz	79 μ V/V	
	1 A		
	10 Hz	98 μ V/V	
	20 Hz	50 μ V/V	
	40 Hz	38 μ V/V	
	400 Hz	39 μ V/V	
	1 kHz	35 μ V/V	
	5 kHz	39 μ V/V	
	10 kHz	48 μ V/V	
	20 kHz	80 μ V/V	
	30 kHz	0.12 mV/V	
	2 A		
	10 Hz	0.11 mV/V	
	20 Hz	56 μ V/V	
	40 Hz	42 μ V/V	
	400 Hz	37 μ V/V	
	1 kHz	35 μ V/V	
	5 kHz	42 μ V/V	
	10 kHz	43 μ V/V	
	20 kHz	55 μ V/V	
	30 kHz	0.11 mV/V	
	3 A		
	10 Hz	0.13 mV/V	
	20 Hz	66 μ V/V	
	40 Hz	57 μ V/V	
	400 Hz	56 μ V/V	
	1 kHz	55 μ V/V	
5 kHz	61 μ V/V		
10 kHz	63 μ V/V		
20 kHz	83 μ V/V		
30 kHz	0.14 mV/V		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure (Current w/ Voltage Output Reading)	5 A		Fluke 792A AC/DC Transfer Standard, Fluke A40 Current Shunts
	10 Hz	0.13 mV/V	
	20 Hz	67 μ V/V	
	40 Hz	56 μ V/V	
	400 Hz	61 μ V/V	
	1 kHz	53 μ V/V	
	5 kHz	58 μ V/V	
	10 kHz	69 μ V/V	
	20 kHz	88 μ V/V	
	30 kHz	0.18 mV/V	
	10 A		
	10 Hz	0.15 mV/V	
	20 Hz	84 μ V/V	
	40 Hz	65 μ V/V	
	400 Hz	64 μ V/V	
	1 kHz	62 μ V/V	
	5 kHz	62 μ V/V	
	10 kHz	62 μ V/V	
	20 kHz	0.1 mV/V	
	30 kHz	0.15 mV/V	
	20 A		
	10 Hz	0.15 mV/V	
	20 Hz	0.12 mV/V	
	40 Hz	81 μ V/V	
	400 Hz	81 μ V/V	
	1 kHz	77 μ V/V	
	5 kHz	77 μ V/V	
	10 kHz	77 μ V/V	
	20 kHz	0.13 mV/V	
	30 kHz	0.18 mV/V	
100 A			
10 Hz	0.16 mV/V		
20 Hz	0.16 mV/V		
40 Hz	96 μ V/V		
400 Hz	86 μ V/V		
1 kHz	86 μ V/V		
5 kHz	0.12 mV/V		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	2 mV		Fluke 792A AC/DC Transfer Standard
	10 Hz	0.56 mV/V	
	20 Hz	0.35 mV/V	
	40 Hz	0.45 mV/V	
	100 Hz	0.39 mV/V	
	1 kHz	0.34 mV/V	
	10 kHz	0.32 mV/V	
	20 kHz	0.32 mV/V	
	50 kHz	0.35 mV/V	
	100 kHz	0.44 mV/V	
	300 kHz	0.51 mV/V	
	500 kHz	0.61 mV/V	
	800 kHz	0.75 mV/V	
	1 MHz	0.76 mV/V	
	6 mV		
	10 Hz	0.23 mV/V	
	20 Hz	0.23 mV/V	
	40 Hz	0.23 mV/V	
	100 Hz	0.19 mV/V	
	1 kHz	0.18 mV/V	
	10 kHz	0.17 mV/V	
	20 kHz	0.2 mV/V	
	50 kHz	0.22 mV/V	
	100 kHz	0.3 mV/V	
	300 kHz	0.41 mV/V	
	500 kHz	0.49 mV/V	
	800 kHz	0.58 mV/V	
	1 MHz	0.63 mV/V	
	10 mV		
	10 Hz	0.11 mV/V	
	20 Hz	0.11 mV/V	
	40 Hz	89 μ V/V	
	100 Hz	0.14 mV/V	
	1 kHz	88 μ V/V	
	10 kHz	0.11 mV/V	
	20 kHz	83 μ V/V	
	50 kHz	0.1 mV/V	
	100 kHz	0.16 mV/V	
	300 kHz	0.22 mV/V	
	500 kHz	0.3 mV/V	
	800 kHz	0.33 mV/V	
	1 MHz	0.42 mV/V	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
AC Voltage – Measure	20 mV		Fluke 792A AC/DC Transfer Standard	
	10 Hz	84 μ V/V		
	20 Hz	68 μ V/V		
	40 Hz	64 μ V/V		
	100 Hz	0.11 mV/V		
	1 kHz	67 μ V/V		
	10 kHz	81 μ V/V		
	20 kHz	62 μ V/V		
	50 kHz	0.11 mV/V		
	100 kHz	0.16 mV/V		
	300 kHz	0.22 mV/V		
	500 kHz	0.31 mV/V		
	800 kHz	0.38 mV/V		
	1 MHz	0.39 mV/V		
	60 mV			
	10 Hz	0.1 mV/V		
	20 Hz	45 μ V/V		
	40 Hz	35 μ V/V		
	100 Hz	33 μ V/V		
	1 kHz	32 μ V/V		
	10 kHz	37 μ V/V		
	20 kHz	35 μ V/V		
	50 kHz	40 μ V/V		
	100 kHz	77 μ V/V		
	300 kHz	0.15 mV/V		
	500 kHz	0.22 mV/V		
	800 kHz	0.29 mV/V		
	1 MHz	0.3 mV/V		
	0.1 V			
	10 Hz	46 μ V/V		
	20 Hz	29 μ V/V		
	40 Hz	21 μ V/V		
	100 Hz	15 μ V/V		
	1 kHz	14 μ V/V		
	10 kHz	26 μ V/V		
	20 kHz	29 μ V/V		
	50 kHz	30 μ V/V		
	100 kHz	45 μ V/V		
	300 kHz	90 μ V/V		
	500 kHz	0.13 mV/V		
	800 kHz	0.19 mV/V		
	1 MHz	0.2 mV/V		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
AC Voltage – Measure	0.2 V		Fluke 792A AC/DC Transfer Standard	
	10 Hz	35 μ V/V		
	20 Hz	21 μ V/V		
	40 Hz	29 μ V/V		
	100 Hz	16 μ V/V		
	1 kHz	12 μ V/V		
	10 kHz	20 μ V/V		
	20 kHz	17 μ V/V		
	50 kHz	28 μ V/V		
	100 kHz	48 μ V/V		
	300 kHz	76 μ V/V		
	500 kHz	0.11 mV/V		
	800 kHz	0.16 mV/V		
	1 MHz	0.19 mV/V		
	0.6 V			
	10 Hz	28 μ V/V		
	20 Hz	24 μ V/V		
	40 Hz	7.6 μ V/V		
	100 Hz	8.7 μ V/V		
	1 kHz	9.2 μ V/V		
	10 kHz	7.8 μ V/V		
	20 kHz	9.7 μ V/V		
	50 kHz	8.6 μ V/V		
	100 kHz	30 μ V/V		
	300 kHz	26 μ V/V		
	500 kHz	47 μ V/V		
	800 kHz	60 μ V/V		
	1 MHz	81 μ V/V		
	1 V			
	10 Hz	29 μ V/V		
	20 Hz	18 μ V/V		
	40 Hz	6.5 μ V/V		
	100 Hz	6.7 μ V/V		
	1 kHz	7 μ V/V		
	10 kHz	6 μ V/V		
	20 kHz	6 μ V/V		
50 kHz	8.2 μ V/V			
100 kHz	14 μ V/V			
300 kHz	22 μ V/V			
500 kHz	35 μ V/V			
800 kHz	36 μ V/V			
1 MHz	48 μ V/V			

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure	2 V		Fluke 792A AC/DC Transfer Standard
	10 Hz	25 μ V/V	
	20 Hz	15 μ V/V	
	40 Hz	6.6 μ V/V	
	100 Hz	6.4 μ V/V	
	1 kHz	6.5 μ V/V	
	10 kHz	6.2 μ V/V	
	20 kHz	6.8 μ V/V	
	50 kHz	7.9 μ V/V	
	100 kHz	14 μ V/V	
	300 kHz	33 μ V/V	
	500 kHz	33 μ V/V	
	800 kHz	32 μ V/V	
	1 MHz	45 μ V/V	
	6 V		
	10 Hz	32 μ V/V	
	20 Hz	16 μ V/V	
	40 Hz	5.6 μ V/V	
	100 Hz	6.1 μ V/V	
	1 kHz	5.8 μ V/V	
	10 kHz	6.3 μ V/V	
	20 kHz	5.8 μ V/V	
	50 kHz	6.5 μ V/V	
	100 kHz	9.4 μ V/V	
	300 kHz	20 μ V/V	
	500 kHz	27 μ V/V	
	800 kHz	33 μ V/V	
	1 MHz	42 μ V/V	
	10 V		
	10 Hz	26 μ V/V	
	20 Hz	15 μ V/V	
	40 Hz	5.5 μ V/V	
	100 Hz	6.3 μ V/V	
	1 kHz	5.9 μ V/V	
	10 kHz	5.5 μ V/V	
	20 kHz	5.6 μ V/V	
50 kHz	7.3 μ V/V		
100 kHz	9.6 μ V/V		
300 kHz	20 μ V/V		
500 kHz	35 μ V/V		
800 kHz	56 μ V/V		
1 MHz	81 μ V/V		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment	
AC Voltage – Measure	20 V		Fluke 792A AC/DC Transfer Standard	
	10 Hz	37 μ V/V		
	20 Hz	17 μ V/V		
	40 Hz	8 μ V/V		
	100 Hz	7.9 μ V/V		
	1 kHz	7.7 μ V/V		
	10 kHz	7.9 μ V/V		
	20 kHz	7.8 μ V/V		
	50 kHz	8.9 μ V/V		
	100 kHz	12 μ V/V		
	300 kHz	22 μ V/V		
	500 kHz	28 μ V/V		
	800 kHz	37 μ V/V		
	1 MHz	55 μ V/V		
	60 V			
	10 Hz	36 μ V/V		
	20 Hz	17 μ V/V		
	40 Hz	7.1 μ V/V		
	100 Hz	6.9 μ V/V		
	1 kHz	7.3 μ V/V		
	10 kHz	7.0 μ V/V		
	20 kHz	7.7 μ V/V		
	50 kHz	15 μ V/V		
	100 kHz	11 μ V/V		
	300 kHz	33 μ V/V		
	100 V			
	10 Hz	27 μ V/V		
	20 Hz	15 μ V/V		
	40 Hz	7.2 μ V/V		
	100 Hz	6.9 μ V/V		
	1 kHz	7 μ V/V		
	10 kHz	7.1 μ V/V		
	20 kHz	7.6 μ V/V		
50 kHz	12 μ V/V			
100 kHz	18 μ V/V			
200 V				
10 Hz	44 μ V/V			
20 Hz	17 μ V/V			
40 Hz	10 μ V/V			
100 Hz	10 μ V/V			
1 kHz	9.7 μ V/V			

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
AC Voltage – Measure	200 V		Fluke 792A AC/DC Transfer Standard		
	10 kHz	9.8 μ V/V			
	20 kHz	10 μ V/V			
	50 kHz	12 μ V/V			
	100 kHz	19 μ V/V			
	600 V				
	10 Hz	54 μ V/V			
	20 Hz	29 μ V/V			
	40 Hz	14 μ V/V			
	100 Hz	15 μ V/V			
	1 kHz	13 μ V/V			
	10 kHz	18 μ V/V			
	20 kHz	20 μ V/V			
	50 kHz	32 μ V/V			
	100 kHz	72 μ V/V			
	1 000 V				
	10 Hz	54 μ V/V			
	20 Hz	22 μ V/V			
	Inductance – Measure ³	1 μ H			Agilent E4980A LCR Meter
		10 kHz		1.6 % of reading	
100 kHz		0.36 % of reading			
1 MHz		0.27 % of reading			
2 MHz		0.66 % of reading			
10 μ H					
10 kHz		0.37 % of reading			
100 kHz		0.2 % of reading			
1 MHz		0.2 % of reading			
2 MHz		0.3 % of reading			
100 μ H					
1 kHz		0.4 % of reading			
10 kHz		0.2 % of reading			
100 kHz		0.12 % of reading			
1 MHz	0.14 % of reading				
2 MHz	0.72 % of reading				

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Inductance – Measure ³	1 mH		Agilent E4980A LCR Meter
	100 Hz	0.55 % of reading	
	1 kHz	0.18 % of reading	
	10 kHz	0.12 % of reading	
	100 kHz	0.092 % of reading	
	1 MHz	0.23 % of reading	
	2 MHz	0.88 % of reading	
	10 mH		
	20 Hz	0.85 % of reading	
	100 Hz	0.22 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.1 % of reading	
	1 MHz	0.35 % of reading	
	2 MHz	1.3 % of reading	
	100 mH		
	20 Hz	0.28 % of reading	
	100 Hz	0.1 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.092 % of reading	
	100 kHz	0.21 % of reading	
	1 MHz	0.88 % of reading	
	1 H		
	20 Hz	0.16 % of reading	
	100 Hz	0.092 % of reading	
	1 kHz	0.092 % of reading	
	10 kHz	0.1 % of reading	
	100 kHz	0.31 % of reading	
	10 H		
	20 Hz	0.15 % of reading	
100 Hz	0.092 % of reading		
1 kHz	0.1 % of reading		
10 kHz	0.21 % of reading		
100 kHz	0.69 % of reading		
100 H			
20 Hz	0.15 % of reading		
100 Hz	0.10 % of reading		
1 kHz	0.15 % of reading		
10 kHz	0.62 % of reading		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ^{1,4}			
Amplitude – DC			
into 50 Ω load	(-5 to 5) V	0.023 % of reading + 19 μV	
into 1 MΩ load	(-200 to 200) V	0.023 % of reading + 19 μV	
Amplitude – Square Wave			
Rate: 10 Hz to 10 kHz			
into 50 Ω load	40 μVp-p to 1 mVp-p	0.78 % of reading + 7.8 μV	
into 1 MΩ load	1 mVp-p to 5 Vp-p	0.078 % of reading + 7.8 μV	
into 50 Ω load	40 μVp-p to 1 mVp-p	0.78 % of reading + 7.8 μV	
Rate: 10 Hz to 100 kHz			
into 50 Ω load	1 mVp-p to 5 Vp-p	0.16 % of reading + 7.8 μV	
into 1 MΩ load	1 mVp-p to 200 Vp-p	0.78 % of reading + 7.8 μV	
Time Markers			
100 mVp-p to 1 Vp-p			
into 50 Ω load	9.009 1 ns to 83 μs	0.19 μs/s	
Square Wave	83 μs to 55s	2.3 μs/s	
Sine Wave	450.5 ps to 9.009 ns	0.19 μs/s	
Pulse	900.91 ns to 83 μs	0.19 μs/s	
Triangle Wave	83 μs to 55s	2.3 μs/s	
Pulse	900.91 ns to 83 μs	0.19 μs/s	
Triangle Wave	83 μs to 55s	2.3 μs/s	
Rise Time			
into 50 Ω load			
Rate: 10 Hz to 2 MHz	5 mVp-p to 3 Vp-p		
	500 ps (nominal)	290 ps	
	150 ps (nominal)	34 ps	
Rate: 10 Hz to 1 MHz	25 mVp-p to 2 Vp-p		
	70 ps (nominal)	21 ps	
	425 mVp-p to 575 mVp-p		
	25 ps (nominal)	5.7 ps	
	200 mVp-p		
	16 ps (nominal)	2.1 ps	

Fluke 9500B
Oscilloscope Calibrator,
Fluke 9530
3.2 GHz Active Head,
Fluke 9550
Active Head w/ 25 ps
Capability,
Fluke 9560
Active Head w/ 70 ps
Capability,
Tektronix 067-1330-000
Calibration Fixture

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes ^{1,4} Leveled Sine Wave 50 kHz Reference into 50 Ω load	5 mVp-p to 5 Vp-p 50 kHz to 10 MHz	1.2 % of reading	Fluke 9500B Oscilloscope Calibrator, Fluke 9530 3.2 GHz Active Head, Fluke 9550
Input Impedance 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	0.39 % of reading 0.083 % of reading 0.39 % of reading 0.39 % of reading 0.083 % of reading 0.39 % of reading	Active Head w/ 25 ps Capability, Fluke 9560 Active Head w/ 70 ps Capability, Tektronix 067-1330-000 Calibration Fixture
Input Capacitance Measure	(1 to 35) pF (35 to 95) pF	1.6 % of reading + 0.19 pF 2.3 % of reading + 0.19 pF	
Bandwidth Flatness Measure ¹ into VSWR (1.2:1) (wrt Reference Frequency)	5 mVp-p to 5 Vp-p 100 Hz to 300 MHz (300 to 550) MHz 5 mVp-p to 3 Vp-p 550 MHz to 1.1 GHz (1.1 to 2.5) GHz 5 mVp-p to 2 Vp-p (2.5 to 3.2) GHz	1.6 % of reading 1.9 % of reading 2.7 % of reading 3.1 % of reading 3.1 % of reading	Fluke 9500B/3200 Oscilloscope Calibrator, Fluke 9530 3.2 GHz Active Head
Bandwidth Flatness Measure ¹ into VSWR (1.2:1) (wrt Reference Frequency)	5 mVp-p to 5 Vp-p 100 Hz to 300 MHz (300 to 550) MHz 5 mVp-p to 3 Vp-p 550 MHz to 1.1 GHz (1.1 to 2.5) GHz 5 mVp-p to 2 Vp-p (2.5 to 3.2) GHz 25 mVp-p to 2 Vp-p (3 to 6) GHz	1.6 % of reading 1.9 % of reading 2.3 % of reading 2.3 % of reading 2.3 % of reading 3.1 % of reading	Fluke 9500B/1100 Oscilloscope Calibrator, Fluke 9560 Active Head w/ 70 ps Capability
Risetime – Source	≥ 14 ps	2.4 ps	Pulser System
Risetime – Measure	≤ 500 ps	2.5 ps	Agilent 83484A, 86100C Oscilloscope Mainframe

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Risetime – Measure	(28 to 300) ps (0.3 to 5) ns (5 to 100) ns 100 ns	14 % of reading 4.7 % of reading 1.4 % of reading 0.73 % of reading	Sampling System
Electrical Simulation of Thermocouple Indicating Devices – Measure/Source ¹	Type B (250 to 350) °C (350 to 445) °C (445 to 580) °C (580 to 750) °C (750 to 1 000) °C (1 000 to 1 820) °C Type C (0 to 250) °C (250 to 1 000) °C (1 000 to 1 500) °C (1 500 to 1 800) °C (1 800 to 2 000) °C (2 000 to 2 250) °C (2 250 to 2 315) °C Type E (-270 to -245) °C (-245 to -195) °C (-195 to -155) °C (-155 to -90) °C (-90 to 0) °C (0 to 15) °C (15 to 890) °C (890 to 1 000) °C Type J (-210 to -180) °C (-180 to -120) °C (-120 to -50) °C (-50 to 990) °C (990 to 1 200) °C Type K (-270 to -255) °C (-255 to -195) °C (-195 to -115) °C (-115 to -55) °C (-55 to 1 000) °C (1 000 to 1 372) °C	1.2 °C 0.9 °C 0.71 °C 0.55 °C 0.45 °C 0.35 °C 0.24 °C 0.19 °C 0.21 °C 0.24 °C 0.27 °C 0.33 °C 0.37 °C 1.6 °C 0.24 °C 0.12 °C 0.095 °C 0.08 °C 0.076 °C 0.064 °C 0.074 °C 0.15 °C 0.12 °C 0.093 °C 0.08 °C 0.094 °C 2.5 °C 0.85 °C 0.16 °C 0.12 °C 0.08 °C 0.094 °C	Ectron 1140A Thermocouple Calibrator/Simulator

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Measure/Source ¹	Type N		Ectron 1140A Thermocouple Calibrator/Simulator
	(-270 to -260) °C	5.4 °C	
	(-260 to -200) °C	1.5 °C	
	(-200 to -140) °C	0.29 °C	
	(-140 to -70) °C	0.18 °C	
	(-70 to 25) °C	0.14 °C	
	(25 to 160) °C	0.12 °C	
	(160 to 1 300) °C	0.11 °C	
	Type R		
	(-50 to -30) °C	0.8 °C	
	(-30 to 45) °C	0.69 °C	
	(45 to 160) °C	0.49 °C	
	(160 to 380) °C	0.41 °C	
	(380 to 775) °C	0.35 °C	
	(775 to 1 768) °C	0.26 °C	
	Type S		
	(-50 to -30) °C	0.76 °C	
	(-30 to 45) °C	0.68 °C	
	(45 to 105) °C	0.49 °C	
	(105 to 310) °C	0.41 °C	
	(310 to 615) °C	0.35 °C	
(615 to 1 768) °C	0.31 °C		
Type T			
(-270 to -255) °C	1.9 °C		
(-255 to -240) °C	0.6 °C		
(-240 to -210) °C	0.36 °C		
(-210 to -150) °C	0.22 °C		
(-150 to -40) °C	0.15 °C		
(-40 to 100) °C	0.095 °C		
(100 to 400) °C	0.08 °C		

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Power – Source ¹ (0.33 to 330) mA	11 μ W to 1.1 mW 1.1 mW to 0.11 W (0.11 to 110) W (110 to 330) W	0.024 % of reading 0.027 % of reading 0.024 % of reading 0.018 % of reading	Fluke 5520A Multiproduct Calibrator
(0.33 to 3) A	11 μ W to 110 mW (0.11 to 990) W (0.99 to 3) kW	0.044 % of reading 0.053 % of reading 0.009 6 % of reading	
(3 to 20.5) A	99 mW to 0.99 W 0.99 W to 6.8 kW (6.8 to 20.5) kW	0.088 % of reading 0.07 % of reading 0.04 % of reading	
AC Power – Source ^{1,4} PF = 1			Fluke 5520A Multiproduct Calibrator
(3.3 to 9) mA	(10 to 65) Hz (0.11 mW to 3) mW 3 mW to 9 W	0.13 % of reading 0.077 % of reading	
(9 to 33) mA	(10 to 65) W (0.3 to 10) mW 10 mW to 33 W	0.089 % of reading 0.077 % of reading	
(33 to 90) mA	(10 to 65) Hz (1 to 30) mW 30 mW to 90 W	0.071 % of reading 0.057 % of reading	
(90 to 330) mA	(10 to 65) Hz (3 to 100) mW 100 mW to 300 W	0.089 % of reading 0.078 % of reading	
(0.33 to 0.9) A	(10 to 65) Hz (11 to 300) mW (0.3 to 900) W	0.071 % of reading 0.081 % of reading	
(0.9 to 2.2) A	(10 to 65) Hz (30 to 720) mW 0.72 W to 2 kW	0.089 % of reading 0.079 % of reading	
(2.2 to 4.5) A	(10 to 65) Hz 80 mW to 1.4 W 1.4 W to 4.5 kW	0.088 % of reading 0.18 % of reading	
(4.5 to 20.5) A	(10 to 65) Hz 150 mW to 20 kW	0.17 % of reading	
(0.5 to 20) A	(65 to 850) Hz 23 W to 13 kW	0.024 % of reading	

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Source ^{1,4} PF = 1 (0.5 to 20) A	(65 to 850) Hz 23 W to 13 kW	0.024 % of reading	Fluke 6105A Electrical Power Quality Calibrator
Phase – Source ¹	(0 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	0.11 ° 0.2 ° 0.39 ° 1.9 ° 3.9 ° 7.8 °	Fluke 5520A Multiproduct Calibrator
Phase – Source 5 V	(0 to 360) ° 1 Hz to 5 kHz (5 to 50) kHz (50 to 200) kHz	0.006 6 ° 0.013 ° 0.052 °	Clark-Hess 5002 Bridge Set (equal amplitude)
Phase – Source 50 mV to 100 V (100 to 120) V	(0 to 360) ° 1 Hz to 1 kHz (1 to 5) kHz (5 to 50) kHz (50 to 200) kHz 1 Hz to 1 kHz (1 to 5) kHz (5 to 50) kHz (50 to 200) kHz	0.006 6 ° 0.013 ° 0.019 ° 0.05 ° 0.012 ° 0.024 ° 0.036 ° 0.094 °	Clark-Hess 5500-2 Phase Standard (ratio independent)
Phase – Measure	(0 to 360) ° 1 Hz to 10 kHz (10 to 50) kHz (50 to 100) kHz (100 to 200) kHz	0.002 3 ° 0.002 7 ° 0.01 ° 0.012 °	Phase Verification Bridge Set (1:1)

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Dips and Interrupts – Measure	Ratio: (0 to 100) % (0 to 360) °	1.3 % of reading	Agilent Infinity Oscilloscope



ANSI National Accreditation Board

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Fast Transients – Measure	(0.25 to 4) kV	2.6 % of reading	Agilent Infinity Oscilloscope, Haefely HV Attenuators
Electrostatic Discharge – Measure	(0.1 to 15) kV	2.5 % of reading	Tektronix TDS7404 Oscilloscope, KeyTech CTC-3 Target, Barth HV Attenuators
Harmonic Flicker – Measure	(100 to 230) V (50 to 400) Hz	3.6 % of reading	Tektronix TDS1012B Oscilloscope, Keysight DMM, CNS HFC-II Load, Ohms Lab CS100 Shunt
Surge – Measure (Open)	(0.25 to 4) kV	1.3 % of reading	Agilent Infinity Oscilloscope, Tektronix 6015A HV Probe
Surge – Measure (Short)	(0.25 to 4) kV	1.4 % of reading	Agilent Infinity Oscilloscope, Tegam RF Current Probe
Impulse – Source (60 dBu nominal)	Band A (10 to 150) kHz Band B 150 kHz to 30 MHz Band C & D 30 MHz to 1 GHz	13 % of reading 13 % of reading 20 % of reading	Schwarzbeck IGLK 2914 High Power Pulse Generator
Modulation – Measure Amplitude Modulation Frequency Modulation Phase Modulation	50 Hz to 50 kHz 50 Hz to 100 kHz 150 kHz to 1.3 GHz	1.3 % of reading 1.6 % of reading 4.3 % of reading	Keysight 8902A Receiver
RF Power – Measure (Noise Figure)	(-40 to 0) dB 10 MHz to 26.5 GHz	0.4 dB	Keysight E4440A Spectrum Analyzer w/ Opt 219 Personality Module, Keysight 346C Noise Source
RF Power – Transfer Measure	(-20 to 10) dBm 9 kHz to 18 GHz 10 MHz to 26.5 GHz (26.5 to 50) GHz	1.3 % of reading 2.6 % of reading 4.8 % of reading	Tegam 2510A Power Standard, Tegam 1803A Power Meter
Absolute RF Power – Measure	50 MHz 1 mW Reference	0.003 2 mW	HP 478A Thermistor, Tegam 1830A RF Power Meter

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power – Measure ¹	(-60 to 20) dBm 9 kHz to 18 GHz (-70 to 20) dBm (26.5 to 40) GHz (40 to 50) GHz (-30 to 10) dBm 30 MHz to 26.5 GHz (10 to 30) dBm 30 MHz to 26.5 GHz	2.6 N5532A Power Sensor 3.8 % of reading 5.1 % of reading 3.3% of reading 5.7 % of reading	Agilent E4419B Power Meter, Agilent E9304A H18 Power Sensor, Agilent 8487A Power Sensor, Keysight E4440A Spectrum Analyzer, Keysight N5532A Power Sensor
Tuned RF Power – Measure	30 MHz to 26.5 GHz (-114 to -78) dBm (-78 to -58) dBm (-58 to 0) dBm	3.5 % of reading 4 % of reading 4.8 % of reading	Keysight E4440A Spectrum Analyzer, Agilent E4419B Power Meter, Keysight N5532A Power Sensor
Tuned Relative RF Power – Measure	30 MHz to 26.5 GHz (-114 to -78) dBm (-78 to -58) dBm (-58 to 0) dBm	1.1 % of reading 2.3 % of reading 3.4 % of reading	Keysight E4440A Spectrum Analyzer, Agilent E4419B Power Meter, Keysight N5532A Power Sensor
Attenuation – Source	(0 to 50) dB 30 MHz	1.6 % of reading	Agilent 11812A Verification Kit
Sine Flatness (RF)	9 kHz to 6 GHz	0.073 dB	Agilent E4418B Power Meter, Agilent E9304A Power Sensor
SSB Phase Noise – Measure RMS (Noise/Jitter)	(-50 to 20) dBm 1 MHz to 3 GHz (3 to 6.6) GHz (6.6 to 13.2) GHz (13.2 to 22) GHz (22 to 26.5) GHz	0.62 dB 0.92 dB 1.3 dB 1.2 dB 1.6 dB	Keysight E4440A Spectrum Analyzer w/ Opt 219 Personality Module
Signal Source Phase Noise – Measure 1 MHz to 50 GHz	10 mHz ≤ offset ≤ 1 MHz 1 MHz ≤ offset ≤ 30 MHz offset > 30 MHz	1.6 dB 2 dB 3 dB	Rhode & Schwarz FSWP Phase Noise Analyzer

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Spectral Analysis – Measure (Amplitude) (w/o pre-amp)	(-127 to 30) dBm 3 Hz to 3 GHz (3.0 to 6.6) GHz (6.6 to 13.2) GHz (13.2 to 22) GHz (22 to 26.5) GHz (26.5 to 40) GHz (33 to 50) GHz	0.9 dB 1.1 dB 1.4 dB 1.4 dB 1.7 dB 3.6 dB 3.6 dB	Keysight E4440A Spectrum Analyzer, Keysight 11970A/11970Q Mixers
Attenuation – Measure (Tuned RF Relative Power)	2.5 MHz to 26.5 GHz (-120 to -110) dB (-110 to -100) dB (-100 to -90) dB (-90 to -80) dB (-80 to -70) dB	0.12 dB 0.1 dB 0.099 dB 0.09 dB 0.082 dB	Agilent 8902A Measuring Receiver, Agilent 11793A Microwave Sensor
Attenuation – Measure (Tuned RF Relative Power)	2.5 MHz to 26.5 GHz (-70 to -60) dB (-60 to -50) dB (-50 to -40) dB (-40 to -30) dB (-30 to -20) dB (-20 to -10) dB (-10 to 0) dB	0.077 dB 0.069 dB 0.06 dB 0.056 dB 0.048 dB 0.038 dB 0.026 dB	Agilent 8902A Measuring Receiver, Agilent 11793A Microwave Sensor
RF Impedance – Measure	5 Hz to 3 GHz 1 Ω to 2 k Ω	3 % of reading	Keysight E5061B Vector Network Analyzer
RF Current – Measure (Insertion Loss)	(-90 to 10) dB 10 kHz to 400 MHz	2.9 dB	Keysight E5061B Vector Network Analyzer, FCC BCICF-1 Cal Fixture
RF Current – Measure (Transfer Z)	(-90 to 10) dB 10 kHz to 400 MHz	2.2 dB	Keysight E5061B Vector Network Analyzer, FCC BCICF-1 Cal Fixture
Transmission Longitudinal Conversion Loss	(-90 to 10) dB 10 kHz to 100 MHz	5.6 % of reading	Schaffner BCS-1000 Bridge, Keysight E5061B Vector Network Analyzer
S-Parameter S11-S22 – Measure ⁶ (0 to 1) Lin Mag (BNC)	(-90 to 10) dB 10 Hz to 100 kHz 100 kHz to 10 MHz	0.03 0.03	Agilent E5061B Vector Network Analyzer, Agilent 8550CK Calibration Kit

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S-Parameter S11-S22 – Measure ⁶ (0 to 1) Lin Mag (7 mm)	(-90 to 10) dB 300 kHz to 1.3 GHz (1.3 to 3) GHz (3 to 6) GHz	0.006 0.007 0.013	Agilent 8753ES Network Analyzer, Agilent 8550C Calibration Kit
S-Parameter S11-S22 – Measure ⁶ (0 to 1) Lin Mag (N-type)	(-90 to 10) dB (10 to 500) MHz 500 MHz to 2 GHz	0.025 0.017	Agilent N5230A Network Analyzer, Agilent N4690C Ecal Calibration Kit
S-Parameter S11-S22 – Measure ⁶ (0 to 1) Lin Mag (3.5 mm)	(-90 to 10) dB (10 to 500) MHz 500 MHz to 2 GHz (2 to 26.5) GHz	0.026 0.025 0.076	Agilent N5230A Network Analyzer, Agilent N4692C Ecal Calibration Kit
S-Parameter S11-S22 – Measure ⁶ (0 to 1) Lin Mag (2.9 mm)	(-90 to 10) dB (10 to 500) MHz 500 MHz to 2 GHz (2 to 26.5) GHz	0.026 0.025 0.076	Agilent N5230A Network Analyzer, Agilent N4692C Ecal Calibration Kit
S-Parameter S11-S22 – Measure ⁶ (0 to 1) Lin Mag (2.4 mm)	(-90 to 10) dB 50 MHz to 50 GHz	0.22	Agilent N5225A Microwave Network Analyzer, Agilent N4692C Ecal Calibration Kit
S-Parameter S21-S12 – Measure (BNC)	(-50 to 10) dB 10 Hz to 100 kHz 100 kHz to 10 MHz (10 to 500) MHz	0.57 dB 0.37 dB 0.36 dB	Agilent E5061B Vector Network Analyzer, Agilent 8550CK Calibration Kit
S-Parameter S21-S12 – Measure (7 mm)	(-50 to 10) dB 300 kHz to 1.3 GHz (1.3 to 3) GHz	0.24 dB 0.25 dB	Agilent 8753ES Network Analyzer, Agilent 85050C Calibration Kit

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S-Parameter S21-S12 – Measure (N-type)	(-30 to 10) dB (10 to 500) MHz	0.43 dB	Agilent N5230A Network Analyzer, Agilent N4690C Ecal Calibration Kit
	(-50 to 10) dB (10 to 500) MHz	2.6 dB	
	(-50 to 10) dB 500 MHz to 2 GHz	0.17 dB	
	(2 to 18) GHz	0.39 dB	
S-Parameter S21-S12 – Measure (3.5 mm)	(-30 to 10) dB (10 to 500) MHz	0.5 dB	Agilent N5230A Network Analyzer, Agilent N4692C Ecal Calibration Kit
	(-50 to 10) dB (10 to 500) MHz	2.6 dB	
	(-50 to 10) dB 500 MHz to 2 GHz	0.28 dB	
	(2 to 26.5) GHz	0.79 dB	
S-Parameter S21-S12 – Measure (2.9 mm)	(-30 to 10) dB (10 to 500) MHz	0.49 dB	Agilent N5230A Network Analyzer, Agilent N4692C Ecal Calibration Kit
	(-50 to 10) dB (10 to 500) MHz	2.7 dB	
	(-50 to 10) dB 500 MHz to 2 GHz	0.28 dB	
	(2 to 26.5) GHz (26.5 to 40) GHz	0.79 dB 0.82 dB	
S-Parameter S21-S12 – Measure (2.4 mm)	(-30 to 10) dB (50 to 500) MHz	0.24 dB	Agilent N5225A Microwave Network Analyzer, Agilent 85056D Calibration Kit
	(-50 to 10) dB (50 to 500) MHz	0.93 dB	
	(-50 to 10) dB 500 MHz to 2 GHz	0.14 dB	
	(2 to 26.5) GHz (26.5 to 50) GHz	0.56 dB 0.86 dB	
Harmonic Distortion – Measure	10 Hz to 100 kHz	0.7 dB	Agilent U8903A Audio Analyzer
Risetime – Measure	≤ 500 ps	2.5 ps	Agilent 83484A, 86100C Oscilloscope Mainframe
Total Harmonic Distortion CW, Modulation	5 Hz to 500 kHz	1.4 dB	Krohn-Hite 6900B Distortion Analyzer
	500 kHz to 1 MHz	2.3 dB	
Harmonic Distortion	100 kHz to 2.9 GHz	1.7 dB	Spectrum Analyzer
	(2.9 to 6.5) GHz	1.9 dB	
	(6.5 to 13.2) GHz	2.6 dB	
	(13.2 to 22) GHz	2.9 dB	
	(22 to 26.5) GHz	3.7 dB	

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Angles	(0 to 60) °	8.3"	Sine Bar
	90 °	2.8"	Master Square
Micrometers and Calipers ^{1,2} (Outside, Inside, Depth)	(0.01 to 0.5) in (0.5 to 1) in (1 to 4) in (4 to 15) in (15 to 40) in	13 μin 14 μin (3.5 + 10L) μin (4.3 + 11L) μin (4.4 + 11L) μin	Comparison to Gage Blocks
Anvil Flatness ¹	Up to 1 in Diameter	6.1 μin	Optical Flats
Dial Indicators ¹	Up to 6 in	(1.5 + 21L) μin	Comparison to Gage Blocks
Length Single Axis ² Outside Dimension	(0 to 1.0) in (1.0 to 7.0) in (7.0 to 21) in	(6 + 1L) μin (4.3 + 3.5L) μin (1 + 4L) μin	Universal Length Measuring Machine
Length Single Axis Inside Dimension	(0.04 to 0.125) in (0.125 to 0.25) in (0.025 to 1) in (1 to 2.5) in (2.5 to 10) in (10 to 14) in	11 μin 11 μin 11 μin 17 μin (18 + 3L) μin (38 + 3L) μin	Universal Length Measuring Machine
Height Gages ^{1,2}	Up to 24 in	(60 + 0.7L) μin	Comparison to Gage Blocks
Thread Wires	2 TPI to 120 TPI (0.008 to 0.5) in	12 μin	Universal Length Measuring Machine
Cylindrical Plug Gages ² Outside Diameter	Up to 1 in (1 to 7) in	12 μin (9 + 3L) μin	Universal Length Measuring Machine
Cylindrical Ring Gages ² Inside Diameter	(0.04 to 0.125) in (0.125 to 0.25) in (0.025 to 1) in (1 to 2.5) in (2.5 to 10) in (10 to 14) in	11 μin 11 μin 11 μin 17 μin (18 + 3L) μin (38 + 3L) μin	Universal Length Measuring Machine, Working Reference Rings

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Plug Gages ² Pitch Diameter 60° Thread	Up to 1 in (1 to 4) in (4 to 7) in	79 µin 80 µin 83 µin	Universal Length Measuring Machine, Thread Wires
Major Diameter	Up to 1 in (1 to 7) in	13 µin (10 + 3L) µin	
Tapered Thread Plug Gage Pitch Diameter	Up to 3 in	90 µin	Universal Length Measuring Machine
Standoff	Up to 1 in	31 µin	Gage Blocks, Amplifier
Thread Ring Gages Inner Pitch Diameter	Up to 1 in (1 to 4) in (4 to 7) in	79 µin 80 µin 83 µin	Master Plug Uncertainty

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass Determination (Metric)	1 mg	64 µg	Echelon III
	2 mg	64 µg	
	5 mg	97 µg	
	10 mg	84 µg	
	20 mg	73 µg	
	50 mg	64 µg	
	100 mg	65 µg	
	200 mg	76 µg	
	500 mg	78 µg	
	1 g	83 µg	
	2 g	0.16 mg	
	5 g	0.13 mg	
	10 g	0.14 mg	
	20 g	0.16 mg	
	50 g	0.11 mg	
	100 g	0.35 mg	
	200 g	0.39 mg	
500 g	1 mg		

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Mass Determination (Metric)	1 kg	1.6 mg	Echelon III
	2 kg	10 mg	
	4 kg	12 mg	
	5 kg	13 mg	
	6 kg	15 mg	
	7 kg	16 mg	
	8 kg	18 mg	
	16 kg	98 mg	
	32 kg	0.21 g	
Balances and Scales ^{1,7}	Up to 1 g	76 µg	ASTM E617 Class 1 & Class 2 weights and internal calibration procedure utilized in the calibration of the weighing system.
	(1 to 50) g	0.15 mg	
	(50 to 100) g	0.35 mg	
	(100 to 200) g	0.56 mg	
	(200 to 500) g	1 mg	
	(500 to 1) kg	1.6 mg	
	(1 to 2) kg	10 mg	
	(2 to 4) kg	12 mg	
	(4 to 5) kg	13 mg	
Balances and Scales ^{1,7}	(5 to 6) kg	15 mg	ASTM E617 Class 1 & Class 2 weights and internal calibration procedure utilized in the calibration of the weighing system.
	(6 to 7) kg	16 mg	
	(7 to 8) kg	18 mg	
	(8 to 16) kg	98 mg	
	(16 to 32) kg	0.21 g	
Pneumatic Absolute Pressure Devices	(32 to 64) kg	0.45 g	ASTM E617 Class 1 & Class 2 weights and internal calibration procedure utilized in the calibration of the weighing system.
	(64 to 114) kg	0.6 g	
	(0.2 to 1.45) psia	0.001 % of reading + 0.000 29 psi	
Pneumatic Absolute Pressure Devices	(1.45 to 50) psia	0.001 5 % of reading	DHI FPG 7601 Absolute Piston Gauge
	(50 to 1 000) psia	0.001 9 % of reading	
Pneumatic Pressure Devices	(-14.7 to -0.2) psiv	0.001 4 % of reading	Ruska 2465 Gas Piston Gauge
	(0.2 to 100) psig	0.001 4 % of reading	
	(100 to 1 000) psig	0.001 9 % of reading	
Pneumatic Pressure Devices	(-60 to 60) inH ₂ O	0.002 9 % of reading	DHI FPG 7601 Absolute Piston Gauge
Hydraulic Pressure Devices	(72.5 to 7 250) psig	0.002 % of reading + 0.002 9 psi	DHI PG7000 Piston Gauge
	(200 to 20 000) psig	0.003 % of reading + 0.007 3 psi	
	(20 000 to 72 500) psig	0.006 % of reading + 0.015 psi	
Determination of Piston Area	(0.2 to 100) psi	0.001 1% of reading	Ruska 2465 Gas Piston Gauge
	(100 to 1 000) psi	0.001 7 % of reading	

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Determination of Piston Area	(72.5 to 7 250) psig (200 to 20 000) psig (20 000 to 72 500) psig	0.001 7 % of reading 0.002 6 % of reading 0.005 1 % of reading	DHI PG7000 Piston Gauge (Gas to 6 000 psi)
Pneumatic Pressure – Source ¹	(-14.7 to -0.2) psiv (0.2 to 100) psig	0.001 4 % of reading 0.001 4 % of reading	Ruska 2465 Gas Piston Gauge (Gauge Mode)
	(0.2 to 100) psia	0.001 2 % of reading	Ruska 2465 Gas Piston Gauge (Absolute Mode)
	(100 to 1 000) psi	0.001 9 % of reading	Ruska 2465 Gas Piston Gauge (Absolute or Gauge Mode)
Hydraulic Pressure Devices ¹	(50 to 15 000) psig	0.011 % of reading + 0.17 psi	Ametek T-150 Deadweight Tester
Pneumatic Absolute Pressure – Source	(0.000 27 to 0.005 1) Pa (0.000 7 to 0.027) Pa	22 % of reading 8 % of reading	Ion Gauge
	(0.028 to 2 500) Pa	0.05 % of reading + 0.07 Pa	Capacitive Diaphragm Gauge
Gas Flow Devices	(1 to 10) sccm (20 to 200) sccm (0.2 to 2) slm (2 to 20) slm (20 to 50) slm (50 to 100) slm	0.22 % of reading + 0.004 2 sccm 0.25 % of reading + 0.001 7 sccm 0.25 % of reading + 0.000 02 slm 0.25 % of reading + 0.000 36 slm 0.34 % of reading 0.34 % of reading	Fluke Molbox, Fluke Molblocc
Torque – Hydraulic ¹ (1 000 to 10 000) psig	(270 to 2 700) N·m (2 700 to 4 000) N·m	1.3 % of reading 1.3 % of reading	Torque Calibration System
	(200 to 2 000) lbf·ft (2 000 to 20 000) lbf·ft	1.3 % of reading 1.3 % of reading	
Torque Multipliers ¹	(270 to 2 700) N·m (2 700 to 4 000) N·m	1.5 % of reading 1.5 % of reading	Torque Calibration System
	(200 to 2 000) lbf·ft (2 000 to 20 000) lbf·ft	1.5 % of reading 1.5 % of reading	
Torque Devices ¹	2 lbf·in to 811 lbf·ft	1.2 % of reading	Torque Calibrator

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity – Measure ¹	(15 to 25) °C (10 to 90) %RH (90 to 95) %RH (25 to 40) °C (10 to 50) %RH (50 to 75) %RH (75 to 95) %RH	1.3 % RH 2 % RH 1.7 % RH 2 % RH 2.3 % RH	Master Thermohygrometer
Temperature – Source	(-20 to 100) °C 100 °C to 150) °C (150 to 230) °C (230 to 300) °C (300 to 420) °C (420 to 660) °C	0.011 °C 0.013 °C 0.016 °C 0.018 °C 0.074 °C 0.12 °C	Liquid Baths, Metrology Wells, SPRT, Super Thermometer
Temperature – Measure ¹	(-195 to 0) °C (0 to 420) °C (420 to 660) °C	0.012 °C 0.025 °C 0.036 °C	SPRT, Fluke Black Stack
Temperature – Measure ¹	(660 to 750) °C (750 to 1 000) °C	1.3 °C 1.8 °C	Type K Thermocouple Probe w/ Reader
Infrared Temperature Measuring Devices 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 0.95 °C 1.6 °C 2.1 °C	Black Body Source (Flat Plate) $\epsilon = (0.9 \text{ to } 1)$, $\lambda = (8 \text{ to } 14) \mu\text{m}$
Isothermal Block Verification ¹	Ambient (~ 23 °C)	0.02 °C	Thermocouple Half Junction

Time and Frequency


Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Source/Measure ⁸	10 MHz	3.7 pHz/Hz	Fluke 910R GPS Frequency Standard
Frequency Comparison – Measure	(-20 to 30) dBm 10 MHz Reference	8.2 nHz	Fluke PM6681R Rubidium Counter
Frequency Drift – Measure	(-20 to 30) dBm 10 MHz Reference	8.2 nHz	Fluke PM6681R Rubidium Counter

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Measure (without Pre-amp)	(-127 to 30) dBm 3 Hz to 10 MHz 10 MHz to 1 GHz (1 to 10) GHz (10 to 26.5) GHz	0.2 Hz 1.2 Hz 1.2 Hz 3.1 Hz	Keysight PSA E4440A Spectrum Analyzer
Frequency – Measure (with Pre-amp)	(-127 to 30) dBm (26.5 to 50) GHz	3.3 Hz	Keysight PSA E4440A Spectrum Analyzer
Time Interval/Duty Cycle – Measure	10 s interval	8.5 nHz	Fluke PM6681R Rubidium 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. L = length in inches; " = arc-second.
 3. As frequency & amplitude deviate from the listed values, uncertainty may be higher than stated. If needed, contact laboratory for more information regarding uncertainties at frequency and range combinations other than the ones shown.
 4. The stated uncertainty is the laboratory's ability to source a fast rise pulse that is approximately 500 ps, 125 ps, and 25 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 uncertainties shown are for the most favorable conditions. There is an increase in uncertainty that corresponds to the laboratory's AC voltage and current uncertainties at different frequencies other than the ones shown. Power factors (PF) other than the one shown contribute to the power uncertainty. PF is related to the cosine of phase. Therefore, uncertainties track the laboratory's phase uncertainty closely at PF near one, but are magnified heavily as PF approaches zero. The lab may also report reactive power, apparent power, and power factor under this accreditation. If needed, contact laboratory for more information regarding uncertainties at frequency and power factor combinations other than the ones shown.
 6. This parameter is a unitless measurement.
 7. The CMC for scales and balances is highly dependent upon the resolution of the unit under test. The CMC presented here does not include the resolution of the unit under test. The resolution will be included in the reported measurement uncertainty at the time of calibration.
 8. Uncertainty values of derivatives of 10 MHz will differ due to resolution, noise and gating errors.
 9. This scope is formatted as part of a single document including Certificate of Accreditation No. AC-2489.02.



R. Douglas Leonard Jr., VP, PILR SBU