CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Transcat - Chesapeake
2509 Walmer Avenue
Norfolk, VA 23513

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.

Jason Stine, Vice President

Expiry Date: 07 September 2027
Certificate Number: AC-2489.21

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

AND

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

Transcat – Chesapeake
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Dante Daneri 757-558-2500

CALIBRATION

ISO/IEC 17025 Accreditation Granted: **07 September 2025**

Certificate Number: **AC-2489.21** Certificate Expiry Date: **07 September 2027**

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Vibration – Measure (any single axis)			Comparison to Reference Accelerometer w/ Calibrator
Voltage Sensitivity	100 Hz 10 mV/g	1.5 % of reading	
Frequency Response	(0.8 to 20) g RMS		
	(5 to 20) Hz	2.1 % of reading	
	(20 to 100) Hz	1.9 % of reading	
	(100 to 2 500) Hz	1.5 % of reading	
	(2 500 to 10 000) Hz	2.8 % of reading	
Sound – Generate	1 kHz 110 dB	0.42 dB	Comparisons to SPL Calibrator
Sound – Measure	20 Hz to 10 kHz (50 to 120) dB	0.5 dB	Comparisons to Sound Level Meter

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Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
pH Meters	4 pH 7 pH 10 pH	0.014 pH 0.011 pH 0.016 pH	Comparisons to Accredited pH Solutions
Conductivity Meters	10 µS/cm 25 µS/cm 75 µS/cm 100 µS/cm 1 015 µS/cm 1 408 µS/cm 10 000 µS/cm	0.35 µS/cm 1.4 µS/cm 1.5 µS/cm 0.86 µS/cm 6 µS/cm 8 µS/cm 50 µS/cm	Comparisons to Accredited Conductivity Solutions
Gas Detection Equipment [1]			
CO (Carbon Monoxide)	0.002 % CO Concentration 0.006 % CO Concentration 0.01 % CO Concentration 0.1 % CO Concentration 0.5 % CO Concentration	0.000 096 % CO Concentration 0.000 15 % CO Concentration 0.000 22 % CO Concentration 0.000 83 % CO Concentration 0.01 % CO Concentration	
CH_4 (Methane LEL)	50 % LEL Concentration	1 % LEL Concentration	
C_5H_{12} (Pentane LEL)	58 % LEL Concentration	1.5 % LEL Concentration	
H_2S (Hydrogen Sulfide)	0.002 % H_2S Concentration 0.002 5 % H_2S Concentration	0.000 1 % H_2S Concentration 0.000 11 % H_2S Concentration	Comparisons to Certified Gas Mixtures
O_2 (Oxygen)	0.5 % O_2 Concentration 5 % O_2 Concentration 15 % O_2 Concentration 18 % O_2 Concentration	0.005 2 % O_2 Concentration 0.038 % O_2 Concentration 0.14 % O_2 Concentration 0.16 % O_2 Concentration	
C_4H_8 (Isobutylene)	0.01 % C_4H_8 Concentration	0.000 23 % C_4H_8 Concentration	
CO_2 (Carbon Dioxide)	0.5 % CO_2 Concentration 5 % CO_2 Concentration	0.004 4 % CO_2 Concentration 0.081 % CO_2 Concentration	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – Source [1]	(0 to 220) mV (0.22 to 2.2) V (2.2 to 11) V (11 to 22) V (22 to 220) V (220 to 1 100) V	7.5 µV/V + 0.4 µV 5 µV/V + 0.7 µV 3.5 µV/V + 2.5 µV 3.5 µV/V + 4 µV 5 µV/V + 40 µV 6.5 µV/V + 0.4 mV	Comparison to Fluke 5730A/03 Multiproduct Calibrator
DC Voltage – Measure [1]	(0 to 200) mV (0.2 to 2) V (2 to 20) V (20 to 200) V (200 to 1 000) V	5.2 µV/V + 90 nV 3.6 µV/V + 0.39 µV 3.5 µV/V + 3.9 µV 5.5 µV/V + 39 µV 5.5 µV/V + 0.47 mV	Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter
DC High Voltage – Measure [1]	(1 to 10) kV	0.039 % of reading + 92 mV	Comparison to Vitrek 4700 High Voltage Meter
DC High Voltage – Measure [1]	Up to 40 kV	2 % of reading	Comparison to Fluke 80K40HV Probe, Fluke 8508A opt 001 8.5 Digit Multimeter
DC Current – Source [1]	(0 to 220) µA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A	40 µA/A + 6 nA 35 µA/A + 7 nA 35 µA/A + 40 nA 45 µA/A + 0.7 µA 80 µA/A + 12 µA	Comparison to Fluke 5730A/03 Multiproduct Calibrator
DC Current – Source [1]	(2.2 to 3) A (3 to 11) A (11 to 20.5) A	0.3 mA/A + 31 µA 0.51 mA/A + 0.39 mA 0.93 mA/A + 0.58 mA	Comparison to Fluke 5522A/11 Multiproduct Calibrator
DC Current – Source [1]	(20 to 100) A	0.04 % of reading	Comparison to Current Source, SR-100 Current Shunt, Fluke 8508 8.5 Digit Multimeter
DC Clamp-on Ammeter (Non-Toroidal Type) Hall Effect Sensor [1]	(20 to 150) A (150 to 1 000) A	0.51 % of reading + 0.14 A 0.52 % of reading + 0.5 A	Comparison to Fluke 5522A/11 Multiproduct Calibrator, 50-turn Coil

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current – Measure [1]	(0 to 200) µA (0.2 to 2) mA (2 to 20) mA (20 to 200) mA (0.2 to 2) A (2 to 20) A	13 µA/A + 0.31 nA 13 µA/A + 3.1 nA 14 µA/A + 31 nA 47 µA/A + 0.62 µA 0.18 mA/A + 12 µA 0.39 mA/A + 0.31 mA	Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter
DC Current – Measure [1]	(20 to 100) A	0.04 % of reading + 24 µA	Comparison to SR-100 Current Shunt, Fluke 8508A opt 001 8.5 Digit Multimeter
DC Resistance – Source [1] (Simulation)	(0 to 11) Ω (11 to 33) Ω (33 to 110) Ω (110 to 330) Ω (0.33 to 1.1) kΩ (1.1 to 3.3) kΩ (3.3 to 11) kΩ (11 to 33) kΩ (33 to 110) kΩ (110 to 330) kΩ (0.33 to 1.1) MΩ (1.1 to 3.3) MΩ (3.3 to 11) MΩ (11 to 33) MΩ (33 to 110) MΩ (110 to 330) MΩ (0.33 to 1.1) GΩ	32 µΩ/Ω + 0.78 mΩ 24 µΩ/Ω + 1.2 mΩ 22 µΩ/Ω + 1.1 mΩ 22 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 1.6 mΩ 22 µΩ/Ω + 0.16 Ω 22 µΩ/Ω + 0.16 Ω 27 µΩ/Ω + 1.6 Ω 26 µΩ/Ω + 1.6 Ω 66 µΩ/Ω + 23 Ω 0.1 mΩ/Ω + 39 Ω 0.19 mΩ/Ω + 1.9 kΩ 0.41 mΩ/Ω + 2.3 kΩ 0.23 % of reading + 78 kΩ 1.2 % of reading + 0.39 MΩ	Comparison to Fluke 5522A/11 Multiproduct Calibrator
DC Resistance – Source [1] (Fixed Artifacts)	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ	40 µΩ 95 µΩ/Ω 95 µΩ/Ω 23 µΩ/Ω 23 µΩ/Ω 10 µΩ/Ω 10 µΩ/Ω 6.5 µΩ/Ω	Comparison to Fluke 5730A/03 Multiproduct Calibrator

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Resistance – Source [1] (Fixed Artifacts)	1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	6.5 μΩ/Ω 6.5 μΩ/Ω 6.5 μΩ/Ω 8.5 μΩ/Ω 8.5 μΩ/Ω 13 μΩ/Ω 18 μΩ/Ω 40 μΩ/Ω 47 μΩ/Ω 0.1 mΩ/Ω	Comparison to Fluke 5730A/03 Multiproduct Calibrator
DC High Resistance – Source [1] (Variable Artifact)	(1 to 1 000) MΩ (1 to 100) GΩ	0.2 % of reading 1 % of reading	Comparison to Biddle 72-6346-1 Decade Resistor
DC Resistance – Source/Measure [1] Normal Mode – 4W	(0 to 2) Ω (2 to 20) Ω (20 to 200) Ω (0.2 to 2) kΩ (2 to 20) kΩ (20 to 200) kΩ (0.2 to 2) MΩ (2 to 20) MΩ (20 to 200) MΩ (0.2 to 2) GΩ	17 μΩ/Ω + 3.9 μΩ 9.5 μΩ/Ω + 14 μΩ 7.8 μΩ/Ω + 47 μΩ 8.1 μΩ/Ω + 0.47 mΩ 7.8 μΩ/Ω + 4.7 mΩ 8.6 μΩ/Ω + 47 mΩ 9.5 μΩ/Ω + 93 mΩ 27 μΩ/Ω + 9.3 Ω 0.12 mΩ/Ω + 0.93 kΩ 0.14 % of reading + 93 kΩ	Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter, Decade Resistor
DC Resistance – Source/Measure [1] Low Current Mode – 4W	(0 to 2) Ω (2 to 20) Ω (20 to 200) Ω (0.2 to 2) kΩ (2 to 20) kΩ (20 to 200) kΩ (0.2 to 2) MΩ (2 to 20) MΩ (20 to 200) MΩ (0.2 to 2) GΩ	17 μΩ/Ω + 3.9 μΩ 9.4 μΩ/Ω + 14 μΩ 8 μΩ/Ω + 0.14 mΩ 8.2 μΩ/Ω + 1.4 mΩ 7.9 μΩ/Ω + 14 mΩ 8.6 μΩ/Ω + 93 mΩ 21 μΩ/Ω + 0.93 Ω 88 μΩ/Ω + 93 Ω 0.14 % of reading + 93 kΩ 0.14 % of reading + 0.93 MΩ	Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter, Decade Resistor
DC Resistance – Source/Measure [1] High Voltage Mode – 4W	(2 to 20) MΩ (20 to 200) MΩ (0.2 to 2) GΩ (2 to 20) GΩ	25 μΩ/Ω + 9.3 Ω 70 μΩ/Ω + 0.93 kΩ 0.19 mΩ/Ω + 93 kΩ 0.14 % of reading + 9.3 MΩ	Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter, Decade Resistor
Capacitance – Source [1] (Variable Artifact)	(50 to 200) pF 200 pF to 1.111 15 μF	0.63 % of reading + 5.8 pF 0.59 % of reading + 5.8 pF	Comparison to General Radio 1412-BC Decade Capacitor

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Electrical – DC/Low Frequency

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Capacitance – Source [1] (Simulation)	(0.22 to 0.4) nF (0.4 to 1.1) nF (1.1 to 3.3) nF (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF (0.33 to 1.1) µF (1.1 to 3.3) µF (3.3 to 11) µF (11 to 33) µF (33 to 110) µF (110 to 330) µF	0.4 % of reading + 7.8 pF 0.4 % of reading + 7.8 pF 0.4 % of reading + 7.8 pF 0.21 % of reading + 7.8 pF 0.2 % of reading + 78 pF 0.21 % of reading + 78 pF 0.2 % of reading + 0.23 nF 0.21 % of reading + 0.78 nF 0.21 % of reading + 2.3 nF 0.2 % of reading + 7.8 nF 0.32 % of reading + 23 nF 0.37 % of reading + 78 nF 0.38 % of reading + 0.23 µF	Comparison to Fluke 5522A/11 Multiproduct Calibrator
Capacitance – Source [1] (Simulation)	(0.33 to 1.1) mF (1.1 to 3.3) mF (3.3 to 11) mF (11 to 33) mF (33 to 110) mF	0.35 % of reading + 0.78 µF 0.35 % of reading + 2.3 µF 0.35 % of reading + 7.8 µF 0.58 % of reading + 23 µF 0.85 % of reading + 78 µF	Comparison to Fluke 5522A/11 Multiproduct Calibrator
Capacitance – Measure [1,7]	1 kHz Up to 10 pF (10 to 100) pF 100 pF to 1 µF (1 to 100) µF 100 µF to 1 mF	 0.48 % of reading + 50 fF 0.06 % of reading+ 50 fF 0.027 % of reading+ 50 fF 0.037 % of reading+ 50 fF 0.25 % of reading	Comparison to General Radio 1689 RLC Digibridge
Inductance – Measure [1,7]	1 kHz (1 to 10) mH 10 mH to 10 H	 0.026 % of reading + 0.1 µH 0.026 % of reading + 1.4 µH	Comparison to General Radio 1689 RLC Digibridge
Inductance – Source [1,7] (Fixed Artifacts)	1kHz 1 mH 100 mH	 0.001 2 mH 0.12 mH	Comparison to General Radio 1482-E, General Radio 1482-L Standard Inductors
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	 0.024 % of reading + 4 µV 0.009 % of reading + 4 µV 0.008 % of reading + 4 µV 0.02 % of reading + 4 µV 0.05 % of reading + 5 µV 0.11 % of reading + 10 µV 0.14 % of reading + 20 µV 0.27 % of reading + 20 µV	Comparison to Fluke 5730A/03 Multiproduct Calibrator

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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		Comparison to Fluke 5730A/03 Multiproduct Calibrator
	(10 to 20) Hz	0.024 % of reading + 4 µV	
	(20 to 40) Hz	0.009 % of reading + 4 µV	
	40 Hz to 20 kHz	0.008 % of reading + 4 µV	
	(20 to 50) kHz	0.02 % of reading + 4 µV	
	(50 to 100) kHz	0.05 % of reading + 5 µV	
	(100 to 300) kHz	0.11 % of reading + 10 µV	
	(300 to 500) kHz	0.14 % of reading + 20 µV	
	500 kHz to 1 MHz	0.27 % of reading + 20 µV	
	(22 to 220) mV		
	(10 to 20) Hz	0.024 % of reading + 12 µV	
	(20 to 40) Hz	0.009 % of reading + 7 µV	
	40 Hz to 20 kHz	0.005 7 % of reading + 7 µV	
	(20 to 50) kHz	0.012 % of reading + 7 µV	
	(50 to 100) kHz	0.031 % of reading + 17 µV	
	(100 to 300) kHz	0.066 % of reading + 20 µV	
	(300 to 500) kHz	0.14 % of reading + 25 µV	
	500 kHz to 1 MHz	0.27 % of reading + 45 µV	
	(0.22 to 2.2) V		
	(10 to 20) Hz	0.024 % of reading + 40 µV	
	(20 to 40) Hz	0.009 % of reading + 15 µV	
	40 Hz to 20 kHz	0.004 2 % of reading + 8 µV	
	(20 to 50) kHz	0.006 7 % of reading + 10 µV	
	(50 to 100) kHz	0.008 5 % of reading + 30 µV	
	(100 to 300) kHz	0.034 % of reading + 80 µV	
	(300 to 500) kHz	0.1 % of reading + 0.2 mV	
	500 kHz to 1 MHz	0.17 % of reading + 0.3 mV	
	(2.2 to 22) V		
	(10 to 20) Hz	0.024 % of reading + 0.4 mV	
	(20 to 40) Hz	0.009 % of reading + 0.15 mV	
	40 Hz to 20 kHz	0.004 2 % of reading + 0.05 mV	
	(20 to 50) kHz	0.006 7 % of reading + 0.1 mV	
	(50 to 100) kHz	0.008 3 % of reading + 0.2 mV	
	(100 to 300) kHz	0.026 % of reading + 0.6 mV	
	(300 to 500) kHz	0.1 % of reading + 2 mV	
	500 kHz to 1 MHz	0.15 % of reading + 3.2 mV	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source [1]	(22 to 220) V		Comparison to Fluke 5730A/03 Multiproduct Calibrator
	(10 to 20) Hz	0.024 % of reading + 4 mV	
	(20 to 40) Hz	0.009 % of reading + 1.5 mV	
	40 Hz to 20 kHz	0.005 2 % of reading + 0.6 mV	
	(20 to 50) kHz	0.008 % of reading + 1 mV	
	(50 to 100) kHz	0.015 % of reading + 2.5 mV	
	(100 to 300) kHz	0.09 % of reading + 16 mV	
	(300 to 500) kHz	0.44 % of reading + 40 mV	
	500 kHz to 1 MHz	0.8 % of reading + 80 mV	
	(220 to 250) V		
	(15 to 50) Hz	0.03 % of reading + 16 mV	
	(250 to 1 100) V		
	50 Hz to 1 kHz	0.007 % of reading + 3.5 mV	
AC Voltage – Source [1]	(220 to 330) V		Comparison to Fluke 5522A/11 Multiproduct Calibrator
	(1 to 10) kHz	0.016 % of reading + 4.7 mV	
	(10 to 20) kHz	0.02 % of reading + 4.7 mV	
	(20 to 50) kHz	0.025 % of reading + 4.7 mV	
	(50 to 100) kHz	0.16 % of reading + 39 mV	
	(330 to 1 020) V		
	(1 to 5) kHz	0.02 % of reading + 7.8 mV	
	(5 to 10) kHz	0.023 % of reading + 7.8 mV	
AC Voltage – Source [1] (Wideband Amplitude)	30 Hz to 500 kHz		Comparison to Fluke 5730A/03 Multiproduct Calibrator
	(0.3 to 1.1) mV	0.62 % of reading + 0.78 µV	
	(1.1 to 3) mV	0.54 % of reading + 1.2 µV	
	(3 to 11) mV	0.54 % of reading + 3.1 µV	
	(11 to 33) mV	0.47 % of reading + 6.2 µV	
	(33 to 110) mV	0.47 % of reading + 16 µV	
	(110 to 330) mV	0.39 % of reading + 39 µV	
	(0.33 to 1.1) V	0.39 % of reading + 0.16 mV	
	(1.1 to 3.5) V	0.31 % of reading + 0.19 mV	
	Up to 1.1 mV		
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	120 Hz to 1.199 9 kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	120 kHz to 1.199 9 MHz	0.16 % of reading + 1.2 µV	
	(1.2 to 2) MHz	0.16 % of reading + 1.2 µV	
	(2 to 12) MHz	0.31 % of reading + 1.2 µV	
	(12 to 20) MHz	0.47 % of reading + 1.2 µV	
	(20 to 30) MHz	2.1 % of reading + 5.8 µV	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Wideband Amplitude Flatness – Source [1] (1 kHz reference)	(1.1 to 3.3) mV		Comparison to Fluke 5730A/03 Multiproduct Calibrator
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	120 Hz to 1.199 9 kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	120 kHz to 1.199 9 MHz	0.078 % of reading + 1.2 µV	
	(1.2 to 2) MHz	0.078 % of reading + 1.2 µV	
	(2 to 12) MHz	0.23 % of reading + 1.2 µV	
	(12 to 20) MHz	0.39 % of reading + 1.2 µV	
	(20 to 30) MHz	1.2 % of reading + 1.2 µV	
	(3.3 to 11) mV		
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	120 Hz to 1.199 9 kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	120 kHz to 1.199 9 MHz	0.078 % of reading + 1.2 µV	
	(1.2 to 2) MHz	0.078 % of reading + 1.2 µV	
	(2 to 12) MHz	0.16 % of reading + 1.2 µV	
	(12 to 20) MHz	0.31 % of reading + 1.2 µV	
	(20 to 30) MHz	0.78 % of reading + 1.2 µV	
	(11 to 33) mV		
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	120 Hz to 1.199 9 kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	120 kHz to 1.199 9 MHz	0.078 % of reading + 1.2 µV	
	(11 to 16.5) mV		
	(1.2 to 2) MHz	0.16 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % reading + 1.2 µV	
	(12 to 20) MHz	0.39 % reading + 1.2 µV	
	(20 to 30) MHz	0.85 % reading + 1.2 µV	
	(16.5 to 33) mV		
	(1.2 to 2) MHz	0.078 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % reading + 1.2 µV	
	(12 to 20) MHz	0.31 % reading + 1.2 µV	
	(20 to 30) MHz	0.78 % reading + 1.2 µV	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Wideband Amplitude Flatness – Source [1] (1 kHz reference)	(33 to 110) mV		Comparison to Fluke 5730A/03 Multiproduct Calibrator
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	120 Hz to 1.199 9 kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	120 kHz to 1.199 9 MHz	0.078 % of reading + 1.2 µV	
	(33 to 55) mV		
	(1.2 to 2) MHz	0.16 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % reading + 1.2 µV	
	(12 to 20) MHz	0.39 % reading + 1.2 µV	
	(20 to 30) MHz	0.85 % reading + 1.2 µV	
	(55 to 110) mV		
	(1.2 to 2) MHz	0.078 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % reading + 1.2 µV	
	(12 to 20) MHz	0.31 % reading + 1.2 µV	
	(20 to 30) MHz	0.78 % reading + 1.2 µV	
	(110 to 330) mV		
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	120 Hz to 1.199 9 kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	120 kHz to 1.199 9 MHz	0.078 % of reading + 1.2 µV	
	(110 to 165) mV		
	(1.2 to 2) MHz	0.16 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % reading + 1.2 µV	
	(12 to 20) MHz	0.39 % reading + 1.2 µV	
	(20 to 30) MHz	0.85 % reading + 1.2 µV	
	(165 to 330) mV		
	(1.2 to 2) MHz	0.078 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % reading + 1.2 µV	
	(12 to 20) MHz	0.31 % reading + 1.2 µV	
	(20 to 30) MHz	0.78 % reading + 1.2 µV	
	(0.33 to 1.1) V		
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	120 Hz to 1.199 9 kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	120 Hz to 1.199 9 MHz	0.078 % of reading + 1.2 µV	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Wideband Amplitude Flatness – Source [1] (1 kHz reference)	(0.33 to 0.55) V		Comparison to Fluke 5730A/03 Multiproduct Calibrator
	(1.2 to 2) MHz	0.16 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % reading + 1.2 µV	
	(12 to 20) MHz	0.39 % reading + 1.2 µV	
	(20 to 30) MHz	0.85 % reading + 1.2 µV	
	(0.55 to 1.1) V		
	(1.2 to 2) MHz	0.078 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % reading + 1.2 µV	
	(12 to 20) MHz	0.31 % reading + 1.2 µV	
	(20 to 30) MHz	0.78 % reading + 1.2 µV	
	(1.1 to 3.5) V		
	(10 to 30) Hz	0.23 % of reading	
	(30 to 119.99) Hz	0.078 % of reading	
	120 Hz to 1.199 9 kHz	0.078 % of reading	
	(1.2 to 11.999) kHz	0.078 % of reading	
	(12 to 119.99) kHz	0.078 % of reading	
	120 kHz to 1.199 9 MHz	0.078 % of reading + 1.2 µV	
	(1.1 to 1.75) V		
	(1.2 to 2) MHz	0.16 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.23 % reading + 1.2 µV	
	(12 to 20) MHz	0.39 % reading + 1.2 µV	
	(20 to 30) MHz	0.85 % reading + 1.2 µV	
	(1.75 to 3.5) V		
	(1.2 to 2) MHz	0.078 % reading + 1.2 µV	
	(2 to 11.9) MHz	0.16 % reading + 1.2 µV	
	(12 to 20) MHz	0.31 % reading + 1.2 µV	
	(20 to 30) MHz	0.78 % reading + 1.2 µV	
AC Voltage – Measure [1]	Up to 200 mV		Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter
	(1 to 10) Hz	0.017 % of reading + 70 µV	
	(0.2 to 200) V		
	(1 to 10) Hz	0.015 % of reading + 60 µV	
	(200 to 1 000) V		
	(1 to 10) Hz	0.015 % of reading + 70 µV	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure [1]	(0.6 to 2.2) mV		Comparison to Fluke 5790A-03 AC Measurement Standard
	(10 to 20) Hz	0.17 % of reading + 1.3 µV	
	(20 to 40) Hz	0.074 % of reading + 1.3 µV	
	40 Hz to 20 kHz	0.042 % of reading + 1.3 µV	
	(20 to 50) kHz	0.081 % of reading + 2 µV	
	(50 to 100) kHz	0.12 % of reading + 2.5 µV	
	(100 to 300) kHz	0.23 % of reading + 4 µV	
	(300 to 500) kHz	0.24 % of reading + 8 µV	
	500 kHz to 1 MHz	0.35 % of reading + 8 µV	
	(2.2 to 7) mV		
	(10 to 20) Hz	0.085 % of reading + 1.3 µV	
	(20 to 40) Hz	0.037 % of reading + 1.3 µV	
	40 Hz to 20 kHz	0.021 % of reading + 1.3 µV	
	(20 to 50) kHz	0.04 % of reading + 2 µV	
	(50 to 100) kHz	0.06 % of reading + 2.5 µV	
	(100 to 300) kHz	0.12 % of reading + 4 µV	
	(300 to 500) kHz	0.13 % of reading + 8 µV	
	500 kHz to 1 MHz	0.23% of reading + 8 µV	
	(7 to 22) mV		
	(10 to 20) Hz	0.029 % of reading + 1.3 µV	
	(20 to 40) Hz	0.019 % of reading + 1.3 µV	
	40 Hz to 20 kHz	0.011 % of reading + 1.3 µV	
	(20 to 50) kHz	0.021 % of reading + 2 µV	
	(50 to 100) kHz	0.031 % of reading + 2.5 µV	
	(100 to 300) kHz	0.081 % of reading + 4 µV	
	(300 to 500) kHz	0.089 % of reading + 8 µV	
	500 kHz to 1 MHz	0.17 % of reading + 8 µV	
	(22 to 70) mV		
	(10 to 20) Hz	0.024 % of reading + 1.5 µV	
	(20 to 40) Hz	0.012 % of reading + 1.5 µV	
	40 Hz to 20 kHz	65 µV/V + 1.5 µV	
	(20 to 50) kHz	0.013 % of reading + 2 µV	
	(50 to 100) kHz	0.026 % of reading + 2.5 µV	
	(100 to 300) kHz	0.051 % of reading + 4 µV	
	(300 to 500) kHz	0.067 % of reading + 8 µV	
	500 kHz to 1 MHz	0.11 % of reading + 8 µV	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure [1]	(70 to 220) mV		Comparison to Fluke 5790A-03 AC Measurement Standard
	(10 to 20) Hz	0.021 % of reading + 1.5 µV	
	(20 to 40) Hz	85 µV/V + 1.5 µV	
	40 Hz to 20 kHz	38 µV/V + 1.5 µV	
	(20 to 50) kHz	69 µV/V + 2 µV	
	(50 to 100) kHz	0.016 % of reading + 2.5 µV	
	(100 to 300) kHz	0.025 % of reading + 4 µV	
	(300 to 500) kHz	0.038 % of reading + 8 µV	
	500 kHz to 1 MHz	0.1 % of reading + 8 µV	
	(220 to 700) mV		
	(10 to 20) Hz	0.021 % of reading + 1.5 µV	
	(20 to 40) Hz	76 µV/V + 1.5 µV	
	40 Hz to 20 kHz	33 µV/V + 1.5 µV	
	(20 to 50) kHz	51 µV/V + 2 µV	
	(50 to 100) kHz	79 µV/V + 2.5 µV	
	(100 to 300) kHz	0.018 % of reading + 4 µV	
	(300 to 500) kHz	0.03 % of reading + 8 µV	
	500 kHz to 1 MHz	0.096 % of reading + 8 µV	
	(0.7 to 2.2) V		
	(10 to 20) Hz	0.021 % of reading + 1.5 µV	
	(20 to 40) Hz	76 µV/V + 1.5 µV	
	40 Hz to 20 kHz	33 µV/V + 1.5 µV	
	(20 to 50) kHz	51 µV/V + 2 µV	
	(50 to 100) kHz	79 µV/V + 2.5 µV	
	(100 to 300) kHz	0.018 % of reading + 4 µV	
	(300 to 500) kHz	0.03 % of reading + 8 µV	
	500 kHz to 1 MHz	0.096 % of reading + 8 µV	
	(2.2 to 7) V		
	(10 to 20) Hz	0.02 % of reading	
	(20 to 40) Hz	67 µV/V	
	40 Hz to 20 kHz	24 µV/V	
	(20 to 50) kHz	48 µV/V	
	(50 to 100) kHz	81 µV/V	
	(100 to 300) kHz	0.02 % of reading	
	(300 to 500) kHz	0.04 % of reading	
	500 kHz to 1 MHz	0.12 % of reading	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure [1]	(7 to 22) V		Comparison to Fluke 5790A-03 AC Measurement Standard
	(10 to 20) Hz	0.02 % of reading	
	(20 to 40) Hz	67 µV/V	
	40 Hz to 20 kHz	27 µV/V	
	(20 to 50) kHz	48 µV/V	
	(50 to 100) kHz	81 µV/V	
	(100 to 300) kHz	0.02 % of reading	
	(300 to 500) kHz	0.04 % of reading	
	500 kHz to 1 MHz	0.12 % of reading	
	(22 to 70) V		
	(10 to 20) Hz	0.02 % of reading	
	(20 to 40) Hz	68 µV/V	
	40 Hz to 20 kHz	32 µV/V	
	(20 to 50) kHz	57 µV/V	
	(50 to 100) kHz	94 µV/V	
	(100 to 300) kHz	0.02 % of reading	
	(300 to 500) kHz	0.04 % of reading	
	500 kHz to 1 MHz	0.12 % of reading	
	(70 to 220) V		
	(10 to 20) Hz	0.02 % of reading	
	(20 to 40) Hz	68 µV/V	
	40 Hz to 20 kHz	31 µV/V	
	(20 to 50) kHz	69 µV/V	
	(50 to 100) kHz	98 µV/V	
	(100 to 300) kHz	0.02 % of reading	
	(300 to 500) kHz	0.05 % of reading	
	(220 to 700) V		
	(10 to 20) Hz	0.02 % of reading	
	(20 to 40) Hz	99 µV/V	
	40 Hz to 20 kHz	41 µV/V	
	(20 to 50) kHz	0.01 % of reading	
	(50 to 100) kHz	0.05 % of reading	
	(700 to 1 000) V		
	(10 to 20) Hz	0.02 % of reading	
	(20 to 40) Hz	99 µV/V	
	40 Hz to 20 kHz	38 µV/V	
	(20 to 50) kHz	0.01 % of reading	
	(50 to 100) kHz	0.05 % of reading	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Wideband Amplitude Flatness – Measure [1] (1 kHz reference)	(0.6 to 2.2) mV		Comparison to Fluke 5790A-03 AC Measurement Standard
	50 kHz to 1.2 MHz	0.07 % of reading + 1 µV	
	(1.2 to 2) MHz	0.07 % of reading + 1 µV	
	(2 to 10) MHz	0.17 % of reading + 1 µV	
	(10 to 20) MHz	0.3 % of reading + 1 µV	
	(20 to 30) MHz	0.7 % of reading + 2 µV	
	(2.2 to 7) mV		
	50 kHz to 1.2 MHz	0.07 % of reading + 1 µV	
	(1.2 to 2) MHz	0.07 % of reading + 1 µV	
	(2 to 10) MHz	0.1 % of reading + 1 µV	
	(10 to 20) MHz	0.17 % of reading + 1 µV	
	(20 to 30) MHz	0.37 % of reading + 1 µV	
	(7 to 22) mV		
	50 kHz to 1.2 MHz	0.07 % of reading	
	(1.2 to 2) MHz	0.07 % of reading	
	(2 to 10) MHz	0.1 % of reading	
	(10 to 20) MHz	0.17 % of reading	
	(20 to 30) MHz	0.37 % of reading	
	(22 to 70) mV		
	50 kHz to 1.2 MHz	0.05 % of reading	
	(1.2 to 2) MHz	0.05 % of reading	
	(2 to 10) MHz	0.1 % of reading	
	(10 to 20) MHz	0.15 % of reading	
	(20 to 30) MHz	0.35 % of reading	
	(70 to 220) mV		
	50 kHz to 1.2 MHz	0.05 % of reading	
	(1.2 to 2) MHz	0.05 % of reading	
	(2 to 10) MHz	0.1 % of reading	
	(10 to 20) MHz	0.15 % of reading	
	(20 to 30) MHz	0.35 % of reading	
	(220 to 700) mV		
	50 kHz to 1.2 MHz	0.05 % of reading	
	(1.2 to 2) MHz	0.05 % of reading	
	(2 to 10) MHz	0.1 % of reading	
	(10 to 20) MHz	0.15 % of reading	
	(20 to 30) MHz	0.35 % of reading	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Wideband Amplitude Flatness – Measure [1] (1 kHz reference)	(0.7 to 2.2) V 50 kHz to 1.2 MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (2.2 to 7) V 50 kHz to 1.2 MHz (1.2 to 2) MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	 0.05 % of reading 0.05 % of reading 0.1 % of reading 0.15 % of reading 0.35 % of reading 0.05 % of reading 0.05 % of reading 0.1 % of reading 0.15 % of reading 0.35 % of reading	Comparison to Fluke 5790A-03 AC Measurement Standard
AC High Voltage – Measure [1]	(0.7 to 9) kV 10 mHz to 10 Hz (10 to 30) Hz (30 to 50) Hz (50 to 70) Hz (70 to 100) Hz (100 to 200) Hz (200 to 450) Hz (450 to 600) Hz (9 to 10) kV 10 mHz to 10 Hz (10 to 30) Hz (30 to 50) Hz (50 to 70) Hz (70 to 100) Hz (100 to 200) Hz (200 to 450) Hz (450 to 600) Hz	 0.15 % reading + 0.17 V 0.15 % reading + 0.17 V 0.14 % reading + 0.17 V 0.14 % reading + 0.17 V 0.14 % reading + 0.17 V 0.14 % reading + 0.17 V 0.48 % reading + 0.17 V 0.87 % reading + 0.17 V 0.15 % reading + 0.69 V 0.15 % reading + 0.69 V 0.14 % reading + 0.69 V 0.14 % reading + 0.69 V 0.14 % reading + 0.69 V 0.14 % reading + 0.69 V 0.48 % reading + 0.69 V 0.87 % reading + 0.69 V	Comparison to Vitrek 4700 High Voltage Meter

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source [1]	Up to 220 µA		Comparison to Fluke 5730A/03 Multiproduct Calibrator
	(10 to 20) Hz	0.025 % of reading + 16 nA	
	(20 to 40) Hz	0.016 % of reading + 10 nA	
	40 Hz to 1 kHz	0.011 % of reading + 8 nA	
	(1 to 5) kHz	0.028 % of reading + 12 nA	
	(5 to 10) kHz	0.11 % of reading + 65 nA	
	(0.22 to 2.2) mA		
	(10 to 20) Hz	0.025 % of reading + 40 nA	
	(20 to 40) Hz	0.016 % of reading + 35 nA	
	40 Hz to 1 kHz	0.011 % of reading + 35 nA	
	(1 to 5) kHz	0.02 % of reading + 0.11 µA	
	(5 to 10) kHz	0.11 % of reading + 0.65 µA	
	(2.2 to 22) mA		
	(10 to 20) Hz	0.025 % of reading + 0.4 µA	
	(20 to 40) Hz	0.016 % of reading + 0.35 µA	
	40 Hz to 1 kHz	0.011 % of reading + 0.35 µA	
	(1 to 5) kHz	0.02 % of reading + 0.55 µA	
	(5 to 10) kHz	0.11 % of reading + 5 µA	
	(22 to 220) mA		
	(10 to 20) Hz	0.025 % of reading + 4 µA	
	(20 to 40) Hz	0.016 % of reading + 3.5 µA	
	40 Hz to 1 kHz	0.011 % of reading + 2.5 µA	
	(1 to 5) kHz	0.02 % of reading + 3.5 µA	
	(5 to 10) kHz	0.11 % of reading + 10 µA	
	(0.22 to 2.2) A		
	20 Hz to 1 kHz	0.025 % of reading + 35 µA	
	(1 to 5) kHz	0.045 % of reading + 80 µA	
	(5 to 10) kHz	0.7 % of reading + 0.16 mA	
	(2.2 to 3) A		
	(10 to 45) Hz	0.18 % of reading + 0.1 mA	
	45 Hz to 1 kHz	0.06 % of reading + 0.1 mA	
	(1 to 5) kHz	0.6 % of reading + 1 mA	
	(5 to 10) kHz	2.5 % of reading + 5 mA	
AC Current – Source [1]	(3 to 11) A		Comparison to Fluke 5522A/11 Multiproduct Calibrator
	(45 to 100) Hz	0.049 % of reading + 1.6 mA	
	(0.1 to 1) kHz	0.079 % of reading + 1.6 mA	
	(1 to 5) kHz	2.3 % of reading + 1.6 mA	
	(11 to 20.5) A		
	(45 to 100) Hz	0.095 % of reading + 3.9 mA	
	100 Hz to 1 kHz	0.12 % of reading + 3.9 mA	
	(1 to 5) kHz	2.3 % of reading + 3.9 mA	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Clamp-on Ammeters (Toroidal Type) Transformer Type Sensor [1]	(20 to 150) A (45 to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	 0.31 % of reading + 26 mA 0.84 % of reading + 47 mA 0.35 % of reading + 0.12 A 1.2 % of reading + 0.22 A	Comparison to Fluke 5522A/11 Multiproduct Calibrator, 50-turn Coil
AC Clamp-on Ammeters (Non-Toroidal Type) Hall Effect Sensor [1]	(20 to 150) A (45 to 65) Hz (65 to 440) Hz (150 to 1 000) A (45 to 65) Hz (65 to 440) Hz	 0.58 % of reading + 0.25 A 1.1 % of reading + 0.25 A 0.6 % of reading + 0.9 A 1.3 % of reading + 0.92 A	Comparison to Fluke 5522A/11 Multiproduct Calibrator, 50-turn Coil
AC Current – Measure [1]	Up to 200 µA 1 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (0.2 to 2) mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (2 to 20) mA (1 to 10) Hz 10 Hz to 10 kHz (10 to 30) kHz (30 to 100) kHz (20 to 200) mA 1 Hz to 10 Hz 10 Hz to 10 kHz (10 to 30) kHz (0.2 to 2) A 10 Hz to 2 kHz (2 to 10) kHz (10 to 30) kHz (2 to 20) A 10 Hz to 2 kHz (2 to 10) kHz	 0.031 % of reading + 20 nA 0.071 % of reading + 20 nA 0.4 % of reading + 20 nA 0.031 % of reading + 0.2 µA 0.03 % of reading + 0.2 µA 0.071 % of reading + 0.2 µA 0.4 % of reading + 0.2 µA 0.031 % of reading + 2 µA 0.03 % of reading + 2 µA 0.071 % of reading + 2 µA 0.4 % of reading + 2 µA 0.031 % of reading + 20 µA 0.029 % of reading + 20 µA 0.063 % of reading + 20 µA 0.062 % of reading + 0.2 mA 0.074 % of reading + 0.2 mA 0.3 % of reading + 0.2 mA 0.082 % of reading + 2 mA 0.25 % of reading + 2 mA	Comparison to Fluke 8508A opt 001 8.5 Digit Multimeter

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Measure [1]	(1 to 10) mA		Comparison to Fluke 5790A-03 AC Measurement Standard, Fluke A40 Current Shunts
	(5 to 400) Hz	0.002 % of reading	
	400 Hz to 20 kHz	0.003 % of reading	
	(20 to 50) kHz	0.004 % of reading	
	(50 to 100) kHz	0.006 % of reading	
	(10 to 30) mA		
	(5 to 400) Hz	0.002 % of reading	
	400 Hz to 20 kHz	0.003 % of reading	
	(20 to 50) kHz	0.005 % of reading	
	(50 to 100) kHz	0.007 % of reading	
	(30 to 300) mA		
	(5 to 400) Hz	0.003 % of reading	
	400 Hz to 20 kHz	0.004 % of reading	
	(20 to 50) kHz	0.007 % of reading	
	(50 to 100) kHz	0.01 % of reading	
	(0.3 to 3) A		
	(5 to 400) Hz	0.002 % of reading	
	400 Hz to 20 kHz	0.003 % of reading	
	(20 to 50) kHz	0.005 % of reading	
	(50 to 100) kHz	0.01 % of reading	
	(3 to 10) A		
	(5 to 400) Hz	0.002 % of reading	
	400 Hz to 20 kHz	0.003 % of reading	
	(20 to 50) kHz	0.005 % of reading	
	(10 to 20) A		
	(5 to 400) Hz	0.007 % of reading	
	400 Hz to 20 kHz	0.012 % of reading	
	(20 to 50) kHz	0.018 % of reading	
DC Power – Source [1]			Comparison to Fluke 5520A Multiproduct Calibrator
330 µW to 330 mA	11 µW to 1.1 mW	0.024 % of reading	
	(1.1 to 110) mW	0.027 % of reading	
	110 mW to 110 W	0.024 % of reading	
	(110 to 330) W	0.018 % of reading	
330 mA to 3 A	11 µW to 110 mW	0.044 % of reading	
	110 mW to 990 W	0.053 % of reading	
	990 W to 3 kW	0.01 % of reading	
(3 to 20.5) A	99 mW to 0.99 W	0.088 % of reading	
	0.99 W to 6.8 kW	0.07 % of reading	
	(6.8 to 20.5) kW	0.04 % of reading	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Power – Source [1,2,8] PF = 1			Comparison to Fluke 5520A Multiproduct Calibrator
(3.3 to 9) mA	(10 to 65) Hz		
	110 µW to 3 mW	0.13 % of reading	
	3 mW to 9 W	0.077 % of reading	
(9 to 33) mA	(10 to 65) Hz		
	300 µW to 10 mW	0.089 % of reading	
	10 mW to 33 W	0.077 % of reading	
(33 to 90) mA	(10 to 65) Hz		
	(1 to 30) mW	0.071 % of reading	
	30 mW to 90 W	0.057 % of reading	
(90 to 330) mA	(10 to 65) Hz		
	(3 to 100) mW	0.089 % of reading	
	100 mW to 300 W	0.078 % of reading	
(330 to 900) mA	(10 to 65) Hz		
	(11 to 300) mW	0.071 % of reading	
	300 mW to 900 W	0.081 % of reading	
900 mA to 2.2 A	(10 to 65) Hz		
	(30 to 720) mW	0.089 % of reading	
	0.72 W to 2 kW	0.079 % of reading	
(2.2 to 4.5) A	(10 to 65) Hz		
	80 mW to 1.4 W	0.088 % of reading	
	1.4 W to 4.5 kW	0.18 % of reading	
(4.5 to 20.5) A	(10 to 65) Hz		
	150 mW to 20kW	0.17 % of reading	
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure [1]	Type B		Comparison to Fluke 5522A/11 Multiproduct Calibrator
	(600 to 800) °C	0.35 °C	
	(800 to 1 000) °C	0.28 °C	
	(1 000 to 1 550) °C	0.24 °C	
	(1 550 to 1 820) °C	0.26 °C	
	Type C		
	(0 to 150) °C	0.24 ºC	
	(150 to 650) °C	0.21 ºC	
	(650 to 1000) °C	0.24 ºC	
	(1 000 to 1 800) °C	0.39 ºC	
	(1 800 to 2 316) °C	0.65 ºC	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure [1]	Type E		Comparison to Fluke 5522A/11 Multiproduct Calibrator
	(-250 to -100) °C	0.39 °C	
	(-100 to -25) °C	0.13 °C	
	(-25 to 350) °C	0.12 °C	
	(350 to 650) °C	0.13 °C	
	(650 to 1 000) °C	0.17 °C	
	Type J		
	(-210 to -100) °C	0.21 °C	
	(-100 to -30) °C	0.13 °C	
	(-30 to 150) °C	0.12 °C	
	(150 to 760) °C	0.14 °C	
	(760 to 1 200) °C	0.18 °C	
	Type K		
	(-200 to -100) °C	0.26 °C	
	(-100 to -25) °C	0.15 °C	
	(-25 to 120) °C	0.13 °C	
	(120 to 1 000) °C	0.21 °C	
	(1 000 to 1 372) °C	0.31 °C	
	Type L		
	(-200 to -100) °C	0.29 °C	
	(-100 to 800) °C	0.21 °C	
	(800 to 900) °C	0.14 °C	
	Type N		
	(-200 to -100) °C	0.31 °C	
	(-100 to -25) °C	0.18 °C	
	(-25 to 120) °C	0.15 °C	
	(120 to 410) °C	0.15 °C	
	(410 to 1 300) °C	0.21 °C	
	Type R		
	(0 to 250) °C	0.46 °C	
	(250 to 400) °C	0.29 °C	
	(400 to 1 000) °C	0.26 °C	
	(1 000 to 1 767) °C	0.32 °C	
	Type S		
	(0 to 250) °C	0.45 °C	
	(250 to 1 000) °C	0.3 °C	
	(1 000 to 1 400) °C	0.29 °C	
	(1 400 to 1 767) °C	0.36 °C	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of Thermocouple Indicating Devices – Source/Measure [1]	Type T (-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C Type U (-200 to 0) °C (0 to 600) °C	 0.49 °C 0.19 °C 0.13 °C 0.12 °C 0.44 °C 0.21 °C	Comparison to Fluke 5522A/11 Multiproduct Calibrator
Electrical Simulation of RTD Indicating Devices – Source [1]	Pt 385, 100 Ω (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 800) °C Pt 385, 200 Ω (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C Pt 385, 500 Ω (-200 to -80) °C (-80 to 0) °C (0 to 100) °C (100 to 260) °C (260 to 300) °C (300 to 400) °C (400 to 600) °C (600 to 630) °C	 0.039 °C 0.039 °C 0.054 °C 0.07 °C 0.078 °C 0.093 °C 0.18 °C 0.031 °C 0.031 °C 0.031 °C 0.039 °C 0.093 °C 0.1 °C 0.11 °C 0.12 °C 0.031 °C 0.039 °C 0.039 °C 0.047 °C 0.062 °C 0.062 °C 0.07 °C 0.085 °C	Comparison to Fluke 5522A/11 Multiproduct Calibrator

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Electrical Simulation of RTD Indicating Devices – Source [1]	Pt 385, 1 kΩ		Comparison to Fluke 5522A/11 Multiproduct Calibrator
	(-200 to -80) °C	0.023 °C	
	(-80 to 0) °C	0.023 °C	
	(0 to 100) °C	0.031 °C	
	(100 to 260) °C	0.039 °C	
	(260 to 300) °C	0.047 °C	
	(300 to 400) °C	0.054 °C	
	(400 to 600) °C	0.054 °C	
	(600 to 630) °C	0.18 °C	
	Pt 3916, 100 Ω		
	(-200 to -190) °C	0.19 °C	
	(-190 to -80) °C	0.031 °C	
	(-80 to 0) °C	0.039 °C	
	(0 to 100) °C	0.047 °C	
	(100 to 260) °C	0.054 °C	
	(260 to 300) °C	0.062 °C	
	(300 to 400) °C	0.07 °C	
	(400 to 600) °C	0.078 °C	
	(600 to 630) °C	0.18 °C	
	Pt 3926, 100 Ω		
	(-200 to -80) °C	0.039 °C	
	(-80 to 0) °C	0.039 °C	
	(0 to 100) °C	0.054 °C	
	(100 to 300) °C	0.07 °C	
	(300 to 400) °C	0.078 °C	
	(400 to 630) °C	0.093 °C	
	PtNi 385, 120 Ω		
	(-80 to 0) °C	0.062 °C	
	(0 to 100) °C	0.062 °C	
	(100 to 260) °C	0.1 °C	
	Cu 427, 10 Ω		
	(-100 to 260) °C	0.23 °C	
Phase – Source [1]	(0 to 90)°		Comparison to Fluke 5522A/11 Multiproduct Calibrator
	(10 to 65) Hz	0.11°	
	(65 to 500) Hz	0.21°	
	500 Hz to 1 kHz	0.39°	
	(1 to 5) kHz	1.9°	
	(5 to 10) kHz	3.9°	
	(10 to 30) kHz	7.8°	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Phase – Measure [1]			
(0 to 360)°	10 mV to 350 V		
(Sine Wave)	(5 to 10) Hz	0.23°	Comparison to Clarke-Hess 6000 Precision Phase Meter
	10 Hz to 50 kHz	0.051°	
	10 mV to 12.5 V		
	(50 to 100) kHz	0.23°	
	(12.5 to 350) V		
	10 Hz to 10 kHz	0.051°	
Oscilloscopes [1,2]			
Amplitude DC			
into 50 Ω load	(-6.6 to 6.6) V	0.22 % of reading + 31 µV	
into 1 MΩ load	(-130 to 130) V	0.12 % of reading + 31 µV	
Amplitude Square Wave			
into 50 Ω load	10 Hz to 10 kHz		
	1 mVp-p to 6.6 Vp-p	0.22 % of reading + 31 µV	
into 1 MΩ load	10 Hz to 1 kHz		
	1 mVp-p to 130 Vp-p	0.14 % of reading + 31 µV	
	(1 to 10) kHz		
	1 mVp-p to 130 Vp-p	0.19 % of reading + 31 µV	
Timing – Generate			Comparison to Fluke 5522A/11 Multiproduct Calibrator
into 50 Ω load	1 ns to 20 ms	0.000 22 % reading	
	50 ms	0.005 9 % reading	
	100 ms	0.009 8 % reading	
	200 ms	0.018 % reading	
	500 ms	0.041 % reading	
	1 s	0.08 % reading	
	2 s	0.16 % reading	
	5 s	0.39 % reading	
Rise Time – Generate			
into 50 Ω Load	5 mVp-p to 2.5 Vp-p		
Rate: 1 kHz to 2 MHz	(200 to 300) ps	51 ps	
Rate: 2 MHz to 10 MHz	(250 to 350) ps	51 ps	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Oscilloscopes [1,2]			Comparison to Fluke 5522A/11 Multiproduct Calibrator
Leveled Sine Wave – Generate			
into 50 Ω load	5 mVp-p to 5.5 Vp-p		
	50 kHz	1.8 % of reading + 0.23 mV	
	100 kHz to 100 MHz	2.8 % of reading + 0.23 mV	
	(100 to 300) MHz	3.2 % of reading + 0.23 mV	
	(300 to 600) MHz	4.7 % of reading + 0.23 mV	
	5 mVp-p to 3.5 Vp-p		
	600 MHz to 1.1 GHz	5.5 % of reading + 0.23 mV	
Bandwidth/Flatness – Measure (50 kHz Reference)			
into 50 Ω load	5 mVp-p to 5.5 Vp-p		
	50 kHz to 100 MHz	1.4 % of reading + 78 µV	
	(100 to 300) MHz	1.8 % of reading + 78 µV	
	(300 to 600) MHz	3.2 % of reading + 78 µV	
	5 mVp-p to 3.5 Vp-p		
	600 MHz to 1.1 GHz	4 % of reading + 78 µV	
Input Impedance – Measure			
into 50 Ω load	(40 to 60) Ω	0.082 % of reading	
into 1 MΩ load	(0.5 to 1.5) MΩ	0.081 % of reading	
Input Capacitance – Measure	(5 to 50) pF	3.9 % of reading + 0.39 pF	
Wave Generator – Source Amplitude (Sine, Square, Triangle)	10 Hz to 10 kHz		
into 50 Ω load	1.8 mVp-p to 2.5 Vp-p	2.3 % of reading + 78 µV	
into 1 MΩ load	1.8 mVp-p to 55 Vp-p	2.3 % of reading + 78 µV	
Frequency	10 Hz to 10 kHz	0.001 9 % of reading + 12 mHz	
Oscilloscopes [1,2]			Comparison to Fluke 96720A RF Reference Source, Fluke 96040A-50 Low Phase Noise Reference Source
Bandwidth/Flatness – Measure			
into 50 Ω load	(5 to 89.3) mVp-p		
	(1.1 to 4) GHz	5.7 % of reading	
	89.3 mVp-p to 3.17 Vp-p		
	(1.1 to 4) GHz	3.3 % of reading	

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Absolute Power – Source [1,3]	(-35 to 14) dBm 100 MHz to 2.4 GHz (2.4 to 8) GHz (8 to 18) GHz (18 to 26.5) GHz	 0.08 dB 0.11 dB 0.14 dB 0.17 dB	Comparison to Fluke 96720A RF Reference Source, R&S NRP-Z55(x2) Power Sensor, Agilent 11667B Power Splitter, Sucoflex 102EA 40 GHz Test Cable
RF Absolute Power – Measure [1]	1 mW Reference 50 MHz	 0.03 % of reading	Comparison to HP 8478B Power Sensor, HP 432A Power Meter
RF Absolute Power – Measure [1,3]	(-65 to -35) dBm (> 0.01 to ≤ 0.03) GHz (> 0.03 to ≤ 4.00) GHz (> 4.00 to ≤ 8.00) GHz (> 8.00 to ≤ 10.00) GHz (> 10.00 to ≤ 13.00) GHz (> 13.00 to ≤ 15.00) GHz (> 15.00 to ≤ 18.00) GHz	 2.8 % of reading 1.9 % of reading 2.3 % of reading 2.4 % of reading 3 % of reading 3.5 % of reading 3.8 % of reading	Comparison to HP 8484A Power Sensor, Agilent E4419B Power Meter
RF Absolute Power – Measure [1,3]	(-35 to 20) dBm DC to 100 MHz (> 0.1 to ≤ 2.4) GHz (> 2.4 to ≤ 8) GHz (> 8 to ≤ 12.4) GHz (> 12.4 to ≤ 18) GHz (> 18 to ≤ 26.5) GHz (> 26.5 to ≤ 33) GHz (> 33 to ≤ 40) GHz	 0.04 dB 0.048 dB 0.054 dB 0.063 dB 0.082 dB 0.086 dB 0.11 dB 0.11 dB	Comparison to Fluke 96720A RF Reference Source, R&S NRP-Z55(x2) Power Sensor
Tuned RF Absolute Power – Measure [3]	2.5 MHz to 26.5 GHz (-127 to -110) dBm (-110 to -90) dBm (-90 to -80) dBm (-80 to -50) dBm (-50 to -40) dBm (-40 to -10) dBm (-10 to 0) dBm (0 to 10) dBm	 0.54 dB 0.39 dB 0.37 dB 0.34 dB 0.33 dB 0.31 dB 0.3 dB 0.3 dB	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor, HP 11792A Microwave Converter, HP 11793A Microwave Converter

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Amplitude Modulation – AM Depth Measure [1]			
Rate: 50 Hz to 10 kHz	150 kHz to 10 MHz		
	(5 to 40) % Depth	0.85 % Depth	
	(40 to 99) % Depth	2.3 % Depth	
Rate: (20 to 50) Hz	150 kHz to 10 MHz		Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor, HP 11792A Microwave Converter, HP 11793A Microwave Converter
	(5 to 40) % Depth	1.3 % Depth	
	(40 to 99) % Depth	3.3 % Depth	
Rate: 50 Hz to 50 kHz	10 MHz to 1.3 GHz		
	(5 to 40) % Depth	0.45 % Depth	
	(40 to 99) % Depth	1.3 % Depth	
Rate: 50 Hz to 50 kHz	(1.3 to 26.5) GHz		
	(5 to 40) % Depth	0.65 % Depth	
	(40 to 99) % Depth	1.8 % Depth	
Rate: (20 to 50) Hz or (50 to 100) kHz	10 MHz to 26.5 GHz		
	(5 to 40) % Depth	1.3 % Depth	
	(40 to 99) % Depth	3.3 % Depth	
Frequency Modulation – Measure [1,7]			
Rate: 20 Hz to 10 kHz	250 kHz to 10 MHz		Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor, HP 11792A Microwave Converter, HP 11793A Microwave Converter
	Dev: ≤ 40 kHz pk	2 % of reading	
Rate: 50 Hz to 100 kHz	10 MHz to 1.3 GHz		
	Dev: ≤ 400 kHz pk	1 % of reading	
	10 MHz to 26.5 GHz		
	Dev: ≤ 400 kHz pk	1 % of reading	
Rate: 20 Hz to 200 kHz	10 MHz to 1.3 GHz		
	Dev: ≤ 400 kHz pk	6 % of reading	
	10 MHz to 26.5 GHz		
	Dev: ≤ 400 kHz pk	6 % of reading	

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Phase Modulation – Measure [1,7] Rate: 200 Hz to 10 kHz Rate: 200 Hz to 20 kHz	 150 kHz to 10 MHz 10 MHz to 26.5 GHz	 5 % of reading 4 % of reading	Comparison to HP 8902A Measuring Receiver, HP 11722A Power Sensor, HP 11792A Microwave Converter, HP 11793A Microwave Converter
Power Range Accuracy – Measure	3 µW to 100 mW	0.31 % of reading	Comparison to HP 11683A Power Meter
Distortion – Measure	20 Hz to 20 kHz (-80 to 0) dB (20 to 100) kHz (-65 to 0) dB	 1.3 dB 2.4 dB	Comparison to HP 8903B Audio Analyzer
RF Amplitude Frequency Response – Measure	9 kHz to 2.9 GHz (2.90 to 6.46) GHz (6.46 to 13) GHz (13 to 19.7) GHz (19.7 to 22) GHz	1.1 dB 1.5 dB 2.1 dB 3.1 dB 3.1 dB	Comparison to HP 8562A Spectrum Analyzer
Leveled Sine Wave Output – Absolute Amplitude Accuracy Level [3]	10 Hz to 4 GHz (-130 to -94) dBm (-94 to -74) dBm (-74 to -17) dBm (-17 to 24) dBm	 1.1 dB 0.68 dB 0.34 dB 0.2 dB	Comparison to Fluke 96720A RF Reference Source, Fluke 96040A-50 Low Phase Noise Reference Source
Leveled Sine Wave Output – Absolute Amplitude Accuracy Level [3]	10 Hz to 4 GHz (-120 to -100) dBm (-100 to -80) dBm (-80 to 18) dBm	 1.1 dB 0.67 dB 0.34 dB	Comparison to Fluke 96720A RF Reference Source, Fluke 96040A-75 Low Phase Noise Reference Source

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S11/S22 Reflection Magnitude – Measure [1,6] (Linear)	50 MHz to 2 GHz ≤ 0.25 lin (> 0.25 to 0.5) lin (> 0.5 to ≤ 0.7) lin (> 0.7 to ≤ 1) lin (2 to 8) GHz ≤ 0.25 lin (> 0.25 to 0.5) lin (> 0.5 to ≤ 0.7) lin (> 0.7 to ≤ 1) lin	 0.013 0.012 0.012 0.013 0.013 0.012 0.012 0.014	Comparison to HP 8722ES Network Analyzer, Agilent 85056A Calibration Kit
S11/S22 Reflection Magnitude – Measure [1,6] (Linear)	(8 to 20) GHz ≤ 0.25 lin (> 0.25 to 0.5) lin (> 0.5 to ≤ 0.7) lin (> 0.7 to ≤ 1) lin (20 to 40) GHz ≤ 0.25 lin (> 0.25 to 0.5) lin (> 0.5 to ≤ 0.7) lin (> 0.7 to ≤ 1) lin	 0.013 0.012 0.012 0.014 0.022 0.022 0.023 0.026	Comparison to HP 8722ES Network Analyzer, Agilent 85056A Calibration Kit
S11/S22 Reflection Phase – Measure [1] (Linear)	50 MHz to 2 GHz ≤ 0.25 lin (> 0.25 to 0.5) lin (> 0.5 to ≤ 0.7) lin (> 0.7 to ≤ 1) lin (2 to 8) GHz ≤ 0.25 lin (> 0.25 to 0.5) lin (> 0.5 to ≤ 0.7) lin (> 0.7 to ≤ 1) lin (8 to 20) GHz ≤ 0.25 lin (> 0.25 to 0.5) lin (> 0.5 to ≤ 0.7) lin (> 0.7 to ≤ 1) lin (20 to 40) GHz ≤ 0.25 lin (> 0.25 to 0.5) lin (> 0.5 to ≤ 0.7) lin (> 0.7 to ≤ 1) lin	 2.7° 1.4° 1° 0.9° 2.7° 1.4° 1.1° 1.1° 2.7° 1.4° 1.1° 1.1° 4.9° 2.6° 2.1° 2°	Comparison to HP 8722ES Network Analyzer, Agilent 85056A Calibration Kit

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S21/S12 Transmission Magnitude – Measure [1] (dB)	50 MHz to 2 GHz (-90 to ≤ -80) dB (-80 to ≤ -70) dB (-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	 0.35 dB 0.18 dB 0.15 dB 0.15 dB 0.14 dB 0.14 dB 0.14 dB 0.14 dB 0.14 dB	Comparison to HP 8722ES Network Analyzer, Agilent 85056A Calibration Kit
S21/S12 Transmission Magnitude – Measure [1] (dB)	(2 to 8) GHz (-90 to ≤ -80) dB (-80 to ≤ -70) dB (-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 (8 to 20) GHz (-90 to ≤ -80) dB (-80 to ≤ -70) dB (-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 (20 to 40) GHz (-90 to ≤ -80) dB (-80 to ≤ -70) dB (-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	 0.36 dB 0.19 dB 0.17 dB 0.17 dB 0.16 dB 0.16 dB 0.16 dB 0.16 dB 0.16 dB 0.46 dB 0.25 dB 0.21 dB 0.21 dB 0.21 dB 0.2 dB 0.2 dB 0.2 dB 0.2 dB 0.84 dB 0.44 dB 0.37 dB 0.36 dB 0.36 dB 0.36 dB 0.36 dB 0.36 dB 0.36 dB	Comparison to HP 8722ES Network Analyzer, Agilent 85056A Calibration Kit

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
S21/S12 Transmission Phase – Measure [1]	50 MHz to 2 GHz (-90 to ≤ -40) dB (-40 to ≤ -30) dB (-30 to ≤ -20) dB (-20 to ≤ -10) dB (-10 to ≤ 0) dB (2 to 8) GHz (-80 to ≤ -40) dB (-40 to ≤ -30) dB (-30 to ≤ -20) dB (-20 to ≤ -10) dB (-10 to ≤ 0) dB (8 to 20) GHz (-90 to ≤ -40) dB (-40 to ≤ -30) dB (-30 to ≤ -20) dB (-20 to ≤ -10) dB (-10 to ≤ 0) dB (20 to 40) GHz (-80 to ≤ -30) dB (-30 to ≤ -20) dB (-20 to ≤ -10) dB (-10 to ≤ 0) dB	 180° 30° 9.2° 2.9° 1° 180° 35° 10° 3.3° 1.2° 180° 47° 13° 4.2° 1.5° 180° 24° 7.4° 2.6°	Comparison to HP 8722ES Network Analyzer, Agilent 85056A Calibration Kit

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Micrometers – Travel (Outside, Inside, Depth and Step) [1,2]	Up to 40 in	(13 + 4.3L) µin	Comparison to Gage Blocks
Anvil Flatness [1]	Up to 1 in Diameter	14 µin	Comparison to Optical Flats
Spindle Parallelism [1]	Up to 1 in Diameter	14 µin	Comparison to Optical Flats
Calipers [1,2] (Outside, Inside, Depth, Step)	Up to 40 in	(51 + 3.5L) µin	Comparison to Gage Blocks

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Bore Gages [1,2]	Up to 1 in (1 to 6) in	(43 + 8*L*) µin (41 + 10*L*) µin	Comparison to Characterized Cylindrical Rings
Single Axis Length – Outside [1,2]	Up to 1 in (1 to 4) in (4 to 15) in (15 to 20) in	(15 + 6*L*) µin (15 + 6*L*) µin (12 + 6.5*L*) µin (11+ 6.5*L*) µin	Comparison to Universal Length Measuring Machine
Single Axis Length – Outside [1,2]	(20 to 40) in	(84 + 3*L*) µin	Comparison to Gage Amplifier/Check, Gage Blocks
Single Axis Length – Inside [1,2]	Up to 1 in (1 to 4) in (4 to 7) in (7 to 14) in	(22 + 6*L*) µin (20 + 7*L*) µin (16 + 8*L*) µin (15 + 8*L*) µin	Comparison to Universal Length Measuring Machine
Height Gages [1,2]	Up to 48 in	(21 + 3.2*L*) µin	Comparison to Gage Blocks, Grade AA Surface Plate
Cylindrical Ring Gages [2] Inside Diameter	Up to 0.25 in (0.25 to 4) in (4 to 16) in	(17 + 5.9*L*) µin (17 + 5.9*L*) µin (21 + 5.9*L*) µin	Comparison to Universal Length Measuring Machine, Master Ring Gages
Thread Ring Gages [2] Pitch Diameter	Up to 1 in (1 to 4) in (4 to 10) in	(81 + 7.2*L*) µin (81 + 7.2*L*) µin (81 + 7.2*L*) µin	Tactile fit using Set Plugs
Cylindrical Plug Gages [2] Outside Diameter	Up to 0.25 in (0.25 to 4) in (4 to 16) in	(20 + 7.1*L*) µin (20 + 7.1*L*) µin (7.1*L*) µin	Comparison to Universal Length Measuring Machine
Thread Plug Gages [2] Major Diameter Pitch Diameter	Up to 1 in (1 to 4) in (4 to 10) in Up to 1 in (1 to 4) in (4 to 10) in	(37 + 5.8*L*) µin (37 + 5.8*L*) µin (37 + 5.8*L*) µin (81 + 7.2*L*) µin (81 + 7.2*L*) µin (81 + 7.2*L*) µin	Comparison to Universal Length Measuring Machine, Thread Wires

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Surface Plates [1,2] Overall Flatness Local Area Flatness	 Up to 161 in*DL* Up to 0.001 in	 110 µin 38 µin	In accordance with ASME B89.3.7 using Planekator Repeat-O-Meter
Coating Thickness Gages (Eddy Current, Magnetic Induction, Surface Profile)	Up to 3 000 µm Up to 118 mils	0.49 µm 0.019 mils	Comparison to Universal Length Measuring Machine, Shims
Indicators [1,2] (Dial, Digital, Test)	Up to 1 in (1 to 4) in (4 to 12) in	(24 + 2.5*L*) µin (23 + 3.5*L*) µin (23 + 5*L*) µin	Comparison to Gage Blocks, Surface Plate

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Air/Nitrogen Flow Meters	Up to 100 slpm	0.73 % of reading	Comparison to CME FCS Laminar Flow Elements
Liquid Flow Meters	Up to 250 gpm	0.33 % of reading	Comparison to FT-32 Turbine Flow System
Low Pressure Gages (Gauge)	(0 to 2) inH_2O	0.008 inH_2O	Comparison to Dwyer 1430 Microtector
Pneumatic Pressure Gages, Vacuum Gages [4] (Gauge)	(-14.7 to 10) psig (10 to 1 000) psig	0.002 1 psig 0.02% of reading + 0.002 3 psig	Comparison to DHI PPC4EX-7M Pressure Controller
Pneumatic Pressure Gages, Vacuum Gages [4] (Absolute)	Up to 10 psia (10 to 1 000) psia	0.007 6 psia 0.02% of reading + 0.003 psia	Comparison to DHI PPC4EX-7M Pressure Controller
Pneumatic Pressure Gages (Absolute or Gauge)	(0.2 to 718) psi	0.003 % of reading	Comparison to Ruska 2465 Gas Piston Gauge
Hydraulic Pressure Gages (Gauge)	(100 to 50 000) psig	0.008 % of reading	Comparison to DHI 5306 Liquid Piston Gauge

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Pressure/Vacuum Gages [1] (Pneumatic and Hydraulic Gauge)	(0 to 900) mmHg (15 to 30) psig (30 to 300) psig (300 to 500) psig (500 to 3 000) psig (3 000 to 10 000) psig	0.29 mmHg 0.023 psi 0.16 psi 0.15 psi 1.8 psi 8.3 psi	Comparison to Meriam DAI0900 Fluke 700PD5 Fluke 700P27 Meriam DGI0500-11-1 Meriam GGI3000-11-1 Fluke 700P31
Scales and Balances [1,5]	Up to 500 mg (0.5 to 5) g (5 to 10) g (10 to 20) g (20 to 100) g (100 to 210) g	12 µg 40 µg 59 µg 89 µg 0.000 31 % of reading 0.000 41 % of reading	ASTM E617 Class 1 weights and internal calibration procedure utilized for the calibration of the weighing system.
Scales and Balances [1,5]	100 g to 10 kg	0.000 59 % of reading	ASTM E617 Class 2 Weights and internal calibration procedure utilized for the calibration of the weighing system.
Scales and Balances [1,5]	Up to 7 g (7 to 453) g 453 g to 2.2 kg (2.2 to 454) kg	0.12 % of reading 0.024 % of reading 0.019 % of reading 0.012 % of reading	NIST Class F Weights and internal calibration procedure utilized for the calibration of the weighing system.
Scales and Balances [1,5]	Up to 30 lb (30 to 40) lb (40 to 70) lb (70 to 90) lb	0.012 % of reading 0.01 % of reading 0.009 % of reading 0.008 % of reading	ASTM E617 Class 6 Weights and internal calibration procedure utilized for the calibration of the weighing system.
Scales and Balances [1,5]	Up to 0.5 lb (0.5 to 1) lb (1 to 5) lb (5 to 1 000) lb	0.12 % of reading 0.024 % of reading 0.019 % of reading 0.012 % of reading	NIST Class F Weights and internal calibration procedure utilized for the calibration of the weighing system.
Force Measuring Equipment – Compression [1]	Up to 10 lbf (10 to 25) lbf (25 to 50) lbf (50 to 150) lbf (150 to 250) lbf (250 to 500) lbf	0.001 5 lbf 0.002 1 lbf 0.008 3 lbf 0.023 lbf 0.065 lbf 0.13 lbf	Comparison to NIST Class F Weights

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Force Measuring Equipment – Compression [1]	(500 to 1 000) lbf	0.77 lbf	Comparison to Optima OP-312 Load Cell
Force Measuring Equipment – Compression [1]	(1 000 to 5 000) lbf	2.8 lbf	Comparison to Optima OP-312 Load Cell
Force Measuring Equipment – Compression [1]	(5 000 to 20 000) lbf	8.1 lbf	Comparison to Transcell BSS-20K Load Cell
Force Measuring Equipment – Tension [1]	Up to 10 lbf (10 to 25) lbf (25 to 50) lbf (50 to 150) lbf (150 to 250) lbf (250 to 500) lbf	0.001 5 lbf 0.002 1 lbf 0.008 3 lbf 0.023 lbf 0.065 lbf 0.13 lbf	Comparison to NIST Class F Weights
Force Measuring Equipment – Tension [1]	(500 to 1 000) lbf	0.77 lbf	Comparison to Optima OP-312 Load Cell
Force Measuring Equipment – Tension [1]	(1 000 to 5 000) lbf	2.8 lbf	Comparison to Optima OP-312 Load Cell
Force Measuring Equipment – Tension [1]	(5 000 to 10 000) lbf	4.2 lbf	Comparison to Transcell BSS-10K Load Cell
Force Measuring Equipment – Tension [1]	(10 000 to 20 000) lbf	8.1 lbf	Comparison to Transcell BSS-20K Load Cell
Force Measuring Equipment – Tension [1]	(20 000 to 50 000) lbf	23 lbf	Comparison to Optima OP-351 Load Cell
Force Measuring Equipment – Tension [1]	(50 000 to 100 000) lbf	44 lbf	Comparison to Rinstrum TLWS-100K Load Cell
Torque Indicating Devices	2 ozf·in to 2 000 lbf·ft	0.24 % of reading	Comparison to AKO TSD2050 Torque Master
Torque Transducers	20 ozf·in to 100 lbf·in 100 lbf·in to 125 lbf·ft (125 to 2 000) lbf·ft	0.05 % of reading 0.06 % of reading 0.08 % of reading	Comparison to Torque Arms, Master Weights

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Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Illuminance – Lux Meters	(180 to 1 792) lux (1 792 to 17 000) lux	1.8 % of reading 1.7 % of reading	Comparison to FEL 1000W Lamp with Power Supply Unit

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Humidity – Source/Measure	(10 to 30) °C (10 to 90) %RH	1.3 %RH	Comparison to Vaisala HMI-41/HMP-46 Temp/Humidity Indicator/Probe
Temperature – Measure [1]	(-196 to 0) °C (0 to 100) °C (100 to 420) °C	0.062 °C 0.061 °C 0.061 °C	Direct measure using Digital Thermometer. SPRT Probe
Temperature – Measure [1]	(420 to 960) °C	0.091 °C	Direct measure using Digital Thermometer, Ceramic SPRT Probe
Temperature – Source [1] (Temperature Measuring Devices)	(-30 to 0) °C (0 to 150) °C (150 to 420) °C	0.069 °C 0.084 °C 0.41 °C	Comparison to Digital Thermometer. SPRT Probe, Metrology Wells
Temperature – Source [1] (Temperature Measuring Devices)	(420 to 960) °C	0.59 °C	Comparison to Digital Thermometer, Ceramic SPRT Probe, Metrology Wells
Infrared Measuring Devices [1]	(35 to 200) °C (200 to 350) °C (350 to 500) °C	0.95 °C 1.6 °C 2.1 °C	Comparison to Black Body Source (Flat Plate) $\varepsilon = 0.95$, $\lambda = (8 \text{ to } 14)$ µm

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Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency – Reference [1]	10 MHz	38 µHz	Comparison to Fluke 910R GPS Rubidium Frequency Standard
Frequency – Source [1]	(1 to 70) Hz	58 nHz/Hz	Comparison to Agilent 33250A Function Generator, Fluke 910R GPS Frequency Standard
Frequency – Source [1]	70 Hz to 27 GHz	0.18 nHz/Hz + 3.9 µHz	Comparison to Fluke 96270A Reference Source, Fluke 910R GPS Frequency Standard
Frequency – Measure [1]	1 Hz to 10 kHz 10 kHz to 10 MHz (10 to 225) MHz 225 MHz to 1.1 GHz	1 nHz/Hz + 4.7 µHz 1 nHz/Hz + 0.31 mHz 1 nHz/Hz + 6.4 mHz 1.3 nHz/Hz	Comparison to Agilent 53131A Universal Counter, Fluke 910R GPS Frequency Standard
Frequency – Measure [1]	(1.1 to 26.5) GHz	0.18 nHz/Hz + 1.2 Hz	Comparison to HP 5343A Microwave Counter, Fluke 910R GPS Frequency Standard
Stopwatches, Timers	Up to 19.99 s/d	58 ms/d	Comparison to Helmut Klein TM-4500 Timometer
Optical Rotational Speed – Source [2]	Up to 100 000 rpm	0.000 13 % of reading + 0.021 rpm	Comparison to Agilent 33250A Function Generator
Non-Contact Rate of Rotation [1,2]	Up to 600 rpm (600 to 100 000) rpm	0.000 13 % of reading + 1.2 rpm 0.006 9 % of reading + 2.1 rpm	Direct measure using Optical Tachometer

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Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Duty Cycle – Source [1] Square Wave: < 3.3 Vp-p Freq: 10 mHz to 100 kHz	(1 to 10) % Duty Cycle 10 µs to 100 s (10 to 49) % Duty Cycle 10 µs to 100 s 50 % Duty Cycle 10 µs to 100 s (51 to 90) % Duty Cycle 10 µs to 100 s (91 to 99) % Duty Cycle 10 µs to 100 s	0.62 % of period + 78 ns 0.039 % of period + 78 ns 0.016 % of period + 78 ns 0.039 % of period + 78 ns 0.62 % of period + 78 ns	Comparison to Fluke 55xxA Multiproduct Calibrator

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. t = time in seconds; L = length in inches; DL = diagonal length in inches; rpm = revolutions per minute; PF = power factor.
3. CMC does not include the Mismatch value. It will be added in the Measurement Uncertainty reported on the Certificate of Calibration.
4. The span is user set on the unit. The minimum range for this unit is 10 psi.
5. 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.
6. The Measurement Uncertainty presented here is a unitless measurement.
7. For this parameter, 1 Digit will be added to the Measurement Uncertainty (MU) at the time of calibration.
8. 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.
9. Unless otherwise specified in the far-right column, the laboratory is utilizing an in-house developed calibration procedure and validated it internally.
10. The legal entity for this laboratory is Transcat, Inc.

Jason Stine, Vice President

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