CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

NA Caltechnologies Co., Ltd.
75/107 Moo 11, Klongnueng, Klongluang
Pathumthani 12120, Thailand

Fulfills the requirements of

ISO/IEC 17025:2017

In the fields of

CALIBRATION AND DIMENSIONAL MEASURMENT

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: 15 February 2027

Certificate Number: AC-2658

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

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CALIBRATION AND DIMENSIONAL MEASUREMENT

ISO/IEC 17025 Accreditation Granted: **08 February 2025**

Certificate Number: **AC-2658** Certificate Expiry Date: **08 February 2027**

CALIBRATION

Acoustics and Vibration

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Sound Level Meter	94 dB 114 dB	0.28 dB 0.28 dB	Sound Level Calibrator; EN-0001-GE: Direct Measurement.
[1] Sound Level Calibrator	94 dB 114 dB	0.15 dB 0.15 dB	Sound Level Calibrator, Sound Level Meter; EN-0010-GE: Comparison Measurement
[1] Vibration – Measuring and Generating Equipment and System			Standard Accelerometer, Charge Amplifier, Vibration Calibrator, Precision Multimeter; EN-0002-GE: Comparison Measurement.
Acceleration	20 Hz to 5 kHz (1 to 180) m/s^2	0.8 % of reading	
Velocity	(50 to 160) Hz (1 to 350) mm/s	0.8 % of reading	
Displacement	(50 to 160) Hz (0.01 to 1.2) mm	0.8 % of reading	

Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,11] pH Meter	2 pH 4 pH 6.88 pH 7 pH 9.18 pH 10 pH	0.008 pH 0.005 pH 0.005 pH 0.008 pH 0.01 pH 0.005 pH	Certified pH Solution; CH-0002-GE: Direct Measurement; Referenced to 25 °C
[1,11] Conductivity Meter	5 µS/cm 10 µS/cm 84 µS/cm 100 µS/cm 200 µS/cm 500 µS/cm 1 000 µS/cm 1 413 µS/cm 5 mS/cm 10 mS/cm 12.88 mS/cm 50 mS/cm 100 mS/cm 111.3 mS/cm 200 mS/cm	0.15 µS/cm 0.17 µS/cm 0.75 µS/cm 0.85 µS/cm 1.5 µS/cm 3.6 µS/cm 6.5 µS/cm 10 µS/cm 32 µS/cm 65 µS/cm 80 µS/cm 0.31 mS/cm 0.33 mS/cm 0.62 mS/cm 1.3 mS/cm	Certified Conductivity Solution; CH-0003-GE: Direct Measurement; Referenced to 25 °C
[1,11] Total Dissolved Meter (TDS)	10 mg/L 50 mg/L 100 mg/L 500 mg/L 1 000 mg/L 1 500 mg/L 2 000 mg/L	65 µg/L 0.66 mg/L 0.55 mg/L 2 mg/L 3.1 mg/L 5.3 mg/L 5.9 mg/L	Certified TDS Solution; CH-0004-GE: Direct Measurement; Referenced to 25 °C
[1,11] Refractometer	5 % Brix 10 % Brix 20 % Brix 30 % Brix 40 % Brix 50 % Brix 60 % Brix	0.012 % Brix 0.012 % Brix 0.023 % Brix 0.031 % Brix 0.032 % Brix 0.043 % Brix 0.053 % Brix	NIMT's Certified Reference Material; CH-0008-GE: Direct Measurement; Referenced to 20 °C

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Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,11] Refractometer	5 % Brix 10 % Brix 20 % Brix 30 % Brix 40 % Brix 50 % Brix 60 % Brix	0.015 % Brix 0.015 % Brix 0.025 % Brix 0.035 % Brix 0.035 % Brix 0.045 % Brix 0.055 % Brix	Certified Sucrose Solution, Reference Refractometer; CH-0020-GE; Comparison Measurement
[1,11] Refractive Index Meter	1.340 26 nD 1.347 82 nD 1.363 84 nD 1.381 15 nD 1.399 86 nD 1.420 09 nD 1.441 93 nD	0.000 082 nD 0.000 082 nD 0.000 082 nD 0.000 082 nD 0.000 084 nD 0.000 086 nD 0.000 088 nD	NIMT's Certified Reference Material; CH-0008-GE: Direct Measurement; Referenced to 20 °C
[1,11] Refractive Index Meter	1.340 26 nD 1.347 82 nD 1.363 84 nD 1.381 15 nD 1.399 86 nD 1.420 09 nD 1.441 93 nD	0.000 086 nD 0.000 086 nD 0.000 086 nD 0.000 086 nD 0.000 088 nD 0.000 09 nD 0.000 092 nD	Certified Sucrose Solution, Reference Refractometer; CH-0020-GE; Comparison Measurement
[1,11] Dissolved Oxygen Meter (DO)	6.2 mg/L	0.25 mg/L	Certified DO Solution; CH-0012-GE: Direct Measurement.
[1,11] Gas Detector/Analyzer Oxygen in Nitrogen Methane in Air Hydrogen Sulfide in Nitrogen Carbon Monoxide in Air Carbon Dioxide in Nitrogen	 18 cmol/mol 20 cmol/mol 1 cmol/mol 2.2 cmol/mol 25 µmol/mol 50 µmol/mol 100 µmol/mol 1 000 µmol/mol 0.5 cmol/mol 5 cmol/mol	 0.6 % of reading 0.6 % of reading 1.1 % of reading 1.1 % of reading 4.1 % of reading 1.1 % of reading 1.1 % of reading 1.1 % of reading 1.1 % of reading 1.1 % of reading	Certified Gas Standards; CH-0013-GE: Direct Measurement.

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Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,11] Gas Detector/Analyzer Iso-Butane in Air	0.345 cmol/mol 0.75 cmol/mol	1.1 % of reading 1.1 % of reading	Certified Gas Standards; CH-0013-GE: Direct Measurement.
[1,11] Breath Alcohol Tester	44 mg/100 mL 70 mg/100 mL	0.7 mg/100 mL 0.9 mg/100 mL	Certified Gas Standards; CH-0021-GE: Direct Measurement.
[1,11] Turbidity Meter	0.5 NTU 1 NTU 5 NTU 10 NTU 15 NTU 20 NTU 50 NTU 100 NTU 200 NTU 500 NTU 750 NTU 800 NTU 1 000 NTU 2 000 NTU 4 000 NTU	0.01 NTU 0.025 NTU 0.025 NTU 0.055 NTU 0.15 NTU 0.15 NTU 0.25 NTU 0.55 NTU 1.5 NTU 3.5 NTU 4.5 NTU 5.5 NTU 7.5 NTU 17 NTU 35 NTU	Certified Turbidity Solution; CH-0014-GE: Direct Measurement.
[1,11] Chemical Oxygen Demand Meter (COD)	20 mg/L 50 mg/L 100 mg/L 200 mg/L 400 mg/L 1 000 mg/L 2 000 mg/L 5 000 mg/L 10 000 mg/L	0.22 mg/L 0.56 mg/L 1.3 mg/L 2.1 mg/L 3.4 mg/L 9.2 mg/L 21 mg/L 55 mg/L 102 mg/L	Certified COD Solution; CH-0017-GE: Direct Measurement.
[1,11] Total Organic Carbon Meter (TOC)	10 mg/L 50 mg/L 100 mg/L 500 mg/L 2 000 mg/L	60 µg/L 0.18 mg/L 0.51 mg/L 2.3 mg/L 7.8 mg/L	Certified TOC Solution; CH-0018-GE: Direct Measurement.
[1] Total Hardness Meter	(5 to 1 000) mg/L	0.7 % of reading	Certified Total Hardness Solution; CH-0019-GE: Direct Measurement.

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Chemical Quantities

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Salinity Meter	0.03 % NaCl (0.03 to 0.2) % NaCl (0.2 to 25) % NaCl	0.24 % of reading 0.19 % of reading 0.11 % of reading	Certified Sodium Chloride Solution; CH-0006-GE: Direct Measurement.
Light Scattering Airborne Particle Counter Flow Rate	< 50 lpm (50 to 100) lpm	0.9 % of reading 1.2 % of reading	Standard Flow Meter per P-0005-GE: Comparison Measurement
[11] Counting Efficiency	0.3 µm 0.5 µm 1 µm 3 µm 5 µm 10 µm	5.4 % of reading 5.8 % of reading 6.2 % of reading 6.2 % of reading 6.2 % of reading 6.2 % of reading	Reference Particle Counter, Polystyrene Particle Size Standard per CH-0015-GE: Comparison Measurement
[1] Chlorine Meters	Up to 2 mg/L Cl	0.6 % of reading + 0.03 mg/L	Agilent 34970A, ORP Probe, CH-0023-GE; Comparison Measurement
Moisture Balance/Analyzer			CH-0022-GE: Direct and Comparison Measurement;
Moisture Content	(4 to 20) %MC	0.04 % of reading + 0.22 %MC	Certified Moisture Content
Temperature	Up to 200 °C	0.08 °C	Reference Thermometer
Weighing System (Balance)	Up to 200 g (> 200 to 500) g	1 mg 15 mg	Reference Weights

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Electrical Simulation of Thermocouple Generating/Measuring Devices	Type B		Fluke 55xxA Multiproduct Calibrators; T-0008-GE, T-0010-GE: Direct Measurement.
	(600 to 800) ºC	0.34 °C	
	(800 to 1 000) ºC	0.26 °C	
	(1 000 to 1 550) ºC	0.23 °C	
	(1 550 to 1 820) ºC	0.26 °C	
	Type C		
	(0 to 150) °C	0.19 °C	
	(150 to 650) °C	0.16 °C	
	(650 to 1 000) °C	0.2 °C	
	(1 000 to 1 800) °C	0.35 °C	
	(1 800 to 2 316) °C	0.61 °C	
	Type E		
	(-250 to -150) ºC	0.31 °C	
	(-150 to -25) ºC	0.11 °C	
	(-25 to 350) ºC	0.09 °C	
	(350 to 650) ºC	0.12 °C	
	(650 to 1 000) ºC	0.16 °C	
	Type J		
	(-210 to -100) ºC	0.19 °C	
	(-100 to -30) ºC	0.1 °C	
	(-30 to 150) ºC	0.09 °C	
	(150 to 760) ºC	0.11 °C	
	(760 to 1 200) ºC	0.16 °C	
	Type K		
	(-200 to -100) ºC	0.22 °C	
	(-100 to -25) ºC	0.1 °C	
	(-25 to 120) ºC	0.09 °C	
	(120 to 1 000) ºC	0.11 °C	
	(1 000 to 1 372) ºC	0.16 °C	
	Type L		
	(-200 to -100) °C	0.24 °C	
	(-100 to 800) °C	0.16 °C	
	(800 to 900) °C	0.09 °C	
	Type N		
	(-200 to -100) ºC	0.26 °C	
	(-100 to -25) ºC	0.12 °C	
	(-25 to 410) ºC	0.09 °C	
	(410 to 1 300) ºC	0.16 °C	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Electrical Simulation of Thermocouple Generating/Measuring Devices	Type R (0 to 250) ºC (250 to 400) ºC (400 to 1 000) ºC (1 000 to 1 767) ºC Type S (0 to 250) ºC (250 to 1 000) ºC (1 000 to 1 400) ºC (1 400 to 1 767) ºC Type T (-250 to -150) ºC (-150 to 0) ºC (0 to 120) ºC (120 to 400) ºC Type U (-200 to 0) °C (0 to 600) °C	 0.4 °C 0.23 °C 0.21 °C 0.26 °C 0.33 °C 0.24 °C 0.25 °C 0.32 °C 0.47 °C 0.16 °C 0.1 °C 0.09 °C 0.33 °C 0.09 °C	Fluke 55xxA Multiproduct Calibrators; T-0008-GE, T-0010-GE: Direct Measurement.
[1] Electrical Simulation of Thermocouple Measuring Devices – Generate (with CJC Mode)	Type E (-250 °C to -240) °C (-240 °C to -230) °C (-230 °C to -210) °C (-210 °C to -180) °C (-180 °C to -100) °C (-100 °C to 0) °C (0 °C to 1 000) °C Type J (-210 °C to -190) °C (-190 °C to -170) °C (-170 °C to -140) °C (-140 °C to 0) °C (0 °C to 1 200) °C Type K (-200 °C to -190) °C (-190 °C to -170) °C (-170 °C to -120) °C (-120 °C to 0) °C (0 °C to 1 372) °C	 0.26 °C 0.19 °C 0.16 °C 0.13 °C 0.11 °C 0.089 °C 0.083 °C 0.15 °C 0.12 °C 0.11 °C 0.10 °C 0.09 °C 0.21 °C 0.19 °C 0.16 °C 0.13 °C 0.12 °C	DC Voltage Source, Ice Point, TC Reference Junction Wire; T-0031-GE: Based on EURAMET/cg-11 version 2.0

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Electrical Simulation of Thermocouple Measuring Devices – Generate (with CJC Mode)	Type N (-200 °C to -190) °C (-190 °C to -180) °C (-180 °C to -160) °C (-160 °C to -120) °C (-120 °C to 0) °C (0 °C to 600) °C (600 °C to 1 300) °C Type R (0 °C to 50) °C (50 °C to 100) °C (100 °C to 150) °C (150 °C to 250) °C (250 °C to 500) °C (500 °C to 800) °C (800 °C to 1 767) °C Type S (0 °C to 50) °C (50 °C to 100) °C (100 °C to 150) °C (150 °C to 250) °C (250 °C to 500) °C (500 °C to 800) °C (800 °C to 1 767) °C Type T (-250 to -240) ºC (-240 to -230) ºC (-230 to -220) ºC (-220 to -200) ºC (-200 to -140) ºC (-140 to 0) ºC (0 to 400) ºC	 0.24 °C 0.22 °C 0.2 °C 0.17 °C 0.14 °C 0.12 °C 0.11 °C 0.46 °C 0.38 °C 0.34 °C 0.32 °C 0.29 °C 0.27 °C 0.26 °C 0.45 °C 0.38 °C 0.35 °C 0.33 °C 0.3 °C 0.28 °C 0.28 °C 0.38 °C 0.27 °C 0.22 °C 0.2 °C 0.17 °C 0.13 °C 0.094 °C	DC Voltage Source, Ice Point, TC Reference Junction Wire; T-0031-GE: Based on EURAMET/cg-11 version 2.0
[1] Electrical Simulation of Thermocouple Measuring Devices – Generate (without CJC Mode)	Type B (600 °C to 650) °C (650 °C to 700) °C (700 °C to 900) °C (900 °C to 1 200) °C (1 200 °C to 1 820) °C	 0.24 °C 0.23 °C 0.21 °C 0.17 °C 0.15 °C	DC Voltage Source; T-0031-GE: Based on EURAMET/cg-11 version 2.0

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Electrical Simulation of Thermocouple Measuring Devices – Generate (without CJC Mode)	Type E		DC Voltage Source; T-0031-GE: Based on EURAMET/cg-11 version 2.0
	(-250 °C to -240) °C	0.16 °C	
	(-240 °C to -230) °C	0.12 °C	
	(-230 °C to -210) °C	0.089 °C	
	(-210 °C to -180) °C	0.066 °C	
	(-180 °C to -100) °C	0.05 °C	
	(-100 °C to 0) °C	0.033 °C	
	(0 °C to 1 000) °C	0.032 °C	
	Type J		
	(-210 °C to -190) °C	0.079 °C	
	(-190 °C to -170) °C	0.061 °C	
	(-170 °C to -100) °C	0.051 °C	
	(-100 °C to 0) °C	0.036 °C	
	(0 °C to 1 200) °C	0.04 °C	
	Type K		
	(-200 °C to -190) °C	0.096 °C	
	(-190 °C to -170) °C	0.085 °C	
	(-170 °C to -120) °C	0.071 °C	
	(-120 °C to 0) °C	0.052 °C	
	(0 °C to 600) °C	0.039 °C	
	(600 °C to 900) °C	0.046 °C	
	(900 °C to 1 372) °C	0.06 °C	
	Type N		
	(-200 °C to -190) °C	0.15 °C	
	(-190 °C to -170) °C	0.13 °C	
	(-170 °C to -120) °C	0.11 °C	
	(-120 °C to 0) °C	0.075 °C	
	(0 °C to 300) °C	0.055 °C	
	(300 °C to 900) °C	0.046 °C	
	(900 °C to 1 300) °C	0.054 °C	
	Type R		
	(0 °C to 30) °C	0.27 °C	
	(30 °C to 60) °C	0.23 °C	
	(60 °C to 200) °C	0.21 °C	
	(200 °C to 1 200) °C	0.16 °C	
	(1 200 °C to 1 767) °C	0.14 °C	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Electrical Simulation of Thermocouple Measuring Devices – Generate (without CJC Mode)	Type S (0 °C to 30) °C (30 °C to 60) °C (60 °C to 200) °C (200 °C to 1 200) °C (1 200 °C to 1 767) °C Type T (-250 to -245) ºC (-245 to -235) ºC (-235 to -210) ºC (-210 to -90) ºC (-90 to 0) ºC (0 to 400) ºC	 0.26 °C 0.23 °C 0.21 °C 0.17 °C 0.16 °C 0.24 °C 0.19 °C 0.15 °C 0.11 °C 0.050 °C 0.037 °C	DC Voltage Source; T-0031-GE: Based on EURAMET/cg-11 version 2.0
[1] Electrical Simulation of Thermocouple Generating Devices – Measure (with CJC Mode)	Type E (-200 °C to -180) °C (-180 °C to -140) °C (-140 °C to -100) °C (-100 °C to 0) °C (0 °C to 1 000) °C Type J (-210 °C to -200) °C (-200 °C to -180) °C (-180 °C to -120) °C (-120 °C to 100) °C (100 °C to 1 200) °C Type K (-200 °C to -190) °C (-190 °C to -170) °C (-170 °C to -130) °C (-130 °C to 0) °C (0 °C to 1 372) °C Type N (-200 °C to -190) °C (-190 °C to -180) °C (-180 °C to -160) °C (-160 °C to -120) °C (-120 °C to -80) °C (-80 °C to 100) °C (100 °C to 1 300) °C	 0.12 °C 0.11 °C 0.1 °C 0.094 °C 0.09 °C 0.15 °C 0.14 °C 0.13 °C 0.11 °C 0.11 °C 0.18 °C 0.16 °C 0.15 °C 0.13 °C 0.12 °C 0.23 °C 0.21 °C 0.19 °C 0.17 °C 0.14 °C 0.13 °C 0.12 °C	DC Voltage Meter, Ice Point, TC Reference Junction Wire; T-0032-GE: Based on EURAMET/cg-11 version 2.0

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Electrical Simulation of Thermocouple Generating Devices – Measure (with CJC Mode)	Type R (0 °C to 40) °C (40 °C to 70) °C (70 °C to 110) °C (110 °C to 170) °C (170 °C to 330) °C (330 °C to 600) °C (600 °C to 1 767) °C Type S (0 °C to 40) °C (40 °C to 70) °C (70 °C to 110) °C (110 °C to 170) °C (170 °C to 330) °C (330 °C to 600) °C (600 °C to 1 767) °C Type T (-200 to -190) ºC (-190 to -160) ºC (-160 to -120) ºC (-120 to 0) ºC (0 to 400) ºC	 0.43 °C 0.37 °C 0.35 °C 0.32 °C 0.3 °C 0.27 °C 0.25 °C 0.42 °C 0.37 °C 0.35 °C 0.33 °C 0.31 °C 0.28 °C 0.27 °C 0.16 °C 0.15 °C 0.14 °C 0.12 °C 0.11 °C	DC Voltage Meter, Ice Point, TC Reference Junction Wire; T-0032-GE: Based on EURAMET/cg-11 version 2.0
[1] Electrical Simulation of Thermocouple Generating Devices – Measure (without CJC Mode)	Type B (600 °C to 700) °C (700 °C to 1 000) °C (1 000 °C to 1 600) °C (1 600 °C to 1 820) °C Type E (-200 °C to -180) °C (-180 °C to -140) °C (-140 °C to -100) °C (-100 °C to 0) °C (0 °C to 1 000) °C Type J (-210 °C to -190) °C (-190 °C to -150) °C (-150 °C to -110) °C (-110 °C to 0) °C (0 °C to 1 200) °C	 0.2 °C 0.18 °C 0.14 °C 0.11 °C 0.06 °C 0.056 °C 0.048 °C 0.046 °C 0.042 °C 0.085 °C 0.076 °C 0.069 °C 0.065 °C 0.063 °C	DC Voltage Meter; T-0032-GE: Based on EURAMET/cg-11 version 2.0

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Electrical Simulation of Thermocouple Generating Devices – Measure (without CJC Mode)	Type K		DC Voltage Meter; T-0032-GE: Based on EURAMET/cg-11 version 2.0
	(-200 °C to -180) °C	0.11 °C	
	(-180 °C to -140) °C	0.095 °C	
	(-140 °C to -80) °C	0.086 °C	
	(-80 °C to 100) °C	0.08 °C	
	(100 °C to 1 000) °C	0.077 °C	
	(1 000 °C to 1 372) °C	0.08 °C	
	Type N		
	(-200 °C to -190) °C	0.13 °C	
	(-190 °C to -150) °C	0.12 °C	
	(-150 °C to -90) °C	0.087 °C	
	(-90 °C to 100) °C	0.071 °C	
	(100 °C to 400) °C	0.061 °C	
	(400 °C to 1 300) °C	0.058 °C	
	Type R		
	(0 °C to 40) °C	0.23 °C	
	(40 °C to 100) °C	0.19 °C	
	(100 °C to 170) °C	0.16 °C	
	(170 °C to 500) °C	0.14 °C	
	(500 °C to 1 767) °C	0.11 °C	
	Type S		
	(0 °C to 40) °C	0.22 °C	
	(40 °C to 100) °C	0.19 °C	
	(100 °C to 170) °C	0.17 °C	
	(170 °C to 500) °C	0.15 °C	
	(500 °C to 1 767) °C	0.13 °C	
	Type T		
	(-200 to -180) ºC	0.088 °C	
	(-180 to -80) ºC	0.079 °C	
	(-80 to -20) ºC	0.061 °C	
	(-20 to 50) ºC	0.057 °C	
	(50 to 400) ºC	0.054 °C	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Electrical Simulation of RTD Measuring Devices – Generate	Pt 385, 100 Ω		Fluke 55xxA Multiproduct Calibrators; T-0007: Direct Measurement.
	(-200 to -80) ºC	0.04 °C	
	(-80 to 0) ºC	0.04 °C	
	(0 to 100) ºC	0.05 °C	
	(100 to 300) ºC	0.07 °C	
	(300 to 400) ºC	0.08 °C	
	(400 to 630) ºC	0.09 °C	
	(630 to 850) ºC	0.18 °C	
	Pt 3926, 100 Ω		
	(-200 to -80) ºC	0.04 °C	
	(-80 to 0) ºC	0.04 °C	
	(0 to 100) ºC	0.05 °C	
	(100 to 300) ºC	0.07 °C	
	(300 to 400) ºC	0.08 °C	
	(400 to 630) ºC	0.09 °C	
	Pt 3916, 100 Ω		
	(-200 to -190) ºC	0.19 °C	
	(-190 to -80) ºC	0.03 °C	
	(-80 to 0) ºC	0.04 °C	
	(0 to 100) ºC	0.05 °C	
	(100 to 260) ºC	0.05 °C	
	(260 to 300) ºC	0.06 °C	
	(300 to 400) ºC	0.07 °C	
	(400 to 600) ºC	0.08 °C	
	(600 to 630) ºC	0.18 °C	
	Pt 385, 200 Ω		
	(-200 to -80) ºC	0.03 °C	
	(-80 to 0) ºC	0.03 °C	
	(0 to 100) ºC	0.03 °C	
	(100 to 260) ºC	0.04 °C	
	(260 to 300) ºC	0.09 °C	
	(300 to 400) ºC	0.1 °C	
	(400 to 600) ºC	0.11 °C	
	(600 to 630) ºC	0.12 °C	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Electrical Simulation of RTD Measuring Devices – Generate	Pt 385, 500 Ω (-200 to -80) ºC (-80 to 0) ºC (0 to 100) ºC (100 to 260) ºC (260 to 300) ºC (300 to 400) ºC (400 to 600) ºC (600 to 630) ºC Pt 385, 1 000 Ω (-200 to -80) ºC (-80 to 0) ºC (0 to 100) ºC (100 to 260) ºC (260 to 300) ºC (300 to 400) ºC (400 to 600) ºC (600 to 630) ºC PtNi 385, 120 Ω (-80 to 0) °C (0 to 100) °C (100 to 260) °C Cu 427, 10 Ω (-100 to 260) °C	 0.03 °C 0.04 °C 0.04 °C 0.05 °C 0.06 °C 0.06 °C 0.07 °C 0.09 °C 0.02 °C 0.02 °C 0.03 °C 0.04 °C 0.05 °C 0.06 °C 0.05 °C 0.18 °C 0.06 °C 0.06 °C 0.11 °C 0.23 °C	Fluke 55xxA Multiproduct Calibrators; T-0007: Direct Measurement.
[1] Electrical Simulation of RTD Measuring Devices – Generate/Measure Fixed Points 20 Ω 30 Ω 40 Ω Fixed Points 50 Ω 100 Ω 120 Ω 140 Ω 150 Ω 200 Ω 300 Ω 330 Ω	 Pt 358, 100 Ω -196.572 °C -173.158 °C -149.336 °C Pt 385, 100 Ω -125.147 °C 0 °C 51.565 °C 103.944 °C 130.446 °C 266.347 °C 557.687 °C 651.14 °C	 0.000 6 °C 0.000 8 °C 0.001 °C 0.001 2 °C 0.002 2 °C 0.002 8 °C 0.003 2 °C 0.003 4 °C 0.006 °C 0.009 °C 0.01 °C	Agilent 3458A 8.5 Digit Multimeter, or Fluke 8508A 8.5 Digit Multimeter, Standard Resistors; T-0028-GE: Comparison Measurement.

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Electrical Simulation of RTD Generating Devices – Measure	Pt 385, 100 Ω		Fluke 8508A 8.5 Digit Multimeter, or Agilent 3458A 8.5 Digit Multimeter; T-0009-GE: Direct Measurement of Resistance Values, then Covert to Temperature.
	(-200 to -140) °C	0.001 2 °C	
	(-140 to -100) °C	0.001 5 °C	
	(-100 to -50) °C	0.001 9 °C	
	(-50 to 0) °C	0.002 3 °C	
	(0 to 100) °C	0.003 2 °C	
	(100 to 200) °C	0.004 1 °C	
	(200 to 300) °C	0.006 2 °C	
	(300 to 400) °C	0.007 3 °C	
	(400 to 630) °C	0.009 8 °C	
	(630 to 850) °C	0.013 °C	
	Pt 3926, 100 Ω		
	(-200 to -140) °C	0.001 2 °C	
	(-140 to -100) °C	0.001 5 °C	
	(-100 to -50) °C	0.001 9 °C	
	(-50 to 0) °C	0.002 3 °C	
	(0 to 100) °C	0.003 2 °C	
	(100 to 200) °C	0.004 °C	
	(200 to 300) °C	0.006 2 °C	
	(300 to 400) °C	0.007 2 °C	
	(400 to 630) °C	0.009 8 °C	
	(630 to 850) °C	0.013 °C	
	Pt 3916, 100 Ω		
	(-200 to -140) °C	0.001 2 °C	
	(-140 to -100) °C	0.001 5 °C	
	(-100 to -50) °C	0.001 9 °C	
	(-50 to 0) °C	0.002 3 °C	
	(0 to 100) °C	0.003 2 °C	
	(100 to 200) °C	0.004 °C	
	(200 to 300) °C	0.006 2 °C	
	(300 to 400) °C	0.007 2 °C	
	(400 to 630) °C	0.009 8 °C	
	(630 to 850) °C	0.013 °C	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Electrical Simulation of RTD Generating Devices – Measure	Pt 385, 200 Ω (-200 to -140) °C (-140 to -100) °C (-100 to -50) °C (-50 to 0) °C (0 to 100) °C (100 to 200) °C (200 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 850) °C Pt 385, 500 Ω (-200 to -140) °C (-140 to -100) °C (-100 to -50) °C (-50 to 0) °C (0 to 100) °C (100 to 200) °C (200 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 850) °C Pt 385, 1 000 Ω (-200 to -140) °C (-140 to -100) °C (-100 to -50) °C (-50 to 0) °C (0 to 100) °C (100 to 200) °C (200 to 300) °C (300 to 400) °C (400 to 630) °C (630 to 850) °C	 0.001 2 °C 0.001 4 °C 0.001 8 °C 0.002 2 °C 0.003 8 °C 0.004 6 °C 0.005 6 °C 0.006 6 °C 0.009 °C 0.012 °C 0.001 3 °C 0.001 6 °C 0.002 °C 0.002 4 °C 0.003 3 °C 0.004 2 °C 0.005 2 °C 0.006 2 °C 0.008 6 °C 0.012 °C 0.001 2 °C 0.001 5 °C 0.001 9 °C 0.002 3 °C 0.003 2 °C 0.004 2 °C 0.006 3 °C 0.007 3 °C 0.009 8 °C 0.013 °C	Fluke 8508A 8.5 Digit Multimeter, or Agilent 3458A 8.5 Digit Multimeter; T-0009-GE: Direct Measurement of Resistance Values, then Covert to Temperature.
[1] Thermocouple Measurement of Multiproduct Calibrators – Source	Type J (20 to 26) °C	0.06 °C	Type J Reference Junction Thermocouple Wire, PRT Sensor w/ Temperature Readout, Temperature Ice Point, DC Voltage Calibrator; T-0029-GE: Based on EURAMET cg-8.

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Voltage – High Accuracy Measuring Devices	(0.1 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 200) V (200 to 300) V (300 to 400) V (400 to 500) V (500 to 600) V (600 to 700) V (700 to 800) V (800 to 900) V (900 to 1 000) V	3 µV/V + 0.55 µV 1.9 µV/V + 0.76 µV 0.9 µV/V + 2.5 µV 3 µV/V + 40 µV 4 µV/V + 0.25 mV 4.3 µV/V + 0.25 mV 5.2 µV/V + 0.25 mV 6.4 µV/V + 0.25 mV 8 µV/V + 0.25 mV 9.8 µV/V + 0.25 mV 12 µV/V + 0.25 mV 15 µV/V + 0.25 mV 17 µV/V + 0.25 mV	Fluke 732B DC Voltage Standard, Agilent 3458A 8.5 Digit Multimeter, Fluke 5720A Multiproduct Calibrator; E-DCV-M-0004-GE: comparison with HP 3458A using transfer 10 V DC standard from Fluke 732B.
[1] DC Voltage – High Accuracy Measuring Devices	(0.1 to 100) mV (0.1 to 1) V (1 to 10) V (10 to 100) V (100 to 200) V (200 to 300) V (300 to 400) V (400 to 500) V (500 to 600) V (600 to 700) V (700 to 800) V (800 to 900) V (900 to 1 000) V	3.8 µV/V + 0.55 µV 3 µV/V + 0.76 µV 2.5 µV/V + 2.5 µV 3.8 µV/V + 40 µV 5 µV/V + 0.25 mV 5.5 µV/V + 0.25 mV 6.2 µV/V + 0.25 mV 7.3 µV/V + 0.25 mV 8.7 µV/V + 0.25 mV 11 µV/V + 0.25 mV 13 µV/V + 0.25 mV 15 µV/V + 0.25 mV 18 µV/V + 0.25 mV	HP/Agilent 3458A 8.5 Digit Multimeter, Fluke 5720A Multiproduct Calibrator; E-DCV-M-0004-GE: comparison with HP 3458A using transfer 10 V DC standard from Fluke 5720A.
[1] DC Voltage – Source	Up 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	10 µV/V + 0.6 µV 6 µV/V + 1 µV 4 µV/V + 3 µV 4 µV/V + 5 µV 6 µV/V + 70 µV 7 µV/V + 0.8 mV	Fluke 55xxA or Fluke 57xxA Multiproduct Calibrators, or Yokogawa 2560 Precision DC Calibrator; E-DCV-M-0001-GE, E-DCV-M-0002-GE, E-DCV-M-0003-GE, Direct Measurement against calibrators.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] DC High Voltage – Source	(0.1 to 1) kV (1 to 5) kV (5 to 10) kV (10 to 15) kV (15 to 20) kV (20 to 25) kV (25 to 30) kV	0.38 mV/V + 1 V 0.38 mV/V + 1.5 V 0.38 mV/V + 2 V 0.38 mV/V + 5 V 0.38 mV/V + 6 V 0.8 mV/V + 8 V 1.8 mV/V + 10 V	Trek 10/10B High Voltage Power Amplifier, Vitrek 4700 Digital High Voltage Meter, Vitrek 4700-HVL-35 High Voltage Probe, High Voltage Source; E-DCV-M-0005-GE: Direct or Comparison Measurements.
[1] DC Electrostatic Volt Meter	Up to 1 kV (1 to 5) kV (5 to 10) kV (10 to 15) kV (15 to 20) kV (20 to 25) kV (25 to 30) kV	0.38 mV/V + 3 V 0.38 mV/V + 4 V 0.38 mV/V + 6 V 0.5 mV/V + 5 V 0.5 mV/V + 6 V 1 mV/V + 8 V 2 mV/V + 10 V	Trek 10/10B High Voltage Power Amplifier, Vitrek 4700 Digital High Voltage Meter, Vitrek 4700-HVL-35 High Voltage Probe, High Voltage Source; E-DCV-M-0007-GE: Direct Measurement against Calibrators.
DC Voltage – Measure (Fixed Points)	1.018 V 10 V	3 µV/V 1.5 µV/V	Fluke 732B DC Voltage Standard, Agilent 3458A 8.5 Digit Multimeter; E-DCV-G-0002-GE: Comparison with DCV standard from Fluke 732B.
[7] DC Voltage – Source Devices	0 mV (10 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	0.15 µV 0.9 µV/V + 0.24 µV 0.7 µV/V + 0.32 µV 0.6 µV/V + 2 µV 0.6 µV/V + 2.5 µV 0.7 µV/V + 16 µV 0.9 µV/V + 60 µV	Fluke 732B DC Voltage Standard, Fluke 752A Reference Divider, Fluke 845AR DC Null Meter, Agilent 34420A Micro-Ohmmeter, Data Proof 160A Low Thermal EMF Scanner; E-DCV-G-0004-GE: transfer 10V DC standard from Fluke 732B

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[1,7] DC Voltage – Source Devices	0 mV (10 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	0.15 µV 2.5 µV/V + 0.24 µV 2.5 µV/V + 0.32 µV 2.5 µV/V + 2 µV 2.5 µV/V + 2.5 µV 2.5 µV/V + 16 µV 2.6 µV/V + 60 µV	Fluke 5720A Multiproduct Calibrator, Fluke 752A Reference Divider, Fluke 845AR DC Null Meter, Agilent 34420A Micro-Ohmmeter, Data Proof 160A Low Thermal EMF Scanner; E-DCV-G-0004-GE: transfer 10V DC standard from Fluke 5720A.
[1] DC Voltage – Measure	Up to 200 mV (0.22 to 2) V (2 to 20) V (20 to 200) V (200 to 1 050) V	5 µV/V + 0.38 µV 3.5 µV/V + 0.9 µV 3.5 µV/V + 8 µV 5.5 µV/V + 80 µV 5.5 µV/V + 0.8 mV	Fluke 8508A 8.5 Digit Multimeter, or Agilent 3458A 8.5 Digit Multimeter; E-DCV-G-0001-GE: Direct Measurement with Multimeters.
[1] DC High Voltage – Measure	(0.1 to 1) kV (1 to 5) kV (5 to 10) kV (10 to 15) kV (15 to 20) kV (20 to 25) kV (25 to 30) kV (30 to 35) kV (35 to 50) kV (50 to 70) kV (70 to 90) kV	0.38 mV/V + 0.3 V 0.38 mV/V + 1 V 0.38 mV/V + 2 V 0.38 mV/V + 5 V 0.38 mV/V + 6 V 0.8 mV/V + 8 V 1.8 mV/V + 10 V 3.6 mV/V + 15 V 1 mV/V + 60 V 1 mV/V + 60 V 1 mV/V + 70 V	Vitrek 4700 Digital High Voltage Meter, or Kikusui 149-10A Digital High Voltage Meter, TD1230 Verification Device for Withstanding Voltage Tester, Vitrek 4700-HVL-35 and HVL-150 High Voltage Probe; E-DCV-G-0003-GE: Direct Measurement with High-Voltage Meters.

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,7] DC Current – High Accuracy Measuring Devices	0 nA (10 to 100) nA 100 nA to 1 µA (1 to 10) µA (10 to 100) µA 100 µA to 1 mA (1 to 10) mA (10 to 100) mA 100 mA to 1 A (1 to 20) A	10 pA 56 µA/A 18 µA/A 10 µA/A 6 µA/A 4 µA/A 8 µA/A 12 µA/A 20 µA/A 20 µA/A	Fluke 55xxA or Fluke 57xxA Multiproduct Calibrators, Guideline 9230A DC Current Shunt, Guideline 9334A DC Current Shunt, Fluke 732B DC Voltage Standard, Fluke 8508A 8.5 Digit Multimeter, or Agilent 3458A 8.5 Digit Multimeter; E-DCA-M-0004-GE: Transfer Standard Current through the known values of Resistors.
[1] DC Current – Source	Up to 2 pA (2 to 20) pA (20 to 200) pA 200 pA to 2 nA (2 to 20) nA (20 to 200) nA 200 nA to 2 µA (2 to 20) µA (20 to 200) µA 200 µA to 2 mA (2 to 20) mA	5 mA/A + 12 fA 4.4 mA/A + 12 fA 2.9 mA/A + 36 fA 1.8 mA/A + 0.6 pA 1.2 mA/A + 6 pA 0.9 mA/A + 60 pA 0.6 mA/A + 0.6 nA 0.6 mA/A + 6 nA 0.6 mA/A + 60 nA 0.29 mA/A + 0.14 µA 1.8 mA/A + 1.4 µA	Keithley 263 Calibrator/Source; E-DCA-M-0001-GE, E-DCA-M-0002-GE, E-DCA-M-0003-GE: Direct Measurement against Calibrators.
[1] DC Current – Source	Up to 220 µA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 2.2) A (2.2 to 3.1) A (3.1 to 12) A (12 to 20.5) A (20.5 to 30.2) A	40 µA/A + 7 nA 35 µA/A + 20 nA 35 µA/A + 70 nA 45 µA/A + 1 µA 80 µA/A + 20 µA 0.23 mA/A + 0.15 mA 0.23 mA/A + 0.3 mA 0.78 mA/A + 0.9 mA 0.78 mA/A + 0.9 mA	Fluke 55xxA or Fluke 57xxA Multiproduct Calibrators or Yokogawa 2560 Precision DC Calibrator; E-DCA-M-0001-GE, E-DCA-M-0002-GE, E-DCA-M-0003-GE: Direct Measurement against Calibrators.

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] DC Current Clamp Meters – Source (Toroidal and Non-toroidal Types)	Up to 10 A (10 to 16.5) A (16.5 to 60) A (60 to 150) A (150 to 155) A (155 to 550) A (550 to 1 000) A (1 000 to 1 510) A	0.23 mA/A + 0.3 mA 2.4 mA/A + 0.6 mA 2.4 mA/A + 0.8 mA 2.4 mA/A + 6 mA 2.4 mA/A + 10 mA 2.4 mA/A + 25 mA 2.5 mA/A + 30 mA 2.5 mA/A + 30 mA	Fluke 55xxA Multiproduct Calibrator, Fluke 5500A/COIL 50-turn Coil; E-DCA-M-0005-GE: Direct Measurement against Calibrators.
[1] DC Current Clamp Meters – Source (UUC w/out Indication) (Toroidal and Non-toroidal Types)	Up to 10 A (10 to 16.5) A (16.5 to 60) A (60 to 150) A (150 to 155) A (155 to 550) A (550 to 1 000) A (1 000 to 1 510) A	0.23 mA/A + 0.27 mA 2.4 mA/A + 0.15 mA 2.4 mA/A + 5.8 mA 2.4 mA/A + 5.8 mA 2.4 mA/A + 8 mA 2.4 mA/A + 20 mA 2.5 mA/A + 30 mA 2.5 mA/A + 30 mA	Fluke 55xxA Multiproduct Calibrator, Fluke 5500A/COIL, 8.5 Digit Multimeter; E-DCA-M-0005-GE: Direct Measurement against Calibrators.
[1] DC Current – Measure	Up to 220 µA (220 to 330) µA (0.33 to 2.2) mA (2.2 to 3.3) mA (3.3 to 22) mA (22 to 33) mA (33 to 220) mA (220 to 330) mA (0.33 to 2.2) A (2.2 to 3) A (3 to 11) A (11 to 20.5) A (20.5 to 50) A (50 to 100) A (100 to 500) A (500 to 1 500) A	5 µA/A + 0.45 nA 5 µA/A + 1 nA 5 µA/A + 4.5 nA 5 µA/A + 12 nA 5 µA/A + 56 nA 5 µA/A + 80 nA 10 µA/A + 0.56 µA 10 µA/A + 0.8 µA 15 µA/A + 7.5 µA 20 µA/A + 10 µA 20 µA/A + 50 µA 20 µA/A + 78 µA 0.1 mA/A + 0.8 mA 0.1 mA/A + 5 mA 0.31 mA/A + 6 mA 1 mA/A + 0.6 A	Fluke 8508A 8.5 Digit Multimeter, or Agilent 3458A 8.5 Digit Multimeter, Standard Resistor Set; E-DCA-G-0002-GE: Ohm's Law.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] DC Current – Measure	Up to 100 nA (0.1 to 1) µA (1 to 10) µA (10 to 100) µA (100 to 200) µA (0.2 to 1) mA (1 to 2) mA (2 to 10) mA (10 to 20) mA (20 to 100) mA (100 to 200) mA (0.2 to 1.05) A (1.05 to 2) A (2 to 20) A	42 µA/A + 55 pA 29 µA/A + 50 pA 29 µA/A + 0.12 nA 12 µA/A + 0.45 nA 12 µA/A + 0.45 nA 12 µA/A + 5 nA 12 µA/A + 5 nA 14 µA/A + 50 nA 14 µA/A + 50 nA 47 µA/A + 0.6 µA 48 µA/A + 0.85 µA 0.14 mA/A + 10 µA 0.19 mA/A + 15 µA 0.4 mA/A + 0.45 mA	Agilent 3458A 8.5 Digit Multimeter, or Fluke 8508A 8.5 Digit Multimeter; E-DCA-G-0001-GE: Direct Measurement with Multimeters.
[1] DC Current – Measure	(0 to 999.9A)	24 mA/A + 0.6 A	Fluke 376 True-RMS AC/DC Clamp Meter; E-DCA-G-0003-GE Direct Measurement.
[1] Resistance – Source (Simulated-Fixed Points)	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ 19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	0.1 µΩ 96 µΩ/Ω 96 µΩ/Ω 24 µΩ/Ω 24 µΩ/Ω 11 µΩ/Ω 11 µΩ/Ω 8.6 µΩ/Ω 8.6 µΩ/Ω 8.6 µΩ/Ω 8.6 µΩ/Ω 12 µΩ/Ω 12 µΩ/Ω 25 µΩ/Ω 25 µΩ/Ω 47 µΩ/Ω 55 µΩ/Ω 0.12 mΩ/Ω	Fluke 57xxA Multiproduct Calibrators; E-DCR-M-0001-GE: Direct Measurement against Calibrators.

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[1] Resistance – Source (Fixed Artifact)	50 µΩ 100 µΩ 500 µΩ 1 mΩ 5 mΩ 10 mΩ 50 mΩ 100 mΩ 500 mΩ 1 Ω 1.9 Ω 10 Ω 100 Ω 1 kΩ 10 kΩ 19 kΩ 100 kΩ 1 MΩ 10 MΩ 19 MΩ	0.5 mΩ/Ω 0.33 mΩ/Ω 0.45 mΩ/Ω 35 µΩ/Ω 0.35 mΩ/Ω 12 µΩ/Ω 0.15 mΩ/Ω 10 µΩ/Ω 0.15 mΩ/Ω 8.5 µΩ/Ω 2.6 µΩ/Ω 2.6 µΩ/Ω 2.6 µΩ/Ω 2.6 µΩ/Ω 2.6 µΩ/Ω 2.6 µΩ/Ω 4.2 µΩ/Ω 5.8 µΩ/Ω 14 µΩ/Ω 15 µΩ/Ω	PCN Metal Clad Resistors, Yokogawa 2743 Standard Current Shunt, Yokogawa 2792 Standard Resistor, Guildline 9230A Precision DC Current Shunts, Fluke 742A Series Resistance Standards; E-DCR-M-0003-GE: Direct Measurement against Standard Resistors.
[1] Resistance – Source (Fixed Artifact)	100 MΩ 1 GΩ 10 GΩ	5 µΩ/Ω 70 µΩ/Ω 0.2 mΩ/Ω	Guideline 9334A Air Resistance Standards; E-DCR-M-0003-GE: Direct Measurement against Standard Resistors.
[1] Resistance – Source (Fixed Artifact)	100 GΩ 1 TΩ 10 TΩ	0.7 mΩ/Ω 1.5 mΩ/Ω 2.8 mΩ/Ω	JF HVR-1020 High Resistance Standards; E-DCR-M-0003-GE: Direct Measurement against Standard Resistors.
[1] Resistance – Source (Simulation)	Up to 12 Ω (12 to 120) Ω (0.12 to 1.2) kΩ (1.2 to 12) kΩ (12 to 120) kΩ (0.12 to 1.2) MΩ (1.2 to 12) MΩ (12 to 33) MΩ	19 µΩ/Ω + 0.8 mΩ 19 µΩ/Ω + 1 mΩ 19 µΩ/Ω + 2 mΩ 19 µΩ/Ω + 18 mΩ 19 µΩ/Ω + 0.17 Ω 19 µΩ/Ω + 2 Ω 27 µΩ/Ω + 43 Ω 0.2 mΩ/Ω + 3 kΩ	Fluke 55xxA Multiproduct Calibrators; E-DCR-M-0002-GE: Direct Measurement against Calibrators.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Resistance – Source (Simulation)	(33 to 120) MΩ (120 to 330) MΩ (0.33 to 1.1) GΩ (1.1 to 1.2) GΩ	0.33 mΩ/Ω + 3 kΩ 2.4 mΩ/Ω + 80 kΩ 3.1 mΩ/Ω + 0.1 MΩ 3.1 mΩ/Ω + 0.1 MΩ	Fluke 55xxA Multiproduct Calibrators; E-DCR-M-0002-GE: Direct Measurement against Calibrators.
[1] Resistance – Source (Artifacts)	10 V to 1 kV 10 MΩ to 1 TΩ (1 to 10) TΩ (1 to 2.5) kV (1 to 10) TΩ (2.5 to 5) kV (1 to 10) TΩ (5 to 10) kV (1 to 10) TΩ	 12 mΩ/Ω 0.12 Ω/Ω 0.13 Ω/Ω 0.17 Ω/Ω 0.26 Ω/Ω	IET HRRS-F-6-10M-10kV Decade Resistance Box or High Voltage Resistors; E-DCR-M-0004-GE: Direct Measurement against Decade Resistance Boxes.
[1] Resistance – Source (Artifacts)	10 V to 1 kV 10 mΩ to 10 Ω 10 Ω to 1 kΩ (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ (1 to 10) GΩ (10 to 100) GΩ (0.1 to 1) TΩ	 0.14 mΩ/Ω + 2.4 mΩ 0.14 mΩ/Ω + 12 mΩ 0.14 mΩ/Ω + 20 mΩ 0.14 mΩ/Ω + 2.5 Ω 0.14 mΩ/Ω + 6 Ω 0.14 mΩ/Ω + 0.36 kΩ 1.2 mΩ/Ω 2.4 mΩ/Ω 8.2 mΩ/Ω 18 mΩ/Ω 0.12 Ω/Ω	IET HARS-X-6-01, GenRad 1433-F/G/H, IET HARS-B-6-100, E&C DR25500, E&C DR26610, E-DCR-M-0004-GE: Direct Measurement against Decade Resistance Boxes.
[1,7] Resistance – Measure (Fixed Points)	0 Ω 1 Ω 1.9 Ω 10 Ω 19 Ω 100 Ω 190 Ω 1 kΩ 1.9 kΩ 10 kΩ	4.5 µΩ 10 µΩ/Ω 6.5 µΩ/Ω 4.5 µΩ/Ω 4.5 µΩ/Ω 2.6 µΩ/Ω 2.6 µΩ/Ω 2.6 µΩ/Ω 2.6 µΩ/Ω 2.6 µΩ/Ω	Fluke 742A Series Resistance Standards, Guideline 9334A Air Resistance Standards, Fluke 8508A 8.5 Digit Multimeter; E-DCR-G-0003-GE: Substitution with Standard Resistors.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,7] Resistance – Measure (Fixed Points)	19 kΩ 100 kΩ 190 kΩ 1 MΩ 1.9 MΩ 10 MΩ 19 MΩ 100 MΩ	2.6 μΩ/Ω 4.5 μΩ/Ω 4.5 μΩ/Ω 5.8 μΩ/Ω 5.8 μΩ/Ω 18 μΩ/Ω 18 μΩ/Ω 56 μΩ/Ω	Fluke 742A Series Resistance Standards, Guideline 9334A Air Resistance Standards, Fluke 8508A 8.5 Digit Multimeter; E-DCR-G-0003-GE: Substitution with Standard Resistors.
[1] Resistance – Measure	(50 to 500) μΩ (0.5 to 5) mΩ (5 to 50) mΩ (50 to 500) mΩ 500 mΩ to 5 Ω (5 to 50) Ω (50 to 500) Ω (0.5 to 5) kΩ (5 to 50) kΩ (50 to 500) kΩ (0.5 to 5) MΩ (5 to 50) MΩ (50 to 500) MΩ (0.5 to 5) GΩ (5 to 10) GΩ	0.32 mΩ/Ω 70 μΩ/Ω 19 μΩ/Ω 16 μΩ/Ω 9 μΩ/Ω 4 μΩ/Ω 4 μΩ/Ω 3.5 μΩ/Ω 3.5 μΩ/Ω 5 μΩ/Ω 8 μΩ/Ω 14 μΩ/Ω 35 μΩ/Ω 60 μΩ/Ω 0.16 mΩ/Ω	PCN Metal Clad Resistor Set, Yokogawa 2743 Standard Current Shunt, Yokogawa 2792 Standard Resistor, Fluke 742A Series Resistance Standards, Guildline 9230A Precision DC Current Shunts, Guildline 9334A Air Resistance Standards; E-DCR-G-0004-GE: Voltage Inter-comparison with Standard Resistors.
[1] Resistance – Measure	Up 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 + 4.5 μΩ 9.5 μΩ/Ω + 15 μΩ 8 μΩ/Ω + 55 μΩ 8 μΩ/Ω + 0.5 mΩ 8 μΩ/Ω + 5.5 mΩ 8 μΩ/Ω + 55 mΩ 9 μΩ/Ω + 1.5 Ω 20 μΩ/Ω + 0.12 kΩ 0.12 mΩ/Ω + 12 kΩ 1.5 mΩ/Ω + 1.2 MΩ	Agilent 3458A 8.5 Digit Multimeter, or Fluke 8508A 8.5 Digit Multimeter; E-DCR-G-0001-GE: Direct Measurement with Multimeters.
[1] Resistance – Measure	Up to 20 MΩ (20 to 200) MΩ (0.2 to 2) GΩ (2 to 20) GΩ	17 μΩ/Ω + 15 mΩ 65 μΩ/Ω + 1.5 kΩ 0.18 mΩ/Ω + 0.15 MΩ 1.5 mΩ/Ω + 15 MΩ	Fluke 8508A 8.5 Digit Multimeter (High Voltage Mode), E-DCR-G-0001-GE: Direct Measurement with Multimeters.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Resistance – Measure	(1 to 33) MΩ 33 MΩ to 1.1 GΩ	22 µΩ/Ω 78 µΩ/Ω	Fluke 742A-1M Resistance Standard, Fluke 742A-10M Resistance Standard, Fluke 8508A or Agilent 3458A 8.5 Digit Multimeters, E-DCR-G-0002-GE: Resistance Parallel Circuit Measurement.
[1] Resistance – Measure	(10 to 20) V (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ (1 to 10) GΩ (10 to 100) GΩ (0.1 to 1) TΩ (1 to 10) TΩ (20 to 100) V (1 to 10) kΩ (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ (1 to 10) GΩ (10 to 100) GΩ (0.1 to 1) TΩ (1 to 10) TΩ	 0.4 mΩ/Ω 0.4 mΩ/Ω 0.4 mΩ/Ω 0.6 mΩ/Ω 0.7 mΩ/Ω 2 mΩ/Ω 3 mΩ/Ω 3.2 mΩ/Ω 20 mΩ/Ω 20 mΩ/Ω 0.3 mΩ/Ω 0.3 mΩ/Ω 0.2 mΩ/Ω 0.6 mΩ/Ω 0.7 mΩ/Ω 2.5 mΩ/Ω 3.5 mΩ/Ω 3.5 mΩ/Ω 3.5 mΩ/Ω 20 mΩ/Ω	Fluke 57xxA Multiproduct Calibrators or Fluke 55xxA Multiproduct Calibrators, Keithley 617 Electrometer, Agilent 3458A 8.5 Digit Multimeter; E-DCR-G-0005-GE: Apply Voltage and Measure Current, then calculate Resistance as Ohm's Law.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Resistance – Measure	(100 to 200) V (10 to 100) kΩ (100 to 1000) kΩ (1 to 10) MΩ (10 to 100) MΩ (100 to 1000) MΩ (1 to 10) GΩ (10 to 100) GΩ (100 to 1 000) GΩ (1 to 10) TΩ (0.1 to 1) kV (10 to 100) kΩ (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ (1 to 10) GΩ (10 to 100) GΩ (0.1 to 1) TΩ (1 to 10) TΩ (1 to 2) kV (0.1 to 1) MΩ (1 to 10) MΩ (10 to 100) MΩ (0.1 to 1) GΩ (1 to 10) GΩ (10 to 100) GΩ (0.1 to 1) TΩ (1 to 10) TΩ	 0.4 mΩ/Ω 0.4 mΩ/Ω 0.4 mΩ/Ω 0.5 mΩ/Ω 0.7 mΩ/Ω 3 mΩ/Ω 3 mΩ/Ω 20 mΩ/Ω 20 mΩ/Ω 0.2 mΩ/Ω 0.1 mΩ/Ω 0.1 mΩ/Ω 0.2 mΩ/Ω 0.2 mΩ/Ω 0.5 mΩ/Ω 3.2 mΩ/Ω 2 mΩ/Ω 2 mΩ/Ω 2.5 mΩ/Ω 2.5 mΩ/Ω 2.5 mΩ/Ω 2.5 mΩ/Ω 2.5 mΩ/Ω 2.5 mΩ/Ω 3.8 mΩ/Ω 4 mΩ/Ω	Fluke 57xxA Multiproduct Calibrators or Fluke 55xxA Multiproduct Calibrators, Keithley 617 Electrometer, Agilent 3458A 8.5 Digit Multimeter; E-DCR-G-0005-GE: Apply Voltage and Measure Current, then calculate Resistance as Ohm's Law.
[1] Resistance – Measure	(2 to 10) kV (1 to 10) MΩ (10 to 100) MΩ (100 to 1000) MΩ (1 to 10) GΩ (10 to 100) GΩ (100 to 1 000) GΩ (1 to 10) TΩ	 2.5 mΩ/Ω 2.5 mΩ/Ω 2.5 mΩ/Ω 2.5 mΩ/Ω 2.5 mΩ/Ω 3.8 mΩ/Ω 3.8 mΩ/Ω	Trek 10/10B High Voltage Power Amplifier, Keithley 617 Electrometer, Agilent 3458A 8.5 Digit Multimeter; E-DCR-G-0005-GE: Apply Voltage and Measure Current, then calculate Resistance as Ohm's Law.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Resistance – Measure	(0.1 to 1) V		Agilent 4339A High Resistance Meter; E-DCR-G-0007-GE: Direct Measurement with High Resistance Meter.
	(1 to 10) kΩ	13 % of reading	
	(10 to 100) kΩ	14 % of reading	
	(0.1 to 1) MΩ	13 % of reading	
	(1 to 10) MΩ	13 % of reading	
	(10 to 100) MΩ	13 % of reading	
	(0.1 to 1) GΩ	15 % of reading	
	(1 to 10) GΩ	17 % of reading	
	(10 to 100) GΩ	18 % of reading	
	(1 to 10) V		
	(10 to 100) kΩ	2.1 % of reading	
	(0.1 to 1) MΩ	2.9 % of reading	
	(1 to 10) MΩ	2.1 % of reading	
	(10 to 100) MΩ	2.2 % of reading	
	(0.1 to 1) GΩ	2.4 % of reading	
	(1 to 10) GΩ	4.5 % of reading	
	(10 to 100) GΩ	6.6 % of reading	
	(0.1 to 1) TΩ	7 % of reading	
	(1 to 10) TΩ	14 % of reading	
	(10 to 100) V		
	(0.1 to 1) MΩ	1 % of reading	
	(1 to 10) MΩ	1.8 % of reading	
	(10 to 100) MΩ	1.1 % of reading	
	(0.1 to 1) GΩ	1.2 % of reading	
	(1 to 10) GΩ	1.4 % of reading	
	(10 to 100) GΩ	3.5 % of reading	
	(0.1 to 1) TΩ	5.6 % of reading	
	(1 to 10) TΩ	5.9 % of reading	
	(10 to 100) TΩ	13 % of reading	
	(100 to 1 000) V		
	(1 to 10) MΩ	1 % of reading	
	(10 to 100) MΩ	1.8 % of reading	
	(0.1 to 1) GΩ	1 % of reading	
	(1 to 10) GΩ	1.1 % of reading	
	(10 to 100) GΩ	1.3 % of reading	
	(0.1 to 1) TΩ	3.4 % of reading	
	(1 to 10) TΩ	5.5 % of reading	
	(10 to 100) TΩ	5.9 % of reading	
	(0.1 to 1) PΩ	13 % of reading	

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AC Voltage – Source (Fixed Points)	2 mV		Fluke 792A AC/DC Transfer Standard; E-ACV-M-0008-GE; Comparison Measurements.
	10 Hz	0.38 mV/V	
	20 Hz	0.38 mV/V	
	40 Hz	0.38 mV/V	
	100 Hz	0.37 mV/V	
	1 kHz	0.37 mV/V	
	10 kHz	0.37 mV/V	
	20 kHz	0.37 mV/V	
	50 kHz	0.37 mV/V	
	100 kHz	0.46 mV/V	
	300 kHz	0.55 mV/V	
	500 kHz	0.65 mV/V	
	800 kHz	0.74 mV/V	
	1 MHz	0.74 mV/V	
	6 mV		
	10 Hz	0.23 mV/V	
	20 Hz	0.23 mV/V	
	40 Hz	0.20 mV/V	
	100 Hz	0.19 mV/V	
	1 kHz	0.19 mV/V	
	10 kHz	0.19 mV/V	
	20 kHz	0.19 mV/V	
	50 kHz	0.23 mV/V	
	100 kHz	0.30 mV/V	
	300 kHz	0.42 mV/V	
	500 kHz	0.48 mV/V	
	800 kHz	0.58 mV/V	
	1 MHz	0.62 mV/V	

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AC Voltage – Source (Fixed Points)	10 mV		Fluke 792A AC/DC Transfer Standard; E-ACV-M-0008-GE; Comparison Measurements.
	10 Hz	0.11 mV/V	
	20 Hz	95 µV/V	
	40 Hz	95 µV/V	
	100 Hz	95 µV/V	
	1 kHz	95 µV/V	
	10 kHz	95 µV/V	
	20 kHz	95 µV/V	
	50 kHz	0.10 mV/V	
	100 kHz	0.16 mV/V	
	300 kHz	0.23 mV/V	
	500 kHz	0.30 mV/V	
	800 kHz	0.34 mV/V	
	1 MHz	0.38 mV/V	
	20 mV		
	10 Hz	90 µV/V	
	20 Hz	85 µV/V	
	40 Hz	85 µV/V	
	100 Hz	75 µV/V	
	1 kHz	75 µV/V	
	10 kHz	75 µV/V	
	20 kHz	75 µV/V	
	50 kHz	95 µV/V	
	100 kHz	0.15 mV/V	
	300 kHz	0.23 mV/V	
	500 kHz	0.31 mV/V	
	800 kHz	0.38 mV/V	
	1 MHz	0.38 mV/V	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source (Fixed Points)	60 mV		Fluke 792A AC/DC Transfer Standard; E-ACV-M-0008-GE; Comparison Measurements.
	10 Hz	70 µV/V	
	20 Hz	50 µV/V	
	40 Hz	45 µV/V	
	100 Hz	45 µV/V	
	1 kHz	45 µV/V	
	10 kHz	45 µV/V	
	20 kHz	45 µV/V	
	50 kHz	50 µV/V	
	100 kHz	87 µV/V	
	300 kHz	0.15 mV/V	
	500 kHz	0.22 mV/V	
	800 kHz	0.29 mV/V	
	1 MHz	0.29 mV/V	
	100 mV		
	10 Hz	48 µV/V	
	20 Hz	32 µV/V	
	40 Hz	20 µV/V	
	100 Hz	20 µV/V	
	1 kHz	20 µV/V	
	10 kHz	20 µV/V	
	20 kHz	20 µV/V	
	50 kHz	31 µV/V	
	100 kHz	46 µV/V	
	300 kHz	86 µV/V	
	500 kHz	0.13 mV/V	
	800 kHz	0.19 mV/V	
	1 MHz	0.19 mV/V	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Source (Fixed Points)	200 mV		Fluke 792A AC/DC Transfer Standard; E-ACV-M-0008-GE; Comparison Measurements.
	10 Hz	32 µV/V	
	20 Hz	27 µV/V	
	40 Hz	18 µV/V	
	100 Hz	18 µV/V	
	1 kHz	18 µV/V	
	10 kHz	18 µV/V	
	20 kHz	18 µV/V	
	50 kHz	27 µV/V	
	100 kHz	46 µV/V	
	300 kHz	81 µV/V	
	500 kHz	0.12 mV/V	
	800 kHz	0.17 mV/V	
	1 MHz	0.19 mV/V	
	600 mV		
	10 Hz	31 µV/V	
	20 Hz	22 µV/V	
	40 Hz	14 µV/V	
	100 Hz	14 µV/V	
	1 kHz	14 µV/V	
	10 kHz	14 µV/V	
	20 kHz	14 µV/V	
	50 kHz	14 µV/V	
	100 kHz	17 µV/V	
	300 kHz	30 µV/V	
	500 kHz	35 µV/V	
	800 kHz	60 µV/V	
	1 MHz	70 µV/V	

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AC Voltage – Source (Fixed Points)	1 V		Fluke 792A AC/DC Transfer Standard; E-ACV-M-0008-GE; Comparison Measurements.
	10 Hz	31 µV/V	
	20 Hz	21 µV/V	
	40 Hz	12 µV/V	
	100 Hz	12 µV/V	
	1 kHz	12 µV/V	
	10 kHz	12 µV/V	
	20 kHz	12 µV/V	
	50 kHz	14 µV/V	
	100 kHz	17 µV/V	
	300 kHz	27 µV/V	
	500 kHz	31 µV/V	
	800 kHz	40 µV/V	
	1 MHz	50 µV/V	
	2 V		
	10 Hz	31 µV/V	
	20 Hz	22 µV/V	
	40 Hz	15 µV/V	
	100 Hz	15 µV/V	
	1 kHz	15 µV/V	
	10 kHz	15 µV/V	
	20 kHz	15 µV/V	
	50 kHz	15 µV/V	
	100 kHz	18 µV/V	
	300 kHz	27 µV/V	
	500 kHz	32 µV/V	
	800 kHz	40 µV/V	
	1 MHz	50 µV/V	

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AC Voltage – Source (Fixed Points)	6 V		Fluke 792A AC/DC Transfer Standard; E-ACV-M-0008-GE; Comparison Measurements.
	10 Hz	31 µV/V	
	20 Hz	21 µV/V	
	40 Hz	13 µV/V	
	100 Hz	13 µV/V	
	1 kHz	13 µV/V	
	10 kHz	13 µV/V	
	20 kHz	13 µV/V	
	50 kHz	14 µV/V	
	100 kHz	14 µV/V	
	300 kHz	26 µV/V	
	500 kHz	31 µV/V	
	800 kHz	40 µV/V	
	1 MHz	50 µV/V	
	10 V		
	10 Hz	31 µV/V	
	20 Hz	21 µV/V	
	40 Hz	13 µV/V	
	100 Hz	13 µV/V	
	1 kHz	13 µV/V	
	10 kHz	13 µV/V	
	20 kHz	13 µV/V	
	50 kHz	14 µV/V	
	100 kHz	15 µV/V	
	300 kHz	26 µV/V	
	500 kHz	31 µV/V	
	800 kHz	40 µV/V	
	1 MHz	50 µV/V	

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AC Voltage – Source (Fixed Points)	20 V		Fluke 792A AC/DC Transfer Standard; E-ACV-M-0008-GE; Comparison Measurements.
	10 Hz	32 µV/V	
	20 Hz	23 µV/V	
	40 Hz	17 µV/V	
	100 Hz	17 µV/V	
	1 kHz	17 µV/V	
	10 kHz	17 µV/V	
	20 kHz	17 µV/V	
	50 kHz	17 µV/V	
	100 kHz	19 µV/V	
	300 kHz	30 µV/V	
	500 kHz	32 µV/V	
	800 kHz	40 µV/V	
	1 MHz	50 µV/V	
	60 V		
	10 Hz	32 µV/V	
	20 Hz	22 µV/V	
	40 Hz	15 µV/V	
	100 Hz	15 µV/V	
	1 kHz	15 µV/V	
	10 kHz	15 µV/V	
	20 kHz	15 µV/V	
	50 kHz	16 µV/V	
	100 kHz	18 µV/V	
	300 kHz	35 µV/V	
	100 V		
	10 Hz	32 µV/V	
	20 Hz	22 µV/V	
	40 Hz	14 µV/V	
	100 Hz	14 µV/V	
	1 kHz	14 µV/V	
	10 kHz	14 µV/V	
	20 kHz	14 µV/V	
	50 kHz	16 µV/V	
	100 kHz	22 µV/V	

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AC Voltage – Source (Fixed Points)	200 V		Fluke 792A AC/DC Transfer Standard; E-ACV-M-0008-GE; Comparison Measurements.
	10 Hz	45 µV/V	
	20 Hz	23 µV/V	
	40 Hz	18 µV/V	
	100 Hz	18 µV/V	
	1 kHz	18 µV/V	
	10 kHz	18 µV/V	
	20 kHz	18 µV/V	
	50 kHz	20 µV/V	
	100 kHz	37 µV/V	
	600 V		
	40 Hz	18 µV/V	
	100 Hz	18 µV/V	
	1 kHz	18 µV/V	
	10 kHz	18 µV/V	
	20 kHz	18 µV/V	
	50 kHz	23 µV/V	
	100 kHz	46 µV/V	
	1 000 V		
	40 Hz	18 µV/V	
	100 Hz	18 µV/V	
	1 kHz	18 µV/V	
	10 kHz	18 µV/V	
	20 kHz	18 µV/V	
	30 kHz	18 µV/V	
[1] AC Voltage – Source	Up to 2.2 mV		Fluke 55xxA Multiproduct Calibrator, or Fluke 57xxA Multiproduct Calibrator, or Yokogawa 2558 Precision AC Calibrator; E-ACV-M-0001-GE, E-ACV-M-0002-GE, E-ACV-M-0003-GE, Direct Measurement against calibrators.
	(3 to 5) Hz	1.9 mV/V + 6 µV	
	(5 to 10) Hz	0.68 mV/V + 6 µV	
	(10 to 20) Hz	0.24 mV/V + 4.2 µV	
	(20 to 40) Hz	90 µV/V + 4.2 µV	
	40 Hz to 20 kHz	80 µV/V + 4.2 µV	
	(20 to 50) kHz	0.2 mV/V + 4.2 µV	
	(50 to 100) kHz	0.5 mV/V + 5.2 µV	
	(100 to 300) kHz	1.1 mV/V + 10 µV	
	(300 to 500) kHz	1.4 mV/V + 22 µV	
	500 kHz to 1 MHz	2.7 mV/V + 22 µV	

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[1] AC Voltage – Source	(2.2 to 22) mV		Fluke 55xxA Multiproduct Calibrator, or Fluke 57xxA Multiproduct Calibrator, or Yokogawa 2558 Precision AC Calibrator; E-ACV-M-0001-GE, E-ACV-M-0002-GE, E-ACV-M-0003-GE, Direct Measurement against calibrators.
	(3 to 5) Hz	1.9 mV/V + 6 µV	
	(5 to 10) Hz	0.68 mV/V + 6 µV	
	(10 to 20) Hz	0.24 mV/V + 4.2 µV	
	(20 to 40) Hz	90 µV/V + 4.2 µV	
	40 Hz to 20 kHz	80 µV/V + 4.2 µV	
	(20 to 50) kHz	0.2 mV/V + 4.2 µV	
	(50 to 100) kHz	0.5 mV/V + 5.2 µV	
	(100 to 300) kHz	1.1 mV/V + 10 µV	
	(300 to 500) kHz	1.4 mV/V + 22 µV	
	500 kHz to 1 MHz	2.7 mV/V + 22 µV	
	(22 to 220) mV		
	(3 to 5) Hz	1.9 mV/V + 60 µV	
	(5 to 10) Hz	0.68 mV/V + 60 µV	
	(10 to 20) Hz	0.24 mV/V + 13 µV	
	(20 to 40) Hz	90 µV/V + 7.2 µV	
	40 Hz to 20 kHz	80 µV/V + 7.2 µV	
	(20 to 50) kHz	0.2 mV/V + 7.2 µV	
	(50 to 100) kHz	0.46 mV/V + 18 µV	
	(100 to 300) kHz	0.9 mV/V + 22 µV	
	(300 to 500) kHz	1.4 mV/V + 26 µV	
	500 kHz to 1 MHz	2.7 mV/V + 0.14 mV	
	(0.22 to 2.2) V		
	(3 to 5) Hz	1.9 mV/V + 0.6 mV	
	(5 to 10) Hz	0.68 mV/V + 0.6 mV	
	(10 to 20) Hz	0.24 mV/V + 45 µV	
	(20 to 40) Hz	90 µV/V + 20 µV	
	40 Hz to 20 kHz	45 µV/V + 20 µV	
	(20 to 50) kHz	75 µV/V + 16 µV	
	(50 to 100) kHz	0.11 mV/V + 35 µV	
	(100 to 300) kHz	0.42 mV/V + 82 µV	
	(300 to 500) kHz	1 mV/V + 0.22 mV	
	500 kHz to 1 MHz	1.7 mV/V + 0.38 mV	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] AC Voltage – Source	(2.2 to 22) V (3 to 5) Hz (5 to 10) Hz (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz (300 to 500) kHz 500 kHz to 1 MHz (22 to 220) V (3 to 5) Hz (5 to 10) Hz (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 (220 to 1 100) V (10 to 50) Hz 50 Hz to 1 kHz (220 to 1 100) V 40 Hz to 1 kHz (1 to 20) kHz (20 to 30) kHz	 1.9 mV/V + 6 mV 0.68 mV/V + 6 mV 0.24 mV/V + 0.45 mV 90 µV/V + 0.2 mV 45 µV/V + 0.18 mV 75 µV/V + 0.14 mV 0.1 mV/V + 0.28 mV 0.28 mV/V + 0.62 mV 1 mV/V + 2.2 mV 1.5 mV/V + 3.5 mV 1.9 mV/V 60 mV 0.68 µV/V + 60 mV 0.24 mV/V + 4.5 mV 90 µV/V + 2.4 mV 52 µV/V + 1.8 mV 80 µV/V + 1.6 mV 0.15 mV/V + 3.2 mV 0.9 mV/V + 18 mV 4.4 mV/V + 45 mV 8 mV/V + 85 mV 0.3 mV/V + 18 mV 75 µV/V + 5.8 mV 90 µV/V + 4.5 mV 0.17 mV/V + 6.2 mV 0.6 mV/V + 12 mV	Fluke 55xxA Multiproduct Calibrator, or Fluke 57xxA Multiproduct Calibrator, or Yokogawa 2558 Precision AC Calibrator; E-ACV-M-0001-GE, E-ACV-M-0002-GE, E-ACV-M-0003-GE, Direct Measurement against calibrators.
[1] AC Voltage – Source	(220 to 750) V (30 to 50) kHz (50 to 100) kHz (330 to 1 020) V (3 to 5) Hz (5 to 10) Hz	 0.6 mV/V + 12 mV 2.3 mV/V + 46 mV 1.9 mV/V + 60 mV 0.68 mV/V + 60 mV	Fluke 55xxA Multiproduct Calibrator, or Fluke 57xxA Multiproduct Calibrator, or Yokogawa 2558 Precision AC Calibrator; E-ACV-M-0001-GE, E-ACV-M-0002-GE, E-ACV-M-0003-GE, Direct Measurement against calibrators.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] AC High Voltage – Source	(50 to 60) Hz Up to 3 kV (3 to 5) kV (5 to 10) kV (10 to 15) kV (15 to 20) kV (20 to 25) kV (25 to 30) kV	 1.5 mV/V + 1.2 V 1.5 mV/V + 1.7 V 1.5 mV/V + 3 V 1.5 mV/V + 6 V 1.5 mV/V + 8 V 1.5 mV/V + 9 V 1.5 mV/V + 10 V	Trek 10/10B High Voltage Power Amplifier, Vitrek 4700 Digital High Voltage Meter, Vitrek 4700-HVL-35 High Voltage Probe, High Voltage Source; E-ACV-M-0005-GE: Direct or Comparison Measurement.
[1] AC Voltage – Source Amplitude Flatness (Relative to 1 kHz)	(0.33 to 1.1) mV (10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (1.1 to 3) mV (10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (3 to 11) mV (10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (11 to 33) mV (10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	 3 mV/V + 3 µV 1.1 mV/V + 3 µV 2 mV/V + 4 µV 4 mV/V + 4 µV 6 mV/V + 4 µV 15 mV/V + 20 µV 3 mV/V + 3 µV 1 mV/V + 3 µV 1 mV/V + 4 µV 3 mV/V + 4 µV 5 mV/V + 4 µV 15 mV/V + 4 µV 3 mV/V + 3 µV 1 mV/V + 3 µV 1 mV/V + 4 µV 2 mV/V + 4 µV 4 mV/V + 4 µV 10 mV/V + 4 µV 3 mV/V + 3 µV 1 mV/V + 3 µV 1 mV/V + 4 µV 2 mV/V + 4 µV 4 mV/V + 4 µV 10 mV/V + 4 µV	Fluke 5700A/03 Multiproduct Calibrator (Wide Band Function), E-ACV-M-0007-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] AC Voltage – Source Amplitude Flatness (Relative to 1 kHz)	(33 to 110) mV		Fluke 5700A/03 Multiproduct Calibrator (Wide Band Function), E-ACV-M-0007-GE: Direct Measurement.
	(10 to 30) Hz	3 mV/V + 3 µV	
	30 Hz to 120 kHz	1 mV/V + 3 µV	
	120 kHz to 2 MHz	1 mV/V + 4 µV	
	(2 to 10) MHz	2 mV/V + 4 µV	
	(10 to 20) MHz	4 mV/V + 4 µV	
	(20 to 30) MHz	10 mV/V + 4 µV	
	(110 to 330) mV		
	(10 to 30) Hz	3 mV/V + 30 µV	
	30 Hz to 120 kHz	1 mV/V + 30 µV	
	120 kHz to 2 MHz	1 mV/V + 30 µV	
	(2 to 10) MHz	2 mV/V + 30 µV	
	(10 to 20) MHz	4 mV/V + 30 µV	
	(20 to 30) MHz	10 mV/V + 30 µV	
	330 mV to 1.1 V		
	(10 to 30) Hz	3 mV/V + 30 µV	
	30 Hz to 120 kHz	1 mV/V + 30 µV	
	120 kHz to 2 MHz	1 mV/V + 30 µV	
	(2 to 10) MHz	2 mV/V + 30 µV	
	(10 to 20) MHz	4 mV/V + 30 µV	
	(20 to 30) MHz	10 mV/V + 30 µV	
	(1.1 to 3.5) V		
	(10 to 30) Hz	3 mV/V + 0.3 mV	
	30 Hz to 120 kHz	1 mV/V + 0.3 mV	
	120 kHz to 2 MHz	1 mV/V + 0.3 mV	
	(2 to 10) MHz	2 mV/V + 0.3 mV	
	(10 to 20) MHz	4 mV/V + 0.3 mV	
	(20 to 30) MHz	10 mV/V + 0.3 mV	

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AC Voltage – Measure (Fixed Points)	2 mV		Fluke 792A AC/DC Transfer Standard; E-ACV-G-0005-GE; Comparison Measurements.
	10 Hz	0.38 mV/V	
	20 Hz	0.38 mV/V	
	40 Hz	0.38 mV/V	
	100 Hz	0.37 mV/V	
	1 kHz	0.37 mV/V	
	10 kHz	0.37 mV/V	
	20 kHz	0.37 mV/V	
	50 kHz	0.37 mV/V	
	100 kHz	0.46 mV/V	
	300 kHz	0.55 mV/V	
	500 kHz	0.65 mV/V	
	800 kHz	0.74 mV/V	
	1 MHz	0.74 mV/V	
	6 mV		
	10 Hz	0.23 mV/V	
	20 Hz	0.23 mV/V	
	40 Hz	0.2 mV/V	
	100 Hz	0.19 mV/V	
	1 kHz	0.19 mV/V	
	10 kHz	0.19 mV/V	
	20 kHz	0.19 mV/V	
	50 kHz	0.23 mV/V	
	100 kHz	0.3 mV/V	
	300 kHz	0.42 mV/V	
	500 kHz	0.48 mV/V	
	800 kHz	0.58 mV/V	
	1 MHz	0.62 mV/V	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure (Fixed Points)	10 mV		Fluke 792A AC/DC Transfer Standard; E-ACV-G-0005-GE; Comparison Measurements.
	10 Hz	0.11 mV/V	
	20 Hz	95 µV/V	
	40 Hz	95 µV/V	
	100 Hz	95 µV/V	
	1 kHz	95 µV/V	
	10 kHz	95 µV/V	
	20 kHz	95 µV/V	
	50 kHz	0.1 mV/V	
	100 kHz	0.16 mV/V	
	300 kHz	0.23 mV/V	
	500 kHz	0.30 mV/V	
	800 kHz	0.34 mV/V	
	1 MHz	0.38 mV/V	
	20 mV		
	10 Hz	90 µV/V	
	20 Hz	85 µV/V	
	40 Hz	85 µV/V	
	100 Hz	75 µV/V	
	1 kHz	75 µV/V	
	10 kHz	75 µV/V	
	20 kHz	75 µV/V	
	50 kHz	95 µV/V	
	100 kHz	0.15 mV/V	
	300 kHz	0.23 mV/V	
	500 kHz	0.31 mV/V	
	800 kHz	0.38 mV/V	
	1 MHz	0.38 mV/V	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure (Fixed Points)	60 mV		Fluke 792A AC/DC Transfer Standard; E-ACV-G-0005-GE; Comparison Measurements.
	10 Hz	70 µV/V	
	20 Hz	50 µV/V	
	40 Hz	45 µV/V	
	100 Hz	45 µV/V	
	1 kHz	45 µV/V	
	10 kHz	45 µV/V	
	20 kHz	45 µV/V	
	50 kHz	50 µV/V	
	100 kHz	87 µV/V	
	300 kHz	0.15 mV/V	
	500 kHz	0.22 mV/V	
	800 kHz	0.29 mV/V	
	1 MHz	0.29 mV/V	
	100 mV		
	10 Hz	48 µV/V	
	20 Hz	32 µV/V	
	40 Hz	20 µV/V	
	100 Hz	20 µV/V	
	1 kHz	20 µV/V	
	10 kHz	20 µV/V	
	20 kHz	20 µV/V	
	50 kHz	31 µV/V	
	100 kHz	46 µV/V	
	300 kHz	86 µV/V	
	500 kHz	0.13 mV/V	
	800 kHz	0.19 mV/V	
	1 MHz	0.19 mV/V	

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AC Voltage – Measure (Fixed Points)	200 mV		Fluke 792A AC/DC Transfer Standard; E-ACV-G-0005-GE; Comparison Measurements.
	10 Hz	32 µV/V	
	20 Hz	27 µV/V	
	40 Hz	18 µV/V	
	100 Hz	18 µV/V	
	1 kHz	18 µV/V	
	10 kHz	18 µV/V	
	20 kHz	18 µV/V	
	50 kHz	27 µV/V	
	100 kHz	46 µV/V	
	300 kHz	81 µV/V	
	500 kHz	0.12 mV/V	
	800 kHz	0.17 mV/V	
	1 MHz	0.19 mV/V	
	600 mV		
	10 Hz	31 µV/V	
	20 Hz	22 µV/V	
	40 Hz	14 µV/V	
	100 Hz	14 µV/V	
	1 kHz	14 µV/V	
	10 kHz	14 µV/V	
	20 kHz	14 µV/V	
	50 kHz	14 µV/V	
	100 kHz	17 µV/V	
	300 kHz	30 µV/V	
	500 kHz	35 µV/V	
	800 kHz	60 µV/V	
	1 MHz	70 µV/V	

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AC Voltage – Measure (Fixed Points)	1 V		Fluke 792A AC/DC Transfer Standard; E-ACV-G-0005-GE; Comparison Measurements.
	10 Hz	31 µV/V	
	20 Hz	21 µV/V	
	40 Hz	12 µV/V	
	100 Hz	12 µV/V	
	1 kHz	12 µV/V	
	10 kHz	12 µV/V	
	20 kHz	12 µV/V	
	50 kHz	14 µV/V	
	100 kHz	17 µV/V	
	300 kHz	27 µV/V	
	500 kHz	31 µV/V	
	800 kHz	40 µV/V	
	1 MHz	50 µV/V	
	2 V		
	10 Hz	31 µV/V	
	20 Hz	22 µV/V	
	40 Hz	15 µV/V	
	100 Hz	15 µV/V	
	1 kHz	15 µV/V	
	10 kHz	15 µV/V	
	20 kHz	15 µV/V	
	50 kHz	15 µV/V	
	100 kHz	18 µV/V	
	300 kHz	27 µV/V	
	500 kHz	32 µV/V	
	800 kHz	40 µV/V	
	1 MHz	50 µV/V	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure (Fixed Points)	6 V		Fluke 792A AC/DC Transfer Standard; E-ACV-G-0005-GE; Comparison Measurements.
	10 Hz	31 µV/V	
	20 Hz	21 µV/V	
	40 Hz	13 µV/V	
	100 Hz	13 µV/V	
	1 kHz	13 µV/V	
	10 kHz	13 µV/V	
	20 kHz	13 µV/V	
	50 kHz	14 µV/V	
	100 kHz	14 µV/V	
	300 kHz	26 µV/V	
	500 kHz	31 µV/V	
	800 kHz	40 µV/V	
	1 MHz	50 µV/V	
	10 V		
	10 Hz	31 µV/V	
	20 Hz	21 µV/V	
	40 Hz	13 µV/V	
	100 Hz	13 µV/V	
	1 kHz	13 µV/V	
	10 kHz	13 µV/V	
	20 kHz	13 µV/V	
	50 kHz	14 µV/V	
	100 kHz	15 µV/V	
	300 kHz	26 µV/V	
	500 kHz	31 µV/V	
	800 kHz	40 µV/V	
	1 MHz	50 µV/V	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure (Fixed Points)	20 V		Fluke 792A AC/DC Transfer Standard; E-ACV-G-0005-GE; Comparison Measurements.
	10 Hz	32 µV/V	
	20 Hz	23 µV/V	
	40 Hz	17 µV/V	
	100 Hz	17 µV/V	
	1 kHz	17 µV/V	
	10 kHz	17 µV/V	
	20 kHz	17 µV/V	
	50 kHz	17 µV/V	
	100 kHz	19 µV/V	
	300 kHz	30 µV/V	
	500 kHz	32 µV/V	
	800 kHz	40 µV/V	
	1 MHz	50 µV/V	
	60 V		
	10 Hz	32 µV/V	
	20 Hz	22 µV/V	
	40 Hz	15 µV/V	
	100 Hz	15 µV/V	
	1 kHz	15 µV/V	
	10 kHz	15 µV/V	
	20 kHz	15 µV/V	
	50 kHz	16 µV/V	
	100 kHz	18 µV/V	
	300 kHz	35 µV/V	
	100 V		
	10 Hz	32 µV/V	
	20 Hz	22 µV/V	
	40 Hz	14 µV/V	
	100 Hz	14 µV/V	
	1 kHz	14 µV/V	
	10 kHz	14 µV/V	
	20 kHz	14 µV/V	
	50 kHz	16 µV/V	
	100 kHz	22 µV/V	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Voltage – Measure (Fixed Points)	200 V		Fluke 792A AC/DC Transfer Standard; E-ACV-G-0005-GE; Comparison Measurements.
	10 Hz	45 µV/V	
	20 Hz	23 µV/V	
	40 Hz	18 µV/V	
	100 Hz	18 µV/V	
	1 kHz	18 µV/V	
	10 kHz	18 µV/V	
	20 kHz	18 µV/V	
	50 kHz	20 µV/V	
	100 kHz	37 µV/V	
	600 V		
	40 Hz	18 µV/V	
	100 Hz	18 µV/V	
	1 kHz	18 µV/V	
	10 kHz	18 µV/V	
	20 kHz	18 µV/V	
	50 kHz	23 µV/V	
	100 kHz	46 µV/V	
	1 000 V		
	40 Hz	18 µV/V	
	100 Hz	18 µV/V	
	1 kHz	18 µV/V	
	10 kHz	18 µV/V	
	20 kHz	18 µV/V	
	30 kHz	18 µV/V	
[1] AC Voltage – Measure	Up to 2.2 mV		Fluke 5790A or Fluke 5790B AC Measurement Standards; E-ACV-G-0003-GE: Direct Measurement.
	(10 to 20) Hz	1.4 mV/V + 1.2 µV	
	(20 to 40) Hz	0.58 mV/V + 1.2 µV	
	40 Hz to 20 kHz	0.33 mV/V + 1.2 µV	
	(20 to 50) kHz	0.64 mV/V + 1.6 µV	
	(50 to 100) kHz	0.94 mV/V + 2 µV	
	(100 to 300) kHz	1.8 mV/V + 3.2 µV	
	(300 to 500) kHz	2.1 mV/V + 6.2 µV	
	500 kHz to 1 MHz	3.9 mV/V + 6.2 µV	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] AC Voltage – Measure	(2.2 to 7) mV		Fluke 5790A or Fluke 5790B AC Measurement Standards; E-ACV-G-0003-GE: Direct Measurement.
	(10 to 20) Hz	0.66 mV/V + 1.2 µV	
	(20 to 40) Hz	0.29 mV/V + 1.2 µV	
	40 Hz to 20 kHz	0.17 mV/V + 1.2 µV	
	(20 to 50) kHz	0.32 mV/V + 1.6 µV	
	(50 to 100) kHz	0.48 mV/V + 2 µV	
	(100 to 300) kHz	0.94 mV/V + 3.2 µV	
	(300 to 500) kHz	1.1 mV/V + 6.2 µV	
	500 kHz to 1 MHz	2.8 mV/V + 6.2 µV	
	(7 to 22) mV		
	(10 to 20) Hz	0.23 mV/V + 1.2 µV	
	(20 to 40) Hz	0.15 mV/V + 1.2 µV	
	40 Hz to 20 kHz	86 µV/V + 1.2 µV	
	(20 to 50) kHz	0.17 mV/V + 1.6 µV	
	(50 to 100) kHz	0.25 mV/V + 2 µV	
	(100 to 300) kHz	0.65 mV/V + 3.2 µV	
	(300 to 500) kHz	0.78 mV/V + 6.2 µV	
	500 kHz to 1 MHz	2.1 mV/V + 6.2 µV	
	(7 to 22) mV		
	(10 to 20) Hz	0.23 mV/V + 1.2 µV	
	(20 to 40) Hz	0.15 mV/V + 1.2 µV	
	40 Hz to 20 kHz	86 µV/V + 1.2 µV	
	(20 to 50) kHz	0.17 mV/V + 1.6 µV	
	(50 to 100) kHz	0.25 mV/V + 2 µV	
	(100 to 300) kHz	0.65 mV/V + 3.2 µV	
	(300 to 500) kHz	0.78 mV/V + 6.2 µV	
	500 kHz to 1 MHz	2.1 mV/V + 6.2 µV	
	(22 to 70) mV		
	(9.5 to 10) Hz	0.78 mV/V + 1.2 µV	
	(10 to 20) Hz	0.19 mV/V + 1.2 µV	
	(20 to 40) Hz	0.11 mV/V + 1.2 µV	
	40 Hz to 20 kHz	54 µV/V + 1.2 µV	
	(20 to 50) kHz	0.11 mV/V + 1.6 µV	
	(50 to 100) kHz	0.21 mV/V + 2 µV	
	(100 to 300) kHz	0.42 mV/V + 3.2 µV	
	(300 to 500) kHz	0.53 mV/V + 6.2 µV	
	500 kHz to 1 MHz	1.1 mV/V + 6.2 µV	

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[1] AC Voltage – Measure	(70 to 220) mV		Fluke 5790A or Fluke 5790B AC Measurement Standards; E-ACV-G-0003-GE: Direct Measurement.
	(9.5 to 10) Hz	0.78 mV/V + 2 µV	
	(10 to 20) Hz	0.17 mV/V + 2 µV	
	(20 to 40) Hz	68 µV/V + 2 µV	
	40 Hz to 20 kHz	34 µV/V + 2 µV	
	(20 to 50) kHz	57 µV/V + 2 µV	
	(50 to 100) kHz	0.13 mV/V + 2 µV	
	(100 to 300) kHz	0.22 mV/V + 4 µV	
	(300 to 500) kHz	0.32 mV/V + 7 µV	
	500 kHz to 1 MHz	0.94 mV/V + 7 µV	
	(220 to 700) mV		
	(9.5 to 10) Hz	0.78 mV/V + 2 µV	
	(10 to 20) Hz	0.17 mV/V + 2 µV	
	(20 to 40) Hz	61 µV/V + 3 µV	
	40 Hz to 20 kHz	30 µV/V + 2 µV	
	(20 to 50) kHz	44 µV/V + 2 µV	
	(50 to 100) kHz	66 µV/V + 3 µV	
	(100 to 300) kHz	0.17 mV/V + 6 µV	
	(300 to 500) kHz	0.27 mV/V + 12 µV	
	500 kHz to 1 MHz	0.94 mV/V + 12 µV	
	(0.7 to 2.2) V		
	(9.5 to 10) Hz	0.78 mV/V + 10 µV	
	(10 to 20) Hz	0.16 mV/V + 10 µV	
	(20 to 40) Hz	54 µV/V + 10 µV	
	40 Hz to 20 kHz	23 µV/V + 10 µV	
	(20 to 50) kHz	41 µV/V + 10 µV	
	(50 to 100) kHz	59 µV/V + 10 µV	
	(100 to 300) kHz	0.16 mV/V + 20 µV	
	(300 to 500) kHz	0.25 mV/V + 20 µV	
	500 kHz to 1 MHz	0.94 mV/V + 20 µV	
	(2.2 to 7) V		
	(9.5 to 10) Hz	0.78 mV/V + 10 µV	
	(10 to 20) Hz	0.16 mV/V + 10 µV	
	(20 to 40) Hz	55 µV/V + 10 µV	
	40 Hz to 20 kHz	23 µV/V + 10 µV	
	(20 to 50) kHz	42 µV/V + 10 µV	
	(50 to 100) kHz	69 µV/V + 20 µV	
	(100 to 300) kHz	0.18 mV/V + 20 µV	
	(300 to 500) kHz	0.37 mV/V + 20 µV	
	500 kHz to 1 MHz	1.2 mV/V + 20 µV	

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] AC Voltage – Measure	(7 to 22) V		Fluke 5790A or Fluke 5790B AC Measurement Standards; E-ACV-G-03-GE: Direct Measurement.
	(9.5 to 10) Hz	0.78 mV/V + 40 µV	
	(10 to 20) Hz	0.16 mV/V + 40 µV	
	(20 to 40) Hz	55 µV/V + 40 µV	
	40 Hz to 20 kHz	25 µV/V + 40 µV	
	(20 to 50) kHz	42 µV/V + 40 µV	
	(50 to 100) kHz	66 µV/V + 60 µV	
	(100 to 300) kHz	0.18 mV/V + 60 µV	
	(300 to 500) kHz	0.37 mV/V + 60 µV	
	500 kHz to 1 MHz	1.2 mV/V + 60 µV	
	(22 to 70) V		
	(9.5 to 10) Hz	0.78 mV/V + 40 µV	
	(10 to 20) Hz	0.16 mV/V + 40 µV	
	(20 to 40) Hz	56 µV/V + 40 µV	
	40 Hz to 20 kHz	31 µV/V + 40 µV	
	(20 to 50) kHz	50 µV/V + 40 µV	
	(50 to 100) kHz	86 µV/V + 60 µV	
	(100 to 300) kHz	0.18 mV/V + 60 µV	
	(300 to 500) kHz	0.4 mV/V + 0.2 mV	
	500 kHz to 1 MHz	1.2 mV/V + 0.2 mV	
	(70 to 220) V		
	(10 to 20) Hz	0.16 mV/V + 0.2 mV	
	(20 to 40) Hz	56 µV/V + 0.4 mV	
	40 Hz to 20 kHz	30 µV/V + 0.4 mV	
	(20 to 50) kHz	60 µV/V + 1 mV	
	(50 to 100) kHz	86 µV/V + 2 mV	
	(100 to 300) kHz	0.21 mV/V + 2 mV	
	(300 to 500) kHz	0.55 mV/V + 2 mV	
	(220 to 700) V		
	(10 to 20) Hz	0.16 mV/V + 0.7 mV	
	(20 to 40) Hz	86 µV/V + 0.7 mV	
	40 Hz to 20 kHz	37 µV/V + 0.5 mV	
	(20 to 50) kHz	0.12 mV/V + 1 mV	
	(50 to 100) kHz	0.66 mV/V + 2 mV	
	(700 to 1 050) V		
	(10 to 20) Hz	0.16 mV/V + 0.7 mV	
	(20 to 40) Hz	86 µV/V + 0.7 mV	
	40 Hz to 20 kHz	35 µV/V + 0.5 mV	
	(20 to 50) kHz	0.12 mV/V + 1 mV	
	(50 to 100) kHz	0.66 mV/V + 2 mV	

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[1] AC Voltage – Measure	Up to 200 mV		Fluke 8508A 8.5 Digit Multimeter; E-ACV-G-0001-GE: Direct Measurement.
	(1 to 10) Hz	0.17 mV/V + 20 µV	
	(10 to 40) Hz	0.14 mV/V + 5 µV	
	(40 to 100) Hz	0.12 mV/V + 5 µV	
	100 Hz to 2 kHz	0.11 mV/V + 3 µV	
	(2 to 10) kHz	0.14 mV/V + 5 µV	
	(10 to 30) kHz	0.34 mV/V + 9 µV	
	(30 to 100) kHz	0.8 mV/V + 20 µV	
	(0.2 to 2) V		
	(1 to 10) Hz	0.15 mV/V + 0.2 mV	
	(10 to 40) Hz	0.12 mV/V + 25 µV	
	(40 to 100) Hz	90 µV/V + 25 µV	
	100 Hz to 2 kHz	75 µV/V + 25 µV	
	(2 to 10) kHz	0.11 mV/V + 25 µV	
	(10 to 30) kHz	0.22 mV/V + 45 µV	
	(30 to 100) kHz	0.57 mV/V + 0.22 mV	
	(100 to 300) kHz	3 mV/V + 2.2 mV	
	300 kHz to 1 MHz	10 mV/V + 22 mV	
	(2 to 20) V		
	(1 to 10) Hz	0.15 mV/V + 2 mV	
	(10 to 40) Hz	0.12 mV/V + 0.25 mV	
	(40 to 100) Hz	90 µV/V + 0.25 mV	
	100 Hz to 2 kHz	75 µV/V + 0.25 mV	
	(2 to 10) kHz	0.11 mV/V + 0.25 mV	
	(10 to 30) kHz	0.22 mV/V + 0.45 mV	
	(30 to 100) kHz	0.57 mV/V + 2.2 mV	
	(100 to 300) kHz	3 mV/V + 22 mV	
	300 kHz to 1 MHz	10 mV/V + 0.22 V	
	(20 to 200) V		
	(1 to 10) Hz	0.15 mV/V + 20 mV	
	(10 to 40) Hz	0.12 mV/V + 2.5 mV	
	(40 to 100) Hz	90 µV/V + 2.5 mV	
	100 Hz to 2 kHz	75 µV/V + 2.5 mV	
	(2 to 10) kHz	0.11 mV/V + 2.5 mV	
	(10 to 30) kHz	0.22 mV/V + 4.5 mV	
	(30 to 100) kHz	0.57 mV/V + 22 mV	
	(100 to 300) kHz	3 mV/V + 0.22 V	
	300 kHz to 1 MHz	10 mV/V + 2.2 V	

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[1] AC Voltage – Measure	(200 to 1 050) V		Fluke 8508A 8.5 Digit Multimeter; E-ACV-G-0001-GE: Direct Measurement.
	(1 to 10) Hz	0.15 mV/V + 80 mV	
	(10 to 40) Hz	0.12 mV/V + 25 mV	
	40 Hz to 10 kHz	0.12 mV/V + 25 mV	
	(10 to 30) kHz	0.23 mV/V + 45 mV	
	(30 to 100) kHz	0.58 mV/V + 0.22 V	
[1] AC Voltage – Measure	Up to 10 mV		Agilent 3458A 8.5 Digit Multimeter; E-ACV-G-0001-GE: Direct Measurement.
	(1 to 40) Hz	0.35 mV/V + 3.5 µV	
	40 Hz to 1 kHz	0.24 mV/V + 1.4 µV	
	(1 to 20) kHz	0.35 mV/V + 1.4 µV	
	(20 to 50) kHz	1.2 mV/V + 1.4 µV	
	(50 to 100) kHz	5.8 mV/V + 1.4 µV	
	(100 to 300) kHz	47 mV/V + 2.4 µV	
	(10 to 100) mV		
	(1 to 40) Hz	84 µV/V + 5 µV	
	40 Hz to 1 kHz	84 µV/V + 2.5 µV	
	(1 to 20) kHz	0.17 mV/V + 2.5 µV	
	(20 to 50) kHz	0.35 mV/V + 3 µV	
	(50 to 100) kHz	0.93 mV/V + 3 µV	
	(100 to 300) kHz	3.5 mV/V + 12 µV	
	300 kHz to 1 MHz	12 mV/V + 12 µV	
	(1 to 2) MHz	18 mV/V + 12 µV	
	(0.1 to 1) V		
	(1 to 40) Hz	84 µV/V + 50 µV	
	40 Hz to 1 kHz	84 µV/V + 25 µV	
	(1 to 20) kHz	0.17 mV/V + 25 µV	
	(20 to 50) kHz	0.35 mV/V + 30 µV	
	(50 to 100) kHz	0.93 mV/V + 30 µV	
	(100 to 300) kHz	3.5 mV/V + 0.12 mV	
	300 kHz to 1 MHz	12 mV/V + 0.12 mV	
	(1 to 2) MHz	18 mV/V + 0.12 mV	
	(1 to 10) V		
	(1 to 40) Hz	84 µV/V + 0.5 mV	
	40 Hz to 1 kHz	84 µV/V + 0.25 mV	
	(1 to 20) kHz	0.17 mV/V + 0.25 mV	
	(20 to 50) kHz	0.35 mV/V + 0.3 mV	
	(50 to 100) kHz	0.93 mV/V + 0.3 mV	
	(100 to 300) kHz	3.5 mV/V + 1.2 mV	
	300 kHz to 1 MHz	12 mV/V + 1.2 mV	
	(1 to 2) MHz	18 mV/V + 1.2 mV	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] AC Voltage – Measure	(10 to 100) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (100 to 1 000) V (1 to 40) Hz 40 Hz to 1 kHz (1 to 20) kHz (20 to 50) kHz (50 to 100) kHz	 0.24 mV/V + 5 mV 0.24 mV/V + 2.5 mV 0.24 mV/V + 2.5 mV 0.41 mV/V + 2.5 mV 1.4 mV/V + 3 mV 4.7 mV/V + 12 mV 18 mV/V + 12 mV 0.47 mV/V + 50 mV 0.47 mV/V + 25 mV 0.7 mV/V + 25 mV 1.4 mV/V + 25 mV 3.5 mV/V + 30 mV	Agilent 3458A 8.5 Digit Multimeter; E-ACV-G-0001-GE: Direct Measurement.
[1] AC High Voltage – Measure	(50 to 60) Hz (Up to 1) kV (1 to 5) kV (5 to 10) kV (10 to 15) kV (15 to 20) kV (20 to 25) kV (25 to 30) kV (30 to 50) kV (50 to 70) kV	 1.5 mV/V + 0.4 V 1.5 mV/V + 1.5 V 1.5 mV/V + 3 V 1.5 mV/V + 6 V 1.5 mV/V + 8 V 1.5 mV/V + 9 V 1.5 mV/V + 10 V 6 mV/V + 60 V 6 mV/V + 60 V	Vitrek 4700 Digital High Voltage Meter, or Kikusui 149-10A Digital High Voltage Meter, TD1230 Verification Device for Withstanding Voltage Tester, Vitrek 4700-HVL-35 and HVL-150 High Voltage Probe; E-ACV-G-0002-GE: Direct Measurement with High Voltage Meters.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] AC Voltage – Measure Amplitude Flatness (Relative to 1 kHz)	Up to 2.2 mV		Fluke 5790A or Fluke 5790B AC Measurement Standards (Wide Band Functions); E-ACV-G-0004-GE: Direct Measurement.
	(10 to 30) Hz	1.5 mV/V + 0.3 µV	
	30 Hz to 120 kHz	0.75 mV/V + 0.3 µV	
	(120 to 500) kHz	1.1 mV/V + 1.6 µV	
	500 kHz to 1.2 MHz	1.1 mV/V + 1.6 µV	
	(1.2 to 2) MHz	1.1 mV/V + 1.6 µV	
	(2 to 10) MHz	2.6 mV/V + 1.6 µV	
	(10 to 20) MHz	4.5 mV/V + 1.6 µV	
	(20 to 30) MHz	11 mV/V + 4 µV	
	(2.2 to 7) mV		
	(10 to 30) Hz	1.5 mV/V + 0.3 µV	
	30 Hz to 120 kHz	0.75 mV/V + 0.3 µV	
	(120 to 500) kHz	1.1 mV/V + 1.6 µV	
	500 kHz to 1.2 MHz	1.1 mV/V + 1.6 µV	
	(1.2 to 2) MHz	1.1 mV/V + 1.6 µV	
	(2 to 10) MHz	1.5 mV/V + 1.6 µV	
	(10 to 20) MHz	2.6 mV/V + 1.6 µV	
	(20 to 30) MHz	5.6 mV/V + 1.6 µV	
	(7 to 22) mV		
	(10 to 30) Hz	1.5 mV/V + 0.3 µV	
	30 Hz to 120 kHz	0.75 mV/V + 0.3 µV	
	(120 to 500) kHz	1.1 mV/V + 0.3 µV	
	500 kHz to 1.2 MHz	1.1 mV/V + 0.3 µV	
	(1.2 to 2) MHz	1.1 mV/V + 0.3 µV	
	(2 to 10) MHz	1.5 mV/V + 0.3 µV	
	(10 to 20) MHz	2.6 mV/V + 0.3 µV	
	(20 to 30) MHz	5.6 mV/V + 0.3 µV	
	(22 to 70) mV		
	(10 to 30) Hz	1.5 mV/V + 1 µV	
	30 Hz to 120 kHz	0.75 mV/V + 1 µV	
	(120 to 500) kHz	0.75 mV/V + 1 µV	
	500 kHz to 1.2 MHz	0.75 mV/V + 1 µV	
	(1.2 to 2) MHz	0.75 mV/V + 1 µV	
	(2 to 10) MHz	1.5 mV/V + 1 µV	
	(10 to 20) MHz	2.3 mV/V + 1 µV	
	(20 to 30) MHz	5.3 mV/V + 1 µV	

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[1] AC Voltage – Measure Amplitude Flatness (Relative to 1 kHz)	(70 to 220) mV		Fluke 5790A or Fluke 5790B AC Measurement Standards (Wide Band Functions); E-ACV-G-0004-GE: Direct Measurement.
	(10 to 30) Hz	1.5 mV/V + 1 µV	
	30 Hz to 120 kHz	0.6 mV/V + 1 µV	
	(120 to 500) kHz	0.6 mV/V + 1 µV	
	500 kHz to 1.2 MHz	0.75 mV/V + 1 µV	
	(1.2 to 2) MHz	0.75 mV/V + 1 µV	
	(2 to 10) MHz	1.5 mV/V + 1 µV	
	(10 to 20) MHz	2.3 mV/V + 1 µV	
	(20 to 30) MHz	5.3 mV/V + 1 µV	
	(220 to 700) mV		
	(10 to 30) Hz	1.5 mV/V + 10 µV	
	30 Hz to 120 kHz	0.45 mV/V + 10 µV	
	(120 to 500) kHz	0.45 mV/V + 10 µV	
	500 kHz to 1.2 MHz	0.75 mV/V + 10 µV	
	(1.2 to 2) MHz	0.75 mV/V + 10 µV	
	(2 to 10) MHz	1.5 mV/V + 10 µV	
	(10 to 20) MHz	2.3 mV/V + 10 µV	
	(20 to 30) MHz	5.3 mV/V + 10 µV	
	700 mV to 2.2 V		
	(10 to 30) Hz	1.5 mV/V + 10 µV	
	30 Hz to 120 kHz	0.45 mV/V + 10 µV	
	(120 to 500) kHz	0.45 mV/V + 10 µV	
	500 kHz to 1.2 MHz	0.75 mV/V + 10 µV	
	(1.2 to 2) MHz	0.75 mV/V + 10 µV	
	(2 to 10) MHz	1.5 mV/V + 10 µV	
	(10 to 20) MHz	2.3 mV/V + 10 µV	
	(20 to 30) MHz	5.3 mV/V + 10 µV	
	(2.2 to 7) V		
	(10 to 30) Hz	1.5 mV/V + 60 µV	
	30 Hz to 120 kHz	0.45 mV/V + 60 µV	
	(120 to 500) kHz	0.45 mV/V + 60 µV	
	500 kHz to 1.2 MHz	0.75 mV/V + 60 µV	
	(1.2 to 2) MHz	0.75 mV/V + 60 µV	
	(2 to 10) MHz	1.5 mV/V + 60 µV	
	(10 to 20) MHz	2.3 mV/V + 60 µV	
	(20 to 30) MHz	5.3 mV/V + 60 µV	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current – Source (Fixed Points)	100 µA		Fluke 792A AC/DC Transfer Standard, and AC/DC Current Shunt; E-ACA-M-0006-GE: Comparison Measurements.
	10 Hz	0.14 mA/A	
	20 Hz	0.1 mA/A	
	40 Hz	0.1 mA/A	
	1 kHz	0.1 mA/A	
	5 kHz	0.11 mA/A	
	10 kHz	0.14 mA/A	
	30 kHz	0.17 mA/A	
	200 µA		
	10 Hz	0.14 mA/A	
	20 Hz	0.1 mA/A	
	40 Hz	0.1 mA/A	
	1 kHz	0.1 mA/A	
	5 kHz	0.11 mA/A	
	10 kHz	0.14 mA/A	
	30 kHz	0.17 mA/A	
	1 mA		
	10 Hz	65 µA/A	
	20 Hz	61 µA/A	
	40 Hz	58 µA/A	
	1 kHz	58 µA/A	
	5 kHz	58 µA/A	
	10 kHz	58 µA/A	
	30 kHz	60 µA/A	
	2 mA		
	10 Hz	65 µA/A	
	20 Hz	60 µA/A	
	40 Hz	57 µA/A	
	1 kHz	57 µA/A	
	5 kHz	57 µA/A	
	10 kHz	57 µA/A	
	30 kHz	60 µA/A	

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AC Current – Source (Fixed Points)	10 mA		Fluke 792A AC/DC Transfer Standard, and AC/DC Current Shunt; E-ACA-M-0006-GE: Comparison Measurements.
	10 Hz	55 µA/A	
	20 Hz	51 µA/A	
	40 Hz	48 µA/A	
	1 kHz	48 µA/A	
	5 kHz	48 µA/A	
	10 kHz	52 µA/A	
	30 kHz	60 µA/A	
	20 mA		
	10 Hz	55 µA/A	
	20 Hz	51 µA/A	
	40 Hz	48 µA/A	
	1 kHz	48 µA/A	
	5 kHz	48 µA/A	
	10 kHz	52 µA/A	
	30 kHz	60 µA/A	
	50 mA		
	10 Hz	58 µA/A	
	20 Hz	54 µA/A	
	40 Hz	51 µA/A	
	1 kHz	51 µA/A	
	5 kHz	51 µA/A	
	10 kHz	56 µA/A	
	30 kHz	60 µA/A	
	100 mA		
	10 Hz	56 µA/A	
	20 Hz	53 µA/A	
	40 Hz	50 µA/A	
	1 kHz	50 µA/A	
	5 kHz	50 µA/A	
	10 kHz	55 µA/A	
	30 kHz	60 µA/A	
	200 mA		
	10 Hz	56 µA/A	
	20 Hz	52 µA/A	
	40 Hz	48 µA/A	
	1 kHz	48 µA/A	
	5 kHz	48 µA/A	
	10 kHz	53 µA/A	
	30 kHz	60 µA/A	

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AC Current – Source (Fixed Points)	500 mA		Fluke 792A AC/DC Transfer Standard, and AC/DC Current Shunt; E-ACA-M-0006-GE: Comparison Measurements.
	10 Hz	68 µA/A	
	20 Hz	65 µA/A	
	40 Hz	62 µA/A	
	1 kHz	62 µA/A	
	5 kHz	62 µA/A	
	10 kHz	66 µA/A	
	30 kHz	75 µA/A	
	1 A		
	20 Hz	63 µA/A	
	40 Hz	60 µA/A	
	1 kHz	60 µA/A	
	5 kHz	60 µA/A	
	10 kHz	64 µA/A	
	2 A		
	20 Hz	60 µA/A	
	40 Hz	58 µA/A	
	1 kHz	58 µA/A	
	5 kHz	58 µA/A	
	10 kHz	61 µA/A	
	5 A		
	40 Hz	61 µA/A	
	1 kHz	61 µA/A	
	5 kHz	61 µA/A	
	10 kHz	65 µA/A	
	10 A		
	40 Hz	64 µA/A	
	1 kHz	64 µA/A	
	5 kHz	64 µA/A	
	10 kHz	68 µA/A	
	20 A		
	40 Hz	64 µA/A	
	1 kHz	64 µA/A	
	5 kHz	64 µA/A	
AC Current – Source	Up to 220 µA		Fluke 55xxA or Fluke 57xxA Multiproduct Calibrators; E-ACA-M-0001-GE, E-ACA-M-0002-GE, E-ACA-M-0003-GE: Direct Measurement.
	(3 to 10) Hz	0.19 mA/A + 0.1 µA	
	(10 to 20) Hz	0.25 mA/A + 20 nA	
	(20 to 40) Hz	0.16 mA/A + 12 nA	
	40 Hz to 1 kHz	0.12 mA/A + 9 nA	
	(1 to 5) kHz	0.28 mA/A + 13 nA	
	(5 to 10) kHz	1.1 mA/A + 70 nA	

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AC Current – Source	(0.22 to 2.2) mA		Fluke 55xxA or Fluke 57xxA Multiproduct Calibrators; E-ACA-M-0001-GE, E-ACA-M-0002-GE, E-ACA-M-0003-GE: Direct Measurement.
	(3 to 10) Hz	0.19 mA/A + 1 µA	
	(10 to 20) Hz	0.25 mA/A + 70 nA	
	(20 to 40) Hz	0.16 mA/A + 50 nA	
	40 Hz to 1 kHz	0.12 mA/A + 40 nA	
	(1 to 5) kHz	0.2 mA/A + 0.2 µA	
	(5 to 10) kHz	1.1 mA/A + 0.7 µA	
	(2.2 to 22) mA		
	(3 to 10) Hz	0.19 mA/A + 8 µA	
	(10 to 20) Hz	0.25 mA/A + 0.5 µA	
	(20 to 40) Hz	0.16 mA/A + 0.5 µA	
	40 Hz to 1 kHz	0.12 mA/A + 0.4 µA	
	(1 to 5) kHz	0.2 mA/A + 0.6 µA	
	(5 to 10) kHz	1.1 mA/A + 6 µA	
	(22 to 220) mA		
	(3 to 10) Hz	0.19 mA/A + 80 µA	
	(10 to 20) Hz	0.25 mA/A + 5 µA	
	(20 to 40) Hz	0.16 mA/A + 5.5 µA	
	40 Hz to 1 kHz	0.12 mA/A + 5 µA	
	(1 to 5) kHz	0.2 mA/A + 5 µA	
	(5 to 10) kHz	1.1 mA/A + 20 µA	
	(0.22 to 2.2) A		
	(3 to 20) Hz	0.29 mA/A + 0.4 mA	
	20 Hz to 1 kHz	0.26 mA/A + 40 µA	
	(1 to 5) kHz	0.45 mA/A + 90 µA	
	(5 to 10) kHz	7 mA/A + 0.2 mA	
	(2.2 to 11) A		
	(3 to 40) Hz	0.29 mA/A + 1 mA	
	40 Hz to 1 kHz	0.46 mA/A + 0.2 mA	
	(1 to 5) kHz	0.95 mA/A + 0.4 mA	
	(5 to 10) kHz	3.6 mA/A + 0.8 mA	
	(11 to 30.2) A		
	(3 to 45) Hz	0.78 mA/A + 7.8 mA	
	45 Hz to 1 kHz	0.55 mA/A + 4 mA	
	(1 to 5) kHz	3.9 mA/A + 7 mA	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] AC Current – Source	Up to 330 µA (10 to 30) kHz (0.33 to 3.3) mA (10 to 30) kHz (3.3 to 33) mA (10 to 30) kHz (33 to 330) mA (10 to 30) kHz (11 to 20.5) A (45 to 100) Hz 100 Hz to 1 kHz (1 to 5) kHz	 13 mA/A + 0.3 µA 7.8 mA/A + 0.5 µA 3.2 mA/A + 4 µA 3.2 mA/A + 0.16 mA 0.94 mA/A + 4 mA 1.2 mA/A + 4 mA 24 mA/A + 4 mA	Fluke 55xxA Multiproduct Calibrator; E-ACA-M-0002-GE: Direct Measurement.
[1] AC Current – Source	(20.5 to 60) A 50 Hz, 60 Hz 400 Hz	 1.8 mA/A + 20 mA 2.4 mA/A + 20 mA	Yokogawa 2558 Precision AC Calibrator; E-ACA-M-0003-GE: Direct Measurement.
[1] AC Current Clamp Meters – Source (Toroidal and Non-toroidal type)	Up to 10 A (45 to 440) Hz (10 to 16.5) A (45 to 65) Hz (65 to 440) Hz (16.5 to 60) A (45 to 440) Hz (60 to 150) A (45 to 440) Hz (150 to 155) A (45 to 440) Hz (155 to 550) A (45 to 65) Hz (550 to 1 000) A (45 to 65) Hz (1 000 to 1 500) A (45 to 65) Hz	 0.23 mA/A + 60 mA 2.4 mA/A + 60 mA 2.4 mA/A + 60 mA 2.4 mA/A + 60 mA 2.4 mA/A + 60 mA 2.4 mA/A + 60 mA 2.4 mA/A + 70 mA 2.4 mA/A + 70 mA 2.4 mA/A + 70 mA	Fluke 55xxA Multiproduct Calibrator, Fluke 5500A/COIL 50-turn Coil; E-ACA-M-0005-GE: Direct Measurement.

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[1] AC Current Clamp Meters – Source (without Indication) (Toroidal and Non-toroidal type)	Up to 10 A (45 to 65) Hz (65 to 440) Hz (10 to 16.5) A (45 to 65) Hz (65 to 440) Hz (16.5 to 60) A (45 to 440) Hz (60 to 150) A (45 to 440) Hz (60 to 155) A (45 to 440) Hz (155 to 550) A (45 to 65) Hz (550 to 1 000) A (45 to 65) Hz (1 000 to 1 500) A (45 to 65) Hz	 0.25 mA/A + 0.5 mA 0.25 mA/A + 0.5 mA 2.4 mA/A + 60 µA 2.4 mA/A + 60 µA 2.4 mA/A + 60 µA 2.4 mA/A + 0.4 mA 2.4 mA/A + 0.4 mA 2.4 mA/A + 0.6 mA 2.4 mA/A + 7 mA 2.4 mA/A + 7 mA	Fluke 55xxA Multiproduct Calibrator, Fluke 5500A/COIL, 8.5 Digit Multimeter; E-ACA-M-0005-GE: Direct Measurement.
AC Current – Measure (Fixed Points)	200 µA 10 Hz 20 Hz 40 Hz 1 kHz 5 kHz 10 kHz 2 mA 10 Hz 20 Hz 40 Hz 1 kHz 5 kHz 10 kHz 20 mA 10 Hz 20 Hz 40 Hz 1 kHz 5 kHz 10 kHz	 0.14 mA/A 0.1 mA/A 0.1 mA/A 0.1 mA/A 0.11 mA/A 0.14 mA/A 65 µA/A 60 µA/A 57 µA/A 57 µA/A 57 µA/A 57 µA/A 55 µA/A 51 µA/A 48 µA/A 48 µA/A 48 µA/A 52 µA/A	Fluke 792A AC/DC Transfer Standard, and AC/DC Current Shunt; E-ACA-G-0004-GE, Comparison Measurements.

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AC Current – Measure (Fixed Points)	200 mA		Fluke 792A AC/DC Transfer Standard, and AC/DC Current Shunt; E-ACA-G-0004-GE, Comparison Measurements.
	10 Hz	56 µA/A	
	20 Hz	52 µA/A	
	40 Hz	48 µA/A	
	1 kHz	48 µA/A	
	5 kHz	48 µA/A	
	10 kHz	53 µA/A	
	2 A		
	20 Hz	60 µA/A	
	40 Hz	58 µA/A	
	1 kHz	58 µA/A	
	5 kHz	58 µA/A	
	10 kHz	61 µA/A	
	10 A		
	40 Hz	64 µA/A	
	1 kHz	64 µA/A	
	5 kHz	64 µA/A	
	10 kHz	68 µA/A	
	20 A		
	40 Hz	64 µA/A	
	1 kHz	64 µA/A	
	5 kHz	64 µA/A	
[1] AC Current – Measure	(9 to 330) µA		Fluke 5790A or Fluke 5790B AC Measurement Standards, Metal Film Resistor, Fluke A40/A40A AC Current Shunts, Holt HCS-50A AC Current Shunt; E-ACA-G-0003-GE: AC-DC Difference Transfer.
	(10 to 20) Hz	0.39 mA/A	
	(20 to 40) Hz	0.25 mA/A	
	40 Hz to 5 kHz	0.24 mA/A	
	(5 to 10) kHz	0.36 mA/A	
	(10 to 20) kHz	0.7 mA/A	
	(20 to 30) kHz	1.2 mA/A	
	(30 to 50) kHz	2.5 mA/A	
	(0.33 to 3.3) mA		
	(10 to 20) Hz	0.29 mA/A	
	(20 to 40) Hz	0.14 mA/A	
	40 Hz to 5 kHz	0.13 mA/A	
	(5 to 10) kHz	0.13 mA/A	
	(10 to 20) kHz	0.24 mA/A	
	(20 to 30) kHz	0.24 mA/A	
	(30 to 50) kHz	0.24 mA/A	

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[1] AC Current – Measure	(3.3 to 20) mA		Fluke 5790A or Fluke 5790B AC Measurement Standards, Metal Film Resistor, Fluke A40/A40A AC Current Shunts, Holt HCS-50A AC Current Shunt; E-ACA-G-0003-GE: AC-DC Difference Transfer.
	(10 to 20) Hz	0.21 mA/A	
	(20 to 40) Hz	0.14 mA/A	
	40 Hz to 5 kHz	0.13 mA/A	
	(5 to 10) kHz	0.13 mA/A	
	(10 to 20) kHz	0.13 mA/A	
	(20 to 30) kHz	0.24 mA/A	
	(30 to 50) kHz	0.24 mA/A	
	(20 to 50) mA		
	(10 to 20) Hz	0.21 mA/A	
	(20 to 40) Hz	0.15 mA/A	
	40 Hz to 5 kHz	0.14 mA/A	
	(5 to 10) kHz	0.14 mA/A	
	(10 to 20) kHz	0.14 mA/A	
	(20 to 30) kHz	0.25 mA/A	
	(30 to 50) kHz	0.25 mA/A	
	(50 to 200) mA		
	(10 to 20) Hz	0.21 mA/A	
	(20 to 40) Hz	0.14 mA/A	
	40 Hz to 5 kHz	0.13 mA/A	
	(5 to 10) kHz	0.13 mA/A	
	(10 to 20) kHz	0.13 mA/A	
	(20 to 30) kHz	0.24 mA/A	
	(30 to 50) kHz	0.24 mA/A	
	(200 to 500) mA		
	(10 to 20) Hz	0.23 mA/A	
	(20 to 40) Hz	0.17 mA/A	
	40 Hz to 5 kHz	0.16 mA/A	
	(5 to 10) kHz	0.16 mA/A	
	(10 to 20) kHz	0.21 mA/A	
	(20 to 30) kHz	0.26 mA/A	
	(30 to 50) kHz	0.37 mA/A	
	(0.5 to 2) A		
	(10 to 20) Hz	0.22 mA/A	
	(20 to 40) Hz	0.16 mA/A	
	40 Hz to 5 kHz	0.15 mA/A	
	(5 to 10) kHz	0.15 mA/A	
	(10 to 20) kHz	0.20 mA/A	
	(20 to 30) kHz	0.25 mA/A	
	(30 to 50) kHz	0.36 mA/A	

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[1] AC Current – Measure	(2 to 5) A (10 to 20) Hz (20 to 40) Hz 40 Hz to 5 kHz (5 to 10) kHz (10 to 20) kHz (20 to 30) kHz (30 to 50) kHz (5 to 11) A (10 to 20) Hz (20 to 40) Hz 40 Hz to 5 kHz (5 to 10) kHz (10 to 20) kHz (20 to 30) kHz (30 to 50) kHz (11 to 20) A (10 to 20) Hz (20 to 40) Hz 40 Hz to 5 kHz (5 to 10) kHz (10 to 20) kHz (20 to 30) kHz (30 to 50) kHz	 0.52 mA/A 0.5 mA/A 0.49 mA/A 0.49 mA/A 0.49 mA/A 0.52 mA/A 0.58 mA/A 0.5 mA/A 0.48 mA/A 0.47 mA/A 0.47 mA/A 0.47 mA/A 0.54 mA/A 0.54 mA/A 0.86 mA/A 0.84 mA/A 0.84 mA/A 0.84 mA/A 0.84 mA/A 0.88 mA/A 0.88 mA/A	Fluke 5790A or Fluke 5790B AC Measurement Standards, Metal Film Resistor, Fluke A40/A40A AC Current Shunts, Holt HCS-50A AC Current Shunt; E-ACA-G-0003-GE: AC-DC Difference Transfer.
[1] AC Current – Measure	(20 to 50) A (10 to 20) Hz (20 to 40) Hz 40 Hz to 1 kHz (1 to 5) kHz (5 to 10) kHz	 0.89 mA/A 0.89 mA/A 0.89 mA/A 1.2 mA/A 1.6 mA/A	Fluke 5790A or Fluke 5790B AC Measurement Standards, Metal Film Resistor, Fluke A40/A40A AC Current Shunts, Holt HCS-50A AC Current Shunt; E-ACA-G-0003-GE: AC-DC Difference Transfer.

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[1] AC Current – Measure	Up to 200 µA		Agilent 3458A 8.5 Digit Multimeter, or Fluke 8508A 8.5 Digit Multimeter; E-ACA-G-0001-GE: Direct Measurement.
	(1 to 10) Hz	0.31 mA/A + 25 nA	
	10 Hz to 10 kHz	0.3 mA/A + 25 nA	
	(10 to 30) kHz	0.71 mA/A + 25 nA	
	(30 to 100) kHz	4 mA/A + 25 nA	
	(0.2 to 2) mA		
	(1 to 10) Hz	0.31 mA/A + 0.25 µA	
	10 Hz to 10 kHz	0.3 mA/A + 0.25 µA	
	(10 to 30) kHz	0.71 mA/A + 0.25 µA	
	(30 to 100) kHz	4 mA/A + 0.25 µA	
	(2 to 20) mA		
	(1 to 10) Hz	0.31 mA/A + 2.5 µA	
	10 Hz to 10 kHz	0.3 mA/A + 2.5 µA	
	(10 to 30) kHz	0.71 mA/A + 2.5 µA	
	(30 to 100) kHz	4 mA/A + 2.5 µA	
	(20 to 200) mA		
	(1 to 10) Hz	0.31 mA/A + 25 µA	
	10 Hz to 10 kHz	0.29 mA/A + 25 µA	
	(10 to 30) kHz	0.63 mA/A + 25 µA	
	(0.2 to 2) A		
	10 Hz to 2 kHz	0.62 mA/A + 0.25 mA	
	(2 to 10) kHz	0.73 mA/A + 0.25 mA	
	(10 to 30) kHz	3 mA/A + 0.25 mA	
	(2 to 20) A		
	10 Hz to 2 kHz	0.82 mA/A + 2.5 mA	
	(2 to 10) kHz	2.5 mA/A + 2.5 mA	
AC Current – Measure Clamp	Up to 999.9 A		Fluke 376 True RMS AC/DC Clamp Meter with Flexible Current Probe; E-ACA-G-0005-GE Direct Measurement.
	(50 to 60) Hz	24 mA/A + 0.6 A	
Flexible Current Probe	Up to 999.9 A		
	(50 to 60) Hz	35 mA/A + 0.6 A	
	(999.9 to 2 500) A		
	(50 to 60) Hz	35 mA/A + 6 A	
AC Current – Measure			Fluke 55xxA Multiproduct Calibrator, Keysight 3458A 8.5 Digit Multimeter with Current Clamp C103; E-ACA-G-0006-GE Direct Measurement.
1-turn Coil	Up to 1 000 A		
	(50 to 400) Hz	1.8 mA/A + 25 µA	
2-turn Coil	Up to 1 000 A		
	(50 to 400) Hz	1.8 mA/A + 25 µA	
10-turn Coil	Up to 1 000 A		
	(50 to 400) Hz	2 mA/A + 9 mA	

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AC Current – Measure 50-turn Coil	Up to 1 000 A (50 to 400) Hz	2 mA/A + 9 mA	Fluke 55xxA Multiproduct Calibrator, Keysight 3458A 8.5 Digit Multimeter with Current Clamp C103; E-ACA-G-0006-GE Direct Measurement.
[1] Capacitance – Source (Simulation)	10 Hz to 10 kHz (0.19 to 0.4) nF (0.4 to 1.1) nF 10 Hz to 3 kHz (1.1 to 3.3) nF 10 Hz to 1 kHz (3.3 to 11) nF (11 to 33) nF (33 to 110) nF (110 to 330) nF (10 to 600) Hz 330 nF to 1.1 µF (10 to 300) Hz (1.1 to 3.3) µF (10 to 150) Hz (3.3 to 11) µF (10 to 120) Hz (11 to 33) µF (10 to 80) Hz (33 to 110) µF (0 to 50) Hz (110 to 330) µF (0 to 20) Hz 330 µF to 1.1 mF (0 to 6) Hz (1.1 to 3.3) mF (0 to 2) Hz (3.3 to 11) mF (0 to 0.6) Hz (11 to 33) mF (0 to 0.2) Hz (33 to 110) mF	3.9 mF/F + 8 pF 3.9 mF/F + 10 pF 2 mF/F + 10 pF 2 mF/F + 12 pF 2 mF/F + 0.1 nF 2 mF/F + 0.12 nF 2 mF/F + 0.65 nF 2 mF/F + 1 nF 2 mF/F + 6.5 nF 2 mF/F + 10 nF 3.2 mF/F + 62 nF 3.5 mF/F + 0.1 µF 3.5 mF/F + 0.65 µF 3.5 mF/F + 1 µF 3.5 mF/F + 6.5 µF 3.5 mF/F + 10 µF 5.9 mF/F + 65 µF 8.6 mF/F + 0.1 mF	Fluke 552xA Multiproduct Calibrator; E-ACC-M-0001-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Capacitance – Source (Simulation)	(50 to 1 000) Hz (0.33 to 0.5) nF (0.5 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 330 nF to 1.1 µF (1.1 to 3.3) µF (50 to 400) Hz (3.3 to 11) µF (11 to 33) µF (50 to 200) Hz (33 to 110) µF (50 to 100) Hz (110 to 330) µF 330 µF to 1.1 mF	 3.9 mF/F + 8 pF 3.9 mF/F + 10 pF 3.9 mF/F + 10 pF 3.9 mF/F + 10 pF 2 mF/F + 0.1 nF 2 mF/F + 0.1 nF 2 mF/F + 0.62 nF 2 mF/F + 1 nF 2.8 mF/F + 6.2 nF 2.8 mF/F + 10 nF 3.2 mF/F + 62 nF 3.9 mF/F + 0.1 µF 5.5 mF/F + 0.62 µF 7.8 mF/F + 0.62 µF	Fluke 550xA Multiproduct Calibrator; E-ACC-M-0001-GE: Direct Measurement.
[1] Capacitance – Source (Simulation)	100 Hz to 1 kHz Up to 1.2 nF 150 Hz to 5 kHz (1.2 to 12) nF 200 Hz to 1.3 kHz (12 to 120) nF (2 to 310) Hz (0.12 to 1.2) µF (0.5 to 110) Hz (1.2 to 12) µF (0.5 to 40) Hz (12 to 120) µF (0.1 to 11) Hz (0.12 to 1.2) mF 30 mHz to 4 Hz (1.2 to 12) mF 10 mHz to 1.3 Hz (12 to 120) mF	 0.9 mF/F + 2 pF 0.9 mF/F + 9 pF 1 mF/F + 24 pF 1 mF/F + 0.6 nF 1 mF/F + 6 nF 1.2 mF/F + 60 nF 1.9 mF/F + 0.6 µF 1.9 mF/F + 60 µF 3.9 mF/F + 70 µF	Fluke 556xA Multiproduct Calibrator; E-ACC-M-0001-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Capacitance – Source (Variable Artifact)	1 kHz (1 to 10) pF (10 to 100) pF (0.1 to 1) nF (1 to 10) nF (10 to 100) nF (0.1 to 1) µF	 0.59 mF/F + 0.58 pF 0.59 mF/F + 0.58 pF 0.59 mF/F + 0.59 pF 0.59 mF/F + 1 pF 0.59 mF/F + 1.5 pF 0.59 mF/F + 10 pF	GenRad 1413 Precision Decade Capacitance Box; E-ACC-M-0004-GE: Direct Measurement.
[1] Capacitance – Source (Fixed Artifact)	1 pF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.19 mF/F 0.21 mF/F 0.31 mF/F 0.46 mF/F 0.67 mF/F 0.91 mF/F 2.7 mF/F 4.1 mF/F	HP 16380A (16381A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement.
[1] Capacitance – Source (Fixed Artifact)	10 pF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.15 mF/F 0.15 mF/F 0.15 mF/F 0.15 mF/F 0.15 mF/F 0.15 mF/F 0.20 mF/F 0.25 mF/F	HP 16380A (16382A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement.
[1] Capacitance – Source (Fixed Artifact)	100 pF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.13 mF/F 0.13 mF/F 0.14 mF/F 0.15 mF/F 0.16 mF/F 0.19 mF/F 0.36 mF/F 0.53 mF/F	HP 16380A (16383A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement.

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[1] Capacitance – Source (Fixed Artifact)	1 nF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.13 mF/F 0.14 mF/F 0.2 mF/F 0.33 mF/F 0.48 mF/F 0.68 mF/F 2.1 mF/F 3.1 mF/F	HP 16380A (16384A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement
[1] Capacitance – Source (Fixed Artifact)	10 nF (20 to 120) Hz 120 Hz to 1 kHz 10 kHz 100 kHz	 0.13 mF/F 0.13 mF/F 0.13 mF/F 0.13 mF/F	HP 16380C (16385A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement
[1] Capacitance – Source (Fixed Artifact)	100 nF (20 to 120) Hz 120 Hz to 1 kHz 10 kHz 100 kHz	 0.13 mF/F 0.13 mF/F 0.13 mF/F 0.13 mF/F	HP 16380C (16386A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement
[1] Capacitance – Source (Fixed Artifact)	1 µF (20 to 120) Hz 120 Hz to 1 kHz 10 kHz 100 kHz	 0.13 mF/F 0.13 mF/F 0.13 mF/F 0.18 mF/F	HP 16380C (16387A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement
[1] Capacitance – Source (Variable Artifact)	1 µF 100 Hz 120 Hz 1 kHz 10 µF 100 Hz 120 Hz 1 kHz 100 µF 100 Hz 120 Hz 1 kHz	 0.18 % of reading 0.18 % of reading 0.18 % of reading 0.18 % of reading 0.18 % of reading 0.24 % of reading 0.24 % of reading 0.24 % of reading 0.32 % of reading	Quad Tech 1417 Decade Capacitor; E-ACC-M-0003-GE: Direct Measurement.

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[1] Capacitance – Source (Variable Artifact)	1 mF 100 Hz 120 Hz 1 kHz 10 mF 100 Hz 120 Hz 1 kHz 100 mF 100 Hz 120 Hz	 0.42 % of reading 0.52 % of reading 1 % of reading 2 % of reading 2 % of reading 8 % of reading 14 % of reading 16 % of reading	Quad Tech 1417 Decade Capacitor; E-ACC-M-0003-GE: Direct Measurement.
[1,5] Dissipation Factor – Source (Fixed Artifact)	1 pF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.000 08 0.000 08 0.000 12 0.000 14 0.000 18 0.000 23 0.000 59 0.000 85	HP 16380A (16381A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement.
[1,5] Dissipation Factor – Source (Fixed Artifact)	10 pF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.000 08 0.000 08 0.000 1 0.000 1 0.000 1 0.000 1 0.000 12 0.000 14	HP 16380A (16382A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement.
[1,5] Dissipation Factor – Source (Fixed Artifact)	100 pF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.000 08 0.000 08 0.000 1 0.000 1 0.000 11 0.000 12 0.000 2 0.000 27	HP 16380A (16383A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,5] Dissipation Factor – Source (Fixed Artifact)	1 nF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.000 08 0.000 08 0.000 16 0.000 18 0.000 21 0.000 33 0.000 69 0.000 98	HP 16380A (16384A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement.
[1,5] Dissipation Factor – Source (Fixed Artifact)	10 nF (20 to 120) Hz 120 Hz to 1 kHz 10 kHz 100 kHz	 0.000 08 0.000 08 0.000 08 0.000 08	HP 16380C (16385A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement.
[1,5] Dissipation Factor – Source (Fixed Artifact)	100 nF (20 to 120) Hz 120 Hz to 1 kHz 10 kHz 100 kHz	 0.000 08 0.000 08 0.000 08 0.000 08	HP 16380C (16386A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement.
[1,5] Dissipation Factor – Source (Fixed Artifact)	1 µF (20 to 120) Hz 120 Hz to 1 kHz 10 kHz 100 kHz	 0.000 08 0.000 08 0.000 08 0.000 08	HP 16380C (16387A) Precision Air Capacitor; E-ACC-M-0002-GE: Direct Measurement
[1,5] Dissipation Factor – Source (Variable Artifact)	1 µF 100 Hz 120 Hz 1 kHz 10 µF 100 Hz 120 Hz 1 kHz 100 µF 100 Hz 120 Hz 1 kHz 1 mF 100 Hz 120 Hz 1 kHz	 0.001 6 0.001 6 0.001 6 0.001 6 0.001 6 0.002 4 0.002 4 0.002 4 0.003 4 0.004 2 0.005 2 0.012	Quad Tech 1417 Decade Capacitor; E-ACC-M-0003-GE: Direct Measurement.

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[1,5] Dissipation Factor – Source (Variable Artifact)	10 mF 100 Hz 120 Hz 1 kHz 100 mF 100 Hz 120 Hz	 0.016 0.016 0.082 0.14 0.16	Quad Tech 1417 Decade Capacitor; E-ACC-M-0003-GE: Direct Measurement.
[1] Capacitance – Measure	1 kHz (1 to 80) pF (80 to 160) pF (160 to 400) pF (400 to 800) pF (0.8 to 1.6) nF (1.6 to 4.8) nF (4.8 to 12) nF (12 to 40) nF (40 to 120) nF (120 to 400) nF (0.4 to 1.2) µF	 8.5 µF/F 6.5 µF/F 6.5 µF/F 6.5 µF/F 6.5 µF/F 7 µF/F 8.5 µF/F 14 µF/F 30 µF/F 84 µF/F 0.24 mF/F	Andeen Hagerling 2500A Capacitance Bridge; E-ACC-G-0004-GE: Direct Measurement.
[1] Capacitance – Measure/Source	(20 to 50) Hz (10 to 100) pF (0.1 to 1) nF (1 to 10) nF (10 to 100) nF (0.1 to 1) µF (50 to 100) Hz (10 to 100) pF (0.1 to 1) nF (1 to 10) nF (10 to 100) nF (0.1 to 1) µF (1 to 10) µF (10 to 100) µF (0.1 to 1) mF (1 to 10) mF	 51 mF/F + 2 fF 6.4 mF/F + 20 fF 2 mF/F + 0.2 pF 1.6 mF/F + 2 pF 1.6 mF/F + 20 pF 22 mF/F + 2 fF 3.6 mF/F + 20 fF 1.8 mF/F + 0.2 pF 1.6 mF/F + 2 pF 1.6 mF/F + 20 pF 1.6 mF/F + 0.2 nF 1.8 mF/F + 2 nF 4 mF/F + 20 nF 8.5 mF/F + 0.2 µF	Agilent E4980A Precision LCR Meter; E-ACC-G-0003-GE: Direct / Comparison Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Capacitance – Measure/Source	100 Hz to 1 kHz		Agilent E4980A Precision LCR Meter; E-ACC-G-0003-GE: Direct / Comparison Measurement.
	(1 to 10) pF	15 mF/F + 0.2 fF	
	(10 to 100) pF	2.4 mF/F + 2 fF	
	(0.1 to 1) nF	1.2 mF/F + 20 fF	
	(1 to 10) nF	1 mF/F + 0.2 pF	
	(10 to 100) nF	1 mF/F + 2 pF	
	(0.1 to 1) µF	1 mF/F + 20 pF	
	(1 to 10) µF	1 mF/F + 0.2 nF	
	(10 to 100) µF	1.8 mF/F + 2 nF	
	(0.1 to 1) mF	4.2 mF/F + 20 nF	
	(1 to 10) mF	12 mF/F + 0.2 µF	
	(1 to 10) kHz		
	(1 to 10) pF	2.4 mF/F + 0.2 fF	
	(10 to 100) pF	1.2 mF/F + 2 fF	
	(0.1 to 1) nF	1.2 mF/F + 20 fF	
	(1 to 10) nF	1 mF/F + 0.2 pF	
	(10 to 100) nF	1 mF/F + 2 pF	
	(0.1 to 1) µF	1 mF/F + 20 pF	
	(1 to 10) µF	2 mF/F + 0.2 nF	
	(10 to 100) µF	3.2 mF/F + 2 nF	
	(0.1 to 1) mF	8 mF/F + 20 nF	
	(1 to 10) mF	54 mF/F + 0.2 µF	
	(10 to 100) kHz		
	(1 to 10) pF	2.8 mF/F + 0.2 fF	
	(10 to 100) pF	1.8 mF/F + 2 fF	
	(0.1 to 1) nF	1.2 mF/F + 20 fF	
	(1 to 10) nF	1 mF/F + 0.2 pF	
	(10 to 100) nF	1.2 mF/F + 2 pF	
	(0.1 to 1) µF	1.9 mF/F + 20 pF	
	(1 to 10) µF	2.8 mF/F + 0.2 nF	
	(10 to 100) µF	6.9 mF/F + 2 nF	
	100 kHz to 1 MHz		
	(1 to 10) pF	2.9 mF/F + 0.2 fF	
	(10 to 100) pF	2.2 mF/F + 2 fF	
	(0.1 to 1) nF	1.2 mF/F + 20 fF	
	(1 to 2) MHz		
	(1 to 10) pF	5.8 mF/F + 0.2 fF	
	(10 to 100) pF	2.4 mF/F + 2 fF	
	(0.1 to 1) nF	2.4 mF/F + 20 fF	

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[1] Multiproduct Calibrator – Capacitance Output (Simulation)	DC (200 to 330) µF (0.33 to 110) mF	 0.25 mF/F 0.16 mF/F	Keysight 3458A 8.5 Digit Multimeter, Fluke 57xxA Multiproduct Calibrator; E-ACC-G-0005-GE: Based on Fluke 55xxA Service Manual; C = I*Δt/Δv
[1] Capacitance – Measure	1 pF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.19 mF/F 0.21 mF/F 0.31 mF/F 0.46 mF/F 0.67 mF/F 0.91 mF/F 2.7 mF/F 4.1 mF/F	HP 16380A (16381A) Precision Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method
[1] Capacitance – Measure	10 pF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.15 mF/F 0.15 mF/F 0.15 mF/F 0.15 mF/F 0.15 mF/F 0.15 mF/F 0.2 mF/F 0.25 mF/F	HP 16380A (16382A) Precision Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method
[1] Capacitance – Measure	100 pF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.13 mF/F 0.13 mF/F 0.14 mF/F 0.15 mF/F 0.16 mF/F 0.19 mF/F 0.36 mF/F 0.53 mF/F	HP 16380A (16383A), Precision Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Capacitance – Measure	1 nF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.13 mF/F 0.14 mF/F 0.2 mF/F 0.33 mF/F 0.48 mF/F 0.68 mF/F 2.1 mF/F 3.1 mF/F	HP 16380A (16384A) Precision Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method
[1] Capacitance – Measure	10 nF (20 to 120) Hz 120 Hz to 1 kHz 10 kHz 100 kHz	 0.13 mF/F 0.13 mF/F 0.13 mF/F 0.13 mF/F	HP 16380A (16385A) Precision Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method
[1] Capacitance – Measure	100 nF (20 to 120) Hz 120 Hz to 1 kHz 10 kHz 100 kHz	 0.13 mF/F 0.13 mF/F 0.13 mF/F 0.13 mF/F	HP 16380A (16386A) Precision Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method
[1] Capacitance – Measure	1 µF (20 to 120) Hz 120 Hz to 1 kHz 10 kHz 100 kHz	 0.13 mF/F 0.13 mF/F 0.13 mF/F 0.18 mF/F	HP 16380A (16387A) Precision Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method

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[1] Capacitance – Measure	1 µF		Quad Tech 1417 Decade Capacitor, Agilent E4980A Precision LCR Meter; E-ACC-G-0002-GE: Substitution Method.
	100 Hz	0.18 % of reading	
	120 Hz	0.18 % of reading	
	1 kHz	0.18 % of reading	
	10 µF		
	100 Hz	0.18 % of reading	
	120 Hz	0.18 % of reading	
	1 kHz	0.24 % of reading	
	100 µF		
	100 Hz	0.24 % of reading	
	120 Hz	0.24 % of reading	
	1 kHz	0.32 % of reading	
	1 mF		
	100 Hz	0.42 % of reading	
	120 Hz	0.52 % of reading	
	1 kHz	1 % of reading	
	10 mF		
	100 Hz	2 % of reading	
	120 Hz	2 % of reading	
	1 kHz	8 % of reading	
	100 mF		
	100 Hz	14 % of reading	
	120 Hz	16 % of reading	
[1,5] Dissipation Factor – Measure	1 pF		HP 16380A (16381A) Standard Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method.
	20 Hz to 1 kHz	0.000 08	
	1 kHz to 1 MHz	0.000 08	
	2 MHz	0.000 12	
	3 MHz	0.000 14	
	4 MHz	0.000 18	
	5 MHz	0.000 23	
	10 MHz	0.000 59	
	13 MHz	0.000 85	
[1,5] Dissipation Factor – Measure	10 pF		HP 16380A (16382A) Standard Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method.
	20 Hz to 1 kHz	0.000 08	
	1 kHz to 1 MHz	0.000 08	
	2 MHz	0.000 1	
	3 MHz	0.000 1	
	4 MHz	0.000 1	
	5 MHz	0.000 1	
	10 MHz	0.000 12	
	13 MHz	0.000 14	

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[1,5] Dissipation Factor – Measure	100 pF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.000 08 0.000 08 0.000 1 0.000 1 0.000 11 0.000 12 0.000 2 0.000 27	HP 16380A (16383A) Standard Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method.
[1,5] Dissipation Factor – Measure	1 nF 20 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.000 08 0.000 08 0.000 16 0.000 18 0.000 21 0.000 33 0.000 69 0.000 98	HP 16380A (16384A) Standard Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method.
[1,5] Dissipation Factor – Measure	10 nF (20 to 120) Hz 120 Hz to 1 kHz 10 kHz 100 kHz	 0.000 08 0.000 08 0.000 08 0.000 08	HP 16380A (16385A) Standard Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method.
[1,5] Dissipation Factor – Measure	100 nF (20 to 120) Hz 120 Hz to 1 kHz 10 kHz 100 kHz	 0.000 08 0.000 08 0.000 08 0.000 08	HP 16380A (16386A) Standard Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0100-GE: Substitution Method.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,5] Dissipation Factor – Measure	1 µF (20 to 120) Hz 120 Hz to 1 kHz 10 kHz 100 kHz	 0.000 08 0.000 08 0.000 08 0.000 08	HP 16380A (16387A) Standard Air Capacitor, Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACC-G-0001-GE: Substitution Method.
[1,5] Dissipation Factor – Measure	1 µF 100 Hz 120 Hz 1 kHz 10 µF 100 Hz 120 Hz 1 kHz 100 µF 100 Hz 120 Hz 1 kHz 1 mF 100 Hz 120 Hz 1 kHz	 0.001 6 0.001 6 0.001 6 0.001 6 0.001 6 0.002 4 0.002 4 0.002 4 0.003 5 0.004 2 0.005 2 0.01	Quad Tech 1417 Decade Capacitor, Agilent E4980A Precision LCR Meter; E-ACC-G-0002-GE: Substitution Method.
[1,5] Dissipation Factor – Measure	10 mF 100 Hz 120 Hz 1 kHz 100 mF 100 Hz 120 Hz	 0.016 0.018 0.08 0.14 0.16	Quad Tech 1417 Decade Capacitor, Agilent E4980A Precision LCR Meter; E-ACC-G-0002-GE: Substitution Method.
[1] Inductance – Source (Fixed Artifact)	100 µH 100 Hz 1 kHz 10 kHz	 55 mH/H 0.5 mH/H 1.2 mH/H	Ando RS-102 or GenRad 1482B Standard Inductor; E-ACL-M-0001-GE: Direct Measurement.
[1] Inductance – Source (Fixed Artifact)	1 mH 100 Hz 1 kHz 10 kHz	 5.6 mH/H 0.2 mH/H 1.5 mH/H	Ando RS-104 or GenRad 1482E Standard Inductor; E-ACL-M-0001-GE: Direct Measurement.

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[1] Inductance – Source (Fixed Artifact)	10 mH 100 Hz 1 kHz 10 kHz	 1.6 mH/H 0.18 mH/H 0.62 mH/H	Ando RS-106 or GenRad 1482H Standard Inductor; E-ACL-M-0001-GE: Direct Measurement.
[1] Inductance – Source (Fixed Artifact)	100 mH 100 Hz 1 kHz 10 kHz	 1.2 mH/H 0.19 mH/H 0.64 mH/H	Ando RS-108 or GenRad 1482L Standard Inductor; E-ACL-M-0001-GE: Direct Measurement.
[1] Inductance – Source (Fixed Artifact)	1 H 100 Hz 1 kHz	 1.2 mH/H 0.24 mH/H	Ando RS-110 or GenRad 1482P Standard Inductor; E-ACL-M-0001-GE: Direct Measurement.
[1] Inductance – Source (Fixed Artifact)	10 H 100 Hz 1 kHz	 1.6 mH/H 0.26 mH/H	GenRad 1482T Standard Inductor; E-ACL-M-0001-GE: Direct Measurement.
[1] Inductance – Source (Variable Artifact)	1 kHz (1 to 10) mH (10 to 100) mH 100 mH to 1 H	 12 mH/H + 2 µH 12 mH/H + 20 µH 12 mH/H + 0.2 mH	Ando AM-3301 Standard Decade Inductor; E-ACL-M-0003-GE: Direct Measurement.
[1] Inductance – Measure (Fixed Points)	100 µH 100 Hz 1 kHz 10 kHz	 55 mH/H 0.5 mH/H 1.2 mH/H	Ando RS-102 or GenRad 1482B Standard Inductor, Agilent E4980A Precision LCR Meter; E-ACL-G-0001-GE: Direct Measurement.
[1] Inductance – Measure (Fixed Points)	1 mH 100 Hz 1 kHz 10 kHz	 5.6 mH/H 0.2 mH/H 1.5 mH/H	Ando RS-104 or GenRad 1482E Standard Inductor, Agilent E4980A Precision LCR Meter; E-ACL-G-0001-GE: Direct Measurement.
[1] Inductance – Measure (Fixed Points)	10 mH 100 Hz 1 kHz 10 kHz	 1.6 mH/H 0.18 mH/H 0.62 mH/H	Ando RS-106 or GenRad 1482H Standard Inductor, Agilent E4980A Precision LCR Meter; E-ACL-G-0001-GE: Direct Measurement.

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[1] Inductance – Measure (Fixed Points)	100 mH 100 Hz 1 kHz 10 kHz	 1.2 mH/H 0.19 mH/H 0.64 mH/H	Ando RS-108 or GenRad 1482L Standard Inductor, Agilent E4980A Precision LCR Meter; E-ACL-G-0001-GE: Direct Measurement.
[1] Inductance – Measure (Fixed Points)	1 H 100 Hz 1 kHz 10 kHz	 1.2 mH/H 0.19 mH/H 4.9 mH/H	Ando RS-110 or GenRad 1482P Standard Inductor, Agilent E4980A Precision LCR Meter; E-ACL-G-0001-GE: Direct Measurement.
[1] Inductance – Measure (Fixed Points)	10 H 100 Hz 1 kHz	 1.2 mH/H 0.24 mH/H	GenRad 1482T Standard Inductor, Agilent E4980A Precision LCR Meter; E-ACL-G-0001-GE: Direct Measurement.
[1] Inductance – Measure/Source	100 Hz to 1 kHz (10 to 100) µH (0.1 to 1) mH (1 to 10) mH (10 to 100) mH (0.1 to 1) H (1 to 10) H	 4 mH/H + 3 nH 1.9 mH/H + 30 nH 0.96 mH/H + 0.3 µH 0.94 mH/H + 3 µH 0.94 mH/H + 30 µH 0.94 mH/H + 0.3 mH	Ando AM-3301 Standard Decade Inductor, Agilent E4980A Precision LCR Meter; E-ACL-G-0002-GE: Direct / Comparison Measurement.
[1] Inductance – Measure/Source	(1 to 10) kHz (10 to 100) µH (0.1 to 1) mH (1 to 10) mH (10 to 100) mH (0.1 to 1) H (1 to 10) H	 2 mH/H + 3 nH 1.2 mH/H + 30 nH 0.94 mH/H + 0.3 µH 0.94 mH/H + 3 µH 0.94 mH/H + 30 µH 1 mH/H + 0.3 mH	Ando AM-3301 Standard Decade Inductor, Agilent E4980A Precision LCR Meter; E-ACL-G-0002-GE: Direct / Comparison Measurement.
[1] AC Resistance – Source (Fixed Artifacts)	1 mΩ DC to 1 kHz 10 mΩ DC to 1 kHz 100 mΩ DC to 1 kHz 1 Ω DC to 1 kHz	 0.4 mΩ/Ω 0.2 mΩ/Ω 0.3 mΩ/Ω 0.2 mΩ/Ω	HP 42030A Standard Resistor Set; E-ACR-M-0001-GE: Direct Measurement.

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[1] AC Resistance – Source (Fixed Artifacts)	10 Ω 1 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz 100 Ω 1 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 90 µΩ/Ω 0.4 mΩ/Ω 0.65 mΩ/Ω 0.75 mΩ/Ω 0.8 mΩ/Ω 1.1 mΩ/Ω 4.1 mΩ/Ω 6.1 mΩ/Ω 90 µΩ/Ω 0.35 mΩ/Ω 0.5 mΩ/Ω 0.6 mΩ/Ω 0.6 mΩ/Ω 0.6 mΩ/Ω 2.1 mΩ/Ω 3.1 mΩ/Ω	HP 42030A Standard Resistor Set; E-ACR-M-0001-GE: Direct Measurement.
[1] AC Resistance – Source (Fixed Artifacts)	1 kΩ 1 Hz to 1 kHz (1 to 100) kHz 100 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz 10 kΩ 1 Hz to 1 kHz (1 to 100) kHz 100 kHz to 1 MHz 100 kΩ 1 Hz to 1 kHz (1 to 100) kHz 100 kHz to 1 MHz	 90 µΩ/Ω 0.35 mΩ/Ω 0.35 mΩ/Ω 0.45 mΩ/Ω 0.45 mΩ/Ω 0.55 mΩ/Ω 0.65 mΩ/Ω 2.1 mΩ/Ω 3.1 mΩ/Ω 90 µΩ/Ω 0.25 mΩ/Ω 0.35 mΩ/Ω 90 µΩ/Ω 0.35 mΩ/Ω 0.35 mΩ/Ω	HP 42030A Standard Resistor Set; E-ACR-M-0001-GE: Direct Measurement.

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[1] Reactance – Source (Fixed Artifacts)	10 Ω 1 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz 100 Ω 1 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 5 mΩ 5 mΩ 6 mΩ 7 mΩ 8 mΩ 9 mΩ 22 mΩ 42 mΩ 50 mΩ 50 mΩ 50 mΩ 50 mΩ 50 mΩ 50 mΩ 90 mΩ 0.1 Ω	HP 42030A Standard Resistor Set; E-ACR-M-0001-GE: Direct Measurement.
[1] Susceptance – Source (Fixed Artifacts)	1 kΩ 100 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz 10 kΩ 100 kHz to 1 MHz 100 kΩ 100 kHz to 1 MHz	 0.5 µS 0.5 µS 0.5 µS 0.5 µS 0.5 µS 0.8 µS 0.8 µS 50 nS 5 nS	HP 42030A Standard Resistor Set; E-ACR-M-0001-GE: Direct Measurement.
[1] AC Low Resistance – Source Test Current	(50 to 60) Hz (1 to 100) A	6 mA/A	PCN RH-250M4 Metal Clad Resistors, Agilent 3458 8.5 Digit Multimeter or Fluke 8846A 6.5 Digit Multimeter; E-ACR-M-0003-GE: Direct Measurement

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[1] AC Low Resistance – Source (Fixed Artifacts)	(50 to 60) Hz 1 mΩ to 1 Ω	6 mΩ/Ω	PCN RH-250M4 Metal Clad Resistors; E-ACR-M-0003-GE: Direct Measurement
[1] AC Low Resistance – Measure (Fixed Points)	(50 to 60) Hz 1 mΩ to 1 Ω	2 mΩ/Ω	Yokogawa 2558 Precision AC Calibrator, Agilent 3458 8.5 Digit Multimeter; E-ACR-G-0003-GE: Apply Current and Measure Voltage, then Calculate Resistance.
[1] AC Resistance – Measure/Source	(20 to 50) Hz (10 to 100) mΩ (0.1 to 1) Ω (1 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ (50 to 100) Hz (10 to 100) mΩ (0.1 to 1) Ω (1 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ 100 Hz to 1 kHz (10 to 100) mΩ (0.1 to 1) Ω (1 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ	 20 mΩ/Ω + 2 µΩ 4.9 mΩ/Ω + 20 µΩ 2.7 mΩ/Ω + 0.2 mΩ 1.6 mΩ/Ω + 2 mΩ 1.6 mΩ/Ω + 20 mΩ 1.6 mΩ/Ω + 0.2 Ω 1.7 mΩ/Ω + 2 Ω 17 mΩ/Ω + 2 µΩ 4.6 mΩ/Ω + 20 µΩ 2.6 mΩ/Ω + 0.2 mΩ 1.6 mΩ/Ω + 2 mΩ 1.6 mΩ/Ω + 20 mΩ 1.6 mΩ/Ω + 0.2 Ω 1.7 mΩ/Ω + 2 Ω 11 mΩ/Ω + 2 µΩ 3.4 mΩ/Ω + 20 µΩ 1.8 mΩ/Ω + 0.2 mΩ 0.96 mΩ/Ω + 2 mΩ 0.94 mΩ/Ω + 20 mΩ 0.94 mΩ/Ω + 0.2 Ω 1.1 mΩ/Ω + 2 Ω	Agilent E4980A Precision LCR Meter; E-ACR-G-0001-GE: Direct / Comparison Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] AC Resistance – Measure/Source	(1 to 100) kHz (10 to 100) mΩ (0.1to 1) Ω (1 to 10) Ω (10 to 100) Ω (0.1 to 1) kΩ (1 to 10) kΩ (10 to 100) kΩ 100 kHz to 1 MHz (10 to 100) Ω (0.1 to 1) Ω (1 to 10) kΩ (10 to 100) kΩ (1 to 2) MHz (10 to 100) Ω (0.1 to 1) kΩ	 8.6 mΩ/Ω + 2 μΩ 3.2 mΩ/Ω + 20 μΩ 1.9 mΩ/Ω + 0.2 mΩ 1.2 mΩ/Ω + 2 mΩ 0.94 mΩ/Ω + 20 mΩ 0.94 mΩ/Ω + 0.2 Ω 1.1 mΩ/Ω + 2 Ω 1.3 mΩ/Ω + 2 mΩ 1.2 mΩ/Ω + 20 mΩ 1.7 mΩ/Ω + 0.2 Ω 3.4 mΩ/Ω + 2 Ω 3.5 mΩ/Ω + 2 mΩ 2.4 mΩ/Ω + 20 mΩ	Agilent E4980A Precision LCR Meter; E-ACR-G-0001-GE: Direct / Comparison Measurement.
[1] AC Resistance – Measure (Fixed Points)	1 mΩ DC to 1 kHz 10 mΩ DC to 1 kHz 100 mΩ DC to 1 kHz 1 Ω DC to 1 kHz 10 Ω 1 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 0.4 mΩ/Ω 0.2 mΩ/Ω 0.3 mΩ/Ω 0.2 mΩ/Ω 90 μΩ/Ω 0.40 mΩ/Ω 0.65 mΩ/Ω 0.75 mΩ/Ω 0.80 mΩ/Ω 1.1 mΩ/Ω 4.1 mΩ/Ω 6.1 mΩ/Ω	HP 42030A Standard Resistor Set. Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACR-G-0002-GE: Substitution.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] AC Resistance – Measure (Fixed Points)	100 Ω 1 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz 1 kΩ 1 Hz to 1 kHz (1 to 100) kHz 100 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz 10 kΩ 1 Hz to 1 kHz (1 to 100) kHz 100 kHz to 1 MHz 100 kΩ 1 Hz to 1 kHz (1 to 100) kHz 100 kHz to 1 MHz	 90 µΩ/Ω 0.35 mΩ/Ω 0.5 mΩ/Ω 0.6 mΩ/Ω 0.6 mΩ/Ω 0.6 mΩ/Ω 2.1 mΩ/Ω 3.1 mΩ/Ω 90 µΩ/Ω 0.35 mΩ/Ω 0.35 mΩ/Ω 0.45 mΩ/Ω 0.45 mΩ/Ω 0.55 mΩ/Ω 0.65 mΩ/Ω 2.1 mΩ/Ω 3.1 mΩ/Ω 90 µΩ/Ω 0.25 mΩ/Ω 0.35 mΩ/Ω 90 µΩ/Ω 0.35 mΩ/Ω 0.35 mΩ/Ω	HP 42030A Standard Resistor Set. Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACR-G-0002-GE: Substitution.

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[1] AC Reactance – Measure (Fixed Points)	10 Ω 1 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz 100 Ω 1 Hz to 1 kHz 1 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz	 5 mΩ 5 mΩ 6 mΩ 7 mΩ 8 mΩ 9 mΩ 22 mΩ 42 mΩ 50 mΩ 50 mΩ 50 mΩ 50 mΩ 50 mΩ 50 mΩ 90 mΩ 0.1 Ω	HP 42030A Standard Resistor Set. Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACR-G-0002-GE: Substitution.
[1] Susceptance – Measure (Fixed Points)	1 kΩ 100 kHz to 1 MHz 2 MHz 3 MHz 4 MHz 5 MHz 10 MHz 13 MHz 10 kΩ 100 kHz to 1 MHz 100 kΩ 100 kHz to 1 MHz	 0.5 µS 0.5 µS 0.5 µS 0.5 µS 0.5 µS 0.8 µS 0.8 µS 50 nS 6 nS	HP 42030A Standard Resistor Set. Agilent E4980A Precision LCR Meter, HP 4192A Impedance Analyzer; E-ACR-G-0002-GE: Substitution.
[1] DC Power – Source 33 mV to 1 020 V 0.12 mA to 30.2 A	 10.9 µW to 336.6 W 336.6 W to 3.06 kW (3.06 to 20.91) kW (20.01 to 30.804) kW	 0.2 mW/W 0.18 mW/W 0.56 mW/W 0.8 mW/W	Fluke 55xxA, Multiproduct Calibrator; E-POW-M-0001-GE: Direct Measurement.
[1] DC Power – Source 33 mV to 1 020 V (10 to 1 510) A	 0.33 W to 1.045 5 MW (1.045 5 to 1.540 2) MW	 2.4 mW/W 2.5 mW/W	Fluke 55xxA, Multiproduct Calibrator, Fluke 5500A/COIL; E-POW-M-0005-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] AC Power – Source 33 mV to 1 020 V 1.2 mA to 30.2 A (45 to 65) Hz	39.6 µW to 30.804 kW PF = 1 PF = (0.985 to 0.999) PF = (0.94 to 0.984) PF = (0.866 to 0.939) PF = (0.766 to 0.865) PF = (0.643 to 0.765) PF = (0.5 to 0.642) PF = (0.342 to 0.499) PF = (0.174 to 0.341)	 0.4 mW/W 0.6 mW/W 0.8 mW/W 1.2 mW/W 1.8 mW/W 2.5 mW/W 3.6 mW/W 5.7 mW/W 12 mW/W	Fluke 55xxA, Multiproduct Calibrator; E-POW-M-0002-GE: Direct Measurement.
[1] AC Power – Source 33 mV to 1 020 V (10 to 1 051) A (45 to 65) Hz	0.33 W to 1.540 2 MW PF = 1 PF = (0.985 to 0.999) PF = (0.940 to 0.984) PF = (0.866 to 0.939) PF = (0.766 to 0.865) PF = (0.643 to 0.765) PF = (0.500 to 0.642) PF = (0.342 to 0.499) PF = (0.174 to 0.341)	 2.4 mW/W 2.4 mW/W 2.5 mW/W 2.7 mW/W 2.9 mW/W 3.5 mW/W 4.3 mW/W 6.0 mW/W 12 mW/W	Fluke 55xxA, Multiproduct Calibrator, Fluke 5500A/COIL 50-turn Coil; E-POW-M-0006-GE: Direct Measurement.
[1] Phase Angle – Source Test Voltage: 10 mV to 630 V	(0 to 360)° 10 Hz to 2 kHz (2 to 5) kHz (5 to 10) kHz (10 to 30) kHz	 0.024° 0.02° 0.038° 0.06°	Fluke 55xxA, Multiproduct Calibrator, Clarke-Hess 6000A or Krohn-Hite 6610 Precision Phase Meter; E-PHS-M-0001-GE: Comparison and Direct Measurement.
[1] Phase Angle – Measure Test Voltage: 10 mV to 630 V	(0 to 360)° 5 Hz to 2 kHz (2 to 5) kHz (5 to 10) kHz (10 to 50) kHz (50 to 100) kHz	 0.024° 0.027° 0.038° 0.06° 0.08°	Clarke-Hess 6000A or Krohn-Hite 6610 Precision Phase Meters; E-PHS-G-0001-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,5] Power Factor – Source	(10 to 65) Hz		Fluke 55xxA, Multiproduct Calibrator; E-PHS-M-0002-GE: Direct Measurement.
Phase Angle (φ)	Power Factor (Cos φ)		
(0 to 10)°	(0.985 to 1)	0.000 8	
(10 to 20)°	(0.94 to 0.984)	0.001	
(20 to 30)°	(0.866 to 0.939)	0.001 1	
(30 to 40)°	(0.766 to 0.865)	0.001 2	
(40 to 50)°	(0.643 to 0.765)	0.001 5	
(50 to 60)°	(0.5 to 0.642)	0.001 6	
(60 to 70)°	(0.342 to 0.499)	0.001 7	
(70 to 80)°	(0.174 to 0.341)	0.001 8	
(80 to 90)°	(0 to 0.173)	0.001 9	
	(65 to 500) Hz		
Phase Angle (φ)	Power Factor (Cos φ)		
(0 to 10)°	(0.985 to 1)	0.001	
(10 to 20)°	(0.94 to 0.984)	0.001 6	
(20 to 30)°	(0.866 to 0.939)	0.001 9	
(30 to 40)°	(0.766 to 0.865)	0.002 4	
(40 to 50)°	(0.643 to 0.765)	0.003	
(50 to 60)°	(0.5 to 0.642)	0.003 2	
(60 to 70)°	(0.342 to 0.499)	0.003 4	
(70 to 80)°	(0.174 to 0.341)	0.003 8	
(80 to 90)°	(0 to 0.173)	0.003 8	
	500 Hz to 1 kHz		
Phase Angle (φ)	Power Factor (Cos φ)		
(0 to 10)°	(0.985 to 1)	0.001 6	
(10 to 20)°	(0.94 to 0.984)	0.002 8	
(20 to 30)°	(0.866 to 0.939)	0.003 6	
(30 to 40)°	(0.766 to 0.865)	0.004 6	
(40 to 50)°	(0.643 to 0.765)	0.005 6	
(50 to 60)°	(0.5 to 0.642)	0.006	
(60 to 70)°	(0.342 to 0.499)	0.006 6	
(70 to 80)°	(0.174 to 0.341)	0.007	
(80 to 90)°	(0 to 0.173)	0.007	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,5] Power Factor – Source	(1 to 5) kHz		
Phase Angle (φ)	Power Factor (Cos φ)		
(0 to 10)°	(0.985 to 1)	0.007	
(10 to 20)°	(0.94 to 0.984)	0.013	
(20 to 30)°	(0.866 to 0.939)	0.018	Fluke 55xxA, Multiproduct Calibrator; E-PHS-M-0002-GE: Direct Measurement.
(30 to 40)°	(0.766 to 0.865)	0.023	
(40 to 50)°	(0.643 to 0.765)	0.027	
(50 to 60)°	(0.5 to 0.642)	0.03	
(60 to 70)°	(0.342 to 0.499)	0.033	
(70 to 80)°	(0.174 to 0.341)	0.034	
(80 to 90)°	(0 to 0.173)	0.034	
[1] Oscilloscopes			
DC Voltage			
into 50 Ω load	(0 to 25) mV	0.2 % of reading + 35 µV	
	(25 to 110) mV	0.2 % of reading + 35 µV	
	110 mV to 2.2 V	0.2 % of reading + 0.1 mV	
	(2.2 to 6.6) V	0.2 % of reading + 0.1 mV	
into 1 MΩ load	(0 to 25) mV	0.02 % of reading + 20 µV	Fluke 5820A Oscilloscope Calibrator, or Fluke 5520A/SC600 Multiproduct Calibrator, or Fluke 5500A/SC300 Multiproduct Calibrator; E-OSC-M-0001-GE: Direct Measurement.
	(25 to 110) mV	0.02 % of reading + 20 µV	
	110 mV to 2.2 V	0.02 % of reading + 80 µV	
	(2.2 to 11) V	0.02 % of reading + 0.6 mV	
	(11 to 33) V	0.02 % of reading + 8 mV	
	(33 to 130) V	0.02 % of reading + 8 mV	
AC Square Wave			
into 50 Ω load	10 Hz to 10 kHz		
	(1 to 25) mVp-p	0.2 % of reading + 35 µV	
	(25 to 110) mVp-p	0.2 % of reading + 35 µV	
	110 mV to 2.2 Vp-p	0.2 % of reading + 0.1 mV	
	(2.2 to 6.6) Vp-p	0.2 % of reading + 0.6 mV	

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[1] Oscilloscopes			
AC Square Wave			
into 1 MΩ load	10 Hz to 1 kHz		
	(1 to 25) mVp-p	0.04 % of reading + 9 µV	
	(25 to 110) mVp-p	0.04 % of reading + 9 µV	
	110 mVp-p to 2.2 Vp-p	0.04 % of reading + 0.6 mV	
	(2.2 to 11) Vp-p	0.04 % of reading + 6 mV	
	(11 to 130) Vp-p	0.04 % of reading + 60 mV	
	(1 to 10) kHz		
	(1 to 25) mVp-p	0.2 % of reading + 35 µV	
	(25 to 110) mVp-p	0.2 % of reading + 35 µV	
	(0.11 to 2.2) Vp-p	0.2 % of reading + 0.6 mV	
	(2.2 to 11) Vp-p	0.2 % of reading + 6 mV	
	(11 to 130) Vp-p	0.2 % of reading + 60 mV	
Time Markers	5 s	2 µs/s + 0.2 ms	Fluke 5820A Oscilloscope Calibrator, or Fluke 5520A/SC600 Multiproduct Calibrator, or Fluke 5500A/SC300 Multiproduct Calibrator; E-OSC-M-0001-GE: Direct Measurement.
	2 s	2 µs/s + 20 µs	
	1 s	2 µs/s + 6 µs	
	0.5 s	2 µs/s + 2 µs	
	0.2 s	2 µs/s + 0.6 µs	
	0.1 s	2 µs/s + 0.3 µs	
	50 ms	2 µs/s + 0.2 µs	
	(20 to 10) ms	0.26 µs/s + 6 ns	
	(5 to 1) ms	0.26 µs/s + 0.6 ns	
	(0.5 to 0.1) ms	0.26 µs/s + 60 ps	
	(50 to 10) µs	0.26 µs/s + 6 ps	
	(5 to 1) µs	0.26 µs/s + 0.6 ps	
	(500 to 100) ns	0.26 µs/s + 60 fs	
	(50 to 10) ns	0.26 µs/s + 6 fs	
	(5 to 2) ns	0.26 µs/s + 0.6 fs	
Bandwidth	(5 to 12) mV		
	50 kHz to 100 MHz	0.32 dB	
	(100 to 300) MHz	0.35 dB	
	(300 to 500) MHz	0.43 dB	
	(500 to 600) MHz	0.46 dB	
	12 mV to 5.5 V		
	50 kHz to 100 MHz	0.26 dB	
	(100 to 300) MHz	0.28 dB	
	(300 to 500) MHz	0.35 dB	
	(500 to 600) MHz	0.38 dB	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Oscilloscope Calibrators			
Amplitude – DC			
into 1 MΩ load	0 to ± 25 mV	30 µV/V + 0.8 µV	Agilent 3458A 8.5 Digit Multimeter, HP 11048C 50 Ω Feedthrough; E-OSC-G-0001-GE: Based on Manufacturer Manual. (Direct Measurement)
	± (25 to 120) mV	30 µV/V + 1 µV	
	± 120 mV to ±1.2 V	10 µV/V + 6 µV	
	± (1.2 to 12) V	10 µV/V + 60 µV	
	± (12 to 120) V	10 µV/V + 0.6 mV	
	± (120 to 200) V	10 µV/V + 0.8 mV	
into 50 Ω load	0 to ± 25 mV	0.6 mV/V + 1 µV	
	± (25 to 120) mV	0.6 mV/V + 6 µV	
	± 120 mV to ±1.2 V	0.6 mV/V + 60 µV	
	± (1.2 to 12) V	0.6 mV/V + 0.6 mV	
[1] Oscilloscope Calibrators			
Amplitude – AC Square Wave			Agilent 3458A 8.5 Digit Multimeter, HP 11048C 50 Ω Feedthrough; E-OSC-G-0001-GE: Based on Manufacturer Manual. (Topline to Baseline DC Voltage Measurement)
into 1 MΩ load	10 Hz to 10 kHz		
	(1 to 25) mVp-p	40 µV/V + 5 µV	
	(25 to 120) mVp-p	40 µV/V + 5 µV	
	120 mVp-p to 1.2 Vp-p	40 µV/V + 10 µV	
	(1.2 to 12) Vp-p	40 µV/V + 0.1 mV	
	(12 to 120) Vp-p	40 µV/V + 1 mV	
	(120 to 200) Vp-p	40 µV/V + 4 mV	
[1] Oscilloscope Calibrators			
Amplitude – AC Square Wave			Agilent 3458A 8.5 Digit Multimeter, HP 11048C 50 Ω Feedthrough; E-OSC-G-0001-GE: Based on Manufacturer Manual. (Topline to Baseline DC Voltage Measurement)
into 50 Ω load	(1 to 25) mVp-p	0.82 mV/V + 5 µV	
	(25 to 120) mVp-p	0.82 mV/V + 10 µV	
	120 mVp-p to 1.2 Vp-p	0.82 mV/V + 0.1 mV	
	(1.2 to 12) Vp-p	0.82 mV/V + 1 mV	
Amplitude – Edge			
into 50 Ω load	(1 to 10) kHz		
	(4 to 120) mVp-p	0.82 mV/V + 10 µV	
	120 mVp-p to 1.2 Vp-p	0.82 mV/V + 0.1 mV	
	(1.2 to 12) Vp-p	0.82 mV/V + 1 mV	

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[1,5] Oscilloscope Calibrators Edge Duty Cycle	(45 to 55) %	0.1 %	Tektronix TDS684B Oscilloscope or HP 53132A (Opt.010) Universal Counter; E-OSC-G-0001-GE: Based on Manufacturer Manual.
[1] Oscilloscope Calibrators Edge Rise Time	≤ 300 ps	0.12 % of reading + 4.7 ps	HP 83480A Digital Communications Analyzer w/ 83485B Plug-in Module and 20 dB Attenuator; E-OSC-G-0001-GE: Based on Manufacturer Manual.
[1] Oscilloscope Calibrators Amplitude – Tunnel Diode Pulse Drive	100 Hz to 100 kHz (11 to 120) Vp-p	40 µV/V + 1 mV	Agilent 3458A 8.5 Digit Multimeter; E-OSC-G-0001-GE: Based on Manufacturer Manual. (Topline to Baseline DC Voltage Measurement)
[1] Oscilloscope Calibrators Amplitude – Leveled Sine Wave into 50 Ω load	(50 to 100) kHz Up to 19.8 mVp-p (19.8 to 62.2) mVp-p (62.5 to 198) mVp-p (198 to 622) mVp-p (0.622 to 1.98) Vp-p (1.98 to 6.22) Vp-p	 0.8 mV/V + 20 µV 0.7 mV/V + 20 µV 0.7 mV/V + 0.2 mV 0.6 mV/V + 0.2 mV 0.6 mV/V + 0.2 mV 0.6 mV/V + 2 mV	Fluke 5790A or Fluke 5790B AC Measurement Standard, HP 11048C 50 Ω Feedthrough; E-OSC-G-0001-GE: Based on Manufacturer Manual.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Oscilloscope Calibrators Leveled Sine Wave – Low Frequency Flatness (Relative to 50 kHz) 50 Ω Load	Up to 6.22 mVp-p (10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (6.22 to 19.8) mVp-p (10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (19.8 to 62.2) mVp-p (10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (62.2 to 198) mVp-p (10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz (198 to 622) mVp-p (10 to 30) Hz 30 Hz to 120 kHz 120 kHz to 2 MHz (2 to 10) MHz (10 to 20) MHz (20 to 30) MHz	 1.5 mV/V + 2 µV 0.8 mV/V + 2 µV 1.2 mV/V + 5 µV 2.6 mV/V + 5 µV 4.5 mV/V + 5 µV 11 mV/V + 10 µV 1.5 mV/V + 2 µV 0.8 mV/V + 2 µV 1.2 mV/V + 5 µV 1.5 mV/V + 5 µV 2.6 mV/V + 5 µV 5.6 mV/V + 5 µV 1.5 mV/V + 2 µV 0.8 mV/V + 2 µV 1.2 mV/V + 2 µV 1.5 mV/V + 2 µV 2.6 mV/V + 2 µV 5.6 mV/V + 2 µV 1.5 mV/V + 20 µV 0.8 mV/V + 20 µV 0.8 mV/V + 20 µV 1.5 mV/V + 20 µV 2.3 mV/V + 20 µV 5.3 mV/V + 20 µV 1.5 mV/V + 20 µV 0.6 mV/V + 20 µV 0.8 mV/V + 20 µV 1.5 mV/V + 20 µV 2.3 mV/V + 20 µV 5.3 mV/V + 20 µV	Fluke 5790A or Fluke 5790B AC Measurement Standard (Wide Band Function); E-OSC-G-0001-GE: Based on Manufacturer Manual.

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[1] Oscilloscope Calibrators			
Leveled Sine Wave –	(622 to 1 980) mVp-p		
Low Frequency Flatness	(10 to 30) Hz	1.5 mV/V + 0.2 mV	
(Relative to 50 kHz)	30 Hz to 120 kHz	0.5 mV/V + 0.2 mV	
50 Ω Load	120 kHz to 2 MHz	0.8 mV/V + 0.2 mV	
	(2 to 10) MHz	1.5 mV/V + 0.2 mV	
	(10 to 20) MHz	2.3 mV/V + 0.2 mV	
	(20 to 30) MHz	5.3 mV/V + 0.2 mV	
	(1.98 to 6.22) Vp-p		
	(10 to 30) Hz	1.5 mV/V + 0.2 mV	
	30 Hz to 120 kHz	0.5 mV/V + 0.2 mV	
	120 kHz to 2 MHz	0.8 mV/V + 0.2 mV	
	(2 to 10) MHz	1.5 mV/V + 0.2 mV	
	(10 to 20) MHz	2.3 mV/V + 0.2 mV	
	(20 to 30) MHz	5.3 mV/V + 0.2 mV	
	(6.22 to 19.8) Vp-p		
	(10 to 30) Hz	1.5 mV/V + 0.2 mV	
	30 Hz to 120 kHz	0.5 mV/V + 0.2 mV	
	120 kHz to 2 MHz	0.8 mV/V + 0.2 mV	
	(2 to 10) MHz	1.5 mV/V + 0.2 mV	
	(10 to 20) MHz	2.3 mV/V + 0.2 mV	
	(20 to 30) MHz	5.3 mV/V + 0.2 mV	
	Up to 6.22 mVp-p		
	(10 to 20) Hz	1.4 mV/V + 6 µV	
	(20 to 40) Hz	0.6 mV/V + 6 µV	
	40 Hz to 20 kHz	0.4 mV/V + 6 µV	
	(20 to 50) kHz	0.7 mV/V + 6 µV	
	(50 to 100) kHz	1 mV/V + 6 µV	
	(6.22 to 19.8) mVp-p		
	(10 to 20) Hz	0.7 mV/V + 4 µV	
	(20 to 40) Hz	0.3 mV/V + 4 µV	
	40 Hz to 20 kHz	0.2 mV/V + 4 µV	
	(20 to 50) kHz	0.4 mV/V + 4 µV	
	(50 to 100) kHz	0.7 mV/V + 4 µV	
	(19.8 to 62.2) mVp-p		
	(10 to 20) Hz	0.3 mV/V + 4 µV	
	(20 to 40) Hz	0.2 mV/V + 4 µV	
	40 Hz to 20 kHz	0.1 mV/V + 4 µV	
	(20 to 50) kHz	0.2 mV/V + 4 µV	
	(50 to 100) kHz	0.4 mV/V + 4 µV	

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[1] Oscilloscope Calibrators			
Amplitude – Wave Generator	(62.2 to 622) mVp-p		
Sine Wave	(10 to 20) Hz	0.2 mV/V + 20 µV	
(Relative to 50 kHz)	(20 to 40) Hz	0.1 mV/V + 20 µV	
1 MΩ Load	40 Hz to 20 kHz	0.1 mV/V + 20 µV	
	(20 to 50) kHz	0.1 mV/V + 20 µV	
	(50 to 100) kHz	0.2 mV/V + 20 µV	
	(0.622 to 6.22) Vp-p		
	(10 to 20) Hz	0.2 mV/V + 0.2 mV	
	(20 to 40) Hz	0.1 mV/V + 0.2 mV	
	40 Hz to 20 kHz	0.1 mV/V + 0.2 mV	
	(20 to 50) kHz	0.1 mV/V + 0.2 mV	
	(50 to 100) kHz	0.1 mV/V + 0.2 mV	
	(6.22 to 62.2) Vp-p		
	(10 to 20) Hz	0.2 mV/V + 2 mV	
	(20 to 40) Hz	0.1 mV/V + 2 mV	
	40 Hz to 20 kHz	0.1 mV/V + 2 mV	
	(20 to 50) kHz	0.1 mV/V + 2 mV	
	(50 to 100) kHz	0.1 mV/V + 2 mV	
	(62.2 to 198) Vp-p		
	(10 to 20) Hz	0.2 mV/V + 20 mV	
	(20 to 40) Hz	0.1 mV/V + 20 mV	
	40 Hz to 20 kHz	0.1 mV/V + 20 mV	
	(20 to 50) kHz	0.1 mV/V + 20 mV	
	(50 to 100) kHz	0.1 mV/V + 20 mV	

Fluke 5790A or Fluke 5790B AC Measurement Standard; E-OSC-G-0001-GE: Based on Manufacturer Manual.

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Oscilloscope Calibrators Amplitude – Wave Generator Sine Wave (Relative to 50 kHz) 50 Ω Load	Up to 6.22 mVp-p (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (6.22 to 19.8) mVp-p (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (19.8 to 62.2) mVp-p (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (62.2 to 622) mVp-p (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz (0.622 to 6.22) Vp-p (10 to 20) Hz (20 to 40) Hz 40 Hz to 20 kHz (20 to 50) kHz (50 to 100) kHz	 1.5 mV/V + 6 µV 0.9 mV/V + 6 µV 0.7 mV/V + 6 µV 0.9 mV/V + 6 µV 1.2 mV/V + 6 µV 0.9 mV/V + 4 µV 0.7 mV/V + 4 µV 0.6 mV/V + 4 µV 0.8 mV/V + 4 µV 0.9 mV/V + 4 µV 0.7 mV/V + 4 µV 0.6 mV/V + 4 µV 0.6 mV/V + 4 µV 0.7 mV/V + 4 µV 0.8 mV/V + 4 µV 0.6 mV/V + 20 µV 0.6 mV/V + 20 µV 0.6 mV/V + 20 µV 0.6 mV/V + 20 µV 0.6 mV/V + 20 µV 0.6 mV/V + 0.2 mV 0.6 mV/V + 0.2 mV 0.6 mV/V + 0.2 mV 0.6 mV/V + 0.2 mV 0.6 mV/V + 0.2 mV	Fluke 5790A or Fluke 5790B AC Measurement Standard, HP 11048C 50 Ω Feedthrough Terminator; E-OSC-G-0001-GE: Based on Manufacturer Manual.

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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Oscilloscope Calibrators Amplitude – Wave Generator Square Wave (Relative to 50 kHz) 1 MΩ Load	Up to 44 mVp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (44 to 440) mVp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (0.44 to 4.4) Vp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (4.4 to 44) Vp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (44 to 140) Vp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz	 1.2 mV/V + 6 µV 1.9 mV/V + 6 µV 5.9 mV/V + 6 µV 1.2 mV/V + 20 µV 2.1 mV/V + 20 µV 5.9 mV/V + 20 µV 1.2 mV/V + 0.2 mV 2.1 mV/V + 0.2 mV 5.9 mV/V + 0.2 mV 1.2 mV/V + 2 mV 2.1 mV/V + 2 mV 5.9 mV/V + 2 mV 1.2 mV/V + 20 mV 2.1 mV/V + 20 mV 5.9 mV/V + 20 mV	Fluke 5790A or Fluke 5790B AC Measurement Standard; E-OSC-G-0001-GE: Based on Manufacturer Manual.
[1] Oscilloscope Calibrators Amplitude – Wave Generator Square Wave (Relative to 50 kHz) 50 Ω Load	Up to 44 mVp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (44 to 440) mVp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (0.44 to 4.4) Vp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz	 1.3 mV/V + 6 µV 2.1 mV/V + 6 µV 5.9 mV/V + 6 µV 1.3 mV/V + 20 µV 2.1 mV/V + 20 µV 5.9 mV/V + 20 µV 1.3 mV/V + 0.2 mV 2.1 mV/V + 0.2 mV 5.9 mV/V + 0.2 mV	Fluke 5790A or Fluke 5790B AC Measurement Standard, HP 11048C 50 Ω Feedthrough; E-OSC-G-0001-GE: Based on Manufacturer Manual.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Oscilloscope Calibrators Amplitude – Wave Generator Square Wave (Relative to 50 kHz) 50 Ω Load	Up to 76.2 mVp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (76.2 to 762) mVp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (0.762 to 7.62) Vp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (7.62 to 76.2) Vp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (76.2 to 242) Vp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz	 1.2 mV/V + 6 µV 2.1 mV/V + 6 µV 6.1 mV/V + 10 µV 1.2 mV/V + 30 µV 2.1 mV/V + 30 µV 6.1 mV/V + 30 µV 1.2 mV/V + 0.3 mV 2.1 mV/V + 0.3 mV 6.1 mV/V + 0.3 mV 1.2 mV/V + 3 mV 2.1 mV/V + 3 mV 6.1 mV/V + 3 mV 1.2 mV/V + 30 mV 2.1 mV/V + 30 mV 6.1 mV/V + 30 mV	Fluke 5790A or Fluke 5790B AC Measurement Standard, HP 11048C 50 Ω Feedthrough; E-OSC-G-0001-GE: Based on Manufacturer Manual.
[1] Oscilloscope Calibrators Amplitude – Wave Generator Triangle Wave (Relative to 50 kHz) 1 MΩ Load	Up to 76.2 mVp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (76.2 to 762) mVp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (0.762 to 7.62) Vp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (7.62 to 76.2) Vp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (76.2 to 242) Vp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz	 1.2 mV/V + 6 µV 2.1 mV/V + 6 µV 6.1 mV/V + 10 µV 1.2 mV/V + 30 µV 2.1 mV/V + 30 µV 6.1 mV/V + 30 µV 1.2 mV/V + 0.3 mV 2.1 mV/V + 0.3 mV 6.1 mV/V + 0.3 mV 1.2 mV/V + 3 mV 2.1 mV/V + 3 mV 6.1 mV/V + 3 mV 1.2 mV/V + 30 mV 2.1 mV/V + 30 mV 6.1 mV/V + 30 mV	Fluke 5790A or Fluke 5790B AC Measurement Standard; E-OSC-G-0001-GE: Based on Manufacturer Manual.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Oscilloscope Calibrators Amplitude – Wave Generator Triangle Wave (Relative to 50 kHz) 50 Ω Load	Up to 76.2 mVp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (76.2 to 762) mVp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz (0.762 to 7.62) Vp-p 10 Hz to 1 kHz (1 to 20) kHz (20 to 100) kHz	 1.3 mV/V + 6 µV 2.1 mV/V + 6 µV 6.1 mV/V + 10 µV 1.3 mV/V + 30 µV 2.1 mV/V + 30 µV 6.1 mV/V + 30 µV 1.3 mV/V + 0.3 mV 2.1 mV/V + 0.3 mV 6.1 mV/V + 0.3 mV	Fluke 5790A or Fluke 5790B AC Measurement Standard, HP 11048C 50 Ω Feedthrough; E-OSC-G-0001-GE: Based on Manufacturer Manual.
[1] Oscilloscope Calibrators Measure Z Resistance	(40 to 60) Ω (0.5 to 1.5) MΩ	0.002 % of reading + 6 mΩ 0.006 % of reading + 0.15 kΩ	Decade Resistor, Agilent 3458A 8.5 Digit Multimeter; E-OSC-G-0001-GE: Based on Manufacturer Manual.
[1] Oscilloscope Calibrators Measure Z Capacitance	(5 to 50) pF	0.12 % of reading + 0.08 pF	Decade Capacitor, HP 4192A Impedance Analyzer; E-OSC-G-0001-GE: Based on Manufacturer Manual.
[1] Oscilloscope Calibrators Leveled Sine Wave – Frequency	50 kHz to 3 GHz	0.000 004 % of reading	Keysight 53132A, Opt.010 Universal Counter; E-OSC-G-0001-GE: Based on Manufacturer Manual.
[1] Oscilloscope Calibrator Time Marker	2 ns to 5 s	0.000 004 % of reading	Keysight 53132A, Opt.010 Universal Counter; E-OSC-G-0001-GE: Based on Manufacturer Manual
[1] Oscilloscope Calibrator Pulse Period	2 ns to 5 s	0.000 004 % of reading	Keysight 53132A, Opt.010 Universal Counter; E-OSC-G-0001-GE: Based on Manufacturer Manual.
[1] Tesla Meter/Gauss Meter	(0.1 to 20) G (20 to 30) G (30 to 500) G (500 to 3 000) G (3 000 to 10 000) G (10 000 to 20 000) G	1 % of reading 0.6 % of reading 0.6 % of reading 0.6 % of reading 0.6 % of reading 0.6 % of reading	Standard Magnetic; EN-0006-GE: Direct Measurement

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Magnetic – Measure			
Magnets	(1 to 10) G	1 % of reading + 0.002 G	LakeShore 425 Digital Gauss Meter; EN-0013-GE: Direct Measurement.
	(10 to 350) G	0.1 % of reading + 0.02 G	
	(350 to 3 500) G	0.25 % of reading + 0.2 G	
	(3 500 to 24 000) G	0.25 % of reading + 2 G	
Helmholtz Coils	(2 to 10) G	1 % of reading + 0.002 G	
	(10 to 200) G	0.35 % of reading + 0.02 G	
[1] Electric Charge – Source	1 fC to 20 pC	1.5 % of reading	Keithley 263 Calibrator/Source; E-ACC-M-0005-GE: Direct Measurement.
	(20 to 200) pC	0.63 % of reading	
	200 pC to 2 nC	0.15 % of reading	
	(2 to 20) nC	0.15 % of reading	
	(20 to 200) nC	0.6 % of reading	
	200 nC to 2 µC	0.6 % of reading	
	(2 to 20) µC	0.6 % of reading	
[1] Strain Indicator – Source	±500 µε	0.02 % of reading	Strain Calibrator, Multi-Product Calibrator; E-DCR-M-0005-GE: Direct Measurement.
	±1 000 µε	0.015 % of reading	
	±1 500 µε	0.013 % of reading	
	±2 000 µε	0.013 % of reading	
	±3 000 µε	0.013 % of reading	
	±4 000 µε	0.012 % of reading	
	±5 000 µε	0.012 % of reading	
	±6 000 µε	0.012 % of reading	
[1, 8] Magnetic Flux Meter	(0.1 to 0.5) mWb	1.8 % of Reading	Magnetic Flux Meter Calibrator; EN-0012-GE: Direct Measurement.
	(0.5 to 1) mWb	1.4 % of Reading	
	(1 to 5) mWb	0.5 % of Reading	
	(5 to 10) mWb	0.3 % of Reading	
	(10 to 50) mWb	0.12 % of Reading	
	(50 to 100) mWb	0.04 % of Reading	
	(100 to 1 000) mWb	0.03 % of Reading	
	(1 to 10) Wb	0.03 % of Reading	
[1, 8] Magnetic Flux Meter Calibrator	(10 to 100) mV		Agilent 3458A 8.5 Digit Multimeter, Agilent 53132A Universal Frequency Counter; E-COM-G-0008-GE: Direct Measurement.
	0.1 mWb	0.7 % of reading	
	(0.1 to 0.5) mWb	0.3 % of reading	
	(0.5 to 1) mWb	0.2 % of reading	
	(1 to 5) mWb	0.15 % of reading	
	(5 to 10) mWb	0.065 % of reading	
	(10 to 50) mWb	0.022 % of reading	
	(50 to 100) mWb	0.014 % of reading	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1, 8] Magnetic Flux Meter Calibrator	(0.1 to 1) V (10 to 50) mWb (50 to 100) mWb (100 to 500) mWb (0.5 to 1) Wb (1 to 5) Wb (5 to 10) Wb	 0.005 % of reading 0.003 % of reading 0.003 % of reading 0.003 % of reading 0.003 % of reading 0.003 % of reading	Agilent 3458A 8.5 Digit Multimeter, Agilent 53132A Universal Frequency Counter; E-COM-G-0008-GE: Direct Measurement.
[1] Electrical Power Energy – Source 33 mV to 1 020 V, 3.3 mA to 20.5 A, (45 to 65) Hz Time: (300 to 3 600) s	1.6 µWh to 30.8 kWh PF = (0.174 to 0.341) PF = (0.342 to 0.499) PF = (0.5 to 0.642) PF = (0.643 to 0.765) PF = (0.766 to 0.865) PF = (0.866 to 0.939) PF = (0.94 to 0.984) PF = (0.985 to 0.999) PF = 1	 1.2 % of reading 0.57 % of reading 0.36 % of reading 0.25 % of reading 0.19 % of reading 0.13 % of reading 0.09 % of reading 0.06 % of reading 0.05 % of reading	Fluke 55xxA Multiproduct Calibrator, Digital Stopwatch; E-POW-M-0003-GE: Direct Measurement.

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Frequency Counter – Frequency Sensitivity	0.01 Hz to 100 kHz (-30 to 0) dBm 100 kHz to 2 GHz (-30 to 0) dBm (2 to 4) GHz (-30 to 0) dBm (4 to 20) GHz (-30 to 0) dBm (20 to 40) GHz (-30 to 0) dBm	 0.6 dB 0.7 dB 1.2 dB 1.2 dB 1.5 dB	Keysight 33220A, Keysight 33250A, Keysight ESG4000A, Keysight E4433B, Keysight 83620A, Keysight 8340B, Keysight 83640A Function and Signal Generators; E-TMF-M-0001-GE: Direct Measurement

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Oscilloscope – Bandwidth (50 Ω, Type N Connector)	0.2 mVp-p to 2 Vp-p 10 MHz to 2 GHz (2 to 6) GHz (6 to 11) GHz (11 to 18) GHz	 0.41 dB 0.48 dB 0.6 dB 0.62 dB	Keysight EPM442A, Keysight E4419B Power Meters, Keysight E4412A, Keysight N8481A Power Sensors, Keysight 11667A Power Splitter; E-OSC-M-0001-GE: Comparison Measurement
[1] Oscilloscope – Bandwidth (50 Ω, 3.5 mm Connector)	0.2 mVp-p to 2 Vp-p (10 to 50) MHz 50 MHz to 18 GHz (18 to 26.5) GHz	 0.55 dB 0.53 dB 0.72 dB	Keysight EPM442A Keysight E4419B Power Meters, Keysight E4413A, Keysight N8485A Power Sensors, Keysight 11667B Power Splitter; E-OSC-M-0001-GE: Comparison Measurement.
[1] Oscilloscope – Bandwidth (50 Ω, 2.4 mm Connector)	20 mVp-p to 2 Vp-p 50 MHz to 12.4 GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz	 0.89 dB 0.91 dB 0.97 dB 1 dB 1.2 dB	Keysight EPM442A Keysight E4419B Power Meters, Keysight 8487A Power Sensor, Keysight 11667B Power Splitter; E-OSC-M-0001-GE: Comparison Measurement.
[1] Oscilloscope Calibrators Leveled Sine Wave – High Frequency Flatness (Relative to 10 MHz) 50 Ω Load	5 mVp-p to 6.22 Vp-p 10 MHz to 1 GHz (1 to 14) GHz (14 to 18) GHz	 0.6 % of reading 0.7 % of reading 0.9 % of reading	Keysight EPM442A Keysight E4419B Power Meters, Keysight E4412A Power Sensor; E-OSC-G-0001-GE: Based on Manufacturer Manual.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Oscilloscope Calibrators and Leveled Sine Wave Generators – Harmonics, Sub-harmonics, and Non-harmonics 50 Ω Load	18 kHz to 2.9 GHz (2.75 to 6.5) GHz (6 to 22) GHz (22 to 26.8) GHz (26.8 to 40) GHz	1.7 dB 2 dB 2.4 dB 3 dB 3.3 dB	Keysight 8593E, Keysight 8562EC, Keysight 8564E Spectrum Analyzers; E-OSC-G-0001-GE: Based on Manufacturer Manual and Direct Measurement.
[1] Oscilloscope Calibrator Pulse Width	Up to 2.5 Vp-p (1 to 10) ns (10 to 100) ns (100 to 1 000) ns (1 to 10) µs (10 to 100) µs (100 to 1 000) µs (1 to 10) ms (10 to 100) ms (0.1 to 1) s	 0.12 % of reading + 4.7 ps 0.12 % of reading + 7.4 ps 0.12 % of reading + 58 ps 0.12 % of reading + 0.58 ns 0.12 % of reading + 5.8 ns 0.12 % of reading + 58 ns 0.12 % of reading + 0.58 µs 0.12 % of reading + 5.8 µs 0.12 % of reading + 58 µs	Agilent 83480A, Agilent 83485A Digital Communications Analyzer with Plug-in Module; E-OSC-G-0001-GE: Based on Manufacturer Manual.
[1] RF Power – Source Absolute RF Power (50 Ω, Type N Connector)	(-30 to -27) dBm (100 to 300) kHz 300 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz (-27 to -25) dBm (100 to 300) kHz 300 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz (-25 to -20) dBm (100 to 300) kHz 300 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz	 0.66 dB 0.66 dB 0.66 dB 0.66 dB 0.33 dB 0.33 dB 0.33 dB 0.33 dB 0.21 dB 0.21 dB 0.21 dB 0.21 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter, Keysight 8482A/8482B, Keysight N8481A, Keysight E4412A Type N Power Sensors; E-COM-M-0001-GE: Comparison Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Source Absolute RF Power (50 Ω, Type N Connector)	(-20 to -15) dBm (100 to 300) kHz 300 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz (-15 to +10) dBm (100 to 300) kHz 300 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz (+10 to +20) dBm (100 to 300) kHz 300 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz	 0.10 dB 0.09 dB 0.09 dB 0.10 dB 0.08 dB 0.08 dB 0.08 dB 0.08 dB 0.15 dB 0.15 dB 0.15 dB 0.15 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter, Keysight 8482A Type N Power Sensors; E-COM-M-0001-GE: Comparison Measurement.
[1] RF Power – Source Absolute RF Power (50 Ω, Type N Connector)	(0 to +3) dBm 100 kHz to 2 GHz (2 to 4.2) GHz (+3 to +5) dBm 100 kHz to 2 GHz (2 to 4.2) GHz (+5 to +10) dBm 100 kHz to 2 GHz (2 to 4.2) GHz (+10 to +35) dBm 100 kHz to 2 GHz (2 to 4.2) GHz (+35 to +44) dBm 100 kHz to 2 GHz (2 to 4.2) GHz	 0.69 dB 0.69 dB 0.38 dB 0.38 dB 0.28 dB 0.28 dB 0.21 dB 0.21 dB 0.27 dB 0.27 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 8482B, Type N Power Sensor; E-COM-M-0001-GE: Comparison Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Source Absolute RF Power (50 Ω, Type N Connector)	(-32 to -30) dBm		Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter, Keysight N8481A Type N Power Sensors; E-COM-M-0001-GE: Comparison Measurement. .
	(10 to 30) MHz	0.73 dB	
	(30 to 50) MHz	0.73 dB	
	50 MHz to 2 GHz	0.73 dB	
	(2 to 12.4) GHz	0.73 dB	
	(12.4 to 18) GHz	0.73 dB	
	(-30 to -27) dBm		
	(10 to 30) MHz	0.45 dB	
	(30 to 50) MHz	0.45 dB	
	50 MHz to 2 GHz	0.45 dB	
	(2 to 12.4) GHz	0.45 dB	
	(12.4 to 18) GHz	0.47 dB	
	(-27 to -25) dBm		
	(10 to 30) MHz	0.23 dB	
	(30 to 50) MHz	0.23 dB	
	50 MHz to 2 GHz	0.23 dB	
	(2 to 12.4) GHz	0.23 dB	
	(12.4 to 18) GHz	0.26 dB	
	(-25 to -20) dBm		
	(10 to 30) MHz	0.15 dB	
	(30 to 50) MHz	0.15 dB	
	50 MHz to 2 GHz	0.15 dB	
	(2 to 12.4) GHz	0.15 dB	
	(12.4 to 18) GHz	0.19 dB	
	(-20 to +15) dBm		
	(10 to 30) MHz	0.08 dB	
	(30 to 50) MHz	0.08 dB	
	50 MHz to 2 GHz	0.08 dB	
	(2 to 12.4) GHz	0.08 dB	
	(12.4 to 18) GHz	0.14 dB	
	(+15 to +20) dBm		
	(10 to 30) MHz	0.08 dB	
	(30 to 50) MHz	0.08 dB	
	50 MHz to 2 GHz	0.08 dB	
	(2 to 12.4) GHz	0.08 dB	
	(12.4 to 18) GHz	0.14 dB	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Source Absolute RF Power (50 Ω, Type N Connector)	(-62 to -60) dBm		Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter, Keysight E4412A Type N Power Sensors; E-COM-M-0001-GE: Comparison Measurement.
	(10 to 30) MHz	0.77 dB	
	30 MHz to 2 GHz	0.77 dB	
	(2 to 6) GHz	0.77 dB	
	(6 to 11) GHz	0.77 dB	
	(11 to 18) GHz	0.79 dB	
	(-60 to -57) dBm		
	(10 to 30) MHz	0.49 dB	
	30 MHz to 2 GHz	0.49 dB	
	(2 to 6) GHz	0.49 dB	
	(6 to 11) GHz	0.49 dB	
	(11 to 18) GHz	0.51 dB	
	(-57 to -55) dBm		
	(10 to 30) MHz	0.27 dB	
	30 MHz to 2 GHz	0.27 dB	
	(2 to 6) GHz	0.27 dB	
	(6 to 11) GHz	0.27 dB	
	(11 to 18) GHz	0.31 dB	
	(-55 to -50) dBm		
	(10 to 30) MHz	0.2 dB	
	30 MHz to 2 GHz	0.2 dB	
	(2 to 6) GHz	0.2 dB	
	(6 to 11) GHz	0.2 dB	
	(11 to 18) GHz	0.25 dB	
	(-50 to +10) dBm		
	(10 to 30) MHz	0.15 dB	
	30 MHz to 2 GHz	0.15 dB	
	(2 to 6) GHz	0.15 dB	
	(6 to 11) GHz	0.15 dB	
	(11 to 18) GHz	0.21 dB	
	(+10 to +20) dBm		
	(10 to 30) MHz	0.21 dB	
	30 MHz to 2 GHz	0.21 dB	
	(2 to 6) GHz	0.21 dB	
	(6 to 11) GHz	0.21 dB	
	(11 to 18) GHz	0.27 dB	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Source Absolute RF Power (50 Ω, Type N Connector)	(-52 to -50) dBm		Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter, Keysight E9304A Type N Power Sensor; E-COM-M-0001-GE: Comparison Measurement.
	9 kHz to 500 MHz	0.77 dB	
	500 MHz to 1.2 GHz	0.77 dB	
	(1.2 to 6) GHz	0.77 dB	
	(6 to 14) GHz	0.77 dB	
	(14 to 18) GHz	0.78 dB	
	(-50 to -47) dBm		
	9 kHz to 500 MHz	0.49 dB	
	500 MHz to 1.2 GHz	0.49 dB	
	(1.2 to 6) GHz	0.49 dB	
	(6 to 14) GHz	0.49 dB	
	(14 to 18) GHz	0.5 dB	
	(-47 to -45) dBm		
	9 kHz to 500 MHz	0.27 dB	
	500 MHz to 1.2 GHz	0.27 dB	
	(1.2 to 6) GHz	0.27 dB	
	(6 to 14) GHz	0.27 dB	
	(14 to 18) GHz	0.29 dB	
	(-45 to -40) dBm		
	9 kHz to 500 MHz	0.2 dB	
	500 MHz to 1.2 GHz	0.2 dB	
	(1.2 to 6) GHz	0.2 dB	
	(6 to 14) GHz	0.2 dB	
	(14 to 18) GHz	0.23 dB	
	(-40 to -10) dBm		
	9 kHz to 500 MHz	0.15 dB	
	500 MHz to 1.2 GHz	0.15 dB	
	(1.2 to 6) GHz	0.15 dB	
	(6 to 14) GHz	0.15 dB	
	(14 to 18) GHz	0.19 dB	
	(-10 to 0) dBm		
	9 kHz to 500 MHz	0.12 dB	
	500 MHz to 1.2 GHz	0.12 dB	
	(1.2 to 6) GHz	0.12 dB	
	(6 to 14) GHz	0.12 dB	
	(14 to 18) GHz	0.17 dB	

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Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Source Absolute RF Power (50 Ω, Type N Connector)	(0 to +20) dBm 9 kHz to 500 MHz 500 MHz to 1.2 GHz (1.2 to 6) GHz (6 to 14) GHz (14 to 18) GHz	 0.1 dB 0.1 dB 0.1 dB 0.1 dB 0.16 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter, Keysight E9304A Type N Power Sensor; E-COM-M-0001-GE: Comparison Measurement.
[1] RF Power – Source Absolute RF Power (50 Ω, 3.5 mm Connector)	(-32 to -30) dBm (10 to 50) MHz (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (-30 to -27) dBm (10 to 50) MHz (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (-27 to -25) dBm (10 to 50) MHz (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (-25 to -20) dBm (10 to 50) MHz (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz	 0.73 dB 0.73 dB 0.73 dB 0.73 dB 0.73 dB 0.74 dB 0.45 dB 0.45 dB 0.45 dB 0.45 dB 0.46 dB 0.47 dB 0.23 dB 0.23 dB 0.23 dB 0.24 dB 0.24 dB 0.26 dB 0.16 dB 0.16 dB 0.16 dB 0.17 dB 0.17 dB 0.19 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter, Keysight N8485A 3.5 mm Power Sensors; E-COM-M-0001-GE: Comparison Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Source Absolute RF Power (50 Ω, 3.5 mm Connector)	(-20 to +15) dBm (10 to 50) MHz (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (+15 to +20) dBm (10 to 50) MHz (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz	 0.09 dB 0.09 dB 0.09 dB 0.12 dB 0.12 dB 0.15 dB 0.08 dB 0.08 dB 0.08 dB 0.11 dB 0.11 dB 0.14 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter, Keysight N8485A 3.5 mm Power Sensors; E-COM-M-0001-GE: Comparison Measurement.
[1] RF Power – Source Absolute RF Power (50 Ω, 3.5 mm Connector)	(-62 to -60) dBm (50 to 100) MHz 100 MHz to 8 GHz (8 to 18) GHz (18 to 26.5) GHz (-60 to -57) dBm (50 to 100) MHz 100 MHz to 8 GHz (8 to 18) GHz (18 to 26.5) GHz (-57 to -55) dBm (50 to 100) MHz 100 MHz to 8 GHz (8 to 18) GHz (18 to 26.5) GHz (-55 to -50) dBm (50 to 100) MHz 100 MHz to 8 GHz (8 to 18) GHz (18 to 26.5) GHz	 0.78 dB 0.78 dB 0.78 dB 0.78 dB 0.49 dB 0.49 dB 0.5 dB 0.5 dB 0.28 dB 0.28 dB 0.29 dB 0.29 dB 0.21 dB 0.21 dB 0.22 dB 0.24 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter, Keysight E4413A 3.5 mm Power Sensors; E-COM-M-0001-GE: Comparison Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Source Absolute RF Power (50 Ω, 3.5 mm Connector)	(-50 to +10) dBm (50 to 100) MHz 100 MHz to 8 GHz (8 to 18) GHz (18 to 26.5) GHz (+10 to +20) dBm (50 to 100) MHz 100 MHz to 8 GHz (8 to 18) GHz (18 to 26.5) GHz	 0.16 dB 0.16 dB 0.17 dB 0.19 dB 0.22 dB 0.22 dB 0.23 dB 0.24 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter, Keysight E4413A 3.5 mm Power Sensors; E-COM-M-0001-GE: Comparison Measurement.
[1] RF Power – Source Absolute RF Power (50 Ω, 2.4 mm Connector)	(-30 to -27) dBm (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz (-27 to -25) dBm (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz (-25 to -20) dBm (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz	 0.66 dB 0.66 dB 0.66 dB 0.66 dB 0.67 dB 0.68 dB 0.69 dB 0.33 dB 0.33 dB 0.33 dB 0.33 dB 0.34 dB 0.35 dB 0.37 dB 0.21 dB 0.21 dB 0.21 dB 0.21 dB 0.24 dB 0.25 dB 0.28 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter, Keysight 8487A, 2.4 mm Power Sensors; E-COM-M-0001-GE: Comparison Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Source Absolute RF Power (50 Ω, 2.4 mm Connector)	(-20 to -15) dBm (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz (-15 to +10) dBm (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz (+10 to +20) dBm (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz	 0.09 dB 0.09 dB 0.1 dB 0.1 dB 0.15 dB 0.17 dB 0.2 dB 0.08 dB 0.08 dB 0.09 dB 0.09 dB 0.13 dB 0.16 dB 0.19 dB 0.15 dB 0.15 dB 0.16 dB 0.16 dB 0.19 dB 0.2 dB 0.23 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter, Keysight 8487A, 2.4 mm Power Sensors; E-COM-M-0001-GE: Comparison Measurement.
[1] RF Power – Source Absolute RF Power (75 Ω, Type N Connector)	(-30 to -27) dBm (100 to 600) kHz 600 kHz to 2 GHz (-27 to -25) dBm (100 to 600) kHz 600 kHz to 2 GHz (-25 to -20) dBm (100 to 600) kHz 600 kHz to 2 GHz	 0.67 dB 0.66 dB 0.34 dB 0.32 dB 0.23 dB 0.21 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter; Keysight 8483A Type N Power Sensor E-COM-M-0001-GE: Comparison Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Source Absolute RF Power (75 Ω, Type N Connector)	(-20 to -15) dBm (100 to 600) kHz 600 kHz to 2 GHz (-15 to +10) dBm (100 to 600) kHz 600 kHz to 2 GHz (+10 to +20) dBm (100 to 600) kHz 600 kHz to 2 GHz	 0.13 dB 0.09 dB 0.11 dB 0.08 dB 0.17 dB 0.15 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter; Keysight 8483A Type N Power Sensor E-COM-M-0001-GE: Comparison Measurement.
[1] RF Power – Measure Absolute RF Power (50 Ω, Type N Connector)	(-30 to -27) dBm (100 to 300) kHz 300 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz (-27 to -25) dBm (100 to 300) kHz 300 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz (-25 to -20) dBm (100 to 300) kHz 300 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz (-20 to -15) dBm (100 to 300) kHz 300 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz (-15 to +10) dBm (100 to 300) kHz 300 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz (+10 to +20) dBm (100 to 300) kHz 300 kHz to 1 MHz 1 MHz to 2 GHz (2 to 4.2) GHz	 0.68 dB 0.66 dB 0.66 dB 0.66 dB 0.35 dB 0.33 dB 0.33 dB 0.33 dB 0.25 dB 0.21 dB 0.21 dB 0.21 dB 0.16 dB 0.09 dB 0.09 dB 0.1 dB 0.15 dB 0.08 dB 0.08 dB 0.08 dB 0.2 dB 0.15 dB 0.15 dB 0.16 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 8482A Type N Power Sensors; E-COM-G-0001-GE: Direct Measurement.

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[1] RF Power – Measure Absolute RF Power (50 Ω, Type N Connector)	(0 to +3) dBm 100 kHz to 2 GHz (2 to 4.2) GHz (+3 to +5) dBm 100 kHz to 2 GHz (2 to 4.2) GHz (+5 to +10) dBm 100 kHz to 2 GHz (2 to 4.2) GHz (+10 to +35) dBm 100 kHz to 2 GHz (2 to 4.2) GHz (+35 to +44) dBm 100 kHz to 2 GHz (2 to 4.2) GHz	 0.66 dB 0.66 dB 0.33 dB 0.33 dB 0.22 dB 0.22 dB 0.11 dB 0.1 dB 0.20 dB 0.20 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 8482B Type N Power Sensors; E-COM-G-0001-GE: Direct Measurement.
[1] RF Power – Measure Absolute RF Power (50 Ω, Type N Connector)	(-32 to -30) dBm (10 to 30) MHz (30 to 50) MHz 50 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (-30 to -27) dBm (10 to 30) MHz (30 to 50) MHz 50 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (-27 to -25) dBm (10 to 30) MHz (30 to 50) MHz 50 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (-25 to -20) dBm (10 to 30) MHz (30 to 50) MHz 50 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz	 0.74 dB 0.73 dB 0.73 dB 0.73 dB 0.73 dB 0.47 dB 0.45 dB 0.45 dB 0.45 dB 0.45 dB 0.26 dB 0.23 dB 0.23 dB 0.23 dB 0.23 dB 0.2 dB 0.15 dB 0.15 dB 0.16 dB 0.16 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight N8481A Type N Power Sensors; E-COM-G-0001-GE: Direct Measurement.

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[1] RF Power – Measure Absolute RF Power (50 Ω, Type N Connector)	(-20 to +15) dBm (10 to 30) MHz (30 to 50) MHz 50 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (+15 to +20) dBm (10 to 30) MHz (30 to 50) MHz 50 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz	 0.15 dB 0.08 dB 0.08 dB 0.09 dB 0.09 dB 0.15 dB 0.08 dB 0.08 dB 0.08 dB 0.08 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight N8481A Type N Power Sensors; E-COM-G-0001-GE: Direct Measurement.
[1] RF Power – Measure Absolute RF Power (50 Ω, Type N Connector)	(-62 to -60) dBm (10 to 30) MHz 30 MHz to 2 GHz (2 to 6) GHz (6 to 11) GHz (11 to 18) GHz (-60 to -57) dBm (10 to 30) MHz 30 MHz to 2 GHz (2 to 6) GHz (6 to 11) GHz (11 to 18) GHz (-57 to -55) dBm (10 to 30) MHz 30 MHz to 2 GHz (2 to 6) GHz (6 to 11) GHz (11 to 18) GHz (-55 to -50) dBm (10 to 30) MHz 30 MHz to 2 GHz (2 to 6) GHz (6 to 11) GHz (11 to 18) GHz	 0.77 dB 0.77 dB 0.77 dB 0.77 dB 0.78 dB 0.49 dB 0.49 dB 0.49 dB 0.49 dB 0.49 dB 0.27 dB 0.27 dB 0.27 dB 0.27 dB 0.28 dB 0.2 dB 0.2 dB 0.2 dB 0.2 dB 0.22 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight E4412A Type N Power Sensors; E-COM-G-0001-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Measure Absolute RF Power (50 Ω, Type N Connector)	(-50 to +10) dBm (10 to 30) MHz 30 MHz to 2 GHz (2 to 6) GHz (6 to 11) GHz (11 to 18) GHz (+10 to +20) dBm (10 to 30) MHz 30 MHz to 2 GHz (2 to 6) GHz (6 to 11) GHz (11 to 18) GHz	 0.15 dB 0.15 dB 0.15 dB 0.15 dB 0.17 dB 0.22 dB 0.22 dB 0.22 dB 0.22 dB 0.24 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight E4412A Type N Power Sensors; E-COM-G-0001-GE: Direct Measurement.
[1] RF Power – Measure Absolute RF Power (50 Ω, Type N Connector)	(-52 to -50) dBm 9 kHz to 500 MHz 500 MHz to 1.2 GHz (1.2 to 6) GHz (6 to 14) GHz (14 to 18) GHz (-50 to -47) dBm 9 kHz to 500 MHz 500 MHz to 1.2 GHz (1.2 to 6) GHz (6 to 14) GHz (14 to 18) GHz (-47 to -45) dBm 9 kHz to 500 MHz 500 MHz to 1.2 GHz (1.2 to 6) GHz (6 to 14) GHz (14 to 18) GHz (-45 to -40) dBm 9 kHz to 500 MHz 500 MHz to 1.2 GHz (1.2 to 6) GHz (6 to 14) GHz (14 to 18) GHz	 0.77 dB 0.77 dB 0.77 dB 0.77 dB 0.77 dB 0.49 dB 0.49 dB 0.49 dB 0.49 dB 0.49 dB 0.27 dB 0.27 dB 0.27 dB 0.27 dB 0.27 dB 0.2 dB 0.2 dB 0.2 dB 0.2 dB 0.2 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight E9304A Type N Power Sensor; E-COM-G-0001-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Measure Absolute RF Power (50 Ω, Type N Connector)	(-40 to -10) dBm 9 kHz to 500 MHz 500 MHz to 1.2 GHz (1.2 to 6) GHz (6 to 14) GHz (14 to 18) GHz (-10 to 0) dBm 9 kHz to 500 MHz 500 MHz to 1.2 GHz (1.2 to 6) GHz (6 to 14) GHz (14 to 18) GHz (0 to +20) dBm (9 kHz to 500 MHz 500 MHz to 1.2 GHz (1.2 to 6) GHz (6 to 14) GHz (14 to 18) GHz	 0.15 dB 0.15 dB 0.15 dB 0.15 dB 0.15 dB 0.12 dB 0.12 dB 0.12 dB 0.13 dB 0.13 dB 0.1 dB 0.1 dB 0.1 dB 0.11 dB 0.11 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight E9304A Type N Power Sensor; E-COM-G-0001-GE: Direct Measurement.
[1] RF Power – Measure Absolute RF Power (50 Ω, 3.5 mm Connector)	(-32 to -30) dBm (10 to 50) MHz (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (-30 to -27) dBm (10 to 50) MHz (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (-27 to -25) dBm (10 to 50) MHz (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz	 0.74 dB 0.74 dB 0.74 dB 0.74 dB 0.74 dB 0.74 dB 0.46 dB 0.46 dB 0.46 dB 0.46 dB 0.46 dB 0.46 dB 0.26 dB 0.23 dB 0.23 dB 0.23 dB 0.23 dB 0.24 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight N8485A 3.5 mm Power Sensors; E-COM-G-0001-GE: Direct Measurement.

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[1] RF Power – Measure Absolute RF Power (50 Ω, 3.5 mm Connector)	(-25 to -20) dBm (10 to 50) MHz (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (-20 to +15) dBm (10 to 50) MHz (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (+15 to +20) dBm (10 to 50) MHz (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz	 0.2 dB 0.15 dB 0.15 dB 0.16 dB 0.16 dB 0.18 dB 0.15 dB 0.08 dB 0.08 dB 0.1 dB 0.1 dB 0.12 dB 0.15 dB 0.08 dB 0.08 dB 0.09 dB 0.09 dB 0.11 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight N8485A 3.5 mm Power Sensors; E-COM-G-0001-GE: Direct Measurement.
[1] RF Power – Measure Absolute RF Power (50 Ω, 3.5 mm Connector)	(-62 to -60) dBm (50 to 100) MHz 100 MHz to 8 GHz (8 to 18) GHz (18 to 26.5) GHz (-60 to -57) dBm (50 to 100) MHz 100 MHz to 8 GHz (8 to 18) GHz (18 to 26.5) GHz (-57 to -55) dBm (50 to 100) MHz 100 MHz to 8 GHz (8 to 18) GHz (18 to 26.5) GHz	 0.77 dB 0.77 dB 0.78 dB 0.78 dB 0.49 dB 0.49 dB 0.49 dB 0.49 dB 0.27 dB 0.27 dB 0.28 dB 0.28 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight E4413A 3.5 mm Power Sensors; E-COM-G-0001-GE: Direct Measurement.

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[1] RF Power – Measure Absolute RF Power (50 Ω, 3.5 mm Connector)	(-55 to -50) dBm (50 to 100) MHz 100 MHz to 8 GHz (8 to 18) GHz (18 to 26.5) GHz (-50 to +10) dBm (50 to 100) MHz 100 MHz to 8 GHz (8 to 18) GHz (18 to 26.5) GHz (+10 to +20) dBm (50 to 100) MHz 100 MHz to 8 GHz (8 to 18) GHz (18 to 26.5) GHz	 0.21 dB 0.21 dB 0.22 dB 0.22 dB 0.16 dB 0.16 dB 0.17 dB 0.17 dB 0.22 dB 0.22 dB 0.23 dB 0.23 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight E4413A 3.5 mm Power Sensors; E-COM-G-0001-GE: Direct Measurement.
[1] RF Power – Measure Absolute RF Power (50 Ω, 2.4 mm Connector)	(-30 to -27) dBm (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz (-27 to -25) dBm (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz (-25 to -20) dBm (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz	 0.66 dB 0.66 dB 0.66 dB 0.66 dB 0.67 dB 0.67 dB 0.69 dB 0.33 dB 0.33 dB 0.33 dB 0.33 dB 0.34 dB 0.35 dB 0.38 dB 0.21 dB 0.21 dB 0.21 dB 0.21 dB 0.24 dB 0.24 dB 0.29 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 8487A 2.4 mm Power Sensor; E-COM-G-0001-GE: Direct Measurement.

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[1] RF Power – Measure Absolute RF Power (50 Ω, 2.4 mm Connector)	(-20 to -15) dBm (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz (-15 to +10) dBm (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz (+10 to +20) dBm (50 to 100) MHz 100 MHz to 2 GHz (2 to 12.4) GHz (12.4 to 18) GHz (18 to 26.5) GHz (26.5 to 40) GHz (40 to 50) GHz	 0.09 dB 0.09 dB 0.09 dB 0.1 dB 0.14 dB 0.15 dB 0.22 dB 0.08 dB 0.08 dB 0.08 dB 0.09 dB 0.13 dB 0.14 dB 0.21 dB 0.15 dB 0.15 dB 0.15 dB 0.16 dB 0.18 dB 0.2 dB 0.25 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 8487A 2.4 mm Power Sensor; E-COM-G-0001-GE: Direct Measurement.
[1] RF Power – Measure Absolute RF Power (75 Ω, Type N Connector)	(-30 to -27) dBm (100 to 600) kHz 600 kHz to 2 GHz (-27 to -25) dBm (100 to 600) kHz 600 kHz to 2 GHz (-25 to -20) dBm (100 to 600) kHz 600 kHz to 2 GHz	 0.72 dB 0.66 dB 0.42 dB 0.32 dB 0.34 dB 0.21 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 8483A Type N Power Sensor; E-COM-G-0001-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Measure Absolute RF Power (75 Ω, Type N Connector)	(-20 to -15) dBm (100 to 600) kHz 600 kHz to 2 GHz (-15 to +10) dBm (100 to 600) kHz 600 kHz to 2 GHz (-15 to +10) dBm (100 to 600) kHz 600 kHz to 2 GHz	 0.27 dB 0.09 dB 0.27 dB 0.08 dB 0.3 dB 0.15 dB	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 8483A Type N Power Sensor; E-COM-G-0001-GE: Direct Measurement.
[1] RF Power – Measure Amplitude Flatness of Function/Signal Generators (50 Ω)	(-20 to -10) dBm 10 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 10) MHz (10 to 50) MHz (50 to 80) MHz 80 MHz to 1 GHz (1 to 3) GHz (3 to 11) GHz (11 to 14) GHz (14 to 17) GHz (17 to 18) GHz (-10 to 0) dBm 10 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 10) MHz (10 to 50) MHz (50 to 80) MHz 80 MHz to 1 GHz (1 to 3) GHz (3 to 11) GHz (11 to 14) GHz (14 to 17) GHz (17 to 18) GHz	 0.01 dB 0.01 dB 0.013 dB 0.034 dB 0.043 dB 0.043 dB 0.043 dB 0.043 dB 0.043 dB 0.043 dB 0.043 dB 0.062 dB 0.062 dB 0.082 dB 0.082 dB 0.02 dB 0.014 dB 0.02 dB 0.039 dB 0.04 dB 0.04 dB 0.04 dB 0.04 dB 0.04 dB 0.04 dB 0.04 dB 0.06 dB 0.06 dB 0.082 dB 0.082 dB	Keysight 3458A 8.5 Digit Multimeter, Keysight EPM442A/E4419B Power Meters, Keysight 11667A Power Splitter, Keysight E9304A Power Sensor, 20 dB Attenuator; E-COM-G-0001-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Measure Amplitude Flatness of Function/Signal Generators (50 Ω)	(0 to 10) dBm		Keysight 3458A 8.5 Digit Multimeter, Keysight EPM442A/E4419B Power Meters, Keysight E9304A Power Sensor, 20 dB Attenuator; E-COM-G-0001-GE: Direct Measurement.
	10 Hz to 1 kHz	0.008 dB	
	(1 to 10) kHz	0.006 dB	
	(10 to 100) kHz	0.012 dB	
	(100 to 300) kHz	0.039 dB	
	300 kHz to 1 MHz	0.041 dB	
	(1 to 2) MHz	0.041 dB	
	(2 to 10) MHz	0.041 dB	
	(10 to 50) MHz	0.041 dB	
	(50 to 80) MHz	0.041 dB	
	80 MHz to 1 GHz	0.041 dB	
	(1 to 3) GHz	0.041 dB	
	(3 to 11) GHz	0.06 dB	
	(11 to 14) GHz	0.06 dB	
	(14 to 17) GHz	0.082 dB	
	(17 to 18) GHz	0.082 dB	
	(10 to 20) dBm		
	10 Hz to 1 kHz	0.004 dB	
	(1 to 10) kHz	0.004 dB	
	(10 to 100) kHz	0.01 dB	
	(100 to 300) kHz	0.035 dB	
	300 kHz to 1 MHz	0.044 dB	
	(1 to 2) MHz	0.044 dB	
	(2 to 10) MHz	0.044 dB	
	(10 to 50) MHz	0.044 dB	
	(50 to 80) MHz	0.044 dB	
	80 MHz to 1 GHz	0.044 dB	
	(1 to 3) GHz	0.045 dB	
	(3 to 11) GHz	0.06 dB	
	(11 to 14) GHz	0.06 dB	
	(14 to 17) GHz	0.082 dB	
	(17 to 18) GHz	0.082 dB	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power – Measure Amplitude Flatness of Function/Signal Generators (50 Ω)	(20 to 30) dBm 10 Hz to 1 kHz (1 to 10) kHz (10 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz (1 to 2) MHz (2 to 10) MHz (10 to 50) MHz (50 to 80) MHz 80 MHz to 1 GHz	 0.004 dB 0.004 dB 0.01 dB 0.033 dB 0.11 dB 0.16 dB 0.18 dB 0.18 dB 0.18 dB 0.18 dB	Keysight 3458A 8.5 Digit Multimeter, Keysight EPM442A/E4419B Power Meters, Keysight E9304A Power Sensor, 20 dB Attenuator; E-COM-G-0001-GE: Direct Measurement.
[1] RF Power Sensor – Calibration Factor (50 Ω, Type N)	(9 to 100) kHz 100 kHz to 5 MHz (5 to 10) MHz (10 to 30) MHz 50 MHz 50 MHz to 1 GHz (1 to 4.2) GHz (4.2 to 6) GHz (6 to 8) GHz (8 to 13) GHz (13 to 18) GHz	1 % of reading 1 % of reading 0.98 % of reading 0.74 % of reading Reference 0.74 % of reading 0.79 % of reading 0.89 % of reading 0.98 % of reading 1.1 % of reading 1.4 % of reading	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A Power Splitter; Keysight 8482A/8482B, Keysight 8481A/N8481A, Keysight E4412A, Keysight E9304A Type N Power Sensors; E-COM-M-0002-GE: Comparison Measurement.
[1] RF Power Sensor – Calibration Factor (50 Ω, 3.5 mm Sensors)	10 MHz to 30 MHz (30 to 50) MHz 50 MHz 50 MHz to 3 GHz (3 to 6) GHz (7 to 10) GHz (11 to 12.4) GHz (12.4 to 15) GHz (15 to 18) GHz (18 to 26.5) GHz	1.4 % of reading 1 % of reading Reference 1 % of reading 1.1 % of reading 1.3 % of reading 1.4 % of reading 1.6 % of reading 1.7 % of reading 2 % of reading	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667B Power Splitter; Keysight 83640A Keysight 8485A, Keysight N8485A, Keysight E4413A 3.5 mm Power Sensors; E-COM-M-0002-GE: Comparison Measurement.

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[1] RF Power Sensor – Calibration Factor (50 Ω. 2.4 mm Sensors)	50 MHz 50 MHz to 4 GHz (4 to 16) GHz (16 to 20) GHz (20 to 22) GHz (22 to 29) GHz (29 to 30) GHz (30 to 34) GHz (34 to 38) GHz (38 to 40) GHz	Reference 1.8 % of reading 2 % of reading 2.1 % of reading 2.3 % of reading 2.6 % of reading 3.1 % of reading 3.2 % of reading 3.3 % of reading 3.4 % of reading	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667C Power Splitter; Keysight 83640A, Keysight 8487A 2.4 mm Power Sensor; E-COM-M-0002-GE: Comparison Measurement
[1] RF Power Sensor – Calibration Factor (75 Ω, Type N Sensors)	100 kHz to 50 MHz 50 MHz 50 MHz to 2 GHz	1.2 % of reading Reference 1.2 % of reading	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 8483A Type N Power Sensor; E-COM-M-0002-GE: Comparison measurement.
[1] RF Power Sensor – Power Linearity (3.5 mm and Type N Sensors)	50 MHz (-36 to -30) dBm (-29 to -25 dBm) (-24 to -15) dBm (-14 to -11) dBm (-10 to -7) dBm (-6 to -2) dBm -1 dBm 0 dBm (1 to 5) dBm (6 to 8) dBm (9 to 10) dBm (11 to 16) dBm (17 to 20) dBm	 0.49 % of reading 0.41 % of reading 0.36 % of reading 0.32 % of reading 0.35 % of reading 0.31 % of reading 0.16 % of reading Reference 0.16 % of reading 0.14 % of reading 0.16 % of reading 0.22 % of reading 0.24 % of reading	Keysight EPM442A, Keysight E4419B Power Meters; Keysight 11667A/11667B Power Splitters; Keysight 8481A, Keysight N8485A, Keysight E4412A, Keysight E4413A Power Sensors; E-COM-M-0002-GE: Comparison measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] RF Power Meter (Instrument Accuracy)	Watt Mode		Keysight 11683A Range Calibrator; E-COM-M-0003-GE: Comparison measurement.
	0 Test	20 nW	
	3.16 µW	0.66 % of reading	
	10 µW	0.31 % of reading	
	31.6 µW	0.19 % of reading	
	100 µW	0.14 % of reading	
	316 µW	0.14 % of reading	
	1 mW	0.13 % of reading	
	3.16 mW	0.14 % of reading	
	10 mW	0.13 % of reading	
	31.6 mW	0.14 % of reading	
	100 mW	0.18 % of reading	
[1] RF Power Meter (Instrument Accuracy)	dBm Mode (Absolute)		Keysight 11683A Range Calibrator; E-COM-M-0003-GE: Comparison measurement.
	-25 dBm	0.029 dB	
	-20 dBm	0.013 dB	
	-15 dBm	0.008 2 dB	
	-10 dBm	0.006 1 dB	
	-5 dBm	0.006 1 dB	
	0 dBm	0.005 6 dB	
	5 dBm	0.006 1 dB	
	10 dBm	0.005 6 dB	
	15 dBm	0.006 1 dB	
	20 dBm	0.007 8 dB	
	dB Mode (Relative)		
	-15 dB	0.029 dB	
	-10 dB	0.013 dB	
	-5 dB	0.008 2 dB	
	0 dB (-10 dBm Ref.)	Reference	
	5 dB	0.007 4 dB	
	10 dB	0.007 4 dB	
	15 dB	0.007 4 dB	
	20 dB	0.007 4 dB	
	25 dB	0.007 4 dB	
	30 dB	0.007 4 dB	

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[1] RF Power Meter (Reference Power)	1 mW 50 MHz	0.3 % of reading	Keysight 432A Power Meter; Keysight 478A/8478B Thermistor Mounts; Agilent 3458A 8.5 Digit Multimeter; E-COM-M-0003-GE: DC Substitution Method.
[1] Tuned RF Power – Measure Relative Power/Attenuation (50 Ω)	2.5 MHz to 1.3 GHz (0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -70) dB (-70 to -80) dB (-80 to -90) dB (-90 to -100) dB (-100 to -110) dB (-110 to -120) dB	 0.09 dB 0.1 dB 0.11 dB 0.12 dB 0.14 dB 0.16 dB 0.18 dB 0.2 dB 0.23 dB 0.25 dB 0.27 dB 0.36 dB	HP 8902A Measuring Receiver, HP 11722A Sensor Module; E-COM-G-0003-GE: Direct Measurement.
[1] Tuned RF Power – Measure Relative Power/Attenuation (50 Ω)	2.5 MHz to 1.3 GHz (0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -70) dB (-70 to -80) dB (-80 to -90) dB (-90 to -100) dB (-100 to -110) dB (-110 to -120) dB	 0.08 dB 0.09 dB 0.11 dB 0.12 dB 0.14 dB 0.16 dB 0.18 dB 0.2 dB 0.22 dB 0.25 dB 0.34 dB 0.36 dB	HP 8902A Measuring Receiver, HP 11792A Sensor Module, HP 11793A Microwave Converter; E-COM-G-0003-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Tuned RF Power – Measure Relative Power/Attenuation (50 Ω)	(1.3 to 12.4) GHz (0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -70) dB (-70 to -80) dB (-80 to -90) dB (-90 to -100) dB (-100 to -110) dB (12.4 to 26.5) GHz (0 to -10) dB (-10 to -20) dB (-20 to -30) dB (-30 to -40) dB (-40 to -50) dB (-50 to -60) dB (-60 to -70) dB (-70 to -80) dB (-80 to -90) dB (-90 to -100) dB	 0.1 dB 0.11 dB 0.12 dB 0.13 dB 0.15 dB 0.17 dB 0.19 dB 0.21 dB 0.23 dB 0.25 dB 0.34 dB 0.1 dB 0.11 dB 0.12 dB 0.14 dB 0.15 dB 0.17 dB 0.19 dB 0.21 dB 0.23 dB 0.25 dB	HP 8902A Measuring Receiver, HP 11792A Sensor Module, HP 11793A Microwave Converter; E-COM-G-0003-GE: Direct Measurement.
[1] Tuned RF Power – Measure Absolute Power (50 Ω)	2.5 MHz to 1.3 GHz (0 to -10) dBm (-10 to -20) dBm (-20 to -30) dBm (-30 to -40) dBm (-40 to -50) dBm (-50 to -60) dBm (-60 to -70) dBm (-70 to -80) dBm (-80 to -90) dBm (-90 to -100) dBm (-100 to -110) dBm (-110 to -120) dBm	 0.16 dB 0.16 dB 0.17 dB 0.18 dB 0.19 dB 0.21 dB 0.22 dB 0.24 dB 0.26 dB 0.28 dB 0.3 dB 0.34 dB	HP 8902A Measuring Receiver, HP 11722A Sensor Module; E-COM-G-0003-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Tuned RF Power – Measure Absolute Power (50 Ω)	2.5 MHz to 1.3 GHz		HP 8902A Measuring Receiver, HP 11792A Sensor Module, HP 11793A Microwave Converter; E-COM-G-0003-GE: Direct Measurement.
	(0 to -10) dBm	0.1 dB	
	(-10 to -20) dBm	0.12 dB	
	(-20 to -30) dBm	0.12 dB	
	(-30 to -40) dBm	0.14 dB	
	(-40 to -50) dBm	0.15 dB	
	(-50 to -60) dBm	0.17 dB	
	(-60 to -70) dBm	0.19 dB	
	(-70 to -80) dBm	0.21 dB	
	(-80 to -90) dBm	0.23 dB	
	(-90 to -100) dBm	0.25 dB	
	(-100 to -110) dBm	0.34 dB	
	(1.3 to 12.4) GHz		
	(0 to -10) dBm	0.14 dB	
	(-10 to -20) dBm	0.14 dB	
	(-20 to -30) dBm	0.14 dB	
	(-30 to -40) dBm	0.16 dB	
	(-40 to -50) dBm	0.17 dB	
	(-50 to -60) dBm	0.19 dB	
	(-60 to -70) dBm	0.20 dB	
	(-70 to -80) dBm	0.22 dB	
	(-80 to -90) dBm	0.24 dB	
	(-90 to -100) dBm	0.29 dB	
	(12.4 to 18) GHz		
	(0 to -10) dBm	0.2 dB	
	(-10 to -20) dBm	0.2 dB	
	(-20 to -30) dBm	0.21 dB	
	(-30 to -40) dBm	0.22 dB	
	(-40 to -50) dBm	0.23 dB	
	(-50 to -60) dBm	0.24 dB	
	(-60 to -70) dBm	0.25 dB	
	(-70 to -80) dBm	0.27 dB	
	(-80 to -90) dBm	0.29 dB	
	(-90 to -100) dBm	0.3 dB	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Tuned RF Power – Measure Absolute Power (50 Ω)	(18 to 26.5) GHz (0 to -10) dBm (-10 to -20) dBm (-20 to -30) dBm (-30 to -40) dBm (-40 to -50) dBm (-50 to -60) dBm (-60 to -70) dBm (-70 to -80) dBm (-80 to -90) dBm	 0.24 dB 0.24 dB 0.24 dB 0.25 dB 0.26 dB 0.27 dB 0.28 dB 0.3 dB 0.31 dB	HP 8902A Measuring Receiver, HP 11792A Sensor Module, HP 11793A Microwave Converter; E-COM-G-0003-GE: Direct Measurement.
[1] Distortion (DISTN), Signal-to-Noise Ratio and Distortion (SINAD) – Measure	(0 to 99.99) dB 20 Hz to 20 kHz (20 to 100) kHz	 1.2 dB 2.4 dB	HP 8903B Audio Analyzer; E-COM-G-0006-GE: Direct Measurement.
[1] Distortion (DISTN), Signal-to-Noise Ratio and Distortion (SINAD) – Source	20 Hz to 100 kHz (0 to 40) dB (40 to 100) dB	 0.2 dB 0.25 dB	Keysight 33250A, Keysight 33220A Function Generators; Keysight 355D VHF Step Attenuator; E-COM-M-0006-GE: Based on HP's Audio Analyzer Performance Test Method.
[1] Amplitude Modulation – Measure Freq: 150 kHz to 10 MHz Rate: (20 to 50) Hz	Modulation Depth < 40) % Depth (40 to 99) % Depth	 3.5 % of reading + 0.03 % Depth 3.5 % of reading + 0.3 % Depth	HP 8902A Measuring Receiver, HP 8901B Modulation Analyzer; E-COM-G-0004-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Amplitude Modulation – Measure	Modulation Depth		HP 8902A Measuring Receiver, HP 8901B Modulation Analyzer; E-COM-G-0004-GE: Direct Measurement.
Freq: 150 kHz to 10 MHz Rate: 50 Hz to 10 kHz	(5 to 40) % Depth (40 to 99) % Depth	2.4 % of reading + 0.03 % Depth 2.4 % of reading + 0.3 % Depth	
Freq: 10 MHz to 1.3 GHz Rate: (20 to 50) Hz	< 40) % Depth (40 to 99) % Depth	3.5 % of reading + 0.03 % Depth 3.5 % of reading + 0.3 % Depth	
Freq: 10 MHz to 1.3 GHz Rate: 50 Hz to 50 kHz	(5 to 40) % Depth (40 to 99) % Depth	1.2 % of reading + 0.03 % Depth 1.2 % of reading + 0.3 % Depth	
Freq: 10 MHz to 1.3 GHz Rate: (50 to 100) kHz	< 40) % Depth (40 to 99) % Depth	3.5 % of reading + 0.03 % Depth 3.5 % of reading + 0.3 % Depth	
Demodulated Distortion	≤ 50 % Depth ≤ 95 % Depth	0.35 % Distortion 0.70 % Distortion	
[1] Frequency Modulation – Measure	Modulation Deviation		HP 8902A Measuring Receiver, HP 8901B Modulation Analyzer; E-COM-G-0004-GE: Direct Measurement.
Freq: 250 kHz to 10 MHz Rate: 20 Hz to 10 kHz	< 5 kHz peak (5 to 40) kHz peak	2.4 % of reading + 3 Hz 2.4 % of reading + 30 Hz	
Freq: 250 kHz to 10 MHz Rate: (20 Hz to 50) Hz	< 5 kHz peak (5 to 40) kHz peak (40 to 400) kHz peak	5.8 % of reading + 3 Hz 5.8 % of reading + 30 Hz 5.8 % of reading + 0.3 kHz	
Freq: 10 MHz to 1.3 GHz Rate: 50 Hz to 100 kHz	< 5 kHz peak (5 to 40) kHz peak (40 to 400) kHz peak	1.2 % of reading + 3 Hz 1.2 % of reading + 30 Hz 1.2 % of reading + 0.3 kHz	
Freq: 10 MHz to 1.3 GHz Rate: (100 to 200) kHz	< 5 kHz peak (5 to 40) kHz peak (40 to 400) kHz peak	5.8 % of reading + 3 Hz 5.8 % of reading + 30 Hz 5.8 % of reading + 0.3 kHz	
Demodulated Distortion	≤ 10 kHz peak ≤ 100 kHz peak	0.12 % Distortion 0.12 % Distortion	

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[1] Phase Modulation – Measure	Deviation		
Freq: 150 kHz to 10 MHz	(1 to 4) rad	4.7 % of reading + 0.003 rad	
Rate: 200 Hz to 10 kHz	(4 to 40) rad	4.7 % of reading + 0.03 rad	HP 8902A
	(40 to 400) rad	4.7 % of reading + 0.3 rad	Measuring Receiver,
			HP 8901B
Freq: 10 MHz to 1.3 GHz	(1 to 4) rad	3.5 % of reading + 0.003 rad	Modulation Analyzer;
Rate: 200 Hz to 20 kHz	(4 to 40) rad	3.5 % of reading + 0.03 rad	E-COM-G-0004-GE:
	(40 to 400) rad	3.5 % of reading + 0.3 rad	Direct Measurement.
Demodulated Distortion	Dev. ≤4 00 rad	0.12 % of Distortion	
[1,5] Reflection Coefficient, S11/S22 – Measure (Type N, APC-7, APC-3.5, 2.4 mm) Reflection Phase Uncertainty is calculated as: arc-sine (Ur/Γ). If equation is undefined, uncertainty is ±180°.	Linear Magnitude		Keysight E5071C, Keysight 8753C, Keysight 8722ES Vector Network Analyzers; Keysight 85047A, Keysight 85047B S-Parameter Test Sets; Keysight 85050B, Keysight 85031B 7 mm Calibration Kits; Keysight 85052D, Keysight 85033D 3.5 mm Calibration Kits; Keysight 85054D, Keysight 85032B Type N Calibration Kits; Keysight 85056D 2.4 mm Calibration Kit; Keysight 85036B 75 Ω Calibration Kit; E-COM-G-0007-GE: Direct Measurement.
	(9 to 300) kHz		
	(0.001 to 0.01) linear	0.01	
	(0.01 to 0.1) linear	0.011	
	(0.1 to 0.2) linear	0.012	
	(0.2 to 0.3) linear	0.013	
	(0.3 to 0.4) linear	0.015	
	(0.4 to 0.5) linear	0.017	
	(0.5 to 0.6) linear	0.019	
	(0.6 to 0.7) linear	0.022	
	(0.7 to 0.8) linear	0.025	
	(0.8 to 0.9) linear	0.028	
	(0.9 to 0.99) linear	0.029	
	300 kHz to 50 MHz		
	(0.001 to 0.01) linear	0.002	
	(0.01 to 0.1) linear	0.003	
	(0.1 to 0.2) linear	0.004	
	(0.2 to 0.3) linear	0.005	
	(0.3 to 0.4) linear	0.006	
	(0.4 to 0.5) linear	0.007	
	(0.5 to 0.6) linear	0.008	
	(0.6 to 0.7) linear	0.009	
	(0.7 to 0.8) linear	0.011	
	(0.8 to 0.9) linear	0.012	
	(0.9 to 0.99) linear	0.013	

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[1,5] Reflection Coefficient, S11/S22 – Measure (Type N, APC-7, APC-3.5, 2.4 mm) Reflection Phase Uncertainty is calculated as: arc-sine (Ur/Γ). If equation is undefined, uncertainty is ±180°.	Linear Magnitude 50 MHz to 2 GHz (0.001 to 0.01) linear (0.01 to 0.1) linear (0.1 to 0.1) linear (0.2 to 0.3) linear (0.3 to 0.4) linear (0.4 to 0.5) linear (0.5 to 0.6) linear (0.6 to 0.7) linear (0.7 to 0.8) linear (0.8 to 0.9) linear (0.9 to 0.99) linear (2 to 8) GHz (0.001 to 0.01) linear (0.01 to 0.1) linear (0.1 to 0.2) linear (0.2 to 0.3) linear (0.3 to 0.4) linear (0.4 to 0.5) linear (0.5 to 0.6) linear (0.6 to 0.7) linear (0.7 to 0.8) linear (0.8 to 0.9) linear (0.9 to 0.99) linear (8 to 18) GHz (0.001 to 0.01) linear (0.01 to 0.1) linear (0.1 to 0.2) linear (0.2 to 0.3) linear (0.3 to 0.4) linear (0.4 to 0.5) linear (0.5 to 0.6) linear (0.6 to 0.7) linear (0.7 to 0.8) linear (0.8 to 0.9) linear (0.9 to 0.99) linear	 0.002 0.003 0.004 0.006 0.006 0.007 0.008 0.009 0.01 0.011 0.012 0.003 0.004 0.005 0.006 0.008 0.009 0.01 0.011 0.013 0.014 0.015 0.004 0.005 0.006 0.008 0.01 0.012 0.014 0.016 0.018 0.022 0.023	Keysight E5071C, Keysight 8753C, Keysight 8722ES Vector Network Analyzers; Keysight 85047A, Keysight 85047B S-Parameter Test Sets; Keysight 85050B, Keysight 85031B 7 mm Calibration Kits; Keysight 85052D, Keysight 85033D 3.5 mm Calibration Kits; Keysight 85054D, Keysight 85032B Type N Calibration Kits; Keysight 85056D 2.4 mm Calibration Kit; Keysight 85036B 75 Ω Calibration Kit; E-COM-G-0007-GE: Direct Measurement.

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[1,5] Reflection Coefficient, S11/S22 – Measure (Type N, APC-7, APC-3.5, 2.4 mm) Reflection Phase Uncertainty is calculated as: arc-sine (Ur/Γ). If equation is undefined, uncertainty is ±180°.	Linear Magnitude (18 to 20) GHz (0.001 to 0.01) linear (0.01 to 0.1) linear (0.1 to 0.2) linear (0.2 to 0.3) linear (0.3 to 0.4) linear (0.4 to 0.5) linear (0.5 to 0.6) linear (0.6 to 0.7) linear (0.7 to 0.8) linear (0.8 to 0.9) linear (0.9 to 0.99) linear (20 to 26.5) GHz (0.001 to 0.01) linear (0.01 to 0.1) linear (0.1 to 0.2) linear (0.2 to 0.3) linear (0.3 to 0.4) linear (0.4 to 0.5) linear (0.5 to 0.6) linear (0.6 to 0.7) linear (0.7 to 0.8) linear (0.8 to 0.9) linear (0.9 to 0.99) linear (26.5 to 40) GHz (0.001 to 0.01) linear (0.01 to 0.1) linear (0.1 to 0.2) linear (0.2 to 0.3) linear (0.3 to 0.4) linear (0.4 to 0.5) linear (0.5 to 0.6) linear (0.6 to 0.7) linear (0.7 to 0.8) linear (0.8 to 0.9) linear (0.9 to 0.99) linear	 0.015 0.018 0.021 0.026 0.031 0.037 0.044 0.051 0.06 0.07 0.074 0.032 0.034 0.038 0.044 0.050 0.058 0.068 0.078 0.089 0.1 0.11 0.050 0.056 0.065 0.075 0.089 0.1 0.12 0.14 0.16 0.18 0.19	Keysight E5071C, Keysight 8753C, Keysight 8722ES Vector Network Analyzers; Keysight 85047A, Keysight 85047B S-Parameter Test Sets; Keysight 85050B, Keysight 85031B 7 mm Calibration Kits; Keysight 85052D, Keysight 85033D 3.5 mm Calibration Kits; Keysight 85054D, Keysight 85032B Type N Calibration Kits; Keysight 85056D 2.4 mm Calibration Kit; Keysight 85036B 75 Ω Calibration Kits; E-COM-G-0007-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Transmission Coefficient, S21/S12 – Measure (Type N, APC-7, APC-3.5, 2.4 mm) Transmission phase uncertainty is calculated as: arcsine($10^{(Ut/20)}$ - 1). If equation is undefined, uncertainty is 180°.	Transmission Magnitude (9 to 300) kHz (-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 to 10) dB 300 kHz to 50 MHz (-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 to 10) dB (50 to 500) MHz (-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 to 10) dB 500 MHz to 2 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 to 10) dB	 0.27 dB 0.18 dB 0.13 dB 0.1 dB 0.08 dB 0.08 dB 0.07 dB 0.08 dB 0.27 dB 0.15 dB 0.1 dB 0.1 dB 0.08 dB 0.08 dB 0.07 dB 0.08 dB 0.30 dB 0.15 dB 0.1 dB 0.1 dB 0.082 dB 0.062 dB 0.053 dB 0.053 dB 0.30 dB 0.15 dB 0.1 dB 0.092 dB 0.082 dB 0.062 dB 0.043 dB 0.07 dB	Keysight E5071C, Keysight 8753C, Keysight 8722ES Vector Network Analyzers; Keysight 85047A, Keysight 85047B S-Parameter Test Sets; Keysight 85050B, Keysight 85031B 7 mm Calibration Kits; Keysight 85052D, Keysight 85033D 3.5 mm Calibration Kits; Keysight 85054D, Keysight 85032B Type N Calibration Kits; Keysight 85056D 2.4 mm Calibration Kit; Keysight 85036B 75 Ω Calibration Kits; E-COM-G-0007-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Transmission Coefficient, S21/S12 – Measure (Type N, APC-7, APC-3.5, 2.4 mm) Transmission phase uncertainty is calculated as: arcsine($10^{(Ut/20)}$ - 1). If equation is undefined, uncertainty is 180°.	(2 to 8) 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 to 10) dB (8 to 20) 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 to 10) dB Transmission Magnitude (20 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 to 10) dB (26.5 to 40) 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 to 10) dB	 0.37 dB 0.19 dB 0.13 dB 0.11 dB 0.092 dB 0.079 dB 0.070 dB 0.088 dB 0.37 dB 0.21 dB 0.17 dB 0.15 dB 0.13 dB 0.12 dB 0.11 dB 0.21 dB 0.92 dB 0.54 dB 0.43 dB 0.41 dB 0.37 dB 0.37 dB 0.37 dB 0.40 dB 0.99 dB 0.62 dB 0.55 dB 0.53 dB 0.50 dB 0.48 dB 0.49 dB 0.55 dB	Keysight E5071C, Keysight 8753C, Keysight 8722ES Vector Network Analyzers; Keysight 85047A, Keysight 85047B S-Parameter Test Sets; Keysight 85050B, Keysight 85031B 7 mm Calibration Kits; Keysight 85052D, Keysight 85033D 3.5 mm Calibration Kits; Keysight 85054D, Keysight 85032B Type N Calibration Kits; Keysight 85056D 2.4 mm Calibration Kit; Keysight 85036B 75 Ω Calibration Kits; E-COM-G-0007-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Attenuators – Measure (50 Ω, 75 Ω, 600 Ω)	(10 to 20) Hz		Keysight 33220A, Keysight 33250A Function Generators; Fluke 5790A/WB, Fluke 5790B/WB, 50 Ω, 75 Ω, 600 Ω Feedthrough Terminations; E-COM-G-0005-GE: Direct Measurement.
	(0 to 40) dB	0.007 dB	
	(40 to 50) dB	0.009 dB	
	(50 to 60) dB	0.012 dB	
	(60 to 70) dB	0.022 dB	
	(20 to 40) Hz		
	(0 to 40) dB	0.006 dB	
	(40 to 50) dB	0.008 dB	
	(50 to 60) dB	0.010 dB	
	(60 to 70) dB	0.017 dB	
	(40 to 20) kHz		
	(0 to 40) dB	0.006 dB	
	(40 to 50) dB	0.008 dB	
	(50 to 60) dB	0.009 dB	
	(60 to 70) dB	0.016 dB	
	(20 to 50) kHz		
	(0 to 40) dB	0.007 dB	
	(40 to 50) dB	0.009 dB	
	(50 to 60) dB	0.012 dB	
	(60 to 70) dB	0.022 dB	
	(50 to 100) kHz		
	(0 to 40) dB	0.007 dB	
	(40 to 50) dB	0.009 dB	
	(50 to 60) dB	0.014 dB	
	(60 to 70) dB	0.025 dB	
	(100 to 300) kHz		
	(0 to 40) dB	0.009 dB	
	(40 to 50) dB	0.012 dB	
	(50 to 60) dB	0.018 dB	
	(60 to 70) dB	0.040 dB	
	(300 to 500) kHz		
	(0 to 40) dB	0.011 dB	
	(40 to 50) dB	0.015 dB	
	(50 to 60) dB	0.026 dB	
	(60 to 70) dB	0.064 dB	
	500 kHz to 1 MHz		
	(0 to 40) dB	0.018 dB	
	(40 to 50) dB	0.028 dB	
	(50 to 60) dB	0.044 dB	
	(60 to 70) dB	0.082 dB	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Site Masters, Cable and Antenna Analyzers			Frequency Counter, Frequency Standard, RF Power Meter, RF Power Sensor, RF Coaxial Attenuator; E-COM-M-0004-GE: Direct Measurement.
Frequency – Measure	50 kHz to 3 GHz (3 to 6) GHz	1.4 nHz/Hz 1.6 nHz/Hz	
Test Power – Measure	10 MHz to 6 GHz (-30 to +10) dBm (+10 to +20) dBm	 0.10 dB 0.15 dB	
[1,5] Site Masters, Cable and Antenna Analyzers			Calibration Kits, Attenuators; E-COM-M-0004-GE: Direct Measurement.
S11/S22 Mag/ VSWR Measurement	50 MHz to 2 GHz @VSWR 1.000:1 to 1.060:1 1.060:1 to 1.222:1 1.222:1 to 1.288:1 1.288:1 to 1.499:1 1.499:1 to 1.671:1 1.671:1 to 1.925:1 1.925:1 to 2.323:1 2.323:1 to 3.010:1 3.010:1 to 4.419:1 4.419:1 to 8.724:1 (2 to 6) GHz @VSWR 1.000:1 to 1.060:1 1.060:1 to 1.222:1 1.222:1 to 1.288:1 1.288:1 to 1.499:1 1.499:1 to 1.671:1 1.671:1 to 1.925:1 1.925:1 to 2.323:1 2.323:1 to 3.010:1 3.010:1 to 4.419:1 4.419:1 to 8.724:1	 0.012 0.044 0.054 0.062 0.072 0.091 0.13 0.20 0.47 2.0 0.028 0.071 0.076 0.089 0.12 0.14 0.18 0.28 0.69 3.1	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,5] Site Masters, Cable and Antenna Analyzers S12/S21 Cable Loss Measurement	50 MHz to 2 GHz (0 to 3) dB (3 to 6) dB (6 to 10) dB (10 to 20) dB (20 to 30) dB (2 to 6) GHz (0 to 3) dB (3 to 6) dB (6 to 10) dB (10 to 20) dB (20 to 30) dB	 0.22 dB 0.24 dB 0.26 dB 0.28 dB 0.38 dB 0.32 dB 0.34 dB 0.36 dB 0.38 dB 0.44 dB	Calibration Kits, Attenuators; E-COM-M-0004-GE: Direct Measurement.
[1,6] Amplitude Modulation – Source AM Calibrator Residual AM AM Distortion	Rate: 10 kHz 33.33 % Depth Freq: (10.3 to 14.7) MHz Residual AM≤0.01% rms Freq: (11 to 13.5) MHz Rate: 20 Hz to 20 kHz AM: (0 to 50) % Depth Distortion ≤0.6% THD AM: (50 to 99) % Depth Distortion ≤0.6% THD Rate: (20 to 100) kHz AM: (0 to 50) % Depth Distortion ≤0.6% THD AM: (50 to 99) % Depth Distortion ≤0.6% THD	 0.28 % relative 0.004 % rms 0.060 % THD 0.12 % THD 0.066 % THD 0.12 % THD	HP 11715A AM/FM Test Source; HP 8903B Audio Analyzer; Agilent 33220A/33250A Function Generators; E-COM-M-0005-GE: Based on HP Measuring Receiver / Modulation Analyzer's Performance Tests.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Amplitude Modulation – Source			
AM Flatness (Relative to 1 kHz Rate)	Freq: (11 to 13.5) MHz AM: (0 to 99) % Depth Rate: 50 Hz to 50 kHz Rate: 20 Hz to 100 kHz	 0.32 % of reading 0.42 % of reading	HP 11715A AM/FM Test Source; HP 8903B Audio Analyzer; Agilent 33220A/33250A Function Generators; E-COM-M-0005-GE: Based on HP Measuring Receiver / Modulation Analyzer's Performance Tests.
AM Accuracy	Freq: (11 to 13.5) MHz Rate: 20 Hz to 100 kHz Up to 95 % Depth (95 to 99) % Depth	 0.32 % of reading 0.38 % of reading	
AM Rejection	Rejection with FM ≤ 20 Hz ΦM ≤ 0.03 rad	 3.6 Hz 0.005 rad	
[1,6] Frequency Modulation – Source			
Residual FM	Freq: 560 MHz ± 50 kHz Residual FM ≤ 4 Hz	 1.5 Hz	HP 11715A AM/FM Test Source; HP 8903A Audio Analyzer; Agilent 33250A Function Generator; E-COM-M-0005-GE: Based on HP Measuring Receiver / Modulation Analyzer's Performance Tests.
FM Calibrator	Rate: 10 kHz FM: 34 kHz Deviation	 0.17 % of reading	
FM Modulation (Peak) Rate Distortion			
Freq: (11 to 13.5) MHz Rate: 20 Hz to 10 kHz	FM: Up to 12.5 kHz Dev. Distortion ≤ 0.1 % THD	 0.030 % THD	
Freq: (88 to 108) MHz Rate: 20 Hz to 100 kHz	FM: Up to 100 kHz Dev. Distortion ≤ 0.1 % THD	 0.034 % THD	
Freq: (352 to 425) kHz Rate: 20 Hz to 100 kHz	FM: Up to 400 kHz Dev. Distortion ≤ 0.1 % THD	 0.033 % THD	

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[1,6] Frequency Modulation – Source FM Accuracy (Peak) Freq: (11 to 13.5) MHz Rate: 20 Hz to 10 kHz	FM: Up to 12.5 kHz Dev.	0.34 % of reading	HP 11715A AM/FM Test Source; HP 8903A Audio Analyzer; Agilent 33250A Function Generator; E-COM-M-0005-GE: Based on HP Measuring Receiver / Modulation Analyzer's Performance Tests.
Freq: (88 to 108) MHz Rate: 20 Hz to 100 kHz	Up to 100 kHz Dev.	0.32 % of reading	
Freq: (352 to 425) kHz Rate: 20 Hz to 100 kHz	Up to 400 kHz Dev.	0.32 % of reading	
FM Rejection	Rejection with AM ≤ 0.2 % Depth	0.094 % Depth	
[1] Phase Modulation – Source ΦM Accuracy Relation between peak ΦM Deviation and peak FM Deviation is: ΦM Dev. = FM Dev./Rate (FM Frequency Values are Peak)	Freq: (11 to 13.5) MHz Rate: 20 Hz to 10 kHz FM: Up to 12.5 kHz Dev. ΦM: Up to 400 rad Dev.	0.32 % of reading	HP 11715A AM/FM Test Source; HP 8903A Audio Analyzer; Agilent 33250A Function Generator; E-COM-M-0005-GE: Based on HP Measuring Receiver / Modulation Analyzer's Performance Tests.
	Freq: (88 to 108) MHz Rate: 20 Hz to 100 kHz FM: Up to 100 kHz Dev. ΦM: Up to 400 rad Dev.	0.32 % of reading	
	Freq: (352 to 425) MHz Rate: 20 Hz to 100 kHz FM: Up to 400 kHz Dev. ΦM: Up to 400 rad Dev.	0.32 % of reading	

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[1] Phase Modulation – Source ΦM Modulation Rate Distortion (FM Frequency Values are Peak)	Freq: (11 to 13.5) MHz Rate: 20 Hz to 10 kHz FM: Up to 12.5 kHz Dev. ΦM: Up to 400 rad Dev. Distortion ≤ 0.1 % THD Freq: (88 to 108) MHz Rate: 20 Hz to 100 kHz FM: Up to 100 kHz Dev. ΦM: Up to 400 rad Dev. Distortion ≤ 0.1 % THD Freq: (352 to 425) MHz Rate: 20 Hz to 100 kHz FM: Up to 400 kHz Dev. ΦM: Up to 400 rad Dev. Distortion ≤ 0.1 % THD	0.034 % THD 0.042 % THD 0.042 % THD	HP 11715A AM/FM Test Source; HP 8903A Audio Analyzer; Agilent 33250A Function Generator; E-COM-M-0005-GE: Based on HP Measuring Receiver / Modulation Analyzer's Performance Tests.
[1] Audio Filters – Source (Low and High Pass Filters)	Freq: (88 to 108) MHz Rate: 20 Hz to 100 kHz FM: Up to 100 kHz $_{peak}$ Dev. Up to 1 % Flatness	0.32 % Flatness	HP 11715A AM/FM Test Source; HP 8903A Audio Analyzer; Agilent 33250A Function Generator; E-COM-M-0005-GE: Based on HP Measuring Receiver / Modulation Analyzer's Performance Tests.
[1] Audio Residual Noise and Distortion – Source Bandwidth: 20 Hz to 50 kHz	Level: Up to < 1 Vp-p Up to 3 % Distortion Level: ≥ to 8 Vp-p Up to 3 % Distortion	0.04 % Distortion 0.06 % Distortion	Agilent 33250A Function Generator; E-COM-M-0005-GE.

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[1] Audio Distortion – Source Freq: 20 Hz to 1 kHz Level: Up to 8 Vp-p	Up to 0.12 % Distortion	0.03 % Distortion	Agilent 33250A Function Generator, HP 8903A Audio Analyzer; E-COM-M-0005-GE: Based on HP Modulation Analyzer's Performance Tests.
[1] Input Return Loss / SWR – Measure (Sensor Module's, Sensor Module Thru-Path's, and Input's SWR)	Freq: 5 MHz to 2 GHz RL > 14 dB	2.8 dB	Wiltron 60N50 SWR Bridge, Keysight 8593E Spectrum Analyzer, Keysight ESG-4000A RF Signal Generator; E-COM-M-0005-GE.
[1] Tuned RF Level / Attenuation – Source Detector Linearity	30 MHz, 50 MHz 10 dB	0.37 % of reading	Reference RF Coaxial Attenuator Set, Keysight ESG-4000A RF Signal Generator; E-COM-M-0007-GE.
IF Range-to-Range Accuracy	30 MHz, 50 MHz		
	10 dB	0.35 % of reading	
	20 dB	0.36 % of reading	
	30 dB	0.37 % of reading	
	40 dB	0.41 % of reading	
	50 dB	0.51 % of reading	
	60 dB	0.55 % of reading	
Relative Level Accuracy	30 MHz, 50 MHz		
	-100 dB	0.063 dB	
	-90 dB	0.061 dB	
	-80 dB	0.060 dB	
	-70 dB	0.059 dB	
	-60 dB	0.048 dB	
	-50 dB	0.045 dB	
	-40 dB	0.036 dB	
	-30 dB	0.032 dB	
	-20 dB	0.032 dB	
	-10 dB	0.030 dB	
	0 dB	Reference	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Spectrum and Signal Analyzers – Source			
Display Linearity or Scale Fidelity Accuracy Test	50 MHz Displayed Scale Ranges (0 to 70) dB (70 to 100) dB	 0.08 dB 0.09 dB	
Reference Level Accuracy Test	50 MHz Reference Level Ranges (+10 to -60) dBm (-60 to -100) dBm	 0.08 dB 0.09 dB	Signal Generators, Step Attenuators, Coaxial Terminators; E-COM-M-0008-GE
Noise Floor or Displayed Average Noise Level (DANL) Test	9 kHz to 40 GHz DANL ≤ -60 dBm	 1.2 dB	
Input Attenuator Test	50 MHz Attenuator Ranges (0 to 100) dB	 0.12 dB	

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[1] Spectrum and Signal Analyzers – Source Frequency Span Test	9 kHz to 40 GHz Frequency Span Ranges		Signal Generators, Rubidium Frequency Standard; E-COM-M-0008-GE
	(1 to 3) kHz	0.002 % of reading	
	(3 to 5) kHz	0.0012 % of reading	
	(5 to10) kHz	0.005 8 % of reading	
	(10 to 30) kHz	0.002 0 % of reading	
	(30 to 50) kHz	0.001 2 % of reading	
	(50 to 100) kHz	0.005 8 % of reading	
	(100 to 300) kHz	0.002 0 % of reading	
	(300 to 500) kHz	0.001 2 % of reading	
	500 kHz to 1 MHz	0.005 8 % of reading	
	(1 to 3) MHz	0.002 0 % of reading	
	(3 to 5) MHz	0.001 2 % of reading	
	(5 to 10) MHz	0.005 9 % of reading	
	(10 to 30) MHz	0.002 2 % of reading	
	(30 to 50) MHz	0.001 5 % of reading	
	(50 to 100) MHz	0.001 2 % of reading	
	(100 to 300) MHz	0.001 2 % of reading	
	(300 to 500) MHz	0.001 2 % of reading	
	500 MHz to 1 GHz	0.001 2 % of reading	
	(1 to 3) GHz	0.042 % of reading	
	(3 to 5) GHz	0.042 % of reading	
	(5 to 10) GHz	0.045 % of reading	
	(10 to 30) GHz	0.075 % of reading	
	(30 to 40) GHz	0.15 % of reading	

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[1] Spectrum and Signal Analyzers – Source			Signal Generators, Rubidium Frequency Standard; E-COM-M-0008-GE
Sweep Time Accuracy Test	Sweep Time Ranges		
	1 µs to 100 ms	0.058 % of reading	
	100 ms to 1 s	0.058 % of reading	
	(1 to 10) s	0.058 % of reading	
	(10 to 100) s	0.058 % of reading	
Resolution Bandwidth Test(RBW 3 dB)	9 kHz to 40 GHz RBW Ranges		
	10 Hz to 300 kHz	1.7 % of reading	
	300 kHz to 3 MHz	1.8 % of reading	
	(3 to 10) MHz	1.9 % of reading	
Selectivity Test (RBW 60:3 dB)	9 kHz to 40 GHz Selectivity ≤ 16:1 RBW Ranges		
	10 Hz to 10 MHz	3.8 % of reading	
Resolution Bandwidth Switching Test	9 kHz to 40 GHz RBW Ranges		
	10 Hz to 10 MHz	0.04 dB	
Noise Sideband Test	f_c: ≤ 500 MHz Offset 10 Hz to 10 MHz		
	Noise ≤ -80 dBc/Hz	0.68 dB	
Residual FM Test	f_c: 9 kHz to 40 GHz RBW 300 Hz to 3 kHz Span 10 Hz to 1 GHz		
	Residual FM ≤ 500 Hz	4.6 Hz	

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[1] Spectrum and Signal Analyzers – Source Harmonic Distortion Test	f_c: 9 kHz to 40 GHz Harmonic ≤ -30 dBc	0.62 dB	Signal Generators, Rubidium Frequency Standard, Low Pass Filter Set, Directional Coupler; E-COM-M-0008-GE
Third-Order Intermodulation Intercept Test	f_c: (1 to 18) GHz T.O.I. > 5 dBm	1.4 dB	
Gain Compression Test	f_c: (1 to 18) GHz RBW Ranges 10 Hz to 10 MHz	0.17 dB	

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Gauge Block (Steel, Ceramic, Tungsten Carbide)	(0.1 to 10) mm (10 to 25) mm (25 to 50) mm (50 to 75) mm (75 to 100) mm	0.07 µm 0.08 µm 0.09 µm 0.12 µm 0.15 µm	Master Gauge Blocks, Gauge Block Comparator; D-0001-GE: based on JIS B 7506:2004 by Mechanical Comparison.
Long Gauge Block (Steel, Ceramic, Tungsten Carbide)	(100 to 125) mm (125 to 150) mm (150 to 175) mm (175 to 200) mm (200 to 250) mm (250 to 300) mm (300 to 400) mm (400 to 500) mm	0.19 µm 0.21 µm 0.22 µm 0.24 µm 0.26 µm 0.32 µm 0.42 µm 0.49 µm	Long Gauge Blocks, ULM; D-0006-GE: based on JIS B 7506:2004 by Mechanical Comparison.
[1] Depth Micro-Checker	Up to 150) mm (150 to 300) mm	0.6 µm 0.8 µm	Gauge Blocks, Surface Plate, Electrical Comparator; D-0020-GE: Comparison with Gauge Block.
[1] Height Master	Block Accuracy Up to 300 mm (300 to 450) mm (450 to 600) mm Micrometer Head Up to 25 mm	 1.2 µm 1.3 µm 1.4 µm 1.4 µm	Gauge Blocks, Surface Plate, Electrical Comparator; D-0021-GE: Based on ISO 7863 (1984).

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Length – Dimensional Metrology

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[1] Riser Block	150 mm 250 mm 300 mm 600 mm	1.2 µm 1.2 µm 1.2 µm 1.4 µm	Gauge Blocks, Surface Plate, Electrical Comparator; D-0044-GE: based on ISO 7863 (1984).
[1] Caliper Checker/Check Master	Up to 360 mm (360 to 670) mm (670 to 1 000) mm	1.3 µm 1.4 µm 1.6 µm	Gauge Blocks, Surface Plate, Electrical Comparator; D-0017-GE: Comparison with Gauge Block.
[1] High Accuracy Micrometer Resolution 0.000 1 mm	Up to 7.7 mm (>7.7 to 17.6) mm (>17.6 to 22.8) mm (>22.8 to 25) mm	0.2 µm 0.2 µm 0.2 µm 0.3 µm	Gauge Blocks; D-0043-GE: Based on JIS B 7502:2016.
[1]Micrometer Head	Up to 50 mm	1 µm	Gauge Block, D-0049-GE: based on JIS B 7502:2016
[1] V-Anvil Micrometer	(1 to 40) mm (40 to 100) mm	2 µm 3 µm	Standard Pin Gauges, Limit Plug Gauges, Gauge Blocks; D-0053-GE: Based on JIS B 7502:2016.
[1] Micrometer for External Measurement	Up to 125 mm (125 to 275) mm (275 to 425) mm (425 to 500) mm	1 µm 2 µm 3 µm 4 µm	Gauge Blocks; D-0002-GE: Based on JIS B 7502:2016.
[1] Disk Micrometer/Tooth Thickness Micrometer	Up to 100 mm (100 to 275) mm (275 to 300) mm	1 µm 2 µm 3 µm	Gauge Blocks; D-0068-GE: Based on JIS B 7502:2016.
[1] Indicating Micrometer	Up to 100 mm	1 µm	Gauge Blocks; D-0003-GE: Based on JIS B 7520:1981.
[1] Micrometer for Internal Measurement/ Tubular Inside Micrometer	(5 to 125) mm (125 to 275) mm (275 to 400) mm (400 to 500) mm	1 µm 2 µm 3 µm 4 µm	Gauge Blocks; D-0009-GE: Based on JIS B 7502:2016.

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Tubular Inside Micrometer	(50 to 75) mm (75 to 100) mm (100 to 125) mm (125 to 150) mm (150 to 175) mm (175 to 200) mm (200 to 225) mm (225 to 250) mm (250 to 275) mm (275 to 300) mm (300 to 325) mm (325 to 350) mm (350 to 375) mm (375 to 400) mm (400 to 425) mm (425 to 450) mm (450 to 475) mm (475 to 500) mm	0.8 µm 0.8 µm 0.9 µm 1 µm 1.1 µm 1.2 µm 1.3 µm 1.4 µm 1.5 µm 1.6 µm 1.8 µm 1.8 µm 1.9 µm 1.9 µm 2.2 µm 2.2 µm 2.2 µm 2.3 µm	Universal Length Measuring Machine; D-0052-GE: Based on JIS B 7502:2016.
[1] Holtest/Boremetic/3-Point Internal Micrometer	(2 to 100) mm (100 to 200) mm	1 µm 2 µm	Ring Gauges; D-0019-GE: based on DIN 863-4:1999-04.
[1] Depth Micrometer	Up to 100 mm (100 to 150) mm (150 to 225) mm (225 to 300) mm	2 µm 3 µm 4 µm 5 µm	Gauge Blocks, Depth Micro-Checker; D-0012-GE: Based on JIS B 7544:1994.
Micrometer Standard/Setting Standard for External Micrometer	Up to 25 mm (25 to 50) mm (50 to 75) mm (75 to 100) mm (100 to 125) mm (125 to 150) mm (150 to 175) mm (175 to 200) mm	0.3 µm 0.4 µm 0.5 µm 0.6 µm 0.7 µm 0.8 µm 1 µm 1.1 µm	Universal Length Measuring Machine; D-0023-GE: Direct Measurement.

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Micrometer Standard/Setting Standard for External Micrometer	(200 to 225) mm (225 to 250) mm (250 to 275) mm (275 to 300) mm (300 to 325) mm (325 to 350) mm (350 to 375) mm (375 to 400) mm (400 to 425) mm (425 to 450) mm (450 to 475) mm (475 to 500) mm	1.2 µm 1.3 µm 1.4 µm 1.5 µm 1.7 µm 1.7 µm 1.8 µm 2 µm 2.1 µm 2.1 µm 2.2 µm 2.4 µm	Universal Length Measuring Machine; D-0023-GE: Direct Measurement.
[1] Vernier, Dial and Digital Height Gauges	Resolution ≥ 0.01 mm Up to 600 mm (600 to 1 000) mm Resolution 0.005 mm Up to 300 mm (300 to 1 000) mm	 18 µm 19 µm 10 µm 12 µm	Gauge Blocks, Caliper Checker, Surface Plate; D-0005-GE: Based on JIS B 7517:2018.
[1] Vernier, Dial and Digital Calipers (External, Internal and Depth Measurements)	Resolution ≥ 0.01 mm Up to 1 500 mm (1 500 to 2 500) mm	 20 µm 30 µm	Gauge Blocks, Caliper Checker, Surface Plate; D-0004-GE: Based on JIS B 7507:2016.
[1] Precision Digital Calipers (External, Internal and Depth Measurements)	Resolution 0.001 mm Up to 50 mm (50 to 100) mm (100 to 150) mm Resolution 0.005 mm Up to 150 mm (150 to 200) mm (200 to 300) mm	 2 µm 2 µm 2 µm 7 µm 7 µm 7 µm	Gauge Blocks, Surface Plate; D-0070-GE: Direct Measurement.
[1] Linear Height Gauge	Resolution ≤ 0.001 mm Up to 50 mm (50 to 100) mm (100 to 200) mm (200 to 300) mm (300 to 400) mm (400 to 500) mm (500 to 600) mm	 1 µm 1 µm 1 µm 1 µm 1 µm 2 µm 2 µm	Gauge Blocks; D-0050-GE: Based on JIS B 7517:2018.

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Dial and Digital Depth Gauge	Up to 12 mm (12 to 30) mm	2 µm 3 µm	Gauge Blocks, Surface Plate; D-0069-GE: Direct Measurement.
[1] Vernier, Dial and Digital Depth Gauge	Up to 300 mm (300 to 600) mm (600 to 1 000) mm	20 µm 20 µm 20 µm	Gauge Blocks, Caliper Checker, Surface Plate; D-0031-GE: Based on JIS B 7518:2018.
[1] Dial and Digital Indicator	Up to 2 mm (2 to 10) mm (10 to 25) mm (25 to 50) mm (50 to 75) mm (75 to 100) mm	0.6 µm 0.8 µm 1.2 µm 1.5 µm 1.6 µm 1.8 µm	Calibration Tester, Gauge Blocks; D-0010-GE: Based on JIS B 7503:2017.
[1] Dial Test Indicator (Lever Type)	Up to 1.6 mm (1.6 to 3) mm	0.6 µm 1.3 µm	Calibration Tester; D-0011-GE: Based on JIS B 7533:2015.
[1] Dial and Digital Thickness Gauge	Up to 100 mm	1 µm	Gauge Blocks; D-0008-GE: Direct Measurement.
[1] Bore Gauge/Cylinder Gauge	(6 to 100) mm (100 to 160) mm (160 to 250) mm (250 to 400) mm (400 to 600) mm	1 µm 2 µm 3 µm 4 µm 7 µm	Gauge Blocks, Calibration Tester; D-0042-GE: Based on JIS B 7515:1982.
[1] External Caliper Gauge	Up to 10 mm (10 to 20) mm (20 to 50) mm (50 to 100) mm (100 to 300) mm	2 µm 3 µm 5 µm 20 µm 30 µm	Gauge Blocks; D-0045-GE: Direct Measurement.
[1] Internal Caliper Gauge	(2.5 to 15) mm (15 to 180) mm	2 µm 6 µm	Gauge Block; D-0046-GE: Direct Measurement.
[1]Metal Rule	Up to 150 mm (150 to 300) mm (300 to 450) mm (450 to 600) mm (600 to 1 000) mm (1 000 to 2 000) mm (2 000 to 3 000) mm	14 µm 15 µm 16 µm 17 µm 19 µm 27 µm 35 µm	Scale Calibrator or Linear Scale with Digital Reading; D-0027-GE: Based on JIS B 7516:2005.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Steel Tape Measure	Up to 1 000 mm (1 000 to 3 000) mm (3 000 to 5 000) mm (5 000 to 7 000) mm (7 000 to 8 000) mm (8 000 to 10 000) mm (10 000 to 15 000) mm (15 000 to 20 000) mm (20 000 to 25 000) mm (25 000 to 30 000) mm (30 000 to 35 000) mm (35 000 to 40 000) mm (40 000 to 45 000) mm (45 000 to 50 000) mm	60 µm 70 µm 80 µm 90 µm 0.1 mm 0.11 mm 0.15 mm 0.19 mm 0.23 mm 0.27 mm 0.31 mm 0.35 mm 0.39 mm 0.43 mm	Scale Calibrator or Linear Scale with Digital Reading; D-0036-GE: Based on JIS B 7512:2018.
[1] Textile Tape	Up to 1 000 mm (1 000 to 2 000) mm (2 000 to 3 000) mm (3 000 to 4 000) mm (4 000 to 5 000) mm (5 000 to 6 000) mm (6 000 to 7 000) mm (7 000 to 8 000) mm (8 000 to 9 000) mm (9 000 to 10 000) mm (10 000 to 15 000) mm (15 000 to 20 000) mm (20 000 to 25 000) mm (25 000 to 30 000) mm (30 000 to 35 000) mm (35 000 to 40 000) mm (40 000 to 45 000) mm (45 000 to 50 000) mm	0.13 mm 0.14 mm 0.16 mm 0.19 mm 0.22 mm 0.25 mm 0.28 mm 0.31 mm 0.35 mm 0.38 mm 0.55 mm 0.72 mm 0.9 mm 1.1 mm 1.3 mm 1.5 mm 1.6 mm 1.8 mm	Scale Calibrator or Linear Scale with Digital Reading; D-0040-GE: Based on JIS B 7522:2016.
[1] Feeler Gauge (Thickness and Camber)	(0.01 to 1) mm (1 to 2) mm (2 to 3) mm (3 to 5) mm	0.4 µm 0.4 µm 0.5 µm 0.5 µm	Digital Indicator with Stand; D-0007-GE: Based on JIS B 7524:2008.
[1] Screw Pitch Gauge	(0.1 to 4) mm (4 to 10) mm (10 to 20) mm	10 µm 14 µm 20 µm	Portable Digital Microscope; D-0047-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Radius Gauge (Convex and Concave)	(0.1 to 4) mm (4 to 10) mm (10 to 20) mm	0.01 mm 0.014 mm 0.02 mm	Portable Digital Microscope; D-0048-GE: Direct Measurement.
[1] Protractor/Inclinometer Up to 300 mm	(-90 to 90)°	0.02°	Angle Blocks; D-0055-GE: Direct Measurement.
[1] Digital Microscope Angle Measurement	(-90 to 180)°	0.04°	Angle Blocks; D-0055-GE: Direct Measurement.
[1] Angle Block, Angle of Object	(-0.1 to 90)°	0.08°	Digital Protractor; D-0067-GE: Direct Measurement.
[1] Angle Block, Angle of Object	(-180 to 180)°	0.12°	Digital Microscope; D-0067-GE: Direct Measurement.
[1] Precision Level, Electric Level	Up to 5 mm/m	8 µm/m	Small Angle Generator; D-0022-GE: Based on JIS B 7510:1993.
Taper Gauge (Scale Type)	Up to 60 mm	12 µm	ULM w/ Magnification Scale by Digital Microscope; D-0041-GE: Direct Measurement.
[1] Taper Gauge (Scale Type)	Up to 60 mm	14 µm	Linear Scale with Digital Reading; D-0041-GE: Direct Measurement.
Precision Square, Master Square	Up to 150 mm (150 to 250) mm (250 to 350) mm (350 to 450) mm	5 µm 5.2 µm 5.4 µm 5.6 µm	Master Square Gauge, Surface Plate, Electrical Comparator; D-0032-GE: Based on JIS B 7526:1995.
Scale Loupe, Micrometer Microscope	Up to 20 mm	1 µm	ULM w/ Magnification Scale by Digital Microscope; D-0034-GE: Based on JIS B 7150:1993.
[1] Scale Loupe, Micrometer Microscope	Up to 20 mm	1 µm	Standard Glass Scale; D-0034-GE: Based on JIS B 7150:1993.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Glass Scale, Objective Micrometer Calibrator	Up to 1 mm (1 to 50) mm (50 to 100) mm (100 to 150) mm (150 to 200) mm (200 to 300) mm	0.28 µm 0.34 µm 0.58 µm 0.82 µm 1.2 µm 1.5 µm	ULM with Magnification Scale by Digital Microscope, D-0033-GE: based on JIS B 7541:2001
[1] Glass Scale, Objective Micrometer Calibrator	Up to 200 mm (200 to 500) mm (500 to 1 000) mm	2 µm 3 µm 4 µm	Linear Scale with Digital Reading; D-0033-GE: Based on JIS B 7541:2001.
Optical Flat (Diameter ≤ 60 mm)	Flatness Up to 10 µm	0.04 µm	Master Optical Flat, NIMT Flatness Tester; D-0035-GE: Based on JIS B 7430:1977.
Optical Parallel (Diameter ≤ 60 mm)	Flatness Up to 10 µm Parallelism Up to 10 µm Thickness (12 to 41) mm	0.04 µm 0.06 µm 0.22 µm	Master Optical Flat, NIMT Flatness Tester, Gauge Block and Gauge Block Comparator; D-0035-GE: Based on JIS B 7431:1977.
[1] Electrical Comparator, Linear Gauge, Mu-Checker	Up to 1 mm (1 to 5) mm (5 to 10) mm (10 to 15) mm (15 to 20) mm (20 to 25) mm (25 to 30) mm (30 to 40) mm (40 to 50) mm	0.08 µm 0.09 µm 0.11 µm 0.15 µm 0.18 µm 0.22 µm 0.25 µm 0.32 µm 0.38 µm	Gauge Blocks, Calibration Tester, Digital Linear Gauge; D-0015-GE: Based on JIS B 7536:1982.
[1] Calibration Tester, Dial Gauge Tester	Up to 10 mm (10 to 20) mm (20 to 30) mm (30 to 50) mm (50 to 70) mm (70 to 90) mm (90 to 100) mm	0.3 µm 0.4 µm 0.5 µm 0.6 µm 0.7 µm 0.8 µm 0.9 µm	Digital Linear Gauge; D-0016-GE: Direct Measurement.
[1] Laser Scan Micrometer	Up to 10 mm (10 to 30) mm	0.5 µm 0.6 µm	Standard Pin Gauge; D-0051-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Plain Plug Gauge	(1 to 10) mm (10 to 25) mm (20 to 50) mm (50 to 75) mm (75 to 100) mm	0.2µm 0.3 µm 0.4 µm 0.5 µm 0.6 µm	ULM; D-0026-GE: Based on JIS B 7420:1997.
[1] Plain Plug Gauge	(1 to 10) mm (10 to 30) mm	0.6 µm 0.7 µm	Standard Pin Gauges, Laser Scan Micrometer; D-0013-GE: Based on JIS B 7420:1997.
[1] Plain Plug Gauge	(1 to 10) mm (10 to 30) mm	0.3 µm 0.4 µm	High Accuracy Digital Micrometer; D-0013-GE: Based on JIS B 7420:1997.
Pin Gauge, 3-Wire/Thread Wire	(0.1 to 10) mm (10 to 25) mm (20 to 50) mm (50 to 75) mm (75 to 100) mm	0.2 µm 0.3 µm 0.4 µm 0.5 µm 0.6 µm	ULM; D-0025-GE: based on JIS B 0271:2004
[1] Pin Gauge, 3-Wire/Thread Wire	(0.1 to 10) mm (10 to 30) mm	0.6 µm 0.7 µm	Standard Pin Gauges, Laser Scan Micrometer, D-0014-GE: Based on JIS B 0271:2004.
[1] Pin Gauge, 3-Wire/Thread Wire	(0.1 to 20) mm (20 to 25) mm	0.3 µm 0.4 µm	High Accuracy Digital Micrometer, D-0014-GE: Based on JIS B 0271:2004.
Cylindrical Ring Gauge	(3 to 50) mm (50 to 75) mm (75 to 100) mm (100 to 125) mm (125 to 150) mm (150 to 175) mm (175 to 200) mm	0.5 µm 0.6 µm 0.7 µm 0.8 µm 0.9 µm 1 µm 1.2 µm	Standard Ring Gauges, ULM; D-0028-GE: Based on EURAMET/cg-06/v.02.
Thread Ring Gauge (Pitch Diameter)	(M3 to M24) mm (M24 to M48) mm (M48 to M74) mm (M74 to M98) mm (M98 to M124) mm (M124 to M150) mm	1.5 µm 1.5 µm 1.5 µm 1.7 µm 1.7 µm 2 µm	Standard Ring Gauges, ULM; D-0029-GE: Based on EURAMET/cg-10/v.02.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Thread Plug Gauge (Pitch Diameter)	(M0.8 to M1) mm (M1 to M25) mm (M25 to M50) mm (M50 to M75) mm (M75 to M100) mm (M100 to M125) mm (M125 to M150) mm	1.4 µm 1.4 µm 1.4 µm 1.4 µm 1.4 µm 1.5 µm 1.5 µm	Thread Wire Set, ULM, And T-Ball Set; D-0030-GE: Based on JIS B 0261:2004 and EURAMET/cg-10/v.02.
[1] Thread Plug Gauge (Pitch Diameter)	(M0.8 to M1) mm (M1 to M25) mm (M25 to M50) mm (M50 to M75) mm (M75 to M100) mm	1.7 µm 1.7 µm 1.7 µm 1.7 µm 1.8 µm	Thread Wire Set, External Micrometer; D-0030-GE: Based on JIS B 0261:2004 and EURAMET/cg-10/v.02.
[1] Granite/Cast Iron Surface Plate, Dial Gauge Stand Local (Small) Area Flatness	Up to 5 µm (5 to 20) µm (20 to 50) µm (50 to 140) µm	1.5 µm 2 µm 2.5 µm 4 µm	Electrical Comparator or Dial Test Indicator, Surface Plate; D-0057-GE: Based on JIS B 7513:1992.
[1,2] Granite/Cast Iron Surface Plate Overall Flatness	Up to 3 606 mmDL	0.8 µm$\sqrt{DL}$	Electronic Level Meter; D-0024-GE: Based on JIS B 7513:1992.
[1] Step Height/Step Block	Up to 10 mm	0.3 µm	Digital Linear Gauge; D-0054-GE: Direct Measurement.
Step Height/Step Block	Up to 25 mm	0.2 µm	ULM; D-0054-GE: Direct Measurement.
[1] Standard Foils	Up to 10 mm	0.3 µm	Digital Linear Gauge, D-0039-GE: Direct Measurement.
Standard Foils	Up to 25 mm	0.2 µm	ULM; D-0039-GE: Direct Measurement.
[1] Coating Thickness Gauge	Up to 100 µm (100 to 500) µm (500 to 1 000) µm (1 000 to 3 016) µm (3 016 to 5 682) µm	0.5 µm 0.8 µm 1.5 µm 1.9 µm 2 µm	Standard Foils; D-0037-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Ultrasonic Thickness Gauge	Up to 100 mm (100 to 300) mm	1.2 µm 3.2 µm	Gauge Blocks; D-0038-GE: Direct Measurement.
[1] Laser Distance Meter	Up to 20 m	1 mm	Reference Steel Tape; D-0056-GE: Comparison Measurement.
[1] Universal Length Measuring Machine (ULM)	Up to 10 mm (10 to 25) mm (25 to 50) mm (50 to 75) mm (75 to 100) mm (100 to 125) mm (125 to 150) mm (150 to 175) mm (175 to 200) mm (200 to 250) mm (200 to 300) mm (300 to 400) mm (400 to 500) mm	0.08 µm 0.1 µm 0.16 µm 0.24 µm 0.32 µm 0.44 µm 0.52 µm 0.56 µm 0.64 µm 0.82 µm 0.95 µm 1.2 µm 1.5 µm	Gauge Blocks; D-0058-GE: Direct Measurement.
[1] Surface Roughness Tester – Measurement Accuracy	Ra: Up to 0.42 µm (0.42 to 2.93) µm (2.93 to 2.97) µm (2.97 to 4.2) µm Rz: Up to 1.6 µm (1.6 to 9.4) µm (9.4 to 10) µm (10 to 11.6) µm	 0.03 µm 0.045 µm 0.045 µm 0.066 µm 0.15 µm 0.2 µm 0.2 µm 0.25 µm	Roughness Standard; D-0059-GE: Based on JIS B 0651:2001.
[1] Roundness Tester – Rotational Accuracy	Up to 1 mm	30 nm	Master Gauge Balls; D-0060-GE: Based on JIS B 7451:1997.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Profile Projector X/Y-Axis Linearity	Up to 50 mm (50 to 100) mm (100 to 150) mm (150 to 200) mm (200 to 250) mm (250 to 300) mm	0.7 µm 0.9 µm 1.2 µm 1.5 µm 1.9 µm 2 µm	Standard Glass Scale; D-0061-GE: Based on JIS B 7184:1999.
Magnification	10X 20X 50X 100X	0.01 % magnification 0.02 % magnification 0.04 % magnification 0.08 % magnification	
[1] Vision Measuring Machine/Measuring Microscope X/Y-Axis Linearity	Up to 50 mm (50 to 100) mm (100 to 150) mm (150 to 200) mm (200 to 250) mm (250 to 300) mm	0.7 µm 0.9 µm 1.2 µm 1.5 µm 1.9 µm 2 µm	Standard Glass Scale; D-0062-GE: Based on JIS B 7153:1995.
[1] Gauge Block Comparator	Up to 100 mm	40 nm	Master Gauge Blocks; D-0063-GE: Based on EURAMET cg-2, V.2 (03/2011).
[1] Scale Calibrator/Digital Scale Unit/Linear Scale with Digital Reading	Up to 100 mm (100 to 150) mm (150 to 200) mm (200 to 250) mm (200 to 300) mm (300 to 400) mm (400 to 500) mm (500 to 600) mm (600 to 700) mm (700 to 800) mm (800 to 900) mm (900 to 1 000) mm	0.4 µm 0.5 µm 0.6 µm 0.8 µm 0.9 µm 1.2 µm 1.5 µm 1.8 µm 2.1 µm 2.4 µm 2.7 µm 3 µm	Gauge Blocks; D-0064-GE: Based on JIS B 7450:1989.

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Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Coordinate Measuring Machine (CMM) – Length Measurement Error	Up to 110 mm (110 to 210) mm (210 to 310) mm (310 to 410) mm (410 to 510) mm (510 to 610) mm (610 to 800) mm (800 to 1000) mm	0.9 µm 1.2 µm 1.5 µm 2.1 µm 2.4 µm 2.8 µm 2.8 µm 3.2 µm	Long Gauge Blocks, 3-D Master; D-0065-GE: Based on JIS B 7440-2:2013.
[1] Contour Measuring Instruments X-Axis Linearity	Up to 25 mm (25 to 50) mm (50 to 75) mm (75 to 100) mm (100 to 125) mm (125 to 150) mm (150 to 175) mm (175 to 200) mm	0.3 µm 0.4 µm 0.5 µm 0.6 µm 0.8 µm 0.9 µm 0.9 µm 0.9 µm	Contour Standards; D-0071-GE: Direct Measurement.
Z-Axis Linearity	Up to 40 mm (40 to 60) mm	0.3 µm 0.4 µm	
Diameter	Up to 30 mm	0.6 µm	
Straightness	Up to 200 mm	70 nm	
[1] Roughness Specimens	Ra: Up to 0.42 µm (0.42 to 2.93) µm (2.93 to 2.97) µm (2.97 to 4.2) µm Rz: Up to 1.6 µm (1.6 to 9.4) µm (9.4 to 10) µm (10 to 11.6) µm	 0.03 µm 0.045 µm 0.045 µm 0.065 µm 0.15 µm 0.15 µm 0.2 µm 0.25 µm	Master Roughness Specimens, Roughness Tester; D-0072-GE: Comparison Measurement.

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Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Dynamic Viscosity Meters (20 to 40) ºC	(3.4 to 5.3) mPa·s (6.8 to 10.5) mPa·s (35.8 to 54) mPa·s (71.5 to 107) mPa·s (370 to 552) mPa·s 737 mPa·s to 1.1 Pa·s (3.5 to 5.2) Pa·s (8.7 to 13) Pa·s (21.9 to 32.5) Pa·s (41.6 to 61.6) Pa·s (73.7 to 110) Pa·s	0.3 % of reading 0.28 % of reading 0.28 % of reading 0.34 % of reading 0.34 % of reading 0.4 % of reading 0.4 % of reading 0.5 % of reading 0.5 % of reading 0.5 % of reading 0.5 % of reading	CANNON Silicone & Thomas®-Stormer® Viscosity Standards; CH-0001-GE: Direct Measurement.
[1] Dynamic Viscosity Meters (20 to 50) ºC	(24 to 92) mPa·s (30 to 141) mPa·s (41 to 170) mPa·s (74 to 340) mPa·s (130 to 650) mPa·s (0.21 to 1.2) Pa·s (0.37 to 2.2) Pa·s (0.46 to 2.9) Pa·s (0.68 to 4.3) Pa·s (1.1 to 9) Pa·s (1.4 to 17) Pa·s (2.1 to 25) Pa·s (2.8 to 33) Pa·s (5.4 to 68) Pa·s (7.5 to 92) Pa·s (9.3 to 110) Pa·s	0.38 % of reading 0.47 % of reading 0.47 % of reading 0.47 % of reading 0.47 % of reading 0.58 % of reading 0.56 % of reading 0.58 % of reading 0.57 % of reading 0.61 % of reading 0.69 % of reading 0.70 % of reading 0.73 % of reading 0.73 % of reading 0.71 % of reading 0.71 % of reading	CANNON General Purpose Viscosity Standards; CH-0001-GE: Direct Measurement.
[1] Kinematic Viscosity Meters (20 to 40) ºC	(3.5 to 5.5) mm²/s (7.1 to 10.8) mm²/s (37.4 to 55.3) mm²/s (74.7 to 109.8) mm²/s (387 to 567) mm²/s (771 to 1 130) mm²/s (3 600 to 5 400) mm²/s (9 100 to 13 300) mm²/s (22 800 to 33 400) mm²/s (43 500 to 63 200) mm²/s (77 100 to 113 000) mm²/s	0.3 % of reading 0.28 % of reading 0.28 % of reading 0.34 % of reading 0.34 % of reading 0.4 % of reading 0.4 % of reading 0.5 % of reading 0.5 % of reading 0.5 % of reading 0.5 % of reading	CANNON Silicone & Thomas®-Stormer® Viscosity Standards; CH-0001-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Kinematic Viscosity Meters (20 to 50) ºC	(30 to 110) mm²/s (35 to 160) mm²/s (50 to 200) mm²/s (90 to 400) mm²/s (160 to 770) mm²/s (250 to 1 400) mm²/s (440 to 2 600) mm²/s (550 to 3 400) mm²/s (820 to 5 100) mm²/s	0.42 % of reading 0.45 % of reading 0.45 % of reading 0.47 % of reading 0.46 % of reading 0.56 % of reading 0.55 % of reading 0.56 % of reading 0.56 % of reading	CANNON General Purpose Viscosity Standards; CH-0001-GE: Direct Measurement.
[1] Kinematic Viscosity Meters (20 to 50) ºC	(1 300 to 10 400) mm²/s (1 600 to 20 000) mm²/s (2 500 to 28 000) mm²/s (3 200 to 41 000) mm²/s (6 100 to 77 000) mm²/s (8 500 to 103 000) mm²/s (11 000 to 122 600) mm²/s	0.64 % of reading 0.74 % of reading 0.7 % of reading 0.72 % of reading 0.72 % of reading 0.71 % of reading 0.72 % of reading	CANNON General Purpose Viscosity Standards; CH-0001-GE: Direct Measurement.
[1,11] Liquid Density Meters	0.6595 g/cm³ @ 20 °C 0.8383 g/cm³ @ 20 °C 0.998 g/cm³ @ 20 °C 0.997 g/cm³ @ 25 °C 1.2849 g/cm³ @ 20 °C	0.000 095 g/cm³ 0.000 12 g/cm³ 0.000 13 g/cm³ 0.000 13 g/cm³ 0.000 15 g/cm³	Liquid Density Solution; CH-0001-GE: Direct Measurement.
[1,11] Viscosity Cups – Kinematic Viscosity (23 to 25) °C			
ISO Cups	17 mm²/s (cSt) 34 mm²/s (cSt) 66 mm²/s (cSt) 120 mm²/s (cSt) 230 mm²/s (cSt)	0.46 % of reading 0.44 % of reading 0.5 % of reading 0.54 % of reading 0.63 % of reading	Viscosity Reference Standards; CH-0016-GE: Based on ASTM D 1200-94, ASTM D 4212-99, ISO 2431 and DIN 53211.
Zahn Cups	17 mm²/s (cSt) 34 mm²/s (cSt) 66 mm²/s (cSt) 120 mm²/s (cSt) 230 mm²/s (cSt)	0.48 % of reading 0.46 % of reading 0.58 % of reading 0.56 % of reading 0.71 % of reading	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,11] Viscosity Cups – Kinematic Viscosity (23 to 25) °C			Viscosity Reference Standards; CH-0016-GE: Based on ASTM D 1200-94, ASTM D 4212-99, ISO 2431 and DIN 53211.
Ford Cups	17 mm²/s (cSt)	0.42 % of reading	
	34 mm²/s (cSt)	0.5 % of reading	
	66 mm²/s (cSt)	0.48 % of reading	
	120 mm²/s (cSt)	0.54 % of reading	
	230 mm²/s (cSt)	0.56 % of reading	
Shell Cups	17 mm²/s (cSt)	0.52 % of reading	
	34 mm²/s (cSt)	0.44 % of reading	
	66 mm²/s (cSt)	0.46 % of reading	
	120 mm²/s (cSt)	0.56 % of reading	
	230 mm²/s (cSt)	0.56 % of reading	
DIN Cups	120 mm²/s (cSt)	0.66 % of reading	
	230 mm²/s (cSt)	0.58 % of reading	
[4] Hydrometers – Specific Gravity Hydrometer, Density Hydrometer, Baumé Pattern Hydrometer, Alcohol Hydrometer, Sugar Hydrometer, API Hydrometer	(0.6 to 2) g/cm³	0.000 14 g/cm³	Electronic Balance, Density Standard Ring, Dodecane Liquid, Digital Thermometer with RTD Sensors, Standard Weight Class E2, Barometer, Digital Micrometer; CH-0007-GE: Based on the Organization of American State no. SIM MWG7/cg-03/v.00, 2016, SIM Guidelines on the calibration of hydrometers, Cuckow's method.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Volumetric Glass Ware and Operated Volumetric Apparatus – Burette, Volumetric Pipette, Measuring Pipette, Volumetric Flask, Graduated Cylinder, Beaker, Single-channel Piston Pipette, Multi-channel Piston Pipette, Positive-displacement Pipette, Piston Burette, Dilutor, Dispenser	(0.1 to 10) µL (10 to 20) µL (20 to 50) µL (50 to 100) µL (100 to 200) µL (200 to 500) µL (500 to 1 000) µL (1 to 2) mL (2 to 5) mL (5 to 10) mL (10 to 20) mL (20 to 50) mL (50 to 100) mL (100 to 200) mL (200 to 500) mL	15 nL 17 nL 20 nL 23 nL 30 nL 65 nL 0.15 µL 0.25 µL 0.6 µL 1.2 µL 2.4 µL 5.9 µL 12 µL 24 µL 59 µL	Micro Balances and Electronic Balances; CH-0010-GE: Gravimetric Method based on ASTM E 542-01 and ISO 8655-6.
[1] Volumetric Glass Ware and Operated Volumetric Apparatus – Burette, Volumetric Pipette, Measuring Pipette, Volumetric Flask, Graduated Cylinder, Beaker, Single-channel Piston Pipette, Multi-channel Piston Pipette, Positive-displacement Pipette, Piston Burette, Dilutor, Dispenser	(500 to 1 000) mL (1 000 to 1 200) mL (1 200 to 2 000) mL (2 000 to 3 000) mL (3 000 to 4 000) mL (4 000 to 5 000) mL (5 000 to 6 000) mL	0.12 mL 0.14 mL 0.24 mL 0.39 mL 0.50 mL 0.61 mL 0.72 mL	Micro Balances and Electronic Balances; CH-0010-GE: Gravimetric Method based on ASTM E 542-01 and ISO 8655-6.
[1] Mass Determination – OIML Weight (Class E2 and below)	1 mg 2 mg 5 mg 10 mg 20 mg 50 mg 100 mg 200 mg 500 mg	2 µg 2 µg 2 µg 3 µg 3 µg 4 µg 5 µg 6 µg 8 µg	OIML Class E1 Standard Weights, Mass Comparator; M-0001-GE: Based on OIML R111: 2004, ABBA Method.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Mass Determination – OIML Weight (Class E2 and below)	1 g 2 g 5 g 10 g 20 g 50 g 100 g 200 g 500 g 1 kg 2 kg 5 kg 10 kg 20 kg	10 µg 12 µg 16 µg 20 µg 25 µg 30 µg 50 µg 0.1 mg 0.25 mg 0.5 mg 1 mg 2.5 mg 5 mg 10 mg	OIML Class E1 Standard Weights, Mass Comparator; M-0001-GE: Based on OIML R111: 2004, ABBA Method.
Mass Determination – Non OIML Weight	Up to 20 g (20 to 100) g (100 to 200) g (200 to 600) g (600 to 1 200) g (1.2 to 2) kg (2 to 5) kg (5 to 10) kg (10 to 30) kg	0.05 mg 0.25 mg 0.4 mg 1.8 mg 2.6 mg 4 mg 38 mg 40 mg 0.12 g	Micro Balances and Electric Balances; M-0003-GE: Direct Measurement.
[1,12] Balance, Scale, Weighing Machine	Up to 2 mg (2 to 5) mg (5 to 10) mg (10 to 20) mg (20 to 50) mg (50 to 100) mg (100 to 200) mg (200 to 500) mg (500 to 1 000) mg	1.8 µg 1.8 µg 1.8 µg 1.8 µg 2.1 µg 2.6 µg 3.2 µg 4 µg 4.7 µg	OIML Class E1, lower accuracy class weights, and internal procedure M-0002-GE, based on UKAS Publication Ref. LAB 14, Edition 6, October 2019, utilized in the calibration of the weighing system.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,12] Balance, Scale, Weighing Machine	(1 to 2) g	6.2 µg	OIML Class E1, lower accuracy class weights, and internal procedure M-0002-GE, based on UKAS Publication Ref. LAB 14, Edition 6, October 2019, utilized in the calibration of the weighing system.
	(2 to 5) g	7.7 µg	
	(5 to 10) g	9.3 µg	
	(10 to 20) g	13 µg	
	(20 to 50) g	16 µg	
	(50 to 100) g	25 µg	
	(100 to 200) g	47 µg	
	(200 to 500) g	0.16 mg	
	(500 to 1 000) g	0.27 mg	
	(1 to 2) kg	0.47 mg	
	(2 to 3) kg	1.2 mg	
	(3 to 4) kg	1.4 mg	
	(4 to 5) kg	1.6 mg	
	(5 to 6) kg	1.8 mg	
	(6 to 7) kg	2 mg	
	(7 to 10) kg	2.7 mg	
	(10 to 12) kg	3.1 mg	
	(12 to 15) kg	3.8 mg	
	(15 to 20) kg	5 mg	
	(20 to 25) kg	22 mg	
	(25 to 30) kg	25 mg	
	(30 to 40) kg	32 mg	
	(40 to 50) kg	40 mg	
	(50 to 100) kg	2.3 g	
	(100 to 150) kg	3.5 g	
	(150 to 200) kg	4.6 g	
	(200 to 250) kg	5.8 g	
	(250 to 300) kg	6.9 g	
	(300 to 350) kg	8.1 g	
	(350 to 400) kg	9.2 g	
	(400 to 450) kg	11 g	
	(450 to 500) kg	12 g	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Dial Tension Gauge (Tension Only)	Up to 50 mN (50 to 100) mN (100 to 200) mN (200 to 300) mN (300 to 500) mN (0.5 to 1) N (1 to 1.5) N (1.5 to 3) N (3 to 5) N (5 to 10) N (10 to 20) N	0.37 mN 0.81 mN 1.7 mN 2.1 mN 3.7 mN 8.1 mN 11 mN 21 mN 37 mN 62 mN 0.13 N	Standard Weights; F-0001-GE: Direct Measurement.
[1] Spring Tension Gauge (Tension Only)	Up to 0.1 N (0.1 to 0.5) N (0.5 to 1.1) N (1.1 to 3) N (3 to 5) N (5 to 10) N (10 to 40) N (40 to 50) N (50 to 200) N (200 to 300) N	0.57 mN 1.2 mN 2.4 mN 12 mN 24 mN 57 mN 0.12 N 0.24 N 0.57 N 1.2 N	Standard Weights; F-0001-GE: Direct Measurement.
[1] Force Gauge, Push-Pull Scale, Tension & Tensile Test Equipment, Force Measuring Equipment with Indicator (Tension and Compression)	Up to 2 N (2 to 5) N (5 to 10) N (10 to 20) N (30 to 50) N (50 to 100) N (100 to 200) N (200 to 300) N (300 to 500) N (500 to 1 000) N	0.18 mN 0.43 mN 1.1 mN 1.8 mN 4.3 mN 11 mN 18 mN 26 mN 51 mN 0.12 N	Standard Weights; F-0001-GE: Direct Measurement.
[1] Force Gauge, Push-Pull Scale, Tension & Tensile Test Equipment, Force Measuring Equipment with Indicator (Tension and Compression)	Up to 1 kN (1 to 10) kN	0.05 % of reading 0.05 % of reading	Force Transducers, Universal Tensile Machine; F-0006-GE: Comparison Measurement.
[1] Load Cell with Indicator (Tension and Compression)	Up to 1 kN (1 to 10) kN (10 to 50) kN (50 to 100) kN	0.05 % of reading 0.05 % of reading 0.09 % of reading 0.15 % of reading	Force Transducers, Universal Tensile Machine; F-0005-GE: Based on ISO 376 (2011).

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Load Cell – Output DC Voltage Tension and Compression	Up to 1 kN (1 to 10) kN (10 to 50) kN (50 to 100) kN	0.05 % of reading 0.05 % of reading 0.09 % of reading 0.15 % of reading	Force Transducer, Universal Testing Machine; F-0005-GE: Based on ISO 376 (2011).
[1] Load Cell – Output DC Current Tension and Compression	Up to 1 kN (1 to 10) kN (10 to 50) kN (50 to 100) kN	0.11 % of reading 0.12 % of reading 0.13 % of reading 0.2 % of reading	Force Transducer, Universal Testing Machine; F-0005-GE: Based on ISO 376 (2011).
[1] Tensile Testing Machine Tension and Compression	Up to 1 kN (1 to 10) kN (10 to 50) kN (50 to 100) kN	0.06 % of reading 0.07 % of reading 0.1 % of reading 0.15 % of reading	Force Transducers; F-0004-GE: Based on ISO 7500-1 (2018).
[1] Torque Wrench (Indicating and Setting Types)	(0.01 to 0.6) N·m (0.6 to 10) N·m (10 to 1 500) N·m	1.2 % of reading 1 % of reading 0.5 % of reading	Torque Transducers; TQ-0001-GE and TQ-0002-GE: based on ISO 6789:2003.
[1] Torque Wrench (Indicating and Setting Types)	(0.01 to 0.6) N·m (0.6 to 200) N·m	1.2 % of reading 1 % of reading	Digital Torque Meters; TQ-0004-GE and TQ-0005-GE: based on ISO 6789:2003.
[1] Torque Screw Driver (Indicating and Setting Types)	(0.01 to 0.6) N·m (0.6 to 10) N·m (10 to 20) N·m	1.2 % of reading 1 % of reading 0.5 % of reading	Torque Transducers; TQ-0001-GE and TQ-0002-GE: Based on ISO 6789:2003
[1] Torque Screw Driver (Indicating and Setting Types)	(0.01 to 0.6) N·m (0.6 to 20) N·m	1.2 % of reading 1 % of reading	Digital Torque Meter; TQ-0004-GE and TQ-0005-GE: Based on ISO 6789:2003.
[1] Torque Measuring Device, Torque Tester, Torque Transducer	(0.1 to 0.2) N·m (0.2 to 0.5) N·m (0.5 to 1) N·m (1 to 2) N·m (1 to 20) N·m (20 to 200) N·m (200 to 500) N·m (500 to 1 000) N·m (1 000 to 1 500) N·m	0.3 % of reading 0.25 % of reading 0.2 % of reading 0.2 % of reading 0.2 % of reading 0.1 % of reading 0.05 % of reading 0.05 % of reading 0.05 % of reading	Calibration Arm, Standard Weights; TQ-0003-GE: Based on BS 7882:2008.

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[1] Torque Gauge	1 mN·m to 200 cN·m	1 % of reading	Small Calibration Arm, Standard Weight; TQ-0006-GE: Direct Measurement.
[1] Rockwell Hardness Tester	HRA (20 to 75) HRA (75 to 95) HRA HRBW (10 to 45) HRBW (45 to 80) HRBW (80 to 100) HRBW HRC (10 to 70) HRC HREW 90 HREW	 0.5 HRA 0.5 HRA 0.5 HRBW 0.5 HRBW 0.5 HRBW 0.5 HRC 0.6 HREW	Indirect verification using Reference Hardness Blocks per H-0001-GE: Based on ISO 6508-2 (2015).
[1] Leeb Hardness Tester	HLD 530 HLD 630 HLD 790 HLD	 6.1 HLD 7.8 HLD 9.7 HLD	Indirect verification using Reference Hardness Blocks per H-0004-GE: Based on ISO 16859-2 (2015).
[1] Vickers Hardness Tester	Scale 0.1 ≤ 225 HV (400 to 600) HV ≥ 700 HV Scale 1 ≤ 225 HV (400 to 600) HV ≥ 700 HV	 5 % of reading 6.8 % of reading 8.1 % of reading 0.52 % of reading 0.53 % of reading 0.52 % of reading	Indirect verification using Reference Hardness Blocks per H-0002-GE: Based on ISO 6507-2 (2018).
[1,6] Durometers (Type A, B, E, O, C, D, DO, M, OO, OOO, OOO-S) Indenter Dimensions Length Angle Radius Spring Force	 Up to 3.57 mm Up to 36° Up to 0.51 mm Up to 8.05 N (8.05 to 44.5) N	 0.6 µm 0.12° 7 µm 0.016 N 0.055 N	Full verification per H-0003-GE: Based on ASTM D 2240-15 using: Universal Length Measuring Machine or Portable Digital Microscope Force Transducers

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Gas Flow – Air Volumetric Flow Mass Flow	(5 to 500) mL/min 300 mL/min to 30 L/min (30 to 500) L/min (5.92 to 592) mg/min (0.3552 to 35.52) g/min (35.52 to 592) g/min	0.9 % of reading 0.9 % of reading 1.2 % of reading 0.9 % of reading 0.9 % of reading 1.2 % of reading	Gas Flow Calibrator; P-0005-GE: Comparison Based on ISO 9951-1993.
[1] Liquid Flow Meter (Electrical Output, Indicator) Volumetric Flow Rate Volumetric Flow Mass Flow Rate Mass Flow	Up to 100 000 L/hr Up to 1 600 L Up to 100 000 kg/hr Up to 1 600 kg	0.15 % of reading 0.15 % of reading 0.15 % of reading 0.15 % of reading	Master Meter Provers; Liquid Flow Calibration ; FL-0001-GE, Manual of Petroleum Measurement Standards Chapter 4.5
[1] Silk Screen Tension Meter	(6 to 100) N/cm	1 % of reading	Force Transducer, Vernier Caliper, Screen Tension Calibration Set; F-0002-GE: Based on DIN 16611 (1990).
[1] Wire/Cable Tension Meter	Up to 200 g (200 to 500) g (500 g to 1 000) g (1 000 to 2 000) g (2 000 to 5 000) g (5 to 10) kg (10 to 20) kg (20 to 50) kg	0.2 g 0.4 g 1.5 g 2 g 3.5 g 0.02 kg 0.03 kg 0.07 kg	Standard Weights; F-0003-GE: Direct Measurement.
[1] Pressure Measuring Equipment – Gauge Pressure (Pneumatic)	(-80 to 0) kPa (0 to 1) kPa (1 to 130) kPa	15 Pa 0.4 Pa 8 Pa	Yokogawa MT210 Series Standard Manometers; P-0001-GE: Based on DKD-R 6-1 (03/2014).
[1] Pressure Measuring Equipment – Gauge Pressure (Pneumatic)	(-14 to 0) psiv (0 to 5) psig (5 to 30) psig (30 to 300) psig (300 to 1 500) psig	0.003 psi 0.005 5 psi 0.007 5 psi 0.015 psi 0.15 psi	GE IPM 620 Series Pressure Modules or GE/Druck Pressure Calibrator; P-0001-GE: Based on DKD-R 6-1 (03/2014).

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Pressure Measuring Equipment – Gauge Pressure (Hydraulic)	(0 to 100) psig (100 to 1 000) psig (1 000 to 5 000) psig (5 000 to 10 000) psig	0.05 psi 0.5 psi 1.5 psi 3.5 psi	Hydraulic Pressure Calibrator with Digital Test Gauge; P-0002-GE: based on DKD-R 6-1 (03/2014).
[1] Absolute Pressure Measuring Equipment (Pneumatic)	(0 to 20) bar	2 mbar	GE IPM620-13A Pressure Calibrator, P-0006-GE: Based on DKD-R 6-1 (03/2014).
[1] Pressure Measuring Equipment with Electrical Output – Gauge Pressure (Pneumatic) Output (1 to 5) V	(-80 to < 0) kPa (> 0 to 1) kPa (1 to 130) kPa	0.013 % of reading + 8 Pa 0.013 % of reading + 1 Pa 0.013 % of reading + 3.6 Pa	Yokogawa MT210 Series Standard Manometers, Digital Multimeter; P-0003-GE: Based on DKD-R 6-1 (03/2014).
[1] Pressure Measuring Equipment with Electrical Output – Gauge Pressure (Pneumatic) Output (1 to 5) V	(-14 to < 0) psiv (> 0 to 5) psig (5 to 30) psig (30 to 300) psig (300 to 1 500) psig	0.006 % of reading + 0.003 psi 0.006 % of reading + 0.0025 psi 0.006 % of reading + 0.07 psi 0.006 % of reading + 0.07 psi 0.006 % of reading + 0.1 psi	GE IPM 620 Series Pressure Modules, Digital Multimeter; P-0003-GE: Based on DKD-R 6-1 (03/2014).
[1] Pressure Measuring Equipment with Electrical Output – Gauge Pressure (Hydraulic) Output (1 to 5) V	(> 0 to 100) psig (100 to 1 000) psig (1 000 to 5 000) psig (5 000 to 10 000) psig	0.006 % of reading + 0.04 psi 0.006 % of reading + 0.4 psi 0.006 % of reading + 2 psi 0.006 % of reading + 2 psi	Hydraulic Pressure Calibrators with Digital Test Gauges, Digital Multimeter; P-0004-GE: Based on DKD-R 6-1 (03/2014).
[1] Pressure Measuring Equipment with Electrical Output – Gauge Pressure (Pneumatic) Output (4 to 20) mA	(-80 to < 0) kPa (> 0 to 1) kPa (1 to 130) kPa	0.088 % of reading + 8 Pa 0.088 % of reading + 1 Pa 0.088 % of reading + 3.6 Pa	Yokogawa MT210 Series Standard Manometers, Digital Multimeter; P-0003-GE: Based on DKD-R 6-1 (03/2014).
[1] Pressure Measuring Equipment with Electrical Output – Gauge Pressure (Pneumatic) Output (4 to 20) mA	(-14 to < 0) psiv (> 0 to 5) psig (5 to 30) psig (30 to 300) psig (300 to 1 500) psig	0.087 % of reading + 0.003 psi 0.087 % of reading + 0.002 5 psi 0.087 % of reading + 0.007 psi 0.087 % of reading + 0.02 psi 0.087 % of reading + 0.1 psi	GE IPM 620 Series Pressure Modules, Digital Multimeter; P-0003-GE: Based on DKD-R 6-1 (03/2014).
[1] Pressure Measuring Equipment with Electrical Output – Gauge Pressure (Hydraulic) Output (4 to 20) mA	(> 0 to 100) psig (100 to 1 000) psig (1 000 to 5 000) psig (5 000 to 10 000) psig	0.087 % of reading + 0.04 psi 0.087 % of reading + 0.4 psi 0.087 % of reading + 2 psi 0.087 % of reading + 2 psi	Hydraulic Pressure Calibrators with Digital Test Gauges, Digital Multimeter; P-0004-GE: Based on DKD-R 6-1 (03/2014).

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[1,9] Pressure Measuring Equipment – Gauge Pressure (Pneumatic)	(1 to 500) psig	1.9 x 10^{-4} Pe	Pneumatic Dead Weight Testers; P-0008-GE: Based on DKD-R 6-1 (03/2014).
[1] Pressure Measuring Equipment – Gauge Pressure (Hydraulic)	(2 to 100) psig (100 to 10 000) psig	2.1 x 10^{-4} Pe 1.7 x 10^{-4} Pe	Hydraulic Dead Weight Testers; P-0009-GE: Based on DKD-R 6-1 (03/2014).
[1] Barometer	(50 to 110) kPa	20 Pa	Vaisala PTB330 Standard Barometer; P-0007-GE: Based on DKD-R 6-1 (03/2014).
[1] Pirani Vacuum Gauge	Up to 1.3 mbar (1.3 to 13) mbar (13 to 130) mbar (130 to 1 300) mbar	1.9 % of reading 1 % of reading 1 % of reading 3 % of reading	MKS Baratron® Standard Capacitance Manometer, P-0010-GE: Based on ISO 3567:2011
[1] Air Velocity – Air Velocity Meter, Anemometers	Up to 35 m/s	1.2 % of reading + 0.02 m/s	Wind Tunnel, Standard Anemometer, Standard Manometer; EN-0003-GE: Comparison Measurement.
[1] Fume Hood Velocity Illuminance	Up to 6 000 ft/min Up to 2 999 lux	1.9 % of reading + 1.1 ft/min 2 % of reading	EN-0015-GE: Based on ASHRAE 110; Standard Anemometer Illuminance Meter

Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] UV/VIS Spectrophotometer Wavelength Accuracy	329 nm 472 nm 512 nm 681 nm 875 nm	0.4 nm 0.25 nm 0.25 nm 0.4 nm 0.6 nm	Didymium Glass Filter, Holmium Oxide Glass Filter, Potassium Dichromate Liquid Filter; CH-0011-GE: Based on ASTM E 275-01.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] UV/VIS Spectrophotometer Wavelength Accuracy	279 nm 361 nm 453 nm 536 nm 638 nm	0.25 nm 0.25 nm 0.25 nm 0.32 nm 0.35 nm	Didymium Glass Filter, Holmium Oxide Glass Filter, Potassium Dichromate Liquid Filter; CH-0011-GE: Based on ASTM E 275-01.
[1] UV/VIS Spectrophotometer Photometric Accuracy	0.75 Abs @ 235 nm 0.04 Abs @ 250 nm 0.42 Abs @ 250 nm 0.97 Abs @ 250 nm 0.86 Abs @ 257 nm 1.15 Abs @ 270 nm 1.15 Abs @ 280 nm 1.25 Abs @ 297 nm 0.3 Abs @ 313 nm 0.75 Abs @ 321 nm 0.5 Abs @ 342 nm 0.65 Abs @ 350 nm 0.03Abs @ 360 nm 0.51 Abs @ 360 nm 0.96 Abs @ 360 nm 0.53 Abs @ 440 nm 0.03Abs @ 465 nm 0.48 Abs @ 465 nm 0.59 Abs @ 465 nm 1.03 Abs @ 465 nm 0.03Abs @ 546.1 nm 0.5 Abs @ 546.1 nm 0.59 Abs @ 546.1 nm 1.03 Abs @ 546.1 nm 0.56 Abs @ 590 nm 0.55 Abs @ 635 nm 0.03 Abs @ 635 nm 0.60 Abs @ 635 nm 1.07 Abs @ 635 nm	0.013 Abs 0.003 Abs 0.005 Abs 0.006 Abs 0.012 Abs 0.005 Abs 0.005 Abs 0.004 Abs 0.0055 Abs 0.005 Abs 0.0045 Abs 0.0076 Abs 0.003 Abs 0.005 Abs 0.006 Abs 0.004 Abs 0.003 Abs 0.004 Abs 0.005 Abs 0.006 Abs 0.003 Abs 0.004 Abs 0.005 Abs 0.006 Abs 0.005 Abs 0.005 Abs 0.003 Abs 0.005 Abs 0.006 Abs	Didymium Glass Filter, Neutral Density Glass Filter, Potassium Dichromate Liquid Filter, Metal-on-Quartz Filters; CH-0011-GE: Based on ASTM E 275-01.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] UV/VIS Spectrophotometer Photometric Accuracy	0.03 Abs @ 1 100 nm 0.6 Abs @ 1 100 nm 1.07 Abs @ 1 100 nm 0.03 Abs @ 1 700 nm 0.6 Abs @ 1 700 nm 1.07 Abs @ 1 700 nm 0.03 Abs @ 2 210 nm 0.6 Abs @ 2 210 nm 1.07 Abs @ 2 210 nm 0.03 Abs @ 2 500 nm 0.6 Abs @ 2500 nm 1.07 Abs @ 2 500 nm 0.03 Abs @ 2 800 nm 0.6 Abs @ 2 800 nm 1.07 Abs @ 2 800 nm	0.007 Abs 0.015 Abs 0.012 Abs 0.007 Abs 0.015 Abs 0.012 Abs 0.007 Abs 0.015 Abs 0.012 Abs 0.007 Abs 0.015 Abs 0.012 Abs 0.007 Abs 0.015 Abs 0.012 Abs	Didymium Glass Filter, Neutral Density Glass Filter, Potassium Dichromate Liquid Filter, Metal-on-Quartz Filters; CH-0011-GE: Based on ASTM E 275-01.
[1] Transmittance Meter	(250 to 2 800) nm 100 % of Transmittance (250 to 799) nm 10 % of Transmittance 30 % of Transmittance 90 % of Transmittance (800 to 2 800) nm 10 % of Transmittance 30 % of Transmittance 90 % of Transmittance	0.06 % of Transmittance 1.2 % of Transmittance 0.4 % of Transmittance 0.55 % of Transmittance 0.3 % of Transmittance 0.8 % of Transmittance 1.4 % of Transmittance	Metal-on-Quartz Filters; CH-0011-GE: Based on ASTM E 275-01.
[1] Optical Absolute Power for Multi-mode Fibre – Measure (Fixed Wavelength)	850 nm (-80 to -70) dBm (-70 to -60) dBm (-60 to 3) dBm (3 to 10) dBm	 0.3 dB 0.084 dB 0.066 dB 0.085 dB	Keysight 81520A, Keysight 81525A Optical Head; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Absolute Power for Single-mode Fibre – Measure (Fixed Wavelength)	1 310 nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to 0) dBm (0 to 10) dBm	 1.4 dB 0.17 dB 0.049 dB 0.042 dB 0.044 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0001-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Optical Absolute Power for Single-mode Fibre – Measure (Fixed Wavelength)	1 550 nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to 0) dBm (0 to 10) dBm 1 625 nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to 0) dBm (0 to 10) dBm	 1.4 dB 0.17 dB 0.049 dB 0.042 dB 0.044 dB 1.4 dB 0.17 dB 0.049 dB 0.042 dB 0.044 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Absolute Power for Multi-mode Fibre – Measure (Full Wavelength Range)	(450 to 600) nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to -50) dBm (-50 to 10) dBm (600 to 800) nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to -50) dBm (-50 to 10) dBm (800 to 1 020) nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to 10) dBm (10 to 27) dBm	 2.2 dB 0.5 dB 0.29 dB 0.27 dB 0.26 dB 2.2 dB 0.45 dB 0.24 dB 0.23 dB 0.22 dB 2.2 dB 0.45 dB 0.24 dB 0.22 dB 0.27 dB	Keysight 81520A, Keysight 81525A Optical Heads; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Absolute Power for Multi-mode Fibre – Measure (Full Wavelength Range)	(1 020 to 1 300) nm (-60 to -50) dBm (-50 to -40) dBm (-40 to -30) dBm (-30 to -20 dBm (-20 to 10) dBm (10 to 27) dBm	 2.2 dB 0.48 dB 0.27 dB 0.27 dB 0.27 dB 0.27 dB	Keysight 81520A, Keysight 81525A Optical Heads; E-OPT-G-0001-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Optical Absolute Power for Single-mode Fibre – Measure (Full Wavelength Range)	(800 to 1 000) nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to -50) dBm (-50 to 10) dBm (10 to 27) dBm (1 000 to 1 600) nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to -50) dBm (-50 to 10) dBm (10 to 27) dBm (1 600 to 1 650) nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to -50) dBm (-50 to 10) dBm (1 650 to 1 700) nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to -50) dBm (-50 to 10) dBm	 2.3 dB 0.53 dB 0.32 dB 0.22 dB 0.19 dB 0.27 dB 2.2 dB .48 dB 0.27 dB 0.22 dB 0.19 dB 0.27 dB 2.2 dB 0.48 dB 0.27 dB 0.22 dB 0.19 dB 2.3 dB 0.53 dB 0.32 dB 0.22 dB 0.19 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Power Linearity for Multi-mode Fibre – Measure	(600 to 1 020) nm (-80 to -75) dBm (-75 to -70) dBm (-70 to -60) dBm (-60 to 3) dBm (1 020 to 1 300) nm (-50 to -45) dBm (-45 to -40) dBm (-40 to -30) dBm (-30 to 0) dBm (0 to 10) dBm	 0.25 dB 0.093 dB 0.056 dB 0.05 dB 0.25 dB 0.095 dB 0.057 dB 0.053 dB 0.053 dB	Keysight 81520A, Keysight 81525A Optical Heads; E-OPT-G-0001-GE: Direct Measurement.

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[1] Optical Power Linearity for Single-mode Fibre – Measure	(1 000 to 1 650) nm (-90 to -85) dBm (-85 to -80) dBm (-80 to -75) dBm (-75 to -70) dBm (-70 to -65) dBm (-65 to -60) dBm (-60 to 10) dBm	1.4 dB 0.46 dB 0.16 dB 0.062 dB 0.042 dB 0.039 dB 0.034 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Power Flatness versus Wavelength for Multi-mode Fibre – Measure	(600 to 1 020) nm (-20 to 3) dBm (1 020 to 1 300) nm (-20 to 10) dBm	0.05 dB 0.053 dB	Keysight 81520A, Keysight 81525A, Optical Heads; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Power Flatness versus Wavelength for Single-mode Fibre – Measure	(1 000 to 1 650) nm (-20 to 10) dBm	0.034 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Power Stability for Multi-mode Fibre – Measure	(450 to 1 300) nm (-20 to 10) dBm	0.006 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Power Stability for Single-mode Fibre – Measure	(800 to 1 700) nm (-20 to 10) dBm	0.006 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Power Repeatability for Multi-mode Fibre – Measure	(450 to 1 300) nm (-20 to 10) dBm	0.006 dB	Keysight 81520A, Keysight 81525A, Optical Heads; E-OPT-G-0001-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Optical Power Repeatability for Single-mode Fibre – Measure	(800 to 1 700) nm (-20 to 10) dBm	0.006 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Power Signal-to-Source Spontaneous Emission (SSSE) for Multi-mode and Single-mode Fibre – Measure	(600 to 1 650) nm (0 to -70) dB	0.5 dB	Anritsu MS9710B Optical Spectrum Analyzer; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Absolute Wavelength – Measure	(700 to 1 700) nm	0.25 µm/m + 0.8 pm	Burleigh WA-1600, HP 86120B Optical Wavelength Meters; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Relative Wavelength – Measure	(700 to 1 700) nm	0.8 pm	Burleigh WA-1600, HP 86120B Optical Wavelength Meters; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Wavelength Spectral Bandwidth – Measure	(700 to 1 700) nm	0.35 nm	Anritsu MS9710B Optical Spectrum Analyzer; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Wavelength Stability – Measure	(700 to 1 700) nm	0.8 pm	Burleigh WA-1600, HP 86120B Optical Wavelength Meters; E-OPT-G-0001-GE: Direct Measurement.
[1] Optical Wavelength Repeatability – Measure	(700 to 1 700) nm	0.8 pm	Burleigh WA-1600, HP 86120B Optical Wavelength Meters; E-OPT-G-0001-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Optical Absolute Power Accuracy for Multi-mode Fibre – Source	850 nm (-80 to -70) dBm (-70 to -60) dBm (-60 to 0) dBm (0 to 10) dBm	 0.3 dB 0.086 dB 0.068 dB 0.086 dB	Keysight 81520A, Keysight 81525A, Optical Heads; E-OPT-M-0001-GE: Comparison Measurement with Standard Power, Based on IEC 61315.
[1] Optical Absolute Power Accuracy for Single-mode Fibre – Source	1 310 nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to -50) dBm (-50 to -40) dBm (-40 to -10) dBm (-10 to 0) dBm (0 to 10) dBm 1 550 nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to -50) dBm (-50 to -40) dBm (-40 to -10) dBm (-10 to 0) dBm (0 to 10) dBm	 1.4 dB 0.18 dB 0.07 dB 0.064 dB 0.062 dB 0.06 dB 0.044 dB 0.04 dB 1.4 dB 0.18 dB 0.07 dB 0.064 dB 0.062 dB 0.06 dB 0.042 dB 0.04 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-M-0001-GE: Comparison Measurement with Standard Power, Based on IEC 61315.
[1] Optical Absolute Power Accuracy for Single-mode Fibre – Source	1 625 nm (-90 to -80) dBm (-80 to -70) dBm (-70 to -60) dBm (-60 to -50) dBm (-50 to -40) dBm (-40 to -10) dBm (-10 to 0) dBm (0 to 10) dBm	 1.4 dB 0.18 dB 0.07 dB 0.064 dB 0.062 dB 0.06 dB 0.042 dB 0.04 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-M-0001-GE: Comparison Measurement with Standard Power, Based on IEC 61315.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Optical Power Linearity for Multi-mode Fibre – Source (Method #1)	850 nm (-60 to -50) dBm (-50 to -40) dBm (-40 to -30) dBm (-30 to -20) dBm -20 dBm (-20 to -10) dBm (-10 to 0) dBm (0 to 10) dBm	 0.016 dB 0.013 dB 0.011 dB 0.008 dB Reference 0.008 dB 0.011 dB 0.013 dB	Variable Optical Attenuators, Laser Sources, Optical Power Meters; E-OPT-M-0001-GE: Superposition Method, Based on IEC 61315.
[1] Optical Power Linearity for Multi-mode Fibre – Source (Method #2)	850 nm (-80 to -70) dBm (-70 to -60) dBm (-60 to -20) dBm (-20 to 10) dBm	 0.25 dB 0.06 dB 0.05 dB 0.05 dB	Keysight 81520A, Keysight 81525A Optical Heads; E-OPT-M-0001-GE: Comparison Measurement with Standard Power, Based on IEC 61315.
[1] Optical Power Linearity for Multi-mode Fibre – Source (Method #3)	850 nm (-80 to -50) dBm (-50 to -20) dBm (-20 to 0) dBm	 0.18 dB 0.09 dB 0.09 dB	Variable Optical Attenuators, Laser Sources, and Optical Power Meters; E-OPT-M-0001-GE: Comparison Measurement with Attenuator, Based on IEC 61315.
[1] Optical Power Linearity for Single-mode Fibre – Source (Method #1)	1 310 nm (-70 to -60) dBm (-60 to -50) dBm (-50 to -40) dBm (-40 to -30) dBm (-30 to -20) dBm -20 dBm (-20 to -10) dBm (-10 to 0) dBm (0 to 10) dBm	 0.017 dB 0.014 dB 0.012 dB 0.01 dB 0.007 dB Reference 0.007 dB 0.01 dB 0.012 dB	Variable Optical Attenuators, Laser Sources, and Optical Power Meters; E-OPT-M-0001-GE: Superposition Method, Based on IEC 61315.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Optical Power Linearity for Single-mode Fibre – Source (Method #1)	1 550 nm		Variable Optical Attenuators, Laser Sources, Optical Power Meters; E-OPT-M-0001-GE: Superposition Method, Based on IEC 61315.
	(-70 to -60) dBm	0.019 dB	
	(-60 to -50) dBm	0.016 dB	
	(-50 to -40) dBm	0.013 dB	
	(-40 to -30) dBm	0.011 dB	
	(-30 to -20) dBm	0.008 dB	
	-20 dBm	Reference	
	(-20 to -10) dBm	0.008 dB	
	(-10 to 0) dBm	0.011 dB	
	(0 to 10) dBm	0.013 dB	
	1 625 nm		
	(-70 to -60) dBm	0.032 dB	
	(-60 to -50) dBm	0.025 dB	
	(-50 to -40) dBm	0.022 dB	
	(-40 to -30) dBm	0.018 dB	
	(-30 to -20) dBm	0.013 dB	
	-20 dBm	Reference	
	(-20 to -10) dBm	0.013 dB	
	(-10 to 0) dBm	0.018 dB	
	(0 to 10) dBm	0.022 dB	
[1] Optical Power Linearity for Single-mode Fibre – Source (Method #2)	1 310 nm		Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-M-0001-GE: Comparison Measurement with Standard Power, Based on IEC 61315.
	(-90 to 80) dBm	1.4 dB	
	(-80 to -70) dBm	0.16 dB	
	(-70 to -60) dBm	0.032 dB	
	(-60 to 0) dBm	0.026 dB	
	(0 to 10) dBm	0.03 dB	
	1 550 nm		
	(-90 to 80) dBm	1.4 dB	
	(-80 to -70) dBm	0.16 dB	
	(-70 to -60) dBm	0.034 dB	
	(-60 to 0) dBm	0.028 dB	
	(0 to 10) dBm	0.03 dB	
	1 625 nm		
	(-90 to 80) dBm	1.4 dB	
	(-80 to -70) dBm	0.16 dB	
	(-70 to -60) dBm	0.046 dB	
	(-60 to 0) dBm	0.034 dB	
	(0 to 10) dBm	0.038 dB	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Optical Power Linearity for Single-mode Fibre – Source (Method #3)	1 310 nm (-90 to -60) dBm (-60 to 0) dBm 1 550 nm (-90 to -60) dBm (-60 to 0) dBm 1 625 nm (-90 to -60) dBm (-60 to 0) dBm	 0.14 dB 0.065 dB 0.14 dB 0.065 dB 0.14 dB 0.065 dB	Variable Optical Attenuators, Laser Sources, Optical Power Meters; E-OPT-M-0001-GE: Comparison Measurement with Attenuator, Based on IEC 61315.
[1] Optical Power Noise for Multi-mode and Single-mode Fibres – Source	(700 to 1 600) nm NL ≤ 0.5 pW NL ≤ 5 pW NL ≤ 50 pW NL ≤ 500 pW	 0.025 pW 0.32 pW 3.2 pW 30 pW	Lightwave Multimeters, Interface Modules; E-OPT-M-0001-GE: Direct Measurement.
[1] Optical Power Return Loss for Single-mode Fibre – Measure	1 310 nm RL ≤ 55 dB RL ≤ 65 dB 1 550 nm RL ≤ 55 dB RL ≤ 65 dB	 0.48 dB 0.76 dB 0.48 dB 0.76 dB	Keysight 8153A Lightwave Multimeter, Keysight 81534A Return Loss Module, Laser Sources, HP 8100BR Reference Reflector; E-OPT-M-0001-GE: Direct Measurement.
[1] Optical Absolute Wavelength – Source	850 nm 1 300 nm 1 310 nm (1 510 to 1 640) nm	0.25 µm/m + 1 pm 0.25 µm/m + 1 pm 0.25 µm/m + 1 pm 0.25 µm/m + 1 pm	Burleigh WA-1600, HP 86120B Optical Wavelength Meters; E-OPT-M-0001-GE: Comparison Measurement.
[1] Optical Wavelength Sensitivity – Source	1 310 nm (-50 to 0) dBm 1 550 nm (-50 to 0) dBm 1 625 nm (-50 to 0) dBm	 0.1 dB 0.1 dB 0.1 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-M-0001-GE: Comparison Measurement with Standard Power.
[1] Optical Attenuation Insertion Loss for Multi-mode Fibre – Measure	850 nm (0 to 10) dB	 0.07 dB	Keysight 81520A Optical Head; E-OPT-G-0002-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Optical Attenuation Insertion Loss for Single-mode Fibre – Measure	1 310 nm (0 to 10) dB 1 550 nm (0 to 10) dB 1 625 nm (0 to 10) dB	0.05 dB 0.05 dB 0.05 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0002-GE: Direct Measurement.
[1] Optical Attenuation Accuracy for Multi-mode Fibre – Measure	850 nm (0 to 60) dB	0.065 dB	Keysight 81520A Optical Head; E-OPT-G-0002-GE: Direct Measurement.
[1] Optical Attenuation Accuracy for Single-mode Fibre – Measure	1 310 nm (0 to 60) dB 1 550 nm (0 to 60) dB 1 625 nm (0 to 60) dB	0.04 dB 0.04 dB 0.04 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0002-GE: Direct Measurement.
[1] Optical Attenuation Repeatability for Multi-mode Fibre – Measure	850 nm (0 to 60) dB	0.006 6 dB	Keysight 81520A Optical Head; E-OPT-G-0002-GE: Direct Measurement.
[1] Optical Attenuation Repeatability for Single-mode Fibre – Measure	1 310 nm (0 to 60) dB 1 550 nm (0 to 60) dB 1 625 nm (0 to 60) dB	0.006 2 dB 0.006 8 dB 0.008 6 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0002-GE: Direct Measurement.
[1] Optical Polarization Controller – Measure Insertion Loss Variation with Rotation of λ/4 and λ/2 Plates	1 310 nm (-40 to 10) dBm (1 510 to 1 630) nm (-40 to 10) dBm	0.026 dB 0.03 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0004-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Optical Polarization Controller – Measure Insertion Loss versus Wavelength	1 310 nm (-40 to 10) dBm (1 510 to 1 630) nm (-40 to 10) dBm	0.03 dB 0.034 dB	Keysight 81624A, Keysight 81521B, Keysight 81525A, Keysight 81532A Optical Heads; E-OPT-G-0004-GE: Direct Measurement.
[1] Optical Time Domain Reflectometers (OTDRs) for Single-mode Fibre	Dynamic Range 1 310 nm 1 550 nm 1 625 nm Event Dead Zone 1 310 nm 1 550 nm 1 625 nm Attenuation Dead Zone 1 310 nm 1 550 nm 1 625 nm	 0.45 dB 0.45 dB 0.45 dB 0.046 m 0.046 m 0.046 m (Excluded reflectance uncertainty) 0.046 m 0.046 m 0.046 m (Excluded reflectance uncertainty)	Optical Fibre Length, Optical Attenuators, Optical Couplers; E-OPT-M-0002-GE: Based on NPL Measurement Good Practice Guide No. 31: Calibration and Use of OTDR.
[1] Optical Time Domain Reflectometers (OTDRs) for Single-mode Fibre	Loss Scale Linearity 1 310 nm 1 550 nm 1 625 nm Central Wavelength (1 100 to 1 700) nm	 0.018 dB 0.018 dB 0.018 dB 0.36 nm	Optical Fibre Length, Optical Spectrum Analyzers, Optical Attenuators; E-OPT-M-0002-GE: Based on Anritsu's Instruction Manual.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Optical Time Domain Reflectometers (OTDRs) for Single-mode Fibre	Pulse Width (1 100 to 1 650) nm 3 ns 5 ns 10 ns 20 ns 50 ns 100 ns 200 ns 500 ns 1 µs 2 µs 5 µs 10 µs 20 µs	 11 % of reading 6.4 % of reading 3.5 % of reading 2.2 % of reading 1.7 % of reading 1.6 % of reading 1.6 % of reading 1.6 % of reading 1.6 % of reading 1.6 % of reading 1.6 % of reading 1.6 % of reading 1.6 % of reading	Optical Attenuators, O/E Converters, Digital Oscilloscopes; E-OPT-M-0002-GE: Based on NPL Measurement Good Practice Guide No. 31: Calibration and Use of OTDR, IEC 61746: Calibration of OTDR and Anritsu's Instruction Manual.
[1] Optical Time Domain Reflectometers (OTDRs) for Single-mode Fibre	Distance Scale Deviation 1 310 nm 1 550 nm 1 625 nm	 0.038 m/km 0.038 m/km 0.038 m/km	Optical Fibres Length, Incremental Fibres Set; E-OPT-M-0002-GE: Based on IEC 61746-1: Calibration of OTDR, Part 1: OTDR for Single-mode Fibres (Distance calibration methods: Concatenated fibre method). Refractive Group Index N = 1.46
[1] Optical Fibres Length for Single-mode Fibre – Measure	1 310 nm 40 km 1 550 nm 40 km 1 625 nm 40 km	 1.5 m 1.5 m 1.5 m	NPL Optical Fibres Length; E-OPT-G-0005-GE: Comparison Measurement. Refractive Group Index N = 1.46
[1,6] Optical Fibres Length for Single-mode Fibre – Measure	1 310 nm Up to 512 km 1 550 nm Up to 512 km 1 625 nm Up to 512 km	 $L*2.4*10^{-5} + 2$ m $L*2.4*10^{-5} + 2$ m $L*2.4*10^{-5} + 2$ m	E-OPT-G-0006-GE: Direct Measurement with Master OTDRs. Refractive Group Index N = 1.46

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Laser Power – Source (Fixed Wavelength)	5 nW to 100 mW 488 nm 633 nm 2 µW to 1.2 W 808 nm 940 nm	 2.3 % of reading 2.3 % of reading 2.8 % of reading 2.8 % of reading	Ophir PD300-3W Photodiode Laser Power Sensor and Diode Laser Sources; E-OPT-M-0003-GE: Comparison Measurement.
[1] Laser Power – Source (Full Wavelength Range)	190 nm to 11 µm 50 mW to 5 W (5 to 50) W	 3.8 % of reading 4.3 % of reading	Ophir F150A-BB-26-V1 Thermal Laser Power Sensor, Diode Laser Sources; E-OPT-M-0003-GE: Comparison Measurement.
[1] Laser Energy – Source (Full Wavelength Range)	190 nm to 11 µm 20 mJ to 100 J	 4.8 % of reading	Ophir F150A-BB-26-V1 Thermal Laser Power Sensor, Pulse Laser Sources with Function Gen 33250A; E-OPT-M-0003-GE: Comparison Measurement.
[1] Laser Power – Measure	(400 to 950) nm 5 nW to 100 mW 2 µW to 3 W 190 nm to 11 µm 50 mW to 150 W	 4.4 % of reading 6.4 % of reading 6 % of reading	Ophir PD300-3W Photodiode Laser Power Sensor, F150A-BB-26-V1 Thermal Laser Power Sensor; E-OPT-G-0003-GE: Direct Measurement.
Illumination/Lux Meter	Up to 29.99 lx (30.0 to 299.9) lx (300 to 2 999) lx (3 000 to 10 000) lx (10 000 to 29 990) lx (30 000 to 35 000) lx	1.5 % of reading + 0.01 lx 1.5 % of reading + 0.1 lx 1.5 % of reading + 1 lx 1.5 % of reading + 10 lx 1.6 % of reading + 20 lx 1.6 % of reading + 200 lx	Light Enclosure, Tungsten Halogen Lamp, Standard Lux Meter; EN-0004-GE: Comparison Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Luminance Colorimeter	Luminance (10 to 99.99) cd/m² (100 to 34 000) cd/m² Chromaticity x y Color Temperature (CCT) (2 600 to 3 200) K (3 200 to 10 000) K	 1.2 % of Reading 1.2 % of Reading 0.3 % of Reading 0.42 % of Reading 1.2 % of Reading 1.6 % of Reading	Master Luminance Colorimeter; EN-0011-GE: Comparison Measurement.
[1] Color Light Boxes	Illuminance Up to 30 lx (30 to 300) lx (300 to 3 000) lx (3 000 to 10 000) lx (10 000 to 30 000) lx (30 000 to 35 000) lx	 1.3 % of reading 1.3 % of reading 1.3 % of reading 1.6 % of reading 1.6 % of reading 1.6 % of reading	Chroma Meters and UV Meters; EN-0014-GE: Direct Measurement.
[1] Color Light Boxes	Correlated Color Temperature (CCT) (2 600 to 3 200) K (3 200 to 10 000) K UV Intensity (UVA) (0.05 to 30) mW/cm² (30 to 500) mW/cm²	 1.2 % of reading 1.6 % of reading 4.6 % of reading 6.6 % of reading	Chroma Meters and UV Meters; EN-0014-GE: Direct Measurement.
UV Meter (UVA)	Up to 30 mW/cm² (30 to 1 800) mW/cm²	7.8 % of reading + 0.02 mW/cm² 8.4 % of reading + 0.02 mW/cm²	UV Light Enclosure, Standard UV Meter; EN-0005-GE: Comparison Measurement.
[1,6] Gloss Meter	Up to 1 900 GU @ 20° Up to 900 GU @ 60° Up to 140 GU @ 85°	1 GU 1 GU 1 GU	Standard Gloss Tiles; EN-0007-GE: Direct Measurement.
[1,6] Gloss of a Gloss Sample	Up to 100 GU @ 60° (100 to 1 000) GU @ 60°	1.2 GU 0.6 % of reading + 1.2 GU	Standard Gloss Meter; EN-0008-GE: Direct Measurement.

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[1,6] Color Meter			
Spectral Diffuse Reflectance	Red		
(380 to 400) nm	(5.30 to 5.50) %R	0.19 % Reflectance	
(400 to 575) nm	(5.30 to 7.40) %R	0.14 % Reflectance	
(575 to 585) nm	(7.40 to 11.00) %R	0.24 % Reflectance	
(585 to 595) nm	(11.00 to 19.40) %R	0.39 % Reflectance	
(595 to 610) nm	(19.40 to 37.20) %R	0.53 % Reflectance	
(610 to 630) nm	(37.20 to 58.70) %R	0.65 % Reflectance	
(630 to 660) nm	(58.70 to 71.70) %R	0.74 % Reflectance	
(660 to 780) nm	(71.70 to 78.20) %R	0.78 % Reflectance	
	Green		
(380 to 400) nm	(6.80 to 7.40) %R	0.24 % Reflectance	
(400 to 440) nm	(7.40 to 11.00) %R	0.16 % Reflectance	
(440 to 480) nm	(11.00 to 22.10) %R	0.26 % Reflectance	
(480 to 505) nm	(22.10 to 30.00) %R	0.32 % Reflectance	
(505 to 550) nm	(30.00 to 29.40) %R	0.36 % Reflectance	
(550 to 560) nm	(29.40 to 24.80) %R	0.33 % Reflectance	
(560 to 575) nm	(24.80 to 18.30) %R	0.28 % Reflectance	Standard Color Plates; EN-0009-GE: Direct Measurement.
(575 to 615) nm	(18.30 to 12.90) %R	0.19 % Reflectance	
(615 to 700) nm	(12.90 to 13.50) %R	0.16 % Reflectance	
(700 to 710) nm	(13.50 to 16.40) %R	0.34 % Reflectance	
(710 to 720) nm	(16.40 to 20.90) %R	0.46 % Reflectance	
(720 to 735) nm	(20.90 to 29.00) %R	0.53 % Reflectance	
(735 to 780) nm	(29.00 to 44.10) %R	0.51 % Reflectance	
	Blue		
(380 to 400) nm	(35.40 to 40.60) %R	1.2 % Reflectance	
(400 to 460) nm	(40.60 to 49.60) %R	0.65 % Reflectance	
(460 to 515) nm	(49.60 to 31.10) %R	0.49 % Reflectance	
(515 to 535) nm	(31.10 to 16.60) %R	0.36 % Reflectance	
(535 to 545) nm	(16.60 to 13.20) %R	0.19 % Reflectance	
(545 to 640) nm	(13.20 to 12.40) %R	0.18 % Reflectance	
(640 to 650) nm	(12.40 to 17.90) %R	0.28 % Reflectance	
(650 to 660) nm	(17.90 to 26.90) %R	0.41 % Reflectance	
(660 to 670) nm	(26.90 to 38.10) %R	0.53 % Reflectance	
(670 to 680) nm	(38.10 to 49.20) %R	0.59 % Reflectance	
(680 to 700) nm	(49.20 to 65.40) %R	0.65 % Reflectance	
(700 to 780) nm	(65.40 to 74.60) %R	0.74 % Reflectance	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,6] Color Meter			
Spectral Diffuse Reflectance	Yellow		
(380 to 490) nm	(7.30 to 8.80) % R	0.28 % Reflectance	
(490 to 500) nm	(8.80 to 14.20) % R	0.34 % Reflectance	
(500 to 510) nm	(14.20 to 26.10) % R	0.51 % Reflectance	
(510 to 580) nm	(26.10 to 71.40) % R	0.69 % Reflectance	
(580 to 780) nm	(71.40 to 77.30) % R	0.77 % Reflectance	
	White		
(380 to 400) nm	(78.20 to 78.40) % R	2.4 % Reflectance	
(400 to 460) nm	(78.30 to 78.60) % R	0.98 % Reflectance	
(460 to 780) nm	(78.60 to 81.40) % R	0.82 % Reflectance	
	Mid-Grey		
(380 to 400) nm	(38.00 to 38.20) % R	0.98 % Reflectance	
(400 to 460) nm	(38.20 to 39.00) % R	0.51 % Reflectance	
(460 to 780) nm	(39.00 to 44.20) % R	0.45 % Reflectance	
	Deep-Grey		
(380 to 400) nm	(15.90 to 16.00) % R	0.44 % Reflectance	
(400 to 460) nm	(16.00 to 16.40) % R	0.26 % Reflectance	
(460 to 780) nm	(16.40 to 19.70) % R	0.22 % Reflectance	
	Black		
(380 to 400) nm	0 % R	3.4 % Reflectance	
(400 to 780) nm	0 % R	3.1 % Reflectance	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,5] Color Meter – Colorimetric Data @ 2° and 10° Observers	Red Illuminant A x y Y L* a* b* Illuminant C, D65 x y Y L* a* b* Green Illuminant A x y Y L* a* b* Illuminant C, D65 x y Y L* a* b*	 0.000 4 0.000 4 0.22 0.27 0.22 0.28 0.000 8 0.000 5 0.18 0.24 0.22 0.25 0.000 7 0.000 7 0.22 0.23 0.16 0.27 0.000 8 0.001 0.23 0.23 0.14 0.25	Standard Color Plates; EN-0009-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,5] Color Meter – Colorimetric Data @ 2º and 10º Observers	Blue Illuminant A x y Y L* a* b* Illuminant C, D65 x y Y L* a* b* Yellow Illuminant A x y Y L* a* b* Illuminant C, D65 x y Y L* a* b* White Illuminant A x y Y L* a* b*	 0.000 8 0.001 0.17 0.22 0.37 0.27 0.000 5 0.000 8 0.21 0.23 0.39 0.27 0.000 8 0.001 0.18 0.22 0.37 0.27 0.000 7 0.000 7 0.52 0.32 0.25 0.27 0.000 5 0.000 5 0.68 0.33 0.12 0.16	Standard Color Plates; EN-0009-GE: Direct Measurement.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,5] Color Meter – Colorimetric Data @ 2º and 10º Observers	White Illuminant C, D65 x y Y L* a* b* Mid-Grey Illuminant A x y Y L* a* b* Illuminant C, D65 x y Y L* a* b* Deep-Grey Illuminant A x y Y L* a* b* Illuminant C, D65 x y Y L* a* b*	 0.000 5 0.000 7 0.68 0.33 0.14 0.18 0.000 5 0.000 5 0.38 0.28 0.1 0.14 0.000 5 0.000 7 0.38 0.28 0.12 0.15 0.000 5 0.000 5 0.19 0.22 0.08 0.1 0.000 5 0.000 7 0.19 0.22 0.1 0.12	Standard Color Plates; EN-0009-GE: Direct Measurement.

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Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,5] Color Meter – Colorimetric Data @ 2º and 10º Observers	Black Illuminant A x y Y L* a* b* Illuminant C, D65 x y Y L* a* b*	 0.002 0.002 0.01 0.1 0.13 0.14 0.002 0.002 0.01 0.1 0.14 0.14	Standard Color Plates; EN-0009-GE: Direct Measurement.

Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] PRT/RTD Sensor	(-80 to -40) °C (-40 to 0) ºC (0 to 100) ºC (100 to 200) ºC (200 to 300) ºC	0.028 °C 0.013 ºC 0.012 ºC 0.014 ºC 0.018 ºC	Digital Multimeter, SPRT/PRT Sensors; T-0001-GE: Comparison using Temperature Sources from Liquid Calibration Baths.
[1] PRT/RTD Sensor	(-20 to 40) ºC (40 to 100) ºC (100 to 200) ºC (200 to 400) °C (400 to 650) ºC	0.07 ºC 0.02 ºC 0.03 ºC 0.037 ºC 0.045 °C	Digital Multimeter SPRT/PRT Sensors; T-0001-GE: Comparison using Temperature Sources from Dry Block Calibrators.
[1] Liquid-in-Glass Thermometer	Total Immersion Type (-80 to -40) °C (-40 to -20) ºC (-20 to 0) ºC (0 to 40) ºC (40 to 100) ºC (100 to 200) ºC (200 to 300) ºC	 0.04 °C 0.03 °C 0.03 °C 0.03 °C 0.03 °C 0.03 °C 0.03 °C	Thermometer Readout with SPRT/PRT Sensors; T-0002-GE: Based on ASTM E77-98, using Temperature Sources from Liquid Calibration Baths.

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Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Liquid-in-Glass Thermometer	Partial Immersion Type (-80 to -40) °C (-40 to -20) ºC (-20 to 0) ºC (0 to 40) ºC (40 to 100) ºC (100 to 200) ºC (200 to 300) ºC	 0.05 °C 0.05 °C 0.05 °C 0.05 °C 0.05 °C 0.05 °C 0.05 °C	Thermometer Readout with SPRT/PRT Sensors; T-0002-GE: Based on ASTM E77-98, using Temperature Sources from Liquid Calibration Baths.
[1] Extension Thermocouple Wire	20 °C or 30 °C Temperature Gradient to the Ice-point Type E, J, K, N, T Type R, S	 0.045 ºC 0.15 ºC	Ice Point, Calibration Bath, Digital Multimeter, Thermometer Readout with SPRT/PRT, T-0027-GE: Based on EURAMET cg-8, ASTM E 220, ASTM E230 using Temperature Sources from Liquid Calibration Baths.
[1, 2] Thermocouple Sensor	Type E (-80 to -40) °C (-40 to 40) ºC (40 to 100) °C (100 to 300) °C Type J, K (-80 to -40) °C (-40 to 40) ºC (40 to 100) °C (100 to 300) °C Type N (-80 to -40) °C (-40 to -20) ºC (-20 to 40) ºC (40 to 100) ºC (100 to 300) ºC	 0.25 °C 0.2 °C 0.3 °C 0.44 °C 0.27 °C 0.2 °C 0.3 °C 0.56 °C 0.3 °C 0.25 °C 0.23 °C 0.32 °C 0.56 °C	Ice Point, Calibration Baths, Digital Multimeter, Extension Wire, Thermometer Readout with SPRT/PRT/TC; T-0003-GE: Based on EURAMET CG-8, ASTM E 220 and ASTM E230.

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Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1, 2] Thermocouple Sensor	Type R, S (-40 to -20) ºC (-20 to 0) ºC (0 to 40) ºC (40 to 100) ºC (100 to 200) ºC (200 to 300) ºC Type T (-80 to -40) °C (-40 to 0) ºC (0 to 100) ºC (100 to 200) ºC (200 to 300) ºC	 1.1 °C 0.85 °C 0.72 °C 0.67 °C 0.65 °C 0.62 °C 0.27 °C 0.23 °C 0.3 °C 0.4 °C 0.56 °C	Ice Point, Calibration Baths, Digital Multimeter, Extension Wire, Thermometer Readout with SPRT/PRT/TC; T-0003-GE: Based on EURAMET CG-8, ASTM E 220 and ASTM E230.
[1, 2] Thermocouple Sensor	Type E (-20 to 40) ºC (40 to 100) ºC (100 to 200) ºC (200 to 400) ºC (400 to 650) ºC (650 to 700) ºC (700 to 800) ºC (800 to 900) ºC (900 to 1 000) ºC Type J, K (-20 to 40) ºC (40 to 100) ºC (100 to 300) ºC (300 to 400) ºC (400 to 650) ºC (650 to 700) ºC (700 to 900) ºC (900 to 1 000) ºC (1 000 to 1 100) ºC (1 100 to 1 200) ºC	 0.23 °C 0.32 °C 0.45 °C 0.52 °C 0.8 °C 1.5 °C 1.7 °C 1.8 °C 1.9 °C 0.23 °C 0.32 °C 0.58 °C 0.74 °C 1.2 °C 1.8 °C 2.1 °C 2.3 °C 2.4 °C 2.6 °C	Ice Point, Dry Block Calibrators, Digital Multimeter, Extension Wire, Thermometer Readout with SPRT/PRT/TC; T-0003-GE: Based on EURAMET CG-8, ASTM E 220 and ASTM E230.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1, 2] Thermocouple Sensor	Type N (-20 to 40) ºC (40 to 100) ºC (100 to 300) ºC (300 to 400) ºC (400 to 650) ºC (650 to 700) ºC (700 to 900) ºC (900 to 1 000) ºC (1 000 to 1 100) ºC (1 100 to 1 200) ºC Type R, S (-20 to 0) ºC (0 to 40) ºC (40 to 200) ºC (200 to 650) ºC (650 to 700) ºC (700 to 800) ºC (800 to 1 100) ºC (1 100 to 1 200) ºC Type T (-20 to 40) ºC (40 to 100) ºC (100 to 200) ºC (200 to 300) ºC (300 to 400) ºC	 0.26 °C 0.34 °C 0.58 °C 0.74 °C 1.2 °C 1.8 °C 2.1 °C 2.3 °C 2.4 °C 2.6 °C 0.95 °C 0.73 °C 0.67 °C 0.64 °C 1.4 °C 1.5 °C 1.6 °C 1.8 °C 0.23 °C 0.32 °C 0.41 °C 0.56 °C 0.73 °C	Ice Point, Dry Block Calibrator, Digital Multimeter, Extension Wire, Thermometer Readout with SPRT/PRT/TC; T-0003-GE: based on EURAMET cg-8, ASTM E 220, ASTM E230.
[1] Temperature Measuring System with PRT/ RTD/ Thermistor Sensor	(-80 to -40) °C (-40 to 0) ºC (0 to 40) ºC (40 to 100) ºC (100 to 200) ºC (200 to 300) ºC	0.028 °C 0.013 °C 0.014 °C 0.015 °C 0.017 °C 0.021 °C	Thermometer Readout with SPRT/PRT Sensors; T-0004-GE: Comparison Measurement using Temperature Sources from Liquid Calibration Baths.
[1] Temperature Measuring System with PRT/ RTD/ Thermistor Sensor	(-20 to 40) ºC (40 to 100) ºC (100 to 200) ºC (200 to 400) °C (400 to 650) ºC	0.07 °C 0.022 °C 0.032 °C 0.04 °C 0.05 °C	Thermometer Readout with SPRT/PRT Sensors; T-0004-GE: Comparison Measurement using Temperature Sources from Dry Block Calibrators.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1, 2] Temperature Measuring System with Thermocouple Sensor	Type B		Thermometer Readout with SPRT/PRT Sensors; T-0004-GE: Comparison Measurement using Temperature Sources from Liquid Calibration Baths.
	(-40 to -20) ºC	0.13 °C	
	(-20 to 0) ºC	0.1 °C	
	(0 to 40) ºC	0.13 °C	
	(40 to 200) ºC	0.25 °C	
	(200 to 300) ºC	0.36 °C	
	Type E		
	(-80 to -40) °C	0.21 °C	
	(-40 to -20) ºC	0.13 °C	
	(-20 to 0) ºC	0.1 °C	
	(0 to 40) ºC	0.13 °C	
	(40 to 100) ºC	0.25 °C	
	(100 to 300) ºC	0.41 °C	
	Type J, K, N		
	(-80 to -40) °C	0.21 °C	
	(-40 to -20) ºC	0.13 °C	
	(-20 to 0) ºC	0.1 °C	
	(0 to 40) ºC	0.13 °C	
	(40 to 100) ºC	0.25 °C	
	(100 to 300) ºC	0.53 °C	
	Type R, S		
	(-40 to -20) ºC	0.13 °C	
	(-20 to 0) ºC	0.1 °C	
	(0 to 40) ºC	0.13 °C	
	(40 to 100) ºC	0.25 °C	
	(100 to 300) ºC	0.36 °C	
	Type T		
	(-80 to -40) °C	0.21 °C	
	(-40 to -20) ºC	0.13 °C	
	(-20 to 0) ºC	0.1 °C	
	(0 to 40) ºC	0.13 °C	
	(40 to 100) ºC	0.25 °C	
	(100 to 200) ºC	0.36 °C	
	(200 to 300) ºC	0.53 °C	

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[1, 2] Temperature Measuring System with Thermocouple Sensor	Type B		Thermometer Readout with SPRT/PRT Sensors; T-0004-GE: Comparison Measurement using Temperature Sources from Dry Block Calibrators.
	(-20 to 0) ºC	0.15 °C	
	(0 to 40) ºC	0.17 °C	
	(40 to 200) ºC	0.28 °C	
	(200 to 300) ºC	0.38 °C	
	(300 to 400) ºC	0.48 °C	
	(400 to 650) ºC	0.78 °C	
	(650 to 700) ºC	1.5 °C	
	(700 to 800) ºC	1.7 °C	
	(800 to 10 00) ºC	1.8 °C	
	(1 000 to 1 100) ºC	1.9 °C	
	(1 100 to 1 200) ºC	2.1 °C	
	Type E		
	(-20 to 0) ºC	0.15 °C	
	(0 to 40) ºC	0.17 °C	
	(40 to 100) ºC	0.28 °C	
	(100 to 300) ºC	0.43 °C	
	(300 to 400) ºC	0.5 °C	
	(400 to 650) ºC	0.78 °C	
	(650 to 700) ºC	1.5 °C	
	(700 to 800) ºC	1.7 °C	
	(800 to 1 000) ºC	1.8 °C	
	Type J, K, N		
	(-20 to 0) ºC	0.15 °C	
	(0 to 40) ºC	0.17 °C	
	(40 to 100) ºC	0.28 °C	
	(100 to 300) ºC	0.55 °C	
	(300 to 400) ºC	0.72 °C	
	(400 to 650) ºC	1.2 °C	
	(650 to 700) ºC	1.8 °C	
	(700 to 800) ºC	2 °C	
	(800 to 900) ºC	2.1 °C	
	(900 to 1 000) ºC	2.2 °C	
	(1 000 to 1 100) ºC	2.4 °C	
	(1 100 to 1 200) ºC	2.6 °C	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1, 2] Temperature Measuring System with Thermocouple Sensor	Type R, S (-20 to 0) ºC (0 to 40) ºC (40 to 100) ºC (100 to 400) ºC (400 to 650) ºC (650 to 700) ºC (700 to 1 100) ºC (1 100 to 1 200) ºC Type T (-20 to 0) ºC (0 to 40) ºC (40 to 100) ºC (100 to 200) ºC (200 to 300) ºC (300 to 400) ºC	 0.15 °C 0.17 °C 0.28 °C 0.39 °C 0.43 °C 1.3 °C 1.5 °C 1.7 °C 0.15 °C 0.17 °C 0.28 °C 0.39 °C 0.55 °C 0.72 °C	Thermometer Readout with SPRT/PRT Sensors; T-0004-GE: Comparison Measurement using Temperature Sources from Dry Block Calibrators.
[1, 3] Calibration Liquid Bath	(-80 to -40) °C (-40 to -20) ºC (-20 to 0) ºC (0 to 40) ºC (40 to 100) ºC (100 to 200) ºC (200 to 300) ºC (300 to 400) ºC (400 to 650) ºC	0.02 °C 0.017 °C 0.018 °C 0.019 °C 0.02 °C 0.021 °C 0.022 °C 0.024 °C 0.12 °C	Thermometer Readout with SPRT/PRT; T-0005-GE: Comparison.
[1, 3] Dry Block Calibrator	(-80 to -40) °C (-40 to -20) °C (-20 to 40) °C (40 to 100) °C (100 to 200) °C (200 to 300) °C (300 to 400) °C (400 to 650) °C (650 to 700) °C (700 to 1 100) °C (1 100 to 1 200) °C	0.12 °C 0.11 °C 0.08 °C 0.1 °C 0.1 °C 0.1 °C 0.12 °C 0.14 °C 1.3 °C 1.4 °C 1.6 °C	Thermometer Readout with SPRT/PRT/TC; T-0006-GE: Based on EURAMET cg-13, Version 3.0 (02/2015).
[1, 3] Water Bath	(25 to 50) ºC (50 to 100) ºC	0.1 °C 0.12 °C	Data Logger with RTD/TC Sensors; T-0014-GE: Based on ASTM E 715-80.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1, 3] Autoclave	(100 to 140) ºC	0.42 °C	Data Logger with RTD/TC Sensors; T-0022-GE: Based on BS 2646 Part 5.
[1, 3] Temperature Controlled Enclosure and Furnace	(-80 to -40) ºC (-40 to 0) ºC (0 to 100) ºC (100 to 200) ºC	0.3 °C 0.22 °C 0.42 °C 0.45 °C	Data Logger with RTD/TC Sensors; T-0011-GE: Based on TLAS G-20.
[1, 3] Temperature Controlled Enclosure and Furnace	(200 to 300) ºC	1.5 °C	Data Logger with TC, T-0011-GE: based on TLAS G-20.
[1, 3] Temperature Controlled Enclosure and Furnace	(300 to 500) ºC (500 to 1 100) ºC (1 100 to 1 200) ºC	1.5 °C 1.6 °C 1.8 °C	Thermometer Readout with TC Sensors; T-0011-GE: Direct Measurement.
[1] Relative Humidity Controlled Chamber	(1 to 10) %RH (10 to 20) %RH (20 to 50) %RH (50 to 80) %RH (80 to 98) %RH	1 %RH 0.5 %RH 0.5 %RH 0.6 %RH 0.6 %RH	Master Dew Point Meter, Standard Humidity Meter or Transmitter; T-0025-GE: Direct Measurement.
[1] Thermo-Hygrograph	Temperature (0 to 50) °C Relative Humidity (20 to 50) %RH (50 to 80) %RH (80 to 90) %RH	 0.6 °C 0.8 %RH 0.9 %RH 1 %RH	Master Dew Point Meter, Thermometer Readout with PRT, Standard Humidity Meter or Transmitter; T-0012-GE: Comparison in Temperature and Humidity Controlled Chambers.
[1] Thermo-Hygrometer	Temperature (-40 to -20) ºC (-20 to 0) ºC (0 to 50) ºC (50 to 100) ºC Relative Humidity (5 to 20) %RH (20 to 50) %RH (50 to 80) %RH (80 to 98) %RH	 0.2 ºC 0.15 ºC 0.15 ºC 0.2 ºC 0.5 %RH 0.5 %RH 0.62 %RH 0.72 %RH	Master Dew Point Meter, Thermometer Readout with PRT, Standard Humidity Meter or Transmitter; T-0013-GE: Comparison in Temperature and Humidity Controlled Chambers.
[1] Temperature Dew Point Meter	(-16 to -5) °C (-5 to 40) ºC	0.17 °C 0.17 ºC	Master Dew Point Meter; T-0013-GE: Comparison in Temperature and Humidity Controlled Chambers.

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Temperature and Humidity Transmitter with Electrical Output Voltage of (0 to 10) V	Temperature (-40 to -20) °C (-20 to 0) °C (0 to 50) °C (50 to 100) °C Relative Humidity (5 to 20) %RH (20 to 50) %RH (50 to 80) %RH (80 to 98) %RH	 0.22 °C 0.17 °C 0.16 °C 0.23 °C 0.51 %RH 0.51 %RH 0.62 %RH 0.73 %RH	Master Dew Point Meter, Thermometer Readout with PRT, Standard Humidity Meter or Transmitter, Digital Multimeter, DC Power Supply; T-0026-GE: Comparison in Temperature and Humidity Controlled Chambers.
[1] Temperature and Humidity Transmitter with Electrical Output Current of (4 to 20) mA	Temperature (-40 to -20) °C (-20 to 0) °C (0 to 50) °C (50 to 100) °C Relative Humidity (5 to 20) %RH (20 to 50) %RH (50 to 80) %RH (80 to 98) %RH	 0.22 °C 0.17 °C 0.16 °C 0.23 °C 0.51 %RH 0.51 %RH 0.62 %RH 0.73 %RH	Master Dew Point Meter, Thermometer Readout with PRT, Standard Humidity Meter or Transmitter, Digital Multimeter, DC Power Supply; T-0026-GE: Comparison in Temperature and Humidity Controlled Chambers.
[1, 2] Temperature Measuring System with Surface Thermocouple Sensor	(-40 to 35) ºC (35 to 100) ºC (100 to 200) ºC (200 to 300) ºC (300 to 400) ºC	0.3 °C 0.5 °C 0.9 °C 1.2 °C 1.8 °C	Temperature Liquid Bath with Aluminum Surface Block, Surface Calibrator, Thermometer Readout with PRT Sensors; T-0023-GE: Comparison.
[1] Industrial Type Infrared Thermometer	(-30 to 80) °C	0.4 °C	Black Body Calibrator (Cavity), Thermometer Readout with PRT/TC Sensors; T-0024-GE $\varepsilon = 1$, $\lambda = (8 \text{ to } 14)$ µm

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Thermodynamic

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Industrial Type Infrared Thermometer	(35 to 50) °C (50 to 100) °C (100 to 150) °C (150 to 200) °C (200 to 250) °C (250 to 300) °C (300 to 350) °C (350 to 400) °C (400 to 450) °C (450 to 500) °C	0.6 °C 0.85 °C 1.3 °C 1.5 °C 2.1 °C 2.5 °C 3.3 °C 3.7 °C 4.5 °C 4.8 °C	Black Body Source (Flat Plate), Thermometer Readout with PRT/TC Sensors; T-0024-GE: Based on IR Calibration Guide by Fluke Corporation. $\varepsilon = 0.95$, $\lambda = (8 \text{ to } 14)$ µm
[1] Industrial Type Infrared Thermometer	(50 to 100) °C (100 to 200) °C (200 to 300) °C (300 to 400) °C (400 to 500) °C (500 to 600) °C (600 to 700) °C (700 to 800) °C (800 to 900) °C (900 to 1 000) °C (1 000 to 1 100) °C (1 100 to 1 200) °C	1 °C 1.2 °C 1.3 °C 1.8 °C 2.2 °C 2.6 °C 3.3 °C 3.9 °C 3.9 °C 4.2 °C 4.4 °C 4.6 °C	Dry Block Calibrator with Black Body Kit and Thermometer Readout with PRT/TC Sensors; T-0024-GE. $\varepsilon = 0.99$, $\lambda = (8 \text{ to } 14)$ µm
[1] Blackbody Radiation Source (IR Calibrator, Blackbody Calibrator)	(-30 to 0) °C (0 to 30) °C (30 to 100) °C (100 to 200) °C (200 to 300) °C (300 to 400) °C (400 to 500) °C (500 to 600) °C (600 to 700) °C (700 to 800) °C (800 to 900) °C (900 to 1 000) °C	0.85 °C 0.85 °C 1 °C 1.4 °C 1.4 °C 1.6 °C 1.9 °C 2.2 °C 2.6 °C 2.9 °C 3.5 °C 4 °C	Reference Radiation Thermometer; Transfer Method, T-0030-GE; $\varepsilon = (0.95 \text{ to } 0.999)$, $\lambda = (8 \text{ to } 14)$ µm

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Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1,6] Centrifuge/Stirrer/ Rotation Speed of Instrument	(5 to 50 000) rpm	0.016 % of reading	Digital Tachometer, CH-0009-GE: Direct Measurement.
[1] Oscilloscope Calibrator – AC Square Wave Frequency	10 Hz to 10 kHz	40 nHz/Hz	Keysight 53132A, Opt.010 Universal Counter; E-OSC-G-0001-GE: Based on Manufacturer Manual.
[1] Oscilloscope Calibrator – Edge Frequency	1 kHz to 10 MHz	40 nHz/Hz	Keysight 53132A, Opt.010 Universal Counter; E-OSC-G-0001-GE: Based on Manufacturer Manual.
[1] Frequency – Source	100 kHz 1 MHz 5 MHz 10 MHz	34 µHz 0.34 mHz 1.7 mHz 3.4 mHz	HP 58503A GPS and Rubidium Frequency Standard, E-TMF-M-0001-GE: Direct Measurement.
[1] Frequency – Source	10 mHz to 40 GHz	0.34 nHz/Hz	Signal and Function Generators with External Time Base Lock from HP 58503A GPS Receiver and Rubidium Frequency Standard; E-TMF-M-0001-GE: Direct Measurement.
[1] Frequency – Source	10 mHz to 100 kHz 100 kHz to 4 GHz (4 to 20) GHz (20 to 26.5) GHz (26.5 to 40) GHz	25 µHz/Hz 0.18 µHz/Hz 0.12 µHz/Hz 0.3 µHz/Hz 0.12 µHz/Hz	Signal and Function Generators with Internal Time Base; E-TMF-M-0001-GE: Direct Measurement.
AC Frequency – Source	10 mV to 1 000 V (5 to 120) Hz 120 Hz to 1.2 kHz (1.2 to 12) kHz (12 to 120) kHz 120 kHz to 1.2 MHz (1.2 to 2) MHz	 2 µHz/Hz + 0.6 mHz 2 µHz/Hz + 1 mHz 2 µHz/Hz + 10 mHz 2 µHz/Hz + 0.1 Hz 2 µHz/Hz + 1 Hz 2 µHz/Hz + 1 Hz	Fluke 57xxA, Fluke 55xxA Multiproduct Calibrators; E-TMF-M-0002-GE: Direct Measurement.

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Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Frequency – Source	10 mV to 1 000 V (5 to 120) Hz 120 Hz to 1.2 kHz (1.2 to 12) kHz (12 to 120) kHz 120 kHz to 1.2 MHz (1.2 to 2) MHz	2 µHz/Hz + 0.6 mHz 2 µHz/Hz + 1 mHz 2 µHz/Hz + 10 mHz 2 µHz/Hz + 0.1 Hz 2 µHz/Hz + 1 Hz 2 µHz/Hz + 1 Hz	Fluke 5560A Multiproduct Calibrator; E-TMF-M-0002-GE: Direct Measurement.
[1] Frequency – Measure	0.1 Hz to 3 GHz (3 to 40) GHz	0.35 nHz/Hz 0.4 nHz/Hz	Universal and Microwave Counters with External Time Base Lock from HP 58503A Rubidium Frequency Standard; E-TMF-G-0001-GE: Direct Measurement.
[1] Frequency – Measure	0.1 Hz to 3 GHz (3 to 40) GHz	40 nHz/Hz 2.8 µHz/Hz	Universal and Microwave Counters with Internal Time Base; E-TMF-G-01-GE: Direct Measurement.
[1] AC Voltage Frequency – Measure	100 mV to 1 000 V (1 to 10) Hz (10 to 195) Hz 195 Hz to 1.95 kHz (1.95 to 19.5) kHz (19.5 to 195) kHz 195 kHz to 1 MHz (1 to 10) MHz	0.58 mHz/Hz 10 µHz/Hz + 0.3 mHz 10 µHz/Hz + 3 mHz 10 µHz/Hz + 30 mHz 10 µHz/Hz + 0.3 Hz 10 µHz/Hz + 3 Hz 0.12 mHz/Hz	Fluke 8508A, Agilent 3458A 8.5 Digit Multimeters; E-TMF-G-0003-GE: Direct Measurement.
[1] Stopwatch/Timer – With Human Interaction	24 hr	50 ms	HP 53132A Universal Counter, HP 33250A Function Generator; E-TMF-M-0005-GE: Direct Comparison and Totalize Methods, based on NIST Practice Guide, Special Publication 960-12.

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Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Stopwatch/Timer – Without Human Interaction	24 hr	13 ms/d	Seiko QT2100, Quartz Tester; E-TMF-M-0007-GE: Direct Measurement using Time Base Method, based on NIST Practice Guide, special publication 960-12.
[1,6,10] Tachometer – Contact and Non-contact Types Revolution Surface Speed	(5 to 99 999) rpm (0.05 to 3 810) m/min (0.4 to 12 500) ft/min (0.13 to 4 167) yd/min (5 to 99 999) in/min	0.000 24 % of reading 0.000 24 % of reading 0.000 24 % of reading 0.000 24 % of reading 0.000 24 % of reading	Agilent 33220A, Agilent 33250A Function Generators; E-TMF-M-0006-GE: Direct Measurement.
[1] Surface Speed/Conveyor Speed – Measure	(0.05 to 99.99) m/min (100 to 1 999.9) m/min (0.2 to 999.9) ft/min (1 000 to 6 560) ft/min	0.058 % of reading + 30 mm/min 0.058 % of reading + 0.3 m/min 0.058 % of reading + 0.3 ft/min 0.058 % of reading + 3 ft/min	Digital Tachometer; E-TMF-G-0008-GE: Direct Measurement.
[1,6] Stroboscope	(30 to 999.99) fpm (1 000 to 9 999.9) fpm (10 000 to 99 999) fpm (100 000 to 300 000) fpm	0.002 fpm 0.02 fpm 0.2 fpm 0.5 fpm	HP 53132A Universal Counter; E-TMF-G-0007-GE: Direct Measurement.
[1] Waveform Characteristics – Measure Waveform Period	10 ps to 4.44 ns 4.44 ns to 500 µs 500 µs to 20 ms (20 to 50) ms (50 to 100) ms (100 to 200) ms (200 to 500) ms 500 ms to 1 s (1 to 2) s (2 to 5) s (5 to 10) s (10 to 50) s	0.12 % of reading + 6.2 ps 0.35 ns/s 0.43 ns/s 0.47 ns/s 0.62 ns/s 0.83 ns/s 1.5 ns/s 2.6 ns/s 4.7 ns/s 11 ns/s 22 ns/s 0.012 % of reading	Universal Counter, GPS Receiver or Rubidium Frequency Standard, Digital Communication Analyzer, Digitizing Oscilloscope; E-TMF-G-0009-GE: Direct Measurement.

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[1] Waveform Characteristics – Measure			
Pulse Width	10 ps to 500 ns	0.12 % of reading + 6.2 ps	Universal Counter, GPS Receiver or Rubidium Frequency Standard, Digital Communication Analyzer, Digitizing Oscilloscope; E-TMF-G-0009-GE: Direct Measurement.
	500 ns to 1 µs	0.72 ms/s	
	(1 to 2) µs	0.36 ms/s	
	(2 to 5) µs	0.15 ms/s	
	(5 to 10) µs	72 µs/s	
	(10 to 20) µs	36 µs/s	
	(20 to 50) µs	15 µs/s	
	(50 to 100) µs	7.2 µs/s	
	(100 to 200) µs	3.6 µs/s	
	(200 to 500) µs	1.5 µs/s	
	500 µs to 1 ms	0.72 µs/s	
	(1 to 2) ms	0.36 µs/s	
	(2 to 5) ms	0.15 µs/s	
	(5 to 10) ms	72 ns/s	
	(10 to 20) ms	37 ns/s	
	(20 to 50) ms	15 ns/s	
	(50 to 100) ms	7.6 ns/s	
	(100 to 200) ms	3.9 ns/s	
	(200 to 500) ms	1.8 ns/s	
	500 ms to 1 s	1.1 ns/s	
	(1 to 2) s	1.2 ns/s	
	(2 to 5) s	0.66 ns/s	
	(5 to 10) s	0.49 ns/s	
	(10 to 50) s	0.012 % of reading	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Waveform Characteristics – Measure			
Rise/Fall Time – (10 to 90) % Threshold Levels	(10 to 20) ps	6.2 ps	Universal Counter, GPS Receiver or Rubidium Frequency Standard, Digital Communication Analyzer, Digitizing Oscilloscope; E-TMF-G-0009-GE: Direct Measurement.
	(20 to 50) ps	6.3 ps	
	(50 to 100) ps	6.3 ps	
	(100 to 200) ps	6.4 ps	
	(200 to 500) ps	6.8 ps	
	500 ps to 1 ns	7.4 ps	
	(1 to 2) ns	8.6 ps	
	(2 to 5) ns	12 ps	
	(5 to 10) ns	18 ps	
	(10 to 20) ns	30 ps	
	(20 to 50) ns	66 ps	
	(50 to 100) ns	0.13 ns	
	(100 to 200) ns	0.26 ns	
	(200 to 500) ns	0.3 ns	
	500 ns to 1 µs	0.36 ns	
	(1 to 2) µs	0.48 ns	
	(2 to 5) µs	0.84 ns	
	(5 to 10) µs	1.4 ns	
	(10 to 20) µs	2.6 ns	
	(20 to 50) µs	6.2 ns	
	(50 to 100) µs	12 ns	
	(100 to 200) µs	24 ns	
	(200 to 500) µs	60 ns	
	500 µs to 1 ms	0.12 µs	
Duty Cycle – (0 to 100) % Duty Cycle	(0.1 to 100) Hz	0.000 12 % Duty Cycle	
	100 Hz to 1 kHz	0.000 18 % Duty Cycle	
	(1 to 10) kHz	0.001 7 % Duty Cycle	
	(10 to 100) kHz	0.008 9 % Duty Cycle	
	100 kHz to 1 MHz	0.038 % Duty Cycle	
	(1 to 2) MHz	0.056 % Duty Cycle	
	(2 to 20) MHz	0.12 % Duty Cycle	
	(20 to 50) MHz	0.14 % Duty Cycle	
	(50 to 100) MHz	0.16 % Duty Cycle	

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[1] Waveform Characteristics – Measure			
Phase – (-180 to 180)° or (0 to 360)°	(0.1 to 100) Hz	0.04°	
	100 Hz to 1 kHz	0.05°	
	(1 to 10) kHz	0.06°	
	(10 to 100) kHz	0.1°	
	(100 to 200) kHz	0.15°	
	(200 to 400) kHz	0.3°	
	(400 to 600) kHz	0.44°	
	(600 to 800) kHz	0.6°	
	800 kHz to 1 MHz	0.73°	
	(1 to 2) MHz	1.5°	
	(2 to 4) MHz	3°	
	(4 to 6) MHz	4.4°	
	(6 to 8) MHz	6°	
	(8 to 10) MHz	7.3°	
Δ Time	(10 to 20) ps	6.2 ps	Universal Counter, GPS Receiver or Rubidium Frequency Standard, Digital Communication Analyzer, Digitizing Oscilloscope; E-TMF-G-0009-GE: Direct Measurement.
	(20 to 50) ps	6.3 ps	
	(50 to 100) ps	6.3 ps	
	(100 to 200) ps	6.4 ps	
	(200 to 500) ps	6.8 ps	
	500 ps to 1 ns	7.4 ps	
	(1 to 2) ns	8.6 ps	
	(2 to 5) ns	12 ps	
	(5 to 10) ns	20 ps	
	(10 to 20) ns	32 ps	
	(20 to 50) ns	66 ps	
	(50 to 100) ns	0.17 ns	
	(100 to 200) ns	0.26 ns	
	(200 to 500) ns	0.3 ns	
	500 ns to 1 µs	0.74 ns	
	(1 to 2) µs	0.86 ns	
	(2 to 5) µs	1.2 ns	
	(5 to 10) µs	7 ns	
	(10 to 20) µs	8.2 ns	
	(20 to 50) µs	12 ns	
	(50 to 100) µs	70 ns	
	(100 to 200) µs	82 ns	
	(200 to 500) µs	0.12 µs	

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Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
[1] Waveform Characteristics – Measure			Universal Counter, GPS Reciever or Rubidium Frequency Standard, Digital Communication Analyzer, Digitizing Oscilloscope; E-TMF-G-0009-GE: Direct Measurement.
Δ Time	500 µs to 1 ms	0.7 µs	
	(1 to 2) ms	0.82 µs	
	(2 to 5) ms	1.2 µs	
	(5 to 10) ms	7 µs	
	(10 to 20) ms	8.2 µs	
	(20 to 50) ms	12 µs	
	(50 to 100) ms	70 µs	
	(100 to 200) ms	82 µs	
	(200 to 500) ms	0.12 ms	
	500 ms to 1 s	0.7 ms	
	(1 to 2) s	0.82 ms	
	(2 to 5) s	1.2 ms	
	(5 to 10) s	7 ms	
	(10 to 20) s	8.2 ms	
	(20 to 50) s	12 ms	
Overshoot, Under-shoot, and Pre-shoot	(0.1 to 1) % of Amplitude	0.053 % of Amplitude	
	(1 to 5) % of Amplitude	0.24 % of Amplitude	
	(5 to 10) % of Amplitude	0.48 % of Amplitude	
	(10 to 20) % of Amplitude	0.96 % of Amplitude	
	(20 to 30) % of Amplitude	1.5 % of Amplitude	
Amplitude	Up to 1 GHz		
	Up to 80 mVp-p	2.5 % of reading + 0.12 mV	
	(80 to 160) mVp-p	2.5 % of reading + 0.24 mV	
	(160 to 400) mVp-p	2.5 % of reading + 0.61 mV	
	(400 to 800) mVp-p	2.5 % of reading + 1.2 mV	
	800 mVp-p to 1.6 Vp-p	2.5 % of reading + 2.4 mV	
	(1.6 to 4) Vp-p	2.5 % of reading + 6 mV	
	(4 to 8) Vp-p	2.5 % of reading + 12 mV	
	(8 to 16) Vp-p	2.5 % of reading + 24 mV	
	(16 to 40) Vp-p	2.5 % of reading + 60 mV	
	(40 to 80) Vp-p	2.5 % of reading + 0.12 V	
	(1 to 40) GHz		
	Up to 80 mVp-p	4.2 % of reading + 0.55 mV	
	(80 to 160) mVp-p	4.2 % of reading + 0.6 mV	
	(160 to 400) mVp-p	4.2 % of reading + 0.82 mV	
	(400 to 800) mVp-p	4.2 % of reading + 1.4 mV	

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DIMENSIONAL MEASUREMENT

1 Dimensional

Specific Tests and / or Properties Measured	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method and/or Equipment
Jigs, Fixtures, Molds, Dies or Dimension of an Object Single Axis Length	Up to 25 mm (25 to 50) mm (50 to 75) mm (75 to 100) mm (100 to 125) mm (125 to 150) mm (150 to 175) mm (100 to 200) mm (200 to 250) mm (250 to 300) mm (300 to 400) mm (400 to 500) mm	0.2 µm 0.3 µm 0.4 µm 0.5 µm 0.7 µm 0.8 µm 0.9 µm 1 µm 1.2 µm 1.4 µm 1.8 µm 2.2 µm	Universal Length Measuring Machine (Mechanical Contact Measurement) utilized as the Reference per D-0066-GE: Direct Measurement.
Jigs, Fixtures, Molds, Dies or Dimension of an Object Single Axis Length	Up to 300 mm (300 to 1 000) mm	50 µm 70 µm	Scale Calibrator (Vision Measurement) utilized as the Reference per D-0066-GE: Direct Measurement.
[1] Jigs, Fixtures, Molds, Dies or Dimension of an Object Single Axis Length	Up to 600 mm (600 to 1 000) mm	5 µm 6 µm	Linear Scale with Digital Reading (Vision Measurement) utilized as the Reference per D-0066-GE: Direct Measurement.
[1] Jigs, Fixtures, Molds, Dies or Dimension of an Object Single Axis Length	Up to 20 mm (20 to 25) mm (25 to 50) mm (50 to 75) mm (75 to 100) mm (100 to 600) mm (600 to 1 000) mm	0.3 µm 0.4 µm 1.1 µm 1.2 µm 1.3 µm 30 µm 50 µm	Dimensional Hand Tools (Mechanical Contact Measurement) utilized as the Reference per D-0066-GE: Direct Measurement.

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DIMENSIONAL MEASUREMENT

1 Dimensional

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Jigs, Fixtures, Molds, Dies or Dimension of an Object Single Axis Length	Up to 25 mm (25 to 50) mm (50 to 75) mm (75 to 100) mm (100 to 125) mm (125 to 150) mm (150 to 175) mm (100 to 200) mm (200 to 250) mm (250 to 300) mm (300 to 400) mm (400 to 500) mm	0.2 µm 0.3 µm 0.4 µm 0.5 µm 0.7 µm 0.8 µm 0.9 µm 1.0 µm 1.2 µm 1.4 µm 1.8 µm 2.2 µm	Universal Length Measuring Machine (Mechanical Contact Measurement) utilized as the Reference per D-0066-GE: Direct Measurement.
Jigs, Fixtures, Molds, Dies or Dimension of an Object Single Axis Length	Up to 300 mm (300 to 1 000) mm	50 µm 70 µm	Scale Calibrator (Vision Measurement) utilized as the Reference per D-0066-GE: Direct Measurement.
[1] Jigs, Fixtures, Molds, Dies or Dimension of an Object Single Axis Length	Up to 600 mm (600 to 1 000) mm	5 µm 6 µm	Linear Scale with Digital Reading (Vision Measurement) utilized as the Reference per D-0066-GE: Direct Measurement.
[1] Jigs, Fixtures, Molds, Dies or Dimension of an Object Single Axis Length	Up to 20 mm (20 to 25) mm (25 to 50) mm (50 to 75) mm (75 to 100) mm (100 to 600) mm (600 to 1 000) mm	0.3 µm 0.4 µm 1.1 µm 1.2 µm 1.3 µm 30 µm 50 µm	Dimensional Hand Tools (Mechanical Contact Measurement) utilized as the Reference per D-0066-GE: Direct Measurement.

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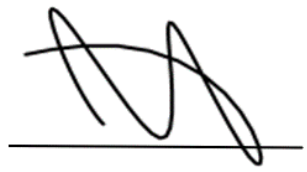
Calibration and Measurement Capability (CMC) is expressed in terms of the measurement parameter, measurement range, expanded uncertainty of measurement and reference standard, method, and/or equipment. The expanded uncertainty of measurement is expressed as the standard uncertainty of the measurement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

Notes:

1. On-site calibration service is available for this parameter, since on-site conditions are typically more variable than those in the laboratory, larger measurement uncertainties are expected on-site than what is reported on the accredited scope.
2. The effect of the inhomogeneity of the thermocouple wires is included in the uncertainty of measurement.
3. The effects of the Unit Under Calibration characteristics (uniformity and stability are included in the uncertainty of measurement.
4. Hydrometer unit of measure g/cm³ equivalent to specific gravity or relative density.
5. Unitless linear measure.
6. rpm = revolutions per minute; fpm = flashes per minute; GU = Gloss Unit; L = measurement length in km; THD = Total Harmonic Distortion; *DL* = diagonal length.
7. Zero reading is achieved by shorting the input terminals using a low-thermal shorting plug (for DC Voltage and DC Resistance) and the input terminal openings (for DC Current); Due to space, % R = percent of Reflectance.
8. Unit of magnetic flux is Weber (Wb), that linking a circuit of one turn, would produce in it an electromotive force of 1 Volt if it were reduced to zero at a uniform rate in 1 second. Therefore, 1Wb = 1 V·s.
9. Pe = Positive or negative excess pressure relative to the prevailing atmospheric pressure.
10. The CMC presented here does not include the resolution of the unit under test. 0.58*R* will be applied to the Measurement Uncertainty on the Calibration Certificate (where *R* = resolution of the unit under test).
11. The numbers presented here are approximate values. The certified values will be reported on the calibration certificate issued to the customer along with the appropriate Measurement Uncertainty (MU).
12. 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.



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