



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017
& ANSI/NCSL Z540-1-1994

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CALIBRATION

Valid To: February 28, 2022

Certificate Number: 2626.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1, 7}:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2, 3, 4, 5} (±)	Comments
DC Voltage – Generate	(0 to 220) mV 220 mV to 2.2 V (2.2 to 11) V	8.7 μV/V + 0.40 μV 5.8 μV/V + 0.70 μV 4.2 μV/V + 2.5 μV	Fluke 5720A
DC Voltage – Measure	(0 to 100) mV 100 mV to 1 V (1 to 10) V	13 μV/V + 0.70 μV 13 μV/V + 0.70 μV 13 μV/V + 0.90 μV	Agilent 3458A, opt 002 (2-year specifications)
DC Resistance – Measure	(0 to 10) Ω (10 to 100) Ω 100 Ω to 1 kΩ (1 to 10) kΩ	29 μΩ/Ω + 0.14 mΩ 29 μΩ/Ω + 1.4 mΩ 24 μΩ/Ω + 1.4 mΩ 24 μΩ/Ω + 14 mΩ	Agilent 3458A, opt 002 (2-year specifications)
DC Resistance – Generate, Fixed Points	(1, 1.9) Ω (10, 19) Ω (100, 190) Ω (1, 1.9, 10, 19) kΩ	0.011 % 27 μΩ/Ω 12 μΩ/Ω 11 μΩ/Ω	Fluke 5720A

Parameter/Equipment	Range	CMC ^{2, 3, 4} (±)	Comments
DC Current – Measure	(1 to 10) μ A (10 to 100) μ A 100 μ A to 1 mA (1 to 10) mA (10 to 100) mA	39 μ A/A + 0.14 nA 39 μ A/A + 1.2 nA 39 μ A/A + 9.0 nA 39 μ A/A + 90 nA 56 μ A/A + 0.90 μ A	Agilent 3458A, opt 002
DC Current – Generate	(10 to 100) μ A (0 to 220) μ A 220 μ A to 2.2 mA (2.2 to 22) mA (22 to 220) mA	590 μ A/A + 20 nA 47 μ A/A + 6.0 nA 41 μ A/A + 7.0 nA 41 μ A/A + 40 nA 52 μ A/A + 0.70 μ A	Keithley 236/237 Fluke 5720A

Parameter/Range	Frequency	CMC ^{2, 3, 4, 5} (±)	Comments
AC Voltage – Generate			
(0 to 2.2) mV	10 Hz to 50 kHz 50 kHz to 1 MHz	0.033 % + 4.0 μ V 0.33 % + 20 μ V	Fluke 5720A
(2.2 to 22) mV	10 Hz to 50 kHz 50 kHz to 1 MHz	0.029 % + 4.0 μ V 0.32 % + 20 μ V	
(22 to 220) mV	10 Hz to 50 kHz 50 kHz to 1 MHz	0.028 % + 12 μ V 0.32 % + 45 μ V	
220 mV to 2.2 V	10 Hz to 50 kHz 50 kHz to 1 MHz	0.028 % + 40 μ V 0.20 % + 300 μ V	
AC Voltage – Measure			
(0 to 10) mV	1 Hz to 100 kHz (100 to 300) kHz	0.59 % + 9.1 μ V 4.7 % + 10 μ V	Agilent 3458A, opt 002 (ACBAND \leq 2 MHz)
(10 to 100) mV	1 Hz to 100 kHz 100 kHz to 2 MHz	0.11 % + 2.4 μ V 1.8 % + 11 μ V	
100 mV to 1 V	1 Hz to 100 kHz 100 kHz to 2 MHz	0.11 % + 24 μ V 1.8 % + 0.11 mV	

Parameter/Range	Frequency	CMC ^{2, 3, 4, 5} (±)	Comments
AC Voltage – Measure (cont)			
(1 to 10) V	1 Hz to 100 kHz 100 kHz to 2 MHz	0.11 % + 240 μV 1.8 % + 1.1 mV	Agilent 3458A, opt 002 (ACBAND ≤ 2 MHz)
(10 to 100) V	1 Hz to 100 kHz 100 kHz to 1 MHz	0.15 % + 2.4 mV 1.8 % + 11 mV	
(100 to 700) V	1 Hz to 100 kHz	0.36 % + 24 mV	
AC Current – Generate			
(9 to 220) μA	10 Hz to 5 kHz (5 to 10) kHz	0.033 % + 12 nA 0.13 % + 65 nA	Fluke 5720A
220 μA to 2.2 mA	10 Hz to 5 kHz (5 to 10) kHz	0.030 % + 110 nA 0.13 % + 650 nA	
(2.2 to 22) mA	10 Hz to 5 kHz (5 to 10) kHz	0.030 % + 550 nA 0.13 % + 5 μA	
(22 to 220) mA	10 Hz to 5 kHz (5 to 10) kHz	0.030 % + 3.5 μA 0.13 % + 10 μA	
AC Current – Measure			
(5 to 100) μA	1 kHz	0.079 % + 30 nA	Agilent 3458A, opt 002
100 μA to 1 mA	1 kHz	0.079 % + 0.30 μA	
(1 to 10) mA	1 kHz	0.045 % + 2.0 μA	
(10 to 100) mA	1 kHz	0.045 % + 20 μA	
100 mA to 1 A	1 kHz	0.13 % + 0.20 mA	

II. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ^{2, 5, 6} (±)	Comments
RF Power – 1 mW Calibration Factor	100 kHz to 50 MHz 50 MHz to 1 GHz (1 to 2) GHz (2 to 3) GHz (3 to 4) GHz (4 to 6) GHz (6 to 10) GHz (10 to 18) GHz	0.62 % 0.61 % 0.59 % 0.61 % 0.63 % 0.68 % 0.80 % 1.7 %	Model F1130 transfer standard
RF Power – Generate & Measure			
1 mW	100 kHz to 50 MHz 50 MHz 50 MHz to 1 GHz (1 to 2) GHz (2 to 3) GHz (3 to 4) GHz (4 to 6) GHz (6 to 10) GHz (10 to 18) GHz	0.62 % 0.58 % 0.61 % 0.59 % 0.61 % 0.63 % 0.68 % 0.80 % 1.7 %	F1130 transfer standard
Up to 1 kW (0.3 to 10) W (10 to 100) W (100 to 250) W	450 kHz to 4.2 GHz 100 kHz to 4.2 GHz 100 kHz to 4.2 GHz 100 kHz to 4.2 GHz	1.2 % 1.1 % 1.1 % 1.2 %	Calibrated with Bramall method
1700 Watts	250 kHz to 5 MHz (10 to 15) MHz (25 to 30) MHz (35 to 65) MHz (95 to 105) MHz (150 to 170) MHz	0.39 % 0.39 % 0.39 % 0.39 % 0.39 %	Yokogawa WT3000 power analyzer PI 140ASX AC power supply (reference only) Bird 6080 calorimeter
700 Watts	250 kHz to 5 MHz (10 to 15) MHz (25 to 30) MHz (35 to 65) MHz (95 to 105) MHz (150 to 170) MHz	0.42 % 0.42 % 0.42 % 0.42 % 0.42 %	Calorimeter

Parameter/Range	Frequency	CMC ^{2, 5, 6} (±)	Comments
RF Power – Generate & Measure (cont) 1700 Watts	(330 to 390) kHz (390 to 440) kHz (12.88 to 14.23) MHz (54 to 63) MHz	0.38 % 0.20 % 0.22 % 0.23 %	Yokogawa 3000 Power Analyzer Pacific 160ASX AC power supply (reference only) Bird 6085B
RF Attenuation – (10 to 40) dB (40 to 70) dB	(0.1 to 1300) MHz (1.3 to 3) GHz (3 to 6) GHz (6 to 8.5) GHz (0.1 to 1300) MHz (1.3 to 3) GHz (3 to 6) GHz (6 to 8.5) GHz	0.08 dB 0.13 dB 0.12 dB 0.13 dB 0.27 dB 0.26 dB 0.26 dB 0.27 dB	Rohde & Schwarz ZNB8
RF Impedance – Measure Reflection Coefficient 0.0 to < 0.2 0.2 to < 0.4 0.4 to < 0.6	(0.1 to 1300) MHz (1.3 to 3) GHz (3 to 6) GHz (6 to 8.5) GHz (0.1 to 1300) MHz (1.3 to 3) GHz (3 to 6) GHz (6 to 8.5) GHz (0.1 to 1300) MHz (1.3 to 3) GHz (3 to 6) GHz (6 to 8.5) GHz	0.0040 (linear, ratio) 0.0063 (linear, ratio) 0.0063 (linear, ratio) 0.0063 (linear, ratio) 0.0068 (linear, ratio) 0.0091 (linear, ratio) 0.0091 (linear, ratio) 0.0091 (linear, ratio) 0.012 (linear, ratio) 0.015 (linear, ratio) 0.015 (linear, ratio) 0.015 (linear, ratio)	Rohde & Schwarz ZNB8

Parameter/Range	Frequency	CMC ^{2, 6} (±)	Comments
RF Impedance – Measure (cont)			
Reflection Coefficient			
0.6 to < 0.8	(0.1 to 1300) MHz (1.3 to 3) GHz (3 to 6) GHz (6 to 8.5) GHz	0.020 (linear, ratio) 0.022 (linear, ratio) 0.022 (linear, ratio) 0.022 (linear, ratio)	Rohde & Schwarz ZNB8
0.8 to < 1.0	(0.1 to 1300) MHz (1.3 to 3) GHz (3 to 6) GHz (6 to 8.5) GHz	0.030 (linear, ratio) 0.033 (linear, ratio) 0.033 (linear, ratio) 0.033 (linear, ratio)	
1.0	(0.1 to 1300) MHz (1.3 to 3) GHz (3 to 6) GHz (6 to 8.5) GHz	0.043 (linear, ratio) 0.045 (linear, ratio) 0.045 (linear, ratio) 0.045 (linear, ratio)	

III. Time & Frequency

Parameter/Range	Frequency	CMC ^{2, 6} (±)	Comments
Frequency – Measure & Measuring Equipment	10 Hz to 100 kHz 100 kHz to 300 MHz 300 MHz to 1 GHz (1 to 5) GHz (5 to 15) GHz	2.8 x 10 ⁻⁵ Hz 8.3 x 10 ⁻² Hz 7.0 Hz 35 Hz 110 Hz	Agilent 53230A counter, 910R GPS receiver, RF / Function generator
Frequency – Time Base	10 MHz	4.2 x 10 ⁻¹² Hz/Hz	Wavetek 910R GPS receiver

¹ This laboratory offers commercial calibration service.

² Calibration and Measurement Capability Uncertainty (CMC) is the smallest uncertainty of measurement that a laboratory can achieve within its scope of accreditation when performing more or less routine calibrations of nearly ideal measurement standards or nearly ideal measuring equipment. CMCs represent expanded uncertainties expressed at approximately the 95 % level of confidence, usually using a coverage factor of $k = 2$. The actual measurement uncertainty of a specific calibration performed by the laboratory may be greater than the CMC due to the behavior of the customer's device and to influences from the circumstances of the specific calibration.

³ The measurands stated are generated with the Fluke 5720A series of instruments. This capability is suitable for the calibration of the devices intended to measure the stated measurand in the ranges indicated. CMC are expressed as either a specific value that covers the full range or as a fraction of the reading plus a fixed floor specification.

⁴ The measurands stated are measured with the HP 3458A. This capability is suitable for the calibration of the devices intended to generate the measurand in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a combination of the fraction of the reading/output plus a range specification.

⁵ In the statement of CMC, uncertainties expressed as a percent are to be read as percent of reading unless otherwise indicated.

⁶ The type of instrument or material being calibrated is defined by the parameter. This indicates the laboratory is capable of calibrating instruments that measure or generate the values in the ranges indicated for the listed measurement parameter.

⁷ This scope meets A2LA's *P112 Flexible Scope Policy*.



Accredited Laboratory

A2LA has accredited

BIRD SERVICE CENTER

Solon, OH

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCCL Z540-1-1994 and R205 – *Specific Requirements: Calibration Laboratory Accreditation Program*. 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*).



Presented this 4th day of June 2020.

A blue ink signature of the Vice President of Accreditation Services.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2626.01
Valid to February 28, 2022

For the calibrations to which this accreditation applies, please refer to the laboratory's Calibration Scope of Accreditation.