



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005
& ANSI/NCSL Z540-1-1994 & ANSI/NCSL Z540.3-2006

CALIBER TEST & MEASUREMENT
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CALIBRATION

Valid until: May 31, 2017

Certificate Number: 3104.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations¹:

I. Electrical – DC/Low Frequency

Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
DC Voltage – Generate & Measure	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 1100) V	34 μV/V + 0.4 μV 21 μV/V 21 μV/V 9.3 μV/V 10 μV/V 14 μV/V	Fluke 5720A-03WB
	(1.0 to 40) kV	0.20 %	Fluke 289 Ross Eng. HV divider
DC Current – Generate & Measure	Up to 220 μA (0.22 to 2.2) mA (2.2 to 22) mA (22 to 220) mA (0.22 to 1.1) A	0.011 % + 6 nA 78 μA/A 75 μA/A 0.018 % 0.20 %	Fluke 5720A-03WB
	(1.1 to 20.0) A	0.58 %	Fluke 5520A & 50 A shunt

Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
DC Resistance – Generate & Measure	1 Ω (>1 to 100) Ω (>0.10 to 1.0) kΩ (>1.0 to 10) kΩ (>10 to 100) kΩ (>0.10 to 1.0) MΩ (1 to 100) MΩ (100 to 300) MΩ	0.047 % 49 μΩ/Ω 74 μΩ/Ω 22 μΩ/Ω 24 μΩ/Ω 43 μΩ/Ω 0.085 % 0.96 %	Fluke 5720A AGILENT 3458A-02
	(0.30 to 1.0) GΩ	0.018 %	HTE-1 GOhm Fluke 5522A Agilent 3458A-02
Fixed Points	1 Ω 10 Ω 100 Ω 10 k Ω	79 μΩ/Ω 40 μΩ/Ω 34 μΩ/Ω 21 μΩ/Ω	Fluke-742A-1 IET-SRX-10 IET-SRX-100 Fluke-742A-10K

Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Voltage – Generate & Measure	(22 to 220) mV (0.22 to 2.2) V	1 kHz 20 kHz	Fluke 5720A-03WB, Agilent 3458A-02
	(2.2 to 22) V (2.2 to 22) V	20 kHz 100 kHz	
(10) V	100 Hz to 1 MHz	0.09 %	
(700) V	30 kHz	0.19 %	Fluke 5720A-03WB, Fluke 5725A amplifier
(1 to 15) kV	60 Hz	0.13 %	Fluke 289 Ross Eng. HV divider



Parameter/Range	Frequency	CMC ^{2,3} (±)	Comments
AC Current – Generate & Measure			
Up to 0.220 mA	100 Hz to 10 kHz	0.37 % + 12 nA	Fluke 5720A-03WB
(0.22 to 2.2) mA	100 Hz to 10 kHz	0.21 %	Agilent 3458A-02
(2.2 to 22) mA	100 Hz to 10 kHz	0.22 %	
(22 to 220) mA	100 Hz to 10 kHz	0.41 %	
(0.22 to 2.2) A	100 Hz to 10 kHz	0.65 %	Fluke 5520A, Agilent 3458A-02
(2.2 to 11) A	40 Hz to 10 kHz	0.15 %	Fluke 5720A-03WB w/ Fluke 5725A amplifier & Fluke 289 meter
(11 to 3000) A	60 Hz	0.94 %	Fluke 5520A, Agilent 3458A-02 HTE multi-turn coils Fluke Flexi i3000s amp Rogowski air cored coil
Capacitance – Generate & Measure			
Fixed Points (1.0, 10, 100, 1000) pF	1 kHz	1.1 %	Capacitor Set, HP 16380A with Instek LCR-817
10 nF to 10 000 µF	At various frequencies ranging anywhere from 10 Hz to 1 kHz	0.78 %	Fluke 5520A calibrator with Instek LCR-817 meter
Inductance – Generate & Measure			
1 mH	(0.1 to 10) kHz	0.13 %	Genrad 1482 series standard inductors
100 mH	(0.1 to 10) kHz	0.13 %	
1 H	(0.1 to 1) kHz	0.15 %	Instek 817 LCR meter



Parameter/Equipment	Range	CMC ^{2,3} (±)	Comments
Electrical Calibration of Thermocouples – Thermocouple Simulation			
Generate & Measure J-Type	(-210 to -100) °C (-100 to -30) °C (-30 to 150) °C (150 to 760) °C (760 to 1200) °C	0.27 °C 0.18 °C 0.16 °C 0.19 °C 0.25 °C	Fluke 5520A
K-Type	(-200 to -100) °C (-100 to -25) °C (-25 to 120) °C (120 to 1000) °C (1000 to 1372) °C	0.35 °C 0.20 °C 0.18 °C 0.28 °C 0.42 °C	
T-Type	(-250 to -150) °C (-150 to 0) °C (0 to 120) °C (120 to 400) °C	0.65 °C 0.26 °C 0.18 °C 0.16 °C	
ESD Impulse Current – Measure	Voltage: (1 to 30) kV	3.8 %	Tek 694C oscilloscope, EMC partner ESD Veri-V, target 2-DN, Agilent 34401A DMM
Oscilloscope – Rise Time - Generate and Measure	150 ps	39 ps	Fluke 9500B, active head 9530 , Tek 694C oscilloscope

II. Electrical – RF/Microwave

Parameter/Range	Frequency	CMC ² (±)	Comments
RF Power Low Frequency – Generate & Measure	0.1 Hz to 100 kHz	0.023 V _{RMS}	Agilent 3325B synthesized signal generator, Agilent 3458A-02 DMM



Parameter/Range	Frequency	CMC ² (±)	Comments
RF Power – Low to Medium Frequency Generate & Measure (-56 to +24) dBm (1mV to 10 V)	(0.1 to 20) MHz	0.095 V _{RMS}	Agilent 3325B synthesized signal generator, HP8902A-050 measuring receiver, HP 11722A sensor
RF Power – Generate & Measure (-5 to -85) dBm (-5 to -85) dBm (-5 to -85) dBm (-5 to -85) dBm	1 GHz 7 GHz 12.4 GHz 20 GHz & 26 GHz	0.69 dBm 1.2 dBm 1.4 dBm 2.1 dBm	HP 8902A-050 measuring receiver; 11793A microwave converter; HP 8340B synthesizer-asset HTE0333 only) w/ 11722A sensor w/ 11792A sensor w/ 11792A sensor w/ 11792A sensor
RF Attenuation Tuned RF Level – Generate & Measure (10 to 100 dB)	10 MHz 50 MHz 1 GHz 4 GHz 10 GHz 15 GHz 18 GHz	0.53 dB 0.55 dB 0.63 dB 0.50 dB 0.94 dB 1.4 dB 0.51 dB	Agilent 8902A-050 measuring receiver Agilent 11793A microwave converter, HP 8496B / 8494B step attenuators w/ Agilent 11722A sensor w/ 11792A power sensor



Parameter/Range	Frequency	CMC ² (±)	Comments
Phase Noise – Measure	10 MHz to 1 GHz (2 to 18) GHz	2.7 dBc/Hz 3.0 dBc/Hz	HP 3048A phase noise test set HP/Agilent 11848A, 11729C, 3561A, 3585A, HP 8663A Fluke 9640A-LPN & HP 8340B

III. Time & Frequency

Parameter/Equipment	Range	CMC ² (±)	Comments
Frequency – Measuring Equipment	1.0 Hz to 26.5 GHz	5.0 parts in 10 ¹² Hz/Hz	Agilent 5071A (cesium beam), Agilent 8340B synthesized sweeper
Frequency – Measure	10 Hz to 40 GHz	1 Hz	Agilent 5071A (cesium beam), HP 5352B-010

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 Unless listed otherwise stated, all CMCs stated in percent are in percent of reading





Accredited Laboratory

A2LA has accredited

CALIBER TEST & MEASUREMENT

Broomfield, CO

for technical competence in the field of

Calibration

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets the requirements of ANSI/NCSLI Z540-1-1994 and the requirements of ANSI/NCSLI Z540.3-2006 and any additional program requirements in the field of calibration. 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 8 January 2009*).



Presented this 14th day of September 2015.

A handwritten signature in black ink, appearing to read "L. J. ...", positioned above a horizontal line.

President & CEO
For the Accreditation Council
Certificate Number 3104.01
Valid to May 31, 2017
Revised December 7, 2016

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