



SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

IKONIX USA, LLC
 28105 N. Keith Drive
 Lake Forest, IL 60045
 Eric Snow Phone: 847 367 4077 ext 1288
<https://www.ikonixusa.com/>

CALIBRATION

Valid To: March 31, 2023

Certificate Number: 2789.01

In recognition of the successful completion of the A2LA evaluation process, accreditation is granted to this laboratory to perform the following calibrations^{1,5}:

I. Electrical – DC / Low Frequency

Parameter/Range	Frequency	CMC ^{2,6} (±)	Comments
AC Voltage – Measure			
(1 to 100) mV 100 mV to 1 V (1 to 750) V	10 Hz to 20 kHz	0.16 % rdg + 0.04 mV 0.11 % rdg + 0.4 mV 0.07 % rdg + 0.3 V	HP 34401A direct read
(10 to 30) V (30 to 100) V (100 to 300) V (300 to 1000) V	(40 to 1000) Hz	0.05 % rdg + 0.2 % rng 0.14 % rdg + 0.1 % rng 0.09 % rdg + 0.1 % rng 0.09 % rdg + 0.1 % rng	N4L PPA530 direct read
(10 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V	(40 to 1000) Hz	0.012 % rdg + 2.0 μV 0.012 % rdg + 20 μV 0.012 % rdg + 0.2 mV 0.012 % rdg + 2.0 mV	HP 3458A direct read for wideband leakage
(10 to 100) mV 100 mV to 1 V (1 to 10) V	(1 to 20) kHz	0.02 % rdg + 2.0 μV 0.02 % rdg + 20 μV 0.02 % rdg + 0.2 mV	
(10 to 100) mV 100 mV to 1 V (1 to 10) V	(20 to 50) kHz	0.04 % rdg + 2.0 μV 0.04 % rdg + 20 μV 0.04 % rdg + 0.2 mV	

Parameter/Range	Frequency	CMC ^{2,6} (±)	Comments
AC Voltage – Measure (cont) (10 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) mV 100 mV to 1 V (1 to 10) V	(50 to 100) kHz (100 to 300) kHz 300 kHz to 1 MHz	0.09 % rdg + 2.0 μV 0.09 % rdg + 20 μV 0.09 % rdg + 0.2 mV 0.31 % rdg + 2.0 μV 0.32 % rdg + 0.1 mV 0.32 % rdg + 1 mV 1.1 % rdg + 10 μV 1.1 % rdg + 0.1 mV 1.1 % rdg + 1.0 mV	HP 3458A direct read for wideband leakage
AC High Voltage – Measure (0.3 to 10) kV (10 to 20) kV	(50, 60) Hz (50, 60) Hz	0.6 % rdg + 0.25 V 1.0 % rdg + 0.25 V	HP 34401A and Ross VD30-12.5Y- A-LB-TAL
AC Current – Measure Up to 100 μA (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (0.1 to 1) mA (1 to 10) mA (0.1 to 1) mA (1 to 10) mA (0.1 to 1) mA (1 to 10) mA (0.1 to 1) mA (1 to 10) mA (30 to 300) mA (0 to 300) μA (0.3 to 20) mA (20 to 100) mA (0.3 to 1) A (1 to 3) A (3 to 10) A (10 to 30) A (30 to 60) A	(45 to 1000) Hz (45 to 5000) Hz (45 to 5000) Hz (45 to 5000) Hz (5 to 20) kHz (5 to 20) kHz (20 to 50) kHz (20 to 50) kHz (50 to 100) kHz (50 to 100) kHz (50 to 60) Hz (65 to 800) Hz (65 to 800) Hz (65 to 800) Hz (50, 60) Hz (50, 60) Hz (50, 60) Hz (50, 60) Hz (50, 60) Hz	0.1 % rdg 0.09 % rdg 0.09 % rdg 0.14 % rdg 0.09 % rdg 0.11 % rdg 0.44 % rdg 0.42 % rdg 0.71 % rdg 0.8 % rdg 0.5 % rdg + 0.3 mA 1.3 % rdg + 35 μA 1.3 % rdg + 35 μA 1.3 % rdg + 0.35 mA 0.15 % rdg + 0.1 % rng 0.35 % rdg + 0.1 % rng 0.21 % rdg + 0.1 % rng 0.35 % rdg + 0.1 % rng 1.3 % rdg	HP 3458A MetraHit 29s, Powerlogger 10 Line test with N4L PPA530 direct read With Metrawatt CP1100 100 A clamp



Parameter/Range	Frequency	CMC ^{2,6} (±)	Comments
AC Current – Measure (cont) (1 to 60) A	(50, 60) Hz	0.31 % rdg + 0.04 A	Ground bond test with HP 34401A and Deltec CS100
Real Power ³ – Measure Power Factor (0 to 1) Voltage Range (10, 30, 100, 300, 1000) V Current Range (1, 3, 10, 30, 100) A	(50, 60) Hz DC, (40 to 1000) Hz DC, (50, 60) Hz	0.1 % rdg + (1 - 0.99 × e ^{1/W}) where: Verror = % rdg + % rng Ierror = % rdg + % rng	Power factor is computed based on measured real power divided by apparent power. Accuracy is dependent of measured watt Pf = W/VA CMCpower (Watts) = Ireading × Verror + Vreading × Ierror Line test with N4L PPA530 direct read

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
DC Voltage – Measure	(1 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V (100 to 1000) V (10 to 100) mV 100 mV to 1 V (1 to 10) V (10 to 100) V	0.015 % rdg + 3.5 μV 0.017 % rdg + 70 μV 0.014 % rdg + 50 μV 92 μV/V + 600 μV 64 μV/V + 10 mV 0.002 % rdg 0.001 % rdg 0.001 % rdg 0.001 % rdg	HP 34401A direct read HP 3458A direct read for DC line leakage test
DC High Voltage – Measure	(0.3 to 10) kV (10 to 20) kV	0.3 % rdg 0.5 % rdg	HP 34401A and Ross VD30-12.5Y- A-LB- TAL

Parameter/Equipment	Range	CMC ^{2,6} (±)	Comments
DC Current – Measure	Up to 100 nA (0.1 to 1) μ A (1 to 10) μ A (10 to 100) μ A (0.1 to 1) mA (1 to 10) mA (10 to 100) mA (30 to 300) mA (1 to 40) A	0.49 nA/A + 0.04 nA 71 μ A/A + 0.04 nA 68 μ A/A + 0.4 nA 33 μ A/A + 0.8 nA 35 μ A/A + 5.0 nA 0.41 mA/A + 5.0 nA 0.016 % + 0.5 μ A 0.05 % rdg + 35 μ A 0.3 % rdg	HP 3458A MetraHit 29s and Powerlogger 10 Ground bond test with HP 3458A and Deltec CS100
Resistance – Generate	(10 to 600) m Ω (0.01 to 0.1) Ω (0.1 to 100) Ω (100 to 1000) Ω (1 to 10) k Ω (10 to 100) k Ω 100 k Ω to 1 M Ω (1 to 10) M Ω (10 to 1000) M Ω (1 to 100) G Ω	0.45 m Ω 0.37 % rdg + 15 m Ω 0.1 % rdg + 15 m Ω 0.1 % rdg + 15 m Ω 0.1 % rdg 0.1 % rdg 0.1 % rdg 0.1 % rdg 1.2 % rdg 2.0 % rdg	Custom load fixture Prime Technology RDS52-A Prime Technology RDS56-A Custom built resistance load fixture
Resistance – Measure	(0.010 to 10) Ω (10 to 100) Ω (100 to 1000) Ω (1 to 10) k Ω (10 to 100) k Ω (100 to 1000) k Ω (1 to 10) M Ω (10 to 100) M Ω (100 to 1000) M Ω	14 $\mu\Omega/\Omega$ + 50 $\mu\Omega$ 15 $\mu\Omega/\Omega$ + 0.5 m Ω 13 $\mu\Omega/\Omega$ + 0.5 m Ω 13 $\mu\Omega/\Omega$ + 5.0 m Ω 13 $\mu\Omega/\Omega$ + 50 m Ω 43 $\mu\Omega/\Omega$ + 2.0 Ω 0.012 % + 100 Ω 0.3 % + 1.0 k Ω 0.53 % + 10 k Ω	HP 3458A

Parameter/Equipment	Range	CMC ^{2,4} (\pm)	Comments
WhaleTeq Multi-function Test System Model AECG 100 –			
Resistance	51 k Ω 620 k Ω	0.016 k Ω 0.16 k Ω	Keithley 7510 DMM
Input Impedance Capacitance	4.7 nF 47 nF	0.046 nF 0.21 nF	Keysight LCR Meter Model U1733C
Output Voltage	(0.5 to 10) mV _{p-p}	0.0016 mV _{p-p}	Keithley 7510 DMM
DC Voltage Offset (fixed/variable)	(200 to 500) mV	0.037 mV	
Precision Divider (1000:1) Output	10 V	0.0006 V	
Divider Ratio (1000:1)	1000	0.086	
Frequency	(1 to 60) Hz	0.025 Hz	
CMRR 3.0+ Common Mode Rejection Ratio Tester –			
Resistance	51 k Ω	0.019 k Ω	Keysight 34465A DMM
Capacitance	47 nF	0.15 nF	Keysight LCR Meter Model U1733C
DC Volt Offset	300 mV	0.016 mV	Keysight 34465A DMM
Frequency (20 V sine-wave)	(50 to 120) Hz	0.031 Hz	
True RMS AC Voltage (100 to 120) Hz (50 to 60) Hz	(0.25 to 0.5) V _{rms} (1 to 20) V _{rms}	0.000 46 V _{rms} 0.013 V _{rms}	
Loaded Output (27 k Ω , 20 V, 100 Hz)	33.92 mV _{rms}	0.065 mV _{rms}	

Parameter/Equipment	Range	CMC ^{2,4} (\pm)	Comments
WhaleTeq MECG 2.0 Multi Channel ECG Test System – Output Voltage Frequency	 (500 to 8333) μ V 40 Hz	 1.6 μ V 0.12 Hz	 Keithley 7510 DMM
WhaleTeq SECG 4.0 Single Channel ECG Test System – Resistance Input Impedance Capacitance Output DC Voltage DC Voltage Offset (fixed/variable) Frequency Pre-divider Out	 51 k Ω 620 k Ω 4.7 nF 47 nF (0.5 to 10) mV (200 to 1000) mV (10 to 40) Hz 10 V	 0.016 k Ω 0.15 k Ω 0.033 nF 0.15 nF 0.0016 mV 0.035 mV 0.0096 Hz 0.000 35 V	 Keithley 7510 DMM Keysight LCR Meter Model U1733C Keithley 7510 DMM
WhaleTeq SECG 5.0 AIO ECG Performance Tester – Resistance Capacitance Output DC Voltage DC Voltage Offset (Variable) DC Voltage Offset (Fixed)	 51 k Ω 620 k Ω 4.7 nF 47 nF (0.5 to 40) mV (200 to 1000) mV 300 mV	 0.015 k Ω 0.15 k Ω 0.15 nF 0.033 nF 0.0021 mV 0.036 mV 0.008 mV	 Keithley 7510 DMM Keysight LCR Meter Model U1733C Keithley 7510 DMM

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
WhaleTeq SECG 5.0 AIO ECG Performance Tester – (cont)			Keithley 7510 DMM
Frequency	(10 to 40) Hz	0.043 Hz	
Signal Source Output Voltage (RCA Monitor)	0.025 V	0.000 058 V	
Signal Source Output Voltage (RCA Monitor)	10 V	0.000 18 V	
Lead Off Resistor	100 Ω 10 MΩ 20 MΩ	0.074 Ω 0.0039 MΩ 0.010 MΩ	
Input Voltage	1.5 V	0.0067 V	
WhaleTeq SEEG 100 Single Channel ECG Test System –			
Input Impedance Capacitance	4.7 nF	0.0066 nF	Keysight LCR Meter Model U1733C
Output Voltage	(0.05 to 0.5) mV _{p-p} (1 to 2) mV _{p-p}	0.0014 mV 0.0060 mV	Keithley 7510 DMM
DC Voltage Offset (fixed/variable)	(150 to 1000) mV	0.043 mV	
Frequency	10 Hz 40 Hz	0.0018 Hz 0.27 Hz	

II. Time & Frequency

Parameter/Equipment	Range	CMC ^{2,4} (±)	Comments
Frequency – Measure 100 mV to 750 V	40 Hz to 300 kHz	0.02 % rdg	HP 34401A

¹ This laboratory offers commercial calibration service.
(A2LA Cert. No. 2789.01) Revised 02/15/2023



- 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 CMC is computed based on voltage and current measurement.
- ⁴ 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.
- ⁵ This scope meets A2LA's *P112 Flexible Scope Policy*.
- ⁶ The stated measured values are determined using the indicated instrument (see Comments). This capability is suitable for the calibration of the devices intended to measure or generate the measured value in the ranges indicated. CMC's are expressed as either a specific value that covers the full range or as a percent or fraction of the reading plus a fixed floor specification.



Accredited Laboratory

A2LA has accredited

IKONIX USA, LLC

Lake Forest, IL

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 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 7th day of January 2021.

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

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 2789.01
Valid to March 31, 2023
Revised February 15, 2023

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