



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

**Golden Falls Trading 429 (Pty) Ltd
T/A Coral-i Services**

**508 Nupen Crescent, Halfway House
Midrand Gauteng, South Africa 1685**

Fulfills the requirements of

ISO/IEC 17025:2017

In the field of

CALIBRATION

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

A handwritten signature in black ink, appearing to read 'R. Douglas Leonard Jr.', is positioned above a horizontal line.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 30 March 2022

Certificate Number: L2448



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

Golden Falls Trading 429 (Pty) Ltd T/A Coral-i Services

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CALIBRATION

Valid to: **March 30, 2022**

Certificate Number: **L2448**

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
DC Current - Generate	(0 to 320) μ A (0.32 to 3.2) mA (3.2 to 32) mA (32 to 320) mA (0.32 to 3.2) A (3.2 to 10.5) A (10.5 to 20) A	30 nA + 0.014 % of reading 0.1 pA + 0.014 % of reading 1.2 μ A + 0.014 % of reading 13 μ A + 0.016 % of reading 158 μ A + 0.06 % of reading 1.5 mA + 0.055 % of reading 5.4 mA + 0.055 % of reading	Wavetek 9100 Universal Calibration System
DC Current - Measure	(0 to 10) mA (10 to 100) mA (0.1 to 1) A (1 to 3) A	23 μ A + 0.05 % of reading 8 μ A + 0.05 % of reading 0.15 mA + 0.1 % of reading 0.8 mA + 0.12 % of reading	HP 34401A Multimeter
AC Current (Generate)	(32 to 320) μ A 10 Hz to 3 kHz (3 to 10) kHz (10 to 20) kHz (0.32 to 3.2) mA 10 Hz to 3 kHz (3 to 10) kHz (10 to 20) kHz (3.2 to 32) mA 10 Hz to 3 kHz (3 to 10) kHz (10 to 20) kHz	4 μ A + 0.07 % of reading 4.1 μ A + 0.1 % of reading 4.6 μ A + 0.2 % of reading 4 μ A + 0.07 % of reading 4.1 μ A + 0.1 % of reading 4.6 μ A + 0.2 % of reading 8.8 μ A + 0.07 % of reading 11 μ A + 0.1 % of reading 17 μ A + 0.2 % of reading	Wavetek 9100 Universal Calibration System
AC Current (Generate)	(32 to 320) mA 10 Hz to 3 kHz (3 to 10) kHz (10 to 20) kHz	88 μ A + 0.08 % of reading 97 μ A + 0.1 % of reading 0.11 mA + 0.2 % of reading	Wavetek 9100 Universal Calibration System

Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
AC Current (Generate)	(0.32 to 3.2) A 10 Hz to 3 kHz (3 to 10) kHz	0.82 mA + 0.1 % of reading 3 mA + 0.25 % of reading	Wavetek 9100 Universal Calibration System
	(3.2 to 10.5) A 10 Hz to 3 kHz (3 to 10) kHz	7 mA + 0.2 % of reading 13 mA + 0.5 % of reading	
AC Current (Measure)	(0 to 1) A 10 Hz to 5 kHz	0.61 mA + 0.1 % of reading	HP 34401A Multimeter
	(1 to 3) A 10 Hz to 5 kHz	2.4 mA + 0.15 % of reading	
Resistance (Generate)	(0 to 40) Ω	58 mΩ + 0.1 % of reading	Wavetek 9100 Universal Calibration System
	(40 to 400) Ω	0.12 μΩ + 0.035 % of reading	
	(400 to 4) kΩ	0.25 μΩ + 0.035 % of reading	
	(4 to 40) kΩ	2.4 Ω + 0.025 % of reading	
	(40 to 400) kΩ	24 Ω + 0.025 % of reading	
	(0.4 to 4) MΩ (4 to 40) MΩ	0.23 kΩ + 0.04 % of reading 2.3 kΩ + 0.05 % of reading	
Resistance (Measure)	(0 to 100) Ω	0.05 Ω + 0.01 % of reading	Wavetek 9100 Universal Calibration System HP 34401A Multimeter
	(0.1 to 1) kΩ	0.02 Ω + 0.01 % of reading	
	(1 to 10) kΩ	0.15 Ω + 0.01 % of reading	
	(10 to 100) kΩ	1.7 Ω + 0.01 % of reading	
	(0.1 to 1) MΩ	23 Ω + 0.01 % of reading	
	(1 to 10) MΩ (10 to 100) MΩ	0.42 kΩ + 0.04 % of reading 2.3 kΩ + 0.8 % of reading	
DC Voltage (Generate)	(0 to 320) mV	5.5 μV + 0.006 % of reading	Wavetek 9100 Universal Calibration System
	(0.32 to 3.2) V	55 μV + 0.006 % of reading	
	(3.2 to 32) V	550 μV + 0.006 5 % of reading	
	(32 to 320) V	5.7 mV + 0.006 5 % of reading	
	(320 to 1 050) V	30 mV + 0.006 % of reading	
DC Voltage (measure)	(0 to 100) mV	0.004 mV + 0.005 % of reading	HP 34401A Multimeter
	(0.1 to 1) V	0.01 mV + 0.004 % of reading	
	(1 to 10) V	0.07 mV + 0.003 5 % of reading	
	(10 to 100) V	0.93 mV + 0.004 5 % of reading	
	(100 to 1 000) V	14 mV + 0.004 5 % of reading	
AC Voltage (Generate)	(0 to 10) mV		Wavetek 9100 Universal Calibration System HP 34401A Multimeter
	10 Hz to 3 kHz (3 to 10) kHz	486 μV + 0.08 % of reading 625 μV + 0.08 % of reading	
	(10 to 32) mV		
	10 Hz to 3 kHz (3 to 10) kHz	229 μV + 0.08 % of reading 249 μV + 0.08 % of reading	



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Electrical – DC/Low Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment		
AC Voltage (Generate)	(32 to 320) mV 10 Hz to 3 kHz (3 to 10) kHz	102 μ V + 0.08 % of reading 104 μ V + 0.08 % of reading	Wavetek 9100 Universal Calibration System HP 34401A Multimeter		
	(0.32 to 3.2) V 10 Hz to 3 kHz (3 to 10) kHz	245 μ V + 0.08 % of reading 313 μ V + 0.08 % of reading			
	(3.2 to 32) V 10 Hz to 3 kHz (3 to 10) kHz	2.3 mV + 0.08 % of reading 3 mV + 0.1 % of reading			
	(32 to 105) V 10 Hz to 3 kHz (3 to 10) kHz	8 mV + 0.08 % of reading 10 mV + 0.1 % of reading			
	(105 to 320) V 40 Hz to 1 kHz (1 to 3) kHz (2 to 10) kHz	23 mV + 0.09 % of reading 23 mV + 0.12 % of reading 38 mV + 0.12 % of reading			
	(320 to 800) V 40 Hz to 1 kHz (1 to 3) kHz (2 to 10) kHz	90 mV + 0.09 % of reading 91 mV + 0.12 % of reading 133 mV + 0.12 % of reading			
	AC Voltage (Measure)	(0 to 100) mV 10 Hz to 20 kHz		0.05 mV + 0.06 % of reading	Wavetek 9100 Universal Calibration System HP 34401A Multimeter
		(0.1 to 1) V 10 Hz to 20 kHz		0.35 mV + 0.06 % of reading	
		(1 to 10) V 10 Hz to 20 kHz		3.5 mV + 0.06 % of reading	
		(10 to 100) V 10 Hz to 20 kHz		35 mV + 0.06 % of reading	
(10 to 100) V 10 Hz to 20 kHz		270 mV + 0.06 % of reading			
Oscilloscopes Vertical System – 50 Ω Vertical System – 1 M Ω	1 mV to 2 V/div 1 mV to 20 V/div	0.65 % of reading	Wavetek 9100 Universal Calibration System		
Oscilloscopes Horizontal System – 50 Ω	2 ns to 5 s/div	0.31 % of reading			
Oscilloscopes Bandwidth – 50 Ω 1 mV to 2 V/div	50 kHz to 100 MHz 50 kHz to 250 MHz 50 kHz to 600 MHz	5.4 % of bandwidth 6.2 % of bandwidth 7.7 % of bandwidth	Wavetek 9100 Universal Calibration System		

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Attenuation	(0 to 11) dB, 1 dB steps 10 MHz to 10 GHz (0 to 70) dB, 10 dB steps (10 to 18) GHz	0.35 dB + 0.005 dB/dB 0.65 dB + 0.015 dB/dB	Step attenuator, power meter
Voltage Reflection Coefficient – 0 to 1 (N-M)	10 MHz to 2 GHz (2 to 10) GHz (10 to 18) GHz	0.016 + 0.013ρ ² + 0.067ρ 0.028 + 0.03ρ ² + 0.067ρ 0.03 + 0.08ρ ² + 0.067ρ	Scalar network analyzer
VRC (N-F)	10 MHz to 2 GHz (2 to 10) GHz (10 to 18) GHz	0.013 + 0.013ρ ² + 0.067ρ 0.027 + 0.045ρ ² + 0.067ρ 0.032 + 0.075ρ ² + 0.067ρ	
RF Power – Measure	1 mW 50 MHz	1 % of reading	RF Power Meter
RF Power – Measure	(-25 to 13) dBm 100 kHz to 10 MHz (-50 to 13) dBm 10 MHz to 50 MHz 50 MHz to 6 GHz (6 GHz to 18) GHz (18 GHz to 26) GHz (26 GHz to 36) GHz (36 GHz to 40) GHz	0.33 dB 0.15 dB 0.14 dB 0.21 dB 0.27 dB 0.34 dB 0.53 dB	RF Power meter w/Power Sensors. UUT SWR ≤1.5
RF Power – Measure	(13 to 50) dBm 10 MHz to 1 GHz	0.21 dB	RF Power meter w/Power Sensors, Attenuator
RF Power – Source	1 mW 50 MHz	1 % of reading	RF Power Meter
RF Power – Source	(-25 to 13) dBm 100 kHz to 10 MHz (-50 to 13) dBm 10 MHz to 50 MHz 50 MHz to 6 GHz (6 GHz to 18) GHz (18 GHz to 26) GHz (26 GHz to 36) GHz (36 GHz to 40) GHz (13 to 50) dBm 200 MHz to 1 GHz	0.46 dB 0.17 dB 0.16 dB 0.26 dB 0.32 dB 0.39 dB 0.66 dB 0.31 dB	RF Power meter w/Power Sensors, RF Signal Generators, Power Amplifier

Electrical – RF/Microwave

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
RF Power Sensors – Calibration Factor	100 kHz to 300 kHz 300 kHz to 50 MHz 50 MHz to 6 GHz (6 GHz to 18) GHz (18 GHz to 26) GHz (26 GHz to 36) GHz (36 GHz to 40) GHz	5.3 % of reading 1.7 % of reading 2 % of reading 3.4 % of reading 5 % of reading ² 6.7 % of reading ² 10 % of reading ²	Reference power sensor and power meter with RF Generator
Amplitude Modulation – Measure & Generate CW: 10 MHz to 1.3 GHz CW: 150 kHz to 10 MHz	Rate: 50 Hz to 50 kHz Depth (5 to 99) %Depth Rate: 50 Hz to 10 kHz Depth (5 to 99) %Depth	1.7 % of reading 2.6 % of reading	Modulation Meter w/ RF Signal Generator
Frequency Modulation – Measure & Generate CW: 10 MHz to 1.3 GHz CW: 250 kHz to 10 MHz	Rate: 50 Hz to 100 kHz 400 kHz Peak Deviation Rate: 20 Hz to 10 kHz 40 kHz Peak Deviation	1.3 % of reading 2.4 % of reading	Modulation Meter w/ RF Signal Generator
Distortion	(-85 to 0) dB 20 Hz to 20 kHz 20 kHz to 100 kHz	1.4 dB 2.5 dB	Audio Analyzer

Length – Dimensional Metrology

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Calipers – Inside, Outside, Step	(0 to 150) mm	17 µm	Multifunction Gauge Block
Micrometers	(0 to 150) mm	12 µm	Multifunction Gauge Block
Dial Gages	(0 to 10) mm	4.5 µm	Multifunction Gauge Block

Mass and Mass Related

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Torque	(0.5 to 40) N·m	1.8 % of reading	Torque transducer

Photometry and Radiometry

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Optical Time Domain Reflectometer – (OTDR): Distance – (1310, 1550, 1625) nm Refractive Index 1.46	18.8 km	0.5 m + 1 sampling interval	Single mode Optical Delay Line
Optical Power (850 to 1 650) nm	(-50 to +20) dBm	0.3 dB + 46 nW	Optical Power meter & head

Time and Frequency

Parameter/Equipment	Range	Expanded Uncertainty of Measurement (+/-)	Reference Standard, Method, and/or Equipment
Frequency - Measure & Generate	10 Hz to 100 kHz 100 kHz to 1 MHz (1 to 10) MHz 10 MHz to 40 GHz	$5.8 \times 10^{-8} \cdot f + 0.0008 \text{ Hz}$ $5.8 \times 10^{-8} \cdot f + 0.008 \text{ Hz}$ $5.8 \times 10^{-8} \cdot f + 0.08 \text{ Hz}$ $5.8 \times 10^{-8} \cdot f + 0.8 \text{ Hz}$	GPS Receiver, Counter and RF Signal Generator

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. For the calibration of RF Power Sensors - Calibration Factor excludes VRC measurements above 18 GHz.
3. This scope is formatted as part of a single document including Certificate of Accreditation No. L2448.



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