CERTIFICATE OF ACCREDITATION

In terms of section 22(2) (b) of the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006 (Act 19 of 2006), read with sections 23(1), (2) and (3) of the said Act, I hereby certify that:-

NATIONAL METROLOGY INSTITUTE OF SOUTH AFRICA

TIME AND FREQUENCY LABORATORY

Accreditation Number: **1604**

is a South African National Accreditation System accredited Calibration Laboratory provided that all SANAS conditions and requirements are complied with

This certificate is valid as per the scope as stated in the accompanying scope of accreditation Annexure "A", bearing the above accreditation number for

TIME AND FREQUENCY METROLOGY

The facility is accredited in accordance with the recognised International Standard

ISO/IEC 17025:2017

The accreditation demonstrates technical competency for a defined scope and the operation of a laboratory quality management system

While this certificate remains valid, the Accredited Facility named above is authorised to use the relevant SANAS accreditation symbol to issue facility reports and/or certificates

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Mr T Baleni
Acting Chief Executive Officer

Effective Date: 11 February 2022
Certificate Expires: 10 January 2027

ANNEXURE A

SCOPE OF ACCREDITATION

TIME AND FREQUENCY METROLOGY

Accreditation Number: 1604

Permanent Address of Laboratory:
National Metrology Institute of SA
Time and Frequency Laboratory
Building 5, CSIR Campus
Meiring Naude Road
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Pretoria
0002

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Technical Signatories: Mr C Matthee (all except 3.4.6)
Ms M Nel (all except 1)
Mr P Jivan (all except 1 & 3.4.6)

Nominated Representative: Ms LN Ntatamala

Issue No.: 16
Date of Issue: 11 February 2022
Expiry Date: 10 January 2027

ITEM	MEASURED QUANTITY OR TYPE OF GAUGE OR INSTRUMENT	RANGE OF MEASURED QUANTITY	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (±)	METHOD / PROCEDURE
1	**TIME**			
1.1	**Time Scale Difference**			
1.1.1	Local clock vs UTC (ZA)	- 1 s to + 1 s	2 ns	Direct measurement between two clocks.
1.1.2	Local clock vs UTC	- 1 s to + 1 s	8 ns	Post-processed direct time interval measurement.
2	**FREQUENCY**			
2.1	**Standard Frequency Source**			
2.1.1	Local	1 MHz, 5 MHz, 10 MHz	$1 \cdot 10^{-13} \cdot f$	Calibration by phase difference measurement against a reference standard.
2.2	**General Frequency Source**			
2.2.1	General	1 mHz to 1,3 GHz 1,3 GHz to 40 GHz	$2 \cdot 10^{-10} \cdot f$ + 10 µHz 3 Hz	Calibration by direct measurement against a reference standard.

The CMC, expressed as an expanded uncertainty of measurement, is stated as the standard uncertainty of measurement multiplied by a coverage factor $k = 2$, corresponding to a confidence level of approximately 95%

Accreditation Manager

ANNEXURE A

Accreditation No.: 1604
Date of Issue: 11 February 2022
Expiry Date: 10 January 2027

ITEM	MEASURED QUANTITY OR TYPE OF GAUGE OR INSTRUMENT	RANGE OF MEASURED QUANTITY	CALIBRATION AND MEASUREMENT CAPABILITY EXPRESSED AS AN UNCERTAINTY (±)	METHOD / PROCEDURE
2.3	**Frequency Meter**			
2.3.1	Frequency Counter	1 mHz to 1,3 GHz	$2 \cdot 10^{-10} \cdot f + 10$ µHz	Calibration by direct generation using laboratory standard.
2.3.2	Frequency Meter	1 mHz to 1,3 GHz	$2 \cdot 10^{-10} \cdot f + 10$ µHz	Calibration by direct generation using laboratory standard.
3	**TIME INTERVAL SOURCE**			
3.1	**Period Source**			
3.1.1	Period source	1 ns to 1 000 s 1 000 s to 100 000 s	$2 \cdot 10^{-11} \cdot t + 200$ ps $5 \cdot 10^{-10} \cdot t$	Calibration by direct measurement against a reference standard.
3.2	**Time Interval Source**			
3.2.1	Rise and fall time source	15 ps to 1 µs	$0{,}006 \cdot t + 6$ ps	Time interval measurement or deconvolution method.
3.2.2	Pulse width	1 ns to 1 000 s 1 000 s to 100 000 s	$2 \cdot 10^{-11} \cdot t + 200$ ps $5 \cdot 10^{-10} \cdot t$	Direct measurement of the time interval using a reference standard.
3.2.4	Delay source	1 ns to 1 000 s 1 000 s to 100 000 s	$2 \cdot 10^{-11} \cdot t + 200$ ps $5 \cdot 10^{-10} \cdot t$	Calibration by direct measurement against laboratory standard.
3.3	**Period Meter**			
3.3.1	Period Meter	1 ns to 1 000 s 1 000 s to 100 000 s	$2 \cdot 10^{-11} \cdot t + 2$ ns 1 ms	Calibration by direct generation or comparison against laboratory standard.
3.4	**Time Interval Meter**			
3.4.1	Rise and fall time meter	15 ps to 1 µs	$0{,}006 \cdot t + 6$ ps	Calibration by direct generation using laboratory standard.
3.4.2	Pulse width meter	1 ns to 1 000 s	$2 \cdot 10^{-11} \cdot t + 2$ ns	Calibration by direct generation using laboratory standard.
3.4.4	Delay meter	1 ns to 1 000 s	$2 \cdot 10^{-11} \cdot t + 2$ ns	Calibration by direct generation using laboratory standard.
3.4.6	LIDAR speed meter	0 km/h to 360 km/h (0 m/s to 100 m/s)	0,5 km/h (0,14 m/s)	Calibration by optical speed simulation.
5	**ROTATIONAL SPEED**			
5.2	Contact Tachometer	5 rpm to 100 rpm 100 rpm to 1 000 rpm 1 000 rpm to 7 000 rpm	$0{,}01$ rpm $+ 3 \cdot 10^{-4} \cdot f$ $0{,}1$ rpm $+ 3 \cdot 10^{-4} \cdot f$ 1 rpm $+ 3 \cdot 10^{-4} \cdot f$	Calibration using frequency meter and a rotation speed generator.

The CMC, expressed as an expanded uncertainty of measurement, is stated as the standard uncertainty of measurement multiplied by a coverage factor $k = 2$, corresponding to a confidence level of approximately 95%

Accreditation Manager

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Accreditation No.: 1604
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5.3	Non-Contact Tachometer (Optical)	5 rpm to 100 rpm 100 rpm to 1 000 rpm 1 000 rpm to 100 000 rpm	0,01 rpm 0,1 rpm 1 rpm	Calibration by optical simulation
5.6	Other rotational devices	5 rpm to 1 000 rpm 1 000 rpm to 100 000 rpm	0,01 rpm + $5 \cdot 10^{-4} \cdot f$ 1 rpm + $5 \cdot 10^{-4} \cdot f$	Calibration by direct measurement against laboratory standard.
6	**PHASE ANGLE**			
6.1	Phase angle meter	0 to 360°, 5 V equal amplitude: 1 Hz to 6,25 kHz 6,25 kHz to 50 kHz 50 kHz to 100 kHz 0 to 360°, 50 mV to 100 V: 1 Hz to 100 kHz	 0,005° 0,01° 0,02° 0,05°	Direct measurement against a phase standard.

The CMC, expressed as an expanded uncertainty of measurement, is stated as the standard uncertainty of measurement multiplied by a coverage factor $k = 2$, corresponding to a confidence level of approximately 95%

ISSUED BY THE SOUTH AFRICAN NATIONAL ACCREDITATION SYSTEM

Accreditation Manager