NMISA Progress Report
APMP TCTF 2017

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Introduction

- Time, Frequency and Fibre Optics (TFFO) team
  - Section head: Chris Matthee
  - R&D Metrologist: Mariesa Nel
  - R&D Metrologist: Pritesh Jivan

Introduction

- TFFO Section Functions
  - Maintain local frequency standard and generate UTC(ZA).
  - Provide traceability to local industry and calibration labs, attract calibration income.
  - Perform research & development toward new frequency standards and applications.
- Calibration Services:
  - Frequency, Time Interval, Phase Angle, Rise/fall-time
  - Rotational speed (tachometers)

Key infrastructure

- Local frequency standard and UTC (ZA)
  - 6 thermal beam caesium atomic clocks (5071A's).
    - All with long-life tubes
  - 3 T4Science Hydrogen masers
  - Used to realise the South African National Timescale, based on one master clock.
  - Typical monthly frequency error since 2016: $<2 \cdot 10^{-14}$
  - Maintained to within 20 ns of UTC (lately within 10 ns)

Key infrastructure

- Time transfer link
  - 2 Septentrio multi-frequency geodetic receivers.
  - One receiver was calibrated by BIPM in 2016.

Competence

- Accreditation
  - Accredited by South African Accreditation service (SANAS) since July 2003.
  - Previous Assessors: Dr P. Fisk and Dr B. Warrington (NMIA); Dr P. Banerjee (NPLI).
  - Re-assessment successfully completed (September 2017).
- Measurement Capabilities
  - Listed on BIPM KCDB since January 2011.
  - CMCs for frequency, rise and fall-time and time interval (delay).

Competence

- International activities
  - Chair of the AFRIMETS working group for Time and Frequency
  - Part of the AFRIMETS CMC review committee
  - Mr Matthee is the chair of the CCTF WG MRA (from CCTF 2017)

New developments

- Improvement of Steering of local frequency standard
  - Deliver and absolute error of not more than $10\ ns$
  - Improved robustness
- Part of the SKA SADT consortium
  - Developing the clock infrastructure for the SKA telescope
- Fibre based time transfer
  - Test the capability of long distance ($\sim 800\ Km$) time transfer via fibre optic cable.
  - Possible implementation from NMISA site (Pretoria) to SKA site (Carnarvon)