

## Report to the 18<sup>th</sup> meeting of the CCTF from the National Metrology Institute of South Africa (NMISA)

May 2009

### 1. UTC(ZA)

UTC(ZA) is based on a single free-running commercial caesium atomic clock. The history of UTC(ZA) is shown in figure 1. The policy of the NMISA is to maintain UTC(ZA) to within 5 microseconds of UTC.

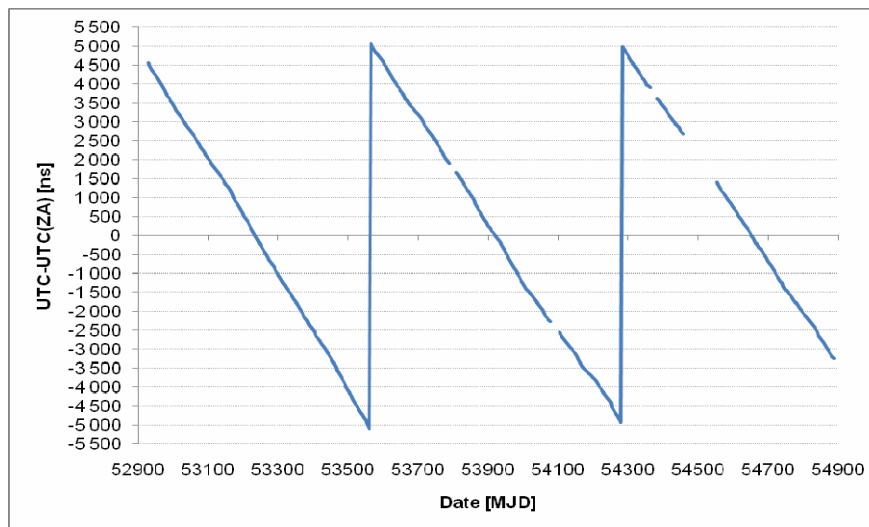


Figure 1: History of UTC(ZA) from October 2003 to March 2009

The average relative frequency error of the currently master clock for UTC(ZA) is  $1,67 \cdot 10^{-13}$ . This is slightly higher than the expected error (due to gravitational red shift) of  $1,4 \cdot 10^{-13}$ .

NMISA is working towards a steered clock that will improve the accuracy of UTC(ZA). To achieve this, the number of clocks has been increased to four caesium atomic clocks. A new monitoring system has been implemented and successfully tested. NMISA is currently working on the software that will submit data from all the clocks to the BIPM for inclusion in the calculation of UTC.

### 2. Time transfer link

NMISA used a dual system single frequency GPS and GLONASS timing receiver for its time transfer link. This system became unstable during December 2007 and was returned to the manufacturer for repair during the beginning of 2008. Unfortunately, the manufacturer was not able to repair the system yet and keep missing the promised dates for the completion of the repair. This means that NMISA has not contributed any data to CCTF.K1-UTC since then.

Due to these and previous problems with the receiver and the difficulty with the manufacturer, a decision was made to purchase a new receiver. NMISA will be changing their timing receiver to a dual frequency GPS and GLONASS receiver.

### **3. Time dissemination services**

NMISA runs a Network Time Protocol (NTP) server to distribute time via the Internet. The server time is synchronised to GPS receivers and the 1 pulse per second from the master clock, but no claim regarding accuracy or traceability is made for this service.

NMISA publishes a monthly bulletin for Time & Frequency users requiring a higher accuracy. In this bulletin, the difference between UTC(ZA) and GPS time, reduced to a single point per day, is published. The bulletin also contains the average frequency of UTC(ZA) for the previous month.

### **4. Research activities**

NMISA has been improving its capability in the optical frequency field during the last few years. An optical frequency comb system with capability in the visible region (from approximately 500 nm to 1100 nm) has been successfully commissioned in 2006.

Research is continuing on designing and implementing an optical frequency standard using a two-photon transition of the Rubidium atom. The research aims to provide a standard that can be used in the Time & Frequency, the Dimensional as well as the Fibre Optical Metrology fields while concentrating on transportability, maintainability and robustness.

The research programme is currently in its infancy. Although some of the capital equipment has been identified and ordered, a lot more work is required to identify all the required items to enable this technology.

### **5. Accreditation status**

The Time & Frequency laboratory has been accredited by the South African Accreditation System (SANAS) since July 2003. (SANAS is a member of ILAC and a signatory of the ILAC MRA.) The initial assessment in 2002 used Dr Peter Fisk from the (then) CSIRO as technical expert, while Dr Bruce Warrington from NMIA conducted the second assessment as technical assessor in 2006.

Due to some misunderstanding, the CMC submission of the laboratory was lost. A new CMC submission has been drawn up. NMISA are contacting technical experts to help with the intra-regional review, since AFRIMETS contains only one other laboratory with the capability to review our CMCs. It is expected that the new CMC file will be submitted for inter-regional review during 2009.

## **6. Participation in AFRIMETS activities**

Mr Chris Matthee from NMISA is the current chair of the Time & Frequency Working Group of Technical Committee 1 of AFRIMETS. The current focus of the working group is to help laboratories to establish some capability in the time and frequency field. NMISA has submitted proposals to donor funding bodies for the establishment of a time network in Africa similar to a time network in the Americas. The aim of such a proposal is to improve the technical knowledge in Africa and to have a working design available for a “timing rack” that can easily be assembled and commissioned in an African country.

## **7. Structure of the Time & Frequency Laboratory**

The Time and Frequency Laboratory is part of the Electromagnetic Metrology Area, led by Mrs Natasha Nel-Sakharova. Mr Chris Matthee is the head of the laboratory.

The research activities are led by Dr Johan Burger while Mrs Sara Prins is head of the NMISA R&D programme.