THE SADCMET PILOT INTERCOMPARISON ON RESISTANCE

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Abstract

The formation of the Southern African Development Community (SADC) through the *Declaration, Treaty and Protocol establishing SADC* of 1992 [1], was the starting point of formal regional integration in Southern Africa. Regional integration was taken even further through the 1996 SADC Protocol on Trade [2], which led to the establishment of an integrated regional market and trading block. SADCMET (the regional metrology network within SADC) was formed during October 1996 with the aim of harmonizing metrology activities within the region [3]. A pilot regional intercomparison on resistance, which began in December 1997 and was coordinated by the author, was carried out until the end of 2000. This paper outlines the objectives and findings of the intercomparison.

1. Introduction

During 1997 a bilateral intercomparison was carried out between CSIR-NML (CSIR-National Metrology Laboratory, South Africa) and NPLI (National Physical Laboratory, India). It was decided, in consultation with the regional coordinator of SADCMET, Dr Franz Hengstberger, to extend the intercomparison to SADC. Altogether, seven countries participated in the exercise, with CSIR – NML (South Africa) acting as the pilot laboratory. The primary aim of the exercise was to establish the capability of the region in terms of facilities available and also to carry out in this exercise a "needs assessment" of each participating country in terms of equipment and training of personnel in carrying out of future intercomparisons. It is for these reasons that the intercomparison was not registered as an official regional intercomparison under the international MRA between National Metrology Institutes (NMIs).

2. Audit Sample

The intercomparison was carried out at the 10 kΩ level and two artifacts were used. The first two laboratories viz., NPLI and MSB (Mauritius Standards Bureau) measured a Fluke 742A-10k resistor. The subsequent participants measured a Yokogawa 2792 10 kΩ resistor. The reason for using the Fluke 742A resistor with the first two laboratories was that the author hand-carried the Fluke 742A resistor to NPLI and MSB during the bilateral intercomparison. Subsequently, when it was decided to include the rest of SADC in the intercomparison, the Yokogawa resistor was used for the following reasons:

a) The artifact was more appropriate given the measurement capabilities of the countries within the region.

b) It was more durable in terms of being couriered by a commercial company.

c) Problems were also anticipated at the customs and excise stations at border points. This could have meant the loss of the artifact or delays experienced.

3. Measurement Instructions

A simple set of instructions was initially sent out. It was later realized then that a more comprehensive set of instructions was needed. During the last leg of the intercomparison the following was sent out with the artifact:

a) A **letter for the attention of customs officials**, explaining the purpose of the intercomparison and that the artefact would return to the pilot laboratory.

b) A **detailed set of instructions** (including certain acceptable methods of measurement). The intercomparison schedule was also included.

c) A **procedure** on how to use the **SUBSTITUTION METHOD** for measurement. This included connection diagrams and factors that need to be taken into account during measurements.

d) An **uncertainty of measurement budget spreadsheet**. A hard copy and an electronic copy were provided.

e) **A guide on expressing uncertainties of measurement (UoMs)** that is acceptable internationally.

f) A **procedure for the completion of the UoM budget** was provided. The procedure discussed the factors to be taken into account and also which factors were significant in this particular exercise.

g) A **sample certificate of calibration**.

4. Intercomparison Schedule

The participating countries, approximate date of measurement and contact persons are given in Table 1. The Tanzania Bureau of Standards could not participate due to their standards being away for calibration at the time of its scheduled participation.

TABLE 1

SADCMET PILOT INTERCOMPARISON ON RESISTANCE			
SCHEDULE			
COUNTRY	**LABORATORY**	**DATE (APPROX)**	**CONTACT**
India	National Physical Laboratory	Nov-97	Dr SK Mahajan
Mauritius	Mauritius Standards Bureau	Dec-97	Mr Christian Ng Ha Kwong
South Africa	CSIR-NML	Dec-97	--
Zimbabwe	Environ. Testing & Tropical Corporation	Oct-98	Mr Chaka Mashembe
South Africa	CSIR-NML	Nov-98	--
Malawi	Malawi Post & Telecomms Corp.	Mar-99	Mr BK Juba
South Africa	CSIR-NML	Apr-99	--
Botswana	Botswana Bureau of Standards	May-00	Mr Keeper Morgan
Zambia	Zambia Telecommunications Company LTD	Sep-00	Mr Evans Mctervish Mukuka
Tanzania	Tanzania Bureau of Standards	Oct-00	Mr Kisamo *

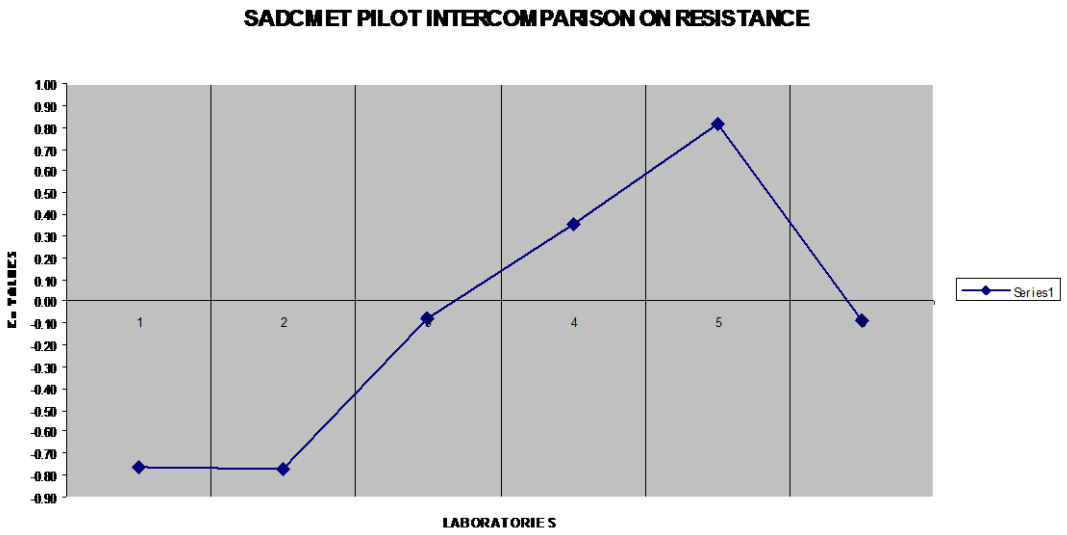
5. Results

Since two artifacts were used, which where significantly different from each other in terms of the nominal value, the results presented here are in the form of *Normalised Error* (E_n) values. The following equation was used to calculate the E_n values.

$$E_n = \frac{Lab_{value} - NML(SA)_{value}}{\sqrt{(UoM_{Lab})^2 + (UoM_{NML(SA)})^2}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

An $|E_n|$ value ≤ 1 is considered as indicating agreement between the pilot lab and a particular participating laboratory, taking into account their claimed uncertainties of measurement (UoMs).

FIGURE 1



The results in Figure 1, which are in no particular order, indicate that there was agreement between all the participating laboratories within their claimed measurement uncertainties. The E_n value for the measurements between NPLI and CSIR-NML was 0,35, with both of the laboratories stating an uncertainty of measurement of ± 2.ppm. NPLI's participation has thus given the exercise additional credibility.

6. Conclusions

The intercomparison was a success. It was the first regional intercomparison within SADCMET and is a forerunner of many to come. The exercise has given SADCMET an insight into what it needs to focus on during the forthcoming Temperature and Mass intercomparisons, scheduled to begin in 2001.

Some problems were experienced at border posts (delay in clearing procedures of the audit sample by the customs and excise offices) which hopefully will be addressed via the SQAM (Standardisation, Quality Assurance & Metrology) structures within SADC.

7. Acknowledgements

The author would like to thank the institutions that participated including the contact persons listed in table 1. The SADCMET regional coordinator's (Dr Franz Hengstberger) support for the intercomparison is appreciated along with the support of the manager of CSIR-NML, Mr Francois Denner, for allowing CSIR-NML to act as the pilot laboratory and making available the intercomparison artifacts.

References

[1] Declaration, Treaty and Protocol of Southern African Development Community, Windhoek (Namibia), 17 August 1992.

[2] SADC Protocol on Trade, Maseru (Lesotho), 24 August 1996.

[3] Moodley, S.S.: The Formation of SADCMET and its role in realizing the broader objectives of SADC, 1998, Technology Leadership Programme, Mini Thesis.