Comparison of Josephson Voltage Standards at 10 V

Proposed comparison identifier: COOMET Project 903/BY/24

Technical protocol
for the key RMO comparison between VNIIM and BelGIM,

1. Introduction

The key RMO Comparison will be performed at 10 V level to check the coherence of the Josephson Array Voltage Standards (JAVS). The comparison will be performed by measuring VNIIM transportable Josephson Voltage Standard (PJVS). The link between VNIIM and BelGIM primary voltage standards will be made through the transportable VNIIM PJVS. The comparison will take place in the BelGIM DC laboratory in November 2024.
We consider that the link to BIPM.EM.K10.b will be done through the results of the VNIIM in the BIPM Josephson Key comparison.

2. Purpose

The purpose of this comparison is to link the voltage standard of BelGIM (Belarussian State Institute of Metrology, Belarus) to the voltage standard of VNIIM (D.I. Mendeleyev Institute for Metrology, Russia) in the frame of the COOMET- RMO comparisons and have link to BIPM voltage standard.

3. The transfer standard

The transfer standard to be measured is the PJVS, with a nominal output voltage of 10 V. The PJVS has a stable output voltage as it is based on the Josephson effect and as it was characterized during VNIIM – BIPM key comparison in November 2010 (S. Solve, R. Chayramy, M. Stock, A. Katkov, Comparison of the Josephson voltage standards of the VNIIM and the BIPM (part of the ongoing BIPM key comparison BIPM.EM-K10.b), Metrologia, 2011, 48, Tech. Suppl., 01007).

4. Preparation to measurements

The PJVS sampler holder will be immersed to liquid helium at least two hours before the beginning of the measurements. The PJVS microwave source will be connected to the mains at most half an hour before measurements. The position of PJVS current steps will be check by 8-digit dc voltmeter. The PJVS output voltage is measured by BelGIM primary voltage standard using routine techniques for 10 V Zener calibration.

5. Measurement's schedule

There will be at least eight series of measurements performed by BelGIM. Planned period of the measurements are November 2024.

6. Temperature and pressure coefficients, environment conditions

The temperature, pressure, and humidity of the laboratory will be measured in each measurement.

7. Uncertainties

An uncertainty budget will be given containing the different sources of uncertainty and their values.
Foreseen sources of uncertainty: frequency;

detector;

leakage resistance;

no compensated thermal electromotive forces;

type A uncertainty.

8. Link with other comparisons

VNIIM participated in the BIPM.EM-K10.b comparison; this allows linking result of BelGIM measurement during this RMO comparison to the BIPM.EM-K10.b.

9. Participant report

The BelGIM report must be sent to the VNIIM within one month from the completion of his measurements.

This report will contain:
The measurement method description and:

for each reported value:

- date and time of measurement;
- measured voltage;
- ambient temperature, humidity, and pressure;
- the Type A standard uncertainty;

an uncertainty budget with the different sources of uncertainty and their values, as:

- uncertainty on the realization of the volt using the primary BELGIM standard;
- detector;
- leakage resistance;
- no compensated thermal electromotive forces.

10. Final report

The draft version of the final report will be issued within two months after completion of the measurements. It will be sent to BelGIM for discussion and approval. The final report will be then submitted to WGLF for consideration.

11. Contact persons

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