

# National Measurement Laboratory

## Report of Calibration



Date of Issue: June 06, 2019

Report No.: E190342A

**Instrument:** Standard Resistor

**Manufacturer:** ESI

**Model:** SR104

**Serial Number:** G202088930104

**Applicant:** Illya Tsemenko

**Address:** [REDACTED]

The result of this calibration, performed by the National Measurement Laboratory, is specified in this report. When the cover and the following 2 pages are separated, the validity of this report no longer exists.



*Shih-Fang Chen*

Approved Signatory

*Jang-Yow Lin*

Chief Executive  
National Measurement Laboratory

## INSTRUCTIONS OF THE CALIBRATION REPORT

1. The result of this calibration, performed by the National Measurement Laboratory, is specified in this report. Only to the designated instrument is the calibration result applied.
2. The calibration data was obtained under the specific conditions of this laboratory. After the calibration, the accuracy and precision of this measuring instrument/standard will depend on the care of handling as well as the frequency of use.
3. Unless otherwise specified, no adjustment to the measuring instrument/standard will be made in our laboratory. It is recommended that the clients have the measuring instrument/standard adjusted by its manufacturer or dealer if needed. The measuring instrument/standard should be recalibrated to ensure its accuracy after any adjustment.
4. Periodical recalibration, with a user-defined period, is recommended for ensuring the accuracy of the measuring instrument/standard.
5. The calibration result has been confirmed and authorized by the technical manager of the National Measurement Laboratory.
6. The client should not dismantle this report. This calibration certificate shall not be reproduced or excerpted from any part of the contents except in full, without written approval of our laboratory.
7. This certificate is consistent with the capabilities that are included in Appendix C of the MRA drawn up by the CIPM. Under the MRA, all participating institutes recognize the validity of each other's calibration and measurement certificates for the quantities, ranges and measurement uncertainties specified in Appendix C (for details see <http://www.bipm.org>).

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Report No.: E190342A

Instrument: Standard Resistor

Ambient Temp.:  $(23.0 \pm 1.5) ^\circ\text{C}$

Manufacturer: ESI

Relative Humidity:  $(45 \pm 10) \%$

Model: SR104

Serial No.: G202088930104

## Calibration Results and Descriptions

### I. Calibration Results

The nominal value is the labeled value of standard resistor. The measurement value of standard resistor is calibrated by direct current resistance system of NML.

<u>Nominal Value</u>	<u>Measurement Value</u>	<u>Relative Expanded Uncertainty</u>
10 k $\Omega$	9.999 9995 k $\Omega$	0.16 $\mu\Omega/\Omega$

### II. Descriptions

#### 1. Date of Calibration

This calibration was performed from June 3, 2019 to June 6, 2019.

#### 2. Calibration Methods

This calibration was carried out according to Instrument Calibration Technique for Direct Current Resistance System (07-3-84-0042)<sup>1</sup>. The measurement value is obtained by comparing this standard with the standard resistor of NML using resistance bridge.

#### 3. Standard Used

The standard used in this calibration is the standard resistors with serial number of 1914648 and 1914649. The certificate of this standard was issued on June 3, 2019 with certificate number of E190341A by National Measurement Laboratory (NML). The calibration interval of this standard is 1 year.

#### 4. Relative Expanded Uncertainty

4.1 The relative expanded uncertainty was evaluated according to Measurement System Validation Procedure for Direct Current Resistance System (07-3-84-0073)<sup>2</sup>.

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4.2 The reported relative expanded uncertainty was obtained by multiplying the relative combined standard uncertainty with a coverage factor  $k = 2$ , corresponding to a level of confidence of approximately 95 %.

## 5. Initial Preparation

5.1 The 4-wire measurement method is used to calibrate the standard resistor. To avoid the errors due to different connecting method and the resistance difference due to different power dissipation, the voltage and current should be wired separately and the power dissipation of the standard resistor should not be more than 0.1 Watt.

5.2 It is suggested that the standard resistor is warmed-up for at least 4 hours under the temperature and humidity controlled before performing the measurements.

## III. References

1. Instrument Calibration Technique for Direct Current Resistance System, 07-3-84-0042, 8<sup>th</sup> ed., Center for Measurement Standards/ITRI, 2019.
2. Measurement System Validation Procedure for Direct Current Resistance System, 07-3-84-0073, 8<sup>th</sup> ed., Center for Measurement Standards/ITRI, 2019.