National Institute of Standards & Technology

Certificate

Standard Reference Material 2590

1-V Josephson Array Voltage Standard

Serial No.:

Standard Reference Material (SRM) 2590 consists of a 6 x 10 mm superconductive integrated circuit chip mounted with a WR-12 band waveguide input and solder pad dc connections. When cooled to 4.2 K or less and irradiated with a millimeter wave input of approximately 5 mW at 75 GHz, it is certified to generate the quantum voltage levels which are the basis for the SI Volt Representation. The physical basis for Josephson array voltage standards and their practical realization is described in references 1-4. The device, together with its input and output connections is shown in Fig. 1. Each device (SRM unit) is individually characterized. The attached data sheet and installation instructions apply only to the SRM unit identified by the above serial number.

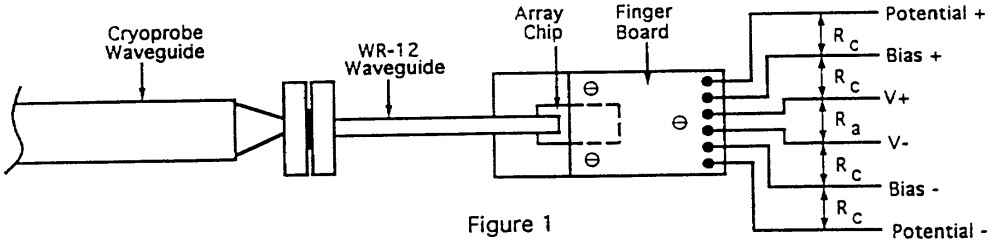

Figure 1

Traceability: The term traceability as commonly used does not apply to a Josephson voltage standard. Because of its realization of a quantum physics phenomenon, and the adoption of that phenomenon as the basis of the SI Volt Representation, a properly used Josephson standard is correct by definition. The Josephson array device and the metrological system based on it, constituted a voltage standard. Comparisons between a Josephson standard and any other standard, including another Josephson standard never lead to a new calibration value for the Josephson standard, but rather to a level of confidence that the Josephson standard itself is functioning correctly (no unaccounted for errors exist).

Experiments to test the precision of the voltages generated by Josephson array devices and their independence from environmental and material effects have found agreement between independent devices in the same liquid helium bath to better than 2 parts in 10^{17}.[5-7] Room temperature comparisons between independent calibration systems have shown agreement to a few parts in 10^{10}. Calibrations of Weston and Zener reference standards are typically limited by the stability of the reference itself or thermal emfs in the wires and reversing switch which connect it to the Josephson array system.[8]

The design, mounting, and testing of this chip were directed by C.A. Hamilton and C.J. Burroughs of the NIST Electromagnetic Technology Division.

The technical and support aspects involved in the preparation, certification, and issuance of this SRM were coordinated through the Standard Reference Materials Program by N.M. Trahey.

Gaithersburg, MD 20899
September 16, 1993

Thomas E. Gills, Acting Chief
Standard Reference Materials Program

(over)

REFERENCES

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