Large voltage modulation HTS 2D SQIF arrays operated on a single stage cryo-cooler

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We report on the development and operation of an integrated miniature portable RF antenna system using high-temperature Superconducting Quantum Interference Filters (SQIFs) cooled using a single stage Stirling-cycle cryo-cooler. The HTS SQIF antenna's small dimensions (10 mm x 10 mm), high temperature operation (77 K) and low power dissipation (< 100 mW) make them ideally suited for an integrated system using a compact lightweight cooler.

We have previously described the performance of 2D SQIF arrays with 20,000 YBCO step-edge Josephson junctions in liquid nitrogen (LN_2) [1]. Here the performance of larger-scale SQIF antennas, with over 100,000 Josephson junctions, operated on a miniature cryocooler is reported. The electrical transport properties of the SQIF arrays, including current -voltage (*I* -*V*) and voltage -magnetic-field (*V* -*B*) characteristics, are compared with LN_2 measurements. We also investigate the electromagnetic and vibrational noise contributions of the cryo-cooler to the system noise of the SQIF array.

V -*B* measurements show SQIF array sensitivities of more than 20 kV/T and voltage modulation depths of ~ 20 mV for 100,200 junctions at 77 K, with good agreement between results obtained with both cooling methods. Improvements in SQIF sensitivity are observed by adjusting the temperature of the cryo-cooler to optimise the array critical current.

[1] E.E. Mitchell *et al*., *Supercond. Sci. Technol*. 29, 06LT01 (2016).