

## An Integrated Superconducting Sub-mm Wave Receiver for Linewidth Measurements of Josephson Flux-Flow Oscillators

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By using an integrated superconducting sub-mm wave receiver, the composite linewidth of two Josephson flux-flow oscillators (FFO) was measured to be less than 2.1 MHz in the band 280-330 GHz. The output power coupled to a 10  $\Omega$  microstripline was about 0.5  $\mu$ W, and could be adjusted by changing the current bias of the oscillator junction. The receiver consists of two identical FFO's and an SIS (superconductor-insulator-superconductor) mixer. The composite linewidth of the oscillators was determined by mixing the two signals in the SIS mixer to a lower intermediate frequency (if). The FFO's are connected to the SIS mixer via centerfed interdigital capacitors. One FFO is well coupled to the SIS mixer by using a 3-step Chebychev microstripline transformer and a fairly large inter-digital capacitor, while the second FFO has about 15-20 dB weaker coupling. A strip inductor, rf-terminated by a radial stub, resonates out the SIS junction capacitance at about 340 GHz. Radial stubs were also used as rf chokes for the if-line (4 GHz). The FFO's and the SIS element are made of Nb/Nb-oxide/PbBi tunnel junctions. The receiver circuit was optimized by careful CAD modeling (HP Microwave Design System).

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