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Microwave Directional Coupler for Quantum Measurement[1] VICTORIA XU, Univ of California - Santa Barbara , CHRIS MACKLIN, ANDREW EDDINS, IRFAN SIDDIQI, University of California, Berkeley — We present the design of a 20dB single-section directional coupler using two edge-coupled, conductor-backed coplanar waveguides (CPW). We begin with an electromagnetic analysis of the physical mechanisms that allow two waveguides to form a directional coupler. Based on the coplanar waveguide geometry used for the coupler, we experienced inherently limited directivity in the performance, and we discuss the mechanisms by which we optimize for directivity despite geometric limitations. After laying out the theory behind CPW directional couplers, an electromagnetic analysis of our simulated design is presented. Two iterations of designs were fabricated. The final directional coupler yields simulated and measured performance even beyond the level of our design goals. At the center frequency of 6 GHz, our coupler showed comparable performance to commercial directional couplers. The 20-dB directional coupler serves as a solid-state equivalent of a 99/1 beam splitter for microwave photons, and will further enable on-chip experiments in quantum measurement.

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