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Optimization of microwave antenna design for millikelvin quantum coherence experiments[1] DILI WANG, Columbia University, TOM ROSENBAUM GROUP, UNIVERSITY OF CHICAGO COLLABORATION — The dilute Ising magnet $LiHo_{0.045}Y_{0.955}F_4$ forms clusters of isolated spins which can be excited into individually addressable states by applying a nonlinear ac magnetic field at resonant frequencies which depend on the cluster size. The dynamics and decoherence of these cluster states are determined, in part, by hyperfine interactions between the electronic and nuclear spins. These interactions create a ladder of states spaced at approximately 6 GHz, opening the possibility of using microwave pumping to probe the dynamics of this hyperfine splitting and the effects that it has on the larger cluster state. We have investigated a range of microwave antenna designs for optimizing this pumping mechanism, focusing on single-arm spiral geometries for both transmitter and receiver. The broadband transmission efficiency in near-field distances was studied, and it was found that the turn count of the spiral was the primary variable determining the efficiency, with the ratio between trace width and trace gap an important secondary factor.

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