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Fast tuning of a high Q microwave cavity for qubit coupling. M. SANDBERG, C.M. WILSON, F. PERSSON, G. JOHANSSON, V. SHUMEIKO, T. DUTY, P. DELSING — In 2004 Wallraff *et al.*[1] demonstrated that an artificial atom in form of a superconducting qubit can exhibit coherent interaction with a superconducting high Q microwave transmissionline resonator. In recent experiments [2,3] similar resonators have been used for coupling and reading out qubits. In these experiments the resonance frequency of the resonator is fixed and the qubit frequency is tuned. Here we present measurements on a superconducting transmission line resonator with a tunable resonance frequency that could be used for qubit coupling [4]. With such a device, qubit gates can be performed while the qubits stay at their optimal points. We demonstrate a tunability of 700 MHz for a 4.8 GHz resonator with a linewidth of 500 kHz and that we can tune the resonance frequency by 330 MHz in a few ns. We show that if the resonator is detuned faster than its decay time the photons inside the resonator will shift their frequency with the resonator.

[1] A. Wallraff, *et al.*, Nature **431**, 162 (2004).

[2] J. Majer, *et al.*, Nature **449**, 443 (2007).

[3] M.A. Sillanpää, J.I. Park, and R.W. Simmonds, Nature **449**, 438 (2007).

[4] M. Wallquist, V.S. Shumeiko, and G. Wendin, Phys. Rev. B **74**, 224506 (2006).

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