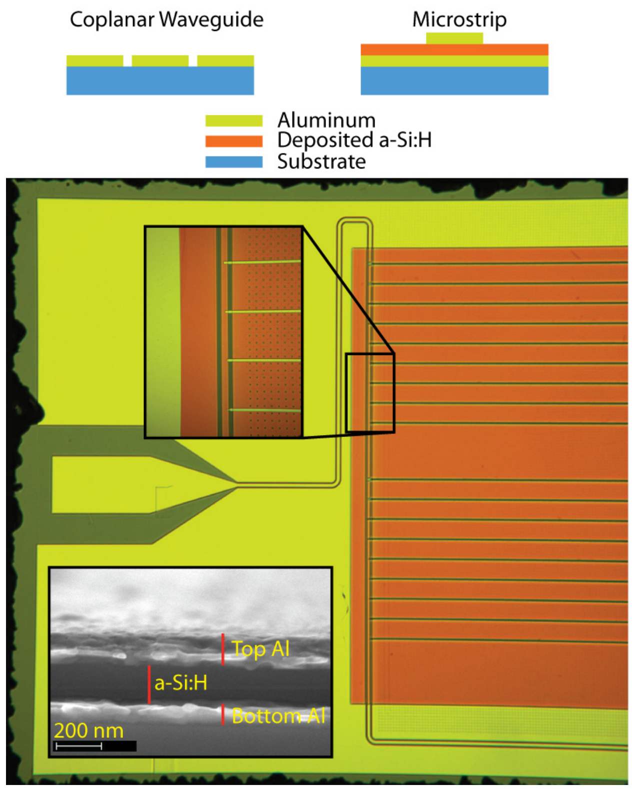

FIG. 1: (Color online) Top: A cross sectional view of a conventional CPW transmission line and the microstrip transmission lines used in this paper. Bottom: An optical microscope image of the a portion of the tested device. The inset on the lower left shows a SEM image of the cross section of a device that has been cleaved. The inset SEM image was used to determine the dielectric thickness $d = 200$ nm, the top aluminum wiring layer thickness of $t_1 = 154$ nm, and the bottom aluminum wiring layer thickness of $t_2 = 93$ nm.

of reaching base temperatures below 100 mK. A coaxial feedline drives the device through a 30 dB attenuator at 4 Kelvin, and a high electron mobility (HEMT) amplifier with a noise temperature $T_n \approx 5.5$ K is used to boost the output signal. A cryoperm magnetic shield is used to shield the device, and a Helmholtz Coil internal to the magnetic shield is used to apply a magnetic field normal to the surface of the chip.

Microstrip resonators, like larger CPW resonators[18], appear to be quite sensitive to the magnetic field normal to the metal surface during cooling through the superconducting transition temperature T_c. Figure 2 shows the applied magnetic field during cooling and the resulting quality factors of the lowest Q_m resonator on the device. Despite the magnetic shield the best quality factor is achieved with an applied magnetic field of around 30 mG.