**Fig. 1.** Experimental setup. Water flows from a reservoir inside a 7 kG permanent magnet through the encoding region where there is a Helmholtz coil used to apply AF ($\approx 1$ kHz) pulses. The water subsequently flows into a channel with dimensions $\approx 1 \times 2 \times 3 \text{ mm}^3$ adjacent to a microfabricated atomic-magnetometer vapor cell containing Cs and 5000 torr of N$_2$. Inset shows a photograph of the chip before the ITO heaters were installed.

**Fig. 2.** Transmission of light through the cell (black trace) as a function of $B_x$ and resulting first harmonic (red trace) as a function of $B_x$ when a rapid modulation is applied. The black and red dashed lines overlaying the data are fits to absorptive and dispersive Lorentzians, respectively.