# NEAR FIELD MICROWAVE POWER IMAGING WITH MICROMACHINED CANTILEVERS

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We have developed techniques based on micromachined, bimaterial cantilevers for spatially-resolved measurements of microwave power emitted by microwave circuits in the 4 to 20 GHz frequency range. Patterned metal structures on the cantilevers absorb microwave power via induced eddy currents within the patterned structures. The power absorption by the cantilever leads to heating which causes a deflection of the bimaterial system. The deflection may be detected with a laser beam bounce technique similar to that employed in some atomic force microscopes. Custom structures may be lithographically patterned onto the cantilever to optimize eddy current induction and lateral spatial resolution. For example, we deposited a gold film on a silicon nitride / silicon oxide cantilever and patterned the film into a ring 10 $\mu$m in diameter.

If the metal structures on the cantilever are patterned from a ferromagnetic material such as permalloy, microwave power absorption may be enhanced by applying an appropriate external magnetic bias field and inducing ferromagnetic resonance (FMR) within the structure. Enhancement of the power absorption by FMR significantly improves the signal to noise ratio. However, where the eddy current effect is broadband, the FMR enhancement occurs only at the resonant frequency.

Images are generated by placing a cantilever in close proximity ($\sim$300 $\mu$m) above a microwave circuit and measuring the cantilever deflection as a function of position. At present, the best lateral spatial resolution achievable with this technique is about 10 $\mu$m with prospects for sub-$\mu$m imaging in the near future. Circuits imaged with this technique to date include a microstrip resonator and the 60 $\mu$m center conductor of a coplanar waveguide.

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2. A - Electromagnetic Metrology
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