

**IST-073**  
**Vacuum Packaged CMOS Micromechanical Mixer Filters**

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**Abstract**

Portable electronics applications, unattended sensor networks and sensor motes embedded in infrastructure are motivating research in the miniaturization and power reduction of wireless communication subsystems. Components for filtering represent a primary bottleneck to reduction in size as they are the primary parts not monolithically integrated in today's wireless transceivers. Filtering requires low-loss resonators, which are typically surface, bulk, or thin plate acoustic wave devices made in special processes that are not compatible with foundry electronics integration. As a step toward a proposed solution, our group has developed MEMS resonators integrated with RF electronics for use as "mixer filters." These devices can perform near-direct frequency conversion from GHz radio frequencies (RF) to the acoustic resonance of the microstructure. This conversion is accomplished through the nonlinear force-voltage characteristic of the electromechanical gap in the device. Initial devices have been shown to operate with single-mode resonance with quality factors up to 2000 in vacuum. This successful development has led to the current work on a next generation of mixers with multi-pole bandpass filter characteristics suitable for demonstrating the RF front end of an on-chip receiver.