Ultra-Low Power Radios

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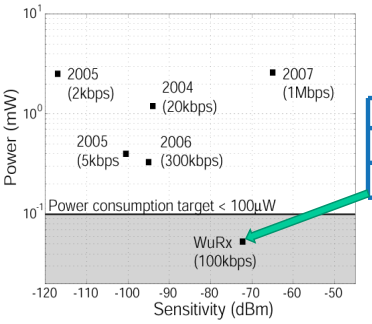
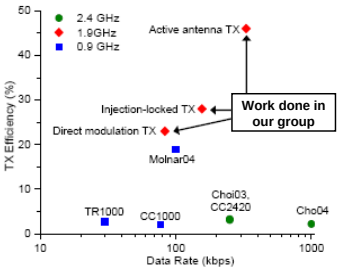
Vision

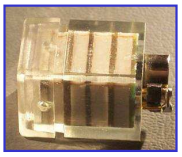
- Pushing the limits of power consumption utilizing novel circuits and devices (e.g. MEMS resonators) to enable self powered wireless sensor nodes
- Developing a portfolio of building blocks such as receivers, transmitters, base band circuits and energy conditioning circuits to cover a wide range of application scenarios
- Integrating these building to achieve small form factors and low cost solutions

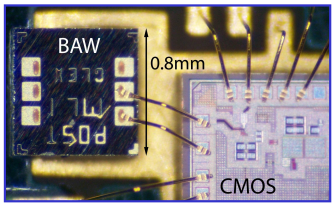


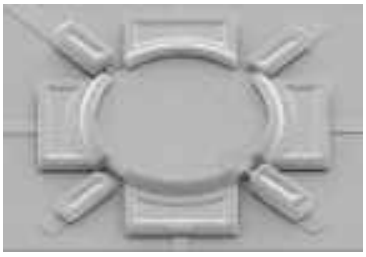
Nominal datarate	100 kbps
Sensitivity for 10^{-3} BER	-72 dBm
Total power dissipation	52 µW

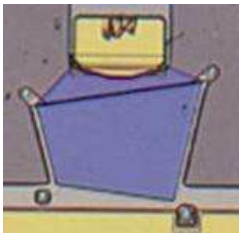
Transmitting 1mW (0dBm) with an efficiency of close to 50 % utilizing MEMS











Research Questions

- What impact do deeply scaled CMOS technologies have on circuit performance and integration?
- Can new devices such as MEMS resonators help to overcome fundamental limitations in circuit design?
- What is the best way to integrate all these different technologies in order to achieve small, cheap, and reliable solutions?

Methods

- Circuits designed and built in state-of-the-art 65 nm CMOS
- Active development and fabrication of new resonators tailored for radio circuits (UC Berkeley Microlab)
- Development of compete radio systems including transmitter, receivers and digital baseband to study integration issues and investigate efficient communication protocols

Findings

- New devices and technologies can significantly help reducing the power consumptions of wireless systems while increasing the level of integration at the same time
- Wireless sensors completely powered by energy harvesting are feasible
- Current research in circuits and system integration will allow to increase performance while decreasing cost and size of sensors