Low Power Transceiver for Wireless Sensor Network

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Goal

- Low power: 1mW when transmitter or receiver is on
- Low cost:
  - ❑ Everything on-chip, including MEMS resonators
  - ❑ No RF options
  - ❑ Small footprint (no on-chip inductor)
- Performance:
  - ❑ Better than -90 dBm sensitivity at RX
  - ❑ Bigger than -6 dBm output power at TX

Comparison with Commercial Radio

	Commercial radio (CC2420)	Proposed transceiver
Power Consumption	51 mW	1 mW
Receiver Sensitivity	-95 dBm	-90 dBm
Transmitter Output Power	0 dBm	-6 dBm

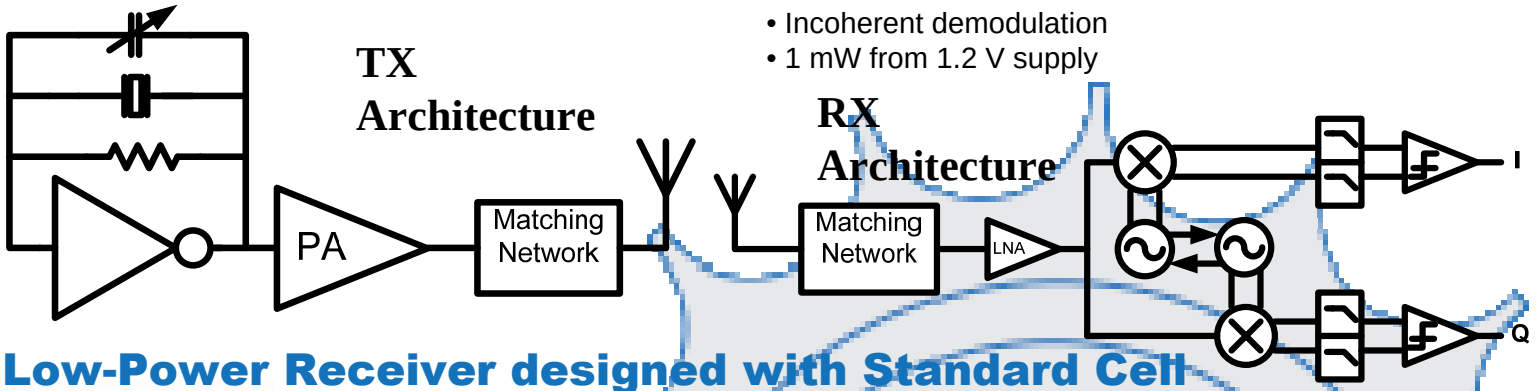
Low Power Transceiver with MEMS resonators

❑Direct VCO Modulation Transmitter

- Pierce oscillator with MEMS resonator
  - ❑ Low phase noise
- Frequency selection through a tunable capacitor array
- Class D power amplifier
- Single-ended output
- 1 mW from 1.2 V supply (.18 µm process)
- BAW MEMS resonators are integrated through wirebonding

❑Phase Diversity receiver

- Single-ended input
- Low noise amplifier attenuates noises from later stages
- Passive mixer converts single-ended input to differential
- Source-Degenrated-Coupling Quadrature VCO
- Sallen-Key Low Pass Filter to eliminate close-by interferers
- Direct conversion receiver
- Incoherent demodulation
- 1 mW from 1.2 V supply



Low-Power Receiver designed with Standard Cell

- Use only standard cells to design a receiver for ISM band 433 MHz and 915 MHz
- LNA is made of an inverter
- Mixer is made of pass-transistor logics
- Limiting amplifier is also made of an inverter
- No passive components except for capacitors
- Ring oscillators are used to allow great tuning range and low power consumption
- 1 mW from 1.8 V supply (.18 µm process)
- Challenge: Band-pass filter before LNA might be needed to suppress out-of-band interference