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## Energy Use in Buildings Enabling Technologies

### Title

Ultra-Low Energy Active RFID

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# Ultra-Low Energy Active RFID

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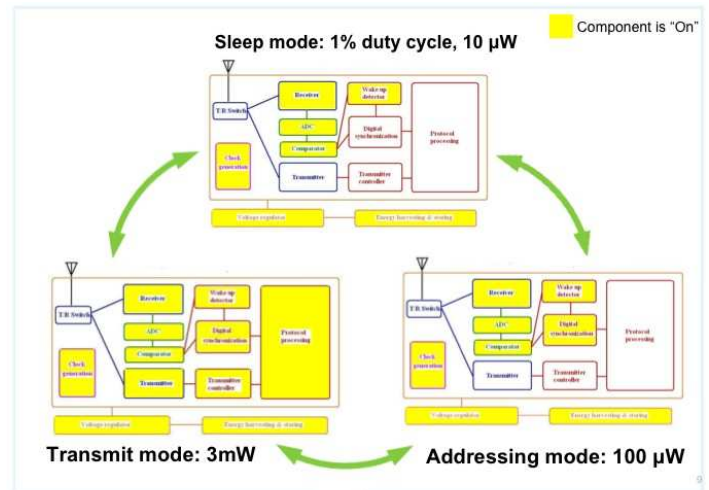


## Vision

- Unlike passive RFID, **ultra-low power active RFIDs**, powered by batteries, enable interrogation by mobiles from distances over 10m.
- Combines advantages of WSN and passive RFID tags:
  - ✓ Simple low power interrogators without complex network infrastructure requirements
  - ✓ Easy deployment
  - ✓ Compatible with existing RFID protocols
  - ✓ Low cost and small form-factor
  - ✓ Secure
- Opens the door for new applications in the residential and commercial space. For example: Enables querying for portable mobile devices (e.g. cell phones), or from a deployed network
- **BUT: Battery only power source!**

## “Self-Contained” Solution

- Tag scavenges energy to increase sensitivity
- Leads to extended communication range, improved data-rate and reliability
- Or equivalently, lower power in polling device
- The best of both worlds: simple, self-contained yet far-reaching
- Specification: (Target)
  - ✓ Fully compatible with RFID link and MAC specification
  - ✓ Operates in 2.4 GHz ISM band
  - ✓ Communication range >10 m
  - ✓ Datarate of 100 kbps
  - ✓ Postage stamp size (while only mm’s thick).
  - ✓ Fully integrated
  - ✓ Can operate indefinitely (for 24 hours/day) from single solar cell – **standby power dissipation on the order of uWs.**



## Related Research

- System Level
  - ✓ Energy efficient wake-up strategy
  - ✓ Low power digital synchronization
  - ✓ Delay efficient protocol implementation
- Circuit Level
  - ✓ Low power receiver and transmitter
  - ✓ Baseband ADC and comparator
  - ✓ Tunable ring oscillator
  - ✓ Low leakage digital logic: Sense Amplifier-based Pass Transistor Logic (SAPTL)
- Energy Level
  - ✓ Energy scavenging
  - ✓ Energy storing
  - ✓ Power regulation

## Timeline

- Spring 2010: Tape out of prototype active RFID tag
- Summer 2010: prototype of tag combining off the shelf components with produced IC
- Fall 2010: Design and tape-out of completely integrated interrogatable tag/sensor, including thick film energy collection and storage
- Spring 2011: demonstration of smart tag/sensor in residential-style settings.

