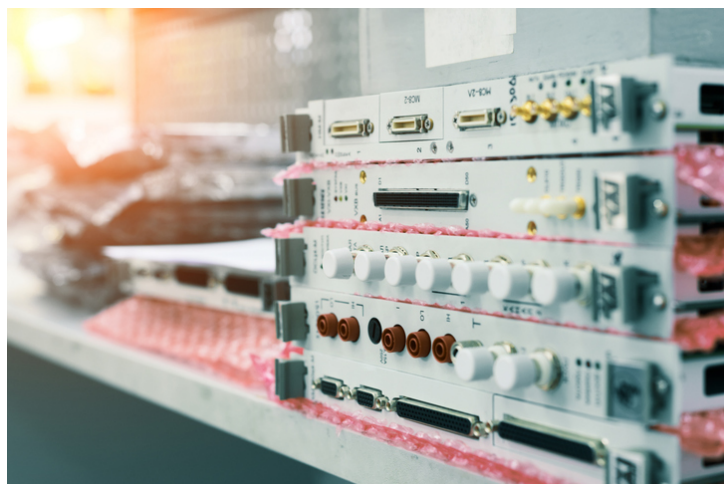




# Baseband Processing Circuitry for Low Power Wake-Up Receiver

TECHNOLOGY NUMBER: 6791



**Technology ID**

6791

**Category**

Hardware

Engineering & Physical Sciences

Semiconductor, MEMS, and

Electronics

**Inventor**

Nan Zheng

Pinaki Mazumder

**Further information**

Joohee Kim

[jooheek@umich.edu](mailto:jooheek@umich.edu)

[View online](#)

## OVERVIEW

Advanced low-power baseband processing for efficient wireless sensor wake-up receivers

- Enhances performance by minimizing power consumption and increasing dynamic range
- IoT, wireless sensor networks, low-power embedded systems, implantable medical devices

## BACKGROUND

Wireless sensor networks often require nodes to conserve energy, so low-power wake-up receivers (WuRx) are essential as they enable devices to remain mostly in sleep mode but still detect incoming communication signals. Traditionally, attention has focused heavily on the RF front-end of these receivers, as it consumes the most power when budgets are larger. However, for devices with an extremely low power limit, such as those supporting IoT applications requiring nano-watt operation, baseband processing becomes a pivotal component that impacts performance and power efficiency. Existing methods address synchronization and dynamic range challenges but often assume high RF front-end power budgets and neglect full-system power optimization. Therefore, there is a necessity for advanced techniques reducing baseband unit power usage, maintaining effective signal processing, and accommodating low power budgets without compromising sensitivity or operational accuracy.

## INNOVATION



Researchers at the University of Michigan have developed techniques for baseband processing units within low-power WuRxs, optimizing them for minimal power consumption and enhanced performance. Two primary methodologies include mitigating signal-to-noise ratio (SNR) degradation caused by sampling offsets and employing noise power estimation for adaptive threshold adjustment. The result is a mostly digital baseband circuit that's highly resistant to sampling errors and interference, enabling robust and efficient low-power operations. The proposed digital-intensive circuit features soft-decision decoding and implements a continuous-time architecture which allows for a seamless and less power-hungry signal processing experience. Applications extend to platforms like IoT devices, implantable medical sensors, and broader wireless sensor networks, promising more reliable communication while maintaining very low energy expenditure. Through these enhancements, these circuits offer potential significant energy savings over current models while widening their application breadth across modern low-power technology needs.

#### ADDITIONAL INFORMATION

#### INTELLECTUAL PROPERTY

[US9980197](#) "Baseband processing circuitry for wake-up receiver"