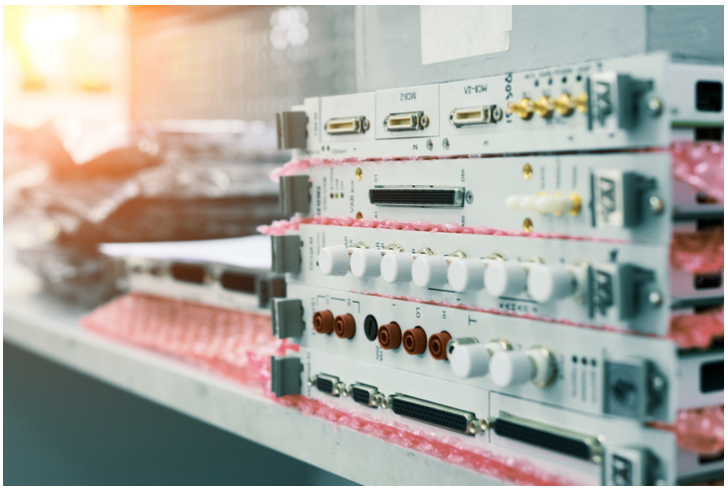
INNOVATION PARTNERSHIPS
UNIVERSITY OF MICHIGAN

Baseband Processing Circuitry for Low Power Wake-Up Receiver

TECHNOLOGY NUMBER: 6791



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 (WuRxs) 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.

Technology ID

6791

Category

Hardware
Engineering & Physical Sciences
Semiconductor, MEMS, and Electronics

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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"