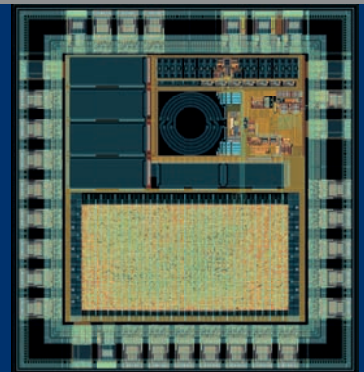




# Fraunhofer

## IIS

FRAUNHOFER INSTITUTE FOR INTEGRATED CIRCUITS IIS



## RFicient® ULTRA-LOW POWER TECHNOLOGY FOR THE INTERNET OF THINGS

The ultra-low power receiver technology RFicient® continuously monitors a radio channel while boasting a very low power consumption in the order of microwatts and reaction times in the range of milliseconds. This enables around-the-clock operation of wireless applications and increases their operating life significantly – up to ten years without battery replacement or even fully autonomous operation via energy harvesting. The particularly fast response capability of the Fraunhofer IIS technology RFicient® also enables real-time applications.

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### Innovative and efficient solution

The integrated ultra-low power receiver RFicient® was developed for ISM frequency bands and built in standard CMOS technology. The current prototypes, which are based on 130-nm CMOS technology, operate in the 868 MHz and 2.4 GHz frequency bands and achieve a receiver sensitivity of -80 dBm. When operating RFicient®Basic in the standard configuration at a data rate of 1 kbit/s, the current consumption is reduced below 3 µA at 1.8 V with a response time of only 30 ms.

RFicient® operates without the use of a microcontroller and recognizes two separate wake-up patterns. After receiving a specific wake-up pattern, a digital control signal is generated to activate an IoT node. Apart from the pure wake-up mode of operation, a selective activation using a 16-bit wide address range and reception of coded data streams is possible. Furthermore, basic functions, frequency bands and additional functionality can be modified to fit the customers' needs. Fraunhofer IIS provides the ULP receiver technology as IP block, which can be transferred to various CMOS technologies.



## Unleashing the full potential of IoT

IoT applications require low energy consumption and rapid response capability. As the RFicient® technology embraces these challenges as opportunities, it is the adequate solution for numerous wireless applications in the domain of IoT. It offers utility across a vast array of applications including building automation, intelligent lighting, electronic labels, remote maintenance, remote control and wireless sensor networks.

In addition to RFicient®Basic, we develop ultra-low power solutions for the localization of objects (RFicient®Locate), decentralized acquisition of radio signal spectra (RFicient®Scan) as well as the detection of radio signals of various wireless standards (RFicient®Spot).

### RFicient®Basic

- Continuous monitoring of the wireless channel: Multiband Sub 1 GHz, 433 MHz, 868 MHz, 2.4 GHz
- Supply current: < 3 µA at 1.8 V (1kbit/s)
- Sensitivity: -80 dBm
- Operation without microcontroller
- Detection of two independent wake-up events
- FEC coded data reception
- Selective wake-up with 16 Bit ID
- Silicon proven prototypes

### RFicient®Locate

- Tri-band ULP receiver: 433 MHz, 868 MHz, 2.4 GHz
- Supply current: < 3 µA
- RSSI based indoor localization for
  - Logistics
  - Industry 4.0

### RFicient®Scan

- Continuous wideband RF monitoring: 380 MHz – 950 MHz
- Supply current: 20 µA @ 61 points
- Fast sweep < 1.8 ms, 61 points
- Integrated ULP statistics:
  - Short term ~1 minute
  - Long term ~12 hours

### RFicient®Spot

- Continuous 2.4-GHz ISM band RF monitoring: 2400 MHz – 2500 MHz
- Supply current: typ. 20 µA @ 1.8 V
- Simultaneous wireless standards recognition:
  - Bluetooth®
  - Wi-Fi®
  - ZigBee®
  - WirelessHART®
- Standard recognition time: < 1 s

## Applications

### Home

- Automated meter reading
- Building automation
- Wireless alarm and security systems
- Smart lighting

### Logistics

- Indoor localization
- Geofencing
- Asset tracking

### Automotive

- Remote keyless entry
- Connected cars
- Real-time yard vehicle localization

### Industry

- Industrial condition monitoring
- Remote wireless control
- Wireless sensor networks

### Retail

- Local based marketing
- Electronic shelf labels
- Instore navigation
- Customer flow analysis

[www.rficient.com](http://www.rficient.com)