# ZL70251
## Ultra-Low-Power Sub-GHz RF Transceiver

Microsemi's ZL70251 RF transceiver is the lowest-power sub-GHz ISM-band radio for continuous-monitoring, wireless-sensor applications. Because both continuous and peak power supply requirements are ultralow, the ZL70251 is the industry's leading choice for sensor networks that are powered by a coin-cell battery or an energy-harvesting power source.

The ZL70251 is also highly integrated. Besides the antenna and in some cases its matching network, only a crystal, resistor, and two decoupling capacitors are required. Available as a 2-mm-by-3-mm CSP, the device enables applications with a very small footprint.

The ZL70251 device operates in unlicensed frequency bands between 779 and 965 MHz and offers a maximum data rate of 186 kbit/s to support voice communication. For data communication, the ZL70251 supports extremely low power consumption in packet-based networks.

The device includes the RF transceiver as well as a Media Access Controller (MAC) that performs most link support functions including Received Signal Strength Indication (RSSI), Clear Channel Assessment (CCA), sniff, preamble and sync, packetization, and whitening. The device uses standard interfaces, enabling easy integration with a standard microcontroller or Digital Signal Processor (DSP).

Actual size:
2 mm × 3 mm

## Key Features

- Ultralow transmit and receive current of less than 2.4 mA
- Low supply voltage of 1.2 V to 1.9 V
- Operates between 779 and 965 MHz (915-MHz ISM band in North America; 868-MHz SRD band in Europe; 779- to 787-MHz band in China)
- High data rate (186 kbit/s raw)
- Very small footprint
  - Few external components (crystal, resistor, and two decoupling capacitors)
  - CSP package: 2 mm by 3 mm
- Standard interfaces
  - SPI bus master for packet data
  - Two-wire for status and control
- Integrated MAC performing all link layer basic functions
- Full functionality over industrial temperature range (–40°C to +85°C)
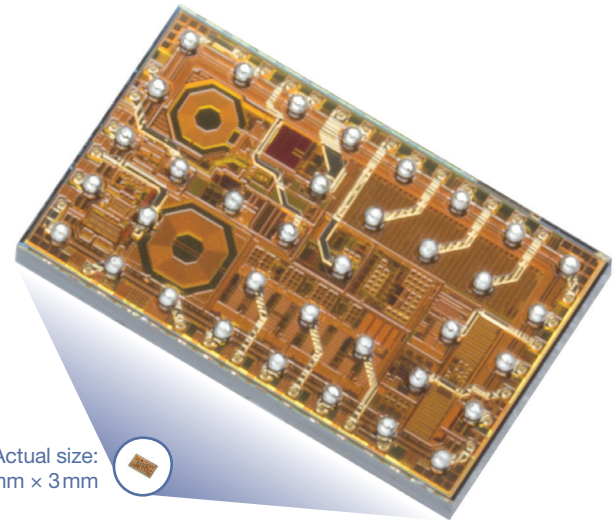
## Applications

The ZL70251 ultra-low-power transceiver is designed for short-range wireless applications, including:
- Battery-powered wireless sensor network
- Applications relying on energy harvesting
- Wireless communication with very long battery life
- Body-area network
- Voice/compressed-Audio Communication
- Active RFID
- Smart cards
- Inventory management / asset monitoring
- Data loggers
- Ambient monitoring
- In-vehicle sensors
- Building automation and home security
- Package transport tracking sensors
- Military sensors

## Ordering Information

| | |
|---|---|
| ZL70251UEB2 | RF Transceiver<br>36-Pin CSP, SAC405, in T&R |
| ZLE70251BADB | WSN Evaluation Kit |
| ZLE70251BADA | Application Development Kit (ADK) |

For more information on Microsemi's ISM-band radio transceiver technology, please refer to our website at http://www.microsemi.com/ultra-low-power-wireless/sub-ghz-radio-transceivers.

# ZL70251 WSN Evaluation Kit with Z-Star Protocol

The ZL70251 Wireless Sensor Network (WSN) Evaluation Kit includes one USB hub and one accelerometer sensor node to demonstrate a high-data-rate, continuous-monitoring application where the node interacts with the hub seamlessly using Microsemi's Z-Star protocol.



The included Z-Star protocol stack software supports Carrier Sense Multiple Access (CSMA) transactions in a star network configuration. This robust, proprietary protocol is optimized for ultra-low-power wireless sensor networks and minimizes both packet size and transaction time. The protocol stack may be further optimized for specific customer applications (for example, by varying packet length, latency, and frequency of transmission).



Main control GUI



Independent data displays for each sensor
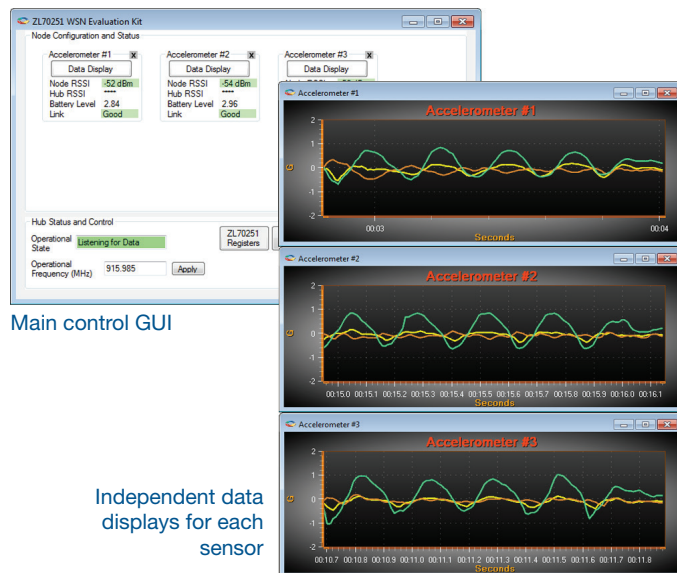
## ZL70251 WSN Evaluation Kit Contents

Each kit contains:

- One USB hub, including:
  - ZL70251 with 50-Ω matching network and dual-band antenna
  - USB interface to monitor and control the Z-Star network from a PC
  - Microcontroller running the Z-Star protocol stack while supporting the USB interface
  - Extender board for customer development
- One sensor node, including:
  - ZL70251 with 50-Ω matching network and dual-band antenna
  - Microcontroller running the Z-Star protocol and accelerometer application
  - Plug-in accelerometer sensor board that attaches to the node board
  - CR1632 coin-cell battery
  - Extender board for customer development
- Software
  - Two types of GUI displays (see figure, left):
    - Main display, allowing configuration and control of sensor network
    - Real-time graphs of data from each sensor
  - C-based API that runs on a PC supporting all commands to the USB hub
  - Firmware for both USB hub and sensor node
  - Source code is available with software license agreement
- Full documentation
  - Software download includes User's Guide, Source Code Overview, and hardware documentation (board schematics, layout, Gerber files, and Bill of Material (BOM)) for all included boards

## Optional Sensor Boards

The ZL70251 WSN Evaluation Kit can be used to develop custom sensor applications.

- Accelerometer
  - Physical therapy and rehabilitation monitoring
  - Body activity monitoring for elderly and recovering patients

# ZL70251 Application Development Kit

The ZL70251 Application Development Kit (ADK) enables rapid evaluation, prototyping, and development of RF communication systems. The kit combines hardware and software to create an end-to-end communication system that demonstrates the ZL70251's exceptional energy efficiency, high integration, and high data rate.

The ZL70251 ADK is an out-of-the-box solution that includes all hardware* and software required to quickly and easily design RF communication systems. The kit includes:

- Application Development Platform (ADP100A) board
  - Bridge board to allow for USB2.0 interface between a PC running the ADK software and the application processor on the ZL70251 evaluation boards
  - Two programmable power supplies with measurement capability
  - USB-rechargeable Li-Ion battery to allow hours of operation disconnected from the host PC
- ZL70251 evaluation boards (BASE251 and REMOTE251)
  - Each board is paired with an ADP100A board, resulting in a complete RF test and evaluation platform for a base station and remote device application
  - RF section includes the ZL70251, probe points of key digital and analog signals, a matching network for 779- to 928-MHz operation (BASE251 includes selectable SAW filters for the European SRD band and the North American ISM band), and a 50-Ω SMA connector
  - Microcontroller with JTAG debug interface controlling the ZL70251
- Programmer Cable Adapter (PCA100) board
  - Adapts to microcontroller IDE

- Pair of 868-MHz and 916-MHz dipole antennas
- Software
  - GUI application that provides a user-friendly visual interface for controlling and demonstrating the capabilities of a ZL70251-enabled RF system including trim and tune, Clear Channel Assessment (CCA), Bit Error Rate (BER), and missed packets, as well as accessing ZL70251-specific registers
  - Well-defined application programming interface (API) realized through a Windows DLL
- Embedded firmware
  - Supports all radio functions for a base station and remote device application
  - Supports RF evaluation by providing test modes and ZL70251 register access
- Full documentation
  - Software download includes ADK User's Guide, Source Code Overview, and extensive hardware documentation (board schematics, layout, Gerber files, and Bill of Material (BOM)) for all included boards

Using the ZL70251 ADK, customers can quickly create their own custom board designs and use Microsemi software as a starting point for software development for specific ZL70251-enabled systems. Microsemi also offers the Z-Star protocol stack, which supports wireless sensor networks.



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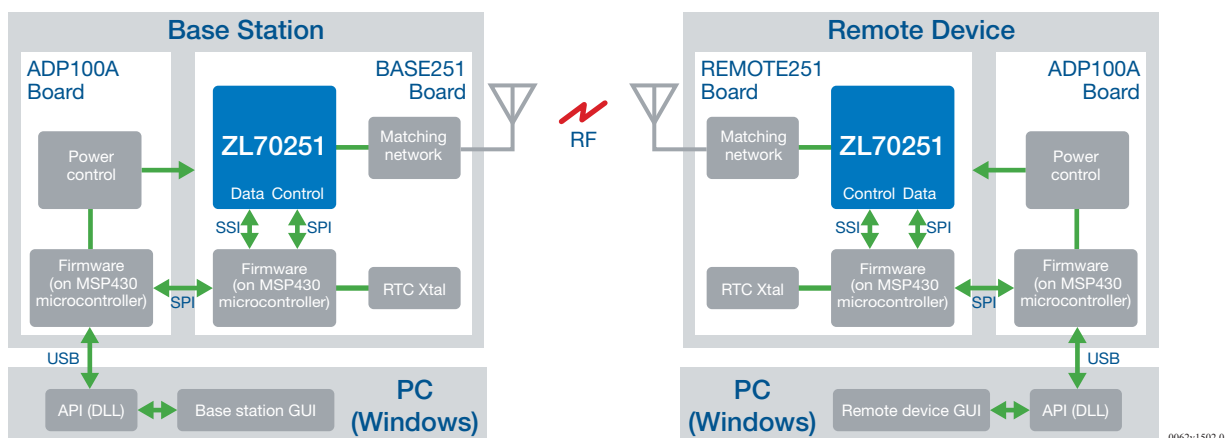
*Requires a Windows-based PC to run graphical user interface (GUI) software. GUI application installs and runs on Windows XP or Windows 7.

# Short-Range, Battery-Powered Communications

The ultra-low-power ZL70251 RF transceiver enables wireless communication in applications powered by coin-cell batteries or energy harvesters, where wireless communication was previously unfeasible. As illustrated below, end-applications may include wireless sensor networks (including on-body sensors) or voice communication.
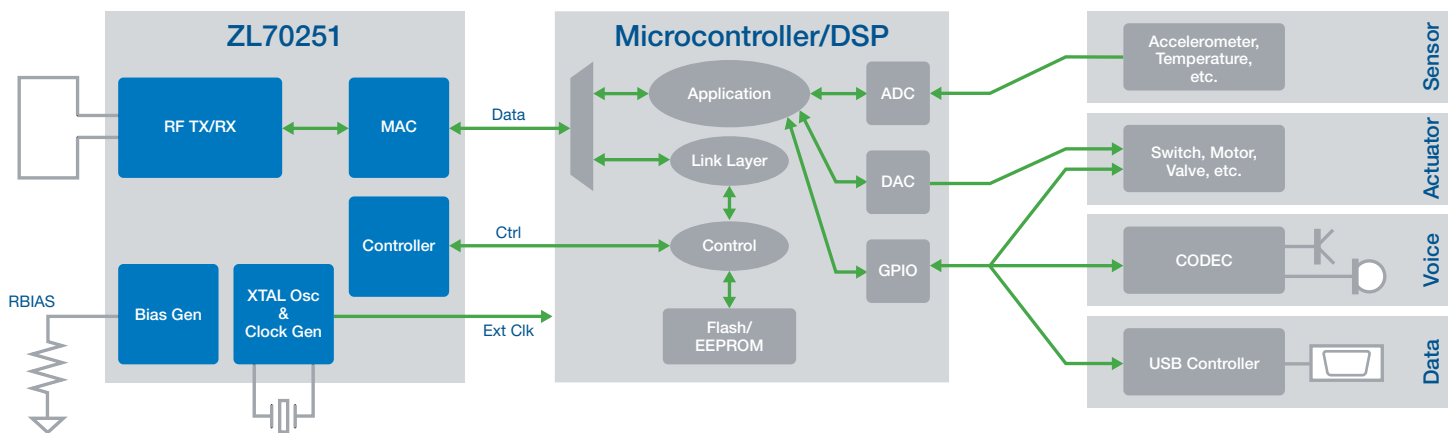
With a typical current consumption below 2.4 mA in both transmit (–11 dBm) and receive (–94 dBm sensitivity), and a data rate of 186 kbit/s, the ZL70251 enables bidirectional RF links over a distance of more than 100 meters (based on antenna gain and operating environment).

The output power is programmable and can be reduced to –24 dBm to save power in cases where the link budget allows. Output power can also be increased up to 0 dBm for more range or to allow for system losses, such as a very small antenna or body tissue absorption.

In order to achieve the minimum possible power consumption, the ZL70251 offers a large number of optimization parameters, all available to the user via the control interface. To streamline the setup and optimization process, most parameters have an on-chip automatic trim capability. The frequency tuning is also highly automated.

While consuming very little power, the ZL70251 also includes a highly flexible MAC that offers all the basic functions needed to implement a link layer. Some of the capabilities include:

- Clear channel assessment
- Automatic receive or sleep after sniff
- Automatic turn-around in bidirectional mode
- Packetization
- Preamble and frame sync
- Whitening
- Receive on preamble detection or RSSI threshold

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