# ZL70550
## Ultra-Low-Power Sub-GHz RF Transceiver

Microsemi's ZL70550 RF transceiver is the lowest-power sub-GHz radio for high- or low-duty-cycle, wireless-sensor applications. The device is optimized for very low power consumption in both active and sleep states, making it the leading choice for sensor networks that are powered by a coin-cell battery or an energy harvesting power source.

The ZL70550 device is also highly integrated and requires, in addition to the antenna, only a crystal, two decoupling capacitors, and a resistor. Available as a 2-mm-by-3-mm CSP, the device enables applications with a very small footprint.
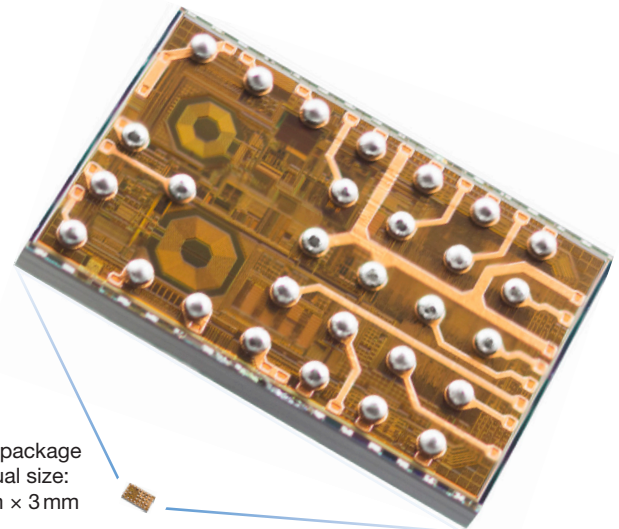
The ZL70550 device operates in unlicensed frequency bands between 779 MHz and 965 MHz and offers a maximum raw data rate of 200 kbit/s at 2.4 mA (typical) with a respectable sensitivity of –95 dBm.

The device includes the Z-Star protocol, which is a powerful and highly optimized MAC that performs complete packet transmissions with acknowledgments and automatic retransmissions on failed receptions. This built-in protocol eliminates the need for processor intervention in packet processing, allowing the processor to go to a power-save state or to perform other critical application processing. Additionally, the MAC supports other user modes of operation with selectable options like CRC, FEC, and auto length.

## Applications

The ZL70550 ultra-low-power transceiver is designed for medium- to short-range wireless applications, including:
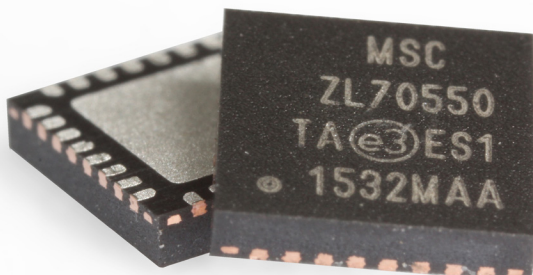
- Medical monitoring
- Industrial/building/home automation
- Security
- Smart cities
- Advanced metering infrastructure
- Asset management
- Energy harvesting
- Voice/compressed-audio communications



QFN package
actual size:
5 mm × 5 mm



CSP package
actual size:
2 mm × 3 mm

## Key Features

- Ultralow current of 2.4 mA in receive and 2.75 mA in transmit
- Ultralow sleep current of 10 nA
- Maximum TX output power of 0 dBm
- Maximum RX sensitivity of –106 dBm
- Wide supply range of 1.71 V to 3.6 V
- Operates between 779 MHz and 965 MHz (915-MHz ISM band in North America; 868-MHz SRD band in Europe; 779-MHz to 787-MHz band in China; 916-MHz to 930-MHz and 950-MHz to 956-MHz bands in Japan)
- Supports GFSK modulation
- Raw data rates of 200 kbit/s, 100 kbit/s, or 50 kbit/s
- Very small footprint
  - Few external components (crystal, resistor, and two decoupling capacitors)
  - Available in 29-pin CSP package (2 mm by 3 mm) or in 32-pin QFN package (5 mm by 5 mm)
- SPI bus slave for packet data and register access
- Built-in MAC
  - Support for Microsemi Z-Star or user protocols
  - Transmit and receive buffer
  - Optional automatic CSMA packet transfers
  - Efficient header optimized for small or large payloads
  - Optional preamble, frame sync, length, FEC, and CRC
- Industrial temperature range (–40°C to 85°C)

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## ZL70550 WSN Evaluation Kit with Z-Star Protocol

The ZL70550 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 on-chip Z-Star protocol supports Carrier Sense Multiple Access (CSMA) packet 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 while offloading the application processor. The protocol may be further optimized for specific customer applications (for example, by varying packet length, data rate, and frequency of transmission). Additionally, customers can develop their own hardware and software for their unique sensor application.



Main control GUI



Independent data displays for each sensor

## ZL70550 WSN Evaluation Kit Contents

Each kit contains:

- One USB hub (HUB200), including:
  - ZL70550 transceiver 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 software development
- One sensor node (NODE200), including:
  - ZL70550 transceiver with 50-Ω matching network and dual-band antenna
  - Microcontroller running the Z-Star protocol and accelerometer application
  - CR1632 coin-cell battery
  - Extender board for customer software development
- Software
  - Two types of GUI displays (see figure, bottom left):
    - Main display, allowing configuration and control of sensor network
    - Real-time graphs of data for up to three sensors
  - 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

Optional sensor boards can be ordered to use with the ZL70550 WSN Evaluation Kit:

- NODE210, an accelerometer node with a built-in loop antenna
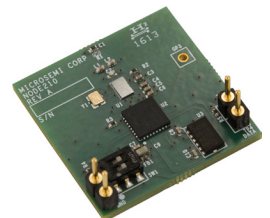
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## ZL70550 Application Development Kit

The ZL70550 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 ZL70550 RF transceiver's exceptional energy efficiency, high integration, and high data rate.

The ZL70550 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 (ADP200) board
  - Bridge board to allow for USB2.0 interface between a PC running the ADK software and the application processor on the ADP200 board
  - One programmable power supply with measurement capability
- ZL70550 evaluation boards (BASE550 and REMOTE550)
  - Each board is paired with an ADP200 board, resulting in a complete RF test and evaluation platform for a base station and remote device application
  - RF section includes the ZL70550 transceiver, probe points of key digital and analog signals, a matching network for 779-MHz to 928-MHz operation (BASE550 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 ZL70550 device
  - Dual-band antennas

- Software
  - Windows GUI application that provides a user-friendly visual interface for controlling and demonstrating the capabilities of a ZL70550-enabled RF system including trim and tune, Packet Error Rate (PER) while demonstrating all packet modes and options, as well as accessing ZL70550-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 ZL70550 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
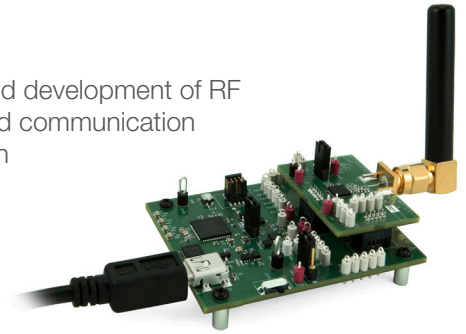
Using the ZL70550 ADK, customers can quickly create their own custom board designs and use Microsemi software as a starting point for software development for specific ZL70550-enabled systems. Microsemi also offers the Z-Star protocol stack, which supports wireless sensor networks.



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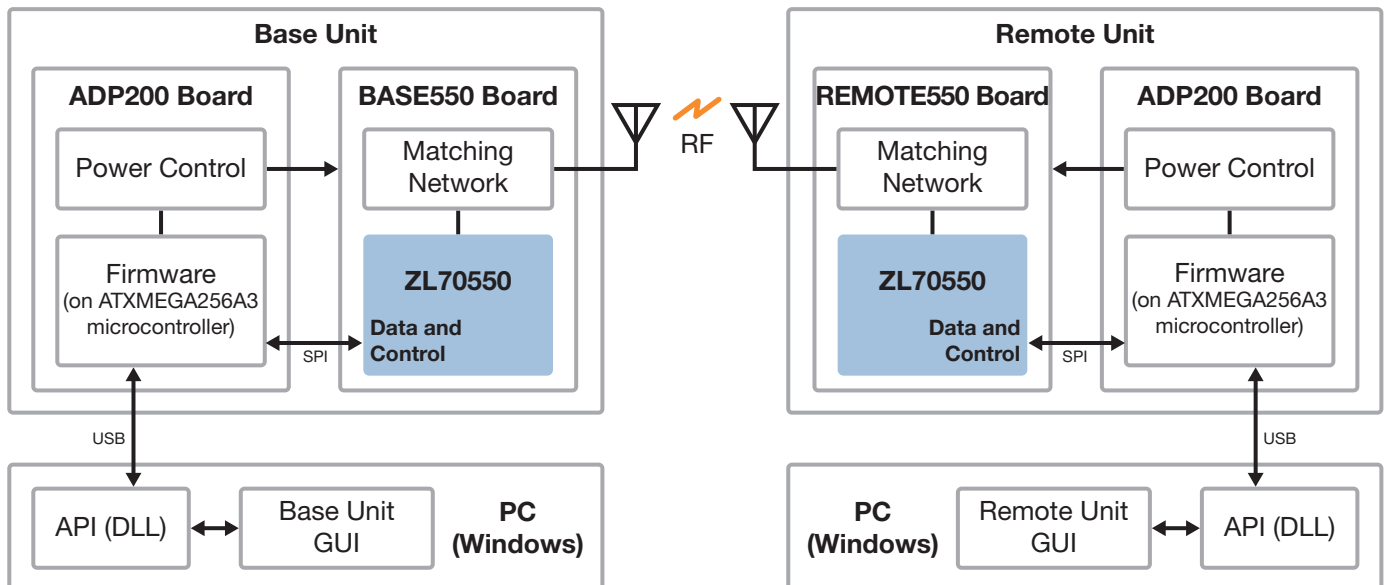
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# Short-Range, Battery-Powered Communications

The ultra-low-power ZL70550 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 2.75 mA in transmit (–10 dBm) and below 2.4 mA in receive (–95 dBm sensitivity), and a data rate of 200 kbit/s, the ZL70550 device enables bidirectional RF links over a distance of more than 100 meters (based on antenna gain and operating environment). A sensitivity of –106 dBm can be achieved by optionally increasing the receiver current consumption (to approximately 3.2 mA), enabling FEC, and using the lowest data rate.

The output power is programmable and can be reduced to –25 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 ZL70550 device offers a large number of optimization parameters, all available to the user via the SPI bus 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 ZL70550 device also includes a powerful MAC that offers a highly flexible and robust set of protocol features for implementing a communications link. Some of the capabilities include:

• Support for Microsemi Z-Star or user protocols
• Transmit and receive buffer
• Optional automatic CSMA packet transfers
• Efficient header optimized for small or large payloads
• Optional preamble, frame sync, length, FEC, and CRC



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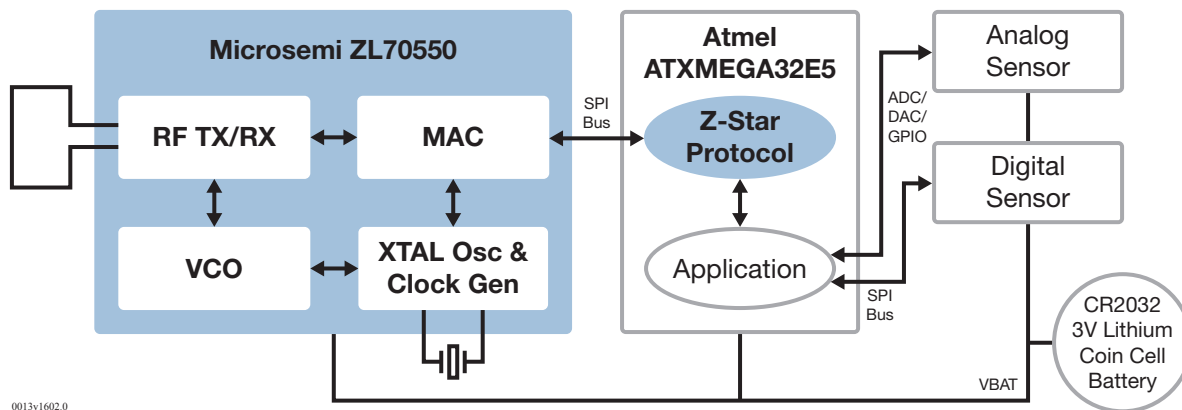
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