Wireless

MICROCHIP

Wireless Product Solutions

www.microchip.com/wireless

Wireless Connectivity for Your Application

Wireless technologies affect our everyday life. Once corded, today's phones are not only cordless, but are no longer tethered to our homes. Formerly large, bulky and connected with a tangle of cables, computers are now no bigger than the palm of your hand and are only connected to a cable for the occasional battery charge.

Today's designers are facing a growing demand to add wireless connectivity to their latest products. With multiple wireless technologies now available and the latest industry standards enabling interoperability between devices, it can be a challenge to select the right solution. As a leader in low-power, drop-in wireless solutions, Microchip has transformed the formerly daunting and expensive task of adding wireless connectivity to your product into an easy and cost-effective process.

How Does Microchip Make Wireless Connectivity Easy?

- Fully certified modules for drop-in wireless connectivity get your products to market fast
- Development tools enable prototype creation in days instead of weeks
- Library of resources includes documentation and free software
- Global support team includes wireless experts

To meet the requirements of your specific application, Microchip offers an extensive portfolio of transmitters and transceivers for a number of different wireless technologies. This portfolio includes agency-certified modules for standards such as **Wi-Fi®, Bluetooth®, IEEE 802.15.4/ZigBee®**, **LoRa™** and proprietary systems that use simple **802.15.4, 2.4 GHz** or **Sub-GHz** ISM bands. Microchip's solutions are designed to address multiple market segments including:

- Internet of Things
- Home/building automation
- Smart energy
- Smartphone to devices
- Remote equipment monitoring
- Asset tracking and telemetry
- Security
- Wireless audio
- Industrial sensors and controls
- Medical devices

Microchip's Broad Wireless Portfolio

Wi-Fi

Easily add Wi-Fi connectivity to an application with drop-in Wi-Fi modules.

Bluetooth

Connect mobile devices to wireless applications with easy-to-use Bluetooth and Bluetooth Smart modules.

Embedded Wireless (EW)

Standard and proprietary module solutions designed for low-power, short- or long-range and multi-node systems.

Security

Integrated microcontroller with RF is an ideal platform for remote keyless entry and secure wireless applications using KEELOQ® Technology and advanced security technologies.

Wi-Fi

Wireless designs are being implemented at exponential rates in home and building automation applications, offering a broad range of new and innovative products. Product designers can find plenty of examples in their own homes where wireless connectivity could make or already has made a significant difference in their personal lives.

Wi-Fi Connectivity Offers:

- Ease of control with a smartphone/tablet
- Connection to the Cloud
- Support for the Internet of Things
- Visibility and control over your devices wherever you are
- Standards-based technology
- Financial savings through energy management
- Personal security for you and your home

The beauty of Wi-Fi is in its ubiquity; it is not limited to just one type of application or environment. In fact, every room in every house can benefit from Wi-Fi connectivity in some way. Potential Wi-Fi applications are everywhere and Microchip has the right Wi-Fi solution for you no matter what type of architecture you are using.

Wi-Fi Products

If you're ready to add Wi-Fi connectivity to your product today, Microchip's large portfolio of Wi-Fi-certified modules and RF chipset solutions are designed with simplicity and low power, enabling extremely fast design cycles and, in turn, reducing time to market.

Our modules come with **full modular radio certifications** and include **full TCP/IP stacks** and **networking services,** all in a compact surface mount component. The modules also offer a variety of general purpose I/Os, analog inputs and serial interfaces that include UART and SPI.

Get The Best Fit: Application-Specific Architecture

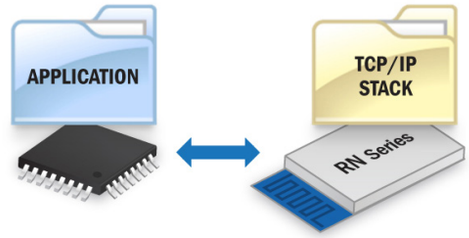
Microchip's Wi-Fi portfolio supports two different architectures. If you are looking for a Wi-Fi solution that can use any microcontroller (MCU) of any size and by any vendor, you will probably find the **RN solution** the best option. It contains the stack and services built onto the module itself with access to the MCU via a simple ASCII interface.

If you are using a PIC® microcontroller and you want to modify or customize your networking services, the **MRF solution** is a good choice. The MRF series of products are designed to run the stack and services on the PIC microcontroller.

Wi-Fi

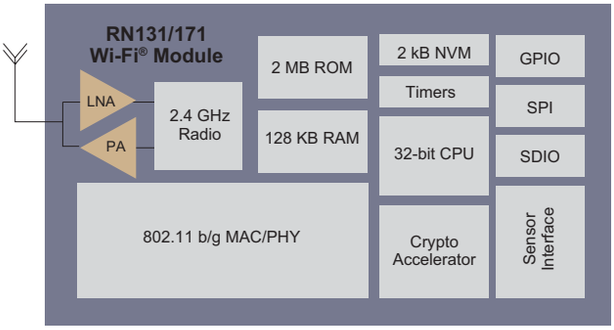
RN Wi-Fi Series

Integrated Stack on Module



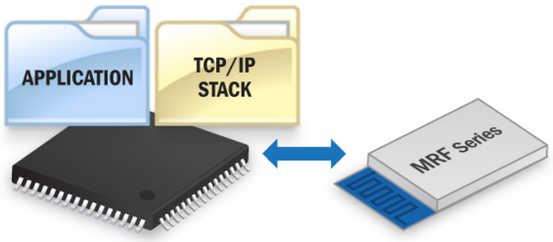
- TCP/IP stack on module (no external drivers required)
- Simple ASCII interface
- Works with any microcontroller

RN Modules Block Diagram



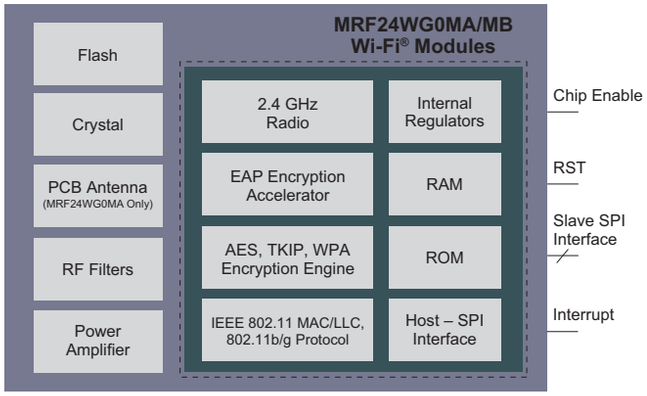
MRF Wi-Fi Series

Stack Runs on PIC Microcontroller



- TCP/IP stack on PIC MCU
- Elegant solution for combined Ethernet and Wi-Fi applications
- Extendable TCP/IP stack for additional services

MRF Modules Block Diagram



Modular Certification

Modular certification enables customers with little or no RF experience to implement Wi-Fi without concerning themselves with costly government agency certifications, which can often lead to additional time and expense.

Microchip has fully certified its portfolio of modules with a number of agencies including:

- FCC (United States)
- IC (Canada)
- EN (European Union)
- KC (Korea)
- NCC (Taiwan)
- TELEC (Japan)
- and others

In addition to its interaction with government agencies, Microchip works with the Wi-Fi Alliance to insure interoperability with other Wi-Fi certified devices.

Network services offered in addition to the base UDP and TCP protocols include:

- Wi-Fi Protected Setup (WPS)
- Built-in web servers for simple browser-based configuration
- File Transfer Protocol (FTP)
- Hypertext Transfer Protocol (HTTP)
- Wi-Fi Direct
- DHCP Client and server modes
- Domain Name Service (DNS)
- Secure Socket Layer (SSL)
- mDNS (Bonjour/Zero Config)
- Simple Mail Transfer Protocol (SMTP)
- and many others

Wi-Fi

Wi-Fi Applications

Microchip's 802.11 Wi-Fi solutions offer over-the-air (OTA) data rates of up to 54 Mbps and data throughputs of up to 5 Mbps, making them perfect for command/control or sensor-type embedded applications. Low 30–40 mA receive currents and 4 µA sleep modes allow for battery-powered Wi-Fi applications such as refrigerator temperature alert sensors, smoke alarms and leak detectors. In all cases, the native IP connectivity allows you to receive notifications and issue commands across the Internet, wherever you may be.

Other Wi-Fi applications for home/building include:

- Smart appliances such as refrigerators, dishwashers and washing machines to monitor energy or water consumption
- Automated lighting
- Automated drapes/curtains/shades
- Smart thermostats for monitoring temperature/humidity
- Security such as automatic lights, wireless cameras, automatic door locks and motion detectors
- Pool sensors for monitoring/managing water level, quality
- Gas/water/smart meters for monitoring/managing energy consumption in real time

Network Security

Microchip knows how important security is to your Wi-Fi application. We support all the latest secure authentication schemes such as WolfSSL, TLS, personal WPA2 or enterprise-level EAP/PEAP, allowing for both commercial and industrial applications. Our solutions also support older, legacy security such as WEP64/128 or the original WPA.

Network support

Microchip's Wi-Fi modules support SoftAP mode. This allows the module to look like an access point and act as the central network coordinator, controlling basic management such as DHCP, routing and gateway redirection directly on the module. We also offer the traditional infrastructure modes that operate through simple routers and ad hoc mode for point-to-point networks.

Wi-Fi Products

Product	Radio	Power Output (dBm)	Tx, Max. Power Consumption (mA)	Rx Power Consumption (mA)	Sleep*	Interface	Packages	Antenna	Range** (meters)	Operating Temp.
MRF Series										
MRF24WN0MA	802.11 b/g/n	+18	115	60	5 µA	SPI	37-pin	PCB	Up to 300	–40°C to +85°C
MRF24WN0MB	802.11 b/g/n	+18	115	60	5 µA	SPI	37-pin	U.FL	Up to 300	–40°C to +85°C
MRF24WG0MA MRF24WG0MB	802.11 b/g	+18	240	156	0.1 mA	SPI	36-pin	PCB or U.FL connector	Up to 300	–40°C to +85°C
RN Series										
RN1723	802.11 b/g	0 to +12	120	40	4 µA	UART	49-pin	RF pad	Up to 180	–40°C to +85°C
RN131G	802.11 b/g	+18	210	40	4 µA	UART	44-pin	Chip, U.FL connector	Up to 300	–40°C to +85°C
RN131G	802.11 b/g	+18	210	40	4 µA	UART	44-pin	Chip, U.FL connector	Up to 300	0°C to +70°C
RN171	802.11 b/g	0 to +12	130	30	4 µA	UART	49-pin	RF pad	Up to 180	–40°C to +85°C
RN171XV	802.11 b/g	0 to +12	130	30	4 µA	UART	2 × 10-pin socket module	Wire, U.FL, SMA connector	Up to 180	–40°C to +85°C

*Indicates "off" current for sleep column **Open air line-of-sight

Wi-Fi Development Tools

Microchip offers several MRF and RN development tools for any development environment. The MRF and RN PICtail™/PICtail Plus Daughter boards seamlessly add Wi-Fi connectivity to Explorer-based systems. For non-Explorer-based systems, the MRF/RN battery-powered, portable pocket demos quickly and easily adds Wi-Fi connectivity to embedded applications.

	Explorer-Based Development Board			Pocket Demos			
Series	MRF	RN		MRF	RN		
Platform	**8-bit:** PICDEM.net2 **16-bit:** Explorer 16 **32-bit:** PIC32 Starter Kit + I/O Board, Explorer 16 + PIC32 PIM, PIC32 Starter Kit + Multimedia Board			Standalone			
Module	MRF24WG0MA/MB	RN131	RN171	MRF24WG0MA/MB	RN131	RN171	RN1723
Image							
Part #	AC164149*	RN-131-PICTAIL	RN-171-PICTAIL	DV102412*	RN-131-EK	RN-171-EK	RN-1723-EK

*MRF Only: TCP/IP stacks and application demos for the Wi-Fi G Demo Board are online at www.microchip.com/mla
TCP/IP stacks and application demos for the MRF24WG0MA Wi-Fi G PICtail are online at www.microchip.com/harmony

www.microchip.com/wifi

Bluetooth

The Bluetooth market is taking off and finding a home in many new applications, thanks to the smartphone and other mobile devices that make it incredibly easy to connect point to point over Bluetooth. Bluetooth Smart—or Bluetooth Low Energy—enables the battery life on these mobile devices to last longer than ever.

Bluetooth Connectivity Offers:

- Ease of control with a smartphone/tablet
- Short-range, personal connections
- Standards-based technology
- Easy connect and disconnect
- Low power for long battery life

Microchip recognizes the value of Bluetooth connectivity and is leading the way with low-power Bluetooth solutions designed for drop-in connectivity.

Bluetooth Products

If Bluetooth connectivity is the best fit for your application, then Microchip has you covered with a large portfolio of low-power embedded Bluetooth modules that are fully certified, easy to use, and ideally suited to any data or audio application. The modules are complete with on-board stack, common application profiles and an ASCII command interface if an external microcontroller is required for a given application.

Bluetooth

Bluetooth Classic

Microchip offers Class 1 and Class 2 Bluetooth 2.1+EDR data modules. For data applications, the RN41 and RN42 are low-power Bluetooth EDR 2.1 modules that share the same footprint, on-board stack and ASCII interface. The modules work seamlessly with Android™ and Apple® iOS devices and can provide up to 100m line-of-sight operation. The RN41 and RN42 are ideal for multiple applications including cable replacement, scanners, sensors, medical devices and asset tracking.

For data applications, the RN series of Bluetooth modules provides a number of on-module profiles including:

Data Profiles

- SPP Serial Port Profile
- HID Human Interface Device
- iAP iPod® Accessory Profile
- DUN Dial-Up Networking

For applications needing a less-common profile, the RN series of Bluetooth modules also offer the Host Controller Interface (HCI), enabling external microcontrollers to offer additional support.

Bluetooth Smart/Bluetooth Smart Ready

Bluetooth Smart, or Bluetooth Low Energy (BLE) enables extremely power-efficient wireless command and control of devices using smartphones and tablets. Bluetooth Smart Ready, also referred to as Bluetooth Dual Mode, supports both Bluetooth Classic (2.1 +EDR) and BLE. Both Bluetooth Smart and Bluetooth Smart Ready solutions are ideal for applications such as fitness devices, battery-powered sensors, home automation, medical devices and more. All of these applications benefit from the efficiency of ultra-low power Bluetooth.

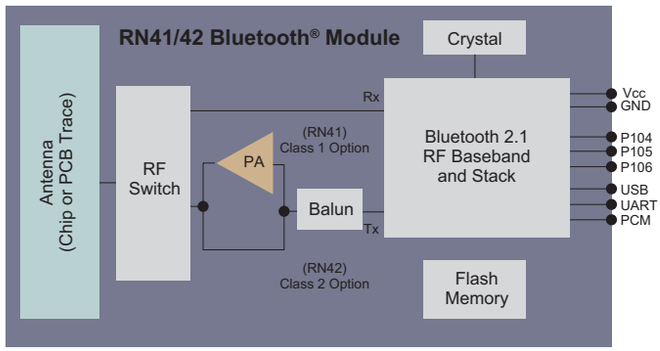
Bluetooth® SMART Bluetooth® SMART READY

Module Features

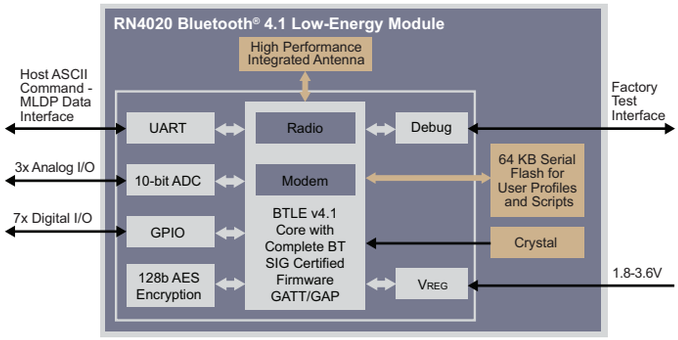
- Fully certified ultra-low power surface mount module
- On-board embedded Bluetooth stack
- Simple ASCII command interface over UART
- Multiple IOs for control and status
- Secure AES128 encryption

Block Diagrams

RN41/42 Bluetooth Module



RN4020 Bluetooth Module



Bluetooth Audio

Bluetooth audio modules can be used to send or receive streaming audio in devices such as speakers, hands-free kits and even toys. Microchip's Bluetooth 3.0 audio modules are fully integrated Class 2 radios with an embedded DSP processor which can be controlled by simple ASCII commands. Internal input and output audio amplifiers allow for stand-alone operation in many applications.

The embedded stack and the audio and data profiles allow for operation with or without an external microcontroller. Additionally, our audio solutions support SBC, aptX® and AAC codecs. This portfolio of modules offers both analog and digital audio interfaces to provide high-quality and robust audio and data links.

Audio Profiles

- A2DP Advanced Audio Distribution Profile
- AVRCP Audio/Video Remote Control Profile
- HFP/HSP Hands-Free Profile/Headset Profile

Bluetooth

Bluetooth Applications

Microchip's Bluetooth solutions are specifically designed for smartphone applications. The data and audio modules work seamlessly with Android and iOS® smartphones and tablets.

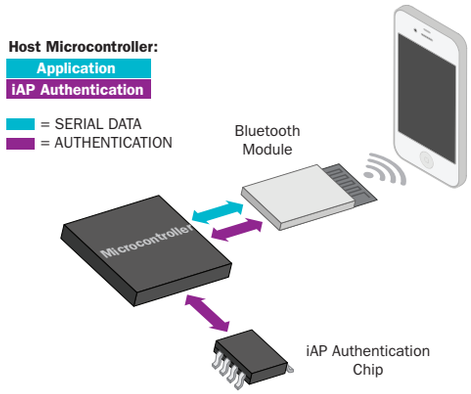
Bluetooth Classic Applications

The RN42 Bluetooth Classic module has a 3 Mbps data rate for distances up to 20 meters and the RN41 has a range of up to 100 meters. Offering a small form factor and complete on-board package, these modules are ideal for applications ranging from basic cable replacement to barcode scanners, medical devices and computer accessories.

The RN41 and RN42 are also available as 'APL' modules. Pin-compatible with the standard part versions, these 'APL' modules natively support iAP (iPod Accessory Protocol) data connections and directly manage authentication to all iPhones, iPads® and iPods, greatly reducing engineering effort and cost and simplifying accessory product design.

Conventional Approach

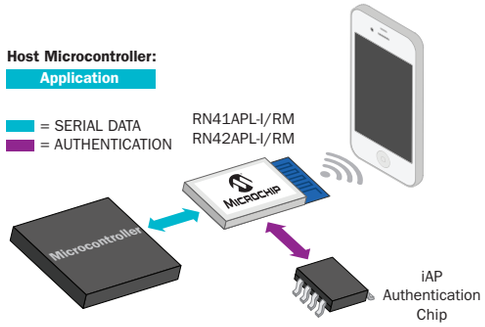
Customer Implements iAP on Microcontroller



- High-end microcontroller
- Management of iAP in embedded software
- Longer development cycles and learning curve for iAP

Microchip's Bluetooth Solution

Bluetooth Module Implements iAP



- Low-cost host microcontroller
- Simple host interface
- iAP transparent to user
- Lets you focus on your design, not iAP protocols
- Interfaces to the system independent of smartphone

IMPORTANT: All products designed to connect to iPhones, iPods and iPads, including those that incorporate the Microchip Bluetooth APL module, must be approved with Apple's Made for iPod (MFi) program. Developers of such products should visit Apple's developer portal at: http://developer.apple.com/ipod to enroll. MFi membership is required to purchase the evaluation kit or modules.

Bluetooth Data Applications

Bluetooth data modules are ideal for a number of applications, including health and fitness, battery-powered sensors, medical devices and much more. Microchip offers ultra-low power Bluetooth Classic modules, Bluetooth Low Energy modules, and also Bluetooth Dual Mode modules that support both Bluetooth Classic and BLE. These modules are complete, fully-certified and simple to develop Bluetooth solutions. They are ideal for designers who want to add wireless capability to their product without spending significant time and money developing Bluetooth-specific hardware and software.

Bluetooth Audio Applications

Microchip offers high-value and high-quality Bluetooth audio silicon and module solutions. They are compliant with the latest Bluetooth specifications and are proven for interoperability. Microchip's audio solutions are low power and small form factor with a built-in Bluetooth stack, which provides excellent audio quality (SNR), sound level and sound effects (DSP). They also support digital audio, a variety of audio sources and value-added features such as support for multiple speakers.

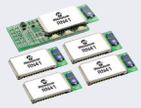
Bluetooth

Bluetooth Products

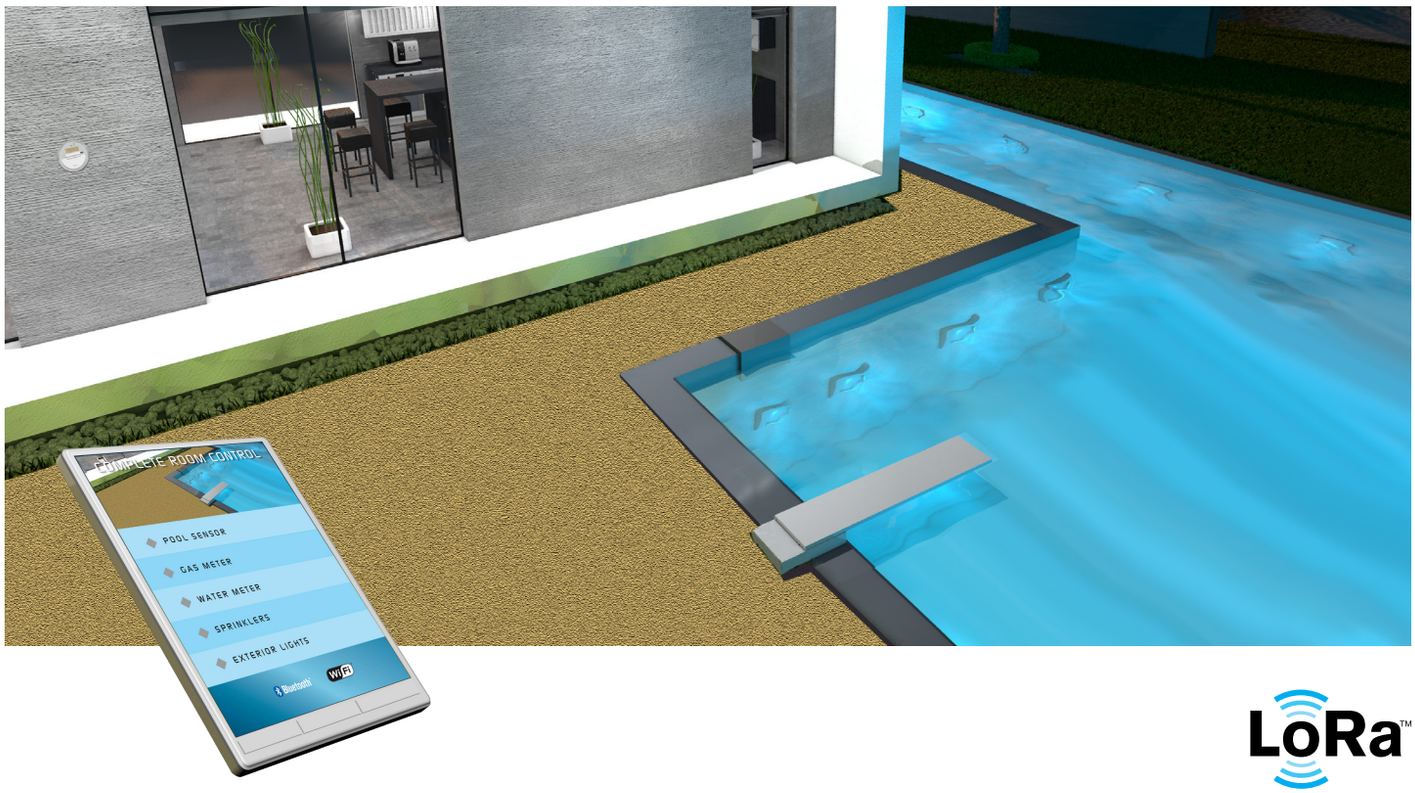
Part #	Bluetooth® Version	Typical Range (meters)	Interface	Output Power (dBm)	Package	Antenna	Size (mm)
RN4020	4.1	100	UART, PIO, AIO, SPI	+7	Surface mount	PCB trace	11.5 × 19.5 × 2.5
RN4677	4.0	100	UART	+2	Surface mount	Chip	12 × 22 × 2.4
BM77	4.0	100	UART	+2	Surface mount	Chip	12 × 22 × 2.4
RN41	2.1	100	UART, USB	+15	Surface mount	Chip	13.4 × 25.8 × 2.0
RN42	2.1	30	UART, USB	+4	Surface mount	PCB trace	13.4 × 25.8 × 2.0
RN52	3.0	30	UART, USB, I²S™, S/PDIF, GPIO	+4	Surface mount	PCB trace	13.5 × 26.0 × 2.7
RN41XVC RN41XVU	2.1	100	UART, USB	+15	Socket (male header)	Chip/U.FL	24.4 × 29.9 × 8.0
RN42XVP RN42XVU	2.1	30	UART, USB	+4	Socket (male header)	PCB trace/ U.FL	24.4 × 29.9 × 8.0

Bluetooth Development Tools

Quickly add Bluetooth connectivity to embedded applications with Microchip's full line of easy-to-use development kits. These USB-powered, plug-and-play evaluation kits, with status LEDs, switches and signal headers, enable rapid prototyping and integration into existing systems.

Part #	Photo		Module	Description	Contents
RN-4020-PICTAIL		Data v4.1	RN4020	USB plug-and-play evaluation kit for the RN4020 Bluetooth Low Energy module with PICtail™/PICtail Plus interfaces and PICkit™ Serial Programmer/ Debugger interface	■ RN4020 PICtail/PICtail Plus board ■ USB cable
RN-4677-PICTAIL		Data v4.0	RN4677	Bluetooth dual-mode development board that showcases the RN4677 module, a fully certified Bluetooth Version 4.0 module with easy-to-use ASCII interface.	■ Evaluation board ■ USB cable
BM-77-PICTAIL		Data v4.0	BM77	Bluetooth® dual-mode development board that showcases the BM77 module, a fully certified Bluetooth Version 4.0 dual-mode module that supports both Bluetooth Classic and Bluetooth Low Energy	■ Evaluation board ■ USB cable
RN-4x-EK		Data v2.1	RN41	USB plug-and-play evaluation kit for the RN4x Bluetooth Classic module	■ Evaluation board ■ USB cable
		Data v2.1	RN42		
RN-52-EK		Audio v3.0	RN52	Pair with any smartphone, stream music and take hands-free calls with this easy-to-use evaluation kit	■ Evaluation board ■ USB cable ■ Two mini-speakers ■ Microphone
RN-4x-APL-EVAL		Data v2.1	RN41APL	Evaluation kit with iAP authentication co-processor on the board simplifies development for iPhone®, iPad® and iPod® devices	■ Evaluation board ■ Four RN4xAPL modules ■ Design docs ■ Source code
		Data v2.1	RN42APL		
RN-XV-EK1		Data v2.1	RN41XV	USB plug-and-play evaluation board with connectors to drop in the RNXV module series	■ Evaluation board ■ USB cable
			RN42XV		
DV320032		Audio v4.1	–	Provides a comprehensive solution for developing Bluetooth A2DP audio streaming solutions and applications	■ Evaluation board ■ USB cable
DM320018		–	–	PIC32 Bluetooth Starter Kit that features an HCI-based Bluetooth radio	■ Evaluation board

Embedded Wireless



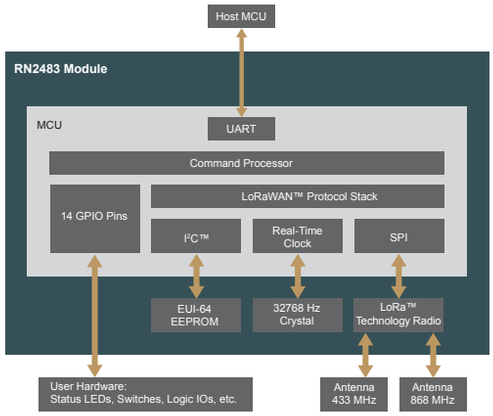
LoRa

LoRa is a wireless modulation for long-range, low-power low data-rate applications. By achieving a range of more than 15 kilometers in a suburban environment and more than 2 kilometers in a dense urban environment, LoRa solutions target multiple application domains, such as Internet of Things (IoT), metering, security and machine-to-machine (M2M).

LoRa Connectivity Offers:

- Long range: greater than 15 km
- Low power consumption for 10+ year battery life
- Bi-directional communication
- Fully integrated LoRa radio, MCU and LoRaWAN™ stack
- Supports millions of nodes

LoRa Block Diagram



LoRa Products

Part #	Photo	Output Power (dBm)	Frequency (MHz)	Package	Sensitivity (dBm)	Range	Size (mm)	Certification
RN2483		+10 at 433 MHz +14 at 868 MHz	433, 858 (Europe)	Surface mount module	–148	>15 km (suburban)	17.8 × 26.7 × 3	European R&TTE
RN2903		+20 dBm	915 (North America)	Surface mount module	–148	>15 km (suburban)	17.8 × 26.7 × 3	FCC

LoRa Development Tools

Development Tool	Photo	Part Number	Description
RN2483 and RN2903 PICtail™/PICtail Plus Development Boards		RN-2483-PICTAIL RN-2903-PICTAIL	These demonstration boards showcase the LoRa™ Sub-GHz modems. (RN-2483-PICTAIL: European version, 433/868 MHz) (RN-2903-PICTAIL: North American version, 915 MHz)

Embedded Wireless

ZigBee

ZigBee was developed to allow embedded products to interconnect via a low-power radio for command and control operations. While many home and building automation protocols exist, the ZigBee protocol is the only multi-vendor, standards-driven protocol available today.

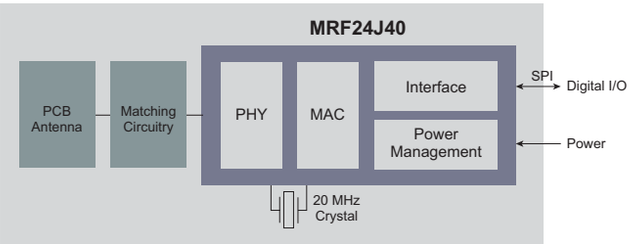
ZigBee Connectivity Offers:

- Low-power radio
- Standard-based technology
- Small footprint
- Scalable from hundreds to thousands of nodes

ZigBee continues to permeate the wireless space due to its low-power and standards-based technology. Microchip offers fully certified ZigBee modules, ZigBee Stacks and royalty-free source code for easy implementation and fast time to market.

ZigBee Block Diagram

MRF24J40MA IEEE Std. 802.15.4™ Module



The Right ZigBee Stacks for Your Application

As a member of the ZigBee Alliance, Microchip offers a certified ZigBee Compliant Platform (ZCP) for the ZigBee PRO, ZigBee RF4CE and ZigBee residential stacks. The ZCP is an ideal starting place if you are looking to develop a ZigBee-compliant product and ensure interoperability with the ZigBee industry standard.

The ZigBee stack is provided royalty free and has an efficient footprint for each of the various options:

- **ZigBee RF4CE:** Developed for consumer remote controls and audio/visual equipment, the ZigBee RF4CE has the smallest ZigBee footprint. Microchip's RF4CE solution is one of the industry's smallest and lowest-power versions.
- **ZigBee PRO:** Designed for much larger networks that may be comprised of thousands of nodes, this stack also offers the lowest power characteristics, allowing for products powered by energy harvesting techniques.

The ZCP suite includes the **ZigBee Smart Energy Profile (SEP)** and is provided as source code. This allows you to customize your design for use with the broad portfolio of PIC microcontrollers, including the PIC24, PIC32 and dsPIC33 DSC families.

IEEE 802.15.4 2.4 GHz Products

Transceivers

Transceiver	Data Rate	Frequency Range (MHz)	Sensitivity (dBm)	Tx Power	Rx Mode	Output Power (dBm)
MRF24J40	250 kbps	2.405–2.48	–94	23 mA	19 mA	+0

Modules

Module	Data Rate	Frequency Range (MHz)	Sensitivity (dBm)	Tx Power	Rx Mode	Output Power (dBm)
MRF24J40MA	250 kbps	2.405–2.48	–94	23 mA	19 mA	+0
MRF24J40MD	250 kbps	2.405–2.475	–102	130 mA	25 mA	+20
MRF24J40ME	250 kbps	2.405–2.475	–104	140 mA	32 mA	+19

ZigBee® Development Tools

Development Kit	Photo	Part Number	Frequency	Technology	Platform
Remote Control Demo Board with ZENA™ Wireless Adapter		DM240315-2	2.4 GHz	ZigBee RF4CE	16-bit

Software

Please contact Microchip Sales for ZigBee software stack and documentation.

www.microchip.com/zigbee

Embedded Wireless

MiWi Wireless Networking Protocol

Some environments demand that the designer apply the lowest cost structures available via proprietary wireless networks rather than focus on interoperability with other vendor's products.

Microchip's proprietary MiWi wireless networking protocol is designed to work on a number of different radios such as Sub-GHz or 2.4 GHz IEEE 802.15.4. It delivers a stack that allows for the lowest microcontroller and memory cost yet provides point-to-point (P2P) or mesh network functionality.

MiWi Protocol Connectivity Offers:

- Low-power radio
- Proprietary technology for greater customization
- Small footprint
- Enables mesh networking; scalable from hundreds to thousands of nodes

MiWi Wireless Networking Protocol Products

The MiWi Development Environment or MiWi DE is Microchip's proprietary wireless solution that is designed to help you to quickly and easily develop short-range wireless applications on the Sub-GHz or 2.4 GHz bands. It is optimized for low-power, low-data-rate and cost-sensitive applications. The MiWi Development Environment also offers a smaller footprint relative to the open standards-based ZigBee-compliant protocol stack.

The MiWi Development Environment includes support for Microchip's MiWi P2P, MiWi and MiWi PRO proprietary protocols. These protocols support short-range wireless network applications, from simple star networks to large mesh networks.

The Right Protocol: MiWi Protocols for Your Application

- **MiWi P2P:** Has a simple star network with a size of about 4 KB.
- **MiWi:** Supports mesh networks with up to four hops with a size of about 16 KB.
- **MiWi PRO:** Supports mesh networks and has up to 64 hops of routing capability. Also supports mesh networks up to 8000 nodes.

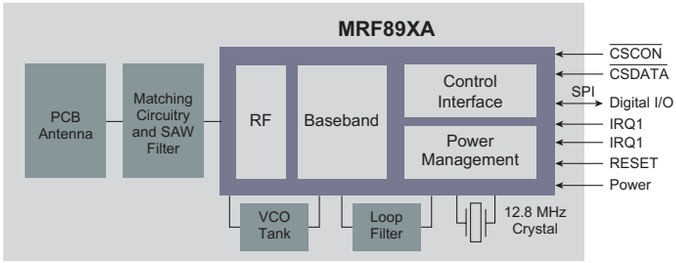
MiWi Protocol and Sub-GHz

Microchip's MiWi protocol supports Sub-GHz as well as 2.4 GHz. The Industrial, Scientific and Medical (ISM) unlicensed Sub-GHz radio frequency bands are used for many short-range, low-data-rate and low-power wireless applications. Microchip's MiWi protocol modules and Sub-GHz stand-alone transceivers and receiver products, including Microchip's family of wireless transmitters with embedded PIC microcontrollers, are all designed to support short-range, low-data-rate applications.

Microchip's MRF89XAM8A and MRF89XAM9A modules—designed from the MRF89XA ultra-low-power Sub-GHz transceiver IC—support the MiWi Development Environment and are footprint-compatible with the 2.4 GHz IEEE 802.15.4™ MRF24J40MA module. These small form factor, surface mount modules connect to hundreds of PIC microcontrollers via a 4-wire SPI interface and are an ideal solution for low-power wireless sensor networks, home automation, building automation and consumer applications. Like Microchip's other embedded modules, the MRF89XAM8A/M9A modules are designed for easy integration into the final product, minimizing development time and speeding time to market.

Block Diagram

MRF89XAM8A Module



MiWi Protocol Applications

There are many home and building applications perfectly suited for the MiWi protocol. Along with 2.4 GHz, the MiWi protocol supports the Sub-GHz radio which is ideal for AMR metering, consumer electronics, home, business, industrial automation, automotive, toys and medical applications.

All of Microchip's Sub-GHz solutions complement our PIC microcontrollers, providing a flexible, cost-effective platform for creating the optimal wireless product for a given application.

Embedded Wireless

IEEE 802.15.4 and Sub-GHz Products

Radios

Radios	Type	Modulation	Data Rate (kbps)	Frequency Range (MHz)	Sensitivity (dBm)	Tx Power (dBm)
MRF39RA	Receiver	FSK/GFSK/MSK/GMSK/OOK	300	315/434/868/915/955	–120	–
MRF89XA	Transceiver	FSK/OOK	200	868/915/955	–113	+12.5
MRF49XA	Transceiver	FSK	256	434/868/915	–110	+7

Modules

Module	Modulation	Data Rate (kbps)	Frequency Range (MHz)	Sensitivity (dBm)	Tx Power (dBm)
MRF89XAM8A	FSK/OOK	40	863–870	–113	+12.5
MRF89XAM9A	FSK/OOK	40	902–928	–113	+12.5

Module	Data Rate	Frequency Range (MHz)	Sensitivity (dBm)	Tx Power	Rx Mode	Output Power (dBm)
MRF24J40MA	250 kbps	2.405–2.48	–94	23 mA	19 mA	+0
MRF24J40MD	250 kbps	2.405–2.475	–102	130 mA	25 mA	+20
MRF24J40ME	250 kbps	2.405–2.475	–104	140 mA	32 mA	+19

MCU Transmitters

MCU Transmitter	Program Memory	Program Memory	Data EEPROM/Flash	RAM (Bytes)	Frequency Range (MHz)
PIC12LF1840T39A	Flash	7.1 KB	256 bytes	256	310–915
PIC12F529T39A	Flash	2.3 KB	64 bytes	201	310–915
PIC16LF1824T39A	Flash	4 KB	256 bytes	256	310–915
rfPIC12F675K	Flash	1.7 KB	128 bytes	64	290–350
rfPIC12F675F	Flash	1.7 KB	128 bytes	64	380–450
rfPIC12F675H	Flash	1.7 KB	128 bytes	64	850–930

MiWi™ Protocol Development Tools

Development Kit	Part Number	Frequency	Platform
MiWi™ to Wi-Fi® Demo Kit	DM182018	2.4 GHz	32-bit
MiWi Demo Kit – 2.4 GHz MRF24J40	DM182016-1	2.4 GHz	8-bit
8-bit Wireless Development Kit – 2.4 GHz MRF24J40	DM182015-1	2.4 GHz	8-bit
MRF24J40MA PICtail™ for PIC18 Explorer Board	AC164134-1	2.4 GHz	8-bit
MRF24J40MD PICtail for PIC18 Explorer Board	AC164134-3	2.4 GHz	8-bit
MiWi Demo Kit – 868 MHz MRF89XA	DM182016-2	868 MHz	8-bit
8-bit Wireless Development Kit – 868 MHz MRF89XA	DM182015-2	868 MHz	8-bit
MRF89XAM8A PICtail for PIC18 Explorer Board	AC164138-1	868 MHz	8-bit
MiWi Demo Kit – 915 MHz MRF89XA	DM182016-3	915 MHz	8-bit
8-bit Wireless Development Kit – 915 MHz MRF89XA	DM182015-3	915 MHz	8-bit
MRF89XAM9A PICtail for PIC18 Explorer Board	AC164138-2	915 MHz	8-bit
MRF24J40MA PICtail for Explorer 16	AC164134-1	2.4 GHz	16- and 32-bit
MRF24J40MD PICtail for Explorer 16	AC164134-3	2.4 GHz	16- and 32-bit
MRF24J40ME PICtail for Explorer 16	AC164143-1	2.4 GHz	16- and 32-bit
MRF89XAM8A PICtail for Explorer 16	AC164138-1	868 MHz	16- and 32-bit
MRF89XAM9A PICtail for Explorer 16	AC164138-2	915 MHz	16- and 32-bit

Embedded Security

Security

It's important to stay one step ahead of the criminal element in today's vast interconnected world. Providing greater security within a product or system is quickly becoming a standard requirement in order to prevent theft of everything from software and hardware, to intellectual property, to data or communications services. Designers of products in markets such as automotive, medical, consumer, wireless and commercial systems have implemented a variety of approaches to providing security.

Microchip brings together both cryptographic and non-cryptographic pieces to help you build a total security solution for your wireless application.

Security Products

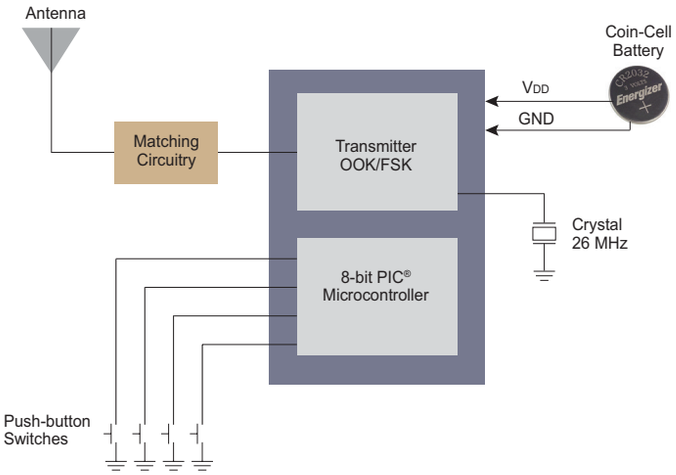
Many wireless applications typically operate in highly constrained environments where energy resources are scarce and long battery life is highly desirable. Some of the key considerations when selecting a wireless device are power consumption, form factor and cost.

Microchip offers several different high-performance security products with low-power features. These small form factor, low-power solutions have an operating voltage of 1.8–3.6V, six GPIO pins, a self-read/write Flash memory, and an internal 32 MHz clock, all in a sleek 14-pin TSSOP package. The RF transmitter has FSK operation up to 100 kbps and OOK operation up to 10 kbps, while the microcontroller has up to 7K of program Flash memory, up to 256 bytes of RAM memory, and up to 256 bytes of EEPROM memory, making these products an ideal fit for demanding security applications.

You can also add Microchip's proprietary, royalty-free KEELOQ technology code hopping technology, an industry-proven technology used by leading manufacturers worldwide to provide additional security to their applications. The relatively small code size is highly configurable and can easily be scaled to provide secure solutions to various markets.

Embedded Security

Block Diagram



Security Applications

Applications for Microchip's security solutions include:

- Garage door openers
- Remote key pads
- Tire pressure monitoring sensors
- Remote Keyless Entry (RKE) systems
- Automotive alarm systems
- Security and safety sensors
- Wireless sensors
- Remote controls

Microchip's nanoWatt XLP microcontroller + RF transmitter is well suited for security applications and was designed by Microchip with many security requirements in mind.

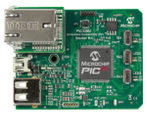
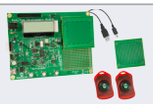
This device combines a low-power Flash microcontroller with a wireless-enabling RF transmitter into a single 14-pin package. This streamlined packaging helps you solve both your power consumption and product footprint problems within one feature-rich device.

These products are ideal for developing low-cost and extremely low-power wireless applications such as remote keyless entry (automotive, garage doors), security systems (alarm keypads, access control, wireless security sensors) and remote monitoring.

Security Products

MCU with RF Transmitter	Program Memory	Frequency
PIC12LF1840T39A	7.1K	310–915 MHz
PIC12F529T39A	2.3K	310–915 MHz
PIC16LF1824T39A	4.0K	310–915 MHz

Security Development Tools

Development Tool	Photo	Part Number	Description
PIC32MZ EC Starter Kit with Crypto Engine		DM320006-C	The PIC32MZ EC Starter Kit with Crypto Engine provides the easiest and lowest-cost method to experience the high performance and advanced peripherals integrated in the PIC32MZ Embedded Connectivity MCUs.
BodyCom™ System Development Kit		DM160213	The BodyCom Development Kit is designed to help you get up to speed quickly using this technology.
Wireless Remote Control Development Kit for Ultimate KEELOQ®		DM182017-4	Demonstration and development platform that supports both Ultimate and Classic KEELOQ protocols
8-bit Wireless Development Kit – 2.4 GHz IEEE 802.15.4		DM182015-1	8-Bit Wireless Development Kit – 2.4GHz MRF24J40 provides a cost-effective method of evaluating and developing low-power wireless applications based on Microchip's wireless protocols.
Wireless Remote Control Development Kit – 433.92/868/915 MHz		DM182017-1/2/3	The Wireless Security Remote Control Development Kit is a demonstration and development platform for wireless security remote control applications.
PICtail™ Daughter Boards		Various	Expand development with PICtail application daughter cards
Smart Card/SIM Card (SC) PICtail Daughter Board		AC164141	The Smart Card/SIM Card (SC) PICtail Daughter Board is an expansion board used for evaluating, reading and writing data on Smart Cards and SIM Cards.

www.microchip.com/security

Support

Microchip is committed to supporting its customers in developing products faster and more efficiently. We maintain a worldwide network of field applications engineers and technical support ready to provide product and system assistance. In addition, the following service areas are available at www.microchip.com:

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