RN-171-EK Evaluation Board

Features

- Ultra-low power: 4-uA sleep, 40-mA Rx, 180-mA Tx at 10 dBm
- Configurable transmit power: 0 to +12 dBm
- UART hardware interfaces and SPI slave
- Up to 1 Mbps data rate over UART
- Powered by battery pack (2 AAA batteries) or via USB cable
- Pushbuttons for AP/WPS mode and reset signals
- 10 general-purpose digital I/O pins
- 8 analog sensor interfaces; configurable sensor power outputs 0 to 3.3-V DC
- Real-time clock for wakeup and time stamping
- Complete on-board TCP/IP networking stack
- Wi-Fi Alliance certified for WPA2-PSK
- FCC/CE/ICS certified and RoHS compliant

Applications

- Wireless serial connections
- Remote sensors
- Telemetry
- Security
- Industrial sensors and controls
- Home automation

Description

The RN-171-EK evaluation board is a field-ready, Wi-Fi Alliance certified, 802.11 prototyping platform for the RN-171 module. The board has the flexibility to connect directly to PCs via a standard USB interface (via FTDI chipset) or to embedded processors through the TTL UART interface. The RN-171-EK contains a battery boost circuit, which makes it possible to power the board using two AAA batteries (the input voltage can go down to 2.0 V DC when using the battery boost circuit). The battery boost circuit makes the RN-171-EK perfect for battery-powered applications such as sensors, data acquisition systems, controllers, etc. The status LEDs and jumpers enable rapid prototyping and integration into existing systems.

The RN-171-EK is based on the Roving Networks RN-171 module. The RN-171 module incorporates a 2.4-GHz radio, processor, full TCP/IP stack, real-time clock, and supports the FTP client, DHCP, DNS, and HTML client protocols. The module supports ad hoc and infrastructure networking modes.

The analog sensor interface provides direct connections to read the sensors' temperature, acceleration, and other analog data without requiring an external microprocessor. The RN-171 module is programmed and controlled from a console with a simple ASCII command language. Once the configuration is set up, the module can automatically scan to find an access point, associate, authenticate, and connect over any Wi-Fi network. Additionally, the module can automatically wake up, send data to a remote host, and go back to a low-power sleep state.

OVERVIEW

- Host data rates up to 921 Kbps TX, 500 Kbps RX for UART

- Intelligent, built-in power management with programmable wake-up events (timers and I/O)

- Real-time clock for time stamping, auto-sleep, and auto-wakeup modes

- Configuration over Wi-Fi or UART using simple ASCII commands

- Over the air firmware upgrade via FTP

- Secure Wi-Fi authentication: WEP, WPA-PSK (TKIP), and WPA2-PSK (AES)

- Built-in networking applications: DHCP, DNS, ARP, ICMP UDP, Telnet, FTP client, and HTML client

- Supports WPS push-button mode for easy network configuration

- Can act as an access point

The evaluation board's moisture sensitivity level (MSL) is 1; its size and weight are:

- *Size*—50.8 mm x 28 mm x 21 mm

- *Weight*—13.5 g

Tables 1 through 5 provide detailed specifications for the evaluation board.

Table 1. Environmental Conditions

Parameter	Value
Temperature range (operating)	-45°C ~ 85°C
Temperature range (storage)	-45°C ~ 85°C
Relative humidity (operating)	≤90%
Relative humidity (storage)	≤90%

Table 2. Electrical Characteristics

Supply Voltage, *Note (1)*	Min	Typ.	Max.	Unit
Power connector (J7)	2.0 *(1)*	3.3	16 *(1)*	V
UART interface (J4)	3.0	3.3	3.6	V
USB interface (J6)	5.0		16	V
Power consumption				
Sleep		4		uA
Standby (doze)	-	15	-	mA
Connected (idle, RX)		40		mA
Connected (TX)		180 at 10 dBm		mA

Notes:

1. Supply voltage range varies depending upon the header used. See "Design Concerns" on page 5 for more details.

Table 3. Analog Sensor Inputs

Parameter	Value
Sensor 0, 1, 2, and 3 wake-up detection threshold	500 mV
AD sensor 0 - 7 measurement range	0 - 400 mV
Precision	14 bits = 12 uV
Accuracy	5% uncalibrated, .01% calibrated
Minimum conversion time	35 us (5 kHz over Wi-Fi)
Sensor power (pin 33) output resistance 3.3 V	10 ohms, maximum current = 50 mA

Table 4. Radio Characteristics

Parameter	Specifications
Frequency	2,402 ~ 2,480 MHz
Modulation	802.11b compatibility: DSSS (CCK-11, CCK-5.5, DQPSK-2, and DBPSK-1) 802.11g: OFDM (default)
Channel intervals	5 MHz
Channels	1 - 14
Transmission rate (over the air)	1 – 11 Mbps for 802.11b / 6 – 54 Mbps for 802.11g
Receive sensitivity	-83 dBm typical
Output level (Class1)	0 to +12 dBm (software configurable)

Table 5. Transmit Power

| Output Power	802.11 b (2 Mbps) Current in mA *Note (1)*	802.11 g (24 Mbps) Current in mA *Note (1)*
0	120	135
2	130	150
4	170	190
6	175	200
8	180	210
10	185	225
12	190	240

Notes:
1. Measured at 3.3-V DC input. The power consumption is the average power, active during actual power consumption.
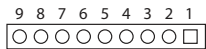
BOARD DESCRIPTION

Figure 1 describes the evaluation board's connectors and interfaces. Table 6 describes the LED indicators.

Figure 1. RN-171-EK Evaluation Board
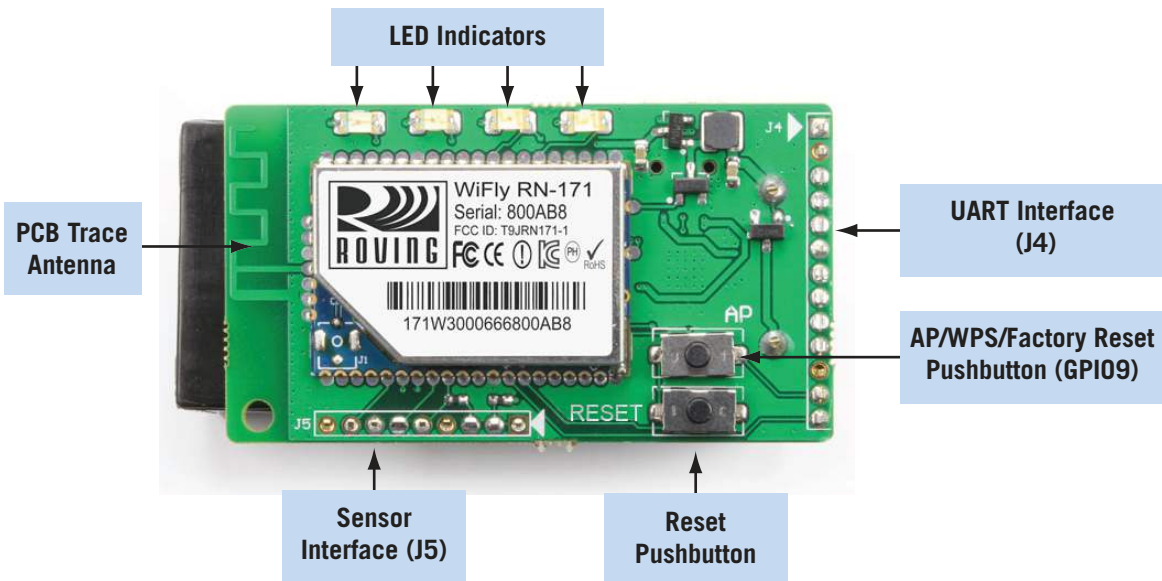
Sensor Interface (J5)

9 8 7 6 5 4 3 2 1

Pin	Description
1	Sensor Power
2	Sensor 4 (3.3-V tolerant)
3	Sensor 5 (3.3-V tolerant)
4	Sensor 7 (1.2 V only)
5	Sensor 5 (1.2 V only)
6	Sensor 4 (1.2 V only)
7	Sensor 6 (1.2 V only)
8	Sensor 3 (1.2 V only)
9	GND

WARNING: Voltage on pins marked *1.2 V Only* should not exceed 1.2 V or permanent damage will occur.

UART Interface (J4)

1 2 3 4 5 6 7 8 9 10 11 12 13

RX - input to evaluation board
TX - output from evaluation board

Pin	Description
1	3.3 VDD
2	GND
3	UART RX
4	UART TX
5	UART RTS
6	UART CTS
7	GPIO4
8	GPIO5
9	GPIO6
10	GPIO7
11	GPIO8, *(1)*
12	GPIO9
13	RESET

Note:

1. The RN-171 module drives GPIO8 HIGH on powerup, which overrides software configured powerup values, such as **set sys value 0x0000** on GPIO8.

Table 6. RN-171-EK Evaluation Board LED Indicators

Condition	Blue LED	Red LED	Yellow LED	Green LED
On solid	Not used	-	-	Connected over TCP
Fast blink	Not used	Not associated	Rx/Tx data transfer	No IP address
Slow blink	Not used	Associated, no Internet	-	IP address OK
Off	Not used	Associated, Internet OK	-	-

PHYSICAL DIMENSIONS

Figure 2 shows the evaluation board's physical dimensions.

Figure 2. RN-171-EK Physical Dimensions
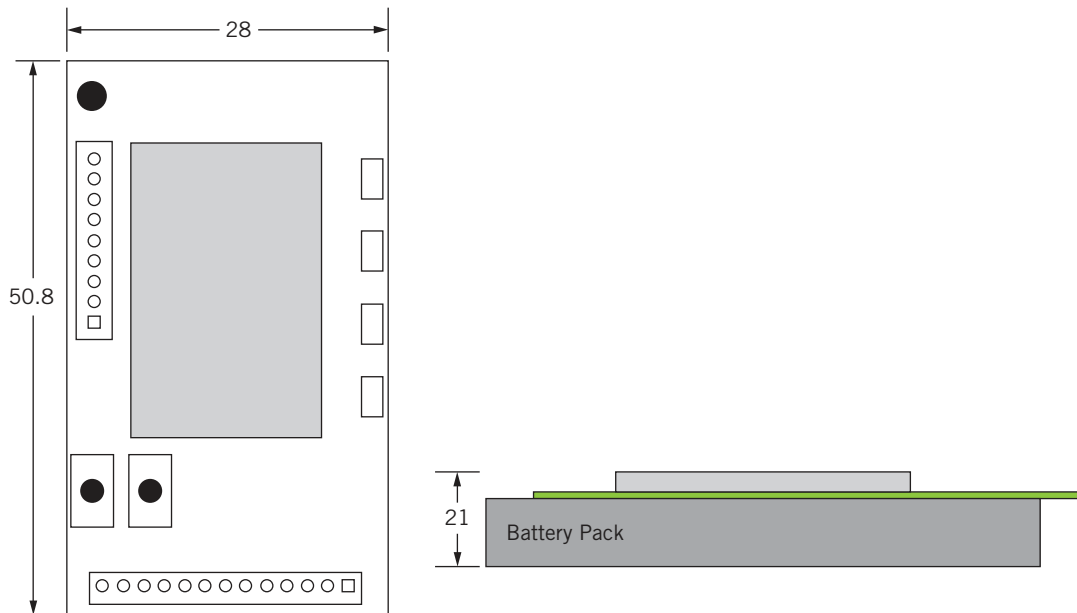
All Dimensions Are in mm

DESIGN CONCERNS

This section provides design information, such as powering the evaluation board, sensor interface settings, ad hoc mode, and restoring factory settings.

Powering the Module

You power the RN-171-EK evaluation board from the USB cable, the UART interface, or via the battery pack, which holds 2 AAA batteries.

> **NOTE:** You can provide power via the USB cable while a battery pack is installed.

Sensor Interfaces

The input voltage on the sensor inputs must not exceed 1.2 V. The ADC saturates at 400 mV. Roving Networks recommends that you use the sensor power output to drive any analog devices that are attached to the sensor pins.

> **NOTE:** Sensor pins 2 and 3 have a resistor network in front of sensors 4 and 5, respectively, so these pins can be driven with up to 3.3 V DC.

GPIO9 Functions

The AP pushbutton is connected to GPIO9. Depending on the state of GPIO9, the module goes into three different modes: access point (AP) mode, factory reset, and WPS mode.

AP Mode

To put the module into AP mode, GPIO9 must be high when the module powers up or wakes from a sleep state. Press the AP mode button to drive GPIO9 high, and then press the RESET button to reset the module. The module is in default AP mode, which creates a default access point network with the default parameters shown in Table 7.

> **NOTE:** This default mode overwrites any software settings.

Table 7. Default AP Mode Settings

Setting	AP Mode Default
SSID	WiFlyAP-*XX*, where *XX* is the last two bytes of the module's MAC address
Channel	1
DHCP server	Enabled
IP address	1.2.3.4
Netmask	255.255.255.0
Gateway	1.2.3.4

After the module boots, other Wi-Fi-enabled devices (such as PCs, iPhones, iPads, Android tablets, etc.) should be able to find the module when they scan for access points.

Factory Reset

In this mode, the module is restored to the factory defaults. To restore the defaults, perform the following steps:

1. Put the module into default AP mode as described in "AP Mode".

2. Press the AP Mode pushbutton 5 times (with 1 or more seconds between presses).

The module is restored to the initial factory default configuration. This feature is useful for cases in which the module is misconfigured and is no longer responding.

WPS Mode

When the module is acting as a client (not in access point mode), you can invoke WPS functionality by pressing the AP pushbutton. Before you can invoke this mode, the WPS functionality must enabled in software using the command **set sys trigger 0x10**.

Reset

The RESET pushbutton reboots the module. You can use the RESET and AP pushbuttons to toggle whether the module is in client or AP mode. If you press the AP pushbutton before pressing RESET, the module goes into default AP mode. If you press the RESET button only, the module goes into client mode.

Drivers

RN-171-EK board uses the FTDI chip set. When you connect the cable to your PC, the PC should install the drivers automatically. If not, you can download the drivers from the Support page on the Roving Networks website at http://www.rovingnetworks.com/support.php.

ORDERING INFORMATION

Table 8 provides ordering information for the RN-171-EK evaluation board.

Table 8. Ordering Information

Part Number	Description
RN-171-EK-P	RN-171-EK board with PCB trace antenna, standard firmware
For other configurations, contact Roving Networks directly.	

Visit http://www.rovingnetworks.com for current pricing and a list of distributors carrying our products.

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