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ISBN: 978-1-5224-0084-4

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Object of Declaration: RN1723 Development Board

EU Declaration of Conformity

Manufacturer: Microchip Technology Inc.
2355 W. Chandler Blvd.
Chandler, Arizona, 85224-6199
USA

This declaration of conformity is issued by the manufacturer.

The development/evaluation tool is designed to be used for research and development in a laboratory environment. This development/evaluation tool is not a Finished Appliance, nor is it intended for incorporation into Finished Appliances that are made commercially available as single functional units to end users under EU EMC Directive 2004/108/EC and as supported by the European Commission's Guide for the EMC Directive 2004/108/EC (8th February 2010).

This development/evaluation tool complies with EU RoHS2 Directive 2011/65/EU.

This development/evaluation tool, when incorporating wireless and radio-telecom functionality, is in compliance with the essential requirement and other relevant provisions of the R&TTE Directive 1999/5/EC and the FCC rules as stated in the declaration of conformity provided in the module datasheet and the module product page available at www.microchip.com.

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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA


Derek Carlson
VP Development Tools

12-Sep-14
Date

RN1723 Development Board User's Guide

NOTES:



RN1723 DEVELOPMENT BOARD USER'S GUIDE

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Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a “DS” number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is “DSXXXXXXXXA”, where “XXXXXXXX” is the document number and “A” is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the RN1723 Development Board. Items discussed in this chapter include:

- [Document Layout](#)
- [Conventions Used in this Guide](#)
- [Recommended Reading](#)
- [The Microchip Web Site](#)
- [Development Systems Customer Change Notification Service](#)
- [Customer Support](#)
- [Document Revision History](#)

DOCUMENT LAYOUT

This document describes how to use the RN1723 Development Board as a development tool to emulate and debug firmware on a target board. This document includes the following chapters:

- **Chapter 1. “Introduction”** provides an overview of the RN1723 Development Board, highlighting its features and uses.
- **Chapter 2. “Hardware”** provides an overview of the RN1723 Development Board hardware components and features.
- **Chapter 3. “Initial Development Board Configuration”** provides information on configuring the development board for first-time use, including setting up a web server.
- **Appendix A. “RN1723 Development Board Schematics”** provides schematic diagram information for the development board.

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CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Italic characters	Referenced books	<i>MPLAB[®] IDE User's Guide</i>
	Emphasized text	...is the <i>only</i> compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	<u><i>File > Save</i></u>
Bold characters	A dialog button	Click OK
	A tab	Click the Power tab
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Plain Courier New	Sample source code	#define START
	Filenames	autoexec.bat
	File paths	c:\mcc18\h
	Keywords	_asm, _endasm, static
	Command-line options	-Opa+, -Opa-
	Bit values	0, 1
	Constants	0xFF, 'A'
<i>Italic Courier New</i>	A variable argument	<i>file.o</i> , where <i>file</i> can be any valid filename
Square brackets []	Optional arguments	mcc18 [options] <i>file</i> [options]
Curly brackets and pipe character: { }	Choice of mutually exclusive arguments; an OR selection	errorlevel {0 1}
Ellipses...	Replaces repeated text	var_name [, var_name...]
	Represents code supplied by user	void main (void) { ... }
Notes	A Note presents information that we want to re-emphasize, either to help you avoid a common pitfall or to make you aware of operating differences between some device family members. A Note can be in a box, or when used in a table or figure, it is located at the bottom of the table or figure.	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p>Note: This is a standard note box.</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center;">CAUTION</p> <p>This is a caution note.</p> </div> <p>Note 1: This is a note used in a table.</p>

RECOMMENDED READING

The following documents are recommended as supplemental reference resources.

RN1723 Family Data Sheet (DS70005224)

Consult this document for detailed information on the RN4020 Bluetooth® Low Energy Module. Reference information found in this data sheet includes:

- Device pinout and packaging details
- Device electrical specifications
- List of features included on the device

WiFly Command Reference Manual (DS50002230)

This reference manual provides information on the commands and features for Microchip products that utilize the WiFly radio module command set. The WiFly radio module is a complete, stand-alone embedded wireless LAN access device. The device has an on-board TCP/IP stack and applications, and in the simplest hardware configuration, requires only four pins: Power, TX, RX, and Ground.

RN131/RN171/RN1723 Evaluation Kits User's Guide (DS50002183)

This user's guide describes the RN evaluation boards that are used for demonstrating the capabilities of the RN131, RN171, and RN1723 modules. These RN evaluation boards have the flexibility to connect directly to a PC or laptop through a standard USB interface or to embedded controllers through the serial UART interface. Reference information in this user's guide includes:

- Overview of the evaluation kit hardware and evaluation board features and components
- Hardware and module configuration
- Sensor interfaces and push button functions
- Evaluation board schematics

PICDEM™ PIC18 Explorer Demonstration Board User's Guide (DS51721)

This document describes how to use the PICDEM PIC18 Explorer Demonstration Board as a development tool to emulate and debug firmware on a target board. Reference information found in this user's guide includes:

- Functionality and features
- Hardware features
- Development board schematics

Explorer 16 Development Board User's Guide (DS50001589)

This document describes how to use the Explorer 16 Development Board as a development tool to emulate and debug firmware on a target board. Reference information found in this user's guide includes:

- Functionality and features
- Hardware features
- Development board schematics

These documents are available for download from the Microchip website (www.microchip.com).

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THE MICROCHIP WEB SITE

Microchip provides online support via our web site at: <http://www.microchip.com>. This web site makes files and information easily available to customers. Accessible by most Internet browsers, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listings
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listings of seminars and events; and listings of Microchip sales offices, distributors and factory representatives

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The Development Systems product group categories are:

- **Compilers** – The latest information on Microchip C compilers and other language tools
- **Emulators** – The latest information on the Microchip in-circuit emulator, MPLAB[®] REAL ICE™
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debugger, MPLAB ICD 3
- **MPLAB X IDE** – The latest information on Microchip MPLAB X IDE, the Windows[®] Integrated Development Environment for development systems tools
- **Programmers** – The latest information on Microchip programmers including the PICkit™ 3 development programmer

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: <http://support.microchip.com>

DOCUMENT REVISION HISTORY

Revision A (December 2015)

This is the initial released version of this document.

RN1723 Development Board User's Guide

NOTES:

Chapter 1. Introduction

Thank you for purchasing the RN1723 Development Board from Microchip Technology Inc. The RN1723 Development Board provides a platform to evaluate Microchip's RN1723 module for low-power client applications. The RN-1723-LPCM kit comes with the RN1723 Development Board, which is preloaded with demonstration software that enables users to explore the features of the RN1723 IEEE 802.11 b/g Wi-Fi® module.

The development board is also expandable through a PICtail™ expansion interface that enables users to extend its functionality by adding various sensor/transceiver expansion boards.

The software package for this development board is available for download from the Microchip website at: www.microchip.com/wireless/RN1723DevBoard.

1.1 CONTENTS

The following are included with the purchase of the RN1723 Development Board:

- Two AA Batteries
- One male 1 x 6 connector header HDR-2.54 (J1)
- One USB cable (Type-A to mini-B)
- RN1723 Development Board Information Sheet

<p>Note: If you are missing any of the contents listed, contact a Microchip sales office for assistance. A list of Microchip offices for sales and service is provided on the last page of this document.</p>
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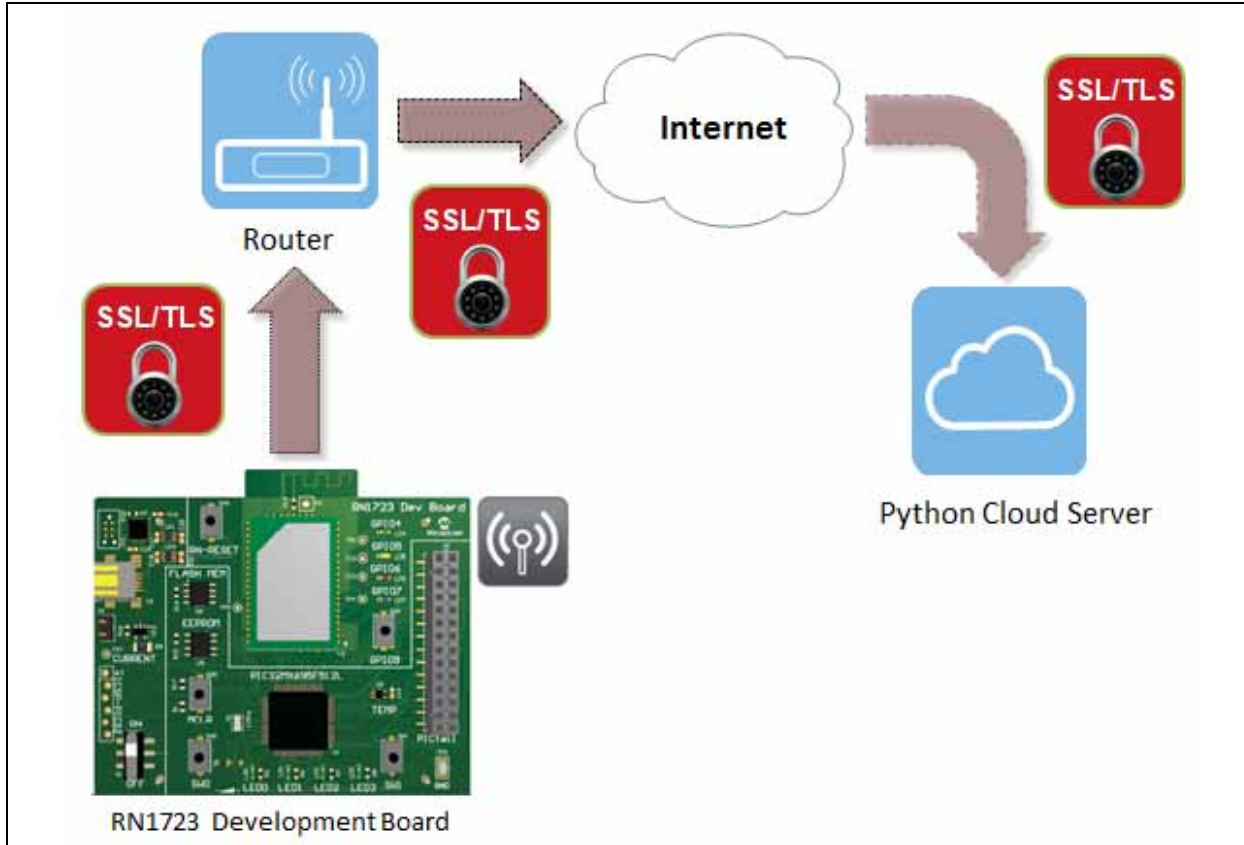
1.2 FUNCTIONALITY AND FEATURES

One of the purposes of the RN1723 Development Board is to demonstrate to customers how the RN1723 module may be used in IoT applications. The RN1723 Development Board incorporates the main components and features that make connecting to and transmitting data to a Web-based server a straightforward process for designers.

[Figure 1-1](#) shows a typical system diagram of how the RN1723 Development Board may be deployed in an Internet of Things (IoT) application. Following the diagram are descriptions of the roles of each of the major system components.

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FIGURE 1-1: IoT APPLICATION SYSTEM DIAGRAM



- The on-board RN1723 module provides the Wi-Fi connectivity capabilities. When associated to a Wi-Fi Access Point, a Wi-Fi network is formed, allowing the RN1723 module to transmit information to and from the cloud-based server.
- The PIC32 device on the board provides the means for customers to create their custom IoT client application. The firmware that manages the customer's specific application, such as a thermostat, a wearable device, or a door lock, resides within the PIC32 device. Additionally, Microchip provides the wolfSSL security suite in library form, which enables customers to provide a secure link between the RN1723 module and their remote server. This security suite is resident on the PIC32 device. The PIC32 device is also used to configure the RN1723 module, oversees its operation, captures data from external sensors, and passes that data, via the Wi-Fi module, up to the server. Similarly, the PIC32 device receives and processes data that is returned from the server via the RN1723 module.
- To assist with the development of an IoT application, a sample server written in Python is included as part of the RN1723 Development Board package. This server may be resident in the cloud or on a local computer.
- The RN1723 Development Board also contains a number of sensors:
 - Potentiometer
 - Temperature sensor
 - Switches and LEDs
 - Tilt-vibe sensor

These components are used in a number of ways, including waking up the RN1723 module, indicating the module status, and providing the source of information that is transmitted to the server.

1.2.1 Demonstration System

Now that the major system components have been identified, the following is a brief description of how the IoT client application provided with the RN1723 Development Board functions to make a complete demonstration system.

1. The RN1723 module and the PIC32 device are woken from sleep on a regular schedule. Initially it occurs once every 5 seconds; however, this interval may be changed by the user.
2. After waking up, the RN1723 module associates to the access point and opens a socket to the server. In parallel, the PIC32 device gathers data from the external sensors that are on the board (e.g., LEDs, switches, potentiometers, etc.). The PIC32 device packages this wake-up “status message” into JSON format and sends it the RN1723 module. The RN1723 then prepends the appropriate HTTP header information and sends it over the Internet to the server.
3. The server, after receiving the “status message”, has the option of asking the RN1723/PIC32 client device to perform additional tasks, or instructing the device to go back the sleep.
4. Regardless of the intervening actions, the final instruction from the server to the client is always to go back to sleep. During the time that the RN1723 module and the PIC32 device are asleep, the entire development board draws only 4 μ A.

1.2.2 Additional Features

In addition to the hardware components, which are described in [Chapter 2. “Hardware”](#), the RN1723 Development Board includes a sample IoT client firmware for the PIC32 device, a sample Python-based server, a UART device driver for the RN1723 module, as well as application code that demonstrates how to integrate the RN1723 module with the wolfSSL security suite.

In summary, the RN1723 Development Board is an excellent starting point for designers interested in developing and experimenting with the mechanics of creating an embedded IoT client device.

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Chapter 2. Hardware

This chapter describes the hardware features of the RN1723 Development Board. The following topics are discussed:

- [Development Board Layout and Components](#)
- [Hardware Features](#)

2.1 DEVELOPMENT BOARD LAYOUT AND COMPONENTS

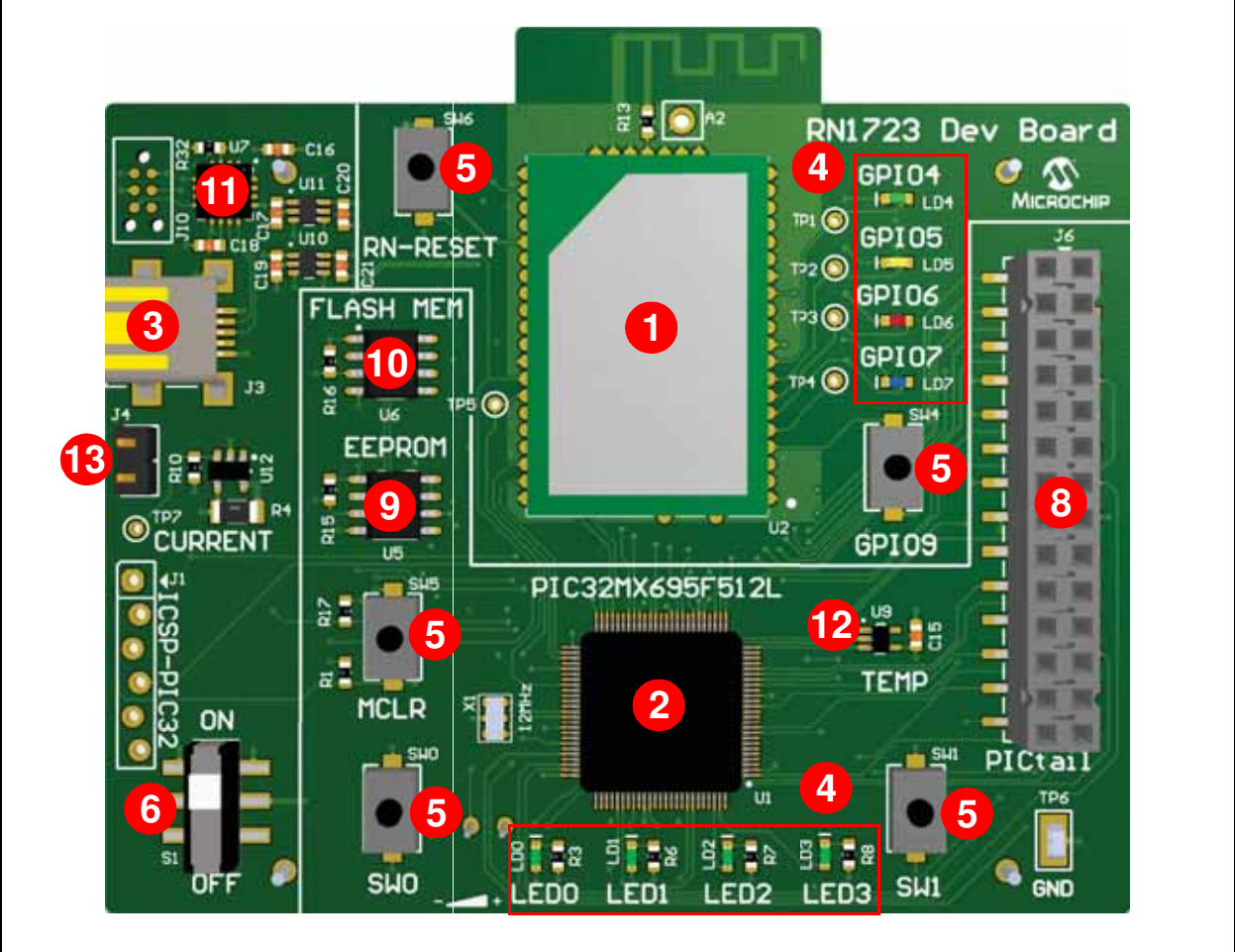
Representations of the layout for the RN1723 Development Board included in the kit are shown in [Figure 2-1](#) and [Figure 2-2](#).

The top assembly of the board includes these key features, as indicated in [Figure 2-1](#).

1. RN1723 IEEE 802.11 b/g Wi-Fi Transceiver (U2).
2. PIC32MX695F512L 32-bit microcontroller (U1).
3. Power supply through USB/AA batteries (J3).
4. Eight LED status indicators (LED0-LED3, GPIO4-GPIO7).
5. Push buttons (MCLR, RN-RESET, GPIO9, SW0, SW1).
6. ON/OFF switch (S1).
7. 6-pin programming/debug port (J1).
8. PICtail expansion port (J6).
9. 256K SPI EEPROM (U5).
10. 1 MB SST Flash memory (U6).
11. PIC16F1455 8-bit microcontroller; USB-UART converter (U7).
12. MCP9700A temperature sensor (U9).
13. PIC32 device power control jumper (J4).

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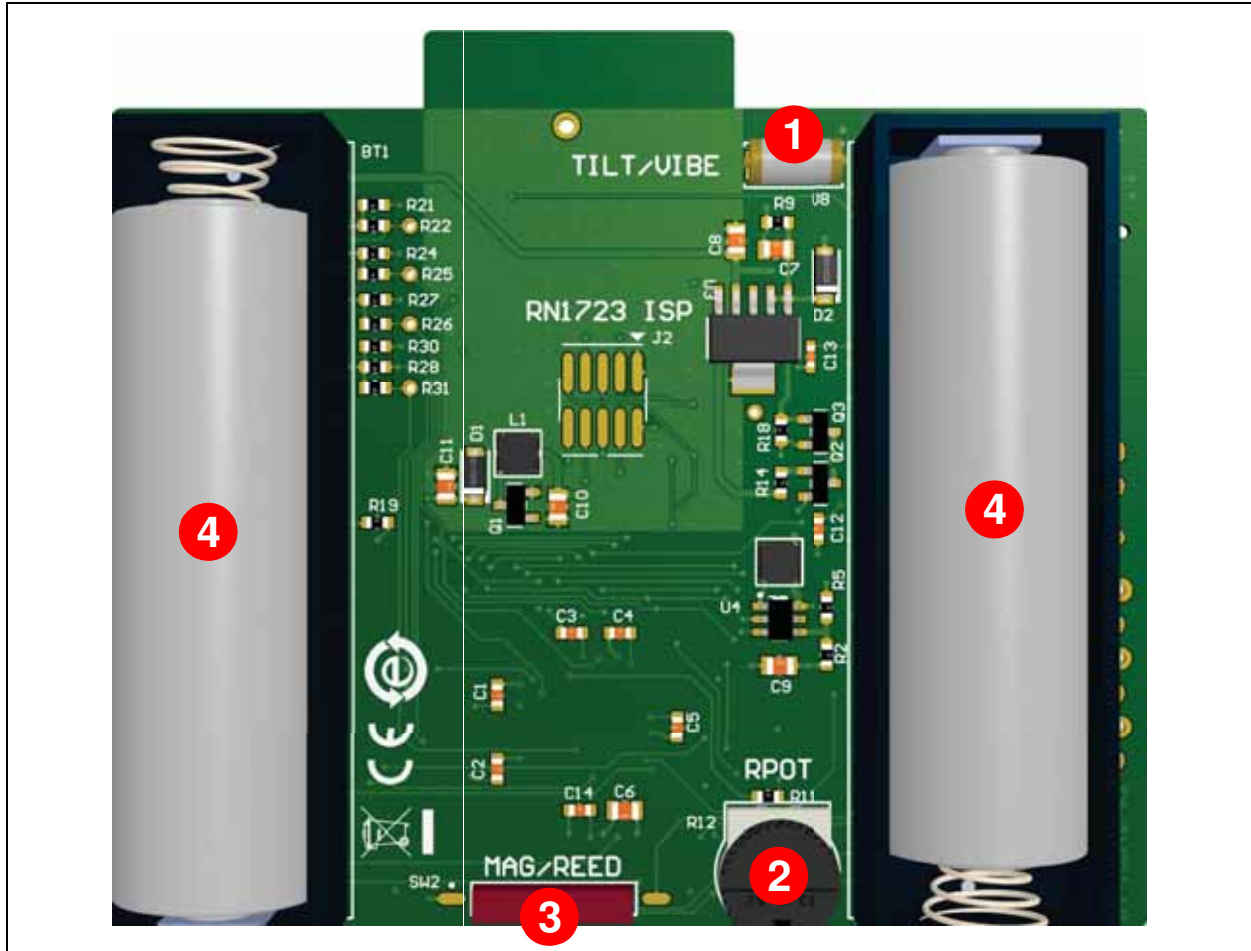
FIGURE 2-1: RN1723 DEVELOPMENT BOARD (TOP LAYOUT)



The bottom assembly of the board includes these key features, as indicated in [Figure 2-2](#).

1. Tilt/Vibe sensor.
2. Potentiometer.
3. Magnetic reed sensor (SW2).
4. AA battery receptacle (BT1, BT2).

FIGURE 2-2: RN1723 DEVELOPMENT BOARD (BOTTOM LAYOUT)



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2.2 HARDWARE FEATURES

This section provides detailed descriptions of the following key features of the development board. Refer to [Figure 2-1](#) and [Figure 2-2](#) for their physical layout locations.

2.2.1 RN1723 IEEE 802.11 b/g Wi-Fi Transceiver Module

The RN1723 IEEE 802.11 b/g Wi-Fi Transceiver Module provides wireless connectivity to the development board. Host communication is through the UART of the PIC32MX695F512L microcontroller on the board.

2.2.2 Processor Support

The RN1723 Development Board is designed with a permanently mounted (i.e., soldered) PIC32MX695F512L microcontroller.

2.2.3 Power Supply

The development board can be powered by two AA batteries or through the USB cable. The battery voltage is monitored and boosted by the MCP1642 Synchronous Boost Regulator.

2.2.4 LEDs

There are two sets of LEDs on the board. The four green LEDs, LED0-LED3, are connected to the PORTE pins of the PIC32 microcontroller. To turn on the LEDs, the port pins need to be set High.

LEDs GPIO 4-GPIO7 are connected to the RN1723 module as I/Os to the module. Their individual functions are defined in [Table 2-1](#).

TABLE 2-1: GPIO4-GPIO7 FUNCTIONS

Pin Name	LED Color	Function
GPIO4	Green	Goes High after the RN1723 module has associated/authenticated and has a valid IP address.
GPIO5	Yellow	Set this pin High to trigger a TCP connection or Low to disconnect.
GPIO6	Red	This pin asserts High when a socket is open, and Low when a socket is closed.
GPIO7	Blue	This pin asserts High when a client connects to WEB_APP to configure the WiFly module.

2.2.5 Switches

The RN1723 Development Board has the following switches:

- ON/OFF – This slider controls the main power to the board. To turn on power to the board, move the S1 slider to the ON position
- SW0 – This active-low push button switch is connected to RD4 of the PIC32 microcontroller
- SW1 – This active-low push button switch is connected to RD13 of the PIC32 microcontroller
- MCLR – This active-low push button switch can be used to reset the PIC32 microcontroller
- RN-RESET – This active-low push button switch is connected to the RESET pin of the RN1723 module
- GPIO9 – This active-low push button switch is connected to the GPIO9 pin of the RN1723 module

2.2.6 Programming/Debug Port

Connector J1 provides access to the PIC32 microcontroller's debug pins. It is used to program or re-flash the development board with new firmware.

2.2.7 PICtail Expansion Port

Connector J6 provides access to the PIC32 microcontroller's spare I/O pins. These pins can function as general purpose I/O ports or as an SPI, I²C, or UART interface to an external circuit.

2.2.8 EEPROM (25LC256)

The development board has a 256K SPI Bus Serial EEPROM for storing and retrieving network or application-specific information, which is connected to SPI4 of the PIC32 microcontroller.

2.2.9 Flash Memory (SST25VF080B)

This device features an 8-Mbit SPI Serial Flash for over-the-air firmware updates of the 32-bit microcontroller, which is connected to SPI4 of the PIC32 microcontroller.

2.2.10 PIC16F1455 (USB-to-UART converter)

The PIC16F1455 8-bit microcontroller translates the USB over UART on U3 of the PIC32 microcontroller.

2.2.11 MCP9700 Temperature Sensor

The temperature sensor (MCP9700A) is a low-power linear active thermistor IC. To minimize power consumption, the sensor is powered from a port pin. On power-up, the sensor output can be measured after one minute. The internal Analog-to-Digital Converter (ADC) of the microcontroller can be used to measure the temperature value.

2.2.12 PIC32 Device Power Control Jumper (J4)

If the jumper on J4 is installed, the PIC32 microcontroller will always be powered on. If the jumper is not installed the operational state of the RN1723 module determines whether the 32-bit microcontroller is on or off. This enables a user to test the power consumption of the low-power client. To measure the power consumption, a test point, TP7, is provided.

The application can be used to construct a sleep profile for the sleep wake cycle of the RN1723 module. For more information about putting the RN1723 module to sleep, refer to the *“WiFly Command Reference Manual”* (DS50002230). [Table 2-2](#) lists the RN1723 module modes and the PIC32 MCU states depending on the jumper position.

TABLE 2-2: JUMPER STATE DEFINITIONS

Jumper Position	RN1723 Module Mode	PIC32MZ695F512L MCU State
Installed	Awake	Powered on
Installed	Asleep	Powered on
Not installed	Awake	Powered on
Not installed	Asleep	Powered off

2.2.13 Tilt/Vibe sensor

The Tilt/Vibe sensor is connected directly to the RN1723 module through the SENSOR3 pin and may be used to wake the module on motion detection.

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2.2.14 Potentiometer

The potentiometer is connected to the PIC32 microcontroller on analog pin AN2/RB2 to demonstrate how to connect an analog input sensor.

2.2.15 Magnetic/Reed Sensor

The Magnetic/Reed sensor is connected directly to the RN1723 module via the SSENSOR0 pin and can also be used to wake the RN1723 module. However, on the current version of the development board, this IC is not populated. If this functionality is desired, it is up to the user to add this component to the development board. Refer to the schematics and bill of materials for details.

Chapter 3. Initial Development Board Configuration

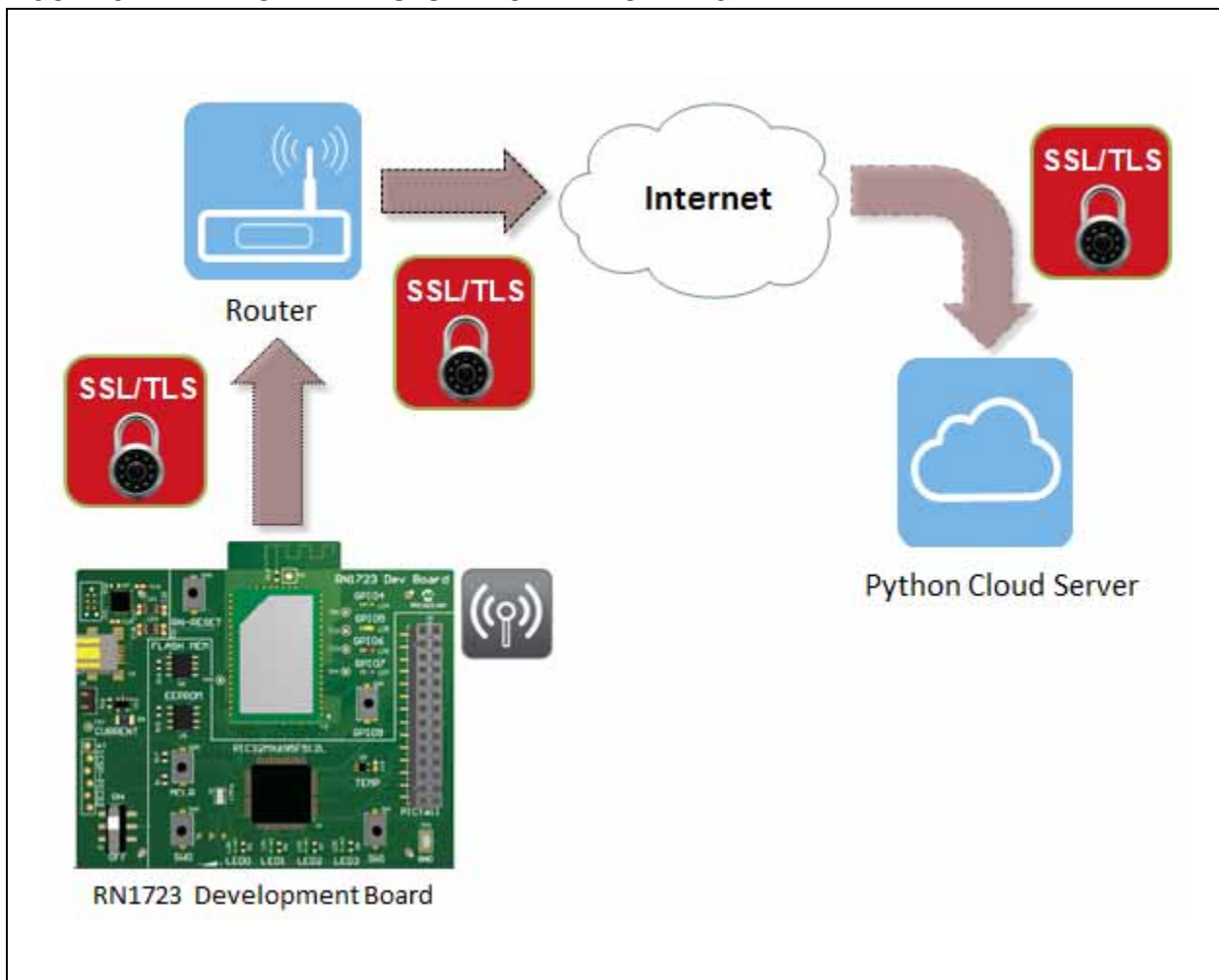
This chapter describes how to configure the development board to communicate with a server. The following topics are included:

- [Setting up the Python™ Server](#)
- [Setting up The RN1723 Embedded Client](#)
- [Sample Terminal Output](#)
- [Advanced Settings](#)

Out of the box, the demonstration for the RN1723 Development Board uses a python script to set up a laptop/PC as a host. Customers can use this platform to develop and test their embedded client application prior to setting up a production cloud-based hosting service.

[Figure 3-1](#) provides a top-level diagram detailing the objective of the system operation.

FIGURE 3-1: TOP-LEVEL SYSTEM OPERATION DIAGRAM



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3.1 SETTING UP THE PYTHON™ SERVER

To set up the Python server, users will need to install `python` and the necessary packages that support SSL before launching the server script. After the server is set up and running properly, the RN1723 Development Board will be able to connect to the server as a client and post the system updates to the server.


The following sections describe the necessary steps to set up a computer as a server for Windows®, Mac OS®, and Linux.

3.1.1 Setting Up the Python Server for Windows 7

To set up the Python server for Windows 7, do the following:

1. Install `python`, version 2.7.10 or later.
 - a) Download and run the installer from:
<https://www.python.org/downloads/release/python-2710/>
 - b) Add the Python directory to your system PATH.

Note: The `pip` package will be installed with Python 2.7 or later.

2. Install `pybottle` by opening a command shell (click Start () and enter `cmd` in the search box) and entering the following command:

```
python -m pip install bottle
```

3. Install `CherryPy`, version 3.2.3 by entering the following command:

```
python -m pip install cherrypy==3.2.3
```

4. Launch the server script from the installed directory by entering the following command:

```
python ServerMainSSL.py
```

3.1.2 Setting Up a Python Server for Mac OS

The instructions provided in this section assume that a previous version of `openssl` has not been installed. If that is not the case, all previous versions must first be uninstalled before proceeding.

Only `openssl` version 1.0.0 or later supports the RN1723 Secure Server Script using TLS1.2. To install `openssl`, do the following:

1. Use Homebrew (<http://brew.sh>) to install the latest version of `openssl` using the following commands in a terminal window, while forcing the links so that Python will use the right version of `openssl`.

```
brew update  
brew install openssl  
brew link --force openssl
```

2. Reinstall Python to use the latest `openssl`.

```
brew install python --with-brewed-openssl
```

3. To verify that `python` was updated, run the following command and verify that the version number of the operating system is greater than 1.0.2d.

```
python -c 'import ssl; print ssl.OPENSSL_VERSION'
```

4. Install `pip` by opening a terminal application (*Applications > Utilities > Terminal*) and entering the following command:.

```
$ sudo easy_install pip
```

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5. Install `pybottle` by entering the following command:

```
$ sudo pip install bottle
```
6. Install `CherryPy` version 3.2.3 by entering the following command:

```
$ sudo pip install cherrypy==3.2.3
```
7. Launch the server script by entering the following command:

```
$ sudo python ServerMain.py
```

3.1.3 Setting Up a Python Server for Linux

1. Install `Python 2.7.x` by opening a terminal application and entering the following command:

```
$ sudo apt-get install python
```
2. Install `pip` by entering the following command:

```
$ sudo apt-get install python-pip
```
3. Install `pybottle` by entering the following command:

```
$ sudo pip install bottle
```
4. Install `CherryPy` version 3.2.3 by entering the following command:

```
$ sudo pip install cherrypy==3.2.3
```
5. Launch the server script by entering the following command:

```
$ sudo python ServerMain.py
```