RN4678 PICtail™/PICtail Plus Daughter Board User’s Guide
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Object of Declaration: RN4678 PICtail™/PICtail Plus Daughter Board

EU Declaration of Conformity

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.
For information regarding the exclusive, limited warranties applicable to Microchip products, please see Microchip’s standard terms and conditions of sale, which are printed on our sales documentation and available at www.microchip.com.
Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA.

Derek Carlson
VP Development Tools

Date
11-NOV-16
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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 website (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 RN4678 PICtail™/PICtail Plus Daughter Board. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Website
- Development Systems Customer Change Notification Service
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how the RN4678 PICtail/PICtail Plus Daughter board allows the designer to evaluate and demonstrate the capabilities of the RN4678 module. The document is organized as follows:

- **Chapter 1. “Overview”** - This chapter describes the hardware and software requirements for the RN4678 PICtail/PICtail Plus Daughter board.
- **Chapter 2. “Interface Description”** - This chapter illustrates and describes the interfaces of the RN4678 PICtail/PICtail Plus Daughter board.
- **Chapter 3. “Getting Started”** - This chapter describes the steps on how to establish connection between the RN4678 PICtail/PICtail Plus Daughter board and PC/Android™/iOS® Apps.
- **Appendix A. “Updating the Firmware on the RN4678”** - This appendix shows the steps to update the firmware on the RN4678 PICtail/PICtail Plus Daughter board.
- **Appendix B. “Schematics and BOM”** - This appendix shows the schematics and BOM for the RN4678 PICtail/PICtail Plus Daughter board.
CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

<table>
<thead>
<tr>
<th>DOCUMENTATION CONVENTIONS</th>
<th>Description</th>
<th>Represents</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Arial font:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Italic characters</td>
<td>Referenced books</td>
<td>MPLAB® IDE User’s Guide</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Emphasized text</td>
<td>...is the only compiler...</td>
<td></td>
</tr>
<tr>
<td>Initial caps</td>
<td>A window</td>
<td>the Output window</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A dialog</td>
<td>the Settings dialog</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A menu selection</td>
<td>select Enable Programmer</td>
<td></td>
</tr>
<tr>
<td>Quotes</td>
<td>A field name in a window or dialog</td>
<td>“Save project before build”</td>
<td></td>
</tr>
<tr>
<td>Underlined, italic text with right angle bracket</td>
<td>A menu path</td>
<td>File&gt;Save</td>
<td></td>
</tr>
<tr>
<td>Bold characters</td>
<td>A dialog button</td>
<td>Click OK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A tab</td>
<td>Click the Power tab</td>
<td></td>
</tr>
<tr>
<td>N'Rnnnn</td>
<td>A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.</td>
<td>4'b0010, 2'hF1</td>
<td></td>
</tr>
<tr>
<td>Text in angle brackets &lt; &gt;</td>
<td>A key on the keyboard</td>
<td>Press &lt;Enter&gt;, &lt;F1&gt;</td>
<td></td>
</tr>
<tr>
<td><strong>Courier New font:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain Courier New</td>
<td>Sample source code</td>
<td>#define START</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Filenames</td>
<td>autoexec.bat</td>
<td></td>
</tr>
<tr>
<td></td>
<td>File paths</td>
<td>c:\mcc18\h</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Keywords</td>
<td>.asm, .endasm, static</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Command-line options</td>
<td>-Opa+, -Opa-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bit values</td>
<td>0, 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Constants</td>
<td>0xFF, ‘A’</td>
<td></td>
</tr>
<tr>
<td>Italic Courier New</td>
<td>A variable argument</td>
<td>file.o, where file can be any valid filename</td>
<td></td>
</tr>
<tr>
<td>Square brackets [ ]</td>
<td>Optional arguments</td>
<td>mcc18 [options] file [options]</td>
<td></td>
</tr>
<tr>
<td>Curly brackets and pipe character: (</td>
<td>)</td>
<td>Choice of mutually exclusive arguments; an OR selection</td>
<td>errorlevel (0</td>
</tr>
<tr>
<td>Ellipses...</td>
<td>Replaces repeated text</td>
<td>var_name [, var_name...]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Represents code supplied by user</td>
<td>void main (void) { ... }</td>
<td></td>
</tr>
</tbody>
</table>
RECOMMENDED READING

This user’s guide describes how to use the RN4678 PICtail/PICtail Plus Daughter board. Other useful documents are listed below. The following Microchip documents are recommended as supplemental reference resources.

RN4678 Bluetooth® 4.2 Low Energy Module Data Sheet (DS50002519)
This document provides the technical specifications for the RN4678 module and is available for download from the Microchip website (www.microchip.com).

RN4678 Bluetooth® Dual Mode Module Command Reference User’s Guide (DS50002506)
This document describes the general command categories of the RN4678 module in detail.

THE MICROCHIP WEBSITE

Microchip provides online support via our website at www.microchip.com. This website is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the website 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 listing
• **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing 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 MPLAB® REAL ICE™ In-Circuit Emulator
• **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 website at:
http://www.microchip.com/support.

DOCUMENT REVISION HISTORY

Revision A (February 2017)

This is the initial release of this document.
1.1 INTRODUCTION

This document describes the hardware and software requirements for the RN4678 PICtail™/PICtail Plus Daughter board.

The RN4678 PICtail/PICtail Plus Daughter board enables the designer to evaluate and demonstrate the capabilities and features of the RN4678 dual mode module. The board includes an MCP2200 USB-UART bridge to enable plug and play connectivity with a host PC.

To demonstrate and evaluate the ability of the RN4678 module to connect with Android™ and iOS® devices, the following apps are available on Apple AppStore® and Google Play™ Store for free download:

- mBioT App (Microchip Bluetooth Internet of Things)
- SmartDiscover
- SmartData

For more information on the RN4678 commands and specifications, refer to the “RN4678 Bluetooth® 4.2 Dual Mode Module Data Sheet” (DS50002519) and the “RN4678 Bluetooth® Dual Mode Module Command Reference User’s Guide” (DS50002506) which are available for download from the Microchip product web page at www.microchip.com/RN4678.

1.2 RN4678 PICtail™/PICtail PLUS DAUGHTER BOARD DESCRIPTION

The RN4678 PICtail/PICtail Plus Daughter board provides rapid prototyping and developing for Bluetooth data applications for the RN4678 dual mode module. It is powered by either USB host or through the Microchip PICtail interface. The RN4678 PICtail/PICtail Plus Daughter board uses the RN4678 module, a fully certified Bluetooth 4.2 Low Energy module which supports both Bluetooth Classic and Bluetooth Low Energy protocols.
Figure 1-1 shows the RN4678 PICtail/PICtail Plus Daughter board.

FIGURE 1-1: RN4678 PICtail™/PICtail PLUS DAUGHTER BOARD

1.3 FEATURES

The RN4678 PICtail/PICtail Plus Daughter board has the following important features:
- RN4678 dual mode module: BT-SIG certified and RF Certified for most regions
- Class 2 transmitter, +1.5 dBm typical
- Embedded MCP2200 USB-UART bridge
- Easy to use ASCII interface for programming
Chapter 2. Interface Description

2.1 RN4678 PICtail™/PICtail PLUS DAUGHTER BOARD

Figure 2-1 shows the interfaces of the RN4678 PICtail/PICtail Plus Daughter board.

FIGURE 2-1: RN4678 PICtail™/PICtail PLUS DAUGHTER BOARD INTERFACES

2.1.1 Interface Description

1. RN4678 module
2. On-board antenna
3. Header pins connecting to the RN4678 pins
4. Module Reset pin
5. Dual In-Line Package (DIP) switch to set the operation mode (Application, EEPROM write, Write Flash) (SW4)
6. Ground test points
7. PICtail interface
8. $I^2C$ interface
9. Module Wake-Up pin
10. SW pin to control Deep Sleep and Shutdown mode (SW1)
11. Status indicator LED (D1)
3.1 INTRODUCTION

The RN4678 PICtail board provides two options to connect and send ASCII commands for operation: Either via the USB interface or via the PICtail pin interface. The simplest method to access the RN4678 module in the PICtail board is to connect the RN4678 PICtail board to a PC host via the Mini-USB port. The MCP2200 USB-UART bridge on the PICtail board provides the interface needed to communicate with the RN4678 via UART.

To interact directly with the RN4678 module, the following softwares are needed:

- Host PC supporting USB CDC virtual serial port
- Terminal Emulator Application
- TeraTerm or CoolTerm is recommended
- Microchip SmartDiscover App
- Available on AppStore® (for iOS) or Google Play™ Store (Android)

3.2 CONNECTING THE RN4678 PICtail/PICtail PLUS DAUGHTER BOARD TO A TERMINAL EMULATOR

To connect and program the RN4678 PICtail/PICtail Plus Daughter board via a terminal emulator, perform the following steps:

1. Ensure that all three pins in the DIP switch (SW4) are set to OFF position.
2. Press the SW button (SW1) to ON position.
3. Connect the RN4678 PICtail/PICtail Plus Daughter board to the host terminal via the mini USB cable.
4. Verify that the virtual COM port is enumerated on the PC. If the COM port does not enumerate, the MCP2200 drivers may be missing from the host PC. The drivers can be downloaded from the www.microchip.com/MCP2200 web page.
5. Press the Reset button (SW3) on the PICtail board. Verify that the blue LED (D1) flashes at a roughly two seconds intervals indicating that it is in Programming mode.
6. Start the Terminal Emulator software. In this example, TeraTerm is used.
   - Configure the serial port settings using the enumerated COM port as shown in Figure 3-1.
7. Enter Command mode by sending the command escape sequence $$$$.
The RN4678 PICtail/PICtail Plus Daughter board responds with CMD> prompt.
When interacting directly with the RN4678 PICtail/PICtail Plus Daughter board
using terminal emulator, enable local echo feature on the RN4678 PICtail/PICtail
Plus Daughter board to see the commands entered. Enter the + character on the
command prompt. The ECHO ON response is displayed as shown in Figure 3-2.
8. To display the basic configuration settings of the RN4678 module, enter letter D.

   Figure 3-3 shows the general response to command D. Refer to the “RN4678 Bluetooth® Dual Mode Module Command Reference User’s Guide” (DS50002506) for a detailed explanation of the commands.

   FIGURE 3-3: RESULTS OF COMMAND D.

   ![Figure 3-3: Results of Command D]

3.3 CHANGING MODULE SETTINGS VIA TERMINAL EMULATOR USING ASCII COMMANDS

   To change the settings of the RN4678 module, the Set commands are used. For more details of the available commands for the RN4678 module, refer to the “RN4678 Bluetooth® Dual Mode Module Command Reference User’s Guide” (DS50002506).

   When a central device scans for the module, the module (if advertising) shows up in the scan. Changing the name of the module using the SN command enables the user to customize the name of their module to make it more efficiently scanned and connected from a central device.

   To change the name of the module, perform the following steps:

   1. Connect the RN4678 PICtail/PICtail Plus Daughter board to the host PC via the USB port
   2. Using Terminal Emulator, open the COM port that is enumerated as the RN4678 module
   3. Type $$ to enter Command mode
   4. Enter + to turn on echo.
   5. Use the SN command to create a unique serialized name based on the Bluetooth (BT) address of the device
      - Type the command SN, MicrochipBLE and press enter. The module responds with AOK.
   6. Enter command R, 1 to reboot the module and enable the configurations set by the Set command to take effect
   7. After reboot, enter Command mode and type command D to check the name of the module. The output of the D command shows the changed name of the module. Figure 3-4 shows the steps.
3.4 CONNECTING THE RN4678 MODULE TO SMARTDISCOVER APP

The SmartDiscover App is an iOS Bluetooth Low Energy (BLE) application created by Microchip to evaluate BLE devices and modules. The App scans for any BLE devices in the vicinity and connects to it as instructed by the user. The App is available for free download from the AppStore® (for iOS).

To connect the RN4678 dual mode module to the SmartDiscover App in iOS, perform the following steps:

1. Connect the RN4678 PICtail/PICtail Plus Daughter board to the host PC and configure it according to the steps in Section 3.3 “Changing Module Settings via Terminal Emulator Using ASCII Commands”. The RN4678 module automatically starts its advertisement with a reboot.

2. In the iOS device, open the SmartDiscover App. The App scans for BLE devices in the vicinity.

3. Verify that the RN4678 device name, MicrochipBLE, is displayed. In this example, the device name is WSG_Chandler as shown in Figure 3.5.
4. Select the RN4678 device from the list to initiate a connection. Once connected, the App discovers the services provided by the module and lists them the subsequent page that is displayed. Figure 3-6 shows the App (iOS) connected to the RN4678 module and the GATT services discovered by the App on the RN4678.
5. The connection status is also sent by the RN4678 module and is echoed in TeraTerm as shown in Figure 3-7.

FIGURE 3-7: CONNECTION STATUS ECHOED BY THE RN4678 ON THE TERA TERM
3.5 CREATING SPP CONNECTION BETWEEN BLUETERM+ APP AND RN4678 MODULE IN BT CLASSIC MODE

In order to create a Serial Port Profile (SPP) connection between the RN4678 module and an Android App in BT Classic mode, download the BlueTerm+ App available in the Android App store and perform the following steps:

1. Connect the RN4678 PICtail/PICtail Plus Daughter board to the host PC and type $$$$ to enter Command mode.
2. Enter + to turn on echo.
3. In the Android device, open the Settings folder and click to open the Bluetooth settings.
4. In the Bluetooth folder, scan for Bluetooth devices and select the RN4678 module from the list. Accept the pairing request if needed. The RN4678 is now paired with the Android device.
5. Open the BlueTerm+ App in the Android device. Click on the menu icon at the bottom right to see the list of the available paired Bluetooth devices.
6. Select “Connect device” option and in the subsequent list of paired devices, select the RN4678 module. The module is now connected to the App. Both the connection confirmation and the opening of the Radio Frequency Communication (RFCOMM) session must echo in the terminal emulator connected to the RN4678 PICtail/PICtail Plus Daughter board as shown in Figure 3-8.

FIGURE 3-8: RFCOMM CONNECTION CONFIRMATION IN TERATERM

7. Once the RFCOMM communication is established, any text entered in the RN4678 (via terminal emulator) shows up in the BlueTerm+ App and vice versa. Figure 3-9 shows the snapshot of the BlueTerm+ App echoing the text entered in the terminal emulator.

FIGURE 3-9: BLUETERM+ APP WITH RFCOMM CONNECTION
3.6 CREATING A TRANSPARENT UART CONNECTION (DATA PIPE) BETWEEN IOS APP AND RN4678 MODULE IN BLE MODE

In order to demonstrate the Transparent UART connection between the RN4678 module and an iOS app, this demo uses the SmartData App. The SmartData App is an application created by Microchip available for free download from the AppStore (for iOS). The SmartData App enables the user to evaluate the features available in various dual mode and BLE products from Microchip.

To create a connection between the SmartData App and the RN4678 module, perform the following steps:

1. Connect the RN4678 PICtail/PICtail Plus Daughter board to the host PC and type $$\$$ to enter Command mode.
2. Open the SmartData App in iOS device. The app automatically starts scanning and displays the results of various BLE devices in the vicinity. Figure 3-10 shows the screenshot from the app during the BLE device scan.

3. Select the RN4678 module from the list (in this example, the device name is WSG_Chandler). The app initiates the connection and once connected, the app opens to a page which creates the data pipe based on the Transparent UART protocol. Figure 3-11 shows the screenshot with the RN4678 connected to the SmartData and the Transparent UART data pipe in operation.
FIGURE 3-11: RN4678 CONNECTED TO THE SMARTDATA APP AND THE TRANSPARENT UART DATA PIPE IN OPERATION
Appendix A. Updating the Firmware on the RN4678

A.1 INTRODUCTION

Firmware for the RN4678 PICtail/PICtail Plus Daughter board can be updated using a PC tool isupdate.exe over the USB port. The latest RN4678 PICtail/PICtail Plus Daughter board firmware files and the isupdate.exe tool are available for download from the product web page at www.microchip.com/RN4678.

To update the firmware on the RN4678 module, perform the following steps:

1. Download the firmware zip file from the product web page and extract the contents. The zip file contains the isupdate.exe utility and a folder including the latest firmware images.
2. Connect the PICtail to the host PC using the micro USB cable.
3. Set all three switches on the blue DIP switch (SW4) to ON position.
4. Click the Reset button and verify that the blue LED (D1) is flashing quickly.
5. Launch the isupdate.exe application:
   - Select the COM port enumerated by the RN4678 PICtail/PICtail Plus Daughter board.
   - Set the other fields in the first row (baudrate, timeout, Banks, FlashID) as shown in Figure A-1.
   - Click the Connect button.
6. Click Browse and select the location of the latest firmware files extracted from the zip file

7. Once the firmware files are selected, click on the Update button to start the update process. Figure A-1 shows the snapshot of the firmware update process.
Appendix B. Schematics and BOM

B.1 INTRODUCTION

This appendix provides the schematics and the Bill of Materials (BOM) for the RN4678 PICtail™/PICtail Plus Daughter Board:

- RN4678 PICtail/PICtail Plus Daughter Board Schematic
- RN4678 PICtail/PICtail Plus Daughter Board BOM
B.2 RN4678 PICtail/PICtail PLUS DAUGHTER BOARD SCHEMATIC

Figure B-1 shows the schematic for the RN4678 PICtail/PICtail Plus Daughter Board.

FIGURE B-1: RN4678 PICtail™/PICtail PLUS DAUGHTER BOARD SCHEMATIC

max-current: 250 mA

SW_BTN
Push-on: pin 2-3
Push-on: pin 1-2

WAKE-UP

EXTERNAL I2C

RESET

P24 OFF OFF ON
P26 OFF ON ON
### TABLE B-1: RN4678 PICtail™/PICtail PLUS DAUGHTER BOARD BOM

<table>
<thead>
<tr>
<th>Qty</th>
<th>Reference</th>
<th>Description</th>
<th>Manufacturer</th>
<th>Manufacturer Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C1</td>
<td>CAP CER 10uF 16V 10% X5R SMD 0805</td>
<td>Murata Electronics North America</td>
<td>GRM21BR61C106KE15L</td>
</tr>
<tr>
<td>6</td>
<td>C2, C3, C4, C5, C6, C12</td>
<td>CAP CER 1uF 16V 10% X7R SMD 0402</td>
<td>TDK Corporation</td>
<td>C1608X7R1C105K</td>
</tr>
<tr>
<td>2</td>
<td>C7, C9</td>
<td>CAP CER 12pF 50V 1% NP0 SMD 0402</td>
<td>Murata Electronics North America</td>
<td>GRM1555C1H120FA01D</td>
</tr>
<tr>
<td>3</td>
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### TABLE B-1: RN4678 PICtail™/PICtail PLUS DAUGHTER BOARD BOM (CONTINUED)

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<td>Tel: 480-792-7200</td>
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