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8-Bit Wireless Development Kit

User's Guide

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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 "DSXXXXXA", where "XXXXX" 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 on-line help. Select the Help menu, and then Topics to open a list of available on-line help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the 8-bit Wireless Development Kit User's Guide. Items discussed in this chapter include:

• Document Layout
• Conventions Used in this Guide
• Warranty Registration
• Recommended Reading
• The Microchip Web Site
• Development Systems Customer Change Notification Service
• Customer Support

DOCUMENT LAYOUT

This document describes how to use the 8-Bit Wireless Development kit to evaluate and experiment with Microchip wireless solutions. The manual layout is as follows:

• **Chapter 1. "Overview"**: This chapter describes the 8-bit Wireless Development Kit and how it works.
• **Chapter 2. "PIC18 Wireless Development Board"**: This chapter details the hardware information of the PIC18 Wireless Development Board.
• **Chapter 3. "Getting Started"**: This chapter describes what you need to know to start using the 8-bit Wireless Development Kit.
• **Chapter 4. "Additional Tutorials"**: This chapter provides additional tutorial programs that demonstrate the additional features of 8-bit Wireless Development Kit.
• **Appendix A. "PIC18 Wireless Development Board Schematic"**: This appendix provides the PCB layout, BOM and PIC18 Wireless Development Board schematics.

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
sArial font:		
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* 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	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
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'`
Italic Courier New	A variable argument	`file`.o, where `file` can be any valid filename
Square brackets []	Optional arguments	`mcc18 [options] file [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) {... }`

WARRANTY REGISTRATION

Please complete the enclosed Warranty Registration Card and mail it promptly. Sending in the Warranty Registration Card entitles users to receive new product updates. Interim software releases are available at the Microchip web site.

RECOMMENDED READING

This user's guide describes how to use 8-bit Wireless Development Kit User's Guide. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

Readme Files

For the latest information on using other tools, read the tool-specific Readme files in the Readmes subdirectory of the MPLAB IDE installation directory. The Readme files contain update information and known issues that may not be included in this user's guide.

THE MICROCHIP WEB SITE

Microchip provides online support via our web site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, 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 listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

DEVELOPMENT SYSTEMS CUSTOMER CHANGE NOTIFICATION SERVICE

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive email notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, access the Microchip web site at www.microchip.com, click on Customer Change Notification and follow the registration instructions.

The Development Systems product group categories are:

• **Compilers** – The latest information on Microchip C compilers and other language tools. These include the MPLAB C18 and MPLAB C30 C compilers; MPASM™ and MPLAB ASM30 assemblers; MPLINK™ and MPLAB LINK30 object linkers; and MPLIB™ and MPLAB LIB30 object librarians.

• **Emulators** – The latest information on Microchip in-circuit emulators.This includes the MPLAB ICE 2000 and MPLAB ICE 4000.

• **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debugger, MPLAB ICD 2.

• **MPLAB® IDE** – The latest information on Microchip MPLAB IDE, the Windows® Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB SIM simulator, MPLAB IDE Project Manager and general editing and debugging features.

• **Programmers** – The latest information on Microchip programmers. These include the MPLAB PM3 and PRO MATE® II device programmers and the PICSTART® Plus and PICkit™ 1 development programmers.

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 (March 2011)

This is the initial release of the document.

Revision B (January 2012)

This revision includes the following updates:

*   Added MRF89XAM8A868 MHz PICtail/PICtail Plus Daughter Boards or MRF89XAM9A915 MHz PICtail/PICtail Plus Daughter Boards in **1.3 "Wireless Daughter Boards"**
*   Added rows, MRF24J40MC and MRF89XAM9A PICtail/PICtail Plus Daughter Board, in **Table 1-1: "Compatible PICtail™ Daughter Boards"**
*   Added a new bullet in **3.3 "Demo Setup"**, **4.2.1 "Set up"**, **4.3.1 "Setup"**, **4.5.1 "Setup"**, **4.6.1 "Set up"**
*   Updated **4.3 "Network Freezer"**
*   Replaced all instances of MRF24J40MA Daughter Boards with Radio Daugher Boards

Chapter 1. Overview

1.1   INTRODUCTION

This chapter introduces the 8-Bit Wireless Development Kit features and its requirements.

The topics discussed in this chapter include:

• 8-Bit Wireless Development Kit Contents
• Wireless Daughter Boards
• 8-Bit Wireless Development Kit

1.2   8-BIT WIRELESS DEVELOPMENT KIT CONTENTS

The 8-Bit Wireless Development Kit contains the following items:

• Two PIC18 Wireless Development Boards with PIC18F46J50 XLP Microcontroller
• Two PICtail™/PICtail Plus Daughter Boards (See Table 1-1)
• Two LCD Serial Accessory Boards
• Two RS232 Serial Accessory Boards
• Two USB A to Mini-B 1 meter Cables
• Two RS232 Serial Cables

1.3   WIRELESS DAUGHTER BOARDS

The 8-Bit Wireless Development Kit, includes either MRF24J40MA 2.4 GHz IEEE 802.15.4 complaint PICtail/PICtail Plus Daughter Boards or MRF89XAM8A 868 MHz PICtail/PICtail Plus Daughter Boards or MRF89XAM9A 915 MHz PICtail/PICtail Plus Daughter Boards. The PIC18 Wireless Development Board is compatible with many other wireless PICtail daughter Boards. Table 1-1 lists the part number of the wireless PICtail daughter boards that are compatible with the PIC18 Wireless Development Board.

TABLE 1-1:   COMPATIBLE PICtail™ DAUGHTER BOARDS

Description	Part Number
MRF24J40MA PICtail/PICtail Plus Daughter Board	AC164134-1
MRF24J40MB PICtail/PICtail Plus Daughter Board	AC164134-2
MRF24J40MC Pictail/PICtail Plus Daughter Board	AC164134-3
MRF49XA PICtail Plus Daughter Board (433.92 MHz)	AC164137-1
MRF49XA PICtail Plus Daughter Board (868/915 MHz)	AC164137-2
MRF89XAM8A PICtail/PICtail Plus Daughter Board (868 MHz)	AC164138-1
MRF89XAM9A PICtail/PICtail Plus Daughter Board (915 MHz)	AC164138-2

The PIC18 Wireless Development Board provides PICtail connectivity, which is compatible with the existing and future radio and sensor daughter boards from Microchip. For more information on compatibility, refer to the Microchip website http://www.microchip.com/wireless

> **Note:** Individual Wireless PICtail Daughter Boards require .hex files for the specific RF transceiver. For more information, refer to the 8-Bit Wireless Development Kit product web page at http://www.microchip.com/wireless.

1.4   8-BIT WIRELESS DEVELOPMENT KIT

The Wireless Development Kit allows developers to evaluate and experiment with sub-GHz and 2.4 GHz RF solutions from Microchip. The Wireless Development Kit provides two RF hardware nodes which can be used to create a simple two-node wireless network. More nodes can be added by purchasing 8-Bit Wireless Development Kit or individual components.

The 8-Bit Wireless Development Kit is pre-programmed with a wireless demo program that allows multiple operational configurations to be tested without writing any firmware. For more information on how to operate the pre-programmed demo program and how to develop other applications, see **Chapter 3. "Getting Started"**. It also enables customer to evaluate Microchip's proprietary wireless stacks. The Microchip wireless stacks and additional application demo source codes can be downloaded from the Microchip web site http://www.microchip.com/wireless.

The PIC18 Wireless Development Board provides all the necessary components required to build an extreme low-power wireless sensor application. The Serial Accessory Port can interface external sensors or modules, like LCD Serial Accessory Board or RS232 Serial Accessory Board. The platform provides USB connectivity and supports different XLP microcontroller options.

Chapter 2. PIC18 Wireless Development Board

2.1   BOARD LAYOUT AND FEATURES

This chapter describes the PIC18 Wireless Development Board hardware. It also features the components shown in Figure 2-1.

FIGURE 2-1:   PIC18 WIRELESS DEVELOPMENT BOARD
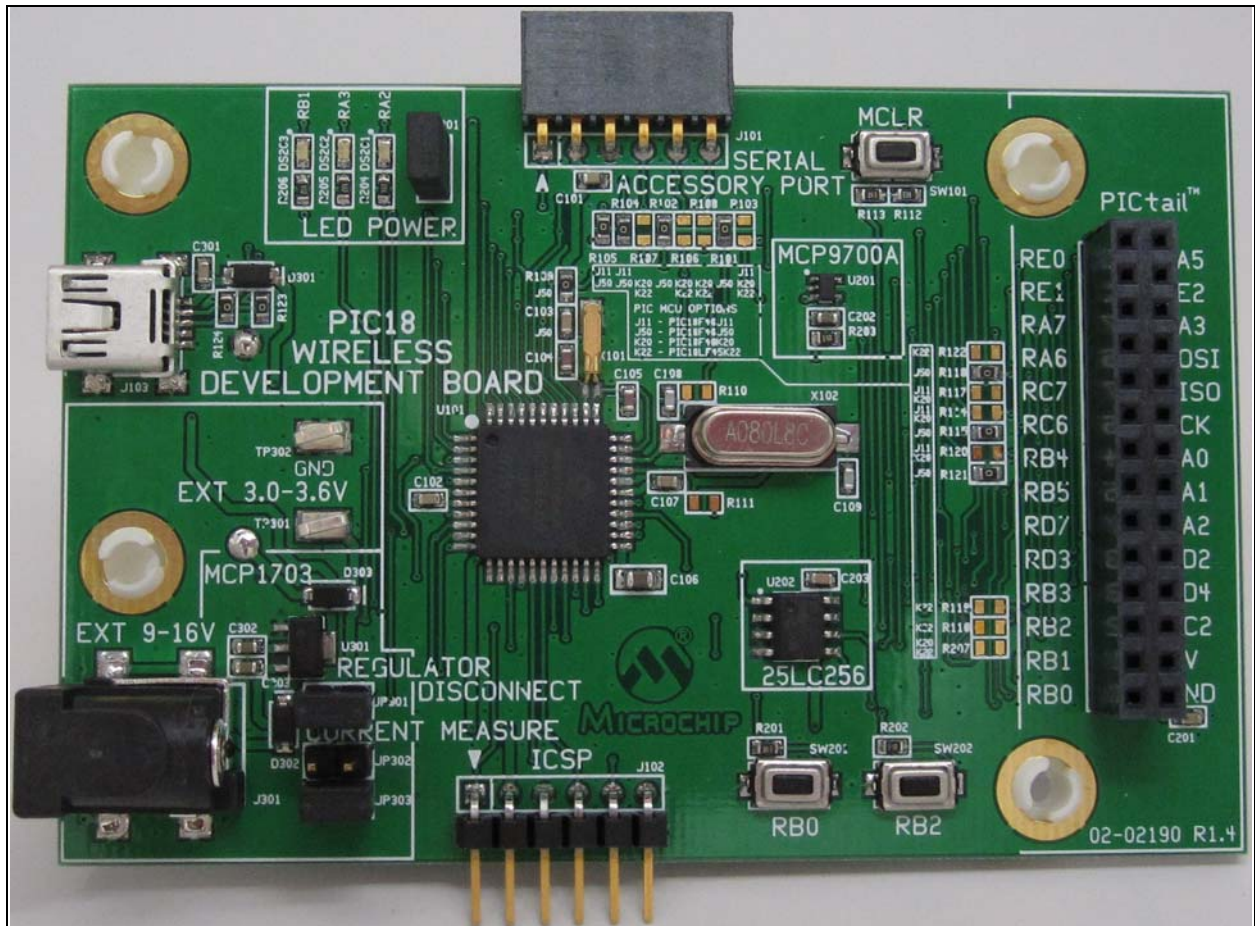
The PIC18 Wireless Development Board supports the XLP microcontroller options such as PIC18F46J11, PIC18F46J50, PIC18F46K20 and PIC18LF45K22.

The default microcontroller option is PIC18F46J50. Different microcontroller options require different components to populate on the PIC18 Wireless Development Board.

> **Note 1:** Missing components on the PIC18 Wireless Development Board does not indicate a defect. Population of these missing components depend on the Microcontroller being used. For more information about using different Microcontrollers, see the **Section A.2 "PIC18 Wireless Development Board Schematic"**.
>
> **2:** Take precautionary measure while changing the microcontroller option as improper tools or poor handling could harm the copper tracks on the surface of the Board, it might destroy it.

The following main blocks are defined on the Board:

• Serial Accessory Port
• USB Interface Port
• PICtail Port
• Push Buttons
• Onboard Temperature Sensor
• Onboard Serial EEPROM
• Debug LEDs
• Power Supply

2.1.1   Serial Accessory Port

Serial Accessory Port provides a simple serial interface for the external modules. These modules may be either external sensor or accessory board. For more information about existing accessory boards refer to the http://www.microchip.com or "*LCD Serial Accessory Board User's Guide*" (DS70650) or "*RS232 Serial Accessory Board User's Guide*" (DS70649).

The following interfaces are supported by the Serial Accessory Port:

• 3 or 4 wire SPI
• I^{2}C™
• USART

These interfaces are selected by the software without modifying the hardware. User should be attentive when different interfaces use the same hardware or share the same port pins of the microcontroller. For more information on the port pin assignment, see Figure A-1.

2.1.2   USB Interface Port

The PIC18F46J50 microcontroller provides USB v2.0 compliant full-speed Universal Serial Bus (USB) interface, which helps suppling power to the PIC18 Wireless Development Board. The relevant USB components are included with the PIC18F46J50 microcontroller option.

2.1.3   PICtail Port

PICtail Port is a 28-pin interface port that supports Microchip's RF based daughter cards. PICtail Port provides the following interfaces to the daughter cards:

• Power supply
• SPI interface
• Interrupt request lines

> **Note:** User must be careful about the PICtail port pins that share different functions of the board. The user needs to check the schematics before assigning functions for any port pins.

2.1.4   Push Buttons

PIC18 Wireless Development board contains two push buttons, RB0 and RB2. These buttons are assigned to the individual interrupt lines of the microcontroller and are not driven by external pull-up circuitry to save power consumption. The user software must enable the Port B pull-ups of the microcontroller before evaluating the button state. Example 2-1 illustrates a possible solution to evaluate the state of RB2.

EXAMPLE 2-1:   CODE EXAMPLE FOR EVALUATING THE STATE OF RB2

```
//Initialize RB2
TRISBbits.TRISB2 = 1;      // RB2 is an input
ANCON1 |= 0x01;            // RB2 is a digital pin

/*
   User code
*/

//Evaluating RB2
INTCON2bits.RBPU = 0;      // PortB pull ups are enabled
if (PORBbits.RB2 == 0)     // RB2 is pushed
{
    /*
       RB2 PB code...
    */
}
INTCON2bits.RBPU = 1;      // PortB pull ups are disabled
```

2.1.5   Onboard Temperature Sensor

The temperature sensor used is the Microchip's MC9700A, which is a low-power Linear Active Thermistor™ IC. To minimize power consumption, the sensor is powered from a port pin. After powering up, the sensor output can be measured after a minute. The internal AD converter of the microcontroller is used to measure the temperature value.

2.1.6   Onboard Serial EEPROM

The Onboard Serial EEPROM is a low-power, Microchip's 25LC256 256K SPI Bus Serial EEPROM, which shares the SPI interface with the PICtail port. But Onboard Serial EEPROM has its own active low chip select line connected to the RD5 port pin.

2.1.7   Debug LEDs

The PIC18 Wireless Development Board contains three LEDs for debug purposes. To conserve battery power, LEDs power can be disconnected by removing the JP201 and LED power jumper.

2.1.8   Power Supply

The board can be powered from any one of these sources:

• 2xAA onboard battery pack is available at the bottom of the PIC18 Wireless Development Board
• USB port
• External 9-16V charger power supply through the standard coaxial power connector
• External 3.0-3.6V power source through test points TP301 and TP302

USB Port and external coaxial port power are stabilized by MCP1703, 250 mA, 3.3V, low quiescent current LDO regulator. The battery operated applications that do not require LDO can be disconnected by removing the JP301, Regulator Disconnect jumper.

> **Note:**   The 9V wall adapter is not included in the kit. A 9V wall adapter may be ordered from http://www.microchipdirect.com/ . The part number of the 9V wall adapter is AC162039.

2.1.8.1   CURRENT CONSUMPTION MEASUREMENT

ThePIC18 Wireless Development Board contains two jumpers, JP302 and JP303, to measure the current consumption of the kit. These jumpers can measure current consumption of the entire kit without disturbing it.

Measuring the operational current:

1. Ensure that either JP302 or JP303, has one jumper connected to it. Only one jumper is required.
2. Connect the current meter to the jumper that is empty. Because the jumpers are electrically parallel, it can be either JP302 or JP303.
3. Set the current measure range of the current meter above 250 mA.
4. Remove the jumper.

> **Note:**   Some current meters set the measuring range automatically, which can cause interruptions in the power line while changing the range. If interruption in the power line occurs, use manual range settings.

Chapter 3.   Getting Started

3.1   INTRODUCTION

This chapter provides a tutorial to familiarize users with the 8-bit Wireless Development Kit. It also explains how to run the pre-programmed demo. The source code for the demo is available along with the MiWi[TM] stack. After unzipping the latest version of the MiWi stack, by default the file is saved at the following location `C:\Microchip Solutions\MiWi DE Demo\8-bit Wireless Development Kit – (Transciver)\8-bit WDK Demo`.

The demo programs use the MiWi Development Environment. For more information about MiWi, refer to www.microchip.com/MiWi.

> **Note:** To run the demo using the PIC18 Wireless out of the box demo boards, the user need not re-program them. Otherwise, the user needs to program this with the 8-bit WDK `Demo.hex` file.

The following topics are discussed in this chapter:

• Hardware Requirements
• Demo Setup
• Pre-programmed Tutorial Operation

3.2   HARDWARE REQUIREMENTS

The following hardwares are required to run the pre-programmed demo application:

• Two pre-programmed PIC18 Wireless Development Boards
• Two Radio Daughter Boards
• Two LCD Serial Accessory Boards
• Four fresh AA batteries or a two 9V external power supply or two USB cables

3.3   DEMO SETUP

This section demonstrates how to create a two node MiWi Wireless Network. Create a network using the two push buttons (RB0 and RB2) available on the PIC18 Wireless Development board (RB0 to create the network and RB2 to join the network). After setting up the network the nodes in the network read the temperature sensor (MCP9700A) and broadcast this information over the network.

Follow these steps to set up the 8-bit WDK demo:

1. Connect the LCD Serial Accessory board J1 port to the J101 connector on the PIC18 Wireless Development Board (See Figure 3-1).
2. Plug in the Radio PICtail Daughter board at slot J201 on the PIC18 Wireless Development Board.
3. To power using AA batteries, remove the jumper at JP301 (Regulator Disconnect). To power through 9V external power supply or USB, ensure JP301 is connected (jumper installed).
4. Insert a jumper at JP201 (LED power) on the PIC18 Wireless Development Board.

5. Ensure that the jumper is disconnected at JP1 position on the LCD Serial Accessory Board. This ensures that the LCD Serial Accessory Board is used in I^2C mode and not in SPI mode. The 8-bit WDK Demo program uses the LCD Serial Accessory board in I^2C mode.

6. Wireless demo board can be powered using any of these options:
    • Two AA Batteries
    • 9V External Power Supply
    • USB port
    • External 3.0-3.6V power source through test points TP301and TP302

7. Insert a jumper at either JP302 or JP303 (Current Measure) on the PIC18 Wireless Development Board.

FIGURE 3-1: **PIC18 WIRELESS DEVELOPMENT BOARD CONNECTED TO LCD SERIAL ACCESSORY BOARD AND MRF24J40MA PICTAIL DAUGHTER BOARD**
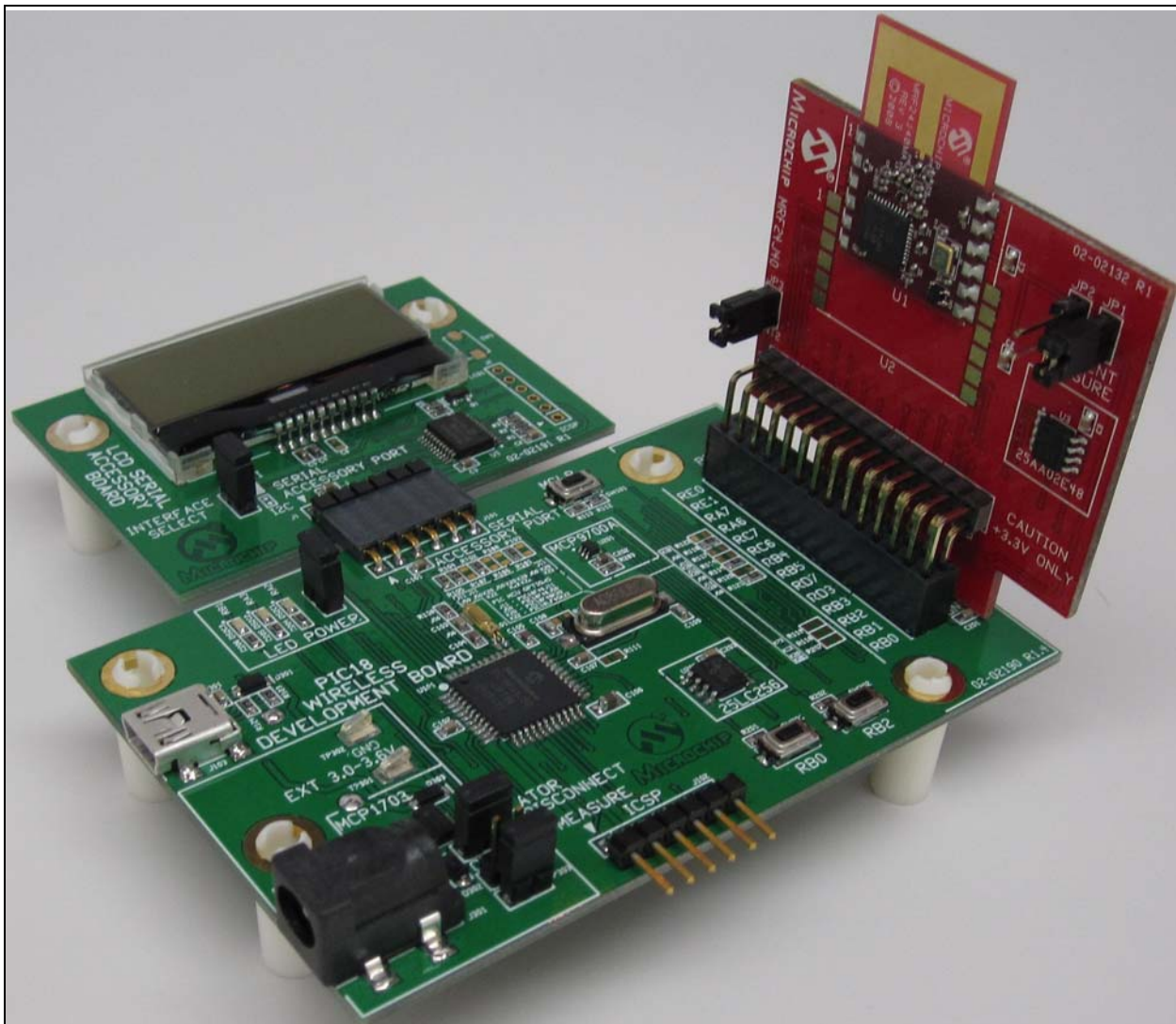
3.4 PRE-PROGRAMMED TUTORIAL OPERATION

The pre-programmed demo is used to demonstrate the basic concepts of the MiWi networking and also to demonstrate the features of the 8-bit Wireless Development Kit. Figure 3-2 illustrates the 8-bit Wireless Development Kit program flow.

FIGURE 3-2: **8-BIT WIRELESS DEVELOPMENT KIT DEMO PROGRAM**
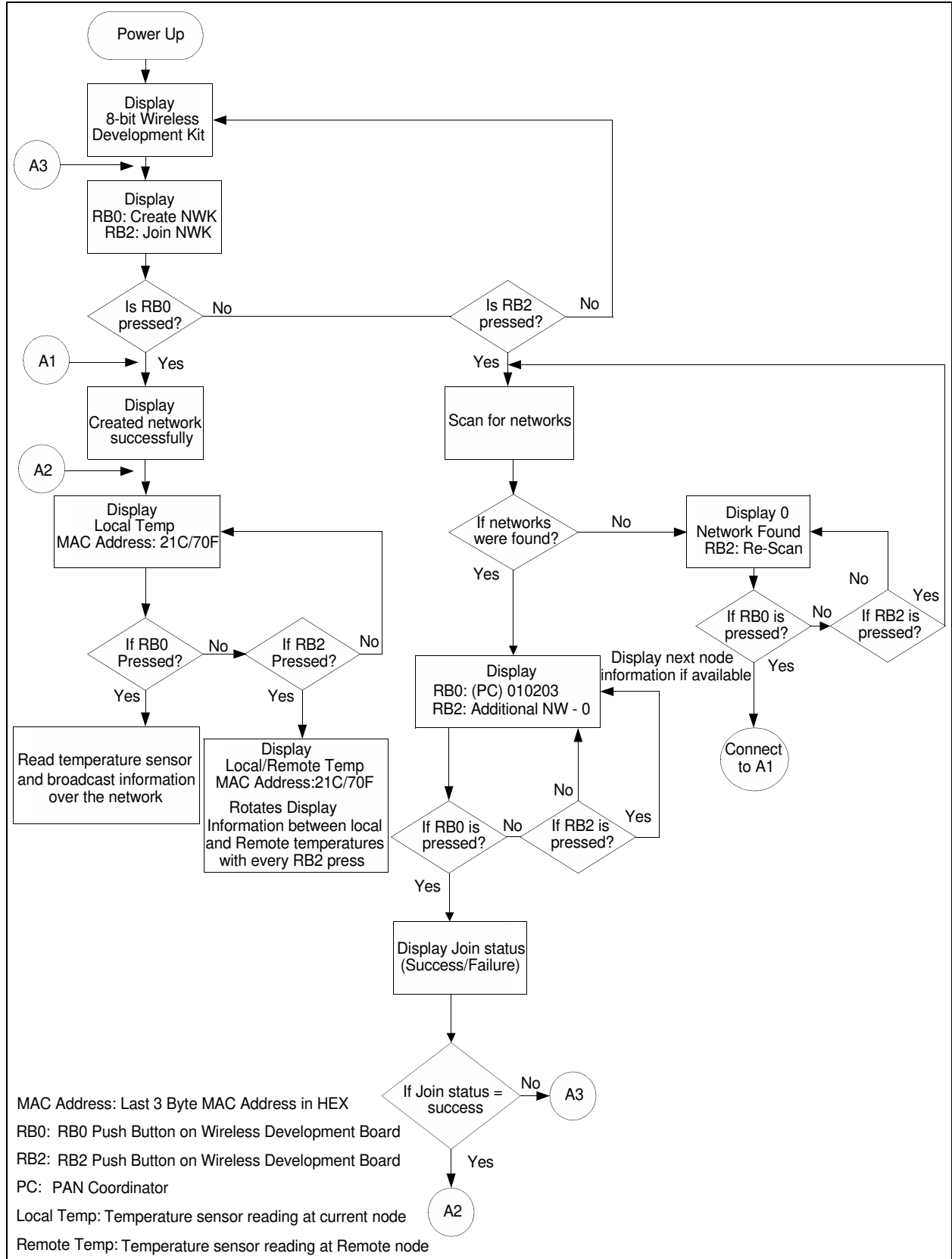
For more information on MiWi networking concepts, such as PAN Coordinator, Coordinator and RFD or End Device, refer to the application note, AN1066 *"Microchip MiWi Wireless Networking Protocol Stack"* (DS01066B).

This demo highlights the following features:

- Creating a MiWi Network
- MCP9700A Temperature Sensor
- MAC Address EEPROM on the Radio Daughter Boards
- LCD Serial Accessory Board

3.4.1   Creating a MiWi Network

3.4.1.1   TO CREATE A MiWi NETWORK

Follow these steps to create a MiWi Network:

1. Configure one node as PAN Coordinator ("Create NWK") and another as Coordinator ("Join NWK").
2. Use the Coordinator to join the PAN Coordinator, "8-bit Wireless Development Kit" message will be displayed on the LCD after powering the nodes. After a few seconds the display changes to:
   - RB0: Create NWK
   - RB2: Join NWK

3.4.1.1.1   To Configure the node as PAN Coordinator

Follow these steps to configure the node as PAN Coordinator

1. On one node press RB0 push button to create the network.

   After the node is configured as PAN Coordinator, "Created Network Successfully" message will be displayed on the LCD. After the device is configured as PAN Coordinator, it measures the temperature sensor for every 30 seconds   (the timer can be modified in the application) and updates the LCD with the temperature information in °C (Celsius) and °F (Fahrenheit). The last three bytes of the MAC address in HEX format are also displayed on the line two of the LCD:
   - Local Temp
   - 010203: 21C/ 70F

3.4.1.1.2   To Join the network as Coordinator

Follow these steps for joining the network as Coordinator

1. On the second node press RB2 push button to join the available networks. This initiates an active scan command. The available network information will be displayed on the LCD:
   - RB0: (PC) 010203
   - RB2: Addtnl NW-0
2. Press RB0 to join PAN Coordinator, with the address of 0x010203, created in the previous step.

   The LCD displays "Joined Network Successfully" message. After the node is successfully joined the PAN Coordinator, it measures the temperature sensor for every 30 seconds and broadcasts the information over the network along with its MAC Address. The LCD is also updated with the temperature sensor reading:
   - Local Temp
   - F1F2F3: 20°C/ 68°F

3. Press RB2 push button to display the remote temperature (PAN Coordinator):
   • Remote Temp
   • 010203: 21°C/ 70°F

3.4.2   MCP9700A Temperature Sensor

This demo uses the on-board MCP9700A Temperature Sensor. The readings are noted every 30 seconds and the information is broadcasted in the network. Both the nodes store the local and remote temperature data and display it on the LCD.

To re-measure the temperature value, press RB0 push button on the PIC18 Wireless Development Board. This also initiates the broadcast message to all the nodes in the network. To scroll through the rotating display of local temperature and remote temperature, use RB2 push button on the PIC18 Wireless Development Board. The two node network can also be expanded to a multi-node network, for more information, see tutorial in **Section 4.7 "8-bit Wireless Development Kit with Additional Nodes"**.

3.4.3   MAC Address EEPROM on Radio Daughter Boards

All the Radio daughter cards have a MAC Address EEPROM. The 6 byte MAC Address in this EEPROM is used for the addressing scheme in MiWi.

3.4.4   LCD Serial Accessory Board

The LCD Serial Accessory board can be used either in the SPI mode or I^{2}C mode. This demo uses the LCD Serial Accessory Board in I^{2}C mode. The demo uses manual backlight mode versus the automatic backlight mode. With the manual backlight mode, the power consumption can be kept to the minimum.

NOTES:

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Chapter 4. Additional Tutorials

4.1 INTRODUCTION

This chapter covers the additional tutorial programs for the 8-bit Wireless Development Kit.

> **Note:** To run few tutorials in this chapter, users must program the PIC18 Wireless Development Board with new `.hex` files. To program the PIC18 Wireless Development board, use either ICD3 or REAL ICE or PICKit™ 3 programmers. If using MPLAB® ICD3 or MPLAB REAL ICE, use AC164110 adapter board. For more information, refer to the tools User's Guides, "*MPLAB® ICD 3 In-Circuit Debugger User's Guide*" (DS51766B), "*MPLAB REAL ICE In-Circuit Emulator User's Guide*" (DS51616C) and "*PICKit 3 Programmer/Debugger User's Guide*" (DS51795).

The following tutorials are discussed in this chapter:

• Extended 8-bit WDK Demo with Hyper-Terminal Program
• Network Freezer
• RFD Device demonstrating Sleep Capability
• Chat Window Demo
• Ping-Pong Demo
• 8-Bit WDK Demo with Additional Nodes.

4.2 EXTENDED 8-BIT WDK DEMO WITH HYPER-TERMINAL PROGRAM

This tutorial demonstrates how to extend the functionality of the pre-programmed demo using the RS232 Serial Accessory Board. Using the hyper terminal program, users can view the connection status, battery status and recorded temperature sensor readings of the node. This demo uses the RS232 Serial Accessory Board to communicate with the PC.

To run this tutorial, no need to re-program the PIC18 Wireless Development Board, instead, a pre-programmed `8-bit WDK Demo.hex` file can be used.

The following hardwares are required to run this tutorial:

• Two pre-programmed PIC18 Wireless Development Boards
• Two Radio Daughter Boards
• Two LCD Serial Accessory Boards
• Two RS232 Serial Accessory Boards
• Four fresh AA batteries or a Two 9V External Power Supply or two USB cables
• Two RS232 to USB adapter (if required)
• Computer with a terminal program

The following are the connection settings for terminal program:

- Baud Rate: 19200 kbps
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None

4.2.1   Set up

Follow these steps to set up the extended 8-bit Wireless Development Kit demo:

1. Connect the LCD Serial Accessory Board J1 port to the J2 or J3 I^{2}C port of the RS232 Serial Accessory Board (see Figure 4-1).
2. Connect the J1 port on the RS232 Serial Accessory Board to the J101 connector on the PIC18 Wireless Development Board.
3. Plug in the Radio PICtail Daughter board at slot J201 on the PIC18 Wireless Development Board.
4. To power from an external power source (9V or USB), insert a jumper at JP301 (Regulator Disconnect) on the PIC18 Wireless Development Board. To power from batteries, remove the jumper at JP301.
5. Insert a jumper at JP201 (LED power) on the PIC18 Wireless Development Board.
6. Ensure that the jumper is disconnected at the JP1 position on the LCD Serial Accessory Board. This ensures that the LCD Serial Accessory Board is used in I^{2}C mode and not in SPI mode. The 8-bit WDK demo uses the LCD Serial Accessory board in I^{2}C mode.
7. Wireless demo board can be powered using any one of these options:
    - Two AA batteries
    - 9V external power supply
    - USB port
    - External 3.0-3.6V power source through test points TP301and TP302
8. Insert a jumper at either JP302 or JP303 (Current Measure) on the PIC18 Wireless Development Board.
9. Connect a RS232 cable between the RS232 Port on RS232 Serial Accessory Board and the PAN Coordinator (PC).
10. Run the terminal program from the PC with the previous settings.

> **Note:**   Windows 98 or Windows XP operating systems (OS) users can use the hyper-terminal program, and Windows 7 or any other OS users can download other terminal software programs from the web.

FIGURE 4-1:   **CONNECTING RS232 SERIAL ACCESSORY BOARD**
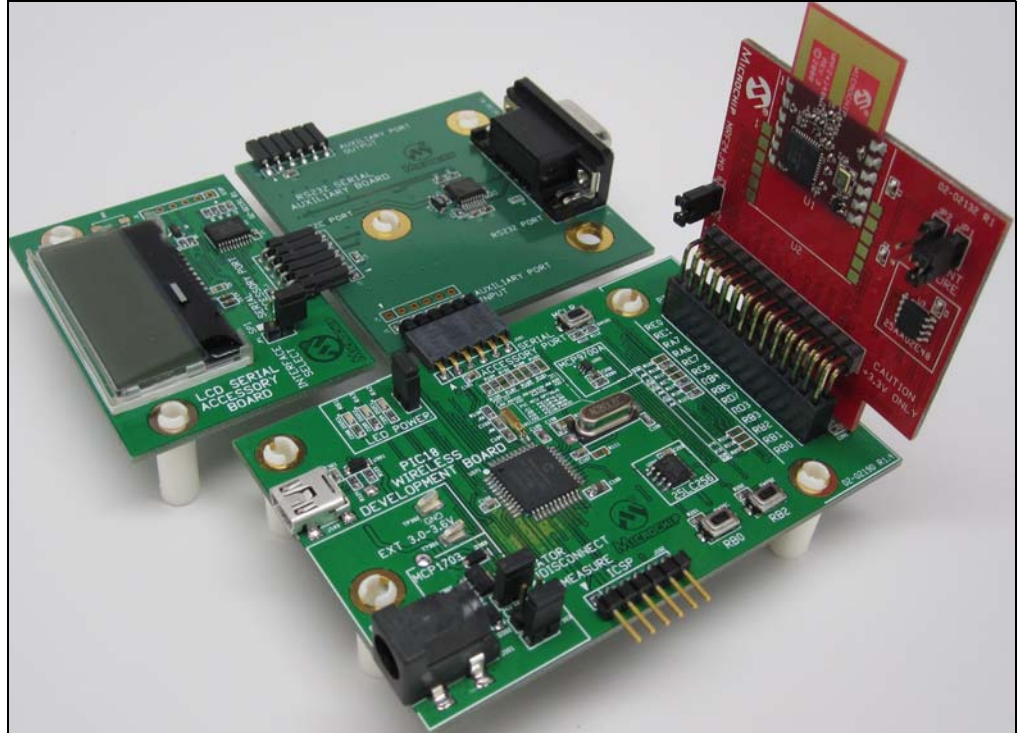
4.2.2   Tutorial Operation

To use the demo program, set up the nodes as described in
Section 3.4 "Pre-programmed Tutorial Operation".

4.2.2.1   USING THE HYPER-TERMINAL PROGRAM:

Follow these steps to use the hyper-terminal program:

1. Press 'Esc' key from the hyper-terminal program to switch to an interactive mode. The interactive mode provides these extended features:
   - Displays connection status: In this mode, the node displays the parent-child information.
   - Displays battery status: This mode can be used to estimate the duration of the battery lasts for that node.
   - Displays node's temperature sensor readings: In this mode, the node displays the previous 20 temperature sensor readings on the screen.
   - Scrolling display of all the node's temperature sensor readings: In this mode, the node displays the local and remote temperatures for every 30 seconds.
2. Press "Ctrl+Z" to exit from the interactive mode.

4.3   NETWORK FREEZER

The tutorial demonstrates the Network Freezer mode available in the MiWi stack. Network Freezer mode enables the device to save network setup time. After a network is established, if the network is powered down for any reason, the network freezer option aids in recovering the network to the original state.

To simulate the power down, use $\overline{\text{MCLR}}$ and RB2 push buttons together. For more information about Network Freezer mode, refer to the Application Note, AN1284 *Microchip Wireless (MiWi™) Application Programming Interface* (DS01284A).