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ZENA™ Wireless Adapter User's Guide

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ZENA™ WIRELESS ADAPTER USER'S GUIDE

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NOTES:

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 “DSXXXXA”, where “XXXX” 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 ZENA™ Wireless Adapter. 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 Revision History](#)

DOCUMENT LAYOUT

This document describes how to use the ZENA Wireless Adapter. The manual layout is as follows:

- **Chapter 1. “Overview”** – This chapter provides a brief overview of the ZENA Wireless Adapter, including kit contents and features.
- **Chapter 2. “Getting Started”** – This chapter describes how to start using your ZENA Wireless Adapter.
- **Appendix A. “ZENA™ Wireless Adapter Construction Details”** – This appendix contains the schematics, PCB layout and Bill of Materials (BOM).

CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
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
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	<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) { ... }

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 the ZENA Wireless Adapter. The following Microchip documents are available from the Microchip web site (www.microchip.com), and are recommended as supplemental reference resources.

MRF24J40MA 2.4 GHz IEEE Std. 802.15.4 RF Transceiver Module Data Sheet (DS70329)

MRF89XAM8A 868 MHz Ultra-Low Power Sub-GHz Transceiver Module Data Sheet (DS70651)

MRF89XAM9A 915 MHz Ultra-Low Power Sub-GHz Transceiver Module Data Sheet (DS75017)

PIC18F46J50 USB Microcontroller Data Sheet (DS39931)

MCP1700 Low Quiescent Current LDO Data Sheet (DS21826)

25LC256 256K SPI Bus Serial EEPROM Data Sheet (DS21822)

2K SPI Bus Serial EEPROM with EUI-48™ Node Identity Data Sheet (DS22123)

THE MICROCHIP WEB SITE

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- **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

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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 (June 2011)

- This is the initial released version of the document.

Revision B (January 2012)

This revision incorporates the following updates:

- Preface:
 - Updated **“Recommended Reading”**
- Chapters:
 - Updated **Table 1-1** in **Chapter 1. “Overview”**
 - Updated the title for **Figure 1-1** in **Chapter 1. “Overview”**
 - Removed the note in **2.2.2 “Installing USB Drivers”**
 - Updated the first paragraph in **2.2.2.1 “Installing the USB Driver for Windows® 2000/XP/Vista/7 OSs”**
 - Updated step 3 and step 4 in **2.2.2.1 “Installing the USB Driver for Windows® 2000/XP/Vista/7 OSs”**
 - Replaced the figure in **Figure 2-5**
 - Replaced the figure in **Figure 2-6**
 - Updated the title for **Figure A-1** in **Appendix A. “ZENA™ Wireless Adapter Construction Details”**
 - Updated the title for **Figure A-2** in **Appendix A. “ZENA™ Wireless Adapter Construction Details”**
 - Added **Figure A-2** in **Appendix A. “ZENA™ Wireless Adapter Construction Details”**
- Minor updates related to formatting and text have been incorporated throughout the document

NOTES:

Chapter 1. Overview

1.1 INTRODUCTION

The ZENA Wireless Adapter is a multi-function USB wireless adapter connecting USB-equipped desktop or notebook computers with Microchip wireless products for development or application uses. As a development tool, the ZENA Wireless Adapter can be used as a protocol analyzer or as a diagnostic tool. It can also be used to connect the computer as a wireless node to the network for application uses. The ZENA Wireless Adapter is capable of performing a variety of functions and each function can be programmed into the adapter using the built in USB boot loader.

Additional software and firmware updates can be downloaded from the Microchip web site: <http://www.microchip.com/zena>.

This chapter discusses:

- [ZENA Wireless Adapter Package Contents](#)
- [ZENA Wireless Adapter Description](#)
- [Regulatory Statements](#)

1.2 ZENA WIRELESS ADAPTER PACKAGE CONTENTS

Depending on the frequency and device type ZENA Wireless Adapter ordered, the package may contain one of the following listed in [Table 1-1](#).

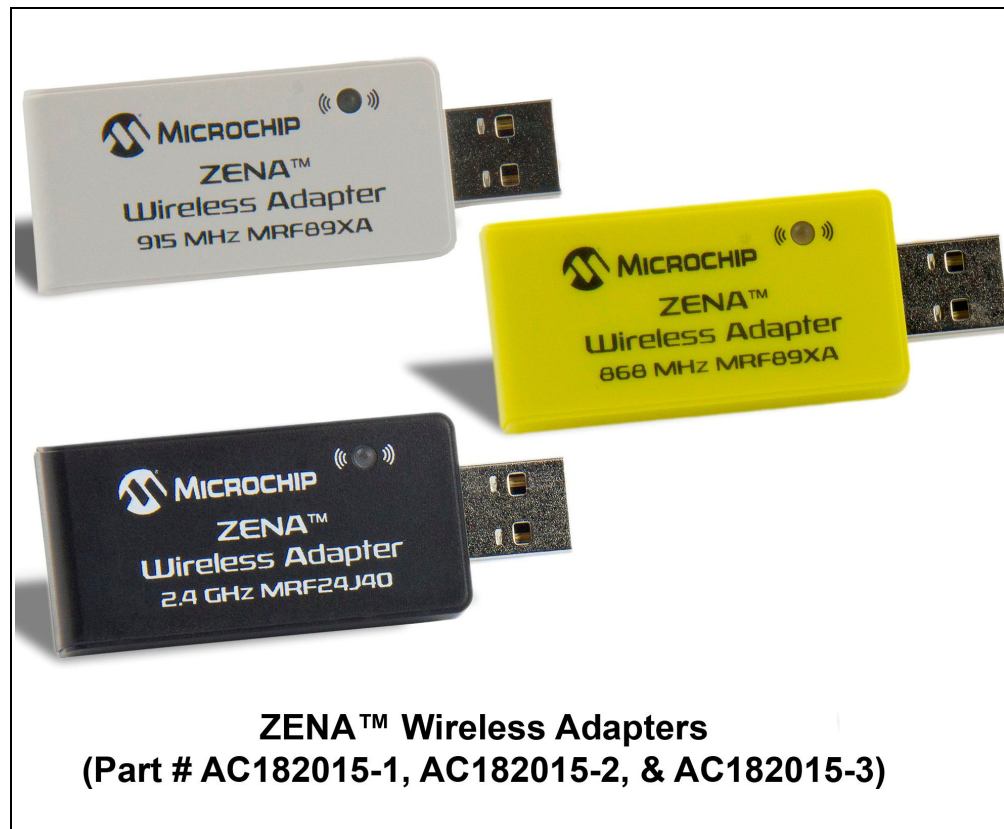
TABLE 1-1: ZENA™ WIRELESS ADAPTER

Description	Part Number
ZENA™ Wireless Adapter – 2.4 GHz MRF24J40	AC182015-1
ZENA Wireless Adapter – 868 MHz MRF89XA	AC182015-2
ZENA Wireless Adapter – 915 MHz MRF89XA	AC182015-3

1.3 ZENA WIRELESS ADAPTER DESCRIPTION

The ZENA Wireless Adapters are shown in [Figure 1-1](#).

FIGURE 1-1: ZENA™ WIRELESS ADAPTERS



The ZENA Wireless Adapter plugs into the computers USB slot either directly or using an extension cable. The LED indicates operation status.

1.4 REGULATORY STATEMENTS

1.4.1 United States

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment OFF and ON. The user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

1.4.2 Canada

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

NOTES:

Chapter 2. Getting Started

2.1 INTRODUCTION

The ZENA Wireless Adapter is a flexible, multipurpose device. Firmware applications can be updated from a computer application program such as the Wireless Development Studio.

The ZENA Wireless Adapter is pre-programmed with a MiWi™ Wireless Protocol Sniffer application. This allows the user to display MiWi Wireless Protocol packets in a graphical format in the Wireless Development Studio.

ZENA Wireless Adapter software and firmware updates can be downloaded from the Microchip web site <http://www.microchip.com/zena>.

2.2 INSTALLATION

2.2.1 Installing the Wireless Development Studio

The Wireless Development Studio can be downloaded from the Microchip web site: <http://www.microchip.com/wds>. Install the program following the installation instructions that come with the package.

2.2.2 Installing USB Drivers

The ZENA Wireless Adapter has been designed to communicate with the Microchip MPLABComm driver which is based on the libusb-win32 (for Windows) and libusb (for Mac and Linux operating systems) libraries. The USB Drivers come with the Wireless Development Studio. To install the USB drivers, follow the sections below for the operating system of choice.

2.2.2.1 INSTALLING THE USB DRIVER FOR WINDOWS® 2000/XP/VISTA/7 OSs

To Install the USB Driver for windows, perform the following tasks:

Note: In the following screenshots, we have used ZENA Wireless Adapter – 2.4 GHz MRF24J40. The same set of sequence is applicable for ZENA Wireless Adapter – 868 MHz MRF89XA and ZENA Wireless Adapter – 915 MHz MRF89XA.

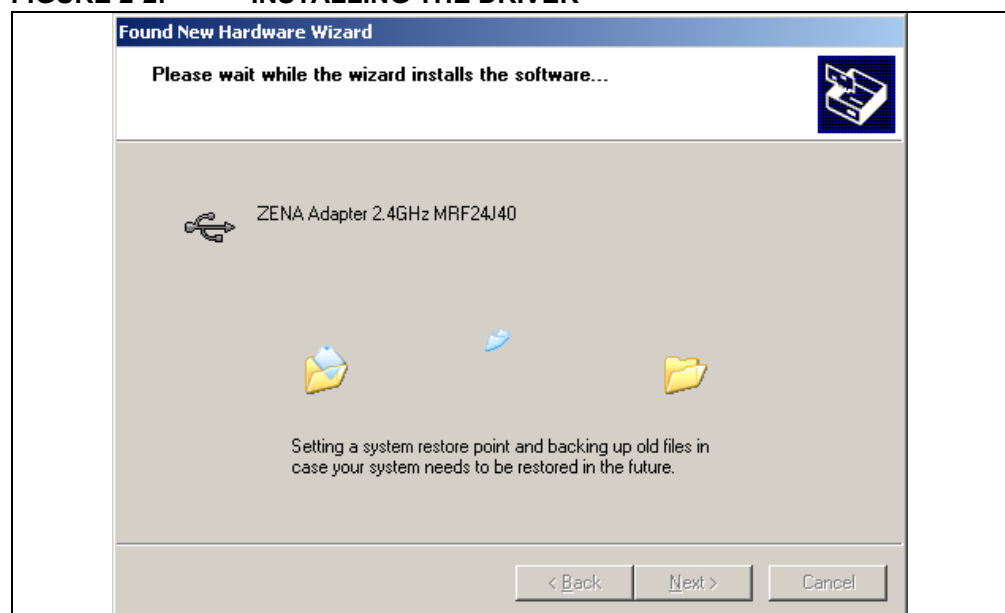
1. Plug in the ZENA Wireless Adapter into a USB port. Windows will prompt for a hardware installation as shown in [Figure 2-1](#).

FIGURE 2-1: FOUND NEW HARDWARE WIZARD WINDOW



2. Select *Install the software automatically (Recommended)* and then click *Next*. Windows will search and install the driver automatically as shown in [Figure 2-2](#).

FIGURE 2-2: INSTALLING THE DRIVER

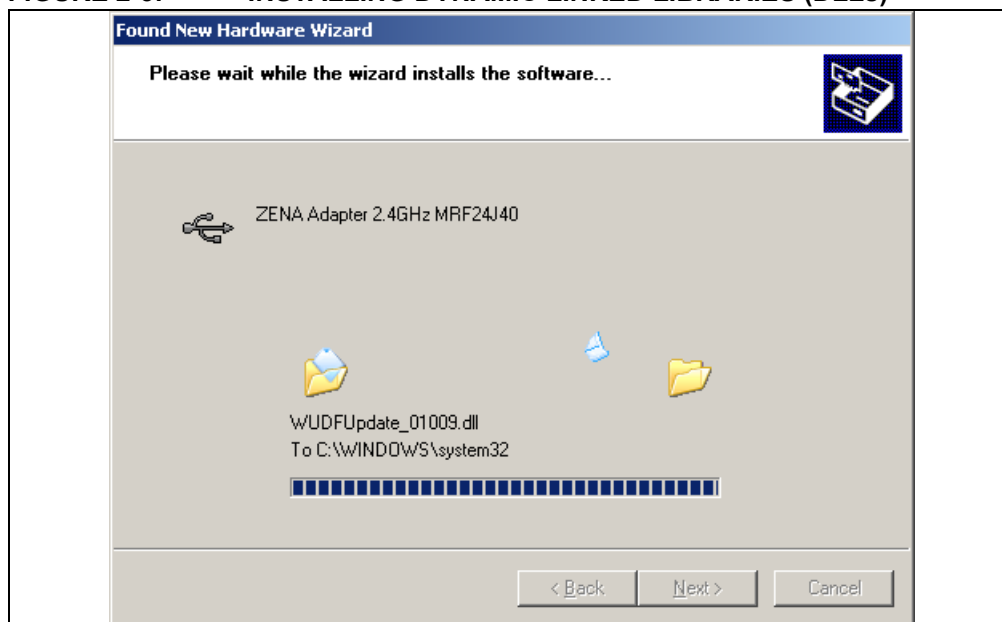


3. If Windows is unable to find the hardware for the device, then click Back and select Install from a list or specific location (Advanced).
 - a) The driver for ZENA Wireless Adapter – 2.4 GHz MRF24J40 is located in the “Wireless Development Studio\Driver and Inf\ZENA Wireless Adapter 2.4 GHz MRF24J40\” folder.

Note: Default installation location for WDS on Windows is C:\Program Files\Microchip\

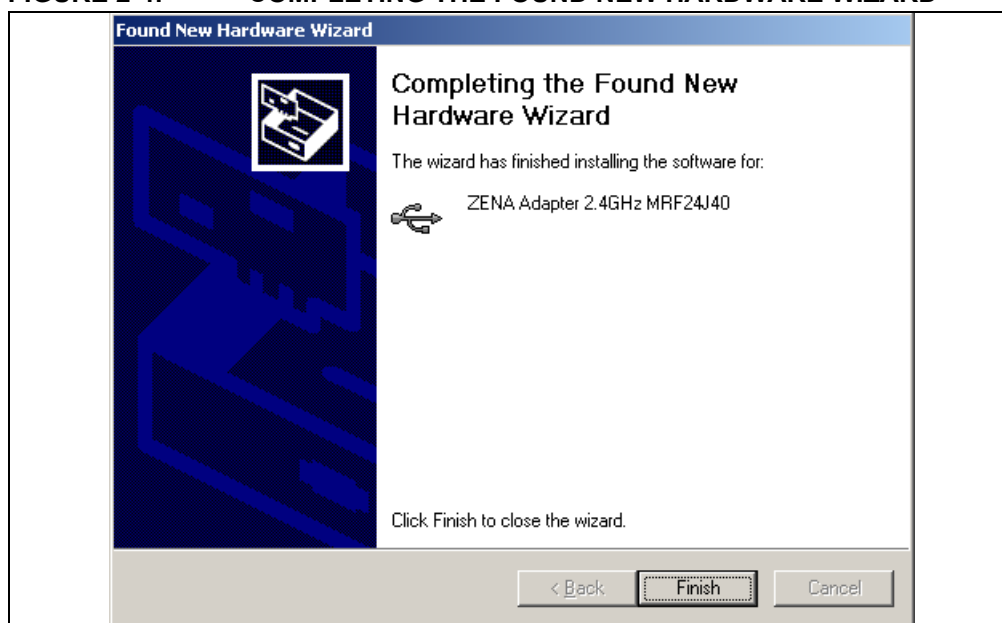
- b) The driver for ZENA Wireless Adapter – 868 MHz MRF89XA is located in the “Wireless Development Studio\Driver and Inf\ZENA Wireless Adapter 868 MHz MRF89XA\” folder.
 - c) The driver for ZENA Wireless Adapter – 915 MHz MRF89XA is located in the “Wireless Development Studio\Driver and Inf\ZENA Wireless Adapter 915 MHz MRF89XA\” folder.
4. After installing the driver, if Windows prompts the following Dynamic Linked Libraries (DLLs): WinUSBCoInstaller2.dll, WdfCoInstaller01009.dll and WUDFUpdate_01009.dll as shown in [Figure 2-3](#):
 - a) If installing in a Windows 32-bit system, point the folder location to “Wireless Development Studio\Driver and Inf\ZENA Wireless Adapter 2.4 GHz MRF24J40\i386\”
(or)
“Wireless Development Studio\Driver and Inf\ZENA Wireless Adapter 868 MHz MRF89XA\i386\”
(or)
“Wireless Development Studio\Driver and Inf\ZENA Wireless Adapter 915 MHz MRF89XA\i386\”
 - b) If installing in a Windows 64-bit system, point the folder location to “Wireless Development Studio\Driver and Inf\ZENA Wireless Adapter 2.4 GHz MRF24J40\amd64\”
(or)
“Wireless Development Studio\Driver and Inf\ZENA Wireless Adapter 868 MHz MRF89XA\amd64\”
(or)
“Wireless Development Studio\Driver and Inf\ZENA Wireless Adapter 915 MHz MRF89XA\amd64\”

FIGURE 2-3: INSTALLING DYNAMIC LINKED LIBRARIES (DLLs)



5. After installing the driver and DLLs, the Completing the Found New Hardware Wizard appears on the screen as shown in [Figure 2-4](#).
6. Click Finish to complete the installation.

FIGURE 2-4: COMPLETING THE FOUND NEW HARDWARE WIZARD



2.2.2.2 INSTALLING THE USB DRIVER FOR MAC OR LINUX OSs

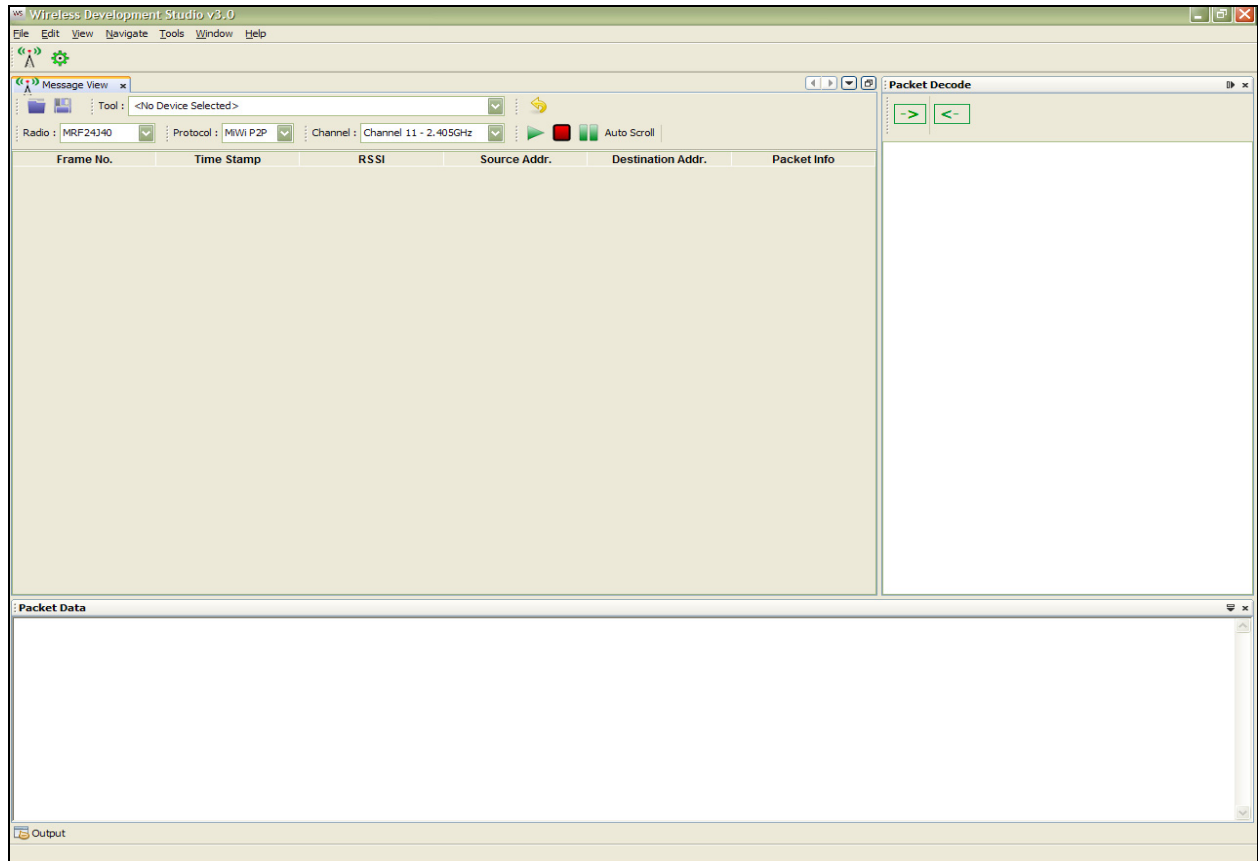
The ZENA Wireless Adapter uses the libUSB drivers. When installing the USB drivers on a Mac or Linux computer, the installer will place the USB drivers in the proper location.

2.3 USING ZENA WIRELESS ADAPTER WITH THE WIRELESS DEVELOPMENT STUDIO

To use the ZENA Wireless Adapter with the Wireless Development Studio, it must first be selected as the source device by performing the following tasks:

1. From the main window, select Sniffer as the active application, see [Figure 2-5](#).
The Packet List window will appear.

FIGURE 2-5: SNIFFER APPLICATION SELECTION



- From the Packet List window, select ZENA Wireless Adapter from the Source drop-down box, see Figure 2-6.

FIGURE 2-6: WIRELESS DEVELOPMENT STUDIO SELECTION

Wireless Development Studio v3.0

File Edit View Navigate Tools Window Help

Message View x

Tool: ZENA Adapter 2.4GHz MRF24J40 : ?

Radio: MRF24J40 Protocol: MiWi P2P Channel: Channel 26 - 2.480GHz Auto Scroll FW Ver: 2.5.3

Frame No.	Time Stamp	RSSI	Source Addr.	Destination Addr.	Packet Info
1	+ 909688020 us	254	0x1122334455667702	0xffff	MiWi P2P Command : P2P Connection Request
2	+ 87109021 us	185	0x1122334455667701	0xffff	MiWi P2P Command : P2P Connection Request
3	+ 949876 us	205	0x1122334455667701	0x1122334455667702	MiWi P2P Command : P2P Connection Response
4	+ 126736 us	205			Acknowledgment; Sequence Number - 0x02
5	+ 687991 us	254	0x1122334455667702	0x1122334455667701	MiWi P2P Command : P2P Connection Response
6	+ 102001 us	254			Acknowledgment; Sequence Number - 0x02
7	+ 1797361890 us	212	0x1122334455667701	0x1122334455667702	Data; Encrypted Payload
8	+ 102766 us	212			Acknowledgment; Sequence Number - 0x03
9	+ 81747901 us	207	0x1122334455667701	0x1122334455667702	Data; Encrypted Payload
10	+ 126226 us	207			Acknowledgment; Sequence Number - 0x04
11	+ 73917106 us	198	0x1122334455667701	0x1122334455667702	Data; Encrypted Payload
12	+ 73907927 us	187	0x1122334455667701	0x1122334455667702	Data; Encrypted Payload
13	+ 125971 us	187			Acknowledgment; Sequence Number - 0x06
14	+ 69125656 us	202	0x1122334455667701	0x1122334455667702	Data; Encrypted Payload
15	+ 102766 us	202			Acknowledgment; Sequence Number - 0x07
16	+ 143519356 us	202	0x1122334455667701	0x1122334455667702	Data; Encrypted Payload
17	+ 102256 us	202			Acknowledgment; Sequence Number - 0x08
18	+ 72911131 us	211	0x1122334455667701	0x1122334455667702	Data; Encrypted Payload
19	+ 126481 us	211			Acknowledgment; Sequence Number - 0x09
20	+ 117443056 us	201	0x1122334455667701	0x1122334455667702	Data; Encrypted Payload
21	+ 102001 us	201			Acknowledgment; Sequence Number - 0x0a
22	+ 73453261 us	211	0x1122334455667701	0x1122334455667702	Data; Encrypted Payload
23	+ 102766 us	211			Acknowledgment; Sequence Number - 0x0b
24	+ 69855211 us	212	0x1122334455667701	0x1122334455667702	Data; Encrypted Payload
25	+ 102001 us	212			Acknowledgment; Sequence Number - 0x0c
26	+ 249887506 us	201	0x1122334455667701	0xffff	Data
27	+ 122298001 us	206	0x1122334455667701	0xffff	Data
28	+ 88725211 us	200	0x1122334455667701	0xffff	Data
29	+ 92326831 us	209	0x1122334455667701	0xffff	Data
30	+ 190310837 us	203	0x1122334455667701	0x1122334455667702	Data; Encrypted Payload
31	+ 126481 us	203			Acknowledgment; Sequence Number - 0x11
32	+ 73180156 us	211	0x1122334455667701	0x1122334455667702	Data; Encrypted Payload

Packet Data

0000: 63 cc 02 34 12 01 77 66 55 44 33 22 11 02 77 66 c..4..wfUD3"..wf

0010: 55 44 33 22 11 91 00 09 02 40 5b 72 fe UD3".....@lr.

Note: If multiple ZENA Wireless Adapters are plugged in, they can be individually chosen by serial number.

For more information on running the Wireless Development Studio, see the Wireless Development Studio help.



ZENA™ WIRELESS ADAPTER USER'S GUIDE

Appendix A. ZENA™ Wireless Adapter Construction Details

A.1 INTRODUCTION

This appendix provides the ZENA Wireless Adapter schematics, PCB layout and Bill of Materials (BOM).

A.2 ZENA WIRELESS ADAPTER SCHEMATIC

[Figure A-1](#) and [Figure A-2](#) illustrate the ZENA Wireless Adapter schematics.

FIGURE A-1: ZENA™ WIRELESS ADAPTER – SCHEMATIC (SHEET 1 OF 2)

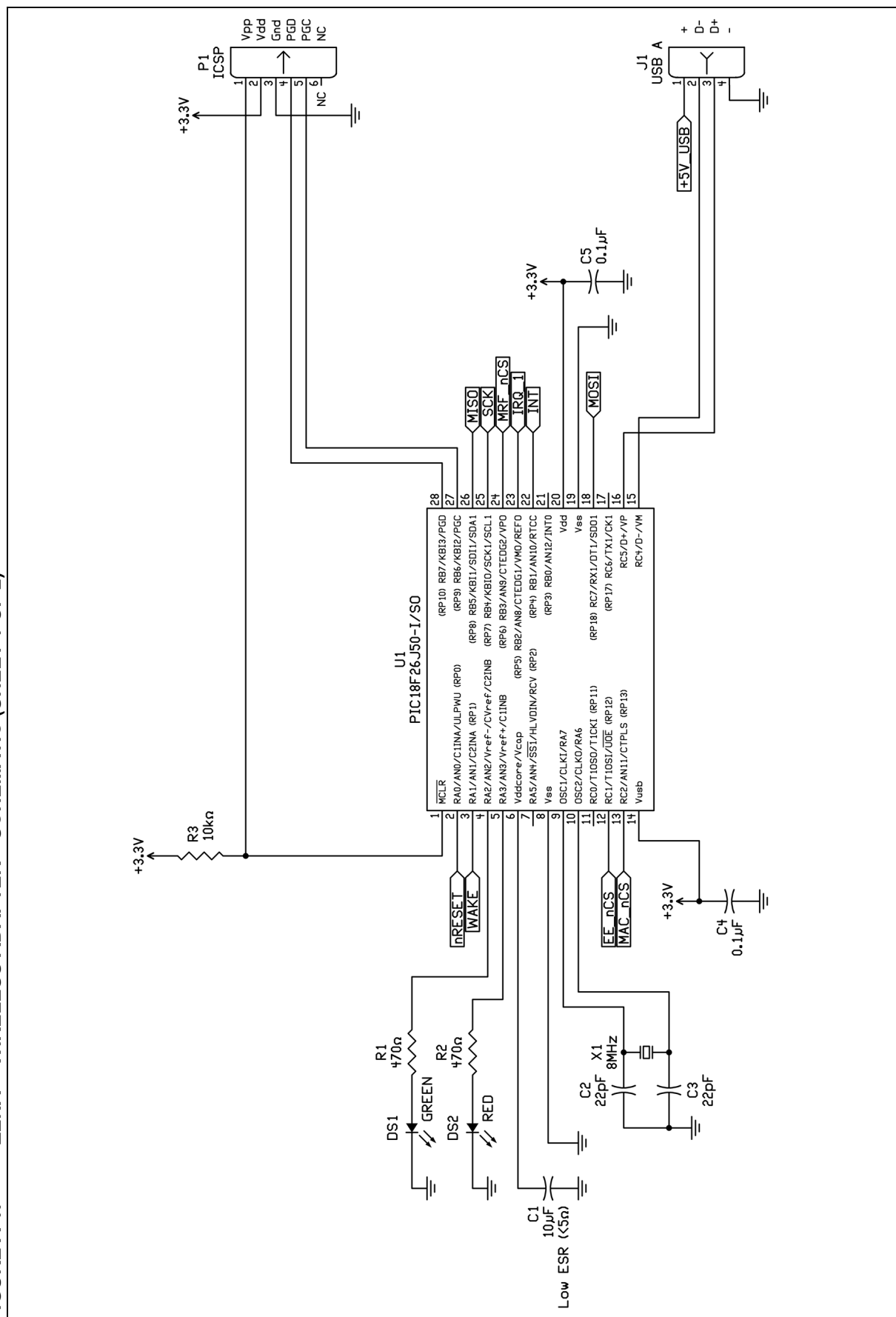
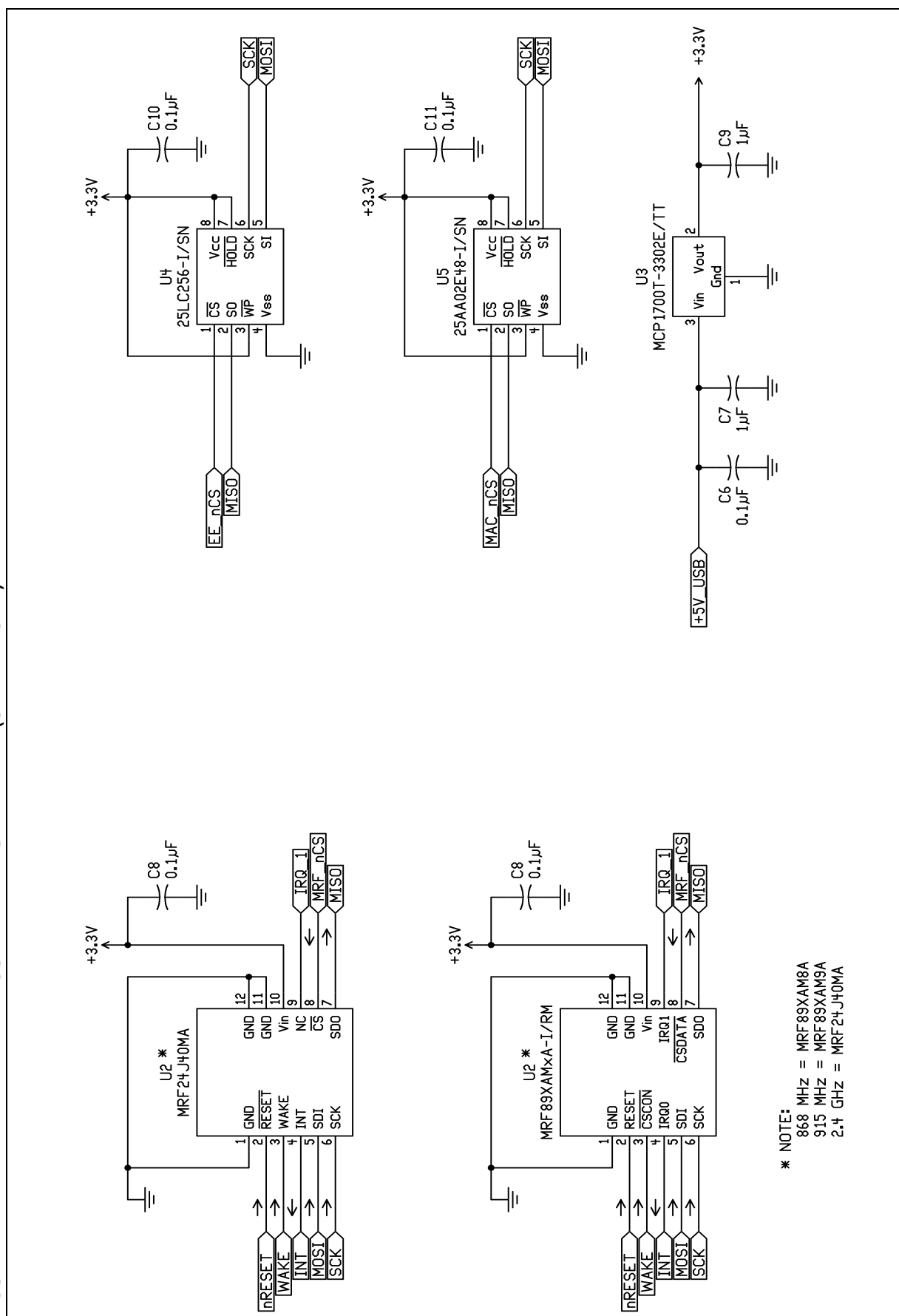


FIGURE A-2: ZENA™ WIRELESS ADAPTER SCHEMATIC (SHEET 2 OF 2)



A.3 ZENA WIRELESS ADAPTER PCB LAYOUT

The ZENA Wireless Adapter PCB is a 4-layer, high temperature FR4, 0.031 inch, plated through hole construction. [Figure A-3](#) through [Figure A-8](#) show the PCB layers. [Figure A-3](#) illustrates the ZENA Wireless Adapter top silk screen.

FIGURE A-3: TOP SILK SCREEN

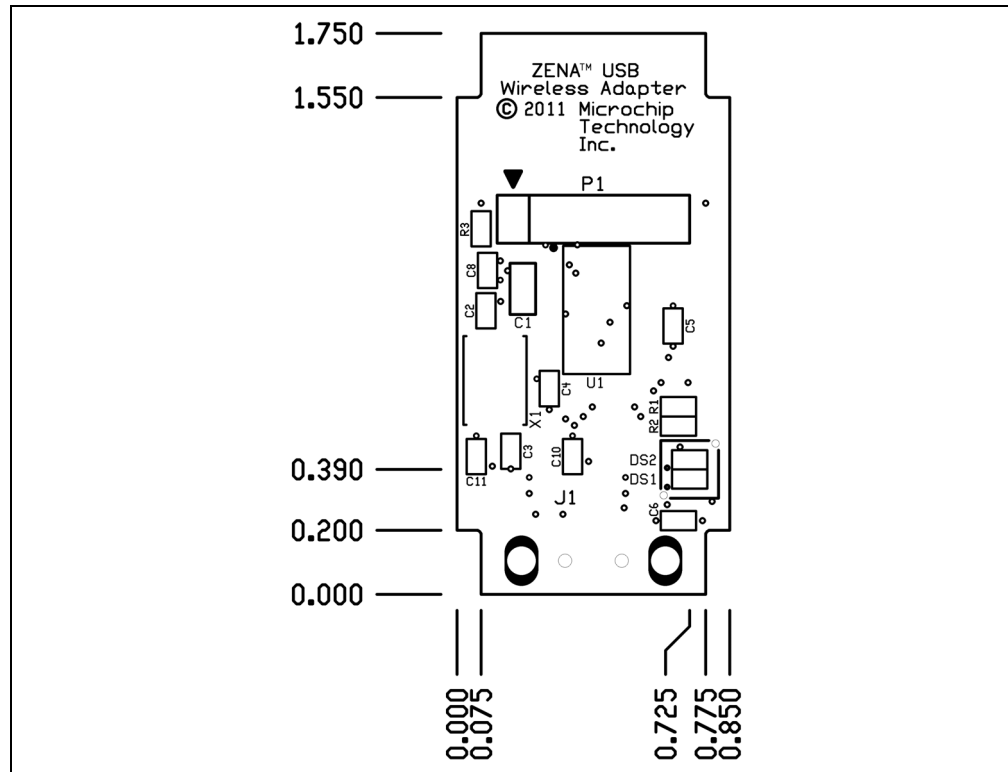


Figure A-4 illustrates the ZENA Wireless Adapter top copper.

FIGURE A-4: LAYER1 — TOP COPPER

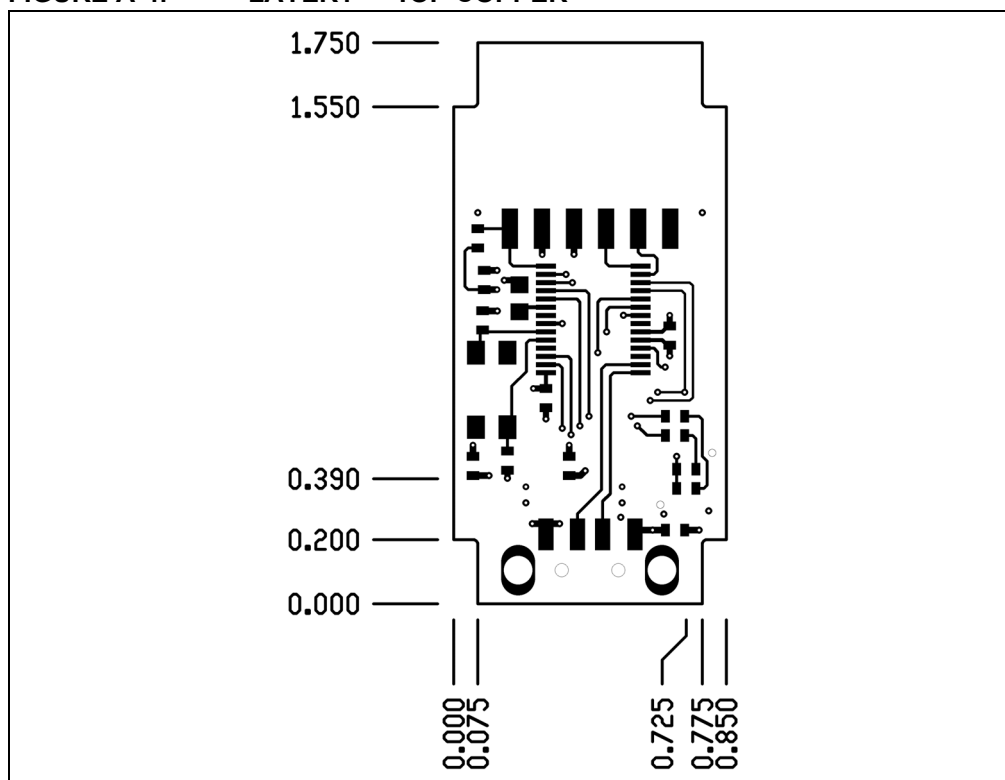


Figure A-5 illustrates the ZENA Wireless Adapter ground plane.

FIGURE A-5: LAYER 2 — GROUND PLANE

