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Wi-Fi[®] G Demo Board User's Guide

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WI-FI® G DEMO BOARD

USER'S GUIDE

Object of Declaration: Wi-Fi G Demo 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).

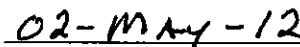
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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA



Derek Carlson
VP Development Tools



Date

NOTES:

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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 “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 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 Wi-Fi G Demo Board. 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 Wi-Fi G Demo Board to create a Wi-Fi network and control the demo board functions from the client device web browser.

The manual layout is as follows:

- **Chapter 1. “Overview”** – This chapter provides a brief overview of the demo board, highlighting its features and uses.
- **Chapter 2. “Hardware”** – This chapter provides the hardware description of the Wi-Fi G Demo Board.
- **Chapter 3. “Getting Started”** – This chapter describes what you need to know to start using the Wi-Fi G Demo Board.
- **Chapter 4. “Description of Modes of Operation”** – This chapter provides the modes of operation description of the Wi-Fi G Demo Board.
- **Chapter 5. “Programming”** – This chapter describes what you need and how to program the Wi-Fi G Demo Board.

- **Chapter 6. “Advanced Features”** – This chapter describes the advanced features such as changing transmit power.
- **Chapter 7. “Customizing Web Pages”** – This chapter provides the guidelines on how to customize web page contents.
- **Appendix A. “Wi-Fi G Demo Board Schematic”** – This appendix includes the Wi-Fi G Demo Board schematic.

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 Wi-Fi G Demo Board. The following Microchip documents are available from the Microchip web site (www.microchip.com), and are recommended as supplemental resources.

MRF24WG0MA/MRF24WG0MB Data Sheet (DS70686)

Microchip MRF24W Getting Started Quick Guide for MRF24WB0MA/B, MRF24WG0MA/B for MLA v5 (DS52108)

PIC32MX5XX/6XX/7XX Family Data Sheet (DS61156)

TCPIP Stack Help.chm (This is bundled together with the TCIP/IP source code releases.)

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
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The Development Systems product group categories are:

- **Compilers** – The latest information on Microchip C compilers, assemblers, linkers and other language tools. These include all MPLAB C compilers; all MPLAB assemblers (including MPASM™ assembler); all MPLAB linkers (including MPLINK™ object linker); and all MPLAB librarians (including MPLIB™ object librarian).
- **Emulators** – The latest information on Microchip in-circuit emulators. This includes the MPLAB REAL ICE™ and MPLAB ICE 2000 in-circuit emulators.
- **In-circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes MPLAB ICD 3 in-circuit debuggers and PICKit™ 3 debug express.
- **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 IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are nonproduction development programmers such as PICSTART® Plus and PICKit 2 and 3.

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://www.microchip.com/support>

DOCUMENT REVISION HISTORY

Revision A (March 2013)

- Initial Release of this Document.

NOTES:

Chapter 1. Overview

1.1 INTRODUCTION

Thank you for purchasing the Microchip Technology's Wi-Fi G Demonstration kit. The Wi-Fi G Demo Board provides a low-cost and portable development system for Microchip's MRF24WG0MA IEEE 802.11b/g Wi-Fi Transceiver Module.

The Wi-Fi G Demo Board is preloaded with a demo software for the user to explore the features of the MRF24WG0MA Wi-Fi module. It is also expandable through an 8-pin expansion interface, which enables the user to extend its functionality by adding various sensor expansion boards.

The topics discussed in this chapter include:

- Wi-Fi G Demonstration Kit Contents
- Functionality and Features

1.2 Wi-Fi G DEMONSTRATION KIT CONTENTS

The Wi-Fi G Demonstration Kit contains the following:

- Wi-Fi G Demo Board
- 2 AAA Batteries
- Male 1x6 Connector Header HDR-2.54 (J14)
- Wi-Fi G Demo Board Information Sheet (DS52107A)

1.3 FUNCTIONALITY AND FEATURES

The Wi-Fi G Demo Board supports the following network types:

- Infrastructure (client)
- Ad hoc
- Wi-Fi Direct (peer-to-peer as group client)
- SoftAP

The security modes supported are:

- Open
- WEP-40, WEP-104 (Wired Equivalent Privacy)
- WPA (Wi-Fi Protected Access)
- WPA2 (Wi-Fi Protected Access)

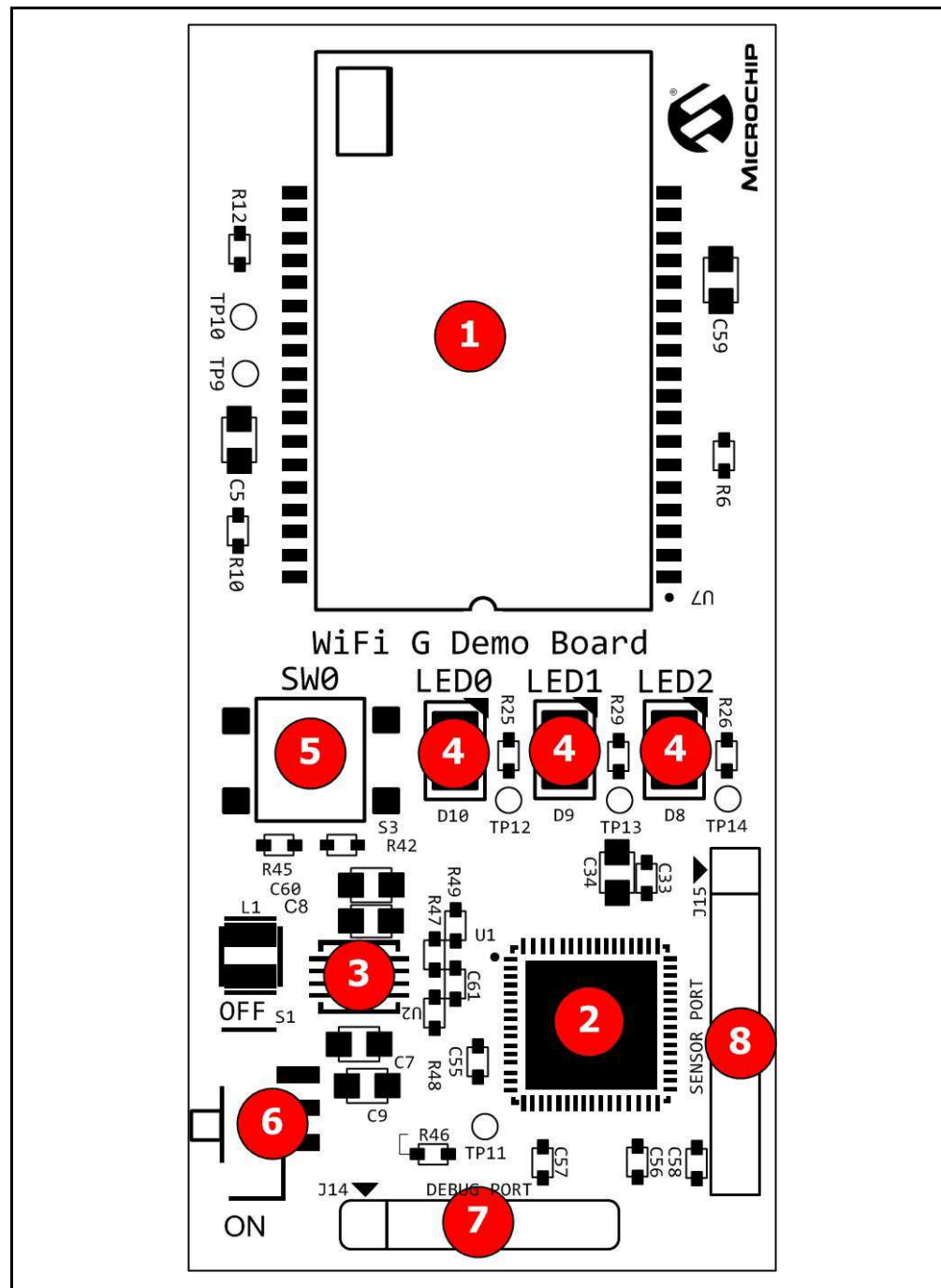
For ease of setup and usability, the following connection methods are also supported.

- WPS-PBC (Wi-Fi Protected Setup Push Button Configuration)
- WPS-PIN (Wi-Fi Protected Setup Personal Information Number)

Note: For Demo Version 1.02, only SoftAP, infrastructure and ad hoc network support are offered. SoftAP supports only open and WEP security at this time. All security modes are supported in other network types. Future versions of the Demo software will include the additional functions noted above.

A representation of the layout for the Wi-Fi G Demo Board is shown in [Figure 1-1](#).

FIGURE 1-1: Wi-Fi® G DEMO BOARD LAYOUT



The Wi-Fi G Demo Board has the following key features:

1. MRF24WG0MA IEEE 802.11 b/g Wi-Fi Transceiver Module
2. PIC32MX695F512H 32-bit microcontroller
3. MCP1642 +3.3V Boost regulator
4. Three LED status indicators (LED0 - GREEN, LED1 - YELLOW, LED2 - RED)
5. One push-button switch for user input (SW0)
6. Power ON/OFF slider switch (S1)
7. 6-pin programming/debug port (J14)
8. 8-pin expansion port (J15)

NOTES:

Chapter 2. Hardware

This chapter describes the hardware features of the Wi-Fi G Demo Board.

2.1 HARDWARE FEATURES

The key features of the Wi-Fi G Demo Board are listed below and are introduced in [Section 1.3 “Functionality and Features”](#). See [Figure 1-1](#) for their locations on the board.

2.1.1 MRF24WG0MA IEEE 802.11 b/g Wi-Fi Transceiver Module

The MRF24WG0MA IEEE 802.11 b/g Wi-Fi Transceiver Module provides wireless connectivity to the demo board. Host communication is through SPI2 of the PIC processor on the board.

2.1.2 Processor Support

The Wi-Fi G Demo Board is designed with a permanently mounted (soldered) PIC32MX695F512H processor.

2.1.3 Power Supply

The board is powered by 2 AAA batteries. If required, the battery voltage is monitored and boosted by the MCP1642 Synchronous Boost Regulator.

2.1.4 LEDs

The LEDs: LED0 (GREEN), LED1 (YELLOW) and LED2 (RED) are connected to PORTE and PORTF of the PIC32MX695F512H processor. To turn the LEDs ON, the port pins are set high.

2.1.5 Switches

The Wi-Fi G Demo Board has the following switches:

- S1 – Controls the main power to the board. To turn on the board, move S1 slider to the ON position.
- SW0 – It is an active low push-button switch, connected to RD9 of the processor. When idle, the switch is pulled high (+3.3V) and when pressed, it is grounded.

2.1.6 Programming/Debug Port

Connector J14 provides easy access to the PIC32MX695F512H processor's debug pins. This is used to program or reflash the demo board with new firmware.

2.1.7 Expansion Port

Connector J15 provides access to six of the processor'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 design.

TABLE 2-1: J15 EXPANSION PORT PIN CONFIGURATIONS

Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Interface
SCK	+3.3V	GND	SDI	SDO	/SS	~*	~*	SPI
-	+3.3V	GND	SDA	SCL	-	~*	~*	I ² C™
RTS	+3.3V	GND	RX	TX	CTS	~*	~*	USART
TX2	+3.3V	GND	RX1	TX1	RX2	~*	~*	DUAL USART

* - Pins 7 and 8 may be used as GPIO or A2D (analog-to-digital) pins.

Chapter 3. Getting Started

3.1 OVERVIEW

The Wi-Fi G Demo application uses a network provisioning mechanism called EasyConfig to enable configuration of an embedded device on a wireless network. EasyConfig utilizes the web server of the TCP/IP stack and a wireless network to enable the user to input the desired network information from a client browser, and then reset the device to connect to the desired network.

3.2 RUNNING THE Wi-Fi G DEMO APPLICATION

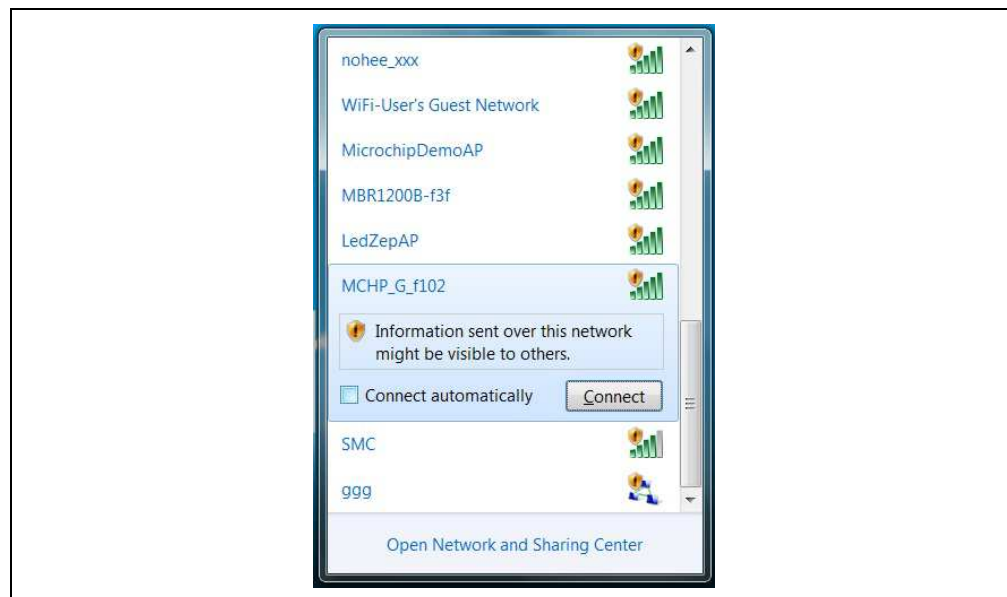
This section describes how to connect to the Wi-Fi G Demo Board to control the on board LEDs and view the status of the SW0 switch from a web browser. It also describes how to connect the Wi-Fi G Demo board to an existing network.

1. After turning the power on, the Wi-Fi G Demo Board broadcasts a SoftAP network with an SSID, MCHP_G_XXXX, where, XXXX is the last four digits of the MRF24WG0MA IEEE 802.11 b/g Wi-Fi Transceiver Module's MAC address (See [Example 3-1](#)).

EXAMPLE 3-1:

```
MRF24WG0MA MAC (SN) : 001EC001F102
SSID: MCHP_G_F102
```

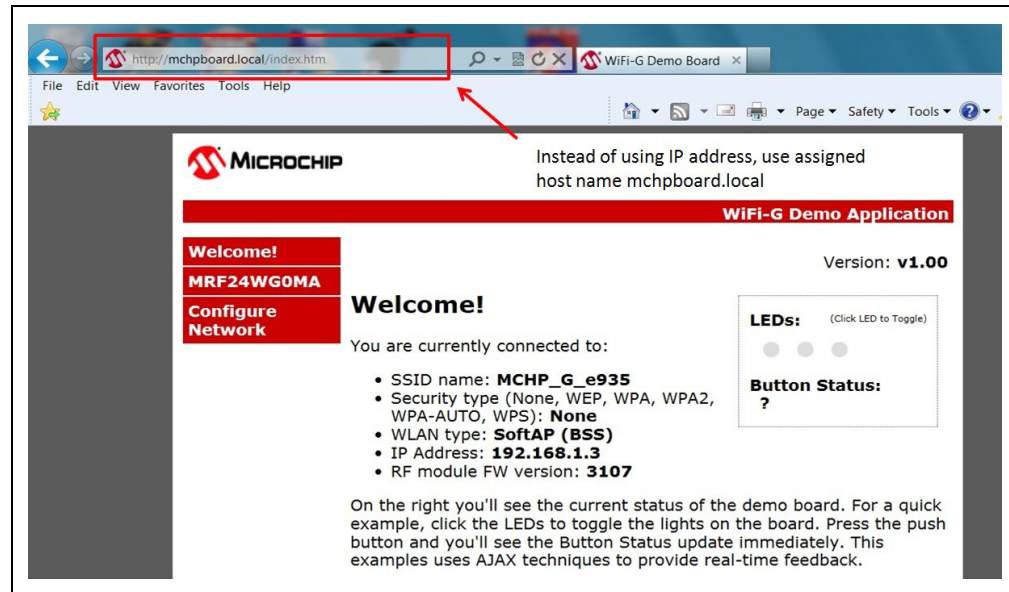
FIGURE 3-1: AVAILABLE WIRELESS NETWORKS



Note: SoftAP is required to transmit beacons within each beacon interval. This increases the transmit power consumption and therefore shorten the battery life.

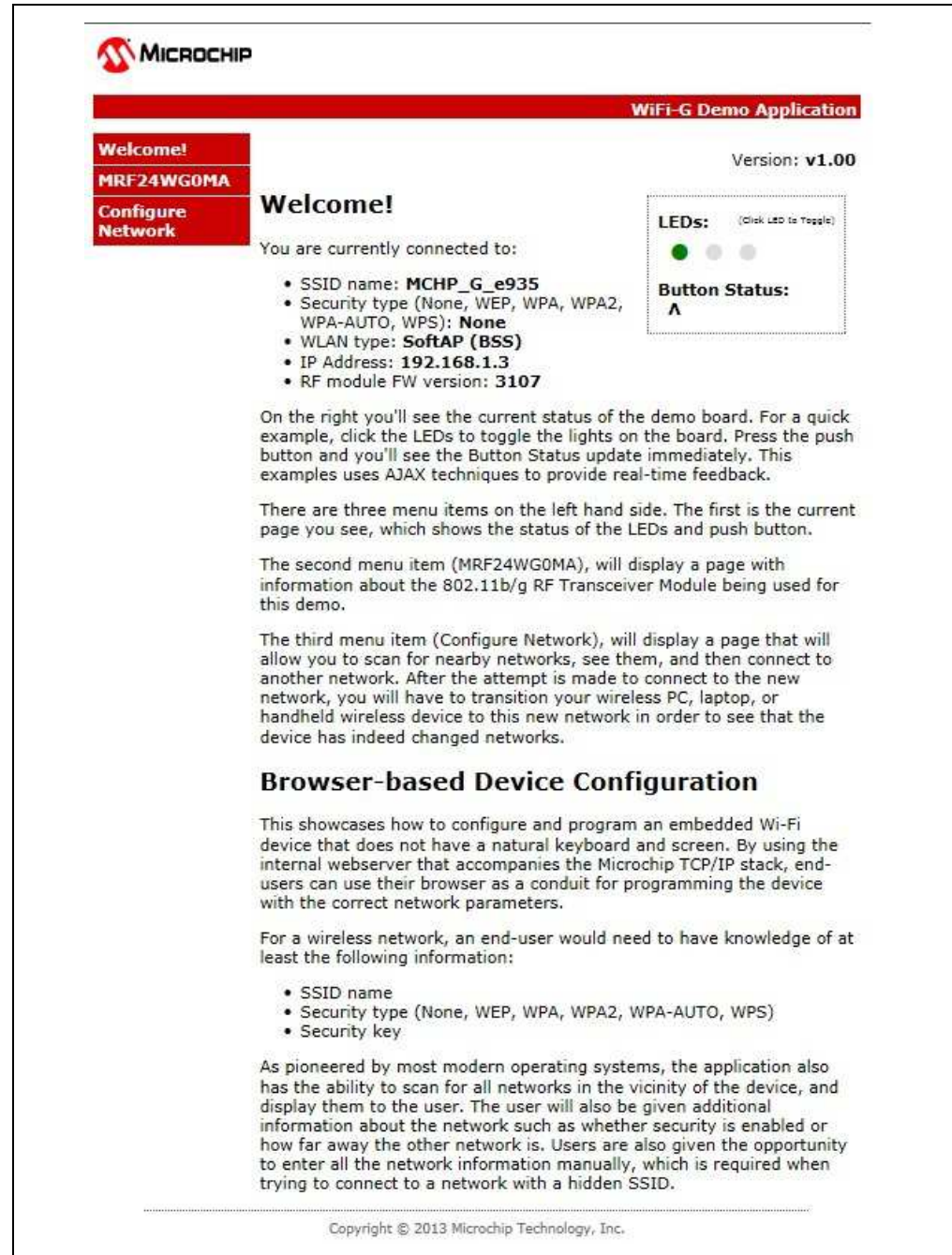
2. Connect a client device (e.g., laptop, smart devices) to the MCHP_G_XXXX SoftAP network.
3. When the client device is connected, use a standard web browser and enter the IP address of the Wi-Fi G Demo Board. The default IP address is <http://192.168.1.3>. Another alternative is to enter “mchpboard.local” into the web browser. See figure Figure 3-2.

FIGURE 3-2: ACCESSING WEB BROWSER



4. The following web pages from the web server that is running on the Wi-Fi G Demo Board are displayed.
 - a) The `index.htm` web page displays the additional information about the Wi-Fi G Demo Board application. It also displays the continually updating status of the three LEDs (LED0, LED1 and LED2) and push-button on the Wi-Fi G Demo Board, see Figure 3-3. To control the LEDs, click on the LED icon on the web page. To see the status of the push-button, press SW0 on the Wi-Fi G Demo Board.

FIGURE 3-3: SAMPLE INDEX .HTM WEB PAGE



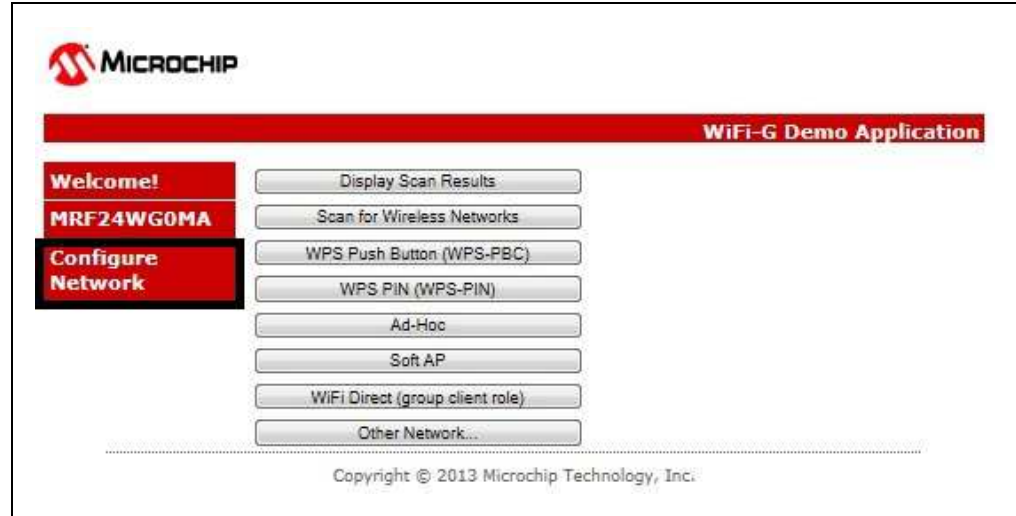
- b) The `mrf24wg0ma.htm` web page highlights the features of the MRF24WG0MA IEEE 802.11 b/g Wi-Fi Transceiver Module and the supporting development tools. See [Figure 3-4](#).

FIGURE 3-4: SAMPLE MRF24WG0MA .HTM WEB PAGE



- c) The `configure.htm` web page enables the user to scan for nearby networks and connect to the selected network to start up as a group client in Wi-Fi Direct network, or as an ad hoc, or as a SoftAP and to select WPS-PBC or WPS-PIN. See [Figure 3-5](#).

FIGURE 3-5: SAMPLE CONFIGURE .HTM WEB PAGE



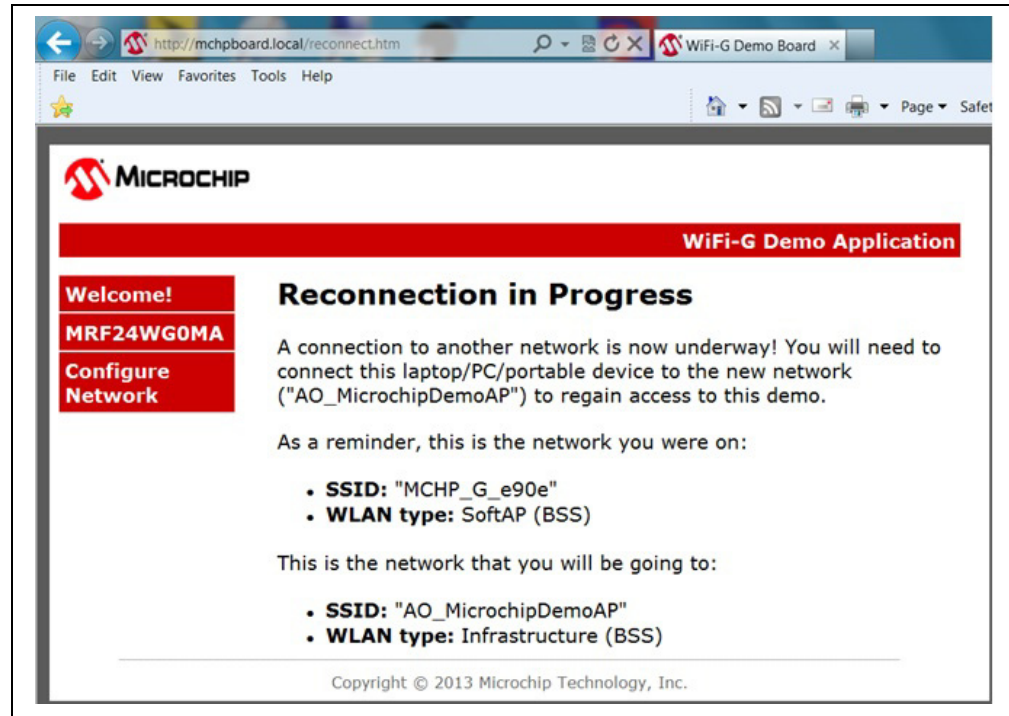
5. To connect the Wi-Fi G Demo board to an existing network, click **Display Scan Results** on the `configure.htm` web page. See [Figure 3-6](#).

FIGURE 3-6: DISPLAY SCAN RESULTS WEB PAGE



6. When a new network is selected, the Wi-Fi G Demo Board resets automatically using the parameters (SSID, security key) of the new network to reconnect to this new network. See [Figure 3-7](#).

FIGURE 3-7: RECONNECTION TO NEW NETWORK



7. To continue using the demo, the client device must be reconnected to the same network where Wi-Fi G Demo Board is redirected to.

Note: This is not applicable for initial release Demo Version 1.02. The demo board always attempts to connect to the last known network. If the user wants to reset the demo board to factory default conditions (startup in SoftAP mode) again, then simply press SW0 for 4 seconds. Do NOT press SW0 immediately on power up, as this initiates a self-test and does not reset the demo board to default factory conditions.

Chapter 4. Description of Modes of Operation

4.1 SoftAP NETWORK

On starting the demo, the factory default conditions has the product start up as a SoftAP without security. This means that all the network information that is being configured on the device is going over-the-air in the open. For most applications, unless another user is specifically attempting to listen in on this network, the potential security impact is minor. However, for applications that require baseline level of security, WEP can be employed on the network.

SoftAP is the centralized coordinator for the network. With MRF24WG0MA IEEE 802.11 b/g Wi-Fi Transceiver Module firmware version 0x3107 and future releases, it supports Wired Equivalent Privacy (WEP) (40-bit/104-bit) security.

4.2 AD HOC NETWORKS

Ad Hoc networks are peer-to-peer networks with no centralized coordinator for the network. All the devices share the responsibilities of keeping the network running. According to 802.11 specifications, ad hoc network only supports 802.11b rates of 1 Mbps, 2 Mbps, 5.5 Mbps and 11 Mbps.

One downfall of ad hoc networks is that typically security is not employed on them.

The MRF24WG0MA IEEE 802.11 b/g Wi-Fi Transceiver Module can secure an ad hoc network with Wired Equivalent Privacy (WEP) (40-bit/104-bit) security, like most of the laptops and ad hoc devices. Very few devices in the market can secure an ad hoc network with Wi-Fi Protected Access (WPA) level security due to tremendous overhead.

For most applications, unless another user is specifically attempting to listen in on this network, the potential security impact is minor. However, for applications that require baseline level of security, WEP can be employed on the network.

Most Android devices do not support ad hoc networks.

4.3 Wi-Fi DIRECT NETWORKS

Wi-Fi Direct network is a peer-to-peer (P2P) network. It enables the user to configure a secured wireless network between several devices, such as smart devices, laptops or computers with wireless network adapters, without using an access point (AP).

Wi-Fi Direct supports Wi-Fi Protected Setup (WPS) connection method, which is known as the WSC (Wi-Fi Simple Configuration) Config Methods in the Wi-Fi Peer-to-Peer (P2P) Technical Specifications, in particular WPS Push Button method with WPA2.

From the negotiation process, each device determines which devices become group owner (GO) or group client (GC). The GroupOwnerIntent field in the P2P information element (IE) indicates the level of desire to become the GO. The higher the value, the higher the desire to be the GO.

MRF24WG0MA IEEE 802.11 b/g Wi-Fi Transceiver Module only supports the role of GC.

Wi-Fi Direct does not support 802.11b.