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*Connecting the Internet of Things*

The 4th Age of Wireless™

# *ZG2100 ZEROG SYSTEM DEVELOPMENT KIT FOR WI-FI® PICTAIL™ USING PICDEM.NET 2 AND EXPLORER 16*

***GSG-102.03***

***REVISION 2.03***

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# Getting Started Guide

## Overview

The Wi-Fi® PICtail™/PICtail™+ Daughtercard Board is an 802.11B demonstration board for evaluating the ZeroG Wireless ZG2100 Wi-Fi® controller on a Microchip Technology's processing platform. It is an expansion board compatible with the Explorer 16 and PICDEM™.NET 2 development boards.

## Features

ZG2100 Wi-Fi controller fully integrating 802.11B MAC and RF PHY requirements

Power regulator to enable use on 3.3V or 5V development boards

PICtail and PICtail+ Daughter Board connection interface

## Hardware

The following items are required for development or evaluation of the Microchip based ZeroG 802.11 solution. **WARNING:** ***The boards in this kit are highly sensitive to electrostatic discharge (ESD). Please ground yourself at all times while in contact with the boards.***

1. ZG2100PCB Wi-Fi® PICtail
2. Microchip Hardware Development board (one of the following)
    1. Explorer16 (PIC24, dsPIC, or PIC32 depending on personality module)
    2. PICDEM.Net2 (PIC18)
3. Microchip ZeroG Software driver and integrated Microchip stack (available on disk) [v4.52 or later]
4. Power supply (9v, 300mA)
5. C compiler (downloadable from Microchip website, see link listings at end of this document)
    1. MPLAB C Compiler for PIC24 v3.11(b) (60day free trial available, see link listings)
    2. MPLAB C Compiler for PIC18 v3.20 upgrade
6. Microchip development environment
    1. Microchip MPLAB IDE v8.15 or later (see link listings for download information)
7. 802.11 access point (B, BG, or BGn)
    1. Linksys WRT54G or WRT54G2 is recommended

Microchip hardware may be acquired from **http://www.microchipdirect.com/**

## *Software*

*This guide has sections on installing the Microchip SDK and TCP/IP stack, the Microchip MPLAB IDE, and the necessary changes to configure the demo software for networks with different characteristics than the default settings. Please check on http://www.microchip.com for the latest information on installation of Microchip tools. Also, any Microchip documentation that comes with the tools takes precedence over this guide.*

*The ZGS2101 software has three ways of configuring for networks. This guide documents the most basic method which is to hard code the data into the source code. The software uses C calls to modify the values in variables used to keep the configurations. The customers application code can thus create a user interface that allows scanning for networks and then configuring based on the end users selection. As an example of using the variables, the projects have a number of source files to allow run time configuration of the networks (select adhoc vs infrastructure, change SSID, change security methods and keys). These files are located in the "ZG2100" project directory (viewed from within MPLAB IDE); and are ZGConsole.c, ZGConsoleIfconfig.c, ZGConsoleIwconfig.c, ZGConsoleIwpriv.c, ZGConsoleMsgHandler.c, and ZGConsoleMsgs.c. This example code creates a very powerful run time command line interface for modifying all attributes of the wireless network. The interface is accessed via a terminal connected to the RS232 port of the Microchip development board. The use of these tools are not detailed in this document but can be found in the "ZGS2101 CLI Usage Document".*



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# Getting Started With Microchip Software

## Software Items to Install

The list of software items to install includes the following:

1. Microchip MPLAB Integrated Development Environment v.8.15 or later
2. Microchip MPLAB C Compiler
3. Microchip In-Circuit Debugger (ICD 2 or ICD 3) Driver
4. Microchip TCPIP Stack Installer

## Installing the Microchip MPLAB IDE v.8.15 or Later

Open web browser and go to:

**http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en019469&part=SW007002**

- Go to the bottom of the page for the software download link
- Click "**OK**" to save the file.
- Extract the .zip file. Open the folder containing the extracted files and click on the "**setup file**" to install.


- Follow default settings for the installation. **Restart** the computer once the installation is complete.

## Installing the Microchip MPLAB C Compiler

*The C Compiler you need to install depends on whether you are using a Microchip PIC18 or a PIC24. If you are using a PICDEM.net 2 board, then you have a PIC18. If you are using an Explorer 16 board, then you have a PIC24. Please install the appropriate compiler.*

To download the PIC18 MPLAB C Compiler, open a web browser and go to:

**http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en010014**

· Click on the student version of the compiler link (*e.g. "MPLAB C Compiler for PIC18 v3.22 - Student Edition"*)

· Click on "**Save File**".

· To download the PIC24 MPLAB C Compiler, open a web browser and go to:

**http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en535364**

· Click on the student version of the compiler (*e.g. "MPLAB C Compiler for PIC24 v3.11(b) Student Edition"*)

· **Install** the C Compiler. Use all default settings for the installation process.

## *Installing the Microchip In-Circuit Debugger Driver*

· Setup the hardware as described in the "**Hardware Setup**" section.

· Plug in the USB cable from the ICD to your PC.

· When attaching the USB cable, the OS should automatically detect the new hardware and issue a pop up a screen asking you to install the driver.

**DO NOT USE THE WINDOWS RECOMMENDED DRIVER.**


Follow the instructions provided by Microchip in their "ICD Getting Started Guide".



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## *Installing the Microchip TCPIP Stack*

- Open the ZeroG CD that came with your System Development Kit.
- Click on Microchip TCPIP Stack Installer.


This will install the "**Microchip Solutions**" folder, containing several projects, on the PC's "C:\ drive".

## *Special Install: Updating Code Drops*

If you are installing an update to a previous install and do not have an installer program ensure you follow the following instructions:

- Install the "Microchip" folder into "C:\Microchip Solutions\" rewriting the previous folder
- Install any new or updated project files directly into "C:\Microchip Solutions\"

# Hardware Setup and Configuration

The list of hardware items to setup includes the following:

## Wi-Fi® PICtail™ Power Jumper J3

- Cable connection
- Wi-Fi® PICtail™ Power Jumper

The Explorer16 has a PICtail™ connector and the PICDEM.net 2 board has a PICtail+™ connector. The Wi-Fi® PICtailTM/PICtailTM+ Daughtercard should be inserted into either the top most socket of J5 on the Explorer16 board, or the PICDEM.NET 2 board. The jumper J3 on the Wi-Fi® PICtail™ is the power jumper and it must be configured appropriately, depending on which platform is selected as shown in Figure 1. For the PICDEM.net 2 board, place the jumper across pins 2 and 3. For the Explorer 16 board, place the jumper across pins 1 and 2.

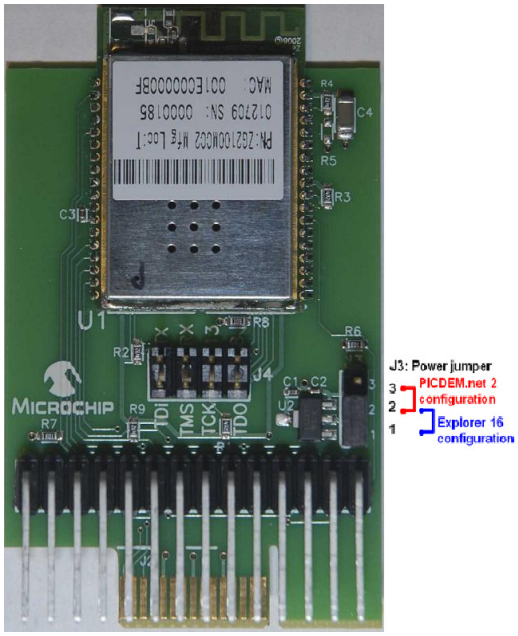


**Figure 1: Configuring the J3 jumper on the Wi-Fi® PICtail™**

## *Cable Connection*

**WARNING:** ***The boards in this kit are highly sensitive to electrostatic discharge (ESD). Please ground yourself at all times while in contact with the boards.***

- Plug the PICtail™ into the Microchip development board (Explorer 16 or PICDEM.net 2) making sure that the ZeroG Wi-Fi® module is facing the microcontroller.
- Connect the RJ25 cable (grey phone cable) to the RJ25 port on the development board to the ICD.
- Connect the serial cable to the serial port (UART port) of the development board and to the serial port (COM port) on the PC. (Typically, the default port on the PC is COM 1, but this default number may differ from PC to PC.)
- Connect the USB cable from the ICD to the PC.
- Power on the router, WRT54G2, and connect to the Ethernet port of the PC to the Ethernet port of the router.



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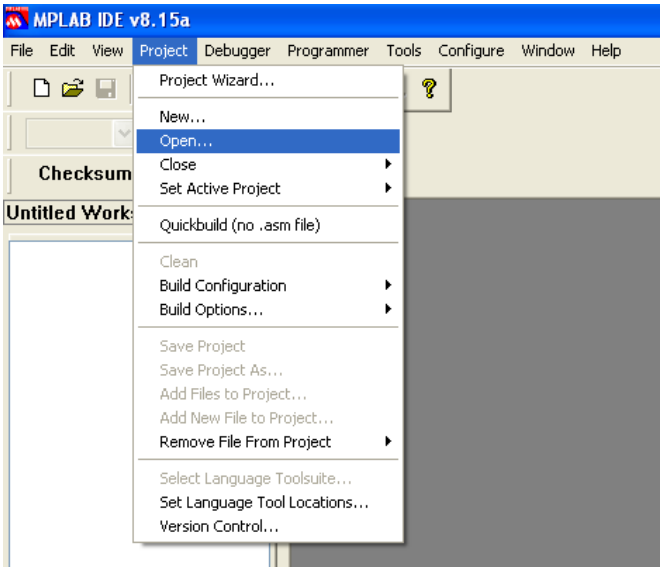
# *Out-of-Box Demo*

Now that you have all the required hardware and software, you are now ready to see a ZeroG demonstration.

Open MPLAB IDE.

Open a project by going to "Project>Open…"




The files displayed are located in:

C:\Microchip Solutions\TCPIP WiFi Demo App\

There are 3 project files:

**TCPIP WiFi Demo App-C18**
*Open this file if your Microchip board is using a PIC18 microcontroller*

**TCPIP WiFi Demo App-C30**
*Open this file if your Microchip board is using a PIC24 or the dsPIC microcontroller*

**TCPIP WiFi Demo App-C32**
*Open this file if your Microchip board is using a PIC32 microcontroller*

Select the TCPIP WiFi Demo App appropriate for your development board. Set your AP to the following configuration (not required with ZeroG purchased AP):

## *AP Setup for Demo*

The demonstration will work with an access point configured as follows:

SSID: MicrochipDemoAP

Security: none

Channel: 1

DHCP: on

**Advanced settings (if having difficulty):**

Basic rate: Default

1&2Mbps (if having trouble with default)

Router starting address: 192.168.1.1

DHCP starting address: 192.168.1.100

DHCP leases: 20

For out of box demo, go to “Compiling Project Code”. You do not need to change any settings in the code if you use the AP settings above.



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# *Example Application Code Development*

There are 2 files that need to modify in order to change the SSID, RF channel, MAC address, security and certain services (DHCP, DNS, PORT and ICMP). These files are:

**TCPIPConfig.h** (located under "Header Files")

**HTTP2.h** (located under "Header Files\TCPIP Stack")

## *Modifying the TCPIPConfig.h file*

- Click on the TCPIPConfig.h file.
- Make sure that the SSID on the file matches the SSID on the router. The default SSID is the "MicrochipDemoAP". Modify the **red** text in order to change the SSID:

**#define MY_DEFAULT_SSID_NAME "MicrochipDemoAP"**

- If the AP has DHCP enabled, make sure the following line is commented out, as shown below (normally you want to use DHCP from the AP):

// **#define STACK_USE_DHCP_SERVER**

- *Optional*: Allow the PC to ping the Microchip development board. Uncomment the line to disable pinging:

**#define STACK_USE_ICMP_CLIENT**

*Optional*: Allow use of the name, "mchpboard" to access the demo instead of the gateway IP address (which has to be determined by inquiring at the AP). Uncomment these lines:

**#define STACK_USE_DNS**

**#define STACK_USE_NBNS**



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## *Configuring the MAC Address*

There are three different sources for the MAC address. There is a built-in MAC address on the ZeroG module that is preprogrammed from the factory with the ZeroG OUI. The second source is from the programmed code image. The third source is from a value that's stored in EEPROM.

At runtime, a data structure (APP_CONFIG) is created in RAM, which stores the valid MAC address to be used for that session. The code will check to see if there is a valid EEPROM APP_CONFIG data structure. If so, the EEPROM MAC address will be used.

If there is no valid APP_CONFIG information in EEPROM, then the value programmed in TCPIPConfig.h will be used. If the value in the source code is 00-04-A3-00-00-00, then this will instruct the code to fetch the MAC address stored inside the ZeroG module, and use that pre-programmed value. Otherwise, the actual value programmed in the source code will be used.

Note that when there is no valid information stored in EEPROM, the code will automatically save either the ZeroG preprogrammed value or the value defined in the source code. These values will be used for runs.

Also, be very cautious when changing the MAC address when there is already a valid MAC address saved in EEPROM. The EEPROM has highest priority, and will always trump values stored in source code. You will need to either erase the EEPROM completely, or program a different value through the Wi-Fi demo configuration page. If you need to completely erase the EEPROM, please see the section Erasing EEPROM on page 22 at the end of the guide.

- *Optional*: Change the MAC address. The default MAC address shown is **"00-1E-C0-00-00-FF".** Modify the parameters in **red** if you wish to change the MAC address to a specific value. NOTE: each ZeroG radio module comes with a pre-programmed unique MAC address (it is not the default value in the code). In order

**#define MY_DEFAULT_MAC_BYTE1 (0x00)**

**#define MY_DEFAULT_MAC_BYTE2 (0x1E)**

**#define MY_DEFAULT_MAC_BYTE3 (0xC0)**

**#define MY_DEFAULT_MAC_BYTE4 (0x00)**

**#define MY_DEFAULT_MAC_BYTE5 (0x00)**

**#define MY_DEFAULT_MAC_BYTE6 (0xFF)**

## *Configuring for Security*

- Select security. Modify the #define statement in **kKeyType** in TCPIPConig.h to match the AP security configuration that is in use. Choices include *none*, *WEP*, *WPA/WPA2 PSK* or *to have the ZeroG chip calculate the (WPA/WPA2)key from a passphrase*.

### *Disable Security*

**#define MY_DEFAULT_ENCRYPTION_TYPE kKeyTypeNone** /*if you don't want to use a security key*/

### *Using WEP*

**#define MY_DEFAULT_ENCRYPTION_TYPE kKeyTypeWep** /*if you want to use WEP*/
**#define kWepKeyID ((tZGU8)0)** /* default TX key */
**#define kWepKeyLen ((tZGU8)kZGWEPKeyLenShort)** /* kZGWEPKeyLenLong */
This is filled out for a short key of 5 bytes. For a long key, each key should be 13 bytes. The active or default key (1 of 4) is selected with the kWepKeyID and is selected as one of [0,1,2,3].

- Modify the red text to change the key:

```
const ROM tWEP kWEPKeyData[ kZGNumDefWepKeys ] =
{
{0xD1, 0xB6, 0x8B, 0x34, 0xB1},
{0x00, 0x2C, 0x0E, 0x25, 0xDE},
{0x2C, 0x82, 0xAE, 0xD7, 0xC4},
{0x73, 0xED, 0x1A, 0x34, 0xB3}
};
```

**Note, often a passphrase is used with WEP. A router will convert the passphrase into Hexidecimal format for the first key (denoted "1" or default in the router, and selected as kWepKeyID "0". The router will use an algorithm for the second through fourth keys that may not be consistent between routers of different makes. The ZeroG code requires the explicit entry of the Hex keys. If you only know the passphrase you can get the default or first key by converting the ASCII passphrase**

**to Hex. Sites like http://www.speedguide.net have tools to do this (see appendix of this document). For keys other than the first, you must copy them from the router entry table.**

- ***Using WPA/WPA2 PSK***

**#define kKeyType kKeyTypePsk** /*if you want to use WPA or WPA2 PSK */

The default WPA/WPA2 PSK key is "QALabWRT54G". To translate this text into hex, please go to this link: **http://www.wireshark.org/tools/wpa-psk.html**


Note that the PSK key generated by Wireshark is "d34c3440e3645dc9b9eb87592b51bf9719de53f2153723e8864d495d221bbed9"

Modify the **red** text to change the key:

```
const ROM tZGU8 kPMKKeyData[] =
{
    0xD3, 0x4C, 0x34, 0x40, 0xE3, 0x64, 0x5D, 0xC9,
    0xB9, 0xEB, 0x87, 0x59, 0x2B, 0x51, 0xBF, 0x97,
    0x19, 0xDE, 0x53, 0xF2, 0x15, 0x37, 0x23, 0xE8,
    0x86, 0x4D, 0x49, 0x5D, 0x22, 0x1B, 0xBE, 0xD9
};
```

## *Using Passphrase for ZeroG Chip to Create WPA/WPA2 Key*

**If you are using WPA or WPA2 type security, you may use the ZG210x radio to calculate the security key. This process involves combining the paraphrase with the SSID to create a unique key of which a portion is actually used as the initial key for authentication. This is a complicated process, but can be offloaded to the ZeroG if connection time is not a concern.**

**#define kKeyType kKeyTypeCalcPsk**
/*if you want to ask the ZeroG chip to calculate the key from a passphrase*/

If you use the calculate key option in kKeyType, then you must specify the desired paraphrase in

**const ROM tZGU8 kTargetSecurityPassPhrase[] = "Microchip 802.11 Secret PSK Password";**

Note: *it will take about 45seconds for the calculation to occur, so allow more time to connect to the access point using this mechanism.*

## *Modifying the HTTP2.h file*

- To modify the **HTTP2.h** file, click on the file

Program accordingly to allow you to either get to the board from the AP via your local LAN, or from the Internet. Modify the #define HTTP_PORT line according to the following:

To access board via the Internet, use port 65000

**#define HTTP_PORT (65000u)// Listening port for HTTP server**

**// #define HTTP_PORT (80u) //Listening port for HTTP server**

*Note: this also requires the AP to be programmed to use port forwarding to the board. This will require knowledge of the IP address provided to the board. Please see instructions for the AP.*

To access board directly via access point and PC (not going out to internet) use port 80

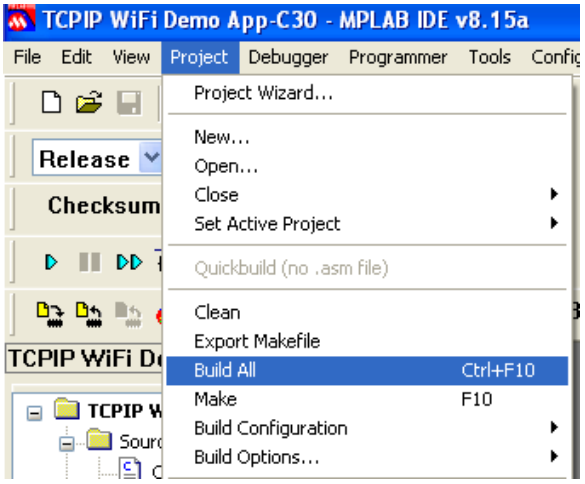
**// #define HTTP_PORT (65000u)// Listening port for HTTP server**

**#define HTTP_PORT (80u) // Listening port for HTTP server**

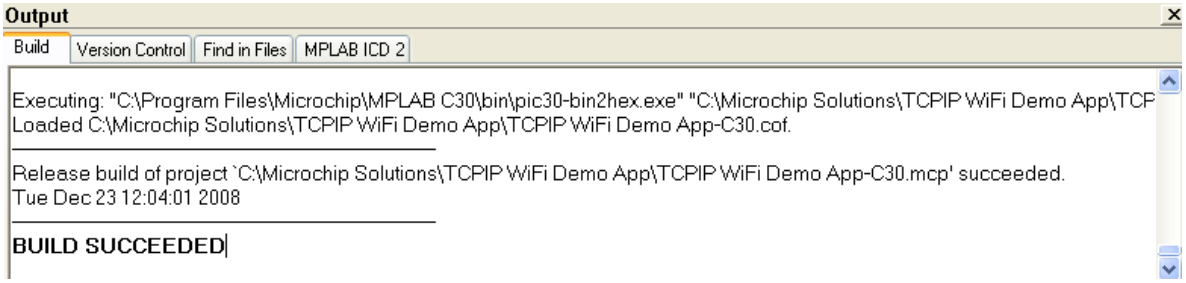
# Compiling Project Code

- Select the appropriate ICD tool (MPLAB ICD 2 shown):

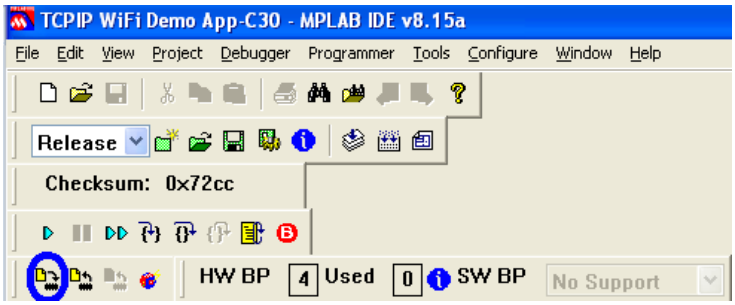

- Compile the code by selecting “Build All”, as shown:



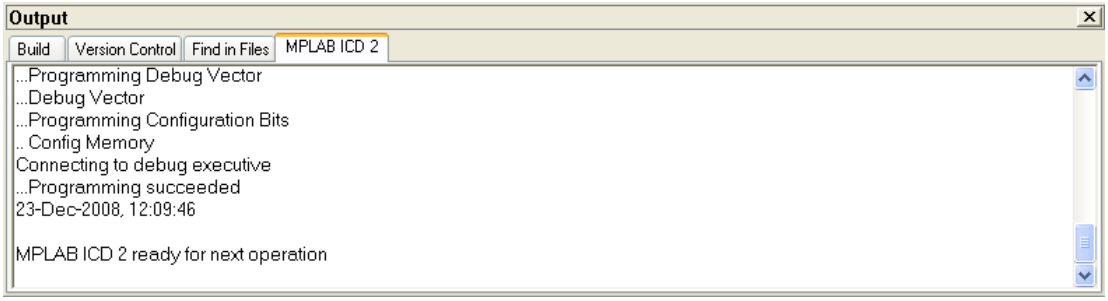

- If the build is successful, you will receive a message “BUILD SUCCEEDED”, similar to the one below:



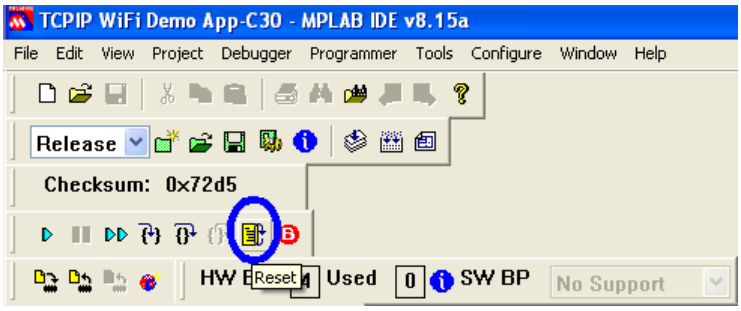
- To program the code to your device, click on the “Program Target Device” icon as shown:



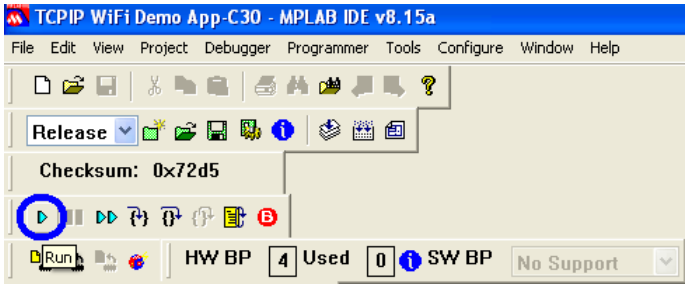

- If successful, you will receive the following message:




- Click on “Reset” as shown below inside the blue circle:




- Click on “Run” as circled below:



# Preparing and Using the Web Server Application

## Loading the web page onto the board

The first time the application is running on the Microchip board, and particularly if the served page has not been programmed into the project, the following will be required. The HTML pages are compiled into a file called MPFSImg2.bin This file needs to be programmed into the board.

Once the Microchip board is up and running with the WiFi PICtail, open a browser on a machine on the same LAN and enter the following (assumes DNS is used):

**http://mchpboard/mpfsupload**

If DNS is not used, then enter the URL directly as noted below:

**http://xxx.xxx.xxx.xxx/mpfsupload**

If port 65000 is used, then enter the URL as noted below:

**http://xxx.xxx.xxx.xxx:65000/mpfsupload**

xxx.xxx.xxx.xxx represents the board IP address assigned by the AP DHCP server (this is displayed on the development board LCD screen).

When requested for the download file, point to

**C:\Microchip Solutions\TCPIP WiFi Demo App\MPFSImg2.bin**

## Observe the board web page from the PC.

Use the following URL to view the demonstration web page from a PC browser:

http://mchpboard (requires the use of DNS)

Or
**http://xxx.xxx.xxx.xxx:65000** (if using port 65000)
Or
**http://xxx.xxx.xxx.xxx** (if using port 80)

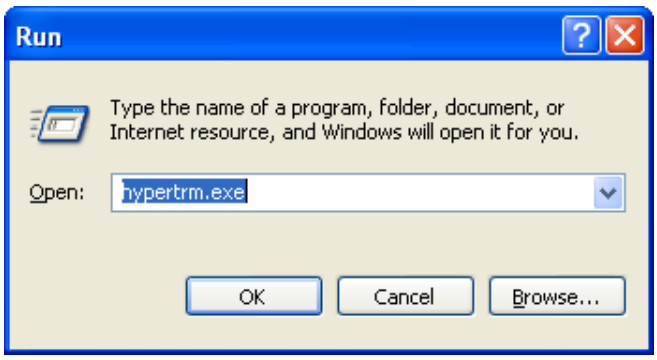
# Debug Port

To assist in bring up, serial data is output on the RS232 port on the Microchip

development board during power up. The following describes how to utilize this function, and what to look for during proper operation.

### Listening Using *Hyperterminal*

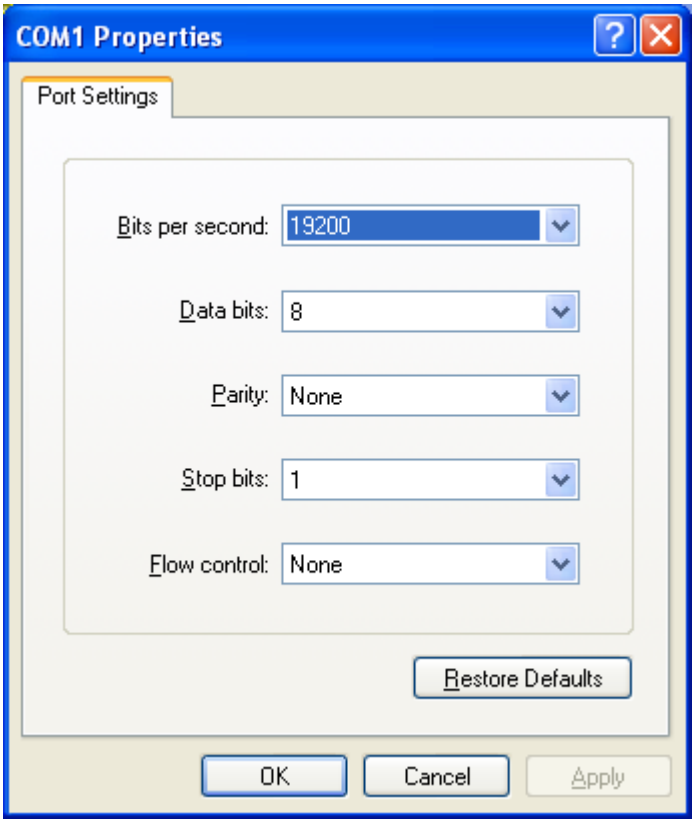
- Open HyperTerminal using “Run”



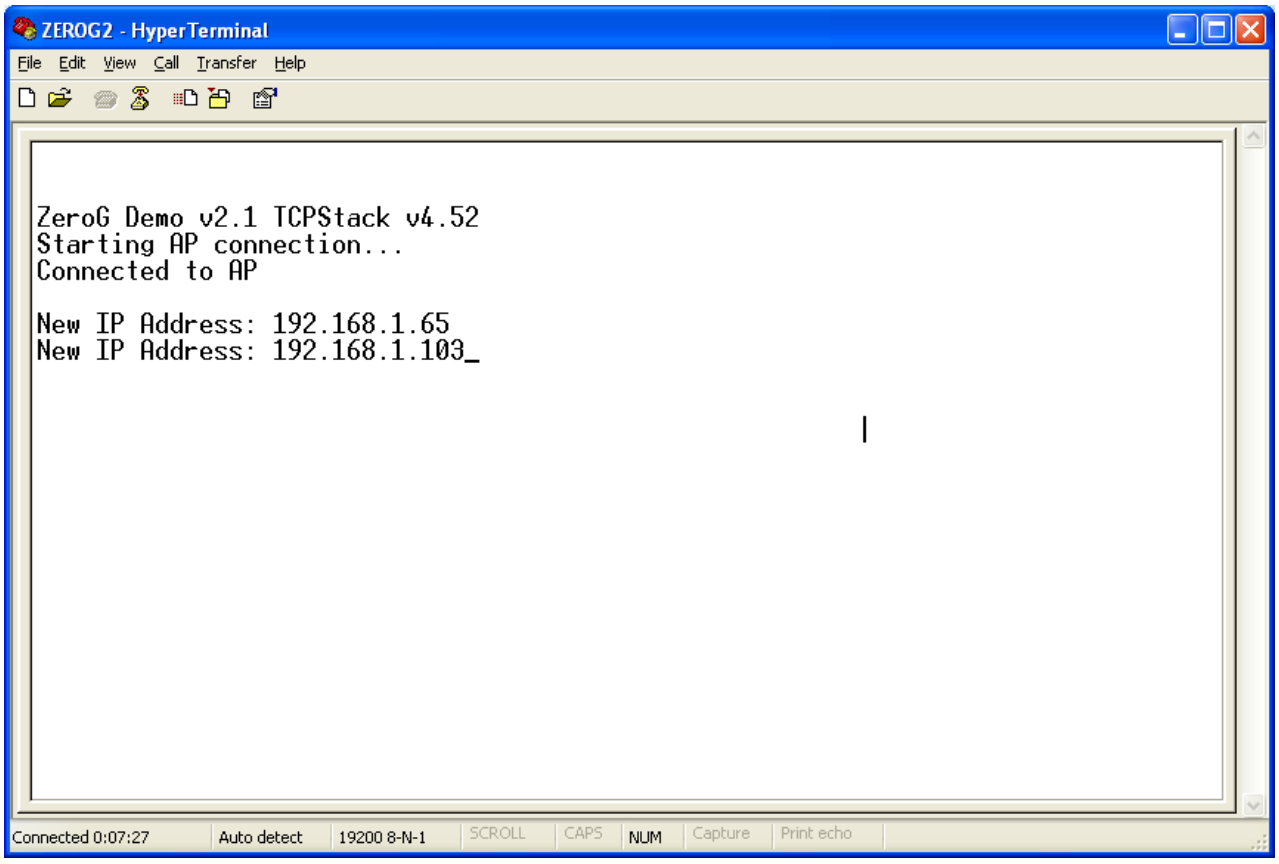

- Enter a name for the new connection and click “OK”

- Select COM1 as the listening port. Note that this port may by different on your PC. Verify the appropriate RS232 port name for your setup.


- Follow settings and click “OK”



- When the Wi-Fi® device is running successfully, you will see the following screen on *HyperTerminal*.




In the display above, 192.168.1.65 is the default static IP address that the ZeroG radio starts with, and 192.168.1.103 is the DHCP IP address provided by the router once connection was made. The IP address of the radio is now 192.168.103 for this connection.

# Microchip Development Board Specifics

## PICDEM.NET 2 Usage

If you have a PICDEM.NET 2 board, please follow the instructions here. If you are using an Explorer16 board, please skip this section.

Signal Connection:

PICtail (note connector J1 on PICTail)

| Function | I/O | Pin | Description |
|---|---|---|---|
| CSN | I | J1-24/RC2 | SPI Chip Select (asserted low) |
| SCK | I | J1-12/RC3 | SPI Clock |
| SDO | O | J1-10/RC4 | SPI Data Out from ZG2100M |
| SDI | I | J1-8/RC5 | SPI Data In to ZG2100M |
| INT_NX | O | J1-27 | Interrupt signal from ZG2100M (asserted low) |
| RST_N | I | J1-25/RB1 | Master reset (asserted low) |
| CE_N | I | J1-23/RB2 | ZG2100M disable (asserted low) |
| VDD | I | J1-26 | 5V power input |

## Explorer 16 Usage

If you have an Explorer16 board, please follow the instructions here. If you are using a PICDEM.NET 2 board, please skip this section.

Explorer 16 Connection

PICtail Plus (note male connector J2 on PICtail, is female connector J5 on Explorer 16)

| Function | I/O | Pin | Description |
|---|---|---|---|
| CSN | I | J2-1/RB2 | SPI Chip Select (asserted low) |
| SCK | I | J2-3/RF6/SCK1 | SPI Clock |
| SDO | O | J2-5/RF7/SDI1_E | SPI Data Out from ZG2100M |
| SDI | I | J2-7/RF8/SDO1_E | SPI Data In to ZG2100M |
| INT_NX | O | J2-18/RE8/INT1 | Interrupt signal from ZG2100M (asserted low) |
| RST_N | I | J2-28/RF0 | Master reset (asserted low) |
| CE_N | I | J2-30/RF1 | ZG2100M disable (asserted low) |
| VDD | I | J2-21 & J2-22 | 3.3V power input |

## Erasing EEPROM

While doing debug, if you notice that settings in code (especially related to SSID name, MAC

address and the like) are not taking effect, then you may need to erase the EEPROM. The value in EEPROM takes precedence over values that are defined in source code (i.e. TCPIPConfig.h). To erase the EEPROM, perform the following:

1. Make sure the development board is programmed and not in debug mode.
2. Disconnect the MPLAB® ICD2 or MPLAB REAL ICE™ from the board.
3. Press and hold BUTTON0 (RD13/S4 on Explorer 16 and RB3/S5 on PICDEM.net™ 2).
4. Press and release the MCLR button.
5. Continue holding BUTTON0 until several LEDs flash indicating the EEPROM has been cleared. This takes about 4 seconds. Alternatively, if you have UART connected to the development board, you should see the following output:
   ```
   BUTTON0 held for more than 4 seconds.  Default settings
   restored.
   ```
6. Release BUTTON0.
7. Press and release the MCLR button again to reset the software.

# *Other Info*

Please refer to the web sites:
http://www.microchip.com/tcpip
http://www.microchip.com/Ethernet
http://www.zerogwireless.com

Microchip IDE v8.15 or later
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en019469&part=SW007002

MPLAB C Compiler for PIC24 v3.11(b) Student edition w/60day free trial
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en535364

MPLAB C Compiler for PIC18 v3.20
http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en010014

HEX keys can be converted from ASCII paraphrases in advance using various on-line calculators. Example:
http://www.speedguide.net/
Look under broadband tools

WPA/WPA2 Keys can be created from your SSID and paraphrase using on-line calculators. Example:
http://www.wireshark.org/tools/wpa-psk.html

# Federal Communication Commission Interference Statement

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 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 that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

FCC Caution: To assure continued compliance, (example - use only shielded interface cables when connecting to computer or peripheral devices). Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.
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.

## FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
This device is intended only for OEM integrators under the following conditions:
1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna.
As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).
IMPORTANT NOTE: In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

## End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users (for example access points, routers, wireless ADSL modems, and similar equipment). The final end product must be labeled in a visible area with the following: "**Contains FCCID: W7OZG2100-ZG2101**".

## Manual Information That Must be Included

The user's manual for end users must include the following in-formation in a prominent location. IMPORTANT NOTE: To comply with FCC RF exposure compliance requirements, the antenna used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

## Revision History

| | | |
|---|---|---|
| Document ID | GSG-102.03 | |
| Title | *ZGS2101 ZeroG System Development Kit for Wi-Fi® PICtail™ using PICDEM.net 2 and Explorer 16* | |
| Revision History | 1.01 | Initial Revision |
| | 2.02 | Revised for General release code. |
| | 2.03 | Updated MAC address default settings. Added Erasing EEPROM section on Microchip development boards. |