

# *MicroAutomata Corporation*

## *WPAN-GW User Manual*

*Version 0.1.0*



[MicroAutomata WPAN-GW User Manual]

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[2007-02-18]

## Feedback

Please direct any comments or suggestions about this document to:  
[admin@microautomata.com](mailto:admin@microautomata.com)

## Document History

<i>Version</i>	<i>Date</i>	<i>Description of Change</i>
[0.1.0]	[2007-02-18]	[Preliminary release]

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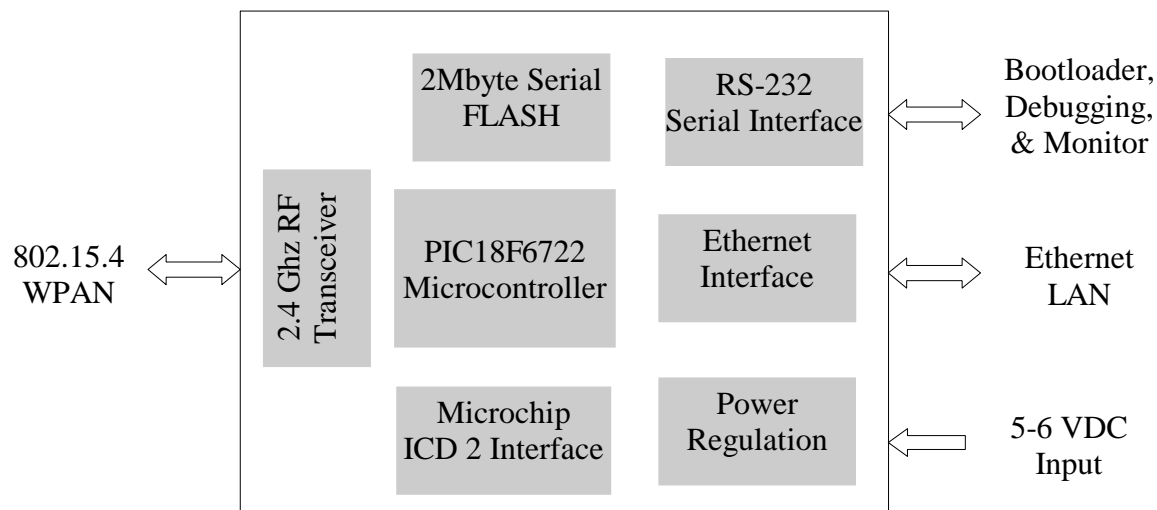
## Section 1: Overview

The WPAN-GW (Wireless Personal Area Network – GateWay) is a development platform that provides an embedded web server as well as support for an Ethernet TCP/IP LAN gateway to an 802.15.4 wireless network.

### WPAN-GW1 Hardware Platform

A block diagram of the WPAN-GW1 circuit board with the optional RF transceiver module is shown in Figure 1-1.

**Figure 1-1: WPAN-GW1 Block Diagram**



The functional hardware blocks shown in the block diagram are:

- Power Regulation** Power input is from a regulated 5VDC, 500mA supply which is used to generate three separate regulated power sources for +5V digital, +3.3V digital, and +3.3V RF analog. Maximum power consumption across operating temperature with all devices active (microcontroller, FLASH, Ethernet, RF transceiver, and RS-232 interface) is less than 500mA.
- Ethernet Interface** The ENC28J60 Ethernet Controller drives the 10mbps Ethernet interface through a serial SPI bus and provides 8Kbytes of transmit/receive packet SRAM.
- Serial Interface** The RS-232 serial interface provides a computer link used for

program development with the boot loader and also serves as a communications link for application debugging, monitoring, and configuration. The serial interface has auto-baud detection with up to 115K baud data rates,

- **Microcontroller** The [Microchip 18F6722 microcontroller](#) is clocked at 40 MHz and provides 128Kbytes of FLASH program memory, 2 SPI ports, 2 serial ports, 3.8Kbytes RAM, 1Kbyte EEPROM,
- **Serial FLASH** Atmel's AT45DB161D serial FLASH provides 2Mbytes of nonvolatile storage used for configuration data, web server files, data logging, and network based firmware updates.
- **ICD 2 Interface** Program development and debugging is fast and efficient with the [Microchip ICD 2](#) interface along with the [Microchip IDE](#) (Integrated Development Environment).
- **RF Transceiver** Optional RF transceiver modules provide access to wireless networks for controlling and monitoring home and building automation devices. Two RF modules are currently available, the WPAN-RF1 and WPAN-RF3, based on the Texas Instruments/Chipcon CC2420 2.4GHz transceiver designed for 802.15.4 wireless solutions. Additional modules are scheduled for release based on the [Microchip MRF24J40 2.4 GHz 802.15.4 transceiver](#). MicroAutomata is also designing modules with the similarly low powered [Texas Instruments/Chipcon CC1100](#) versatile transceiver intended for increased range (up to 1.5 miles line of sight at 1.2kbps with FEC and +10dbm output) designs in the 300-348MHz, 400-464 MHz and 800-928 MHz frequency range.

## Firmware Development Platform

The initial release of this product is accompanied with the three firmware modules freely provided by Microchip Technology Incorporated. The firmware modules include documentation and complete source code downloaded through the following links:

1. [PIC16/18 Boot Loader](#) The AN851 boot loader application is a simple and reliable assembly module that is located in a 2Kbyte protected boot sector in the PIC18F6722 program FLASH. Boot loader compatible firmware applications are downloaded with the RS-232 serial interface and the Microchip P1618QP.exe boot loader utility running on an MS Windows PC.
2. [Microchip TCP/IP Stack](#) Documented in Microchip application note AN833b, support is provided for following TCP/IP stack components:

<a href="#">ARP</a>	<a href="#">DHCP</a>	<a href="#">Socket support for TCP and UDP</a>
<a href="#">IP</a>	<a href="#">SNMP</a>	<a href="#">AJAX</a>
<a href="#">ICMP</a>	<a href="#">HTTP</a>	<a href="#">DNS – Domain Name System</a>
<a href="#">UDP</a>	<a href="#">FTP</a>	<a href="#">NetBIOS Name Service</a>
<a href="#">TCP</a>	<a href="#">TFTP</a>	<a href="#">Ethernet Device Discovery</a>

3. [Microchip ZigBee™ Stack](#) Documented in Microchip application note AN965 (version c), highlights of the stack are:
- Version 1.0-3.8 is compliant with version 1.0 of the ZigBee protocol specification
  - Supports non-slotted (non-beacon) star, cluster tree, and mesh network topologies
  - Implements RFD and FFD devices, with support for Coordinators, Routers, and End Devices
  - Default support for non-volatile neighbor and binding tables
  - Supports Security in MAC, NWK and APL layers
  - Includes support for the Home Control, Lighting Profile

The MPLAB IDE provides an MS Windows integrated firmware development environment and includes the assembler, linker, project manager and support for the MCC18 'C' compiler and ICD 2 programmer/debugger. MPLAB IDE and MCC18 (student version) can be downloaded freely at the Microchip web site, refer to Table 1-2. Target programming and debugging is best done with the low cost MPLAB ICD 2 In Circuit Debugger/programmer. This tool is seamlessly integrated into the MPLAB IDE and is the most cost effective solution for firmware development with the hardware. A workable alternative is to use the boot loader (installed on the WPAN-GW1 when it is shipped), the RS-232 serial interface, and the Microchip P1618QP boot loader utility (an MS Windows application). Although this solution is slower, it is still very effective with a typical build-load-run cycle for a 60Kbyte image of about 60-120 seconds at 57.6k baud and requires several manual steps:

1. Invoke boot loader with reset and boot switches
2. Connect P1618QP application to PIC18F6722 boot loader
3. Erase PIC186722 FLASH program memory
4. Load boot-loader compatible application hex file
5. Write hex file to PIC186722 FLASH program memory
6. Disconnect P1618QP application from PIC18F6722 boot loader
7. Connect MS Windows terminal program for application debug/monitor
8. Reset target to run application

The equivalent typical build-load-run cycle for the MPLAB ICD 2 would be to click on the 'MAKE' Icon and the new application is running on the target within the 5-15 seconds required for the IDE to build, download and run the application. The MPLAB ICD 2 also provides symbolic debugging as well as control of program execution with halt, step, and hardware break points. The MPLAB ICD 2 is highly recommended for serious firmware

development and can be purchased online at the Microchip web site.

## Reference Documentation

***Table 1-1: Reference Documentation***

<b>Description</b>	<b>Source</b>
AN851 rev. b, Microchip Boot Loader	<a href="http://www.microchip.com">www.microchip.com</a>
AN833 rev. b, Microchip TCP/IP Stack	<a href="http://www.microchip.com">www.microchip.com</a>
AN965 rev. c, Microchip Zigbee Stack	<a href="http://www.microchip.com">www.microchip.com</a>
TIMAC-CC2420, IEEE802.15.4 MAC	<a href="http://www.ti.com">www.ti.com</a>
IEEE 802.15.4 Specification	<a href="http://standards.ieee.org">http://standards.ieee.org</a>
PIC18F8722 (includes PIC18F6722) Data Sheet	<a href="http://www.microchip.com">www.microchip.com</a>
CC2420 2.4GHz 802.15.4 RF Transceiver Data Sheet	<a href="http://www.ti.com">www.ti.com</a>
ENC28J60 10Base-T Ethernet MAC and PHY Data Sheet	<a href="http://www.microchip.com">www.microchip.com</a>
IEEE Press, Low-Rate Wireless Personal Area Networks, 2 <sup>nd</sup> Edition	<a href="http://www.ieee.org">www.ieee.org</a>

## Development Tools Reference

***Table 1-2: Development Tools***

<b>Description</b>	<b>Source</b>
Microchip Boot Loader Source Code, revision b	<a href="http://www.microchip.com">www.microchip.com</a>
Microchip TCP/IP Stack Source Code, version 3.75	<a href="http://www.microchip.com">www.microchip.com</a>
Microchip Zigbee Stack Source Code, version 1.0-3.8	<a href="http://www.microchip.com">www.microchip.com</a>
Microchip MPLAB IDE with Assembler and Linker	<a href="http://www.microchip.com">www.microchip.com</a>
Microchip MCC18 'C' Compiler	<a href="http://www.microchip.com">www.microchip.com</a>
Microchip MPLAB ICD 2 In Circuit Debugger/programmer	<a href="http://www.microchip.com">www.microchip.com</a>
Asynchronous JavaScript and XML (AJAX) – Mozilla Development Center	<a href="http://developer.mozilla.org">http://developer.mozilla.org</a>
W3 Schools Web Building Tutorials	<a href="http://www.w3schools.com">www.w3schools.com</a>
Understanding AJAX, Joshua Eichorn	<a href="#">Prentice Hall</a>

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## Section 2: Quick Start

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This section provides instructions on how to get quickly started with the WPAN-GW1 kits. Before getting started, verify the WPAN-GW1 Kit Contents you ordered contains the listed items.

### WPAN-GW1 Kit Contents

All WPAN-GW1 kits include the following:

1. WPAN-GW1 module with enclosure
2. DSUB 9-pin male to 9-pin female cable for RS-232 serial communications
3. CAT5e Ethernet Cable
4. Phihong plug-in 5VDC regulated switching supply with country specific plug adapter
5. CD with documentation and firmware
6. This manual

The RF kits also include an RF module plugged into the WPAN-GW1 circuit board. Kits with RF modules that require an external antenna (WPAN-RF3) ship with an external  $\frac{1}{4}$  wave, omni-directional, 2.0dBi (or 3.2dBi if available) gain dipole RPSMA antenna.

<p><b>NOTE:</b> The external RF antenna must be attached whenever power is applied to the WPAN-GW1.</p>
---

All units are fully tested and inspected prior to shipping.

### Setting up WPAN-GW1 Embedded Web Server

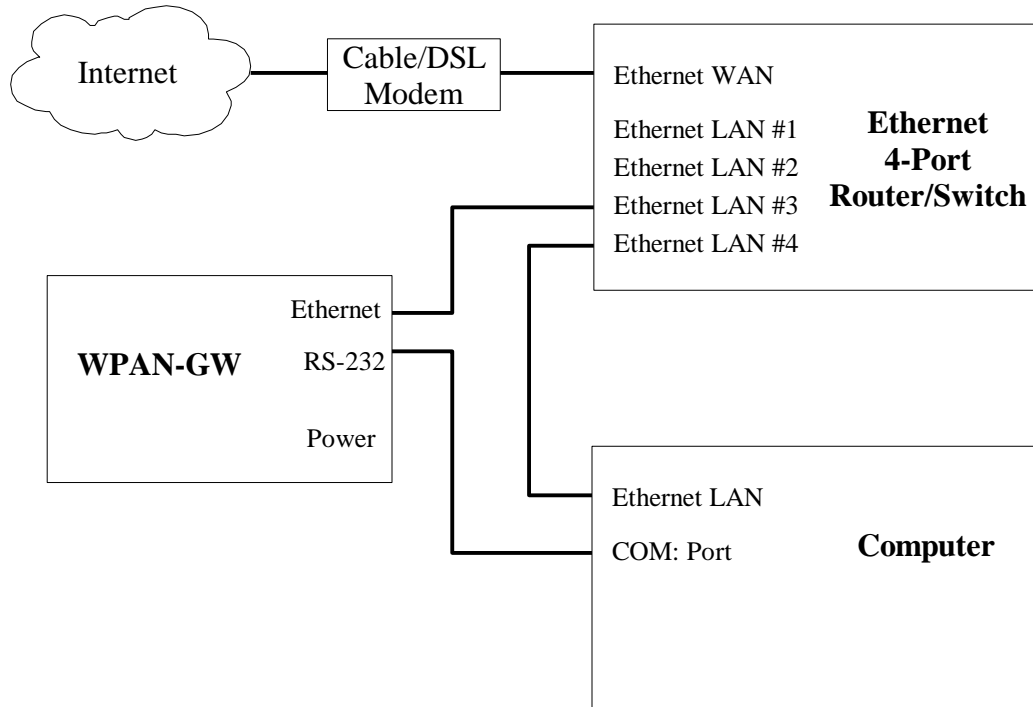
Before setting up and running the embedded web server demo, look over the Microchip application note AN833 referenced in Table 1-1 and also provided on the CD in the directory \wpan\microchip\ApplicationNotes. Information very pertinent to the embedded web server application is found in AN833 starting with page 77, “THE MICROCHIP HTTP SERVER”.

The WPAN-GW1 ships with the AN851 boot loader and the Microchip TCP/IP Stack firmware installed. Additionally, the serial data FLASH on the WPAN-GW1 is preloaded with the example web server files located on the CD in the \MCHPTCP3.60\WebPages directory.

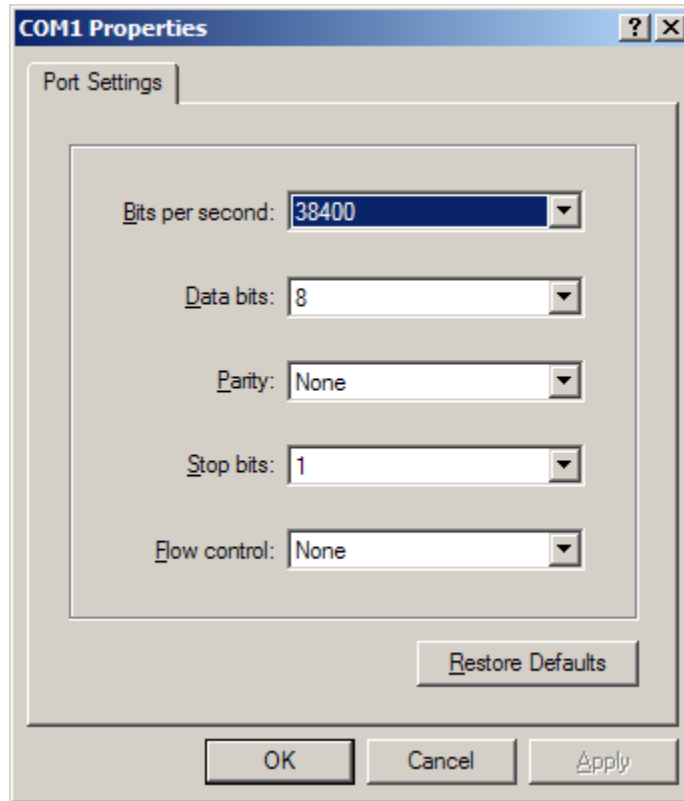
The following demonstration of the TCP/IP stack and embedded web server application requires the use of an Ethernet LAN with an available RJ45 port on the Ethernet LAN switch or router. Connect the WPAN-GW1, a PC and a Ethernet Switch/Router as shown in Figure 2-1.

1. Connect the CAT5e cable from the WPAN-GW1 to the Switch/Router connecting the Ethernet LAN. The PC also needs to be connected to the Ethernet LAN. Make sure the Switch/Router has DHCP enabled so an IP address will be assigned to the WPAN-GW1. Otherwise, when the WPAN-GW1 first executes the TCP/IP application, a configuration menu will appear allowing the user to enter a static IP address.

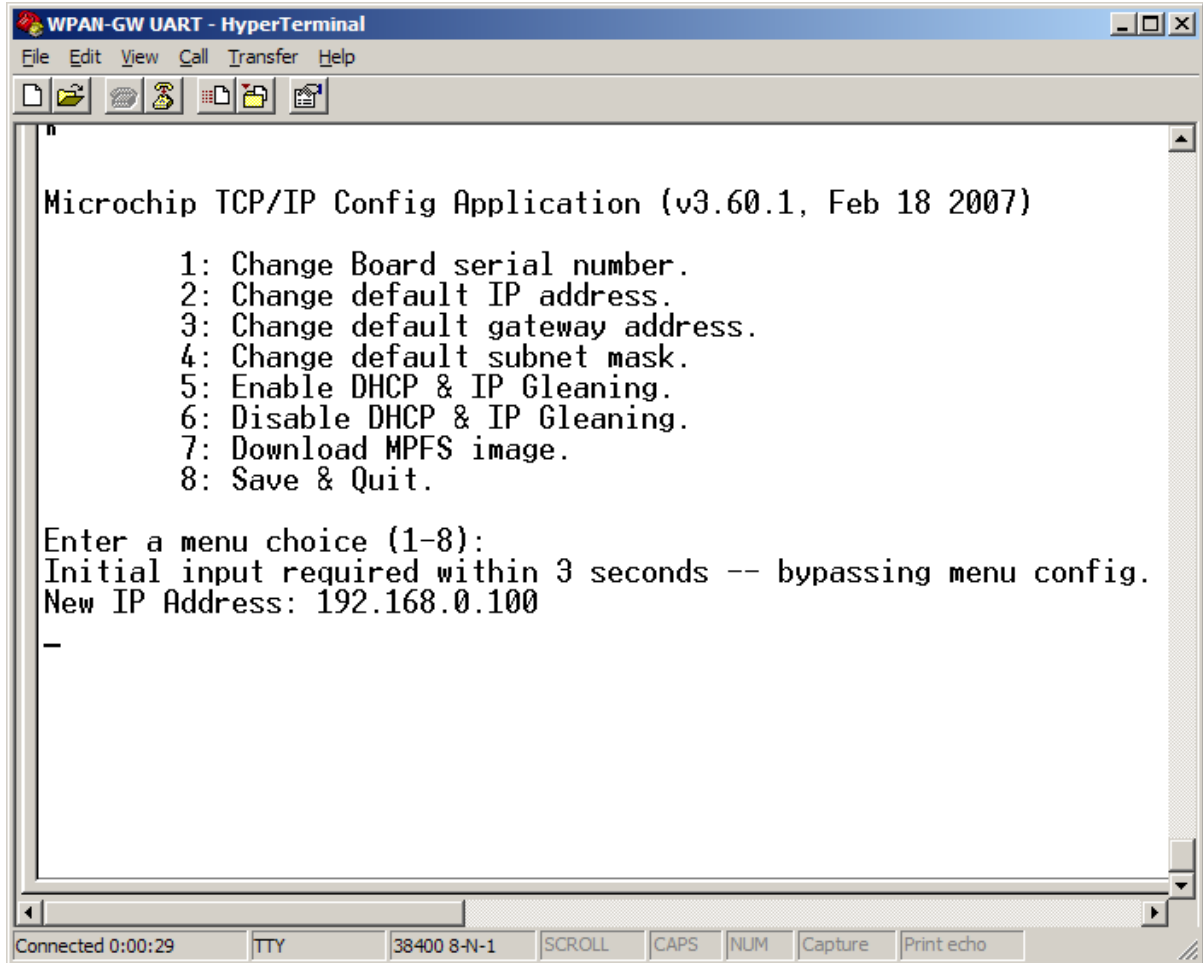
***Figure 2-1: WPAN-GW1 LAN Connection Diagram***



2. Connect the RS-232 serial cable from the WPAN-GW1 to the PC. The PC will require a terminal program, such as the HyperTerminal utility provided with MS Windows and found in start menus programs>accessories>communications folder. Configure the terminal program with the following properties and then connect (call) the COM: port.



3. Connect power to the WPAN-GW1. LED3 will light up and remain lit for 3 seconds. During this time, the TCP/IP configuration menu will be active on the PC terminal program. If no console input (a key is pressed) occurs within this 3 second period, the TCP/IP application will begin execution with the configuration already stored in the data FLASH memory. If DHCP is enabled on your Ethernet Switch/Router, you can let the TCP/IP application proceed and the assigned IP address will be displayed on the terminal window. Otherwise press the number '2' to change the IP address. After entering in the new IP address, pressing the number '6' will disable DHCP. Press '8' when finished and the changes will be saved in the data FLASH and the TCP/IP application will begin execution. When the TCP/IP application is executing, LED3 will flash every second to indicate the main processing loop is running.



```
WPAN-GW UART - HyperTerminal
File Edit View Call Transfer Help

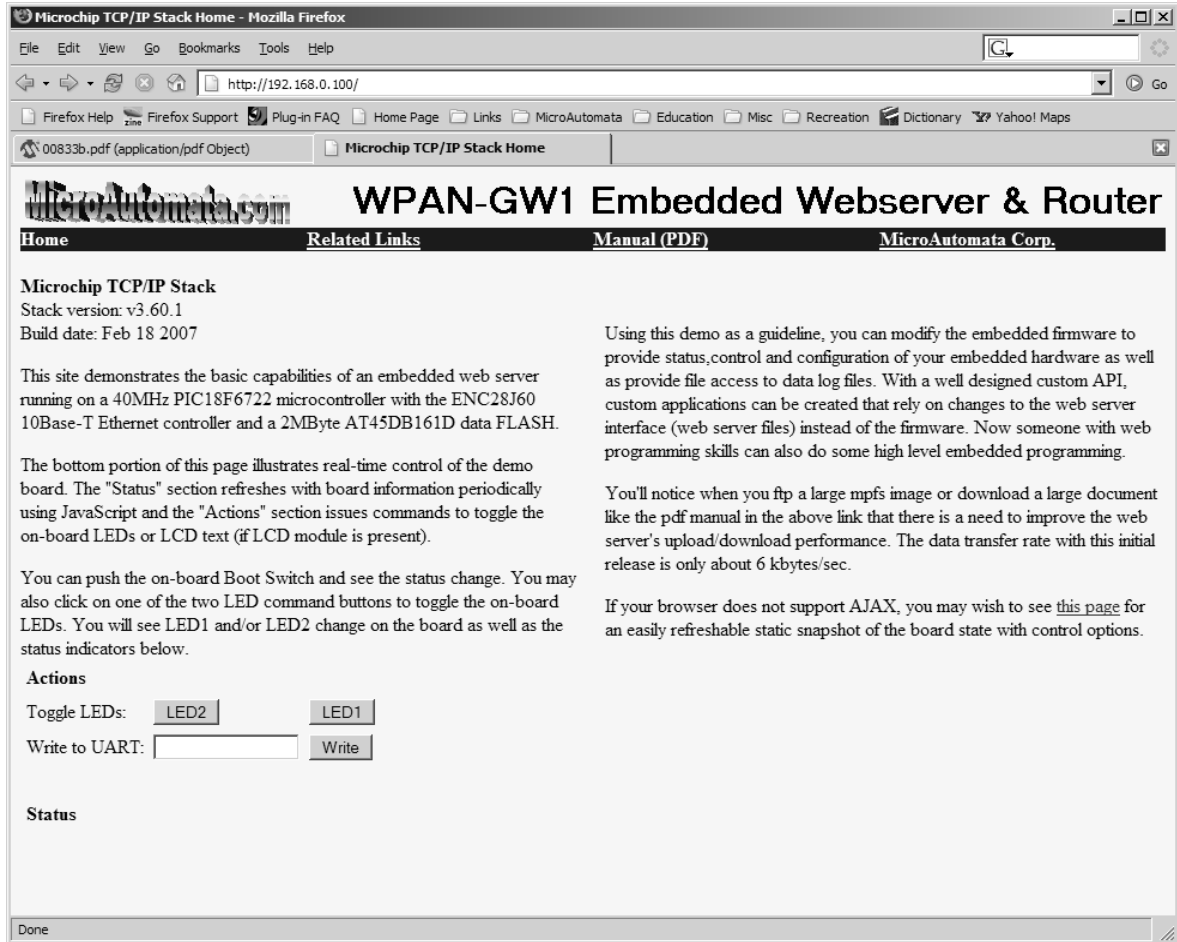
Microchip TCP/IP Config Application (v3.60.1, Feb 18 2007)

1: Change Board serial number.
2: Change default IP address.
3: Change default gateway address.
4: Change default subnet mask.
5: Enable DHCP & IP Gleaning.
6: Disable DHCP & IP Gleaning.
7: Download MPFS image.
8: Save & Quit.

Enter a menu choice (1-8):
Initial input required within 3 seconds -- bypassing menu config.
New IP Address: 192.168.0.100
-

Connected 0:00:29  TTY  38400 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
```

4. Once the TCP/IP application is running, type the IP address into a web browser window running on the PC. The embedded web server home page should appear.



The WPAN-GW1 web server can be accessed by any device with a web browser and access the Ethernet LAN. This includes PDAs, cell phones, Tablet PCs, and remote computers. Refer to the WPAN-GW1 Remote Access white paper found at [www.microautomata.com](http://www.microautomata.com) for an example of how to access the WPAN-GW1 web server attached to a typical residential LAN through the Internet.

## Programming WPAN-GW1 with Boot Loader and P1618QP

Before running the MpZbee Demo Coordinator and Demo RFD applications, the P1618QP MS Windows utility must be installed. The Microchip application note AN851 documents the use of this utility. The P1618QP utility is used to load the .hex program files into the WPAN-GW1 program FLASH. This utility can be downloaded from the Microchip website using the link provided in Table 1-2. Once the P1618QP application is installed, the file `\wpan\gw-02182007\P1618QP\P1618QP.INI` located on the CD must be copied into the directory where the file `p1618qp.exe` is installed. This file contains the definitions required by the `p1618qp` utility for the PIC186722 device. The new `p1618qp.ini` file has the following

highlighted lines added to define the PIC186722 device:

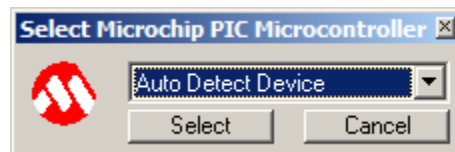
```
[DEVICELIST]
0="PICUNKNOWN"
.
.
.
Added ==> 160="PIC18F6722"
.
.
.
2051="PIC16F876A"
```

Added the following block:

```
[PIC18F6722]
writeblock=8
readblock=1
eraseblock=64
devicetype=1
maxpacketsize=128
bytesperaddr=1
pmrangelow="000800"
pmrangehigh="1FFFF"
eerangelow="000000"
eerangehigh="0003FF"
usrrangelow="200000"
usrrangehigh="20000F"
cfgrangelow="300000"
cfgrangehigh="30000F"
300001="CONFIG1H"
300002="CONFIG2L"
300003="CONFIG2H"
300004="CONFIG3L"
300005="CONFIG3H"
300006="CONFIG4L"
300008="CONFIG5L"
300009="CONFIG5H"
30000A="CONFIG6L"
30000B="CONFIG6H"
30000C="CONFIG7L"
30000D="CONFIG7H"
```

The process for loading a .hex application file into the WPAN-GW1 is:

1. Make sure the COM: port is not in use by another program such as the terminal program used earlier with the TCP/IP Stack Demo. Start the p1618qp utility and press the select button with either the default "Auto Detect Device" or "PIC18F6722". Use the mouse to hover over icons for usage tips.

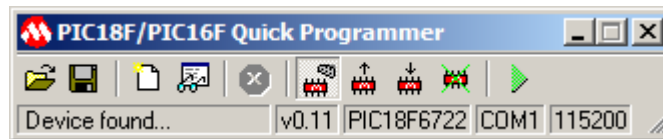


2. Right click on the baud rate field to select a baud rate of 115200 or 57600. If the

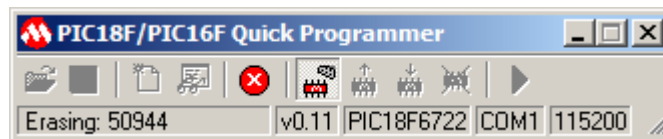
default COM1 port needs to change, right click on the COM1 field and select a different COM: port.



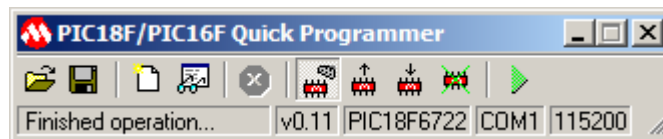
3. Enter the boot loader code on the WPAN-GW1 by pressing Boot Switch while either releasing Reset Switch or applying power. The boot loader checks the state of Boot Switch immediately following a reset or power on event and enters the boot loader mode if it is pressed. All three status LEDs on the WPAN-GW1 board will initially light up when boot loader mode is entered. If the enclosure front panel is present, you will need to use a straightened paper clip to insert into the holes allowing access to the switches. After the WPAN-GW1 enters boot loader mode as indicated by the three status LEDs, click on the P1618QP utilities “Connect to Device” icon.



4. Erase the PIC18F6722 program FLASH by clicking on the “Erase Device” icon. The P1618QP utility's status field will indicate the status of the erase operation and also LED2 will flash each time a boot loader command is received and validated by the WPAN-GW1.

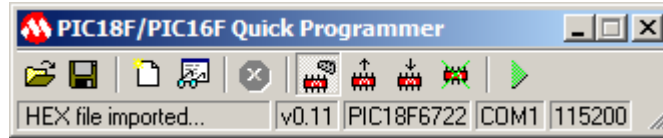


5. When the erase is complete the P1618QP utility's status field will indicate “Finished operation”.

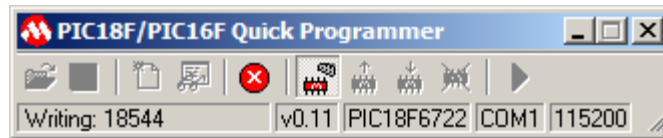


6. Click on the “Open File” icon to load DemoCoordinatorForBootLoader.hex found on the CD in the \wpan\gw-02182007\MpZBeeV1.0-3.6\DemoCoordinator\. Virus protection software may halt this read hex file operation requiring either a response to proceed or temporarily disabling the virus protection application. After the P1618QP status field indicates “HEX file imported...”, right click on the “View memory” icon and make sure only “FLASH” is checked. Finally, click on the P1618QP “Write Device” icon to load the .hex application into the PIC18F6722 program FLASH. If the EEDATA field is checked when the “Write

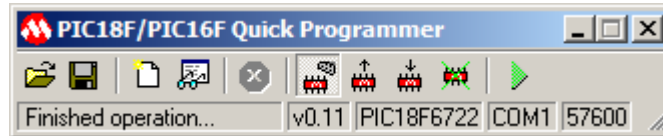
Device” operation is active, the EEPROM data in the PIC18F6722 will be overwritten. If this happens and the most significant byte of the EEPROM data is 0xFF, the boot loader will not execute the loaded application (refer to AN851 for a description of controlling boot loader operation with the EEPROM data field). If this happens load the EEDATA with the “Read Device” operation, change the most significant byte in the EEPROM data by clicking on the “View Memory” icon, and reprogram the EEPROM data with the “Write Device” operation.



7. Again, the P1618QP status field and LED2 will provide indicate the write operation activity.



8. The P1618QP status field will indicate “Finished operation” when programming is complete.



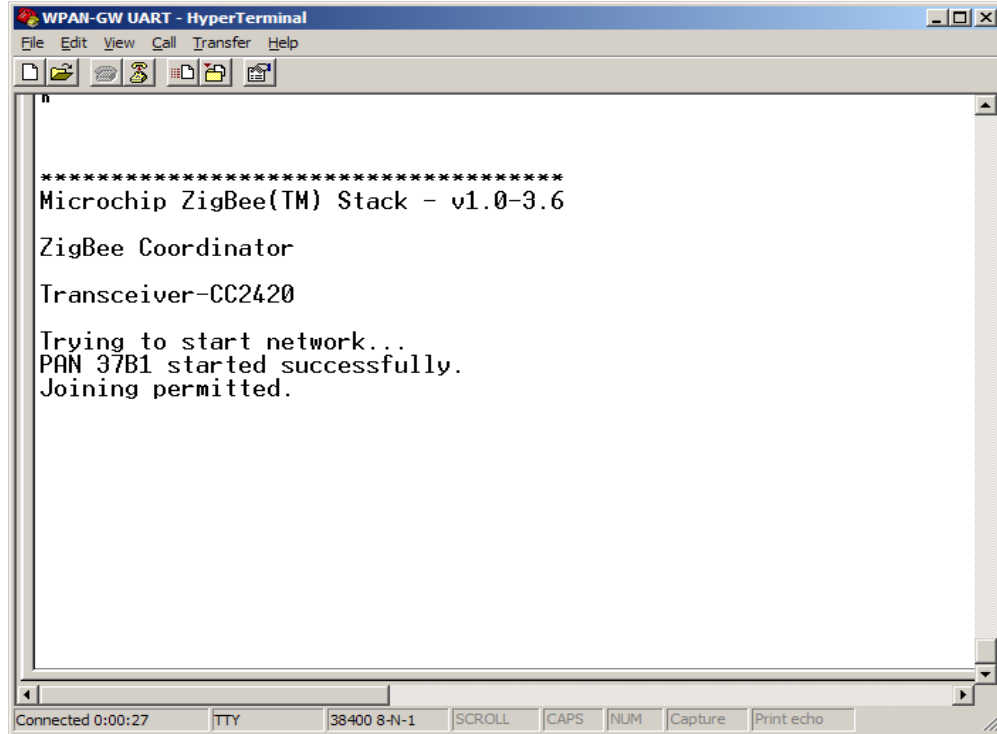
9. Now either press the Reset Switch or cycle power and the application should run. If not, start the process over making sure there are no other programs loaded that may possibly be conflicting with the COM: port operation. Some times if the COM: port was compromised, the PC may need to be rebooted.

NOTE: Sometimes after a successful write operation, the P1618QP utility may generate an error message indicating that the verify operation failed at certain lines in the hex file. This most likely not a problem and occurred as a result of the linker generating two lines with the same address but each line programs only half the flash data. Comparing the error file generated by P1618QP with the hex file will confirm this by noting that two lines with the same address are generated and any bytes not 0xFF in one line are paired with bytes equal to 0xFF in the other line.

## Running MpZbee Demo Coordinator and Demo RFD

If the Demo Coordinator application was successfully downloaded with the P1618QP utility in the previous section, then the application would have started by flashing LED3 at one

second intervals indicating the main processing loop is active. Connecting the terminal program is to the serial port during the application initialization should show:



```

*****
Microchip ZigBee(TM) Stack - v1.0-3.6

ZigBee Coordinator
Transceiver-CC2420

Trying to start network...
PAN 37B1 started successfully.
Joining permitted.

```

The PAN ID will be unique, however what is important is that the network was started successfully and joining is permitted. When joining is permitted, status LED2 will turn on.

Loading the Demo RFD application into a second WPAN-GW1 and another RF module demonstrates a simple remote light switch using the ZigBee protocol and the Boot Switch to toggle LED1 on the Demo Coordinator. After the RFD has joined the network, press and hold the Boot Switch until LED1 turns on, then release the switch. This will result in a toggle light command being sent to the Coordinator and LED1 will be toggled. The LED1 on RFD will remain on for 3 seconds after being pressed during which time the Boot Switch will be ignored by the RFD and no toggle commands will be sent until LED1 on the RFD turns off.

The first time a Demo RFD is turned on, the terminal program will show:

```

*****
Microchip ZigBee(TM) Stack - v1.0-3.6
ZigBee RFD
Transceiver-CC2420
Trying to join network as a new device...

```

Connected 0:00:16 TTY 38400 8-N-1 SCROLL CAPS NUM Capture Print echo

If the Demo Coordinator has successfully started a network, LED2 will turn on and the terminal program will display:

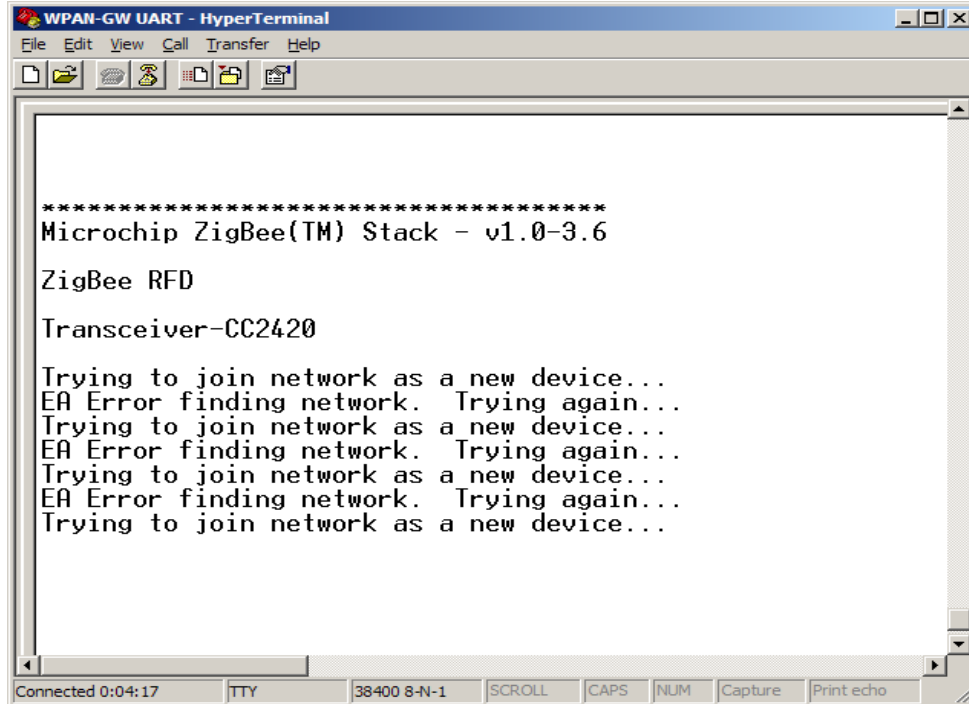
```

*****
Microchip ZigBee(TM) Stack - v1.0-3.6
ZigBee RFD
Transceiver-CC2420
Trying to join network as a new device...
Network(s) found. Trying to join 12B4.
Join successful!
Requesting data...
No data available.
Going to sleep...
Requesting data...
No data available.
Going to sleep...
Requesting data...
No data available.
Going to sleep...

```

Connected 0:00:19 TTY 38400 8-N-1 SCROLL CAPS NUM Capture Prin

The terminal program will display the following when a Demo RFD cannot join a new network.



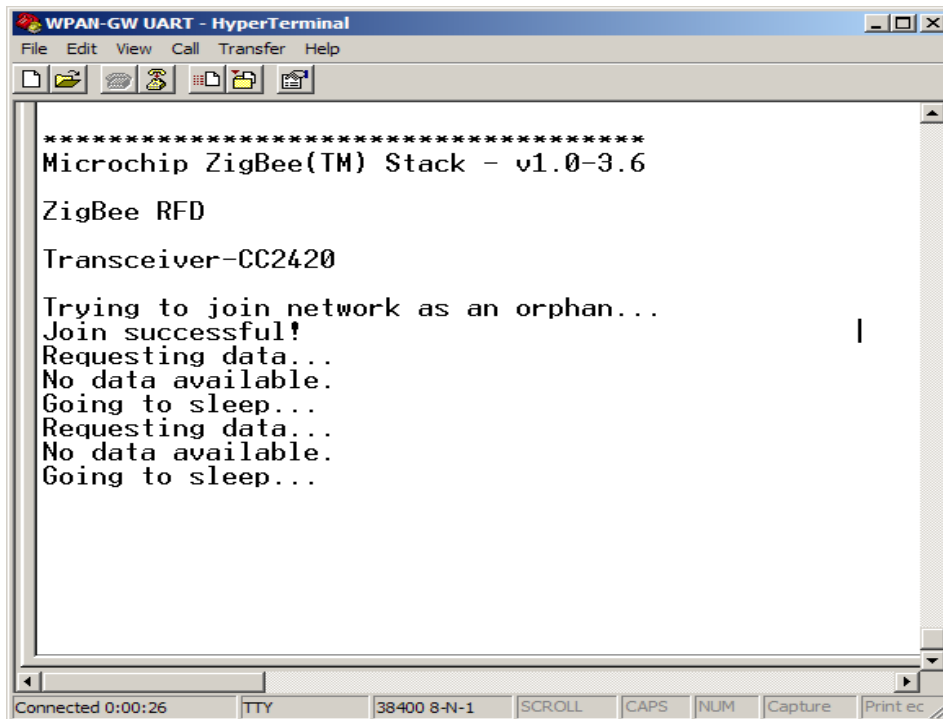
```

WPAN-GW UART - HyperTerminal
File Edit View Call Transfer Help
*****
Microchip ZigBee(TM) Stack - v1.0-3.6
ZigBee RFD
Transceiver-CC2420

Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...
Connected 0:04:17 TTY 38400 8-N-1 SCROLL CAPS NUM Capture Print echo

```

When an RFD has already joined a network, it will try to rejoin as an orphan if it is reset or power cycled:



```

WPAN-GW UART - HyperTerminal
File Edit View Call Transfer Help
*****
Microchip ZigBee(TM) Stack - v1.0-3.6
ZigBee RFD
Transceiver-CC2420

Trying to join network as an orphan...
Join successful!
Requesting data...
No data available.
Going to sleep...
Requesting data...
No data available.
Going to sleep...
Connected 0:00:26 TTY 38400 8-N-1 SCROLL CAPS NUM Capture Print ec

```

If an RFD is reset or power cycled and the previously joined network can't be found, it will try for a while to search and join as an orphan and eventually timeout and join a network as a new device. For the current software release, if the network is lost after an RFD has joined, the RFD will have to be reset or power cycled. This is true for any reason, even for a temporary disconnect from the network.

---

## Section 3: WPAN-GW1 Firmware Development

---

### Microchip Development Environment

Serious code development is best accomplished the the MPLAB IDE, the MCC18 'C' compiler, and the MPLAB ICD 2 In Circuit Debugger/Programmer. The limitations of the student version of the MCC18 'C' compiler should not be an issue with either the TCP/IP stack, MpZbee stack, or the boot loader.

### Boot Loader

The AN851 boot loader is included in both the TCP/IP and MpZbee projects. For each build there is both a version without the boot loader present in the linker output and a version with the boot loader included in the linker output. Refer to AN851 for a description of the boot loader assembly module, the linker script, the c018i.c startup file, and setting up the reset and interrupt vectors.

The projects included on the CD use the file gw\_boot.asm for the boot loader assembly module. This module has been modified to provide LED status and respond to the Boot Switch.

**NOTE:** Microchip has recently included the AN851 Quick Programmer Beta Version module in MPLAB IDE. It is recommended **NOT** to use the AN851 Quick Programmer Beta found in MPLAB IDE, it is unreliable and very slow when programming the PIC18F6722 device.

### TCP/IP and MpZbee Project Directories

Before using the TCP/IP and MpZbee projects provided in \wpan\gw-02182007\ on the CD, the Microchip TCP/IP Stack and ZigBee Stack source code should be loaded from the link provided in Table 1-2. This ensures that the developer has satisfied the Microchip licensing agreements. The original source code and projects are also valuable for reference.

Copying the microautomata directory from the CD into a hard drive root directory should allow the TCP/IP and MpZbee projects to build without any file location issues.

The projects provided on the CD to generate the TCP/IP stack and MpZbee Demo applications loaded into the WPAN-GW1 are described in the following sections.

#### TCP/IP Projects

Two MPLAB IDE projects are provided in \wpan\gw-02182007\MCHPTCP3.60 on the CD.

1. WpanGwWithBootLoader generates an image with the boot loader included in the linker output.
2. WpanGwForBootLoader generates an image without the boot loader in the linker output.

## MpZbee Demo Projects

Four MPLAB IDE projects are provided in \wpan\gw-02182007\MpZBeeV1.0-3.6 on the CD. Two projects are in the directory \DemoCoordinator and two projects are in the directory \DemoRFD.

1. DemoCoordinatorWithBootLoader generates an image with the boot loader included in the linker output.
2. DemoCoordinatorForBootLoader generates an image without the boot loader in the linker output.
3. DemoRFDwithBootLoader generates an image with the boot loader included in the linker output.
4. DemoRFDforBootLoader generates an image without the boot loader in the linker output.

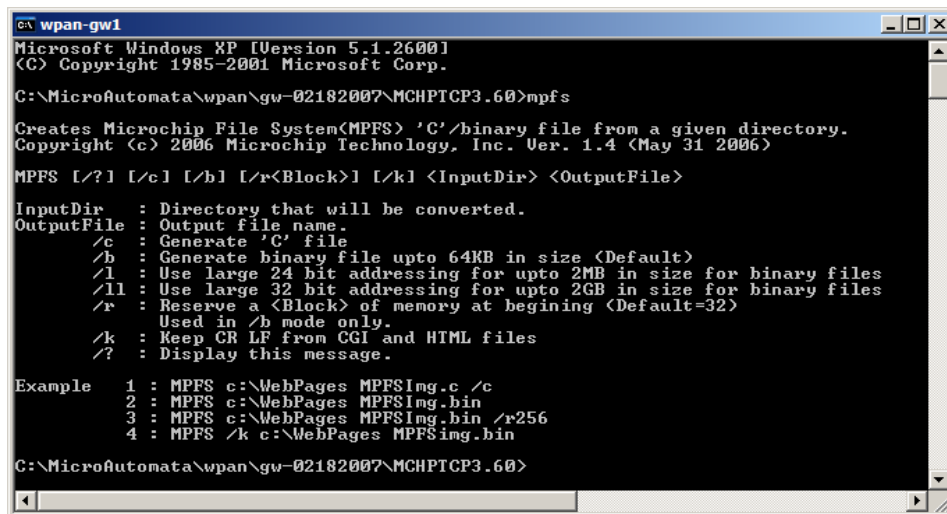
**NOTE:** The Demo Router project has not been created or tested for the WPAN-GW1.

## Using MPFS Utility and FTP with the TCP/IP Stack

The procedure described in this section is documented in the Microchip Application Note AN833.

Microchip provides a utility for building a binary image of the web server directory, mpfs.exe, found in the stack directory (\MCHPTCP3.60 on the CD). The binary image of the web server directory is then loaded into the WPAN-GW1 data FLASH using the DOS ftp program. The following steps outline this procedure.

1. Open a DOS console window in the TCP/IP root directory (\MCHPTCP3.60 on the CD). Enter **mpfs ?** for a description on usage of the mpfs utility.



```

C:\wpan-gw1
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\MicroAutomata\wpan\gw-02182007\MCHPTCP3.60>mpfs

Creates Microchip File System(MPFS) 'C' binary file from a given directory.
Copyright (c) 2006 Microchip Technology, Inc. Ver. 1.4 (May 31 2006)

MPFS [/?] [/c] [/b] [/r<Block>] [/k] <InputDir> <OutputFile>

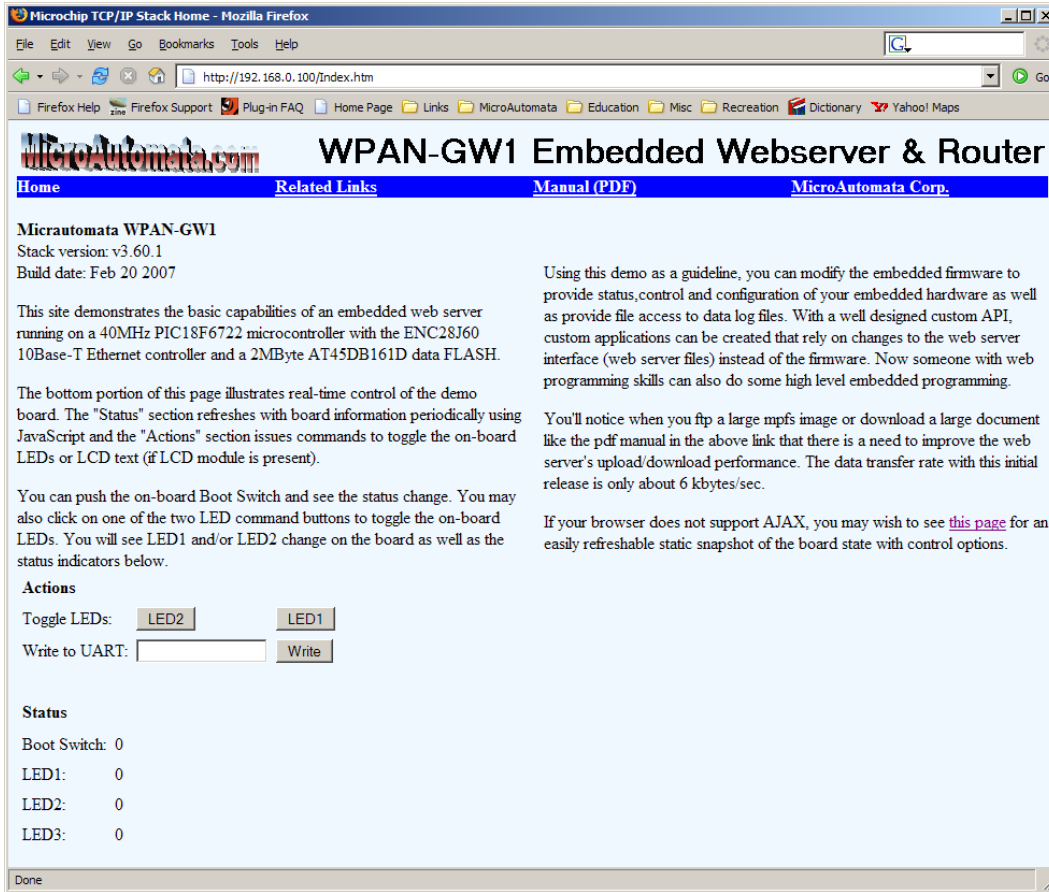
InputDir : Directory that will be converted.
OutputFile : Output file name.
/c : Generate 'C' file
/b : Generate binary file upto 64KB in size (Default)
/l : Use large 24 bit addressing for upto 2MB in size for binary files
/ll : Use large 32 bit addressing for upto 2GB in size for binary files
/r : Reserve a <Block> of memory at beginning (Default=32)
     Used in /b mode only.
/k : Keep CR LF from CGI and HTML files
/? : Display this message.

Example  1 : MPFS c:\WebPages MPFSImg.c /c
         2 : MPFS c:\WebPages MPFSImg.bin
         3 : MPFS c:\WebPages MPFSImg.bin /r256
         4 : MPFS /k c:\WebPages MPFSImg.bin

C:\MicroAutomata\wpan\gw-02182007\MCHPTCP3.60>

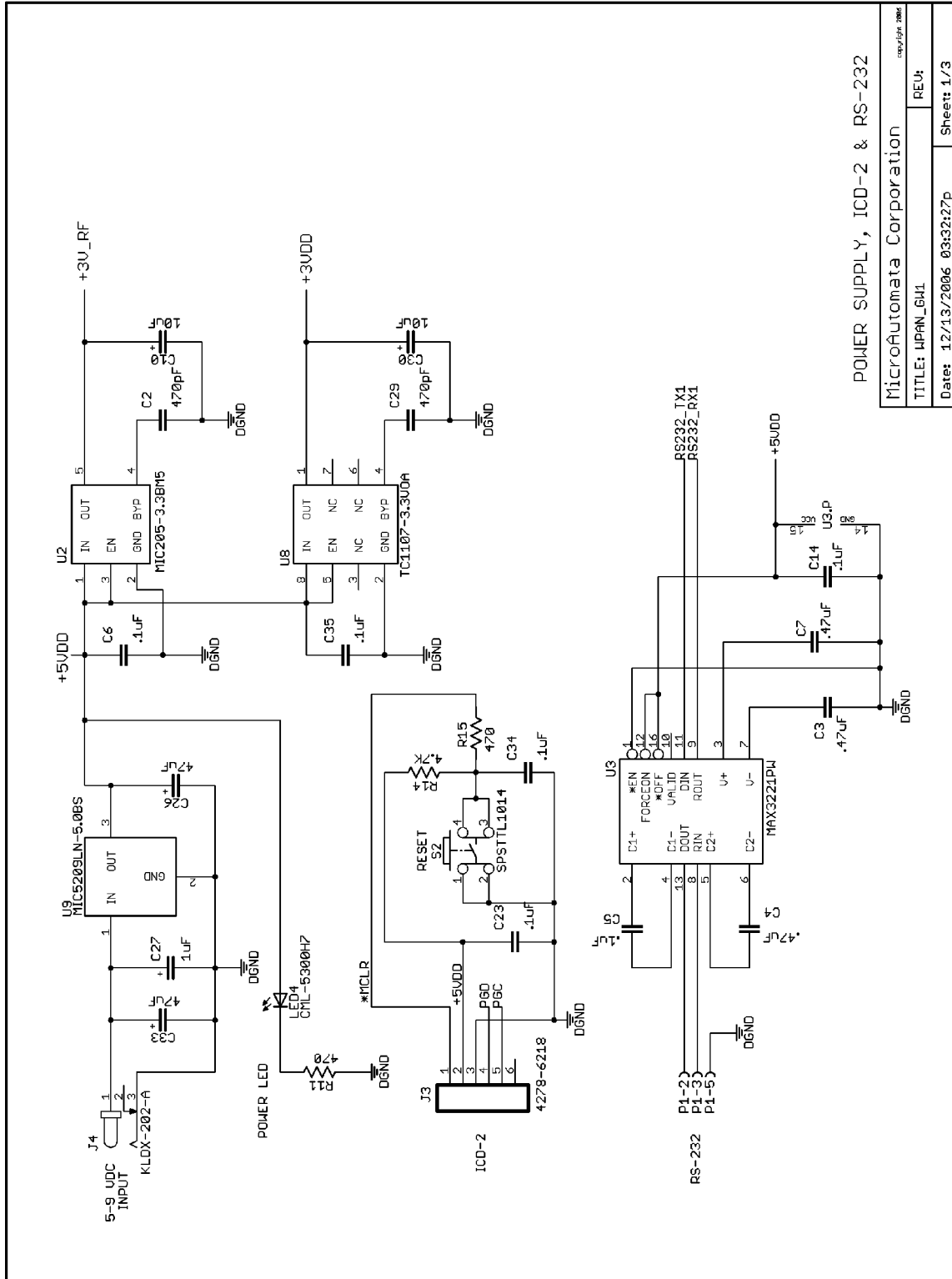
```





# Section 4: WPAN-GW1 Hardware Design

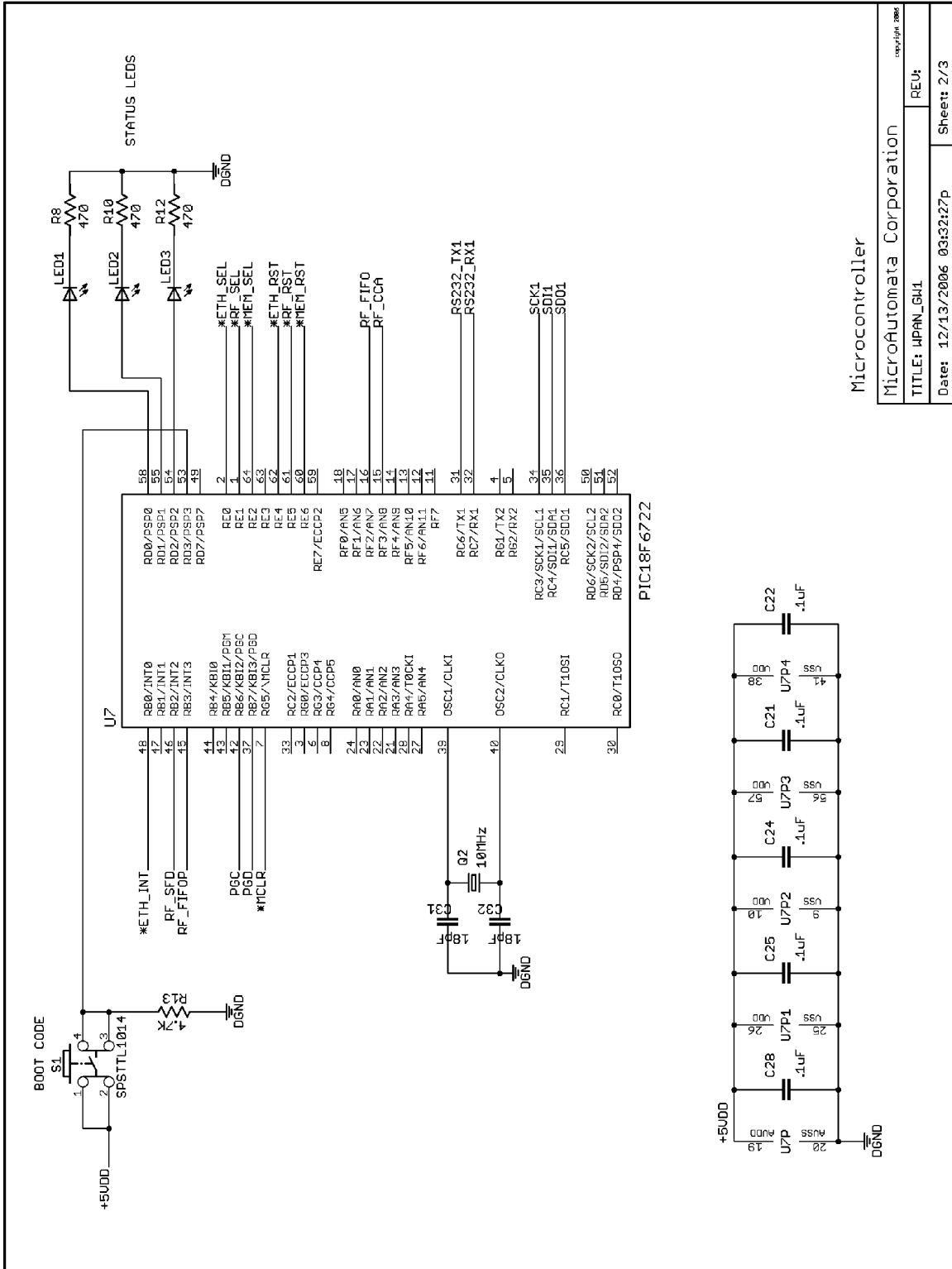
Schematic, Page 1 of 3



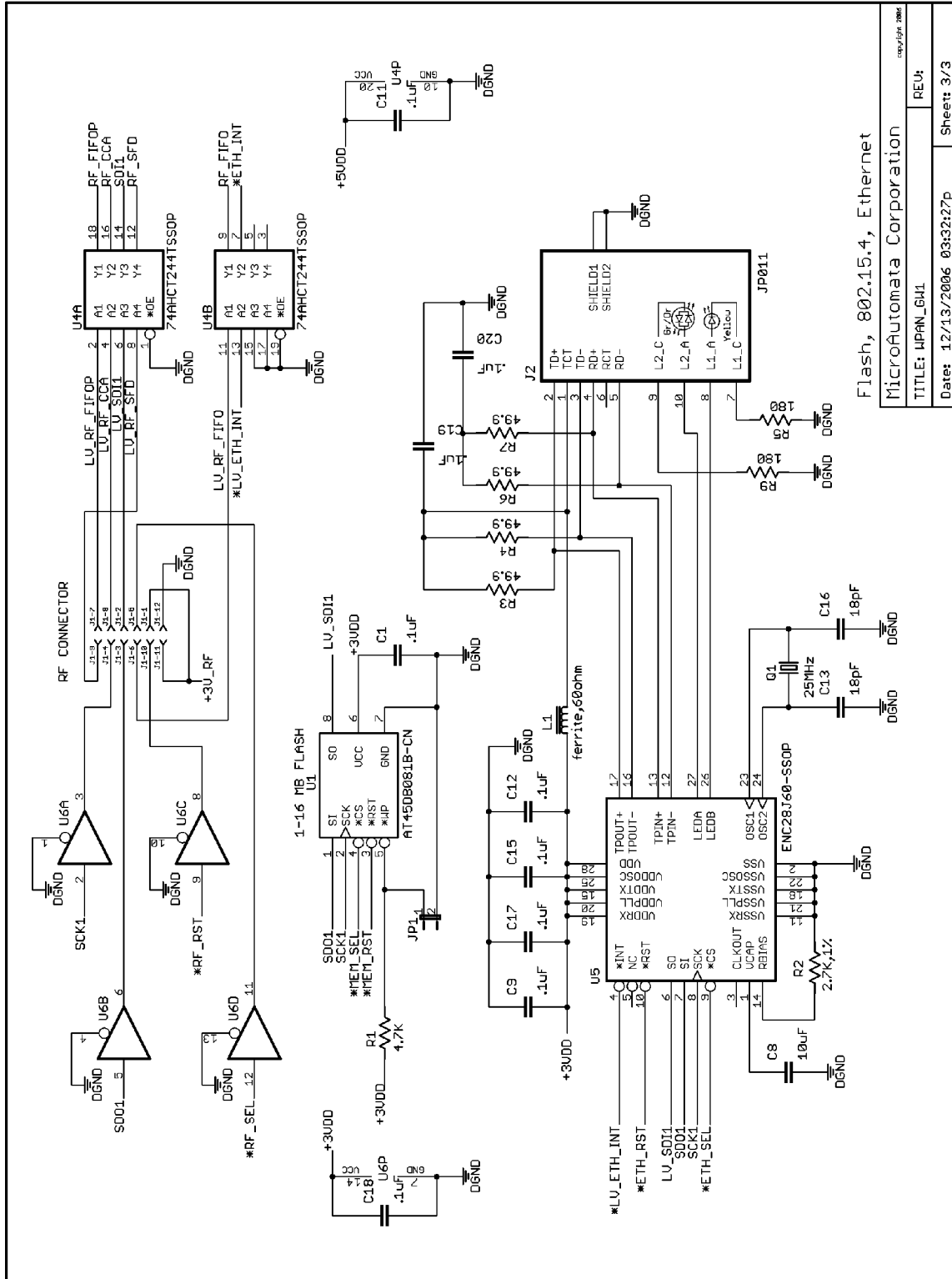
POWER SUPPLY, ICD-2 & RS-232

MicroAutomata Corporation	
TITLE: WPAN_GW1	REV: 1
Date: 12/13/2006 03:32:27P	Sheet: 1/3

Schematic, Page 2 of 3

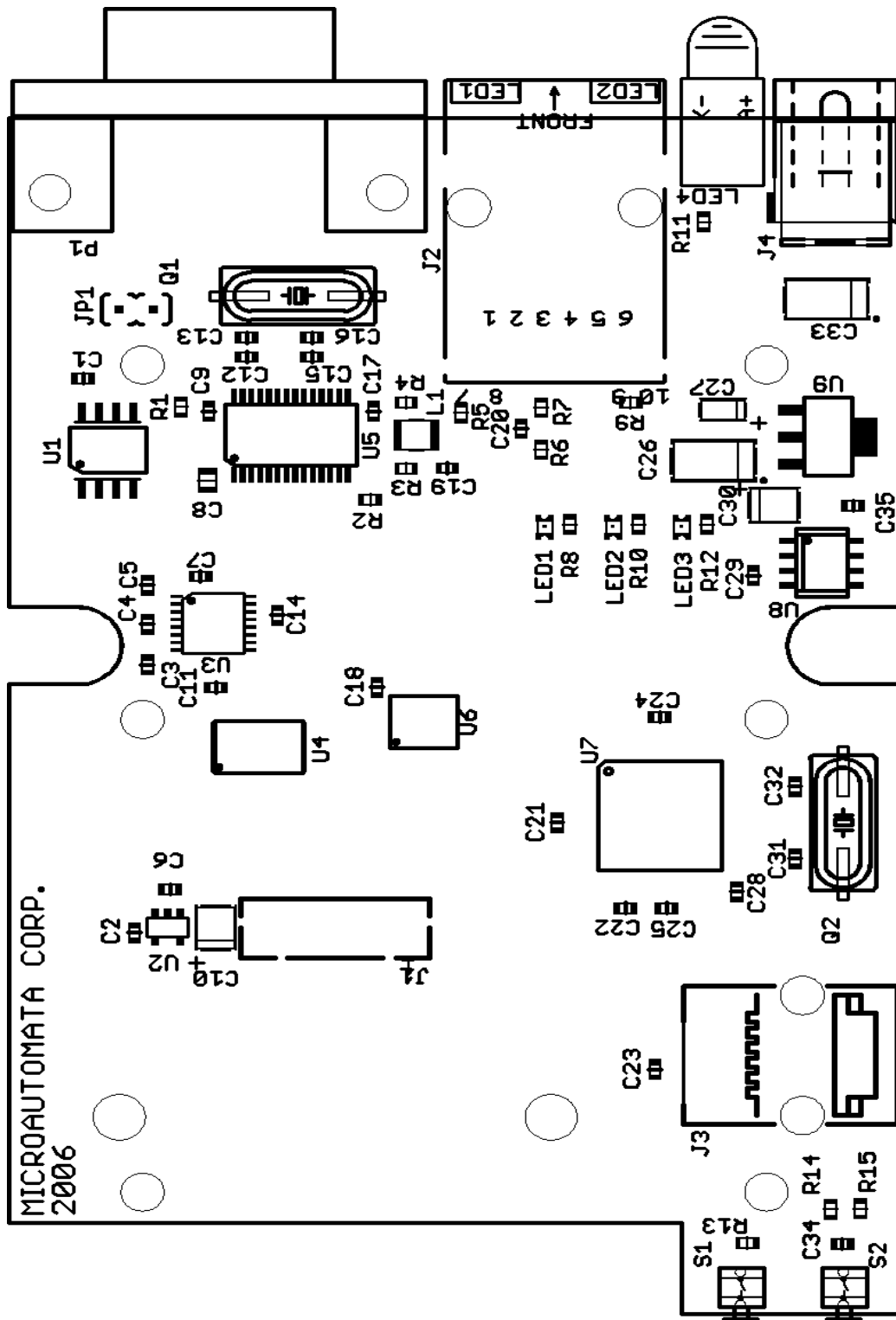


Schematic, Page 3 of 3



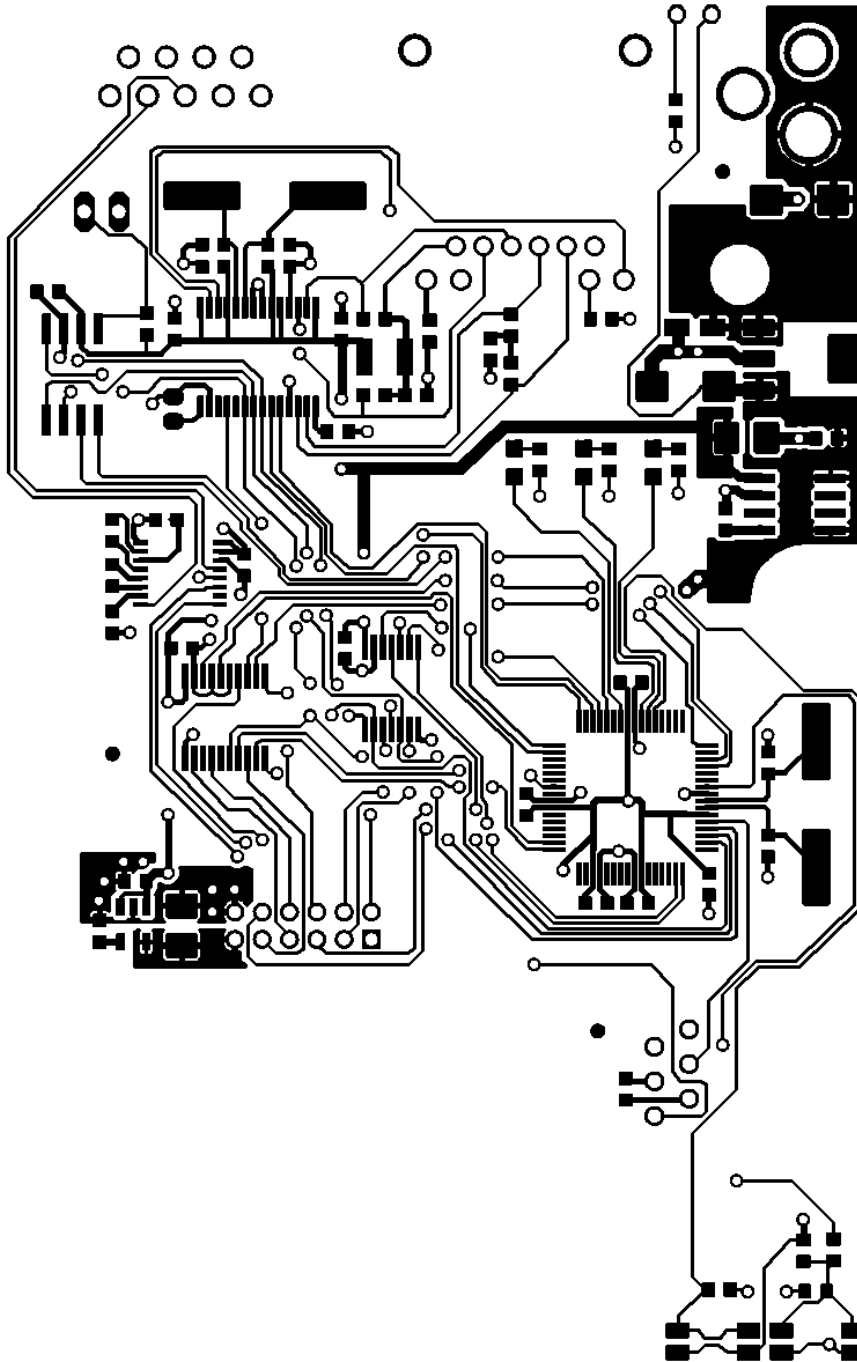
Flash, 802.15.4, Ethernet  
 MicroAutomata Corporation  
 TITLE: WPAN\_GW1  
 Date: 12/13/2006 03:32:27p  
 Sheet: 3/3

PCB Layout, Assembly

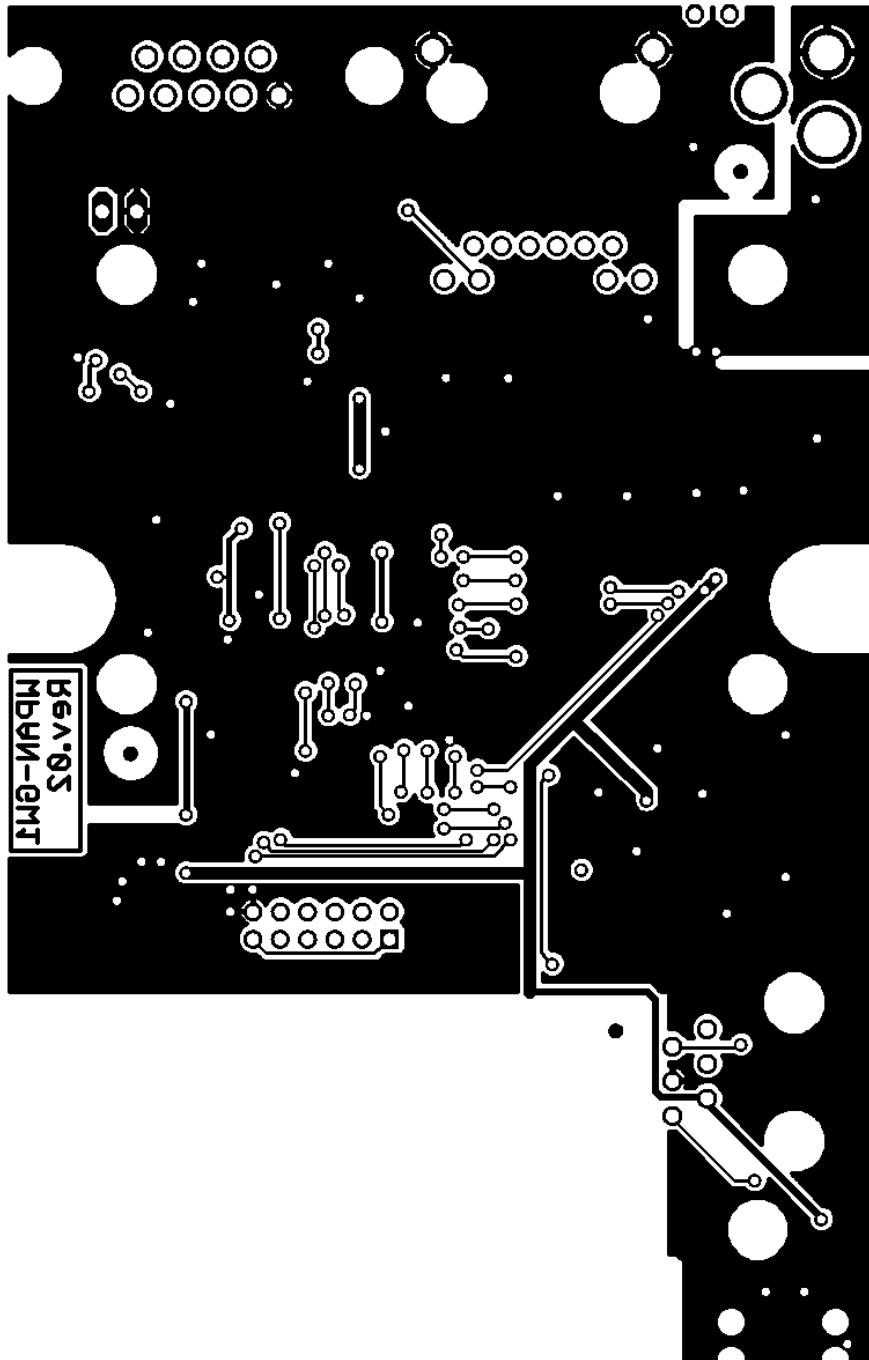




PCB Layout, Component Layer



PCB Layout, Solder Layer

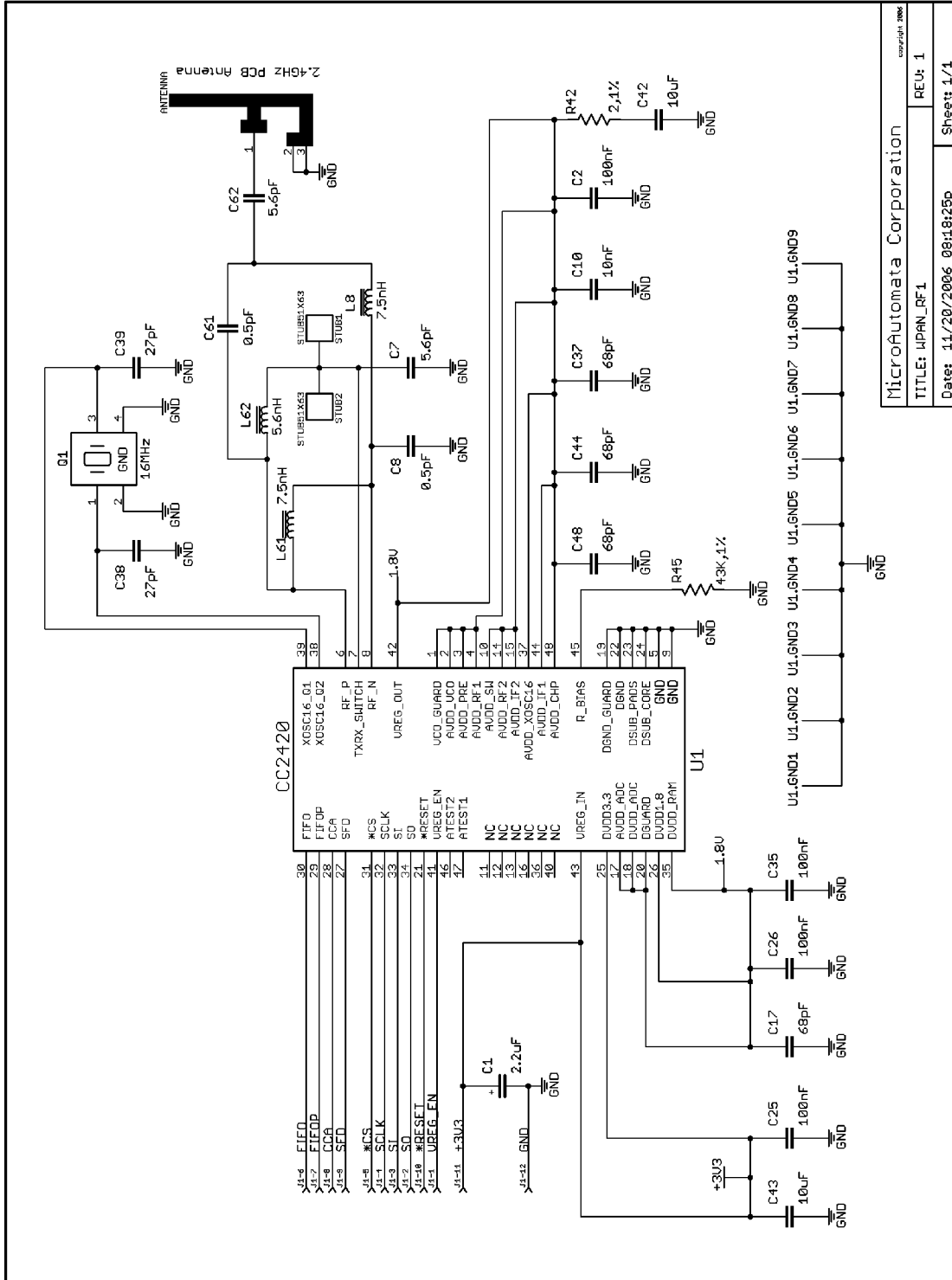


Partlist exported from WPAN\_GW1.sch at 12/21/2006 08:24:23a

Qty	Value	Device	Parts
1		JP1E	(JP1 - Do Not Install)
20	.1uF	CAPACITOR_0603	C1, C5, C6, C9, C11, C12, C14, C15, C17, C18, C19, C20, C21, C22, C23, C24, C25, C28, C34, C35
3	.47uF	CAPACITOR_0603	C3, C4, C7
1	1uF	POLARISED_A_CASE	C27
1	2.7K,1%	RESISTOR_0603	R2
3	4.7K	RESISTOR_0603	R1, R13, R14
1	10MHz	CRYSTALHCM49	Q2
1	10uF	CAPACITOR_0805	C8
2	10uF	POLARISED_B_CASE	C10, C30
4	18pF	CAPACITOR_0603	C13, C16, C31, C32
1	25MHz	CRYSTALHCM49	Q1
2	47uF	POLARISED_C_CASE	C26, (C33 - Do Not Install)
4	49.9	RESISTOR_0603	R3, R4, R6, R7
1	74AHCT244TSSOP	74AHCT244TSSOP	U4
1	74LVTH125MTC	74LVTH125MTC	U6
2	180	RESISTOR_0603	R5, R9
1	152-3409	D-SUB9-RT-ANG	P1
5	470	RESISTOR_0603	R8, R10, R11, R12, R15
2	470pF	CAPACITOR_0603	C2, C29
1	42878-6218	42878-6218	J3
1	AT45DB161D-SU	AT45DB161D-SU	U1
1	CML-5300H7	CML-5300H7	LED4
1	ENC28J60-SSOP	ENC28J60-SSOP	U5
1	DF11-12DP-2DSA	DF11-12DP-2DSA	J1
1	08B0-1X1T-06	08B0-1X1T-06	J2
1	KLDX-202-A	KLDX-202-A	J4
1	LTST-S220KFKT	LED_0805_ORANGE	LED1
1	LTST-S220KSKT	LED_0805_YELLOW	LED2
1	LTST-S220KGKT	LED_0805_GREEN	LED3
1	MAX3221PW	MAX3221PW	U3
1	MIC205-3.3BM5	MIC205-3.3BM5	U2
1	MIC5209LN-5.0BS	MIC5209LN-5.0BS	U9
1	PIC18F6722	PIC18F6722	U7
2	TL1014BF	SW-TACT-SIDE	S1, S2
1	TC1107-3.3VOA	TC1107-3.3VOA	U8
1	ferrite,60ohm	INDUCTOR_1210	L1

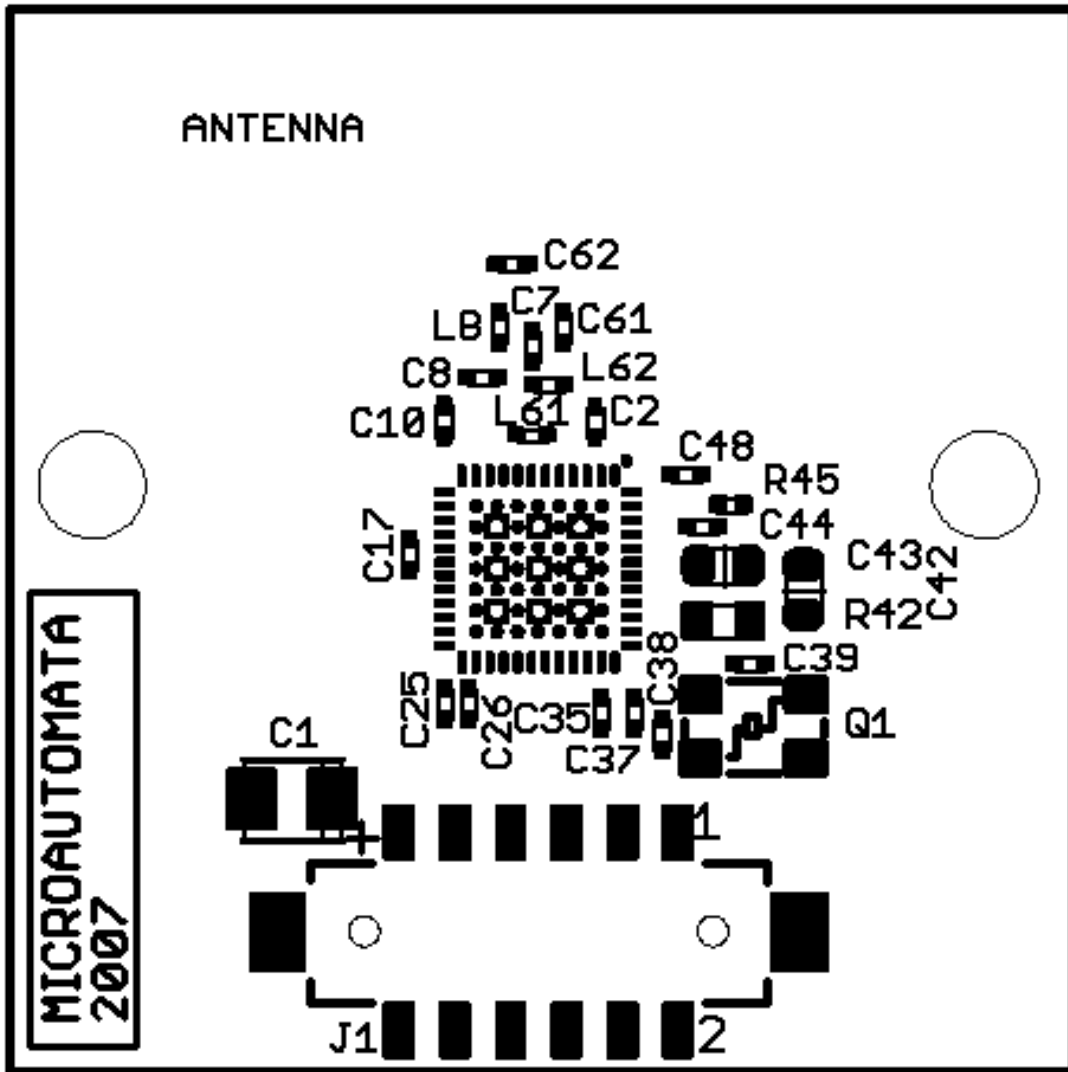
# Section 5: WPAN-RF1 Hardware Design

Schematic, Page 1 of 1

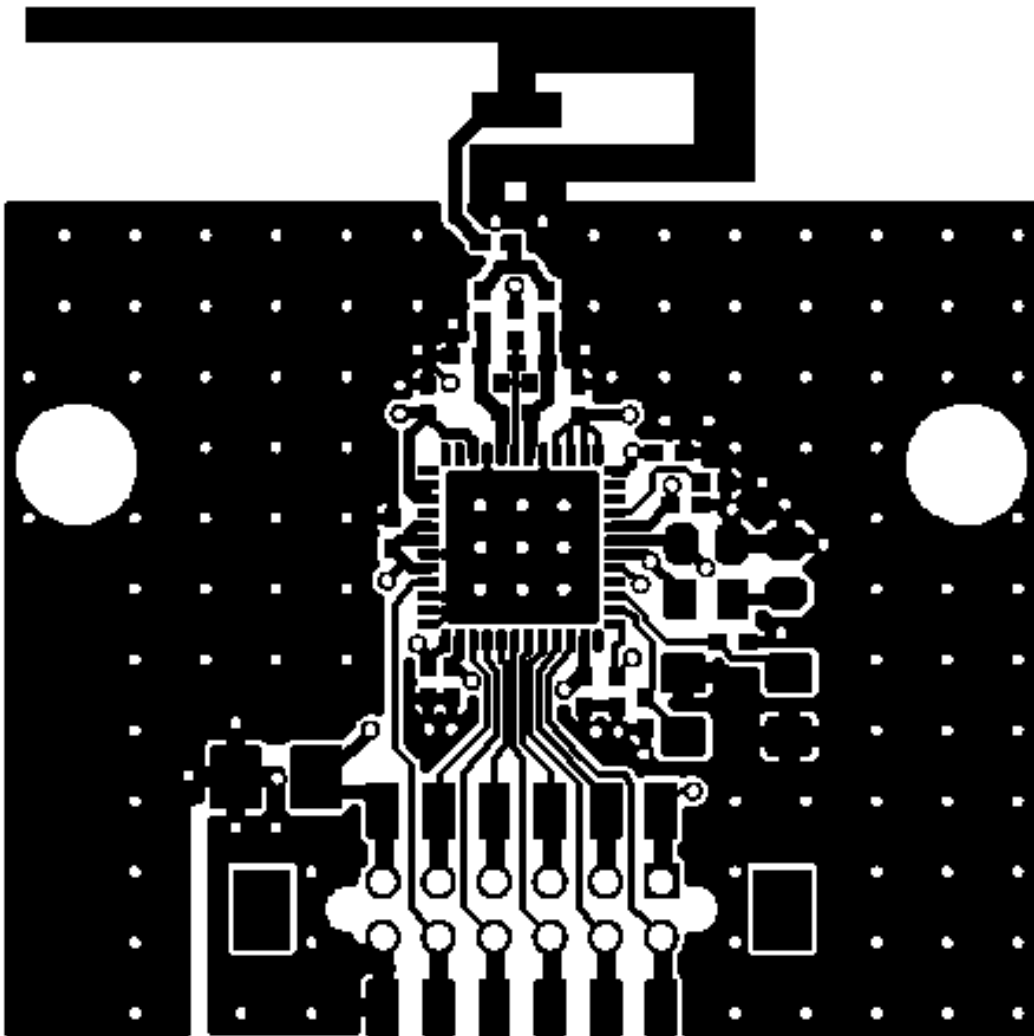


MicroAutomata Corporation	REU: 1
TITLE: WPAN_RF1	Sheet 1/1
Date: 11/20/2006 08:18:25p	

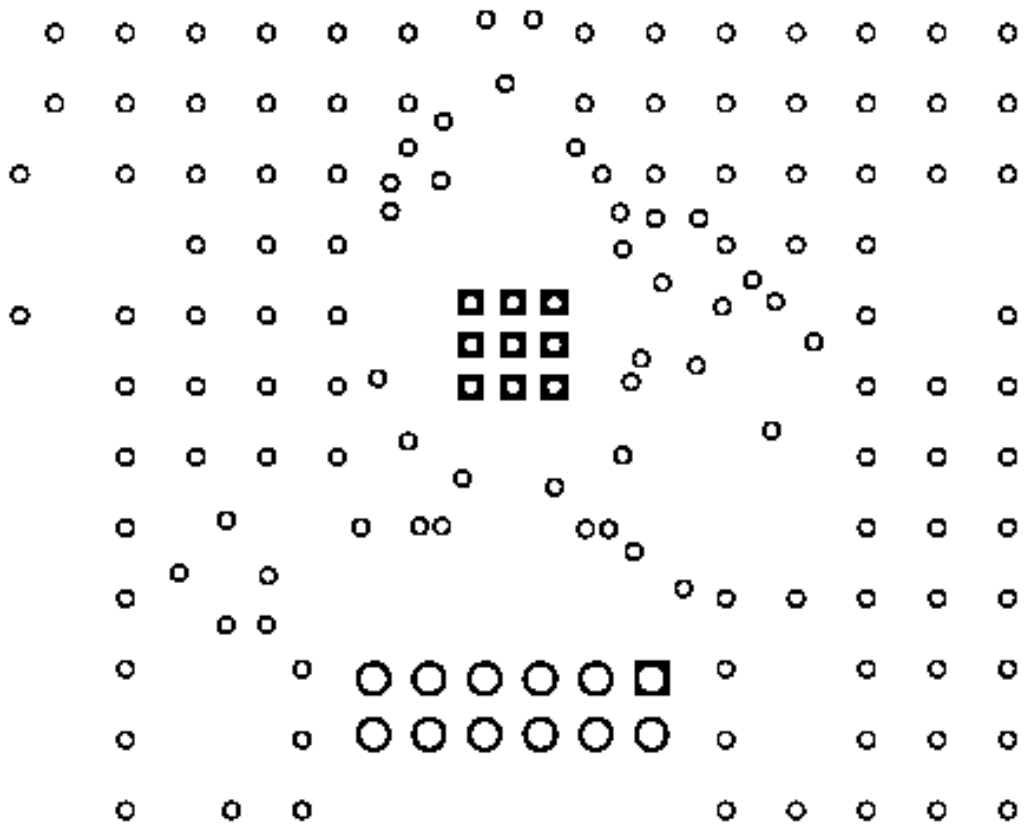
PCB Layout, Assembly



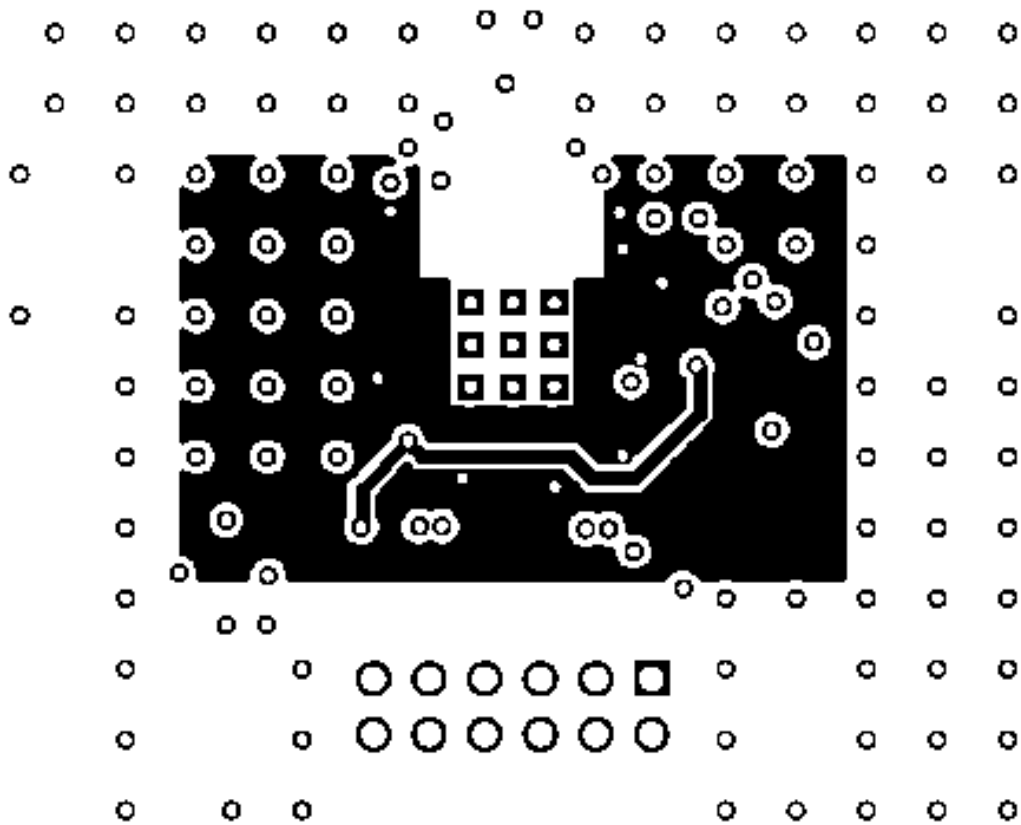
PCB Layout, Component Layer



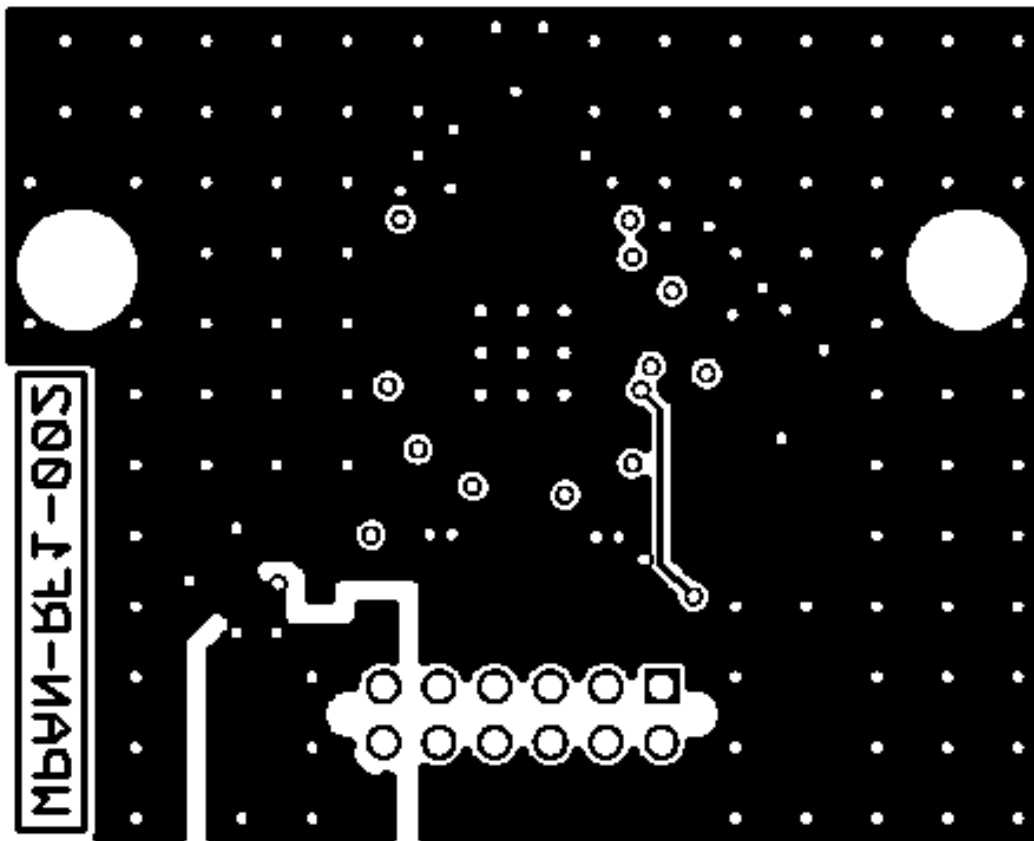
PCB Layout, Layer 2



PCB Layout, Layer 3



PCB Layout, Solder Layer

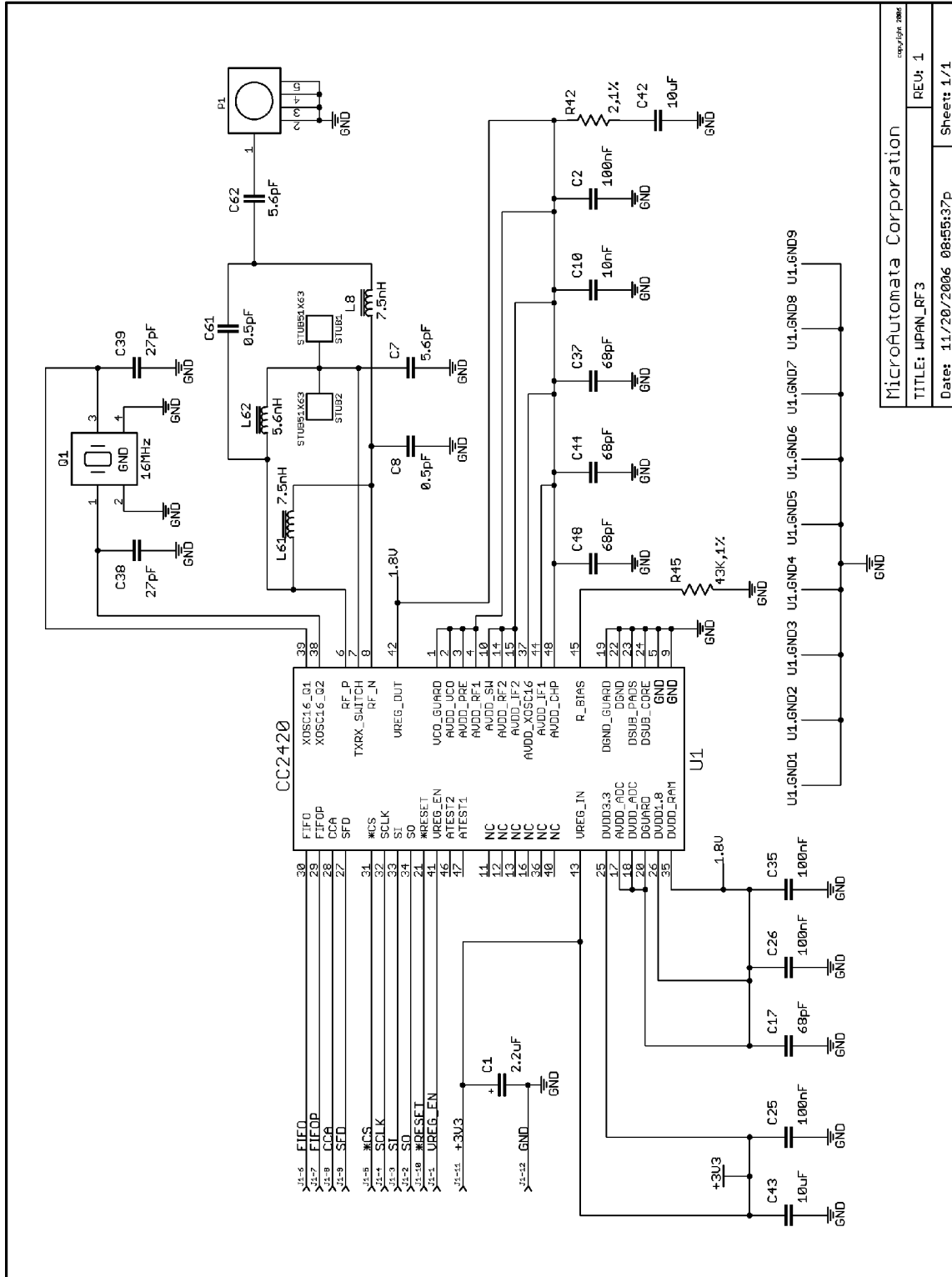


Partlist exported from WPAN\_RF1.sch at 12/27/2006 09:53:41a

Qty	Value	Device	Parts
2	0.5pF	CAPACITOR_0402	C8, C61
1	2,1%	RESISTOR_0805	R42
1	2.2uF	POLARISED_B_CASE	C1
1	5.6nH	INDUCTOR_0402	L62
2	5.6pF	CAPACITOR_0402	C7, C62
2	7.5nH	INDUCTOR_0402	L8, L61
1	10nF	CAPACITOR_0402	C10
2	10uF	CAPACITOR_0805	C42, C43
1	16MHZ	TSX-5032	Q1
2	27pF	CAPACITOR_0402	C38, C39
1	43K,1%	RESISTOR_0402	R45
4	68pF	CAPACITOR_0402	C17, C37, C44, C48
4	100nF	CAPACITOR_0402	C2, C25, C26, C35
1	CC2420	CC2420	U1
1	INVERTED_F_ANTENNA	INVERTED_F_ANTENNA	ANTENNA
1	J-12-DF11-12DS-2V	J-12-DF11-12DS-2V	J1
2	STUB51X63	STUB51X63	STUB1, STUB2

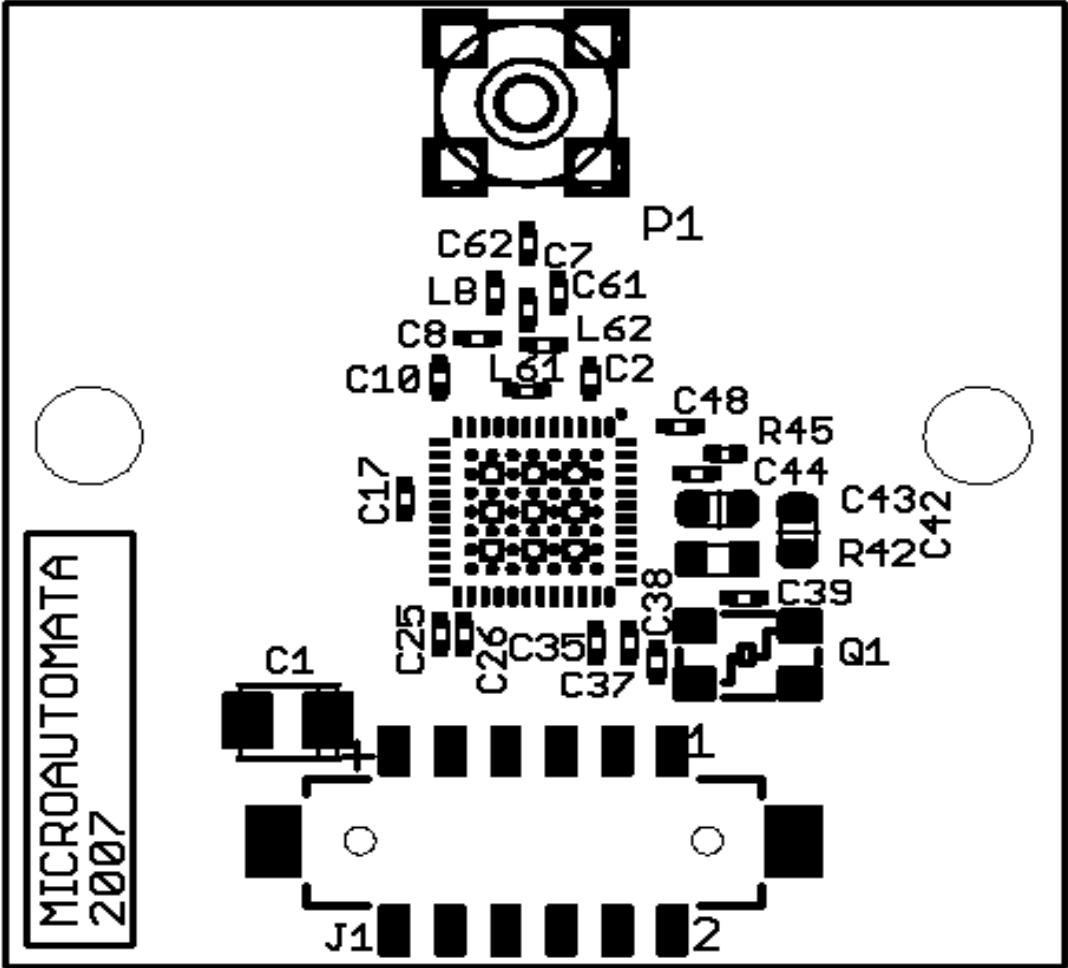
# Section 6: WPAN-RF3 Hardware Design

Schematic, Page 1 of 1

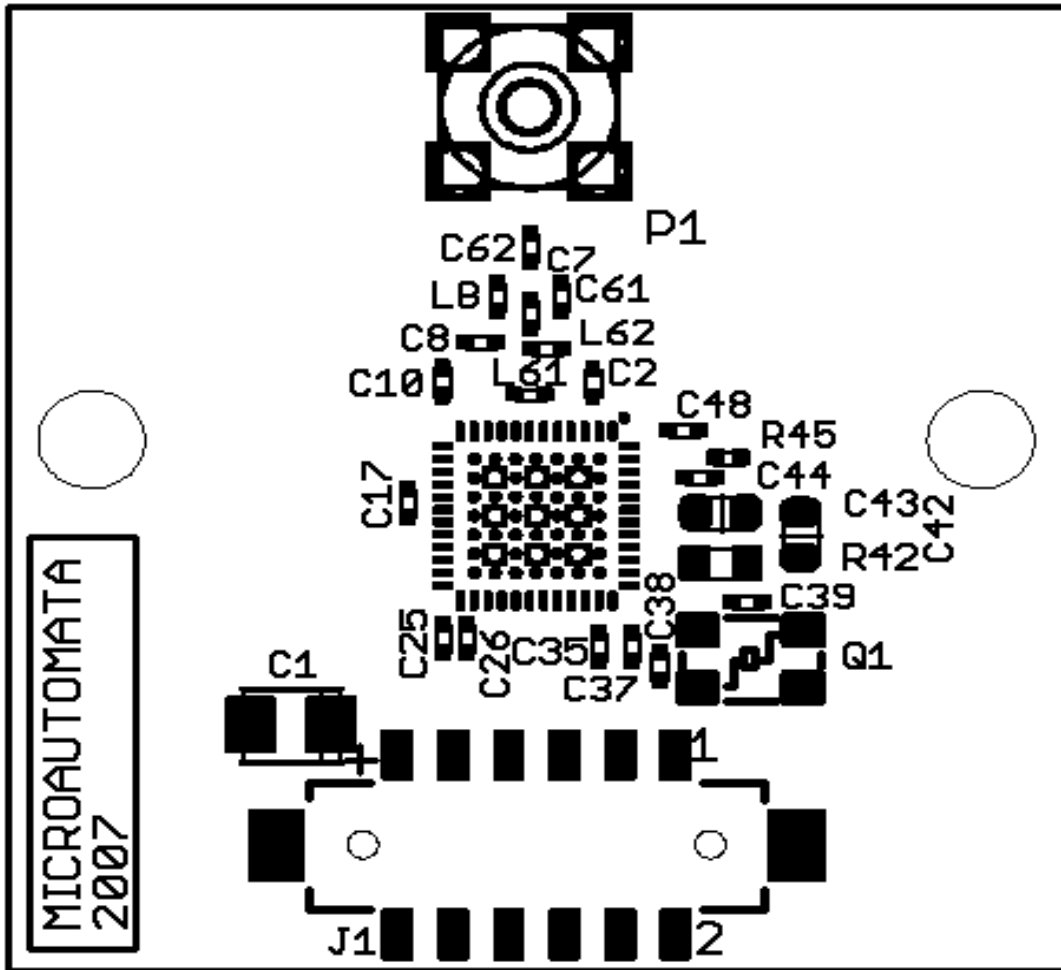


MicroAutomata Corporation	REV: 1
TITLE: WPAN_RF3	Sheet: 1/1
Date: 11/20/2006 08:56:37P	

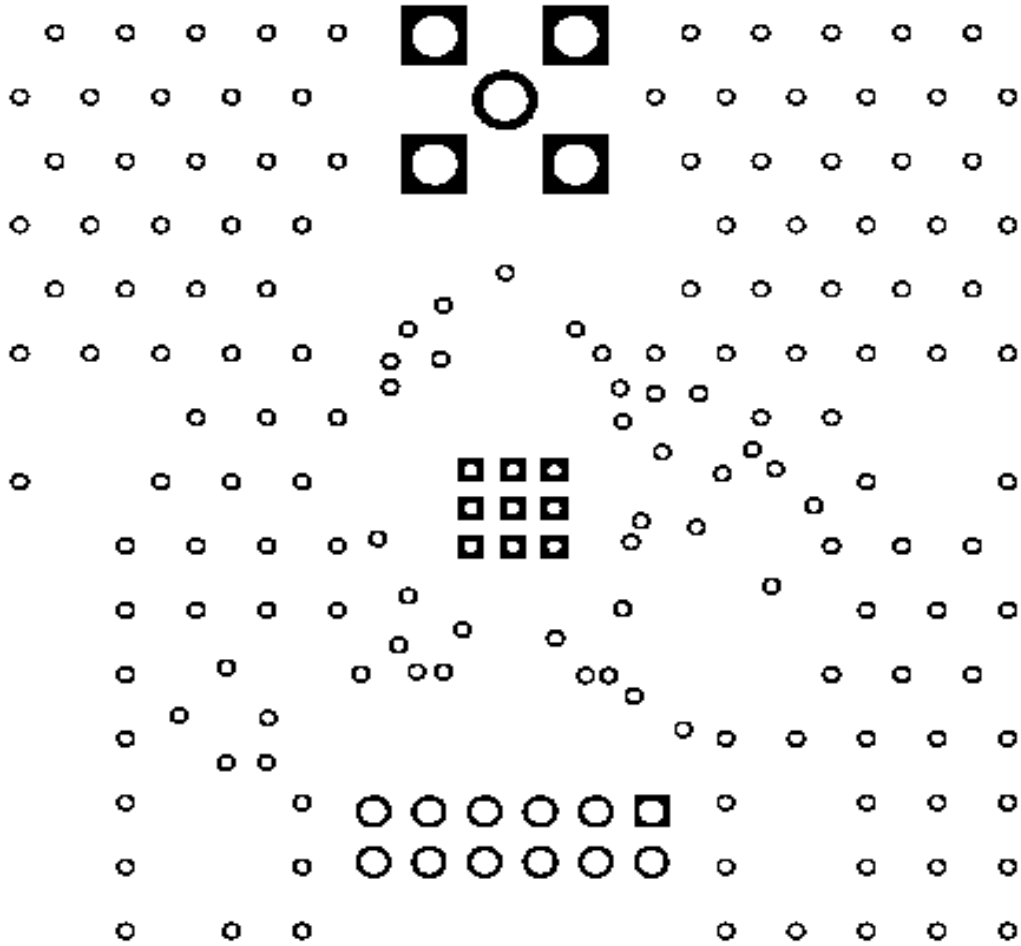
PCB Layout, Assembly



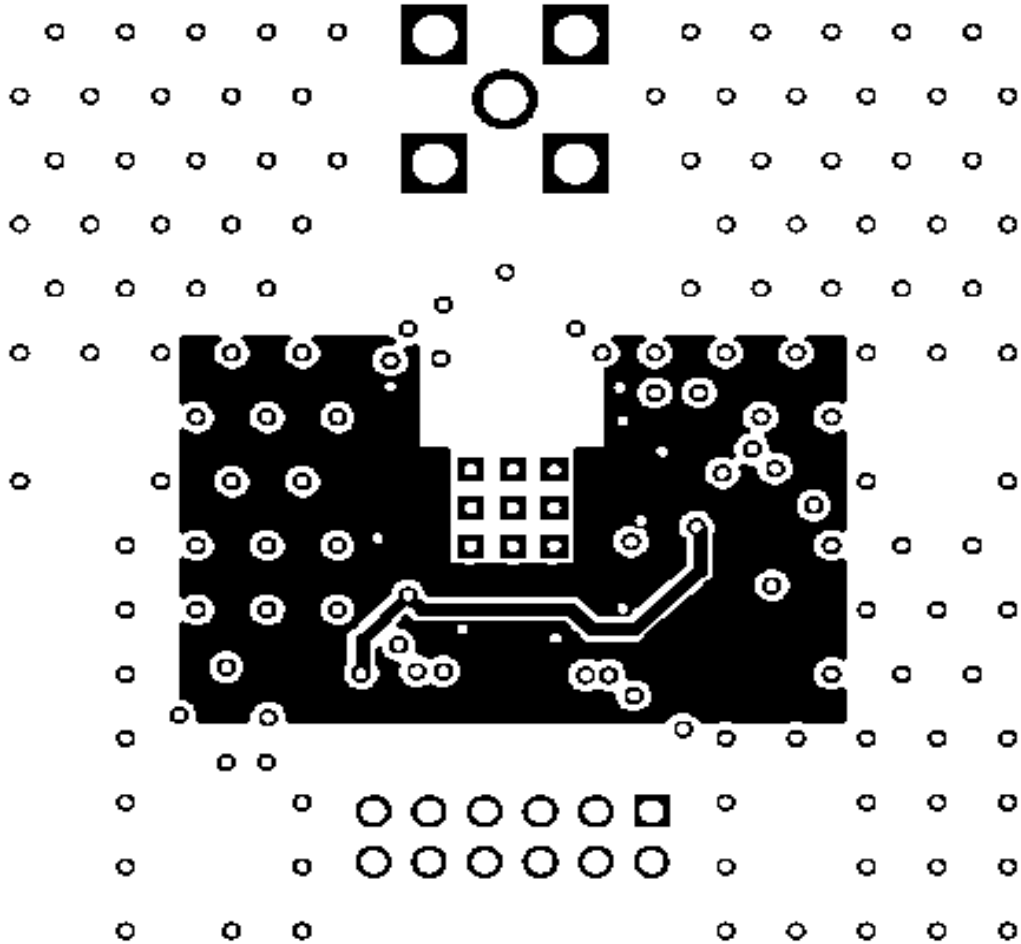
PCB Layout, Component Layer



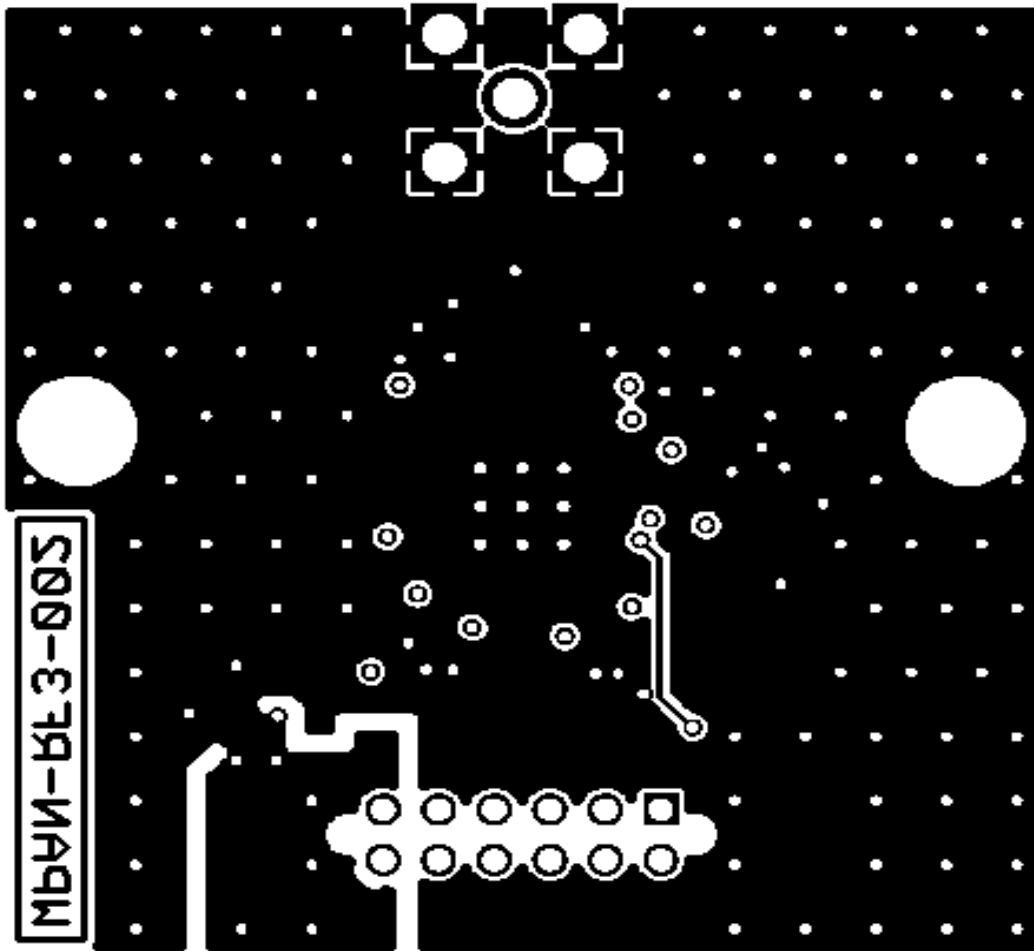
PCB Layout, Layer 2



PCB Layout, Layer 3



PCB Layout, Solder Layer



Partlist exported from WPAN\_RF3.sch at 12/27/2006 10:09:24a

Qty	Value	Device	Parts
1		CONREVSMA001	P1
2	0.5pF	CAPACITOR_0402	C8, C61
1	2,1%	RESISTOR_0805	R42
1	2.2uF	POLARISED_B_CASE	C1
1	5.6nH	INDUCTOR_0402	L62
2	5.6pF	CAPACITOR_0402	C7, C62
2	7.5nH	INDUCTOR_0402	L8, L61
1	10nF	CAPACITOR_0402	C10
2	10uF	CAPACITOR_0805	C42, C43
1	16MHZ	TSX-5032	Q1
2	27pF	CAPACITOR_0402	C38, C39
1	43K,1%	RESISTOR_0402	R45
4	68pF	CAPACITOR_0402	C17, C37, C44, C48
4	100nF	CAPACITOR_0402	C2, C25, C26, C35
1	CC2420	CC2420	U1
1	J-12-DF11-12DS-2V	J-12-DF11-12DS-2V	J1
2	STUB51X63	STUB51X63	STUB1, STUB2

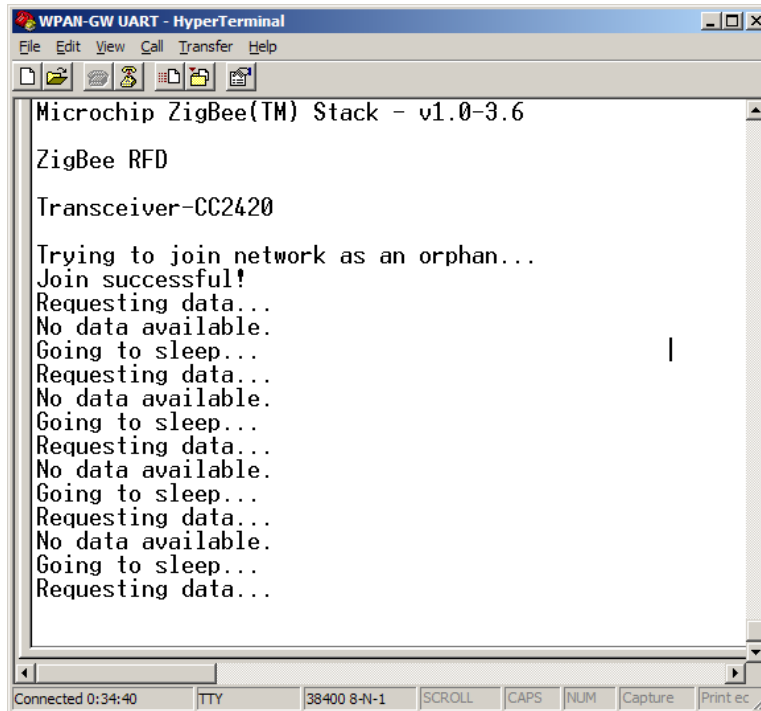
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## Section 7: Known Issues with Demo Applications

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### RFD hanging at “Requesting Data”

**Problem:** After joining network, RFD enters a sleep-wake cycle checking for data every time it wakes up. Occasionally the cycle stops with the RFD remaining in the “Requesting data...” state.

A screenshot of a HyperTerminal window titled "WPAN-GW UART - HyperTerminal". The window displays the following text:

```
Microchip ZigBee(TM) Stack - v1.0-3.6
ZigBee RFD
Transceiver-CC2420
Trying to join network as an orphan...
Join successful!
Requesting data...
No data available.
Going to sleep...
Requesting data...
No data available.
Going to sleep...
Requesting data...
No data available.
Going to sleep...
Requesting data...
No data available.
Going to sleep...
Requesting data...
```

The status bar at the bottom of the window shows "Connected 0:34:40", "TTY", "38400 8-N-1", "SCROLL", "CAPS", "NUM", "Capture", and "Print ec".

**Possible Cause:** Either coordinator was restarted after RFD had joined network or a communications failure with Coordinator occurred

**Work around:** Reboot RFD. If problem persists, reboot the coordinator and then reboot the RFD when joining is permitted.

## Trying to join network as orphan

**Problem:** The RFD was reset or power cycled and generates “CA Could not join as orphan” messages.

```

WPAN-GW UART - HyperTerminal
File Edit View Call Transfer Help
No data available.
Going to sleep...
Requesting data...
No data available.
Going to sleep...
Requesting data...

*****
Microchip ZigBee(TM) Stack - v1.0-3.6
ZigBee RFD
Transceiver-CC2420

Trying to join network as an orphan...
CA Could not join as orphan. Trying again...
Trying to join network as an orphan...
CA Could not join as orphan. Trying again...
Trying to join network as an orphan...
-

Connected 0:58:03 TTY 38400 8-N-1 SCROLL CAPS NUM Capture Print ec

```

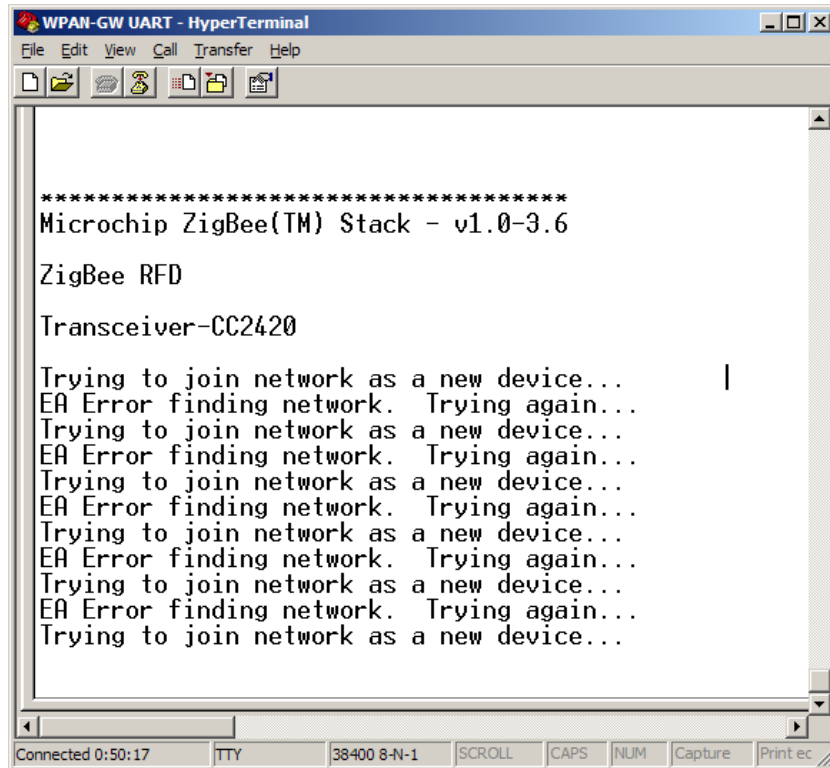
**Probable Cause:** Coordinator is powered off or has been reset/power cycled.

**Work around:** The RFD will try three times to join the network as an orphan and then start trying “join network as new device”. If the RFD fails repeatedly to “join network as a new device” then reset or cycle power to the RFD. If problem persists:

1. Turn off RFD
2. Cycle power to the Coordinator
3. Power on the RFD when joining is permitted

## EA Error finding network.

**Problem:** The Coordinator indicates that joining is permitted but the RFD powers up and fails to join the network.



```

*****
Microchip ZigBee(TM) Stack - v1.0-3.6
ZigBee RFD
Transceiver-CC2420

Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...
Trying to join network as a new device...
EA Error finding network. Trying again...

```

**Possible Cause:** Coordinator has lost frequency lock and drifted off channel frequency.

**Work around:** Reboot Coordinator. If problem persists, cycle power to Coordinator and then cycle power to RFD after joining is permitted.