

HARDWARE MANUAL



WP543
WP543
WP543
WP543
WP543

RoHS compliant

Revision: 1.04

TABLE OF CONTENTS

REVISION HISTORY	2
REASONS USING DEVELOPMENT KIT.....	3
<i>Ordering Options - Standard Configurations*</i>	3
BLOCK DIAGRAM.....	4
KEY FEATURES	5
GENERAL INFORMATION.....	5
INFORMATION ON POWER.....	6
CONFIGURATION AND INSTALLATION.....	7
GPIO BIT MAPPING	7
INTERFACE CONNECTORS	8
LED LABEL AND INDICATOR	8
(SERIAL PORT HEADER	9
SERIAL CONSOLE SETTINGS.....	10
<i>Precaution when using Serial Converter</i>	10
SERIAL CONVERTER PIN LAYOUTS	11
JTAG PORT HEADER	12
ETHERNET CONNECTORS	13
HOW TO EXTEND ANTENNA ALIGNMENT TO CASE LED.....	14
JTAG PROCESS	15
BUILD AND INSTALL PROCESS (FOR OPENWRT FIRMWARE ON COMPEX MYLO LOADER)	18
BUILD AND INSTALL PROCESS (FOR REDBOOT LOADER).....	21
STANDARD PLATFORM.....	21
<i>Requirements</i>	21
<i>Unpacking and Build Process</i>	21
<i>Installation</i>	24
APPENDIX I	28
BOARD FEATURES.....	28
TOP SIDE OF BOARD	29

REVISION HISTORY

Revision	Information / Changes
Rev 1.0	First release for WP543 BareBoard
Rev 1.01	Added Build and Install Process (For OpenWRT Firmware On Complex Mylo Loader)
Rev 1.02	1. Change some information under Build and Install Process (For OpenWRT Firmware On Complex Mylo Loader) - Compiling OpenWRT suitable for use on WP543 - Default Configurations 2. Change default miniPCI-slot
Rev 1.03	Added "How to JTAG Complex Loader"
Rev 1.04	Modify for WP543HV board

REASONS USING DEVELOPMENT KIT

The Development Kit is especially useful for customers who are developing their firmware. Below are the reasons how we have made it more user-friendly for you.

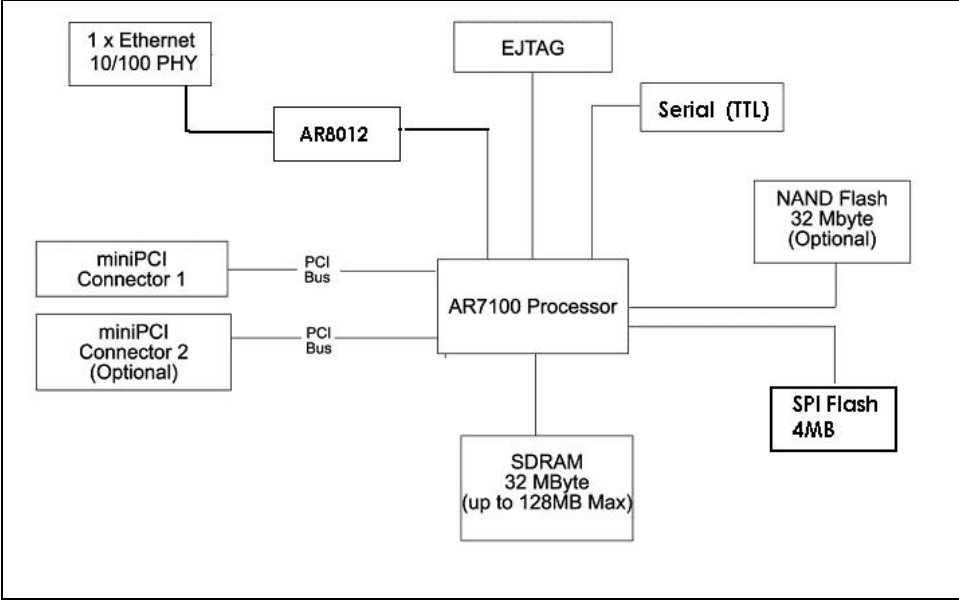
PURPOSE	WHY IS DEVELOPMENT KIT USEFUL?
<ul style="list-style-type: none">Develop Open-WRT firmware on WP543 (using Compex Mylo loader)Develop Redboot loader on WP543	Serial Converter can be used to debug the Open-WRT firmware on Compex Mylo loader. Also, it can be used for developing on redboot loader.
Port Own Firmware Over to WP543	Serial Converter can be used to debug the Serial Output messages.
Port Own Firmware and Loader Over to WP543	Serial Converter can be used to debug the Serial Output messages. JTAG Programmer can be used to load in your loader.

Ordering Options - Standard Configurations*

Currently item codes are not available, please contact our sales team at sales@compex.com.sg

* Configurations are subjected to change without notice

BLOCK DIAGRAM



KEY FEATURES

GENERAL INFORMATION

PROCESSOR	Atheros AR71XX
MEMORY	32MB SDRAM (Up to 128MB max.)
NOR FLASH	SPI Flash 4MB (Up to 16MB max.)
NAND FLASH	NAND Flash 32MB (optional)
PHYSICAL PORTS	1 or 2 x Type III Mini-PCI Slots* 1 X 10/100 Base-TX Ethernet Port (with Auto MDI/MDIX)
RADIO SUPPORTED	802.11b/g, 803.11a/b/g, 802.11n
DEBUG INTERFACE	Serial (TTL) / JTAG (ARM-standard 20 pin) Optional JTAG Programmer** available Optional Serial Converter*** available
OPERATING TEMPERATURE	-22°C to 55°C
LED INDICATORS	6 LEDs total: • Power, Diagnostic, Connection, WLAN, LAN
OTHER FEATURES	Push-Button Reset Surge Arrestors (Optional)
DIMENSIONS	132mm x 130mm x 1.6mm
ENCLOSURE	Directly mountable into Compex's recommended WP, WPM or WPMA enclosure, with the need to separate mounting plates.

INFORMATION ON POWER

POWER OVER ETHERNET	High-power passive PoE input voltage (Passive Range: 24V-48V) (802.11af PoE : up to 56V)
TYPICAL OPERATING POWER	4 W (Without MiniPCI and Optional Radio, Board Only)
DC JACK	24V ~ 48V DC Supply
MINIPCI SLOTS	1)12 W total continuous power at 3.3V 2) if 2 slots can accommodate standard size radio Cards

* Depend on Order Configuration

** JTAG Programmer available to reprogram the flash in case of loader corruption.

*** Serial Converter available to change the TTL signals on board to RS232 signals for debugging

CONFIGURATION AND INSTALLATION

GPIO Bit Mapping

GPIO Bit	Description
0	N/A
1	N/A
2	Jumpstart Button
3	LED at DE1
4	LED at DS1
5	LED at DS3
6	LED at DS4
7	LED at DS5
8	System Reset
9	UART_SIN
10	UART_SOUT
11	N/A
12	JTAG(TCK)
13	JTAG(TDO)
14	JTAG(TDI)
15	JTAG(TMS)
16	JTAG(TRST_L)

Interface Connectors

The board interface connector pin assignments and signal descriptions are included in the following sections. The connectors are listed in the section below and the connector locations are shown in the following diagrams.

Connector	Function
J5	Power Jack
P2	Ethernet Ports
J11	JTAG Port
J29/J30	MiniPCI Slot
J31	Serial Port
SW4	Reset Button

LED Label and Indicator

LED	Label / Function
DS6	Power (Blue)
D24	Ethernet (Green)
DE1	Signal Strength Low (Red)
DS4	Signal Strength Higher-Low (Yellow)
DS3	Signal Strength Lower-High (Green)
DS5	Signal Strength High (Green)
DS5	Diagnostic (green)
DS1,DS2,DS7	Not Used

** based on Compex firmware

(Serial Port Header

The Serial Port (J31) Header signaling is shown in the following table.

Pin	Signal
1	VCC – 3.3V
2	UART 0 Transmit Data
3	UART 0 Receive Data
4	GND

Note:

Our Serial port Implementation requires an external high-impedance serial port not usually available with the serial ports of the notebooks/computers. You will need a Serial Converter available in the market. For our customers' convenience, it is bundled together with the board Development Kit.



Serial Console Settings

The serial console settings used together with the serial port is given below. This serial port uses TTL signals, and therefore you have to use serial converter using MAX-211 IC (or other IC in the market that convert TTL signals to RS232 signals) in order to use it with the PC.

Baud Rate	115200
Data	8 Bit
Parity	None
Stop	1 Bit
Flow Control	None

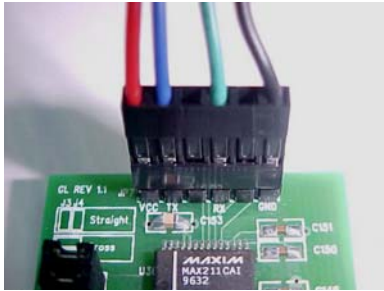
Precaution when using Serial Converter

Please attach the serial converter first on the board serial header, before attaching the power supply. This is to ensure that there is no surge of power to the serial converter, and prevent any damage the chipset on the serial converter.

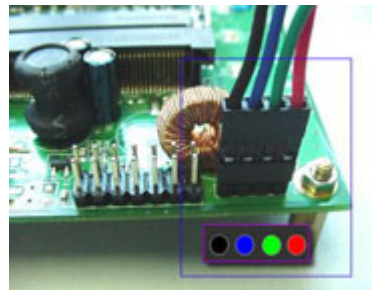
Serial Converter Pin Layouts

Cables on the serial converters are provided. You can use the 6 Pin (Fixed) to 4 Pin (Fixed) provided. The pin layouts of the serial converters for use with the board are as follows:

Pin Assignment (Serial Converters)	Signal (Serial Converters)	Connected to Pin on WP543	Signal (WP543)
Pin 1	VCC(3.3V) – Red	Pin 1	VCC (3.3V)
Pin 2	TX – Blue	Pin 3	RX
Pin 4	RX - Green	Pin 2	TX
Pin 6	GND – Black	Pin 4	GND



Arrangement of Cables on Serial Converter to the board



Arrangement of Cables on the board itself

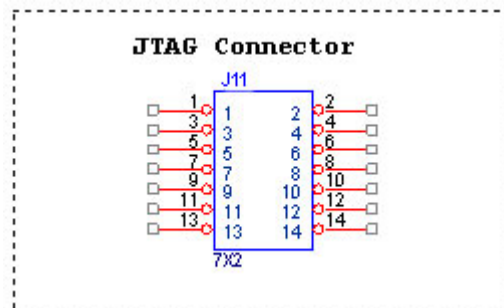
JTAG Port Header

The primary purpose of the board JTAG Port Header is to facilitate program download into Flash memory.

Pin	Signal	Pin	Signal
1	TRST_N	2	GND
3	TDI	4	GND
5	TDO	6	GND
7	TMS	8	GND
9	TCK	10	GND
11	RESET	12	NC
13	DINT	14	3V3

Note:

Normally, it has a JTAG Programmer compatible with the board. It is bundled with the board Development Kit. This JTAG programmer is able to download file onto the Flash, and thus recover a corrupted loader.



Ethernet Connectors

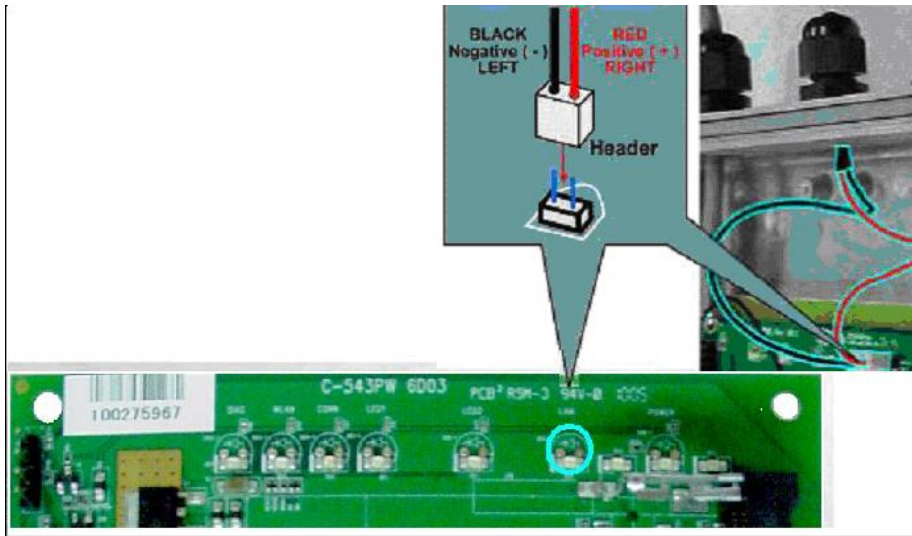
The board contains 1 X 10/100 Base-TX Ethernet Channels. The Ethernet Channels are available through standard 8-pin RJ45 connectors.

Ethernet Connectors(J6) signaling is shown below.

Pin	Signal
1	TX+
2	TX-
3	RX+
4	PoE+V
5	PoE+V
6	RX-
7	GND
8	GND

How to Extend Antenna Alignment to Case LED

You might want to extend the Antenna Alignment LED to the LED of the case. You just need to do a simple extension.



1. Jumper Added on the DIAG LED.
2. Attach a cable to the Antenna Alignment LED to extend to Case LED

JTAG Process

Instructions reference writing a Complex loader

Minimum Requirement

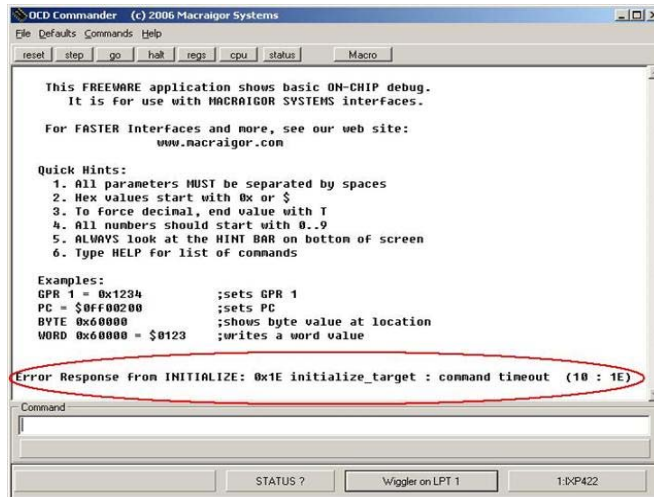
1. OCD Commander ver2.5.4
2. upbios.tst file (same for all Compex device)
3. zMylo.bin file(different device have different zMylo.bin)
4. JTAG cable

Steps

1. Install the OCD Commander to your PC
2. Plug the JTAG cable to the JTAG port of the device
3. Run OCD Commander Program
Set "Target Processor" for the particular device
eg. WP543 boards select MIPS,

Click "OK"

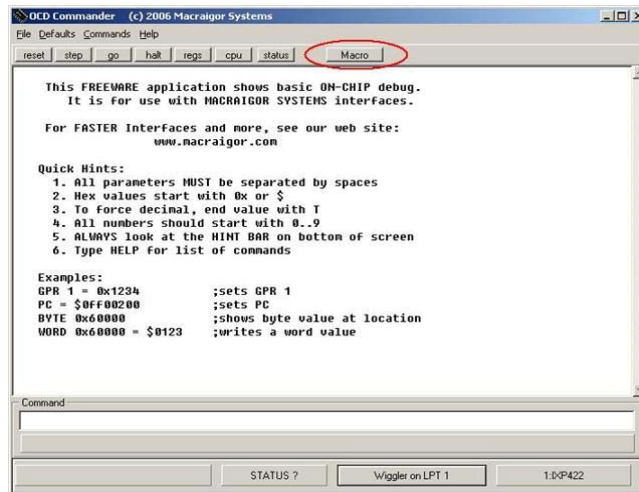
4. If there is this error message "Error Response from INITIALIZE....", please check the JTAG cable connection. Close the OCD Commander Program and go back to Step 3.



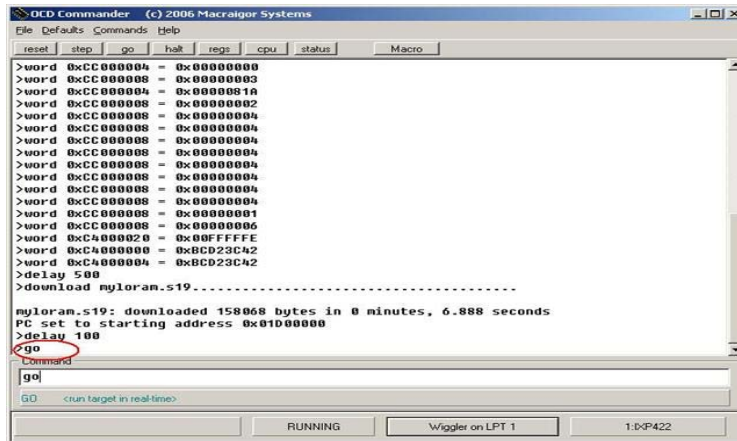
WP543

15

5. Click on the "Macro" and choose a specific .mac file.



6. Let it run until you see "go"



If you connect a console to serial port, it will display firmware upload mode.

7. From a computer, open a DOS command prompt
8. run, tftp upbios.tst
9. then run, tftp zMylo.bin (please observe the DIAG LED is off)
10. If either step 9 or step 10 fail, please start from step 3 again.
11. Power off the device and unplug JTAG cable
12. Power on the device and tftp the firmware into the device.
13. Reboot when done.

Build and Install Process (For OpenWRT firmware on Compex Mylo Loader)

Minimun Requirement

1. Compex loader version 2.54 or above.
2. OpenWRT will only be supported on WP543 with 4MB NOR flash and above.
3. Please ensure that the Ethernet connection is able to ping address = 192.168.168.1
4. If there is a USB NAND flash available on board, you would need to change the loader configuration. Please refer to "what to do if there is a onboard NAND Flash".

Compiling OpenWRT suitable for use on WP543

1. Getting source codes

```
>svn co -r 12448 https://snv.openwrt.org/openwrt/trunk
```
2. Apply patches from the files mod-wp543.tgz

```
>tar zxvf mod-wp543.tgz  
>cp -a mod-wp543/* trunk/
```
3. Compile

```
>cd trunk  
>cp wp543.config .config  
>make
```

OpenWRT Firmware will be in bin/openwrt-ar71xx-wp543.bin

Uploading the OpenWRT firmware to WP543 running MyLoader v2.54.0717

- a. Via Compex Firmware
 - Put the AP in Firmware Upgrade mode and upload the file.
 - This file is for WP543 with 4MB or 8MB NOR flash.
- b. Via TFTP
 - Go to the firmware upgrade mode (By pressing and hold the Reset button and plug-in the power adapter).
 - Upload the OpenWRT image to the device (tftp -i 192.168.168.1 put openwrt-ar71xx-wp543.bin)

First run of OpenWRT

- For customers with Serial console

During first run after flashing the firmware, do not power off the AP until the following messages appear:

jffs2_scan_eraseblock(): End of filesystem marker found at 0x0

jffs2_build_filesystem(): unlocking the mtd device... done.

jffs2_build_filesystem(): erasing all blocks after the end marker... done.

- For customers without Serial console
If you do not have console, just wait for 5 minutes.

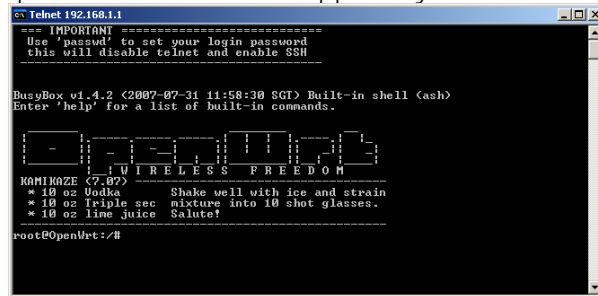
Completion

Reboot the AP.

Start using OpenWRT by telnet to default IP and you will see the picture shows below.

> Telnet 192.168.1.1

> The picture shows below will appear if you are successful.



```
==== IMPORTANT! =====
Use 'passwd' to set your login password
this will disable telnet and enable SSH

BusyBox v1.4.2 (2007-07-31 11:50:30 SGT) Built-in shell (ash)
Enter 'help' for a list of built-in commands.

      _ _ _ _ _
     | | | | | |
     | |_|_| |
     |  _  | |
     | | | | |
     |_|_|_|_|_|
    W I R E L E S S   F R E E D O M
KAMIKOZE (2 of 2)
* 10 oz Vodka      Shake well with ice and strain
* 10 oz Triple sec mixture into 10 shot glasses.
* 10 oz lime juice Salute!

root@OpenWrt:~#
```

What to do if there is a onboard USB Flash

If there is onboard USB flash, you would need to use the serial converter, enter the loader mode, by pressing,

please configure the Loader to use NOR-Flash, i.e.

"9 – USB Flash" → "3 – Boot Device" → "2 – Onboard NOR-Flash"

Default Configurations

LAN (bridge eth0+ath0):

IP Address: 192.168.1.1

Wireless (ath0):

Driver: madwifi

Mode: ap

ESSID: OpenWRT

IP Address: 192.168.2.1

WP543

Please refer to <http://madwifi.org/> for more information.

Use of Compex Patches

1. MAC Address from loader
2. Can detect that it is a Compex board
3. Enable USB

Build and Install Process (For Redboot Loader)

Note: Wireless drivers NOT in SDK
Note that in Compex WP543 SDK, redboot loader binaries are provided as part of the SDK, which is only given to customers who have signed NDA/TLA with Compex

Standard Platform

Requirements

The main requirement for building the standard distribution is having a Linux based development platform with at least 1 GByte of free disk space, and a working GCC compiler tool chain. These procedures have been tested on a Fedora Core 8 machine, and on older machines with Fedora Core 4.

The distribution contains all tools required to build the bootloader, kernel, and jffs2 image to be loaded onto the flash.

Further, a tftp server is required, preferably on the development platform. This server is used by the reference platform to download all file images required.

Unpacking and Build Process

For WP543(NOR) Flash only, **WP543-sdk-NOR-rel.tar** is provided., where "*rel*" is the combination of board and release, such as "**WP543-sdk-NOR-V1.0.tar**". The SDK file contains all of the files associated with the BSP, Kernel distribution, applications provided, build tool source, and the build system. This file can be used if the user is building for another system, and is not interested in the BSP, build tools, etc. for the WP543.

Select a directory to open the build into, and use the following procedure. This procedure assumes that "athbuild" is the directory to unpack into, and that the SDK files are located in the directory immediately above. Modify the procedure according to your configuration:

```
#cd athbuild
#tar -xzvf ../ WP543-sdk-NOR-V1.0.tar
(large number of files unpack)
#tar -xzvf ../ WP543-sdk-NOR-V1.0.tar
(smaller number of files unpack).
```

When the source files are unpacked, the build process can begin. The build directory contains the make file for building all components required. The source distribution will contain the required files for the build of your choice.

The build system will create two new directories: `images` and `rootfs.build`. The `images` directory will receive the final output of the build process that is used to update the platform board. The `redboot` images, the Linux kernel image in compressed format, and the `jffs2` filesystem are all copied into this directory, under the subdirectory for the specific reference platform. The `rootfs.build` directory is used as an install target to create the `jffs2` filesystem. All components that are build are installed into this directory, and the final step is to run `mkfs.jffs2` on this directory to create the filesystem image.

To do a full system build, use the following procedure:

```
#cd build
# make BOARD_TYPE=board
```

where *board* is the specific board type of your reference platform, **WP543**. This will generate a full build of all components, and the cross tools required to build for the reference platform. Note that on subsequent builds the tools will NOT be rebuilt (this is a long process, the first build can take well over an hour).

After a full build is performed, components can be rebuild as required. To build a specific component, you will use the command:

```
# make target BOARD_TYPE=board
```

where *target* is the specific target of choice. If you are unsure if the `rootfs.build` directory is properly populated, run the full build to erase and recreate the image. The following table outlines the main targets available.

Target	Builds
fusion_build	Rebuilds all driver files, and regenerates the module .ko files. Copies new files into the rootfs.build directory. This will also rebuild the jffs2 filesystem.
busybox_build	Rebuilds the busybox component, and installs into the rootfs.build directory.
hostapd_fus	Rebuilds the hostapd application provided to support WPA encryption. Installs into rootfs.build directory.
toolchain_build	Rebuilds the gcc cross build tools provided. These are left in the build area, and are not put into the rootfs.build system
redboot_fusion	Rebuilds the redboot bootloader, and copies the image into the images directory.
enet_build	Rebuilds the Ethernet driver, and copies the ar7100.ko module into the rootfs.build directory.
kernel_build	Rebuilds the Linux kernel. The result is copied to the images directory
fus_supplicant	Rebuilds the WPA supplicant application provided, and installs into the rootfs.build.

Installation

To perform a software update on the system, the following are required

- WP543 board
- A serial converter
- A server system with a tftp server
- A terminal system with terminal emulation software, such as hyperterm or Minicom
- An Ethernet cable between the server system and the WP543

Connect the Ethernet ports on the server system and the Ethernet port. Connect the serial cable between the Terminal system and the AP, using the serial converter. (Refer to "Serial Port Header" section, *pg 8*)

A) Boot Monitor Update (with Compex Bootloader)

This procedure is provided to update the Compex loader to redboot loader. The source code for redboot is included. Redboot.rom is also included in the SDK.

WARNING Incorrect implementation of this procedure can cause board failure due to erasing the boot monitor from the Flash. If this occurs, the board will have to be reloaded via download from an EJTAG emulator.

(Please refer to JTAG Port Header Section)

1. Boot with existing Compex Bootloader and halt it from booting into firmware.

```

Tera Term Web 3.1 - COM1 V1
File Edit Setup Web Control Window Help

Main Menu
1 - Load Firmware
2 - Load Program
3 - BIOS Setup
4 - Disk Utility
5 - Update Flash (Binary Mode)
6 - Update Firmware (Image Mode)
7 - Reboot System
8 - Memory Test
9 - USB Flash

Please select : 5

Update Flash (Binary Mode)
1 - Update BIOS
2 - Update System Parameters
3 - Update Board Parameters
4 - Update Partition Table

Please select : 1

Update BIOS

Mini TFTP Server 1.0 (IP : 192.168.168.1)
Usage (Windows 2000/XP) :
  tftp -i 192.168.168.1 put <filename>

```

2. Load new redboot.rom version into memory using Command Prompt.
tftp -i 192.168.168.1 put redboot.rom
(redboot.rom is included in /bin)
3. Restart the board after the loading is done.

```

Tera Term Web 3.1 - COM1 V1
File Edit Setup Web Control Window Help

Update Flash (Binary Mode)
1 - Update BIOS
2 - Update System Parameters
3 - Update Board Parameters
4 - Update Partition Table

Please select : 1

Update BIOS

Mini TFTP Server 1.0 (IP : 192.168.168.1)
Usage (Windows 2000/XP) :
  tftp -i 192.168.168.1 put <filename>

Starting the TFTP download from IP (192.168.168.99)...
.....
TFTP download completed...
Update BIOS ..... Done

Update Flash (Binary Mode)
1 - Update BIOS
2 - Update System Parameters
3 - Update Board Parameters
4 - Update Partition Table

Please select : █

```

4. Initialize the configuration on the board using the following value (user entries underlined)

```

Redboot> fis init
About to initialize [format] FLASH image system - continue (y/n)? y
*** Initialize FLASH Image System
... Erase from 0xbf7e0000-0xbf7f0000
... Program from 0x80ff0000-0x81000000 at 0xbf7e0000:.

```

B) i) Boot Monitor Update (with Existing Redboot)

This procedure is provided to update the boot monitor with a newer version that is generated. Note that the source code for the boot monitor is included in your distribution.

WARNING Incorrect implementation of this procedure can cause board failure due to erasing the boot monitor from the Flash. If this occurs, the board will have to be reloaded via download from an EJTAG emulator.

(Please refer to JTAG Port Header Section)

1. **Boot with existing Redboot and halt it from booting into Linux.**
2. **Load new redboot.rom version into memory.**
RedBoot> load -r -v -b 0x80500000 redboot.rom -h <tftp server ip addr>
3. **Write redboot to flash**
Redboot> fis write -b 0x80500000 -f 0xbf000000 -l 0x40000
4. **Reboot the board with new Redboot and break into the monitor with <ctrl-c> before booting Linux**
Redboot> reset
5. **Now reformat the flash with new redboot running.**
Redboot> fis init -f
6. **Initialize the configuration on the board using the following values (user entries underlined)**
RedBoot> fconfig -i
Initialize non-volatile configuration - continue (y/n)? y
Run script at boot: true
Boot script:

Enter script, terminate with empty line
>> fis load -d vmlinux
>> exec
>>
Boot script timeout (1000ms resolution): 3
Use BOOTP for network configuration: false
Gateway IP address:
Local IP address: <Your IP address>

Local IP address mask: <Your required netmask>
Default server IP address: <TFTP server IP address>
Console baud rate: 115200
GDB connection port: 9000
Force console for special debug messages: false
Network debug at boot time: false
Update RedBoot non-volatile configuration - continue (y/n)? y
... Erase from 0xbf7e0000-0xbf7f0000: .
... Program from 0x80ff0000-0x81000000 at 0xbf7e0000: .

Since this procedure erases the flash device, you will also have to perform the software update process in the following section. This is the normal process used to update the driver or kernel when changes are made.

ii) Kernel/Driver Update

The Kernel and Driver image update is performed using the Red Boot boot monitor, commands through the serial console, and tftp file transfers. This procedure must be performed after doing a redboot update as described in the preceding section.

1. **Power up the board, and hit <ctrl-c> to break into monitor**

2. **Load with new linux image.**

```
Redboot> load -r -v -b 0x80500000 vmlinux.bin.gz -h <tftp server ip>  
Redboot> fis create -b 0x80500000 -e 0x80256000 -r 0x80060000 -l  
0x100000 vmlinux
```

3. **Load new jffs2 filesystem**

```
Redboot> load -r -v -b 0x80500000 pb42fus-jffs2 -h <tftp server ip>  
Redboot> fis create -b 0x80500000 -e 0x0 -l 0x600000 filesystem
```

4. **Reset the board. Board will now boot up into Linux.**

iii) Board Startup

Once the redboot is loaded.

1. **Power on the board and wait for Linux to boot.**

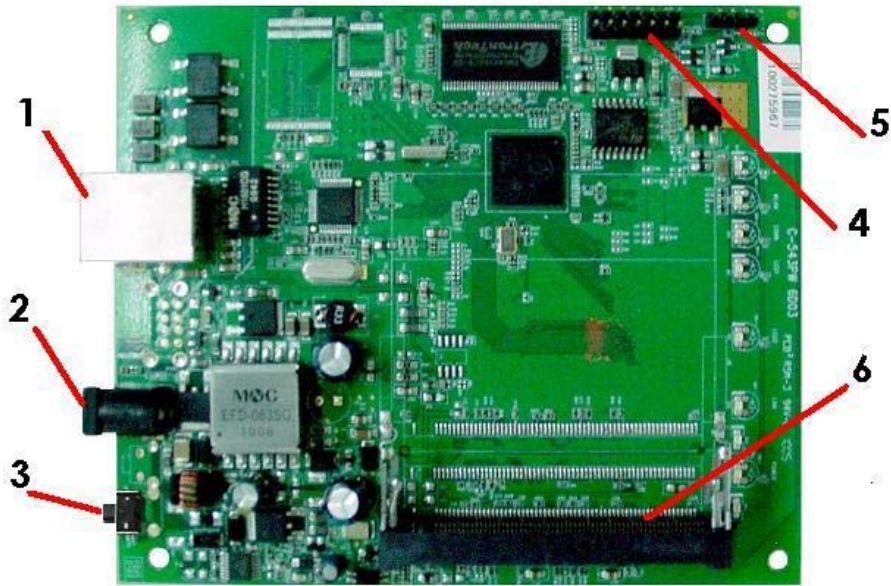
Note that Redboot is configured to automatically boot into Linux.

2. **Log into the board**

User: root Password: 5up

Appendix I

Board Features



TOP SIDE OF BOARD

No:	Feature	Descriptions
1	Ethernet cum PoE port	10/100Mbps Ethernet port and 803.11af PoE (48V)
2	DC Jack	24V – 48V DC Supply
3	Reset button	For board reset and startup mode control
4	JTAG port	JTAG jumper header for programming
5	Serial port	Serial port connection header
6	mini-PCI slot 1	9.2mm high Type IIIB mini-PCI slots
	-	-