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Quick Start Guide

WB50NBT

Version 1.1

REVISION HISTORY

Version	Date	Notes	Approver
1.0	04 April 2016	Initial Version	Andrew Dobbing
1.1	01 May 2017	OS Support	Jay White

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INTRODUCTION TO THE LAIRD WB50NBT

The Laird WB50NBT Wireless Bridge module is a wireless communications subsystem that may be integrated into a variety of host devices via a number of available electronic and logical interfaces.

Interfaces	Features	Specifications
▪ Fast Ethernet ▪ Serial UART ▪ USB ▪ SPI (master) ▪ I2C ▪ MMC/SDIO ▪ GPIO ▪ Bluetooth PCM ▪ 120-pin board with mating options	▪ Cortex A5 processor (536MHz) ▪ 64 MB of LPDDR (Lower Power DDR) memory ▪ 128 MB of NAND flash storage	▪ Length: 47 mm ▪ Width: 37 mm ▪ Height: 4.9 mm

Product Description

The Laird WB50NBT provides complete enterprise-class Wi-Fi connectivity with an integrated TCP/IP stack, full support for 2 x 2 MIMO IEEE 802.11a/b/g/n, Bluetooth 4.0 dual-mode wireless standards, three-wired coexistence scheme, a fully integrated security supplicant providing 802.11i/WPA2 Enterprise authentication and data encryption, and a BT protocol stack. The system is a full Linux 4.1.13 kernel based system with modifiable file system allowing custom applications to run alongside system applications.

The WB50NBT is a fully integrated module with RF shielding and two U.FL type antenna connectors providing two stream MIMO operation for maximum data rate. The Main antenna (for Wi-Fi only) and the Auxiliary antenna (for Wi-Fi and Bluetooth) work together with the three-wired coexistence scheme to provide the best coexistence performance.

Note: For additional information on the hardware aspects of the WB50NBT, please refer to the WB50NBT Datasheet (Hardware Integration Guide) available on the WB50NBT Product Page.

QUICK START GUIDE – WB50NBT

Inventory of Equipment

Qty.	Item
1	WB50NBT device
1	BB40NBT Breakout board
2	U.FL ultra-micro coax cable male to male SMA plus two nuts and washers
2	Dual band 2.5G and 5G antenna with reverse female SMA connector
4	Standoffs and nuts
4	Small Philips head screws
1	Power supply 12V 1A positive center with wall (US/European) adapter cable

Additional Required Equipment

Qty.	Item
1	Small Philips head jeweler's screw driver
1	USB to RS232 DB9/DB25 cable
1	CAT 5 e cable (optional)
1	USB A to USB B cable (optional)

Hardware Installation and Configuration

To assemble the WB50NBT evaluation kit, follow these steps:

Note: To prevent damage, you must connect the U.FL ultra-micro coax cables to the connectors on the WB50NBT prior to fitting the WB50NBT to the BB40NBT evaluation board.

1. Using the four nuts provided, attach the four standoffs to the underside corners of the BB40NBT board.
2. Before fitting the WB50NBT to the BB40NBT evaluation board, turn the WB50NBT so that the 120 way is on the underside of the board.
3. Connect the dual band antennas with an SMA connector to each of the **AUX. ANT** and **MAIN ANTENNA** SMA connectors on the top side of the BB40BNT board. Figure 1 shows the location of the Wi-Fi and Wi-Fi /Bluetooth antennas. This information is also available on the silk screen on the WB50NBT.
4. Plug the WB50NBT module into the 120-pin high-density Kyocera connector situated near the central aperture on the BB40NBT breakout board making sure to feed the two SMA connectors on the ends of the U.FL coax cables through the aperture in the BB40NBT breakout board.

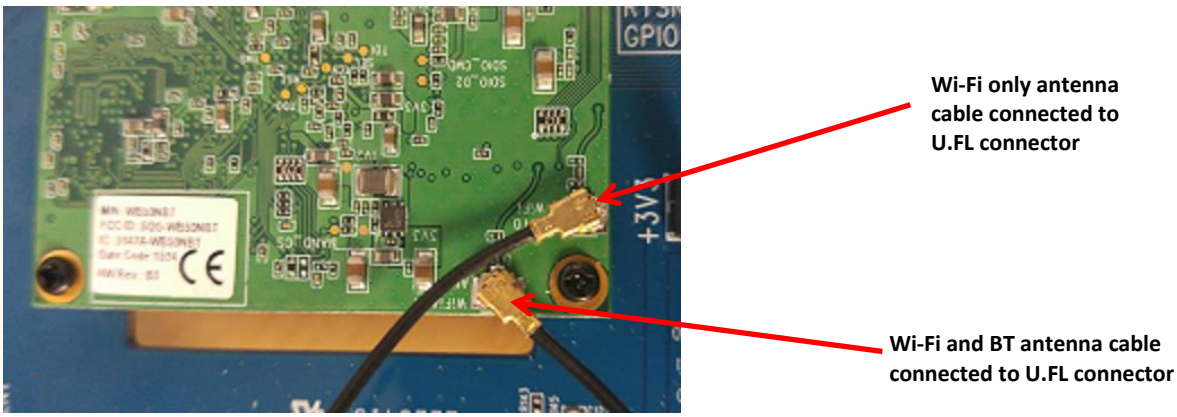

Figure 1: Location of the Wi-Fi and Bluetooth U.FL connectors on the SDB-WB50NBT

5. Using the small Philips head jeweler's screw driver, secure the WB50NBT to the BB40NBT board using the three small Philips screws.
6. Feed the SMA connector connected to the **ANT0 WI-FI** to the aperture marked **MAIN ANTENNA** on the BB40NBT board and, using the provided nuts and washers, secure the SMA connector to the BB40NBT board.
7. Repeat for the ANT1 Wi-Fi and BT SMA, this time to the aperture marked **AUX. ANT** on the BB40NBT board.

You can power the BB40NBT from mains power using the 12v power pack provided. Figure 2 shows the DC jack and the power switch. Ensure the power switch is set to Off.

8. Connect the power supply to the wall outlet and put the barrel into the DC jack connector on the BB40NBT breakout board as shown in Figure 2.

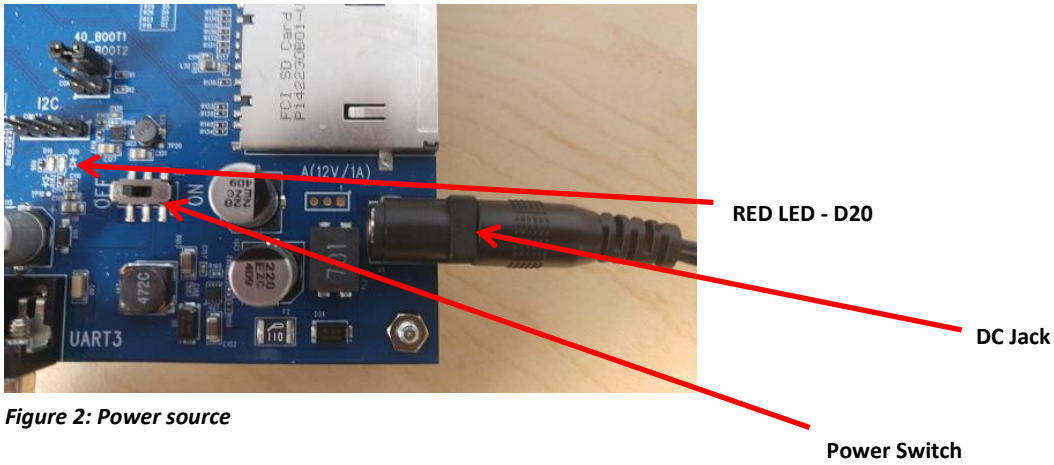

Figure 2: Power source

Basics of the BB40NBT Board

The Laird WB50NBT is a flexible communications module providing a variety of interfaces which are made available on the BB40NBT shown in Figure 3. Additional information regarding all interfaces, their use and configuration is available in the *WB50 Reference Guide*. This guide is accessible from the WB50NBT product page.

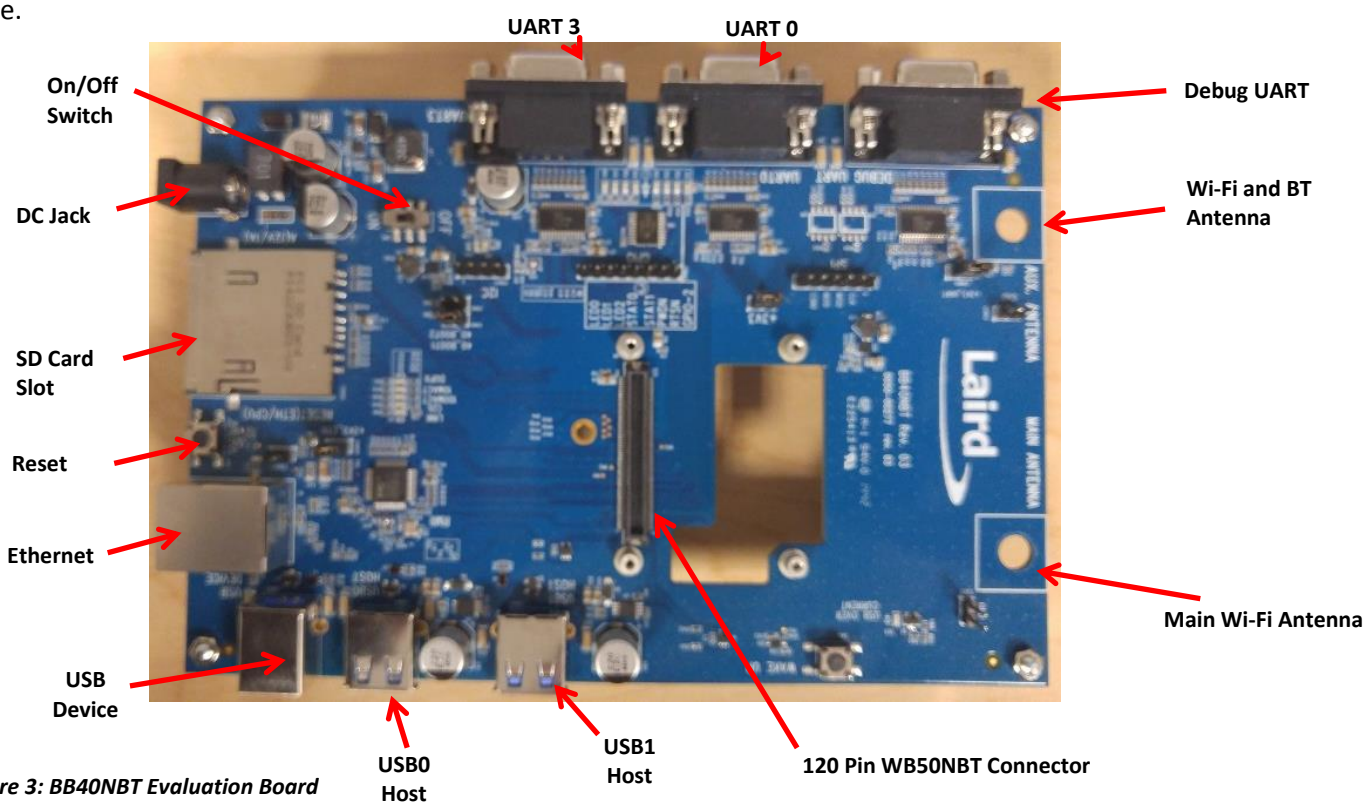

Figure 3: BB40NBT Evaluation Board

The WB50NBT is configurable via either the command line or the web-based version of the Laird Configuration Manager (LCM). WebLCM is explained further in Web LCM Linux Platform Application Note which is available from the Documentation tab of the Laird WB50NBT product page.

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This section briefly details each interface available on the BB40NBT board.

- Debug UART – Used for CLI communications with the WB50NBT module
- UART0 – Spare UART
- UART 3 – Unused
- USB device
  - Available for USB device/gadget operation
  - By default, the port is in Ethernet gadget mode
  - The IP address of the port defaults to 192.168.3.1
  - The WebLCM is always available on this port
- USB0 host
  - Available for USB HOST operation.
  - Use for flash upgrade capability of the WB50NBT
- USB1 host
  - Available for USB HOST operation.
  - Use for flash upgrade capability of the WB50NBT
- Ethernet jack
  - The WebLCM is always available on the Ethernet port
  - The IP address for this port is provided by the DHCP server to which the WB50NBT is connected

Initial Serial Communication with the WB50NBT

The following items are used in this section:

Qty.	Item
1	BB40NBT breakout board with WB50NBT module fitted as described above
1	USB to RS232 cable
1	Power supply 12V/1A with wall (US/European) adapter cable
1	USB A to USB B cable (optional)
1	Ethernet cable (optional)

To communicate with the WB50NBT, follow these steps:

1. Ensure you have loaded the driver for your USB-to-RS232 cable of choice on your host machine. Depending on your cable, the drivers may be automatically installed by your operating system. If they are not, you must download and install the device drivers for the cable.
2. Connect the USB A-type connector of the USB-to-RS232 cable to the computer. Your computer should recognize the USB-to-serial adapter and load the appropriate drivers.
3. Connect the DB9 connector of your USB-to-RS232 cable to the port marked **Debug UART** shown in the BB40NBT overview diagram Figure 3.

   Note: The terminal emulator used depends on the host operating system.

4. To send commands to the WB50NBT, download and set up a terminal emulator such as Putty or Minicom for a Linux host. There are a variety of available emulators.

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Minicom Setup

To set up Minicom on Ubuntu Linux host, follow these steps:

1. At the command prompt, type **sudo apt-get install minicom**.
2. Open Minicom (sudo minicom –D /dev/ttyUSBn –b 115200 -8 –o –l) where ttyUSBn matches the enumerated USB virtual serial port. This command line provides the correct configuration requirements to the Minicom application

Serial Port Configuration

No matter which terminal emulation program you are using, you must configure the serial port to match the requirements of the WB communications.

Adjust the settings (as needed) according to the following:

Port	Must match the COM port of your USB-to-RS232 cable
Baud Rate	115200 (TeraTerm defaults to 9600 baud communications)
Data	8 bit
Parity	None
Stop	1 bit
Flow Control	None

Start Communication with the WB50NBT from the Host

1. Connect the 12v power supply to the wall outlet and the barrel connector to the SC jack on the BB40NBT breakout board.
2. Slide the power switch (shown in Figure 2) to On to power WB50NBT. The Red LED D20 on the BB40NBT board lights up.

   Wait until the WB50NBT is done booting and you see the following prompt:

   ```
   Summit Data Communications
   summit login:
   ```

3. Enter the username and password. The default user name is ***root*** and the default password is ***summit***.

   Note: When entering the password, don't be alarmed if text or asterisks do not show. This is normal operation in Linux.

   Assuming all settings have been set properly, you should now be able to communicate with the WB50NBT. The terminal presented now is the Linux shell on board the WB50NBT and behaves likewise. After logging in, the following should display to indicate that you are now in the Linux shell: #

Important Note about *No Serial Output*

In some BB40NBT boards, the UART_3V3 jumper nearest the Debug UART port can become loose or unseated, which results in no serial output.

If you find you have no serial output, check that this jumper is tightly seated (Figure 4).

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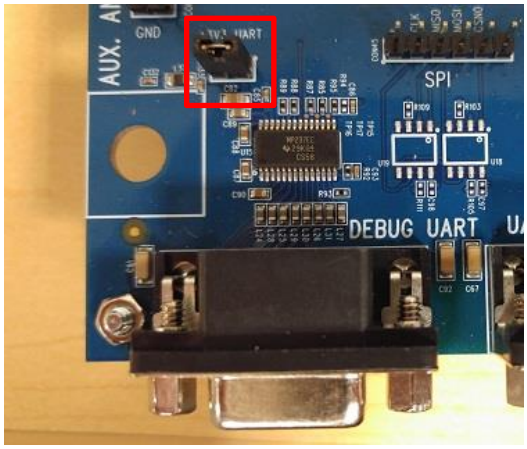

Figure 4: UART_3V3 jumper

ssh communication over Ethernet and USB Ethernet

It is also possible to communicate with the WB50NBT CLI from the host using ssh over USB Ethernet and if required Ethernet.

USB Ethernet

You will need the USB A to USB B cable for this operation.

The USB Ethernet IP address defaults to 192.168.3.1.

Plug the USB A connector into your host and the USB B into the USB Device connection on the BB40NBT board.

IP Address Setup

On Ubuntu the USB drivers should load automatically. The IP address of the host connection will need to be configured manually to match the following.

Address:192.168.3.2

Netmask: 255.255.255.0

Gateway: 192.168.3.1

DNS servers: 8.8.8.8

Once the connection to the WB50NBT has been established an ssh client (e.g. putty) can be used on the host to connect to port 22.

Ethernet

If required, it is possible to connect via ssh to the WB from the host over Ethernet however this first requires modification of the /etc/network/interfaces file on the WB to change the default behavior of the Ethernet port. This first requires using the serial or USB Ethernet interface as described above to access the WB over the CLI. Further instruction on changing the /etc/network/interfaces file is available in the Reference Manual.

Laird CLI Basics

The Laird CLI provides a command line interface to control the Wi-Fi features of the WB50NBT.

The Linux shell prompt is represented by the **#** symbol. From the prompt, enter **`sdc_cli`** to start the Laird CLI. When the Laird CLI starts, the prompt changes to **`sdc#`**.

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Full information on the commands available within the CLI is available from the Documentation tab of the Laird WB50NBT product page.

Information regarding using the CLI commands is also available by typing **`help`** at the `sdc#` prompt. Additional help is available for the commands **iface**, **profile**, **global** and **auto-profile** using the syntax `<command> help` at the `sdc#` prompt.

To see the status of the WB50NBT, type **`status`** at the `sdc#` prompt. The returned status should resemble the following.

```
Status: Not Associated
   Config name: Default
   SSID:
   Channel: 0
   RSSI: 0
   Device Name:
   MAC: 00:17:23:e0:38:e4
   IP: 192.168.1.1
   IPv6:
   AP Name:
   AP MAC:
   Bit Rate: auto
   Tx Power: 0 mW
   Beacon Period: 0
   DTIM: 0
```

To exit from the `sdc#` prompt at any time, enter the command `exit`. You will be returned to the Linux shell prompt, `#`.

Configuring the WB50NBT

The WB50NBT can be configured using the sdc_cli interface. To configure it, follow these steps:

1. At the sdc# prompt type **scan**. This generates a list of available networks currently visible to the WB.
2. Select the appropriate AP and provide the credentials.

   For example, to create a profile ***quickStart*** for an AP with SSID ***quickStartSSID*** using WPA2 PSK with a password ***quickStartPSK***, use the following commands:

```
profile quickStart add
profile quickStart set ssid quickStartSSID
profile quickStart set weptype wpa2-psk
profile quickStart set psk quickStartPSK
profile quickStart activate
```


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Note: Consult the CLI documentation for more detailed information regarding the sdc_cli commands and other examples for profile configuration. This documentation is available from the Documentation tab of the Laird WB50NBT product page.

3. The WB should now be connected to the new AP configured in the profile. Type **status** at the sdc_cli prompt and if all is operating correctly you should receive the following output:

```
Status: Authenticated
   Config name: quickStart
   SSID: quickStartSSID
   Channel: 36
   RSSI: -71
   Device Name:
   MAC: 00:17:23:e0:38:e4
   IP: (DHCP)
   IPv6:
   AP Name:
   AP MAC: 54:78:1a:e0:42:b0
   Bit Rate: 6 mpbs
   Tx Power: 5 mW
   Beacon Period: 102ms
   DTIM: 1
```

Note: It is also possible to configure the WB50 NBT using the integrated laird WebLCM via the Ethernet or g_ether USB connection. See the Web LCM Linux Platform Application Note for information. This documentation is available from the Documentation tab of the Laird WB50NBT product page.

Bluetooth

The WB50NBT uses *smart*BASIC to control the Bluetooth interface**.** *smart*BASIC is an event-driven programming language designed to make Bluetooth development quicker and simpler. Users can write a *smart*BASIC application to perform Bluetooth operations on the WB50NBT.

When the WB50NBT powers up, *smart*BASIC runs as a daemon process which is running a Serial Port Profile to Wi-Fi bridging application named *SPPBr*.

In the command line, enter the command **ps**. The following *smart*BASIC process appears in the list:

```
smartSS -E 7 -d -a -c /usr/share/smartBASIC/apps/$autorun$.SPPBr
```

The WB50NBT comes preloaded with sample applications that can be found in the following directory: **/usr/share/smartBASIC/apps**. The SPP-Wi-Fi bridging application in this directory is the same one that the WB50NBT automatically runs on boot. This application forms a bridge in between Wi-Fi and Bluetooth SPP and sends the data from one interface to another.

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To set up this application, complete the following steps:

1. Connect the WB50NBT (Device name: WB50 SPP-Socket) with another Bluetooth device using SPP (Serial Port Profile).
2. Connect another network device to the WB50NBT on port 3000. For example, to connect a Linux machine to the WB50, enter the following command, where ***xx.xx.xx.xx*** is the IP address of the WB50:

```
nc xx.xx.xx.xx 3000
```

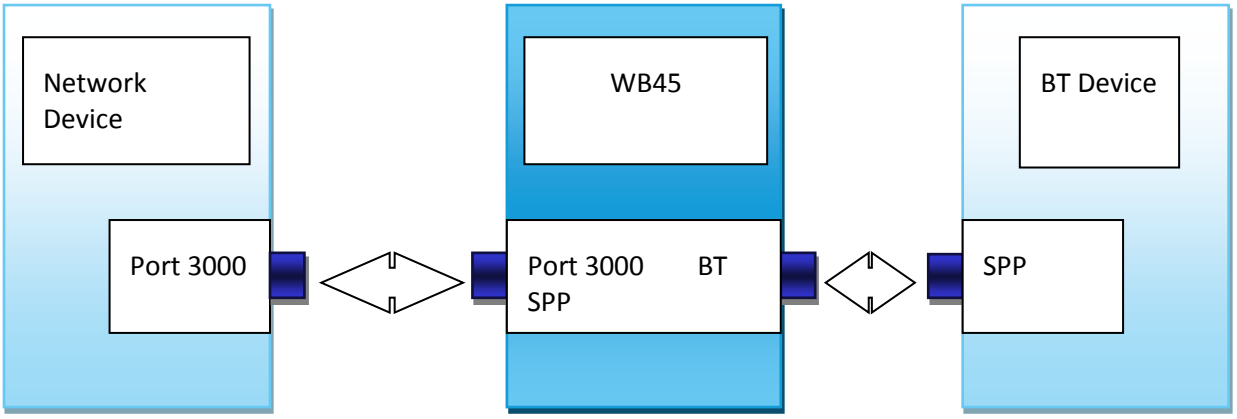

Figure 5: SPP to Wi-Fi bridging structure

As soon as the WB50NBT has established both of these connections, data coming into either interface is echoed out from the opposite interface. See the WB50 *smart*BASIC Extensions guide and the WB50NBT Reference Guide for more information. These documents are available from the Documentation tab of the Laird WB50NBT product page.

WB50NBT File System

This section details some important contents of the WB50NBT file system. For more in-depth information consult the WB50NBT reference guide.

Table 1: Main components

Directory	Content of note	Comment
/usr/bin	sdcsupp	Laird Supplicant
	sdc_cli	Laird CLI
/usr/lib	libsdc_sdk.so.1.0	Laird SDK library
	libsdc_sdk.so.1	A symbolic link to SDK library
/etc/network	wireless.sh	Networking scripts. See the WB50 reference guide for details.
	bridge.sh	Networking script. Sets up Ethernet L2 bridging. See the WB50 reference guide for details.
/etc/init.d	startup scripts	The lowest numbered start up scripts are executed first.

Directory	Content of note	Comment
/etc/init.d/opt/	optional startup scripts	Create a symlink to the item to be started: # ln -s /etc/init.d/opt/<name-of-script> /etc/init.d
/etc/ssl	default wifi certificate location for all certificates	DO NOT put your certificates in /etc/ssl/certs directory
/lib/firmware/ath6k/AR6004/hw3.x	fw-5.bin	Symbolic link to the AR6004 firmware.
	fw_v3.5.0.10006.bin	The AR6004 firmware

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