SNAP2410

Network Access Point

Installation Guide

CIRRONET™

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Important Regulatory Information

Cirronet Product FCC ID: HSW-2410
IC 4492A-2410

Note: This unit has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their expense.

FCC s MPE Requirements

Information to user/installer regarding FCC s Maximum Permissible Exposure (MPE) limits.

Notice to users/installers using the 24 dBi parabolic dish antenna in conjunction with all Cirronet RF products.

*FCC rules limit the use of this antenna, when connected to Cirronet RF products for **point-to-point applications only**. It is the responsibility of the installer to ensure that the system is prohibited from being used in point-to-multipoint applications, omni-directional applications, and applications where there are multiple co-located intentional radiators transmitting the same information. Any other mode of operation using this antenna is forbidden.*

Notice to users/installers using the following fixed antennas, with Cirronet RF products:

Andrews 24dBi parabolic dish *Andrews 18dBi parabolic dish* *Cushcraft 15dBi Yagi,* *Mobile Mark 14dBi Corner Reflector,* *Mobile Mark 9dBi Corner Reflector*	*The field strength radiated by any one of these antennas, when connected to Cirronet RF products, may exceed FCC mandated RF exposure limits. FCC rules require professional installation of these antennas in such a way that the general public will not be closer than 2 m from the radiating aperture of any of these antennas. End users of these systems must also be informed that RF exposure limits may be exceeded if personnel come closer than 2 m to the apertures of any of these antennas.*

Notice to users/installers using the following mobile antennas, with Cirronet RF products:

Mobile Mark 12dBi omni-directional, *Mobile Mark 9dBi omni-directional,* *MaxRad 5dBi whip,* *Cirronet Patch antenna,* *Ace 2dBi dipole,* *Mobile Mark 2dBi Stub*	*The field strength radiated by any one of these antennas, when connected to Cirronet RF products, may exceed FCC mandated RF exposure limits. FCC rules require professional installation of these antennas in such a way that the general public will not be closer than 20 cm from the radiating aperture of any of these antennas. End users of these systems must also be informed that RF exposure limits may be exceeded if personnel come closer than 20 cm to the apertures of any of these antennas.*

Declaration of Conformity

CE 0889 !

Warning! The RLAN transceiver within this device uses a band of frequencies that are not completely harmonized within the European Community. Before using, please read the European Operation Section of the Products User's Guide for limitations.

0889 is the identification number of RADIO FREQUENCY INVESTIGATION LTD - Ewhurst Park, Ramsdell RG26 5RQ Basingstoke, United Kingdom – the Notified Body having performed part or all of the conformity assessment on the product.

The WIT2410 to which this declaration relates is in conformity with the essential requirements of the R&TTE directive 1999/5/EC and complies with the following standards and/or other normative documents:

For Interfaces	**For RLAN Transceiver**
EN 55022	EN 300 328
EN 55024	EN 301 489 -1, -17
	EN 60950

Use Within the European Union

The WIT2410 is intended for use within the European Community States and in the following non-European Union States: Norway & Switzerland

Use of the WIT2410 in France

When used in France, the WIT2410 can only be operated with the France hopping pattern selected. This is accomplished by setting the **pe** parameter to 1. Refer to *European Union Settings* in this manual for details.

Canadian Department of Communications Industry Canada (IC) Notice

Canadian Department of Communications Industry Canada (IC) Notice

This apparatus complies with Health Canada's Safety Code 6 / IC RSS 102.

"To prevent radio interference to the licensed service, this device is intended to be operated indoors and away from windows to provide maximum shielding. Equipment (or its transmit antenna) that is installed outdoors may be subject to licensing."

ICES-003

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations of Industry Canada.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de Classe B prescrites dans le règlement sur le brouillage radioélectrique édicté par Industrie Canada.

WARNING!!

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For our Customers who wish to use this product in hazardous locations.

This SNAP2410 has been tested by Underwriters Laboratories Inc. for use in Class I, Division 2, Groups A, B, C, and D Hazardous Locations as specified in UL1604 and UL/C-UL/Zones(UL2279).

Such areas ***may*** **have Explosive Gases**.

To install this radio in this environment the following steps **must** be implemented.

1) The power supply used with the product **must** be a UL Class 2 rated device.

2) Contract a Qualified Licensed Electrician to install and run the power wiring from a screw type, hard wired 12 VDC 1A Class 2 Output power supply in a UL Listed Box and route a conduit to the radio which **must** be installed in a UL Listed Box suitable for the environment. The conduit **must** be gas tight so no gases can flow through conduit.

3) Any Cirronet products with outdoor radio transceivers (tower mounted) marked for Hazardous Locations **must** have the interconnecting multi-conductor cable run in approved conduit for the location. The cable **must** be in the conduit until out of the Hazardous Location and the conduit **must** be gas tight so no gases can flow through conduit.

4) Do **NOT** remove the power connector to the device while circuit is live. Disconnect power only while circuit is dead, or the location is known to be non-hazardous. Failure to do so, may result in a "**Risk of Fire or Explosion"**

Only then is the unit suitable for a hazardous location.

For more information on Hazardous Locations contact UL and ask for UL1604 requirements.
www.ul.com

RF Exposure

WARNING: End Users of these systems must be informed that RF exposure limits may be exceeded if personnel come closer than 45 cm to the antenna aperture when exceeding 9 dBi of gain in conjunction with the transceiver.

Repairs

Cirronet does not recommend field repairs of the radio equipment. Surface Mount Technology (SMT) has been used in the production of the transceiver module, which requires specialized training and equipment for proper servicing. The equipment should be returned to the factory for any repair.

Table of Contents

INTRODUCTION

The SNAP2410 from Cirronet Incorporated provides Ethernet connectivity to networks of WIT2410 serial radios. Built around the WIT2410, the SNAP2410 provides a 10BaseT connection to Ethernet networks and functions as base stations for remote devices containing WIT2410 transceivers. The SNAP2410 allows non-Ethernet serial devices to appear as Ethernet devices to network-based applications. By supporting seamless roaming, multiple SNAPs can be connected to a network to provide practically unlimited coverage area.

Each SNAP2410 can support 62 simultaneous remotes. Each remote radio has a unique ID number, so the number of remotes that can communicate with a SNAP is unlimited, subject to a limit of 62 remotes at any one time.

The communication between the SNAP and the WIT2410 remotes is performed using the WIT2410 over-the-air protocol. Thus the SNAP products are 802.3 compatible but not 802.11b compatible. By using the 460Kbps over-the-air data rate and the WIT2410 protocol, the full range of WIT2410 radios is realized, three times the range of most 802.11b products.

The SNAPs enjoy the same benefits of frequency-hopping spread spectrum technology that the WIT2410s do. Namely, the immunity to multipath fading and resistance to jamming that is provided by changing frequency every few milliseconds. Operating in the 2.4GHz ISM band, SNAPs can be used license-free.

The SNAP has three modes of operation, TCP/IP, AP and PPP. The default mode is the TCP/IP mode. In TCP/IP mode, the SNAP acts like any other network access point as either a client or server device. This allows standard WinSocket® routines to be utilized. Remote devices are setup to be identified by either an IP address or by a port number under the IP address of the SNAP. The remote devices send and receive unformatted data to and from the SNAP which performs the encapsulation and de-encapsulation of the unformatted data into and out of Ethernet datagrams.

In AP mode the SNAP uses a special protocol mode called SDP (SNAP Datagram Protocol). In order to send receive or transmit data from the SNAP, the application software must use this protocol. The user may use the API roam library included with the SNAP to help shorten software development.

The PPP mode is intended for applications where the remote device is equipped with a PPP client. In these applications, the SNAP functions as a PPP host providing Internet Access to the remote devices.

GETTING STARTED

The SNAP2410 is easy to install and operate. In most instances, the only installation steps will be setting IP addresses and connecting the antenna, power and Ethernet cable.

Setting up a SNAP2410 requires the following steps:

- Enter an IP address into the SNAP
- Configure the SNAP to act as a client to a server-based application or to act as a server to a client application.
- Set remote WIT2410 devices to be identified to the application as individual IP addresses or port numbers.

The default settings in the SNAP are sufficient to allow connection to Ethernet networks and to have remote WIT2410 devices connect with the SNAP. Other steps you may want to take include:

- Enter a default route IP address if data is to be sent off the SNAP's subnetwork (See *Ethernet Commands*)
- Change the network number (*See Radio Commands)*

Instructions on setting up the SNAP are detailed in the *Configuring the SNAP* section of this manual. Details on the various operating modes and configurations can be found the *SNAP Operation* section.

Connecting the SNAP

Figures 1 and 2 identify the various connectors and indicators of the SNAP2410.

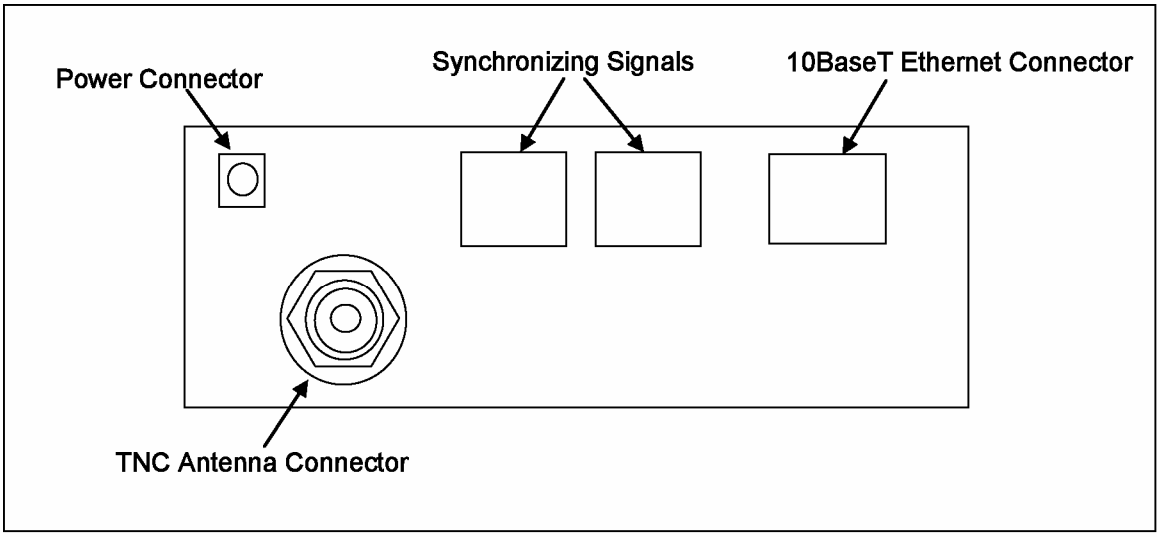

Figure 1. SNAP Rear Panel Diagram

The antenna connector is a TNC type connector. An antenna may be connected directly to this connector. Alternatively, an antenna may be located away from the SNAP using RF cable to connect the SNAP to the antenna. Cirronet does not recommend using RF

cables longer than 5 feet. If more distance is required between the SNAP and the antenna, high-quality, low-loss RF feed line must be used.

The 10BaseT Ethernet connector is the standard RJ-45 connector. The connector is wired to be able to connect directly to an Ethernet hub using a straight-through cable. If it is desired to connect the SNAP directly to a PC without a hub, the SNAP must be connected with a cross-over cable.

The synchronizing signals are provided for special applications where multiple master SNAPs are employed in an environment with slave SNAPs that are moving. The synchronizing signals are RS-485 levels and may be connected using an RJ-11 connector. In most instances the synchronizing signals are not required and may be left unconnected.

The power connector is a 2-pin DIN type connector. The provided AC adapter provides a 9 volt power level to the SNAP. The SNAP can accept DC voltages ranging between 7VDC and 26VDC if alternative power supplies are to be used.

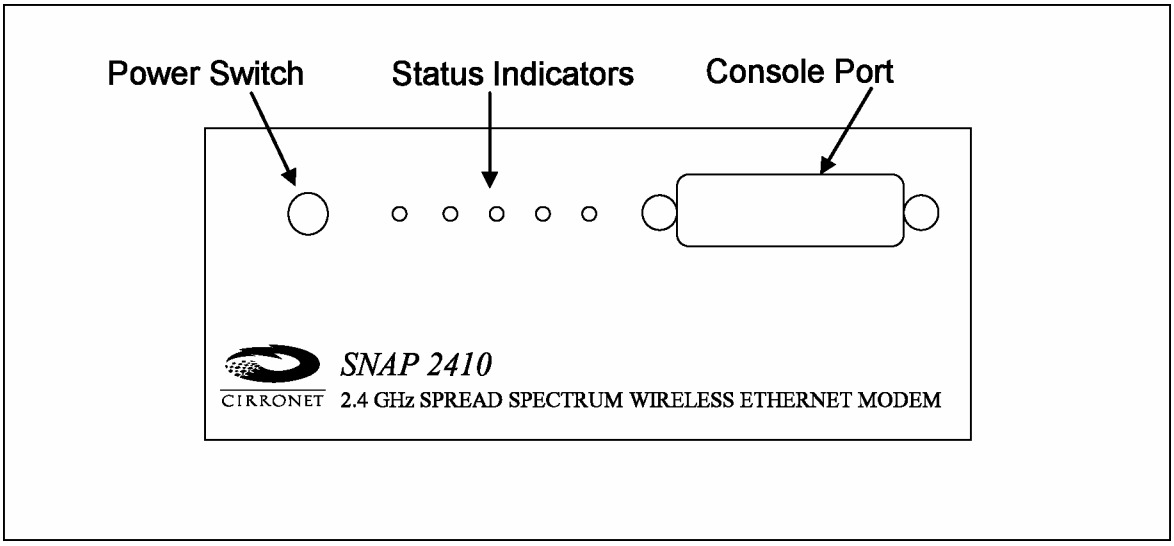

Figure 2. SNAP2410 Front Panel Diagram

The Configuration Port is an RS-232 serial port that may be used to configure the SNAP. This is useful when the default IP address of the SNAP cannot be used with the existing network preventing configuration through a telnet session. See the section *Configuring the SNAP* for details of using this port.

SNAP Status Indicators

The PWR indicator on the front panel indicates that power is applied to the SNAP and that the power switch is in the ON position.

TXD and RXD are indicators of data activity. They indicate the transmission and reception of data over the Ethernet connection. Note that these LEDs can be active even when the SNAP has no remote radios registered.

The COLL indicator is illuminated whenever packets collide on the network segment to which the SNAP is connected. As such, this is rough indicator of the level of traffic on the network

segment. If this LED is glowing brightly on a continuous basis, the throughput of the SNAP may appear to be reduced.

The LINK indicator when illuminated indicates a good connection to the Ethernet network. If this LED is not on, it can indicate a cross-wired connection between the SNAP and the network. It may also indicate a faulty cable connection.

Configuring the SNAP

SNAPs are shipped from the factory with no IP address, no DNS address and no route or gateway address specified. If a BOOTP or DHCP server is not present an IP address must be assigned to the access point before connecting it to a network. To allow IP traffic to leave the particular subnet to which the access point is connected, the IP address of the gateway, bridge, router or other device that allows access outside the subnet must be entered as the routing address. If a DHCP server is present on the network, the IP, default route address and DNS server address can be set up through it. Note that while a BOOTP server can set the IP address in the SNAP, it cannot set the default router or DNS server IP addresses. See the section *BOOTP and DHCP* for details.

The network that the SNAP is connecting to must be compatible with 10BaseT products. The SNAP **will not** work if the network only supports 100BaseT or half duplex 10BaseT products. Before connecting a default configured SNAP to an active network that does not have a BOOTP or DHCP server, ask the network system administrator for an IP address for the SNAP that will not cause any problems on the network.

The SNAP can be configured two ways. The first is through the serial Console port. The settings for the serial port are 38400 baud, 8 data bits, 1 stop bit, and no parity. WinSNAP will automatically find the appropriate serial port and configure the serial port settings for you. The software will inform you of its progress and any problems that arise. After a few seconds the SNAP firmware version is displayed followed by the **TCP>** prompt.

Once a valid IP address has been entered in the SNAP, a second method to complete the configuration of the SNAP is through a telnet session. Most telnet programs work with the SNAP. Windows has a telnet program that works with the SNAP. A telnet session can be started by clicking on Start->Run if the TCP/IP client has been installed. For a SNAP with an IP address of 192.168.0.254, enter the following information in the dialog box:

```
telnet 192.168.0.254
```

A telnet window will open up. The first line is the version of the SNAP firmware followed by the prompt:

```
TCP>
```

To change the IP number of the SNAP, use the **ip** command.

```
ip <xxx.xxx.xxx.xxx> {yyy.yyy.yyy.yyy}
```

Where x is the new IP address and y is the optional netmask number.

To change the default routing address use the **route** command.

```
route add default <xxx.xxx.xxx.xxx> {yyy.yyy.yyy.yyy}
```

Where x is the IP address of the gateway device and y is the optional netmask number.

Store the configuration parameters in non-volatile memory with the **save** command:

```
save<CR>
```

The SNAP will report back the time it took for the save. Reset the SNAP by typing:

```
reset<CR>
```

The SNAP can also be reset by cycling power. Whenever a reset is executed on the SNAP, the telnet session will be lost. It will take the SNAP about 30 seconds to reinitialize after a reset or after cycling power.

Note: The save and reset commands must be entered after modifying the default configuration. Failure to do so will result in the factory defaults to be used.

European Union Settings

When operating the SNAP2410 in France or Spain, a limited frequency mode must be selected. To select the limited frequency band at the SEM> prompt enter:

```
radio a param pe 1<CR>
```

Save this setting by typing:

```
save<CR>
```

The limited frequency operation will take effect immediately and will be saved into memory for use when power is cycled.

European Union Use with Gain Antennas

Use of the SNAP2410 within the European Union is limited to a maximum transmit power including antenna gain of 20dBm. The antenna supplied with the SNAP2410 is a 2dBi antenna. The transmit power of the SNAP2410 in the default mode is 18dBm. Thus the supplied antenna meets the EU limit. If gain antennas are to be used, the low power setting of the SNAP2410 must be selected. This setting sets the transmit power at the antenna connector to 10dBm. In this setting a maximum of 10dB of antenna gain may be used. To select low power mode, at the command line prompt enter:

```
radio a param wp 0<CR>
```

To save this parameter in non-volatile memory type:

```
save<CR>
```

This parameter will take effect immediately and will be saved into memory for use when power is cycled.

SNAP OPERATION

Overview

At the most basic level, SNAPs can be thought of as Ethernet-to-serial interface adapters. That is, they take data from a host application over a 10BaseT Ethernet connection, remove the Ethernet header information, format the data for WIT2410 radios and transmit the data to the on-board WIT2410 through a high-speed serial interface. In the other data flow direction, the on-board WIT2410 receives data from a remote WIT2410 device. The SNAP takes this data and provides the necessary Ethernet datagram encapsulation and transmits the datagram to the host application over the connected network.

A SNAP can be used standalone, or a group of SNAPs can be connected together through a 10BaseT hub to provide seamless roaming over a larger area. When seamless roaming operation is desired, the SNAPs must be synchronized with each other and the AP mode must be used. This synchronization is accomplished either over the Ethernet network or through a differential Sync signal when time delay devices (such as routers) are between SNAPs. See the section on Synchronization for details.

Communication between the host application and a SNAP can occur in one of three modes. In the default TCP/IP mode, the SNAP operates as either a client to a server application running on a workstation or as a server to a client application running on a workstation. Remote radios communicating with the application are assigned either IP addresses or port numbers by the SNAP. The SNAP routes data to and from the remotes to the designated application destination. The TCP/IP mode allows use of WinSocket routines to handle communications between the host application and the remotes. TCP/IP mode is the default mode.

The AP mode is a customized version of the Ethernet protocols that allow applications to take advantage of the seamless roaming features of the SNAP and WIT2410-based devices. Provided with the SNAP is a library of C routines that constitute a high level API for workstation-based applications. Alternatively, host applications can communicate with a SNAP using the SNAP Datagram Protocol (SDP). This protocol is described in detail later in this manual.

In PPP mode, the SNAP hosts PPP sessions with remote WIT2410 devices. To use this mode, the remote host must be capable of establishing and supporting PPP sessions.

DHCP

A DHCP server also can be used to set the SNAP IP address as well as the default route and DNS server IP addresses. This is accomplished by setting the desired default route IP address in the DHCP server using Option 3 and the desired DNS IP addresses using Option 6. The DHCP server will not overwrite a previously entered default router IP address in the SNAP.

If the DHCP server is not used to set the default router IP address, one must be entered using the *route* command. See the previous section for details of the route command.

BOOTP

The SNAP can obtain its IP address from a BOOTP server if one is present in the network. The BOOTP server will require the Ethernet hardware MAC address to be able to assign the IP address to the SNAP. The Ethernet hardware MAC address of the SNAP is configured as 00:30:66:XX:YY:ZZ, where XX:YY:ZZ is the unique ID of the SNAP's radio. The MAC address is displayed on a label on the bottom of the SNAP.

Seamless Roaming

The SNAP in AP mode, allows remote radios to seamlessly roam between multiple SNAPs. The remote radios can also be configured not to roam if this is the required operating condition. In order for the remote to be able to roam seamless the <wg> parameter must be set to 2. When the RSSI (receive signal strength indictor) of the remote reaches a certain threshold, the remote will start looking for another SNAP with a higher RSSI. The SNAP will be notified with a CONNECT and DISCONNECT packet when a remote leaves or connects with a SNAP.

To facilitate seamless roaming among a group of SNAPs, the SNAPs use Ethernet packets to synchronize time relative to each other. A single "master" SNAP will broadcast (or multicast) special UDP datagrams to the "slave" SNAPs to deliver timing information through the network. The SNAPs can also synchronize with one another by RJ-11 cable (telephone cable). The RJ-11 method of synchronization uses a daisy chain fashion to connect the SNAPs together. The SNAPs need to be synchronized this way if the Ethernet packets can not be transmitted in a timely manner, such as going through a router.

Synchronization

Synchronization is only required when seamless roaming is desired. The SNAP uses broadcast or multicast datagrams for time synchronization. The default is for the master SNAP to broadcast datagrams to the 255.255.255.255 all-hosts IP broadcast address. Using the **`sys xcast <ipaddr>`** command, SNAPs can be configured to use a more limited IP broadcast address, or a multicast address. All SNAPs in a network should be configured with the same xcast address. The use of multicast addresses is preferred so that synchronization datagrams do not interfere with hosts other than the SNAPs. Note that the SNAPs use UDP port 2410 as the source and destination UDP port numbers in the synchronization packets.

The **`sync master`** command is used to set a SNAP to the master for time synchronization, and the **`sync slave`** command is used to set a SNAP to be a slave for time synchronization. There should be one master in a given network, even if there is only one SNAP in the network.

There may be a time when there will be SNAP on different sides of a network router. This situation could cause the SNAPs not to be synchronized. This is where the RJ-11 sync connectors can be used. If the remotes will need to be able to roam between the SNAP located on different sides of the network router, the SNAP will have to be connected together using the RJ-11 connectors. The cable will only need to be two twisted pair. This is the same as regular phone cable. If there are more than two SNAPs in the network, the SNAPs will need to be daisy chained together.

SNAP System Commands

The SNAP supports a series of commands that allow for configuring the Ethernet interface as well as the radio parameters of the on-board WIT2410. These commands can be entered during a telnet session or by using the WinSNAP24 utility when the > prompt is displayed. The commands are summarized here with detailed explanations following.

Command	Description
`echo`	Toggles user screen echo mode
`help`	Displays command help screen
`reset`	Resets the SNAP activating changed configuration parameters
`save`	Stores current configuration to memory
`sys [help`	Displays help screen for command
`mode [AP|PPP]`	Sets SNAP to Access Point or PPP server mode
`outmax <1-208>`	Set maximum transmit packet length
`xcast [`	Shows broadcast/multicast address
`<b/mcastaddr>]`	Sets broadcast/multicast address
`version`	Displays SNAP firmware version

echo — Toggles the user screen mode to echo characters typed by the user. Default is on. If echo is turned off, characters typed will not be displayed on the screen unless echoed by the terminal program.

help — Displays a list of all the SNAP commands. Most commands that require a parameter also have a help mode that displays the help screen for that command.

reset — Resets the SNAP and loads saved parameters into active memory. Also causes the SNAP to reinitialize which can take 30 seconds. If reset is issued before the save command, the new parameters are lost and the last saved parameters are used.

save — Saves changed parameters in non-volatile memory to be loaded on power up. Must be issued before the reset command or cycling power to have changed parameters take effect. (An exception is the sys outmax command which becomes active immediately after it is entered.)

sys — These commands modify system operation parameters. The **`mode`** subcommand is used to select the AP or PPP mode of operation. **`outmax`** sets the length in bytes of the packets the processor in the SNAP will send to the internal radio. This command also changes the value in the radio. The xcast subcommand is used to set the multicast address to be used when the SNAP puts data out on the network.

version — Displays the SNAP firmware version.

Ethernet Commands

Command	Description
`arp –a`	Displays arp table
`-d <ipaddr>`	Deletes arp entry
`-s <ipaddr> <eaddr>`	Adds arp entry
`dns [`	Show current DNS server ip addresses
`[0|1] <ipaddr>]`	Sets DNS server ip addresses
`ip [`	Displays current SNAP IP address
`<ipaddr> <netmask>]`	Sets SNAP IP address and optionally the netmask
`password <pwd>`	Sets password for telnet sessions
`ping <ipaddr>`	Pings TCP/IP host
`route [ help`	Displays help screen for command
`add <ipaddr|default> <gwaddr> <netmask>`	Adds IP address and netmask to route list
`del <ipaddr>`	Deletes IP address from route list
`list ]`	Lists route IP addresses
`socks`	Displays network socket information

arp — Manipulates the address resolution procedure table. This command is provided primarily as a debugging tool for setting up networks. **`ipaddr`** is the device IP address and **`eaddr`** is the physical Ethernet address of the device

dns — Sets or displays the ip addresses to be used for the primary and backup DNS servers. If not set, DNS name resolution must be handled by a proxy server or a DNS server ip address must be set in the subscriber PCs.

ip — Sets the IP address of the SNAP. The default IP address is 0.0.0.0. When specified **`netmask`** sets the netmask number. The default netmask is 255.255.255.0.

password — Allows a password to be set to restrict the ability to initiate telnet sessions with the SNAP.

ping — sends inquiry packets to TCP/IP host specified in <ipaddr> and displays the amount of time that elapsed before a response was received. Continuously sends requests until a key is pressed. When a DNS server is present whose IP address has been entered into the SNAP, it is possible to use URLs rather than IP addresses to ping sites.

route	Displays and manipulates gateway IP addresses to route IP traffic off the subnet. *Default* sets the default gateway IP address. When an IP address is entered instead of *default*, the gateway IP address specified will be used only for traffic destined for that IP address. If no default route is entered and a DHCP server is present, the DHCP server can add the default route IP address.
socks	Displays the network socket information.

SNAP Radio Commands

The SNAP Radio Commands manage how the radio interfaces and synchronizes with the SNAP processor. While the hop command changes a radio parameter as well as a SNAP processor parameter, other radios parameters must be changed using the Radio Commands detailed in the next section.

Command	Description
`hop [help`	Displays help screen for command
`length <hoplen>`	Sets/displays hop dwell time in radio and SNAP
`sequence [75|25]`	Informs SNAP of number of frequencies in radio hop pattern
`remote [help|`	Displays help screen for command
`list|`	Displays remotes currently registered with the SNAP
`sync [help`	Displays help screen for command
`disable`	Turns sync off (default)
`ether`	Sets synchronization mode to use Ethernet packets
`master`	Sets SNAP as sync master
`override`	Toggles master backup override
`settings`	Displays synchronization settings
`slave`	Sets SNAP as sync slave
`wire]`	Sets synchronization mode to use RJ-11 wire ports

hop — When using co-located or synchronized access points, used to inform the SNAP of the hop dwell time or the number of frequencies in the hop pattern of the radio in the SNAP. The parameter entered for **`length`** is set in the SNAP and the radio in the SNAP and is the decimal value of the number of 625µsec ticks in the dwell time. A value of **`16`** corresponds to a hop dwell time of 10msec and is the default. When the SNAP is being used standalone (with sync disabled) this value does not need to be set.

The **`sequence`** is the number of hop frequencies in the hop pattern in the radio in the SNAP. The default is 75 for US/ETSI operation. All other frequency bands, as set in the radio by the pe command, have 25 frequencies in their hop patterns. This value is entered as a decimal number. The sequence needs to be modified only if modified in the radio in the SNAP.

remote — Displays the serial numbers of the radios in the SNAPs that are currently registered with the SNAP.

sync — These commands set the operation of the synchronization signal used in co-located SNAP networks. The default mode is the sync OFF. Sync is enabled by selecting a synchronization method. **`ether`** and **`wire`** are mutually exclusive commands and set

the synchronization to occur over the Ethernet or over the RS-485 signal lines. When sync is enabled, the default mode of the SNAP is slave. One SNAP must be configured as the sync master. If sync has been enabled, the slave SNAPs will listen for a sync signal from the master. If no sync is heard, a slave SNAP will make itself a master and provide a sync signal. This is called the master backup override mode. **`override`** toggles the master backup override on and off. In standalone SNAP installations, synchronization is not required.

Radio Commands

The "radio" command provides access to several sub-commands that are useful in configuring the WIT2410 in the SNAP. The format for the radio commands is **`radio {A|B} <sub-cmd> [<sub-cmd-args>]`**, where the **`{A|B}`** is either of the letters 'A' or 'B' used to specify to which radio the sub-command should be applied. The SNAP uses only the radio 'A' designation; the 'B' designation is for future use. The command **`radio {A|B} banner`** can be used to display the banner from the radio. This is useful in determining the unique ID of the radio and the version of firmware running in the radio.

The radios in the SNAP devices are set with factory defaults which should be sufficient for most applications. For other applications, the following radio commands can be used to fine tune the performance of the SNAP.

Command		Description
`radio a`	`help`	Displays command list
	`banner`	Displays power on banner for the radio in the SNAP
	`defaults`	Resets the radio parameters to the factory shipped values
	`maxremotes [ 0..15]`	Displays value currently in use Sets the maximum number of subscribers the SNAP will allow to register. Default = 15
	`network [ 0..63]`	Displays current SNAP network number Sets the network number for the SNAP Default = 0
	`param <rcmd> [arg0,arg1…]`	Sets other radio parameters. Should not be used unless instructed to by Cirronet Technical Support
	`roam <0|1|2>`	Sets roaming mode of SNAP radio. 0 = No roaming (default) 1 = Roaming (not seamless) 2 = Seamless roaming (AP mode only) Roaming modes must also be set in the remote radios
	`show`	Displays radio parameters that have been modified from factory settings

help — Displays list of sub-commands under the radio command.

banner — Displays the power on banner of the radio inside the SNAP.

defaults — Replaces any modified parameters with the factory default values.

maxremotes — Sets a limit to the number of remotes that an access point radio can have registered simultaneously. The default is 15 but the parameter can range from 1 to

15. If more than *maxremotes* subscribers attempt to connect to the access point, they will be denied.

network — The radio in the SNAP has 64 preprogrammed hopping patterns or network numbers. By using different network numbers, nearby co-located networks can avoid interfering with each other's transmissions. Even if both networks tried to use the same frequency, on the next hop they would be at different frequencies. *nwt* can range from 0 to 63.

param — This command allows certain special radio parameters to be modified. These are only useful in debugging circumstances and should not be used unless directed to by Cirronet Technical Support. Modifying these parameters without direction by Cirronet may render the equipment inoperable.

roam — This command is used to set up the SNAP for seamless roaming when set to 2. 0 is the default and a value of 1 has no effect on the SNAP. The roaming mode also must be set in the remote radios.

show — This command displays a list of the current radio parameters including the network number, maxremotes and the sys outmax value.

TCP/IP MODE OPERATION

The default operating mode of the SNAP is the TCP/IP mode. In this mode, the command line prompt is **TCP>.** If the command prompt is **AP>** or **PPP>**, it is an indication the SNAP is in the AP or PPP mode of operation. To change to TCP/IP mode, at the prompt type:

```
sys mode tcp<CR>
save<CR>
reset
```

After the post-reset self-test, the command line prompt will change to **TCP>.** If a telnet session is being used to communicate with the SNAP, it will be necessary to close and reopen the session.

The TCP/IP mode is designed to allow the remotes communicating with the SNAP to appear as Ethernet devices when in fact, they are serial devices transmitting and receiving unformatted data. The SNAP can function as a client device or a server device. When functioning as a client device, the IP address of the server running the host application is entered into the SNAP. The remote devices can be addressed as individual IP addresses or as ports on a single IP address.

Client Mode

Although the SNAP in TCP/IP mode can act as a server to a client workstation on the network, the typical use will have the SNAP as the client to an application running on a server. The SNAP operates as a client device once a server IP address and port number have been entered. If no server IP address is entered into the SNAP, the SNAP will assume the role of the server. Enter the server IP address and port number by typing at the TCP> prompt:

```
tcp server add <ipaddr> <port><CR>
```

where **ipaddr** is the IP address and **port** is the port number of the desired server. Two server IP addresses may be entered. Information on the server IP addresses is displayed by typing:

```
tcp server list<CR>
```

To remove a server IP address, type:

```
tcp server delete <ipaddr><CR>
```

Where **ipaddr** is the IP address of the server to be deleted. If all server IP addresses are deleted, the SNAP will enter server mode.

It is possible to designate servers using domain names rather than IP addresses if a DNS server is present. Before adding or deleting servers by domain name, the IP address of the DNS server must be entered into the SNAP. Two DNS servers can be specified. Enter a DNS server IP address by typing:

```
dns [0:1] <ipaddr><CR>
```

Where 0 and 1 identify the first and second DNS servers to be used and **ipaddr** is the corresponding IP address of the DNS server. In this mode, servers are added and deleted by using the domain name in place of the IP address in the **tcp server add** and **tcp server delete** commands.

When a remote device registers with the SNAP, the SNAP will open a socket with the server using the IP address or port number assigned to the remote. As data is received from the remote device, it will be transmitted to the server over this socket. Data to be sent to the remote device is

sent to the SNAP over the same socket. The SNAP determines to which remote device the data is intended and translates the IP address or port number to the correct radio ID.

When a remote logs off from the SNAP, the socket to the server is closed. When that remote registers with the SNAP the next time, the IP address or port number assignment can be different from the original assignment unless static assignment or a DHCP server is used. Refer to the section *Assigning Remotes IP Addresses* below for details.

Server Mode

In server mode, the SNAP uses a control port to inform the client application of remote devices as they register with and disconnect from the SNAP. The default port number for the control port is 2430. This port number can be changed using the **`tcp control`** command.

```
tcp control <1..65,536><CR>
```

The format of the registration message is:

```
+02:67:95 192.168.0.212 5002
```

Where **`+`** indicates the beginning of a registration message, **`02:67:95`** is the factory serial number of the remote radio and **`192.168.0.212`** is the IP address and **`5002`** is port number to be used to communicate with the remote device.

When a remote device drops connection with the SNAP, a disconnect message is sent using the following format:

```
-02:67:95
```

Where **`–`** indicates the beginning of a disconnect message and **`02:67:95`** is the factory serial number of the radio in the remote device.

In server mode, the client application is responsible for opening sockets with the SNAP for each remote that registers with the SNAP. The client application can wait until it is notified over the control port of a remote registering before opening a socket. Alternatively, the client application can open sockets ahead of time for remotes it expects will be registering with the SNAP. Data transmitted from a remote to the SNAP before the client application opens a socket will be discarded.

Assigning Remotes IP Addresses

Remote devices can be identified to applications by either an IP address. Remote devices can have IP addresses assigned in one of three ways: dynamic assignment by the SNAP, static assignment by the SNAP, or by a DHCP server.

To have remote devices assigned IP addresses dynamically by the SNAP, a pool of consecutive IP addresses must be available. The lowest IP address of the pool is entered in the SNAP as the **`ipbase`**. The first remote device that registers with the SNAP will be assigned that IP address. The next remote device that registers with the SNAP will be assigned the next higher IP address and so on.

Note: When using the SNAP to dynamically assign IP addresses to remotes, if a remote leaves the coverage area of the SNAP and then re-enters, it may be assigned a different IP address than initially.

Enter the first IP address by typing at the TCP> prompt:

```
tcp server ipbase <xxx.xxx.xxx.xxx><CR>
```

where xxx.xxx.xxx.xxx is the first IP address to be assigned. If the remote devices are to be identified as a port number of the IP address of the SNAP, do not enter an **ipbase** address. If an **ipbase** has previously been entered, re-enter the **ipbase** with a value of 0.0.0.0. This will cause the SNAP to use port numbers to identify the remotes.

The size of the pool must be equal to the maximum number of remotes that will register with the SNAP at a given time. The default setting is 16 but the SNAP can support a maximum of 62. The number of remotes that can be simultaneously registered with the SNAP can be modified using the **tcp server ipcount** command.

```
tcp server ipcount <1..62><CR>
```

When using IP addresses to identify remote devices, the SNAP will assign a port number. If a specific port number is desired, the number can be specified using the **tcp server ipport** command.

```
tcp server ipport <1..65,536><CR>
```

To display the current settings of the ipbase, ipcount, ipport and the server IP address and port number, at the TCP> prompt type:

```
tcp server list<CR>
```

If no server IP address has been entered, no server information will be displayed.

To have the SNAP statically assign IP addresses, the **tcp remote add** command is used. The IP addresses are assigned to remotes using the unique factory serial number of the WIT2410 radio in the remote device. For example, to statically assign a remote device with a WIT2410 radio with serial number 104050 the IP address 192.168.0.230 using port 5000, at the TCP> prompt type:

```
tcp remote add 10-40-50 5000 192.168.0.230<CR>
```

Whenever that remote device registers with the SNAP, it can be accessed using IP address 192.168.0.230 and port 5000. To remove a static IP assignment type:

```
tcp remote delete <remote-id><CR>
```

where remote-id is the radio serial number with hyphens between each two digits as in the above example.

To use a DHCP server to assign IP addresses to remote devices, the ipbase must be set to 255.255.255.255. Set the ipbase as above using the **tcp server ipbase** command:

```
tcp server ipbase 255.255.255.255<CR>
```

Assigning Remotes Port Numbers

Remote devices can be identified to applications be either an IP address or a port number of the IP address of the SNAP. There are two ways to assign port numbers to remote devices: dynamic assignment by the SNAP and static assignment by the SNAP. If no **ipbase** value is entered into the SNAP, the remote devices will be identified by dynamically assigned port numbers of the IP

address of the SNAP. As remotes register with the SNAP, the SNAP will dynamically and randomly assign port numbers. The SNAP will not assign a remote device port numbers reserved for standard services, such as FTP.

To make a static assignment of a port number to a specific remote device, use the **`tcp remote add`** command but do not enter an IP address. For example, to assign port number 5000 to a remote device with radio serial number 104050, type:

```
tcp remote add 10-40-50 5000<CR>
```

If an **`ipbase`** has previously been entered but remote identification by port number is desired, re-enter the **`ipbase`** with a value of 0.0.0.0. This will cause the SNAP to use port numbers to identify the remotes.

TCP/IP Commands

The following commands are specific to the TCP mode of operation.

Command			Description
tcp	help		Displays help screen for command
	control		Displays control port setting for server mode
		<1-65536>	Sets control port for server mode
	remote	help	Displays help screen for command
		add <remote-id> <ipaddr>	Add a remote with a static IP address assignment. Remote ID must be broken up by dashes after every two numbers
		delete <remote-id>	Remove a static IP address assignment
		list	Displays a list of remotes with static IP addresses
	server	help	Sets base IP address for SNAP
		add <ipaddr> <port>	Add a server IP address
		delete <ipaddr>	Delete a server IP address
		id [enable|disable]	Enable/disable connect message on remote registration
		ipbase <ipaddr>	Set beginning IP address for dynamic IP assignment
		ipcount <1-62>	Set number of remotes that can be connected to servers simultaneously
		ipport <1-65536>	Set port number to use when IP address used to identify remotes
		list	List servers entered
	status		Displays status of servers and remotes

help — Displays the help screen listing of the **`tcp`** commands.

control — Displays and sets the port to be used to send remote connect messages to a client or server application.

remote — Displays and manages table of remotes registered with the SNAP. Allows static IP address assignment on a per remote basis. Remote-id is the 6-digit serial number of the WIT2410 in the remote device with a dash separating each two digits. For example, serial number 201457 must be entered as 20-14-57.

server	Sets up and manages server or servers to be communicated with when the SNAP is in client mode. Id command turns on a connect message whenever a remote registers with the SNAP. When not enabled, the SNAP will open a socket for each remote as they register but will not provide any other indication of a remote registering.
status	Displays the status of servers and remotes.

PPP MODE OPERATION

The SNAP can be configured to operate as a PPP (Point-Point Protocol) server. PPP is a dial-in network connection that allows TCP/IP communication. A PPP connection allows a remote connected to a computer to be connected to network that the SNAP is on using the TCP/IP protocol. In order to operate the SNAP as a PPP server, the following sequence of commands must be entered.

```
sys mode PPP<CR>
save<CR>
reset<CR>
```

After the post-reset self-test, the command line prompt will change to **`PPP>.`** If a telnet session is being used to communicate with the SNAP, it will be necessary to close and reopen the session.

In addition to supporting DHCP and RADIUS servers, the SNAP will also allow the user to specify the starting IP address for the remotes that logon. The first remote to logon will receive the IP address specified below. The SNAP will then add one to the IP address for the next remote to login. Alternatively, the SNAP supports static IP assignment based on username. Details of the commands for these modes are in the section *PPP Commands* below.

Included in the appendix is a listing of a Windows modem definition file. This inf file will work on Windows 95/98/ME/2000/NT/XP for a remote WIT2410 modem device connected to a serial port. The WIT2410-based modem device needs to be added as a new modem using the standard Windows procedures. When installed, Windows dial-up networking can be used to create a PPP session between the remote PC and the SNAP. The PPP mode of the SNAP also works with various versions of UNIX and LINUX. Contact Cirronet Technical Support for details.

PPP Commands

These commands are unique to the PPP mode. They are preceded by **ppp**.

Command		Description
ppp	help	Displays help screen for command
	acct method	Displays accounting method currently in use
	[local|radius]	Sets accounting method to local or Radius
	auth [chap	Enables CHAP authentication protocol when method is set to RADIUS.
	method [local|radius]	Set authentication method to local or Radius
	settings	Displays authentication settings
	upap]	Enables UPAP authentication protocol when method is set to RADIUS
	base <ipaddr>	Sets base IP address for SNAP
	count	Displays PPP base allocation count
	<1-62>	Set to max number of remotes parameter of radio
	ip <usr> <ipaddr>	Sets static IP address for specified user
	radius help	Displays help screen for command
	add [auth|acct] <ipaddr> [port]	Adds IP address of Radius server for authentication or accounting
	delete [auth|acct] <ipaddr>	Deletes IP address of Radius server
	port [auth|acct] <ipaddr> <port-number>	Sets the port number for a Radius server
	retries <value>	Sets the RADIUS number of retries
	secret [auth|acct] <ipaddr> <secret>	Sets the secret for a Radius server
	settings	Displays Radius servers settings
	timeout <value>	Sets the RADIUS timeout in
	status	Displays status of registered users
	timeout <time>	Sets idle time timer in tenths of seconds

	`user help`	Displays help screen for command
	`add <usr>`	Adds a PPP user
	`delete <usr>`	Deletes a PPP user
	`disable <usr>`	Disables a PPP user
	`enable <usr>`	Enables a PPP user
	`list`	List current PPP users, both enabled and disabled
	`password <usr> <pwd>`	Set PPP user password

help — Displays the subcommands for the PPP mode.

acct — Displays/sets the accounting method to be used for IP traffic. When set to local, the SNAP keeps track of the amount of data traffic and time used by each user. When set to radius, the accounting information is sent to the designated accounting Radius server.

auth — Displays/sets the authentication method to be used when users sign on. When set to local, the password entered by the user when establishing the PPP session must agree with the password entered for that user in the SNAP. When set to Radius, the password entered by the user is sent to the designated authentication Radius server. When using a RADIUS server, either CHAP or UPAP must be enabled.

base — Sets base IP address for IP addresses to be assigned to remotes when in PPP server mode. The base address is assigned to the first remote that registers with the SNAP. The next remote to register is assigned the base IP address incremented by one.

count — Displays/sets the PPP base allocation count. This number must be equal or larger than the maximum number of remotes connecting to the SNAP as it determines the number of buffers the SNAP will set up to assemble datagrams.

ip — Sets static IP assignment for the designated *usr* where *usr* is the username assigned to the subscriber in the SNAP. The IP assignment remains valid after cycling power to the SNAP or issuing resets.

radius — These commands are used to set up one or more Radius servers to perform authentication and accounting functions. Separate servers may be used for each function. The *retries* parameter sets the number of attempts the SNAP will make to contact a RADIUS server before denying access to a user. The *timeout* parameter sets the length of time, in xx of seconds that the SNAP will wait for a response from a RADIUS server before denying access to a user.

status — This command displays the status for all currently registered users including the IP address assigned to the user, the serial number of the remote radio, the number of bytes and packets received and sent as well as bad packets.

timeout — This command allows the SNAP to terminate the PPP session of an idle remote after the specified amount of time. Time is specified in tenths of seconds, thus a value of 600 corresponds to one minute. If the value is set to zero, the timeout feature is disabled.

user — Manipulates users that are entitled to connect to the SNAP. Also sets the password for each entered user. **usr** and **pwd** can be any alphanumeric string up to 32 bytes in length. When a new user is added, a password must be assigned and the user must be **enabled** before access will be granted. A user and password must be assigned only if local authentication is user. If a Radius server is to perform authentication, usernames and passwords are not required. There is no way to display passwords. If a password is forgotten, a new password must be entered.

AP MODE OPERATION

The AP mode is optimized for seamless roaming communications between a workstation or workstations on an Ethernet network and a network of WIT2410-based devices. The AP mode assumes that there is limited intelligence in the remote host. The AP mode is designed to allow the remote host devices to send and receive data to the remote WIT2410 in transparent mode. In order to operate the SNAP in the AP mode, the following sequence of commands must be entered.

```
sys mode AP<CR>
save<CR>
reset<CR>
```

After the post-reset self-test, the command line prompt will change to **`AP>.`** If a telnet session is being used to communicate with the SNAP, it will be necessary to close and reopen the session.

Data exchanges between the SNAP and workstations on the network are made using the SDP protocol. This protocol is described in detail in Appendix A. To shorten software development time, a C library is included that will help with the SNAP protocol. **`roamlib`** will help in the developing the software needed to talk to the remote radios from the SNAP. Also included is a simple multi-window (one per remote) Ethernet chat program, **`roam.exe`**. This program allows the user to send data to the SNAP and to the remote. This program is based on the **`roamlib`**. In order for roam.exe to work the "sys xcast" must be 224.5.5.5, the "sdp" must be 224.1.2.3 and the source and destination port numbers must be 2411 and 2412 respectively. These are the default settings. Using the roam library requires the use of winsock.dll. This file should already be included on any Windows PC that has TCP/IP installed as a protocol.

AP Mode Commands

These commands are specific to the AP mode of operation.

Command		Description
sdp	help	Displays help screen for command
	add <sdp> <ipaddr> <dstprt> <srcprt>	Add an SDP entry
	cache <size>	Set number of cached SDP output packets
	delete <sdp>	Delete an SDP entry
	list	List SDP entries
	max <size>	Set SDP maximum packet size

help — Lists the various commands available under the sdp top level command.

add — Defines the IP address and port numbers that the SNAP will use when sending and receiving SDP messages. A maximum of 4 SDP entries may be set up. They can be either unicast or multicast addresses.

cache — Allows the number of datagrams cached by the SNAP to be modified. Cached datatgrams may be requested to be retransmitted by workstations.

delete — Removes an SDP entry.

list — List SDP entries and their associated IP addresses and port numbers.

max Sets the maximum number of bytes of data that will be included in a SDP datagram before the datagram is sent. If 20ms elapses since the last byte received, the datagram will be sent regardless of the number of bytes in the datagram.

SNAP Datagram Protocol (SDP)

The SNAP Datagram Protocol (SDP) is a UDP (datagram) protocol implemented in the SNAP to communicate remote radio data to and from workstations on the network. The use of UDP datagrams permits the SNAP to unicast, multicast, or broadcast remote radio data to multiple workstations on the network. The SDP datagrams transmitted by the SNAP are sequenced so that a receiving workstation can detect datagrams that do not get delivered. The SNAP caches *SdpCache* number of datagrams so that a receiving workstation can request a retransmit of a particular datagram. The number of cached datagrams, *SdpCache*, defaults to eight and can be configured on the SNAP.

A specific unit of information regarding the SDP or a remote radio is referred to as a "message" and is defined in detail below. Each SDP datagram consists of a header and one or more messages. The sum of the lengths of the header and all of the messages within the datagram will not exceed *SdpMax* bytes, which is a configurable parameter and defaults to 512 bytes. The SNAP builds a datagram as the messages accumulate. As the SNAP builds a datagram, if the next message to be added to the datagram will cause the datagram to exceed *SdpMax* bytes in length, the datagram currently being built is transmitted by the SNAP to all recipients. The SNAP then begins building a new datagram with the current message. If 20 milliseconds elapse after the last message is added to the datagram being built, then that datagram is transmitted by the SNAP to all recipients. If there are no messages to send for 500 milliseconds after the last datagram has been transmitted, the last datagram is retransmitted by the SNAP to all recipients. If there are still no messages to send for 1 second after this, the last datagram is once again transmitted by the SNAP to all recipients. The retransmission of the last datagram aids in the detection of datagrams that fail to be delivered.

Datagrams that are sent by workstations to the SNAP(s) have a similar format to those sent by the SNAP to the workstations. There is currently no provision for acknowledgement or request-for-retransmit of datagrams sent by workstations to the SNAP. One of the messages that a workstation may send to a SNAP in a datagram is used to request the retransmission of a datagram. If the datagram indicated by the sequence number in the request is currently cached by the SNAP, that datagram will be transmitted by the SNAP directly to the host requesting the retransmission.

SDP Header

The header for an SDP datagram is eight bytes long. The first four bytes are a magic number in network byte order which is used to identify/qualify the datagram. When transmitting a datagram, the SNAP places the value SDP_SNAP_MAGIC in the magic field of the header. When receiving a datagram, the SNAP expects the value SDP_USER_MAGIC in the magic field of the header. The next byte is the sequence number which increments for each datagram transmitted by the SNAP. The next three bytes of the header are the unique-ID of the "radio A" for the SNAP.

```
#define SDP_SNAP_MAGIC (0x736470301)   /* 'sdp0' */
#define SDP_USER_MAGIC  (0x534450301)   /* 'SDP0' */

typedef unsigned char byte;
typedef struct {
   ulong magic;
   byte seq;
   byte base_id[3];
} sdphdr_t;
```

SDP Messages

Each "message" that is contained within an SDP datagram consists of a *type* byte, a *length* byte, and some number of parameter bytes depending upon the type of the message. The values for the *type* byte are specified below. The *length* byte specifies the length of the message and includes the type and length bytes. There are seven message types defined for SDP:

TYPE	***SENT-BY***	***Function***
SDP_SM_STARTUP	SNAP	indicates SNAP startup / SDP initialization
SDP_SM_CONNECT	SNAP	Remote radio has connected
SDP_SM_INPUT	SNAP	Data from remote radio
SDP_SM_DISCONNECT	SNAP	Remote radio has disconnected
SDP_UM_STARTUP	Workstation	Indicates workstation startup SDP_UM_RESEND
	Workstation	Requests retransmission of SDP datagram
SDP_UM_OUTPUT	Workstation	Data for remote radio

SDP_SM_STARTUP

Byte	*Value*
0	Type = 's' (0x73)
1	Length = 4
2	<cache> (The number of datagrams the SNAP will cache)
3	<user-request>

When the SNAP is powered on, it will transmit an SM_STARTUP message. The value for <user-request> at this time is 0. When a workstation starts-up (or an application on the workstation which uses SDP to talk to the SNAP) it will send a UM_STARTUP message. At this time, the SNAP will transmit an SM_STARTUP message with a <user-request> value of 1 followed by an SM_CONNECT message for each remote radio currently "connected" to the SNAP. [In future releases, this will be followed by an SM_STARTUP message with a <user-request> value of 2]. This allows the workstation software to become aware of remotes that are present in the network. This message will always be the first message in an SDP datagram.

SDP_SM_CONNECT

Byte(s)	*Value*
0	Type = 'c' (0x63)
1	Length = 7
2-4	Unique-ID of remote radio
5	Receive sequence number for remote radio
6	Transmit sequence number for remote radio

The SM_CONNECT message is transmitted by the SNAP when each remote radio connects to a base radio in the SNAP. This message type is also transmitted by the SNAP for each radio currently connected to the base radio(s) in the SNAP following a UM_STARTUP message from a workstation.

SDP_SM_INPUT

Byte(s)	*Value*
0	Type = 'i' (0x69)
1	Length = 7 + <number of data bytes>
2-4	Unique-ID of remote radio
5	Sequence number for data (modulo 16)
6	Length of data to follow (perhaps redundant)
7-N	Data bytes from remote radio

The SM_INPUT message is transmitted by the SNAP to communicate remote radio data to the workstations.

SDP_SM_DISCONNECT

Byte(s)	*Value*
0	Type = 'd' (0x64)
1	Length = 5
2-4	Unique-ID of remote radio

The SM_DISCONNECT message is transmitted by the SNAP to indicate that a remote radio has disconnected from the base radio in the SNAP. Note that the remote may have already roamed to another SNAP. The workstation should only act on the SM_DISCONNECT message if it currently has the source of this message as the SNAP that owns this remote radio.

SDP_UM_STARTUP

Byte	*Value*
0	Type = 'S' (0x53)
1	Length = 2

A workstation application will transmit this message (as a unicast, broadcast, or multicast) when it initializes, prompting the SNAPs on the network to send the current state of remote radios currently connected to each SNAP (i.e. an SM_STARTUP message followed by SM_CONNECT messages). For multicasting UM_STARTUP messages, the workstation should use the multicast address as set by the "sys xcast" command (see the section above on Synchronization), as the SNAP will be receiving datagrams at this multicast address.

SDP_UM_RESEND

Byte	*Value*
0	Type = 'R' (0x52)
1	Length = 3
2	Sequence number of datagram to retransmit

A workstation will use this message to request that a SNAP retransmit an SDP datagram that the workstation may not have received. The third byte of this message indicates the sequence number of the SDP datagram that the workstation did not receive. The workstation will detect that it has not received an SDP datagram when it receives a datagram out of sequence but within the window defined by the "cache" setting of the SNAP. This message should be unicast to the particular SNAP from which the workstation has missed a datagram.

SDP_UM_OUTPUT

Byte(s)	*Value*
0	Type = 'O' (0x4F)
1	Length = 6 + <number of data bytes>
2-4	Unique-ID of remote radio
5	Number of data bytes to follow (perhaps redundant)
6-N	Data to be transmitted to remote radio

A workstation uses the UM_OUTPUT message to send data to a remote radio. The number of data bytes specified and contained in this message must not exceed the base radio's setting for the maximum transmit packet size. This message may be broadcast or multicast to multiple SNAPs as the SNAP will ignore this message if the remote radio with the Unique-ID contained in the message is not currently connected.

TROUBLESHOOTING

Connect LED is not on.

Check the power LED on the SNAP. Check the Ethernet cable, making sure that it is fully connected. Check

Cannot telnet to SNAP.

Check the power LED on the SNAP. Check the Ethernet cable, making sure that it is fully connected. Make sure the SNAP has a unique IP number on the network and one that is valid for the network, i.e. that can be seen through switches, hubs and routers.

Cannot communicate with a remote radio.

Check the list of registered remotes on the SNAP to make sure the remote is registered using the remote list command. If the remote is not registered, check that the remote is not is sleep mode. Verify that the remote is in range of the SNAP.

Technical Support

Technical Support is available from Cirronet from 8:30am to 5:30pm Eastern Time, Monday through Friday. Contact Technical Support at (678) 684-2000 or by email at tech_sup@digital-wireless.com.

QUICK REFERENCE

SNAP System Commands

`echo`		Toggles user screen echo mode
`help`		Displays command help screen
`reset`		Resets the SNAP to activate new parameters
`save`		Stores current configuration in non-volatile memory
sys	help	
	`mode [AP|PPP]`	Sets SNAP operating mode
	`outmax <1-208>`	Sets maximum transmit packet length
	`xcast <b/mcastaddr>`	Sets SNAP multicast address
`version`		Displays SNAP firmware version number

Ethernet Commands

`arp`	`-a`	Displays arp table
	`-d <ipaddr>`	Deletes arp entry
	`-s <ipaddr> <eaddr>`	Adds arp entry
`dns`		Displays current DNS server IP address
	`<ipaddr> <netmask>`	Sets DNS server IP address
`ip`	`<ipaddr> <netmask>`	Sets SNAP IP address and optional netmask
`password`		Sets password for telnet sessions
`ping`	`<ipaddr>`	Pings TCP/IP hosts
`route`	`help`	
	`add <ipaddr|default> <gwaddr> <netmask>`	Adds IP address and netmask to route table
	`del <ipaddr>`	Deletes IP address from route table
	`list`	Lists route table IP addresses
`socks`		Diplays network socket information

SNAP Radio Commands

`hop`	`help`	
	`length <hoplen>`	Informs SNAP of radio hop dwell time
	`sequence <75|25>`	Informs SNAP of number of frequencies
`remote`	`help`	
	`list`	Displays remotes currently registered
	`send <hnd> <data>`	Sends data to the specified remote
`sync`	`help`	
	`disable`	Turns sync off (default)
	`ether`	Sets sync mode to use Ethernet packets
	`master`	Sets SNAP as sync master
	`override`	Toggles master backup override
	`settings`	Displays sync settings
	`slave`	Sets SNAP as sync slave
	`wire`	Sets sync mode to use RS-485 wire ports

Radio Commands

`radio a help`	
`banner`	Displays power on banner for radio in SNAP
`defaults`	Resets radio to factory shipped values
`maxremotes [0..15]`	Sets maximum number of remotes SNAP allows
`network [0..63]`	Sets the network number for the SNAP
`param <rcmd> [arg0,arg1…]`	Sets other radio parameters
`roam <0|1|2>`	Set roam mode in the SNAP
`show`	Displays modified radio parameters

TCP Commands

`tcp help`	
`control <1-65536>`	Sets control port for server mode
`remote help`	
`add <remote-id> <ipaddr>`	Add remote with static IP assignment
`delete <remote-id>`	Remove a static IP assignment
`list`	Displays remotes with static IP assignment
`server help`	
`add <ipaddr> <port>`	Add a server IP address
`delete <ipaddr>`	Delete a server IP address
`id [enable|disable]`	Enable/disable remote connect message
`ipbase <ipaddr>`	Set beginning IP address for dynamic IP assignment
`ipcount <1-62>`	Set number of remotes that can connect to server simultaneously
`ipport <1-65536>`	Set port number to use when identifying remotes with IP addresses
`list`	List servers entered
`status`	Display status of servers and remotes

PPP Mode Commands

`ppp help`	
`acct method [local|radius]`	Sets accounting method to be used
`auth chap`	Enables CHAP protocol when RADIUS selected
`method [local|radius]`	Sets authentication method to be used
`settings`	Displays authentication settings
`upap`	Enables UPAP protocol when RADIUS selected
`base <ipaddr>`	Sets base IP address for remotes
`count <1-62>`	Set to max number of remotes pararmeter of radio
`ip <usr> <ipaddr>`	Sets static IP address for specified user
`radius help`	
`add [auth|acct] <ipaddr> [port]`	Adds IP address of Radius server
`delete [auth|acct] <ipaddr>`	Deletes IP address of Radius server
`retries <value>`	Sets the RADIUS number of retries
`port [auth|acct] <ipaddr> <pnumber>`	Sets the port number for a Radius server
`secret [auth|acct] <ipaddr> <secret>`	Sets the secret for a Radius server
`settings`	Displays Radius server settings
`timeout <value>`	Sets RADIUS timeout in tenths of a second
`status`	Displays status of registered users
`timeout`	Sets idle time timer in tenths of a second
`user help`	
`add <usr>`	Adds a PPP username
`delete <usr>`	Deletes a PPP username
`disable <usr>`	Disables a PPP username
`enable <usr>`	Enables a PPP username
`list <usr>`	Lists current PPP users
`password <usr> <pwd>`	Sets PPP user password

AP Mode Commands

`sdp help`	
`add <sdp> <ipaddr> <dstprt> <srcprt>`	Adds an SDP entry
`cache <size>`	Sets the number of cached SDP output packets
`delete <sdp>`	Deletes an SDP entry
`list`	Lists SDP entries
`max <size>`	Sets SDP maximum packet size

WIT2410 Command Summary

Serial Commands		
`sd[?|00..ff]`	Set Data Rate Divisor	
`sp[?|00..14]`	Set Protocol Mode	
Network Commands		
`wb[?|0|1]`	Set Transceiver Mode	
`wd[?|1..3f]`	Set Default Handle	
`wn[?|00..3f]`	Set Hopping Pattern	
`wg[?|0|1|2]`	Enable Global Network Modes	
`wp[?|0|1]`	Set Transmit Power	
`wr?`	Read Receive Signal Strength	(remote only)
`dx[?|0..ff]`	Set Range Optimization	(remote only)
Protocol Commands		
`pe[?|0..4]`	Set Alternative Frequency Band	
`ph[?|00..fe]`	Set Hop Duration	(base only)
`pl?`	Get Maximum Data Length	
`pn[?|01..3e]`	Set Maximum Number of Remotes	(base only)
`pk[?|00..d4]`	Set Minimum Data Length	
`pr[?|00..ff]`	Set Packet Attempts Limit	
`pt[?|00..ff]`	Set Data Transmit Delay	(remote only)
`pv[?|0|1]`	Set Slot Assignment Mode	(base only)
`pw[?|00..34]`	Set Base Slot Size	(base only)
`px[?|0|1]`	Set ARQ Mode	
Status Commands		
`zb[?|0|1]`	Banner Display Disable	
`zc[?|0..2]`	Set Escape Sequence Mode	
`zh?`	Read Factory Serial Number High Byte	
`zm?`	Read Factory Serial Number Middle Byte	
`zl?`	Read Factory Serial Number Low Byte	
`zp[?|0..4]`	Set Duty Cycle	(base only)
`zq[?|0|1]`	Enable Low Power Acquisition	(remote only)
`z>`	Exit Modem Control Mode	
Memory Commands		
`m0`	Recall Factory Defaults	
`m<`	Recall Memory	
`m>`	Store Memory	
`m!`	Display non-default settings	

APPENDIX A.

inf file listing for PPP mode.

```
AddReg=All, Common, DWC00Reg, 115200, EXTERNAL

[All]
HKR,,FriendlyDriver,,Unimodem.vxd
HKR,,DevLoader,,*VCOMM
HKR,,PortSubClass,1,02
HKR,,ConfigDialog,,modemui.dll
HKR,,EnumPropPages,,"modemui.dll,EnumPropPages"

[EXTERNAL]
HKR,, DeviceType, 1, 01

[Common]
HKR, Answer, 1,,""
HKR, Hangup, 1,, "Bye"
HKR, Hangup, 2,, "NoResponse"
HKR, Settings, DialSuffix,, ""

; DCB's - dwords and words are byte reversed
;                                                                    ByteSize (Number of bits/byte, 4-8)
;                                                                  Parity (0-4=None,Odd,Even,Mark,Space)
;                                                                     StopBits (0,1,2 = 1, 1.5, 2)
;            |DCBLength   |BaudRate    |Bit Mask    |Rsvd  |XonLim|XofLim|   |   |   Xon|Xof|Err|Eof|Evt
[115200]
HKR,, DCB, 1, 1C,00,00,00, 00,c2,01,00, 15,20,00,00, 00,00, 0a,00, 0a,00, 08, 00, 00, 11, 13, 00, 00, 00

[DWC00Reg] ; Null-Modem
HKR, Init, 1,, "<cr><cr>"
HKR, Init, 2,, "NoResponse"
HKR, Settings, Prefix,,""
HKR, Settings, DialPrefix,, "HELLO<cr>"
HKR, Settings, Terminator,, "<cr>"
HKR, Monitor, 1,, "None"
HKR, Answer, 1,, "HELLO"
HKR, Answer, 2,, "NoResponse"
; Properties - dwords and words are byte reversed
;                   |Dial Options             |InactivityTimeout        |Speaker Mode             |Max DTE Rate
;                                 |CallSetupFailTimeout     |Speaker Volume           |Modem Options            |Max DCE Rate
HKR,, Properties, 1, 00,00,00,00, 00,00,00,00, 00,00,00,00, 00,00,00,00, 00,00,00,00, 30,00,00,00, 00,c2,01,00, 00,c2,01,00
HKR, Responses, "<h00>", 1, 02, 00, 00, 00, 00, 00, 00,00,00,00 ; Accept any recvd data as CONNECTED.
```

```
; 23 May 98 added
HKR, Responses, "<hff>", 1, 02, 00, 00, 00, 00, 00, 00,00,00,00 ; Accept any recvd data as CONNECTED.
HKR, Responses, "<cr>", 1, 02, 00, 00, 00, 00, 00, 00,00,00,00 ; Accept any recvd data as CONNECTED.
HKR, Responses, "<lf>", 1, 02, 00, 00, 00, 00, 00, 00,00,00,00 ; Accept any recvd data as CONNECTED.
HKR, Responses, "<cr><lf>", 1, 02, 00, 00, 00, 00, 00, 00,00,00,00 ; Accept any recvd data as CONNECTED.
; end of 23 May 98 addition


[Strings]
DWC = "Cirronet Incorporated"
Man = "Cirronet Incorporated"
```

SPECIFICATIONS

Radio Specifications

Data Throughput	230.4Kbps
Total over-the-air bandwidth	460.8Kbps
Enclosure	Aluminum
Dimensions	201 x 144 x 53 mm 7.9” x 5.7” x 2.1”
Network Interface	10BaseT
SNAP Network Topologies	Point-to-Point or Multipoint
Repeater	Use Cirronet HN-2010
RF Output Power	100mW with included whip antenna, 400W EIRP with gain antenna
RF Modulation	Frequency hopping, up to 64 user selectable hopping patterns
Frequency Range	2400MHz to 2483.5MHz
Operating Voltage Range	7VDC to 26VDC
Operating Temperature	0°C to +70°C 0 to 95% humidity, non-condensing
Licensing	Type certified for Worldwide License-free operation under FCC Part 15.247 and CE marked

Connectors

Power	2-Pin DIN
Ethernet	RJ-45
Configuration Port	DB-9
Antenna	TNC Male
Sync (2)	RJ-45

Indicators

Power
Ethernet Transmit Data
Ethernet Receive Data
Ethernet Link Status
Ethernet Collision

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