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Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

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Contact us

HN-210/210X

Outdoor Base Remote

User Guide

Revision History

Revision	Date	Author	Change Description
1	2004	F. Perkins	Initial issue
2	01/13/2017	R. Willett	Updated Copyright and format for new Murata V.I.

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 <u>intentional radiators transmitting the same information</u>. 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 0560 ①

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.

0560 is the identification number of TELEFICATION B.V., Utrechtseweg 310, NL-6800 JA ARNHEM - Netherlands – 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.

Table of Contents

Introduction

The HopNet 10 Series family of products provides reliable wireless connectivity for either point-to-point or point-to-multipoint applications. HopNet products are built around the WIT2410 radio transceiver, which employs frequency hopping spread spectrum technology. This technology ensures:

- Maximum resistance to noise
- Maximum resistance to multipath fading
- Robustness in the presence of interfering signals

The HN-210 and HN-210X are NEMA 4X weatherproof versions of the HopNet product line. The HN-214, which is an HN-210 with a 4 ft. cable, is also available. The interface to the 210 and 210X allows the Host to communicate with the Remote unit through an integrated 50 ft (15 meter) cable. The HN-210 and 210X can act as either bases or remotes.

The HN-210 Remote has an internally mounted 6 dBi patch antenna. The built-in antenna of the HN-210 case greatly eases outdoor installation since no antenna feedline cable or adapters are needed. The 6 dBi antenna gain increases the radiated EIRP to +24 dBm and the effective receiver sensitivity to –99 dBm. The HN-210X has a TNC connector for attaching an external antenna and a mounting kit (part no.: HN210X-MKIT) that accommodates both the HN-210X and any of the following external antennas:

CORNER249

CORNER2414

OMNI249

OMNI2412

HopNet Benefits

The HopNet family of products is built with rugged enclosures compliant with IP 66 and NEMA 4X standards for outdoor and harsh industrial environments. All Hopnet products work with each other and can be mixed and matched in a single network. All HopNet Products are WIT2410 compatible and can be used with WIT2410 OEM based products as well as with the SNAP2410 10Base T access point.

Operating Frequency

The HopNet family operates in the 2.4 GHz ISM band that allows for license-free use and worldwide compliance.

HopNet Frequency Hopping Spread Spectrum Advantages

In the frequency domain, a multipath fade can be described as a frequency selective notch that shifts in location and depth over time. Multipath fades typically occupy five percent of the band. A conventional radio system typically has a five percent chance of signal impairment at any given time due to multipath fading.

Frequency Hopping Spread Spectrum reduces the vulnerability of a radio system to interference from jammers and multipath fading by distributing or spreading the signal over a larger region of the frequency band.

The fade resistant, HopNet frequency-hopping technology employs up to 75 channels and switches channels over 100 times a second to achieve high reliability throughput.

HopNet Data Integrity

An on-board 3 KB buffer and error correcting over-the-air protocol ensure data integrity even in the presence of weak signals or jammers. The serial interface handles both data and control of asynchronous data rates of up to 230 Kbps.

Flexible Power Management

The power can be set at 10 milliwatts or 100 milliwatts using the included software. Reduced power can reduce the size of the coverage zone, which may be desirable for multiple network indoor applications. You can also place the transceiver module in a power-save mode, which enables smart power management. Smart power management allows a remote unit to drop into a lower current standby mode during transmission or receiving gaps.

This feature also allows Hopnet products to be used in various countries where the output power requirements may vary due to regulation.

Advanced Features

HopNet modems have many advanced features:

- Employ frequency hopping technology with up to 75 channels in the 2401 to 2475 MHz frequency range
- Support digital addressing for up to 64 networks, with 62 remotes per network.
- Use transparent ARQ protocol
- Use same hardware for all supported data rates
- Supports up to 115 Kbps asynchronous data rates
- Full Duplex operation
- Store setup configuration in nonvolatile memory (FLASH)
- Fast acquisition – less than 2 seconds is the typical time to acquire hopping pattern
- Smart power management features

The HopNet Family of Products

The HopNet family consists of the following products:

HN-210

HN-210X

HN-210D

HN-214

HN-214X

HN-210DX

HN-214D

HN-214DX

HN-510

SNAP2410

SNAP2410X

SNAP2410D

SNAP2410DX

External Antenna

HN-210X Base/Remote Unit

Built-In Antenna

HN-210 Base/Remote Unit

Accessories

Antennas

Adapter

Power Supplies

Getting Started

A pair of HN-210s is set up by performing the following steps:

- Install the HopNet Wizard configuration program on a PC

- Connect the HN-210 to the PC

- Set one HN-210 as a base radio

- Run a communications test

These steps are described in detail below. Other steps you may want to perform include:

- Change the baud rate

- Change the radio network number

- Change how fast the radios change frequencies

Refer to the *Configuring the Network* section of this manual for details on these steps.

## Install the HopNet Configuration Wizard on a PC.

The HopNet Configuration Wizard is located on the software and documentation CD included in the HN-210 package. Install the program by inserting the CD in the PC and following the installation wizard. If Autorun has been turned off, double-click on setup.exe on the CD to start the wizard.

Connect the HN-210 to the PC.

Connect the serial adapter box to a serial port on the PC using the serial cable provided.
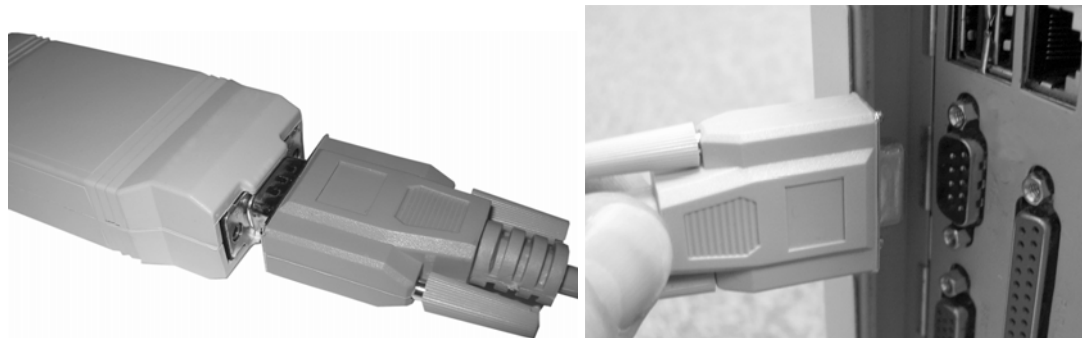
Connect the end of the cable from the HN-210 (RJ45 connector) to the small serial adapter box.
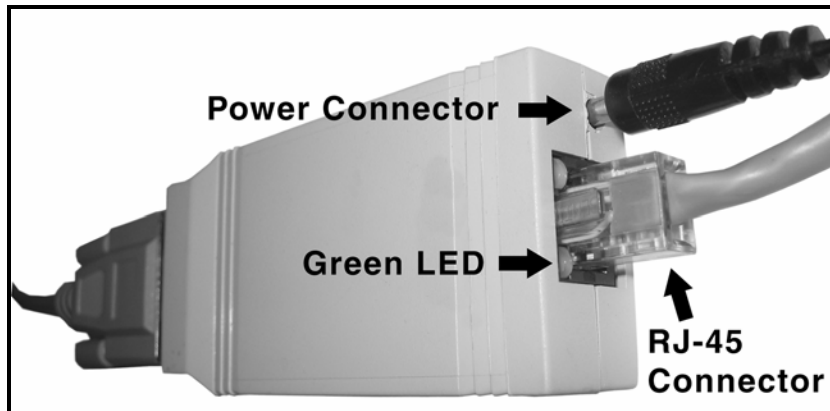

Connect power to the HN-210 by plugging one end of the wall-mount power supply into the serial adapter box and the other end into a wall outlet. A green LED on the serial adapter box will turn on indicating power is present.

Set one HN-210 to act as the base.

When using HN-210s, one unit, and only one, must be set as the base. All other HN-210s must be set as remotes. With an HN-210 connected to the PC, start the HopNet Configuration Wizard program by double-clicking on the icon on the desktop. The HopNet Configuration Wizard will automatically detect which serial port the HN-210 is connected to and the baud rate of the HN-210. When the radio has been detected, the Continue button will appear.


Click on the Continue button to bring up the next screen.
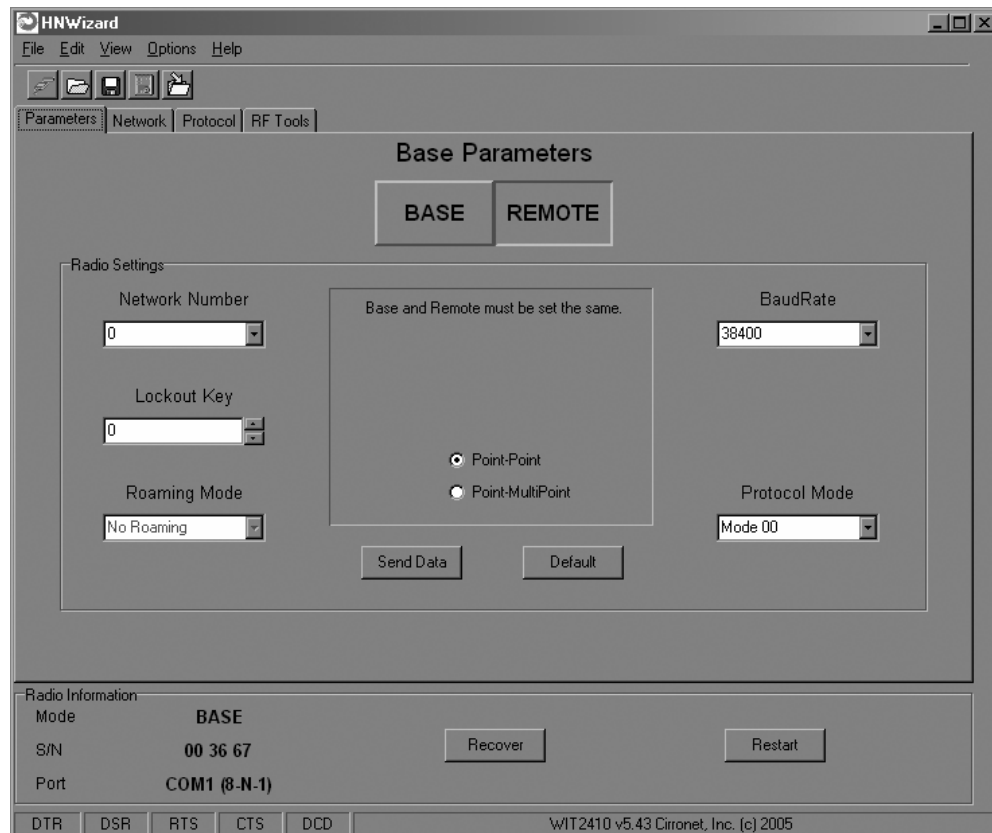
The program will read and display the current settings of the HN-210. The HN-210 is shipped from the factory as a remote. The Remote button on the Wizard screen will appear depressed indicating the HN-210 is a remote.

NOTE: The S/N displayed in the bottom left corner is the serial number of the radio inside the unit and is different from the serial number of the HopNet unit. Both the HopNet unit serial number and the radio serial number are on the radio unit of the HopNet product.

To set the HopNet radio as a base, click on the Base button. The Base button will depress and the Remote button will pop up. The screen heading will change from "Remote Parameters" to "Base Parameters."
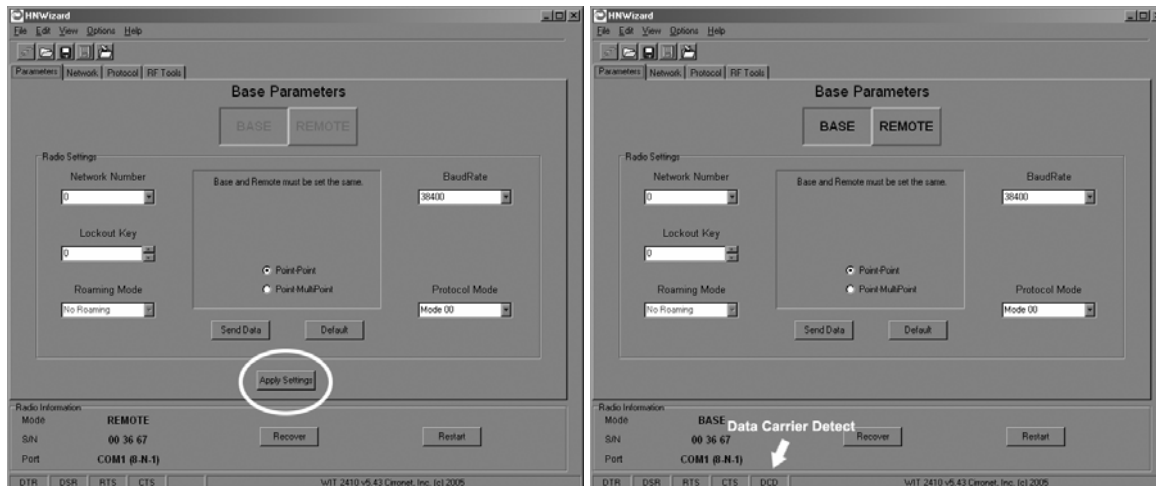
The Apply Settings button will appear at the bottom of the HopNet Configuration Wizard screen. Click on the Apply Settings button to set the HopNet radio as the base.

Run a communications test.

To run a communications test, connect one HopNet radio set as a base to one PC running the Wizard and another HopNet radio set as a remote to another PC running the Wizard. Verify that the Carrier Detect LED (CD) on the radio is on (red), the fifth parameter box on the lower left of the window will have DCD (as shown above right). Click on the Send Data button on the HopNet Configuration Wizard screen on both PCs. The HopNet radio set up as the base will send the message "This is a test message from the Base radio." to the remote HopNet radio. This message will be displayed in the message window of the Wizard running on the remote PC. The remote HopNet radio will send the message "This is a test message from the Remote radio." to the base HopNet radio. This message will be displayed in the message window of the Wizard running on the base PC. The test will run continuously until the Stop button is clicked.
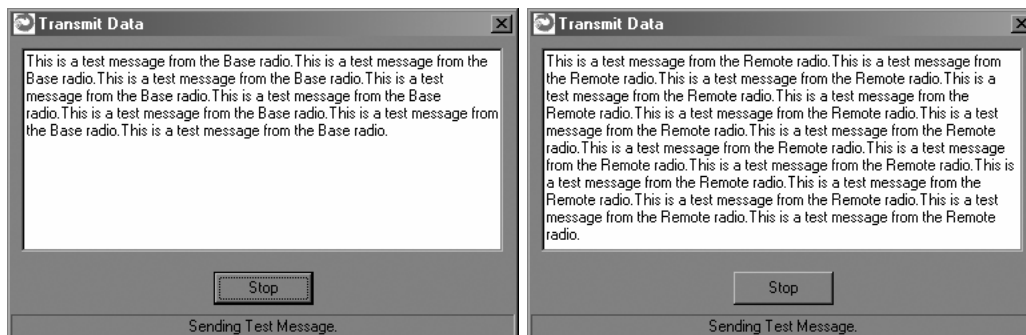

NOTE: If your computer has two serial ports, both the base and the remote HopNet radios can be connected to the same PC and the communications test run by opening a second window running the Wizard. Open the second window by simply double-clicking on the Wizard icon on your desktop.

The Serial Adapter Box

The HN-210 and HN-210X remotes interface with the user's hardware through a serial adapter box. The interface adapter supplies power and signal to the remote unit. The interface to the remote unit is a standard RS-232 DB-9 serial interface. To have all functions of the HN-210 available, including configuration and hardware flow control, the eight signal lines must be connected. The HN-210 serial connector is set up as a DCE device. This allows communication with a PC using the straight through serial cable provided with the HN-210. To connect the HN-210 to another DCE device, a cross-over cable must be used. The connector pin-out is detailed in the figure and table below.

3 Wire Operation

If configuration and hardware flow control is not necessary, the HN-210 can be used in 3-wire mode. In this mode, only Ground, Receive Data and Transmit data are connected

RS-232 Interface
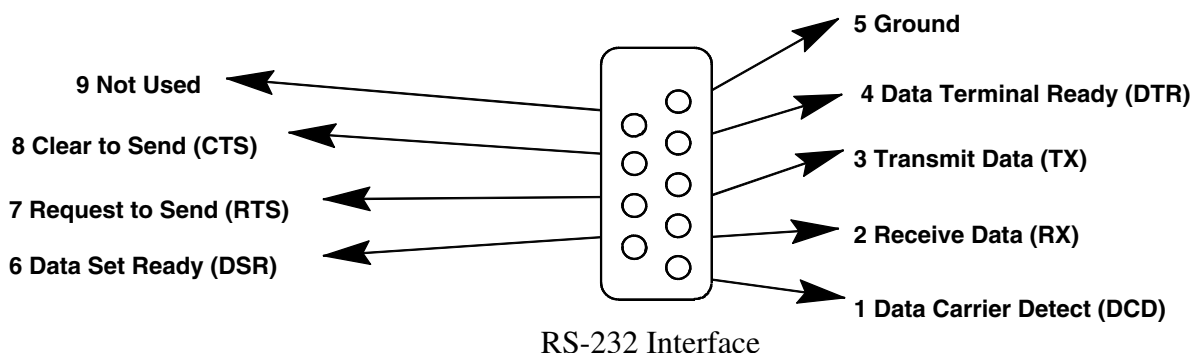
Remote Pin-Out, RS-232

Pin Number	Signal	Type	Description
1	DCD	Output	Data Carrier Detect. For remotes, DCD indicates that the remote has successfully acquired the hopping pattern.
2	RXD	Output	Output for received serial data.
3	TXD	Input	Input Serial Data to be transmitted
4	DTR	Input	Data Terminal Ready. Sleep/ wakes radio transceiver.
5	GND	-	Signal and Chassis Ground
6	DSR	Output	Data Set Ready. Response to DTR.
7	RTS	Input	Request to Send. Gates the flow of receive data from the radio to the user on or off. In normal operation signal should be asserted.
8	CTS	Output	Clear to Send. Used to control transmit flow from the user to the user to the radio. The WIT 2410 radio module supports hardware flow control only and does not support software flow control (e.g. Xon-Xoff).
9	Not Used	-	Not Used

Note: When the HN-210 and HN-210X are used as three wire serial devices, DTR and RTS do not have to be used.

Guidelines for Installation

When installing your system, always consider the following points:

Directional antennas are best for remote unit sites. They may increase the cost, but they confine the transmission path to a narrow lobe and minimize the interference from nearby stations.

For systems with constant interference present, you may need to change the polarity of the antenna system and reduce data streams. Groups of short data streams are more reliable and have a better chance of success in the presence of interference than do long data streams.

Systems installed in rural areas are least likely to encounter urban interference.

Multiple HopNet systems can operate in close proximity to each other but require a unique network address.

Poor quality coaxial cables will seriously degrade system performance. Use low- loss cable that is suitable for 2.4 GHz operation.

Short cable runs minimize signal loss.

Aiming the Antenna and Placing the Remote

Use the following guidelines for aiming the antenna and placing the Remote.

Do not place anything immediately in front of the antenna that could obstruct its radiation pattern. Because the antenna in the HopNet Remote is inside the unit, the antenna must have a clear line of sight.

Use the sticker on the HN-210 Remote unit to help you locate and aim the antenna. The sticker indicates which direction the antenna is pointing.

Be sure the antenna end of the HN-210 Remote faces the Base or Repeater that it is communicating with. Our tests have found that antenna placement is not critical as long as the patch antenna is facing in the general direction of the other end of the link.

If possible, place the Remote unit at a higher elevation than the structures surrounding it to increase range and link reliability. Since the Remote will operate with up to 100 feet of interconnect cable between it and the Host, you can mount the unit on top of a building or other structure that will provide higher elevation.

Interconnect Cable

The HN-210 and HN-210X come with 50' (15 meters) of high quality interconnect cable. The cable may be lengthened by adding an additional 50' cable (part no.: CBLEXT50). The maximum cable length that the HN-210 and HN-210x will support is 100' (30 meters).

Configuring the Network

You can configure the HopNet network using a PC and the HopNet Configuration Wizard software provided by Cirronet, Inc. The Wizard runs under Windows 95/98/NT/2000/XP. This chapter provides the information you need to configure your network.

HopNet Configuration Wizard (5.0 or later)

If you haven't already installed the Wizard program, refer to the *Getting Started* section of this manual for instructions. Open the Wizard by double-clicking on the icon on the desktop. When the Wizard boots up, it will automatically detect the serial port to which the HopNet radio is connected and its baud rate. This process takes a few seconds to complete. During this process, the "Please wait" screen is displayed. Once the radio has been found and the Baudrate determined, the "Finished" screen is displayed. Click on the Continue button to enter the Wizard.
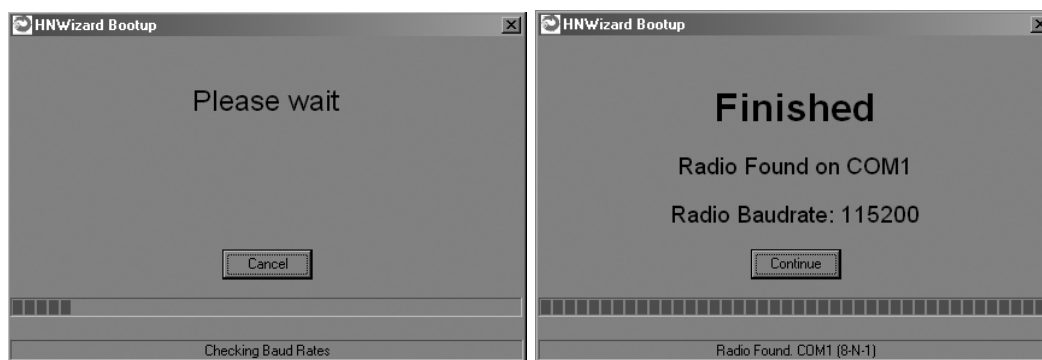
NOTE: The HopNet configuration Wizard is used with a variety of Cirronet radios. Not all radios support all the functions and features of every Cirronet radio. Thus, some selections in the Wizard will be grayed out if they are not applicable to the radio in use.

After detecting the serial port and baud rate of the HopNet radio, the Wizard reads the settings of the HopNet radio that is connected to the PC and will display them in the various parameter windows. In the bottom left corner of the Wizard window, the Base/Remote status, the serial number and the communication port are always displayed.
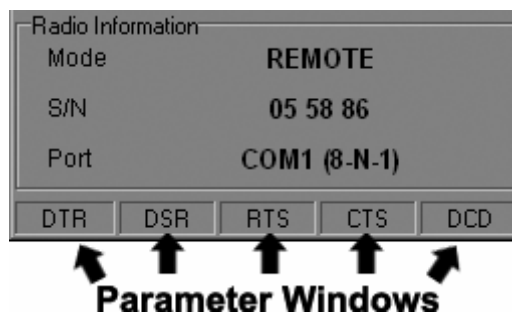
Parameter Windows

NOTE: The S/N displayed in the bottom left corner is the serial number of the radio inside the unit and is different from the serial number of the HopNet unit. Both the HopNet unit serial number and the radio serial number are on the radio unit of the HopNet product. The Wizard will also prompt to save the configuration settings to a file.

When a parameter value is changed from the value currently in the HopNet radio, the parameter label and value will turn red and the Apply Settings button will appear. When the value is changed back to the value that is currently in the attached HopNet radio, the label and parameter value will return back to black. When new values are applied to the HopNet radio, the red values will turn black indicating the updated values in the radio.

NOTE:The changes are not sent to the HopNet radio until the Apply Settings button is clicked.

Context sensitive help is available through the F1 key or Help menu.

About the INIT.INI File

One of the files unpacked with the program is the INIT.INI file. It contains the entries below and an explanation has been included on how each parameter may be used.

ErrorLevel=0

Leave this value as is. Only change it at the request of Cirronet Tech Support.

BiDirectionalHigh=55
BiDirectionalMedium=40
ReceiveHigh=55
ReceiveMedium=40

These parameters change the color levels (in percent) on the RF Tools bar graphs/pie charts.

RFToolsInterval=1000

This parameter sets the how often bar graphs / pie charts will update (in msec)

RSSIMarginal=-60
RSSIPoor=-80

These parameters set the levels (in dBm) of color the bars on the RSSI bar chart will display. Above the level set by **RSSIMarginal**, the bars will be green in color. Between the levels set by **RSSIMarginal** and **RSSIPoor**, the bars will be yellow in color and below the level set by **RSSIPoor,** the bars will be red in color.

FullShow=0, 1, 2

This changes the number of options that are viewable

0 (default) = Shows minimum amount of options.

1 = Adds all other options.

2 = Adds WinCom.

AutoDetect=1

1 = Auto-detects radio,

0 = User-defined inputs

The parameters below should not be changed as they are specific to different radios. These parameters will come from the factory set for your radio.

-40dBm=125
-95dBm=55

When the Wizard program is opened, it reads the parameters of the HopNet radio connected to the PC. These initial parameters are stored by the Wizard until the program is closed. This function allows the initial parameters to be loaded into any HopNet radio that is connected to the PC. Clicking on the Recover button displays the settings stored when the Wizard was first opened but will not load them in the radio until the Apply Settings is clicked. When the Apply Settings button is clicked, all the changed values will be loaded into the radio, even if the changed values are not on the tab currently displayed.
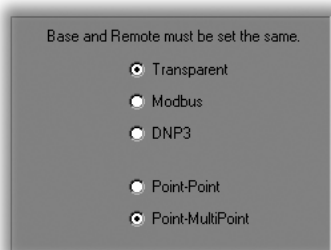
Parameters Tab

The Wizard program opens the main screen with the Parameters Tab displayed. The parameters screen of the Wizard allows the following variables to be set;

1. Base or Remote
2. Point-to-Point or Multipoint
3. Baud rate
4. Network number
5. Lockout Key
6. Roaming Mode
7. Protocol Mode
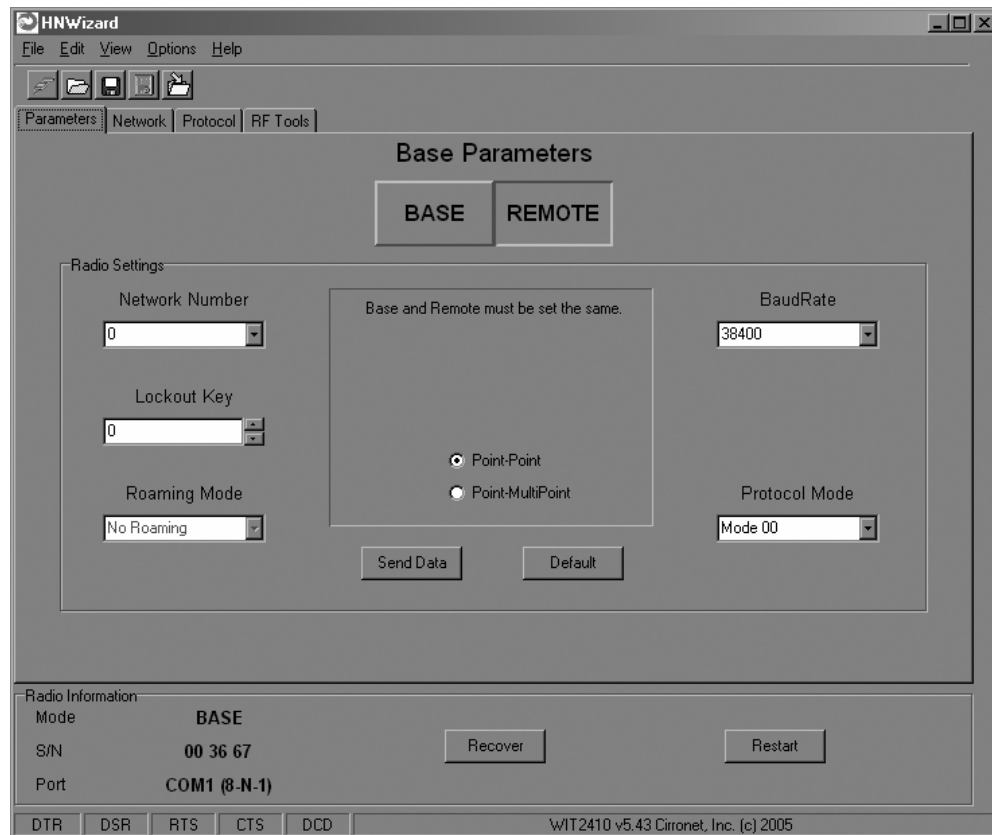
Depending on whether HopNet radio is configured as a Remote or Base when first connected, the heading on the Parameters page will display either "Remote Parameters" or "Base Parameters." If the radio has a Modbus adapter, Transparent, Modbus and DNP3 selections will appear above the Point-Point-Multipoint selection as shown below.

Modbus mode is selected to prevent Modbus errors from occurring due to inter-character gaps that are too long. Refer to the section, Modbus Operation for details on this mode.
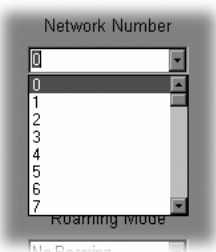
Network Number

This parameter is also known as Set Hopping and is the same command as **wn**.(Refer to "Configuration Commands" section for additional information on commands.) By using different network numbers or "hopping patterns", nearby or co-located networks can avoid interfering with each other's transmissions.
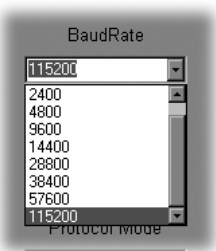

BaudRate

Also known as Set Data Rate Divisor (command **sd**) this parameter sets the serial bit rate between the modem and the host.

Lockout Key

This parameter is the same as **wl** and allows further network segregation beyond the network number. This feature allows multiple co-located networks in which global roaming is enabled. By using different lockout keys, the bases to which remotes link can be limited or segregated.
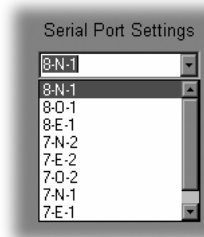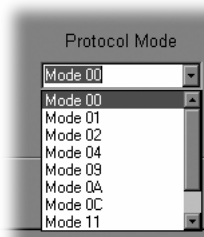
Serial Port Settings

This parameter is the same as **qs** and is only available on radios with Modbus adapters. It allows the setting of even, odd or no parity, 7 or 8 data bits and 1 or 2 stop bits.
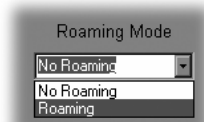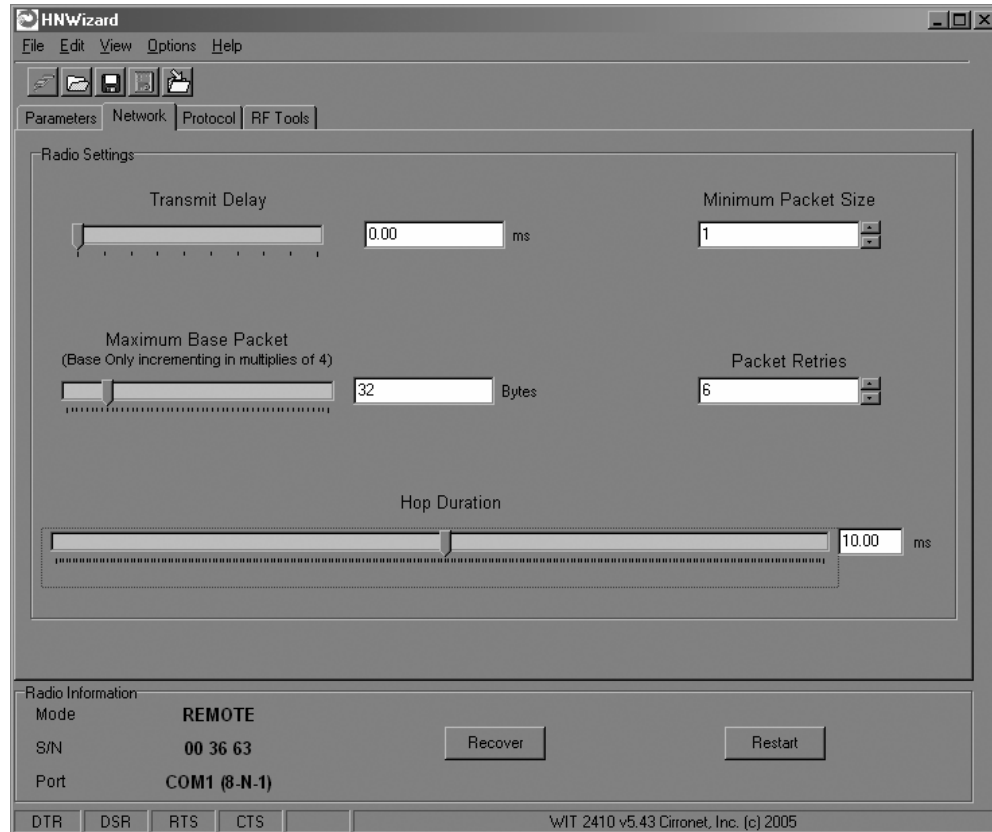
Roaming Mode

This parameter is the same as **wg** and allows remote radios to Roam or only link to specific base stations.

Protocol Mode

This parameter is the same as **sp** and enables the base station to operate in a multipoint network. Depending on the user application, more or less acknowledgment may be desired by the application. Remotes can operate in transparent mode even though the base station is operating in one of the nontransparent modes. When using a protocol mode, make sure to count in packet overhead when calculating network performance. Refer to the section on Protocol Modes for details on each format.

When the radio is linked to another radio, a communications test can be run by clicking on the Send Data button (shown below) on both radios. The remote radio's Transmit Data window (above left) will display the message, "This is a test message from the Base radio", which will repeat until the Stop button is pressed (on the base radio's HN Wizard main screen). The base radio's Transmit Data window (above right) will display the message, "This is a test message from the Remote radio" which will repeat until the Stop button is pressed (on the remote radio's HN Wizard main screen).

Send Data

The Send Data button (shown below) initiates the transmission of data.

Default

The Default button (shown above) returns all parameters to Factory settings.

Network Tab Clicking on the Network tab will bring up a second configuration screen. From this screen it is possible to change the dwell time at which the HopNet radio hops, set a minimum number of bytes of data the radio must receive before it will transmit, set a maximum amount of time the radio will wait to receive the minimum number of bytes before transmitting what is in the radio's buffer and set the number of times the radio will repeat a transmission that is not acknowledged before discarding the data.
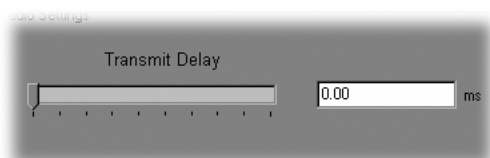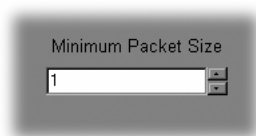
Set Data Transmit Delay

Essentially this is the `pt` command and when used in conjunction with the *minimum data length* parameter, sets the amount of time from the receipt of a first byte of data from the host until the radio will transmit in transparent mode. Default is `00H` which causes transmission to occur without any delay. When a host is sending a group of data that needs to be sent together, setting this parameter will provide time for the group of data to be sent by the host before the radio transmits. If the length of data to be sent together is longer than the time slot can send, the data will not be sent together but will be broken up over multiple hops. The length of time the radio will wait is equal to the specified value times the hop duration.

NOTE: The Transmit Delay is specified as a number of hop durations and thus will be an integer multiple of the Hop Duration. The Maximum Base Packet can only be set in radios set as a base. If the radio is a remote, this value cannot be changed.
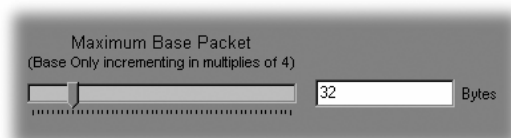
Maximum Base Packet (base station only)

This is the `pw` command and sets the amount of time allocated for transmission on each hop for the base station time slot in 4-byte increments. If using a protocol mode, attempting to send a packet with a length longer than this setting will cause the packet to be discarded.


Set Minimum Data Length

This is the `pk` command and sets the minimum threshold number of bytes required to form a packet in transparent mode. The radio will wait until the data transmit delay elapses before sending a data packet with less than this number of bytes. This parameter can be used to keep short, intermittent transmissions contiguous. In packet modes, the length parameter in the data packet will override this value. This value is subject to the maximum data length even in packet mode.

Set Packet Retries

This is the `pr` command and if *ARQ Mode* is set to 0, it sets the number of times the radio will attempt to send an unsuccessful transmission before discarding it. If *ARQ Mode* is set to 1, it is the number of times every transmission will be sent, regardless of success or failure of a given attempt. When this parameter is set to 255, RF flow control mode is entered for transmissions from the radio. This mode can be entered for one or both radios in a point-to-point system. Using this mode in a point-to-multipoint system will stop transmissions to all radios when any one radio has a full buffer.
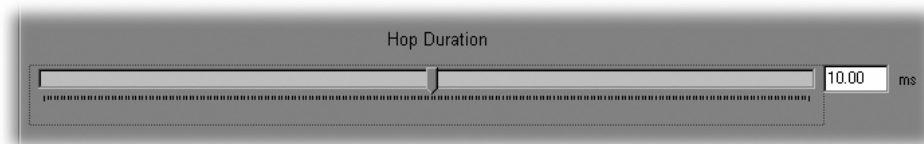
Set Hop Duration

This is the `ph` command and it sets the length of time the transceiver spends on each frequency channel. A smaller value will allow the remote to lock on to the base signal faster at system startup, and will generally decrease packet latency. A larger value increases network capacity, due to decreased overhead in channel switching. This Set Hop Duration value only needs to be set in the base which broadcasts the parameter to all remotes. However, link time can be reduced if this value is also programmed into the remotes, which use it as a starting value when scanning for the base.

The speed at which the radio hops affects both latency and throughput. The faster the radio hops, the shorter the latency but the lower the throughput. The minimum packet length and packet timeout allow fixed-length packets of data to be transmitted on a single hop without leaving data stuck in the radio's transmit buffer.

NOTE: If the hop speed is too fast, there may not be time to send a long packet on a single hop.

Refer to the *Protocol Commands* section of this manual for details on these commands.