



Wireless Modems

ESTeem MODEL 210 SERIES USER'S MANUAL

Models 210C – 210M

*Manual Revision 1.0
November 2012*



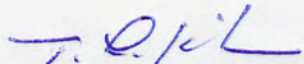
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In the event that a unit or part requires replacement or factory servicing, the following conditions apply:

- a) Customer must obtain from EST an authorized RMA (Return Materials Authorization) Number before shipment of product or parts to EST for any reason;
- b) If the whole unit is shipped, it must be in its original carton and shipping components, or a carton and shipping components supplied by EST, or if parts only are shipped, they must be packaged and cushioned so as to prevent damage in transit and shipped freight prepaid;

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- b) If the product is defective as a result of sand, dirt, or water damage;
- c) If any factory-sealed enclosure has been opened or shows evidence of an attempt to be opened;
- d) If defects or damage are caused by the use of unauthorized parts or unauthorized service;
- e) If the product has had its serial numbers altered or removed.

Warranty repair form must be accompanied by proof of user's purchase of unit. Product must be shipped to the manufacturer at the following address:

Electronic Systems Technology
415 North Quay Street
Kennewick, Washington USA 99336

ADDITIONAL SERVICE:

If EST releases an improvement update to firmware internal to the ESTeem unit during the 90 day period after the unit was purchased by the first user/customer, EST will update the applicable unit with the revised version at no charge other than for UPS handling and shipping to and from your location to the EST factory. Return of any such item must be accompanied with proof of purchase.



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BEFORE YOU BEGIN

Thank you and congratulations on your purchase of the ESTeem Model 210 Wireless Ethernet Radio Modem! This manual was written to help both the first time and advanced user of the 210 to configure the wireless modem for your application. If this is your first time configuring the 210 and you would like to get going as soon as possible, we recommend using the *ESTeem Resource CD* provided with the modem. The Resource CD will provide the software utilities and guide you through the configuration of the wireless modem for your application.



Figure 1: ESTeem Model 210 Series

The ESTeem 210 wireless Ethernet modems are sophisticated networking devices. To keep the manual usably short, many of the application descriptions and programming details assume the user has a good working knowledge of the following network concepts:

- General Ethernet networking and the configuration of LAN topologies
- Common Ethernet terminology and acronyms
- TCP/IP network protocol structure and how to configure TCP/IP networks and subnets
- How to identify and set the TCP/IP address on your computer
- Have administrator privileges to the computer and network you are configuring
- If using routing protocols, you must be able to identify and configure the network routers, gateways and firewalls
- You must be familiar with using web browser software such as Internet Explorer, Netscape or Mozilla

Throughout this User's Manual are "**Technical Tips**" in boxes like this that have been added to help answer the most commonly asked questions.

If you are unfamiliar with any of the above networking concepts, you may need to contact your network administrator for assistance.

MODEL 210 OVERVIEW

The ESTeem Model 210 is a series of wireless LAN transceivers that can be used to build many types of Wireless Local Area Networks (WLAN). The wireless modems in 210 series can provide RF data rates up to 54 Kbps and have an RS-232 serial port for legacy device networks. The Model 210 is a very sophisticated networking device that can be configured for multiple modes of operation depending upon the needs of the wireless and wired LAN system. The following configuration modes are provided as an overview of the basic network types, as all possible network configurations can not be listed. For further help in selecting the correct network type, please refer to Chapter 4 of this User's Manual or call Customer Support at 509-735-9092.

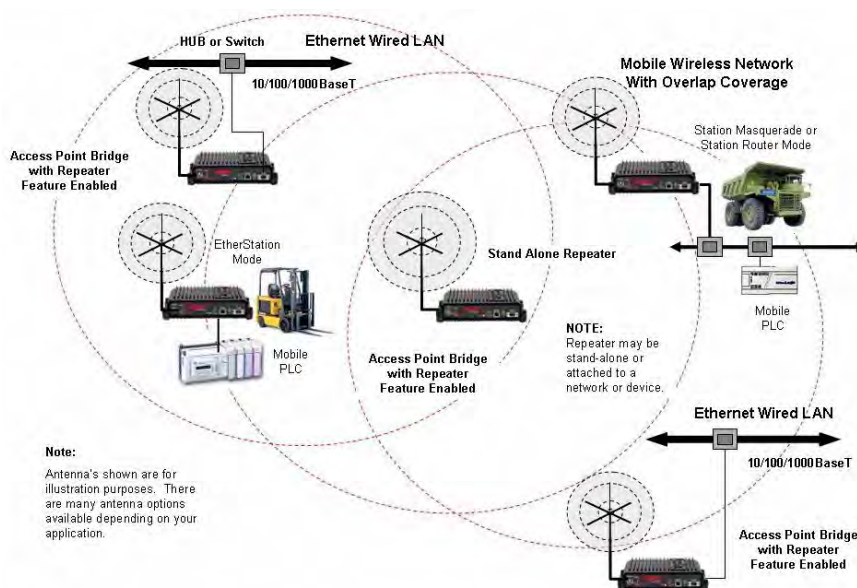


Figure 2: Access Point Bridge Diagram

CONFIGURATION MODES

A Model 210 can be configured for multiple modes of operation without any changes to the hardware. The following are brief descriptions of the configuration modes. For detailed descriptions and suggested applications for each mode, please refer to Chapter 4.

Access Point Modes

When a Model 210 is configured as an Access Point it will provide a wireless bridge for mobile clients. Multiple Access Points can be physically connected to the same network (LAN) or through a radio link using the Access Point Repeater mode to provide overlapping, seamless Ethernet communication for mobile devices.

1. Access Point Bridge Mode

An ESTeem Model 210 in Access Point Bridge mode will both provide wireless access to mobile clients (Access Point) and bridge all Ethernet data connected to the Ethernet ports. The AP Bridge mode will pass all network traffic between connected devices including global network broadcasts. (See Figure 2)

2. Access Point Router Mode

In this mode the ESTeem Model 210 will function as a router between wired Ethernet networks, connected to the 210's Ethernet port, and the wireless clients in the network. As in all standard router configurations, the wireless and wired Ethernet networks will need to be on separate subnets. The 210 in Access Point Router mode will pass network traffic for connected devices but will block global network broadcasts from the wired network. This mode of operation should be used instead of the Access Point Bridge mode when a separation between networks is required or the ESTeem is connected to larger LAN Networks that will continuously send global network broadcasts (Figure 3).

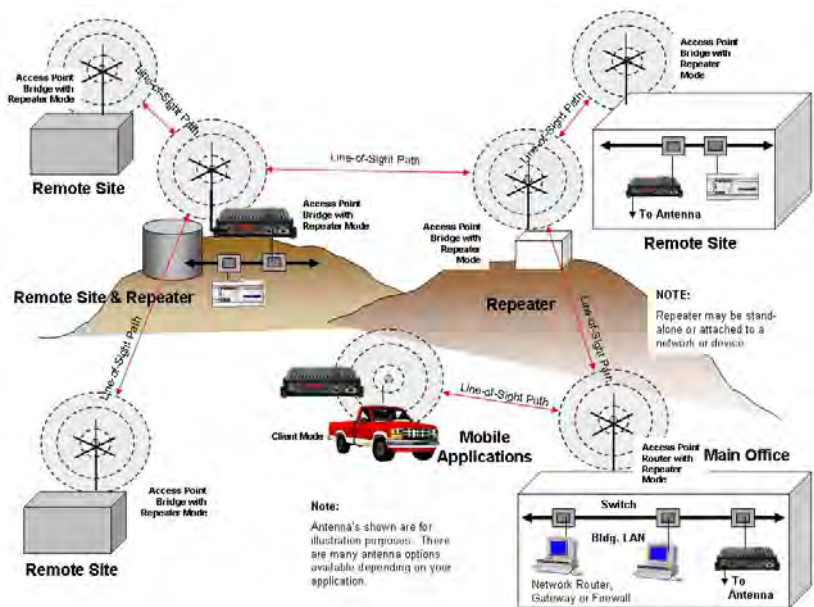


Figure 3: Repeater Mode Diagram

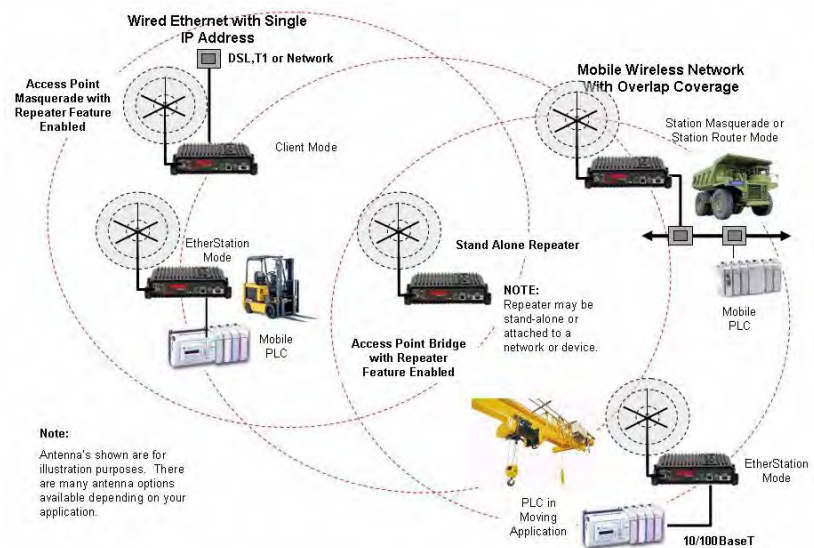


Figure 4: Access Point Masquerade Diagram

Repeater Mode

The Repeater Mode can be used with any of the above Access Point modes. With this repeater feature enabled, the Model 210 Access Points do not have to be hardwired together on the same physical LAN to provide seamless Ethernet communication for roaming clients. In addition to greatly extending the Access Point canopy range, the Model 210 will also bridge any Ethernet device or Ethernet network connected to the unit over this same wireless Ethernet network. This mode gives the user the features of a point to multi-point bridge network but also allows the Model 210 in the Client mode to simultaneously roam under the network canopy.

Self-Healing Mesh Network

If multiple repeater routes are configured to the same destination ESTeem, the 210 will create a “self-healing” mesh network by automatically re-routing data through alternate paths to reach its destination if the primary path is inoperable. The routing and priority of alternate paths is completely user configurable. (See Figure 5)

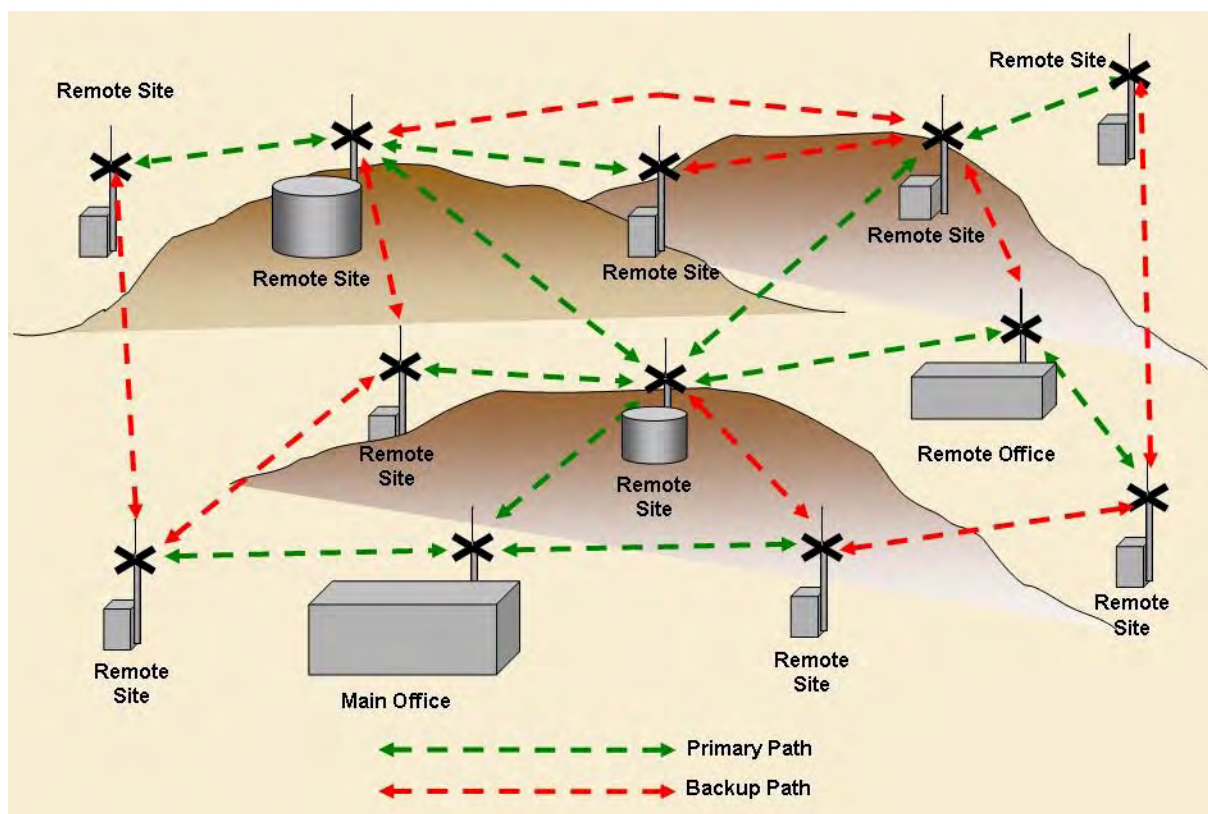


Figure 5: Mesh Network Diagram

Station (Client) Modes

1. EtherStation Mode

When the 210 is configured in the EtherStation mode and attached to a single Ethernet Device, the Model 210 will emulate a wireless card in functionality for communication as a mobile client. The 210 will seamless roam under the radio canopy of Access Points and can provide wireless communication for mobile Ethernet devices such as vehicles, forklifts, cranes, etc (Figures 2-4).

2. Station Router Mode

The Station Router mode will also function as a mobile client, similar to EtherStation, but will allow multiple Ethernet devices to be connected to a single 210 (Figure 4). The 210 will function as a router between the wireless client mode and the wired Ethernet devices connected to the Ethernet port. Similar in configuration to the Access Point Router mode, the wireless and wired Ethernet networks will need to be on separate subnets. To communicate from wireless network to devices on the wired Station Router network, a separate router (connected to the Ethernet side of the Access Point) is required. This mode would be used where multiple Ethernet devices will be connected to a single Model 210 in a mobile client application and the connected Ethernet devices will need to be accessible from the Access Point's LAN network.

RS-232 Serial Applications

The ESTeem 210 is installed with an RS-232 data port for serial data applications run over the wireless links (Figure 6). The serial network can be used in a point-to-point or point-to-multi-point application for networking serial (RS-232C) devices, providing serial connections to legacy hardware in a new Ethernet network.

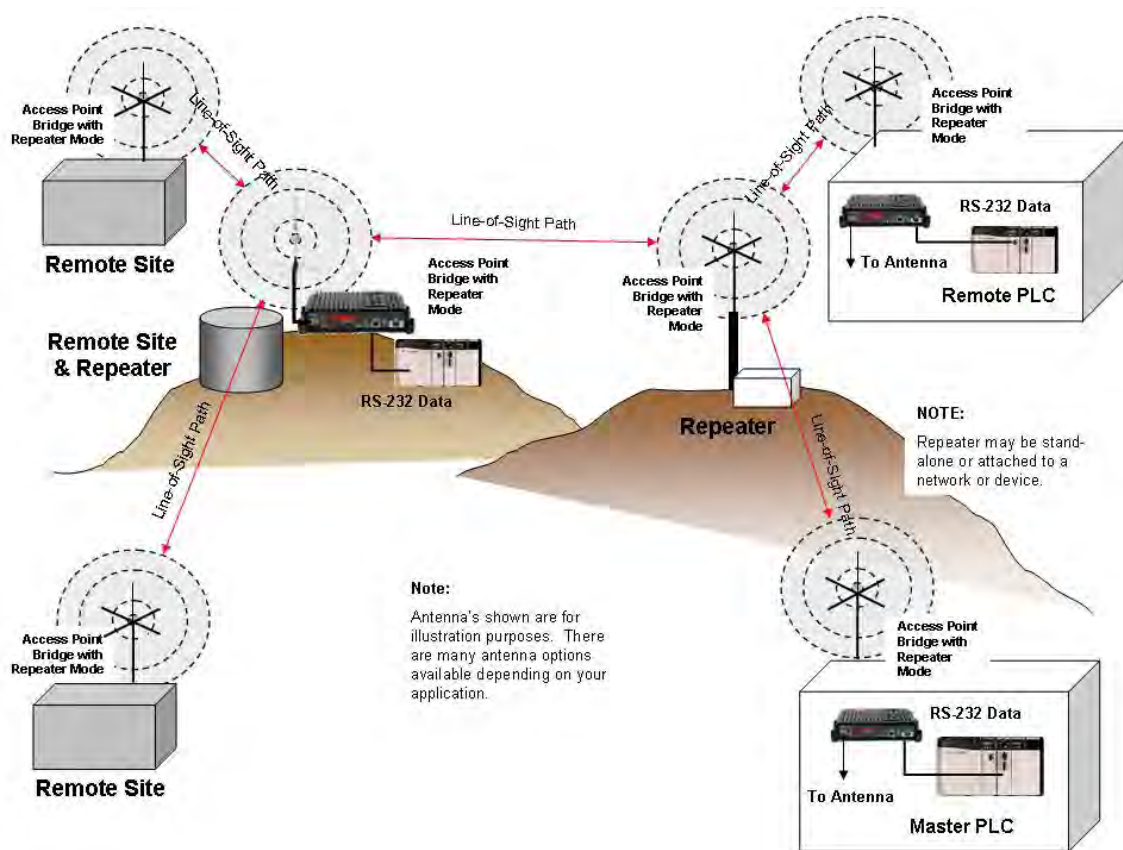


Figure 6: Multi-point Serial Diagram

To begin setup of your wireless Ethernet network, continue to Chapter 2 - Staring Out of this User's Manual.

OVERVIEW

There are three main phases to prepare the ESTeem 210 for operation in a wireless network:

Phase 1 - Determine the correct mode of operation for the ESTeem in the wireless network. The ESTeem 210 is a sophisticated networking device that can be configured for multiple modes of operation. Determining the correct mode of operation for the ESTeem 210 is the first step. Chapter 3 of this User's Manual details the modes of operation and applications where each would be used.

Phase 2 - Program the ESTeem for operation in the wireless network. Once the correct mode of operation for the ESTeem has been determined, the 210 can be programmed for the wireless network. To simplify the programming of the Model 210, ESTeem has created a new software utility called the ESTeem Network Configuration (ENC) Utility which is used to graphically configure the primary and backup communication routes between ESTeem 210's in the network. The ENC Utility can be installed from the ESTeem Resource Disk or from the ESTeem web site (www.esteem.com). Chapter 4 (Utilities and Features) of this User's Manual will guide you in the installation of the software and give a brief overview of operation of the ENC Utility, but a detailed User's Guide is available both on the ESTeem Resource Disk and in the Help section of the program itself.

The ESTeem Model 210 can also be programmed through the internal Web interface (discussed in detail in Chapter 5) if you do not have access to the ENC Utility.

Phase 3 - Install the ESTeem hardware and test communication. After the ESTeem Model 210's programming, install the hardware in each remote location. Chapter 8 of this User's Manual describes the antenna specifications, mounting options and the configuration of the pole mounting hardware for the ESTeem. For instructions on testing and troubleshooting the wireless link, refer to Appendix F (Troubleshooting).

MODEL 210 HARDWARE LAYOUT

To begin the configuration, unpack the ESTeem Model 210 shipping boxes and locate the items below for initial configuration. Take a few minutes to inventory your equipment before you proceed. Report any missing or damaged items to Customer Support (509-735-9092) as soon as possible. Each node in your ESTeem Model 210's network may have different hardware components based upon the final installation location (i.e. Outdoor, Indoor, Point-to-point or Muti-Point). Antenna types, cable lengths, power supplies may be different, but the following items will be required for basic setup:

Model 210



AA109 Resource Disk



**Antenna
(AA20C.1 Displayed)**



**Coax Cable
(Antenna to ESTeem 210)**



**Power Supply
(AA174 Displayed)**



Ethernet Cable



***Note:** Your accessory model numbers may vary from the above, but you will need to locate each of above items to continue configuration.*

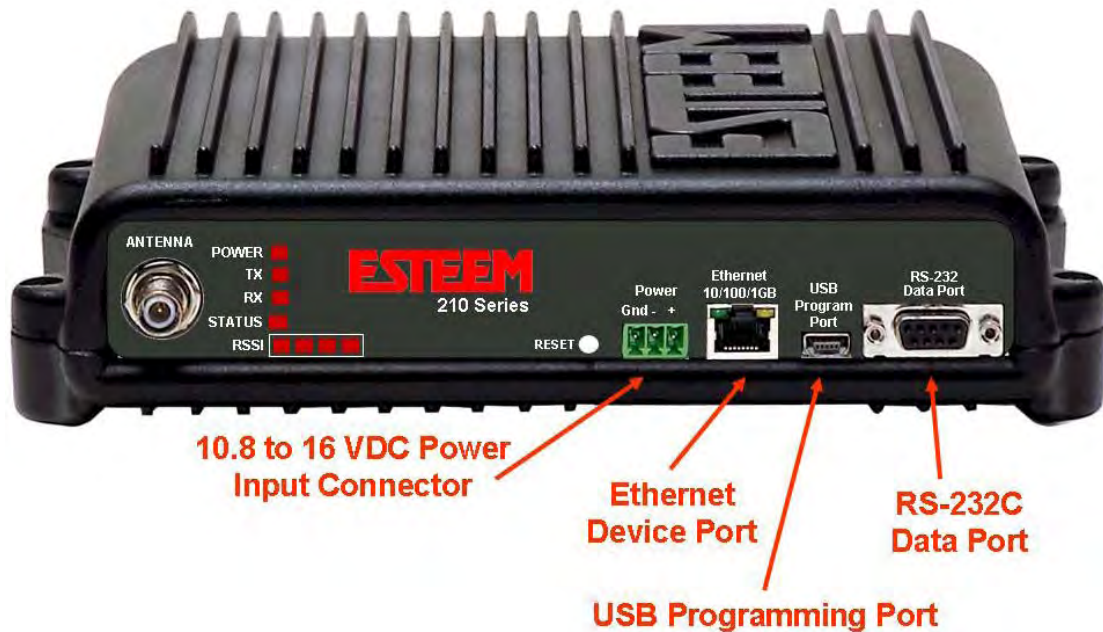


Figure 1: 210 Front Panel Overview

MODEL 210 HARDWARE CONFIGURATION

The following steps should be completed to begin configuration of the ESTeem Model 210:

1. Connect the antenna to the TNC connection on the ESTeem Model 210 (Figure 1).
2. Connect the power supply and Ethernet cable to the ESTeem and proceed to Chapter 3 to begin programming.

Technical Tips:

1. Configure the Model 210 prior to mounting.
2. Attach antenna to the Model 210 before powering up.

MODES OF OPERATION

The ESTeem Model 210 is a sophisticated wireless networking device that can be configured for multiple modes of operation. Determining the correct mode of operation for the ESTeem is the first step in creating a reliable wireless network. This chapter will explain each mode of operation, provide example applications and detailed programming information for each mode. Please review the following modes of operations. If you do not see an example of your application, please contact ESTeem support at 509-735-9092 for help in selecting your mode of operation.

Ethernet Bridge Mode (AP Bridge)

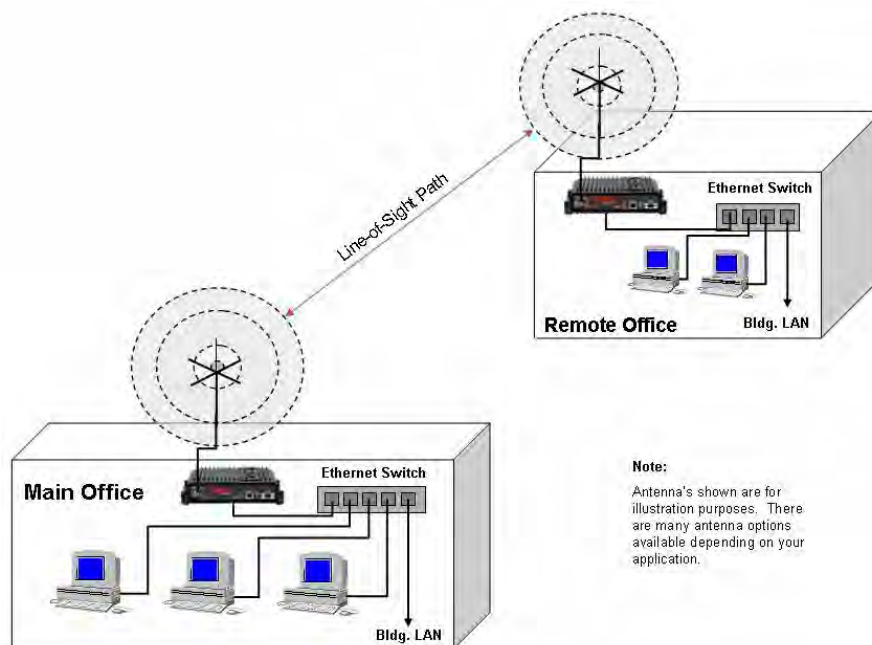
The most commonly used mode of operation with the ESTeem Model 210 is the Ethernet bridge mode. The Ethernet bridge mode will connect two or more ESTeem 210's while passing all network traffic that arrives in both the wireless and connected Ethernet ports; including all global network traffic (Figure 1). This mode will work in most wireless applications of the 210 to wirelessly connect two or more remote Ethernet devices or networks. The Ethernet bridge mode is also used in repeating (Figure 2) and in self-healing Mesh networks (Figure 3) for fixed (non mobile) applications.

Example Applications

- Building to building remote wireless LAN networks
- Point to point wireless Ethernet communication devices
- Multi-point wireless Ethernet networks
- Remote Supervisory Control and Data Acquisition (SCADA) networks
- Redundant, self-healing Mesh networks
- Fixed locations with mobile ESTeem 210's

Applications Where Ethernet Bridge Mode Not Used

- Mobile applications (see Mobile Clients)
- Connections to large Ethernet traffic networks such as large office buildings or plant networks (see Router modes)



Note:

Antenna's shown are for illustration purposes. There are many antenna options available depending on your application.

Figure 1: Point to Point Example

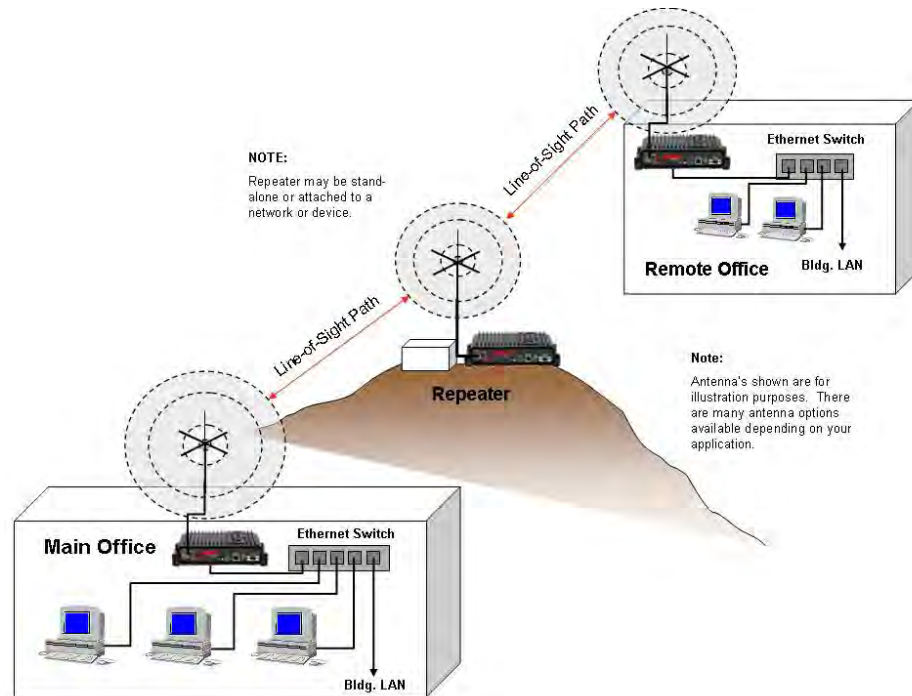


Figure 2: Ethernet Bridge with Repeater

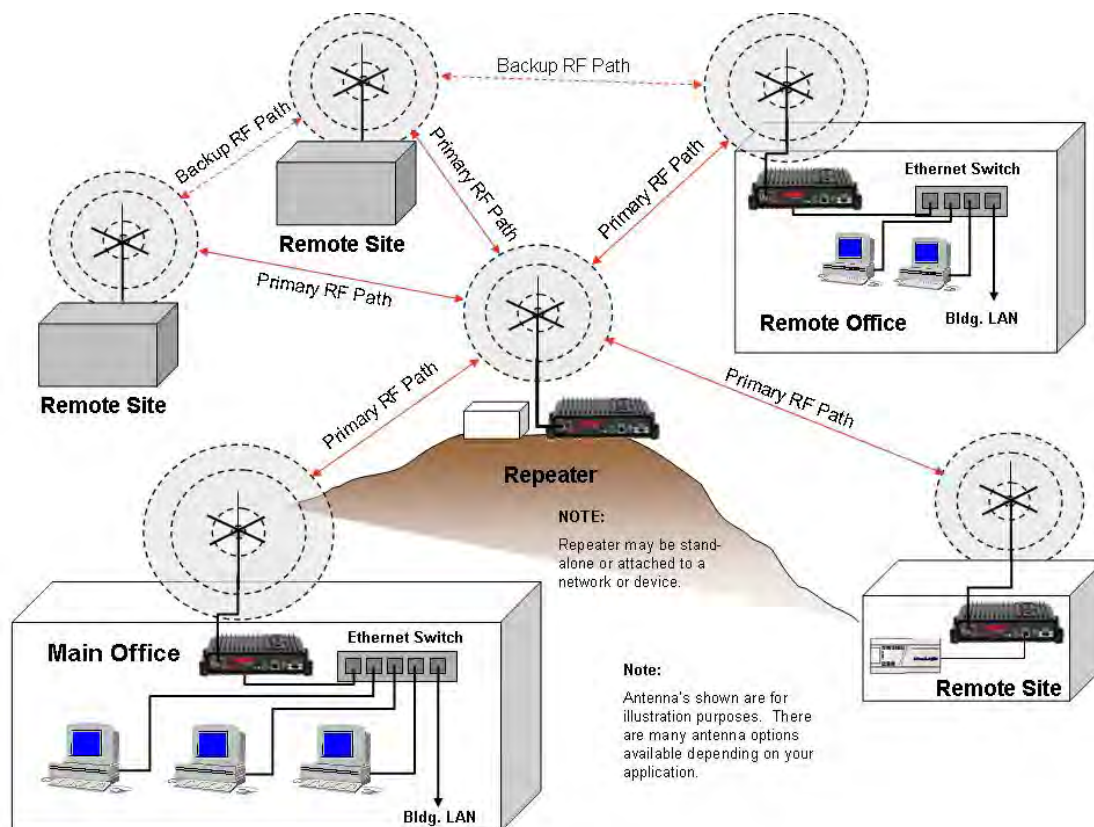


Figure 3: Multipoint Bridge with Mesh Networking

Router Modes (AP Router and AP Masquerade)

The ESTeem 210 can be configured as a network router or network firewall between the Ethernet LAN connection and the wireless network of remote locations. The router modes are used to limit the network traffic from a busy Ethernet network connection to only those specific IP address used on the wireless network (see Figure 4). The Ethernet router mode (AP Router) will allow bi-directional communication from the Ethernet LAN connection to the wireless network.

Example Applications

- Wireless Ethernet networks connected to large company or plant Ethernet LAN networks (AP Router)
- Wireless Ethernet networks with a requirement for network isolation from the plant or company network (AP Router)
- Shared Ethernet connection to direct Internet service (DSL, Cable, T1, etc.) (AP Masquerade)

Applications Where Ethernet Router Mode Not Used

- Mobile applications (see Mobile Clients)
- Simple network connections only using a single IP network subnet (see Ethernet Bridge modes)

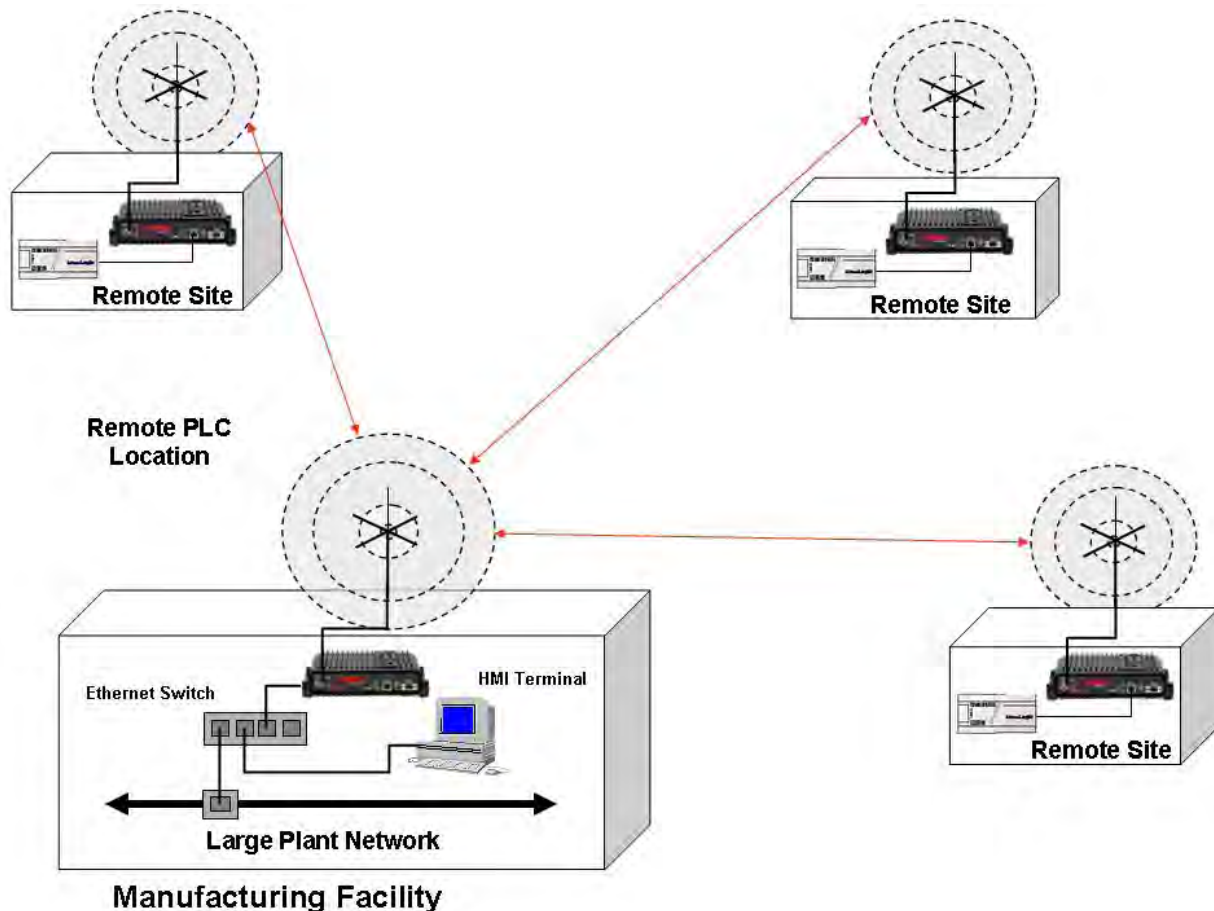


Figure 4: Router Mode Example

Mobile Client Modes (EtherStation, Station Router or Station Masquerade)

The ESTeem 210 can also be configured to function as a mobile client. The client modes allow the 210 to seamlessly roam between fixed Access Points. The client modes will allow mobile Ethernet devices to connect to each other or to an Ethernet LAN through the fixed AP (Figure 5).

The EtherStation mode is used to connect a single Ethernet device to the ESTeem 210. If you are connecting the 210 to multiple Ethernet devices in a mobile mode, the Station Router or Station Masquerade will be required. The Station Router will allow bi-directional communication between the Ethernet devices connected to the 210 and the wireless network, while the Station Masquerade will serve as a firewall on the Ethernet side.

Example Applications

- Mobile applications where the 210 will change links often between fixed Access Points
- Long range mobile client networks
- Public safety applications for police, fire and EMS

Applications Where Mobile Client Mode Not Used

- Fixed locations using Ethernet Bridging or Routing
- Wireless Ethernet networks with repeaters
- Mobile applications

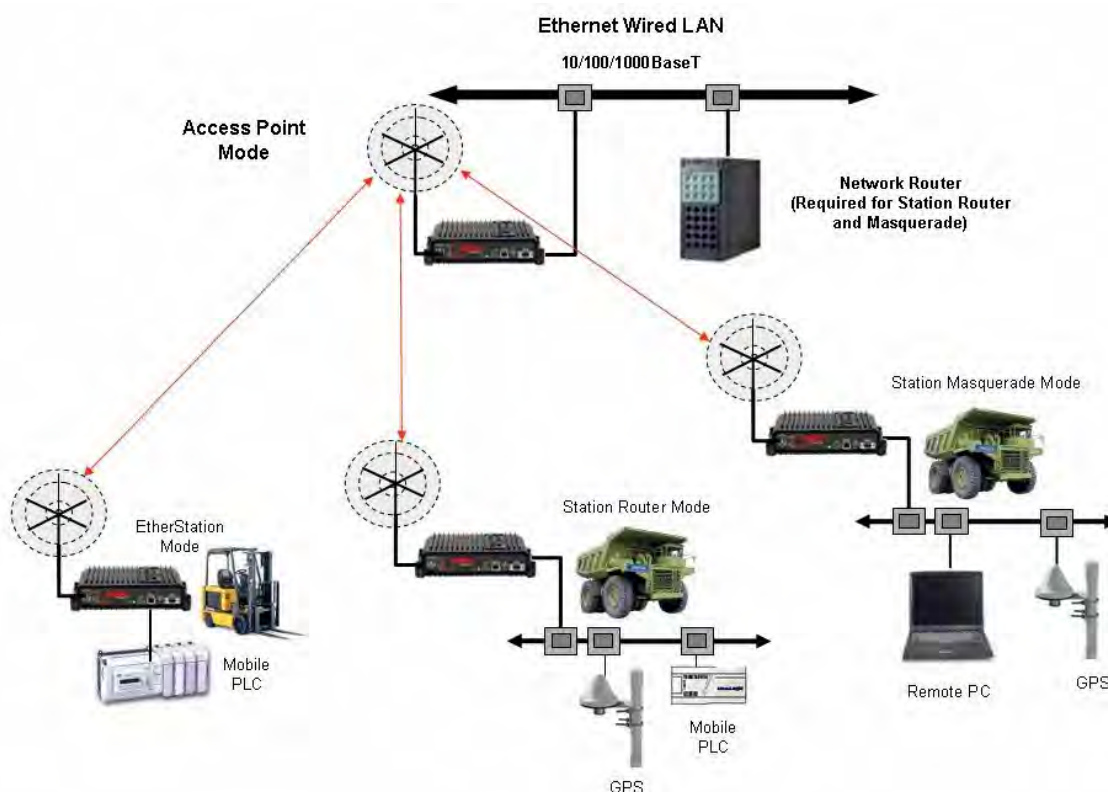


Figure 5: Router Mode Example

PROGRAMMING EXAMPLES

Once the mode of operation for the ESTeem has been determined, you are now ready to program the Model 210 for use. ESTeem has created a simplified network programming utility call the ESTeem Network Configuration (ENC) Utility. This ENC Utility will be used in all the following programming examples. For detailed instructions on installing the ENC Utility, please refer to the User's Guide (found in the ESTeem Resource CD or Utility program itself) or Chapter 4 of this User's Manual.

Technical Tip: The ENC Utility calculates the wireless link information based upon **exact** ESTeem serial numbers. The serial numbers listed in the following examples are for example only. Enter the correct ESTeem serial numbers for your application.

Adding ESTeems to ENC Utility and Changing Name

Each of the example applications will use the following procedure to add and rename ESTeem 210's.

1. Consult the ENC Utility's User Guide on how the create a new wireless network. Once you have a blank network configuration page (Figure 9), select ESTeem from the menu items to display the drop down menu, then select New>New ESTeem.

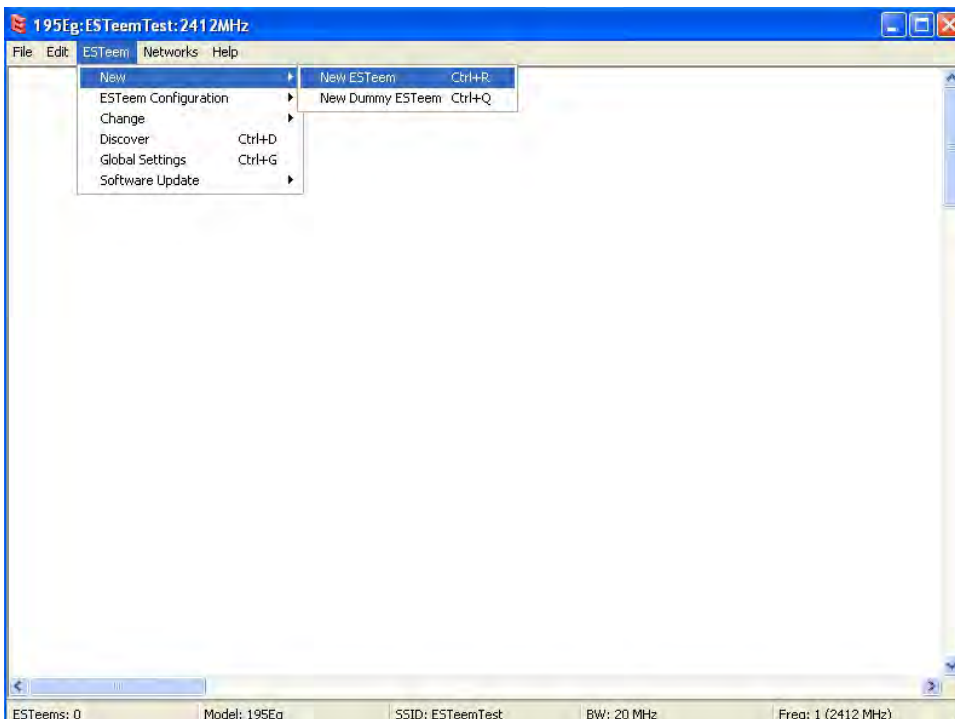


Figure 9: Adding ESTeem to Blank ENC Configuration Page

2. Enter in the ESTeem Model 210 serial numbers used for the example (for example enter E-14000 in the Set Serial Number Box) and press the OK button (Figure 10). The ENC Utility will look up the ESTeem 210's serial number in the database and match the correct Wireless LAN MAC (WLAN MAC) address to the modem. This WLAN MAC address will be displayed above the modem symbol on the screen (Figure 11).

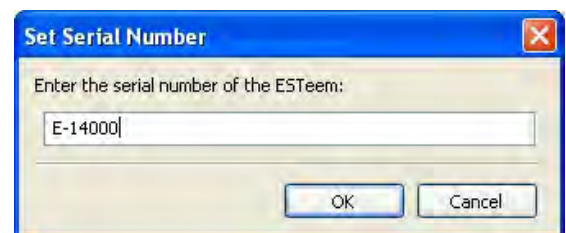


Figure 10: Enter the Serial Number

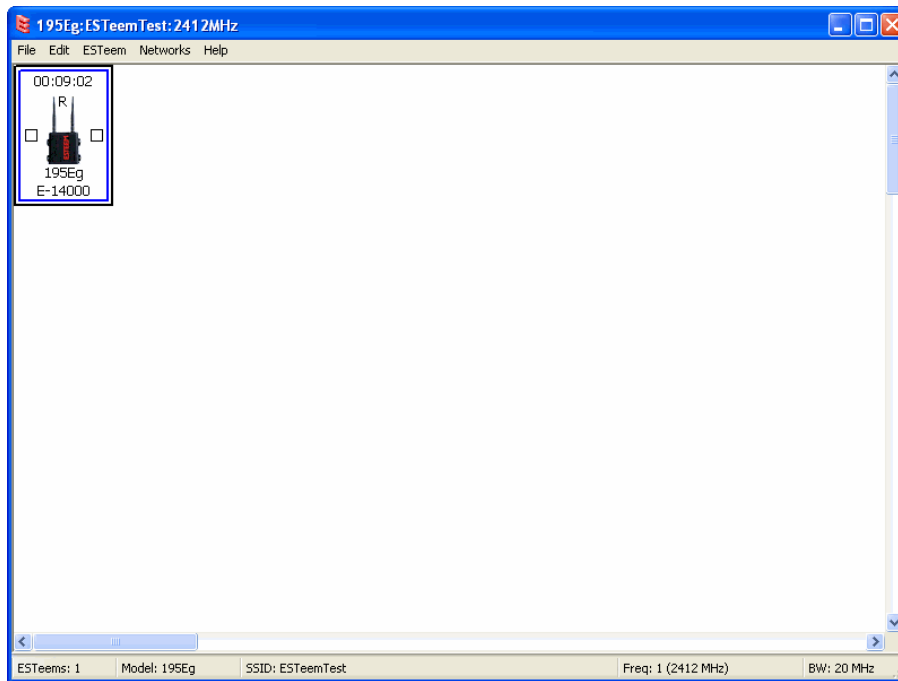


Figure 11: Main Office ESTeem 210

3. To change the name of the ESTeem 210 from the WLAN MAC address to “Main Office” (or any other location name) to match the example configuration, Right-Mouse click on the ESTeem icon and select Change>Change Modem ID (Figure 12). Enter “Main Office” in the pop-up window and select OK.
4. Duplicate the above procedure for each ESTeem 210 added to the network.

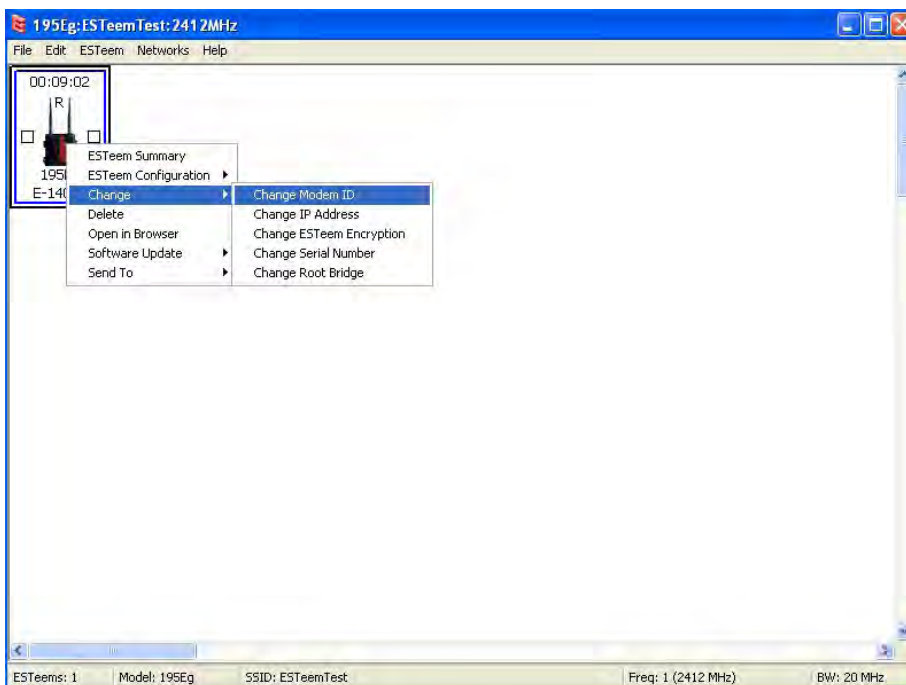


Figure 12: Change Modem ID

Ethernet Bridge Mode Example 1 (Figure 1)

Point to Point Ethernet Bridge

(2) ESTeem Model 210

Serial Numbers: E-14000 (Main Office) and E-14001 (Remote Office)

1. Add the two ESTeem Model 210s to the network using the above procedure. Once both ESTeem 210s are on the configuration page, create a wireless link by clicking on one of the two connection boxes and dragging a line to the other modem (Figure 13).
5. Verify both ESTeem modems are connected to the same switch as the computer running the ENC Utility and send the configuration to both modems at the same time by selecting ESTeem>ESTeem Configuration>Send Configuration to All ESTeems (Figure 14).
6. Once the ENC Utility has downloaded the configuration for both ESTeem 210s, the status box around the ESTeems will change from yellow to blue. This indicates that the configuration was completed successfully and the ESTeem 210s are ready to be installed in the application.

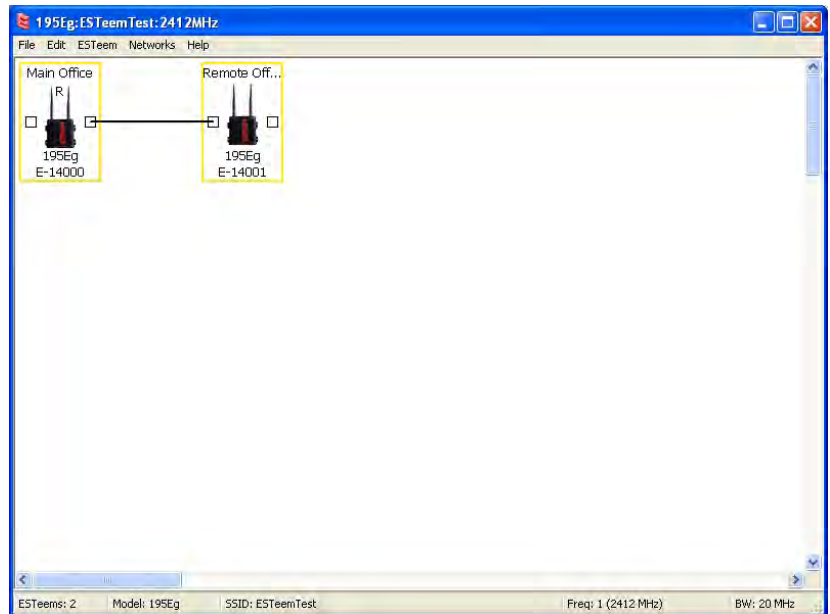


Figure 13: Create Wireless Link

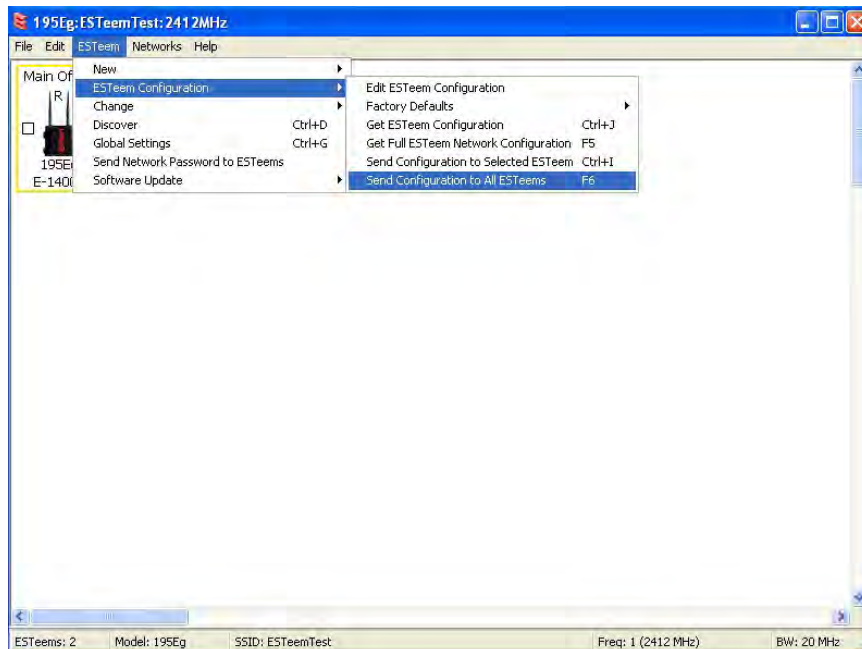


Figure 14: Send Configuration to ESTeems

Ethernet Bridge Mode Example 2 (Figure 2)

Point to Point with Repeater Ethernet Bridge

(3) ESTeem Model 210

Serial Numbers:

E-14000 (Main Office)

E-14001 (Remote Office)

E-14002 (Repeater)

- Using the above procedure, enter the three ESTeem 210s into the ENC Utility. Your layout should appear like Figure 14.
- Move the ESTeem 210 icons on the screen to simulate the layout of the diagram. Draw connection lines between the modems to make the wireless link in the same order as the network layout (Figure 15).
- Verify all ESTeem modems are connected to the same switch as the computer running the ENC Utility and send the configuration to both modems at the same time by selecting ESTeem>ESTeem Configuration>Send Configuration to All ESTeems. Once the ENC Utility has downloaded the configuration for both ESTeem 210's, the status box around the ESTeem's will change from yellow to blue. This indicates that the configuration was completed successfully and the ESTeem 210's are ready to be installed in the application.

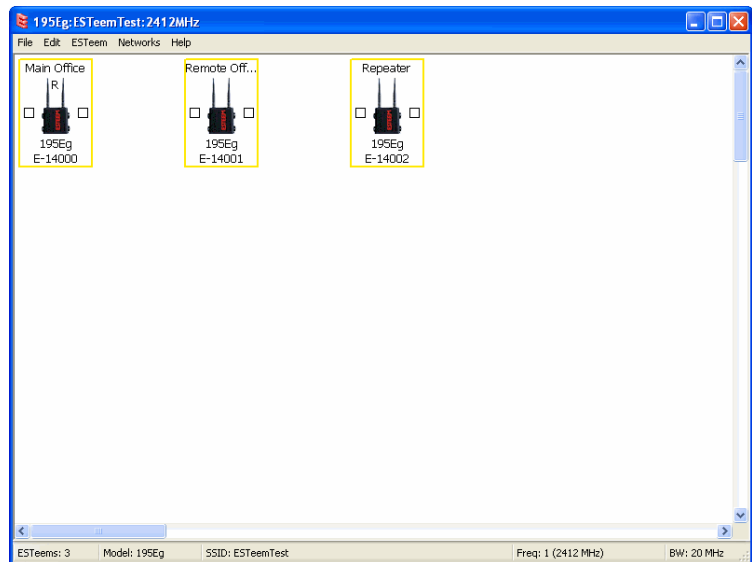


Figure 14: Example 2 Modems

Technical Tip: Although it does not matter where the ESTeem icons are located on the screen, putting them in the same layout as the application makes it easier to visually verify the network connections.

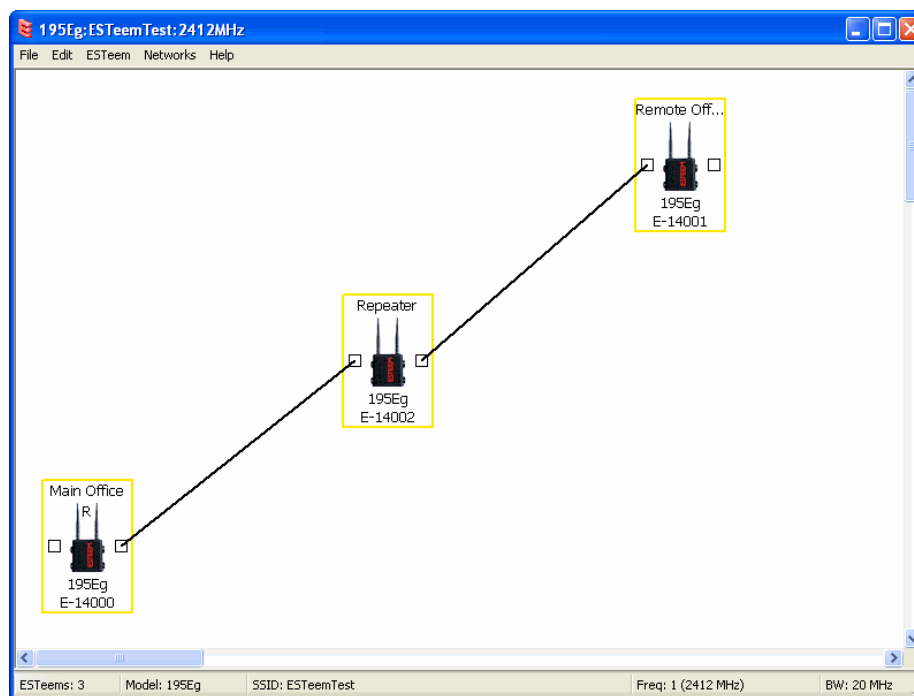


Figure 15: Example 2 Layout

Ethernet Bridge Mode Example 3 (Figure 3)

Point to Multipoint with Mesh Repeater Links

(6) ESTeem Model 210

Serial Numbers:

E-14000 (Main Office)

E-14001 (Remote Office)

E-14002 (Repeater)

E-14003 (Remote Site 1)

E-14004 (Remote Site 2)

E-14005 (Remote Site 3)

1. Using the above procedure for adding ESTeem Model 210s, add the six ESTeem 210s for this example and rename by location. Your layout should appear like Figure 16.
2. Move the ESTeem 210 icons on the screen to simulate the layout of the diagram. Draw connection lines between the primary wireless links modems in the same order as the network layout (Figure 17).

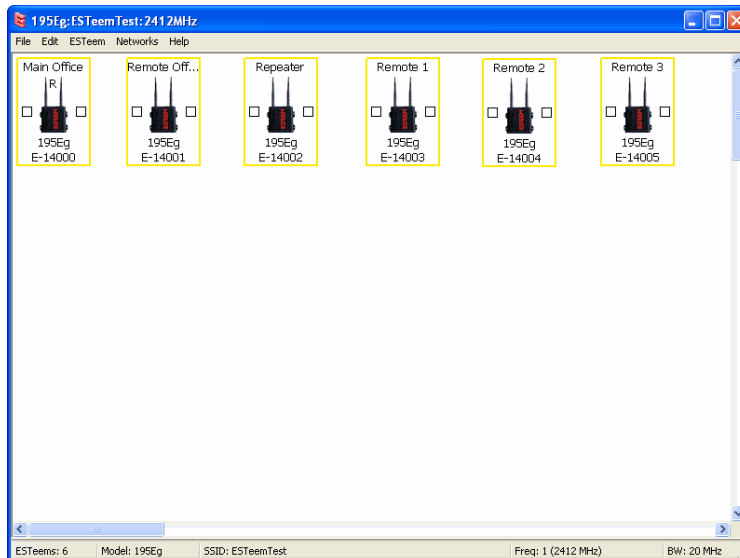


Figure 16: Example 3 Modems

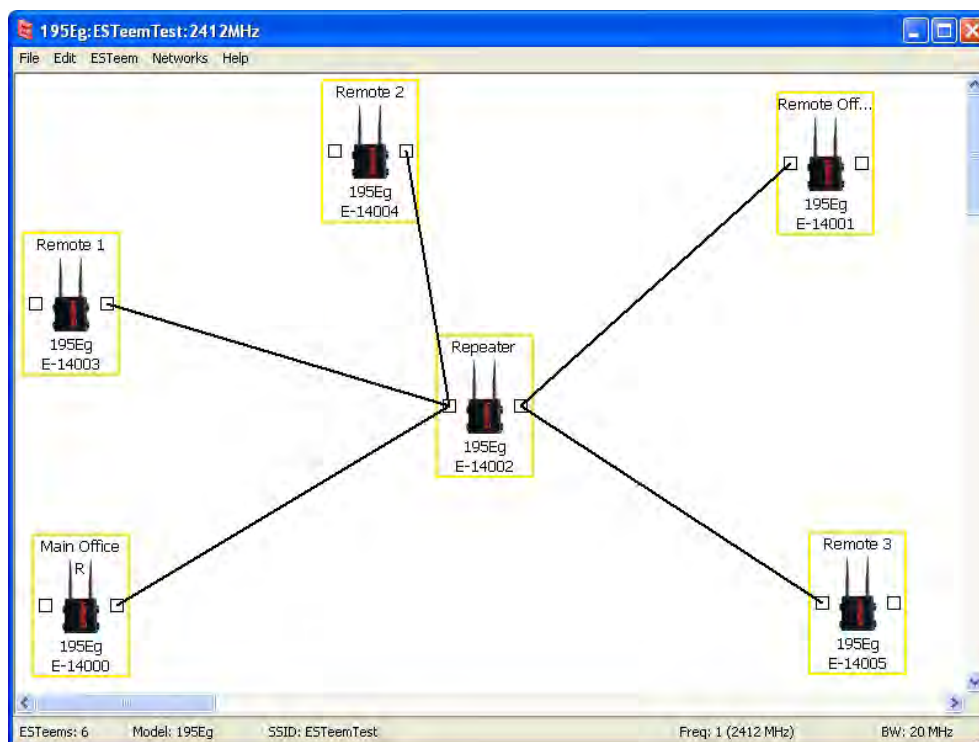


Figure 15: Example 2 Layout

3. To create the backup link between Remote 1 and Remote 2 and the other backup link from Remote 2 to the Remote Office, draw a wireless connection as you would on the primary link. Double-click on the line created. The Link Editor box will be displayed (Figure 16). Any Path Length greater than 1 will display as a dashed line indicating a backup link

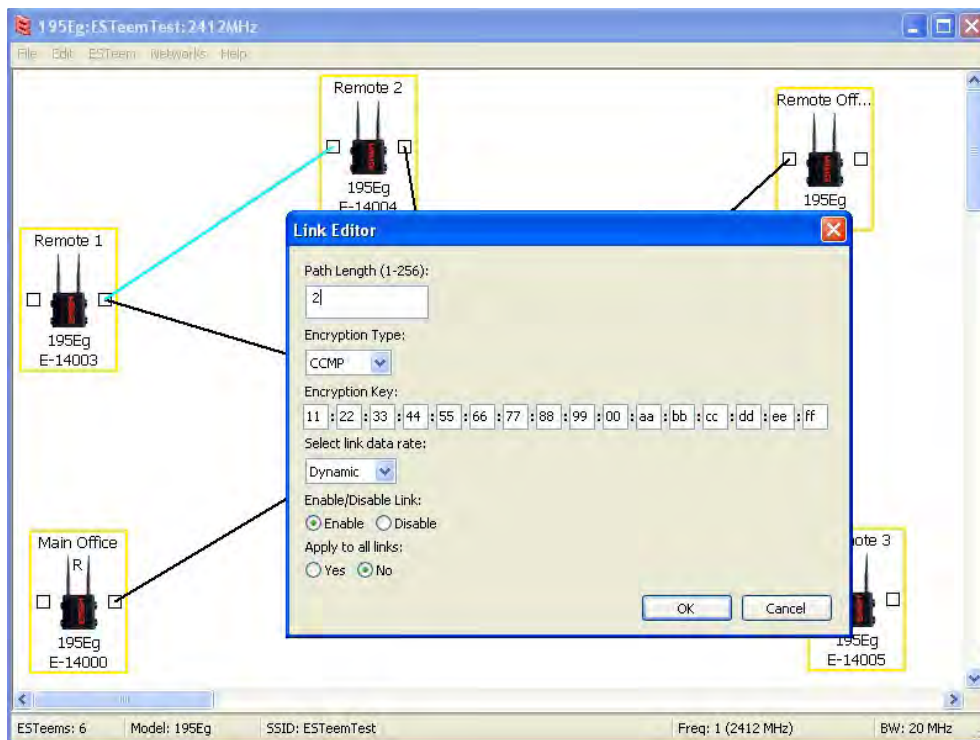


Figure 16: Backup Link Configuration

in the repeater Mesh configuration (Figure 17). For detailed instruction on Mesh network configuration, refer to Chapter 7 of this User's Manual.

4. Verify all ESTEEM modems are connected to the same switch as the computer running the ENC Utility and send the configuration to all modems at the same time by selecting ESTEEM>ESTEEM Configuration>Send Configuration to All ESTEEMs. Once the ENC Utility has downloaded the configuration for both ESTEEM 210's, the status box around the ESTEEM's will change from yellow to blue. This indicates that the configuration was completed successfully and the ESTEEM 210's are ready to be installed in the application.

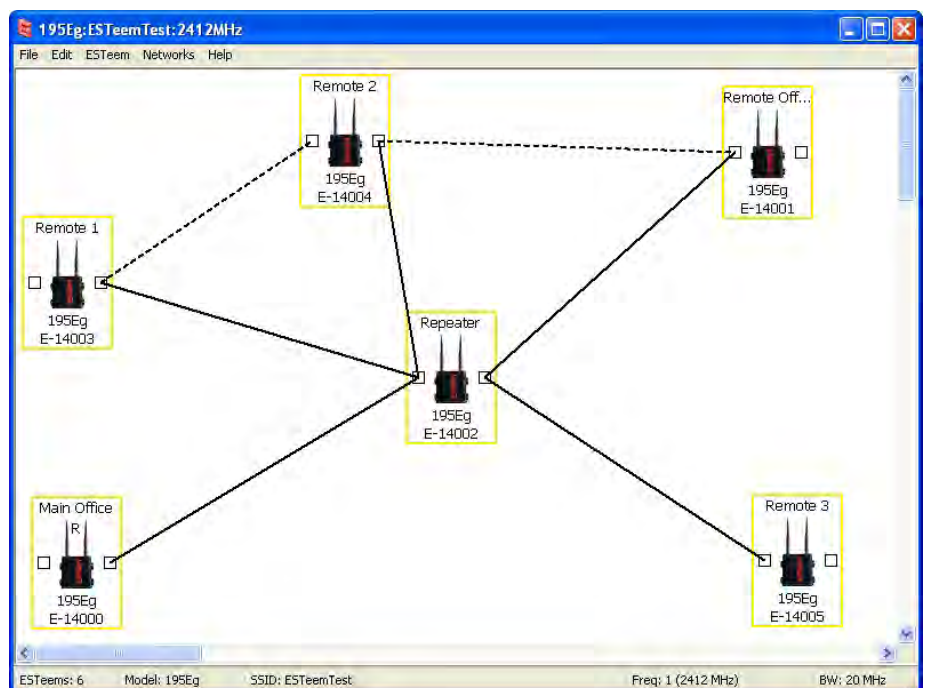


Figure 17: Mesh Network Configuration

Ethernet Router Mode Example (Figure 4)

Point to Multipoint Router Mode

(4) ESTeem Model 210

Serial Numbers:

E-14000 (Router at Network)

E-14001 (Remote Site 1)

E-14002 (Remote Site 2)

E-14003 (Remote Site 3)

1. Using the above procedure for adding ESTeem Model 210s, add the four ESTeem 210s for this example and rename by location. Your layout should appear like Figure 18.
2. Move the ESTeem 210 icons on the screen to simulate the layout of the diagram. Draw connection lines between the wireless links modems in the same order as the network layout (Figure 19).

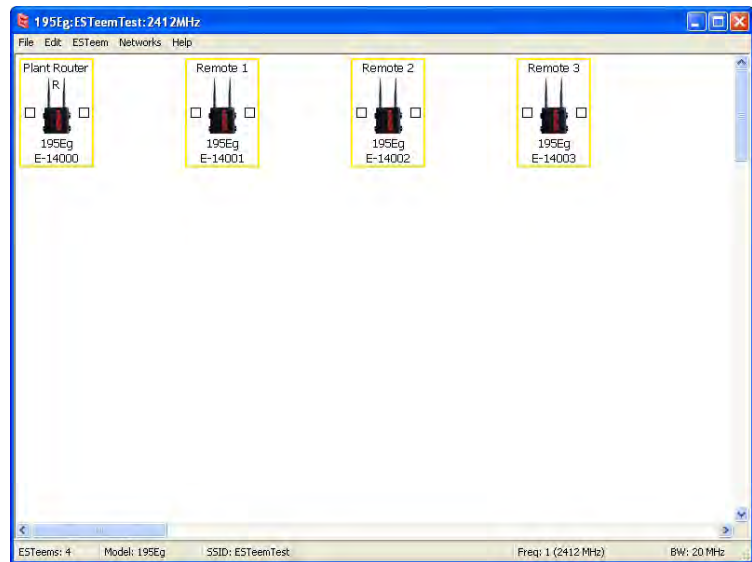


Figure 18: Router Mode Example Modems

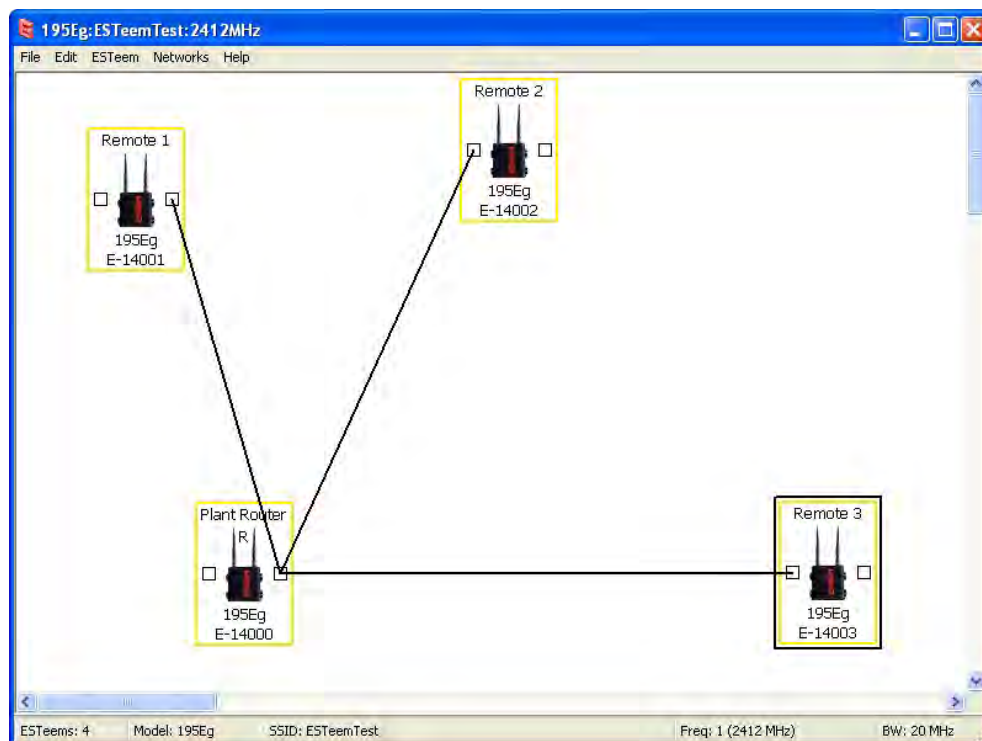


Figure 19: Router Example Layout

- By default, the ENC Utility sets all ESTeem modems in AP Bridge mode. To change the Plant Router ESTeem to AP Router mode, double-click on the icon to bring up the ESTeem Summary window and press the Edit button (Figure 20).
- Change the Mode of Operation from AP Bridge to AP Router (or Masquerade if desired) and press the Next button at the bottom of the window (Figure 21).

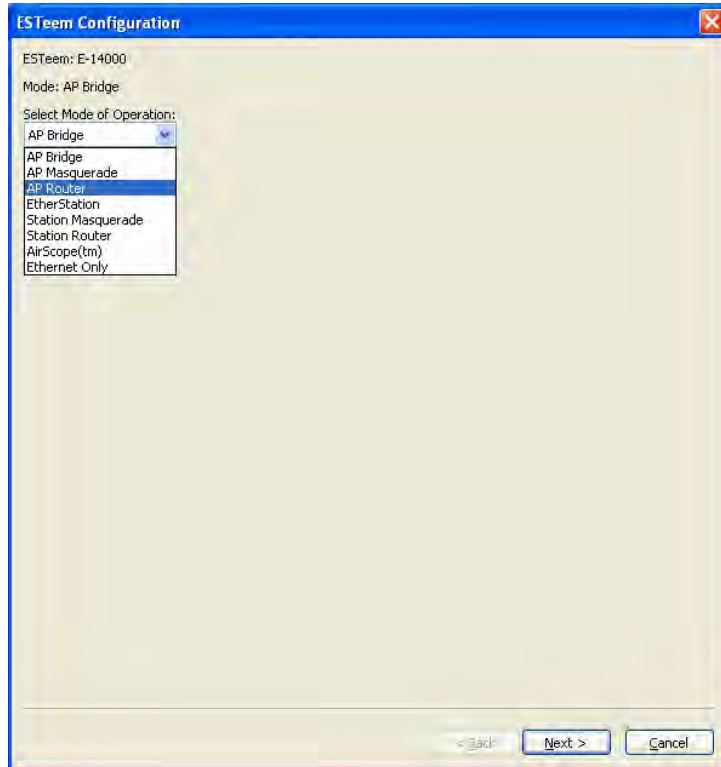


Figure 21: AP Router Configuration

- Continue through the configuration screens setting the AP Router addressing to match the IP address ranges for your network. For help with setting the router addressing please refer to Router Address Examples later in this chapter. You will end on the screen in Figure 22. Press the Finish button to return to the configuration page.
- Verify all ESTeem modems are connected to the same switch as the computer running the ENC Utility and send the configuration to all modems at the same time by selecting ESTeem>ESTeem Configuration>Send Configuration to All ESTeems. Once the ENC Utility has downloaded the configuration for both ESTeem 210s, the status box around the ESTeems will change from yellow to blue. This indicates that the configuration was completed successfully and the ESTeem 210s are ready to be installed in the application.



Figure 20: ESTeem Summary Page

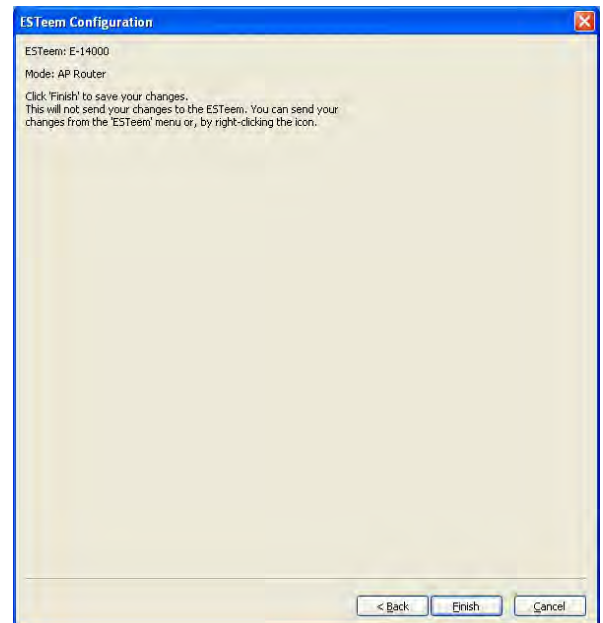


Figure 22: ESTeem Summary Page

Mobile Client Mode Example (Figure 5)

EtherStation, Station Router and Station Masquerade Modes

(3) ESTeem Model 210

Serial Numbers:

E-14000 (EtherStation)

E-14001 (Station Router)

E-14002 (Station Masquerade)

Setting the ESTeem for Mobile Client (station) mode with the ENC Utility is different than the Bridge/Router or Access Point (AP) modes. ESTeem modems configured in as a Mobile Client will not link with a specific fixed modem; but will roam between any 802.11 Access Point with the correct Network Name (SSID) and Encryption. The ESTeem configured as a client is also not set on a specific operating frequency (channel) but will scan all channels looking for the AP. Use the following procedure to configure an ESTeem 210 in one of the three mobile client modes:

1. Starting a new network of ESTeem 210s in Mobile Client mode is the same as any of the Bridge modes except when you are asked for the frequency (channel) of operation, select “Station” (Figure 23).
2. Add the three mobile client modems to the ENC Utility configuration page as instructed above and set the Modem ID to match the three modes of operation. Your configuration will appear as in Figure 24.

Technical Tip: The ESTeem 210's in Mobile Client modes do not have a specific frequency of operation as can be seen in Figure 24.

EtherStation

3. By default, the ENC Utility sets all station mode ESTeem modems to EtherStation mode. The only adjustment necessary to the EtherStation modem in our example is to enter the connected Ethernet device's MAC address. The ESTeem 210 will “clone” the Ethernet MAC address of the connected Ethernet device. To configure the EtherStation modem, double-click on the icon to bring up the ESTeem Summary window and press the Edit button (Figure 20).
4. EtherStation mode should be selected in the Mode of Operation. Press the Next button at the bottom of the window to continue. Enter the connected Ethernet device's MAC address in the “Device MAC Address” box (Figure 25) and press the Next button at the bottom of the window to continue.
5. Verify the encryption settings are correct for the 802.11 AP network in which the EtherStation modem will be working and press the Finish button to return to the configuration page.

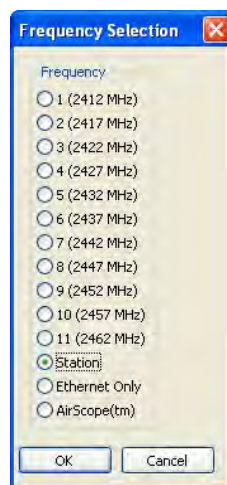


Figure 23: Station

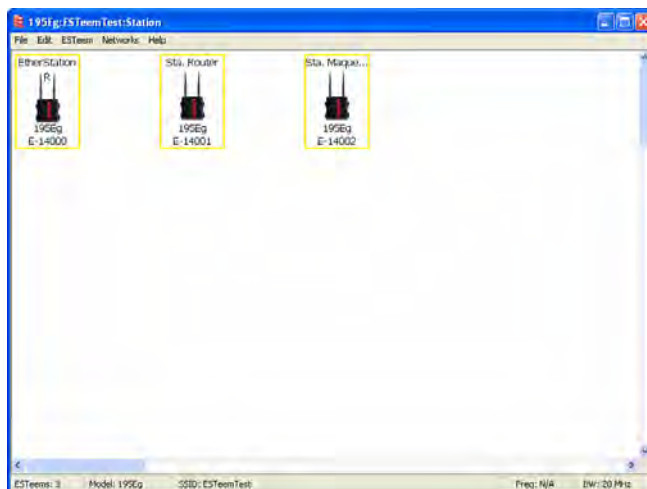


Figure 24: Station Mode Example Modems

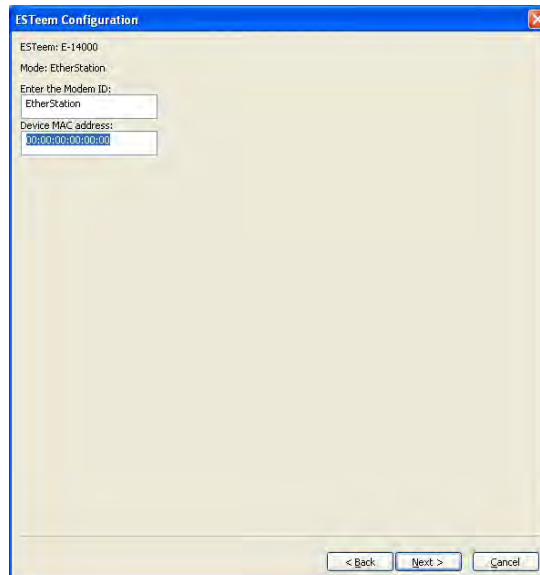


Figure 25: MAC Address Entry

Station Router and Station Masquerade

6. To configure the two other modems, double-click on their icons to bring up the ESTeem Summary window and press the Edit button (Figure 20).
7. Select Station Router for E-14001 and Station Masquerade for E-14002 in the Mode of Operation (Figure 26). Press the Next button at the bottom of the window to continue.
8. Continue through the configuration screens setting the Station Router/Masquerade addressing to match the IP address ranges for your network. For help with setting the router addressing please refer to Router Address Examples later in this chapter.
9. Verify the encryption settings are correct for the 802.11 AP network in which the EtherStation modem will be working and press the Finish button to return to the configuration page.
10. Verify all ESTeem modems are connected to the same switch as the computer running the ENC Utility and send the configuration to all modems at the same time by selecting ESTeem>ESTeem Configuration>Send Configuration to All ESTeems. Once the ENC Utility has downloaded the configuration for both ESTeem 210s, the status box around the ESTeems will change from yellow to blue. This indicates that the configuration was completed successfully and the ESTeem 210s are ready to be installed in the application.

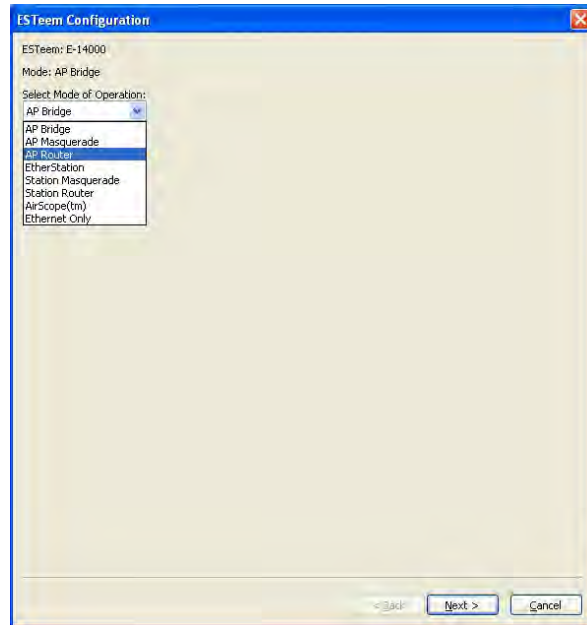


Figure 26: Mode of Operation Selection

ROUTER ADDRESSING EXAMPLES

The following are examples of the IP addressing and subnets required for the ESTeem Router modes.

Point to Point Access Point Router to Station Router

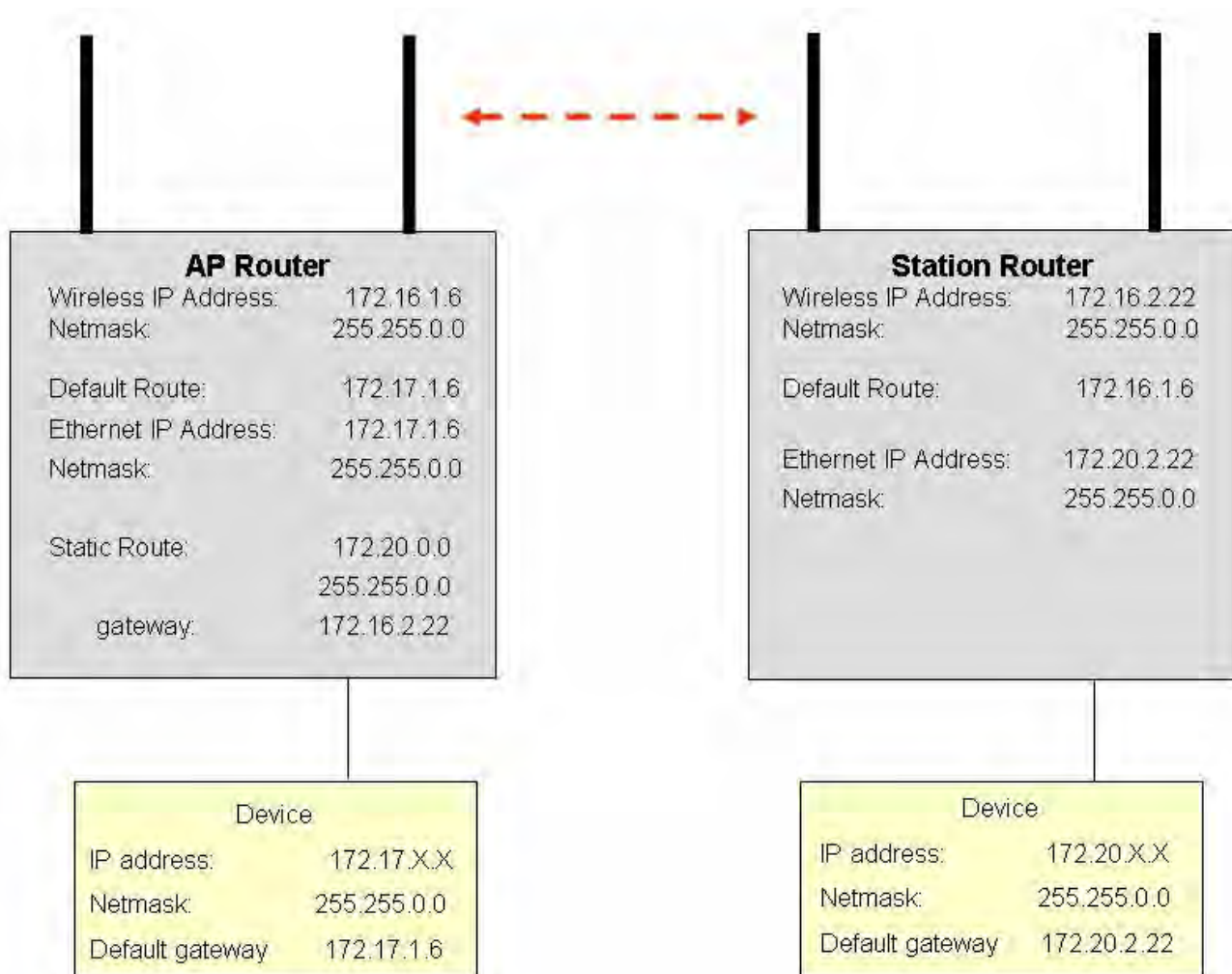


Figure 27: AP Router Addressing Example

Stand-Alone Access Point Router and Single Station Router

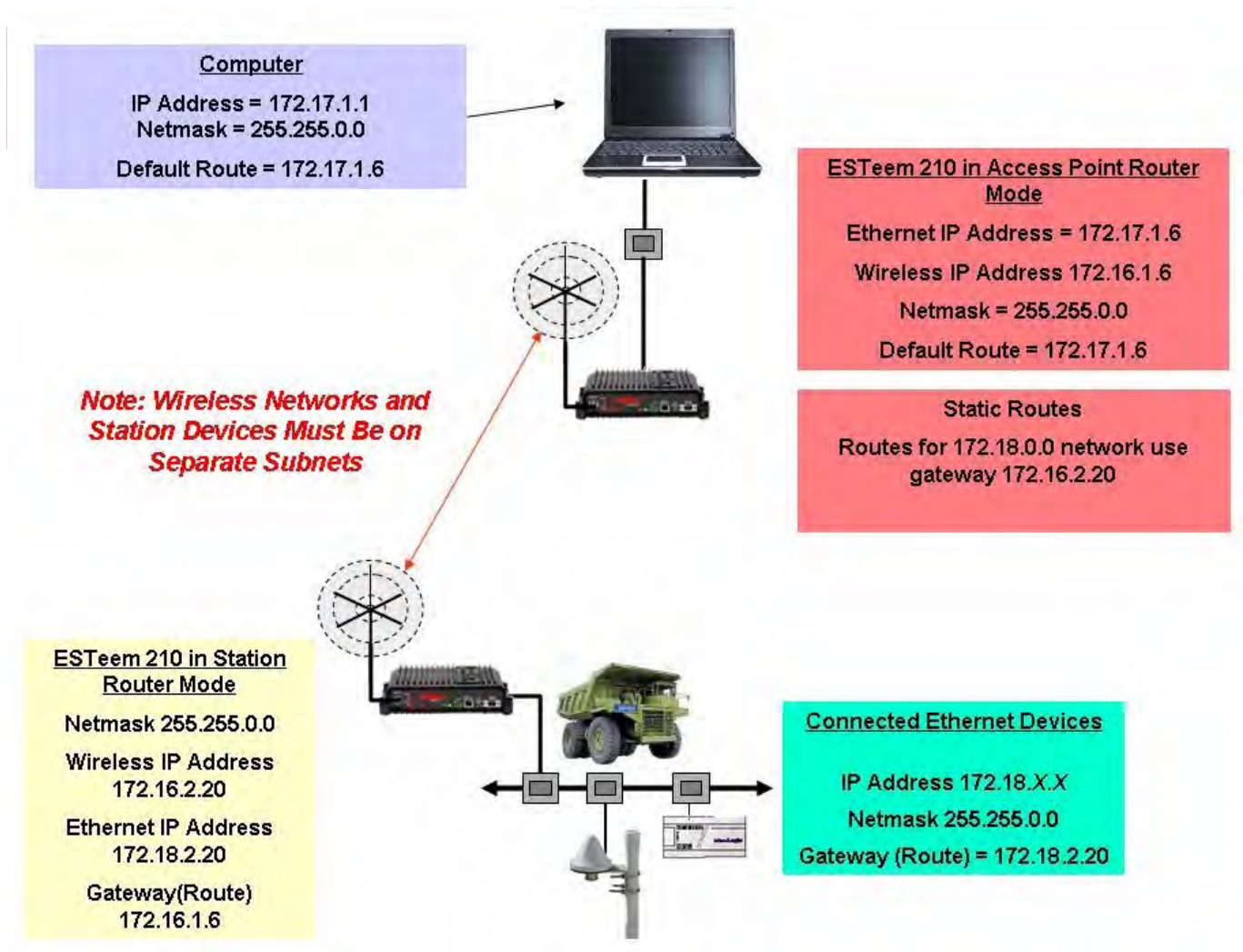


Figure 28: Station Router Addressing Example

Stand-Alone Access Point Router with Multiple Station Routers

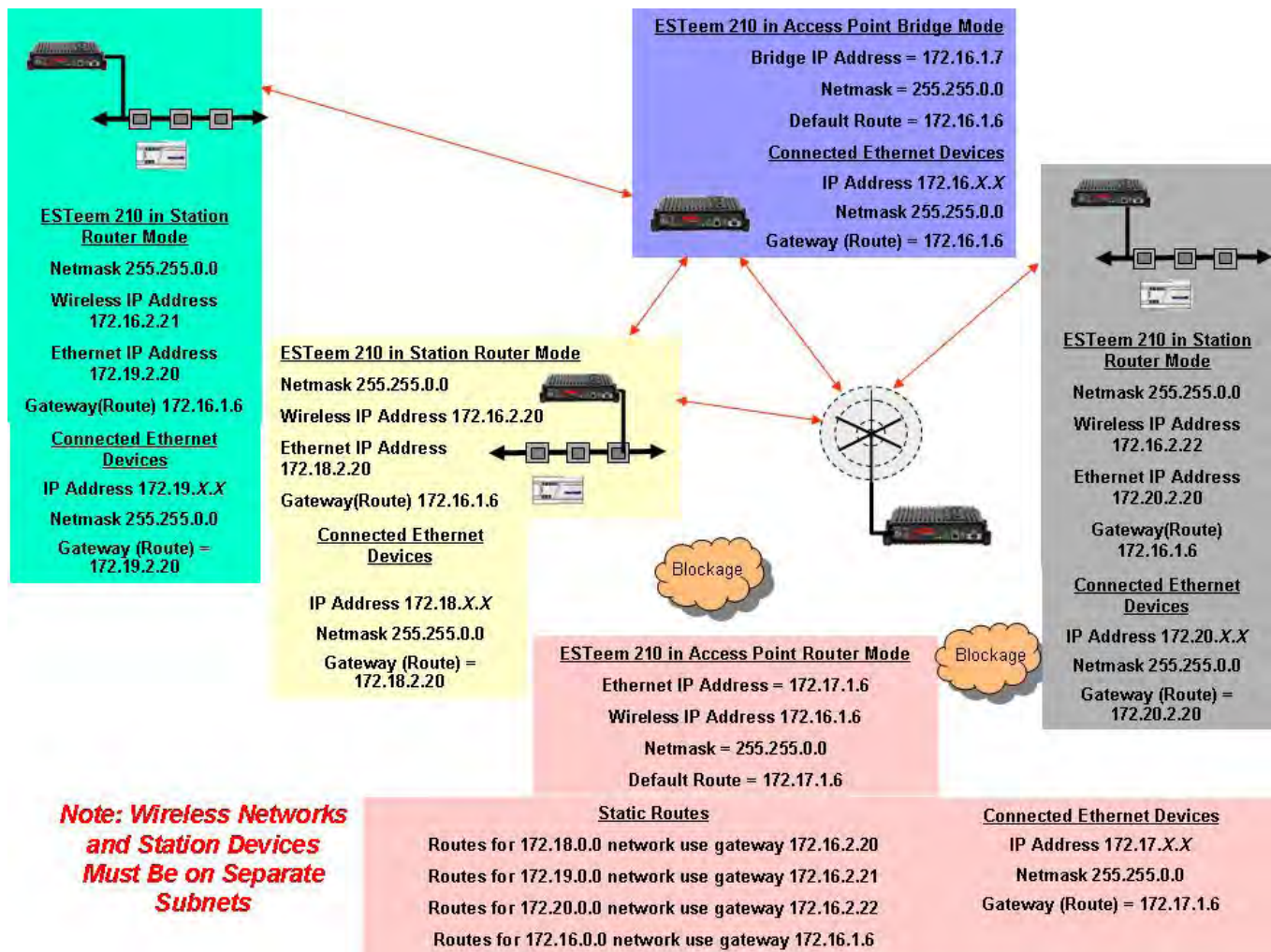


Figure 29: Complete Router Addressing Example

ESTeem Network Configuration Utility (ENC)

The ESTeem Network Configuration (ENC) Utility is a software program designed to greatly simplify the configuration of your ESTeem Model 210 wireless Ethernet network. The ENC Utility will allow graphical, point-and-click configuration of your network routing, then configure each ESTeem wireless modem for the network as designed (Figure 1). The ENC Utility will eliminate the need to program or update each ESTeem wireless modem individually. The ENC Utility can send all wireless modem configuration changes simultaneously to a new or existing network.

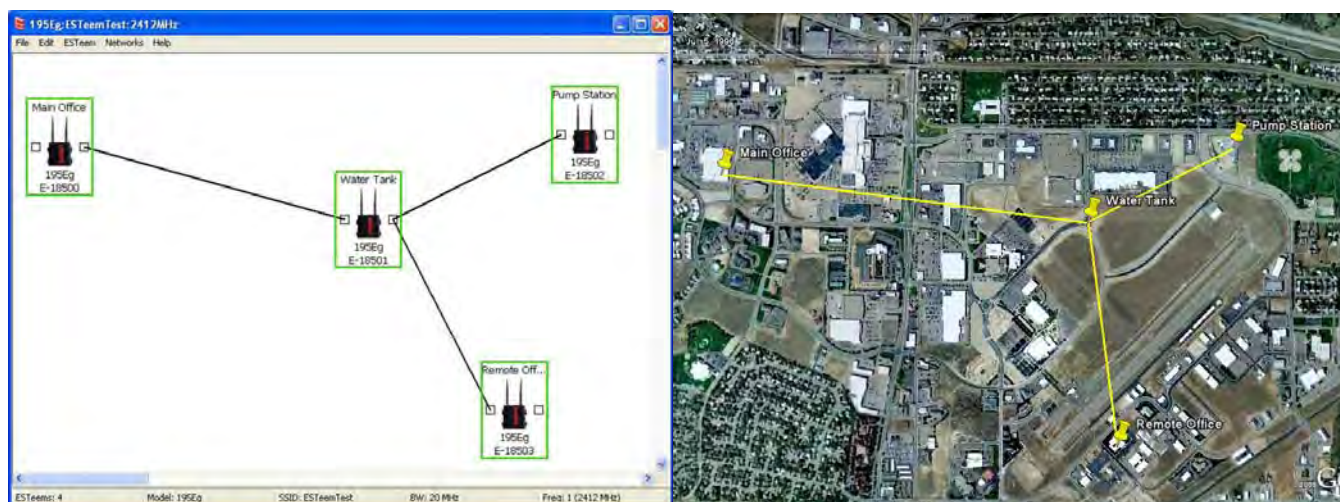


Figure 1: ESTeem Network Configuration Utility

The ENC Utility will be used for all wireless network programming in this User's Manual. For detailed instructions on the use of the ESTeem Network Configuration (ENC) Utility please refer the ENC Utility User's Guide available on the ESTeem Resource CD or in the application itself.

ESTEEM DISCOVERY UTILITY

The ESTeem Discovery Utility will allow you to configure the IP address on the Model 210 to match your network regardless of its current IP subnet. This utility will also allow you to update the software in the 210 and open the web configuration for that wireless modem.

Installation

To install the Discovery Utility on your computer, insert the Resource Disk in your CD drive.

Note: The ESTeem Resource Disk is a stand-alone copy of the ESTeem Web site (Figure 2). Navigation of the Resource Disk is as simple as using your web browser. All technical documentation, User's Manuals and the ESTeem Utility Program are available on the disk.

1. Place the ESTeem Utility CD in your CD-ROM drive. The CD will auto load the ESTeem main page

Note: If the page does not auto load, open your web browser and set your address line to D:\index.html (Where D: is the drive letter for your CD-ROM drive).

2. From the Main Page select ESTeem Utilities and click on ESTeem Discovery Utility (Figure 3).



Figure 2: ESTeem Resource Main Page

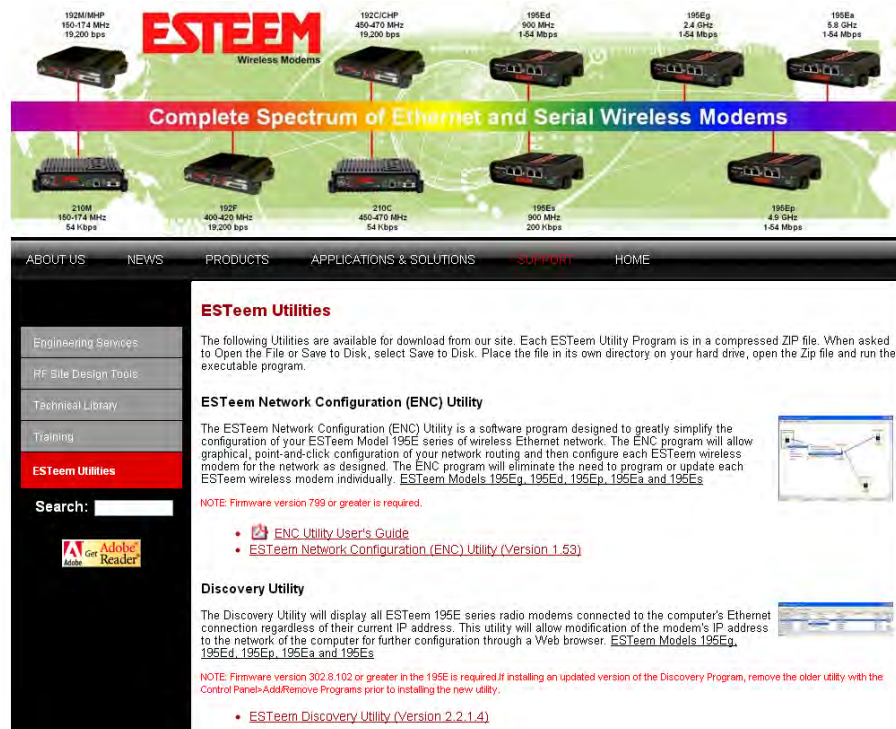


Figure 3: Discovery Utility Download

Note: This program is saved in a compressed file format.

- Double click on the 210DiscoverySetup<Current Version>.exe file listed in the window to install the program.

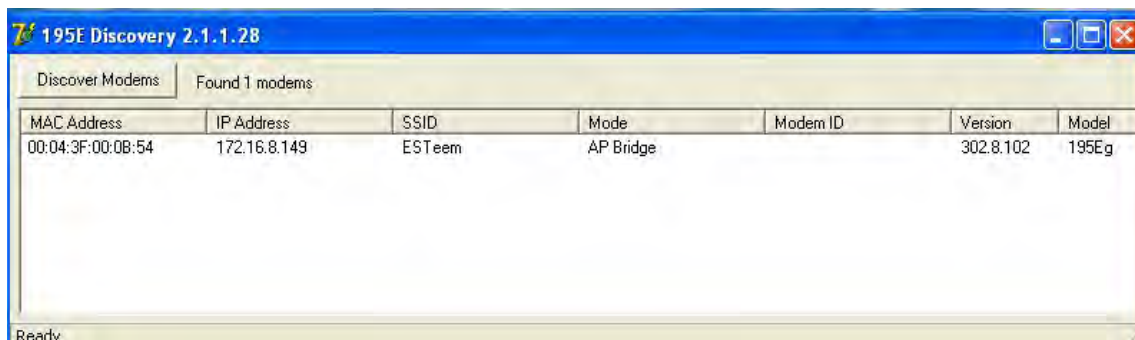


Figure 4: Discovery Program Main Page

- Connect the Model 210 to your computer either directly to the Ethernet card or through a HUB/Switch using a CAT-5e Ethernet cable. The Ethernet port on the 210 supports Auto-Negotiation, so either a patch cable or crossover cable will work. Open the ESTeem Discovery Program and press the Discover Modems button. The Model 210 will be displayed in the program by the Ethernet MAC address and Current IP Address (Figure 4).

Note: The SSID, Mode of Operation and Modem ID will be adjusted through the ENC Utility or the Web Configuration Manager...

- Double-click on the 210 you want to program and the *Configure IP Address* window will be displayed (Figure 5). Enter an IP address and Subnet Mask for the 210 that matches your network subnet and press the **OK** button to save this to the ESTeem. You will receive notification that the Configuration was Successful and the 210 will reboot.

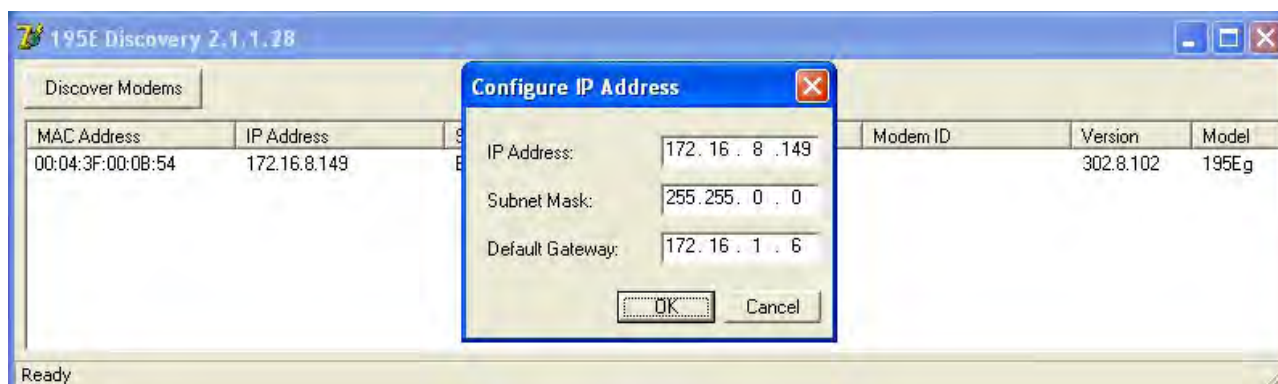


Figure 5: Change IP Address Window

Firmware Updates

To update firmware on any ESTeem Model 195 that is shown on the Discovery program, “right-mouse” click on the 195’s MAC address and select Update from the menu (Figure 6). Once you locate the update file, select the Open button and the 195 will update, validate and then reboot with the updated operating system.

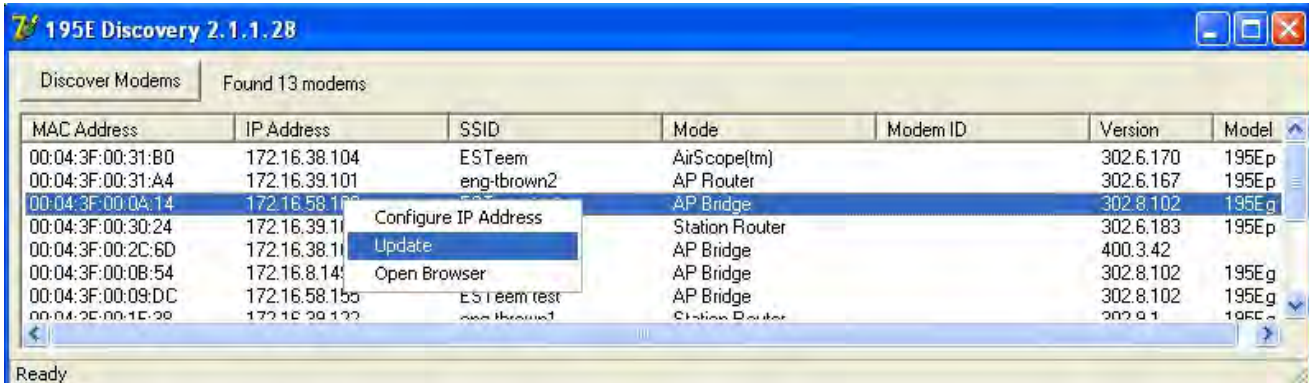


Figure 6: Discovery Features Menu

Opening Web Browser

To quickly open a web browser page to the IP address programmed in the 195 modem, “right-mouse” click on the 195’s MAC address and select Open Browser from the menu (Figure 6). If your computer is configured for the same IP subnet at the ESTeem 195 wireless modem, you will be asked to sign in with the Username and Password (Figure 7). You can now begin programming the Model 195 for your application.



Figure 7: ESTeem Web Page Log-on Screen

ETHERSTATION STATUS PROGRAM

When configured for EtherStation mode, the Web Configuration Manager is turned off. To gather information from the 210 on Access Point, link status and received signal strength you will need to install the ESTeem 210 Status Utility. The EtherStation Status Utility version 2.0.0.0 or greater provides a new feature that will automatically program the connected ESTeem 210 to match up with the computer running the software. This software requires the ESTeem 210 to have software version 302.8.102 or greater installed for this feature to function.

This software program is found on the AA109 Resources Disk or available from the ESTeem web site. To install the utility, please complete the following:

Installation

The ESTeem Discovery Utility will allow you to configure the IP address on the Model 210 to match your network. Install the Discovery Utility on your computer by inserting the Resource Disk in your CD drive.

Note: *The ESTeem Resource Disk is a stand-alone copy of the ESTeem Web site (Figure 1). Navigation of the Resource Disk is as simple as using your web browser. All technical documentation, User's Manuals and the ESTeem Utility Program are available on the disk.*

1. Place the ESTeem Utility CD in your CD-ROM drive. The CD will auto load the ESTeem main page.

Note: *If the page does not auto load, open your web browser and set your address line to D:\index.html (Where D: is the drive letter for your CD-ROM drive).*

2. From the Main Page select ESTeem Utilities and click on EtherStation Status Utility

Note: *This program is saved in a compressed file format. Microsoft Windows XP® will open the file directly, but other operating systems will require a common compression program such as WinZip available for download at <http://www.winzip.com>*

3. Double click on the 210StatusSetup.exe file listed in the window to install the program.
4. Connect the Model 210 to your computer either directly to the Ethernet card or through a Switch using a CAT-5e Ethernet cable. The Ethernet port on the 210 supports Auto-Negotiation so either a patch cable or crossover cable will work. Open the ESTeem Status Program. Status icons will appear in your system tray (Figure 8). When the status menu is opened from the system tray, the status window will be displayed (Figure 8) to show the Access Point MAC address and signal strength. The tray icon and Signal Strength bar will display the colors from Green, Yellow to Red on progressively poorer signal or will show Grey if roaming.

Note: *This Utility will only operate with an ESTeem Model 210 in EtherStation mode.*

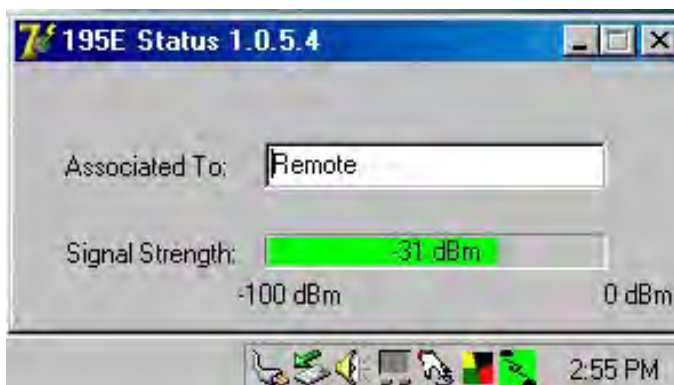


Figure 8: EtherStation Status Program

SETTING LOCAL TIME

The ESTeem Model 210 will be shipped from the factory with the internal real-time clock set to Pacific Time. To change the clock settings to the local time for accurate log file entries:

1. Select **Advanced** from the top Menu, then **Wireless LAN Settings>wlan0 device**. Press the Next button (Figure 9).
2. Select **Global Settings>Set System Time** from the menu and press the Next button to continue.
3. Select the correct date and time from the drop-down menus (Figure 10) and press the Set System Time button to save the time to the real time clock.

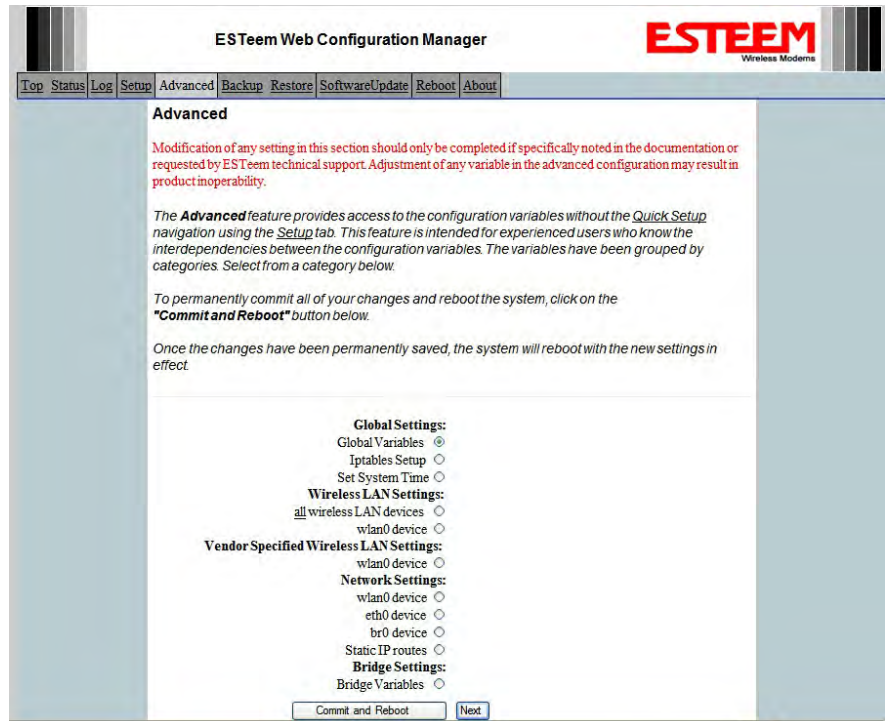


Figure 9: Advanced Features Screen

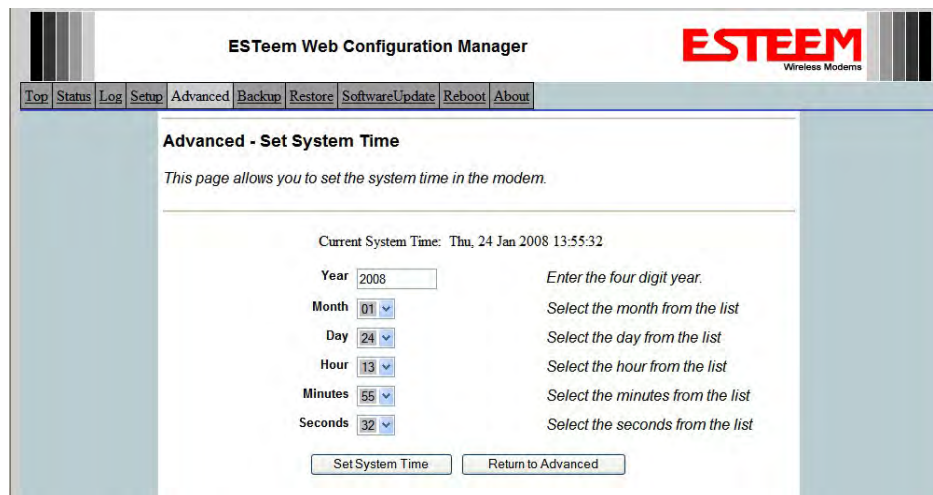


Figure 10: Advanced Features Screen

CONFIGURING TIME SERVER

Enabling NTP time synchronization services on the ESTeem 210 will allow usage of time services from upstream services to keep the time on the system accurate.

To allow time synchronization, the Model 210 must be configured with the NTP Daemon enabled and the appropriate IP address of the upstream network NTP server.

1. Select **Advanced** from the menu items and **Global Variables** (Figure 11).

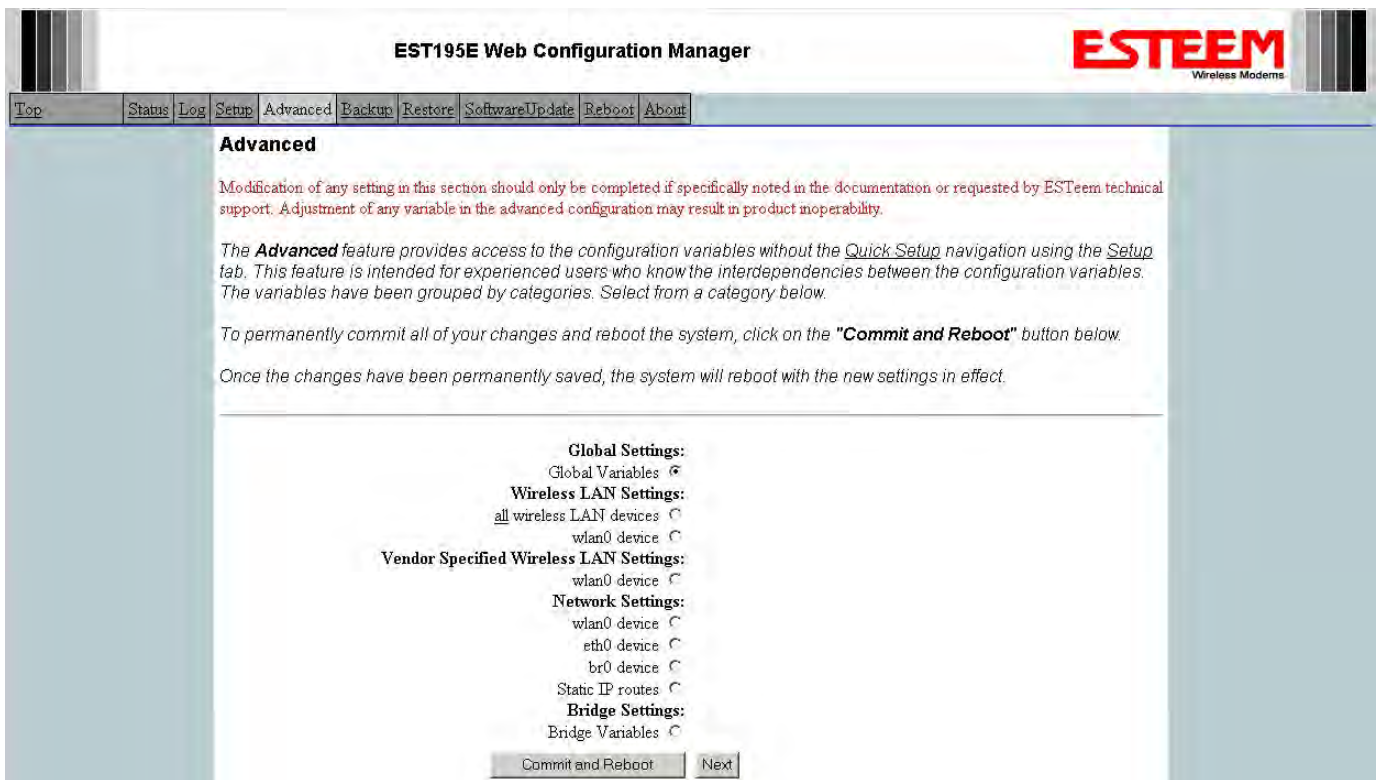


Figure 11: Advanced Settings Menu

2. Press the Next button and Figure 11 will be displayed. At the bottom of the page are the NTP server configurations.

3. The NTP daemon is enabled by selecting YES for **NTP ENABLE** (Figure 12). When enabled, the NTP daemon will use time services from upstream services to keep the time on this system accurate.
4. Next, the **NTP SERVICE ENABLE** should be configured to “YES,” if you want to allow the system to provide NTP service for clients wishing time synchronization (Figure 12).

The screenshot shows the ESTeem Web Configuration Manager interface in a Mozilla Firefox browser window. The URL bar shows <http://172.16.48.202/cgi-bin/avswsweb.cgi/advanced.htm>. The main content area displays various configuration options for network services. On the left, there are radio button controls for enabling or disabling several services. On the right, there are text input fields for specific configurations and detailed help text for each service.

Configuration Option	Value / Selection	Help Text
IP_NAT_INSIDEDEV	br0	Enter the name of a single device, separated by a single space, that will need to be configured with an IP address
IP_NAT_OUTSIDEDEV	eth0	Enter the name of a single device (e.g. wlan0 or eth0)
HTTP_ENABLE	<input checked="" type="radio"/> Yes	Select whether you want to enable the HTTP server
HTTPS_ENABLE	<input type="radio"/> Yes <input checked="" type="radio"/> No	Select whether you want to enable the secure HTTP server
TELNETD_ENABLE	<input checked="" type="radio"/> Yes <input type="radio"/> No	Select whether you want to enable the TELNET daemon
SSHD_ENABLE	<input checked="" type="radio"/> Yes <input type="radio"/> No	Select whether you want to enable the SSH daemon
NTP_ENABLE	<input checked="" type="radio"/> Yes <input type="radio"/> No	Enable/Disable the network time protocol (NTP) daemon. When enabled, the NTP daemon will use time services from upstream services to keep the time on this system accurate.
NTP_SERVICE_ENABLE	<input checked="" type="radio"/> Yes <input type="radio"/> No	Enable/Disable NTP service. When enabled (and NTP_ENABLE is true), this system will provide NTP service for clients wishing time synchronization.
NTP_SERVER	pool.ntp.org	Enter the IP address or the host name of the upstream NTP server. If you are directly connected to the Internet, it is strongly recommended that you enable DNS client services (commonly enabled by default when using DHCP service), and use the NTP server name "pool.ntp.org". This enables a round-robin DNS resolution that provides load balancing across a very large set of NTP servers. For more information see http://www.pool.ntp.org

At the bottom of the configuration area, there is a button labeled "Return to Advanced".

Figure 12: NTP Settings

5. The final step in configuring NTP services is to enter the IP address or the host name of the upstream NTP server.

6. Once configuration is complete, press the Return to Advanced button.
7. To complete the configuration, select “Commit and Reboot.” The ESTeem 210 will now commit the configuration changes and reboot. (Figure 13)

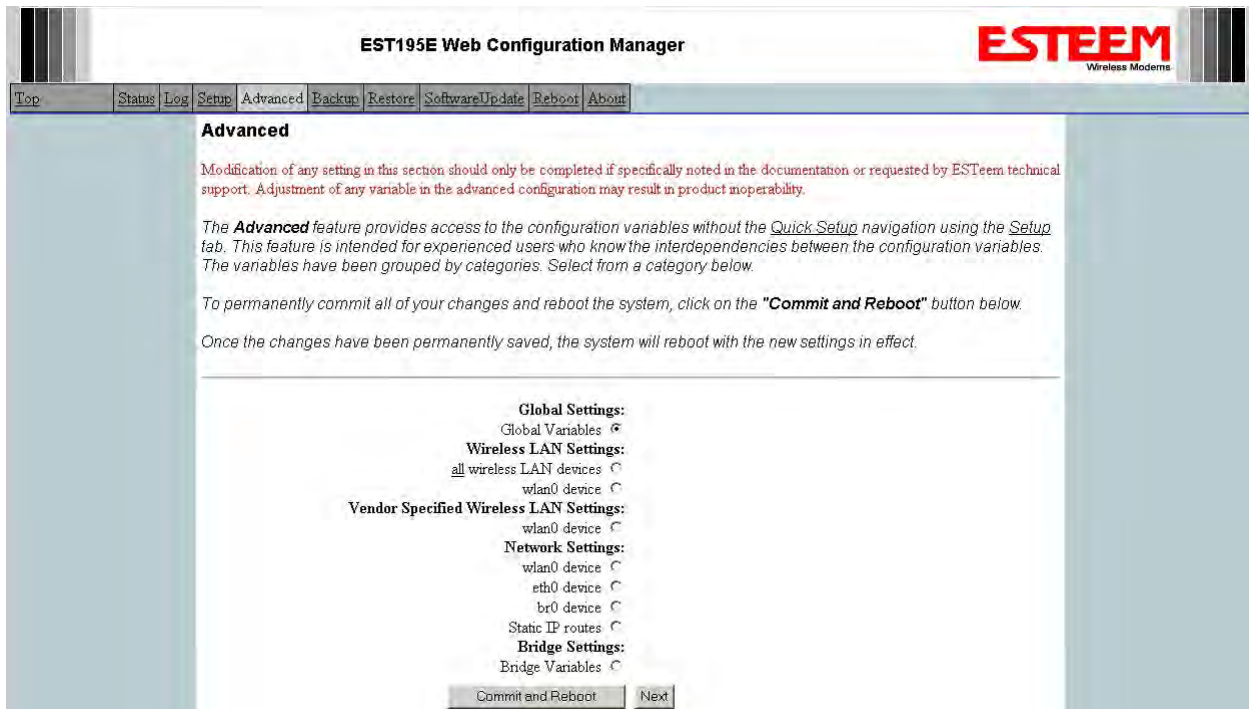


Figure 13: Advanced Settings Menu

Simple Network Management Protocol (SNMP)

The ESTeem 210 supports SNMP Version 1 (SNMPv1) and Version 2 (SNMPv2c) protocol. This protocol enables any SNMP server to view the status of the wireless network while the system is in operation. The following are a list of the Management Information Base (MIB) items that are supported in the ESTeem 210 and their MIB location:

MIB Name	MIB Directory Location	Notes
System Temperature	EST-MIB::sysInternalTemp.0	in C * 1000
Uptime	HOST-RESOURCES-MIB::hrSystemUptime.0	System Update
ModemID	EST-MIB::sysIdentifier.0	User-specified "nickname" for ESTeem
Serial Number	EST-MIB::sysSerialNumber.0	ESTeem serial number
Model	EST-MIB::sysModel.0	ESTeem model number
Firmware Version	EST-MIB::sysFirmwareRevision.0	Firmware revision
System Mode	EST-MIB::sysMode.0	AP_BRIDGE/STA_ETHERSTA, etc
Free Memory	UCD-SNMP-MIB::memTotalFree.0	Total Free Memory
Idle CPU	UCD-SNMP-MIB::ssCpuIdle.0	Percentage of CPU Idle
[[per-interface]]		
IP Address	IF-MIB::ifAddress	
Port Speed	IF-MIB::ifSpeed	In bps
Port Status	IF-MIB::ifOperStatus	
Mac Address	IF-MIB::ifPhysAddress	
[[per-wlاندv entry]]	EST-MIB::wirelessDevicesNumber.0	Wireless Port Identification
Device Name	EST-MIB::wirelessDeviceTable.1.wName.1	Name of device (wlan0 standard)
MAC Address	EST-MIB::wirelessDeviceTable.1.wMacAddress.1	MAC address of WLAN port
Mode	EST-MIB::wirelessDeviceTable.1.wMode.1	Current Mode ap=access point, sta=station mode and airscope
Frequency	EST-MIB::wirelessDeviceTable.1.wFreq.1	Frequency in MHz
Bandwidth	EST-MIB::wirelessDeviceTable.1.wBandwidth.1	Bandwidth (5, 10, or 20 MHz if used)
SSID	EST-MIB::wirelessDeviceTable.1.wSSID.1	Service Set Identification
BSSID	EST-MIB::wirelessDeviceTable.1.wBSSID.1	Basic Service Set Identification
Operational Rates	EST-MIB::wirelessDeviceTable.1.wOpRates.1	List of RF Data Rates in Rate Set
Basic Rates	EST-MIB::wirelessDeviceTable.1.wBasRates.1	List of RF Basic Rates for status messages

[[peer table entry]]		All entries in the Peer Table will have a device entry index, both ESTeem and other wireless devices
	EST-MIB::wirelessPeersNumber.0	Total number of peer entries in table
wlan device	EST-MIB::wirelessPeerTable.1.pDevice.1	index into the wirelessDeviceTable (each entry will have a unique number)
Peer MAC Address	EST-MIB::wirelessPeerTable.1.pMacAddr.1	MAC address of peer
isRepeater?	EST-MIB::wirelessPeerTable.1.pRepeater.1	Is the peer an ESTeem repeater
isAP?	EST-MIB::wirelessPeerTable.1.pAP.1	Is the peer an Access Point
isAssocSta?	EST-MIB::wirelessPeerTable.1.pAssoc.1	Is the peer an Mobile Client
isAdhoc?	EST-MIB::wirelessPeerTable.1.pAdhoc.1	Is the peer an AdHoc Station (802.11 only)
Frequency	EST-MIB::wirelessPeerTable.1.pFreq.1	Frequency in MHz
current rate set	EST-MIB::wirelessPeerTable.1.pCurRates.1	Current Operating Rates
last rx signal	EST-MIB::wirelessPeerTable.1.pSignal.1	Receive Signal in -dBm
last rx noise	EST-MIB::wirelessPeerTable.1.pNoise.1	Background Noise in -dBm
BSSID	EST-MIB::wirelessPeerTable.1.pBssid.1	Basic Service Set ID (In Hex)
SSID	EST-MIB::wirelessPeerTable.1.pSSID.1	SSID in Text
isValid?	EST-MIB::wirelessPeerTable.1.pCurrent.1	True if peer info is for a "current" peer.
last rx	EST-MIB::wirelessPeerTable.1.pLastRxl.1	seconds since last received packet from peer
last tx	EST-MIB::wirelessPeerTable.1.pLastTx.1	seconds since last transmitted packet to peer
current tx rate	EST-MIB::wirelessPeerTable.1.pCurrentRate.1	current tx rate in bps.

Downloading MIB Tables

To download the MIB items listed above and import into your SNMP server, log into any ESTeem 210 and select the **About** page (Figure 20). Press the Download MIB Files hyperlink on the page and save the files to your computer.

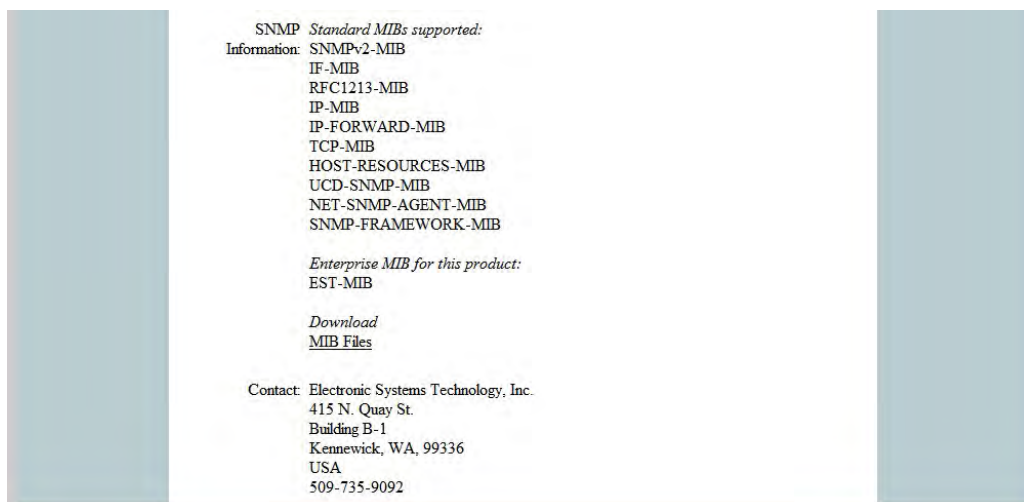


Figure 14: MIB Table Download

The ESTeem Model 210 Web Configuration Manager is an internal web server that will allow setup, monitoring and diagnostics of all operating parameters in the Model 210. The 210 can be configured using any current web browser software such as Internet Explorer, Mozilla, FireFox or Google Chrome®.

LOGGING ON TO THE ESTeem WEB PAGE

1. Using your Web Browser connect to the Model 210 Web Page with the IP Address that you have assigned it in Chapter 3.
2. You will now see the Log-on Menu on Figure 1. To enter the Model 210 Top Menu you will need to log into the system with a User Name and Password.
3. For the User Name enter **admin** and press the Enter key (<Enter>). The User Name is defined at the factory and is not changeable.
4. Enter your Password and press the Enter key (<Enter>).



Figure 1: ESTeem Web Page Log-on Screen

Note: If this is the first time the Model 210 has been programmed and the Password was not changed from the factory default values, proceed with the steps below to access the Configuration Menu. The factory default Password is also admin. Enter admin for the Password and press the Enter key (<Enter>). All characters are lower case.

5. After Log-in the next screen displayed will be the Model 210 Top Menu page (Figure 2). This example screen shows the Top Menu screen.

Note: Throughout the Configuration Manager are Help Screens that can be accessed for further information on each item.



Figure 2: Top Menu Screen

WEB CONFIGURATION MANAGER SECTIONS

The following sections will describe the features in each of the main and sub menu items in the web pages. For step-by-step examples of how to configure the Model 210 in different Modes of Operation, please refer to Chapter 3 – Example Applications.

Top Menu

The Top Menu will be the default web page for the Model 210 Web Configuration Manager (Figure 2). This section will display the current configuration summary for the Model 210 and allow changing of the default password. This page will also display the Modem ID field that can be used to easily identify the 210 you are programming. This Modem ID field can be set to any text combination for example, location name, GPS coordinates or addresses.

Setting the Modem ID

1. The Modem ID field can be adjusted under the *Global Variables* of the Advanced Menu tab. Select Global Variables and press the *Next* button. Figure 3 will be displayed.
2. Scroll to the bottom of the Global Variables window and enter the text you would like displayed in the Modem ID field (Figure 4). When complete, press the *Save Settings* button and the *Commit Changes* button on the next screen to save the name to the 210.

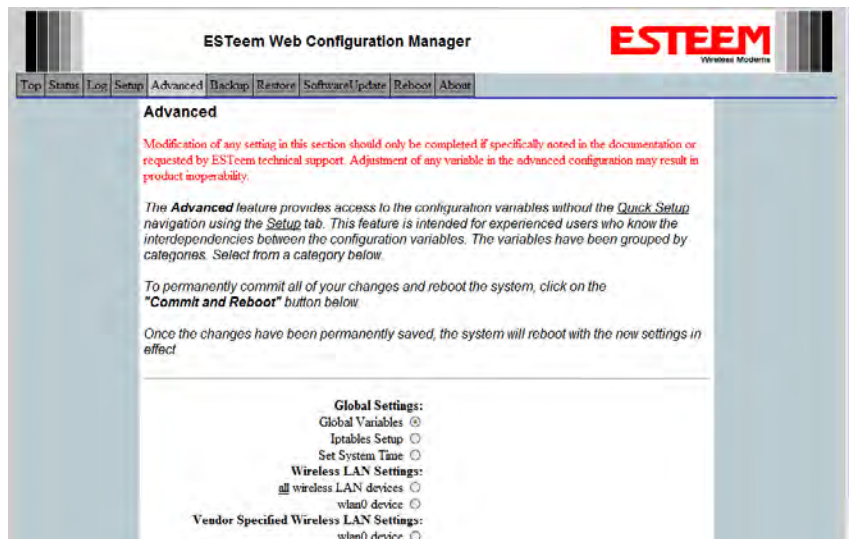


Figure 3: Global Variables Screen

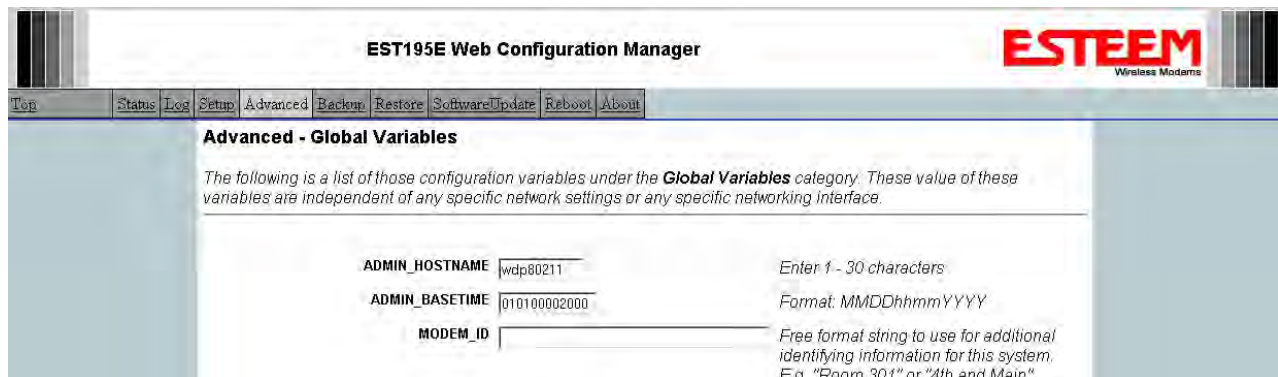


Figure 4: Modem ID Field in Global Variables Screen

Status Menu

The Status Menu provides a summary of the current mode of operation, system time, processor usage, internal temperature and status of the communication links to other wireless devices. An example is shown below in Figure 5. Most of the communication troubleshooting is done in this section of the Web Configuration Manager.

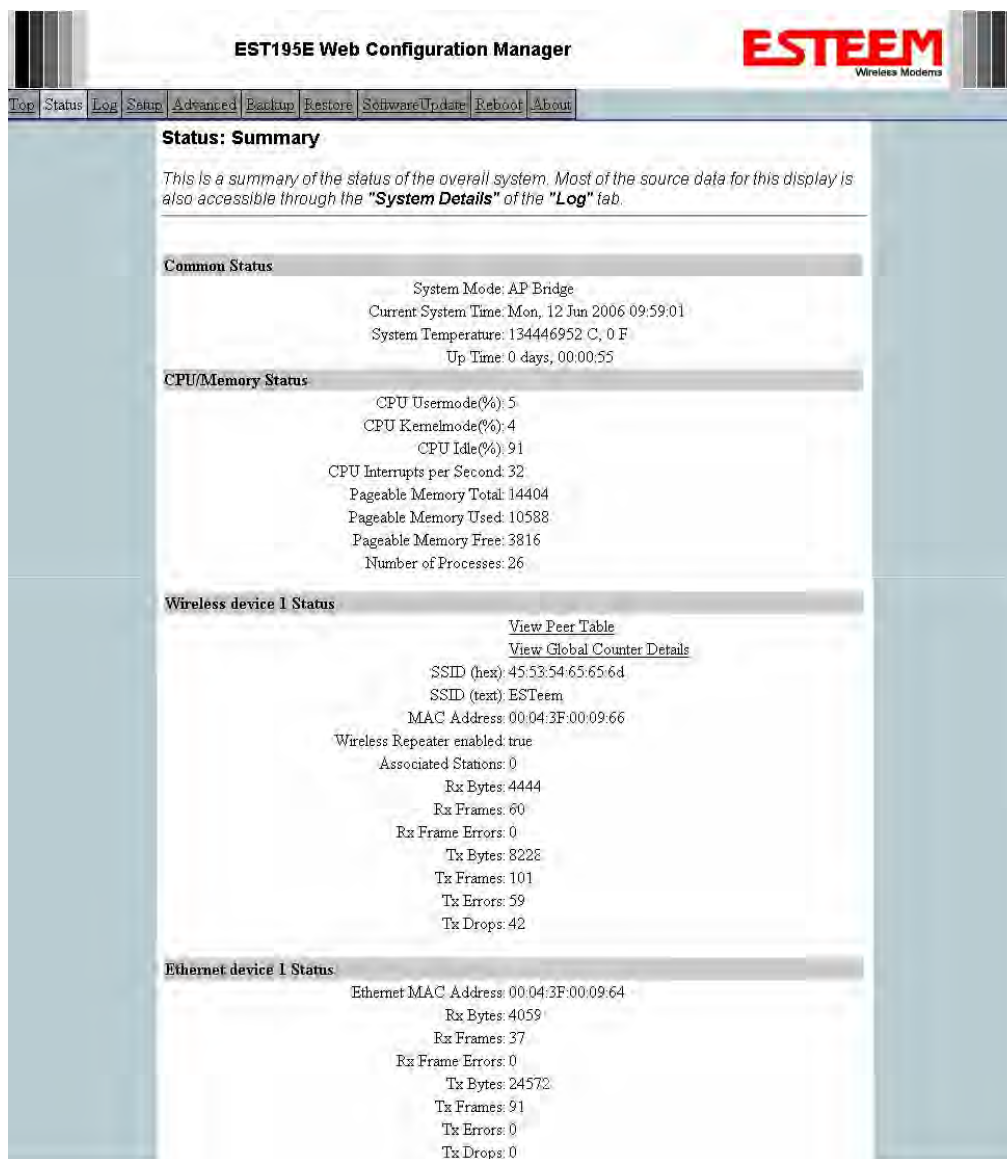


Figure 5: Status Screen

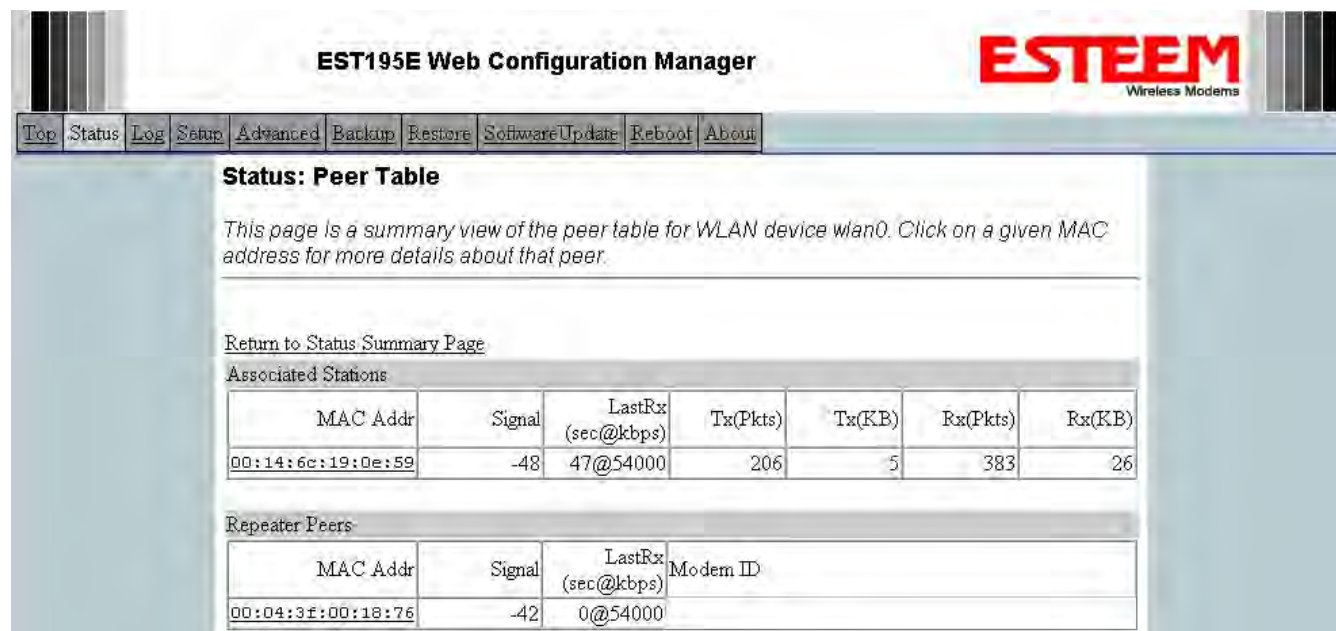
Peer Status Table

The Peer Status submenu lists the connected wireless devices (Model 210's or 802.11 clients), their signal strength, data rate and time of last packet sent. Press the [View Peer Table](#) link and Repeater Peer Status Table will be displayed (Figure 6). For a detailed analysis of the information provided in this table, please review Appendix E – Troubleshooting.

Associated Station – This section will list all the associated stations that are attached to the Access Point. These could be other Model 210's in one of the three Client modes or 802.11 devices.

Repeater Peers – This section will list all connected 210 repeater peers by their Wireless MAC address. For detailed information on repeaters, see Chapter 6 – Repeating Features.

Access Points – This section will list all other 802.11 Access Points that are sharing the operating channel (frequency) of the 210. You can also note that the Repeater Peers listed above are also included in this list.



EST195E Web Configuration Manager

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Status: Peer Table

This page is a summary view of the peer table for WLAN device wlan0. Click on a given MAC address for more details about that peer.

[Return to Status Summary Page](#)

Associated Stations

MAC Addr	Signal	LastRx (sec@kbps)	Tx(Pkts)	Tx(KB)	Rx(Pkts)	Rx(KB)
00:14:6c:19:0e:59	-48	47@54000	206	5	383	26

Repeater Peers

MAC Addr	Signal	LastRx (sec@kbps)	Modem ID
00:04:3f:00:18:76	-42	0@54000	

Figure 6: Peer Table Screen

Counter Details

The Counter Details submenu will summarize all transmitted and receive data packets for the Model 210 (Figure 5).

System Log Screen

The Log Screen is a trouble-shooting tool that shows the current log of Model 210 system messages. See Figure 7. The System Details button will display a more detailed system diagnostics that may be requested by ESTeem technical support.



Figure 7: System Log Screen

Setup Screen

The Setup screen allows the step-by-step configuration of the Model 210. Please see Chapter 5 for complete description on System Setup menu and examples for system configurations. See Figure 8.

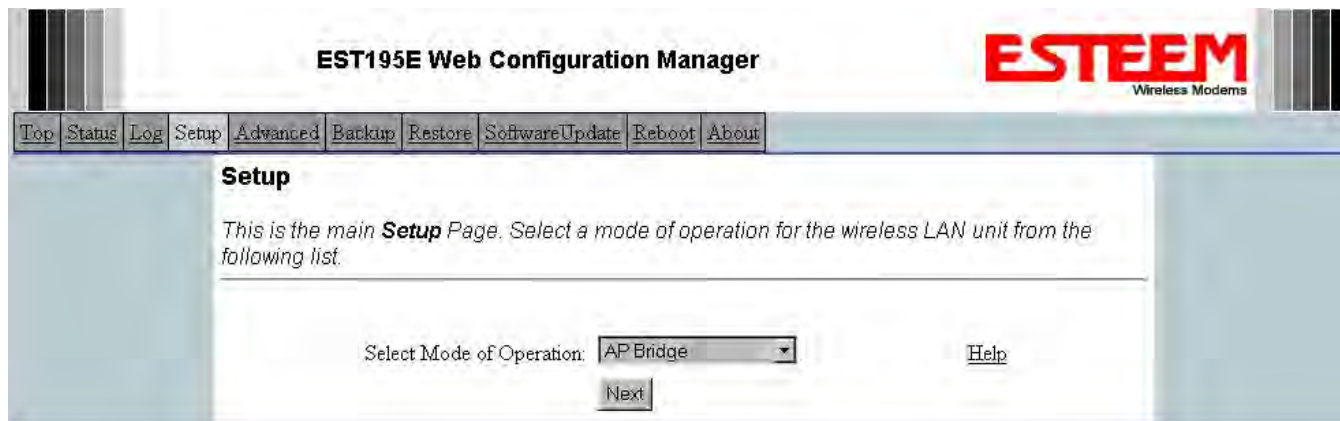


Figure 8: Setup Screen

Advanced Configuration Screen

The Advanced screen allows the user to access all configuration parameters. The parameters are grouped based upon their variable. It is recommended that only advanced users of the Model 210 enter this section unless instructed by ESTeem technical support. See Figure 9.

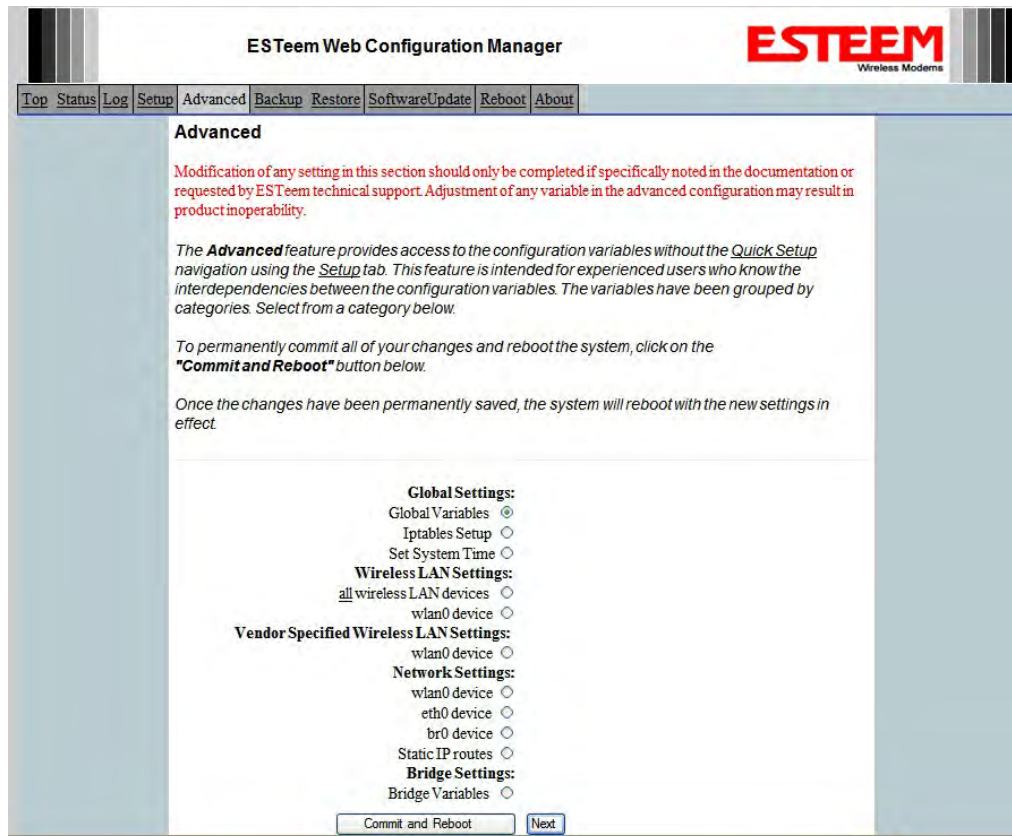


Figure 9: Advanced Features Screen

Backup Screen

The Backup Screen saves the current configuration in the Model 210 to a file on the computer or network. See Figure 10. Pressing the Backup Button will create a configuration file that can be saved to the computer. This saved file can then be later opened, if necessary, by the Restore menu to quickly replace a Model 210 with a spare modem.



Figure 10: Backup Screen

Restore Screen

The Restore screen is used to restore the 210 to factory defaults, return to the last saved configuration or to access the configuration files that were backed up to the computer. See Figure 11.



Figure 11: Restore Setting Screen

Factory Default – Returns the Model 210 to all factory default values.

Last Committed Changes – This button will remove any changes to the modem that have been done since the last committed changes. The last committed changes will be read from the Flash file and reset in the Model 210.

File – Pressing this button will bring up a selection of where the restore file was saved during the Backup (Figure 12). Select “Upload via web browser” to browse for files saved on a local computer or select “Download from an http or ftp URL” for files saved on a network or over the Internet.



Figure 12: Restore From Local File Screen

Software Update Screen

The Software Update feature allows the user to update the latest Model 210 operating system software from a file supplied by the factory or the Internet to the Model 210's flash memory. To upload from a file on your computer, select *Upload via web browser* and a file selection window will be displayed. To upload directly from the Internet, select *Download from an http or ftp URL* and enter the site address. See Figure 13.



Figure 13: Software Update Screen

System Reboot Screen

The Reboot screen allows the user to reset the Model 210. See Figure 14.

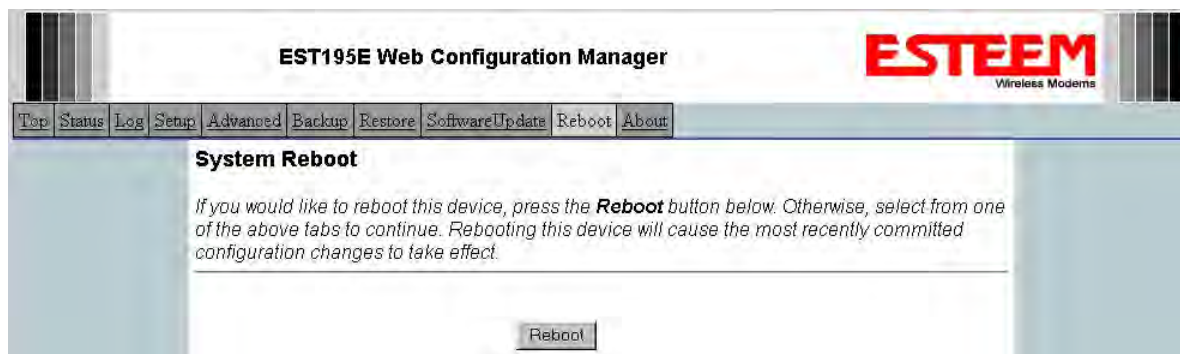


Figure 14: System Reboot Screen

USING THE USB PROGRAMMING PORT

Any terminal emulation program can be used for this configuration of the ESTeem 210 through the USB port. Most Windows users will probably use either Hyper Terminal or the Terminal Emulation in the ESTeem Utility program.

Programming Using the USB Port

1. When configuring the Model 210 for the first time you can use the ESTeem Configuration Menu to setup the basic operating parameters such as assigning the IP Address, IP Net Mask, and Gateway IP Address.
2. Connect the USB cable between the USB connector on the Model 210 to an open USB port on the computer.
3. Plug the Model AA174 power supply into a wall socket and connect an Ethernet patch cable from the Model 210 Ethernet port to the J1 (Data&PWR) port on the power supply. The Power LED on the front of the ESTeem should be illuminated.
4. If your computer is configured properly, you will see the ESTeem Model 210 booting sequence on your Terminal Emulation program. Once the ESTeem boot sequence is complete (approximately 45 seconds) you will receive this message:

“Please press Enter to active this console.”

If you don't see this message press the Reset button on the front panel of the Model 210 and/or check the programming of your RS-232 port.

5. Press the Enter key and you will be at the Configuration Menu 210 login prompt. See Figure 1.
6. To enter the Model 210 Main Menu you will need to log into the system with a login name and password.
7. If this is not the first time configuration of the Model 210, see your network systems administrator for the password.
8. At the 210 login prompt type ***admin*** for the login name and press the Enter key (<Enter>). ***The login name is defined at the factory and is not changeable by the user. Note that all characters are lower case.***

If this is the first time the Model 210 has been programmed or the Password was not changed from the factory default values, the factory default password is also ***admin***. Enter ***admin*** for the password and press the Enter key (<Enter>). The ESTeem Configuration Welcome Screen (Figure 2) will now be displayed. ***Note that all characters are lower case.***

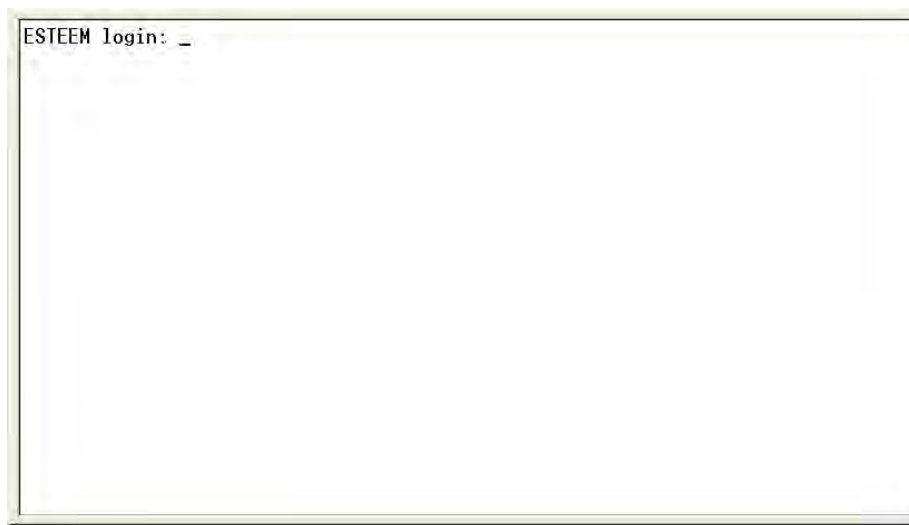


Figure 1: RS-232 Port Log-in Screen

9. To set the IP address in the ESTeem 210, type the letter “A” and press the Enter key. Enter the value for the IP address, Netmask and default route pressing the Enter key after each entry.

```
ESTEEM login: admin
Password:
a) Configure ethernet (and reboot)
b) Ping a host
c) Restore factory defaults (and reboot)
d) Log
e) Show devices
f) Reboot
q) Quit
Enter selection: _
```

Figure 2: RS-232 Welcome Screen

10. After the basic parameters have been entered into the Model 210 you will need to commit the changes to the Model 210 (Figure 3). Press the C key and then Enter. The changes will be saved to flash memory. You can use programming features in the ESTeem Web Configuration Manager to configure the unit for your application.

```
ESTEEM login: admin
Password:
a) Configure ethernet (and reboot)
b) Ping a host
c) Restore factory defaults (and reboot)
d) Log
e) Show devices
f) Reboot
q) Quit
Enter selection: a
eth0      Link encap:Ethernet  HWaddr 00:04:3F:00:26:DC
Enter IP address: 172.16.38.8
Enter netmask: 255.255.0.0
Enter default route: 172.16.1.6
Commit/Redo/Undo [c/r/u]: c_
```

Figure 3: RS-232 Welcome Screen

USING THE RS-232 DATA PORT

The ESTeem 210 has a serial data port that can provide RS-232 communication between two or more serial devices using the wireless broadband link. The serial data is encapsulated and transferred as a standard Ethernet packet over an operating 210 wireless Ethernet system. The configuration for a serial 210 network will be the same as an Ethernet or a serial (RS-232) based communication network.

The serial interface option can be used to link two or more serial devices in a new or existing system. The serial data has very little impact on the network bandwidth and will allow for both Ethernet and serial applications simultaneously. A possible application would be installation of the 210 in an existing serial based network that was looking for future upgrade to an Ethernet based system. Another would be using the high-bandwidth Ethernet connections to provide a link to remote video hardware while also providing a serial link to the existing PLC in a SCADA type application.

SERIAL CONNECTIONS

The 9-pin Sub-D serial data port is located on the face of the 210 (Figure 4). Using the ESTeem AA062 interface cable, the 210 can be connected to a standard DTE-device (PC) with a male 9-pin Sub-D connector. The complete cable configuration is available in Appendix C – Interface Ports.

SERIAL CONFIGURATION

Configuration of the serial port is completed during the standard setup of the 210. After completion of the Repeater Peer configuration screen, the Serial Port Setup screen (Figure 5) will be displayed. Each section in the Serial Port Setup screen is described in detail with the following:

Enable the RS-232 Data Port

Enabling the serial data port allows the modem to send RS-232 data over the broadband wireless connection established with the ESTeem repeater peers. The modem can be configured in a point-to-point or point-to-multipoint system. Select *Yes* if you wish to enable the serial data port.

Mode of Operation

There are two distinct modes of operation for the serial port in the 210. The Redirector mode will provide two-way serial communication between two or more serial devices, while the Terminal Server mode will allow serial communication to a specific remote site by connecting through telnet or SSH. Select one of the following modes of operation:

Full Redirector Mode - This mode allows bi-directional RS-232 data communication with other ESTeem Model 210's. The RS-232 data transmission will appear transparent to the connected devices as if a serial cable is connected between the two ports. This mode will also be used in a multi-point serial network where all serial devices will need bi-directional communication (Figure 6).

Terminal Server Mode - This mode of operation translates RS-232 serial data into a network-oriented terminal protocol, such as telnet or SSH. This mode would be selected if an interactive RS-232 session at remote locations is desired over the wireless Ethernet link.


Baud Rate

Select the data rate of the RS-232 connection to match your serial device.



Figure 4: 210 Front Panel Overview

EST195E Web Configuration Manager



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Setup

Select whether you want to enable the redirector for the external serial port device. If you choose to enable the redirector, then configure the remainder of the settings on the page.

Enable the serial data port?	<input type="radio"/> Yes <input checked="" type="radio"/> No	Help
Select the mode:	<input checked="" type="radio"/> Full Redirector Mode <input type="radio"/> Terminal Server Mode	Help
Select the baud rate:	<input type="radio"/> 2400 baud <input type="radio"/> 4800 baud <input type="radio"/> 9600 baud <input checked="" type="radio"/> 19200 baud <input type="radio"/> 38400 baud <input type="radio"/> 57600 baud <input type="radio"/> 115200 baud	Help
Select the number of data bits:	<input type="radio"/> 7 <input checked="" type="radio"/> 8	Help
Select the number of stop bits:	<input checked="" type="radio"/> 1 <input type="radio"/> 2	Help
Select the parity:	<input type="radio"/> Even <input type="radio"/> Odd <input checked="" type="radio"/> None	Help
Select the serial flow control:	<input type="radio"/> Hardware <input type="radio"/> Software <input checked="" type="radio"/> None	Help
Enter the maximum bridge links for multicast packets (1-255):	<input type="text" value="2"/>	Help
Enter the destination IP address for the serial packets (multicast address for multipoint system):	<input type="text" value="0.0.0.0"/>	Help
Enter the serial IP port number (1024-64535):	<input type="text" value="1412"/>	Help
Enter the maximum packet size in bytes (1-1024):	<input type="text" value="1"/>	Help
Enter the number of milliseconds (10-10000) of silence for packetization:	<input type="text" value="250"/>	Help
Select whether to use delimiter character 1:	<input type="radio"/> Yes <input checked="" type="radio"/> No	Help
Enter delimiter character 1 (00-F hex):	<input type="text" value="00"/>	Help
Select whether to use delimiter character 2:	<input type="radio"/> Yes <input checked="" type="radio"/> No	Help
Enter delimiter character 2 (00-F hex):	<input type="text" value="00"/>	Help
Enter whether the terminal server should read/generate modem control lines:	<input type="radio"/> Yes <input checked="" type="radio"/> No	Help

Figure 5: Serial Configuration Screen

Data Bits

Select the number of data bits on the RS-232 connection to match your serial device.

Stop Bits

Select the number of stop bits on the RS-232 connection to match your serial device.

Parity

Select the parity of the RS-232 connection to match your serial device.

Flow Control

Select the type of data flow control used on the RS-232 connection. The ESTeem can support Hardware flow control (RTS/CTS control lines) or Software Flow Control (XON/XOFF). Select None if no serial flow control is necessary.

Maximum Bridge Links for Multicast Packets

This value sets the maximum number of Ethernet bridge links that the multicast packets will be sent through when used in a multi-point system. A multi-point serial network uses multicast packets (UDP) to send the data to more than one remote ESTeem. You want to limit the number of network bridge links that these UDP packets will be passed through to make the network more efficient.

If you are using multiple ESTeem repeater links to send the serial data to remote locations, the value for the maximum bridge link needs to be increased to a number greater than the longest repeater chain. For example, if you are using four repeater (peer) links to send the serial data between two or more sites the number will need to be five (5) or greater (Figure 4).

Destination IP Address

The ESTeem configured for the correct destination IP and port number will send and receive the serial data from another modem. Set the destination IP address for the ESTeem where the serial data will be sent. If sending to more than one ESTeem (Multipoint) set to a multicast address (i.e 224.0.0.1).

Note: If you are using the ESTeem 210 in a multipoint application (multicast), you must have default Gateway configured in the ESTeem set to the IP address of the Root Bridge modem.

Serial IP Port Number

The ESTeem configured for the correct destination IP and port number will send and receive the serial data from another modem. Set the IP port numbers to match where the serial data will be sent. The serial data will not be sent if both the IP address and port number is not correct.

Maximum Packet Size

This number represents the maximum size of the serial data packet in bytes. If the number of bytes of data in the serial port buffer exceeds the maximum packet size before the timer or delimiter character is reached, the ESTeem will send forward the serial packet. For example, if the maximum packet size is set to a value of 100, when the serial port receives 100 bytes the data will be sent through the wireless connection.

Number of Milliseconds for Packetization

This number represents the time the ESTeem will hold data in the serial data buffer before sending to the remote ESTeem. This feature is generally used if the serial data does not have a consistent packet length or delimiter character. For example, if the number of milliseconds is set to a value of 10 the ESTeem will monitor the incoming serial data stream and any break in characters longer than 10 milliseconds will cause the data will be sent through the wireless connection.

Delimiter Characters

Enabling and specifying a delimiter character will transmit the data in the serial buffer when the delimiter character is recognized in the serial data stream. There are two unique delimiter characters that can be configured and enabled independently.

Terminal Server Control Lines

Enabling this feature will allow the ESTeem in the Terminal Server mode to read and generate modem control lines to the connected device.

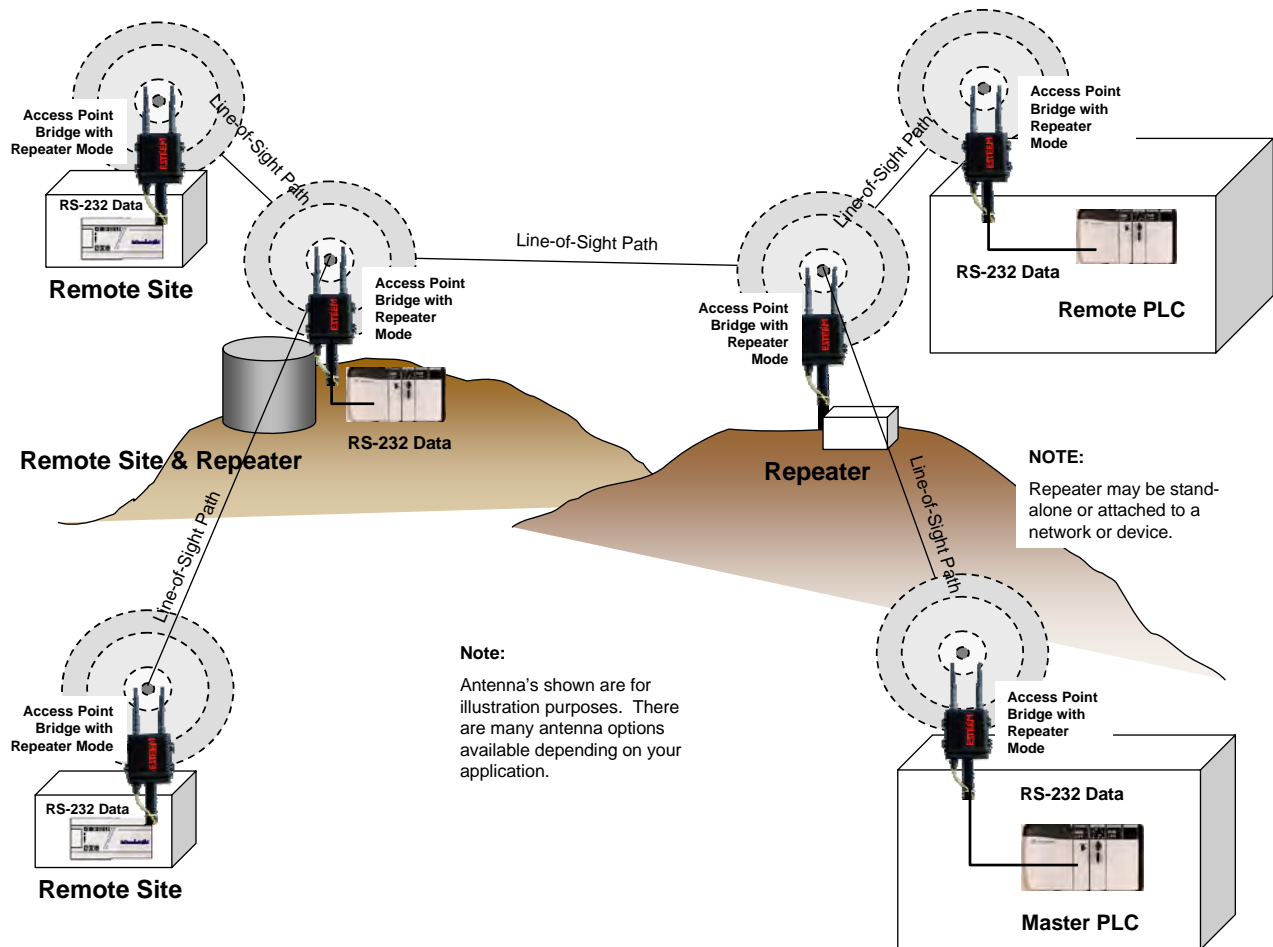


Figure 6: Serial Full Redirector Example

When programmed in any of the three Access Point (AP) Repeater Modes, the Model 210 will create a wireless network with other Model 210 units in radio range that are programmed in the AP Repeater Peer table during setup. This feature adds the increased functionality of repeaters to the typical Ethernet Bridge configuration.

ESTEEM MESH NETWORK

One of the most powerful features of the AP Repeater Mode is the ability to input multiple communication routes and designate the priority for each of these routes to create a wireless Mesh network. The ESTeem Model 210 will automatically change communication routes in the network if a route has failed. The new route will be based upon the priority level set during configuration. This wireless Meshing technology allows the RF network to “self-heal” if any of the communication paths fail.

The routing priority is manually set during the configuration of the 210. A manual path configuration is far superior to standard “self-discovery” networks, because you have direct control over the best RF paths and can easily identify any failed routes for easy troubleshooting. For example, Figure 1 shows a typical wireless Ethernet system used in the Water/Waste Water Industry. The problem with a standard “self-discovery” Mesh network is the selection of routes. Notice that the communication between the Water Plant (Site A) and Pump Site D has a marginal link, but it is the most direct route between the Ethernet devices.

This scenario poses the question, which path will the network select? The ESTeem Mesh Network takes out the guessing games by allowing the user to select and prioritize all communication routes in the system. In our example we would want the primary link to go through Tank B (Repeater) and use the direct link only if this primary link fails. The following sections will show how this completed.

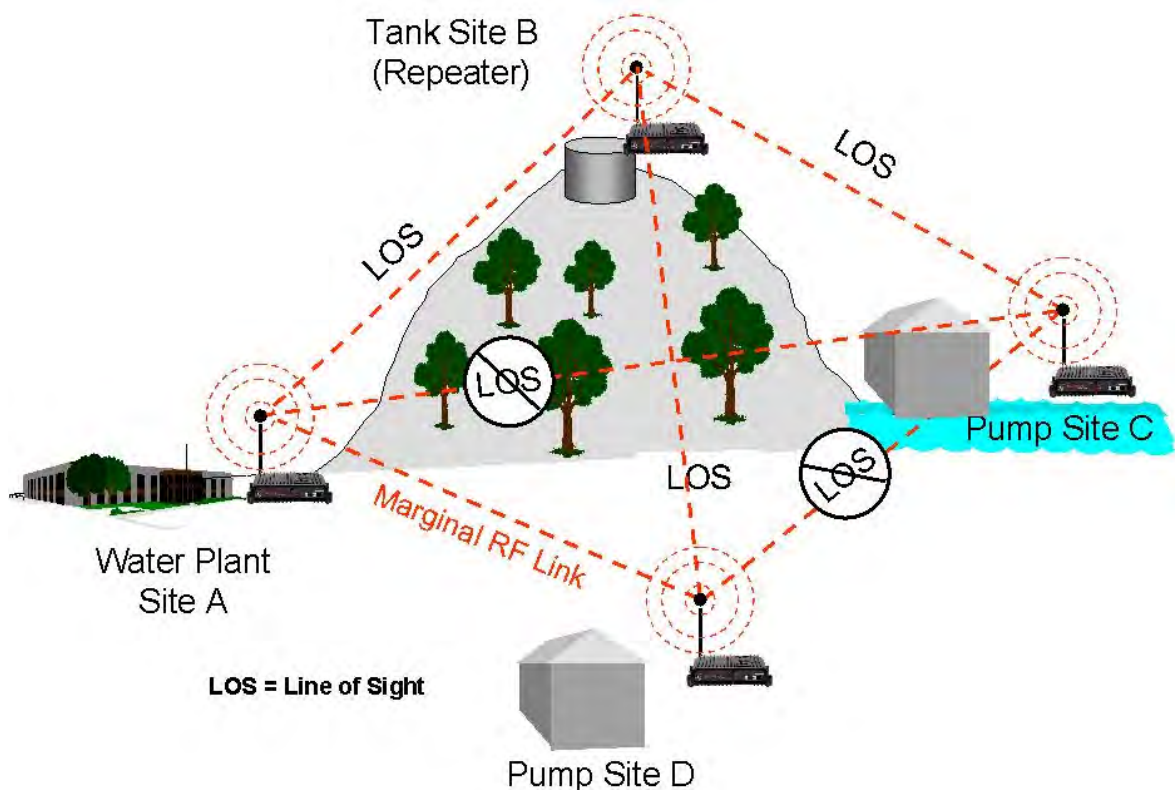


Figure 1: Small Mesh Network Diagram

Configuration

The configuration of the repeater paths is completed during setup of the Access Point modes. All three Access Point modes support repeating and Meshing features. The Mesh network configuration using the ESTeem Network Configuration (ENC) Utility is shown in detail in Chapter 3 of this User's Manual.

ESTeem Web Configuration Manager

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Setup - Add a Repeater Peer

To add a new repeater peer for the **wireless** LAN interface, enter the WLAN MAC address, the path length, the key type, the key and the rate set and click the "Create Repeater Peer" button.

Enter the WLAN MAC address:
 Enter a 48-bit MAC address containing 6 colon separated hex bytes

Enter the path length (1-256):

Select the encryption type: ☐ None
☐ WEP 64-bit
☐ WEP 128-bit
☐ TKIP
☒ CCMP
 Select the repeater link encryption method. Note: the encryption method and key setting must be the same on both repeater peers.

Enter the encryption key:
 Enter the encryption key as a sequence of hexadecimal bytes (e.g. 0a:0b:1c:2d:3e). Key length: None=0 bytes, WEP64=5 bytes, WEP128=13 bytes, TKIP=32 bytes, CCMP=16 bytes.

Select link data rate:
 1 Mbps
 2 Mbps
 5.5 Mbps
 6 Mbps
 9 Mbps
 Allow dynamic rate selection or select a specific data rate for this link to use. It is recommended, but not required, that the rate selections be the same on both peers.

Enable/disable link: ☒ Enable
☐ Disable
 Enable/disable the repeater peer link. Enable must be selected for the repeaters to communicate.

Figure 2: Repeater Configuration Example

You can also configure the Mesh networking directly through the web configuration setup (Chapter 5). Figure 2 shows an example repeater peer table from the setup menus. For an ESTeem 210 to communicate with another ESTeem 210, select **Yes** must at **Enable Repeater Capability**. Next, the Wireless LAN (WLAN) MAC address of each Model 210 that will have direct communications must be added to the Repeater Peer List. Finally, **enabling the link** allows the corresponding 210 to be included in the communication routing. Mobile clients do not require input in the repeater peer table. If multiple Mesh routes are configured, you will also need to set the values for Priority and Path Costs (explained in Spanning Tree below). For multiple examples of repeater configurations, please refer to Chapter 3 of this user's manual.

RAPID SPANNING TREE PROTOCOL (RSTP)

The ESTeem Model 210 uses Rapid Spanning Tree Protocol (RSTP - IEEE 802.1d) to determine the radio routing structure of the wireless network. This RSTP functions the same as standard Spanning Tree Protocol (STP) listed below, but the network recovery is three times faster. If the 210 is used in a network that has any older STP only modems, the entire network will be STP.

SPANNING TREE PROTOCOL (STP)

The ESTeem Model 210 uses standard Ethernet Spanning Tree Protocol (STP) or Rapid Spanning Tree Protocol (RSTP) to determine the radio routing structure of the wireless network. The primary purpose of STP/RSTP is to make sure that “network loops” are not created. A network loop is having two communication paths to the same destination where the remote device would receive the same data multiple times. If there were no way to control the data flow, this data would be constantly passed around this loop causing a “packet storm” that would shut down the entire network. The Spanning Tree Protocol will block all these redundant links.

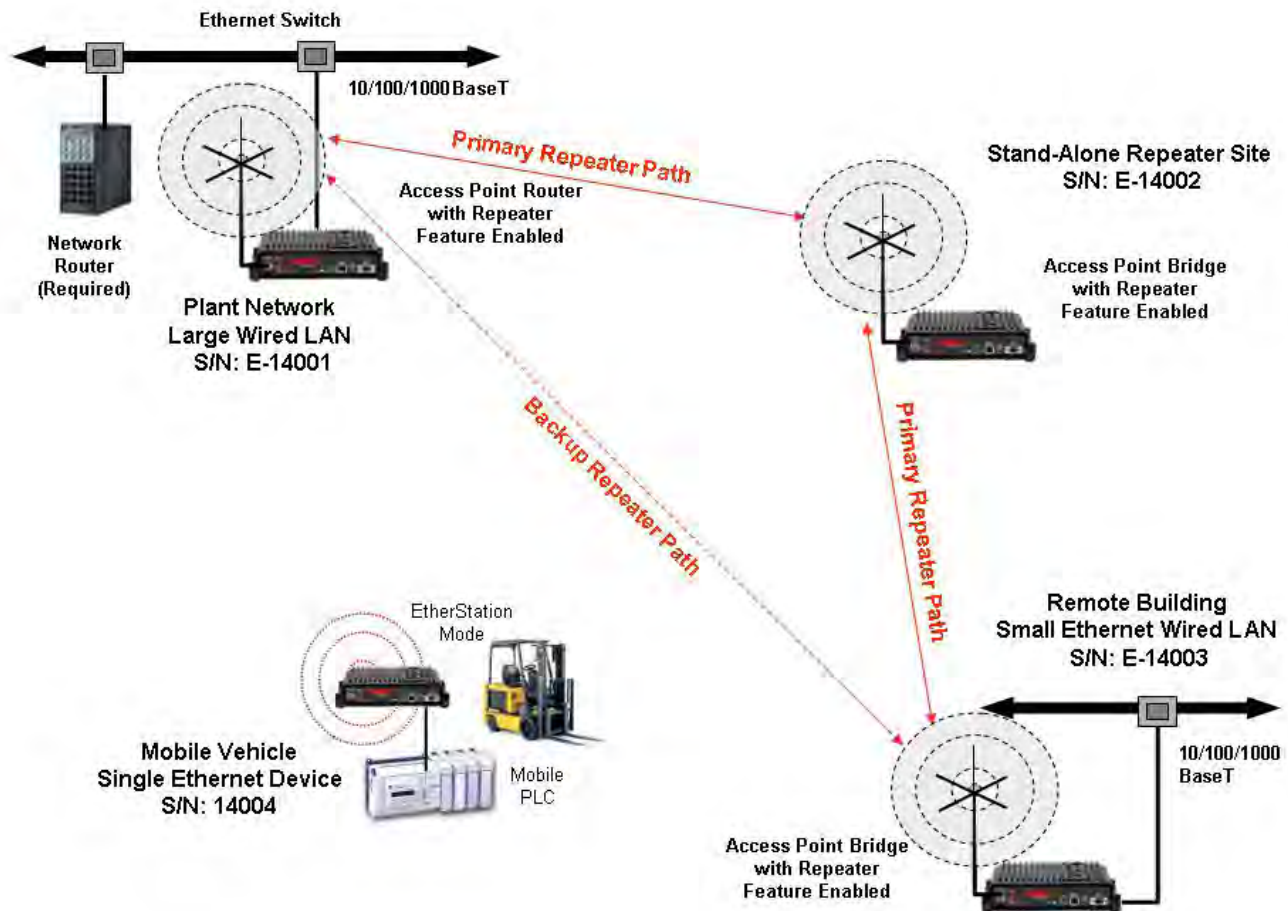


Figure 3: Programming Example #1 Diagram

The STP operation begins by determining which Ethernet device on the network will be the Root Bridge. All Ethernet networks have a Root Bridge that is selected by the lowest MAC address. All path costs are evaluated against this Root Bridge device to determine routing and which paths will be blocked. On a wired Ethernet network, the location of the Root Bridge is not really

important, but in a wireless network selection of the Root Bridge is critical to the wireless network routing. Let's use one of the Example network diagrams from Chapter 3 to continue the discussion (Figure 4).

STP Phases

The following sections describe the process of the STP in the ESTeem Model 210 as how it would happen in the above example.

Learning Phase - Once properly configured, each Model 210 will begin to search out the other Model 210 units in radio range that are programmed in the AP Repeater Peer table. All Model 210's will calculate their routes to every Model 210 in the network based upon the lowest "path length" to the Root Bridge. Path length is the total number of wireless links (repeater peer links) to transmit a packet through the wireless network to the Root Bridge. ***Note: The Root Bridge in a network should be the Model 210 where the majority of the data flow is processed.*** In every wireless network of two or more radios, the Root Bridge should be user defined. If not defined, the ESTeem 210 with the lowest MAC address will be designated as the Root Bridge.

In Figure 4, the Plant network (Example 1) is the most logical location for the Root Bridge based upon the amount of data flow. Setting this site as the root bridge is discussed below in Root Bridge.

Blocking and Forwarding Phase - To ensure you do not have a network loop situation due to redundant paths in your wireless network, the Model 210 will recognize and disable (block) one or more redundant links and provide back up links should the primary link fail. This establishes a wireless mesh network with a series of forwarding links, based upon the shortest path length to the Root Bridge.

For example, looking at Figure 4, the Remote Building has two routes to the Root Bridge (Plant Network - Example #1); directly to the site and through the repeater. The direct link between the two sites is the shortest route (lowest Path Length) and will be selected as the primary route unless overridden by manually changing the Path Length in the configuration.

Path Length

If more than one communication path to the Root Bridge is found, the 210 must determine which route to take based upon the lowest Path Length. The default path length to all links in the 210 network is 1. If the Path Lengths are equal then the lowest MAC address will determine the priority route. In the ESTeem Mesh Network we want to directly control all data flow so do **not** want the routes to be automatically determined.

Looking again at our Example in Figure 4, if we made no changes to the default path length of 1 (note values in Figure 3) the lowest path cost would be direct from the Remote Building to the Root Bridge (Plant Network).

Link Description	Total Path Length
Direct from Remote Building	1
Remote Build to Root Bridge Through Repeater	2 (Length 1 to repeater + Length 1 to Master = 2)

To configure the 210 to select the repeater as the primary radio path, set the path length value for the direct link greater than 2 (such as a value of 3) to make this the primary radio path. The lowest path length will identify the highest priority. The Model 210 will use this routing, but also switch to direct communication if the repeater were to disappear.

Root Bridge

In any Access Point Repeater network consisting of more than two sites, one Model 210 should be designated as the Root Bridge. Only one Model 210 can be designated as the Root Bridge in a given network and should be located where the majority of the Ethernet data flow is processed. This site may be the Master location in a SCADA network or could be configured at a repeater site. Selection is important because all Model 210's **NOT** configured as the Root Bridge will choose routing based upon the Path Length to the Root Bridge. If you have any question as to which site in your AP Repeater application should be the Root Bridge, contact ESTeem Customer Support at 509-735-9092 or e-mail your application to support@esteem.com.

The Root Bridge will be selected in one of two ways: the Root Bridge can be manually set (recommended) during the configuration of the Repeater Peer table (Figure 3) **or** the Root Bridge designation will default to the lowest MAC address of all the Model 210's in the network. The manual Root Bridge configuration is located in the "Advanced Settings" section.

Redundant Backup

The ESTeem Model 210 configured in Access Point Repeater mode will automatically function as a redundant backup if two Model 210's are installed at the same location (Figure 4). If two Model 210's are connected to the same switch, one of the Model 210's will be **Blocked** when the Spanning Tree Protocol is completed. The network will continue to use this route until any problem with the original Model 210 is detected and the second Model 210 will begin operation at that site.

Redundant Master Configuration

The configuration in Figure 4 will also provide a redundant backup for the Master Site (Root Bridge). Configure both Model 210's as Root Bridges (see above) giving the primary Root Bridge a value of 1 and the secondary Root Bridge a value of 2.

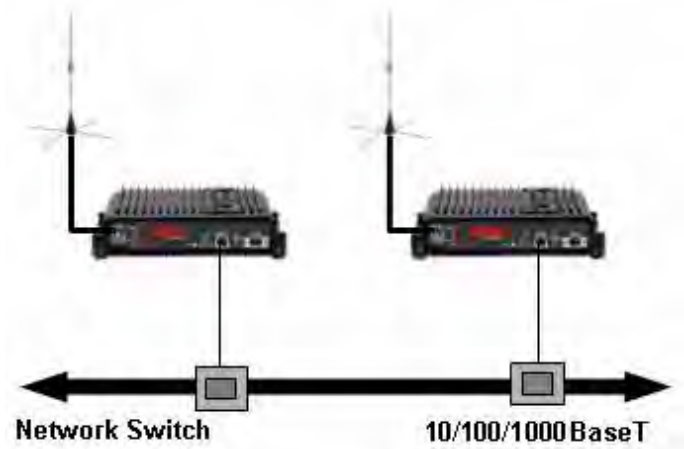


Figure 4: Redundant Backup Diagram

ESTeem offers different types of antennas ranging from $\frac{1}{4}$ wave to $\frac{5}{8}$ wave in physical size. The user choice is dependent on the application.

Communications in the VHF and UHF bands are normally over "*Line of Sight (LOS)*". Looking from the antenna of one wireless modem you must be able to see the antenna of the wireless modem you wish to communicate with. If a large object obstructs the line of sight view it is unlikely that satisfactory communications will result. This means you must relocate the antennas or use the REPEATER FEATURE and a second modem to go over or around the object.

The Model 210C and 210M products are allowed by the FCC to use high gain directional antennas.

It is noted that a $\frac{1}{4}$ wave antenna that does not have ground plane radials requires a ground plane to operate at maximum efficiency. This can simply be a conducting surface under the antenna that is a $\frac{1}{4}$ wavelength in diameter. For the Model 210C (450-470 MHz) this is approximately 6.5 inches. A conducting surface can be anything from the rooftop of an automobile to a file cabinet.

COAXIAL CABLES

To minimize signal loss, the overall length of the coaxial cable should be as short as possible. To avoid corrosion select coaxial cable manufacturers with tinned copper braid, where possible. Listed below are representative cable losses in db/100ft at the VHF and UHF frequencies:

Frequency (MHz)	RG-58u	LMR 195	RG-8 (solid)	LMR600	1/2" Heliax
150-174	-5.2	-4.4	-1.7	-0.964	-0.88
402-420	-8.4	-7.8	-2.9	-1.72	-1.36
450-470	-9	-7.8	-3	-1.72	-1.45

In a severe noise environment it may be desirable to use a double shield type of coax cable such as RG-214/U.

Note: *Pre-made coax cables can be purchased from the factory. A -3 dB loss means you have lost 1/2 of your signal. A +3 dB gain means you have doubled (x2) your signal.*

Keep the antenna feedline as short as possible to minimize losses.

Extreme care must be taken when attaching coax connectors to the antenna feedlines. If there is any error in making this connection the output of the transmitter will be greatly reduced.

WEATHER PROOFING COAX CONNECTIONS

1. Lightly coat the threads of the connectors with silicone lubricant prior to assembly (See Note 1) and hand tighten. Make sure to use the silicon sparingly so when assembled, any excess does not get on center conductor. Care should be taken not to get any lubricant on the center conductor.
2. Wrap the connector assembly with a non-adhesive silicone tape, EST part number AA243, for weather proofing (See Note 2 and instructions below).
 - a) Clean surface to be wrapped. Cut off length to be used.
 - b) Peel back a short length of protective film. Keep tape clean and dry.
 - c) Begin with one complete overlap of tape onto itself.
 - d) STRETCH CoaxWrap while continuing to wrap object with “half-laps”, removing clear film as you go (Figure 1). For greater pressure resistance, use 2 or more tightly wrapped layers.
 - e) End of tape at final wrap should be completely positioned onto itself.

Note: CoaxWrap's bond begins to cure immediately upon contact with itself. Repositioning or removal is not recommended after 2 minutes of wrapping.

3. Apply an electrical coating (sealing agent), over the vapor barrier patch for added protection (See Note 3).

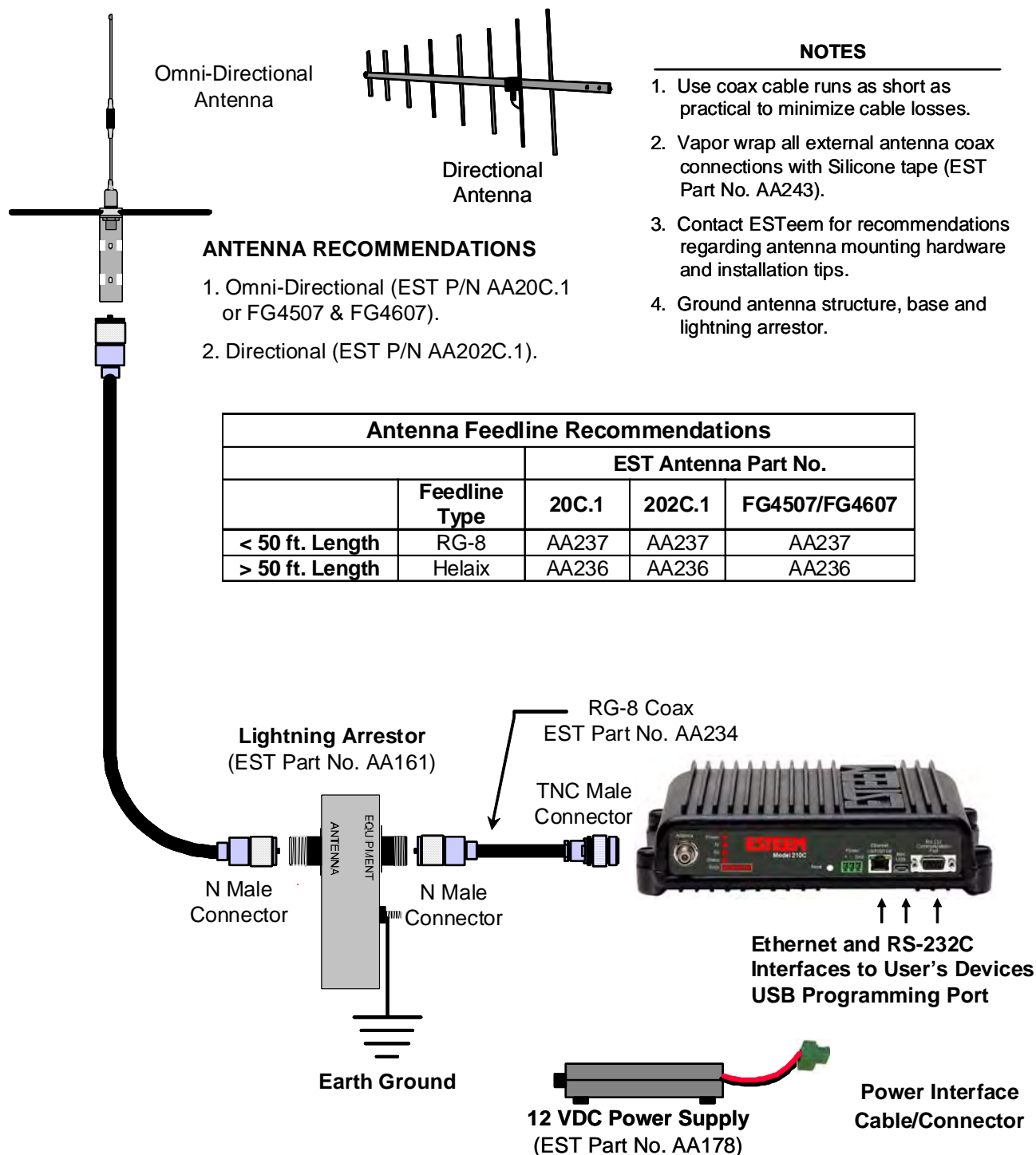
NOTES:

1. Dow Corning RTV-3140 or equivalent.
2. CoaxWrap, CW10B or equivalent.
3. SCOTCHKOTE, 3-M Company, or equivalent.



Figure 1: Installation Example

Model 210C Outdoor Fixed Base Hardware Diagram



INFORMATION TO USERS

WARNING: This equipment 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 generated, 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.

To insure compliance to FCC non-interference regulations, peripherals attached to this modem require shielded I/O cables.

If this equipment does cause interference to radio or television, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

1. Re-orient the radio/TV-receiving antenna.
2. Re-orient the modem antenna.
3. Relocate the modem with respect to the radio/TV-receiving antenna.
4. Plug the power supply for the modem into a different outlet so that the modem and radio/TV receiver are on different branch circuits.
5. Verify that the modem chassis is connected to an earth ground.
6. Attach a split bead (FAIR-RITE PN 2643164251) to the RS-232 cable.

If necessary, the user should consult the dealer or an experienced radio/TV technician for additional suggestions. The user may find the following booklet prepared by the FCC helpful.

"How to Identify and Resolve Radio-TV Interference Problems"

This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402 - Stock No. 004-000-00245-4. Application forms for the license are available from the nearest office of the FCC.

Electronic Systems Technology maintains a list of consultants that provide professional services at a reasonable cost to assists the users in licensing.

RF EXPOSURE WARNING: A minimum separation must be maintained between the user and nearby antenna at the following distances:

Antenna AA19C:	1 meter (40 inches)
Antenna AA20C.1:	1.25 meters (50 inches)
Antenna AA202C:	2.5 meters (100 inches)

Antenna AA19M:	1 meter (40 inches)
Antenna AA20M:	2 meters (80 inches)
Antenna AA202M:	2 meters (80 inches)

Type Acceptance and RF Emssions Information**Model 210C**

12.5 KHz Channel Spacing, 64,800 bps
FCC Type Acceptance No: ENPESTEEM210C
Industry Canada Type Acceptance: 2163A-ESTEEM210C
6.25 KHz Channel Emissions Designator: 6K00D7W
12.5 KHz Channel Emissions Designator: 11K3D7W

Model 210M

12.5 KHz Channel Spacing, 64,800 bps
FCC Type Acceptance No: ENPESTEEM210M
Industry Canada Type Acceptance: 2163A-ESTEEM210M
6.25 KHz Channel Emissions Designator: 6K00D7W
12.5 KHz Channel Emissions Designator: 11K3D7W

FEDERAL COMMUNICATIONS COMMISSION FIELD OFFICES

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Rm 240 Box 2955
Anchorage, AK 99510

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Interstate Office Park
4542 Ruffner St., Room 370
San Diego, CA 92111-2216

Los Angeles Office (LA)
Ceritos Corporate Tower
18000 Studebaker Rd., Room 660
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San Francisco Office (SF)
5653 Stoneridge Drive, Suite 105
Pleasanton, CA 94588-8543

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Denver Office (DV)
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1307 Federal Building
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Buffalo, NY 14202

NEW YORK

New York Office (NY)
201 Varick Street, Suite 1151
New York, NY 10014-4870

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1220 SW 3rd Avenue
Portland, OR 97204

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Room 404
2300 E. Lincoln Hwy
Langhorne, PA 19047-1859

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747 Federal Building
Carlo Chardon Ave.
Hato Rey, PR 00918

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Dallas Office (DL)
9330 LBJ Freeway, Room 1170
Dallas, TX 75243-3429

5636 Federal Building
515 Rusk Avenue
Houston, TX 77002

WASHINGTON DC

Columbia Office (CF)
9300 East Hampton Drive
Capitol Heights, MD 20743

WASHINGTON

Seattle Office (ST)
11410 NE 122nd Way
Room 312
Kirkland, WA 98034-6927

ETHERNET INTERFACE

The ESTeem Model 210's Ethernet Port is a Full and Half-Duplex Auto-negotiation interface supporting 10 Mbps, 100 Mbps and 1Gbps (10/100/1000BaseT). The port is compatible with TIA/EIA-568B cable configuration (Figure 1).

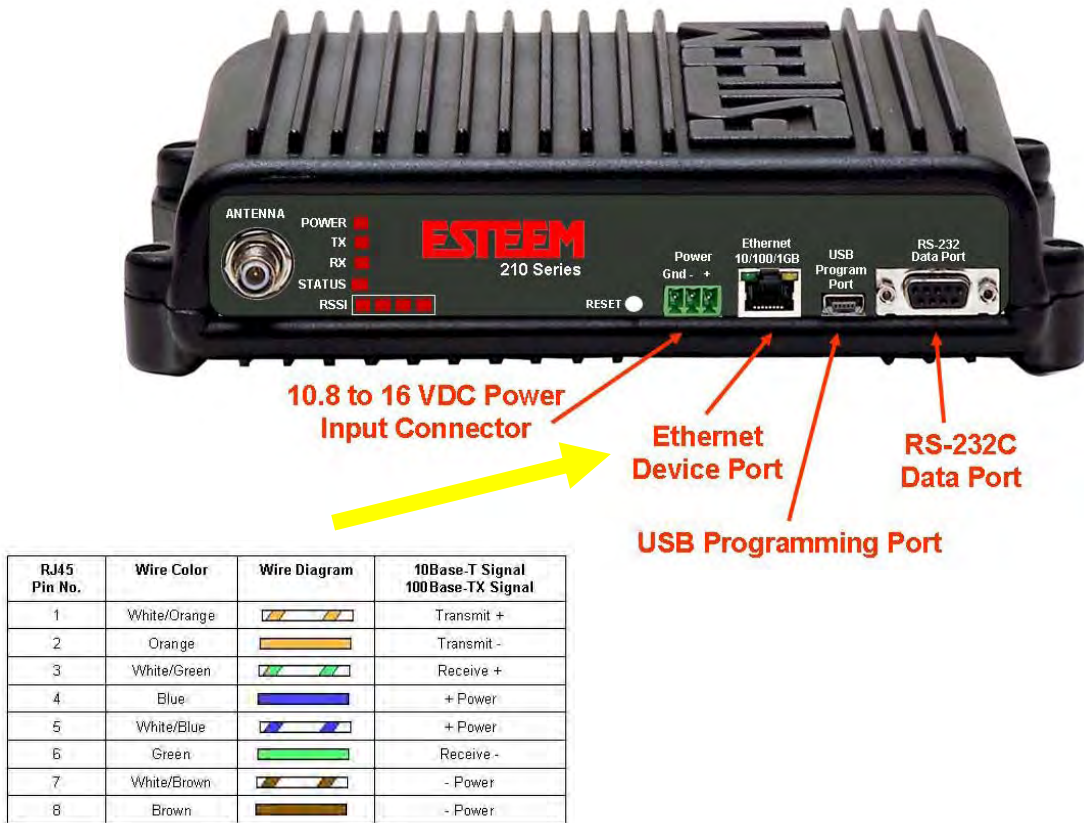


Figure 1: Ethernet Pin Layout

RS-232C DATA PORT CONFIGURATION

The ESTeem Model 210 has a 9-pin RS-232C data interface on the front panel. See Chapter 6 for further information on serial data port configuration. To interface the 210 to the serial port on the computer, you need serial cable with the following pin-out:

ESTeem Model 210

RS-232C Port Pin-Out Table

Function	DB-9 Pin No.
Data Set Ready (DSR)	6
Data Carrier Detect (DCD)	1
Data Terminal Ready (DTR)	4
Signal Ground (GND)	5
Receive Data (RxD)	2
Transmit Data (TxD)	3
Clear to Sent (CTS)	8
Request to Sent (RTS)	7

210 FREQUENCIES OF OPERATION

In a wireless Ethernet network all of the ESTeem Model 210 must be set to the same radio frequency of operation. The frequency of operation is selectable when configuring the mode of operation of the 210 (reference Chapter 3).

SETTING RF POWER LEVEL

The ESTeem Model 210 peak power is adjustable in output power from the advanced configuration menu. The output power is adjusted on the **Advanced Menu>Wireless LAN Settings>Wlan0 Device** screen (Figure 4) of the Web Configuration Manager. Select the value and press the *Save Settings* button.

Max (Maximum)	Full Power
Hi (High)	75% Power
Lo (Low)	50% Power
Min (Minimum)	25% Power

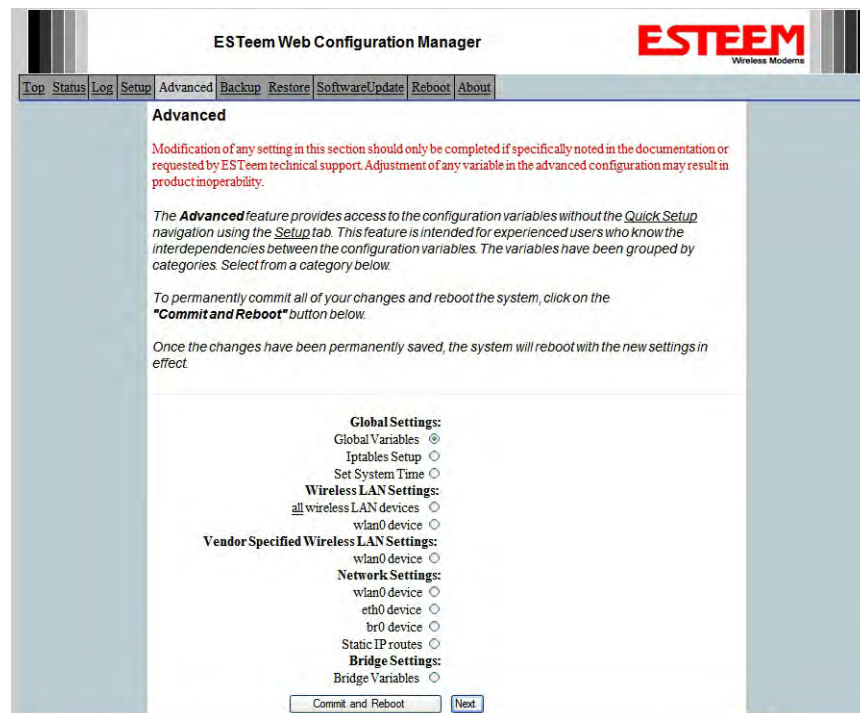


Figure 1: Advanced Global Variables

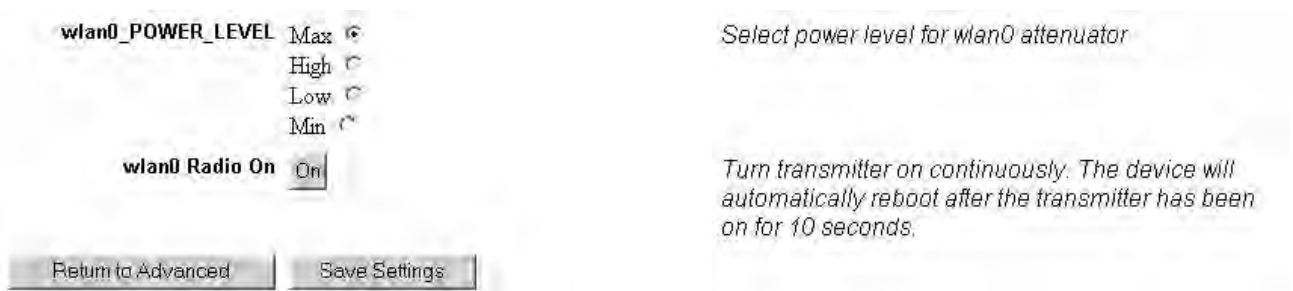


Figure 2: Power Level Settings

OVERVIEW

The security for the ESTeem Model 210, like all network security, must be multi-layered. One level of security is never enough to make sure that data does not end up in the wrong hands. Please review the following security levels and decide what is the most appropriate for your network.

AES-CCMP

AES-CCMP (Advanced Encryption Standard-Counter Mode CBC-MAC Protocol) is the encryption algorithm used in the IEEE 802.11i and WPA-2 security protocols. This national encryption standard uses a 128 bit-AES block cipher and CCMP technique to ensure the highest level of security and integrity available on a wireless network. AES-CCMP incorporates two sophisticated cryptographic techniques (counter mode and CBC-MAC) and adapts them to Ethernet frames to provide a robust security protocol between the mobile client and the access point. AES itself is a very strong cipher, but counter mode makes it difficult for an eavesdropper to spot patterns, and the CBC-MAC message integrity method ensures that messages have not been tampered with. The ESTeem 210 is compatible as either an Access Point or client in either WPA2 or IEEE 802.11i security systems.

Wi-Fi Protected Access 2 with Preshared Key (WPA2 PSK)

WPA2 PSK uses a common passphrase (preshared key) between the Access Point (AP) and the client to begin a secure communication session. This passphrase must be entered exactly the same in both the Access Point and the client. This passphrase is used to authenticate communication session between the AP and client to begin the secure wireless networking session.

Wi-Fi Protected Access 2 with Enterprise Server (WPA Enterprise)

Like WPA2 PSK, WPA2 Enterprise verifies the authenticity of the Access Point and client, but uses an 802.1x backend authentication server handling the authentication decision. The most commonly type of authentication server is a RADIUS server. The ESTeem Model 210 can be configured to operate with an established RADIUS server on the network.

WPA

Wi-Fi Protected Access with Preshared Key (WPA PSK)

WPA, which uses 802.1x, was introduced in 2003 to improve on the authentication and encryption features of WEP. All authentication is handled within this access point device. WPA has two significant advantages over WEP:

1. An encryption key differing in every packet. The TKIP (Temporal Key Integrity Protocol) mechanism shares a starting key between devices. Each device then changes their encryption key for every packet. It is extremely difficult for hackers to read messages even if they have intercepted the data.
2. Certificate Authentication (CA) can be used, blocking a hacker posing as a valid user.

Wi-Fi Protected Access with Enterprise Server (WPA Enterprise)

Like WPA PSK, WPA Enterprise verifies the authenticity of the Access Point and client, but uses an 802.1x backend authentication server handling the authentication decision. The most commonly type of authentication server is a RADIUS server. The ESTeem Model 210 can be configured to operate with an established RADIUS server on the network.

WPA is server/client relationship from a software driver on a computer's wireless LAN (WLAN) card to an Access Point. The scope of WPA is limited in use to this configuration only. The ESTeem Model 210 can support WPA Enterprise and PSK as an Access Point, but the level of security on the Bridging layer is configured separately.

128-BIT WEP

The 128 WEP uses a particular algorithm called RC4 encryption to encode and decode traffic that is based on a 104-bit encryption key and a 24-bit Initialization Vector (IV). RC4 starts with a relatively short encryption key (104 bits) that is expanded into a nearly infinite stream of keys to accompany the stream of packets.

The basic concept of RC4 is good, but the way it's implemented in WEP leaves it open to compromise. The researchers that test the integrity of the system usually focus on one piece of the implementation, the Initialization Vector (IV).

The IV (24 bits) is the algorithm component that's supposed to keep expanded keys from repeating. From the researcher's point of view, a high-volume access point is mathematically guaranteed to reuse the same key stream at least once a day. When this happens, it's called an IV collision this becomes a soft spot to enter the system.

The researchers aren't saying that it's easy to break into the system, or that it's being done on a regular basis, only that it is possible and administrators should consider ways to reduce the possibility

ACCESS CONTROL LIST (ACL)

The ACL is one of the simplest yet most secure methods of network security. The ACL is a configurable MAC filter in the Model 192E that can be set to allow specific MAC address on the wireless network by individual address or address ranges. The same filter can also be set to reject individual MAC addresses or address ranges.

The MAC address is a unique, 6 hexadecimal field addresses assigned at the manufacturer that can not be changed. The MAC address is traceable through the IEEE governing body to the manufacturer and is the "fingerprint" for all Ethernet devices.

Using a combination of either the WPA or 128-Bit WEP encryption and the ACL filter provide the ESTeem an extremely secure wireless networking layer.

TESTING COMMUNICATION LINK

After you have configured at least two of the Model 210 wireless Ethernet modems for operation, you can verify communication with each the following steps:

Status Light

The quickest source of link status is to view the Status Light on the face of the 210 (Figure 1). If the Status light is solid, the Model 210 has a connection to another Model 210 listed in the Peer Table.



Figure 1: Connection Status Light

To view detailed information on the status of the communication link (such as connection speed, signal strength and last update time) you can open the Status Screen from the Web Interface. After press the Status tab at the top of the screen the Status: Summary will be displayed showing the status of all ports and memory in the 210. Under the Wireless Status heading click on the View Peer Table (Figure 2). The Peer Table will list all other Wifi (210g and 210a only) or mobile client wireless activity seen by the 210 and how it is classified.

Note: The data rate displayed is *not necessarily* indicative of the RF data rate between the ESTEems. The rate show in the Repeater Peer table will be the last RF packet, which could consist of either data, repeater beacon or network probes.

EST195E Web Configuration Manager

Top Status Log Setup Advanced Backup Restore SoftwareUpdate Reboot About

Status: Peer Table

This page is a summary view of the peer table for WLAN device wlan0. Click on a given MAC address for more details about that peer.

[Return to Status Summary Page](#)

Opposite Modem's Wireless MAC

Associated Stations: None

Repeater Peers

MAC Addr	Signal	LastRx (sec@kbps)	Modem ID
00:04:3f:00:09:66	-36	0@11000	Remote

Access Points

MAC Addr	Signal	LastRx (sec@kbps)	Enc	SSID
00:02:2d:03:2a:78	-70	0@2000	y	
00:02:2d:3f:7d:d3	-89	8@2000	y	
00:04:3f:00:09:66	-36	0@11000	y	ESTEem

Other Access Points

Figure 2: Repeater Peer Table

Repeater Peers - The Peer Table will display all connected 210s configured to repeat to this ESTeem by their Wireless (WLAN) MAC address.

Received Signal Strength – This is the first of the two numbers listed in the block. This signal strength value is listed in dBm.

Last RX – This is the time of the last received data packet. When monitoring the status menu, it is important to note the time the last transmission was updated so you are not looking at “stale” data.

Current Data Rate – This is the current speed the last data packet received by the Model 210. This may not be the data rate between the radio modems. Note that the speed is listed in kbps, so that 11000 kbps is equal to 11 Mbps.

Note: The ESTeem Model 210 uses spread spectrum technology that analyzes each data packet for signal strength and data quality (strength vs. noise). The higher your signal, the more background noise you can sustain without causing degradation in the data transfer. This is also true for lower signal strengths with a very low background noise. These values are provided for guidance and if you have any questions about the values in your application, please contact ESTeem Customer Support at 509-735-9092 or e-mail your application to support@esteem.com.

Modem ID – This is Modem ID for the opposite repeater peer.

Viewing RF Data Rates

The value shown on the Peer Status Screen for data rate may not be the actual rate of the RF link. To view the link information, click on the Opposite Modems WLAN MAC address in the Repeater Peer list (Figure 2) and further link status information will be displayed (Figure 3).

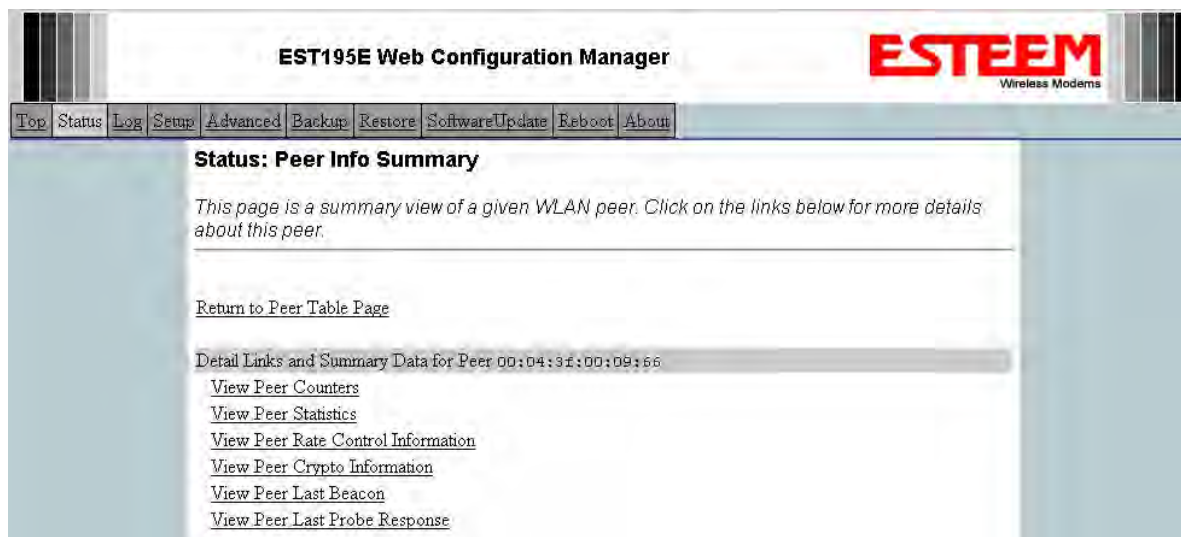


Figure 3: Peer Summary Table

Once loaded, click on View Peer Rate Control Information. (Figure 4)

The value of the Current TX rate is the RF data rate between the two ESTeem Model 210.



Figure 4: Rate Control Information

SIGNAL STRENGTH VS DATA RATE

The average signal strength required to maintain a specific data rate will vary by ESTeem 210 model and bandwidth. To review the required signal level and its effect from distance and hardware selected, please use the ESTeem RF Design program available from our web site (www.esteem.com). Please note that the data rates can be greatly affected by overall activity on the radio channel and the total background noise. These values should be used as a guide, but testing after installation is required.

LONG RANGE POINT TO POINT APPLICATIONS

The factory configuration on the 210 is optimized for distances up to 10 miles. If your application has an RF link with a range greater than 10 miles, you will need to set the maximum range value on both ESTeem 210's on this communication link. To access the Maximum Distance value select **Advanced** from the top Menu then **Wireless LAN Settings>wlan0 device** and press the **Next** button (Figure 5).

Scroll down the menu list until you find the Maximum Distance variable (Figure 6). Enter the maximum distance of the connection in miles. At the bottom of the screen press **Return to Advanced** button and then **Commit and Reboot** button (Figure 5) to save the information.

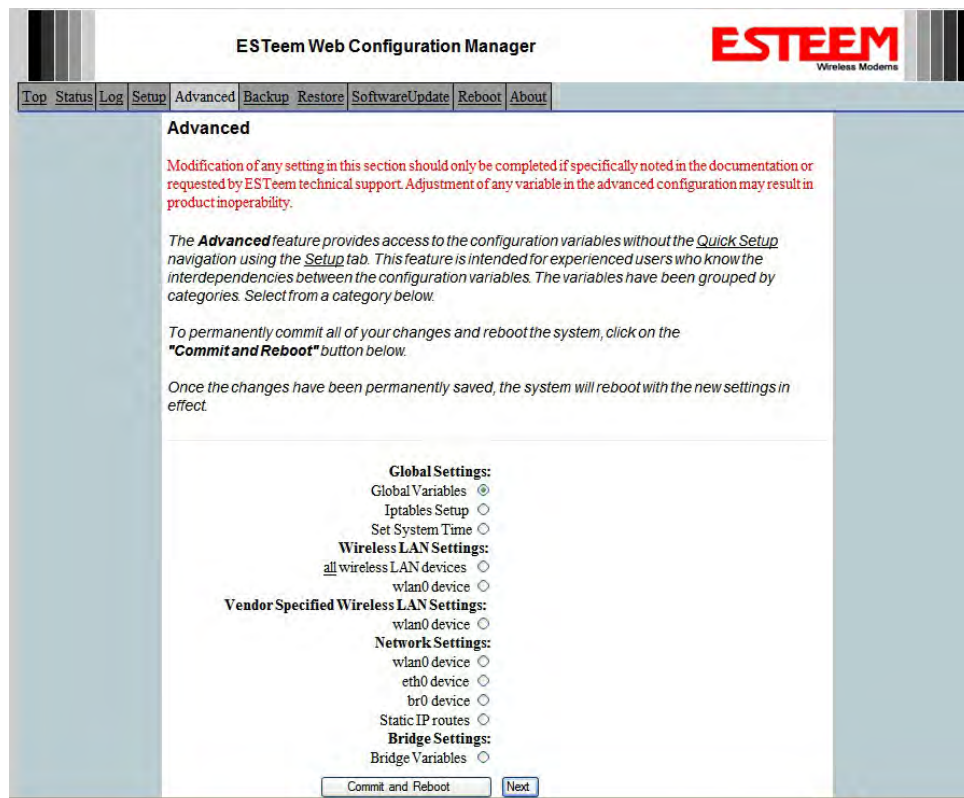


Figure 5: Advanced Features Screen



Figure 6: Maximum Distance Value Entry

TROUBLESHOOTING TIPS

General (Applicable to All Modes of Operation)

Where do I find the latest firmware version number? – We have the latest version number of the Model 210 firmware listed on the ESTeem Web site (www.esteem.com) under the Model 210 product page.

How and when do I update the Model 210 firmware? – You should only update the Model 210 firmware if you are having a specific problem and it is recommended that you do so by ESTeem Customer Support personnel. All the update instructions and files are located on the ESTeem FTP site at the following address:

<ftp://www.esteem.com/210>

Do all firmware versions have to be the same to communicate between the Model 210? – It is not necessary for all the firmware versions to be the same revision to communication, but the later version may have added features that the other versions will not recognize.

What characters are valid for WEP Key entry? – Only the Hexadecimal characters 0-9 and A-F are valid for key entry.

What ESTeem Utility version is required to program the Model 210? – The ESTeem Utility program is not required to program the Model 210. The 210 can be programmed using any Terminal Emulation program (such as Windows HyperTerminal) and any web browser program.

What is the speed and duplex configuration on the Model 210 – The Model 210 is an auto-negotiation full/half-duplex 10/100 Base-T interface. Either a cross-over or patch cable is supported.

Access Point Mode

Wireless LAN cards are not connecting – Verify that the wireless LAN cards are set to Infrastructure Mode, have a matching SSID (or ESSID) set the same as the Model 210 and that all encryption codes are the same.

My Wireless LAN card shows a solid connection, but I can not pass any data – Verify the encryption and the ACL setting on the Model 210 match the wireless LAN card.

Access Point Repeater Mode

How long does it take to re-establish the Wireless Ethernet Network? – If a communication link is lost and the Wireless Network needs to re-establish the repeater routes, the time can take up to 10 seconds.

Should the AP Repeater Mode be used on mobile equipment? – The AP Repeater mode should be used on equipment that will not change the Repeater Route as it moves. For example, if a mobile device such as a crane can communicate directly to another ESTeem and will not lose the link in its travel, the AP Repeater Mode could be used. If the device requires two ESTeem Model 210's (Base and Repeater) to maintain communication across its complete travel, the Station Modes should be used on the mobile device. The problem will be in the time that the mobile ESTeem will take to transfer between the two sites. In Access Point Repeater mode the transfer can take up to 30 seconds, while the EtherStation mode will transfer without a packet loss.

Does WEP have to be used? – The WEP does not have to be enabled for the modems to communicate, but all modems must be configured the same way.

Correct configuration, but cannot establish communications. – In addition to the network configuration, all 210 modems configured in the AP mode must share the same SSID and be on the same frequency channel. The most likely cause of the error is the WLAN MAC address is not configured in **both** 210's repeater tables. If only one side is configured, everything will appear to be correct but no communication will function.

EtherStation

How do I access the Model 210 web page in EtherStation Mode? The Model 210 does not have an active web browser when configured in EtherStation mode. You must access the ESTeem with the ESTeem Discovery Program or through the RS-232 port after configuration in this mode. To monitor the link status, you can use the EtherStation Status program.

What IP address do I configure the ESTeem in EtherStation mode? – The Model 210 will not have an IP address in EtherStation mode.

I can not link my device into the wireless network – Verify that the MAC address of the device is **exactly** the same as configured in the Model 210. The MAC address must have colons between the values.

Can I connect my Model 210 in EtherStation mode to a HUB or Ethernet Switch? – No. The modem must be connected directly to the Ethernet device for which it is programmed. In EtherStation mode the Model 210 can only service ONE Ethernet device.

Model 210C Specifications

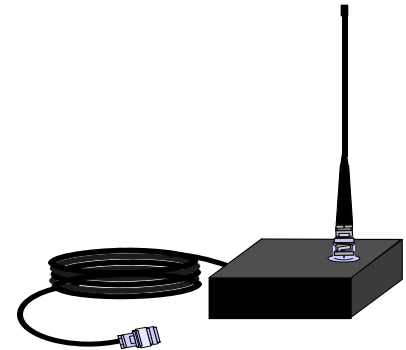
ESTeem 210C Specifications	
Transceiver	
Frequency of Operation (Software Selectable)	450 to 470 MHz
Frequency Selectability	6.25 KHz
Frequency Stability	± 1.5 ppm
RF Data Rate @ 6.25 KHz Channel Bandwidth	9.6 Kbps (4 QAM), 19.2 Kbps (16 QAM), 28.8 Kbps (64 QAM) (software selectable)
RF Data Rate @ 12.5 KHz Channel Bandwidth	21.6 Kbps (4 QAM), 43.2 Kbps (16 QAM), 64.8 Kbps (64 QAM) (software selectable)
RF Output Power @ 50 ohms (Z)	2 Watts (average)/ 10 Watts (peak)
TX Duty Cycle	100%
Transmitter Spurious & Harmonics	> 55 dB down from carrier
Transmitter Rise Time	1 mSec
RX Sensitivity	-113 dBm
Receiver Spurious & Image Rejection	> 50 dB
Receiver Squelch Sensitivity	Software Adjustable
Receiver Adjacent Channel Rejection	> 70 dB
LED Indicators	
Front Panel	Power (On/Off) - Transmitter (On/Off) - Rx Carrier Detect (On/Off) - Status (On/Off) - RSSI (16 levels)
Input/Output Interfaces	
Ethernet Port (10/100/1G)	RJ-45 Female
Radio Configuration Port	Mini-USB Port
RS-232C Comm Port (2,400 to 115.2 K baud)	9 Pin D-Sub Female
Antenna Input/Outputs	TNC Female Connector (50 ohm)
Input Power	Mini-Combicon, 3 pin Female
Switches	
CPU Reset	Front Panel (Push button)
Power Requirements	
Power Supply Voltage	10.8 to 16 VDC
Power Supply Current	400 mA Receive
	2 A Transmit (2 W)
Case	
Temperature Range	-30 to +60 degrees C.
Humidity	95% Non Condensing
Dimensions	2.45 in. (H) x 8.16 in. (W) x 9.37 in. (L)
Weight	5 lbs.
Product Warranty	1 Year
Type Acceptance	
FCC (USA)	ENPESTEEM210C
Industry Canada	2163A-ESTEEM210C

Model 210C Case Layout



Antenna Specifications

Model No:	AA19C
Antenna Type:	Omni-Directional, ½ Wave
Applications:	Mobile Mount.
Frequency:	450 to 470 MHz - AA19C 400 to 420 MHz - AA19F
Polarization:	Vertical
Impedance:	50 ohms
Gain:	2 db.
VSWR:	< 2 to 1
Front To Back Ratio:	n/a
Horizontal Beamwidth:	n/a
Vertical Beamwidth:	60 degrees
Antenna Material:	Rubber duck whip.
Mounting Hardware:	Magnetic base.
Antenna Connector:	TNC with 12 feet integral RG-58 cable.
Antenna Envelope:	16 in. length. Magnetic base 3.5 in. by 3 in by 1 in.
Weight:	1 lb. 5 oz.



Model AA19C

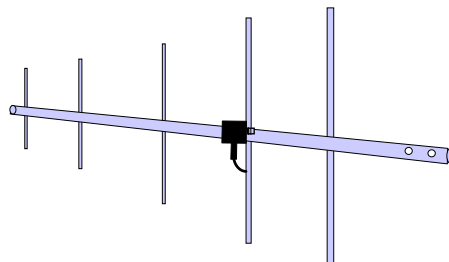
Model No:	AA20C.1
Antenna Type:	Omni-Directional, DC grounded, Collinear 5/8 wave over 1/2 wave.
Applications:	Fixed base or mobile mounting. L shaped mounting bracket may be removed for panel mounting. Ground plane radials may be removed depending on application.
Frequency:	450 to 470 MHz - AA20C.1
Polarization:	Vertical
Impedance:	50 ohms
Gain:	4.5 dB.
VSWR:	< 1.5
Front To Back Ratio:	n/a
Horizontal Beamwidth:	n/a
Vertical Beamwidth:	30 degrees
Antenna Material:	Stainless steel whip and ground plane radials. All other hardware anodized metal.
Mounting Hardware:	Stainless steel clamps for mounting to ¾ in. to 1 ½ in. pipe with right angle mount or direct mount.
Antenna Connector:	N-Type Female
Antenna Envelope:	37 ½ in. length by 16 in width with ground plane radials.
Weight:	2 lbs.



Model AA20C.1

Antenna Specifications

Model No:	AA202C & AA202F
Antenna Type:	Directional, DC grounded, 5 element yagi.
Applications:	Fixed base.
Frequency:	450 to 470 MHz - AA202C 400 to 420 MHz - AA202F
Polarization:	Vertical or Horizontal
Impedance:	50 ohms
Gain:	10 dB
VSWR:	< 1.5
Front To Back Ratio:	20 dB
Horizontal Beamwidth:	59 degrees
Vertical Beamwidth:	53 degrees
Antenna Material:	High strength aluminum with gold chromate finish.
Mounting Hardware:	Heavy duty U bolts for mounting up to 2 1/8 in. pipe with right angle mount or direct panel mount.
Antenna Connector:	N-Type Female
Maximum Power Input:	300 Watts
Antenna Envelope:	34.5 in. length by 13.25 in. width
Windload (RWV):	100 mph
Weight:	1.68 lbs.



Model AA202C/F

Model 210M Specifications

ESTeem 210M Specifications	
Transceiver	
Frequency of Operation (Software Selectable)	150 to 174 MHz
Frequency Selectability	6.25 KHz
Frequency Stability	± 1.5 ppm
RF Data Rate @ 6.25 KHz Channel Bandwidth	9.6 Kbps (4 QAM), 19.2 Kbps (16 QAM), 28.8 Kbps (64 QAM) (software selectable)
RF Data Rate @ 12.5 KHz Channel Bandwidth	21.6 Kbps (4 QAM), 43.2 Kbps (16 QAM), 64.8 Kbps (64 QAM) (software selectable)
RF Output Power @ 50 ohms (Z)	2 Watts (average)/ 4 Watts (peak)
TX Duty Cycle	100%
Transmitter Spurious & Harmonics	> 55 dB down from carrier
Transmitter Rise Time	1 mSec
RX Sensitivity	-113 dBm
Receiver Spurious & Image Rejection	> 50 dB
Receiver Squelch Sensitivity	Software Adjustable
Receiver Adjacent Channel Rejection	> 70 dB
LED Indicators	
Front Panel	Power (On/Off) - Transmitter (On/Off) - Rx Carrier Detect (On/Off) - Status (On/Off) - RSSI (16 levels)
Input/Output Interfaces	
Ethernet Port (10/100/1G)	RJ-45 Female
Radio Configuration Port	Mini-USB Port
RS-232C Comm Port (2,400 to 115.2 K baud)	9 Pin D-Sub Female
Antenna Input/Outputs	TNC Female Connector (50 ohm)
Input Power	Mini-Combicon, 3 pin Female
Switches	
CPU Reset	Front Panel (Push button)
Power Requirements	
Power Supply Voltage	10.8 to 16 VDC
Power Supply Current	400 mA Receive
	2 A Transmit (2 W)
Case	
Temperature Range	-30 to +60 degrees C.
Humidity	95% Non Condensing
Dimensions	2.45 in. (H) x 8.16 in. (W) x 9.37 in. (L)
Weight	5 lbs.
Product Warranty	1 Year
Type Acceptance	
FCC (USA)	ENPESTEEM210M
Industry Canada	2163A-ESTEEM210M

Model 210M Case Layout



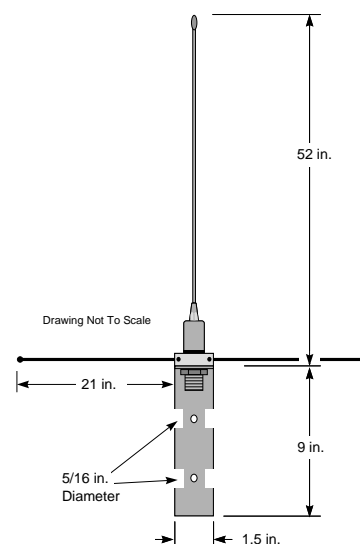
Antenna Specifications

Model No:	AA19M
Antenna Type:	Omni-Directional, ½ Wave over ¼ Wave
Applications:	Mobile Mount.
Frequency:	150-174 MHz
Polarization:	Vertical
Impedance:	50 ohms
Gain:	Unity
VSWR:	< 1.5 to 1
Front To Back Ratio:	n/a
Horizontal Beamwidth:	n/a
Vertical Beamwidth:	60 degrees
Antenna Material:	Rubber duck whip.
Mounting Hardware:	Magnetic base.
Antenna Connector:	TNC with 12 feet integral RG-58 cable.
Antenna Envelope:	11 in. length. Magnetic base 3.5 in. by 3 in by 1 in.
Weight:	1 lb. 5 oz.



Model AA19C

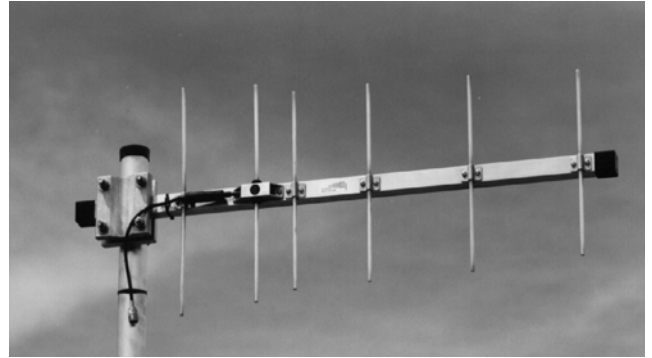
Model No:	AA20M
Antenna Type:	Omni-Directional, DC grounded, Collinear 5/8 wave
Applications:	Fixed base or mobile mounting. L shaped mounting bracket may be removed for panel mounting. Ground plane radials may be removed depending on application.
Frequency:	150 to 175 MHz
Polarization:	Vertical
Impedance:	50 ohms
Gain:	3.0 dBd with ground plane radials
VSWR:	< 1.5
Front To Back Ratio:	n/a
Horizontal Beamwidth:	n/a
Vertical Beamwidth:	60 degrees
Antenna Material:	Stainless steel whip and ground plane radials. All other hardware anodized metal.
Mounting Hardware:	Stainless steel clamps for mounting to ¾ in. to 1.5 in. pipe with right angle mount or direct mount.
Antenna Connector:	UHF Female (SO-239)
Antenna Envelope:	61 in. length by 43.5 in. width with ground plane radials
Weight:	2 lbs.



Model AA20M

Antenna Specifications

Model No:	AA202M
Antenna Type:	Directional, 6 element yagi.
Applications:	Fixed base mounting.
Frequency:	150 to 174 MHz
Polarization:	Vertical or Horizontal
Impedance:	50 ohms
Gain:	8 dBd
VSWR:	< 1.2:1
Front To Back Ratio:	12-18 dB
Horizontal Beamwidth:	80 degrees
Vertical Beamwidth:	58 degrees
Antenna Material:	.250" – 6061-T6 Aluminum
Mounting Hardware:	Heavy duty U bolts for mounting up to 2 1/8 in. pipe with right angle mount or direct panel mount.
Antenna Connector:	N-Type Female
Maximum Power Input:	150 Watts
Antenna Envelope:	61 in. length by 41 in. width
Wind Surface Area (sqr. ft)	0.82
Windload (RWV):	100 mph
Weight:	5 lbs.



Model AA202M