

Wireless Modems

**ESTeem MODEL 195Ed
USER'S MANUAL**

Manual Revision 1.0
October 2008



Electronic Systems Technology, Inc.

ESTeem MODEL 195Ed USER'S MANUAL

Manual Revision 1.0

Firmware Version 263 and above

October 2008

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BEFORE YOU BEGIN

Thank you and congratulations on your purchase of the ESTeem Model 195Ed Wireless Ethernet Radio Modem! This manual was written to help both the first time and advanced user of the 195Ed configure the radio modem for your application. If this your first time configuring the 195Ed and you would like to get going as soon as possible, we recommend using the *195Ed Quick Start Guide* provided with the modem. A copy of the guide is listed in the appendix of this manual for your reference.



The ESTeem 195Ed is a very versatile wireless Ethernet networking device. 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

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

MODEL 195Ed OVERVIEW

The ESTeem Model 195Ed is a wireless LAN transceiver that can be used to build a Wireless Local Area Network (WLAN) for line-of-sight distances to 15 miles for fixed base and 5 miles for mobile applications. The 195Ed can provide RF data rates up to 54 Mbps and can have a serial port for legacy RS-232 devices. The Model 195Ed 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 contact Customer Support at 509-735-9092.

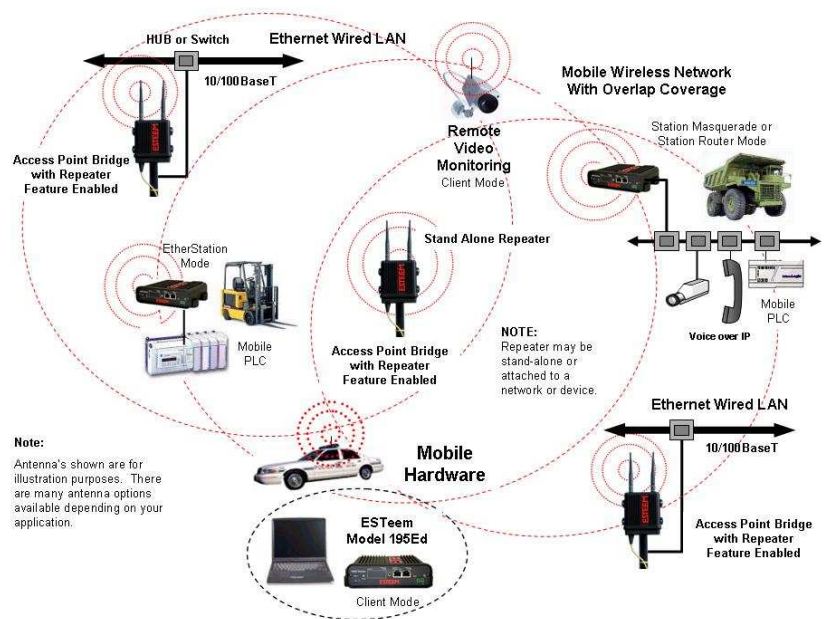


Figure 1- Access Point Bridge Diagram

MODEL 195Ed CONFIGURATION MODES

The Model 195Ed can be configured for multiple modes of operation without any changes to the hardware:

Access Point Modes

1. **Access Point Bridge Mode.** When the Model 195Ed is configured as an Access Point it will provide a wireless bridge from a hardwired Local Area Network (LAN) to other Model 195Ed modems in client modes or other 195Ed's configured as Repeater Peers. Multiple Access Point Bridge modems 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. The ESTeem Model 195Ed in Access Point Bridge mode will pass all network traffic between connected devices including global network broadcasts. See Figure 1.

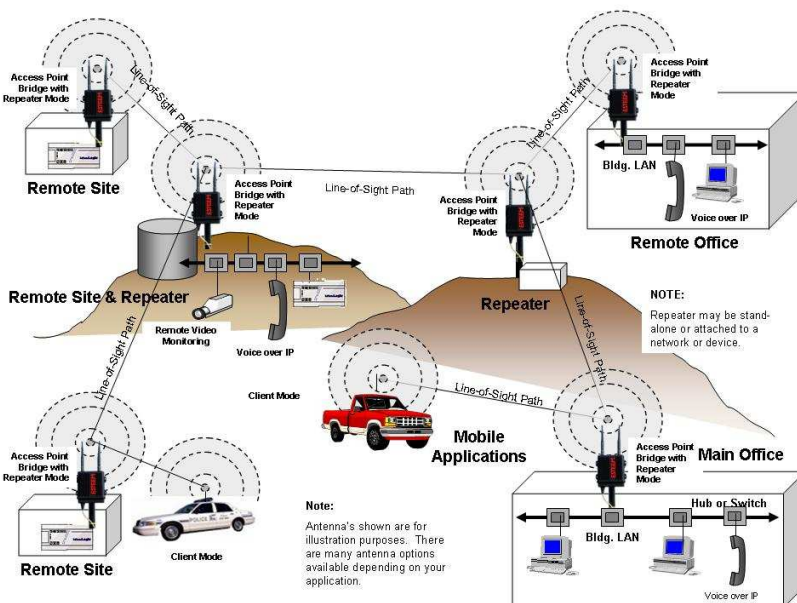


Figure 2 – Repeater Mode Diagram

2. **Access Point Router Mode.** In this mode the ESTeem Model 195Ed will function as a router between the wired Ethernet network, connect to the 195Ed's Ethernet port, and the wireless network of other 195Ed's in repeater peer mode. As in all standard router configurations, the wireless and wired Ethernet networks will need to be on separate subnets. To communicate from the wired Ethernet network to devices on the wireless network, a separate router (or the Model 195Ed configured as a router) is required. The 195Ed 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 2).

3. **Access Point Masquerade Mode.** The Access Point Masquerade mode is a special use of the Access Point mode where the Model 195Ed will connect multiple clients into a single static IP address on a wired network. Data requests from the wireless network will be processed through the Access Point Masquerade 195Ed, but any request from the wired Ethernet network to devices on the wireless network will be rejected similar to the operation of a "firewall". The 195Ed will hide all the IP addresses connected on the wireless link. You should use this mode of operation if Model 195Ed is connected directly to the Internet with a static IP address

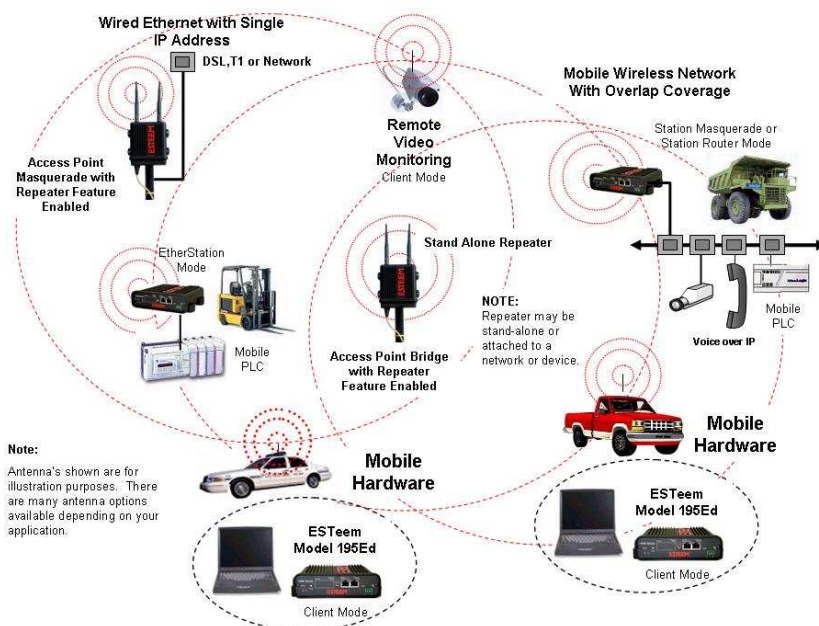


Figure 3- Access Point Masquerade Diagram

(DSL, T1, etc.) and you want the wireless clients to access the information through the Model 195Ed (Figure 3). This mode should also be used for attaching the Model 195Ed to a network where few IP addresses are available or a firewall for the wireless clients is required.

4. **Access Point Repeater.** The Access Point Repeater can be used with any of the above Access Point modes. With this repeater feature enabled, the Model 195Ed 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 195Ed 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 Model 195Ed in the Client mode to simultaneously roam under the network canopy.
5. **Self-Healing Mesh Network.** If multiple Access Point Repeater routes are configured to the same destination ESTeem, the 195Ed 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 4.

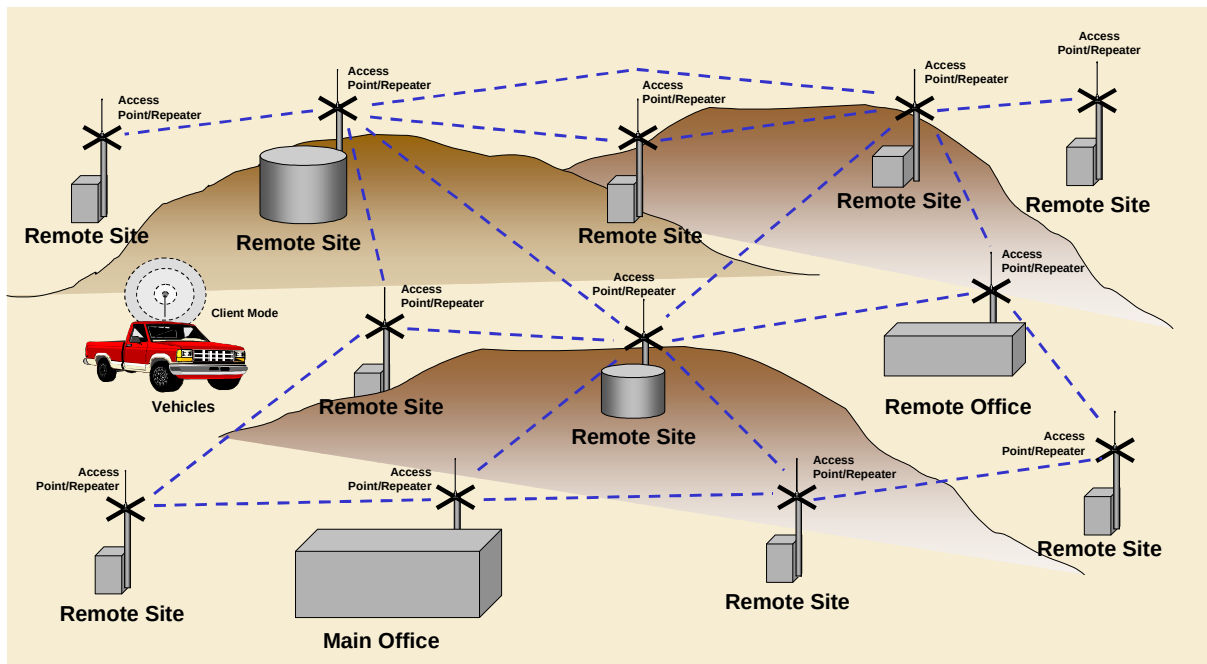


Figure 4 – Mesh Network Diagram

Station (Client) Modes

6. **EtherStation Mode.** When the 195Ed is configured in the EtherStation Mode and attached to a single Ethernet Device, the Model 195Ed will emulate a wireless card in functionality for communication as a mobile client. The 195Ed will seamlessly roam under the radio canopy of Access Point and can provide greatly increased range for mobile Ethernet devices such as vehicles, forklifts, cranes, etc (Figures 1-3).
7. **Station Router Mode.** The Station Router mode will also function as a client, similar to EtherStation, but will allow multiple Ethernet devices to be connected to a single 195Ed (Figure 3). The 195Ed 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 195Ed in a mobile client application and the connected Ethernet devices will need to be accessible from the Access Point's LAN network.

8. **Station Masquerade Mode.** The Station Masquerade Mode is another mode where multiple devices will be connected to a single ESTeem in a mobile or Client application, but unlike the Station Router mode, the Station Masquerade will consolidate all connected Ethernet devices to a single IP address on the network. The devices connected to the Station Masquerade 195Ed will be able to access information from both the wireless and wired LAN, but will be inaccessible the other way similar in application to a firewall. This mode would be used where multiple Ethernet devices will be connected to a single Model 195Ed in a mobile application and the IP addresses for each device will be hidden from the LAN connected to the Access Point. See Figure 3.
9. **Serial Applications.** The ESTeem 195Ed can support RS-232 for serial data applications run over the broadband link (Figure 5). The serial over broadband 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 or providing for high-bandwidth devices (such as Video or Voice over IP) in an existing serial network. Installing the serial port option also provides a second 10/100 Base-T Ethernet port that can be used to connect a second Ethernet device without requiring a HUB/Switch or can be configured as an external Router port.

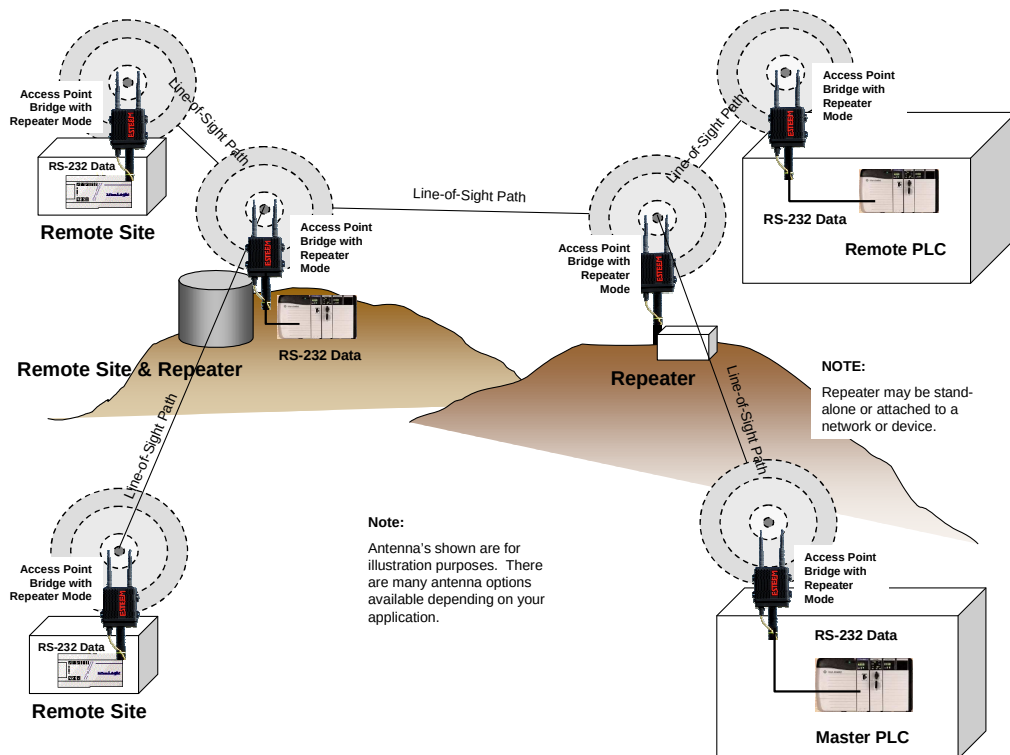


Figure 5 – Multi-point Serial Diagram

To begin setup of your wireless Ethernet network you must first configure the Model 195Ed for the mode desired. Chapter 2 will show several examples of the different modes of operation to help select the correct mode for your application.

MODEL 195Ed ACCESS POINT BRIDGE DIAGRAMS

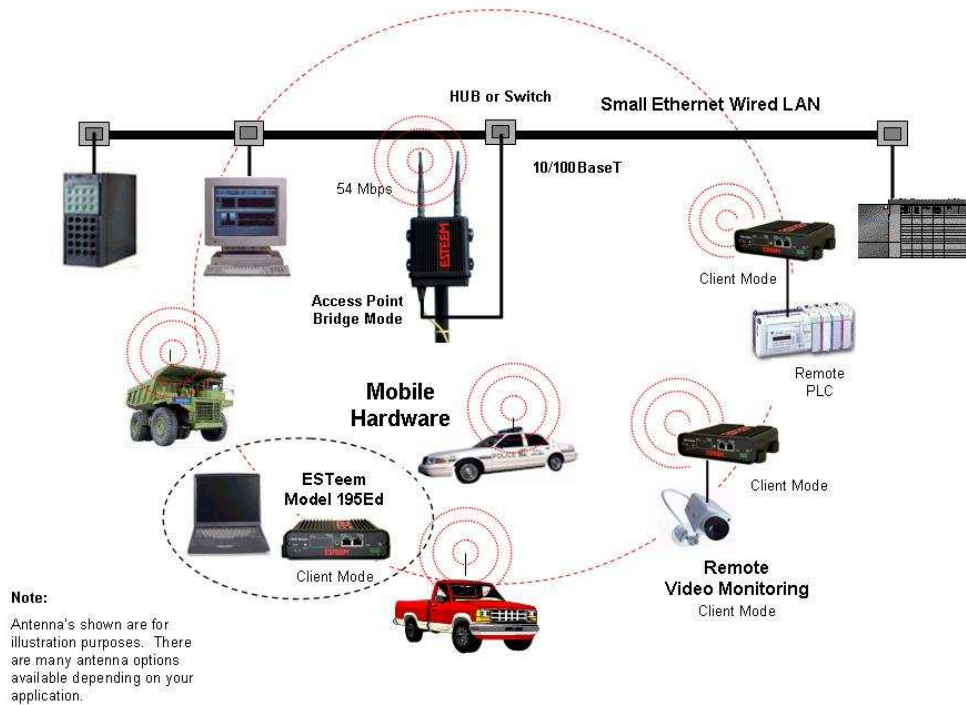


Figure 1: Single Access Point Bridge Diagram

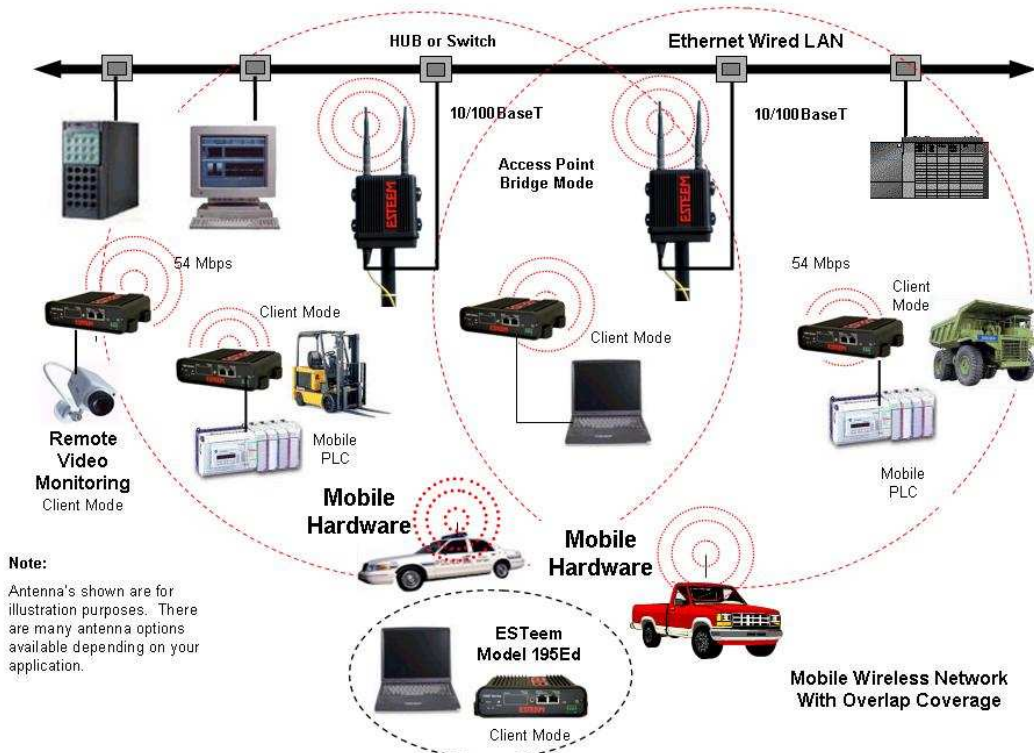


Figure 2: Multiple Access Point Bridge (Overlapping Coverage) Diagram

MODEL 195Ed ACCESS POINT ROUTER DIAGRAM

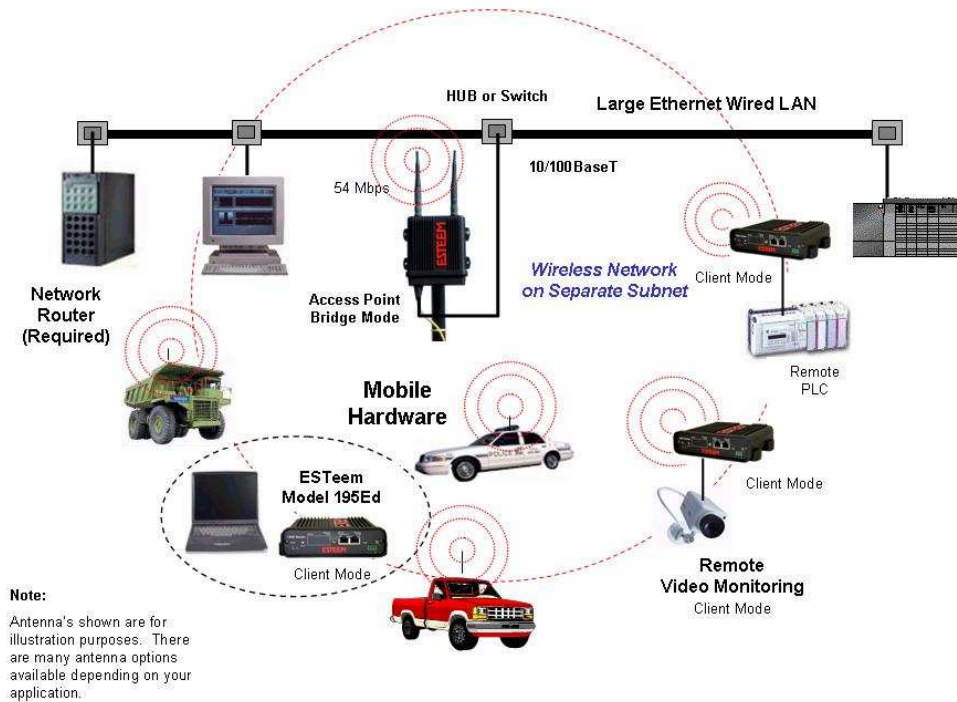


Figure 3: Access Point Router Diagram

MODEL 195Ed ACCESS POINT MASQUERADE DIAGRAM

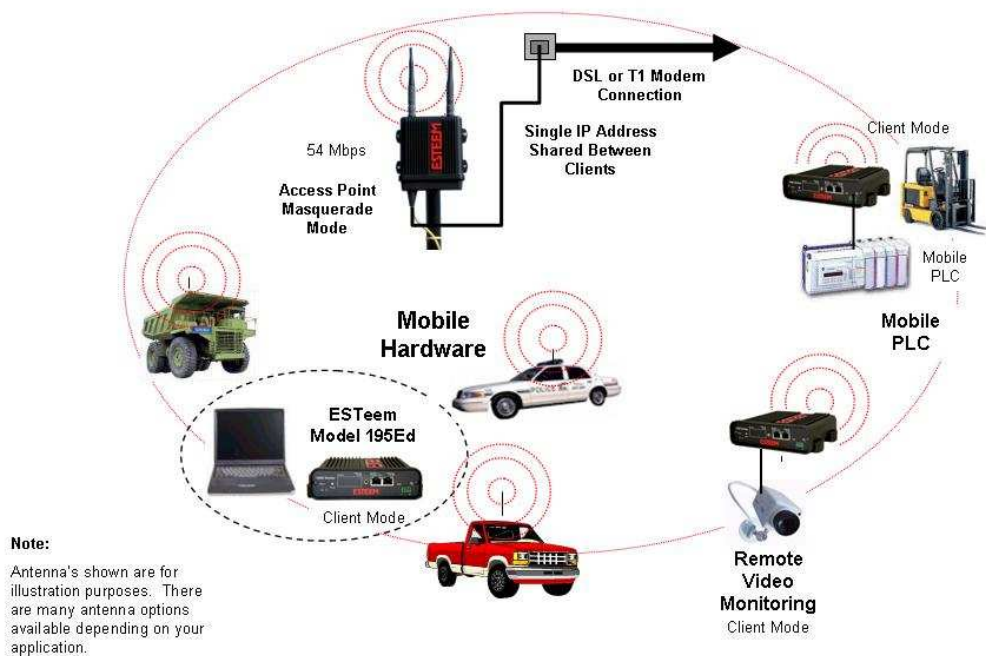


Figure 4: Access Point Masquerade Diagram

MODEL 195Ed ACCESS POINT REPEATER AND CLIENT CONFIGURATION DIAGRAMS

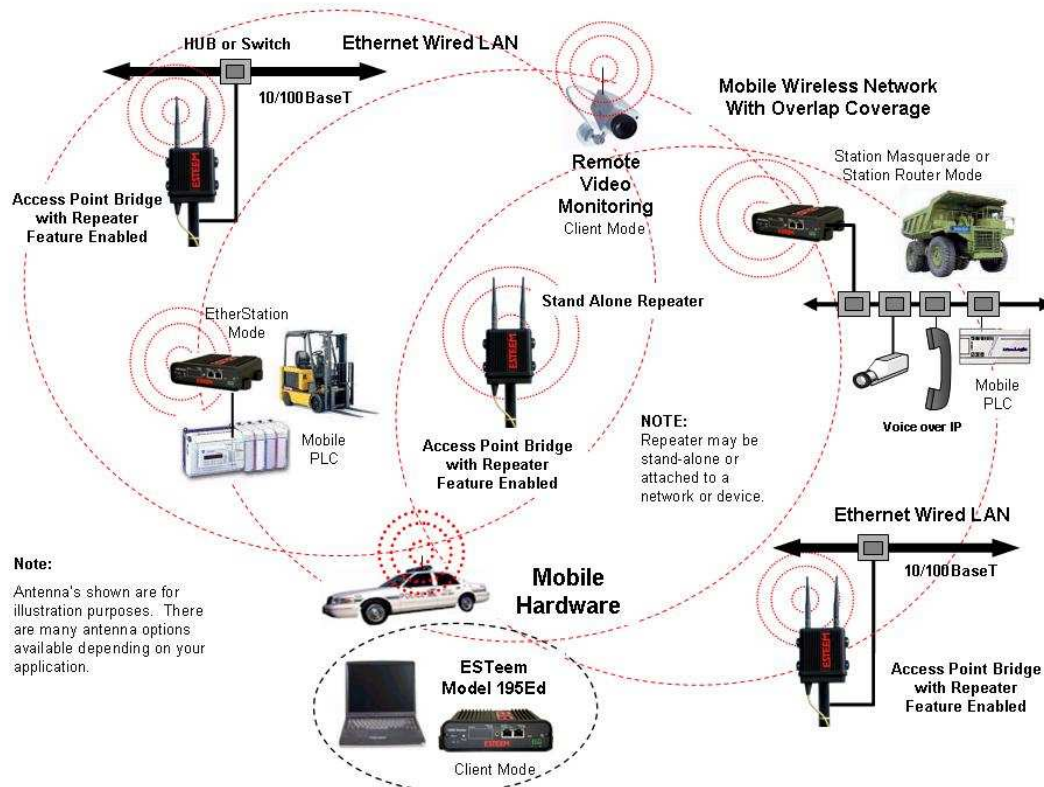


Figure 5: Access Point Bridge Repeater with Clients Diagram

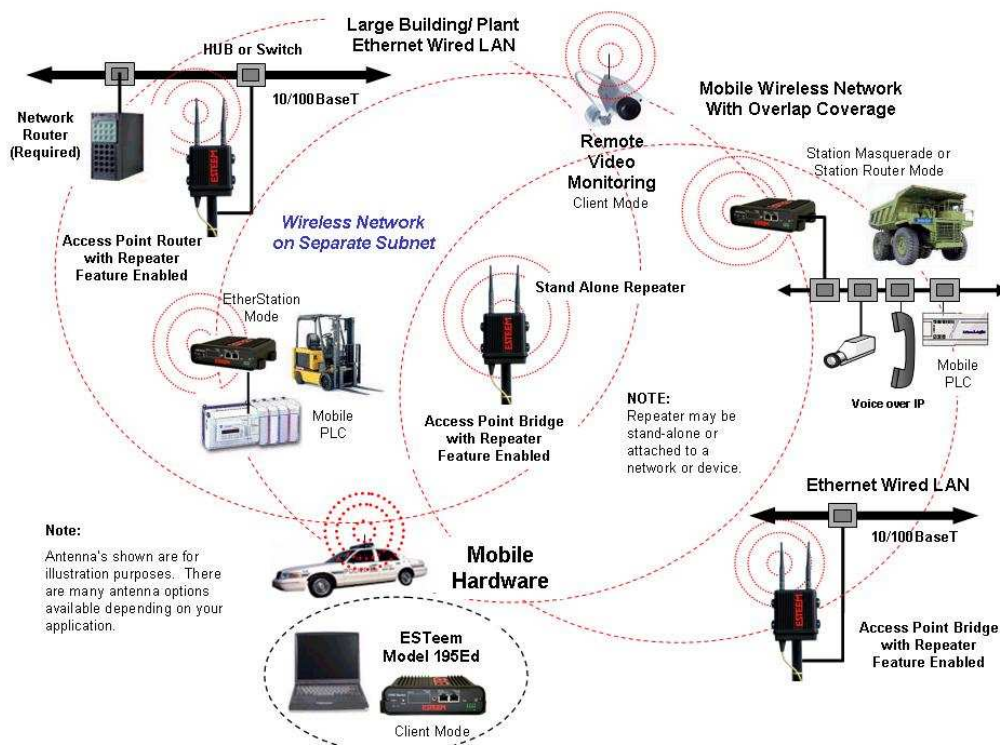


Figure 6: Access Point Router Repeater with Clients Diagram

MODEL 195Ed ACCESS POINT REPEATER AND CLIENT CONFIGURATION DIAGRAMS (Cont.)

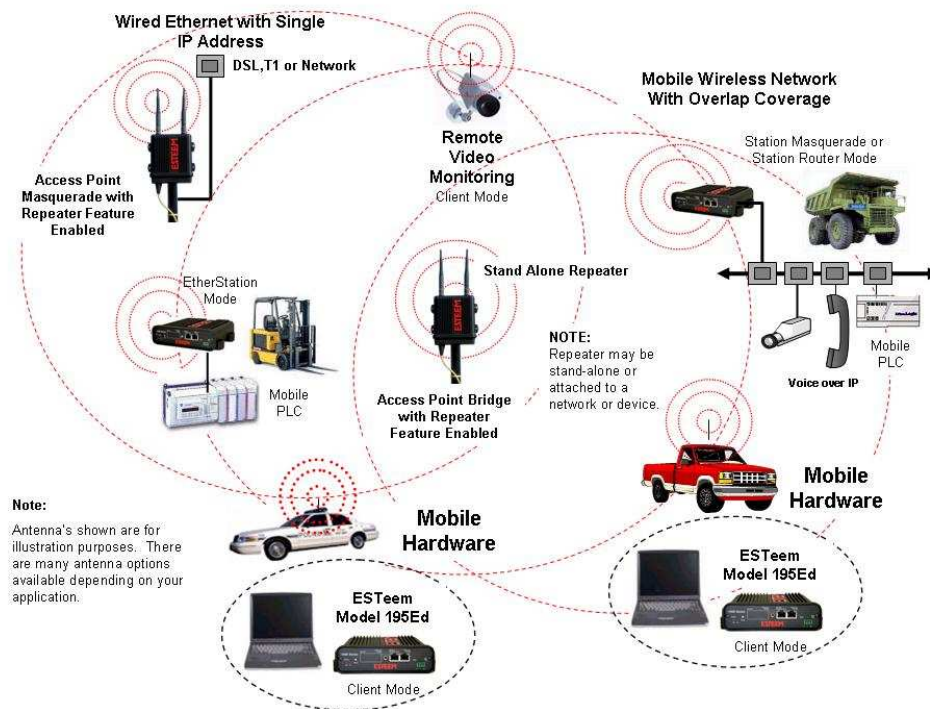


Figure 7: Access Point Masquerade Repeater with Clients Diagram

MODEL 195Ed BUILDING TO BUILDING CONFIGURATION DIAGRAMS

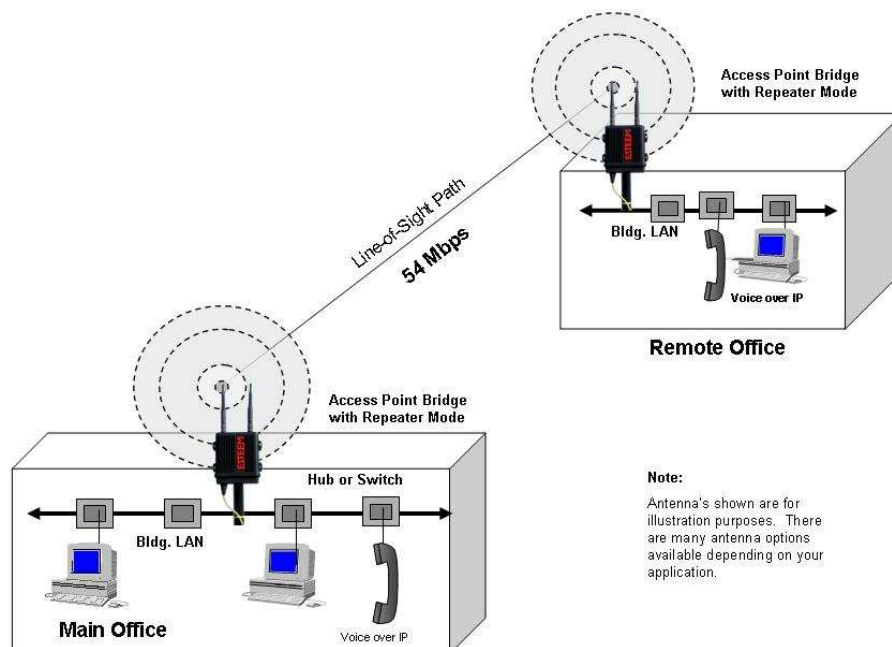


Figure 8: Building to Building Configuration Diagram

MODEL 195Ed BUILDING TO BUILDING CONFIGURATION DIAGRAMS (Cont.)

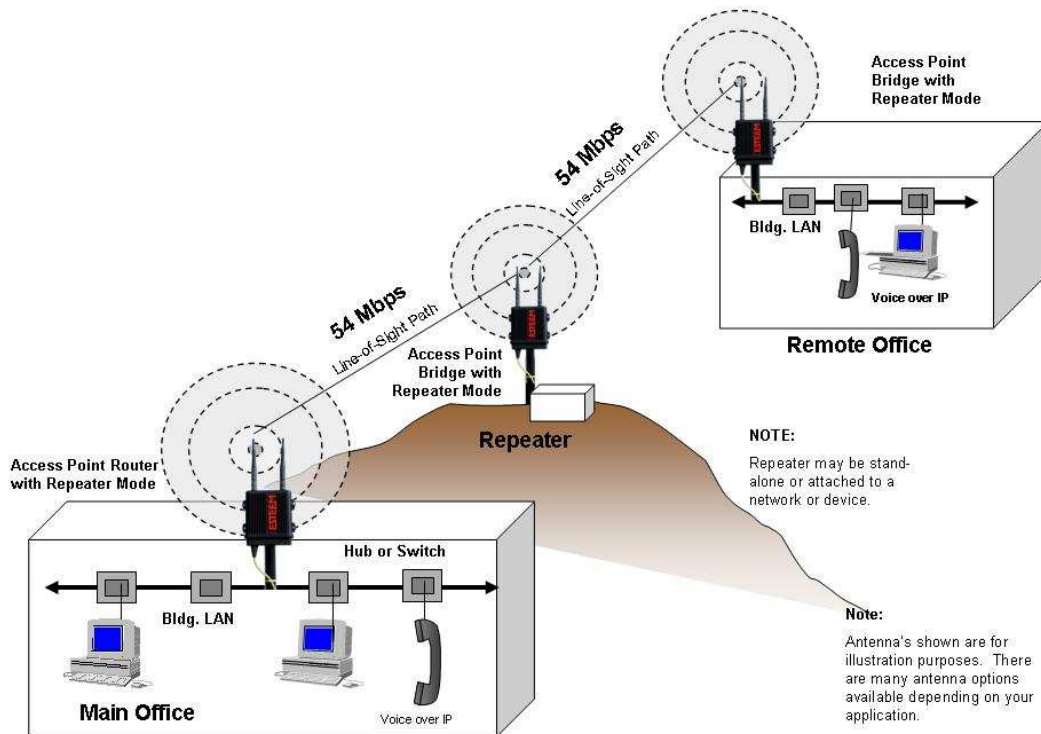


Figure 9: Building to Building with Repeater Diagram

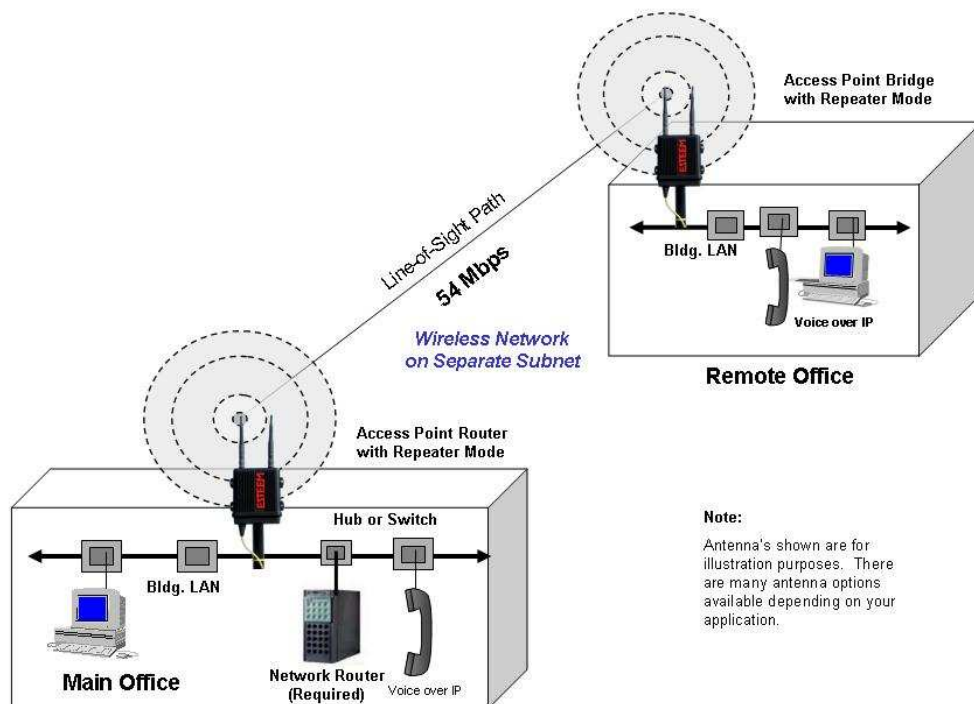


Figure 10: Building to Building Router Diagram

MODEL 195Ed COMPLETE BRIDGE SYSTEM CONFIGURATION DIAGRAMS

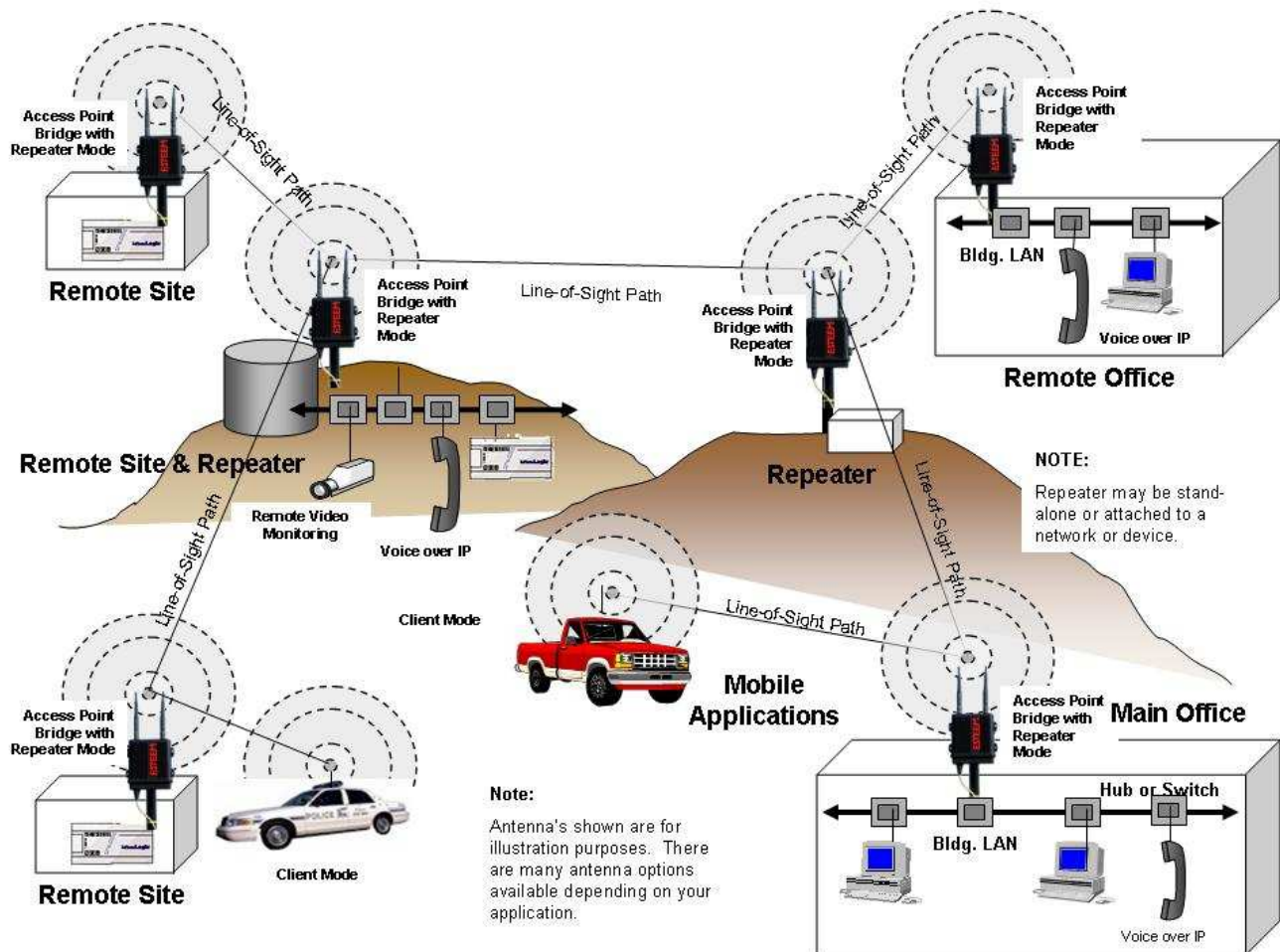


Figure 11: Complete Bridge Network Solutions Diagram

MODEL 195Ed COMPLETE ROUTER SYSTEM CONFIGURATION DIAGRAMS

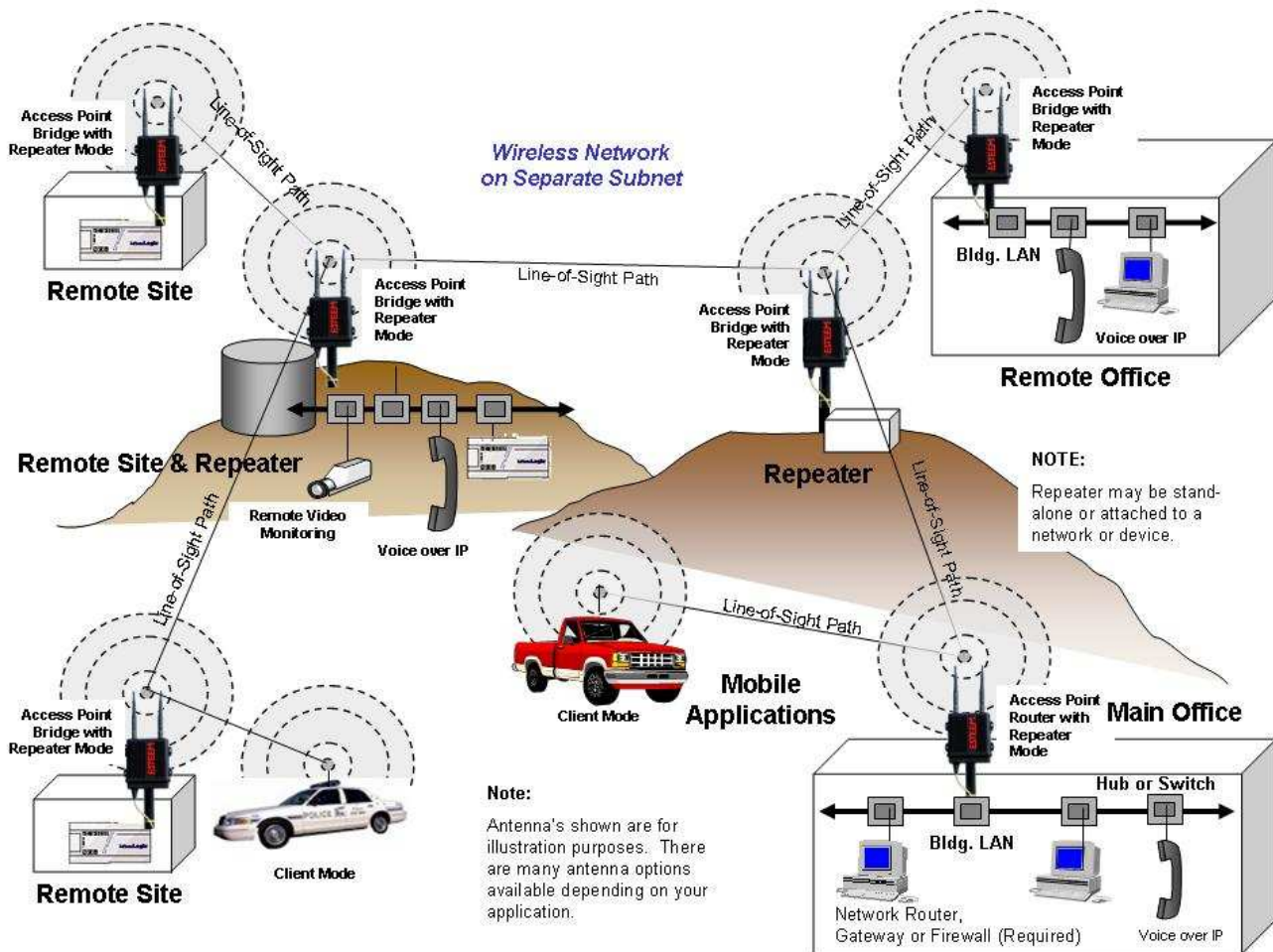


Figure 12: Complete Router Network Solutions Diagram

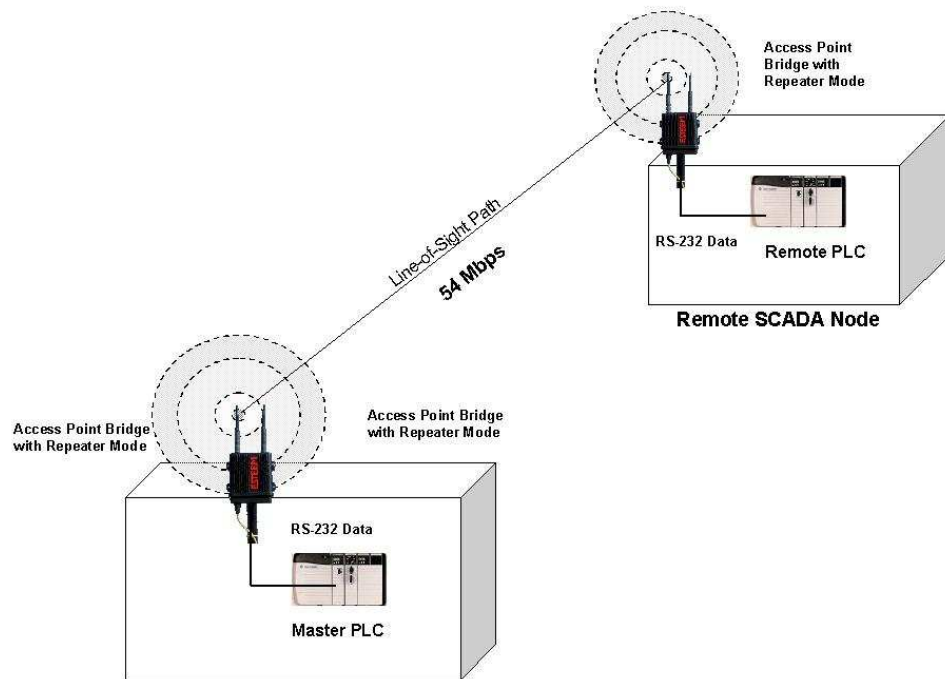


Figure 13: Point to Point Serial Diagram

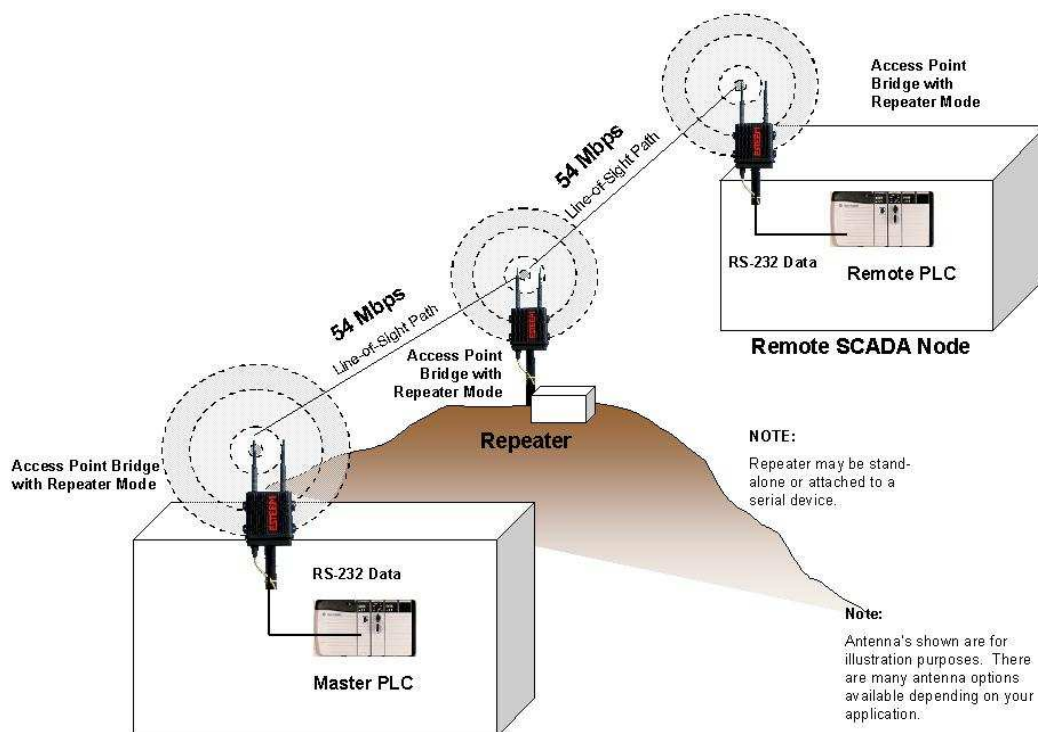


Figure 14: Point to Point With Repeater Serial Diagram

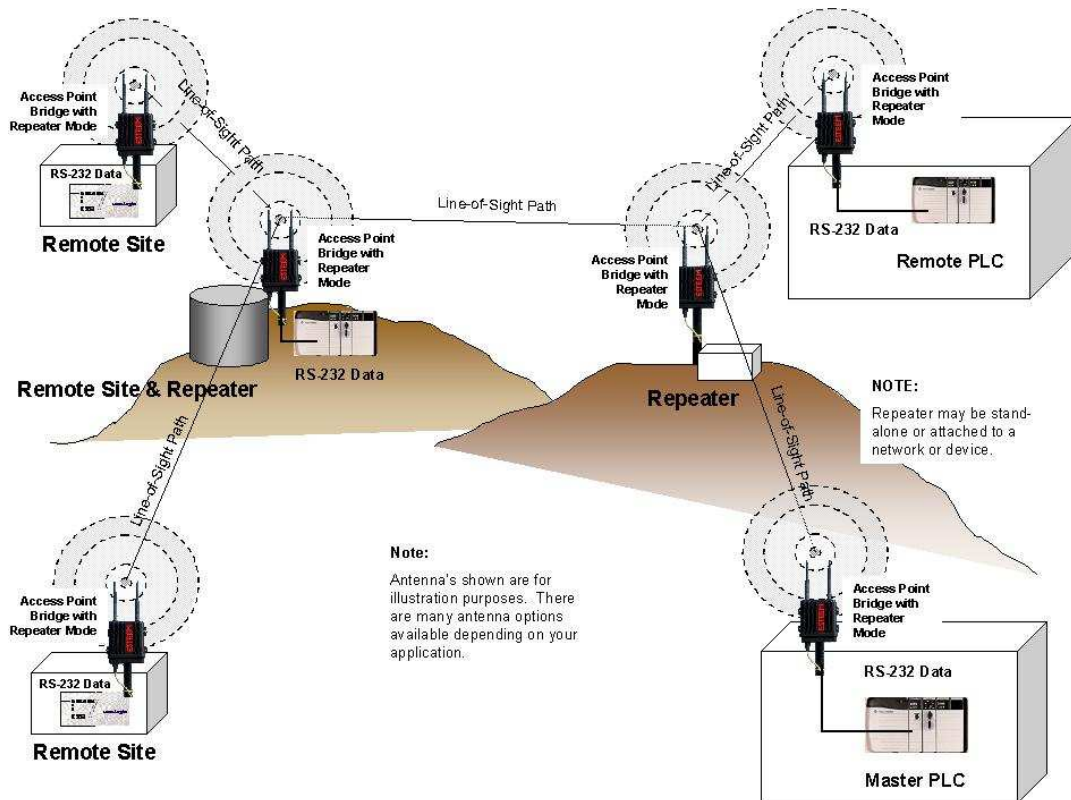


Figure 15: Multi-point Serial Diagram

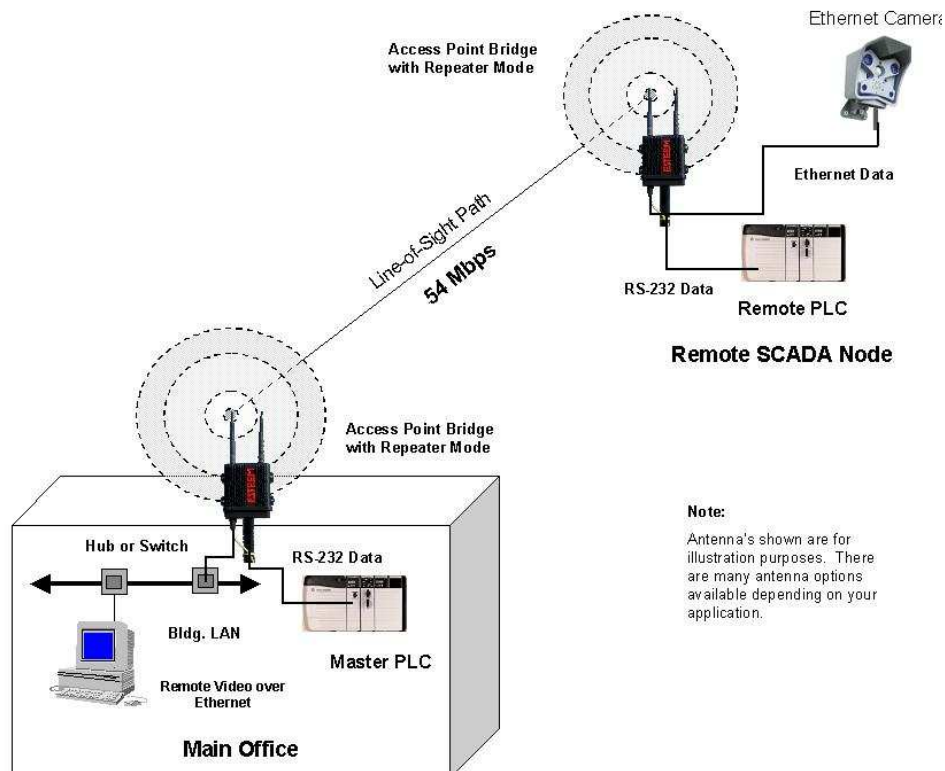


Figure 16: Ethernet and Serial Diagram

OVERVIEW

Most configuration of the ESTeem Model 195Ed is completed using the internal Web interface (discussed in detail in Chapter 4), but to access the modem through a web browser requires first setting the TCP/IP address. The TCP/IP address (IP address) is set at the factory for a static Class B (172.16.xxx.xxx - Mask 255.255.0.0) and listed on the ESTeem documentation. If this IP address does not match your network configuration, you will need to use either the ESTeem 195E Discovery program or the RS-232 interface to set the IP address in the 195Ed.

QUICK START GUIDE

A printed copy of the Model 195Ed Quick Start Guide was provided in the documentation package that arrived with your new ESTeem 195Ed. This guide is an abbreviated step-by-step procedure on configuration of the 195Ed for most Ethernet bridging and Access Point applications. A copy of the Quick Start Guide is provided in Appendix H of this User's Manual for convenience.

MODEL 195Ed HARDWARE LAYOUT

Unpack the ESTeem Model 195Ed shipping boxes and locate the items contained 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 195Ed's network may have different hardware components based upon the final installation location (i.e. Outdoor, Indoor, Point-to-point or Multi-Point). Antenna types, cable lengths, power supplies may be different, but the following items will be required for basic setup:

Model 195Ed



AA109 Resource Disk



**Antenna
(AA20DMES
Displayed)**



(2) Ethernet Cables



**Power Supply
(AA175 Displayed)**



**Serial Interface Cable
(AA6021.1)**



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

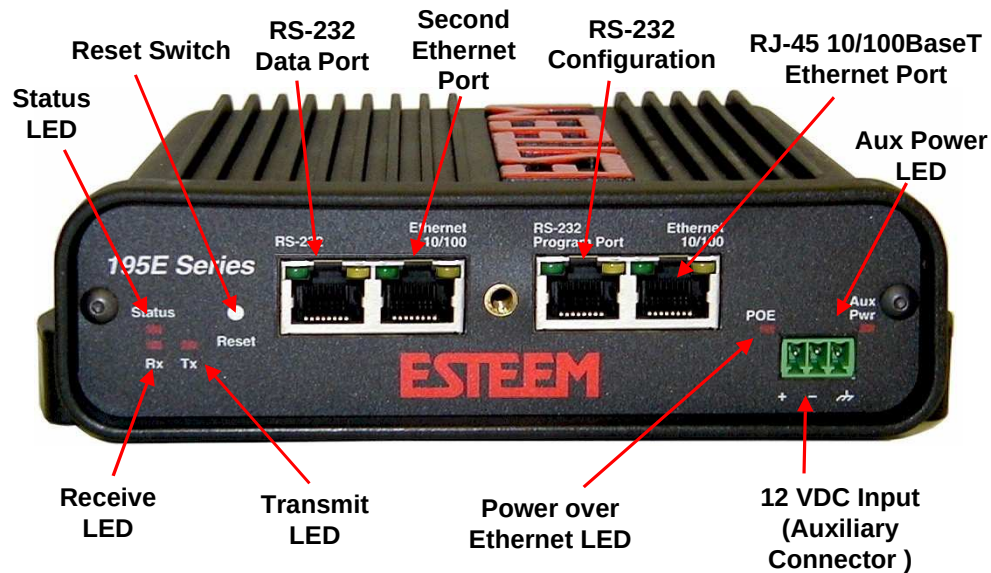


Figure 1: 195Ed Front Panel Overview

Notes:

- There is no Power On/Off switch on the Model 195Ed.
- One word of caution, always attach an antenna to Port A (Figure 2) on the Model 195Ed before power up.



Antenna Port A
(Single Receive Antenna)

Antenna Port B
(Dual Receive Antennas)

Antenna Connectors
(TNC Female-RP)

Figure 2: 195Ed Antenna Overview

MODEL 195Ed HARDWARE CONFIGURATION

The following steps should be completed before any modifications are made to the IP address in the ESTeem Model 195Ed:

1. Connect the antenna to the antenna connector on the ESTeem Model 195Ed (Figure 3). For a single antenna use Antenna Port A and connect both if using dual antennas.

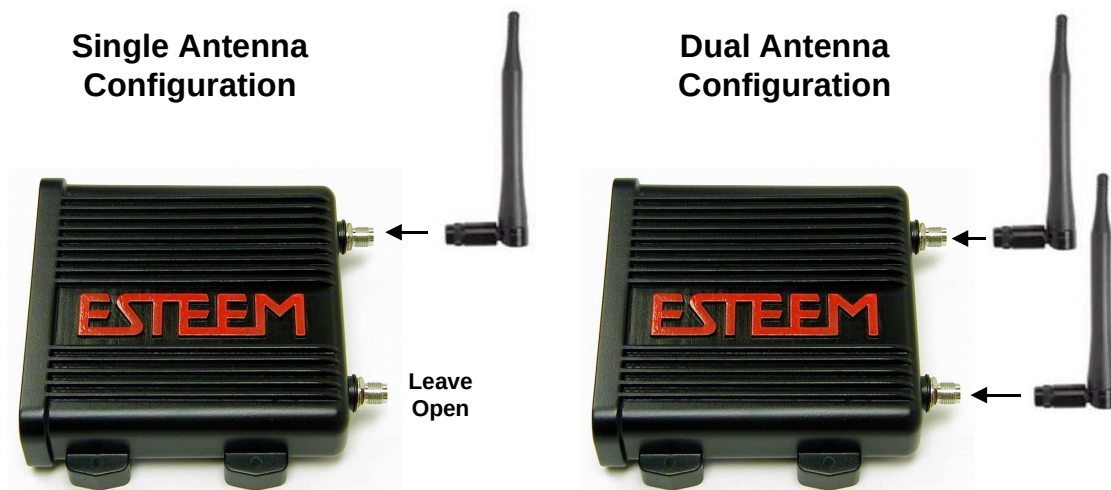


Figure 3: Antenna Configuration Diagram

2. Assemble the 195Ed hardware as shown in Figure 4.

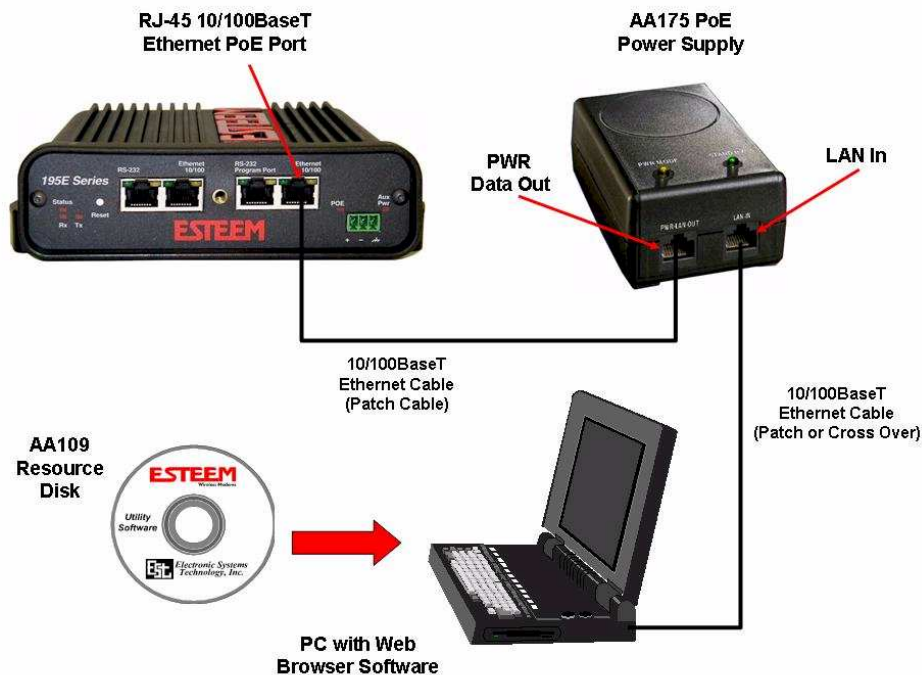


Figure 4: Hardware Configuration Diagram

Notes:

- *Configure the Model 195Ed prior to mounting.*
- *Some of the following steps, such as connecting the serial cable, are easier to perform if the ESTeem is accessible.*
- *Please attach an antenna to the Model 195Ed before power up.*
- *There is no Power On/Off switch on the Model 195Ed.*

3. Complete the following System Configuration Table. The Model 195Ed will link to other Model 195Ed's on the network via the WLAN Media Access Control (MAC) address found on the bottom of the case. This MAC address is six hexadecimal digits separated by colons and is configured at the factory. Every MAC address in the world is unique and can not be changed. Complete the following chart to aid in your when defining modes of operation and repeater routes.

Modem_ID(Name) /Operating Mode	Serial Number	IP Address	Ethernet MAC	WLAN MAC
Example Modem 1 AP_Bridge	E-14001	172.16.8.101	00:04:3f:00:01:01	00:04:3f:00:01:02

ESTEEM DISCOVERY UTILITY

The ESTeem Discovery Utility will allow you to configure the IP address on the Model 195Ed 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 stand-alone copy of the ESTeem Web site (Figure 5). Navigation of the Resource Disk is as simple as using your web browser. All technical documentation, User's Manuals and the ESTeem Utility Program is 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 6).



Figure 5: ESTeem Resource Main Page



Figure 6: Discovery Utility Download

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 195EdiscoverySetup.exe file listed in the window to install the program.

4. Connect the Model 195Ed to your computer either direct to the Ethernet card or through a HUB/Switch using a CAT-5e Ethernet cable. The Ethernet port on the 195Ed 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 195Ed will be displayed in the program by the Ethernet MAC address and Current IP Address (Figure 7).

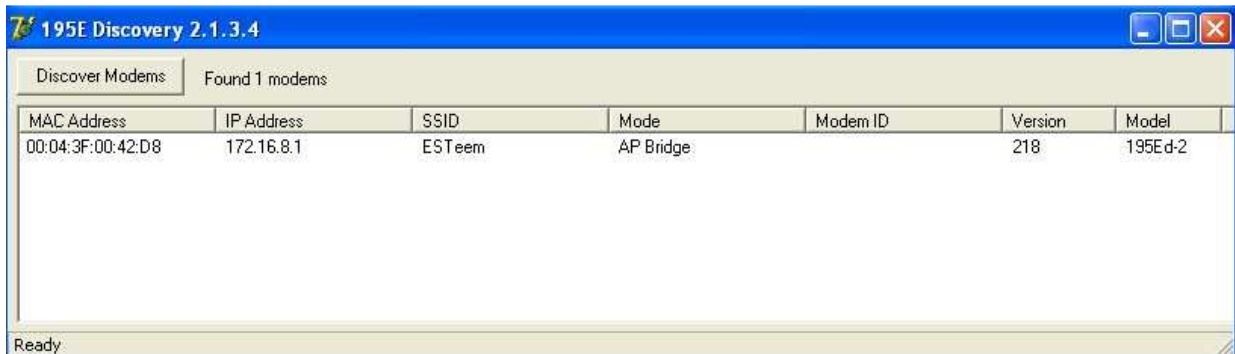


Figure 7: Discovery Program Main Page

Note: The SSID and Mode of Operation will be adjusted later in the configuration.

5. Double-click on the 195Ed you want to program and the *Configure IP Address* window will be displayed (Figure 8). Enter an IP address and Subnet Mask for the 195Ed 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 195Ed will reboot. Proceed to ESTeem Setup in Chapter 4.



Figure 8: Change IP Address Window

USING THE RS-232 INTERFACE

Any terminal emulation program that can run with VT100 emulation can be used for this configuration of the ESTeem. Most Windows users will probably use either Hyper Terminal or the Terminal Emulation in the ESTeem Utility program. Configure your RS-232C port for a Baud Rate to 38,400, Data Bits to 8, Parity to None, Stop Bits to 1 and Handshaking to None and set the Emulation type to VT100. Once your ESTeem has an IP address, you can attach the ESTeem to your network and use the Web Server for further programming.

Programming Using the RS-232 Port

1. When configuring the Model 195Ed for the first time you can use the ESTeem RS-232C Configuration Menu to setup the basic operating parameters such as assigning the IP Address, IP Net Mask, and Gateway IP Address.
2. Connect the serial cable (EST P/N: AA0621.1) between the RS-232 connector (RJ-45) on the Model 195Ed's programming port to the serial port on the computer.
3. Any terminal emulation program can be used for the configuration of the Model 195Ed. Most users will use either the Terminal Emulation section of the ESTeem Utility Program or Hyper Terminal in Windows. Configure your RS-232C port for a Baud Rate to 38,400, Data Bits to 8, Parity to None, Stop Bits to 1, use No Handshaking (Flow Control) and set the Terminal to VT100 emulation.
4. Plug the Model AA175 power supply into a wall socket and connect an Ethernet patch cable from the Model 195Ed Ethernet port to the J1 (Data&PWR) port on the power supply (Figure 4). The Power over Ethernet (POE) LED on the front of the ESTeem should be illuminated.
5. If your computer is configured properly, you will see the ESTeem Model 195Ed 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 195Ed and/or check the programming of your RS-232 port.

6. Press the Enter key and you will be at the Configuration Menu 195Ed login prompt. See Figure 9.
7. To enter the Model 195Ed Main Menu you will need to log into the system with a login name and password.

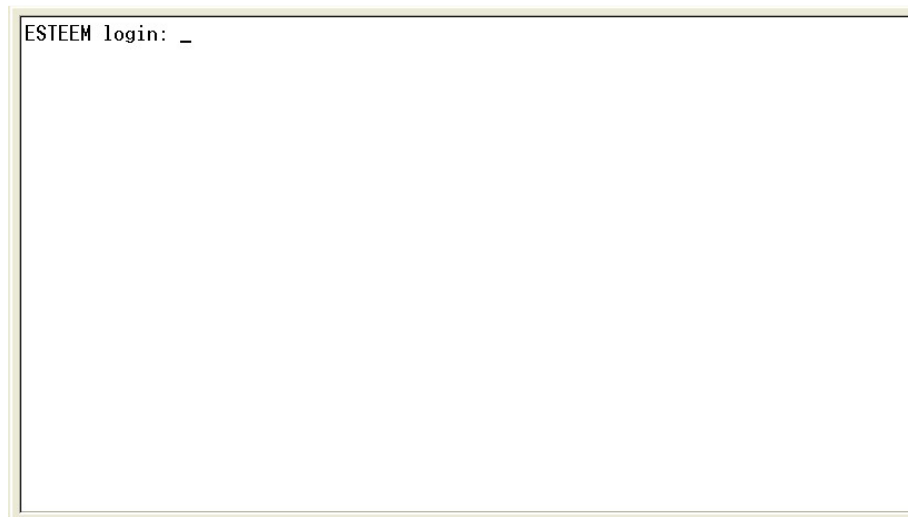


Figure 9: RS-232 Port Log-in Screen

8. If this is not the first time configuration of the Model 195Ed, see your network systems administrator for the password.
9. At the 195Ed 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.**
10. If this is the first time the Model 195Ed 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>).

Note: All characters are lower case.

The ESTeem Configuration Welcome Screen (Figure 10) will now be displayed.

```
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 10: RS-232 Welcome Screen

11. To set the IP address in the ESTeem 195Ed, type the letter A and press the Enter key. Enter the value for the IP address, Netmask and default route and pressing the Enter key after each entry.
12. After the basic parameters have been entered into the Model 195Ed you will need to commit the changes to the Model 195Ed (Figure 11). Press the C key and then the Enter and 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. Proceed to Chapter 4.

```
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 11: RS-232 Welcome Screen

The ESTeem Model 195Ed Web Configuration Manager is an internal web server that will allow setup, monitoring and diagnostics of all operating parameters in the Model 195Ed. The 195Ed can be configured using any current web browser software such as Internet Explorer, Netscape or Mozilla.

LOGGING ON TO THE ESTeem WEB PAGE

1. Using your Web Browser connect to the Model 195Ed 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 195Ed 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

If this is the first time the Model 195Ed has been programmed and 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>).
- Note: All characters are lower case.

5. After Log-in the next screen displayed will be the Model 195Ed Top Menu page (Figure 2). This example screen shows the Top Menu screen.

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

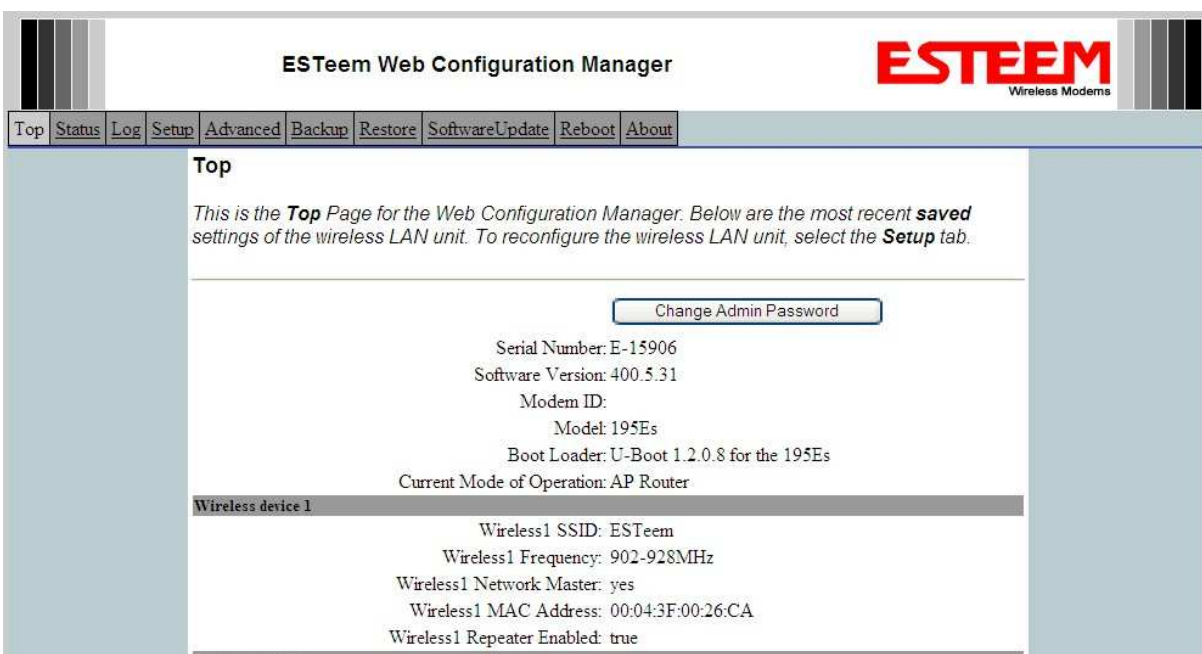


Figure 2: Top Menu Screen

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 195Ed in different Modes of Operation, please refer to Chapter 5 – Example Configurations.

Top Menu

The Top Menu will be the default web page for the Model 195Ed Web Configuration Manager (Figure 2). This section will display the current configuration summary for the Model 195Ed and allow changing of the default password. This page will also display the Modem ID field that can be used to easily identify the 195Ed 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. In 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 195Ed.

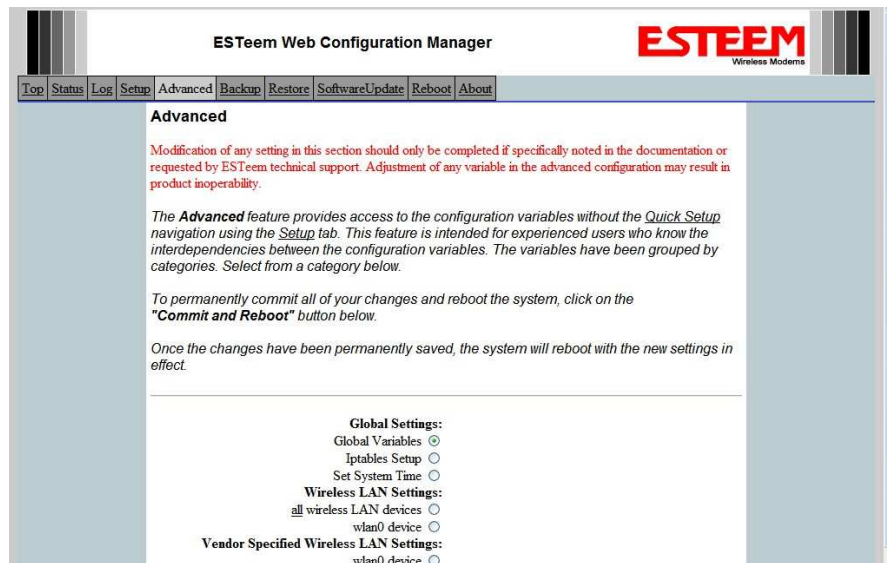


Figure 3: Global Variables Screen

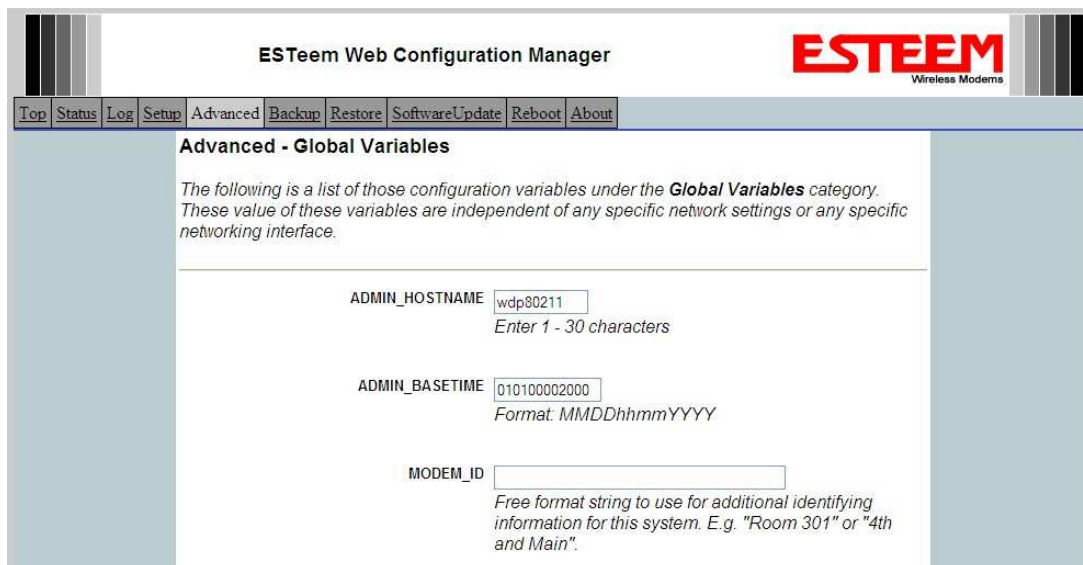


Figure 4: Modem ID Entry Screen

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. For a detailed explanation of how to use the status screen to troubleshoot the wireless network, refer to Appendix F – Troubleshooting in this manual

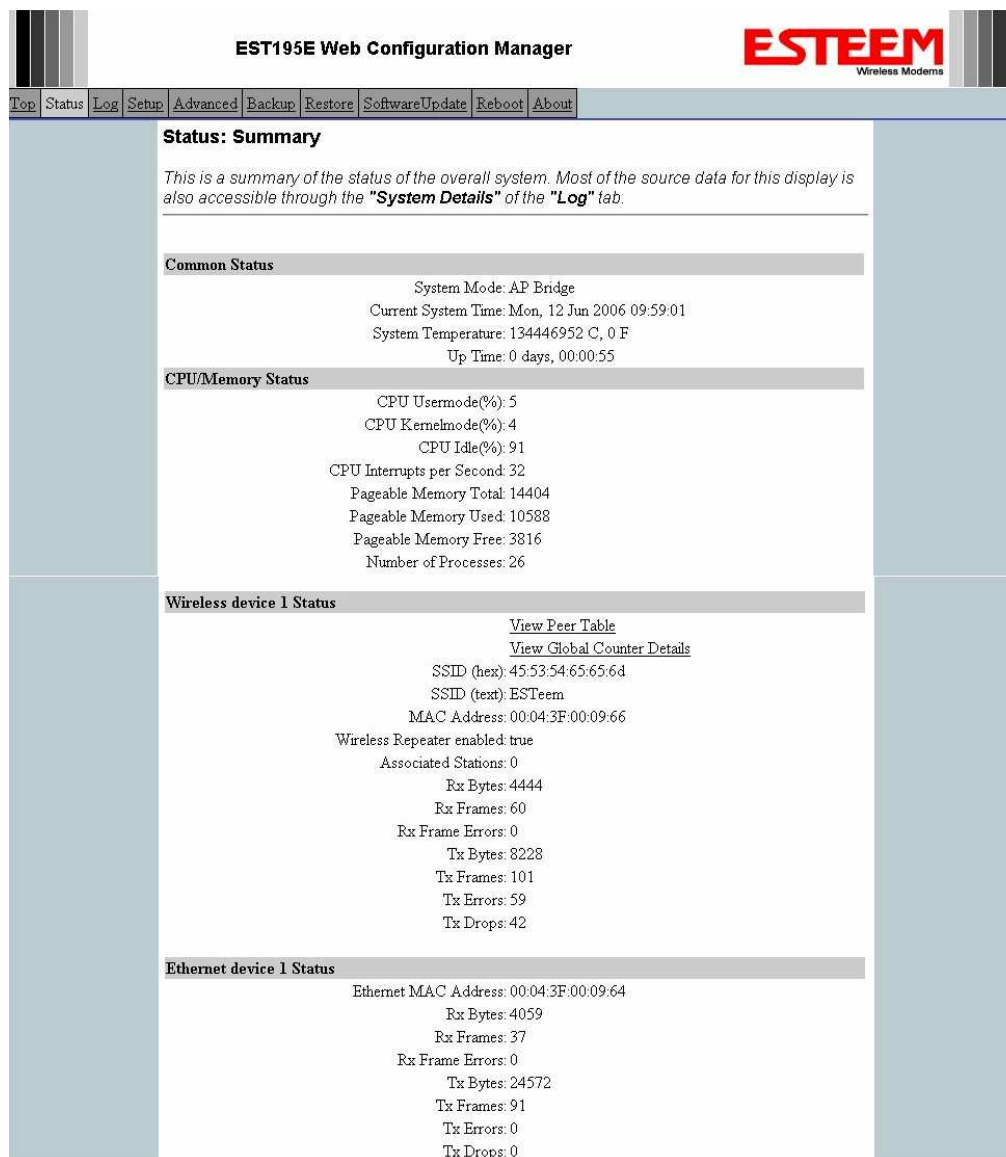


Figure 5: Status Screen

The Counter Details submenu will summarize all transmitted and receive data packets for the Model 195Ed (Figure 5).

System Log Screen

The Log Screen is a trouble-shooting tool that shows the current log of Model 195Ed 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 195Ed. Please see Chapter 5 for complete description on System Setup menu and examples for system configurations. See Figure 8.

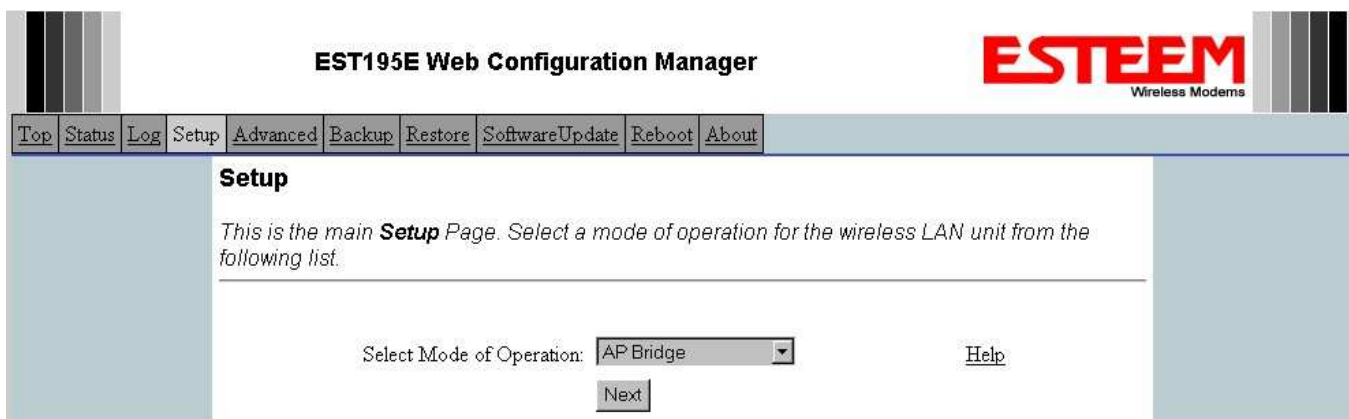


Figure 8: Setup Screen

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 195Ed enter this section unless instructed by ESTeem technical support.** See Figure 9.

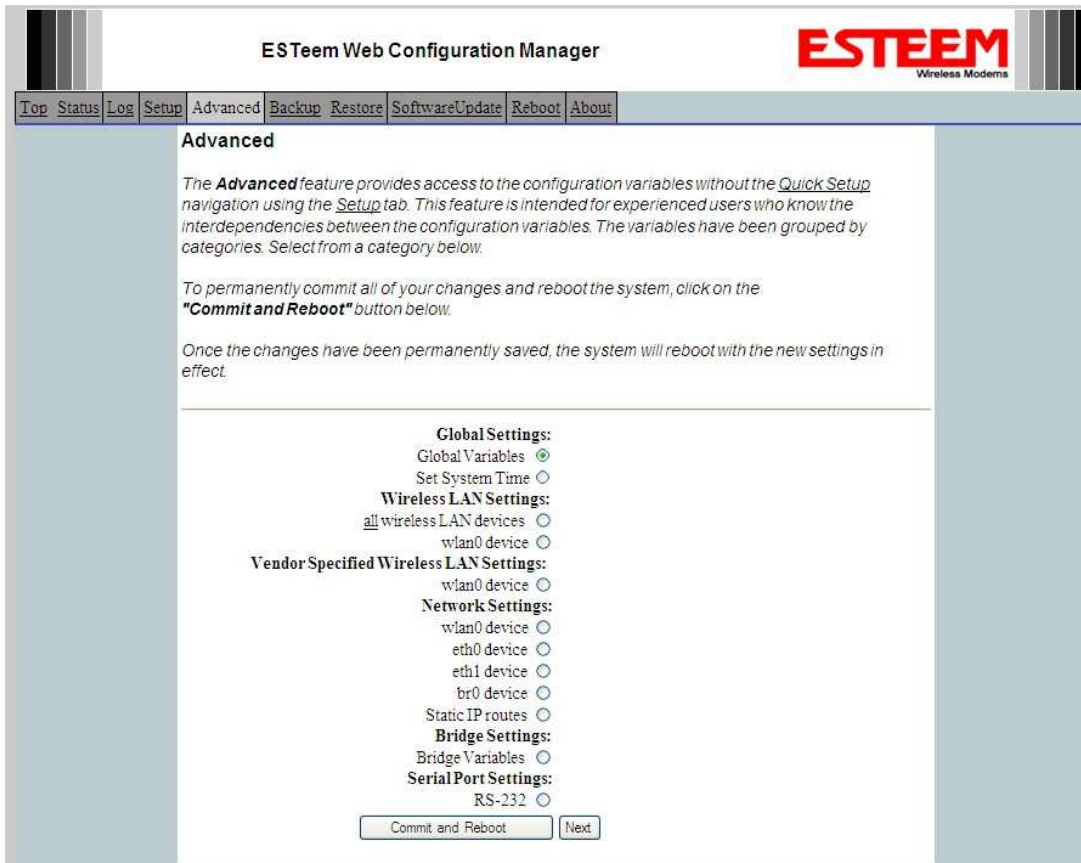


Figure 9: Advanced Features Screen

Backup Screen

The Backup Screen saves the current configuration in the Model 195Ed 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 195Ed with a spare modem.

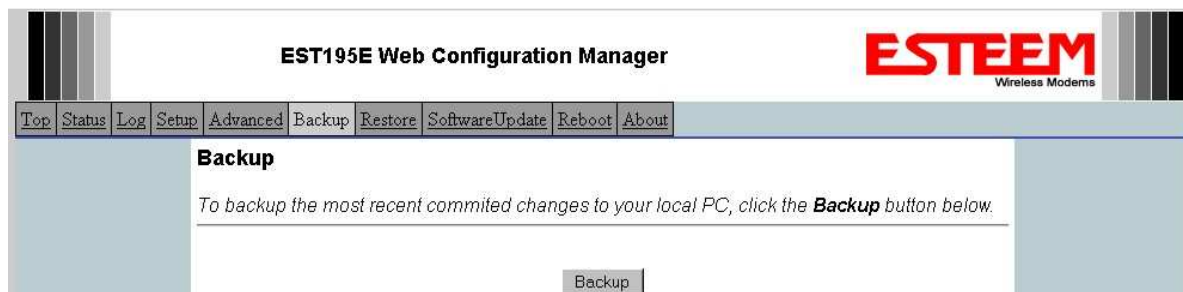


Figure 10: Backup Screen

Restore Screen

The Restore screen is used to restore the 195Ed 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 195Ed 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 195Ed.

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 195Ed operating system software from a file supplied by the factory or the Internet to the Model 195Ed'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 195Ed. See Figure 14.

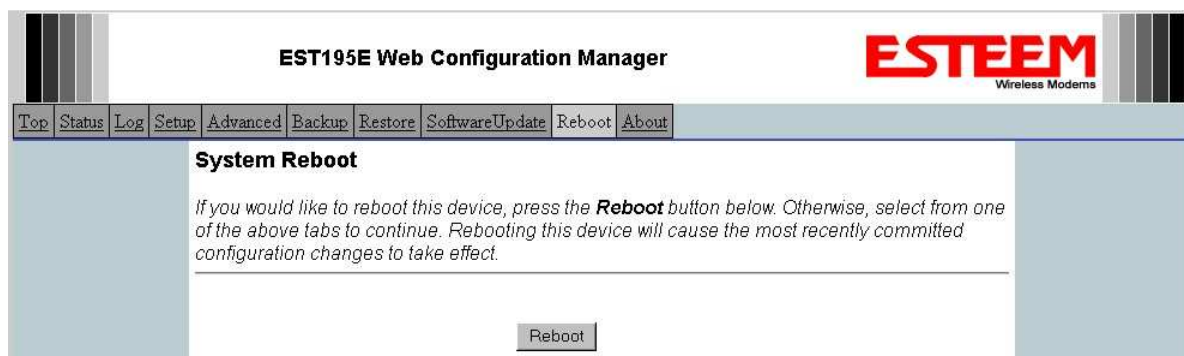


Figure 14: System Reboot Screen

PROGRAMMING EXAMPLES

In this chapter we will demonstrate how to program the ESTeem Model 195Ed for each of the operating modes. For a detailed explanation of the modes, please refer to Chapter 1 of this manual. In the following examples we assume that the modems have been initially configured for IP Address, Net Mask, etc. and are ready for programming from the Model 195Ed's Web Configuration Manager's Setup Menu. The first example network in Figure 1 consist of two wired Ethernet networks (Large Plant LAN and Remote Building) that will be bridged together through a repeater site and have a direct backup pathway. This same wireless mesh canopy will provide wireless access to the single PLC on the forklift (Example 4).

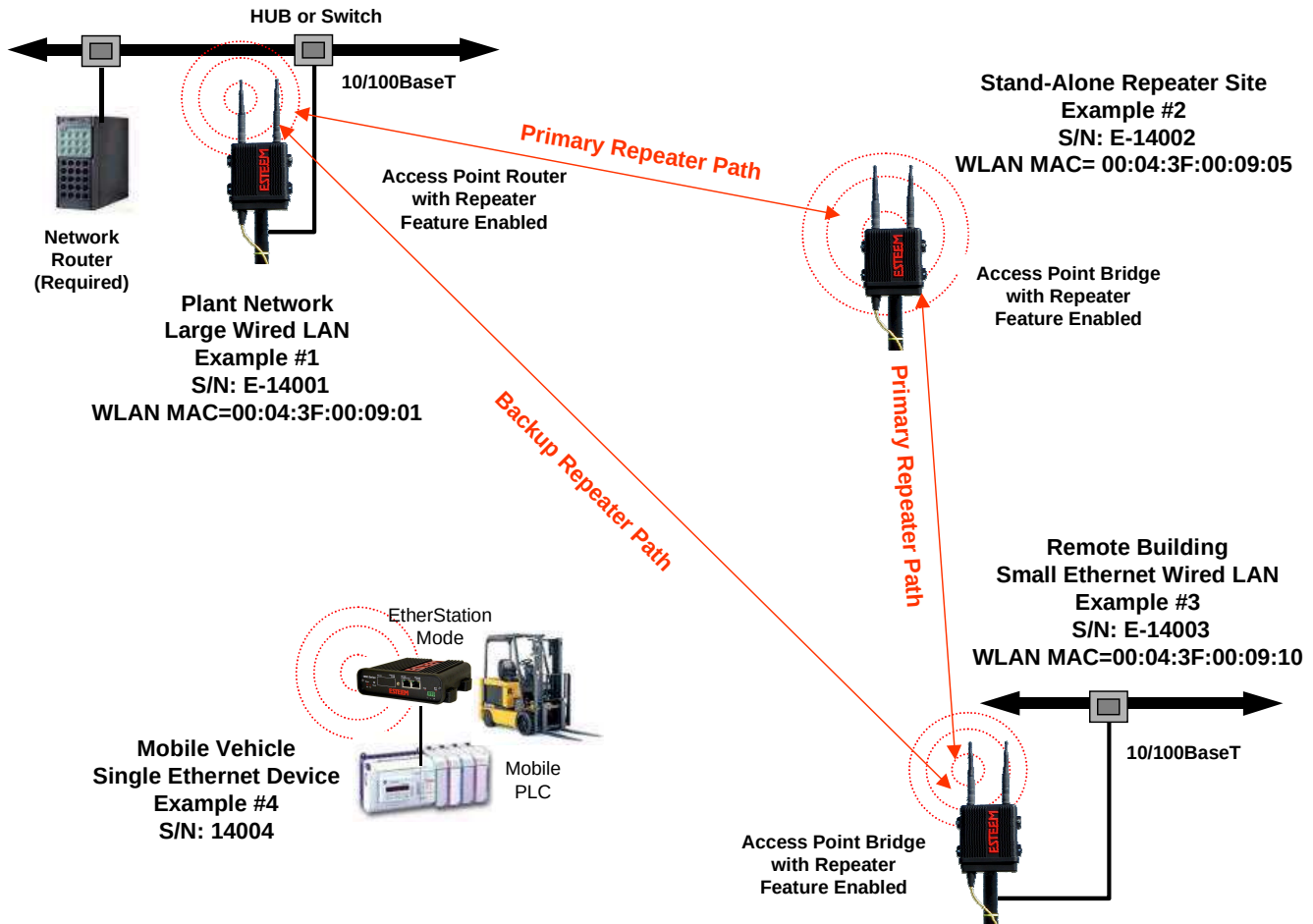


Figure 1: Programming Example #1 Diagram

The second example network (Figure 2) shows how to configure the Model 195Ed if multiple Ethernet devices are connected to a single ESTeem Model 195Ed. A separate network address for the connected hardware is required and can be configured for fixed or dynamic IP (DHCP) addressing. The use of multiple network addresses will require that a network router be programmed for each of the remote devices. As we learned in Chapter 1 of this manual, the difference in the Station Router and the Station Masquerade Mode will depend upon the required availability of accessing the connected Ethernet devices to the 195Ed. The Station Router will allow devices on the Ethernet LAN to access these device and the Station Masquerade will not, very similar to a firewall.

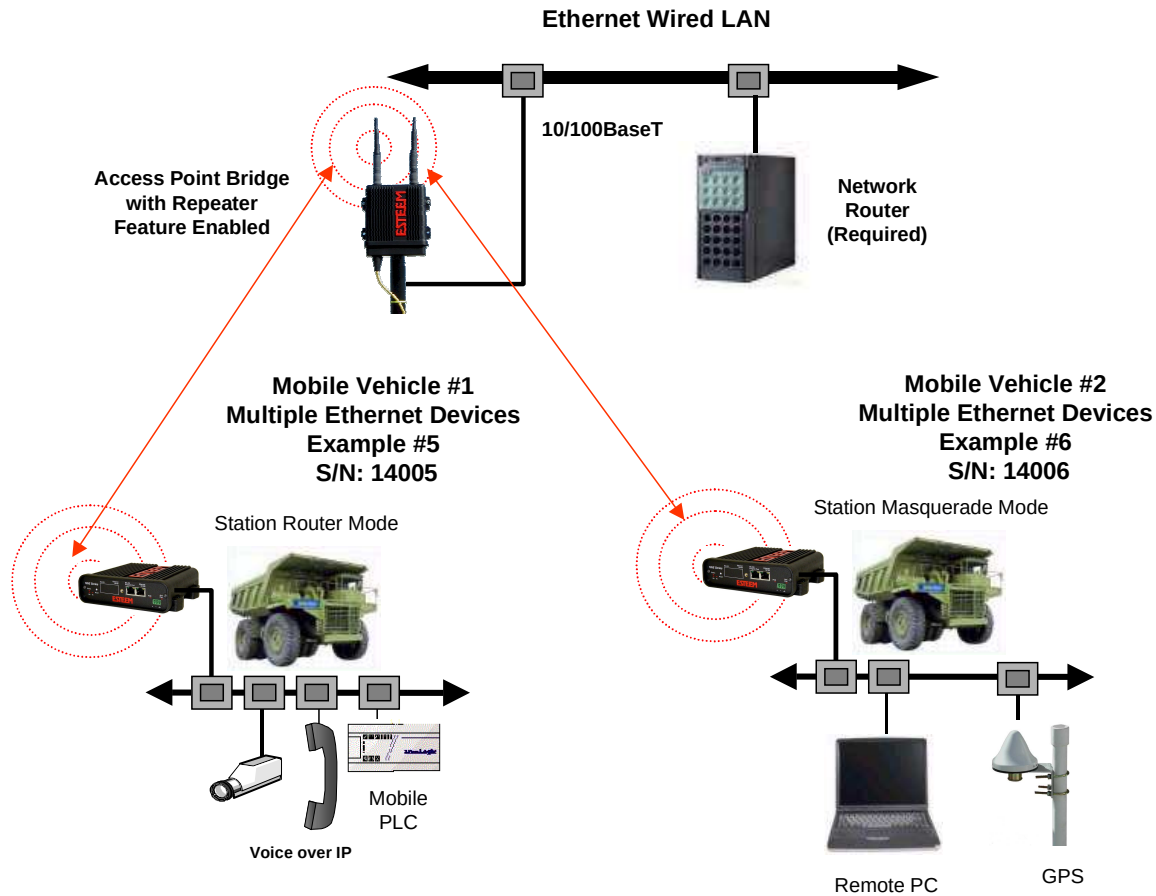


Figure 2: Programming Example #2 Diagram

Documentation

The first step when configuring your wireless system will be to document each Model 195Ed used in the network. The following is an example of the System Configuration Table (Chapter 2 – Starting Out) completed for the two example applications:

Modem_ID(Name) /Operating Mode	Serial Number	IP Address	Ethernet MAC	WLAN MAC
Plant Network AP_Router	E-14001	Ethernet 172.17.2.1 Wireless 172.16.2.1	00:04:3f:00:09:02	00:04:3f:00:09:01
Repeater AP_Bridge	E-14002	Bridge 172.16.2.5	00:04:3f:00:09:06	00:04:3f:00:09:05
Remote Building AP_Bridge	E-14003	Bridge 172.16.2.10	00:04:3f:00:09:11	00:04:3f:00:09:10
Forklift EtherStation	E-14004	N/A	00:04:3f:00:09:21	00:04:3f:00:09:20
Truck #1 Station Router	E-14005	Wireless 172.16.2.20 Ethernet 172.18.1.1	00:04:3f:00:09:26	00:04:3f:00:09:25
Truck #2 Station Masquerade	E-14006	Wireless 172.16.2.30 Ethernet 172.19.1.1	00:04:3f:00:09:31	00:04:3f:00:09:30

Table 1: Example System Configuration Table

Example 1 – Plant Network (Access Point Router with Repeater Enabled)

The ESTeem Model 195Ed configured as an Access Point Router will provide a separation between the larger Plant network and the Ethernet devices connected on the wireless network. This mode of operation is most often used when connecting the wireless system to a larger network to eliminate the Network broadcast traffic from entering the wireless system. If Ethernet devices on the Plant network want to access Ethernet devices on the wireless network, a network router is required to resolve the IP conflict created by having the wired and wireless networks on separate subnets.

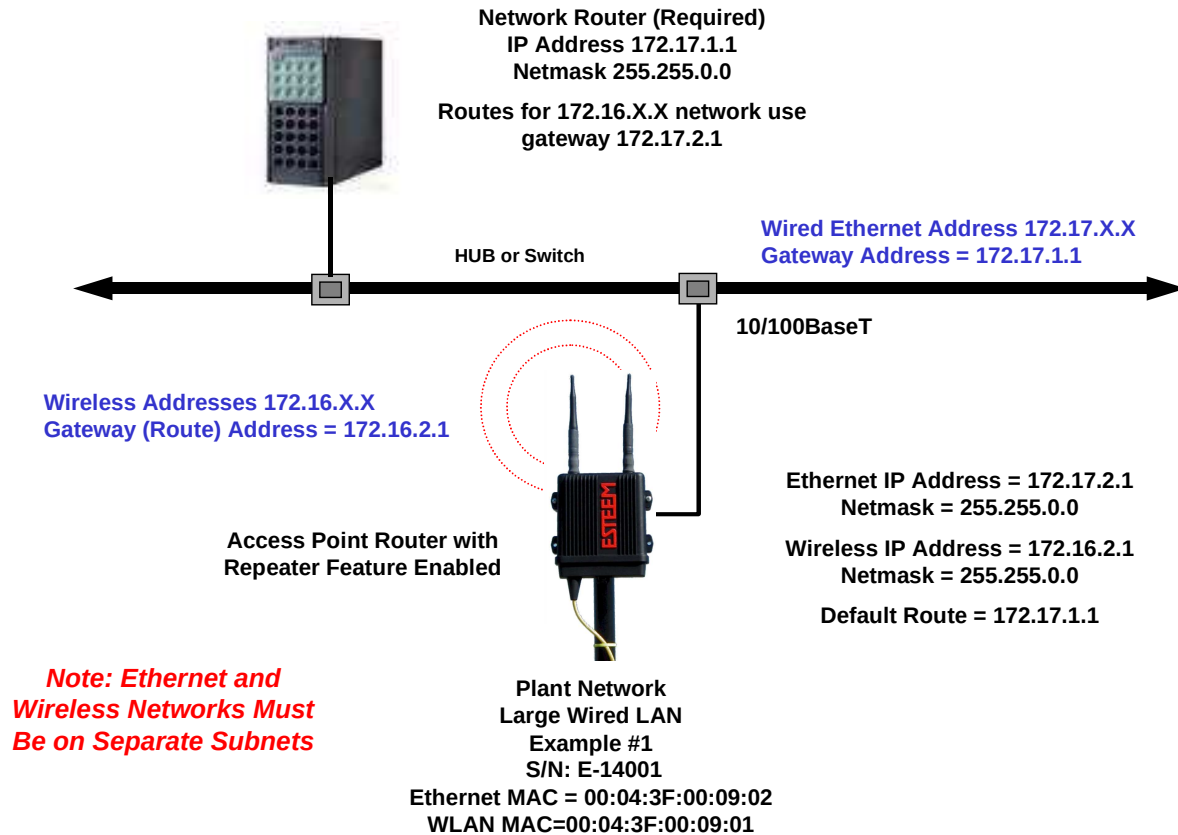


Figure 3: Access Point Router IP Addressing Example

1. Access the ESTeem Web page using your computer's Web Browser as per instructions in Chapter 4. Select Setup from the menu items. From the Select Mode of Operation pull down box , select AP Router (Figure 4) and push the Next button below the pull down box.

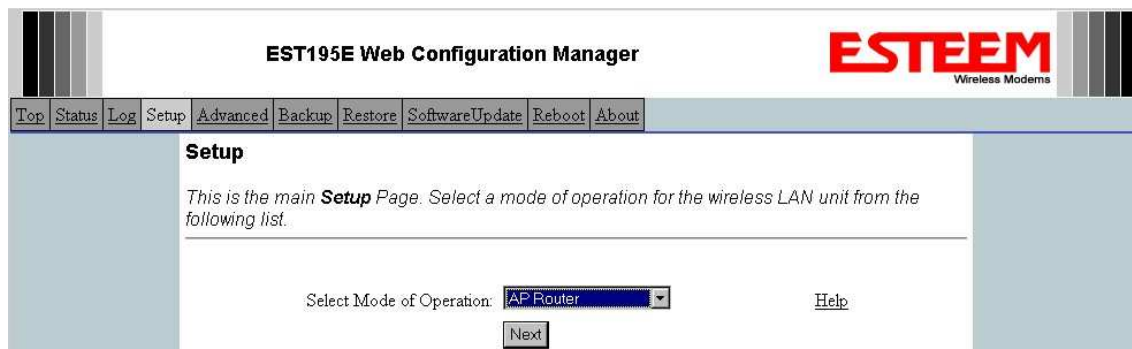


Figure 4: Access Point Router Setup Screen

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

2. Select if you want to use client or server Dynamic Host Configuration Protocol (DHCP) for the **Ethernet** device. If you want to enter a static IP address for the Model 195Ed, select Off and press the *Next* button. For our example, we have fixed IP addresses and will select Off. For more information on the operation and configuration of DHCP, please refer to Appendix C – Interface Ports. Reference Figure 5.

The screenshot shows the 'ESTeem Web Configuration Manager' interface. At the top, there is a navigation bar with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' link is highlighted. Below the navigation bar, the page title is 'Setup'. A descriptive text states: 'Select whether you wish to use DHCP client services or whether you wish configure a DHCP server. Selecting "None" will take you through a manual setup of IP addresses as opposed to using DHCP services.' Below this, it shows 'Selected mode of operation: AP Router'. Under 'DHCP services on the ethernet device:', there are three radio button options: 'None' (which is selected), 'Client', and 'Server'. To the right of these options is a 'Help' link. At the bottom, there are 'Previous' and 'Next' buttons.

Figure 5: DHCP Ethernet Port

3. Refer to the site documentation (Table 1) and enter the IP Address and IP Netmask for the Model 195Ed on the **Ethernet** port. Reference Figure 6.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation bar with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' link is highlighted. Below the navigation bar, the page title is 'Setup'. A descriptive text states: 'Enter values for the following fields for manual IP setup.' Below this, it shows 'Mode of operation: AP Router' and 'DHCP Services: Off'. Under 'Enter IP address for ethernet device:', there is a text input field containing '172.17.2.1'. To the right of this field is a 'Help' link. Under 'Enter netmask for ethernet device:', there is a text input field containing '255.255.0.0'. To the right of this field is another 'Help' link. At the bottom, there are 'Previous' and 'Next' buttons.

Figure 6: Ethernet IP Addressing

- Select if you want to use client or server Dynamic Host Configuration Protocol (DHCP) for the **Wireless** device. If you want to enter a static IP address for the Model 195Ed, select Off and press the *Next* button. For our example, we have fixed IP addresses and will select Off. For more information on the operation and configuration of DHCP, please refer to Appendix C – Interface Ports. Reference Figure 7.

The screenshot shows the 'Setup' page of the ESTEEM Web Configuration Manager. The page has a navigation bar with tabs: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' tab is selected. The main content area is titled 'Setup' and contains the following text: 'Select whether you wish to use DHCP client services or whether you wish configure a DHCP server. Selecting "None" will take you through a manual setup of IP addresses as opposed to using DHCP services.' Below this text, it says 'Selected mode of operation: AP Router'. Then, 'DHCP services on the wireless interface:' is followed by three radio buttons: 'None' (selected), 'Client', and 'Server'. There is a 'Help' link to the right of the radio buttons. At the bottom, there are 'Previous' and 'Next' buttons.

Figure 7: DHCP Wireless Port

- Refer to the site documentation (Table 1) and enter the IP Address and IP Netmask for the Model 195Ed on the **Wireless** port. Reference Figure 8.

The screenshot shows the 'Setup' page of the ESTEEM Web Configuration Manager, specifically the manual IP setup section. The page has the same navigation bar as Figure 7. The main content area is titled 'Setup' and contains the text: 'Enter values for the following fields for manual IP setup of the wireless device.' Below this, it says 'Mode of operation: AP Router' and 'DHCP Services: Off'. Then, there are two input fields: 'Enter IP address for wireless device:' with the value '172.16.2.1' and 'Enter netmask for wireless device:' with the value '255.255.0.0'. There are 'Help' links to the right of each input field. At the bottom, there are 'Previous' and 'Next' buttons.

Figure 8: Wireless IP Address

- Enter the default route (Gateway) address for the network. This AP Router 195Ed will use the Network Router for address resolution (Figure 3). Enter the IP address for the Network Router and any DNS server information. If you are not connecting the Model 195Ed to the Internet, leave blank and press the *Next* button. Figure 9.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation bar with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' tab is selected. Below the navigation bar, the page title is 'Setup'. A sub-header reads: 'Enter values for the following fields to set up the default route and DNS settings'. The form contains the following fields and options:

- Mode of operation: AP Router
- Enter default route IP address: 172.17.1.1 (with a [Help](#) link)
- Use DNS client services? ☐ Yes ☒ No (with a [Help](#) link)
- Enter DNS domain: (with a [Help](#) link)
- Enter primary DNS server IP address: (with a [Help](#) link)
- Enter secondary DNS server IP address: (with a [Help](#) link)

At the bottom of the form are 'Previous' and 'Next' buttons.

Figure 9: Gateway and DNS Settings

- Select Yes if you will be using security for client access to your wireless network (recommended).

NOTE: The setting of this security level is **ONLY** for client access to the Model 195Ed. The security of the Bridge communication between the Model 195Ed's is separate and will be configured during the repeater configuration.

Enter the SSID for your network. The SSID is the unique identification for your wireless network and all 195Ed that share a wireless network **MUST** have the same SSID code. This identification code is case sensitive. Reference Figure 10.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation bar with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' tab is selected. Below the navigation bar, the page title is 'Setup'. A sub-header reads: 'In the following fields, select whether you want wireless security features turned on and enter the service set identifier (SSID) that will be common to all wireless LAN devices.' The form contains the following fields and options:

- Selected mode of operation: AP Router
- Turn on wireless security features? ☒ Yes ☐ No (with a [Help](#) link)
- Enter the SSID: ESTeem (with a [Help](#) link)

At the bottom of the form are 'Previous' and 'Next' buttons.

Figure 10: SSID Entry

- Select the encryption level for the 195Ed mobile client access to the network. For further information on the different levels of security, please refer to Appendix E – Security of this User’s Manual. If you would like to hide the SSID from broadcasting from the Access Point and would like to discard the broadcast probes select **Yes**. If Yes is selected the Model 195Ed will no longer send out periodic SSID radio beacons. The users of the network will have to know the SSID to enter the network and security is increased, but if you want the SSID to be broadcast to the network for easy identification then select **No**. In our example, we will be using mobile clients with 128 bit WEP. Reference Figure 11.

The screenshot shows the 'ESTEEM Web Configuration Manager' interface. At the top, there is a navigation bar with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' link is highlighted. Below the navigation bar, the page title is 'Setup'. A sub-header reads: 'Enter/select values for the following fields to set up wireless security features.' The main content area contains two sections. The first section is 'Select an encryption type:' with a list of radio buttons: None, WEP 64-bit, WEP 128-bit (selected), WPA PSK, WPA Enterprise, WPA2 (AES-CCMP) PSK, and WPA2 (AES-CCMP) Enterprise. A 'Help' link is to the right. The second section is 'Hide Beacon SSID and Discard Broadcast Probes?' with radio buttons for Yes and No (selected). Another 'Help' link is to the right. At the bottom are 'Previous' and 'Next' buttons.

Figure 11: Security Selection

- Enter the WEP key values for your application that will be used by all devices on the wireless network. Reference Figure 12.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation bar with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' link is highlighted. Below the navigation bar, the page title is 'Setup'. A sub-header reads: 'Enter 13 hexadecimal bytes, separated by colons, for each of the following 128-bit WEP keys and select which key should be used as the default WEP key. These values are effective for all wireless LAN devices.' The main content area contains the following fields: 'Encryption type: 128-Bit WEP for ALL wireless LAN devices', 'Enter WEP Key 1 (13 hex bytes):' with a text input field containing '11:22:33:44:55:66:77:88:99:00:aa:bb:cc' and a 'Help' link, 'Enter WEP Key 2 (13 hex bytes):' with a text input field containing '11:22:33:44:55:66:77:88:99:00:aa:bb:cc', 'Enter WEP Key 3 (13 hex bytes):' with a text input field containing '11:22:33:44:55:66:77:88:99:00:aa:bb:cc', 'Enter WEP Key 4 (13 hex bytes):' with a text input field containing '11:22:33:44:55:66:77:88:99:00:aa:bb:cc', and 'Select the default WEP key:' with radio buttons for WEP Key 1 (selected), WEP Key 2, WEP Key 3, and WEP Key 4. A 'Help' link is to the right. At the bottom are 'Previous' and 'Next' buttons.

Figure 12: WEP Key Input Screen

10. Enter the values for the Access Control List (ACL). This is a configurable MAC filter that can be set to allow or deny specific wireless MAC address to the network. This feature is further explained in Appendix E – Security. In our example we will not use the ACL and leave at the default value of “Allow all”. Reference Figure 13.

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Enter the appropriate values in the fields below for configuring MAC Address Authentication. If **allow_all** is selected, the MACs in the access control list are ignored.

Choose one of the following MAC address authentication modes:

☒ allow_all [Help](#)
☐ allow only those client MACs in the list below
☐ deny only those client MACs in the list below

Enter MAC address:

Access Control List:

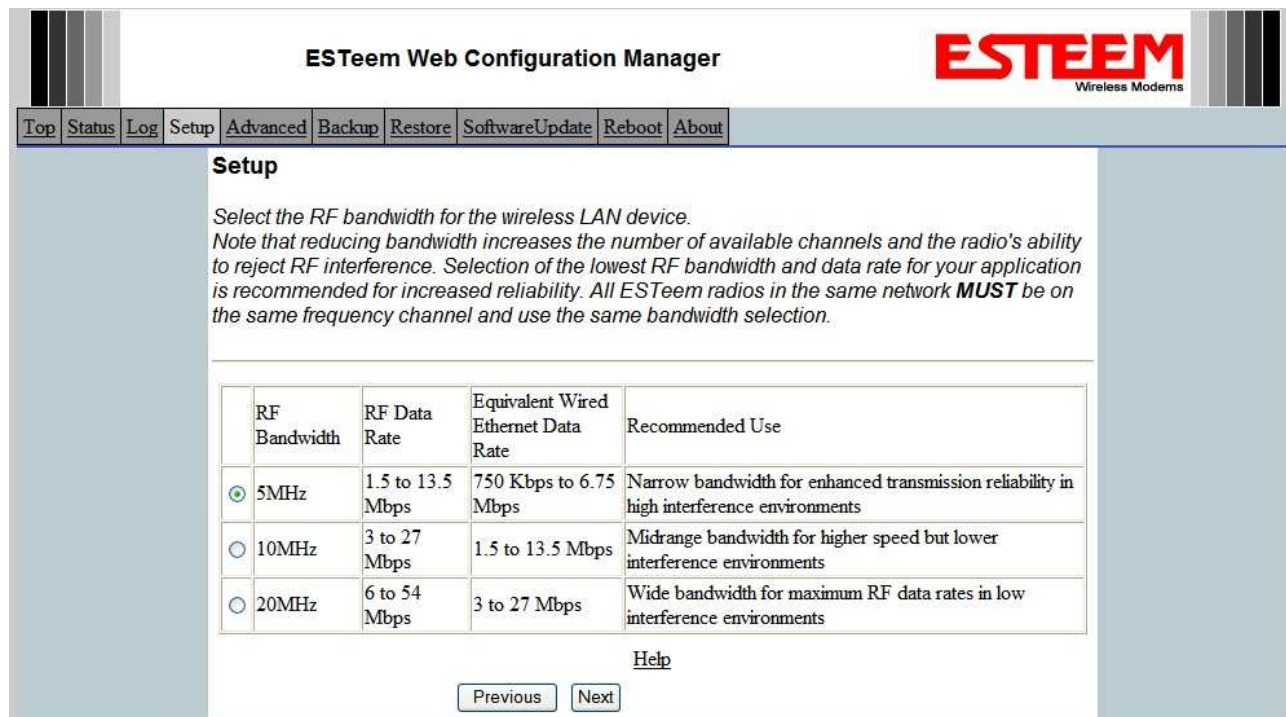
--

To remove a MAC address from the access control list, select the MAC to remove and click the **Remove MAC** button. To remove all MAC addresses from the list, click the **Remove ALL MACs**.

Figure 13: Access Control List Settings

11. Select the RF bandwidth for the operating environment and application. Higher RF Bandwidths allow higher data rates but, the lower bandwidths operate better in higher noise environments. It is suggested to use the lowest bandwidth that your application data rate will allow to increase reliability. For our example we will use 5 MHz bandwidth. Reference Figure 14.

Caution: All ESTeem 195Ed's in the same network must be configured for the same RF Bandwidth to communicate.



ESTeem Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Select the RF bandwidth for the wireless LAN device.
Note that reducing bandwidth increases the number of available channels and the radio's ability to reject RF interference. Selection of the lowest RF bandwidth and data rate for your application is recommended for increased reliability. All ESTeem radios in the same network **MUST** be on the same frequency channel and use the same bandwidth selection.

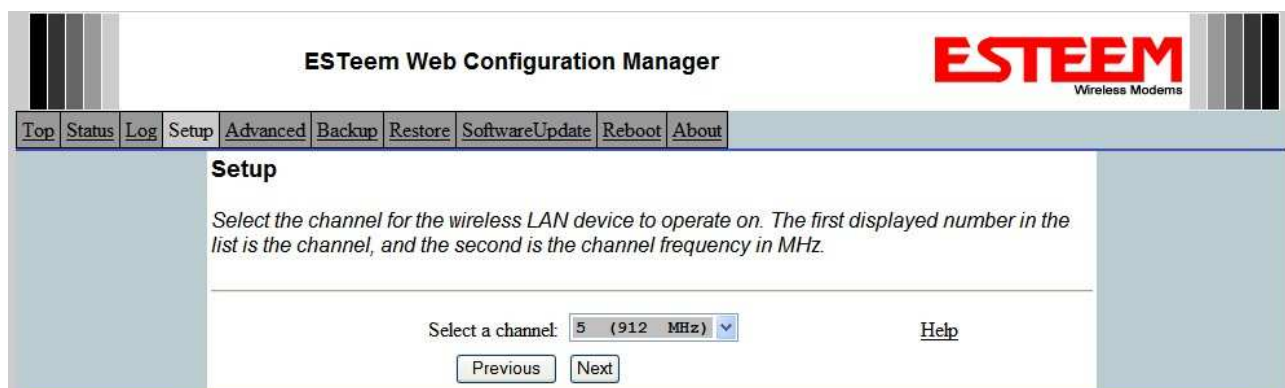
RF Bandwidth	RF Data Rate	Equivalent Wired Ethernet Data Rate	Recommended Use
☒ 5MHz	1.5 to 13.5 Mbps	750 Kbps to 6.75 Mbps	Narrow bandwidth for enhanced transmission reliability in high interference environments
☐ 10MHz	3 to 27 Mbps	1.5 to 13.5 Mbps	Midrange bandwidth for higher speed but lower interference environments
☐ 20MHz	6 to 54 Mbps	3 to 27 Mbps	Wide bandwidth for maximum RF data rates in low interference environments

[Help](#)

[Previous](#) [Next](#)

Figure 14: RF Bandwidth Selection

12. Select the frequency channel of operation. All Access Points in the same Repeater Peer network need to be on the same radio frequency channel. See Appendix D – Radio Configuration for help in selecting the frequency channel. Reference Figure 15.



ESTeem Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Select the channel for the wireless LAN device to operate on. The first displayed number in the list is the channel, and the second is the channel frequency in MHz.

Select a channel: **5 (912 MHz)**

[Help](#)

[Previous](#) [Next](#)

Figure 15: Radio Channel Selection

13. The Repeater Peer Table (Figure 16) identifies which Model 195Ed's will bridge wireless Ethernet communication. Only other Access Point Repeaters need to be listed not the Model 195Ed's in client modes. Multiple links to the same destination will provide a backup pathway (Mesh Network) if the primary pathway is lost. Looking at the system layout in Figure 1, both the repeater site and the direct link will be listed. Using the System Configuration Table (Table 1) as a guide, enter the Wireless (WLAN) MAC address for the 195Ed's that will communicate with the Access Point Router (Example 1) starting with the primary repeater path through the stand-alone repeater.

ESTEEM Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Select whether to enable repeater capability. If the **repeater** capability is disabled, the peer list is ignored. If the **repeater** capability is enabled, then a link is established with each peer in the list.

You may add a peer to the list, remove an existing peer or modify an existing peer by clicking the appropriate button below.

The following configurations are for the wireless LAN device.

Enable the **repeater** capability? ☒ Yes ☐ No [Help](#)

Set as **root bridge**? ☐ Yes ☒ No

MAC	Addr	Port Priority	Path Cost	Encrypt Type	Data Rate	Enable
Repeater Peer List:						

[Add](#) [Remove](#) [Modify](#)

[Previous](#) [Next](#)

Figure 16: Blank Repeater Table

The communication link through repeater site is the best radio path from the Plant Network to the Remote Building and we want this link to be the primary repeater route. The 195Ed follows the same networking “rules” as any other Ethernet device and if we made no changes to the default path cost of 100 the lowest path cost would be directly to the Remote Building (Direct = 100, Repeater = 200 (100+100)). To configure the 195Ed to select the repeater as the primary radio path, the direct link’s path cost must be greater than the cost through the repeater link (any number greater than 200). We will set the path cost at 201 for the direct link, making the repeater link a lower path cost and thus the primary pathway. Press the *Add* button to enter the first repeater link to the Repeater Peer List and Figure 16 will be displayed.

Note: For a more complete description on configuring repeater routes, see Chapter 6 – Repeating Features.

First Repeater Link -

Enter the **Wireless (WLAN) MAC** address of the stand-alone repeater site and the path cost for this link will stay at the default value at 100. Select the level of Encryption for this communication link. The encryption levels for the repeater peer link must be the same on both sides, but is completely independent from the Encryption level for the client access to the network. For consistency in our example, we will also use 128-Bit WEP Encryption for the Repeater Peer link. Setting the link data rate to Dynamic will allow all data rates from 1 Mbps to 54 Mbps to be used. Verify the Repeater Link is set to Enable and press the *Create Repeater Peer Button*.

ESTEEM Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup - Add a Repeater Peer

To add a new repeater peer for the **wireless** LAN interface, enter the WLAN MAC address, the port path cost, 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 port path cost (1-65535):

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:

6 Mbps
9 Mbps
12 Mbps
18 Mbps
24 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 17: First (Primary) Repeater Link

Second Repeater Link (Direct Path) -

Press the Add button a second time (Figure 16) and Figure 18 will be displayed. Enter the Wireless (WLAN) MAC address of the Remote Building and set the path cost for this link to a value of 201. Select the level of Encryption for this communication link. The encryption levels for the repeater peer link must be the same on both sides, but is completely independent from the Encryption level for the client access to the network. For consistency in our example, we will also use 128-Bit WEP Encryption for the Repeater Peer link. Setting the link data rate to Dynamic will allow all data rates to be used. Verify the Repeater Link is set to Enable and press the *Create Repeater Peer Button*.

ESTEEM Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup - Add a Repeater Peer

To add a new repeater peer for the **wireless** LAN interface, enter the WLAN MAC address, the port path cost, 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 port path cost (1-65535):

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:
 6 Mbps
 9 Mbps
 12 Mbps
 18 Mbps
 24 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 18: Second (Backup) Repeater Link

Figure 19 displays the complete repeater peer list with both repeater peer entries. Set Enable repeater capability to Yes and to both repeater paths. This Access Point Router 195Ed is also the primary data path for all Ethernet traffic on the network and will also need to be configured as the Root Bridge. Press the *Next* button to continue.

ESTEEM Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Select whether to enable repeater capability. If the **repeater** capability is disabled, the peer list is ignored. If the **repeater** capability is enabled, then a link is established with each peer in the list.

You may add a peer to the list, remove an existing peer or modify an existing peer by clicking the appropriate button below.

The following configurations are for the wireless LAN device.

Enable the **repeater** capability? ☒ Yes ☐ No [Help](#)

Set as **root** bridge? ☒ Yes ☐ No

MAC Addr	Port Priority	Path Cost	Encrypt Type	Data Rate	Enable	
00:04:3f:00:09:05	128	100	WEP128	Dynamic	true	Add
00:04:3f:00:09:10	128	201	WEP128	Dynamic	true	Remove

[Modify](#)

[Previous](#) [Next](#)

Figure 19: Completed Repeater Peer List

- Figure 20 will be displayed. If no further changes are necessary to the modem, you can commit the changes that will then be saved and the modem rebooted.

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

To permanently commit your changes, click on the "Commit Changes" button below.
Once the changes have been permanently saved, the system will reboot with the new settings in effect.

[Previous](#) [Commit Changes](#) [Go To Advanced Setup](#) [Cancel](#)

Figure 20: Commit Changes

Example 2 – Stand Alone Repeater (Access Point Bridge with Repeater Enabled)

Review the example diagram, Figure 1, and locate the 195Ed marked as Example #2. This ESTeem is being used by two other Model 195Ed's as a repeater but is not connected to an Ethernet network. This modem should be configured for Access Point Bridge mode.

1. Access the ESTeem Web page using your computer's Web Browser as per instructions in Chapter 4. Select Setup from the menu items. From the Select Mode of Operation pull down box, select AP Bridge (Figure 21) and push the *Next* button below the pull down box.

EST195E Web Configuration Manager

Top Status Log Setup Advanced Backup Restore SoftwareUpdate Reboot About

Setup

This is the main **Setup** Page. Select a mode of operation for the wireless LAN unit from the following list.

Select Mode of Operation: AP Bridge

Help

Next

Figure 21: Access Point Bridge

2. Select if you want to use client or server Dynamic Host Configuration Protocol (DHCP) for the 195Ed. If you want to enter a static IP address for the Model 195Ed, select Off and press the Next button. For our example, we have fixed IP addresses and will select Off. Reference Figure 22.

EST195E Web Configuration Manager

Top Status Log Setup Advanced Backup Restore SoftwareUpdate Reboot About

Setup

Select whether you wish to use DHCP client services or whether you wish configure a DHCP server. Selecting "None" will take you through a manual setup of IP addresses as opposed to using DHCP services.

Selected mode of operation: AP Bridge

DHCP services on the bridge interface: ☒ None ☐ Client ☐ Server

Help

Previous Next

Figure 22: DHCP Configuration

3. Enter the **bridge** IP Address and IP Netmask for the Model 195Ed. You will notice that for the 195Ed in AP Bridge mode only a single IP address is entered. Both the ethernet IP and wireless IP addresses will be the same in the bridge mode. Reference Figure 23.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation bar with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' link is highlighted. Below the navigation bar, the page title is 'Setup'. A subtitle reads: 'Enter values for the following fields for manual IP setup of the **bridging** device.' The main content area shows the following configuration options:

- Mode of operation: AP Bridge
- DHCP Services: Off
- Enter IP address for **bridge** device: [Help](#)
- Enter netmask for **bridge** device: [Help](#)

At the bottom of the configuration area, there are two buttons: 'Previous' and 'Next'.

Figure 23: Bridge IP Addresses

4. Enter the default route (Gateway) address for the network. For Ethernet devices on the wireless network (IP 172.16.X.X – See Figure 3), the AP Router 195Ed will be the gateway. Enter the **wireless** IP address for the AP Router 195Ed (configured in Example 1) and any DNS server information. If you are not connecting the Model 195Ed to the Internet, leave blank and press the Next button. Figure 24.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation bar with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' link is highlighted. Below the navigation bar, the page title is 'Setup'. A subtitle reads: 'Enter values for the following fields to set up the default route and DNS settings'. The main content area shows the following configuration options:

- Mode of operation: AP Bridge
- Enter default route IP address: [Help](#)
- Use DNS client services? ☐ Yes [Help](#)
☒ No
- Enter DNS domain: [Help](#)
- Enter primary DNS server IP address: [Help](#)
- Enter secondary DNS server IP address: [Help](#)

At the bottom of the configuration area, there are two buttons: 'Previous' and 'Next'.

Figure 24: Default Route (Gateway) and DNS Configuration

5. Select Yes if you will be using security for your wireless network (recommended).

NOTE: The setting of this security level is ONLY for client access to the Model 195Ed. The security of the Bridge communication between the Model 195Ed's is separate and will be configured during the repeater configuration.

Enter the SSID for your network. The SSID is the unique identification for your wireless network and all 195Ed that share a wireless network MUST have the same SSID code. This identification code is case sensitive. Reference Figure 25.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation bar with tabs: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' tab is selected. Below the navigation bar, the page title is 'Setup'. A message reads: 'In the following fields, select whether you want wireless security features turned on and enter the service set identifier (SSID) that will be common to all wireless LAN devices.' Below this, the 'Selected mode of operation' is set to 'AP Bridge'. The 'Turn on wireless security features?' section has two radio buttons: 'Yes' (selected) and 'No'. There is a 'Help' link next to it. The 'Enter the SSID:' field contains the text 'ESTeem'. There is another 'Help' link next to it. At the bottom, there are 'Previous' and 'Next' buttons.

Figure 25: Security and SSID Configuration

6. Select the encryption level for client access to the wireless network. For further information on the different levels of security, please refer to Appendix E – Security of this User's Manual. If you would like to hide the SSID from broadcasting from the Access Point select **Yes**. If Yes is selected the Model 195Ed will not send out periodic SSID radio. The users of the network will have to know the SSID to enter the network and security is increased, but if you want the SSID to be broadcast to the network for easy identification then select **No**. The 195Ed can also be configured to discard the probe requests from clients. If desired, set Discard Broadcast Probes to Yes. In our example, we will be using mobile clients with 128 bit WEP. Reference Figure 26.

The screenshot shows the 'ESTeem Web Configuration Manager' interface. At the top, there is a navigation bar with tabs: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' tab is selected. Below the navigation bar, the page title is 'Setup'. A message reads: 'Enter/select values for the following fields to set up wireless security features.' Below this, the 'Select an encryption type:' section has a list of radio buttons: 'None', 'WEP 64-bit', 'WEP 128-bit' (selected), 'WPA PSK', 'WPA Enterprise', 'WPA2 (AES-CCMP) PSK', and 'WPA2 (AES-CCMP) Enterprise'. There is a 'Help' link next to it. The 'Hide Beacon SSID and Discard Broadcast Probes?' section has two radio buttons: 'Yes' and 'No' (selected). There is another 'Help' link next to it. At the bottom, there are 'Previous' and 'Next' buttons.

Figure 26: Encryption Level Selection

7. Enter the WEP key values for your application that will be used by all devices on the wireless network. Reference Figure 27.

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Enter 13 hexadecimal bytes, separated by colons, for each of the following 128-bit WEP keys and select which key should be used as the default WEP key. These values are effective for all wireless LAN devices.

Encryption type: 128-Bit WEP for ALL wireless LAN devices

Enter WEP Key 1 (13 hex bytes): [Help](#)

Enter WEP Key 2 (13 hex bytes):

Enter WEP Key 3 (13 hex bytes):

Enter WEP Key 4 (13 hex bytes):

Select the default WEP key:

☒ WEP Key 1
☐ WEP Key 2
☐ WEP Key 3
☐ WEP Key 4

[Help](#)

Figure 27: WEP Key Entry

8. Enter the values for the Access Control List (ACL). This is a configurable MAC filter that can be set to allow or deny specific wireless MAC address to the network. This feature is further explained in Appendix E – Security. In our example we will not use the ACL. Reference Figure 28.

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Enter the appropriate values in the fields below for configuring MAC Address Authentication. If **allow_all** is selected, the MACs in the access control list are ignored.

Choose one of the following MAC address authentication modes:

☒ allow_all
☐ allow only those client MACs in the list below
☐ deny only those client MACs in the list below

[Help](#)

Enter MAC address:

Access Control List:

--

To remove a MAC address from the access control list, select the MAC to remove and click the **Remove MAC** button. To remove all MAC addresses from the list, click the **Remove ALL MACs**.

Figure 28: ACL Configuration

9. Select the RF bandwidth for the operating environment and application. Higher RF Bandwidths allow higher data rates but, the lower bandwidths operate better in higher noise environments. It is suggested to use the lowest bandwidth that your application data rate will allow to increase reliability. For our example we will use 5 MHz bandwidth to match the AP Router configured above. Reference Figure 29.

ESTEEM Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Select the RF bandwidth for the wireless LAN device.
Note that reducing bandwidth increases the number of available channels and the radio's ability to reject RF interference. Selection of the lowest RF bandwidth and data rate for your application is recommended for increased reliability. All ESTEEM radios in the same network **MUST** be on the same frequency channel and use the same bandwidth selection.

RF Bandwidth	RF Data Rate	Equivalent Wired Ethernet Data Rate	Recommended Use
☒ 5MHz	1.5 to 13.5 Mbps	750 Kbps to 6.75 Mbps	Narrow bandwidth for enhanced transmission reliability in high interference environments
☐ 10MHz	3 to 27 Mbps	1.5 to 13.5 Mbps	Midrange bandwidth for higher speed but lower interference environments
☐ 20MHz	6 to 54 Mbps	3 to 27 Mbps	Wide bandwidth for maximum RF data rates in low interference environments

[Help](#)

Previous Next

Figure 29: RF Bandwidth Selection

10. Select the frequency channel of operation. All Access Points in the same Repeater Peer network need to be on the same radio frequency channel. See Appendix D – Radio Configuration for help in selecting the frequency channel. Reference Figure 30.

ESTEEM Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Select the channel for the wireless LAN device to operate on. The first displayed number in the list is the channel, and the second is the channel frequency in MHz.

Select a channel: 5 (912 MHz) ▼

[Help](#)

Previous Next

Figure 30: Channel Configuration

11. The Repeater Peer Table identifies which Model 195Ed's will bridge wireless Ethernet communication. Only other Access Point Repeaters need to be listed not the Model 195Ed's in client modes. Looking at the system layout in Figure 1 and what we discussed in Example 1, both the Plant Network's 195Ed and the Remote Building's 195Ed will be listed by their wireless (WLAN) MAC (Figure 31). There is only a single radio connection path to the other two 195Ed's in the network. The path cost only effects redundant links in the network (not applicable to the repeater) and will be left at default. Enter the WLAN MAC addresses for the other two Access Points and press the *Next* button to continue.

ESTEEM Web Configuration Manager

Top Status Log Setup Advanced Backup Restore SoftwareUpdate Reboot About

Setup

Select whether to enable repeater capability. If the **repeater** capability is disabled, the peer list is ignored. If the **repeater** capability is enabled, then a link is established with each peer in the list.

You may add a peer to the list, remove an existing peer or modify an existing peer by clicking the appropriate button below.

The following configurations are for the wireless LAN device.

Enable the **repeater** capability? ☒ Yes [Help](#)
☐ No

Set as **root** bridge? ☐ Yes
☒ No

MAC	Addr	Port	Path	Encrypt	Data	Enable
		Priority	Cost	Type	Rate	
00:04:3f:00:09:01		128	100	WEP128	Dynamic	true
00:04:3f:00:09:10		128	100	WEP128	Dynamic	true

Repeater Peer List:

Add Remove Modify

Previous Next

Figure 31: Repeater Configuration

12. Select Commit Changes to write the programming to Flash memory and reboot the Model 195Ed. When the reboot process has completed (approximately 45 seconds) the modem will be ready to place in operation.

Example 3 – Remote Building (Access Point Bridge with Repeater Enabled)

1. Review Example #1 diagram (Figure 1) and locate the 195Ed marked as Example 3. This ESTeem is connected to a Remote Building network that will be bridged to the Plant network through the Access Point Router (Example #1) via the repeater. This modem should be configured for Access Point Bridge mode and the configuration for this 195Ed will be identical to Example 2 except that the IP addressing and the Repeater Peer table. You would follow all steps 1-11 in Example 2 to configure this 195Ed also but Figures 32 & 33 will show the changes.

EST195E Web Configuration Manager

ESTEEM
Wireless Modems

[Top](#) [Status](#) [Log](#) [Setup](#) [Advanced](#) [Backup](#) [Restore](#) [SoftwareUpdate](#) [Reboot](#) [About](#)

Setup

Enter values for the following fields for manual IP setup of the **bridging** device.

Mode of operation: AP Bridge

DHCP Services: Off

Enter IP address for **bridge** device: [Help](#)

Enter netmask for **bridge** device: [Help](#)

Figure 32: Example 3 Bridge IP Address

ESTeem Web Configuration Manager

ESTEEM
Wireless Modems

[Top](#) [Status](#) [Log](#) [Setup](#) [Advanced](#) [Backup](#) [Restore](#) [SoftwareUpdate](#) [Reboot](#) [About](#)

Setup

Select whether to enable repeater capability. If the **repeater** capability is disabled, the peer list is ignored. If the **repeater** capability is enabled, then a link is established with each peer in the list.

You may add a peer to the list, remove an existing peer or modify an existing peer by clicking the appropriate button below.

The following configurations are for the wireless LAN device.

Enable the **repeater** capability? ☒ Yes [Help](#)
☐ No

Set as **root** bridge? ☐ Yes
☒ No

MAC Addr	Port Priority	Path Cost	Encrypt Type	Data Rate	Enable
00:04:3F:00:09:01	128	201	WEP128	Dynamic	true
00:04:3F:00:09:05	128	100	WEP128	Dynamic	true

Figure 33: Example 3 Repeater Routing Table

Example 4 – Mobile Vehicle with Single Ethernet Device (EtherStation Mode)

Review the Example Diagram #1 (Figure 1) and locate the 195Ed marked as Example 4. This ESTeem is connected to a single Ethernet device in a mobile application and will be configured for EtherStation mode. In this mode the 195Ed will gain access to the wireless Ethernet canopy created by the three Access Points (Examples 1-3), but will be emulating the MAC address for the connected Ethernet device and will no longer have an IP address in the network. To reprogram the 195Ed after configuration in EtherStation mode requires the ESTeem Discovery Utility or direct connection to the RS-232 port.

1. Access the ESTeem Web page using your computer's Web Browser as per instructions in Chapter 4. Select Setup from the menu items. From the Select Mode of Operation pull down box, select EtherStation (Figure 34) and push the *Next* button below the pull down box.

Figure 34: EtherStation Selection

2. Select the RF bandwidth to match the Access Points in the network. For our example we will use 5 MHz bandwidth to match the AP Router and AP Bridges configured above. Reference Figure 35.

RF Bandwidth	RF Data Rate	Equivalent Wired Ethernet Data Rate	Recommended Use
☒ 5MHz	1.5 to 13.5 Mbps	750 Kbps to 6.75 Mbps	Narrow bandwidth for enhanced transmission reliability in high interference environments
☐ 10MHz	3 to 27 Mbps	1.5 to 13.5 Mbps	Midrange bandwidth for higher speed but lower interference environments
☐ 20MHz	6 to 54 Mbps	3 to 27 Mbps	Wide bandwidth for maximum RF data rates in low interference environments

Figure 35: RF Bandwidth Selection

- Enter the SSID for your network. The SSID is the unique identification for your wireless network and all 195Ed that share a wireless network MUST have the same SSID code. This identification code is case sensitive. Select the encryption level for the wireless network to match the level of the Access Point canopy. Enter the MAC address of the connected Ethernet device. Reference Figure 36.

ESTeem Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

In the following fields, select whether you want wireless security features turned on and enter the service set identifier (SSID) that will be common to all wireless LAN devices.

Selected mode of operation: EtherStation

Enter the SSID: [Help](#)

Select an encryption type:

- ☐ None
- ☐ WEP64
- ☒ WEP128
- ☐ WPA PSK
- ☐ WPA Enterprise with PEAP
- ☐ WPA2 (AES-CCMP) PSK
- ☐ WPA2 (AES-CCMP) Enterprise with PEAP

[Help](#)

Device MAC Address: [Help](#)

Figure 36: SSID and Device MAC Input

- Enter the WEP key values for your application that will be used by all devices on the wireless network. Reference Figure 37.

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Enter 13 hexadecimal bytes, separated by colons, for each of the following 128-bit WEP keys and select which key should be used as the default WEP key. These values are configured for the wireless LAN device.

Encryption type: 128-Bit WEP for the wireless LAN device

Enter WEP Key 1 (13 hex bytes): [Help](#)

Enter WEP Key 2 (13 hex bytes):

Enter WEP Key 3 (13 hex bytes):

Enter WEP Key 4 (13 hex bytes):

Select the default WEP key:

- ☒ WEP Key 1
- ☐ WEP Key 2
- ☐ WEP Key 3
- ☐ WEP Key 4

[Help](#)

Figure 37: WEP Key Input

- Enter the values for the Access Point Access Control List (ACL). This is a configurable MAC filter that can be set to allow or deny connections to specific Access Point wireless MAC address to the network. In our example we will not use the ACL. Reference Figure 38.

ESTeem Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Enter the appropriate values in the fields below for configuring AP MAC Address Authentication. If **allow_all** is selected, the AP MACs in the access control list are ignored.

The following configurations are for the wireless LAN device.

Choose one of the following MAC address authentication modes for the wireless LAN device:

☒ allow_all [Help](#)

☐ allow only those AP MACs in the list below

☐ deny only those AP MACs in the list below

Enter MAC address:

Access Control List:

--

To remove a MAC address from the access control list, select the MAC to remove and click the **Remove MAC** button. To remove all MAC addresses from the list, click the **Remove ALL MACs** button.

Figure 38: Access Point Access Control

- Select Commit Changes to write the programming to Flash memory and reboot the Model 195Ed. When the reboot process has completed (approximately 45 seconds) the modem will be ready to place in operation. Reference Figure 39.

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

To permanently commit your changes, click on the "Commit Changes" button below. Once the changes have been permanently saved, the system will reboot with the new settings in effect.

Figure 39: Commit Changes and Reboot

Example 5 – Mobile Vehicle #1 (Station Router)

Review the Example Diagram #2 (Figure 2) and locate the 195Ed marked as Example 5. This ESTeem is connected to multiple Ethernet devices in a mobile application and will be configured Station Router mode. In this mode the 195Ed's will gain access to the wireless Ethernet canopy created by the Access Point and act as the router between the devices connected to the Ethernet port and wireless network. Each of these networks will require a unique subnet to operate. If Ethernet devices on the wired LAN network want to access Ethernet devices on the Station Router 195Ed, a network router is required on the wired LAN to resolve the IP conflict created by having the wired and wireless networks on separate subnets (Figure 40).

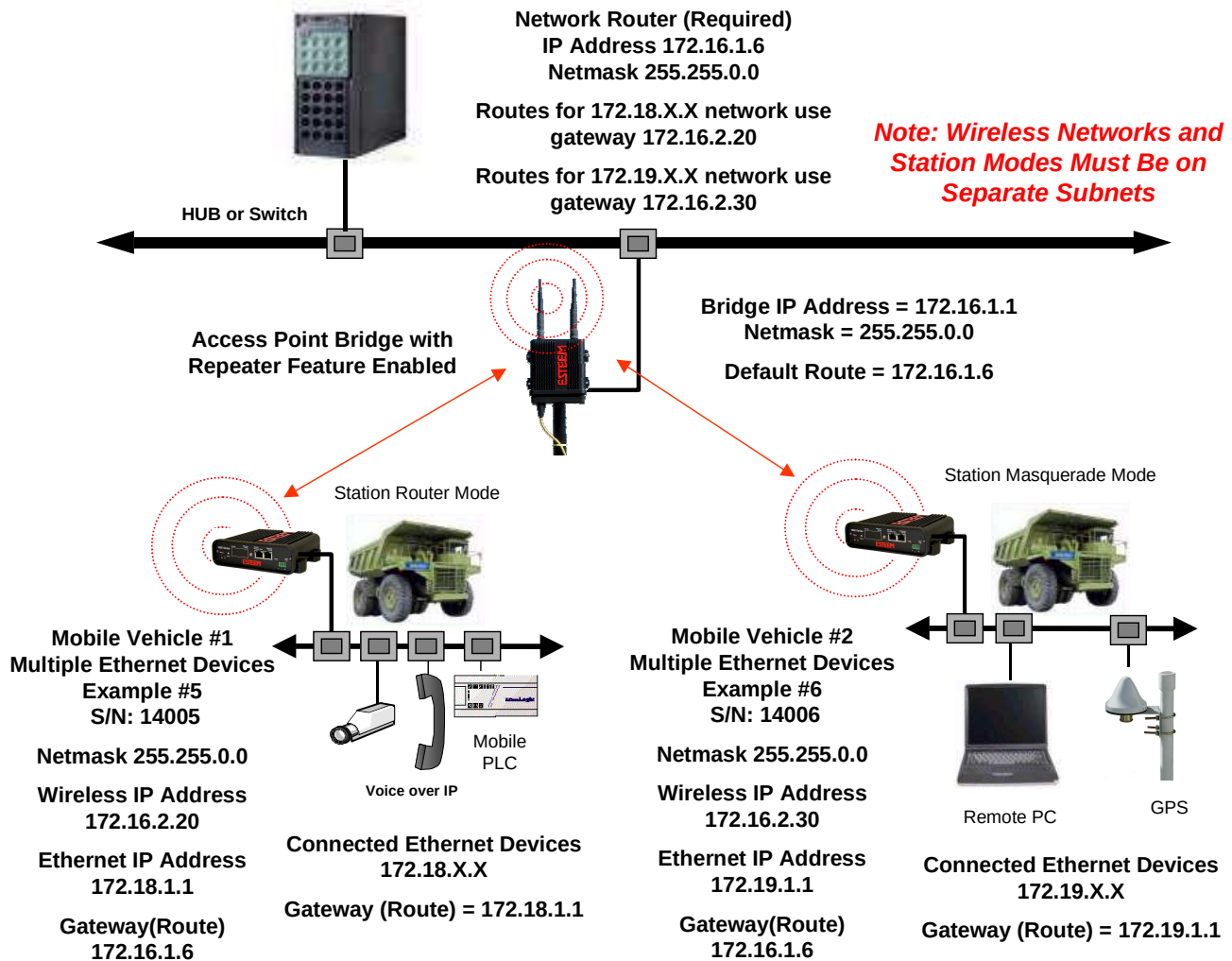


Figure 40: Station Router IP Addressing Diagram

1. Access the ESTeem Web page using your computer's Web Browser as per instructions in Chapter 4. Select Setup from the menu items. From the Select Mode of Operation pull down box, select Station Router (Figure 41) and push the *Next* button below the pull down box.

Figure 41: Station Router Selection

2. Select the RF bandwidth to match the Access Points in the network. For our example we will use 5 MHz bandwidth to match the AP Router and AP Bridges configured above. Reference Figure 42.

	RF Bandwidth	RF Data Rate	Equivalent Wired Ethernet Data Rate	Recommended Use
☒	5MHz	1.5 to 13.5 Mbps	750 Kbps to 6.75 Mbps	Narrow bandwidth for enhanced transmission reliability in high interference environments
☐	10MHz	3 to 27 Mbps	1.5 to 13.5 Mbps	Midrange bandwidth for higher speed but lower interference environments
☐	20MHz	6 to 54 Mbps	3 to 27 Mbps	Wide bandwidth for maximum RF data rates in low interference environments

Figure 42: RF Bandwidth Selection

3. Select **Yes** if you would like to use DHCP services on either the **wireless** or **ethernet** connections. Enter the SSID for your network. The SSID is the unique identification for your wireless network and all 195Ed that share a wireless network **MUST** have the same SSID code. This identification code is case sensitive and must **NOT** contain spaces. Select the encryption level for the wireless network to match the level of the Access Point canopy. Reference Figure 43.

ESTEEM Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

In the following fields, select whether you wish to use DHCP client services or whether you wish configure a DHCP server. Selecting "Off" will take you through a manual setup of IP addresses as opposed to using DHCP services.

*Additionally, select whether you want wireless security features turned on and enter the service set identifier (SSID) for the **wireless** LAN device.*

Selected mode of operation: Station Router

DHCP services on **wireless** interface: ☒ Off [Help](#)
☐ Client
☐ Server

DHCP services on **ethernet** interface: ☒ Off
☐ Client
☐ Server

Enter the SSID: [Help](#)
☐ None
☐ WEP64
☒ WEP128

Select an encryption type: ☐ WPA PSK [Help](#)
☐ WPA Enterprise with PEAP
☐ WPA2 (AES-CCMP) PSK
☐ WPA2 (AES-CCMP) Enterprise with PEAP

Figure 43:DHCP, SSID and Encryption Settings

4. Enter the WEP key values for your application that will be used by all devices on the wireless network. Reference Figure 44.

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Enter 13 hexadecimal bytes, separated by colons, for each of the following 128-bit WEP keys and select which key should be used as the default WEP key. These values are configured for the wireless LAN device.

Encryption type: 128-Bit WEP for the wireless LAN device.

Enter WEP Key 1 (13 hex bytes): [Help](#)

Enter WEP Key 2 (13 hex bytes):

Enter WEP Key 3 (13 hex bytes):

Enter WEP Key 4 (13 hex bytes):

Select the default WEP key:

☒ WEP Key 1
☐ WEP Key 2
☐ WEP Key 3
☐ WEP Key 4

[Help](#)

Figure 44:WEP Key Input

5. Enter the values for the Access Point Access Control List (ACL). This is a configurable MAC filter that can be set to allow or deny connections to specific Access Point wireless MAC address to the network. In our example we will not use the ACL. Reference Figure 45.

ESTeem Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Enter the appropriate values in the fields below for configuring AP MAC Address Authentication. If **allow_all** is selected, the AP MACs in the access control list are ignored.

The following configurations are for the wireless LAN device.

Choose one of the following MAC address authentication modes for the wireless LAN device:

☒ allow_all [Help](#)
☐ allow only those AP MACs in the list below
☐ deny only those AP MACs in the list below

Enter MAC address:

Access Control List:

To remove a MAC address from the access control list, select the MAC to remove and click the **Remove MAC** button. To remove all MAC addresses from the list, click the **Remove ALL MACs** button.

Figure 45: Access Point Access Control

6. Refer to the IP address in Table 1 and enter the **wireless** IP Address and IP Netmask for the Station Router. Reference Figure 46.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation bar with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' link is highlighted. Below the navigation bar, the page title is 'Setup'. A message reads: 'Enter values for the following fields for manual IP setup.' Below this, the configuration options are: 'Mode of operation: Station Router' and 'DHCP Services: Off'. There are two input fields: 'Enter IP address for the wireless LAN interface:' with the value '172.16.2.20' and 'Enter netmask for the wireless LAN interface:' with the value '255.255.0.0'. Each input field has a 'Help' link to its right. At the bottom, there are 'Previous' and 'Next' buttons.

Figure 46: Wireless IP Address

7. Refer to the IP address in Table 1 and enter the **ethernet** IP address and IP netmask. Reference Figure 47.
8. *Note: When configuring the Ethernet devices connected to the Station Router 195Ed, the ethernet IP address will be their Gateway address (Figure 37).*

The screenshot shows the 'ESTeem Web Configuration Manager' interface. At the top, there is a navigation bar with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' link is highlighted. Below the navigation bar, the page title is 'Setup'. A message reads: 'Enter values for the following fields for manual IP setup of the ethernet device.' Below this, the configuration options are: 'Mode of operation: Station Router' and 'DHCP Services: Off'. There are two input fields: 'Enter IP address for ethernet device:' with the value '172.18.1.1' and 'Enter netmask for ethernet device:' with the value '255.255.0.0'. Each input field has a 'Help' link to its right. At the bottom, there are 'Previous' and 'Next' buttons.

Figure 47: Wired Ethernet IP Address

9. All IP requests for the Ethernet devices connected to the 195Ed Station Router (Example #5) will need to be resolved by the Network Router (Figure 37). Enter the default route (Gateway) IP address for the Network Router in the 195Ed. Enter any DNS server information and press the *Next* button. Figure 48.

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Enter values for the following fields to set up the default route and DNS settings

Mode of operation: Station Router

Enter default route IP address: [Help](#)

Use DNS client services? ☐ Yes ☒ No [Help](#)

Enter DNS domain: [Help](#)

Enter primary DNS server IP address: [Help](#)

Enter secondary DNS server IP address: [Help](#)

Figure 48: Default Route (Gateway) Address and DNS Input

10. Select *Commit Changes* to write the programming to Flash memory and reboot the Model 195Ed. When the reboot process has completed (approximately 45 seconds) the modem will be ready to place in operation.

Example 6 – Mobile Vehicle #2 (Station Masquerade)

Review the Example Diagram #2 (Figure 2) and locate the 195Ed marked as Example 6. This ESTeem is connected to multiple Ethernet devices in a mobile application and will be configured Station Masquerade mode. In this mode the 195Ed's will gain access to the wireless Ethernet canopy created by the Access Point and act as a firewall between the devices connected to the Ethernet port and wireless network. Each of these networks will require a unique subnet to operate. In this configuration the Ethernet devices connected to the Station Masquerade 195Ed can access the wired LAN network, but not the other way around. This mode could be used if the Remote PC connected to the Station Masquerade needed to access the Internet (connected to the wired LAN), but did not want to be seen by other Ethernet devices on the network.

1. Access the ESTeem Web page using your computer's Web Browser as per instructions in Chapter 4. Select Setup from the menu items. From the Select Mode of Operation pull down box , select Station Masquerade (Figure 49) and push the Next button below the pull down box.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation bar with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' link is highlighted. Below the navigation bar, the page title is 'Setup'. A message states: 'This is the main **Setup** Page. Select a mode of operation for the wireless LAN unit from the following list.' Below this message, there is a 'Select Mode of Operation' dropdown menu currently showing 'AP Masquerade'. To the right of the dropdown is a 'Help' link. Below the dropdown is a 'Next' button.

Figure 49: Station Masquerade Selection

2. Select the RF bandwidth to match the Access Points in the network. For our example we will use 5 MHz bandwidth to match the AP Router and AP Bridges configured above. Reference Figure 50.

The screenshot shows the 'ESTeem Web Configuration Manager' interface. At the top, there is a navigation bar with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' link is highlighted. Below the navigation bar, the page title is 'Setup'. A message states: 'Select the RF bandwidth for the wireless LAN device. Note that reducing bandwidth increases the number of available channels and the radio's ability to reject RF interference. Selection of the lowest RF bandwidth and data rate for your application is recommended for increased reliability. All ESTeem radios in the same network **MUST** be on the same frequency channel and use the same bandwidth selection.' Below this message is a table with the following data:

	RF Bandwidth	RF Data Rate	Equivalent Wired Ethernet Data Rate	Recommended Use
☒	5MHz	1.5 to 13.5 Mbps	750 Kbps to 6.75 Mbps	Narrow bandwidth for enhanced transmission reliability in high interference environments
☐	10MHz	3 to 27 Mbps	1.5 to 13.5 Mbps	Midrange bandwidth for higher speed but lower interference environments
☐	20MHz	6 to 54 Mbps	3 to 27 Mbps	Wide bandwidth for maximum RF data rates in low interference environments

Below the table, there is a 'Help' link. At the bottom of the page, there are 'Previous' and 'Next' buttons.

Figure 50: RF Bandwidth Selection

3. Select Yes if you would like to use DHCP services on either the **wireless** or **ethernet** connections. Enter the SSID for your network. The SSID is the unique identification for your wireless network and all 195Ed that share a wireless network **MUST** have the same SSID code. This identification code is case sensitive and must **NOT** contain spaces. Select the encryption level for the wireless network to match the level of the Access Point canopy. Reference Figure 51.

ESTeem Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

In the following fields, select whether you wish to use DHCP client services or whether you wish configure a DHCP server. Selecting "Off" will take you through a manual setup of IP addresses as opposed to using DHCP services.

Additionally, select whether you want wireless security features turned on and enter the service set identifier (SSID) for the **wireless** LAN device.

Selected mode of operation: Station Masquerade

DHCP services on **wireless** interface: ☒ Off [Help](#)
☐ Client
☐ Server

DHCP services on **ethernet** interface: ☒ Off
☐ Client
☐ Server

Enter the SSID: [Help](#)

Select an encryption type: ☒ None [Help](#)
☐ WEP64
☐ WEP128
☐ WPA PSK
☐ WPA Enterprise with PEAP
☐ WPA2 (AES-CCMP) PSK
☐ WPA2 (AES-CCMP) Enterprise with PEAP

Figure 51:DHCP, SSID and Encryption Settings

4. Enter the WEP key values for your application that will be used by all devices on the wireless network. Reference Figure 52.

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Enter 13 hexadecimal bytes, separated by colons, for each of the following 128-bit WEP keys and select which key should be used as the default WEP key. These values are configured for the wireless LAN device.

Encryption type: 128-Bit WEP for the wireless LAN device

Enter WEP Key 1 (13 hex bytes): [Help](#)

Enter WEP Key 2 (13 hex bytes):

Enter WEP Key 3 (13 hex bytes):

Enter WEP Key 4 (13 hex bytes):

Select the default WEP key: ☒ WEP Key 1
☐ WEP Key 2
☐ WEP Key 3
☐ WEP Key 4 [Help](#)

Figure 52:WEP Key Entry

- Enter the values for the Access Point Access Control List (ACL). This is a configurable MAC filter that can be set to allow or deny connections to specific Access Point wireless MAC address to the network. In our example we will not use the ACL. Reference Figure 53.

ESTeem Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Enter the appropriate values in the fields below for configuring AP MAC Address Authentication. If **allow_all** is selected, the AP MACs in the access control list are ignored.

The following configurations are for the wireless LAN device.

Choose one of the following MAC address authentication modes for the wireless LAN device:

☒ allow_all [Help](#)
☐ allow only those AP MACs in the list below
☐ deny only those AP MACs in the list below

Enter MAC address:

Access Control List:

--

To remove a MAC address from the access control list, select the MAC to remove and click the **Remove MAC** button. To remove all MAC addresses from the list, click the **Remove ALL MACs** button.

Figure 53: Access Point Access Control

- Refer to the IP address in Table 1 and enter the **wireless** IP Address and IP Netmask for the Station Router. Reference Figure 54.

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Enter values for the following fields for manual IP setup.

Mode of operation: Station Masquerade

DHCP Services: Off

Enter IP address for the **wireless** LAN interface: [Help](#)

Enter netmask for the **wireless** LAN interface: [Help](#)

Figure 54: Wireless IP Settings

7. Refer to the IP address in Table 1 and enter the **ethernet** IP address and IP netmask. Reference Figure 48.

The screenshot shows the 'Setup' page of the EST195E Web Configuration Manager. The page title is 'EST195E Web Configuration Manager' with the ESTEEM Wireless Modems logo. A navigation bar includes links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' section is active. Below the title, it says 'Enter values for the following fields for manual IP setup of the **wired bridging** device.' The configuration fields are: 'Mode of operation: Station Masquerade', 'DHCP Services: Off', 'Enter IP address for wired bridge device: 172.16.38.189', and 'Enter netmask for wired bridge device: 255.255.0.0'. There are 'Previous' and 'Next' buttons at the bottom, and 'Help' links for the IP address and netmask fields.

Figure 48:Wired Ethernet Interface

*Note: When configuring the Ethernet devices connected to the Station Router 195Ed, the ethernet IP address will be **their** Gateway address (Figure 37).*

8. All IP requests for the Ethernet devices connected to the 195Ed Station Router (Example #5) will need to be resolved by the Network Router (Figure 37). Enter the default route (Gateway) IP address for the Network Router in the 195Ed. Enter any DNS server information and press the **Next** button. Figure 49.

The screenshot shows the 'Setup' page of the EST195E Web Configuration Manager. The page title is 'EST195E Web Configuration Manager' with the ESTEEM Wireless Modems logo. A navigation bar includes links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' section is active. Below the title, it says 'Enter values for the following fields to set up the default route and DNS settings'. The configuration fields are: 'Mode of operation: Station Masquerade', 'Enter default route IP address: 172.16.1.6', 'Use DNS client services? ☐ Yes ☒ No', 'Enter DNS domain:', 'Enter primary DNS server IP address:', and 'Enter secondary DNS server IP address:'. There are 'Previous' and 'Next' buttons at the bottom, and 'Help' links for the default route IP address, DNS client services, and each of the DNS fields.

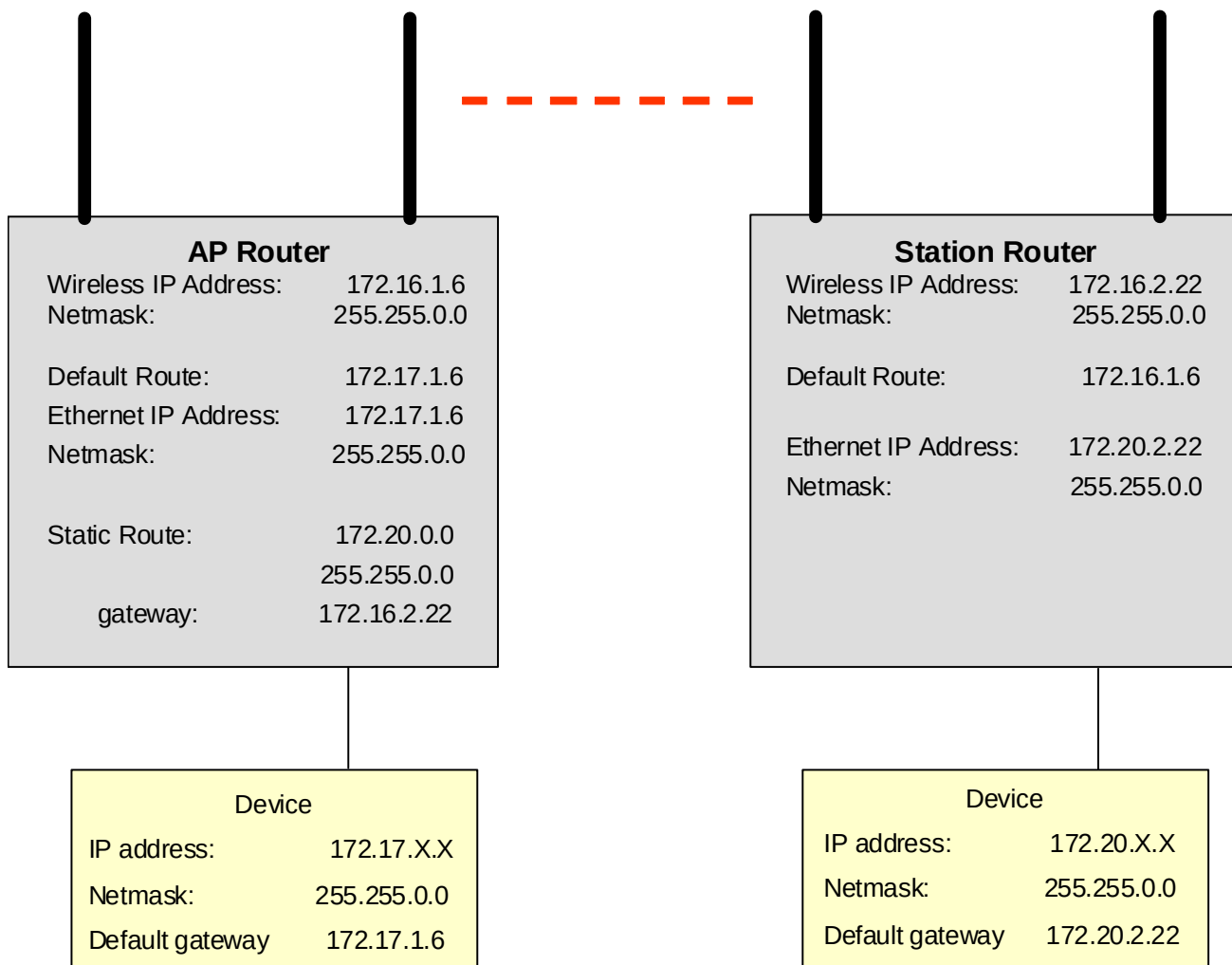
Figure 49:Default Route (Gateway) and DNS Input

9. Select **Commit Changes** to write the programming to Flash memory and reboot the Model 195Ed. When the reboot process has completed (approximately 30 seconds) the modem will be ready to place in operation.

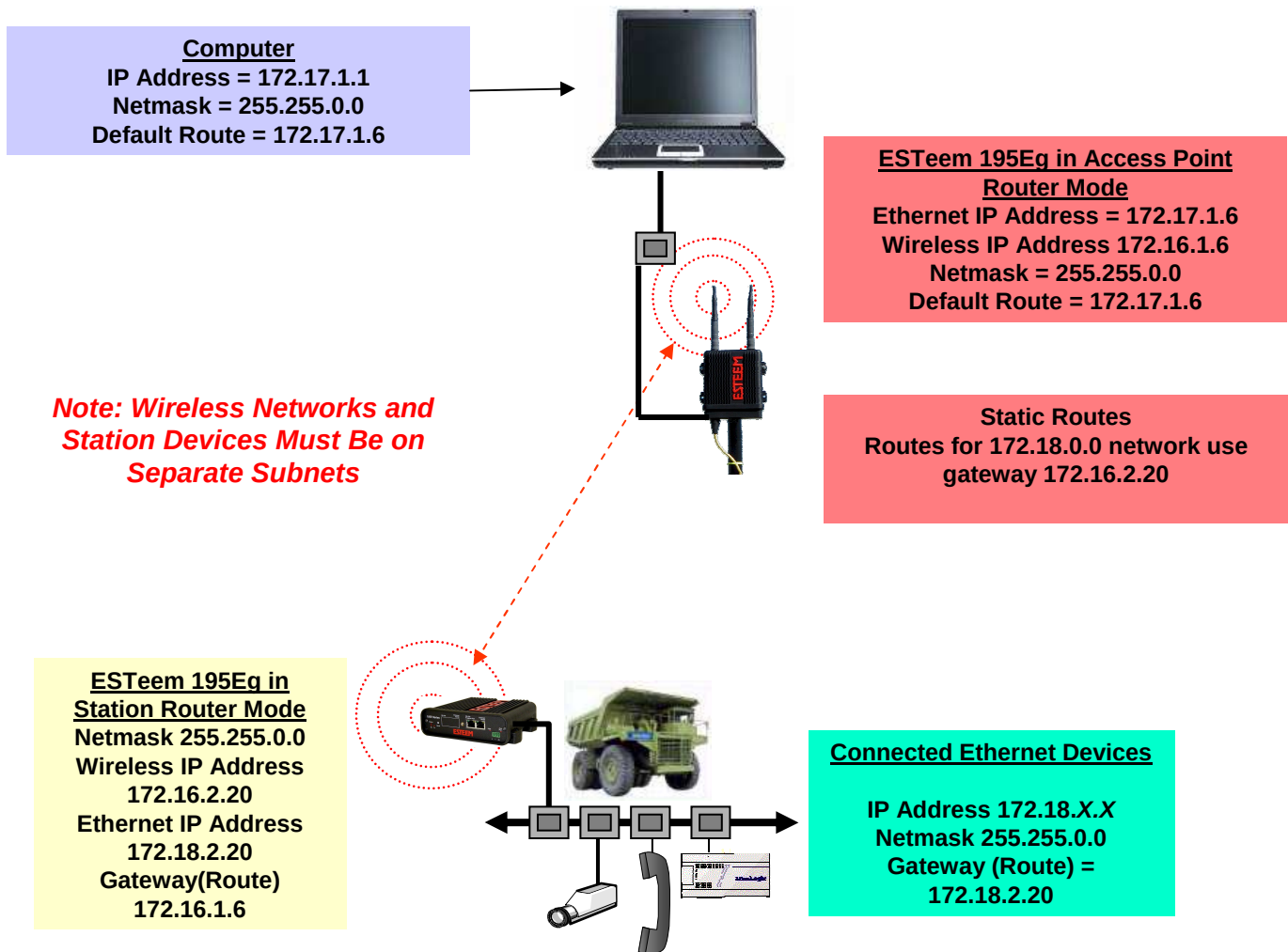
ROUTER ADDRESSING EXAMPLES

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

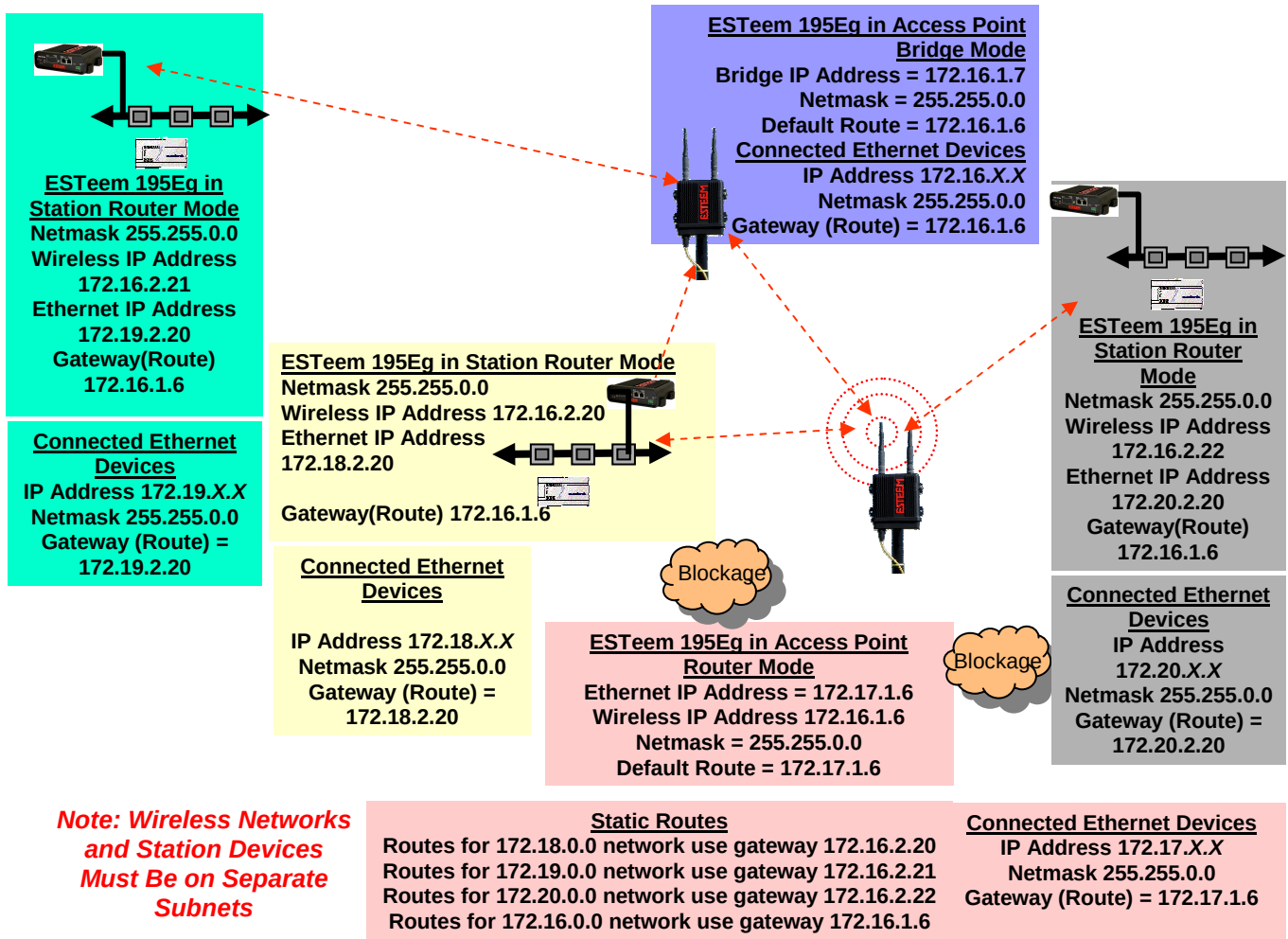
Point to Point Access Point Router to Station Router



Stand-Alone Access Point Router and Single Station Router



Stand-Alone Access Point Router with Multiple Station Routers



The ESTeem 195Ed is installed with a serial 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 195Ed wireless Ethernet system. The configuration for a serial 195Ed 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 few possible applications would be installation of the 195Ed 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 but also provide a serial link to the existing PLC in a SCADA type application.

SERIAL CONNECTIONS

The RJ-45 serial data port is the far-left port on face of the 195Ed (Figure 1). Using the ESTeem AA0621 interface cable, the 195Ed 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.

Second Ethernet Port

Installation of the serial option also includes installing a second 10/100 Base-T Ethernet interface. This second Ethernet port can be used to Bridge to the first Ethernet port (ETH_0) and the wireless link to work as a two-port HUB when configured in the AP Bridge mode. This second Ethernet port can also be configured as Router port between the wireless and the first Ethernet port in AP Router mode (Figure 2).

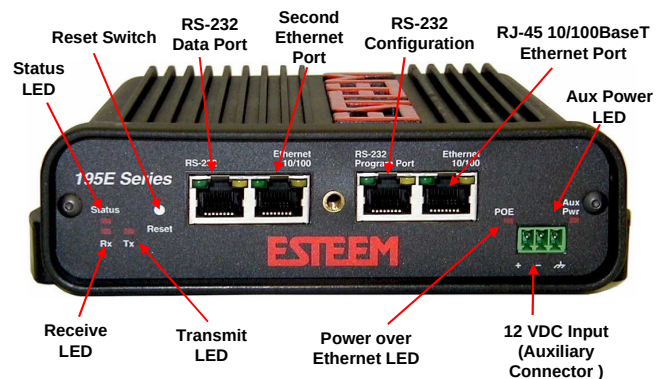


Figure 1: 195Ed Front Panel Overview

AP Bridge Mode

In the AP Bridge mode, both Ethernet ports (ETH_0 and ETH_1) and the wireless port (WLAN_0) are configured for a common subnet and share a common IP address.

AP Router Mode

In the AP Router mode, the two Ethernet ports (ETH_0 and ETH_1) will be on the same subnet. The primary Ethernet port (ETH_0) is bridged to the secondary Ethernet port (ETH_1) and is on a unique subnet than the Wireless port (WLAN_0) configured for Subnet B.

If desired, the secondary Ethernet Port (ETH_1) can be configured for a 3rd subnet (i.e. subnet C). This requires advanced configuration and routing tables specific to the particular networks.

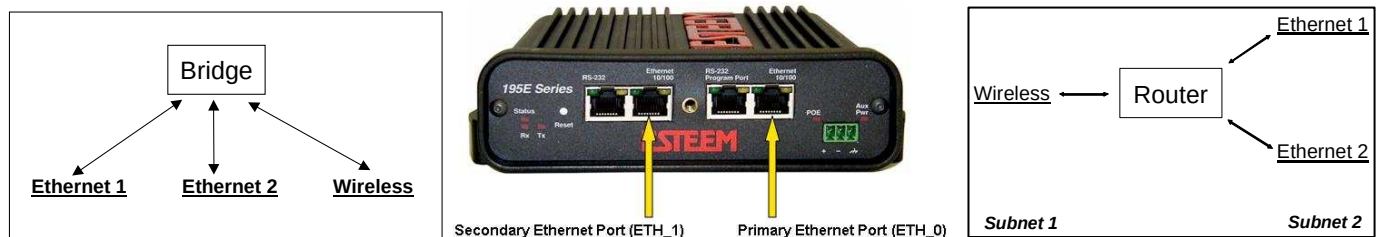


Figure 2: Bridge and Router Configuration for Ethernet Ports

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

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? ☐ Yes ☒ No [Help](#)

Select the mode: ☒ Full Redirector Mode ☐ Terminal Server Mode [Help](#)

Select the baud rate: ☐ 2400 baud ☐ 4800 baud ☐ 9600 baud ☒ 19200 baud ☐ 38400 baud ☐ 57600 baud ☐ 115200 baud [Help](#)

Select the number of data bits: ☐ 7 ☒ 8 [Help](#)

Select the number of stop bits: ☒ 1 ☐ 2 [Help](#)

Select the parity: ☐ Even ☐ Odd ☒ None [Help](#)

Select the serial flow control: ☐ Hardware ☐ Software ☒ None [Help](#)

Enter the maximum bridge links for multicast packets (1-255): [Help](#)

Enter the destination IP address for the serial packets (multicast address for multipoint system): [Help](#)

Enter the serial IP port number (1024-64535): [Help](#)

Enter the maximum packet size in bytes (1-1024): [Help](#)

Enter the number of milliseconds (10-10000) of silence for packetization: [Help](#)

Select whether to use delimiter character 1: ☐ Yes ☒ No [Help](#)

Enter delimiter character 1 (00-ff hex): [Help](#)

Select whether to use delimiter character 2: ☐ Yes ☒ No [Help](#)

Enter delimiter character 2 (00-ff hex): [Help](#)

Enter whether the terminal server should read/generate modem control lines: ☐ Yes ☒ No [Help](#)

Figure 3: Serial Configuration Screen

SERIAL CONFIGURATION

Configuration of the serial port is completed during the standard setup of the 195Ed. After completion of the Repeater Peer configuration screen, the Serial Port Setup screen (Figure 3) 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 195Ed. 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 another ESTeem. 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 4).

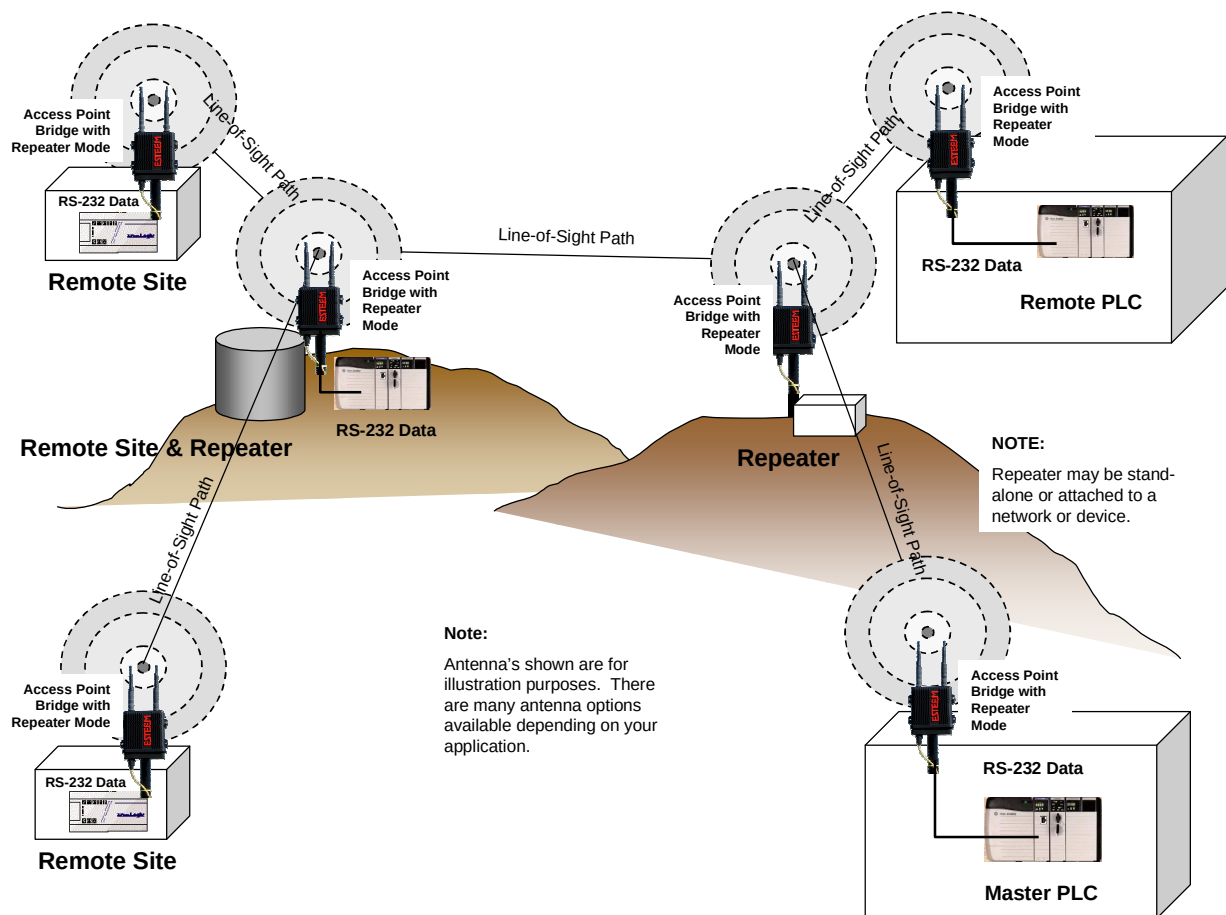


Figure 4: Serial Full Redirector Example

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 (Figure 5).

Baud Rate

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

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 195Ed 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 are 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.

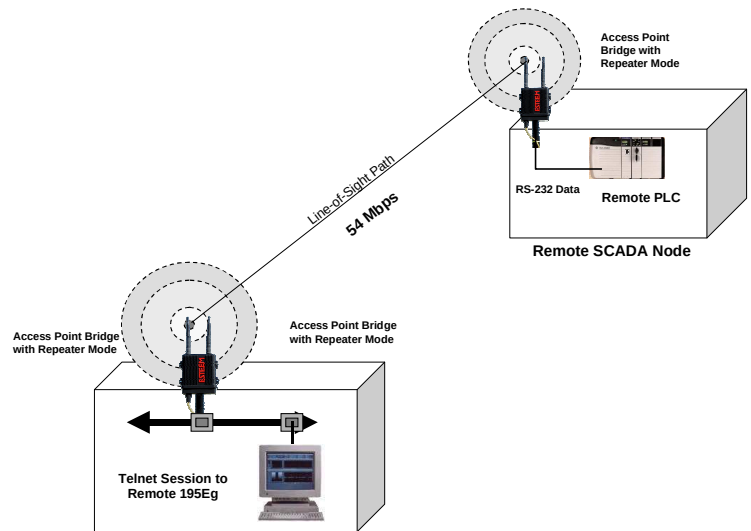


Figure 5: Terminal Server Example

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.

To increase the wireless network's area of coverage for both indoor and outdoor applications, the ESTeem 195Ed utilizes a custom repeating feature that allows increased coverage areas without the added expense of hard cabling or adding an additional point to point radio link.

With a conventional wireless network, all of the APs have to be interfaced to a common network either by hardware, see Figure 1, or a separate, dedicated RF backbone. The Model 195Ed can create this RF backbone, bridge

Ethernet networks connected to the wired Ethernet port and provide the wireless canopy clients simultaneously.

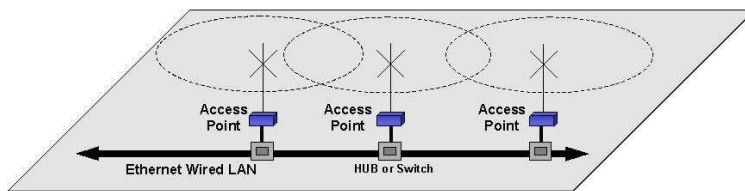


Figure 1: Conventional Access Point Diagram

When programmed in any of the three Access Point (AP) Repeater Modes, the Model 195Ed will create a wireless network with other Model 195Ed 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 195Ed 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 195Ed. 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 2 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.

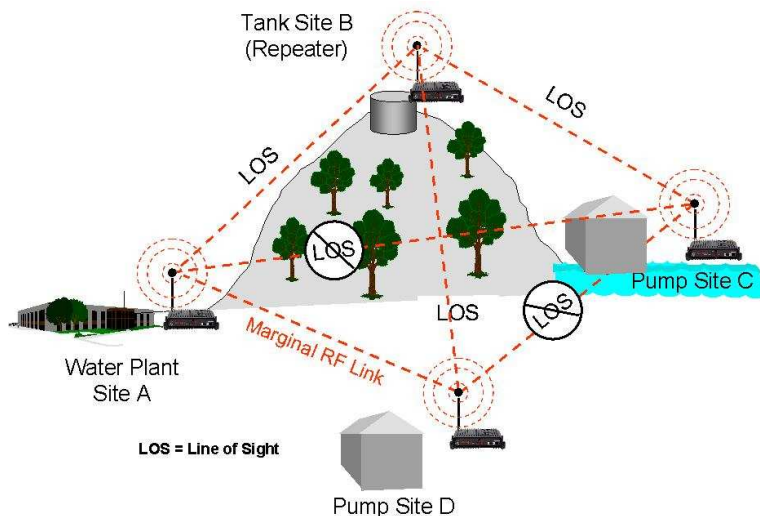


Figure 2: Small Mesh Network Diagram

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.

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. Figure 3 shows an example repeater peer table from the setup menus. For an ESTeem 195Ed to communicate with another ESTeem 195Ed, Yes must be selected at the “Enable Repeater Capability.” Next, the Wireless LAN (WLAN) MAC address of each Model 195Ed that will have direct communications must be added to the Repeater Peer List. Finally, *enabling the link* allows the corresponding 195Ed 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 5 of this user's manual.

ESTeem Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup - Add a Repeater Peer

To add a new repeater peer for the **wireless** LAN interface, enter the WLAN MAC address, the port path cost, 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 port path cost (1-65535):

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:
 6 Mbps
 9 Mbps
 12 Mbps
 18 Mbps
 24 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 3: Repeater Configuration Example

RAPID SPANNING TREE PROTOCOL (RSTP)

The ESTeem Model 195Ed uses Rapid Spanning Tree Protocol (IEEE 802.1d) to determine the radio routing structure of the wireless network. The primary purpose of 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.

The RSTP 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 5 to continue the discussion (Figure 4).

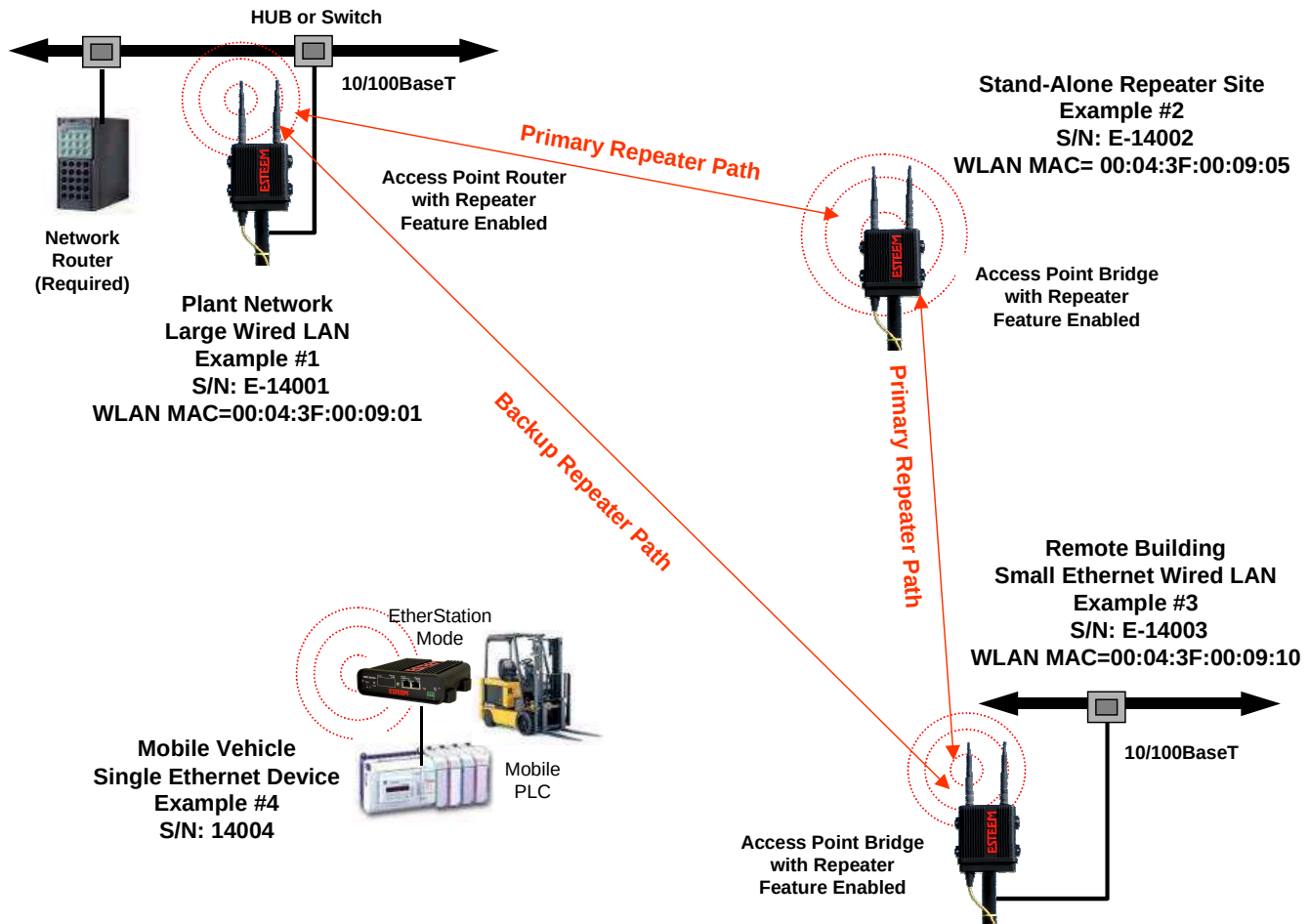


Figure 4: Programming Example #1 Diagram

The following sections describe the process of the RSTP in the ESTeem Model 195Ed as how it would happen in the above example.

Learning Phase - Once properly configured, each Model 195Ed will begin to search out the other Model 195Ed units in radio range that are programmed in the AP Repeater Peer table. All Model 195Ed's will calculate their routes to every Model 195Ed in the network based upon the lowest "path cost" to the Root Bridge. Path cost is the total cost of transmitting a packet through the wireless network to the Root Bridge. **Note:** *The Root Bridge in a network should be the Model 195Ed 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 195Ed 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 195Ed 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 cost 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 Cost) and will be selected as the primary route unless overridden by manually changing the Path Cost in the configuration.

Path Cost

If more than one communication path to the Root Bridge is found, the 195Ed must determine which route to take based upon the lowest Path Cost. The default path cost to all links in the 195Ed network is 100. If the Path Costs 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 cost of 100 (note values in Figure 3) the lowest path cost would be direct from the Remote Building to the Root Bridge (Plant Network).

Link Description	Number of Routes	Total Path Cost
Direct from Remote Building	1	100
Remote Build to Root Bridge Through Repeater	2	200

To configure the 195Ed to select the repeater as the primary radio path, set the path cost value for the direct link greater than 200 (201 for example) to make this the primary radio path. The lowest path cost will identify the highest priority. The Model 195Ed will use this routing, but also switch to direct communication if the repeater were to disappear.

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Select whether to enable repeater capability. If the **repeater** capability is disabled, the peer list is ignored. If the **repeater** capability is enabled, then a link is established with each peer in the list.

You may add a peer to the list, remove an existing peer or modify an existing peer by clicking the appropriate button below.

The following configurations are for the wireless LAN device.

Enable the **repeater** capability? ☒ Yes ☐ No [Help](#)

Set as **root** bridge? ☒ Yes ☐ No

MAC Addr	Port	Priority	Path Cost	Encrypt Type	Data Rate	Enable
00:04:3f:00:09:05	128	100	100	WEP128	Dynamic	true
00:04:3f:00:09:10	128	201	201	WEP128	Dynamic	true

Repeater Peer List: [Add](#) [Remove](#) [Modify](#)

[Previous](#) [Next](#)

Figure 3: Repeater Configuration Example

Root Bridge

In any Access Point Repeater network consisting of more than two sites, one Model 195Ed should be designated as the Root Bridge. Only one Model 195Ed 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 195Ed's NOT configured as the Root Bridge will choose routing based upon the Path Cost 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 195Ed's in the network. The manual Root Bridge configuration is located in the "Advanced Settings" section.

Redundant Backup

The ESTeem Model 195Ed configured in Access Point Repeater mode will automatically function as a redundant backup if two Model 195Ed's are installed at the same location (Figure 7). If two Model 195Ed's are connected to the same HUB or Switch, one of the Model 195Ed'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 195Ed is detected and the second Model 195Ed will begin operation at that site.

Redundant Master Configuration – The configuration in Figure 7 will also provide a redundant backup for the Master Site (Root Bridge). Configure both Model 195Ed's as Root Bridges (see above) giving the primary Root Bridge a value of 1 and the secondary Root Bridge a value of 2.

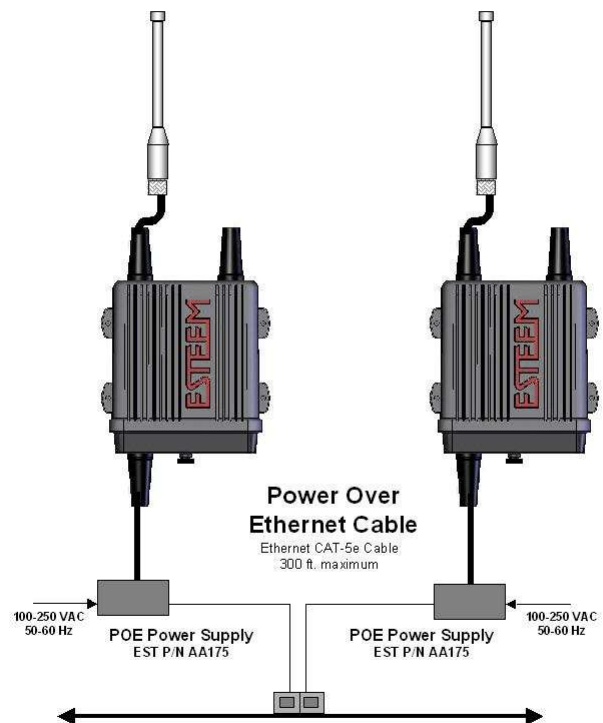


Figure 7: Redundant Backup Diagram

ANTENNA AND CABLE CONFIGURATIONS

Warning: Only the tested cable lengths and antennas provided by EST meet the FCC and DOC maximum peak output power requirements. Any other combination of antennas or coax cables is not authorized. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that permitted for successful communication.

EST offers different types of antennas for both indoor and outdoor configurations. This device has been designed to operate with the antennas listed below, and having a maximum gain of 7 dB. Antennas not included in this list or having a gain greater than 7 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Part Number: AA191Es

- Omni-directional, permanent vehicle mount antenna, 5dB gain with integral 17' coax cable.
- Outdoor mobile applications.
- There must be a minimum separation distance of 23 cm. from the antenna to the user. **See Warnings.**

Part Number: AA20DMs

- Omni-directional direct mount antenna, 2 dBi gain.
- Indoor and outdoor applications.
- There must be a minimum separation distance of 23 cm. from the antenna to the user. **See Warnings.**

Part Number: AA20Es900

- Omni-directional external pole mount antenna, 7 dBi gain with 3-ft. integral feedline and connector.
- Outdoor applications.
- There must be a minimum separation distance of 23cm. from the antenna to the user. **See Warnings.**

Part Number: AA203Es900

- Directional pole mount antenna, 7 dBi gain with 3-ft. integral feedline and connector.
- Point to point and point to multi-point outdoor applications.
- There must be a minimum separation distance of 23 cm. from the antenna to the user. **See Warnings.**

**Antenna
Port A**

**Receive Only
Antenna Port**



Notes:

Antenna Port A is a transmit and receive port for use in all applications.

Antenna Port B is a receive only port and is used for dual diversity antennas applications only. This port is not used for point to point applications.

Warnings:

Only pre-made coax cables from the factory used in conjunction with either the AA20Es900 omni-directional and AA203Es900 directional antennas meet all FCC Section 15.247(b) EIRP maximum power requirements.

ANTENNA DIVERSITY

The dual diversity antenna configuration on the ESTeem Model 195Eg allows the radio to operate more efficiently in areas with high reflections (such as indoors or in a city) and without direct line of sight (LOS) between the antennas. One of the most difficult conditions to control in a radio system is the effect of a destructive reflected radio signal called mutipathing. Multipathing occurs when waves emitted by the transmitter travel along a different path and interfere destructively with waves traveling on a direct line-of-site path. The phenomenon occurs because waves traveling along different paths may be completely out of phase when they reach the antenna, thereby canceling each other out. The dual diversity antenna configuration places a physical distance between the antennas where one reflected signal will be out of phase, but the second will be not. The ESTeem Model 195Eg will sample both antennas and select the best receive signal.

ANTENNA PORT SELECTION

The antenna ports on the Model 195Eg must be configured for either a single receive antenna (external mount antennas) or dual diversity antenna setup. To access the port configuration open ESTeem Web page using your computer's Web Browser as per instructions in Chapter 4. Select Advanced from the menu items and Radio Settings-wlan0 device (Figure 1).

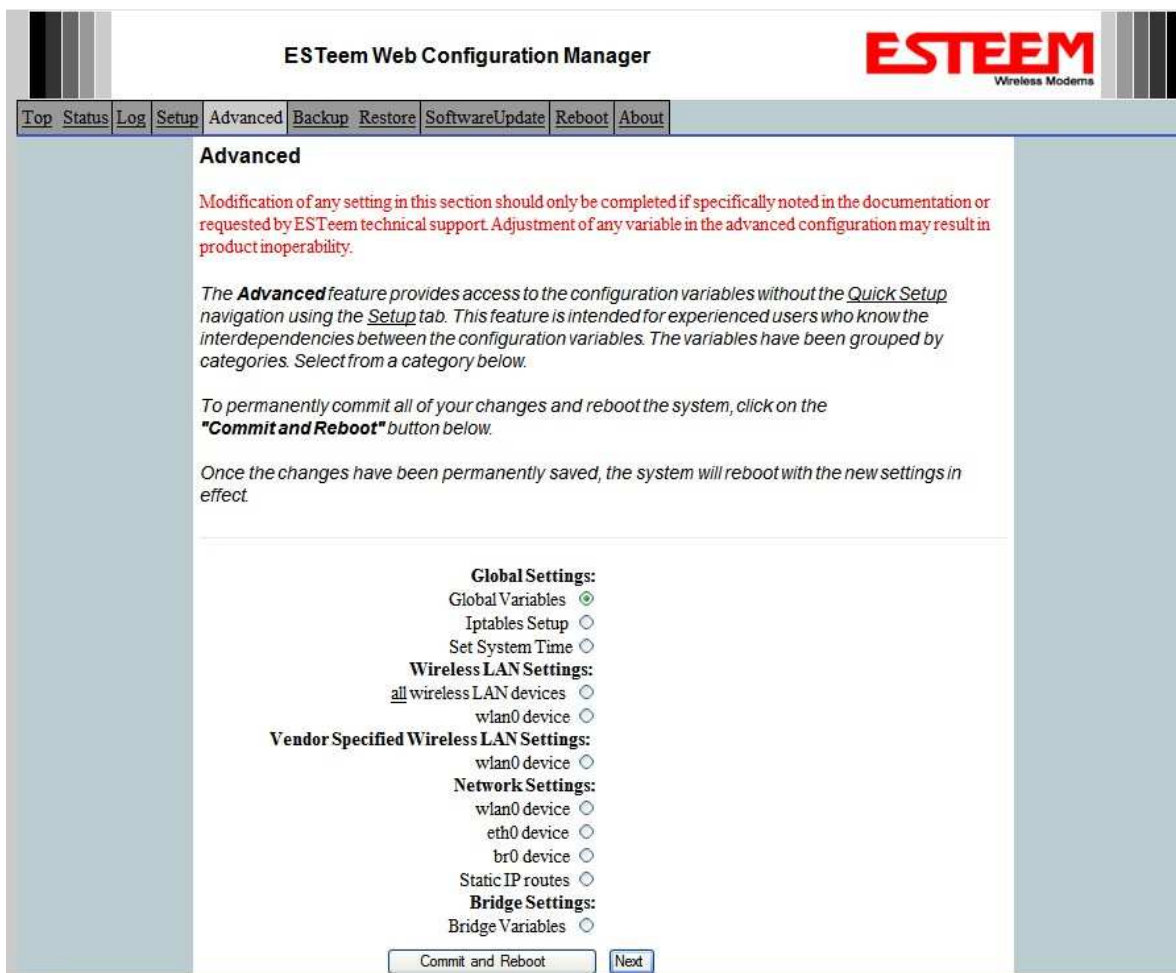


Figure 1: Advanced Settings Menu

Press the next button and Figure 2 will be displayed. The receive antenna is configured by selecting the wlan0_dot11CurrentRXAntenna drop down (Figure 2) and selecting the receive antenna. A value of 0 = Dual diversity (Both antenna Ports A & B will be used to receive). A value of 1 = Single receive source (Antenna Port A only).

EST195E Web Configuration Manager

Top Status Log Setup Advanced Backup Restore Software Update Reboot

Advanced - Wireless LAN Settings for the wlan0 Wireless LAN Device

The following is a list of those configuration variables under the **Wireless LAN Settings** category. These variables contain values for configuring the **wlan0** wireless LAN device hardware.

wlan0_MODE: Access Point

wlan0_SSID: T::ESTeem

wlan0_ChannelList:

wlan0_dot11CurrentTxAntenna: 1

wlan0_dot11CurrentRxAntenna: 0

wlan0_dot11RTSThreshold: 2

Select the operational mode for the **wlan0** device

Format:
T::textual SSID
--OR--
H::hex:hex:hex: ... :hex

Enter the list of frequencies, as a list of integers separated by a single comma, that will be scanned when the WLAN device is operating in a station mode. **NOTE:** if this field is empty, then ALL allowed frequencies will be scanned.

Select the antenna to use for transmit

Select the antenna to use for receive

Enter how many octets in an MPDU below which an RTS/CTS handshake shall not be performed (0-2347)

Figure 2: Receive Antenna Settings Menu

Coax Cable Attenuation

Feedline Type	Attenuation (dB/100 ft.) @ 2.4 GHz
RG-8 (Solid)	7
LMR 600	4.4
3/8" Helix	6.5
1/2" Helix	3.5
7/8" Helix	2
1.25" Helix	1.6

Note: A -3 dB loss means you have lost 1/2 of your signal or transmitter power. A +3 dB gain means you have doubled (x2) your signal or transmitter power.

Example:

A 6 dB antenna will increase the radiated output power of a 1 watt transmitter to 4 watts {times 4 = 3 dB (x2) + 3 dB (x2)} and increase the received signal strength to receiver times 4

ASSEMBLING THE AA195PM TWO-HOLE OUTDOOR POLE MOUNTING KIT

The AA195PM mounting kit contains everything required for pole mounting and weatherproofing the ESTeem Model 195E for outdoor installations. The 195E with AA195PM mounting kit can be directly mounted to a round pole from 1.25" to a diameter of 2.25" OD. Any mounting structure greater than 2" requires hose clamp strapping run through the Pole Mount Brackets. The mounting kit requires the following assembly:

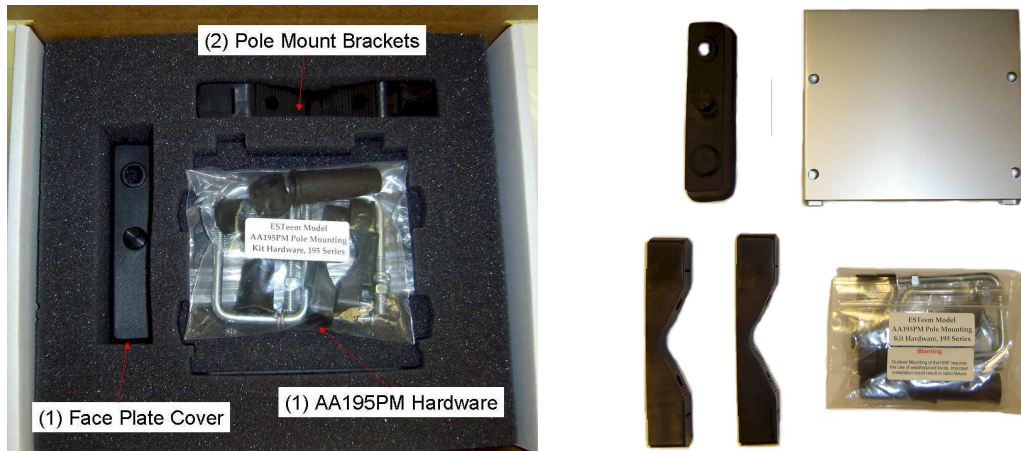


Figure 1: Packet Box Contents

1. If you purchased an AA195PM mounting kit with your Model 195E, the kit will be packed in the same packing box as the ESTeem (Figure 1).
2. Remove and inventory the two (2) Pole Mounting Brackets, one (1) Two-Hole Face Plate Cover (with single port cover installed), one (1) Heat Shield and (1) AA195PM Hardware bag from the packing box (Figure 1). Report any missing or damaged items to ESTeem Customer Support (509-735-9092 Phone) as soon as possible for replacement.

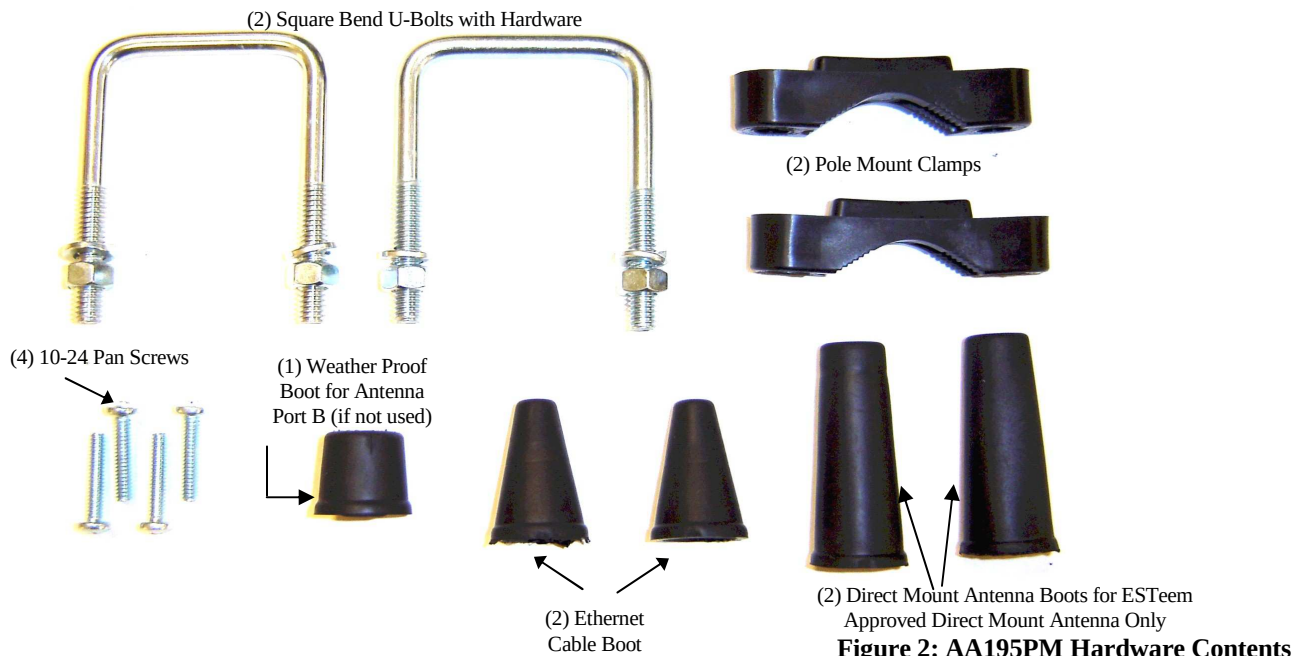


Figure 2: AA195PM Hardware Contents

3. Inventory the AA195PM Hardware bag for all the components listed in Figure 2.
4. Assemble the two Pole Mounting Brackets with the included U-bolts, hardware and Pole Mount Clamps. Reference Figure 3.

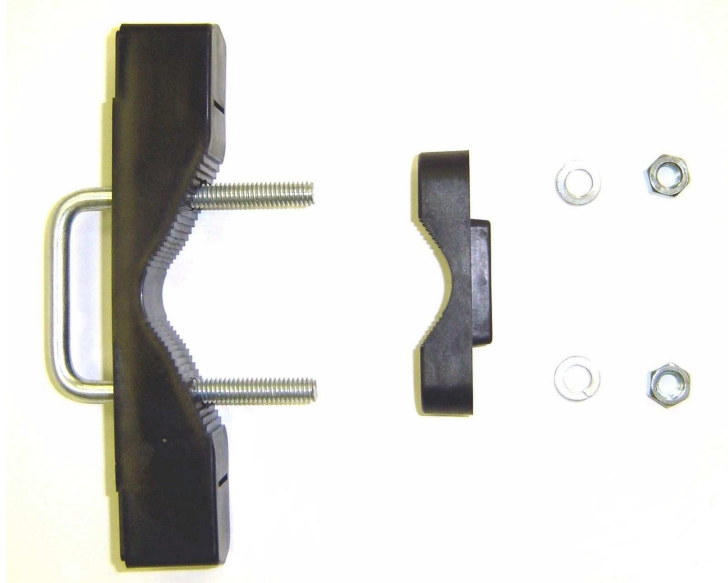


Figure 3: Pole Mount Assembly

5. Place the four supplied 10-24 x 1" Phillips Pan Head screws through the mounting holes of the Heat Shield and attach to the top of the ESTeem 195E (Figure 4).



Figure 4: Heat Shield Attachment

6. Attach the two Pole Mounting Brackets to the ESTeem Model 195E with the 10-24 x 1" Phillips Pan Head screws through the



Figure 5: Pole Mount Connection to Case
(Heat Shield Removed for Detail)

top of the heat shield. Reference Figure 5 (Heat Shield removed for detail).

7. Assemble the outdoor rated CAT-5e Ethernet cable (Not Provided) with the supplied Ethernet Cable Boot (Figure 6).



Ethernet Cable Boot

Figure 6: Ethernet Cable Assembly

8. Feed the CAT-5e Ethernet connector(s) through the Face Plate Cover and secure the Ethernet Cable Boot to the cover. Reference Figure 7. *NOTE: The Ethernet cable boot must be installed before the RJ-45 end is installed. If using the ESTeem AA09.1 outdoor Ethernet cable, verify that the Ethernet cable boot end is routed toward the ESTeem 195E.*

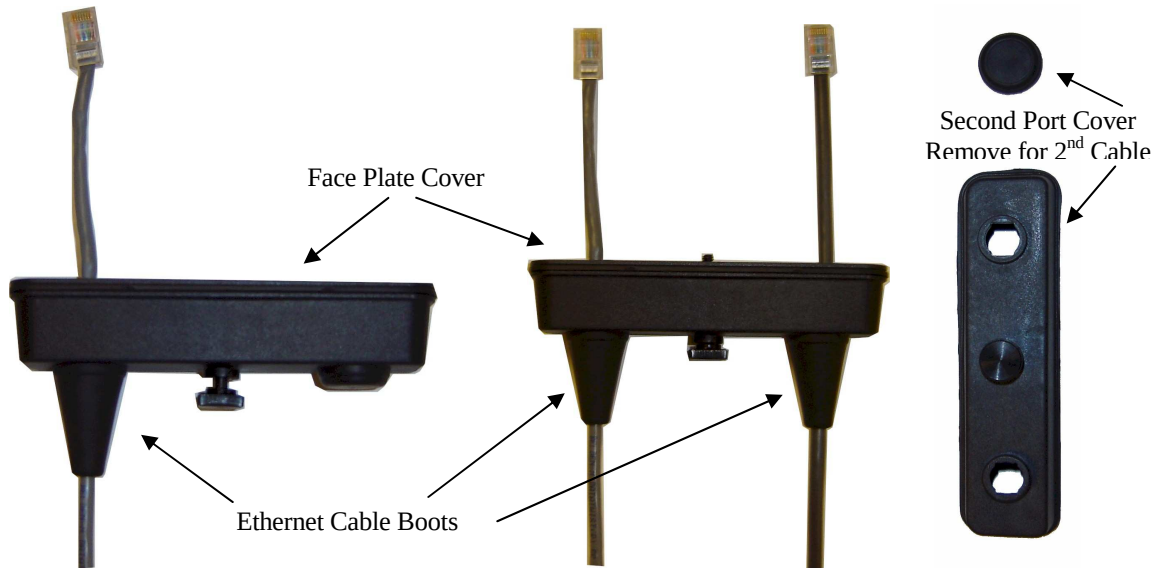


Figure 7: Ethernet Cable Routing

9. Route the CAT-5e Ethernet cable through the molded strain-relief fins in the Face Plate Cover (Figure 8) to secure the cable and provide strain-relief for the connector. If a second Ethernet cable is installed, remove the second port cover and route cable.



Figure 8: Face Plate Cover Strain Relief

10. Plug the CAT-5e Ethernet cable to the Model 195E's Ethernet port and secure the Face Plate Cover with the attached thumb screw. Verify that the weatherproof seal on the Face Plate Cover is sealed against the outer rim of the Model 195E. Reference Figure 9.

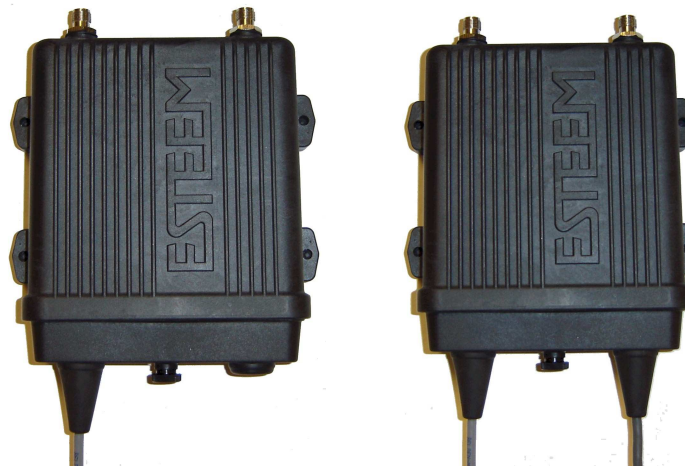


Figure 9: Face Plate Cover Installed on ESTeem

11. Attach the antenna connector boots as show in Figure 10 for either dual attached antennas or external antennas. You are now ready to mount the ESTeem Model 195E

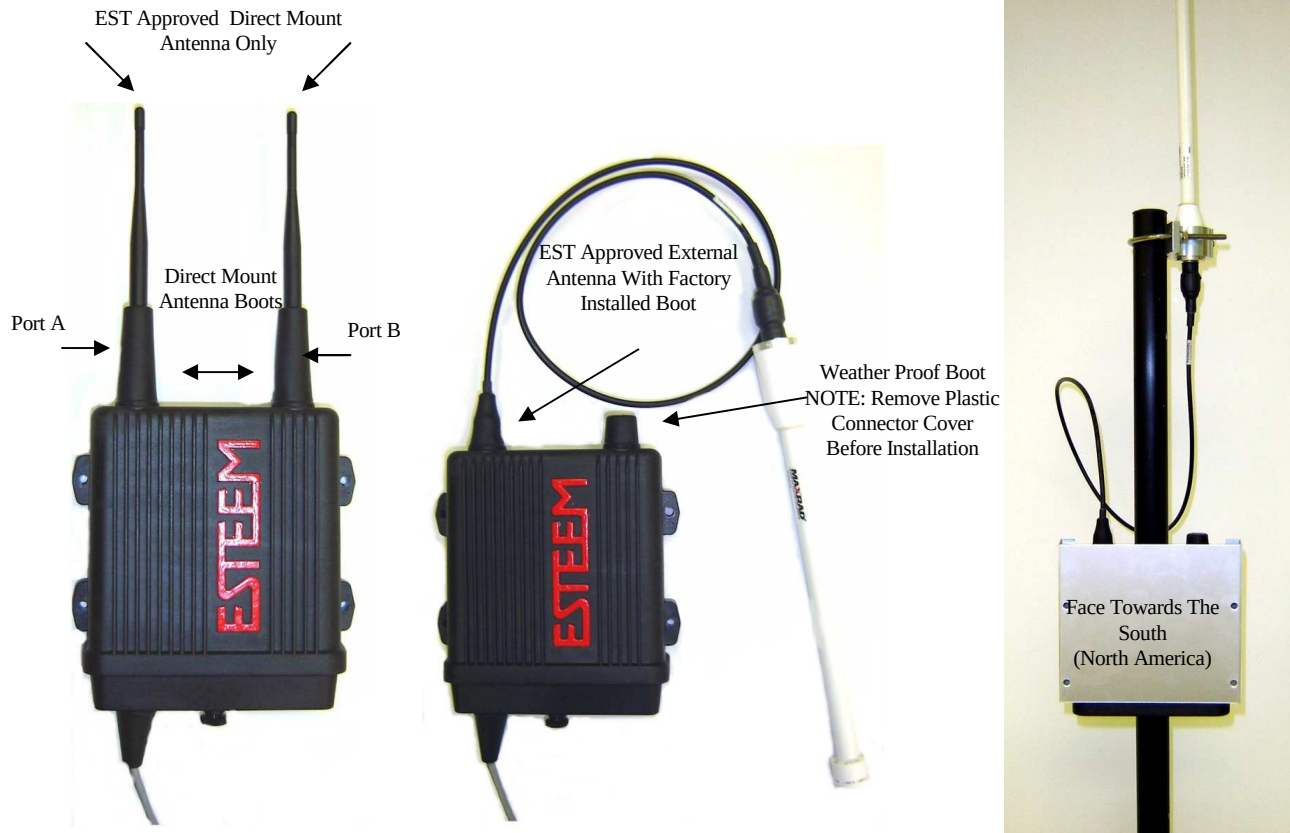


Figure 10: Completed AA195PM Mounts

Caution: Outdoor mounting of the 195E requires the use of weatherproof boots. Improper installation could result in radio failure.

Caution: Always mount the 195E vertically with the antenna ports on top.

195E POLE MOUNT GROUNDING PROCEDURES

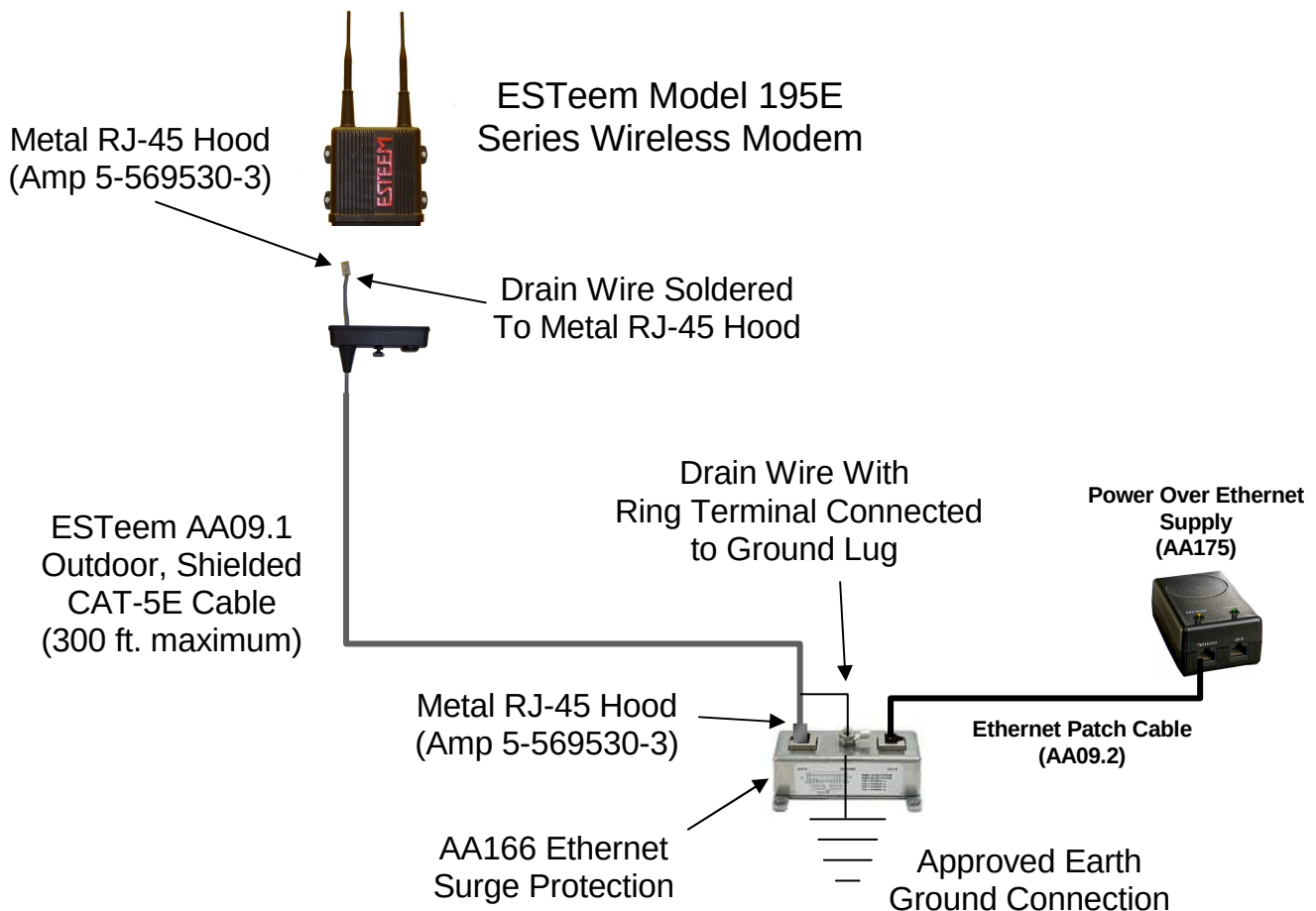
Mounting the 195E series radio modem outdoors requires proper grounding procedures to prevent damage to both the radio hardware and the connected Ethernet and Serial peripherals. The case on the 195E series wireless modem is electrically conductive, but the AA195 Pole Mount kit provides isolation from the connected structure. To bring the 195E case to a ground potential with Earth ground and eliminate any static buildup on the case itself, the shield on the Ethernet cable is used to provide the ground connection.

Outdoor Ethernet Cable

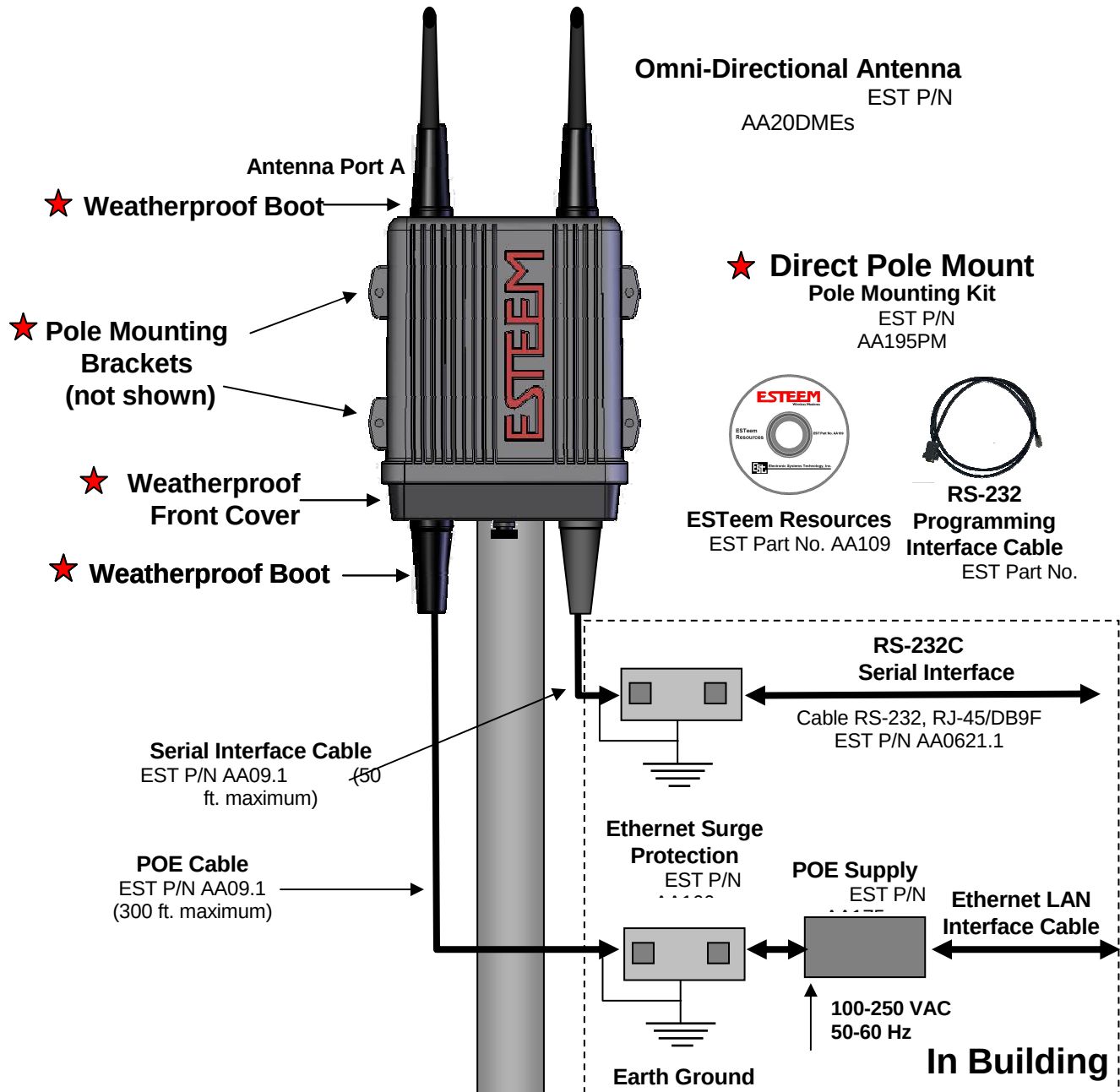
A critical component of this grounding protection system is the ESTeem AA09.1 outdoor, shielded CAT-5E Ethernet cable. This cable provides three, necessary elements; Ethernet data, DC Power over Ethernet (PoE) applications, and a ground from the 195E case to the AA166 surge protector. The Ethernet cable is outdoor rated and protected from UV breakdown.

Installation

The following diagram outlines all the critical components and connections in the 195E series system. The Earth ground connection to the surge protector must be installed to comply with local Electrical code requirements.

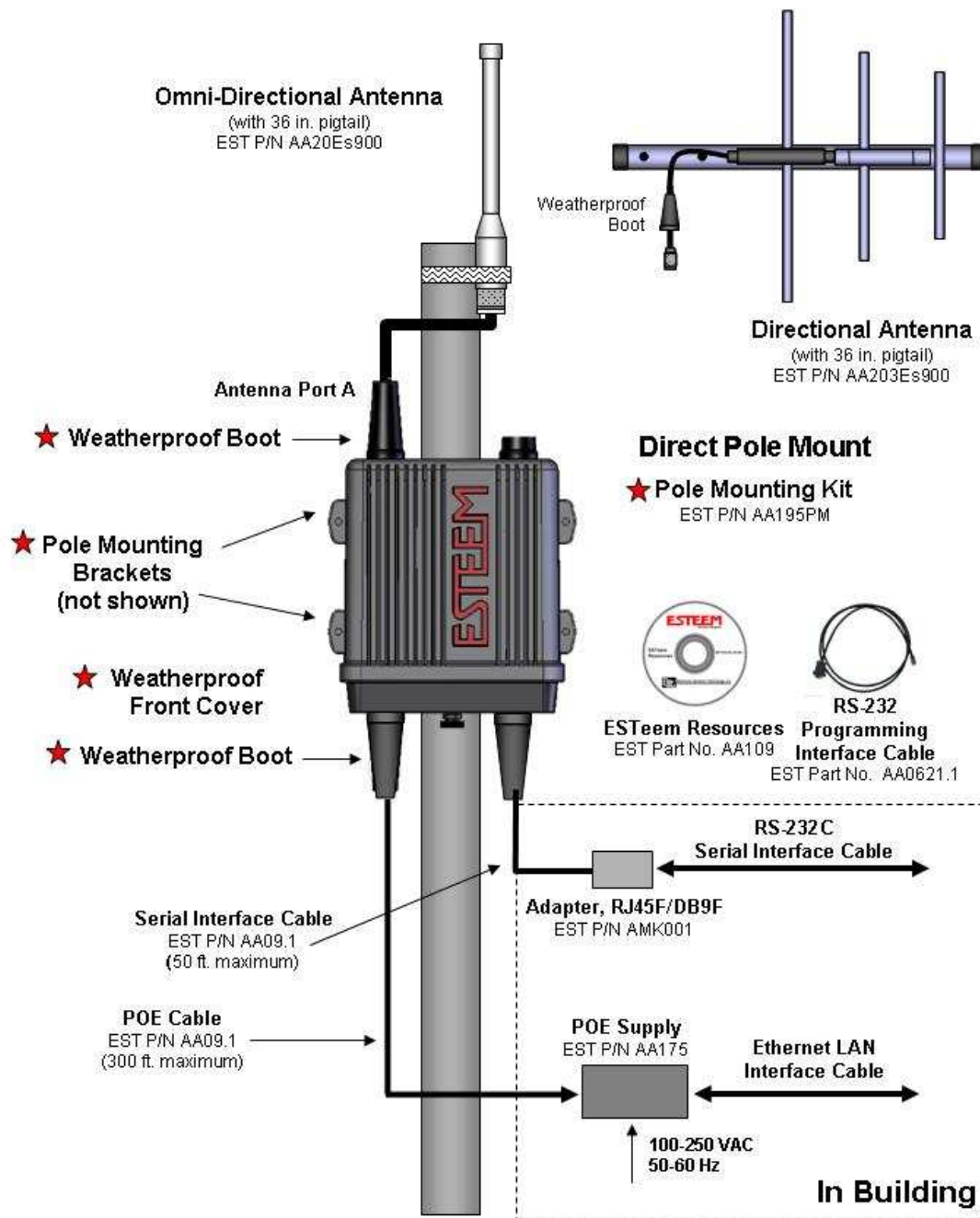


Model 195Ed with Direct Mount Antenna and Surge Protection



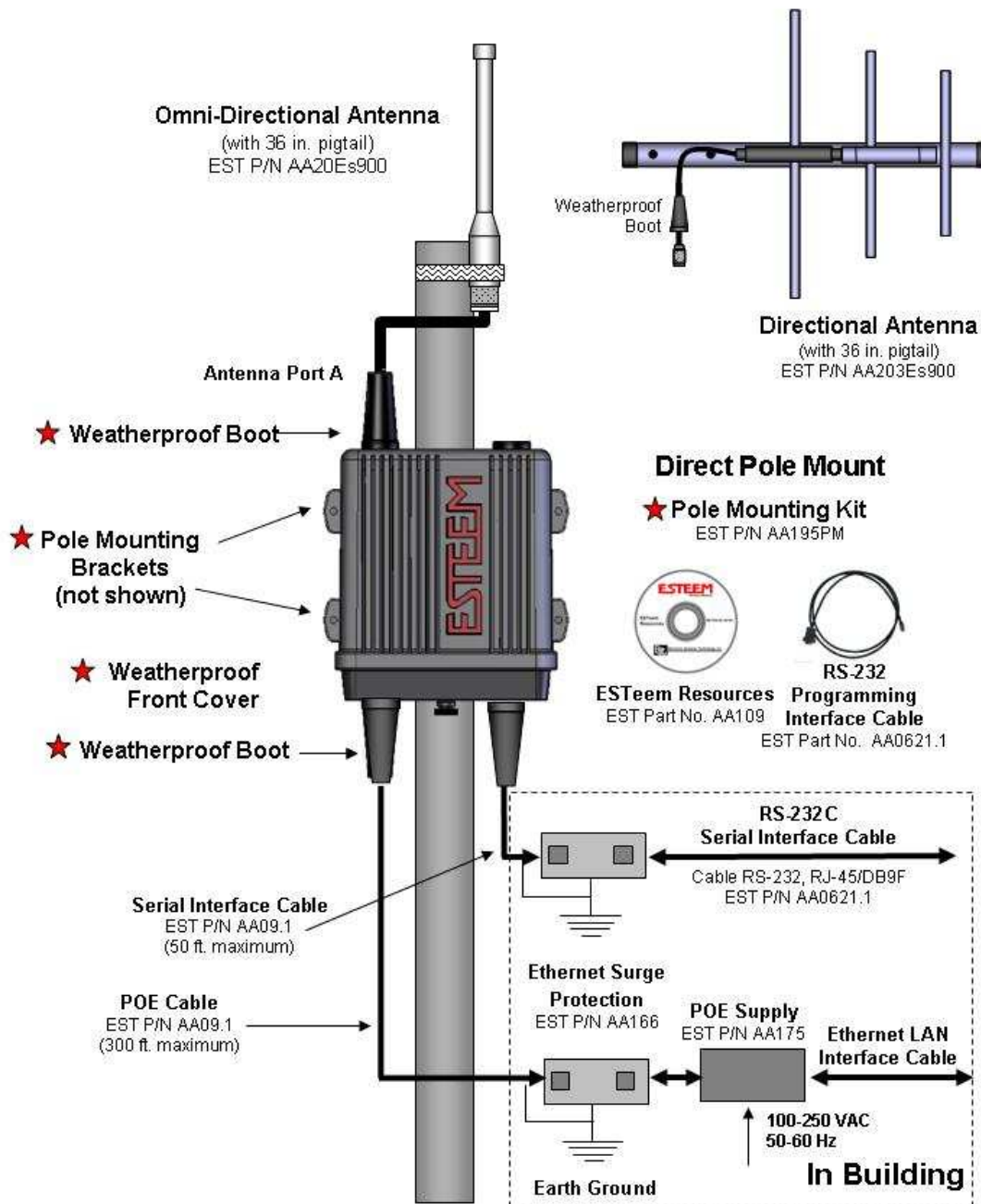
Caution: Always mount the 195Ed vertically with the antenna ports on top.

Model 195Ed with External Mount Antennas



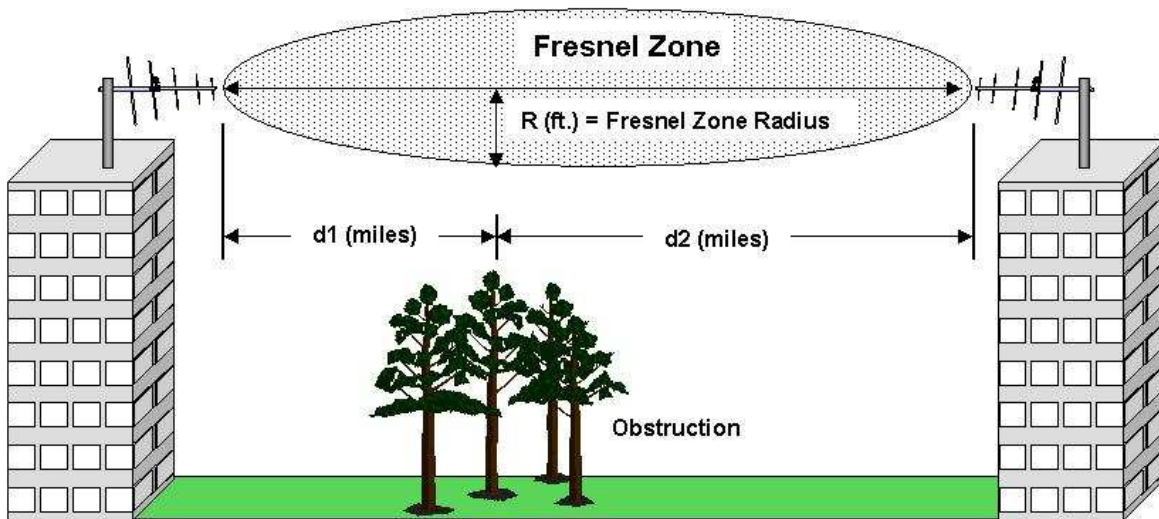
Caution: Always mount the 195Ed vertically with the antenna ports on top.

Model 195Ed with External Mount Antennas and Surge Protection



Caution: Always mount the 195Ed vertically with the antenna ports on top.

FRESNEL ZONE



The Fresnel zone shows the ellipsoid spread of the radio waves around the visual line-of-sight after they leave the antenna (see figure above). This area must be clear of obstructions or the signal strength will be reduced due to signal blockage. Typically, 20% Fresnel Zone blockage introduces little signal loss to the link. Beyond 40% blockage, signal loss will become significant. This calculation is based on a *flat earth*. It does not take into account the curvature of the earth. It is recommended for RF path links greater than 7 miles to have a microwave path analysis done that takes the curvature of the earth and the topography of the terrain into account.

$$\text{Fresnel Zone Radius} = 72.1 \text{ SQRT } [(d_1 d_2) / (F(d_1 + d_2))]$$

Units

Fresnel Zone Radius in feet.

d1 and d2 in statute miles

F in GHz

INFORMATION TO USERS

The ESTeem Model 195Ed complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This Class A digital apparatus complies with Canadian ICES-003. (Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.)

Note to User:

Changes or modifications to this equipment not expressly approved by Electronic Systems Technology for compliance could void the user's authority to operate the equipment.

The 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 generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Other Information

Model 195Ed

Direct Sequence/OFDM Spread Spectrum Device

(USA) FCC ID: **ENPESTEEM195ED**

(Canada) IC No: **1457-195ED**

FEDERAL COMMUNICATIONS COMMISSION FIELD OFFICES

ALASKA

1011 E. Tudor Rd.
Rm 240 Box 2955
Anchorage, AK 99510

CALIFORNIA

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
Cerritos, CA 90701-3684

San Francisco Office (SF)
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Pleasanton, CA 94588-8543

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Denver Office (DV)
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Tampa, FL 33607-2356

GEORGIA

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Duluth, GA 30096-4958

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Honolulu, HI

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New Orleans Office (OR)
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MARYLAND

1017 Geo. Fallon
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Hopkins Plaza
Baltimore, MD

MASSACHUSETTS

Boston Office (BS)
1 Batterymarch Park
Quincy, MA 02169-7495

MICHIGAN

Detroit Office (DT)
24897 Hathaway Street
Farmington Hills, MI 48335-1552

MINNESOTA

691 Federal Building
316 N Robert St.
St. Paul, MN

MISSOURI

Kansas City Office (KC)
520 NE Colbern Road
Second Floor
Lee's Summit, MO 64086

NEW YORK

1307 Federal Building
111 W. Huron
Buffalo, NY 14202

NEW YORK

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

OREGON

1782 Federal Building
1220 SW 3rd Avenue
Portland, OR 97204

PENNSYLVANIA

Philadelphia Office (PA)
One Oxford Valley Office Bld.
Room 404
2300 E. Lincoln Hwy
Langhorne, PA 19047-1859

PUERTO RICO

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

TEXAS

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

Model 195Ed Case Specifications

LED Indicators	
Power On/Off	Receiver On/Off
Carrier Detect On/Off	Transmitter On/Off
Link Status On/Off	

I/O Connectors	
Ethernet 10/100Base T (Port 1)	RJ-45 Female
Ethernet 10/100Base T (Port 2)	RJ-45 Female
RS-232C Port (2,400 to 115.2K baud)	RJ-45 Female
RS-232C Programming Port (38.4 K baud)	RJ-45 Female
Antenna Input/Output	TNC Reverse Polarity Female
Remote Input Power	Power Over Ethernet Cable
Direct Input Power	Optional, Header Screw Connector

Transmitter	
Frequency of Operation	902 to 928 MHz Software Selectable 4 Channels
RF Data Rate	1,2,5.5,6,9,11,12,18,24,36,48, & 54 Mbps Fixed or Auto Scaling DSSS/OFDM Modulation
Tx Output Power	250 to 630 mW
RF Output Impedance	50 ohms

Receiver	
Rx Sensitivity @ Frame Error Rate <10%	-72 dBm @54 Mbps to -95 dBm @ 1 Mbps Frame Error Rate <10%

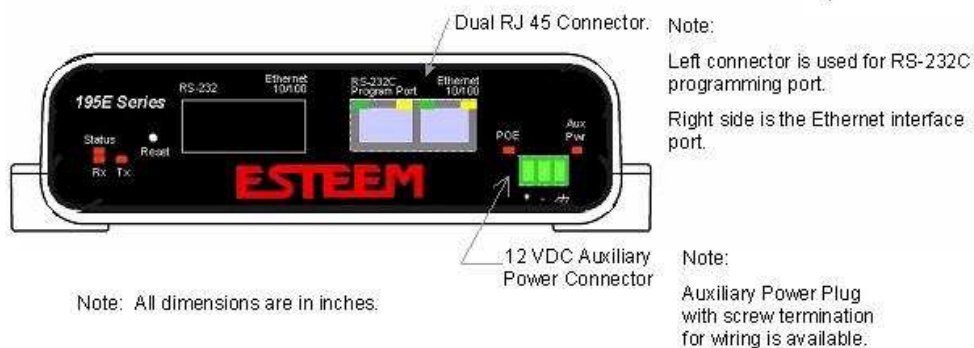
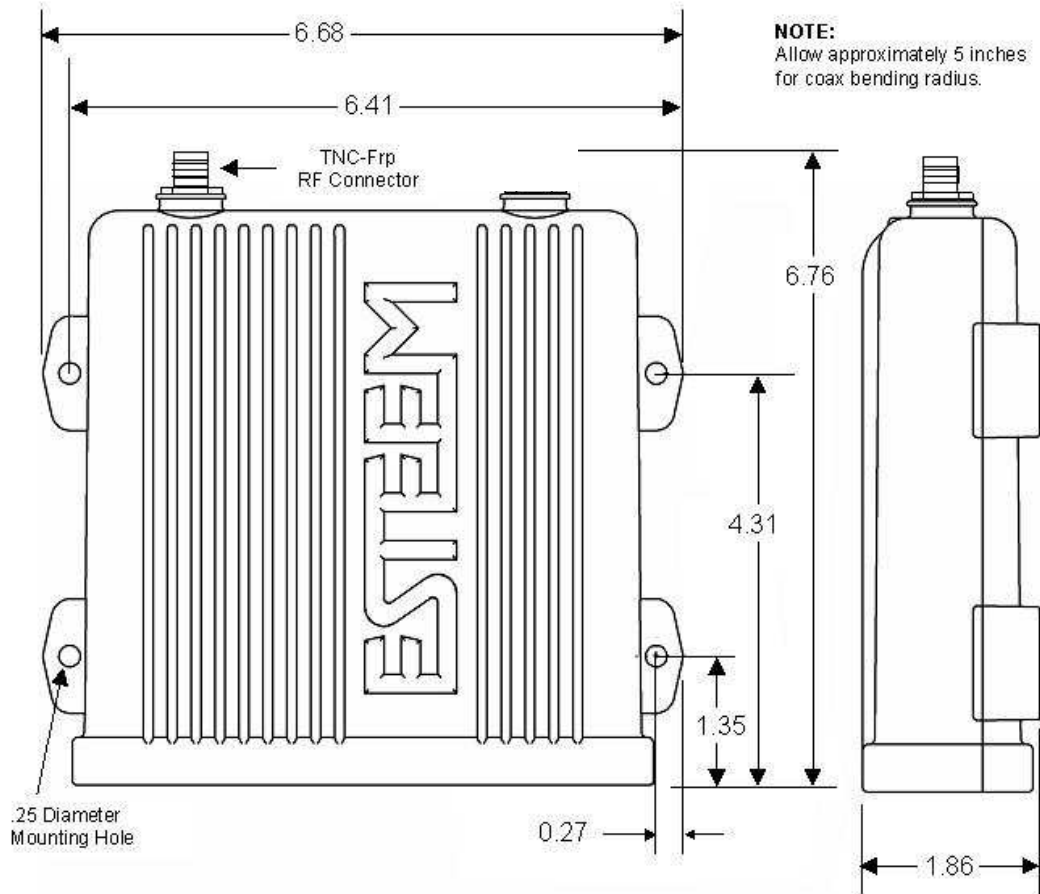
Power	
Power over Ethernet	IEEE 802.3af Standard Power Supply, 48 VDC @ 13 Watts
Power Connector on Unit	10 to 16 VDC
Receive	200 ma @ 12 VDC
Transmit	450 ma @ 12 VDC

Case	
Dimensions	1.9 in. H x 6.7 in. W x 6.2 in. L
Weight	1.25 lbs.
Outdoor Pole Mounting Kit	Optional, EST P/N 195PM

Other	
Warranty	1 Year
Temperature Range	-30° to +60° C
Humidity	95% Non-condensing
FCC ID Number (USA)	ENPESTEEM195ED
IC Number (Canada)	1457-195ED

Specifications Subject to Change Without Notice

Model 195Ed Case Specifications



Antenna Specifications

Model No:	AA191s	
Antenna Type:	Omni-Directional, Permanent Vehicle Mount	
Applications:	Direct mount	
Frequency:	896 to 940 MHz	
Polarization:	Vertical	
Impedance:	50 ohms	
Gain:	7 dBi (5 dBd)	
VSWR:	< 1.5 to 1	
Front to Back Ratio:	n/a	
Horizontal Beamwidth:	n/a	
Vertical Beamwidth:	n/a	
Antenna Material:	Molded Polymer	
Mounting Hardware:	Included	
Antenna Connector:	TNC-R Male	
Antenna Envelope:	32 in. length	
Weight:	<1 lbs.	

Caution

Omni-directional antenna should not be located within 23 cm of personnel.



Model 191Es

Model:	AA20DMEs
Applications:	Model 195Ed direct case mount
Antenna Type:	Omni-Directional, Sleeve dipole
Frequency:	902 to 928 MHz
Polarization:	Vertical
Impedance:	50 ohms
Gain:	2 dBi (0 dBd)
VSWR:	< 2:1
Power:	10 W
Front To Back Ratio:	n/a
Horizontal Beamwidth:	n/a
Vertical Beamwidth:	60 degrees
Antenna Material:	Polyurethane Plastic Radome
Recommended Mounting Hardware:	n/a
Antenna Connector:	TNC-R Male
Flexibility:	+/- 20 °
Antenna Envelope:	8.8 in. length by .51 in. width
Temperature:	-20 to +65 C°
Weight:	35 grams

Caution

Omni-directional antenna should not be located within 23 cm of personnel.



Model AA20DMEs

Antenna Specifications

Model No:	AA20Es900
Antenna Type:	Omni Directional, DC Grounded
Applications:	Fixed base
Frequency:	902 to 928 MHz
Polarization:	Vertical
Impedance:	50 ohms
Gain:	7 dBi (5 dBd)
VSWR:	1.5:1 Typical
Front to Back Ratio:	n/a
Horizontal Beamwidth:	n/a
Vertical Beamwidth:	22 degrees @ ½ power
Antenna Material:	Brass radiator, UV inhibited fiberglass enclosed
Mounting Hardware:	Base to Mast, Supplied.
Maximum Power Input:	150 Watts
Wind Survival:	100 mph
Bending Moment:	14.2 ft-lbs. @ 100 mph
Antenna Connector:	TNC-R Male with 36in. pig-tail.
Antenna Envelope:	48 in. L x 1-5/16 in. Dia.
Weight:	1.75 lbs.

Caution

To comply with the FCC exposure compliance requirements, a separation distance of at least 23 cm must be maintained between the antenna and all persons.



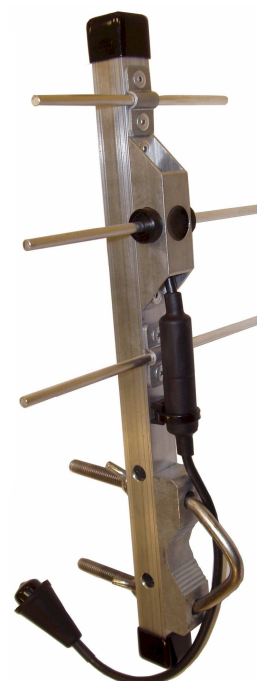
Model AA20Es900

Antenna Specifications

Model No:	AA203Es900
Antenna Type:	Directional, DC grounded
Applications:	Fixed base.
Frequency:	902 to 928 MHz
Polarization:	Vertical or Horizontal
Impedance:	50 ohms
Gain:	7 dBi (5 dBd)
VSWR:	< 1.5:1 Nominal
Front to Back Ratio:	> 16 dB
Horizontal Beamwidth:	130 degrees @ ½ power
Vertical Beamwidth:	70 degrees @ ½ power
Antenna Material:	Aluminum
Mounting Hardware:	Heavy duty U bolts for mounting up to 2.0 in. pipe (included).
Antenna Connector:	TNC-R Male with 2 ft. pigtail with ESTeem weatherproof boot.
Maximum Power Input:	50 Watts
Antenna Envelope:	1.1 ft. length by 6 in. width
Windload (RWV):	150 mph
Wind Surface Area:	.11 ft ²
Weight:	1 lbs.

Caution

To comply with the FCC exposure compliance requirements, a separation distance of at least 23 cm must be maintained between the antenna and all persons.



Model AA203Es900

ETHERNET INTERFACE

The ESTeem Model 195Ed’s Ethernet Port is a Full and Half-Duplex Auto-negotiation interface supporting both 10 Mbps and 100 Mbps (10/100BaseT). The Ethernet port is compliant with IEEE 802.3af Power Over Ethernet (PoE) to provide both data and power over the same CAT-5E grade Ethernet cable. The port is compatible with TIA/EIA-568B cable configuration (Figure 1).

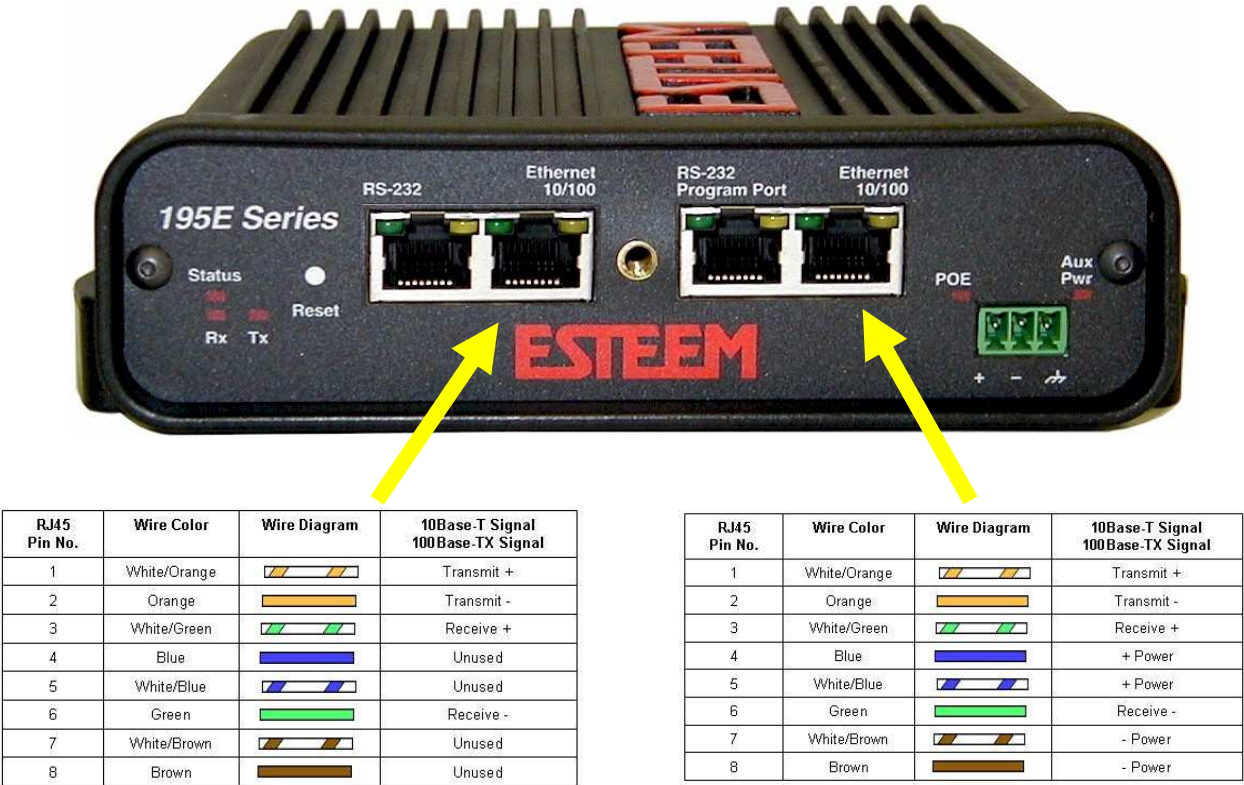


Figure 1: Ethernet Pin Layout

A second Ethernet port is included in the 195Ed and can be used to bridge to the primary Ethernet port (HUB) or as a router.

CONFIGURING DHCP SERVER

The ESTeem 195Ed Ethernet port supports both client and server Dynamic Host Configuration Protocol (DHCP). Figure 2 shows the DHCP host configuration screen that will be shown if DHCP server is selected in the setup screens. Enter the values that match the DHCP configuration for your network.

EST195E Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

*This page configures a DHCP server on the **br0** interface.*

The following fields are the configuration parameters that the DHCP server will return to DHCP clients.

Selected Mode of Operation: AP Bridge
 DHCP Services: Server
 DHCP interface: br0

Enter the local domain name for the network [Help](#)

Enter the IP address of the device on your network running as the primary DNS server

Enter the IP address of the device on your network running as the secondary DNS server

Enter the network netmask

Enter the broadcast IP address for the network

Enter the starting IP address for the lease block of IP addresses

Enter the ending IP address for the lease block of IP addresses

Enter the IP address for the default gateway

Enter the time period (in seconds) at which the DHCP server will write out leases file

Enter the time period (in seconds) that a lease will be issued

Figure 2: DHCP Server Configuration

RS-232C PROGRAMMING PORT CONFIGURATION

The ESTeem Model 195Ed has a proprietary RS-232C interface in a RJ-45 connector on the front panel. To interface the 195Ed to the serial port on the computer, you need ESTeem cable AA0621.1 that combines a standard Ethernet patch cable to a 9-pin Female adapter.

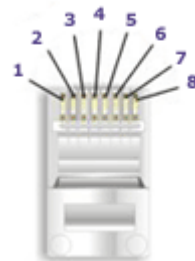
The serial port on the ESTeem Model 192E can be used to access the configuration menu in the ESTeem for system and network configuration. The ESTeem communications port operates at 38,400 bps, No Parity, 8 Data Bits and 1 Stop Bit (38,400,N,8,1). Configure your terminal program to match these settings.



RS-232 PROGRAMMING PORT PIN-OUT TABLE

**ESTeem Model AA0621
RS-232C Port Pin-Out Table**

RJ-45 Pin No.	Function	DB-9 Pin No.
4	Signal Ground (GND)	5
5	Receive Data (RxD)	2
6	Transmit Data (TxD)	3



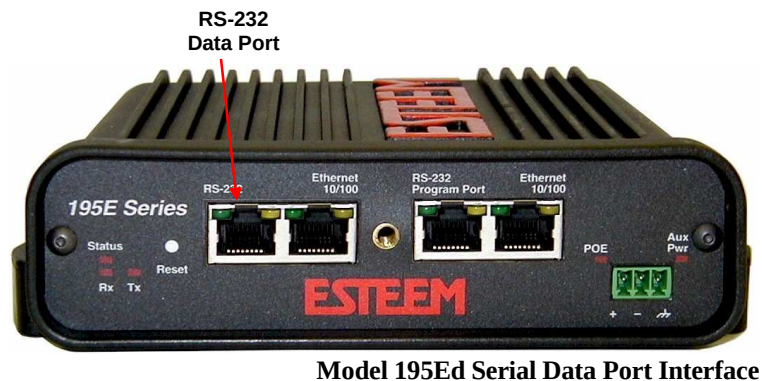
Ethernet Pin-out

RS-232C DATA PORT CONFIGURATION

The ESTeem Model 195Ed has an RS-232C interface in a RJ-45 connector on the front panel that can be installed as an option. To interface the 195Ed to the serial port on the computer, you need serial cable with the following pin-out:

**ESTeem Model AA0621
RS-232C Port Pin-Out Table**

RJ-45 Pin No.	Function	DB-9 Pin No.
1	Data Set Ready (DSR)	6
2	Data Carrier Detect (DCD)	1
3	Data Terminal Ready (DTR)	4
4	Signal Ground (GND)	5
5	Receive Data (RxD)	2
6	Transmit Data (TxD)	3
7	Clear to Sent (CTS)	8
8	Request to Sent (RTS)	7



195Ed FREQUENCY OF OPERATION

In a wireless Ethernet network all of the ESTeem Model 195Ed's must be set to the same radio frequency of operation or channel. In addition all 195Ed must be at the same RF Bandwidth. Listed on the right is a table showing the channel and corresponding frequency of operation. The frequency of operation is selectable when configuring the mode of operation of the 195Ed (reference Chapter 4). See Figure 1.

Channel Number	Frequency
4	907 MHz
5	912 MHz
6	917 MHz
7	922 MHz

Figure 1: RF Channel Selection

RF BANDWIDTH

The ESTeem 195Ed has three adjustable RF bandwidths for operation in the unlicensed 902-928 MHz frequency band. Reducing the RF bandwidth increases the number of available channels and the radio's ability to reject RF interference. When the 195Ed operates at the 5 and 10 MHz bandwidths all four frequency channels are available. When operating at 20 MHz, only channels 5 (912 MHz) and 6 (917 MHz) are available.

It is recommended to use the lowest RF bandwidth and data rate required for your application increase reliability and number of available frequency channels. Figure 2 shows the available selections in the 195Ed.

NOTE: All ESTeem radios in the same network **MUST** be on the same frequency channel and use the same bandwidth selection.

	RF Bandwidth	RF Data Rate	Equivalent Wired Ethernet Data Rate	Recommended Use
	5MHz	1.5 to 13.5 Mbps	750 Kbps to 6.75 Mbps	Narrow bandwidth for enhanced transmission reliability in high interference environments
	10MHz	3 to 27 Mbps	1.5 to 13.5 Mbps	Midrange bandwidth for higher speed but lower interference environments
	20MHz	6 to 54 Mbps	3 to 27 Mbps	Wide bandwidth for maximum RF data rates in low interference environments

Figure 2: RF Bandwidth Selection

RF COMMUNICATIONS DATA RATE

The RF data rate of the Model 195Ed can be programmed for operation at 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48, or 54 Mbps. The RF data rate can be set for a fixed rate or a specific range that is dynamically scaled by the Model 195Ed from monitoring the received signal quality. Dynamic scaling means that the Model 195Ed will operate at the highest RF data rate that is programmed into unit. If the received data quality drops below the required minimums for reliable communications the Model 192E will reduce the data rate to the next lowest step to increase signal quality. Conversely if the signal quality increases above the minimums the Model 192E will increase the RF data rate the next highest level.

The ESTeem 195Ed is set at the factory to operate at maximized scaling speed data rates from 1-54 Mbps and should not need adjustment. The RF Data Rate is programmed in the Model 195Ed through the **Advanced Menu>Wireless LAN Settings>Wlan0 Device** and the value for **wlan0_OPRATES:**. In the example shown in Figure 3 the RF Date Rate is programmed to dynamic scale from 1 to 54 Mbps (recommend factory default setting). To set the values for the data rate, check the box next to the listed data rate to enable this rate for operation.

wlan0_OPRATES: ☒ Use default rate set
☐ 1 ☐ 2
☐ 5.5 ☐ 11
☐ 6 ☐ 9
☐ 12 ☐ 18
☐ 24 ☐ 36
☐ 48 ☐ 54
Select the set of data rates that the radio may transmit. These rates are used when transmitting frames to a single peer. At least one checkbox must be checked to change the settings. If all boxes are unchecked, the rate set will remain unchanged. If Use default rate set is selected, all other boxes are ignored.
Note: All possible data rates are presented here. Not all rates are valid for all conditions. If an invalid rate set is selected, the rate set will be corrected or reset to the default value during the next radio initialization.

Figure 3: Advanced Data Rate Selection

SETTING RF POWER LEVEL

The ESTeem Model 195Ed peak power is adjustable in output power from 250mW to 1 Watt. 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)	630mW
Hi (High)	≈250mW
Lo (Low)	≈100mW
Min (Minimum)	≈40mW

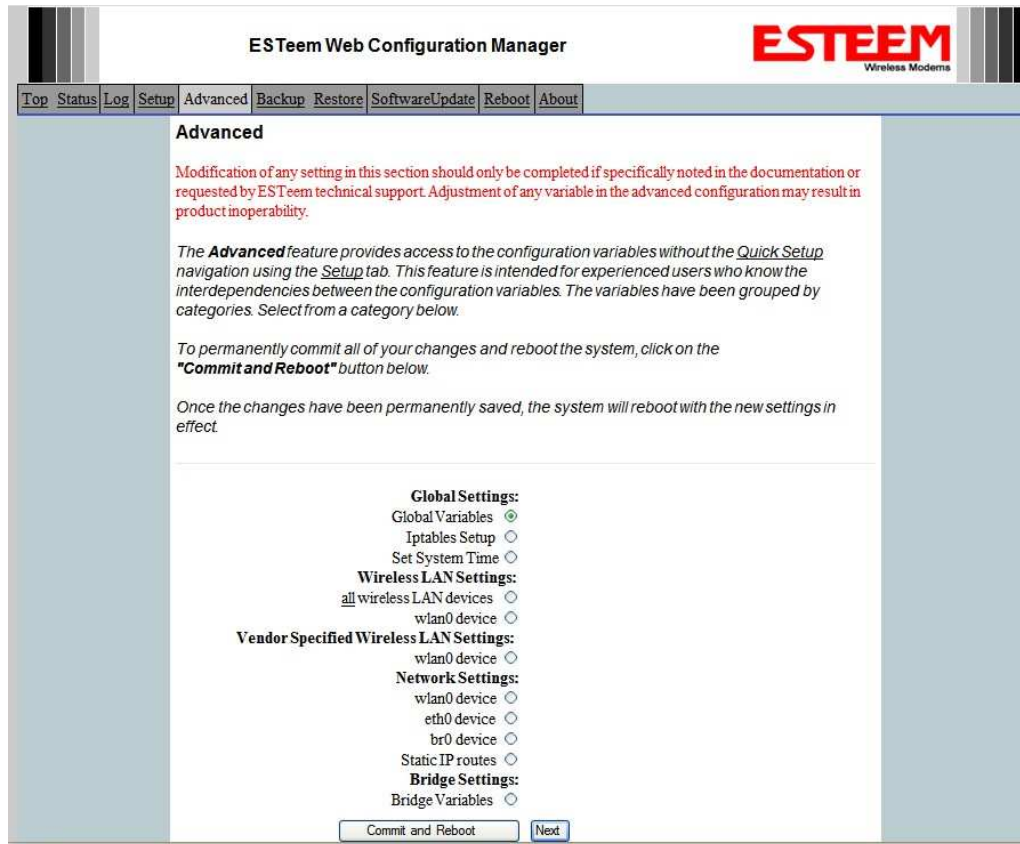


Figure 4: Advanced Global Variables

wlan0_POWER_LEVEL

Max

High

Low

Min

wlan0 Radio On

On

Return to Advanced

Save Settings

Select power level for wlan0 attenuator

Turn transmitter on continuously. The device will automatically reboot after the transmitter has been on for 10 seconds.

Figure 5: Power Level Settings

AVERAGE RF OUTPUT POWER

The average measurable output power on the ESTeem Model 195Ed will vary from 250mW to 630mW depending upon modulation type and RF data rate. The average power is used when entering the output power level in the ESTeem RF Design program. The following table provides that level and modulation type at each data rate:

RF Data Rate (Mbps)	Average Power	Modulation Type
1	630mW	BPSK
2	630mW	BPSK
5.5	630mW	BPSK
6	630mW	OFDM
9	630mW	OFDM
11	630mW	BPSK
12	630mW	OFDM
18	630mW	OFDM
24	630mW	OFDM
36	400mW	OFDM
48	300mW	OFDM
54	250mW	OFDM

OVERVIEW

The security for the ESTeem Model 195Ed, 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.

PROPRIETARY COMMUNICATION

The ESTeem Model 195Ed operates in the unlicensed 900 MHz frequency band. This frequency band does not comply with any “open” standards and no other manufacturer of wireless hardware can access the ESTeem network when either bridging between Ethernet networks or being used as a mobile client. This proprietary communication layer, in combination with the other security settings listed below, allow you as the user to reject wireless clients into the network if so desired.

The security level of the bridge communication link is configurable for 64-Bit WEP, 128-Bit WEP, TKIP and CCMP and is completely independent of the client access level or any other communication link level. For example, an ESTeem Model 195Ed can be configured for WPA Enterprise for client level access, communicate to another ESTeem Model 195Ed using a TKIP bridge link.

CCMP (AES)

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 195Ed is compatible as either an Access Point or mobile client using WPA2 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 (WPA2 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 195Ed can be configured to operate with an established RADIUS server on the network.

In an ESTeem 195Ed wireless network, WPA2 is server/client relationship between an ESTeem 195Ed configured in a Station mode (Etherstation, Station Router or Station Masquerade) and an ESTeem 195Ed configured in an Access Point mode (AP Bridge, AP Router or AP Masquerade). The scope of WPA2 Enterprise is limited in use to this mobile client configuration only. The security level on the Bridging layer is configured separately.

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 195Ed 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 195Ed can support WPA Enterprise and PSK as an Access Point, but the level of security on the Bridging layer is configured separately.

In an ESTeem 195Ed wireless network, WPA is server/client relationship between an ESTeem 195Ed configured in a Station mode (Etherstation, Station Router or Station Masquerade) and an ESTeem 195Ed configured in an Access Point mode (AP Bridge, AP Router or AP Masquerade). The scope of WPA PSK and Enterprise is limited in use to this mobile client configuration only. The security level 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 that administrators should consider ways to reduce the possibility.

MASQUERADE MODES

The ESTeem Model 195Ed functions as a network firewall when configured in either the Access Point Masquerade or Client Masquerade modes. If access to the wired network is the greatest concern, place the ESTeem in the Masquerade mode and the wireless network will be completely isolated from the wired Ethernet network.

INCREASING NETWORK SECURITY

The following are a few suggestions to help improve the overall security of your wireless network:

1. Enable the security. If you research all of the articles regarding hackers, they have gotten into the user's network due to the security not being enabled.
2. Make sure the keys are not reused in your company, since reuse increases the statistical likelihood that someone can figure the key out and change the default password on your access point or wireless router
3. Many access points allow you to control access based on the MAC address of the NIC attempting to associate with it. If the MAC address of your NIC isn't in the table of the access point, you won't associate with it. And while it's true that there are ways of spoofing a MAC address that's been sniffed out of the air, it takes an additional level of sophistication to spoof a MAC address. The downside of deploying MAC address tables is that if you have a lot of access points, maintaining the tables in each access point could be time consuming. Some higher-end, enterprise-level access points have mechanisms for updating these tables across multiple access points of the same brand.
4. If you're deploying a wireless router, think about assigning static IP addresses for your wireless NICs and turn off Dynamic Host Configuration Protocol (DHCP). If you're using a wireless router and have decided to turn off DHCP, also consider changing the IP subnet. Many wireless routers default to the 192.168.1.0 network and use 192.168.1.1 as the default router.
5. Only purchase wireless devices that have flashable firmware. There are a number of security enhancements that are being developed, and you want to be sure that you can upgrade your access point.
6. A simple security technique used by the military is to have the administrator periodically change the key for the system i.e. weekly, monthly, etc.

TESTING COMMUNICATION LINK

After you have configured at least two of the Model 195Ed 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 195Ed (Figure 1). If the Status light is solid on any other 195Ed except the Timing Master, the Model 195Ed has a connection to another Model 195Ed listed in the Peer Table. On the Timing Master the status light will be illuminated at all times.

Status LED
Solid Red on Link



Figure 1: Connection Status Light

Status Screen/Peer Table

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 195Ed (Figure 2).

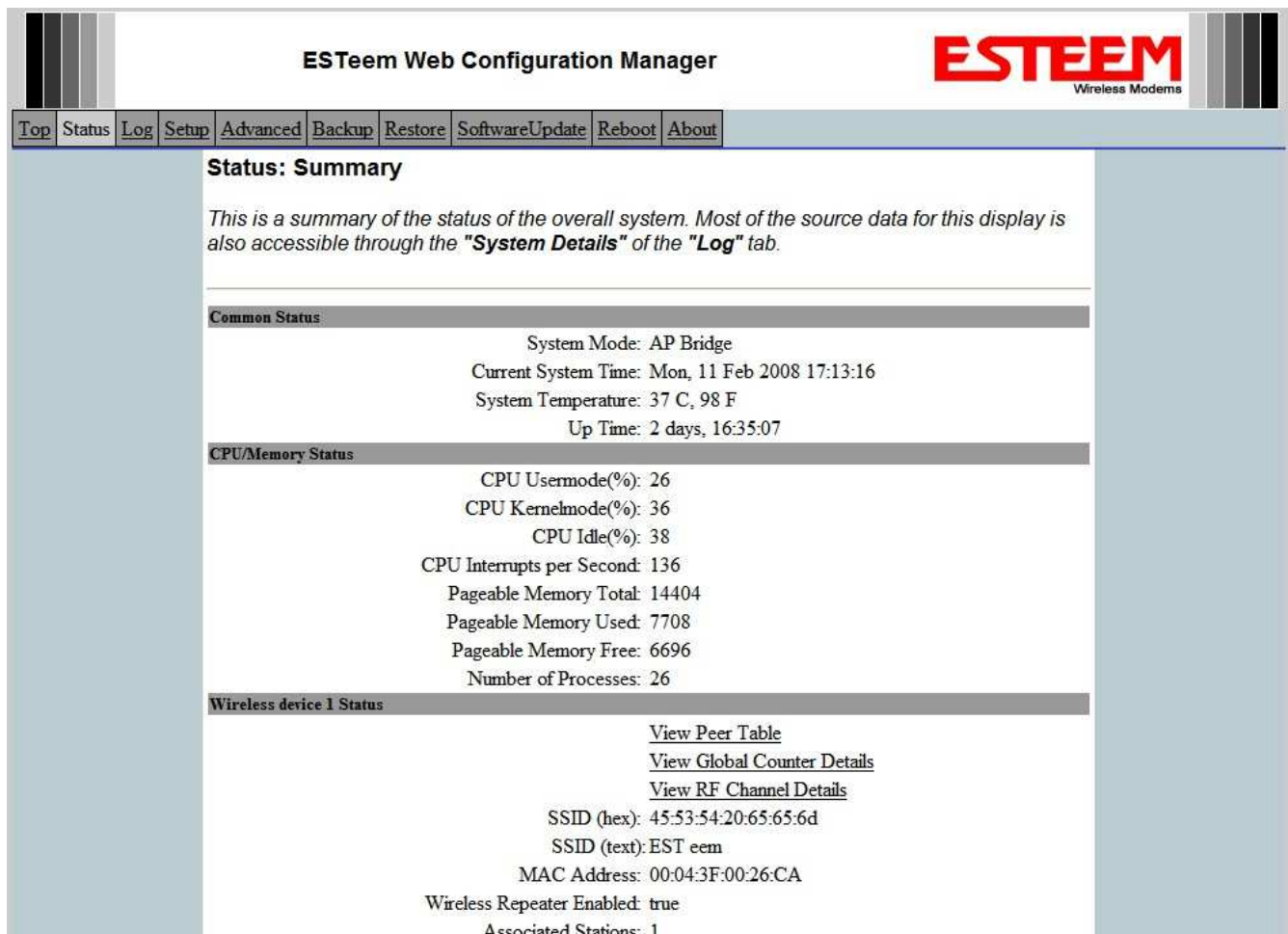


Figure 2: Peer Summary Table

Under the Wireless Status heading click on the [View Peer Table](#) and the Peer Table Screen will be displayed (Figure 3).

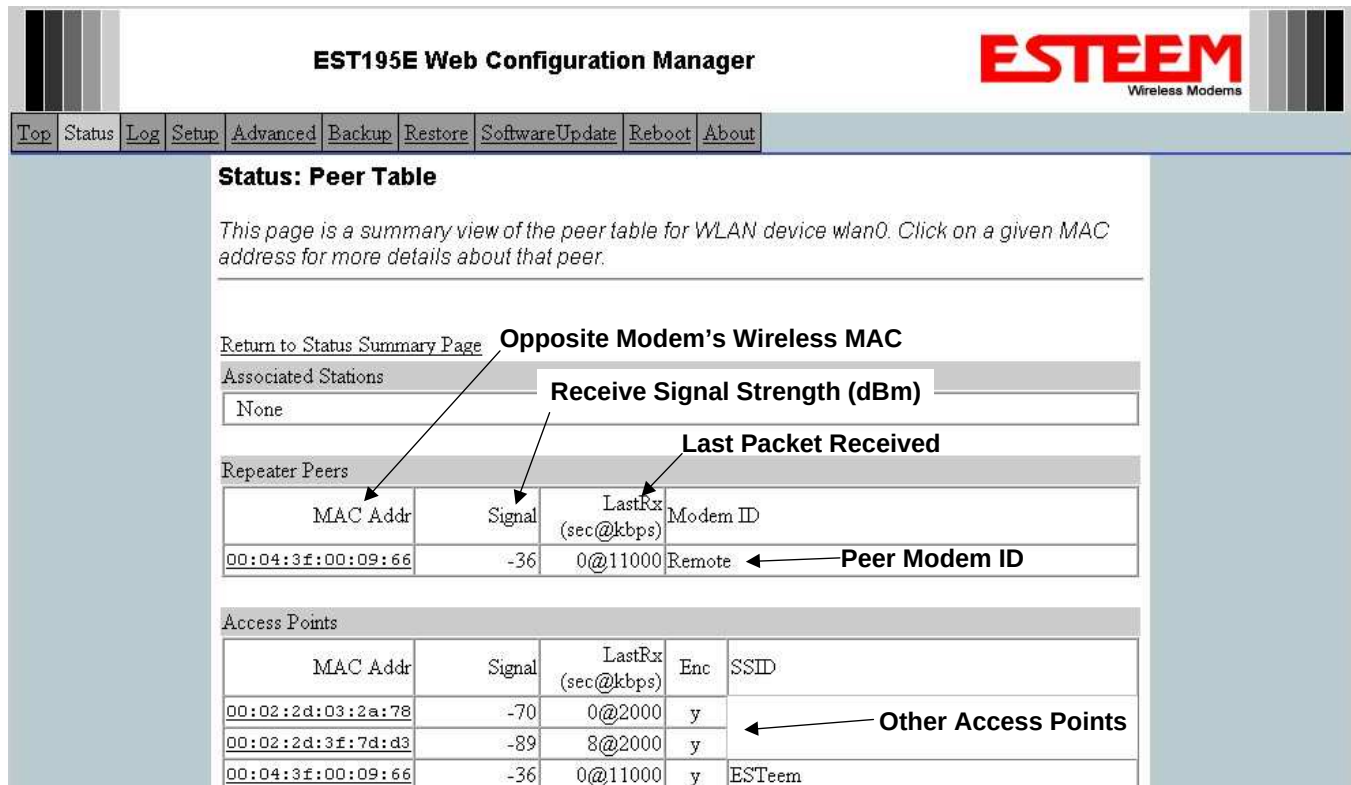


Figure 3: Repeater Peer Table

Repeater Peers - The Peer Table will display all connected 195Ed 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 195Ed. Note that the speed is listed in kbps.

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

Peer Table Details

To further analyze a repeater peer link, press the hyperlink for any WLAN MAC address listed in the repeater peer summary (Figure 3) and the Peer Info screen will be displayed (Figure 4). Detailed information on the Counter, Statistics, Link Encryption, Beacon and Probes can found by selecting the respective hyperlink.

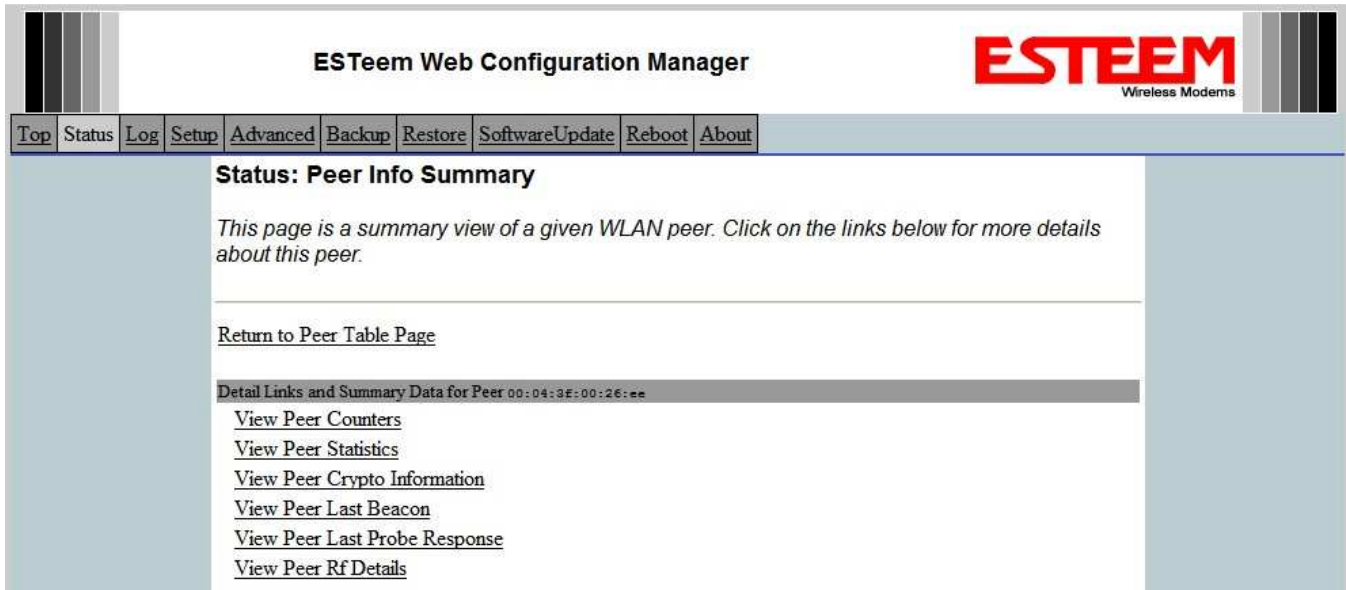


Figure 4: Repeater Peer Table

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 195Ed firmware listed on the ESTeem Web site (www.esteem.com) under the Model 195Ed product page.

How and when do I update the Model 195Ed firmware? - You should only update the Model 195Ed 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/195Ed>

Do all firmware versions have to be the same to communicate between the Model 195Ed? – 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 195Ed? – The ESTeem Utility program is not required to program the Model 195Ed. The 195Ed 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 195Ed – The Model 195Ed is an auto-negotiation full/half-duplex 10/100 Base-T interface. Either a cross-over or patch cable is supported.

Access Point Repeater Mode

If I am unable to communicate with any of the remote sites, what is the most common cause? - The most common cause a communication problems with the 195Ed is that the SSID was entered incorrectly for the radio network. The 195Ed uses the SSID to set the frequency hopping pattern and it must be the same on all modems.

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 30 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 195Ed'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 195Ed 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** 195Ed'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 195Ed web page in EtherStation Mode? The Model 195Ed 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 192E 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 195Ed. The MAC address must have colons between the values.

Can I connect my Model 195Ed 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 195Ed can only service ONE Ethernet device.

ESTEEM DISCOVERY UTILITY

The ESTeem Discovery Utility will allow you to configure the IP address on the Model 195Ed to match your network regardless of its current IP subnet. This utility will also allow you to update the software in the 195Ed and open the web configuration for that wireless modem.

Installation

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

Note: The ESTeem Resource Disk is 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 is 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 2).

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>



Figure 1: ESTeem Resource Main Page



Figure 2: Discovery Utility Download

3. Double click on the 195EdiscoverySetup.exe file listed in the window to install the program.
4. Connect the Model 195Ed to your computer either direct to the Ethernet card or through a HUB/Switch using a CAT-5e Ethernet cable. The Ethernet port on the 195Ed 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 195Ed will be displayed in the program by the Ethernet MAC address and Current IP Address (Figure 3).



Figure 3: Discovery Program Main Page

Note: The SSID, Mode of Operation and Modem ID will be adjusted through the web configuration manager..

5. Double-click on the 195Ed you want to program and the *Configure IP Address* window will be displayed (Figure 4). Enter an IP address and Subnet Mask for the 195Ed 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 195Ed will reboot. Proceed to ESTeem Setup in Chapter 4.



Figure 4: 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 5). Once you locate the update file, select the **Open** button and the 195 will update, validate and then reboot with the updated operating system.

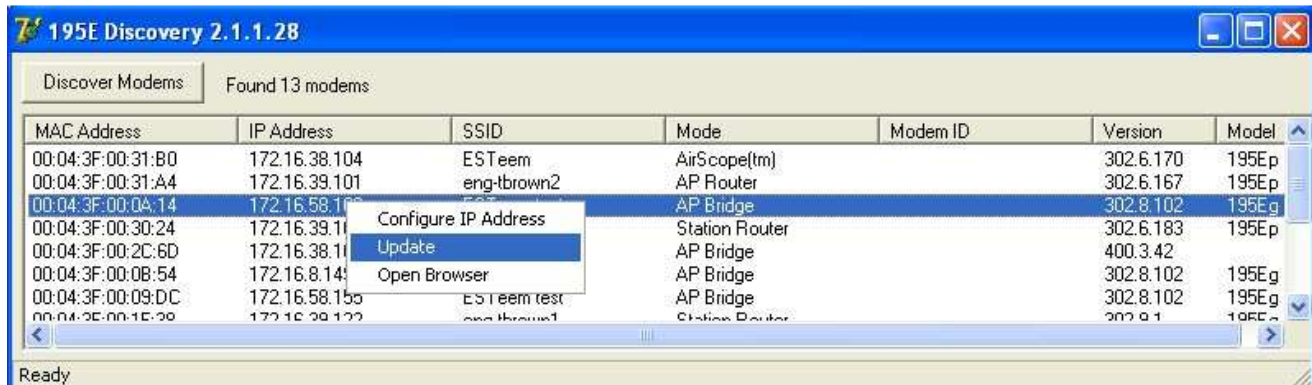


Figure 5: Discovery Features Menu

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 5). 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 6) and you can begin programming the Model 195 for your application.



Figure 6: EStEem Web Page Log-on Screen

ETHERSTATION STATUS PROGRAM

When configured for EtherStation mode, the Web Configuration Manger is turned off. To gather information from the 195Ed on Access Point, link status and received signal strength you will need to install the ESTeem 195E Status Utility. The EtherStation Status Utility version 2.0.1.1 or greater provides a new feature where it will automatically program the connected ESTeem 195Ed to match up with the computer running the software. This software requires that the ESTeem 195Ed has 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 195Ed 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 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 is 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 195EStatusSetup.exe file listed in the window to install the program.

4. Connect the Model 195Ed to your computer either direct to the Ethernet card or through a HUB/Switch using a CAT-5e Ethernet cable. The Ethernet port on the 195Ed supports Auto-Negotiation so either a patch cable or crossover cable will work. Open the ESTeem Status Program and a status icons will appear in your system tray (Figure 9). When the status menu is opened from the system tray, the status window will be displayed (Figure 7) 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.

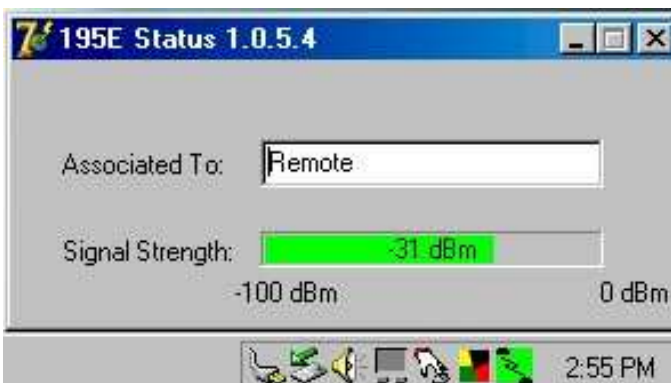


Figure 7: EtherStation Status Program

Note: This Utility will only operate with an ESTeem Model 195Ed in EtherStation mode.

SETTING LOCAL TIME

The ESTeem Model 195Ed 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** and press the **Next** button (Figure 8).
2. Select **Global Settings>Set System Time** from the menu and press the **Next** button to continue.

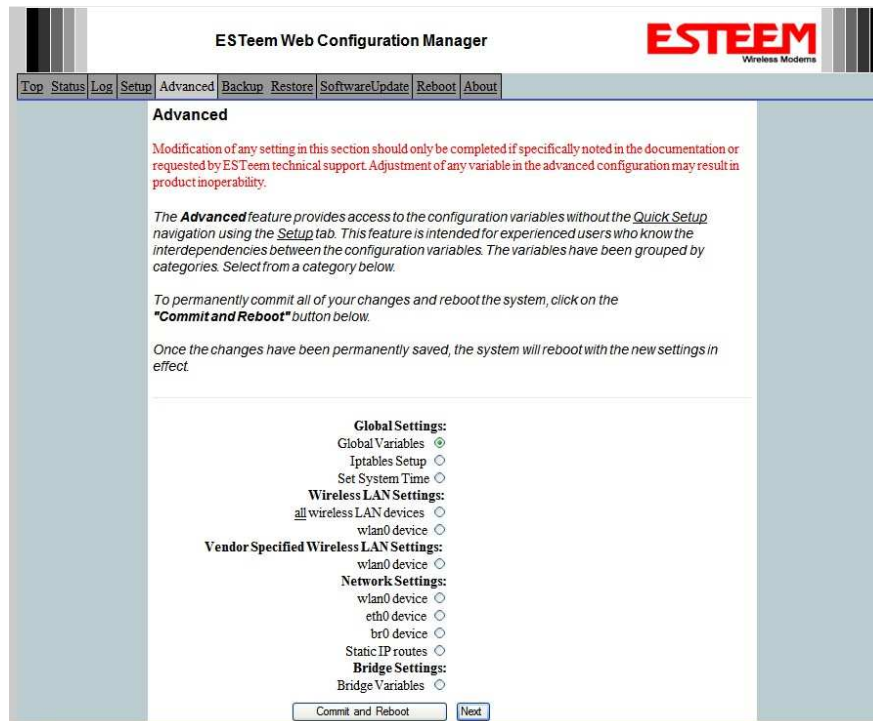


Figure 8: Advanced Features Screen

3. Select the correct date and time from the drop-down menus (Figure 9) and press the **Set System Time** button to save the time to the real time clock.

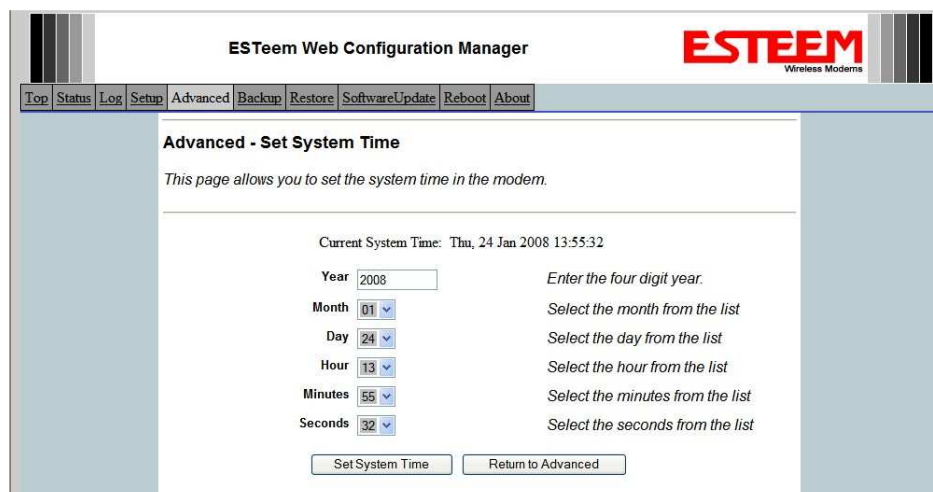


Figure 9: Advanced Features Screen

CONFIGURING TIME SERVER

Enabling NTP time synchronization services on the ESTeem 195Ed will allow to use time services from upstream services to keep the time on the system accurate.

To allow time synchronization, the Model 195Ed 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 10).

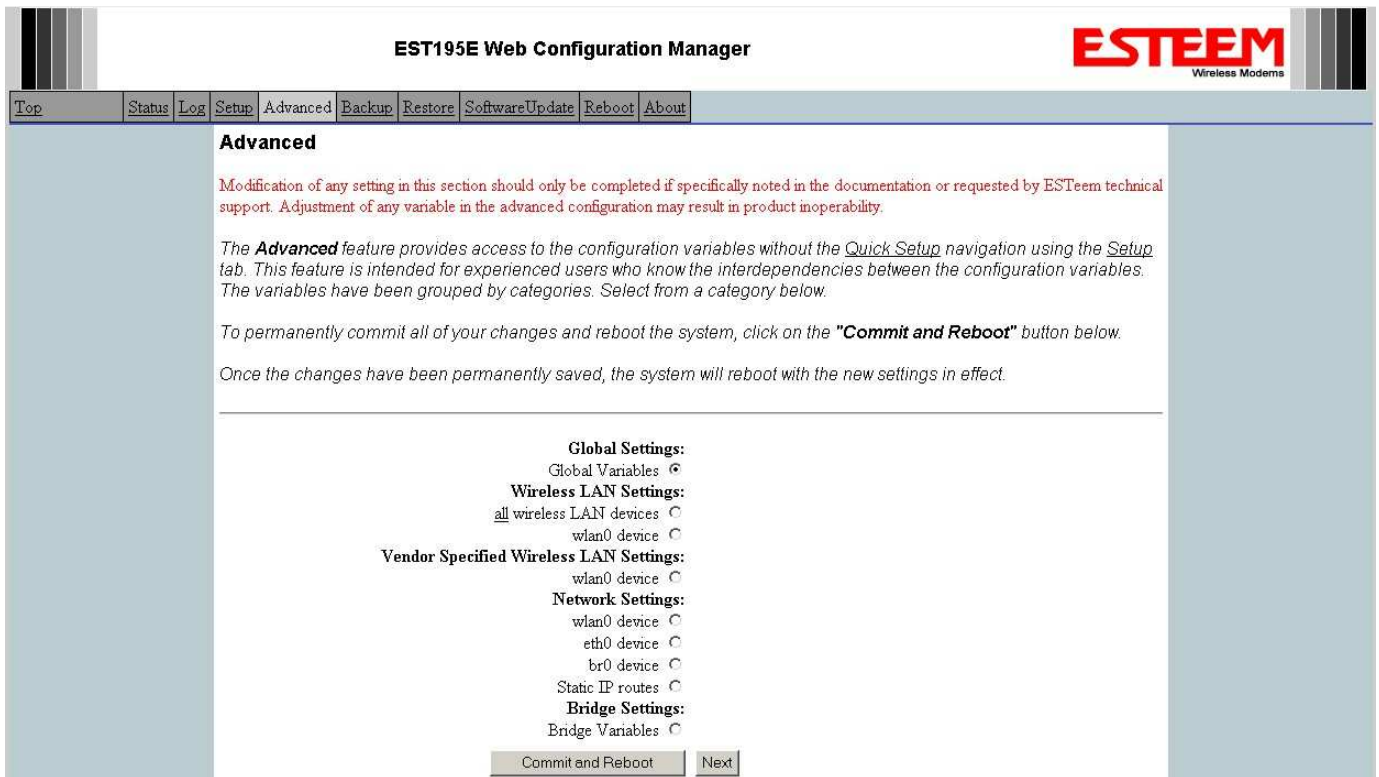


Figure 10: Advanced Settings Menu

- Press the next button and Figure 11 will be displayed. At the bottom of the page are the NTP server configurations.
- The NTP daemon is enabled by selecting YES for **NTP ENABLE** (Figure 11). When enabled, the NTP daemon will use time services from upstream services to keep the time on this system accurate.

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/arsweb.cgi/advanced.fm>. The page contains several configuration fields and radio buttons for enabling various services:

- IP_NAT_INSIDEDEV**:
- IP_NAT_OUTSIDEDEV**:
- HTTP_ENABLE**: ☒ Yes, ☐ No
- HTTPS_ENABLE**: ☐ Yes, ☒ No
- TELNETD_ENABLE**: ☒ Yes, ☐ No
- SSHD_ENABLE**: ☒ Yes, ☐ No
- NTP_ENABLE**: ☒ Yes, ☐ No
- NTP_SERVICE_ENABLE**: ☒ Yes, ☐ No
- NTP_SERVER**:

On the right side of the form, there are detailed instructions for each setting. For NTP_ENABLE, it states: "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." For NTP_SERVICE_ENABLE, it states: "Enable/Disable NTP service. When enabled (and NTP_ENABLE is true), this system will provide NTP service for clients wishing time synchronization." For NTP_SERVER, it states: "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 11: NTP Settings

- 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 11).
- The final step in configuring NTP services is to enter the IP address or the host name of the upstream NTP server.

- Once configuration is complete, press the “Return to Advanced” button.

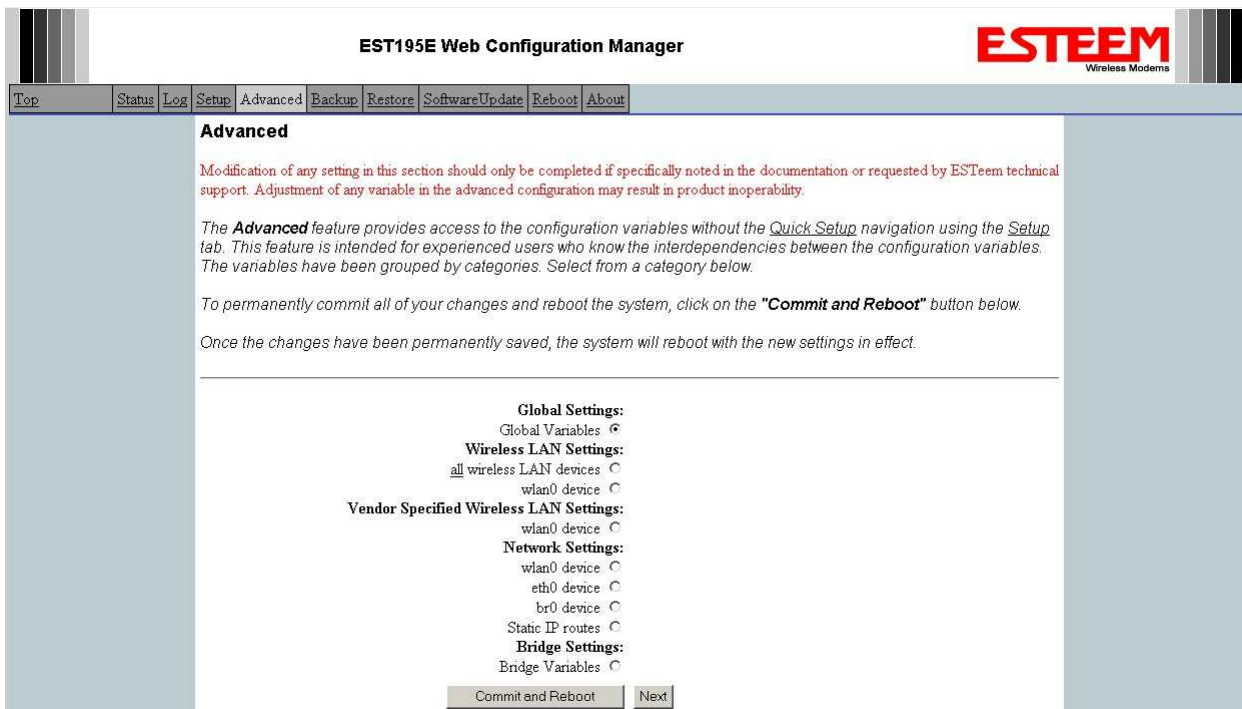


Figure 12: Advanced Settings Menu

- To complete the configuration, select “Commit and Reboot.” The ESTeem 195Ed will now commit the configuration changes and reboot. (Figure 12)

VLAN OPERATION

Virtual LAN (VLAN) systems are rapidly becoming the desired configuration on larger Ethernet networks. The ESTeem 195Ed software will allow the Ethernet modems to transparently pass the VLAN packets for these networks. The 195Ed currently can not be used as a VLAN switch, but will pass VLAN tagged Ethernet packets through the wireless bridge.

IGMP SNOOPING

Internet Group Management Protocol (IGMP) Snooping allows the ESTeem 195Ed to operate more efficiently in networks with high Multicast (UDP, etc.) traffic. IGMP Snooping will define the destination for the Multicast traffic and send the data to the correct wireless Ethernet modem and not the entire network. This limiting of Multicast traffic to specific destinations greatly increases the overall network efficiency.

There are two types of Ethernet packets on a network, unicast and multicast. Unicast is intended for exactly one recipient (and ignored by all others) and multicast is intended to be received by multiple recipients. In a unicast network, all Ethernet traffic is Acknowledged and guaranteed to get to a destination. The problem with using Multicast traffic over a wireless connection is that Multicast packets do not require an Acknowledge on the protocol layer. If the wireless network misses a data packet on the RF network, that Multicast data packet is lost.

Theory of Operation

There are two types of Ethernet packets on a network, unicast and multicast. Unicast is intended for exactly one recipient (and ignored by all others) and multicast is intended to be received by multiple recipients. Interested parties can listen for particular multicast packets, but most nodes ignore it. In any case, the network medium is still utilized no matter how many nodes are listening. Broadcast packets are a special type of multicast traffic which all nodes always receive. These are of particularly useful for global announcements (Hey, I'm Alice!) and queries (Hey, I'm Alice and I'm looking for Bob!). More relevantly, it is how hosts on a network find out each other's addresses, and are absolutely crucial to the proper functioning of a network.

As the network grows physically, it encounters some growing pains. The first is more physical, relating to the cabling limitations. Bridges solve this problem by joining two physical networks together so they appear to be a single large network. Through use of bridges, a network can scale to hundreds or even thousands of hosts. There is a downside, however. Well before the physical limitations of bridging hit, you start to run into efficiency problems, as all traffic has to travel everywhere on the network. The raw carrying capacity of this shared medium, often referred to as bandwidth, is the second scaling problem.

Smart bridges, or switches, help alleviate the bandwidth problem by only passing traffic across the bridge if the destination host was on the other side. This greatly increases the capacity and efficiency of the network by allowing two pairs of hosts communicating simultaneously on each side of the switched bridge. Only when the packet needs to go to the other side is both mediums utilized simultaneously for the same packet.

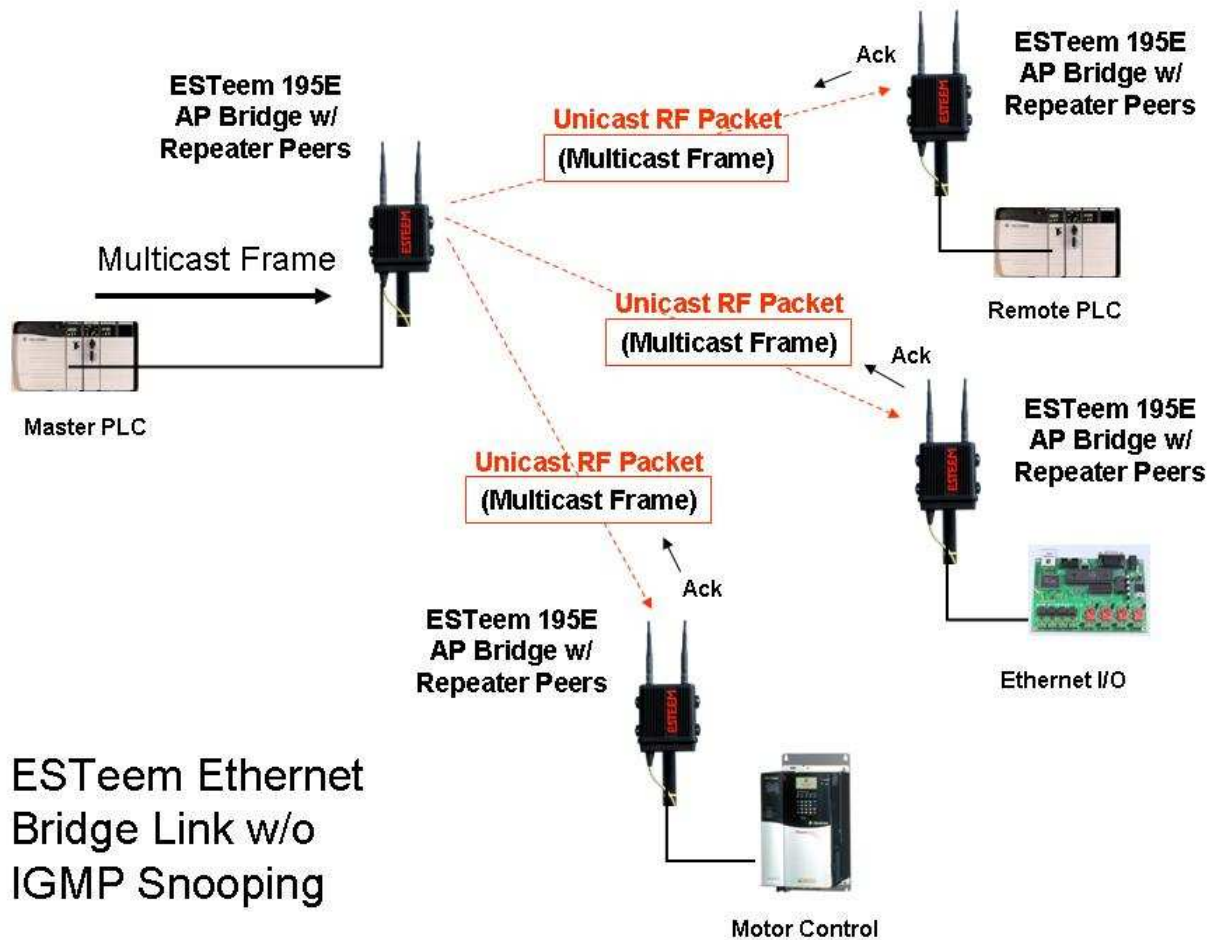
Unfortunately, broadcast and multicast traffic by its very nature has to be always relayed across the bridge. While the number of network nodes may grow linearly, the multicast traffic tends to grow exponentially. This isn't generally a problem for wired networks, as they have a considerable amount of bandwidth to spare, but wireless networks have at best an order of magnitude less bandwidth to begin with. If a wireless network is bridged with a wired network, while the absolute numbers are the same, a much higher proportion of the wireless networks' available bandwidth is used up by multicast traffic. This effect is further magnified if multiple wireless repeaters are in use.

The preferred way of dealing with excess multicast traffic is to put the wireless network on a different sub-network (subnet) and use a router to join it to the wired network. This ensures that only unicast traffic intended for the wireless network crosses over, as multicast and broadcast traffic stays within its local subnet. Normally this is fine, but there are times where you need multicast traffic to span subnets. For IP traffic, this can be obviated by using a multicast-capable router, but for legacy multicast protocols that were not designed to be routed, another solution must be found.

There are two primary types of communication networks used in wireless Ethernet systems; fixed points communicating to each other through an Ethernet Bridge and mobile devices communicating to these fixed points. The fixed point Ethernet bridge communication in the 195Ed is through Repeater Peer links, while the mobile communication is from the Client modes (EtherStation, Station Router and Station Masquerade) to the Access Points (Fixed Locations) in the network. Each of these networks handles Multicast traffic differently as explained below.

Ethernet Bridge Mode (Repeater Peers)

When the ESTeem 195Ed is configured as a repeater peer, all multicast traffic is “wrapped” in a Unicast frame and sent to all other repeater peers. (Figure 13) This operation allows the ESTeem network to receive an acknowledge packet and retransmit the data if the packet is lost during transmission. This unicast encapsulation will work regardless if the protocol can support IGMP or not.



ESTeem Ethernet
Bridge Link w/o
IGMP Snooping

Figure 13: Repeater Peer Operation

Ethernet Bridge Mode (Repeater Peers) With IGMP Snooping

When the ESTeem 195Ed is configured as a repeater peer, IGMP Snooping is enabled and the network supports IGMP protocol, the 195Eg will begin to identify the connected Ethernet devices using Multicast transmissions and report this information to the network. As this process continues, all sites that have Multicast traffic on the wireless network will only send these requests to the specific ESTeem reporting the Ethernet device (see Figure 14).

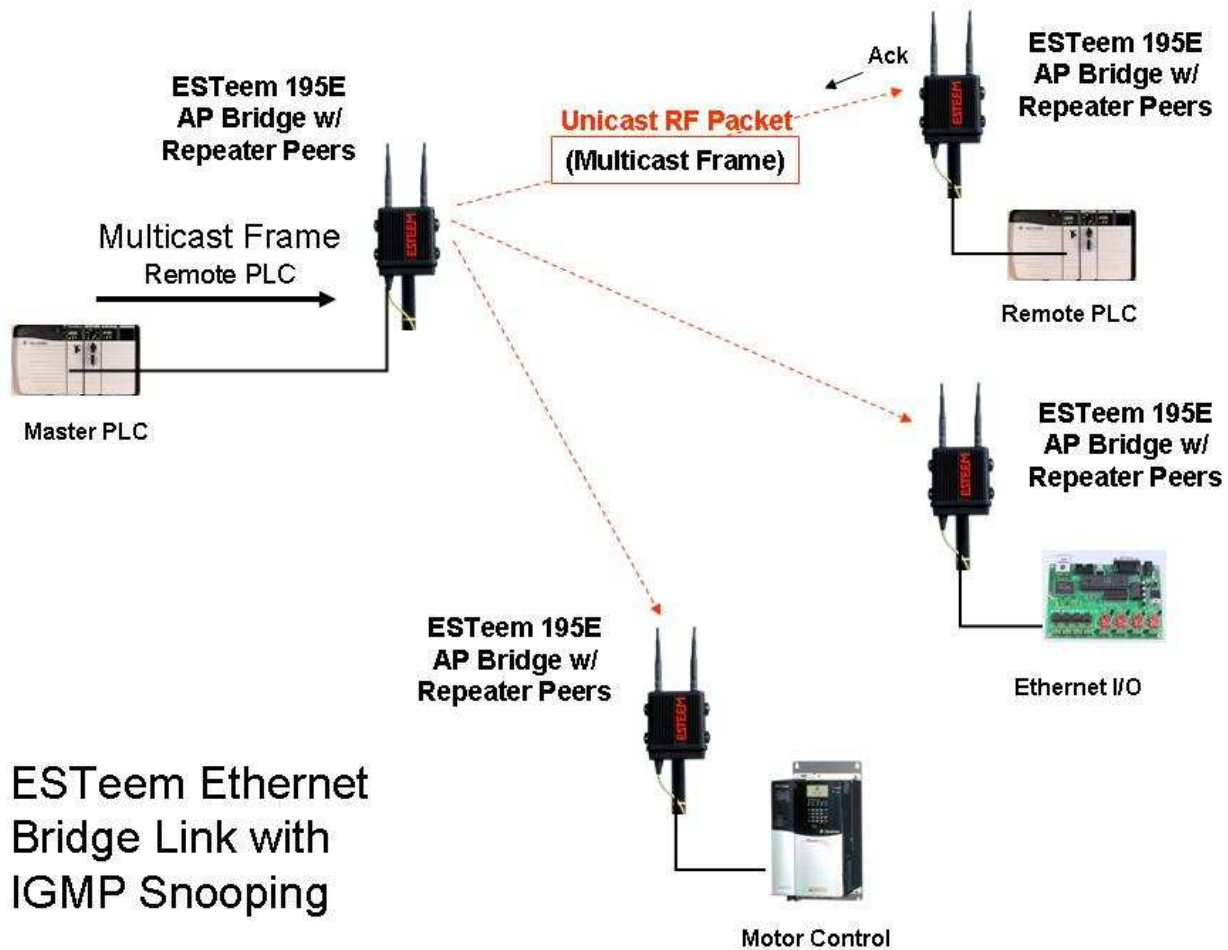
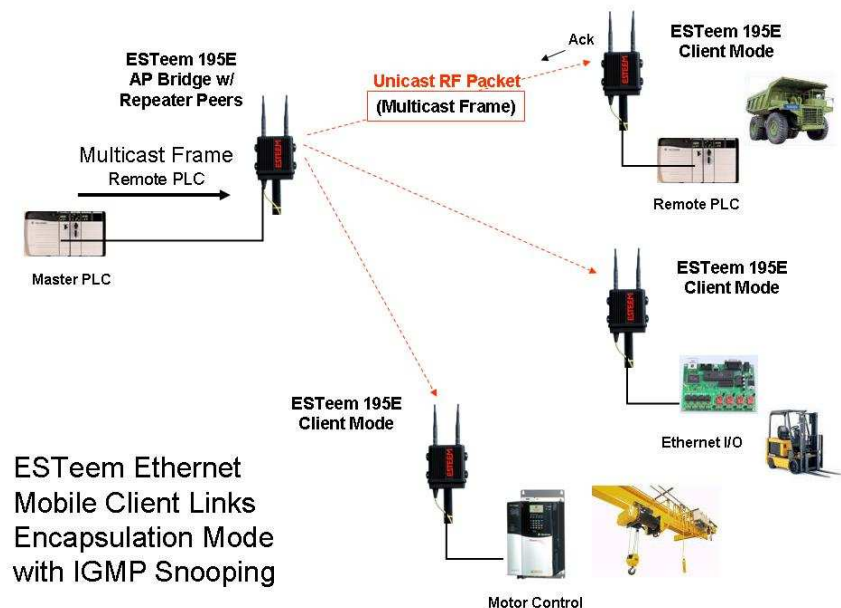
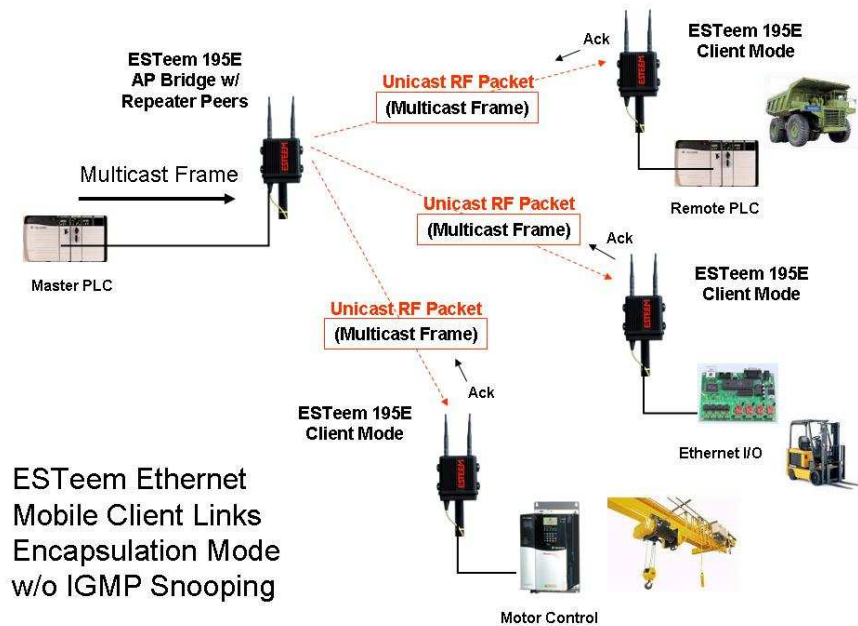


Figure 14: Repeater Peer with IGMP Enabled

Client Modes

When the ESTeem 195Ed is configured as a mobile client (EtherStation, Station Router or Station Masquerade), there are two configurations that will increase the reliability of Multicast traffic. The first phase is encapsulation of the multicast packets, as described in the Repeater Peer, and the second is IGMP Snooping if the network will support the protocol. The encapsulation of the Multicast packets will operate regardless of the IGMP support to increase the reliability.



Multicast Encapsulation

To enable Multicast Encapsulation, select **Advanced>Wireless LAN Settings>wlan0 device** and press the *Next* Button (Figure 15). Select wlan0_EncapsulateMulticast to either Multicast (for all Multicast including Broadcast) or Broadcast (Broadcast only), press the *Accept* Button and then *Commit and Reboot*.

wlan0_EncapsulateMulticast ☒ Off
☐ Multicast
☐ Broadcast

Turn this on to encapsulate multicast/broadcast packets to each associated station. This will prevent stations that do not support this feature from associating!

wlan0_POWER_LEVEL ☒ Max
☐ High
☐ Low
☐ Min

Select power level for wlan0 attenuator

wlan0 Radio On ☐ On
 Turn transmitter on continuously for 10 seconds.

Cancel Accept

Figure 15: Multicast Enable

Enabling IGMP Snooping

To enable the ESTEem 195Ed for IGMP Snooping, select **Advanced>Bridge Variables** and press the *Next* Button (Figure 16). Select IGMP Snoop to YES, press the *Accept* Button and then *Commit and Reboot*.

ESTEem Web Configuration Manager

Top Status Log Setup Advanced Backup Restore SoftwareUpdate Reboot About

Advanced - Bridge Settings

The following is a list of those configuration variables under the **Bridge Settings** category. These variables contain values for configuring bridges.

BRIDGE_DEVICES:

Enter the name(s) of all the bridge devices separated by a single comma

br0_DEVICES:

Enter all the device names, separated by a single space, that will form a bridge device

br0_STP_ON: ☒ Yes
☐ No

Turn STP on or off. NOTE: the ROOT_BRIDGE and BRIDGE_PRIORITY settings have no effect if STP is turned off.

br0_ROOT_BRIDGE: ☐ Yes
☒ No

If you select 'Yes' here you will override the br0_BRIDGE_PRIORITY below and the bridge priority will be forced to 0.

br0_BRIDGE_PRIORITY:

Enter a priority level (0-65535) for the bridge device

IGMP_SNOOP: ☒ Yes
☐ No

Enable IGMP snooping to reduce multicast traffic across the bridge.

Cancel Accept

Figure 16: Repeater Peer with IGMP Enabled

Simple Network Management Protocol (SNMP)

The ESTeem 195Ed 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 195Ed 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-wlandev 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 aircscope
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 195Ed and select the **About** page (Figure 17). Press the Download MIB Files hyperlink on the page and save the files to your computer.

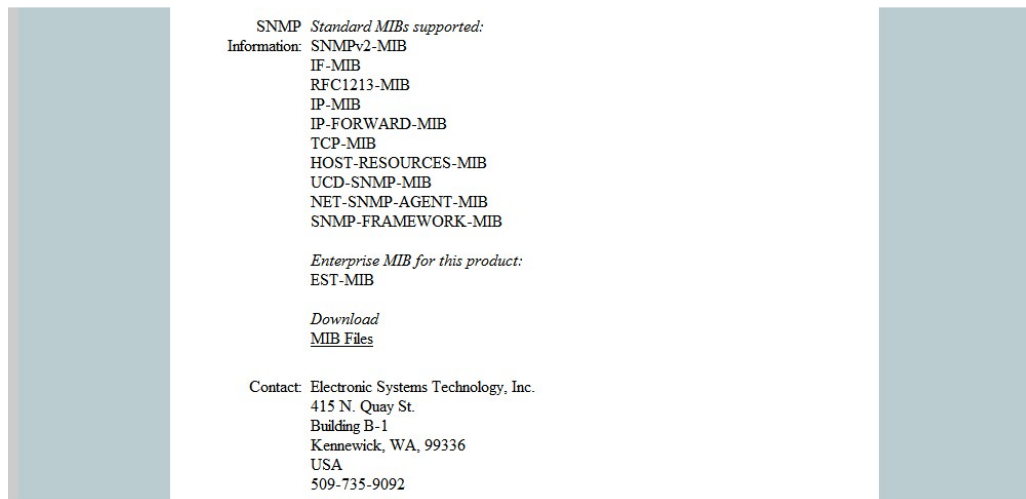


Figure 17: MIB Table Download

Before You Begin

- The ESTeem Model 195Ed wireless Ethernet radio modem is compatible with many different applications. The most common application is to bridge two or more Ethernet devices or networks. This guide will demonstrate the basic configuration and testing of a pair of 195Ed's. For more detailed information, please see the ESTeem Model 195Ed User's Manual.
- This guide assumes you have a working knowledge of Ethernet networking, TCP/IP protocol and how to identify and set the TCP/IP address on your computer.
- The 195Ed can be configured using any current web browser software such as Internet Explorer, Netscape or Mozilla.
- The following procedure will provide an initial communication link between two or more Model 195's for testing purposes. All the example commands listed in this guide can be adjusted to fit your communication network. Please consult the ESTeem Model 195Ed User's Manual for more details.

Unpack Contents

Each node in your ESTeem Model 195Ed'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 195Ed



AA109 Resource Disk



Antenna
(AA20DMEs
Displayed)



(2) Ethernet Cables



Power Supply
(AA175 Displayed)

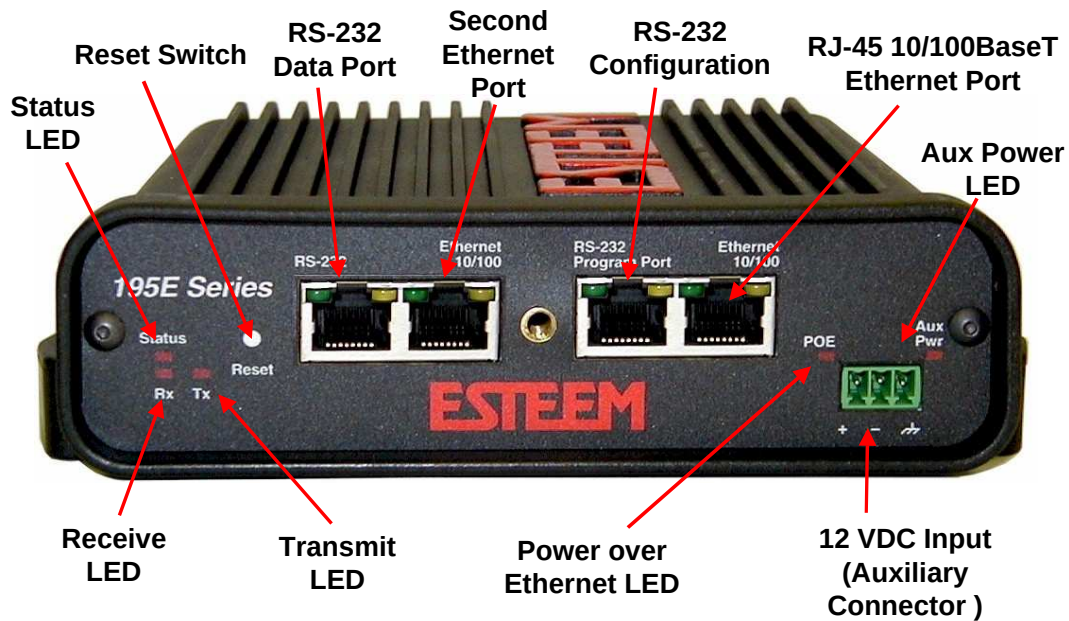


Serial Interface Cable
(AA6021.1)



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

Front Panel Overview (RS-232 Data Port and Second Ethernet Port Optional)



Antenna Overview

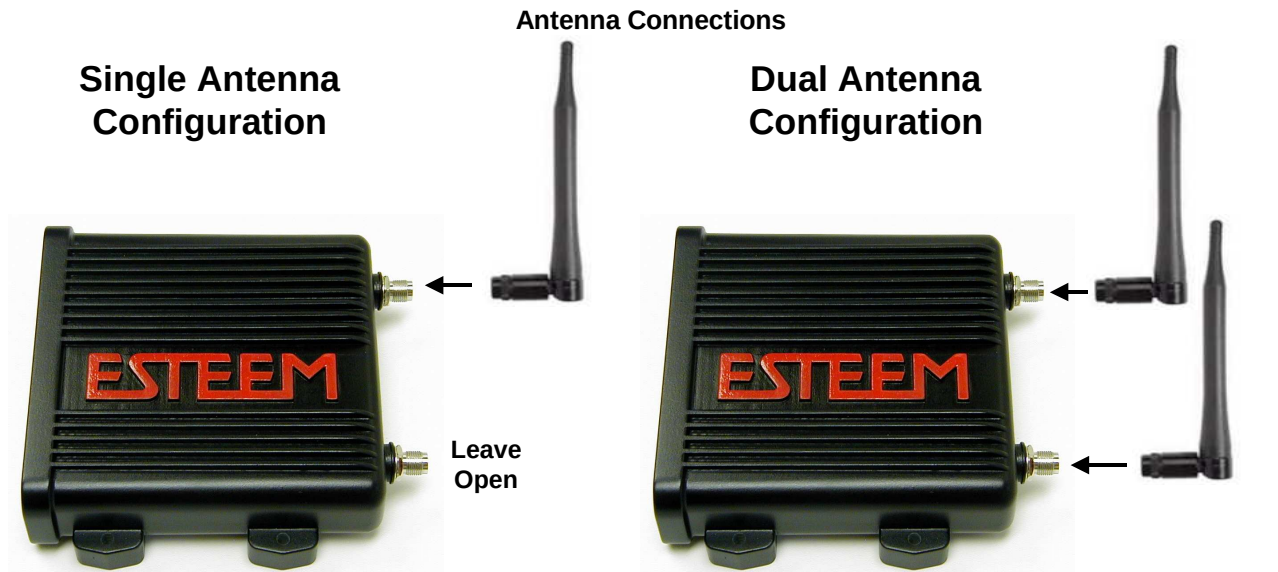


Antenna Port A
(Single Receive Antenna)

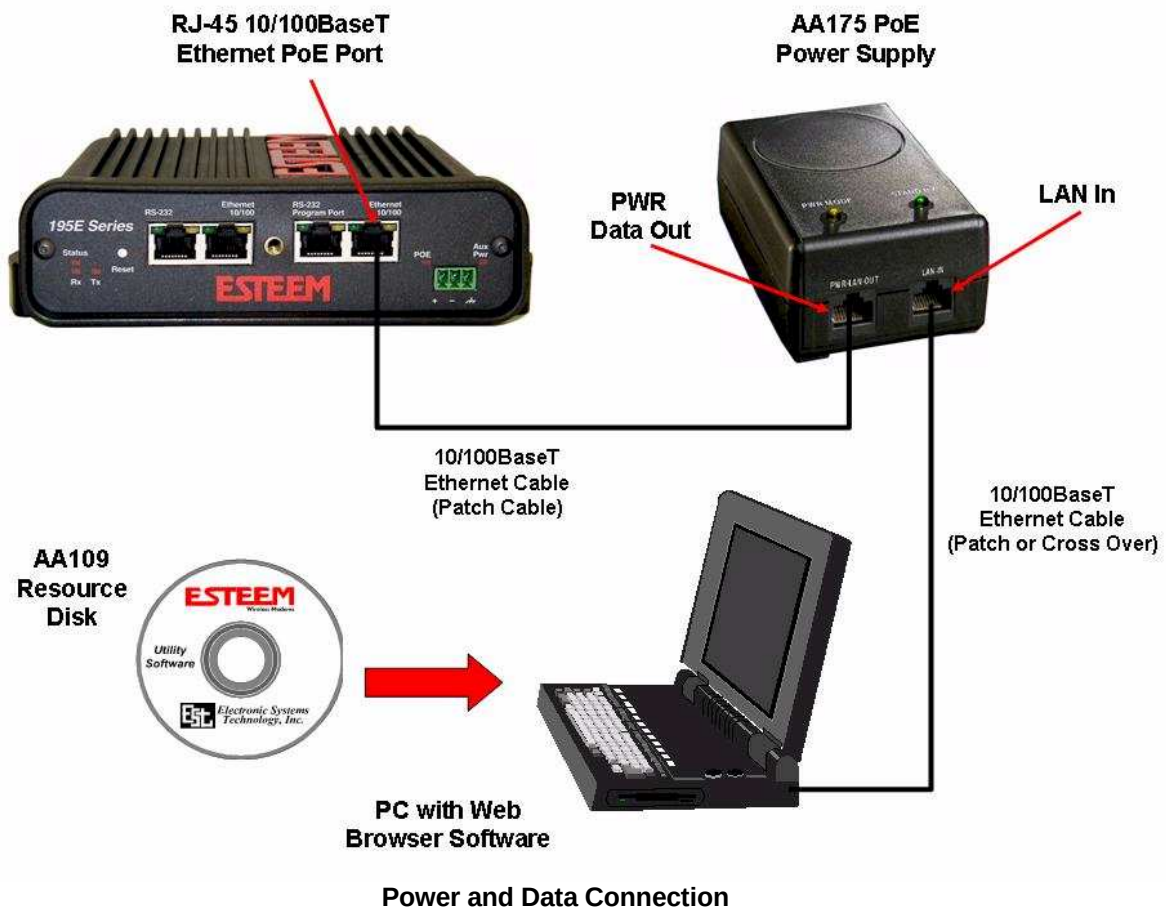
Antenna Port B
(Dual Receive Antennas)

Antenna Connectors
(TNC Female-RP)

Begin Programming



1. Assemble the ESTeem Model 195Ed using the following:



- The Model 195Ed will link to other Model 195Ed's on the network via the WLAN Media Access Control (MAC) address found on the bottom of the case. This MAC address is six hexadecimal digits separated by colons and is configured at the factory. Every MAC address in the world is unique and can not be changed. Complete the following chart to aid in your configuration:

Name	Serial Number	IP Address	Ethernet MAC	WLAN MAC
Example Modem 1	E-14001	172.16.8.101	00:04:3f:00:01:01	00:04:3f:00:01:02

- Configuration of the Model 195Ed is completed through the product's internal web server. To access this configuration page, you will need to enter the 195Ed's IP address in your web browser. The IP address set at the factory is Class B (i.e. 172.16.x.x) address and is printed on the Quality Assurance sheet sent with each 195Ed. If the factory default address matches your network configuration, please proceed to **Using Setup**, otherwise continue to step 4.

- Install the ESTeem Discovery Utility.** The ESTeem Discovery Utility will allow you to configure the IP address on the Model 195Ed 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 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 is available on the disk.

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).

From the Main Page select Support and click on ESTeem Utility.



Figure 1 –ESTeem Resource Disk Main Page

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>

Double click on the 195EdiscoverySetup.exe file listed in the window to install the program.

5. **Set IP Address on the 195Ed.** Connect the Model 195Ed to your computer either direct to the Ethernet card or through a HUB/Switch using a CAT-5e Ethernet cable. The Ethernet port on the 195Ed 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 195Ed will be displayed in the program by the Ethernet MAC address and Current IP Address (Figure 3). *Note: The SSID and Mode of Operation will be adjusted later in the configuration.*



Figure 2- ESTeem Utility Download

Double-click on the 195Ed you wish to program and the *Configure IP Address* window will be displayed (Figure 4). Enter an IP address and Subnet Mask for the 195Ed 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 195Ed will reboot. Proceed to ESTeem Setup to continue configuration.

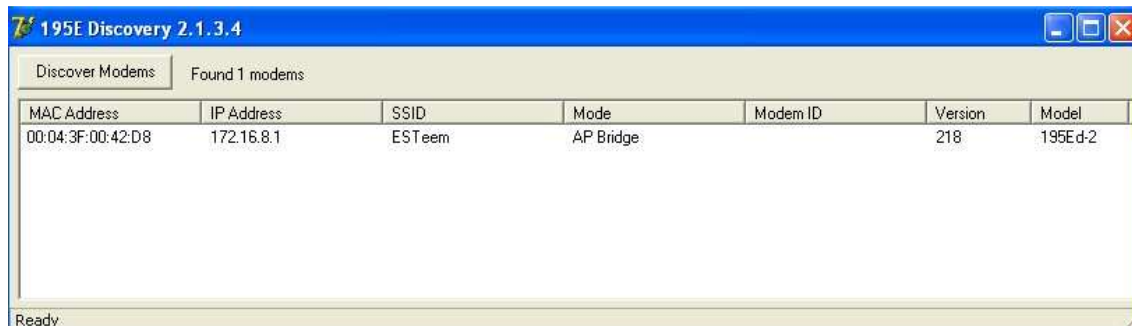


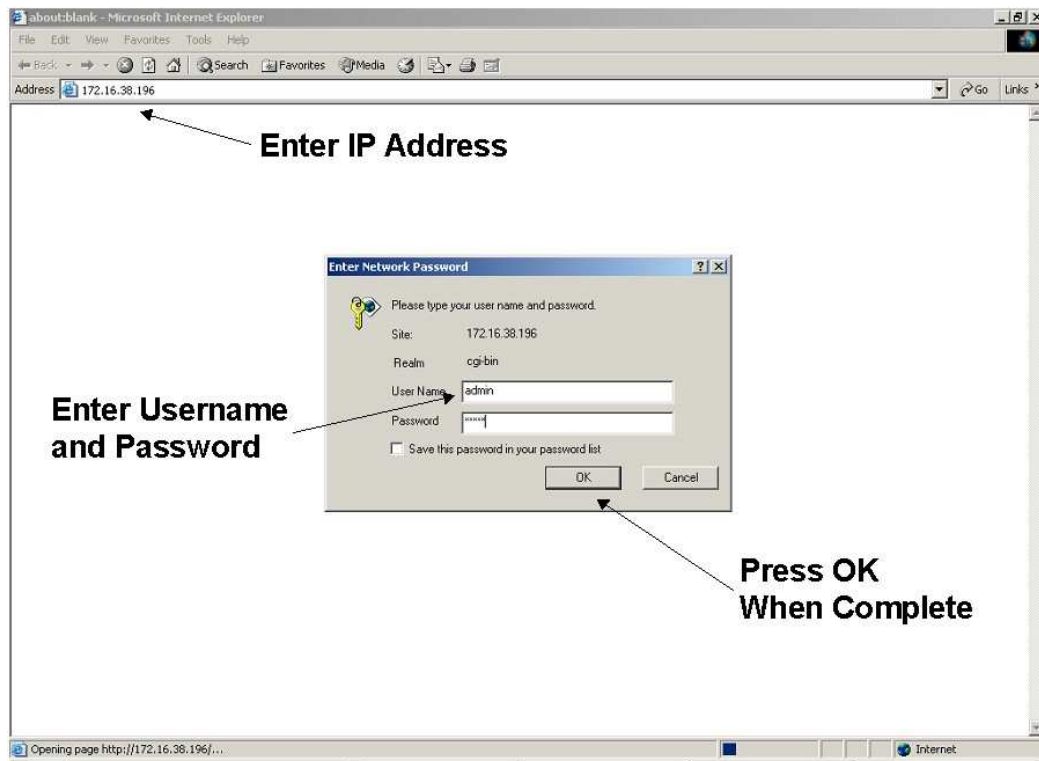
Figure 3 – Discovery Program Main Page

Setup Programming

You should now be ready to configure the Model 195Ed through your web browser. Open the web browser program and enter the IP address of the ESTeem in the address line and press enter.

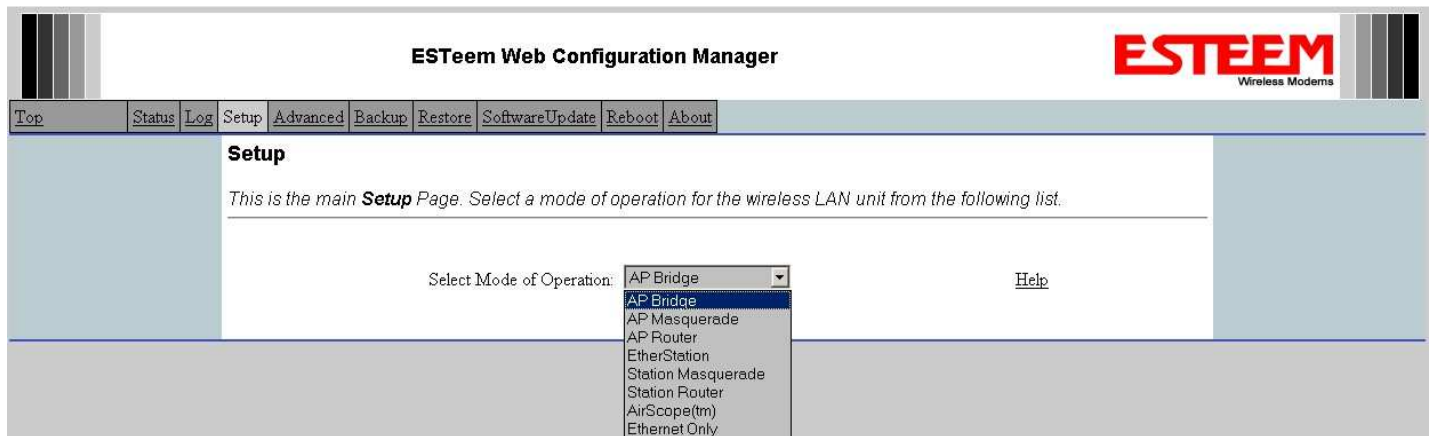


Figure 4 – Change IP Address Window



Step 1 – Sign-In Screen

1. When prompted, enter **admin** for both the username and password and press the OK button.
2. Select Setup on the top menu.
3. Press the drop-down menu and select AP Bridge and press the *N*ext button.



Step 3 – Select AP Bridge

ESTEEM Web Configuration Manager

Top Status Log Setup Advanced Backup Restore SoftwareUpdate Reboot About

Setup

Select whether you wish to use DHCP client services or whether you wish configure a DHCP server. Selecting "None" will take you through a manual setup of IP addresses as opposed to using DHCP services.

Selected mode of operation: AP Bridge

DHCP services on the bridge interface: ☒ None ☐ Client ☐ Server [Help](#)

Previous Next

Step 4 – Turn DHCP Off

4. Set the DHCP services to NONE and press the *Next* button.
5. Verify the IP address and netmask for the 195Ed (listed as **bridge** device) are correct press the *Next* button.

ESTEEM Web Configuration Manager

Top Status Log Setup Advanced Backup Restore SoftwareUpdate Reboot About

Setup

Enter values for the following fields for manual IP setup of the **bridging** device.

Mode of operation: AP Bridge

DHCP Services: Off

Enter IP address for bridge device: 172.16.48.189 [Help](#)

Enter netmask for bridge device: 255.255.0.0 [Help](#)

Previous Next

Step 5 – Verify IP Address

- Enter in the Gateway address in the default route IP address block and any DNS information for the server. If this is not know or on a network without a Gateway, leave these items at factory default.

ESTEEM Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

Enter values for the following fields to set up the default route and DNS settings

Mode of operation: AP Bridge

Enter default route IP address: [Help](#)

Use DNS client services? ☐ Yes [Help](#)
☒ No

Enter DNS domain: [Help](#)

Enter primary DNS server IP address: [Help](#)

Enter secondary DNS server IP address: [Help](#)

Step 6 – Enter Gateway Address

- All 195Ed modems in the network must be have the exact same Service Set Identification (SSID). The default SSID is **ESTEEM** and we will use this for demonstration. Enter the SSID as listed above and turn off the wireless security features by selecting the NO radial. Press the *Next* button to continue.

ESTEEM Web Configuration Manager

Top Status Log Setup **Advanced** Backup Restore SoftwareUpdate Reboot About

Setup

In the following fields, select whether you want wireless security features turned on and enter the service set identifier (SSID) that will be common to all wireless LAN devices.

Selected mode of operation: AP Bridge

Turn on wireless security features? ☐ Yes [Help](#)
☒ No

Enter the SSID: [Help](#)

Step 7 – Enter SSID

Note: It is recommended that security be used in all wireless applications. This procedure will forgo the security configuration for brevity. Please see the example applications and the security appendix for further information.

8. A warning that wireless security is not enabled will be displayed. Press the *Next* button to continue.

Step 8 – Security Warning Screen

9. All ESTEEM 195Ed on the network must use the same RF bandwidth. Set the RF Bandwidth to 5 MHz and press the *Next* button to continue.

RF Bandwidth	RF Data Rate	Equivalent Wired Ethernet Data Rate	Recommended Use
☒ 5MHz	1.5 to 13.5 Mbps	750 Kbps to 6.75 Mbps	Narrow bandwidth for enhanced transmission reliability in high interference environments
☐ 10MHz	3 to 27 Mbps	1.5 to 13.5 Mbps	Midrange bandwidth for higher speed but lower interference environments
☐ 20MHz	6 to 54 Mbps	3 to 27 Mbps	Wide bandwidth for maximum RF data rates in low interference environments

Step 9 – Bandwidth Selection

10. All Model 195Eds on the network must be on the same radio channel, representing a particular frequency. If a particular channel has not been assigned for use, leave the 195Ed at a default value of **5 (912 MHz)** and press the *Next* button.

Step 10 – Set Radio Channel

11. Configure the repeater peer list by selecting Enable the repeater capability radial to YES (Step 11). Press the **Add** button to the right of the repeater peer table and, using the chart created in the **Begin Programming** section of this guide, enter the Wireless MAC (WLAN MAC) address of the opposite 195Ed (the 195Ed this unit you are programming will communicate with) in the Peer 1 – MAC Addr field (below). Leave the Priority Path Cost settings at the default values, Encryption Type to None and change the Enable Link radial to Enable and press the *Create Repeater Peer* button. Press the *Next* button.

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Setup

Select whether to enable repeater capability. If the **repeater** capability is disabled, the peer list is ignored. If the **repeater** capability is enabled, then a link is established with each peer in the list.

You may add a peer to the list, remove an existing peer or modify an existing peer by clicking the appropriate button below.

The following configurations are for the wireless LAN device:

Enable the repeater capability? ☒ Yes ☐ No [Help](#)

Set as root bridge? ☐ Yes ☒ No

Port Path Encrypt Data Enable
Priority Cost Type Rate

Repeater Peer List:

[Add](#) [Remove](#) [Modify](#)

[Previous](#) [Next](#)

Step 11 – Repeater Peer Configuration

Example Addresses				
Name	Serial Number	IP Address	Ethernet MAC	WLAN MAC
195Ed We Are Programming	E-14096	172.16.48.189	00:04:3f:00:01:01	00:04:3f:00:01:02
Opposite 195Ed We Will Create Wireless Link	E-14034	172.16.38.114	00:04:3F:00:0B:00	00:04:3F:00:11:02

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Setup - Add a Repeater Peer

To add a new repeater peer for the first wireless LAN interface, enter the MAC address, the port priority, the port cost, the key type, the key and the rate set and click the "Create Repeater Peer" button.

Enter the MAC address: 00:04:3f:00:11:02

Enter the port path cost: 100

Select the encryption type: ☒ None ☐ WEP 64-bit ☐ WEP 128-bit ☐ TKIP

Enter the encryption key: 11:22:33:44:55:66:77:88:9

Select link data rate: Dynamic

1 Mbps
2 Mbps
5.5 Mbps
6 Mbps
9 Mbps

Enable link: ☒ Enable ☐ Disable

[Return to Repeater Setup](#) [Create Repeater Peer](#)

Enter the 48-bit MAC address of the repeater peer.

Enter the bridge port path cost for this link. (1-65535)

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

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 or disable the repeater peer link. Enable must be selected for the repeaters to communicate.

Step 12 – Configure Peer Table

12. Press the *Commit Changes* button and the modem will save all the changes made and reboot. The reboot time is approximately 1 minute to be ready for operation.
13. Complete all steps in this **Setup Programming** section for the other Model 195Ed's you will be testing before moving on the Testing Communication section.

Testing Communication Link

After you have configured at least two of the Model 195Ed 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 195Ed. If the Status light is solid, the Model 195Ed has a connection to another Model 195Ed listed in the Peer Table.

Status Screen/Peer Table – To view further 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 195Ed. Under the Wireless Status heading click on the [View Peer Table](#) (Figure 5). The Peer Table will list all other 802.11b or 802.11g wireless activity seen by the 195Ed and how it is classified.

Status LED
Solid Red on Link



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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](#)

Opposite Modem's Wireless MAC

Associated Stations	Receive Signal Strength (dBm)
None	

Repeater Peers

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

Access Points

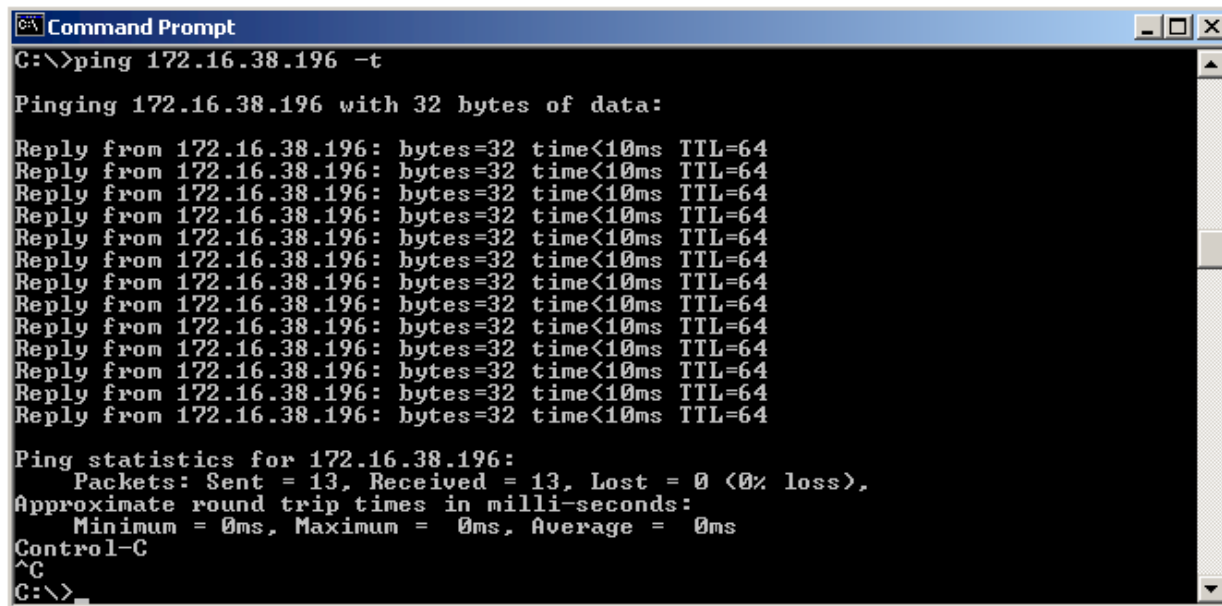
MAC Addr	Signal	LastRx (sec@kbps)	Enc	SSID
00:02:2d:03:2a:78	-70	0@2000	y	← Other Access Points
00:02:2d:3f:7d:d3	-89	8@2000	y	
00:04:3f:00:09:66	-36	0@11000	y	

Figure 5 – Repeater Peer Table

Find the opposite 195Ed in the Repeater Peers list and information such as signal strength (in dBm) and time/speed of last data packet will be displayed.

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. For a detailed analysis on the data rate, please consult the ESTeem User's manual.

Ping Testing – The easiest method for testing the efficiency of data flow between the ESTeem's is to conduct a Ping test to the opposite modem's IP address. This will test all links in the Ethernet bridge.



```
Command Prompt
C:\>ping 172.16.38.196 -t

Pinging 172.16.38.196 with 32 bytes of data:

Reply from 172.16.38.196: bytes=32 time<10ms TTL=64
Reply from 172.16.38.196: bytes=32 time<10ms TTL=64
Reply from 172.16.38.196: bytes=32 time<10ms TTL=64
Reply from 172.16.38.196: bytes=32 time<10ms TTL=64
Reply from 172.16.38.196: bytes=32 time<10ms TTL=64
Reply from 172.16.38.196: bytes=32 time<10ms TTL=64
Reply from 172.16.38.196: bytes=32 time<10ms TTL=64
Reply from 172.16.38.196: bytes=32 time<10ms TTL=64
Reply from 172.16.38.196: bytes=32 time<10ms TTL=64
Reply from 172.16.38.196: bytes=32 time<10ms TTL=64
Reply from 172.16.38.196: bytes=32 time<10ms TTL=64
Reply from 172.16.38.196: bytes=32 time<10ms TTL=64
Reply from 172.16.38.196: bytes=32 time<10ms TTL=64

Ping statistics for 172.16.38.196:
    Packets: Sent = 13, Received = 13, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
Control-C
^C
C:\>
```

Technical Support

User's Manual and Technical Documentation

<http://www.esteem.com>

E-Mail Support

Support@esteem.com

Phone Support (8AM to 5PM PST Monday-Friday)

509-735-9092