

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).

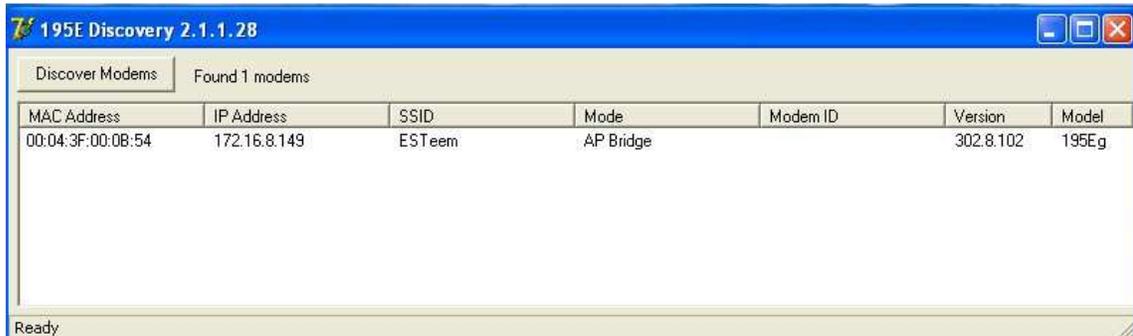


Figure 7: Discovery Program Main Page

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, Gateway IP Address, Domain Name, and DNS 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 30 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 10.

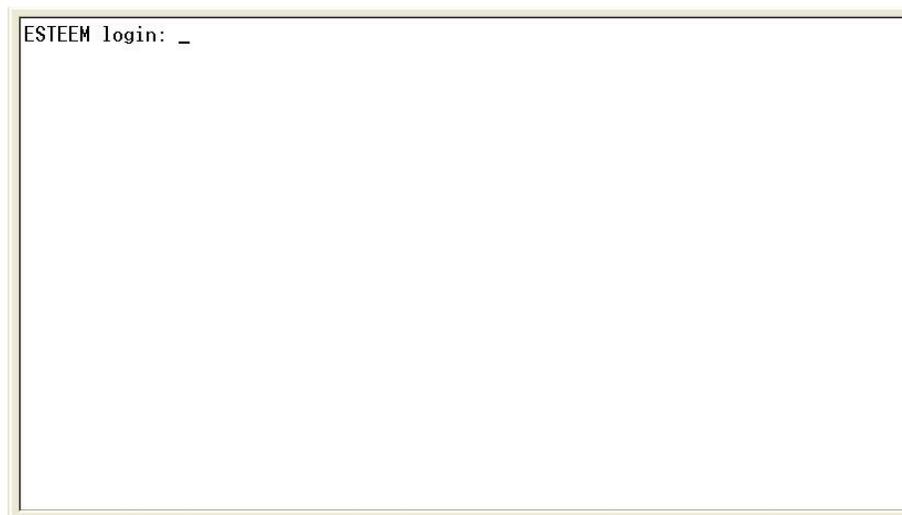


Figure 10: RS-232 Port Log-in Screen

7. To enter the Model 195Ed Main Menu you will need to log into the system with a login name and password.
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 11) 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 11: 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 12). 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 12: 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.

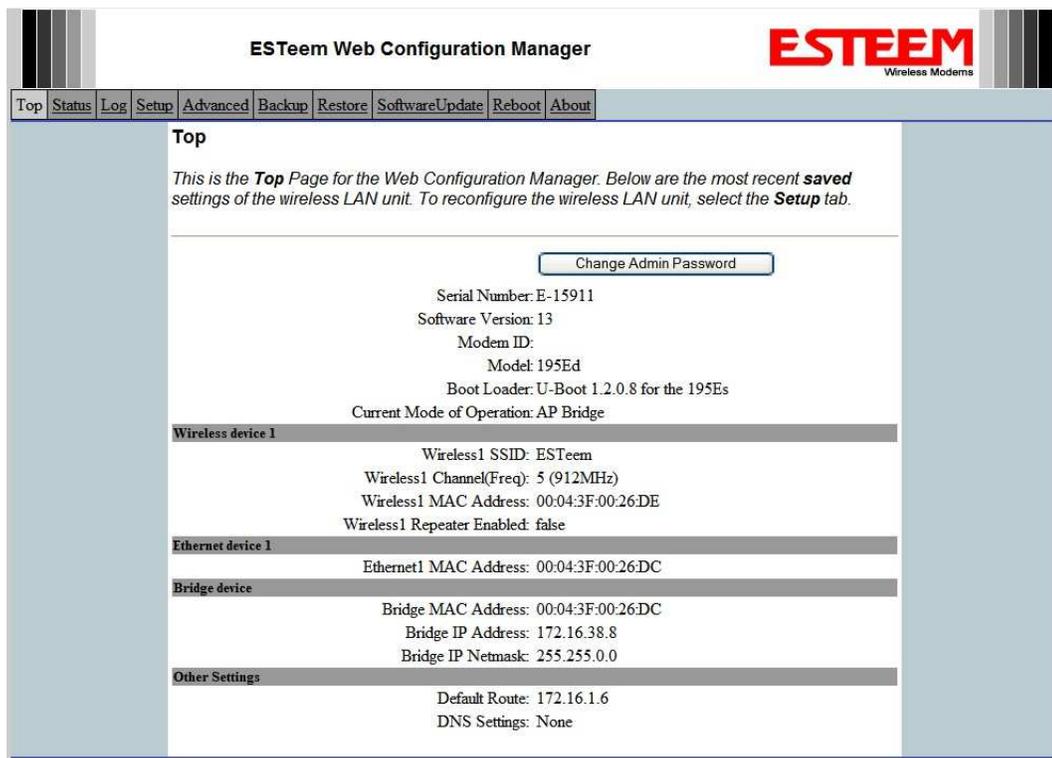


Figure 2: Top Menu Screen

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. Scroll to the bottom of the Global Variables window and enter the text you would like displayed in the Modem ID field (Figure 4). When complete, press the *Save Settings* button and the *Commit Changes* button on the next screen to save the name to the 195Ed.

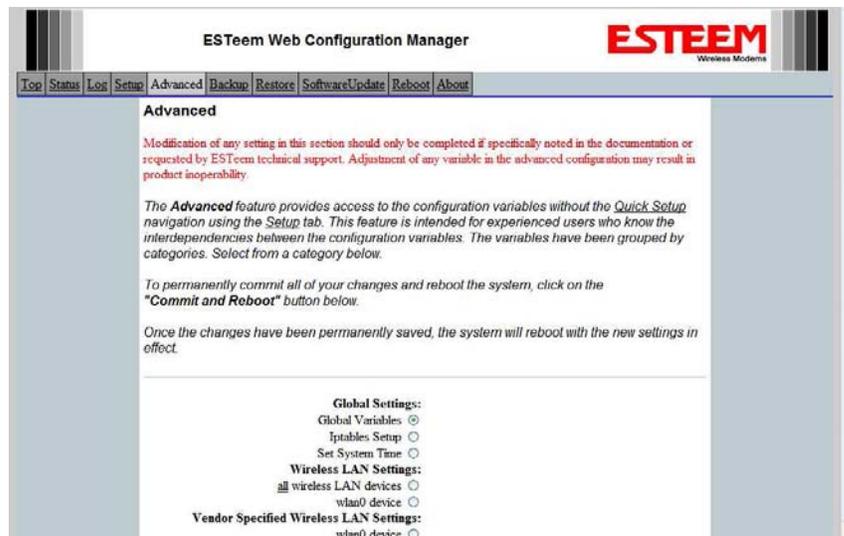


Figure 3: Global Variables Screen

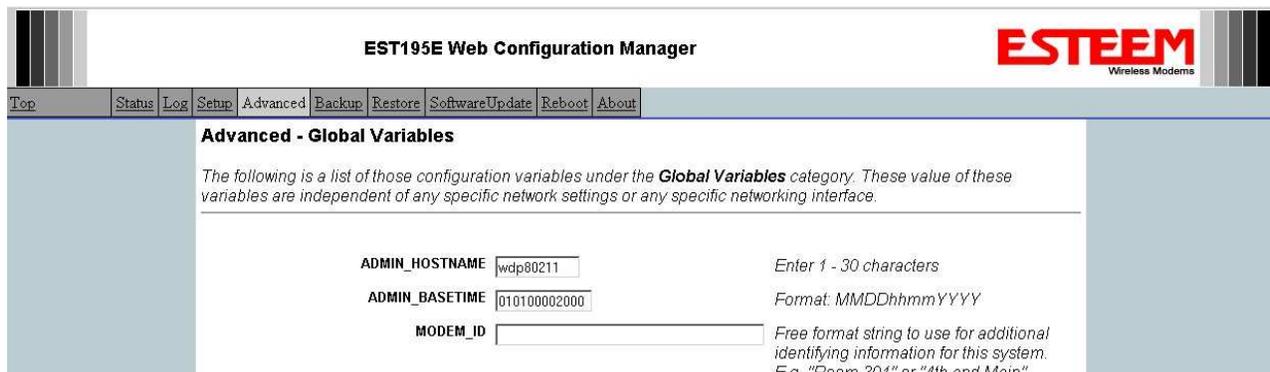


Figure 4: Modem ID Field in Global Variables Screen

Status Menu

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

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation menu with tabs: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Status' tab is selected. The main content area is titled 'Status: Summary' and includes a descriptive paragraph: 'This is a summary of the status of the overall system. Most of the source data for this display is also accessible through the "System Details" of the "Log" tab.' Below this, there are three sections: 'Common Status', 'CPU/Memory Status', and 'Wireless device 1 Status'. The 'Common Status' section lists: System Mode: AP Bridge, Current System Time: Mon, 12 Jun 2006 09:59:01, System Temperature: 134446952 C, 0 F, and Up Time: 0 days, 00:00:55. The 'CPU/Memory Status' section lists: CPU Usermode(%): 5, CPU Kernelmode(%): 4, CPU Idle(%): 91, CPU Interrupts per Second: 32, Pageable Memory Total: 14404, Pageable Memory Used: 10588, Pageable Memory Free: 3816, and Number of Processes: 26. The 'Wireless device 1 Status' section includes links for 'View Peer Table' and 'View Global Counter Details', followed by SSID (hex): 45:53:54:65:65:6d, SSID (text): ESTEem, MAC Address: 00:04:3F:00:09:66, Wireless Repeater enabled: true, Associated Stations: 0, Rx Bytes: 4444, Rx Frames: 60, Rx Frame Errors: 0, Tx Bytes: 8228, Tx Frames: 101, Tx Errors: 59, and Tx Drops: 42. At the bottom, the 'Ethernet device 1 Status' section lists: Ethernet MAC Address: 00:04:3F:00:09:64, Rx Bytes: 4059, Rx Frames: 37, Rx Frame Errors: 0, Tx Bytes: 24572, Tx Frames: 91, Tx Errors: 0, and Tx Drops: 0.

Figure 5: Status Screen

Peer Status Table

The Peer Status submenu lists the connected wireless devices (Model 195Eds clients), their signal strength, data rate and time of last packet sent. Press the [View Peer Table](#) link and Repeater Peer Status Table will be displayed (Figure 6). For a detailed analysis of the information provided in this table, please review Appendix F – Troubleshooting.

Associated Station – This section will list all the associated stations that are attached to the Access Point. These will be other Model 195Ed's in one of the three Client modes.

Repeater Peers – This section will list all connected 195Ed repeater peers by their Wireless MAC address. For detailed information on repeaters, see Chapter 6 – Repeating Features.

Access Points – This section will list all other 195Ed modems that are sharing the operating channel (frequency) of the 195Ed but not part of the same network. You can also note that the Repeater Peers listed above are also included in this list.

The screenshot shows the EST195E Web Configuration Manager interface. At the top, there is a navigation menu with links: Top, Status, Log, Setup, Advanced, Backup, Restore, Software Update, Reboot, and About. The main content area is titled "Status: Peer Table". Below the title, there is a descriptive text: "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." A link "Return to Status Summary Page" is provided. There are two tables: "Associated Stations" and "Repeater Peers".

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

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

Figure 6: Peer Table Screen

Counter Details

The Counter Details submenu will summarize all transmitted and receive data packets for the Model 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.

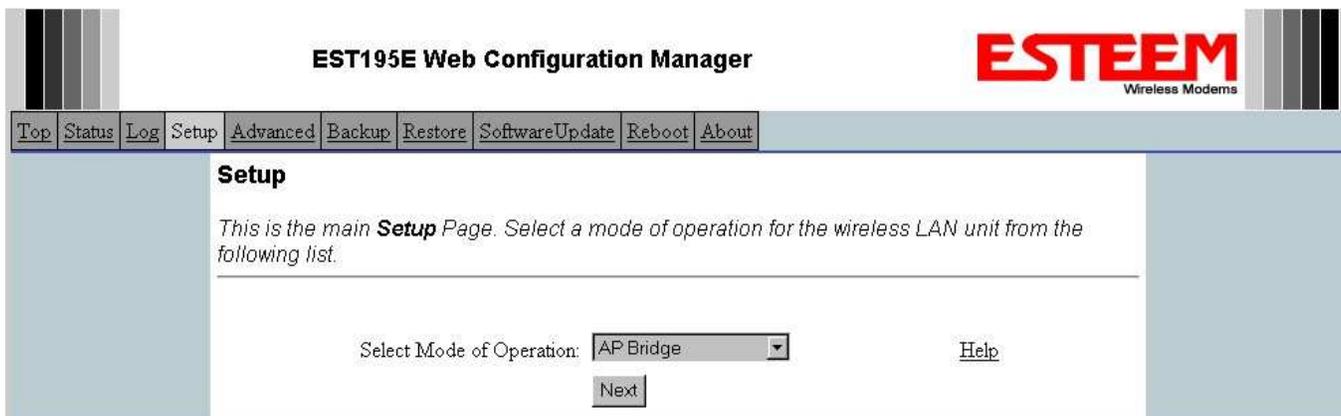


Figure 8: Setup Screen

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.

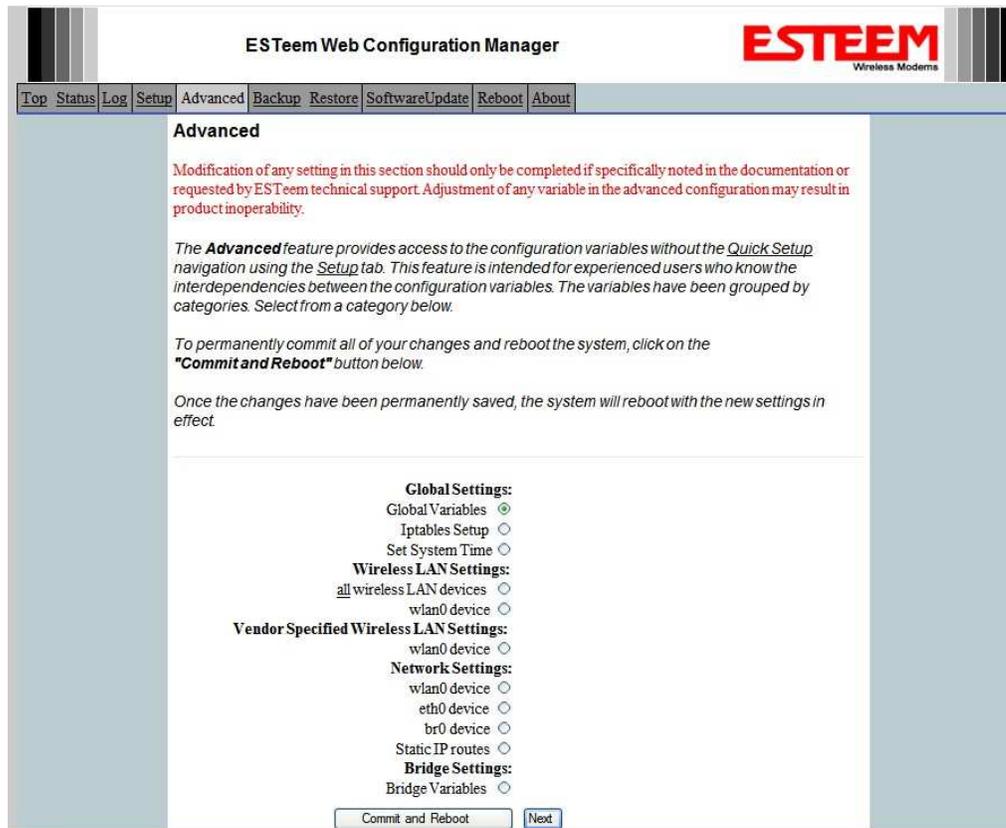


Figure 9: Advanced Features Screen

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.

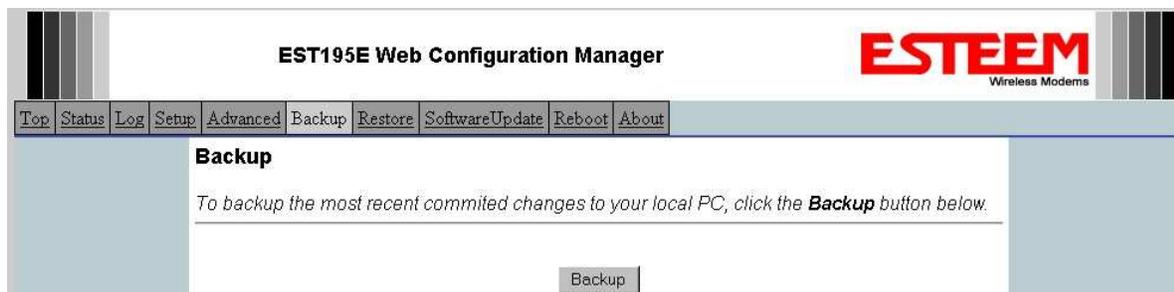


Figure 10: Backup Screen

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.

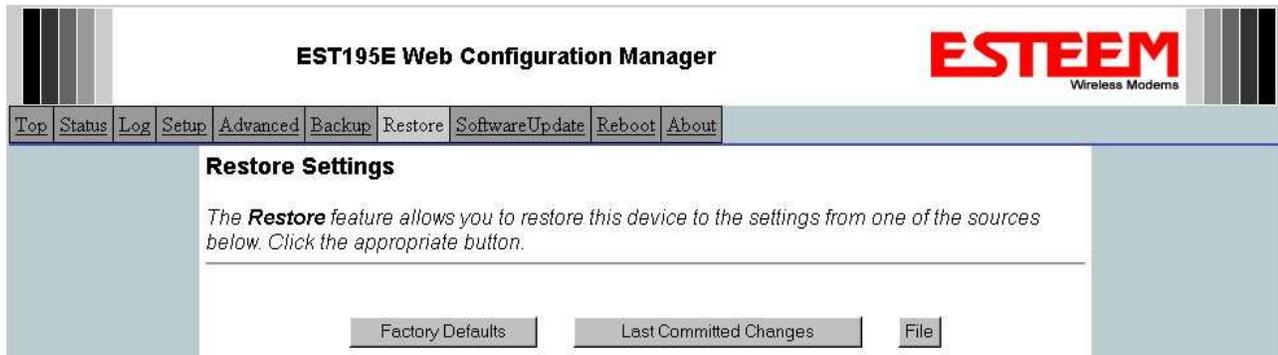


Figure 11: Restore Setting Screen

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.

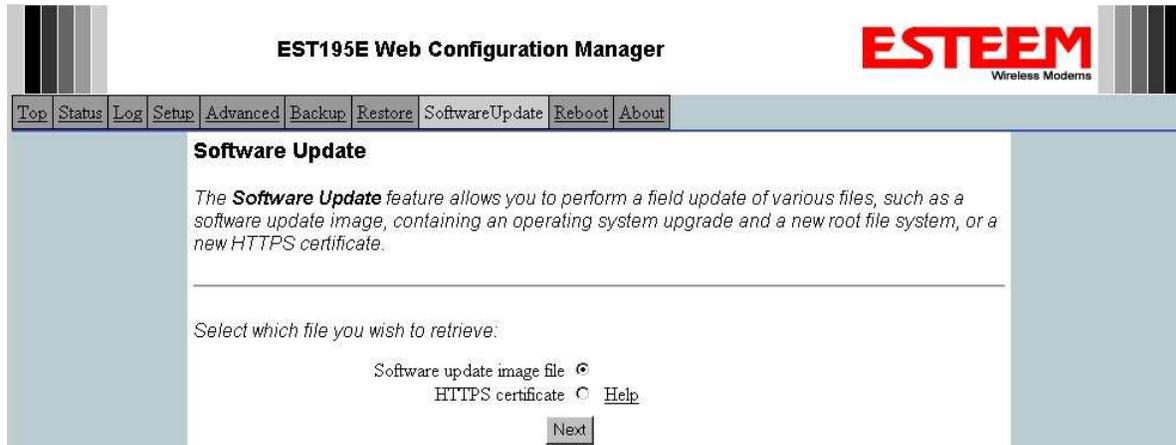


Figure 13: Software Update Screen

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).

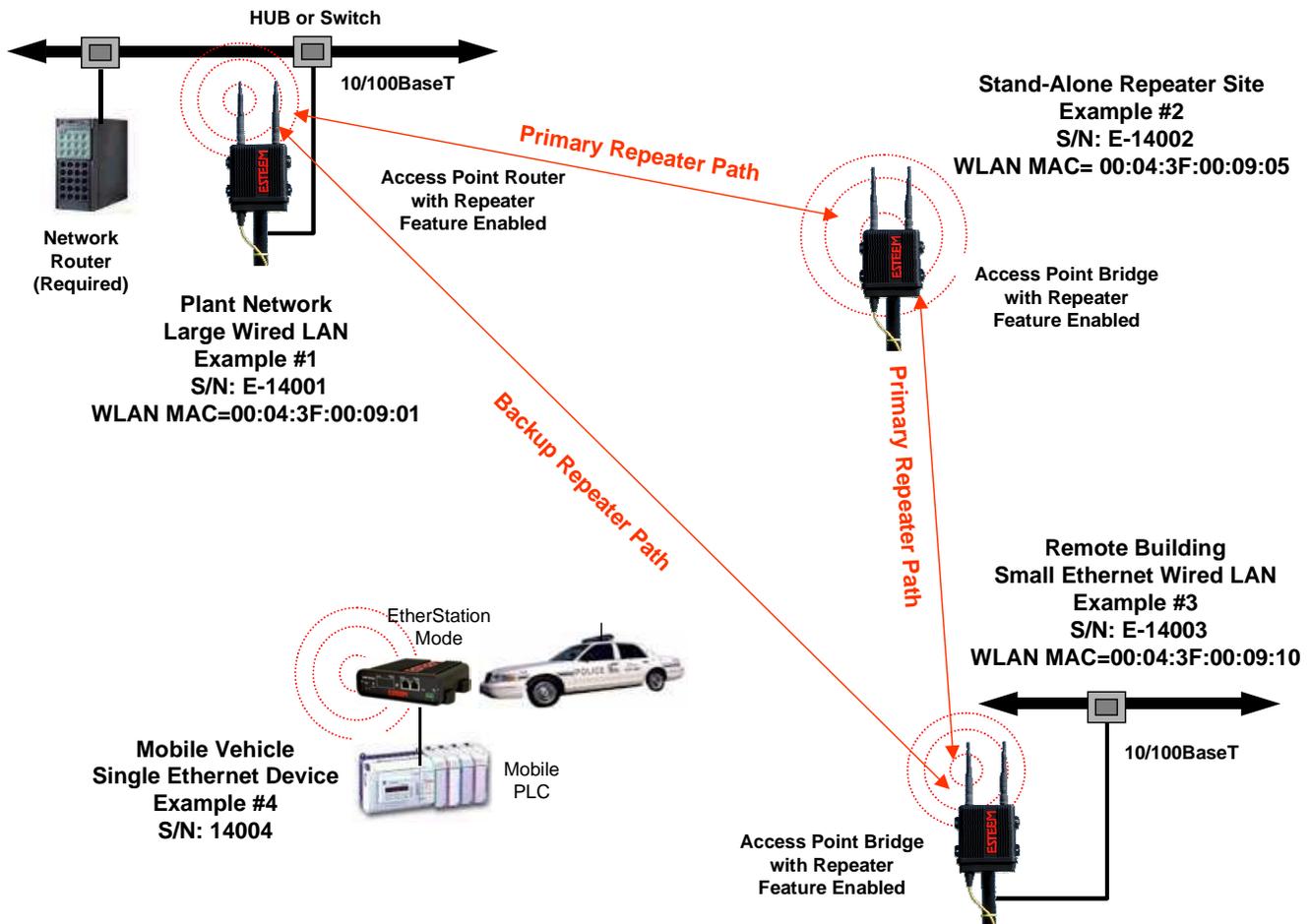


Figure 1: Programming Example #1 Diagram

The second example network in Figure 2 show 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.

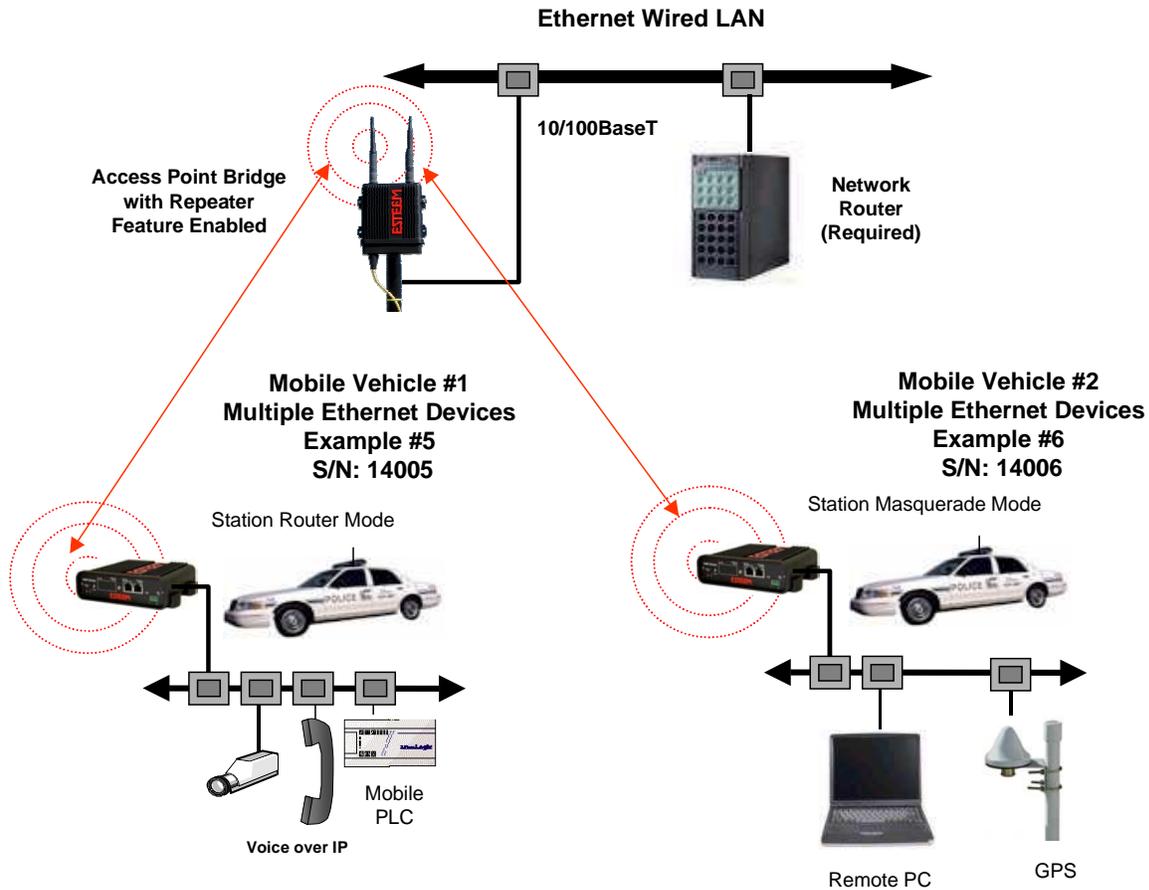


Figure 2: Programming Example #2 Diagram

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.

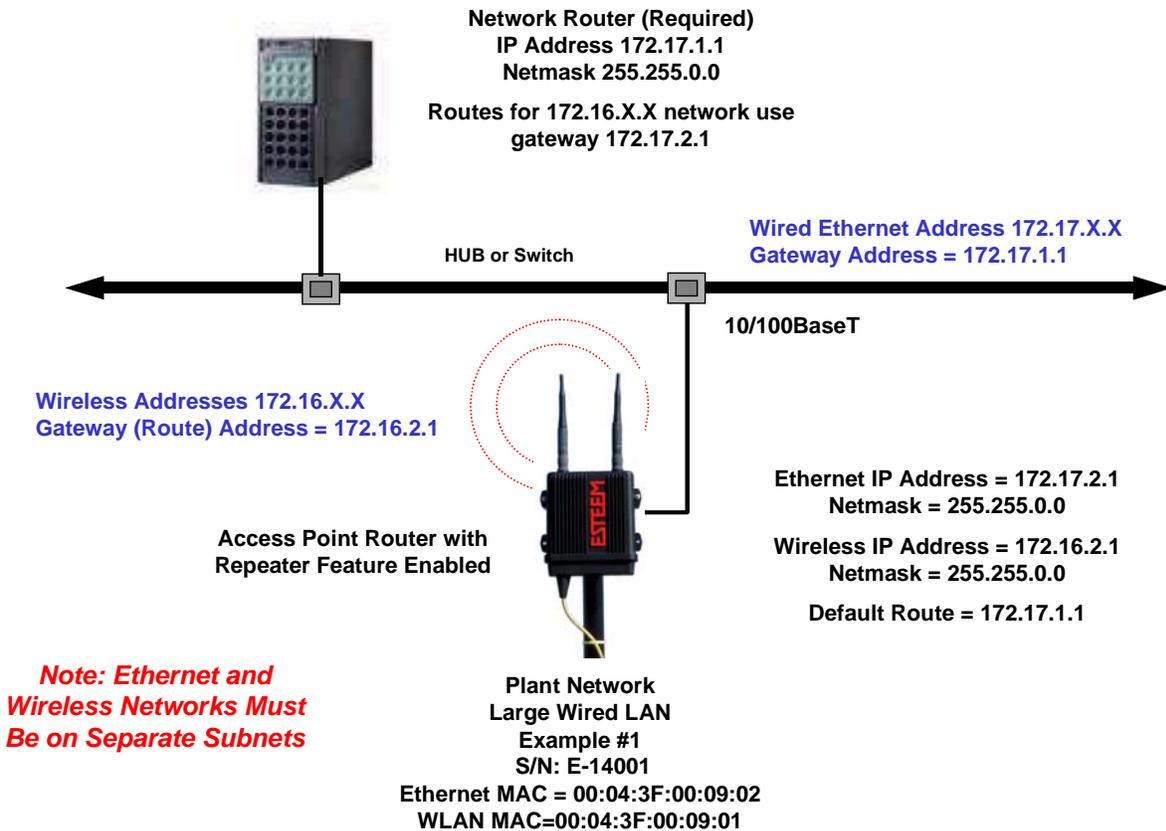


Figure 3: Access Point Router IP Addressing Example

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.

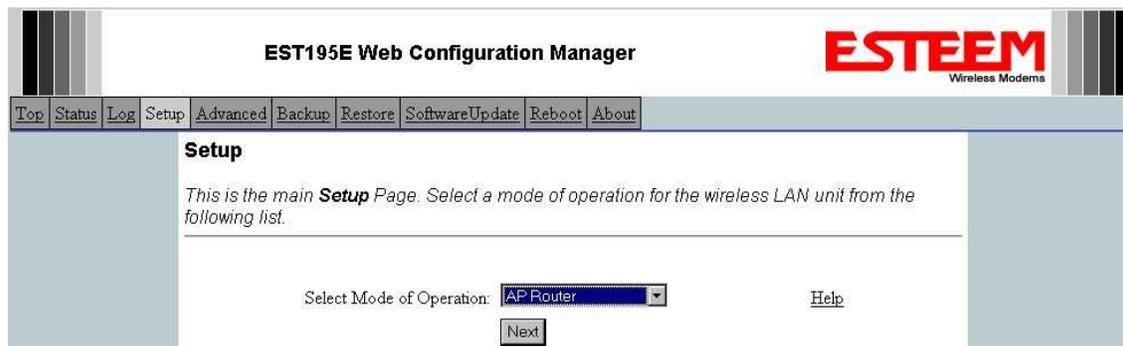


Figure 4: Access Point Router Setup Screen

Note: Throughout the Configuration Manager are Help Screens that can be 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.

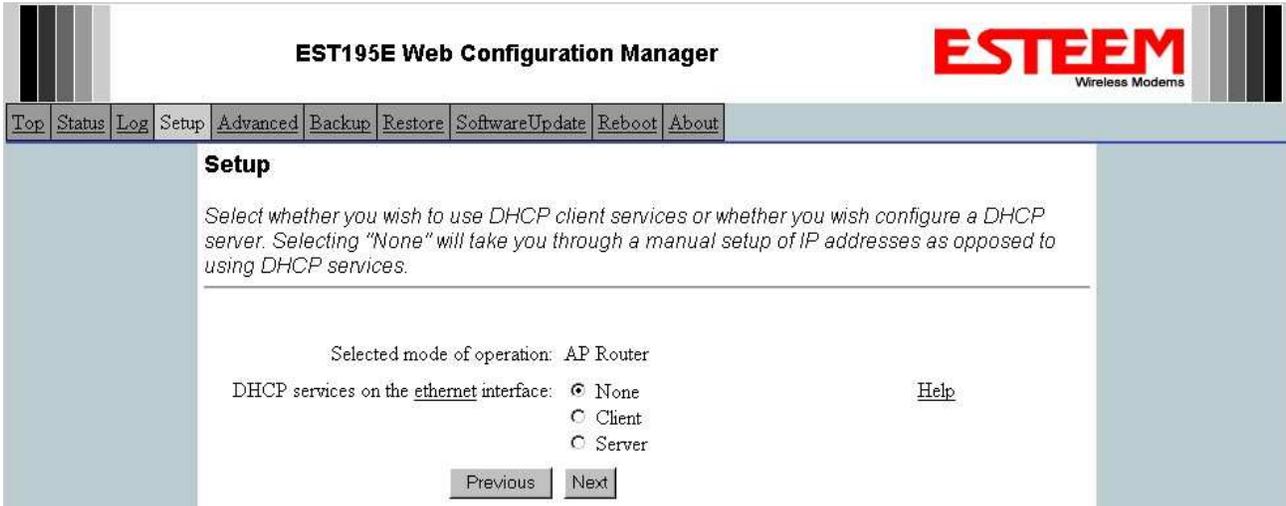


Figure 5: DHCP Ethernet Port

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.

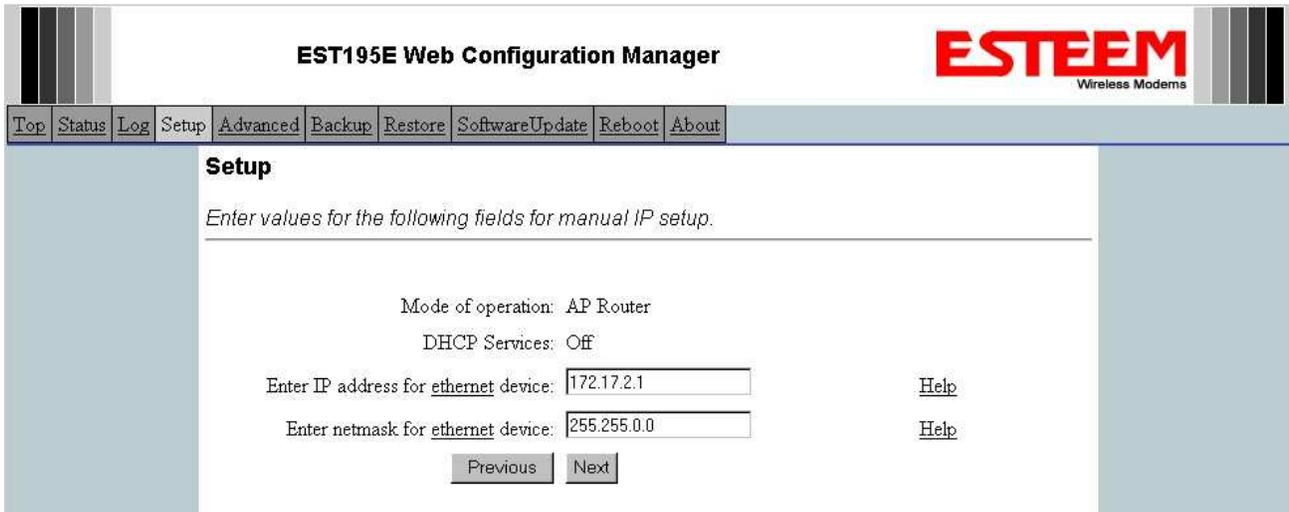


Figure 6: Ethernet IP Addressing

4. 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 'EST195E Web Configuration Manager' interface. At the top, there is a navigation menu with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' section is active. Below the navigation, there is a heading 'Setup' and a paragraph: '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 says 'Selected mode of operation: AP Router'. Then, 'DHCP services on the wireless bridge interface:' is followed by three radio button options: 'None' (which is selected), 'Client', and 'Server'. There is a 'Help' link to the right. At the bottom, there are 'Previous' and 'Next' buttons.

Figure 7: DHCP Wireless Port

5. 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 'EST195E Web Configuration Manager' interface. At the top, there is a navigation menu with links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' section is active. Below the navigation, there is a heading 'Setup' and a paragraph: 'Enter values for the following fields for manual IP setup of the wireless bridging 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 bridge device:' with the value '172.16.2.1' and 'Enter netmask for wireless bridge 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

6. 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 'Setup' page of the ESTEEM Web Configuration Manager. The page title is 'EST195E Web Configuration Manager' and the ESTEEM logo is in the top right. A navigation bar includes links for Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' section is active. Below the title, there is a sub-header 'Setup' and a descriptive text: 'Enter values for the following fields to set up the default route and DNS settings'. The form contains the following fields: 'Mode of operation' set to 'AP Router'; 'Enter default route IP address' with the value '172.17.1.1' and a 'Help' link; 'Use DNS client services?' with radio buttons for 'Yes' and 'No' (selected) and a 'Help' link; 'Enter DNS domain' with an empty text box and a 'Help' link; 'Enter primary DNS server IP address' with an empty text box and a 'Help' link; and 'Enter secondary DNS server IP address' with an empty text box and a 'Help' link. At the bottom of the form are 'Previous' and 'Next' buttons.

Figure 9: Wireless Security Level Settings

7. 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 and must NOT contain spaces. Reference Figure 10.

The screenshot shows the 'Setup' page of the ESTEEM Web Configuration Manager. The page title is 'EST195E Web Configuration Manager' and the ESTEEM logo is in the top right. A navigation bar includes links for Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' section is active. Below the title, there is a sub-header 'Setup' and a descriptive text: '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: 'Selected mode of operation' set to 'AP Router'; 'Turn on wireless security features?' with radio buttons for 'Yes' (selected) and 'No' and a 'Help' link; and 'Enter the SSID' with the value 'ESTeem' and a 'Help' link. At the bottom of the form are 'Previous' and 'Next' buttons.

Figure 10: WEP Key Entry

8. Select the encryption level for the wireless 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 'EST195E Web Configuration Manager' interface. At the top right is the ESTEEM logo with 'Wireless Modems' underneath. A navigation bar contains links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' section is active, displaying the title 'Setup' and the instruction: 'Enter/select values for the following fields to set up wireless security features.' Below this, there are two main sections. The first is 'Select an encryption type:' with radio buttons for 'None', 'WEP 64-bit', 'WEP 128-bit' (which is selected), 'WPA PSK', and 'WPA 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' (which is selected). Another 'Help' link is to the right. At the bottom are 'Previous' and 'Next' buttons.

Figure 11: Security Selection

9. 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 right is the ESTEEM logo with 'Wireless Modems' underneath. A navigation bar contains links: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' section is active, displaying the title 'Setup' and the instruction: '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.' Below this, there are four rows for entering WEP keys. Each row has a label 'Enter WEP Key 1' through '4' and '(13 hex bytes):' followed by a text input field containing '11:22:33:44:55:66:77:88:99:00:aa:bb:cc'. A 'Help' link is to the right of each input field. Below the input fields is the section 'Select the default WEP key:' with radio buttons for 'WEP Key 1' (which is 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. Reference Figure 13.

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 for Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The main content area is titled 'Setup' and contains the following text: '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.' Below this, it says 'Choose one of the following MAC address authentication modes:' followed by three radio button options: 'allow_all' (selected), 'allow only those client MACs in the list below', and 'deny only those client MACs in the list below'. A 'Help' link is next to the first option. There is an input field for 'Enter MAC address:' and an 'Add MAC to Access Control List' button. Below that is an 'Access Control List' table with a 'Remove MAC' button. At the bottom of the table is a 'Remove ALL MACs' button. A note explains: '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**.' At the bottom of the page are 'Previous' and 'Next' buttons.

Figure 13: Access Control List Settings

11. 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 14.

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 for Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The main content area is titled 'Setup' and contains the following text: '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.' Below this is a 'Select a channel:' dropdown menu showing '6 (2437 MHz)'. A 'Help' link is next to the dropdown. At the bottom of the page are 'Previous' and 'Next' buttons.

Figure 14: Radio Channel Selection

12. The Repeater Peer Table (Figure 15) 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.

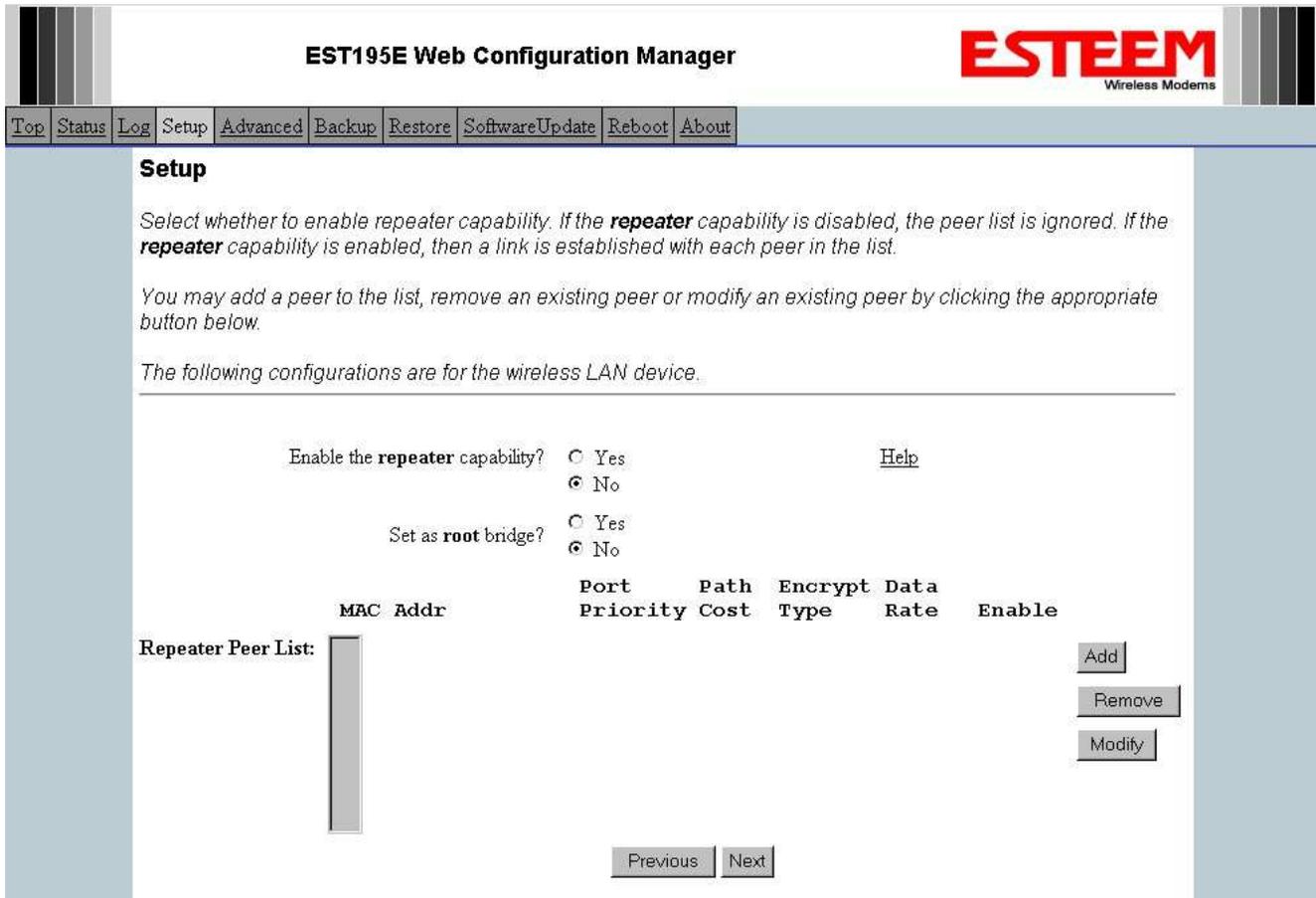


Figure 15: Blank Repeater Table

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*.

EST195E 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 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: *Enter the 48-bit MAC address of the repeater peer.*

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

Select the encryption type: None
 WEP 64-bit
 WEP 128-bit
 TKIP *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=13bytes, TKIP=32 bytes.*

Select link data rate: *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 link: Enable
 Disable *Enable or disable the repeater peer link. Enable must be selected for the repeaters to communicate.*

Figure 16: First (Primary) Repeater Link

Second Repeater Link (Direct Path) -

Press the Add button a second time (Figure15) and Figure 17 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 from 1 Mbps to 54 Mbps to be used. Verify the Repeater Link is set to Enable and press the *Create Repeater Peer Button*.

EST195E Web Configuration Manager **ESTEEM**
Wireless Modems

Top | Status | Log | Setup | **Advanced** | Backup | Restore | Software Update | Reboot | About

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: <input type="text" value="00:04:3f:00:09:10"/>	Enter the 48-bit MAC address of the repeater peer.
Enter the port path cost: <input type="text" value="201"/>	Enter the bridge port path cost for this link. (1-65535)
Select the encryption type: <input type="radio"/> None <input type="radio"/> WEP 64-bit <input checked="" type="radio"/> WEP 128-bit <input type="radio"/> TKIP	Select the repeater link encryption method. Note: the encryption method and key setting <u>must</u> be the same on <u>both</u> repeater peers.
Enter the encryption key: <input type="text" value="11:22:33:44:55:66:77:88:99"/>	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.
Select link data rate: <input type="text" value="Dynamic"/> <input type="text" value="1 Mbps"/> <input type="text" value="2 Mbps"/> <input type="text" value="5.5 Mbps"/> <input type="text" value="6 Mbps"/> <input type="text" value="9 Mbps"/>	Allow dynamic rate selection or select a specific data rate for this link to use. It is recommended, but not required, that the rate selections be the same on both peers.
Enable link: <input checked="" type="radio"/> Enable <input type="radio"/> Disable	Enable or disable the repeater peer link. Enable must be selected for the repeaters to communicate.

Figure 17: Second (Backup) Repeater Link

Figure 18 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.

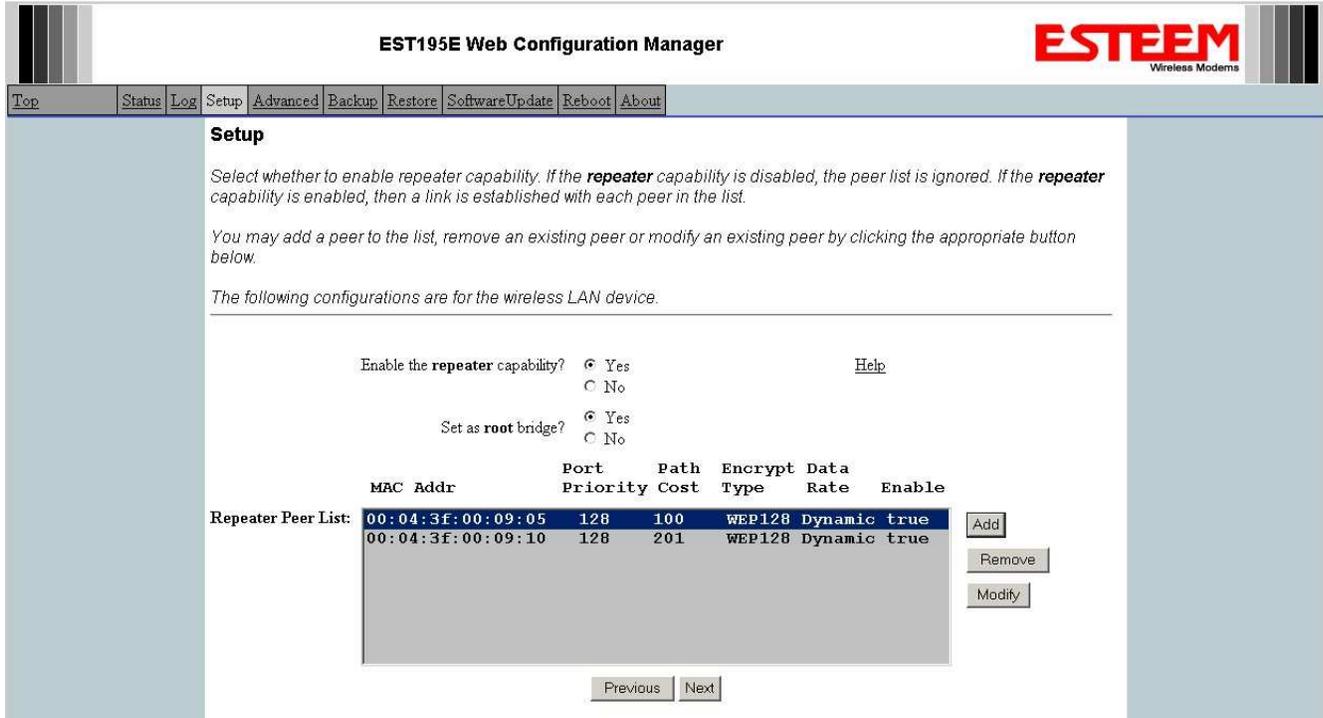


Figure 18: Completed Repeater Peer List

13. Figure 19 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.



Figure 19: 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 20) and push the *Next* button below the pull down box.

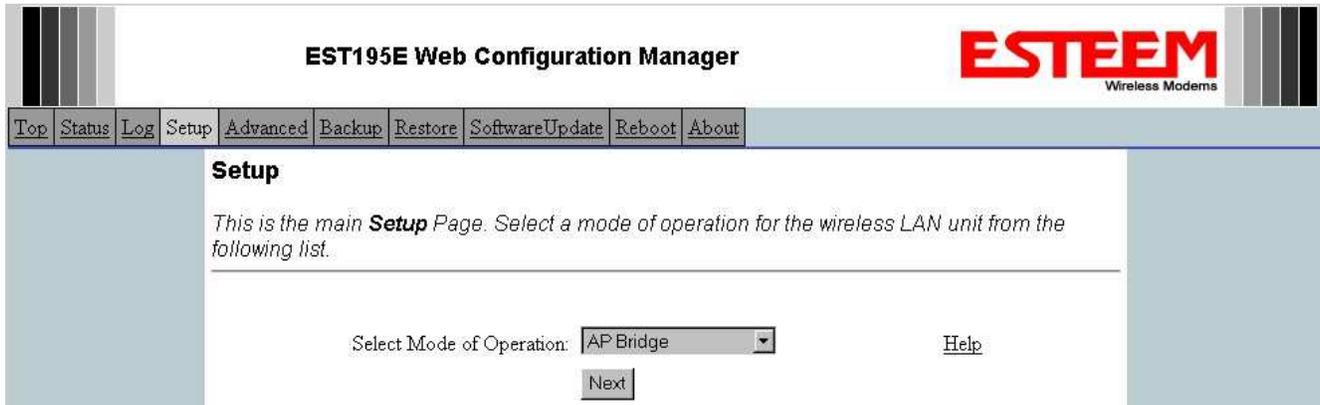


Figure 20: Access Point Bridge

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 21.

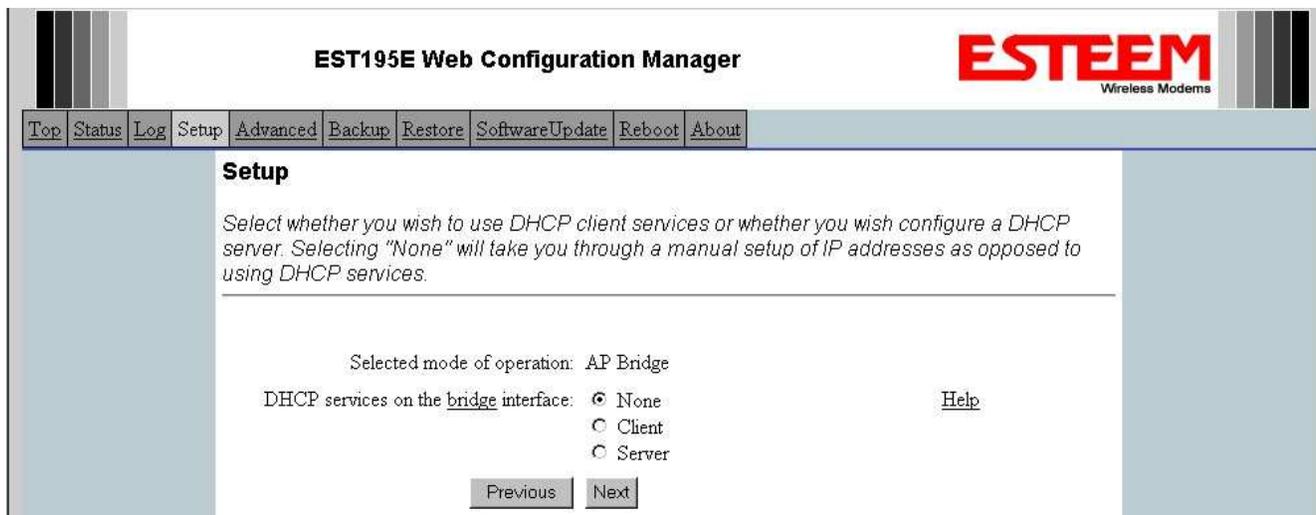


Figure 21: DHCP Configuration

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 22.

The screenshot shows the 'Setup' page of the EST195E Web Configuration Manager. The page title is 'EST195E Web Configuration Manager' and the ESTEEM logo is in the top right. A navigation bar includes links for Top, Status, Log, Setup, Advanced, Backup, Restore, Software Update, Reboot, and About. The 'Setup' section is active, and the instruction reads: 'Enter values for the following fields for manual IP setup of the bridging device.' The configuration shows 'Mode of operation: AP Bridge' and 'DHCP Services: Off'. There are two input fields: 'Enter IP address for bridge device:' with the value '172.16.2.5' and 'Enter netmask for bridge device:' with the value '255.255.0.0'. Each input field has a 'Help' link to its right. At the bottom are 'Previous' and 'Next' buttons.

Figure 22: 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 23.

The screenshot shows the 'Setup' page of the EST195E Web Configuration Manager. The page title is 'EST195E Web Configuration Manager' and the ESTEEM logo is in the top right. A navigation bar includes links for Top, Status, Log, Setup, Advanced, Backup, Restore, Software Update, Reboot, and About. The 'Setup' section is active, and the instruction reads: 'Enter values for the following fields to set up the default route and DNS settings'. The configuration shows 'Mode of operation: AP Bridge'. There are four input fields: 'Enter default route IP address:' with the value '172.16.2.1', 'Enter DNS domain:', 'Enter primary DNS server IP address:', and 'Enter secondary DNS server IP address:'. Each input field has a 'Help' link to its right. There is also a radio button group for 'Use DNS client services?' with 'Yes' and 'No' options, and 'No' is selected. At the bottom are 'Previous' and 'Next' buttons.

Figure 23: 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 and must **NOT** contain spaces. Reference Figure 24.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top right is the 'ESTEEM Wireless Modems' logo. Below the logo is 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: '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 text, it says 'Selected mode of operation: AP Bridge'. There are two radio button options for 'Turn on wireless security features?': 'Yes' (selected) and 'No'. To the right of these options is a 'Help' link. Below the radio buttons is a text input field for 'Enter the SSID:' containing the text 'ESTeem'. To the right of this field is another 'Help' link. At the bottom of the form are two buttons: 'Previous' and 'Next'.

Figure 24: 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 25.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top right is the 'ESTEEM Wireless Modems' logo. Below the logo is 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: 'Enter/select values for the following fields to set up wireless security features.' Below this text, there are four radio button options for 'Select an encryption type:': 'None', 'WEP 64-bit', 'WEP 128-bit' (selected), and 'WPA PSK'. To the right of these options is a 'Help' link. Below the radio buttons are two radio button options for 'Hide Beacon SSID and Discard Broadcast Probes?': 'Yes' and 'No' (selected). To the right of these options is another 'Help' link. At the bottom of the form are two buttons: 'Previous' and 'Next'.

Figure 25: 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 26.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation menu with options: Top, Status, Log, Setup, **Advanced**, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Advanced' tab is selected. The main content area is titled 'Setup' and contains the following text: '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.' Below this text, there are four input fields for WEP keys, each labeled 'Enter WEP Key 1' through '4' and '(13 hex bytes):'. Each field contains the placeholder text '11:22:33:44:55:66:77:88:99:00:aa:bb:cc'. To the right of each field is a 'Help' link. Below the input fields, there is a section 'Select the default WEP key:' with four radio button options: 'WEP Key 1' (selected), 'WEP Key 2', 'WEP Key 3', and 'WEP Key 4'. A 'Help' link is also present to the right of these options. At the bottom of the configuration area, there are 'Previous' and 'Next' buttons.

Figure 26: 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 27.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation menu with options: Top, Status, Log, Setup, **Advanced**, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Advanced' tab is selected. The main content area is titled 'Setup' and contains the following text: '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.' Below this text, there is a section 'Choose one of the following MAC address authentication modes:' with three radio button options: 'allow_all' (selected), 'allow only those client MACs in the list below', and 'deny only those client MACs in the list below'. A 'Help' link is present to the right of these options. Below the radio buttons, there is an 'Enter MAC address:' input field and an 'Add MAC to Access Control List' button. Below the input field, there is an 'Access Control List' list box. To the right of the list box, there are 'Remove MAC' and 'Remove ALL MACs' buttons. Below the list box, there is a note: '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**.' At the bottom of the configuration area, there are 'Previous' and 'Next' buttons.

Figure 27: ACL Configuration

- 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 28.

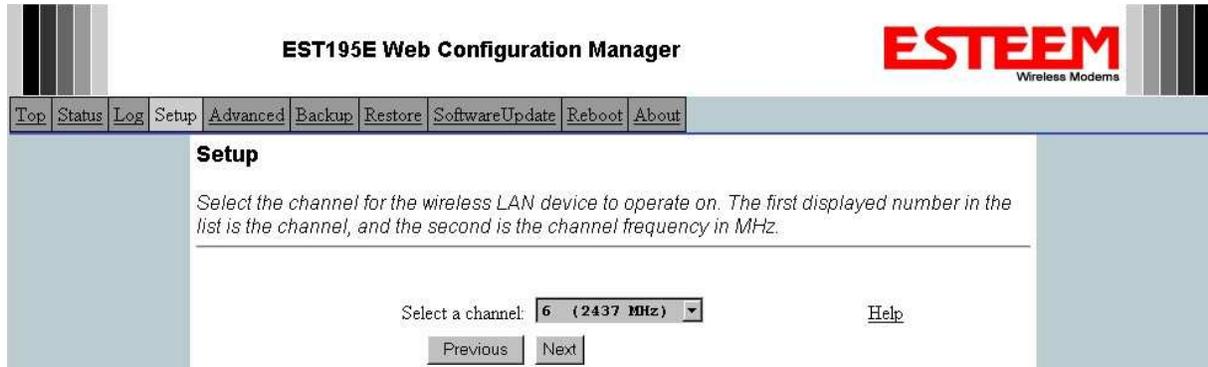


Figure 28: Channel Configuration

- 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 29). 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.
- 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.

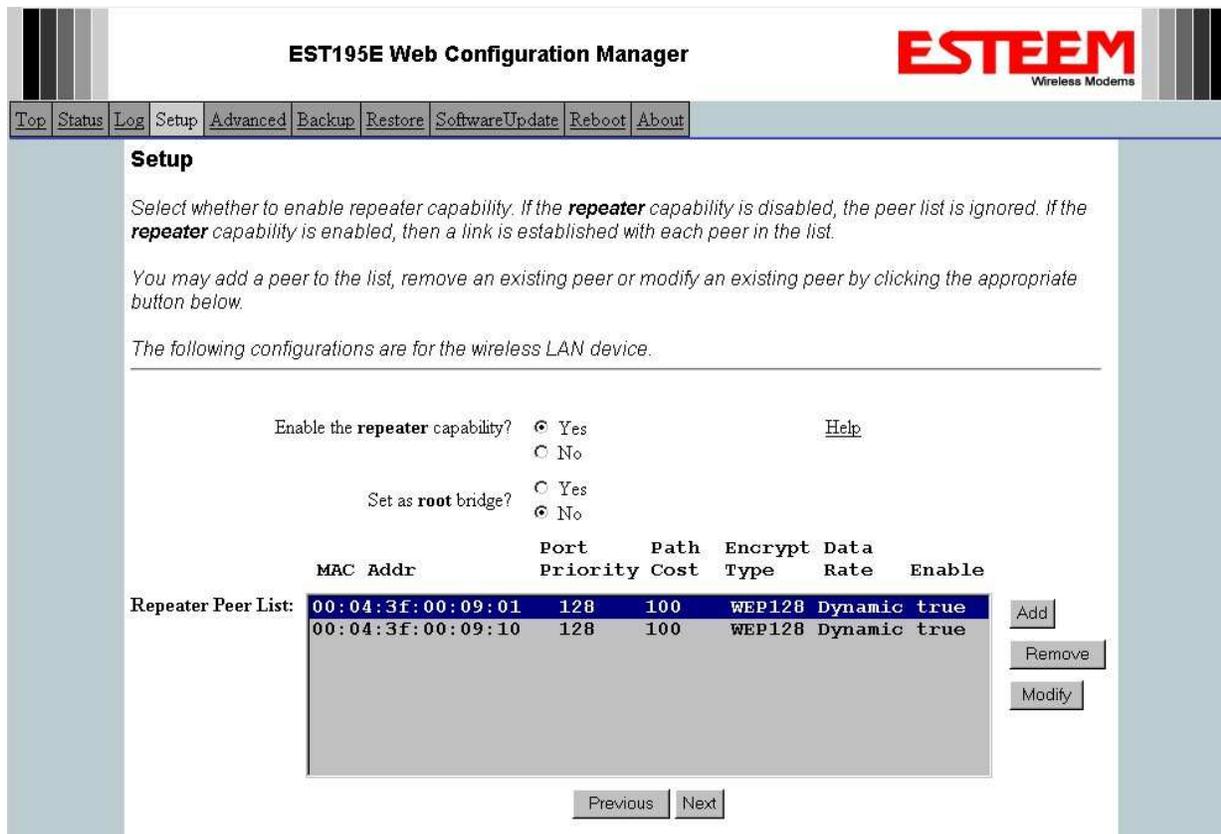


Figure 29: Repeater Configuration

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 31 & 32 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 31: Example 3 Bridge IP Address

EST195E 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

Repeater Peer List:

Figure 32: 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 33) and push the *Next* button below the pull down box.

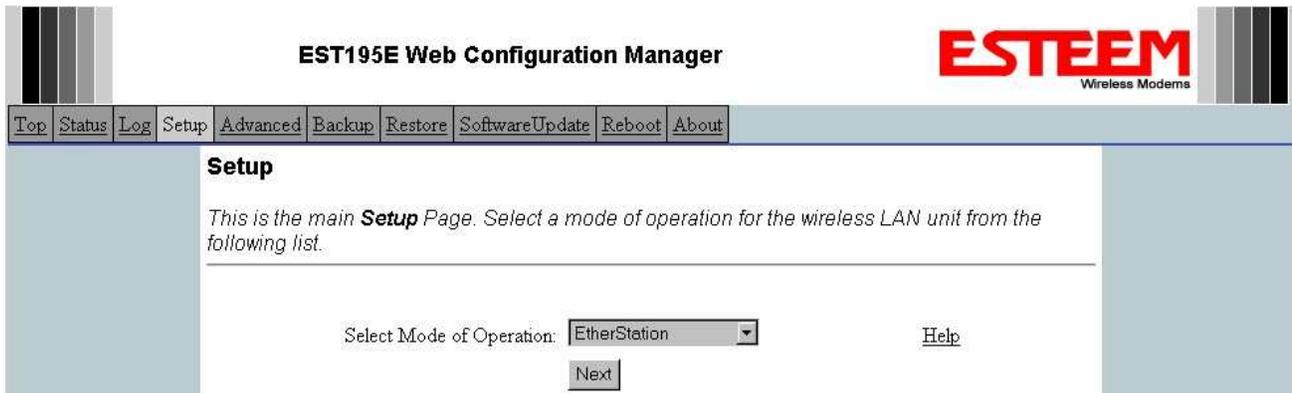


Figure 33: EtherStation Selection

2. 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. Enter the MAC address of the connected Ethernet device. Reference Figure 34.

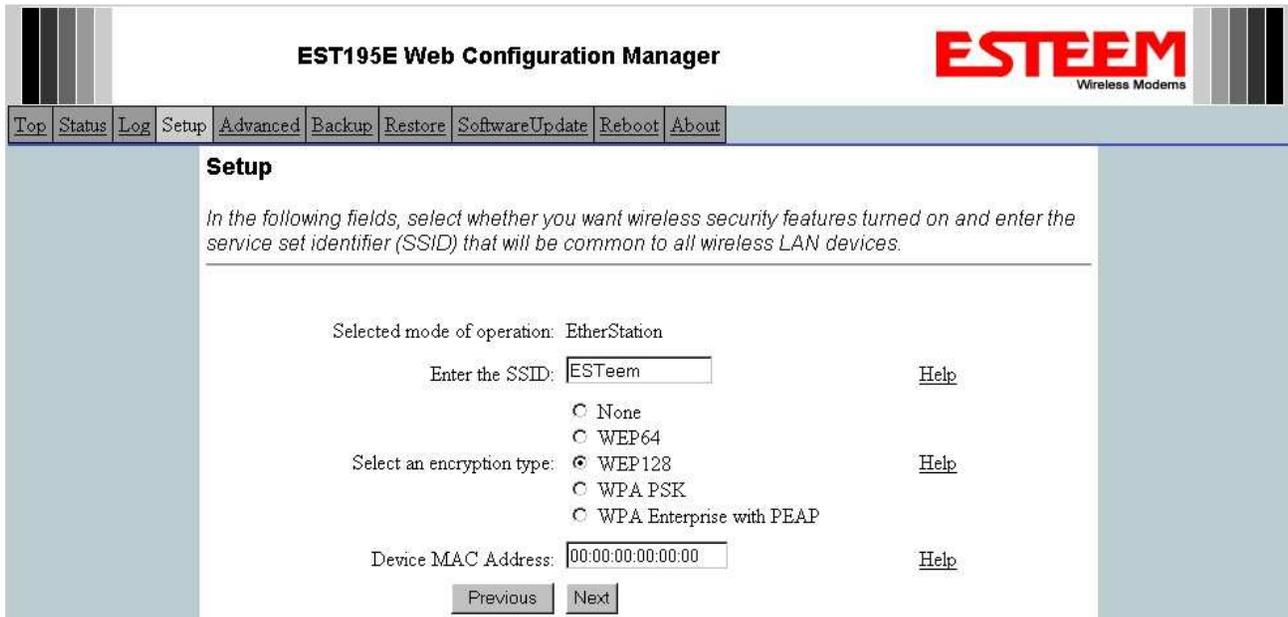


Figure 34: SSID and Device MAC Input

3. Enter the WEP key values for your application that will be used by all devices on the wireless network. Reference Figure 35.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top right is the 'ESTEEM Wireless Modems' logo. Below the logo is a navigation menu with buttons for 'Top', 'Status', 'Log', 'Setup', 'Advanced', 'Backup', 'Restore', 'SoftwareUpdate', 'Reboot', and 'About'. The 'Setup' page is active, displaying the title 'Setup' and a descriptive paragraph: '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.' Below this, the 'Encryption type' is set to '128-Bit WEP for the wireless LAN device'. There are four input fields for 'Enter WEP Key 1' through '4', each with '(13 hex bytes):' and a 'Help' link. Each field contains the placeholder text '11:22:33:44:55:66:77:88:99:00:aa:bb:cc'. Below the input fields are four radio buttons labeled 'WEP Key 1' through '4', with 'WEP Key 1' selected. A 'Select the default WEP key:' label is positioned to the left of the radio buttons, and a 'Help' link is to the right. At the bottom are 'Previous' and 'Next' buttons.

Figure 35: WEP Key Input

4. 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. Reference Figure 36.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top right is the 'ESTEEM Wireless Modems' logo. Below the logo is a navigation menu with buttons for 'Top', 'Status', 'Log', 'Setup', 'Advanced', 'Backup', 'Restore', 'SoftwareUpdate', 'Reboot', and 'About'. The 'Setup' page is active, displaying the title 'Setup' and a descriptive paragraph: '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.' Below this, there are four buttons: 'Previous', 'Commit Changes', 'Go To Advanced Setup', and 'Cancel'.

Figure 36: EtherStation Selection

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 37).

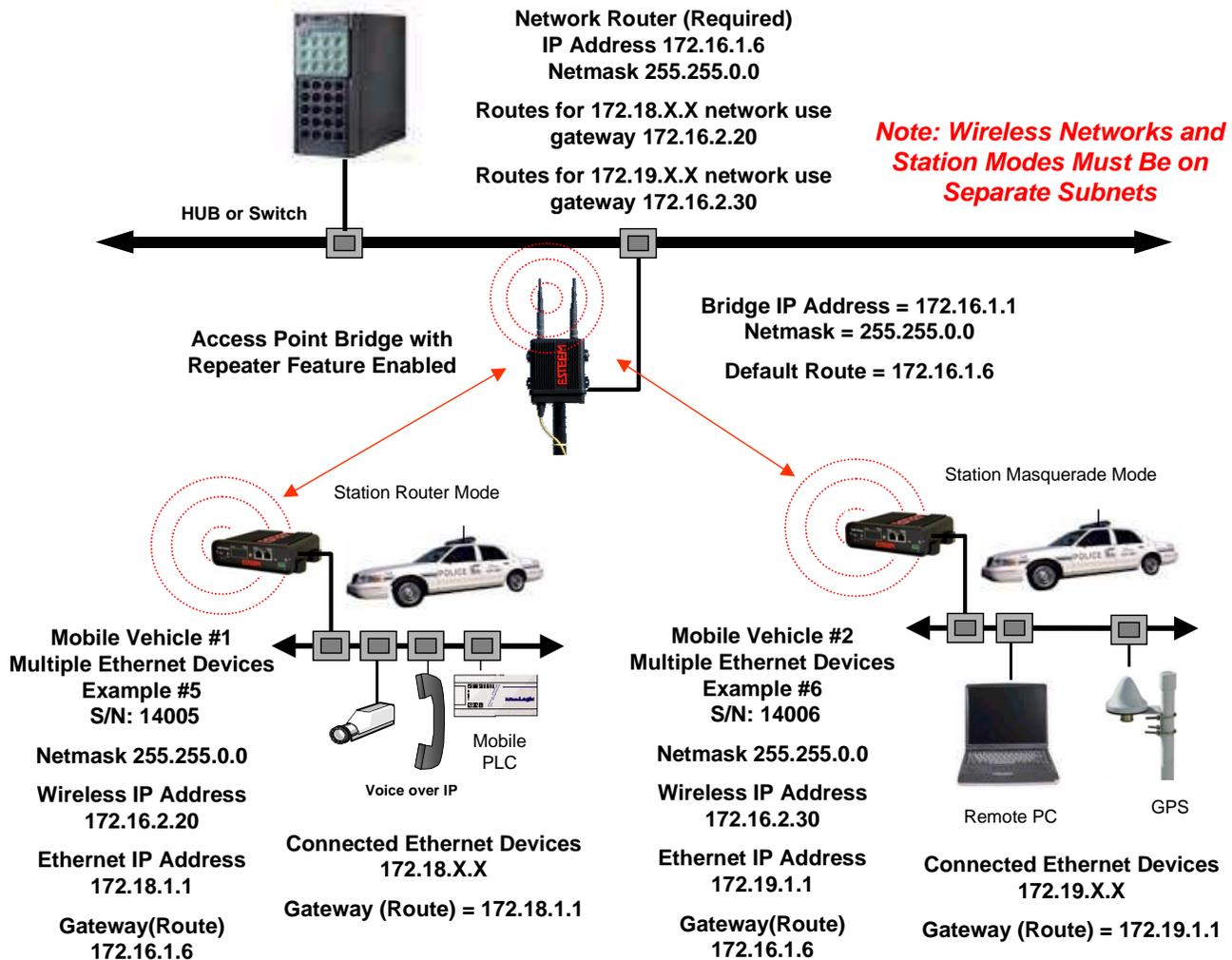


Figure 37: Station Router IP Addressing Diagram

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 38) and push the *Next* button below the pull down box.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top right is the ESTEEM Wireless Modems logo. Below the logo is a navigation menu with items: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' page title is displayed. Below the title, a message reads: 'This is the main Setup Page. Select a mode of operation for the wireless LAN unit from the following list.' A dropdown menu labeled 'Select Mode of Operation:' is set to 'Station Router'. To the right of the dropdown is a 'Help' link. Below the dropdown is a 'Next' button.

Figure 38:Station Router Selection

2. 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 39.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top right is the ESTEEM Wireless Modems logo. Below the logo is a navigation menu with items: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' page title is displayed. Below the title, a message reads: '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.' Another message reads: 'Additionally, select whether you want wireless security features turned on and enter the service set identifier (SSID) for the first wireless LAN device.' Below these messages, the 'Selected mode of operation:' is 'Station Router'. There are two sections for DHCP services: 'DHCP services on wireless interface:' and 'DHCP services on bridge interface:'. Each section has radio buttons for 'Off', 'Client', and 'Server'. Below these is a text input field for 'Enter the SSID:' containing 'ESTeem'. To the right of the SSID field is a 'Help' link. Below the SSID field are radio buttons for encryption types: 'None', 'WEP64', 'WEP128', 'WPA PSK', and 'WPA Enterprise with PEAP'. To the right of the encryption type options is another 'Help' link. At the bottom are 'Previous' and 'Next' buttons.

Figure 39:DHCP, SSID and Encryption Settings

3. Enter the WEP key values for your application that will be used by all devices on the wireless network. Reference Figure 40.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation menu with tabs: Top, Status, Log, Setup, **Advanced**, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Advanced' tab is selected. The main content area is titled 'Setup' and contains the following text: '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.'

Below this text, the configuration options are as follows:

- 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):

Below the keys, there are radio buttons to select the default WEP key:

- WEP Key 1
- WEP Key 2
- WEP Key 3
- WEP Key 4

Below the radio buttons, the text reads: 'Select the default WEP key:'. To the right of this text is a [Help](#) link. At the bottom of the configuration area, there are two buttons: 'Previous' and 'Next'.

Figure 40:WEP Key Input

4. Refer to the IP address in Table 1 and enter the **wireless** IP Address and IP Netmask for the Station Router. Reference Figure 41.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation menu with tabs: Top, Status, Log, Setup, **Advanced**, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Advanced' tab is selected. The main content area is titled 'Setup' and contains the following text: 'Enter values for the following fields for manual IP setup.'

Below this text, the configuration options are as follows:

- Mode of operation: Station Router
- DHCP Services: Off
- Enter IP address for the **wireless** LAN interface: [Help](#)
- Enter netmask for the **wireless** LAN interface: [Help](#)

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

Figure 41:Wireless IP Address

5. Refer to the IP address in Table 1 and enter the **ethernet** IP address and IP netmask. Reference Figure 42.

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 'Setup' page of the EST195E Web Configuration Manager. The page title is 'EST195E Web Configuration Manager' with the ESTEEM logo and 'Wireless Modems' text. A navigation menu includes 'Top', 'Status', 'Log', 'Setup', 'Advanced', 'Backup', 'Restore', 'SoftwareUpdate', 'Reboot', and 'About'. The main content area is titled 'Setup' and contains the instruction: 'Enter values for the following fields for manual IP setup of the **wired bridging** device.' Below this, the 'Mode of operation' is set to 'Station Router' and 'DHCP Services' are 'Off'. There are two input fields: 'Enter IP address for **wired bridge** device:' with the value '172.18.1.1' and a 'Help' link, and 'Enter netmask for **wired bridge** device:' with the value '255.255.0.0' and a 'Help' link. At the bottom are 'Previous' and 'Next' buttons.

Figure 42:Wired Ethernet IP Address

6. 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 43.

The screenshot shows the 'Setup' page of the EST195E Web Configuration Manager. The page title is 'EST195E Web Configuration Manager' with the ESTEEM logo and 'Wireless Modems' text. A navigation menu includes 'Top', 'Status', 'Log', 'Setup', 'Advanced', 'Backup', 'Restore', 'SoftwareUpdate', 'Reboot', and 'About'. The main content area is titled 'Setup' and contains the instruction: 'Enter values for the following fields to set up the default route and DNS settings'. Below this, the 'Mode of operation' is set to 'Station Router'. There are five input fields: 'Enter default route IP address:' with the value '172.16.1.6' and a 'Help' link; 'Use DNS client services?' with radio buttons for 'Yes' and 'No' (selected) and a 'Help' link; 'Enter DNS domain:' with an empty field and a 'Help' link; 'Enter primary DNS server IP address:' with an empty field and a 'Help' link; and 'Enter secondary DNS server IP address:' with an empty field and a 'Help' link. At the bottom are 'Previous' and 'Next' buttons.

Figure 43:Default Route (Gateway) Address and DNS Input

7. 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.

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.

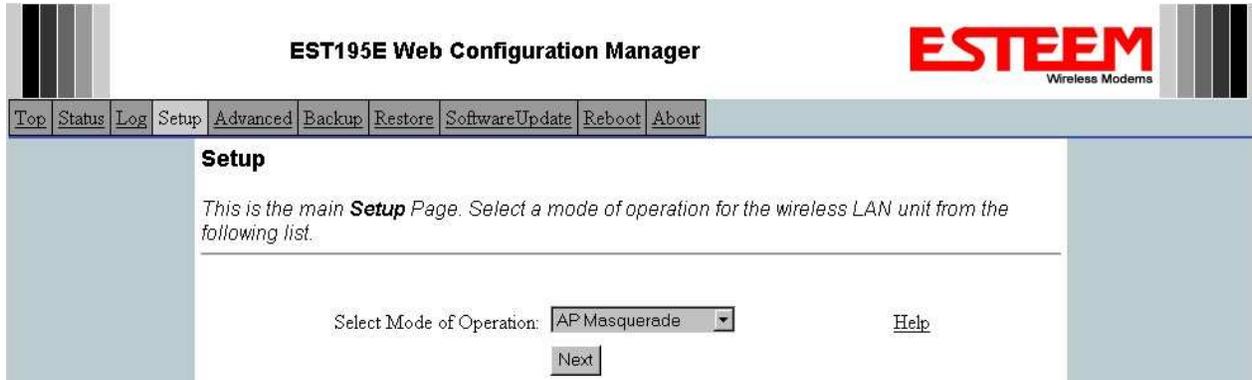


Figure 44: Station Masquerade Selection

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 44) and push the *Next* button below the pull down box.

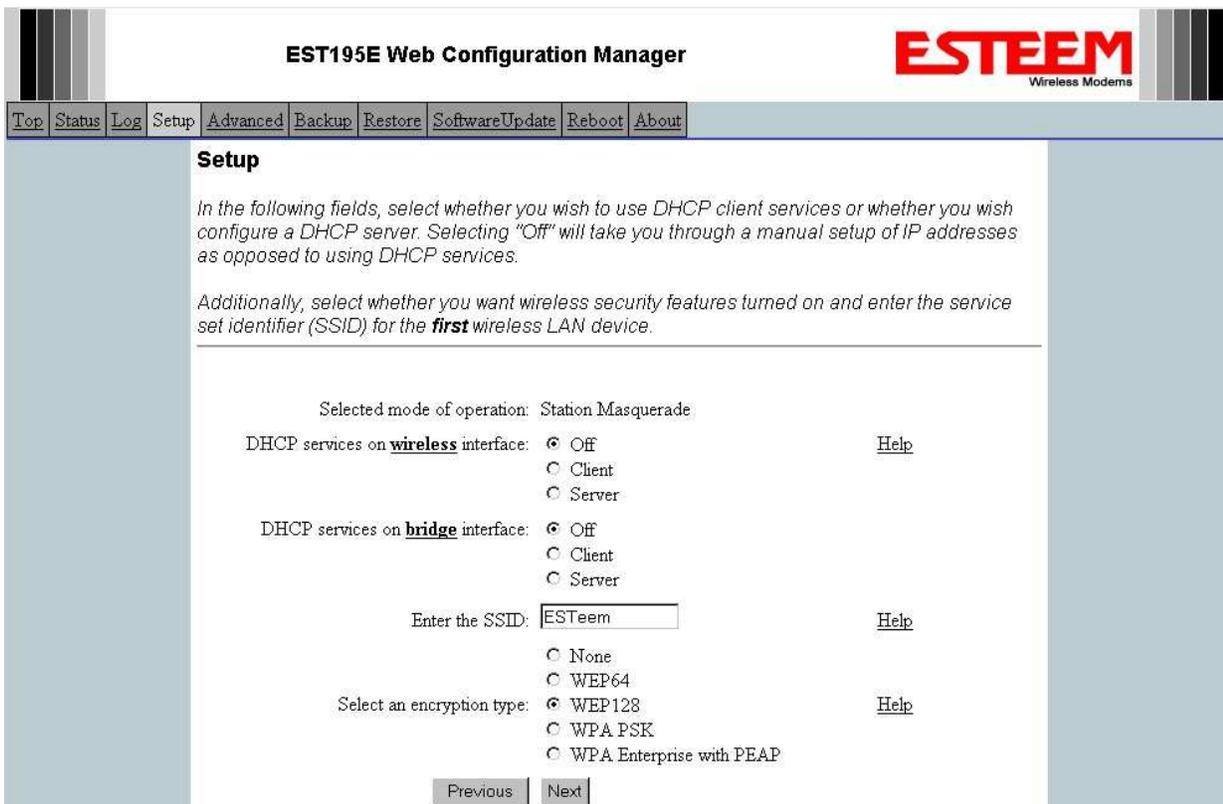


Figure 45: DHCP, SSID and Encryption Settings

2. 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 45.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation menu with options: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' menu item is selected. Below the navigation menu, the page title is 'Setup'. A descriptive text 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 configured for the wireless LAN device.' The main content area shows 'Encryption type: 128-Bit WEP for the wireless LAN device'. There are four input fields for WEP keys, each labeled 'Enter WEP Key X (13 hex bytes):' and containing the value '11:22:33:44:55:66:77:88:99:00:aa:bb:cc'. To the right of each field is a 'Help' link. Below the key fields, there are four radio buttons labeled 'WEP Key 1', 'WEP Key 2', 'WEP Key 3', and 'WEP Key 4'. The 'WEP Key 1' radio button is selected. Below the radio buttons, there is a label 'Select the default WEP key:' followed by the same four radio buttons. A 'Help' link is also present to the right. At the bottom of the form, there are 'Previous' and 'Next' buttons.

Figure 46:WEP Key Entry

3. Enter the WEP key values for your application that will be used by all devices on the wireless network. Reference Figure 46.
4. Refer to the IP address in Table 1 and enter the **wireless** IP Address and IP Netmask for the Station Router. Reference Figure 47.

The screenshot shows the 'EST195E Web Configuration Manager' interface. At the top, there is a navigation menu with options: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' menu item is selected. Below the navigation menu, the page title is 'Setup'. A descriptive text reads: 'Enter values for the following fields for manual IP setup.' The main content area shows 'Mode of operation: Station Masquerade' and 'DHCP Services: Off'. There are two input fields: 'Enter IP address for the wireless LAN interface:' with the value '172.16.2.30' and 'Enter netmask for the wireless LAN interface:' with the value '255.255.0.0'. To the right of each field is a 'Help' link. At the bottom of the form, there are 'Previous' and 'Next' buttons.

Figure 47:Wireless IP Settings

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

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 'EST195E Web Configuration Manager' interface. At the top, there is a navigation menu with options: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' page is active, displaying the title 'Setup' and the instruction: 'Enter values for the following fields for manual IP setup of the **wired bridging** device.' Below this, the configuration options are: 'Mode of operation: Station Masquerade' and 'DHCP Services: Off'. There are two input fields: 'Enter IP address for wired bridge device:' with the value '172.16.38.189' and a 'Help' link; and 'Enter netmask for wired bridge device:' with the value '255.255.0.0' and a 'Help' link. At the bottom of the form are 'Previous' and 'Next' buttons.

Figure 48:Wired Ethernet Interface

6. 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 'EST195E Web Configuration Manager' interface. At the top, there is a navigation menu with options: Top, Status, Log, Setup, Advanced, Backup, Restore, SoftwareUpdate, Reboot, and About. The 'Setup' page is active, displaying the title 'Setup' and the instruction: 'Enter values for the following fields to set up the default route and DNS settings'. Below this, the configuration options are: 'Mode of operation: Station Masquerade', 'Enter default route IP address:' with the value '172.16.1.6' and a 'Help' link, 'Use DNS client services?' with radio buttons for 'Yes' and 'No' (selected) and a 'Help' link, 'Enter DNS domain:' with an empty input field and a 'Help' link, 'Enter primary DNS server IP address:' with an empty input field and a 'Help' link, and 'Enter secondary DNS server IP address:' with an empty input field and a 'Help' link. At the bottom of the form are 'Previous' and 'Next' buttons.

Figure 49:Default Route (Gateway) and DNS Input

7. 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.

The ESTeem 195Ed is now available with an optional factory installed 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).

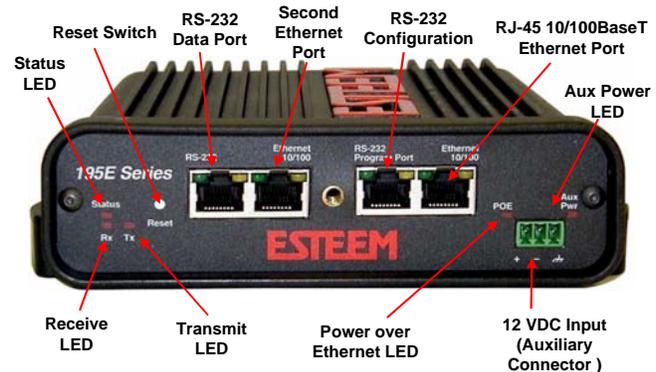


Figure 1: 195Ed Front Panel Overview

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 separate subnets. The primary Ethernet port (ETH_0) is configured for Subnet A. The secondary Ethernet port (ETH_1) is bridged to the Wireless port (WLAN_0), sharing an IP address and 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.

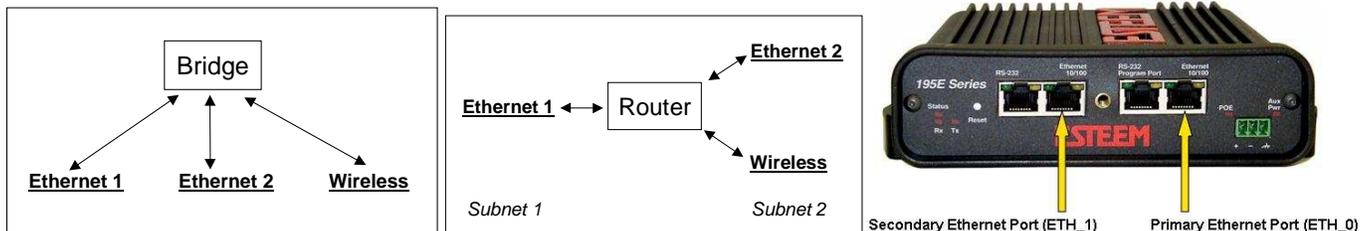


Figure 2: Bridge and Router Configuration for Ethernet Ports

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-f hex): [Help](#)

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

Enter delimiter character 2 (00-f 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).

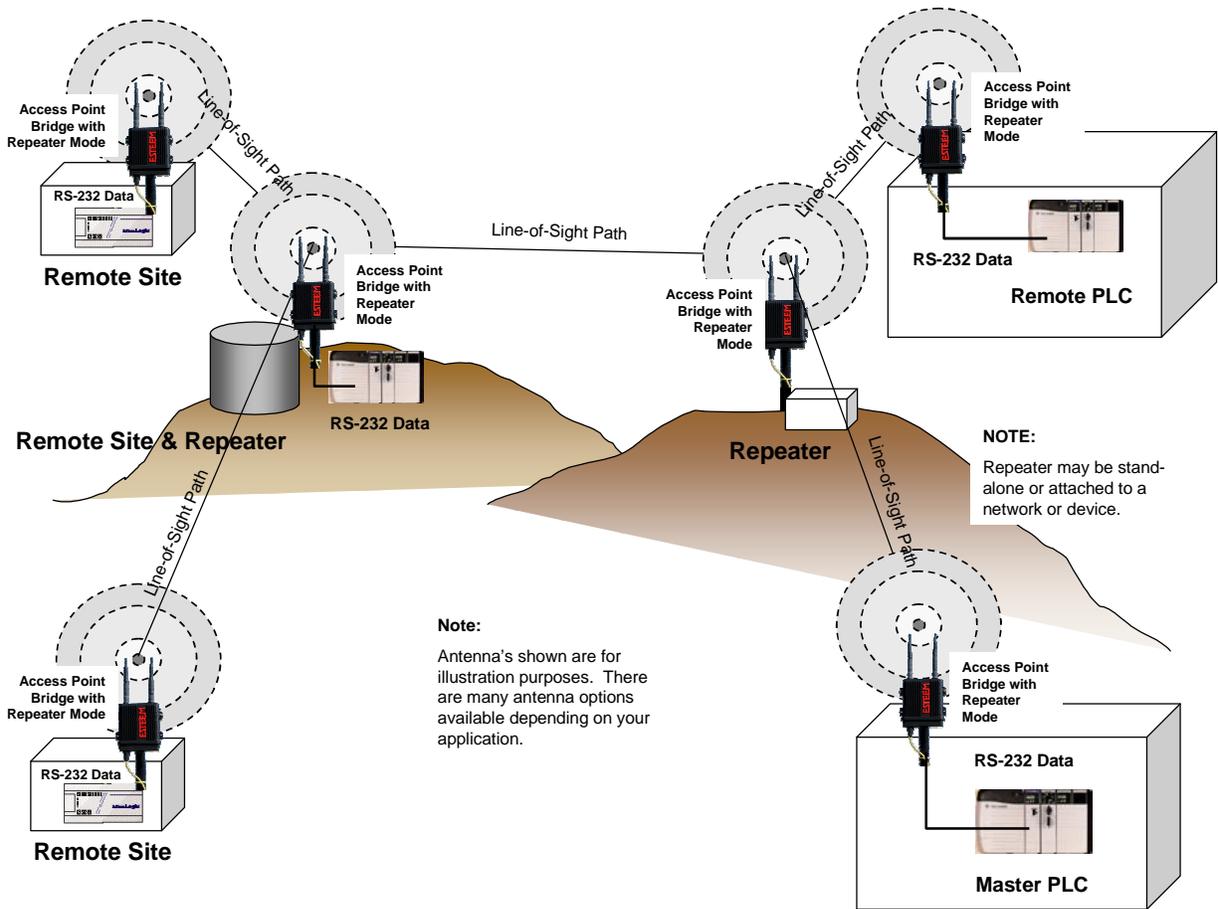


Figure 4: Serial Full Redirector Example

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.

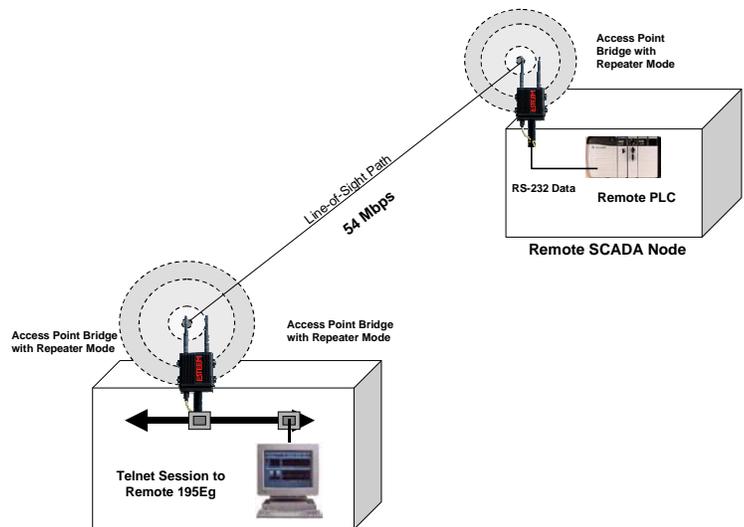


Figure 5: Terminal Server Example

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.

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 hardwire, 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.

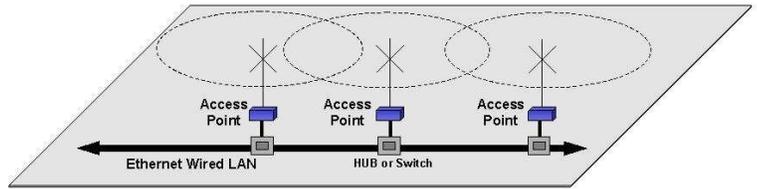


Figure 1: Conventional Access Point Diagram

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.

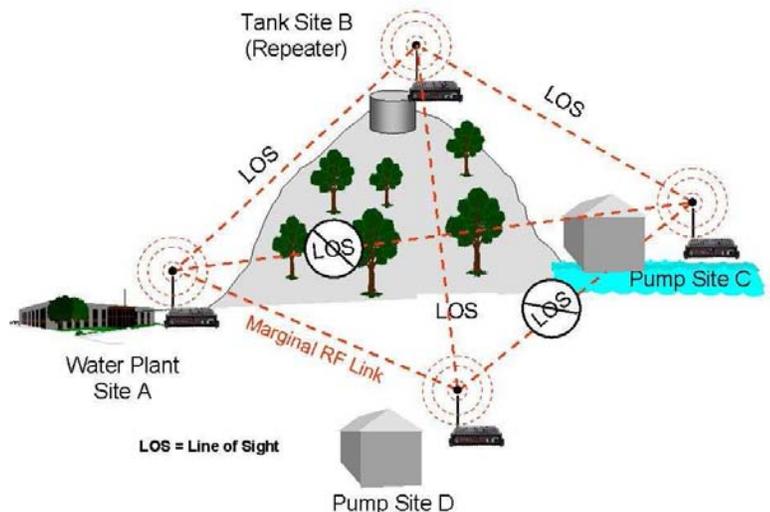


Figure 2: Small Mesh Network Diagram

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.

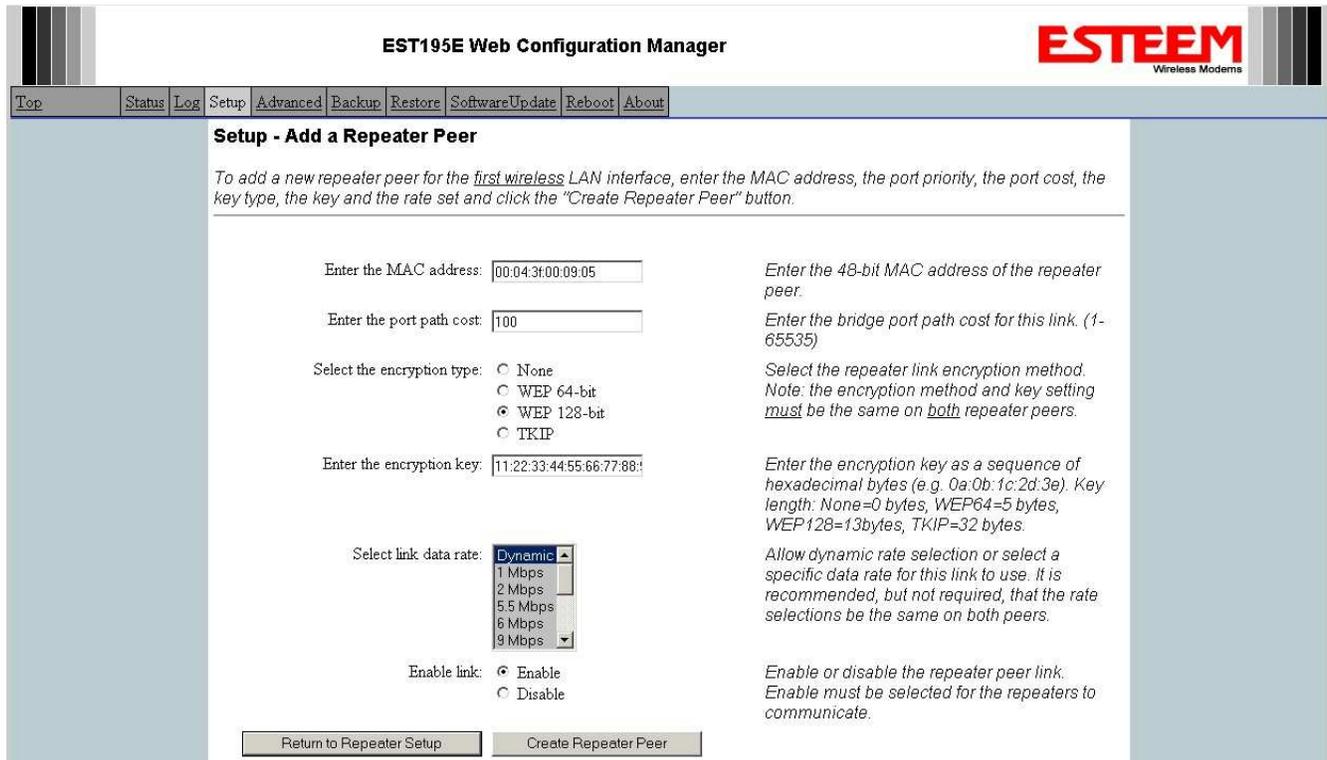


Figure 3: Repeater Configuration Example

SPANNING TREE PROTOCOL (STP)

The ESTeem Model 195Ed uses standard Ethernet Spanning Tree Protocol (STP) to determine the radio routing structure of the wireless network. The primary purpose of STP 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 STP operation begins by determining which Ethernet device on the network will be the Root Bridge. All Ethernet networks have a Root Bridge that is selected by the lowest MAC address. All path costs are evaluated against this Root Bridge device to determine routing and which paths will be blocked. On a wired Ethernet network, the location of the Root Bridge is not really important, but in a wireless network selection of the Root Bridge is critical to the wireless network routing. Let’s use one of the Example network diagrams from Chapter 5 to continue the discussion (Figure 4).

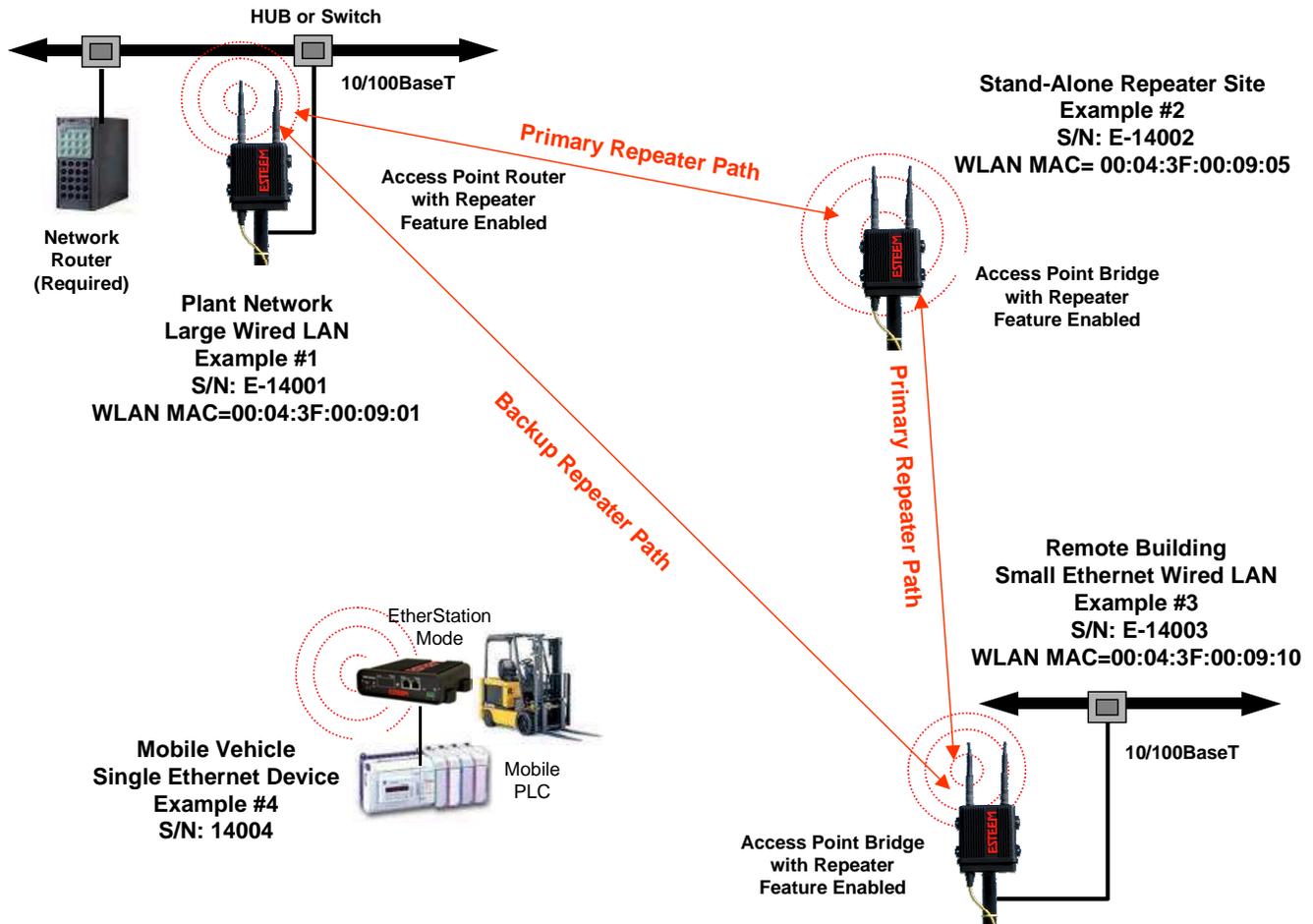


Figure 4: Programming Example #1 Diagram

The following sections describe the process of the STP 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 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.

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.

EST195E 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 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:

Figure 3: Repeater Configuration Example

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.

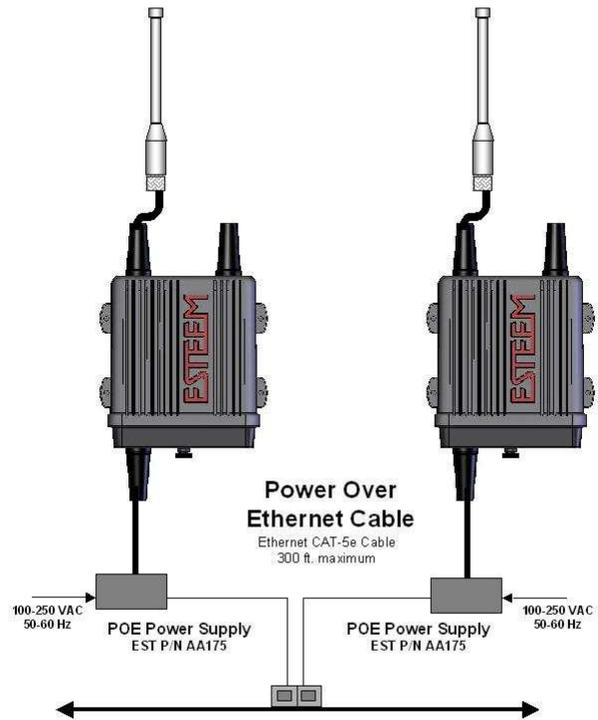


Figure 7: Redundant Backup Diagram

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 23 cm. 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.

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