PROGRAMMING EXAMPLES

In this chapter we will demonstrate how to program the ESTeem Model 195Ep 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 195Ep'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).

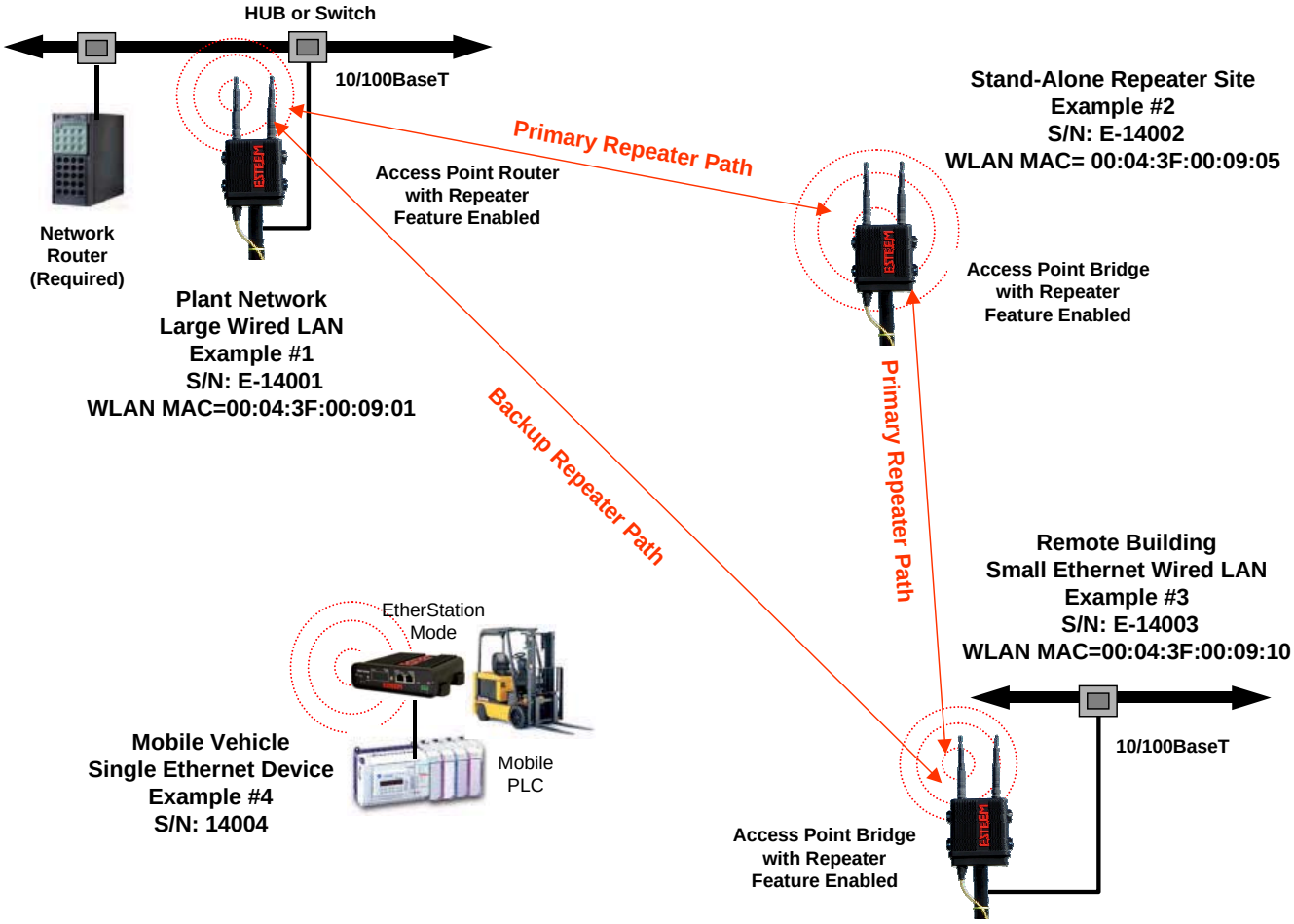

Figure 1: Programming Example #1 Diagram

The second example network in Figure 2 show how to configure the Model 195Ep if multiple Ethernet devices are connected to a single ESTeem Model 195Ep. 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 195Ep. 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.

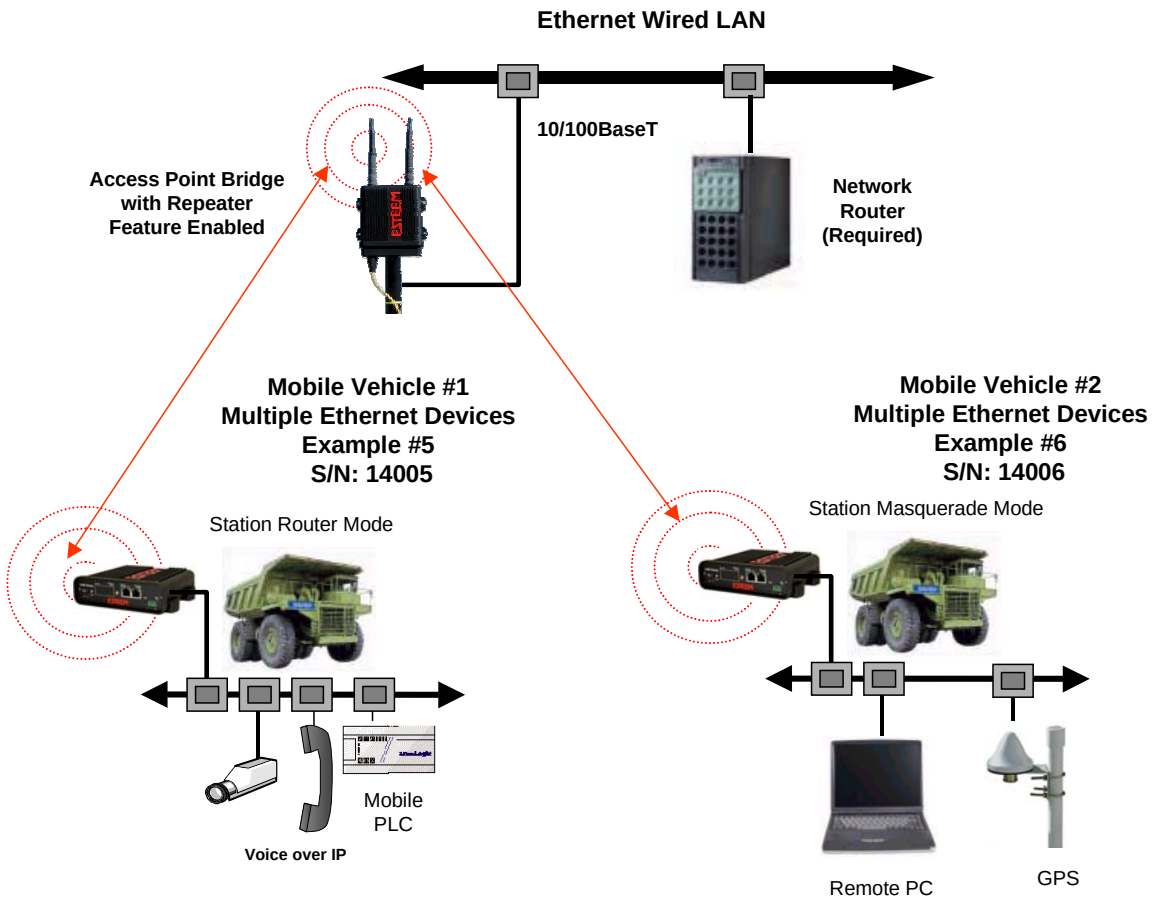

Figure 2: Programming Example #2 Diagram

Documentation

The first step when configuring your wireless system will be to document each Model 195Ep 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 195Ep 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 Ethenet devices on the wireless network, a network router is required to resolve the IP conflict created by having the wired and wireless networks on separate subnets.

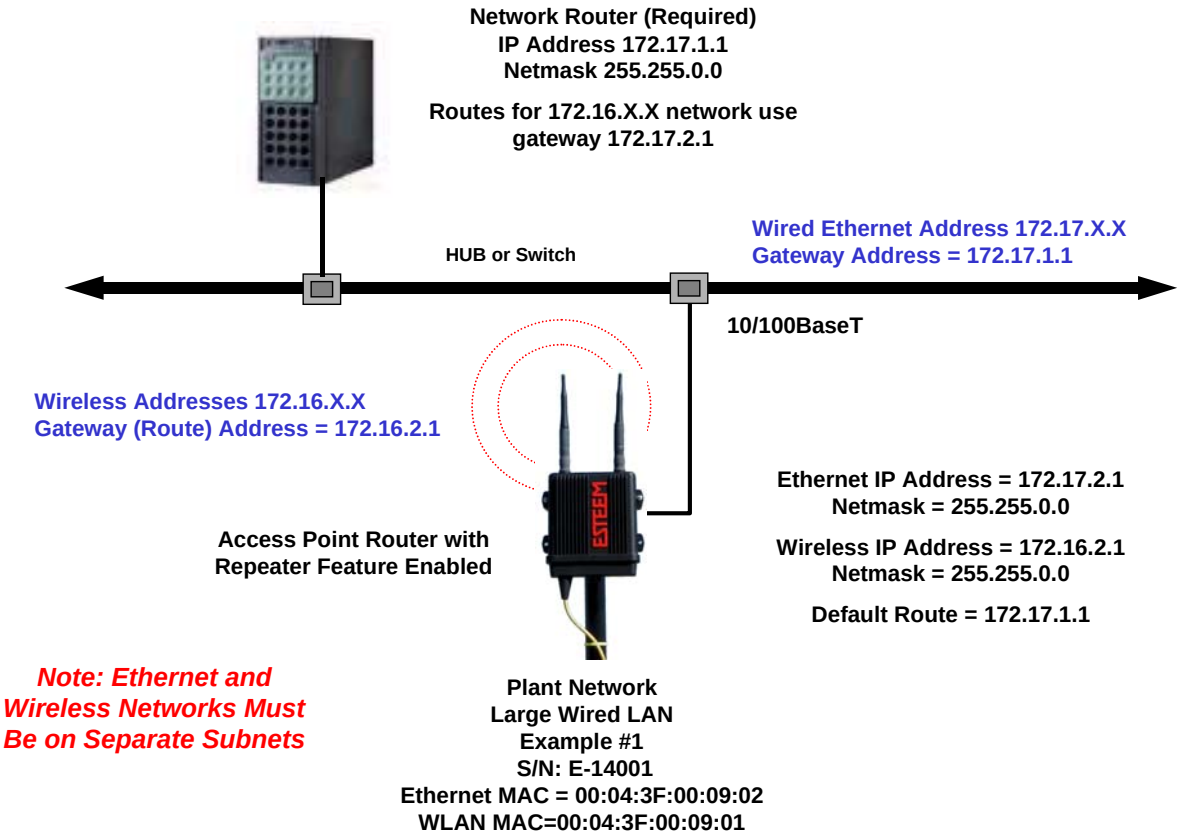

Figure 3: Access Point Router IP Addressing Example

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

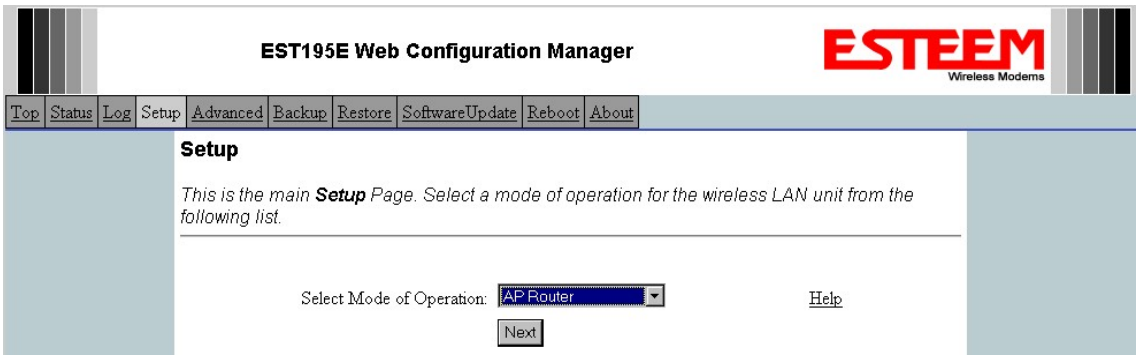

Figure 4: Access Point Router Setup Screen

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

2. Select if you want to use client or server Dynamic Host Configuration Protocol (DHCP) for the **Ethernet** device. If you want to enter a static IP address for the Model 195Ep, 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.

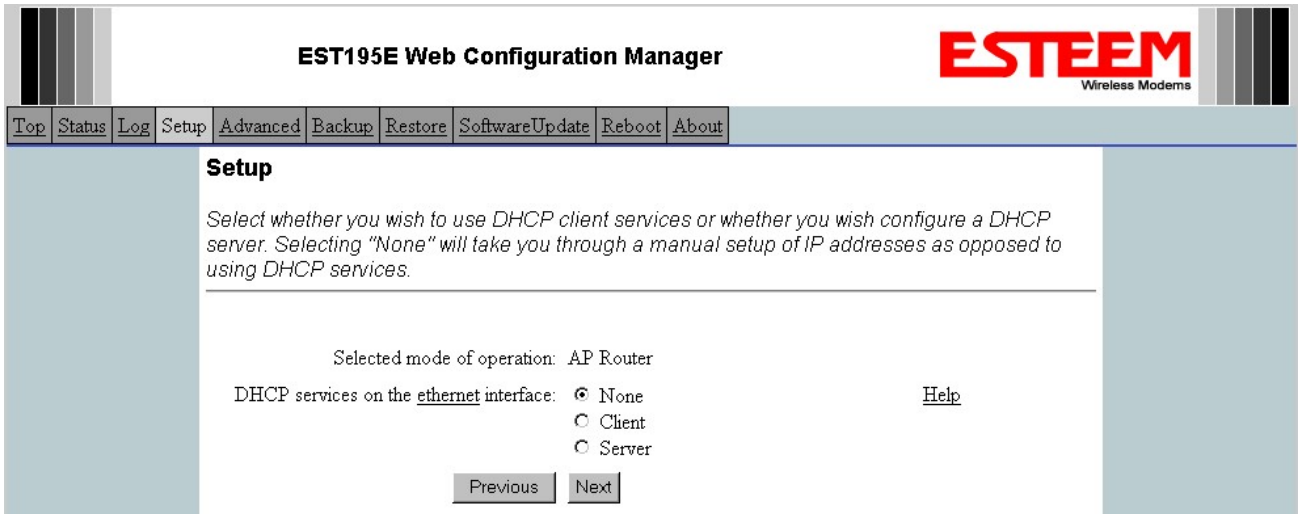

Figure 5: DHCP Ethernet Port

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

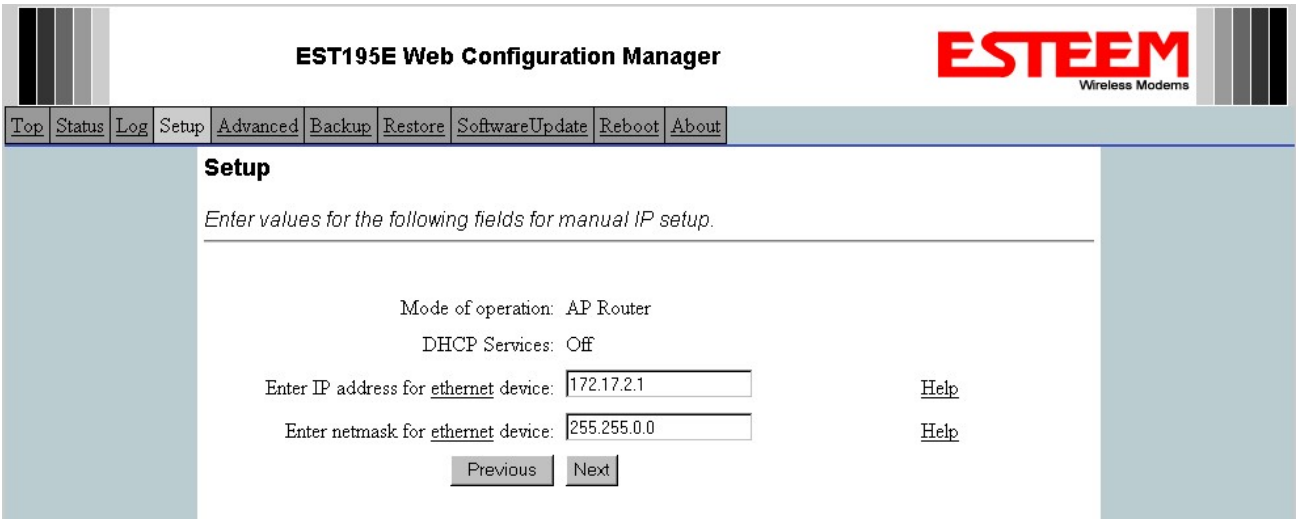

Figure 6: Ethernet IP Addressing

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 195Ep, 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.

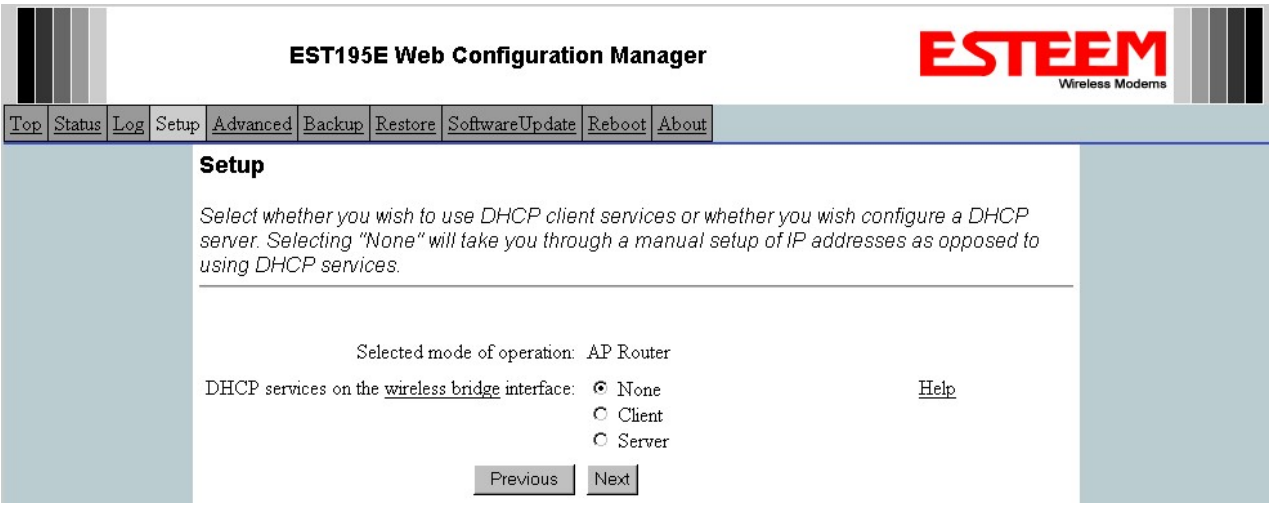

Figure 7: DHCP Wireless Port

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

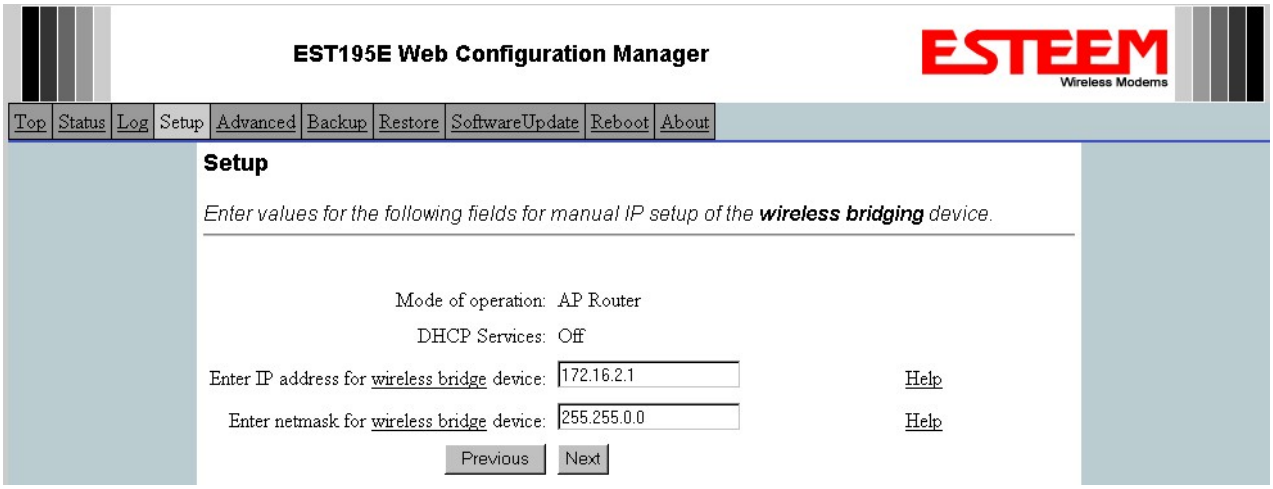

Figure 8: Wireless IP Address

6. Enter the default route (Gateway) address for the network. This AP Router 195Ep 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 195Ep to the Internet, leave blank and press the *Next* button. Figure 9.

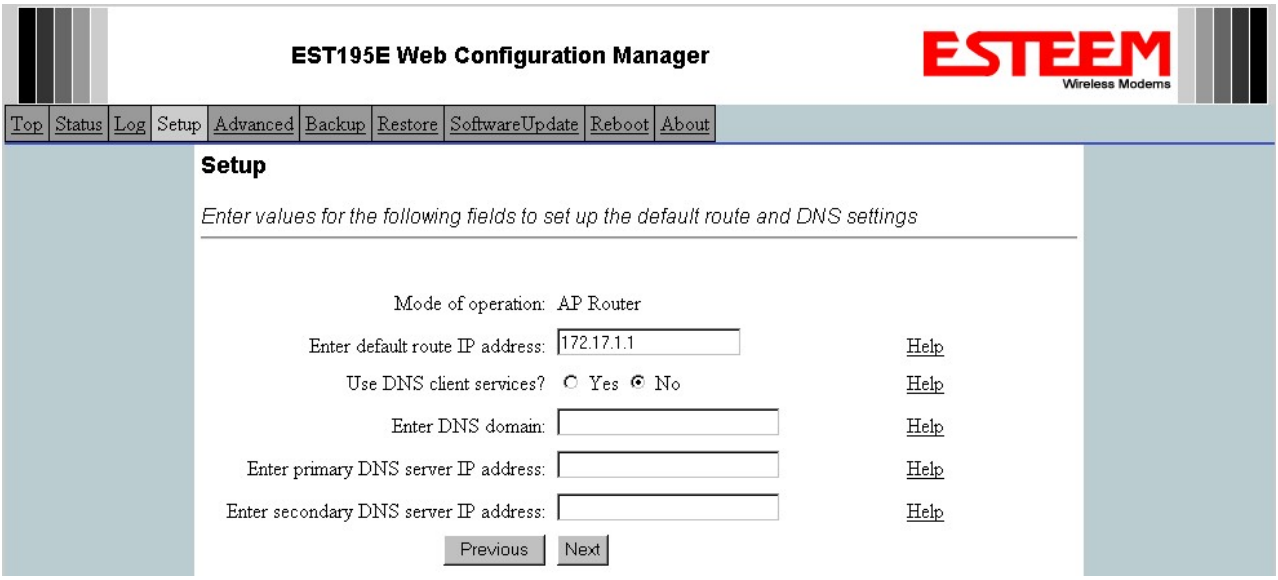

Figure 9: Wireless Security Level Settings

7. Select *Yes* if you will be using security for client access to your wireless network (recommened).

NOTE: The setting of this security level is ONLY for client access to the Model 195Ep. The security of the Bridge communication between the Model 195Ep'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 195Ep 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.

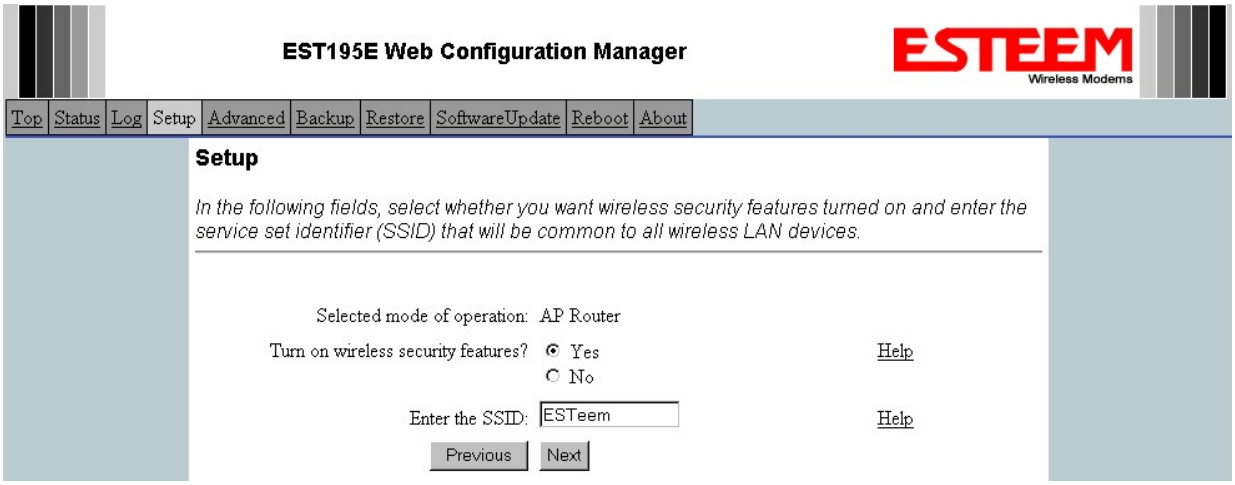

Figure 10: WEP Key Entry

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 195Ep 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.

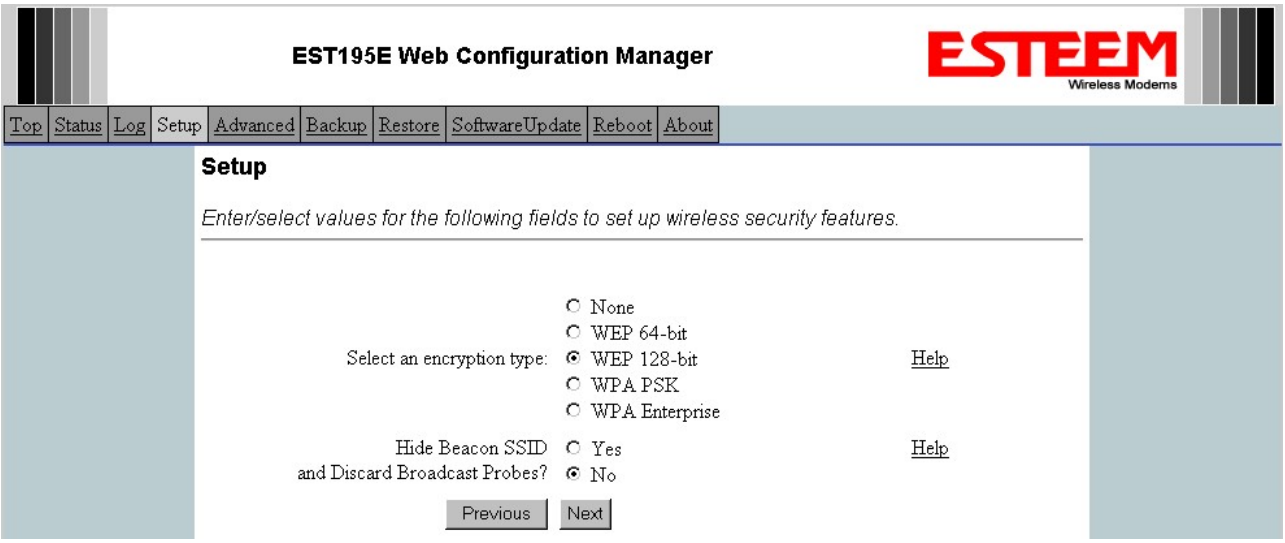

Figure 11: Security Selection

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

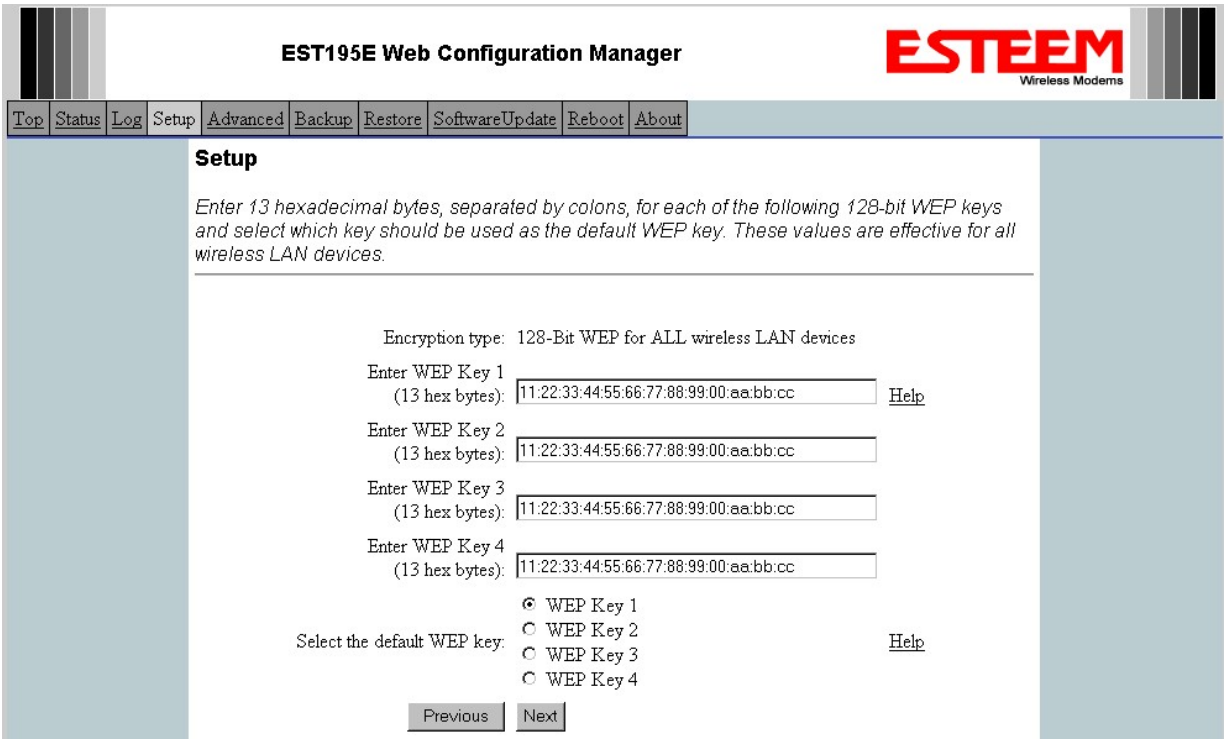

Figure 12: WEP Key Input Screen

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.

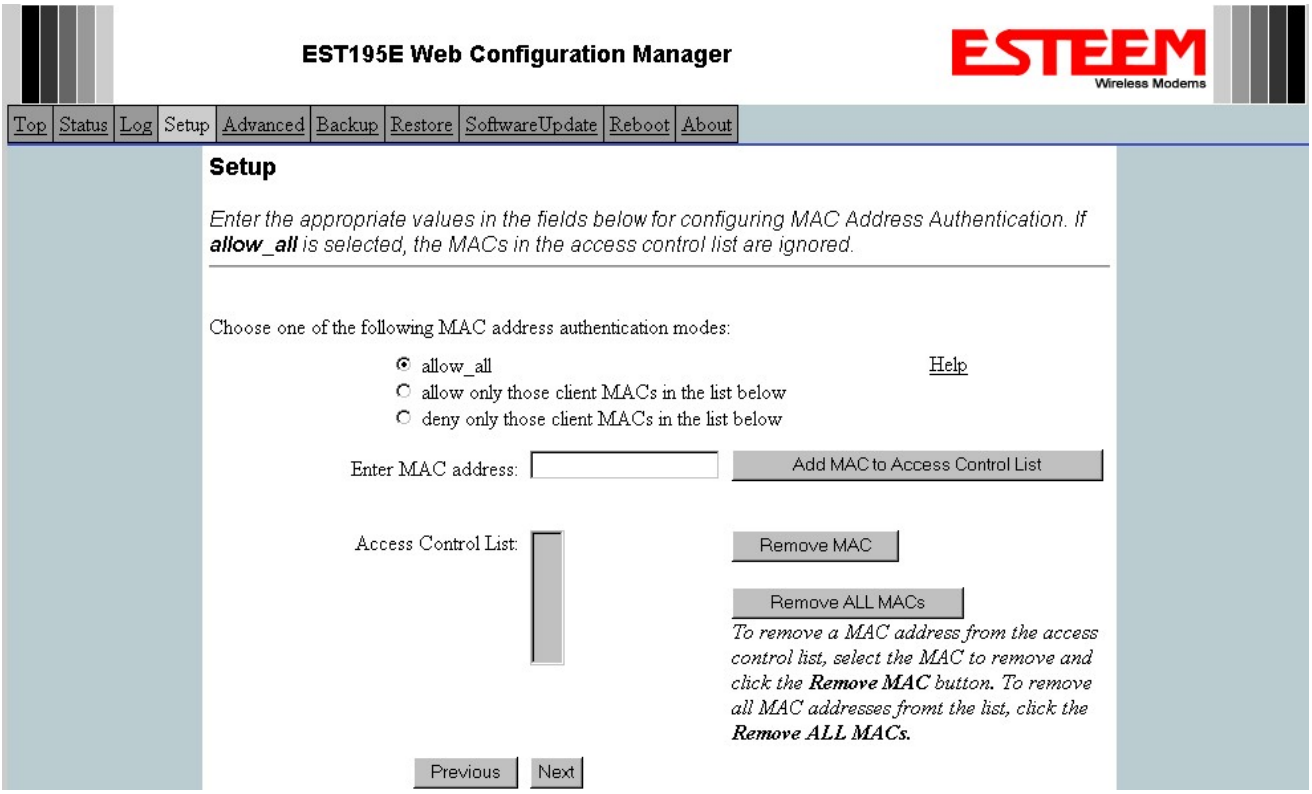

Figure 13: Access Control List Settings

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.

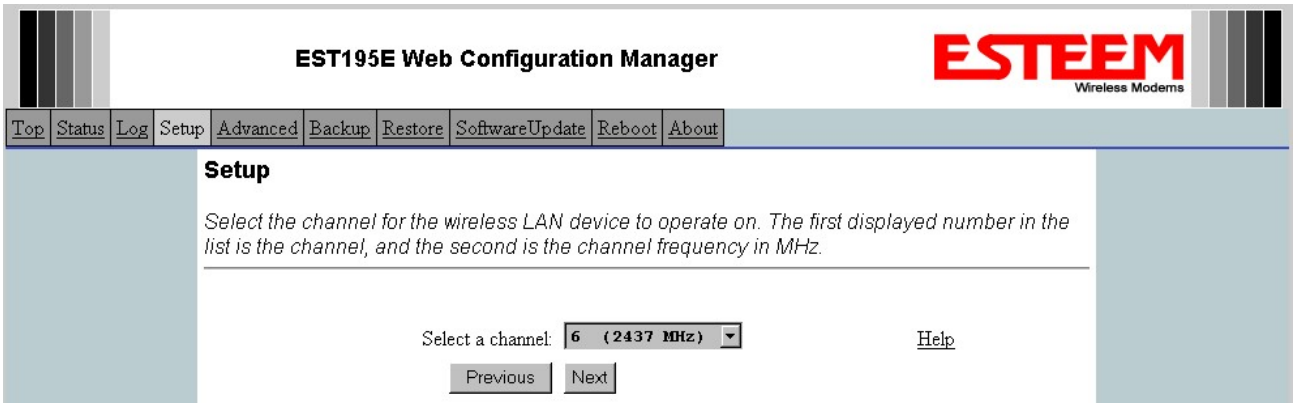

Figure 14: Radio Channel Selection

12. The Repeater Peer Table (Figure 15) identifies which Model 195Ep's will bridge wireless Ethernet communication. Only other Access Point Repeaters need to be listed not the Model 195Ep'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 195Ep's that will communicate with the Access Point Router (Example 1) starting with the primary repeater path through the stand-alone repeater.

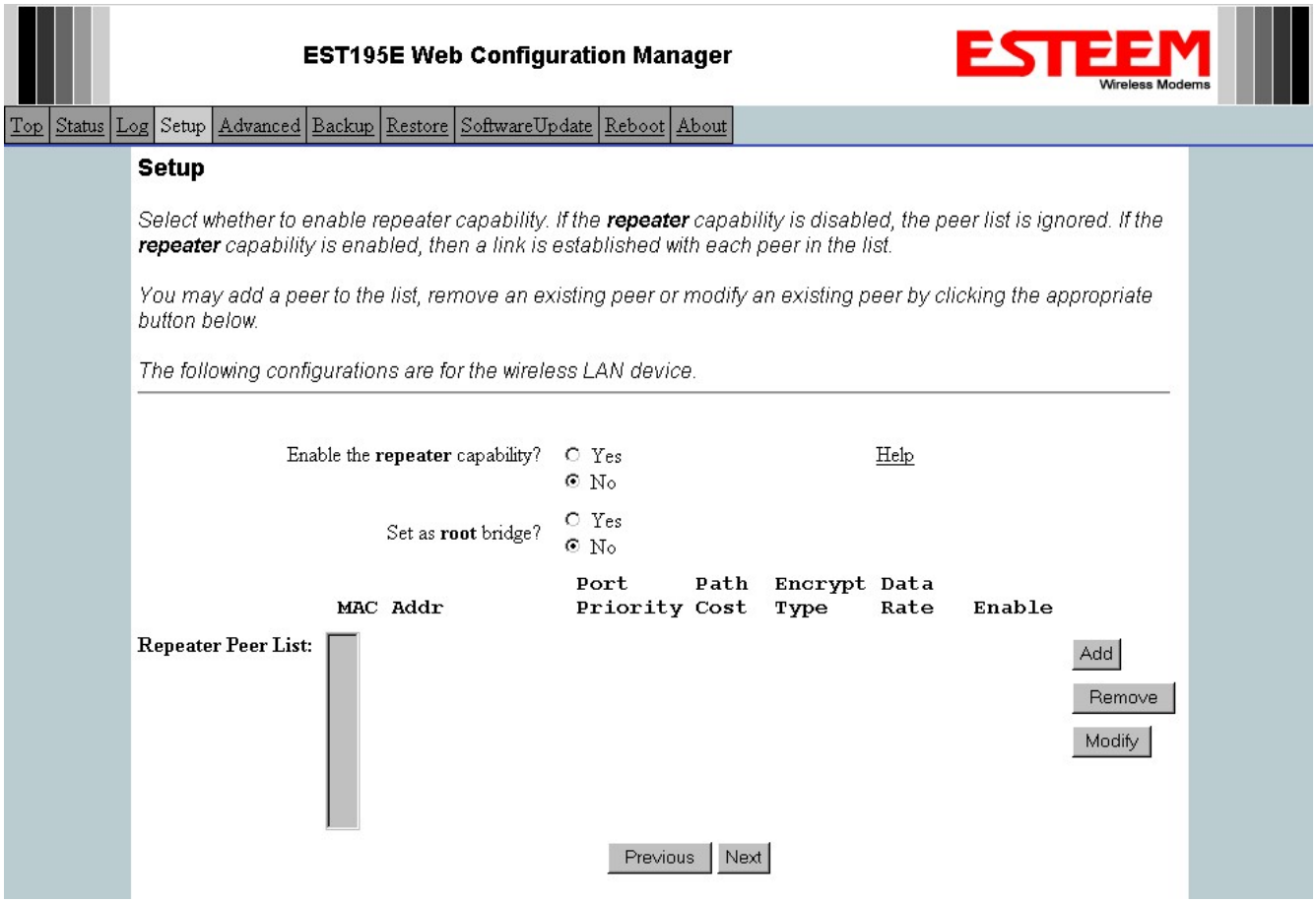

Figure 15: Blank Repeater Table

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 195Ep 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 195Ep 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.*

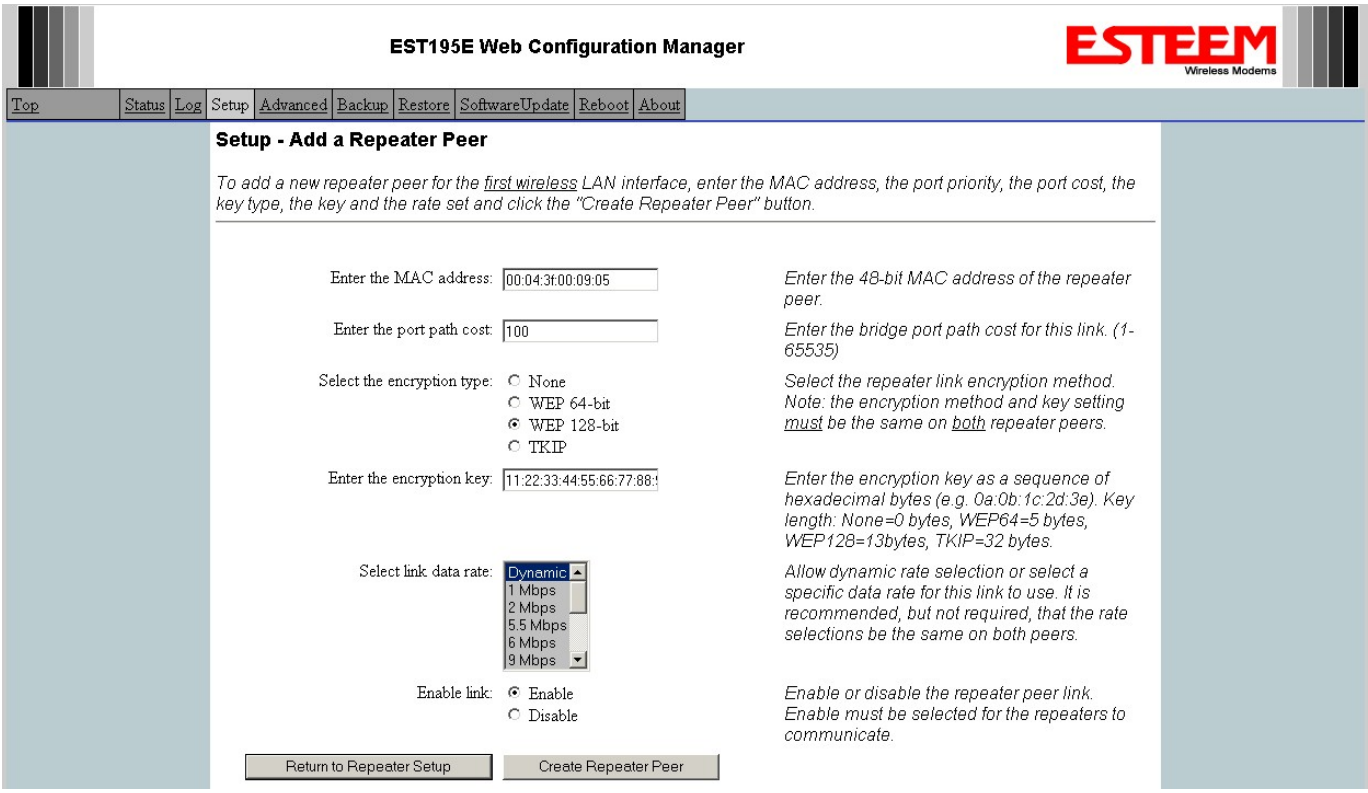

Figure 16: First (Primary) Repeater Link

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.*

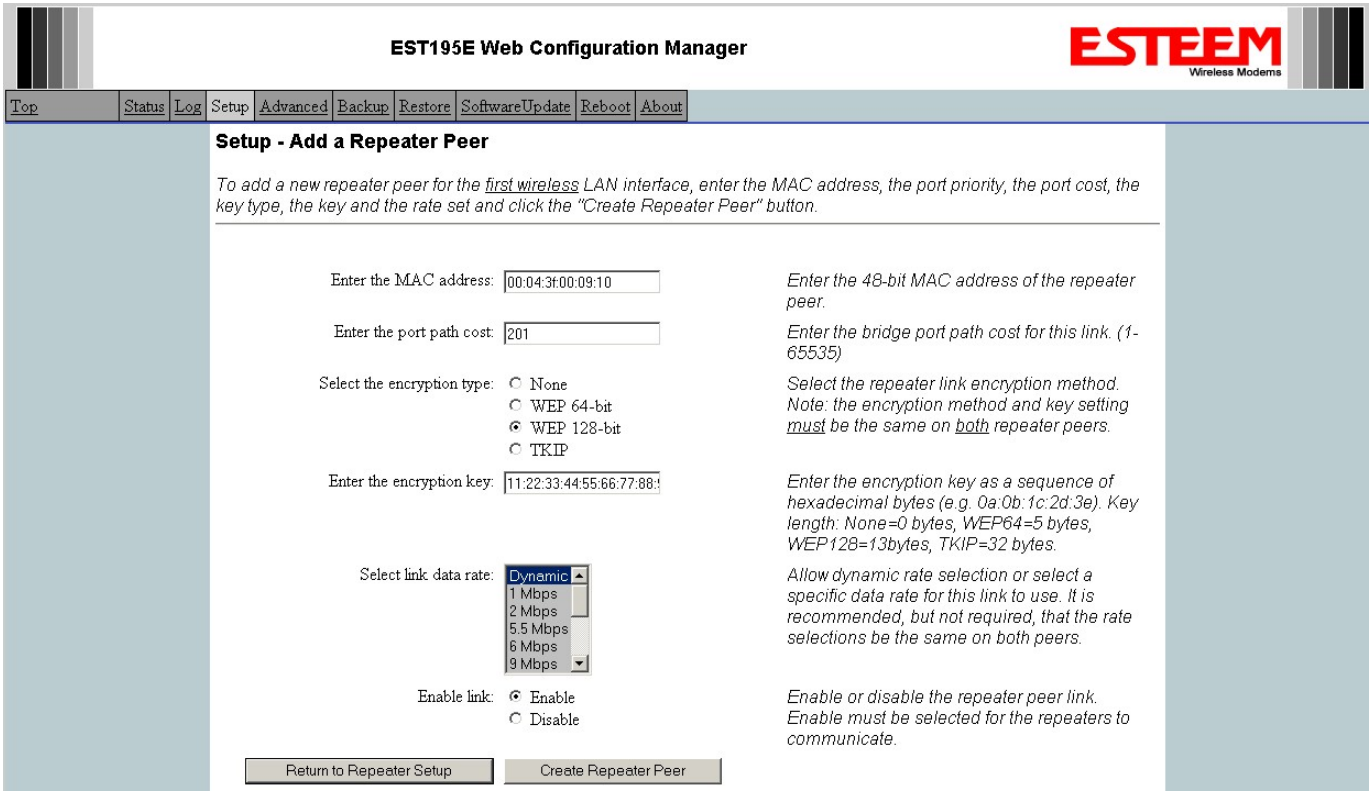

Figure 17: Second (Backup) Repeater Link

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 195Ep 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.

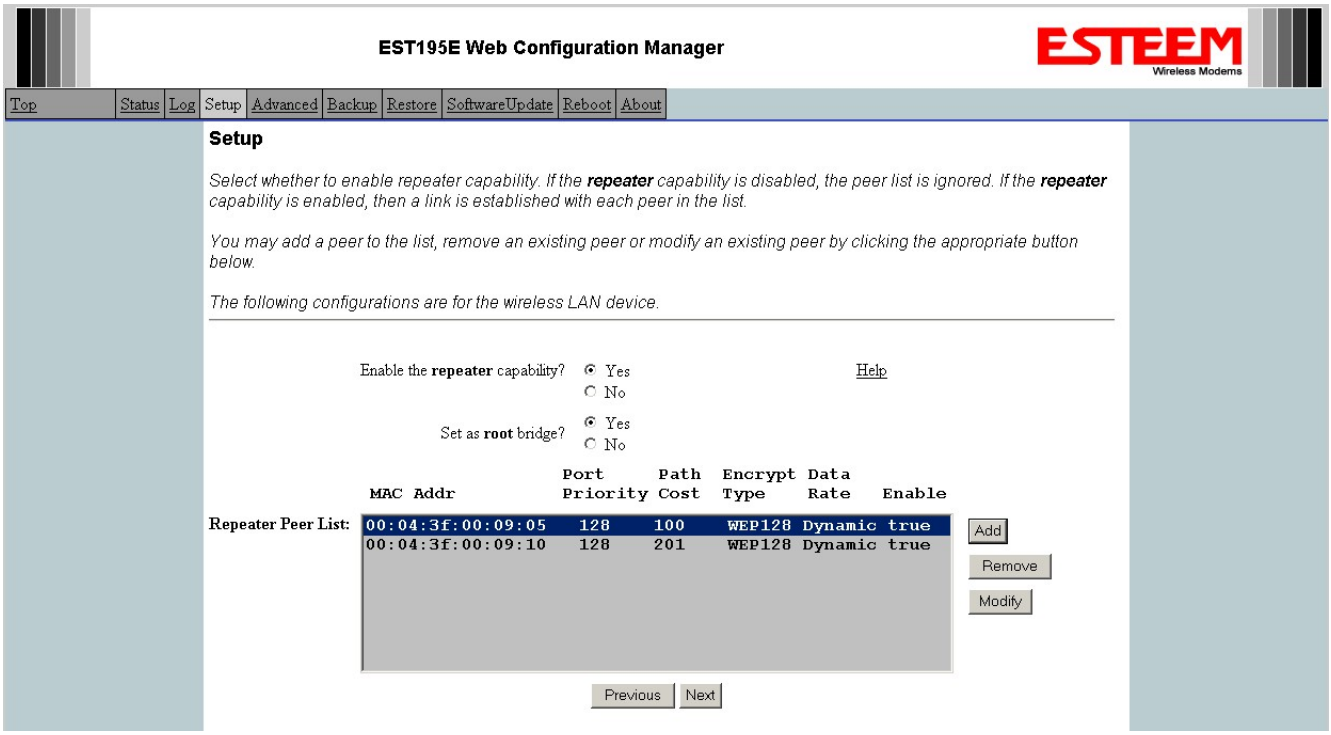

Figure 18: Completed Repeater Peer List

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.

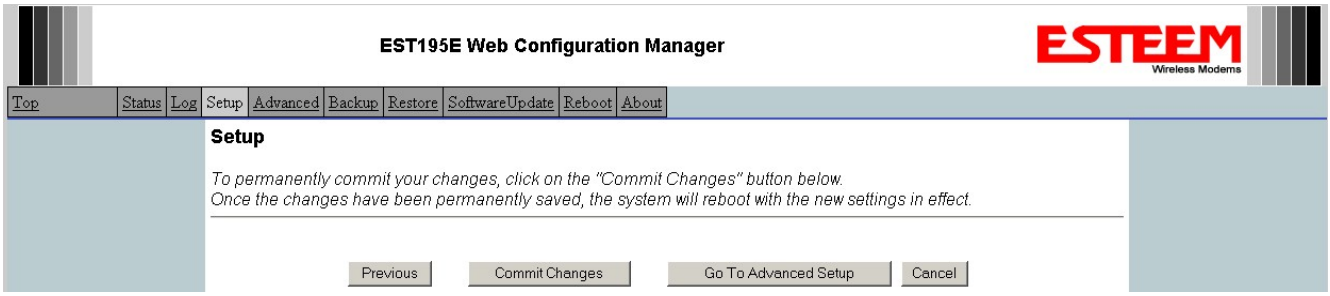

Figure 19: Commit Changes

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

Review the example diagram, Figure 1, and locate the 195Ep marked as Example #2. This ESTeem is being used by two other Model 195Ep'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.

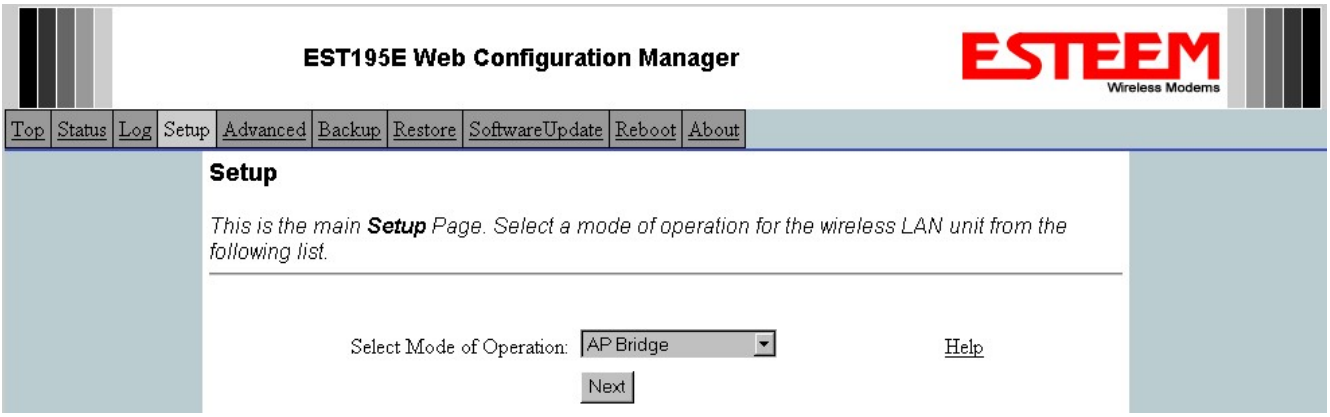

Figure 20: Access Point Bridge

2. Select if you want to use client or server Dynamic Host Configuration Protocol (DHCP) for the 195Ep. If you want to enter a static IP address for the Model 195Ep, select Off and press the Next button. For our example, we have fixed IP addresses and will select Off. Reference Figure 21.

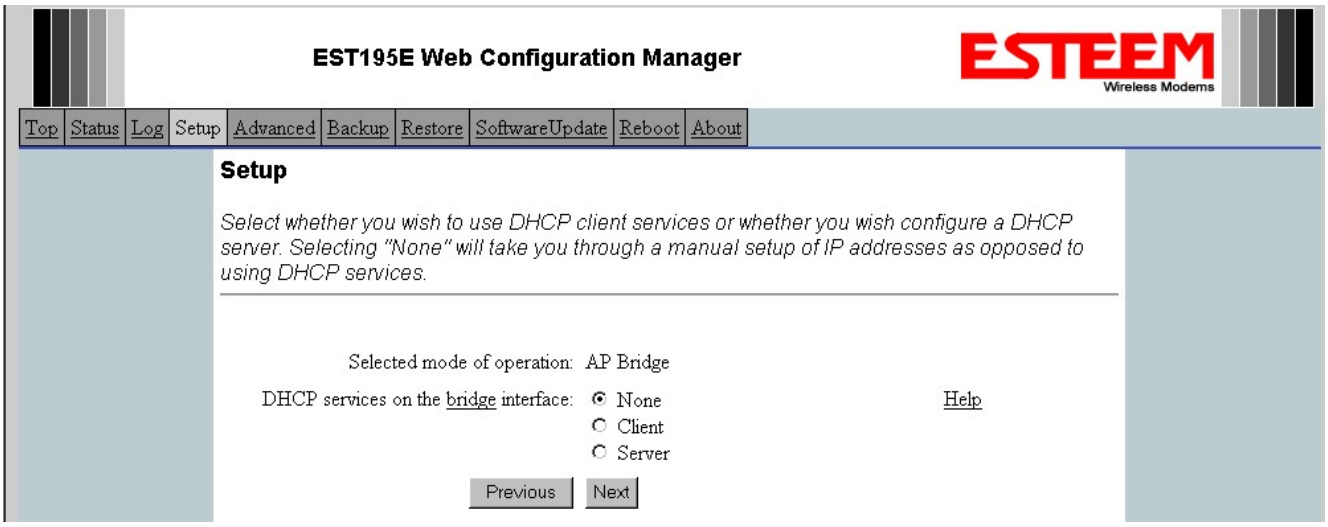

Figure 21: DHCP Configuration