

Overview

The ESTeem Model 210 series of radios (Model 210C and 210M) are low throughput wireless Ethernet devices that provide an Ethernet link to remote devices over difficult terrain and long distances. To maximize the limited throughput (up to 64 Kbps) of these radios, ESTeem has implemented the Access Point Router (AP Router) Mode in the latest version of firmware (version 201905101333). This Router Mode will only pass Ethernet traffic for designated TCP/IP subnets that greatly reduces the wireless packets in the network. Being a router, the ESTeem 210 will not pass global packets or IP packets not specifically configured in the routing table.

This mode of operation is highly suggested for any Ethernet network that requires maximum Ethernet throughput of a Model 210 series wireless network. The ESTeem 210's are not shipped with this specialized firmware version because it is incompatible with all previous versions. This firmware version can be downloaded from our FTP site (<ftp://ftp.esteem.com/210M-M/RouterMode/>) or by contacting ESTeem support at (support@esteem.com) or 509-735-9092.

AP Router - Mode of Operation

The Access Point (AP) Router mode of operation is used in fixed location systems where the Model 210 radios will not change their communication paths. This mode of operation is recommended for maximum wireless throughput because wireless beacons are not required.

Configuration

Ethernet Network Requirements

Controlling an Ethernet network to operate at low throughputs can be challenging. Using the Router mode in the Model 210 will greatly improve network performance but it does require some additional network planning. To operate as a Router, the ESTeem 210 requires that each remote location connected through the wireless network be on a unique TCP/IP subnet. This type of IP network configuration does not take any longer to configure but needs to be planned prior to addressing of the control network.

The attached Ethernet devices will need to have their Ethernet Gateway addresses adjusted to point at the connected ESTeem 210 radio. If there is already an Ethernet gateway on the Ethernet network, the routing information will need to be added to this device.

Example Application

The following example site application will be used to explain the addressing requirements of Ethernet hardware with the Model 210 radio is used in Router Mode:

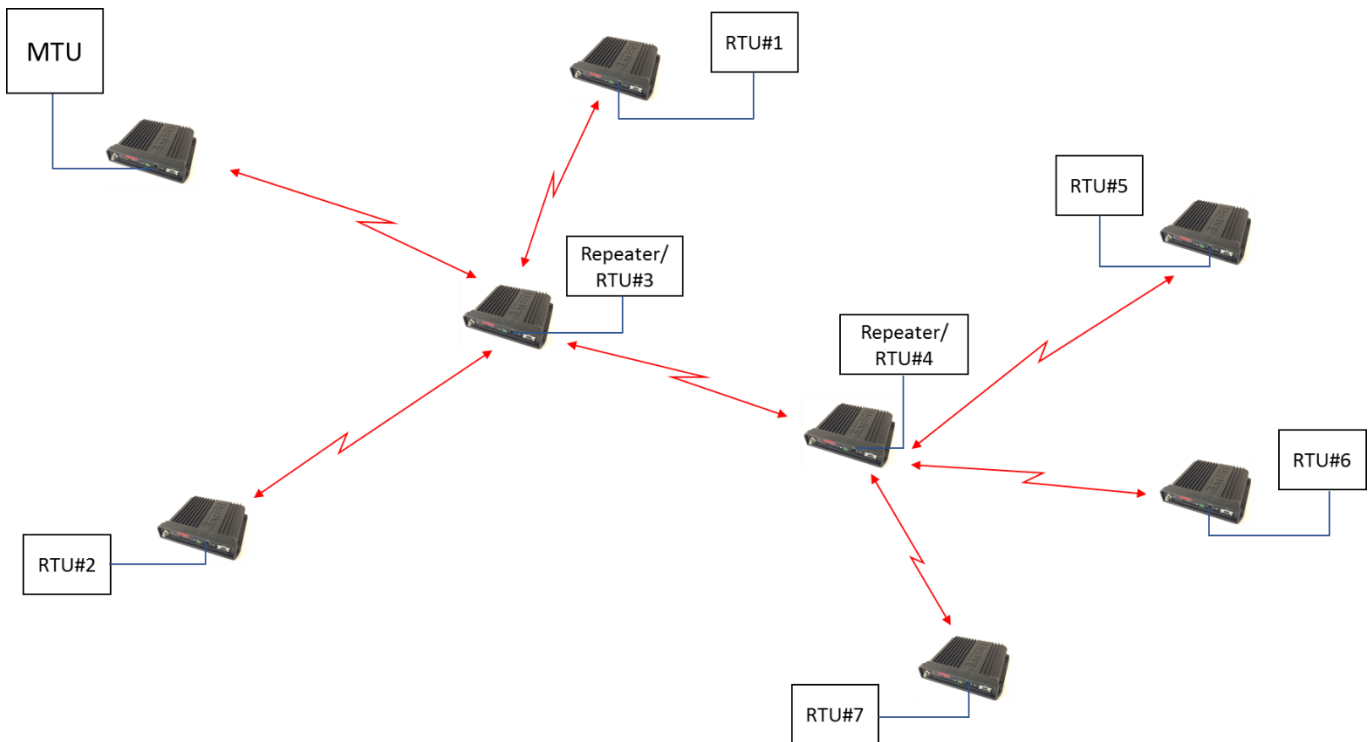


Figure 1: Example Application

In the above example, the Master Terminal Unit (MTU) is gathering Ethernet information from (7) seven Remote Terminal Unit (RTU) using the ESTeem Model 210 series radios. RTU#3 is being used as a repeater for RTU#1, RTU#2 and RTU#4. In addition, RTU#4 is being used as a repeater for RTU#5, RTU#6 and RTU#7.

There are no mobile Ethernet devices in our example, so each of the above radios will be configured for AP Router mode. This network is isolated from the business network, so the routing information will be programmed into each ESTeem Model 210 in the network.

To continue the programming, each ESTeem Model 210 radio (we will use the ESTeem Model 210M for this example) will need to be identified by serial number and an TCP/IP addressing scheme selected. In this example a Class B addressing (172.16.XXX.XXX Mask 255.255.0.0) will be used.

The MTU, each of the remote RTU's and the wireless network will need to be on unique IP subnets as shown in Figure 2 below.

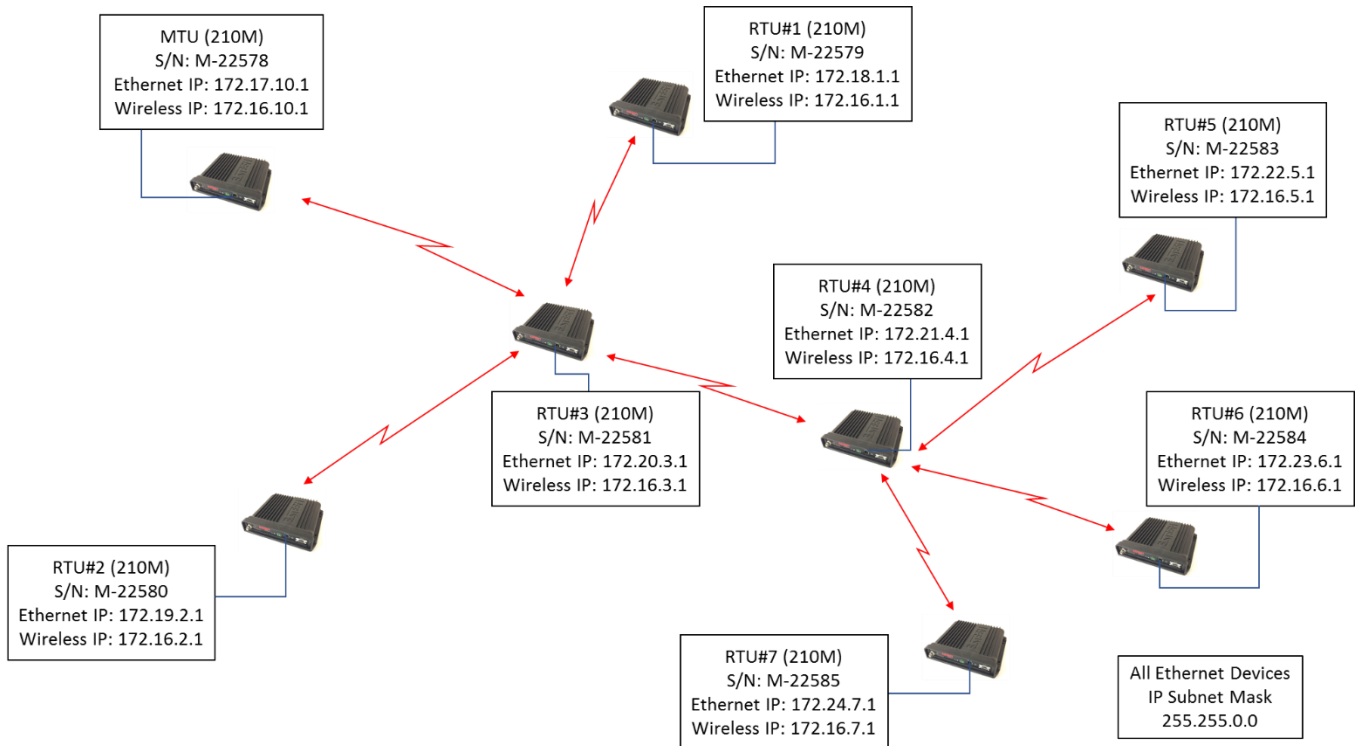


Figure 2: Wireless Networking Details

The following example (Figure 3) provides IP addressing detail for the first wireless link in the network from the MTU to RTU#3 being used as a repeater site:

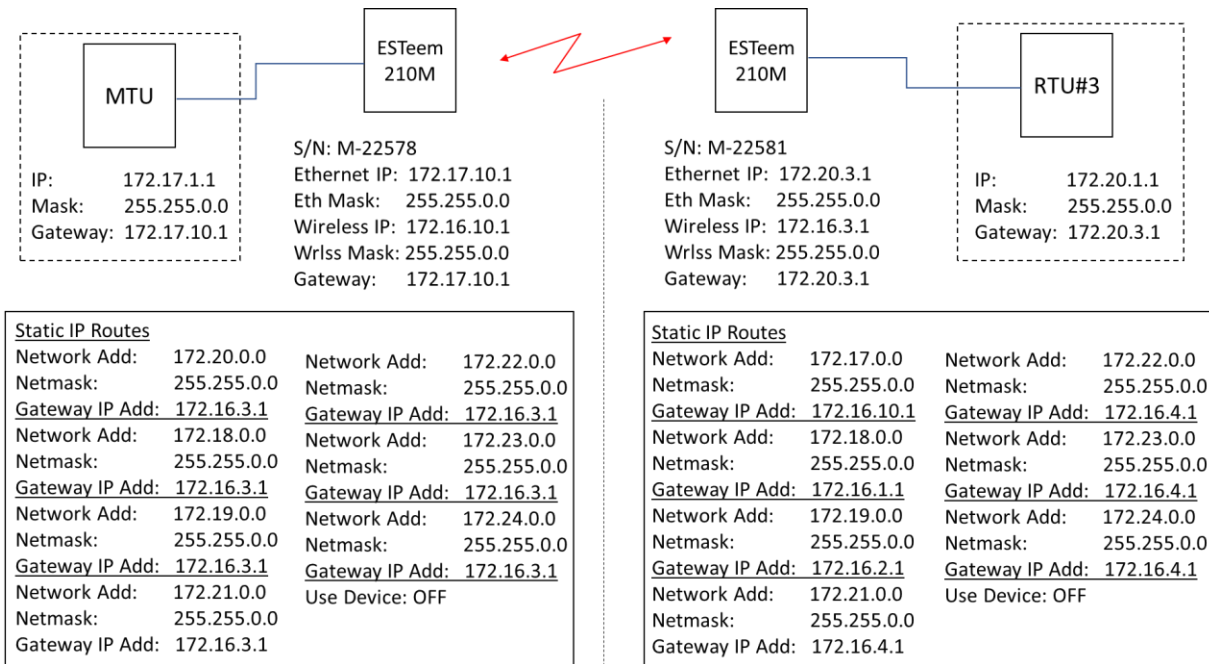


Figure 3: IP Addressing Example

Static Routing

As shown in the above addressing example, each remote IP subnet will have a static route entry in the ESTeem 210 in AP Router mode. This routing table will allow the ESTeem 210 to send IP traffic to the correct destination and eliminate all Ethernet traffic not specifically for remote devices.

Another key configuration point is that the Static Routes beyond a repeater site only require entry of the "Upstream Gateway" IP address. For example, in the MTU configuration the Static Routes for all remote IP subnets point at Wireless IP address of RTU#3. RTU#3 is the Upstream Gateway for the MTU because all remote traffic passes through the repeater site.

In contrast, the Static Route configuration at RTU#3 has the routing information for the MTU, RTU#1, RTU#2 and RTU#4 (direct RF links from this site) but the sites past the RTU#4 repeater (RTU#5, RTU#6 & RTU#7) are programmed for the repeater's wireless IP address acting as the Upstream Gateway for those specific remote locations. This method of programming can be extended to all sites.

ESTeem Model 210 Programming Example – MTU

This programming example will show the internal web configuration of the Model 210M radio at the MTU site. This engineering report assumes the user is familiar with how to Discover the ESTeem 210 series radio and open the radio in a web browser. For questions on how to begin programming, please refer to the ESTeem Model 210 User's Manual.

- 1. From the Home screen in the Model 210 web Configuration Manager select the Setup tab and "AP Router" for mode of operation (Figure 4). Press the Next button to continue.

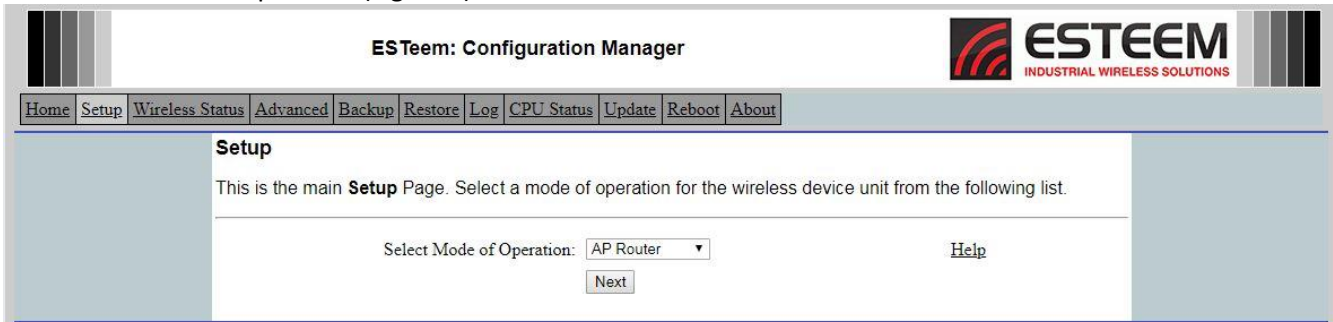


Figure 4:MTU Mode Selection

- 2. Enter the Ethernet IP address, Netmask and Default route (Gateway) IP for the MTU (Figure 5). The Default route should be the same as the Ethernet IP. Press the Next button.

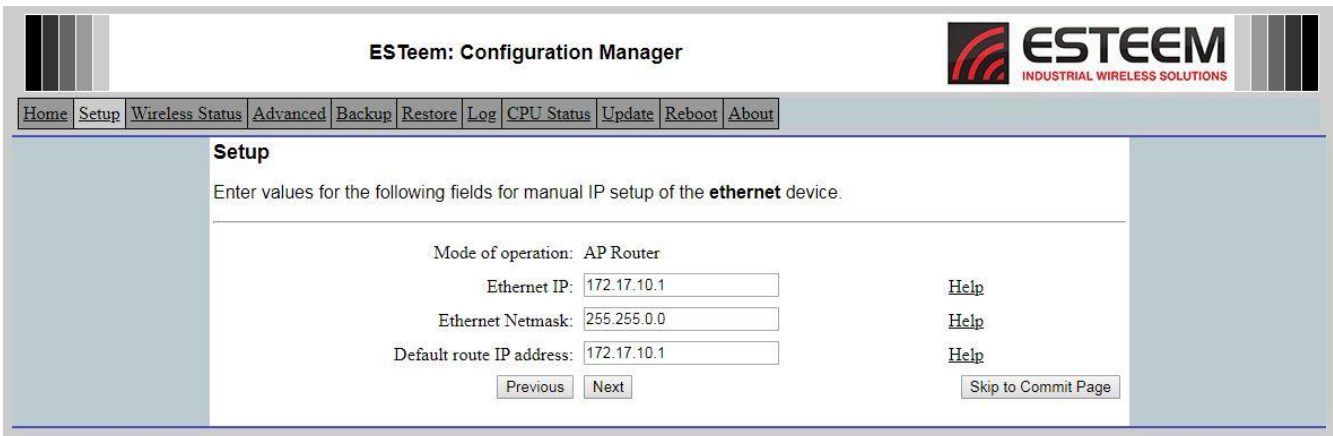


Figure 5:Ethernet IP

3. Enter the Wireless IP and Netmask of the AP Router (Figure 6). Press the Next button to continue.

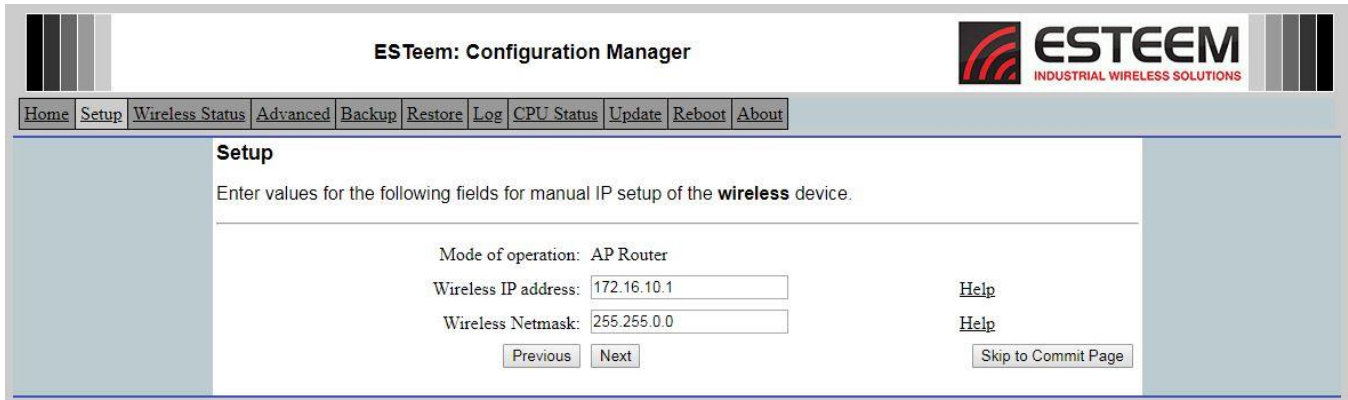


Figure 6: Wireless IP Entry

4. Select the RF Datarate and frequency of operation (Figure 7). These values must match in ALL Model 210 radios in the same wireless network. If there no line of sight (LOS) between antennas, the RF Datarate may need to be lowered to 43.2 Kbps or lower based on testing. Press Next.

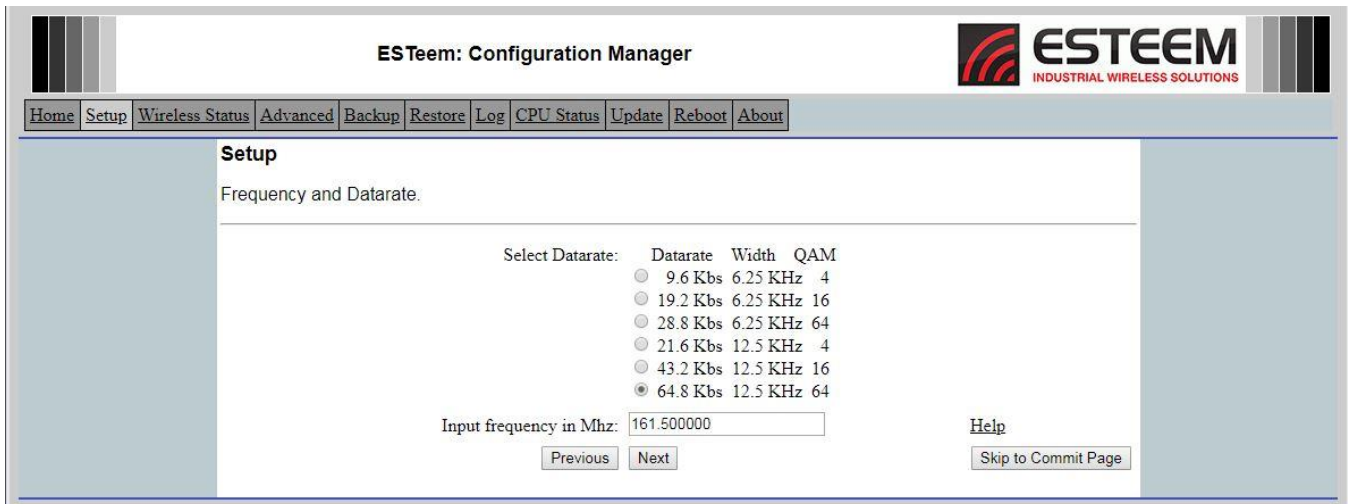


Figure 7: Datarate and Frequency

5. To maximize the Ethernet throughput set the Beacons to Disabled (Figure 8). Enter the SSID, select the Encryption type, and generate/enter the Encryption key. SSID, Encryption type, and Encryption key must match in all Model 210 radios in the same network. No Encryption in this example network so press the Next button.

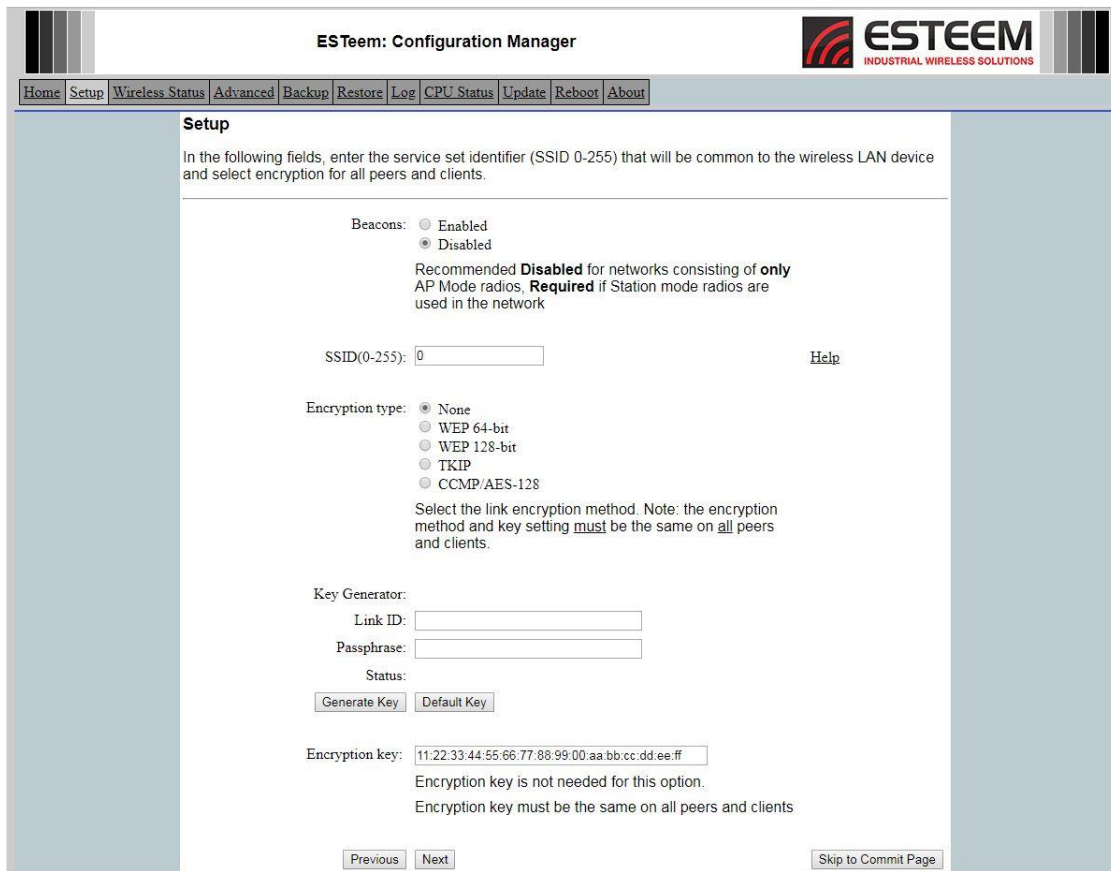


Figure 8:SSID & Encryption

- 6. Figure 9 shows the Access Control list where mobile Model 210 radios can be filtered by their MAC address. No mobile stations are in this example so leave at default and press Next button.

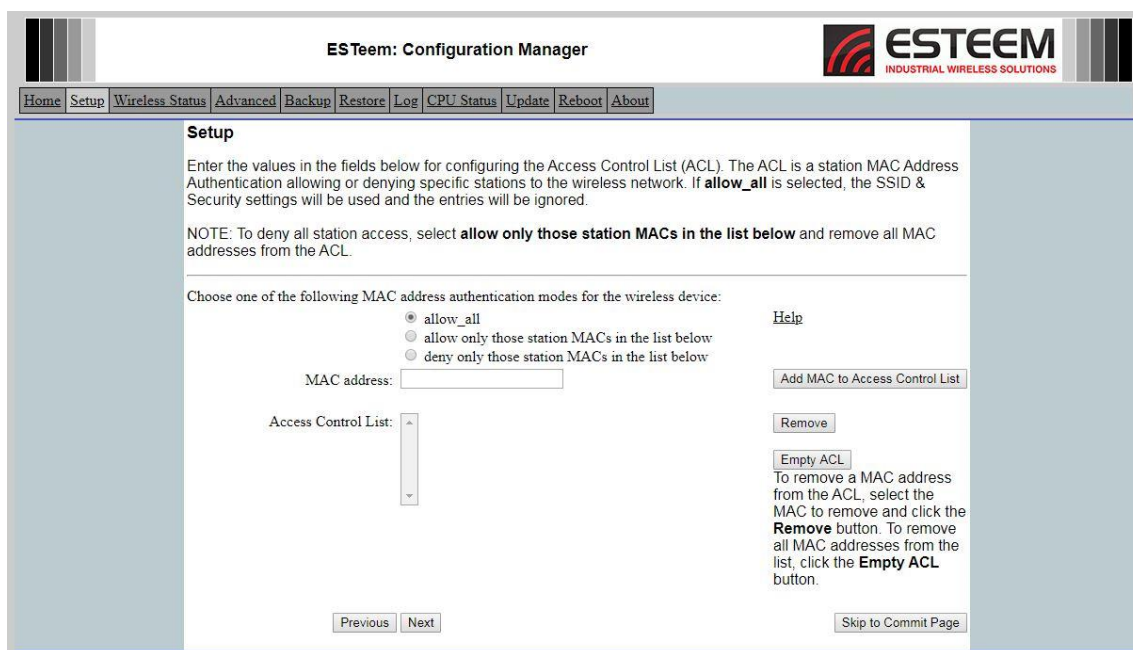


Figure 9:Access Control List

- The Wireless peer configuration screen is where the direct radio communication paths are entered. Enter only the remote ESTeem 210 radios that have a direct RF link to the radio. The MTU has only a single RF link to the repeater (Figure 1). Press the Add button (Figure 11 below) on the screen to add a radio peer link and Figure 10 will be displayed. Enter the serial number of the RTU#3-Repeater radio, verify the Enable Link is set and press the Create Peer button.

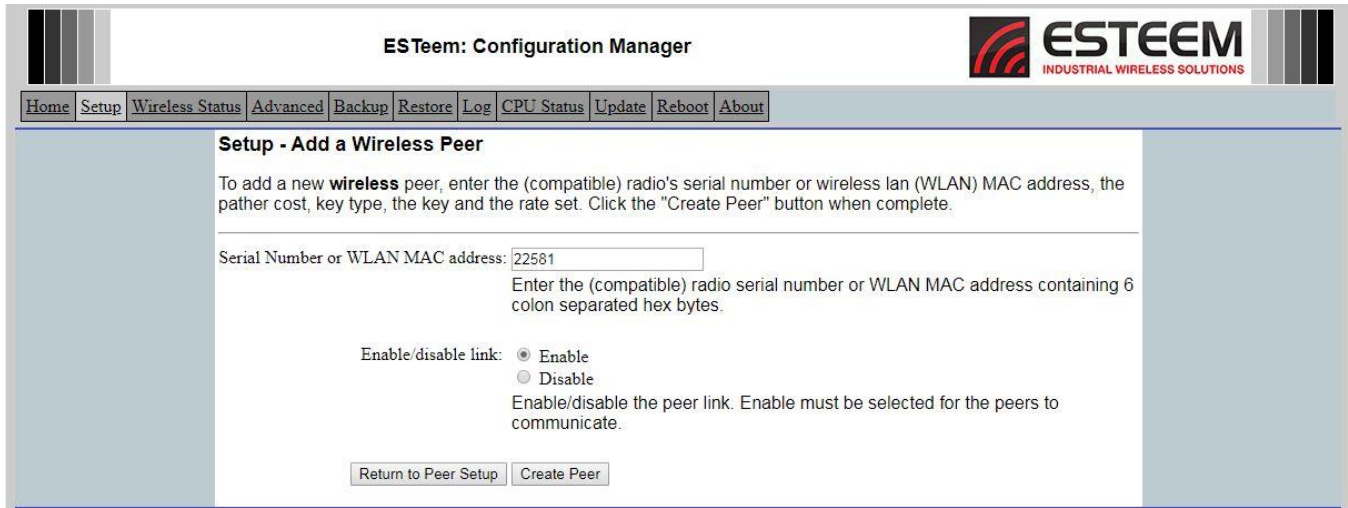


Figure 10: Peer Configuration

- Verify the serial number for the RF peer is correct (Figure 11) and press the Next button.

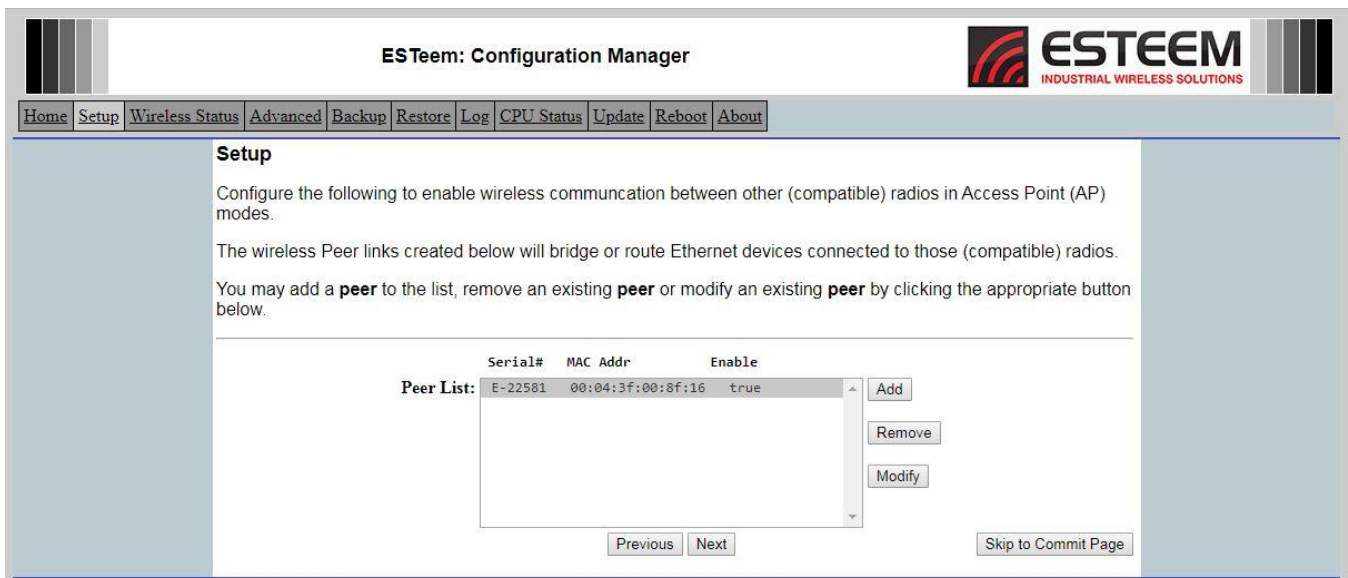


Figure 11: Completed Peer Entry

- Enter the name of the site being programmed in the Radio ID field. This Radio ID will be displayed in the Discovery utility, Home screen and wireless status for the site. AP Router uses both Static Routes and Static ARP Table that are in the Advanced menu. Press the “Go To Advanced Setup” button (Figure 12) to continue the programming.

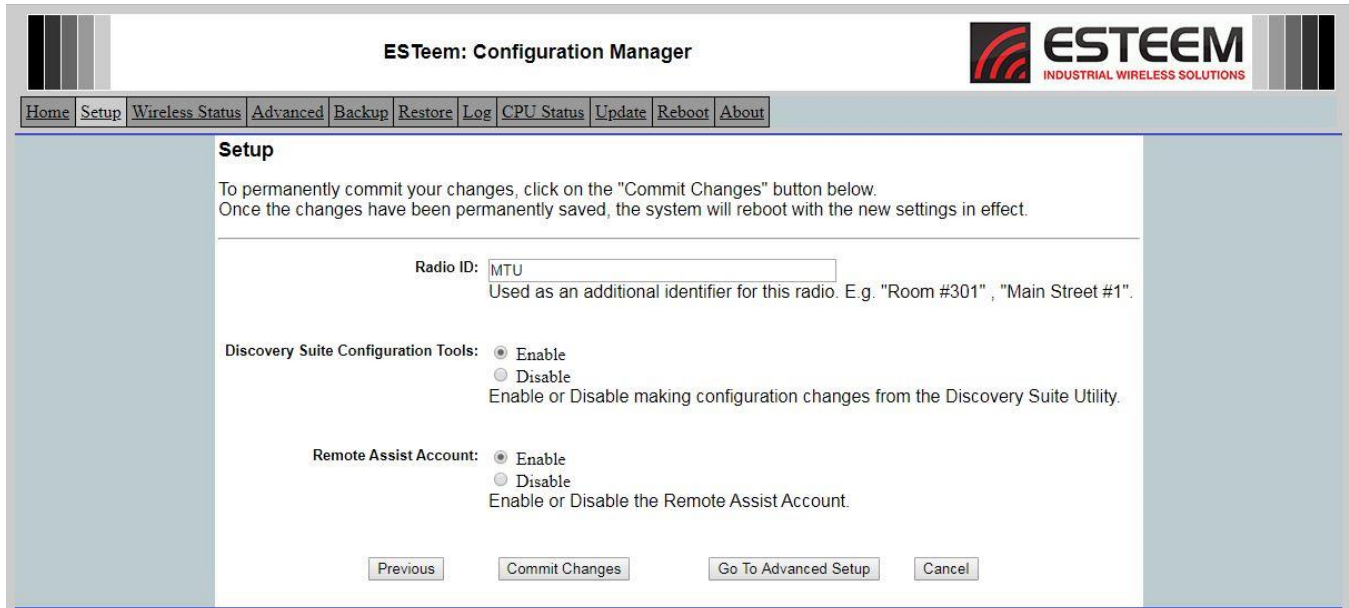


Figure 12:Radio ID and Commit Page

10. Move the radial to Static IP routes (Figure 13) and press the Next button.

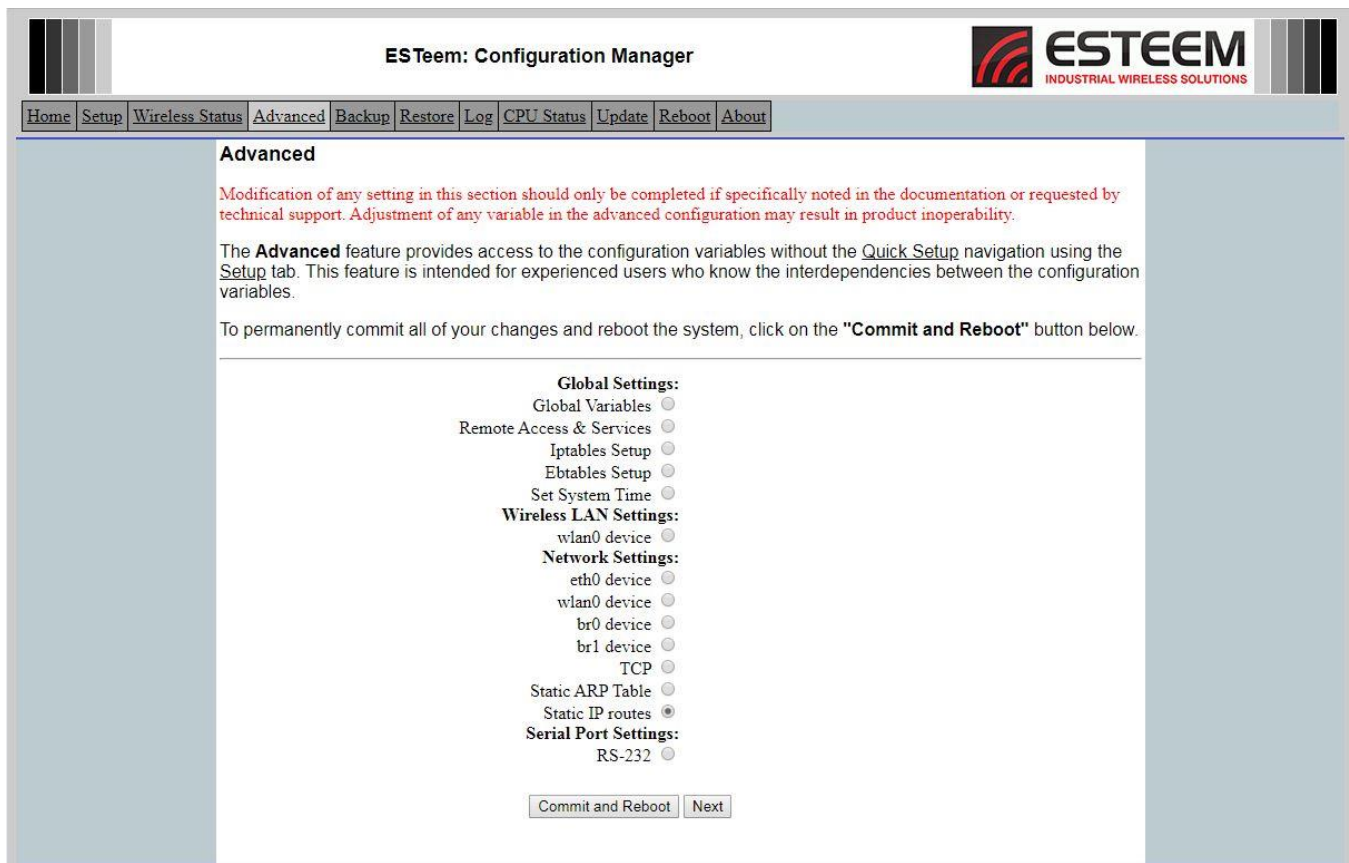


Figure 13: Select Static IP Routes

- 11. A blank Static Route IP table (Figure 14) will be displayed. This Static Route table will instruct the Model 210 how to find all remote IP subnets and their connected Ethernet devices. Press the Add button to begin the static route entry.

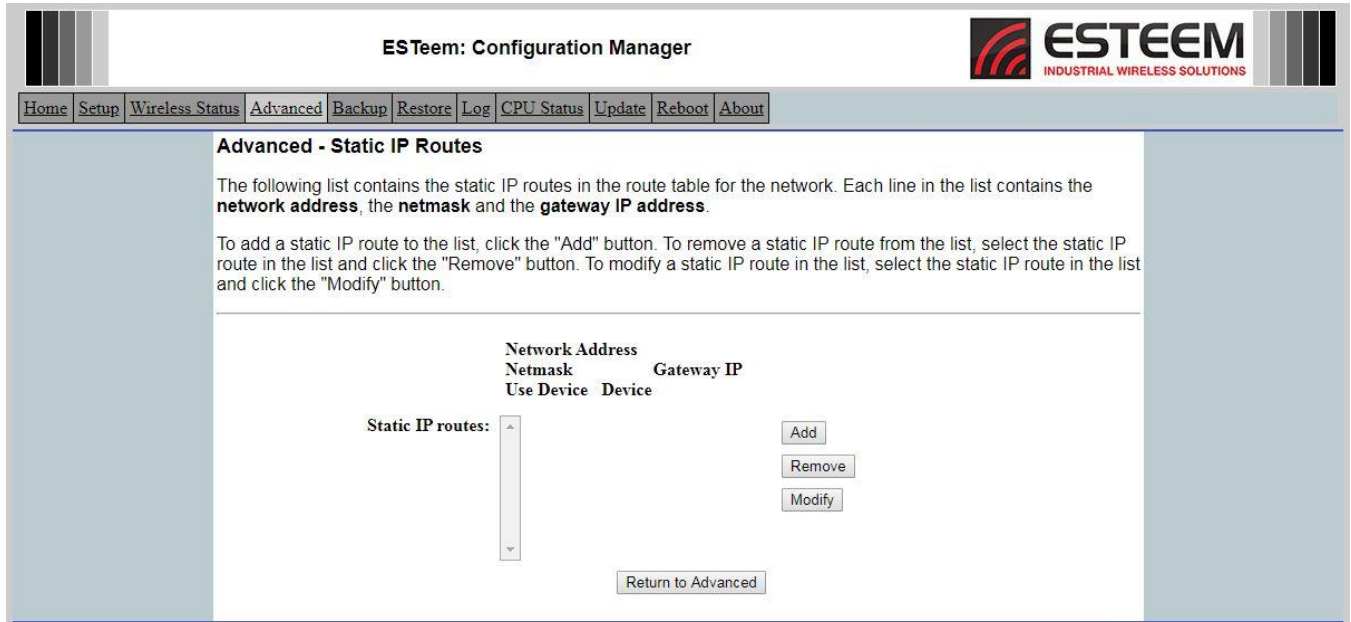


Figure 14:Blank Static Route Page

- 12. Figure 15 will be displayed. Review the site layout diagram (Figure 2) and note that RTU#3’s connected Ethernet devices will use a 172.20.xxx.xxx subnet. Enter the Network Destination address in the “Network address” field to cover all IP address in that subnet and then enter the Wireless IP address of the ESTeem 210 that will service that network (Figure 15) as the Gateway IP address. Press the “Create Static IP Route” button to create the route in the table.

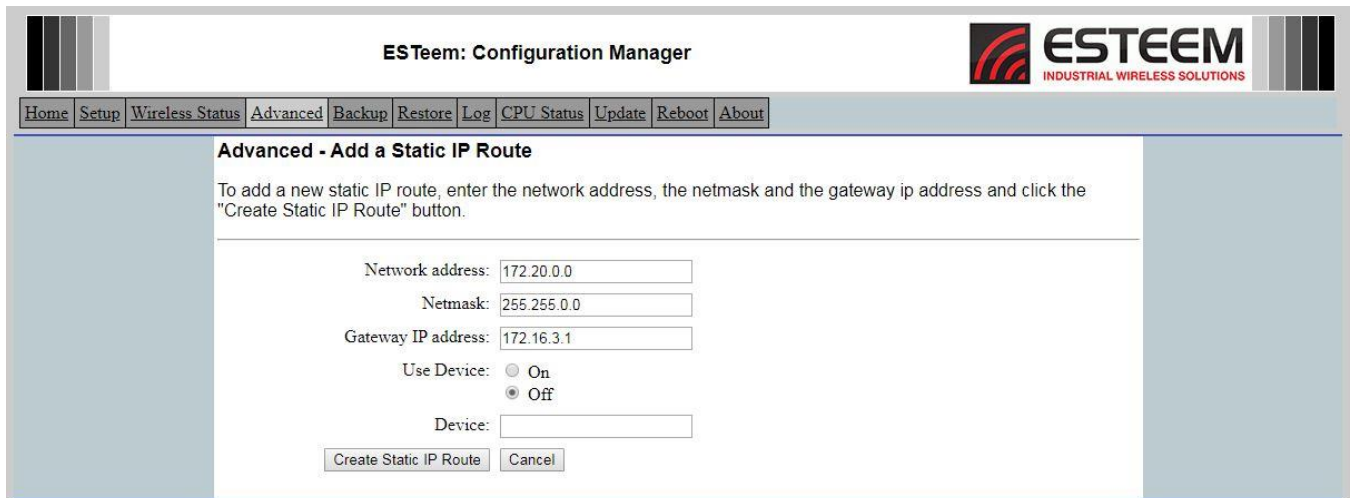


Figure 15:Static Route Entry for RTU#3

13. Every remote IP subnet that the connected Ethernet devices will communicate with need to be added to the Static Route table (Figure 16). In our example, the MTU will gather information from all remote sites so an entry for each remote subnet is required. As discussed in the Static Routing instructions above, only the Upstream Gateway address (Wireless IP of the repeater) is required for sites beyond a repeater. Continue entering until all sites are entered (Figure 16). Press the Return to Advanced button to continue programming.

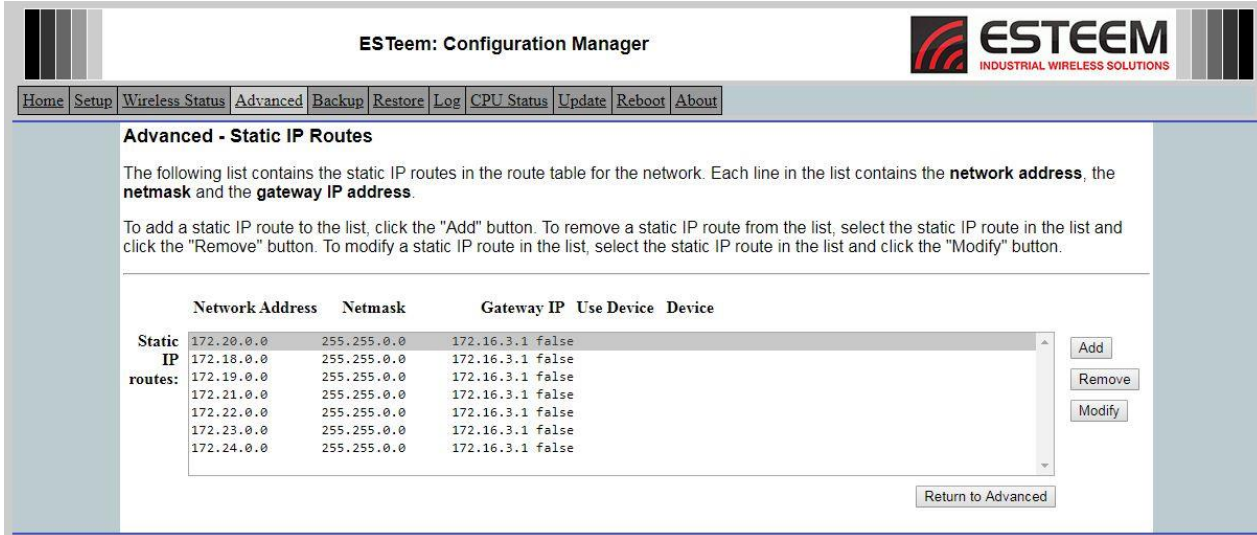


Figure 16: Completed Static Routes for MTU

14. Move the radial to the Static ARP Table entry (Figure 17) and press the Next button.

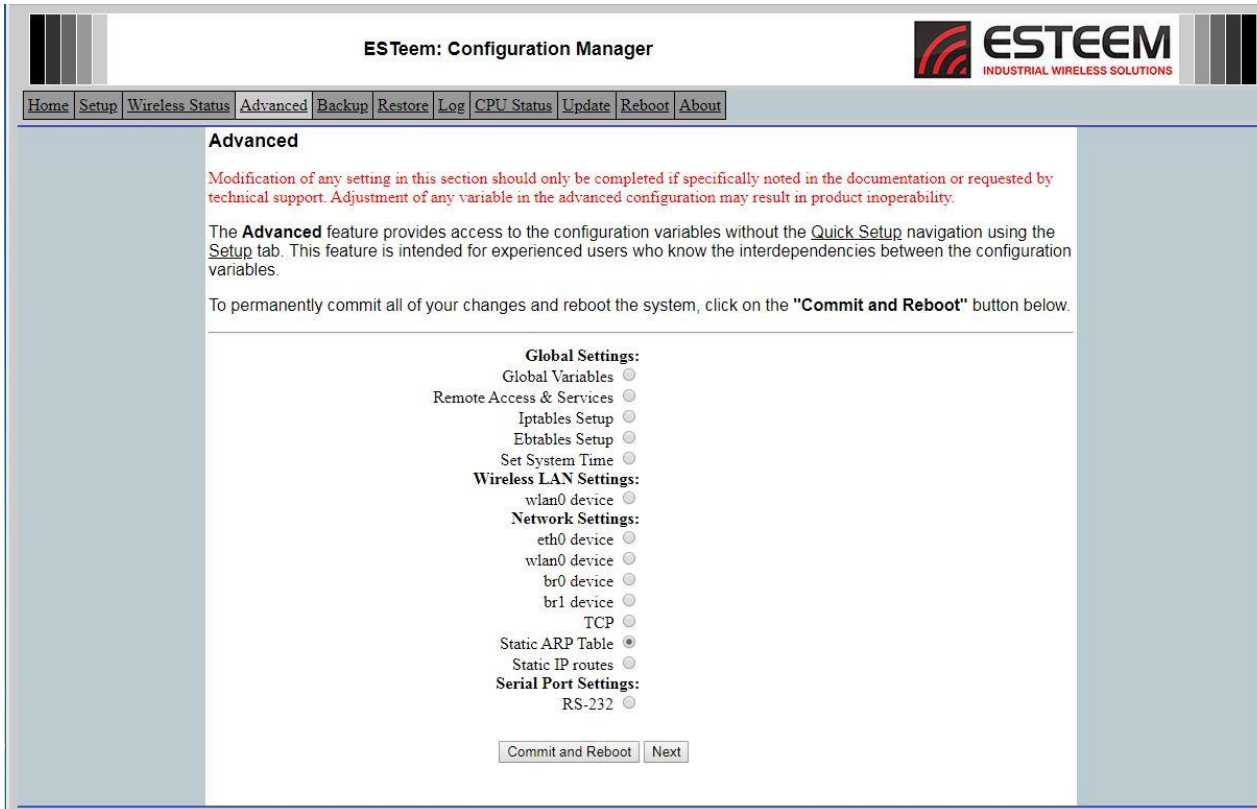


Figure 17: Advanced Menu > Static ARP Table

15. A blank Static ARP table will be displayed (Figure 18). Completing the Static ARP table is not required for operation of a Model 210 AP Router network but is recommended for highest network throughput. This ARP table will eliminate the ARP requests between radios when moving Ethernet packets through the router network. Press the Add button to begin entry.

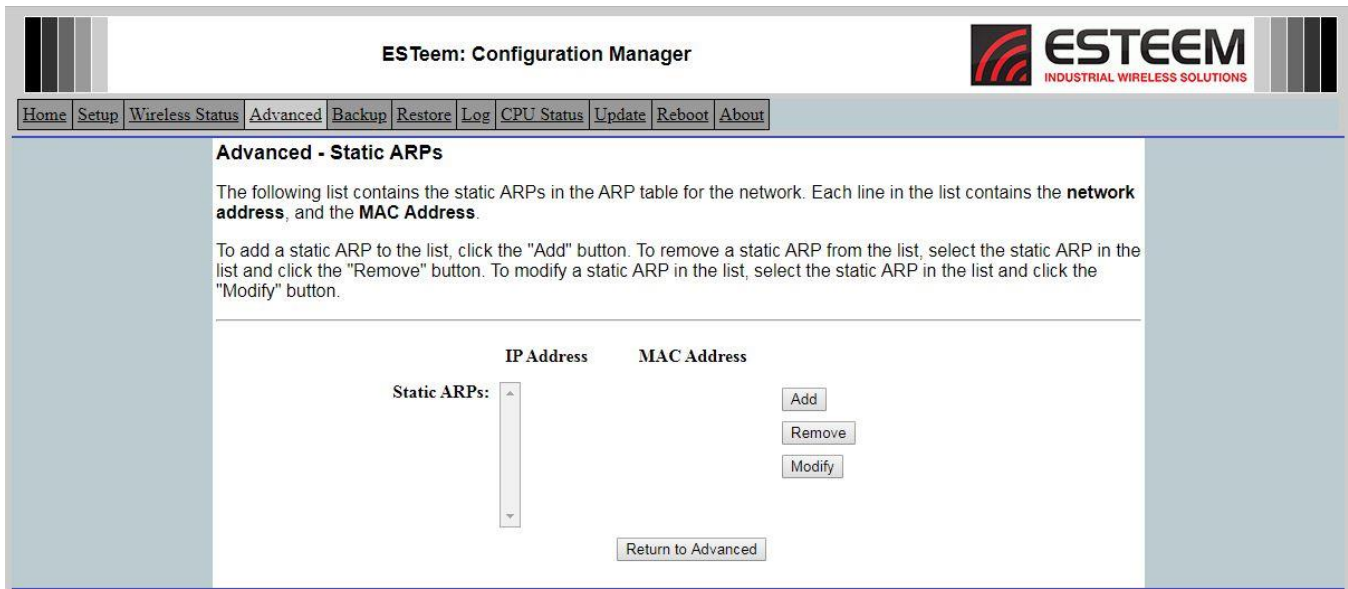


Figure 18: Blank Static ARP Table

16. Enter only the direct RF links from any radio as a Static ARP entry. The MTU in our example only has a single RF link to the RTU#3 repeater. Enter the Wireless IP address for remote radio and the WLAN MAC address (Figure 19) and press the Add button to create the entry.

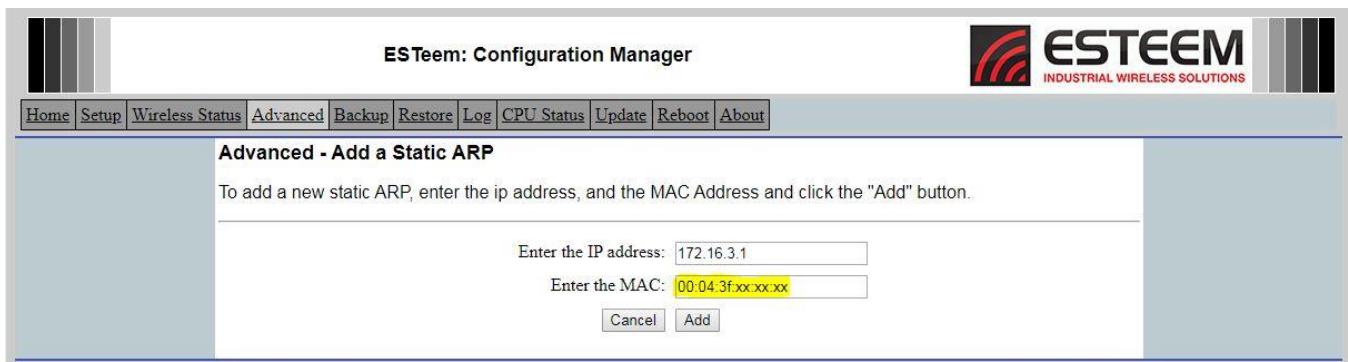


Figure 19: Static ARP Table Entry

17. Press the “Return to Advanced” button and then the “Commit and Reboot” button (Figure 17) to complete the programming of the MTU’s Model 210M radio.

ESTeem Model 210 Programming Example – RTU#3(Repeater)

This programming example is for the Model 210M at RTU#3 repeater site. All radios in wireless network will be programmed similar to the MTU or the RTU#3 repeater. Almost every configuration page for the 210M in RTU#3 is the same as shown above in the MTU configuration example. Only the pages with any programming changes will be shown below:

Setting the Ethernet IP address

Enter the IP address, netmask and Default route IP (Gateway) of RTU#3.

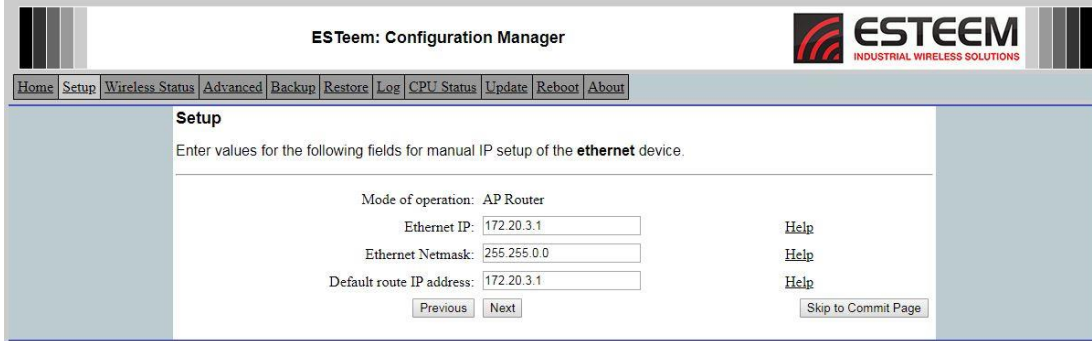


Figure 20: Set IP Address of Ethernet Interface

Setting the Wireless IP address

Enter the IP address and netmask of the wireless interface of RTU#3.

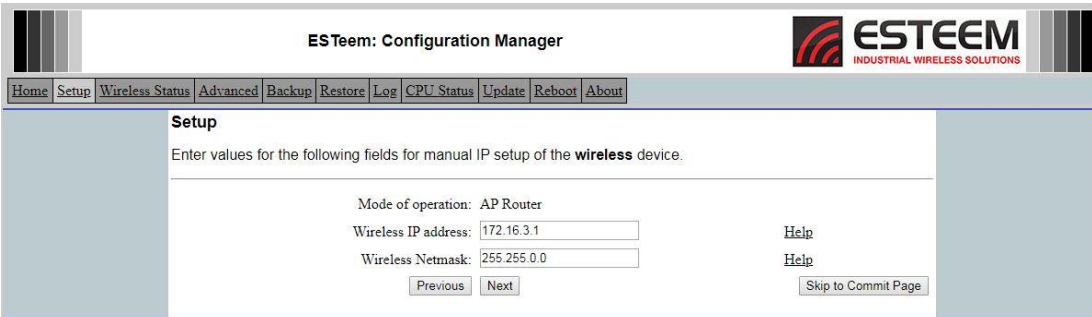


Figure 21: Configure the Wireless IP Address

Wireless Peer Configuration

Unlike the MTU, the RTU#3 radio has four (4) direct RF links. Each of these RF links will be a unique entry in the Peer table (Figure 22).

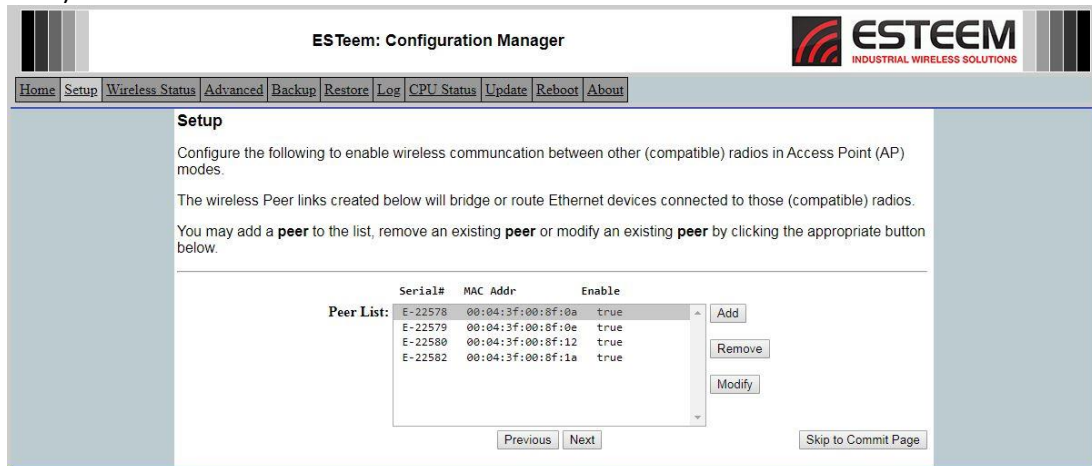


Figure 22: RTU#3 Peer Entry

Static Routing Table

RTU#3 has a direct connection to the MTU, RTU#1, RTU#2 and RTU#4 (second repeater). Note in Figure 23 that each of these direct location’s Ethernet IP subnets are routed to the Wireless IP address for each radio. Just like in the configuration of the MTU, all sites through a repeater (RTU#5, RTU#6 & RTU#7) are configured for the repeater’s Wireless IP address (Upstream Gateway address).

ESTEEM: Configuration Manager

Home Setup **Wireless Status** Advanced Backup Restore Log CPU Status Update Reboot About

Advanced - Static IP Routes

The following list contains the static IP routes in the route table for the network. Each line in the list contains the **network address**, the **netmask** and the **gateway IP address**.

To add a static IP route to the list, click the "Add" button. To remove a static IP route from the list, select the static IP route in the list and click the "Remove" button. To modify a static IP route in the list, select the static IP route in the list and click the "Modify" button.

	Network Address	Netmask	Gateway IP	Use Device	Device
Static IP routes:	172.17.0.0	255.255.0.0	172.16.10.1	false	
	172.18.0.0	255.255.0.0	172.16.1.1	false	
	172.19.0.0	255.255.0.0	172.16.2.1	false	
	172.21.0.0	255.255.0.0	172.16.4.1	false	
	172.22.0.0	255.255.0.0	172.16.4.1	false	
	172.23.0.0	255.255.0.0	172.16.4.1	false	
	172.24.0.0	255.255.0.0	172.16.4.1	false	

Buttons: Add, Remove, Modify, Return to Advanced

Figure 23: Static Routing Table for RTU#3

Static ARP Table

Configure the Static ARP table with all direct RF links from RTU#3. The WLAN MAC address for each radio can be found generated in the Peer Configuration (Figure 22), listed on the radio’s QA sheet or on the product label on the bottom of the Model 210 radio.

ESTEEM: Configuration Manager

Home Setup **Wireless Status** Advanced Backup Restore Log CPU Status Update Reboot About

Advanced - Static ARPs

The following list contains the static ARPs in the ARP table for the network. Each line in the list contains the **network address**, and the **MAC Address**.

To add a static ARP to the list, click the "Add" button. To remove a static ARP from the list, select the static ARP in the list and click the "Remove" button. To modify a static ARP in the list, select the static ARP in the list and click the "Modify" button.

	IP Address	MAC Address
Static ARPs:	172.16.10.1	00:04:3f:00:8f:0a
	172.16.1.1	00:04:3f:00:8f:0e
	172.16.2.1	00:04:3f:00:8f:12
	172.16.4.1	00:04:3f:00:8f:1a

Buttons: Add, Remove, Modify, Return to Advanced

Figure 24: Static ARP Table for RTU#3

Troubleshooting and Testing

Once all radios are configured correctly in the AP Router mode, all connected Ethernet devices can share Ethernet data. The following are a few troubleshooting notes to consider when testing or programming for the Model 210 AP Router network.

- Any Ethernet device connected to the Model 210 radio will need to be in the same IP subnet as the Ethernet IP configuration. The Ethernet device will also need to set its Gateway address to the Ethernet IP of the Model 210 radio. For example, a computer connected to the MTU (direct to the radio or through a switch) will need to have the IP subnet set to 172.17.xxx.xxx and the Gateway address to 172.17.10.1 (Figure 25).

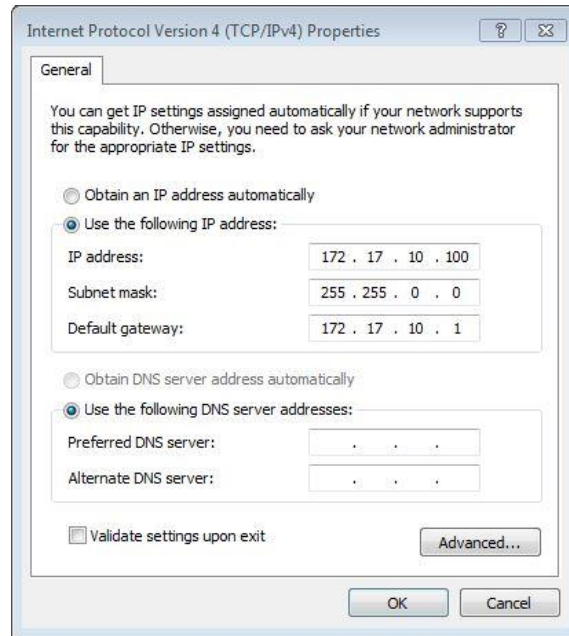


Figure 25: Ethernet Device MTU Settings

- If the computer (or any Ethernet device) is configured for a connection to the MTU (above) is moved to a remote location, the IP address and Gateway address will need to be adjusted. For example, if the computer is moved and connected to RTU#6's radio, the IP address will need to be changed to 172.23.6.100 and the Default gateway set to 172.23.6.1.
- With beacons disabled, the Status LED on the front panel will always be ON. Unlike other modes of operation, the Status LED will not go ON when connected and OFF when disconnected.
- When testing the communication links and routing to the remote radios and their devices, Ping the connected ESTeem 210's Ethernet IP address. You will also be able to Ping the remote radios' Ethernet IP addresses and connected devices but you will NOT be able to Ping the remote Wireless IP address.