

ESTEEM

Wireless Modems

ESTeem USER'S MANUAL

Models 195C – 195M

Manual Revision 1.0

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

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

PRODUCT WILL BE CONSIDERED OUT OF WARRANTY IF:

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

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

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

ADDITIONAL SERVICE:

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



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BEFORE YOU BEGIN

Thank you and congratulations on your purchase of the ESTeem Model 195C or 195M Wireless Radio Modem! This manual was written to help both the first time and advanced user of the 195C/M to configure the wireless modem for your application. If this is your first time configuring the 195C/M and you would like to get going as soon as possible, we recommend using the *ESTeem Resource CD* provided with the modem. The Resource CD will provide the software utilities and guide you through the configuration of the wireless modem for your application.



Figure 1: ESTeem Model 195C/M Series

The ESTeem 195C/M wireless modems are programmed through their Ethernet interface. To keep the manual usably short, many of the application descriptions and programming details assume the user has a good working knowledge of the following network concepts:

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

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

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

MODEL 195C/M OVERVIEW

The ESTeem Model 195C and 195M are wireless modem transceivers that can be used to build many types of Wireless Local Area Networks (WLAN). The ESTeem 195C/M series have multiple serial (RS-232, RS-422 and RS-485), Ethernet and 4/20mA sensor interfaces. The Model 195C and 195M can be configured for multiple modes of operation depending upon the needs of the wireless and wired network. The following interface configurations are provided as an overview of the basic network types, as all possible network configurations can not be listed. For further help in selecting the correct network type, please refer to Chapter 3 of this User's Manual or call Customer Support at 509-735-9092.

SERIAL APPLICATIONS

A Model 195C/M can be configured for point-to-point, multipoint or PLC emulations without any changes to the hardware. The following are brief descriptions of the Serial Device Interface (SDI) configuration modes. For detailed descriptions and suggested applications for each mode, please refer to Chapter 3.

Serial Applications

RS-232 – The ESTeem 195C and 195M have two (2) RS-232 data ports. One RS-232 port (Port 4) is available for use when the ESTeem 195C/M is remote pole mounted (Figure 2), but only supports the basic three wire (Transmit, Receive and Ground)

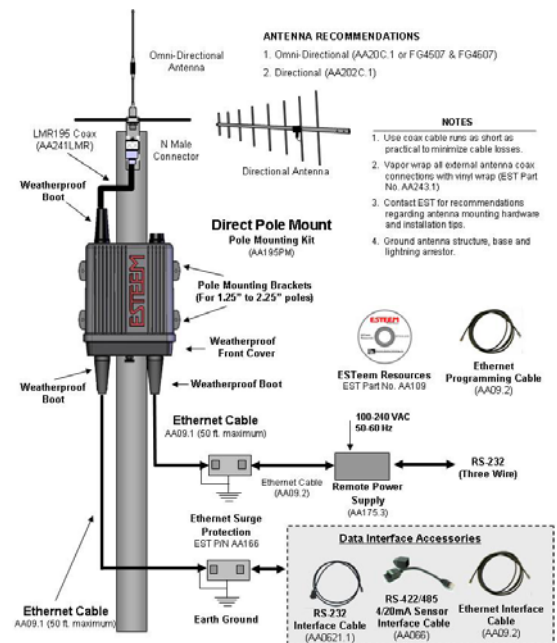


Figure 2 – Pole Mount Configuration

connection without any handshaking. The second RS-232 port (Port 3) has full hardware handshaking through the request to send (RTS) and clear to send (CTS) lines. Both ports are software configurable from 2,400 to 115,000 bps.

RS-422 – The ESTeem 195C and 195M have a single RS-422 data port (Port 2). The RS-422 data port is shared on the front panel with the 10/100 Mbps Ethernet interface. The RS-422 interface is good for long distances to 4,000 feet at bauds rate software configurable from 2,400 to 115,000 bps.

RS-485 – The ESTeems have a single, two-wire RS-485 data port (Port 1). The RS-485 data port is shared on the front panel with the 4/20mA sensors. The RS-485 interface is good for long distances to 4,000 feet at baud rates software configurable from 2,400 to 115,000 bps.

ETHERNET APPLICATIONS

The ESTeem 195C and 195M have a 10/100 Mbps Ethernet interface (Port 2) that is used as both a data port and the primary programming port. When the Ethernet port is used as a data port there are two modes of operation. The primary use will be as a slow speed (9,600 bps) Ethernet bridge to remote locations to gather data from remote Ethernet devices. The secondary mode of operation is to configure the Ethernet port as a TCP or UDP Socket and write custom software applications to access the data port. Each of these modes of operation are described in detail in Chapter 5.

SENSOR APPLICATIONS

The ESTeem 195C and 195M have four (4) independent configurable 4/20mA sensor inputs. The sensor inputs can be read from the 195C/M though either their ModbusTCP address or through a serial software command. These values can be read either locally our through the wireless network.

LEGACY - MODEL 192 APPLICATIONS

The ESTeem 195C can be integrated with our legacy ESTeem Model 192C or Model 192CHP, while the 195M can be integrated with Models 192M or 192MHP networks. There is a specific procedure to follow when integrating the new 195C or 195M in an existing network that can be found in Appendix C of this User's Manual.

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

OVERVIEW

There are three main phases to prepare the ESTeem 195C or 195M for operation in a wireless network:

Phase 1 - Determine the correct mode of operation for the ESTeem in the wireless network. The ESTeem 195C/M have multiple modes of operation and determining the correct mode of operation is the first step. Chapter 3 of this User's Manual details the modes of operation and applications where each would be used.

Phase 2 - Program the ESTeem for operation in the wireless network. Once the correct mode of operation for the ESTeem has been determined, the 195C/M can be programmed for the wireless network. To simplify the programming of the Model 195C/M, ESTeem has created a software utility called the ESTeem 195 Narrow Band Configuration Tool which is used to configure the wireless modem for use in the network. The ENC Utility can be installed from the ESTeem Resource Disk or from the ESTeem web site (www.esteem.com). Chapter 6 (Utilities and Features) of this User's Manual will guide you in the installation of the software and detailed operating guide.

The ESTeem Model 195C/M can also be programmed through individual software commands listed in Appendix A (Software Commands) of this User's Manual.

Phase 3 - Install the ESTeem hardware and test communication. After the ESTeem Model 195C/M's programming, install the hardware in each remote location. Chapter 7 of this User's Manual describes the antenna specifications, mounting options and the configuration of the pole mounting hardware for the ESTeem. For instructions on testing and troubleshooting the wireless link, refer to Chapter 6 (Utilities and Features).

MODEL 195C/M HARDWARE LAYOUT

To begin the configuration, unpack the ESTeem Model 195C/M shipping boxes and locate the items below for initial configuration. Take a few minutes to inventory your equipment before you proceed. Report any missing or damaged items to Customer Support (509-735-9092) as soon as possible. Each node in your ESTeem Model 195C/M's network may have different hardware components based upon the final installation location (i.e. Outdoor, Indoor, Point-to-point or Muti-Point). Antenna types, cable lengths, power supplies may be different, but the following items will be required for basic setup:

Model 195C/M



AA109 Resource Disk



Antenna
(AA20C.1 Displayed)



Coax Cable
(Antenna to ESTeem
195C/M)



Power Supply
(AA179 Displayed)



Ethernet Cable



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

MODEL 195C/M HARDWARE CONFIGURATION

The following steps should be completed to begin configuration of the ESTeem Model 195C/M:

1. Connect the antenna cable to the TNC connection on the ESTeem Model 195C/M (Figure 1).
2. Connect the power supply and Ethernet cable to the ESTeem and proceed to Chapter 3 to begin programming.

Technical Tips:

1. Configure the Model 195C/M prior to mounting.
2. Attach antenna to the Model 195C/M before powering up.

MODES OF OPERATION

The ESTeem Model 195C/M is a sophisticated wireless networking device that can be configured for multiple modes of operation. Determining the correct mode of operation for the ESTeem is the first step in creating a reliable wireless network. This chapter will explain each mode of operation, provide example applications and detailed programming information for each mode. Please review the following modes of operations. If you do not see an example of your application, please contact ESTeem support at 509-735-9092 for help in selecting your mode of operation.

Ethernet Bridge Mode (AP Bridge)

The most commonly used mode of operation with the ESTeem Model 195C/M is the Ethernet bridge mode. The Ethernet bridge mode will connect two or more ESTeem 195C/M's while passing all network traffic that arrives in both the wireless and connected Ethernet ports; including all global network traffic (Figure 1). This mode will work in most wireless applications of the 195C/M to wirelessly connect two or more remote Ethernet devices or networks. The Ethernet bridge mode is also used in repeating (Figure 2) and in self-healing Mesh networks (Figure 3) for fixed (non mobile) applications.

Example Applications

- Building to building remote wireless LAN networks
- Point to point wireless Ethernet communication devices
- Multi-point wireless Ethernet networks
- Remote Supervisory Control and Data Acquisition (SCADA) networks
- Redundant, self-healing Mesh networks
- Fixed locations with mobile ESTeem 195C/M's

Applications Where Ethernet Bridge Mode Not Used

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

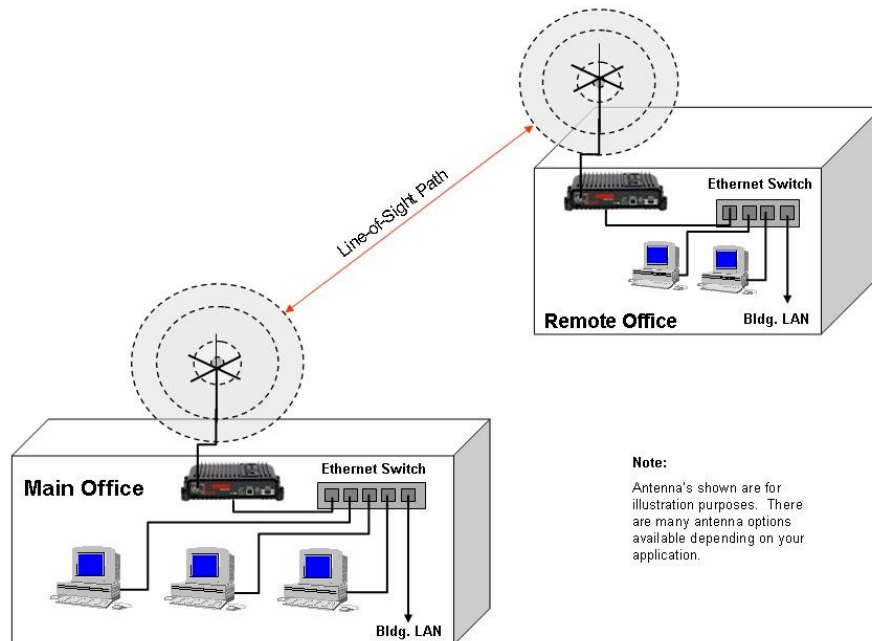


Figure 1: Point to Point Example

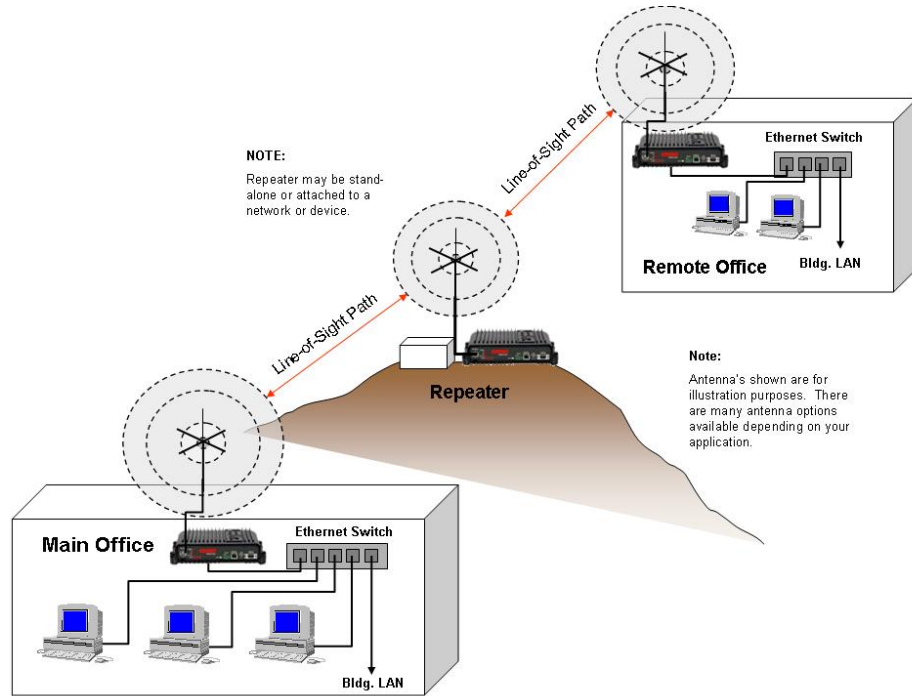


Figure 2: Ethernet Bridge with Repeater

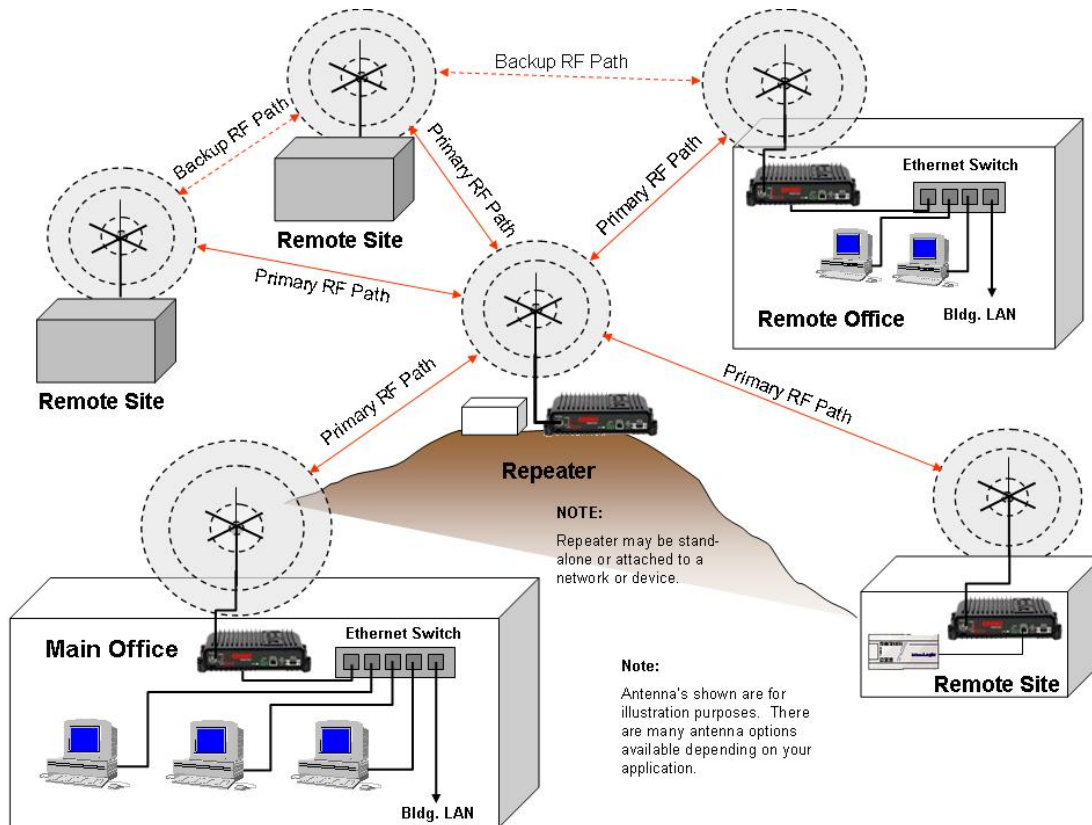


Figure 3: Multipoint Bridge with Mesh Networking

Router Modes (AP Router and AP Masquerade)

The ESTeem 195C/M can be configured as a network router or network firewall between the Ethernet LAN connection and the wireless network of remote locations. The router modes are used to limit the network traffic from a busy Ethernet network connection to only those specific IP address used on the wireless network (see Figure 4). The Ethernet router mode (AP Router) will allow bi-directional communication from the Ethernet LAN connection to the wireless network.

Example Applications

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

Applications Where Ethernet Router Mode Not Used

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

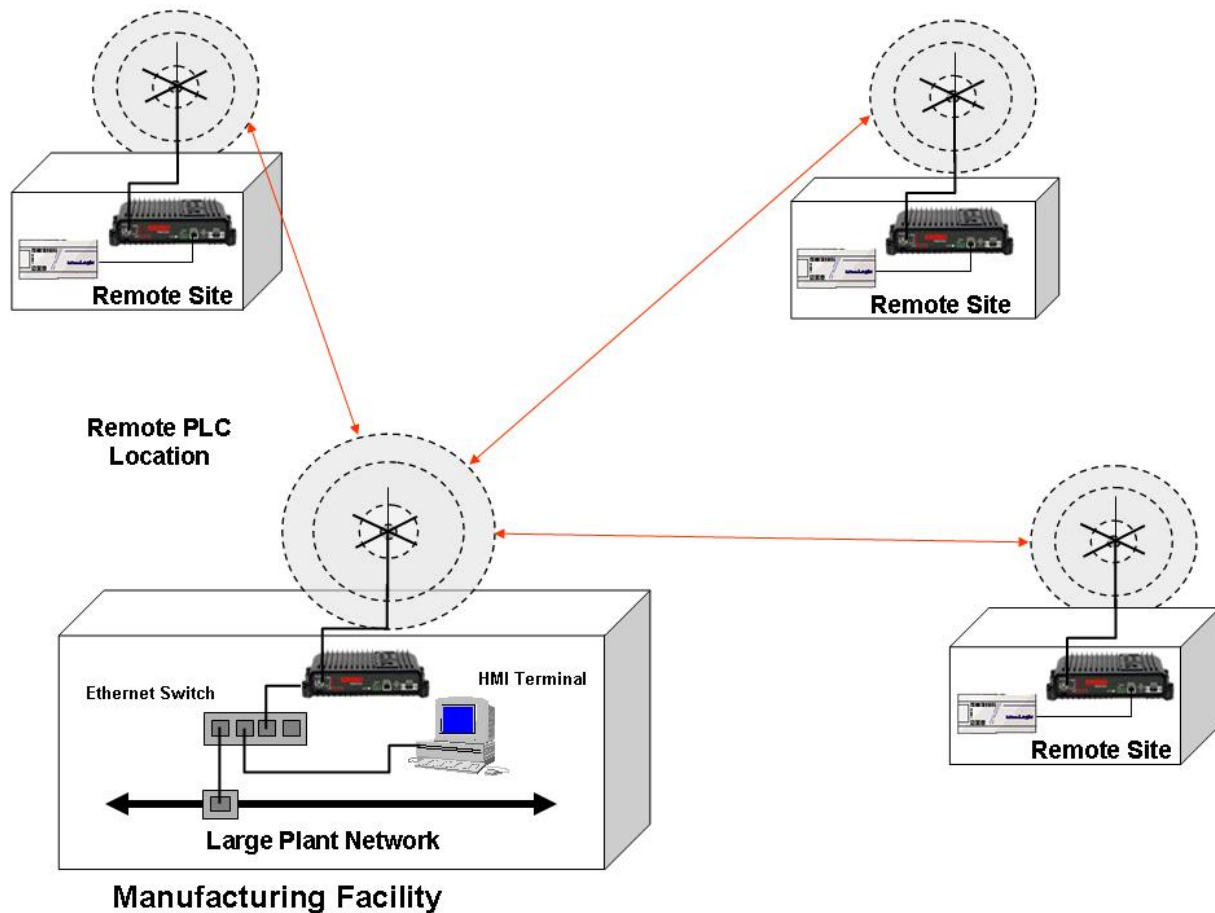


Figure 4: Router Mode Example

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

The ESTeem 195C/M can also be configured to function as a mobile client. The client modes allow the 195C/M to seamlessly roam between fixed Access Points. The client modes will allow mobile Ethernet devices to connect to each other or to an Ethernet LAN through the fixed AP (Figure 5).

The EtherStation mode is used to connect a single Ethernet device to the ESTeem 195C/M. If you are connecting the 195C/M to multiple Ethernet devices in a mobile mode, the Station Router or Station Masquerade will be required. The Station Router will allow bi-directional communication between the Ethernet devices connected to the 195C/M and the wireless network, while the Station Masquerade will serve as a firewall on the Ethernet side.

Example Applications

- Mobile applications where the 195C/M will change links often between fixed Access Points
- Long range mobile client networks
- Public safety applications for police, fire and EMS

Applications Where Mobile Client Mode Not Used

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

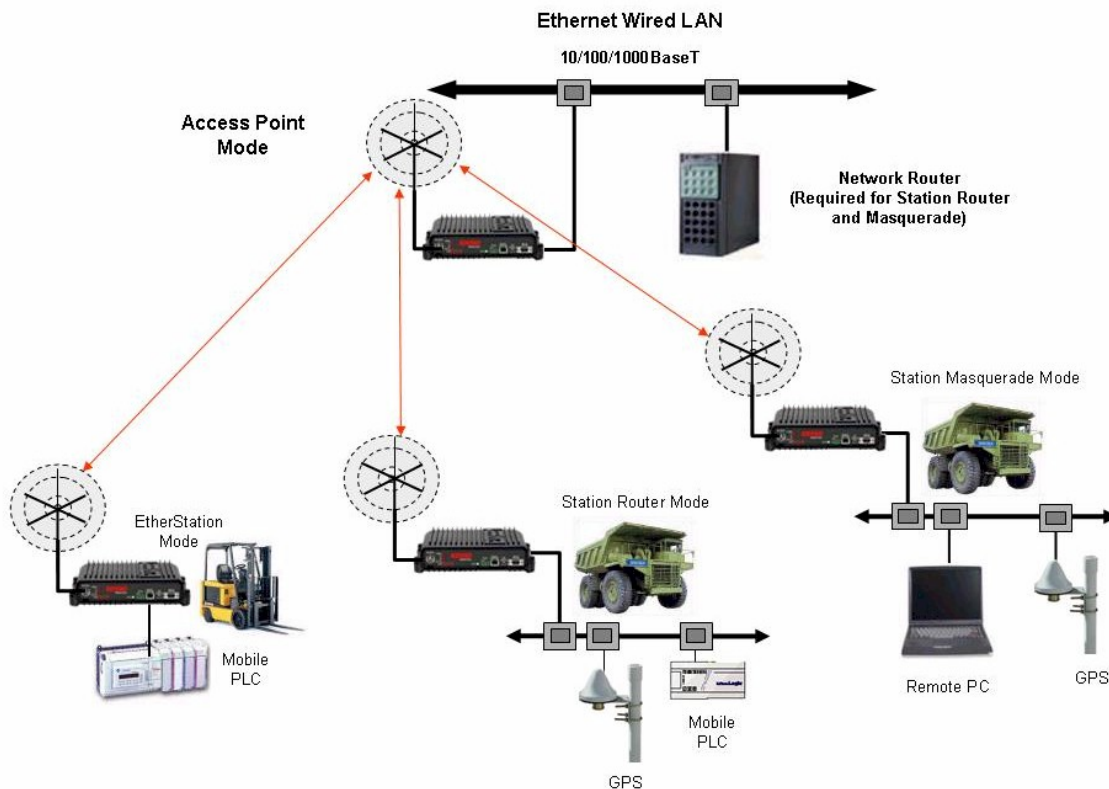


Figure 5: Router Mode Example

PROGRAMMING EXAMPLES

Once the mode of operation for the ESTeem has been determined, you are now ready to program the Model 195C/M for use. ESTeem has created a simplified network programming utility call the ESTeem Network Configuration (ENC) Utility. This ENC Utility will be used in all the following programming examples. For detailed instructions on installing the ENC Utility, please refer to the User's Guide (found in the ESTeem Resource CD or Utility program itself) or Chapter 4 of this User's Manual.

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

Adding ESTeems to ENC Utility and Changing Name

Each of the example applications will use the following procedure to add and rename ESTeem 195C/M's.

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

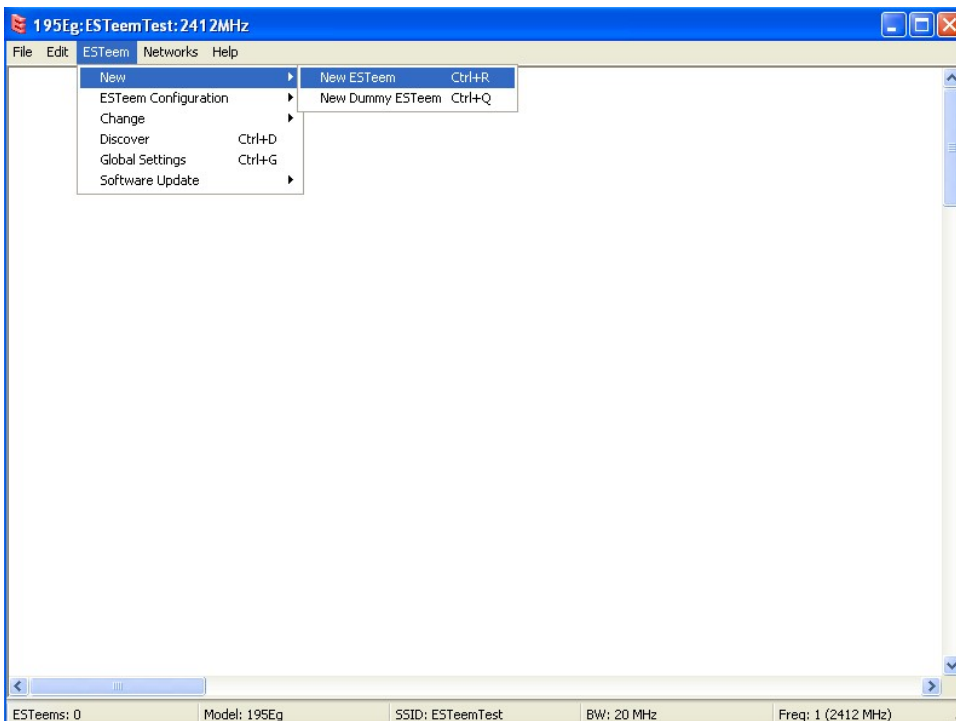


Figure 9: Adding ESTeem to Blank ENC Configuration Page

2. Enter in the ESTeem Model 195C/M serial numbers used for the example (for example enter E-14000 in the Set Serial Number Box) and press the OK button (Figure 10). The ENC Utility will look up the ESTeem 195C/M's serial number in the database and match the correct Wireless LAN MAC (WLAN MAC) address to the modem. This WLAN MAC address will be displayed above the modem symbol on the screen (Figure 11).

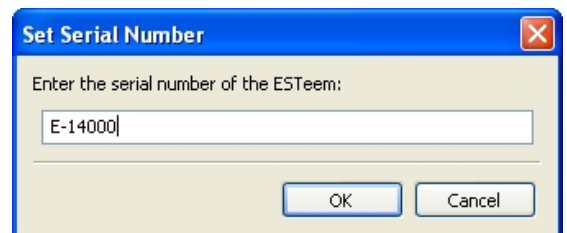


Figure 10: Enter the Serial Number

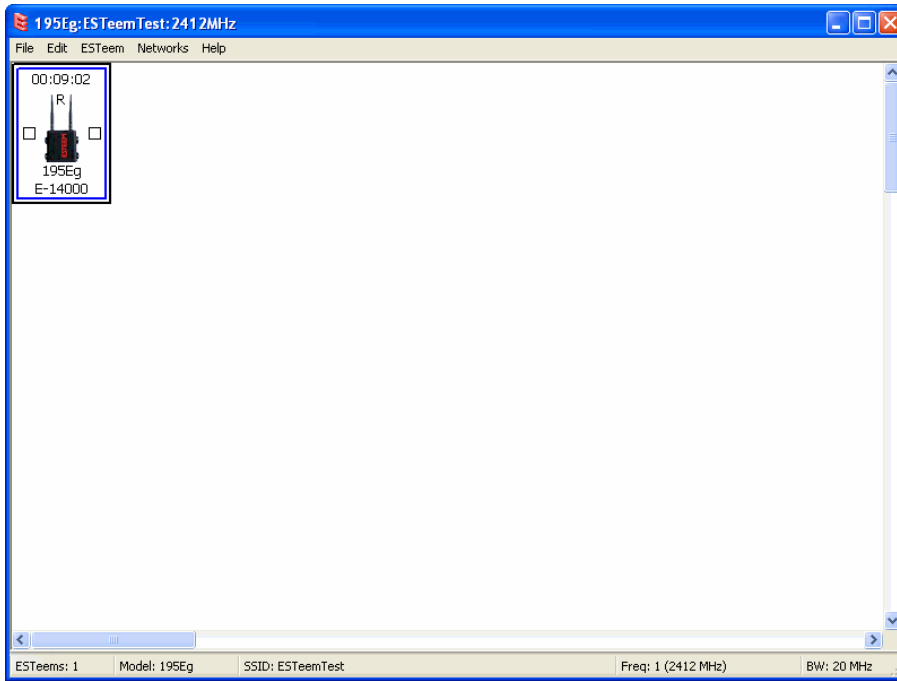


Figure 11: Main Office ESTeem 195C/M

3. To change the name of the ESTeem 195C/M from the WLAN MAC address to “Main Office” (or any other location name) to match the example configuration, Right-Mouse click on the ESTeem icon and select Change>Change Modem ID (Figure 12). Enter “Main Office” in the pop-up window and select OK.
4. Duplicate the above procedure for each ESTeem 195C/M added to the network.

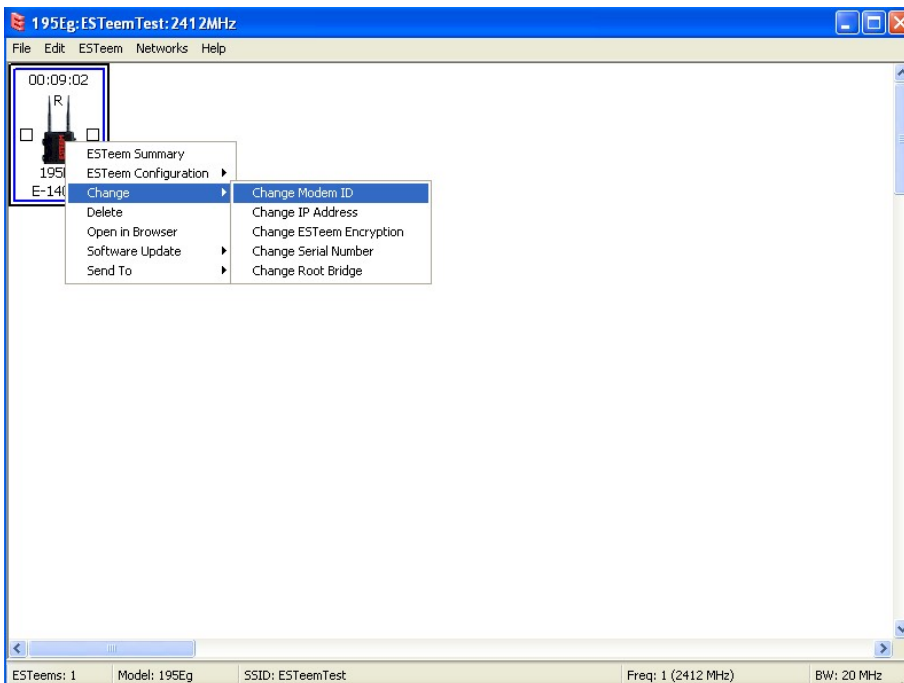


Figure 12: Change Modem ID

Ethernet Bridge Mode Example 1 (Figure 1)

Point to Point Ethernet Bridge

(2) ESTeem Model 195C/M

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

1. Add the two ESTeem Model 195C/Ms to the network using the above procedure. Once both ESTeem 195C/Ms are on the configuration page, create a wireless link by clicking on one of the two connection boxes and dragging a line to the other modem (Figure 13).
5. Verify both ESTeem modems are connected to the same switch as the computer running the ENC Utility and send the configuration to both modems at the same time by selecting ESTeem>ESTeem Configuration>Send Configuration to All ESTeems (Figure 14).
6. Once the ENC Utility has downloaded the configuration for both ESTeem 195C/Ms, the status box around the ESTeems will change from yellow to blue. This indicates that the configuration was completed successfully and the ESTeem 195C/Ms are ready to be installed in the application.

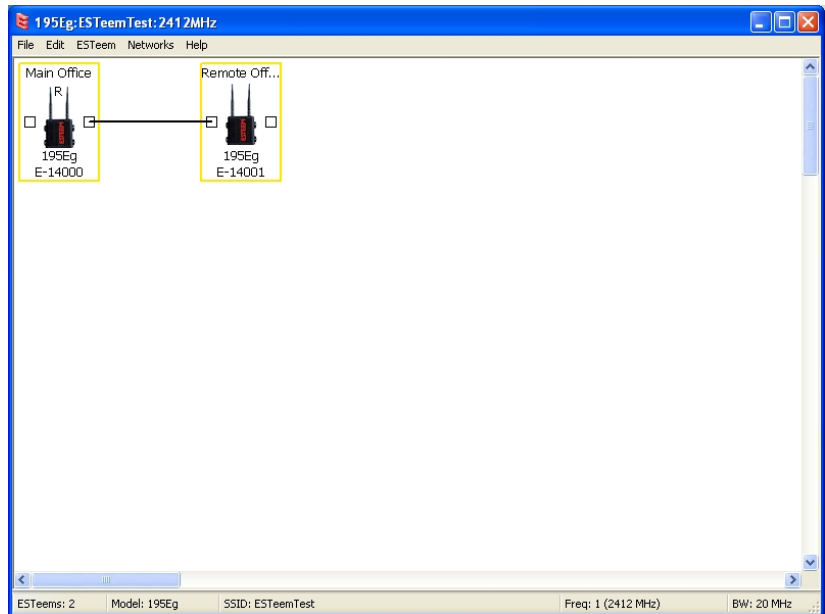


Figure 13: Create Wireless Link

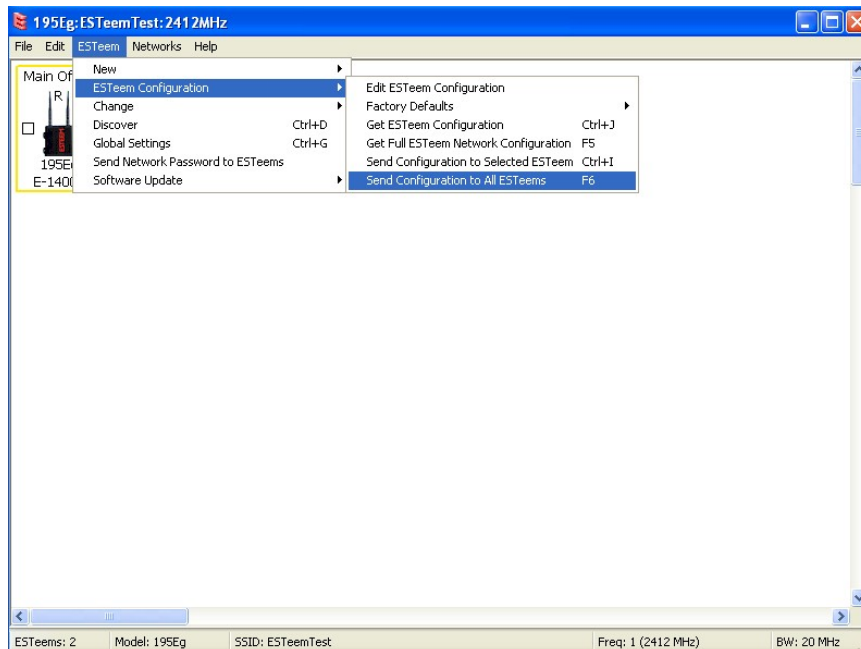


Figure 14: Send Configuration to ESTeems

Ethernet Bridge Mode Example 2 (Figure 2)

Point to Point with Repeater Ethernet Bridge

(3) ESTeem Model 195C/M

Serial Numbers:

E-14000 (Main Office)

E-14001 (Remote Office)

E-14002 (Repeater)

1. Using the above procedure, enter the three ESTeem 195C/Ms into the ENC Utility. Your layout should appear like Figure 14.
2. Move the ESTeem 195C/M icons on the screen to simulate the layout of the diagram. Draw connection lines between the modems to make the wireless link in the same order as the network layout (Figure 15).
3. Verify all ESTeem modems are connected to the same switch as the computer running the ENC Utility and send the configuration to both modems at the same time by selecting ESTeem>ESTeem Configuration>Send Configuration to All ESTeems. Once the ENC Utility has downloaded the configuration for both ESTeem 195C/M's, the status box around the ESTeem's will change from yellow to blue. This indicates that the configuration was completed successfully and the ESTeem 195C/M's are ready to be installed in the application.

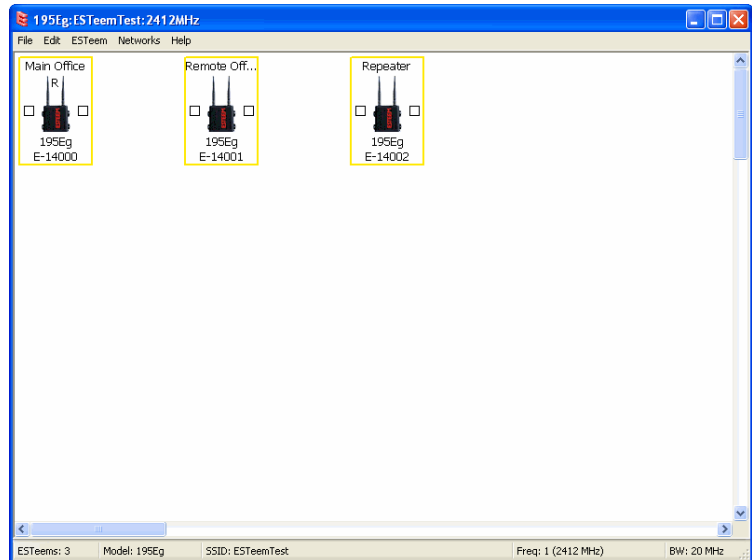


Figure 14: Example 2 Modems

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

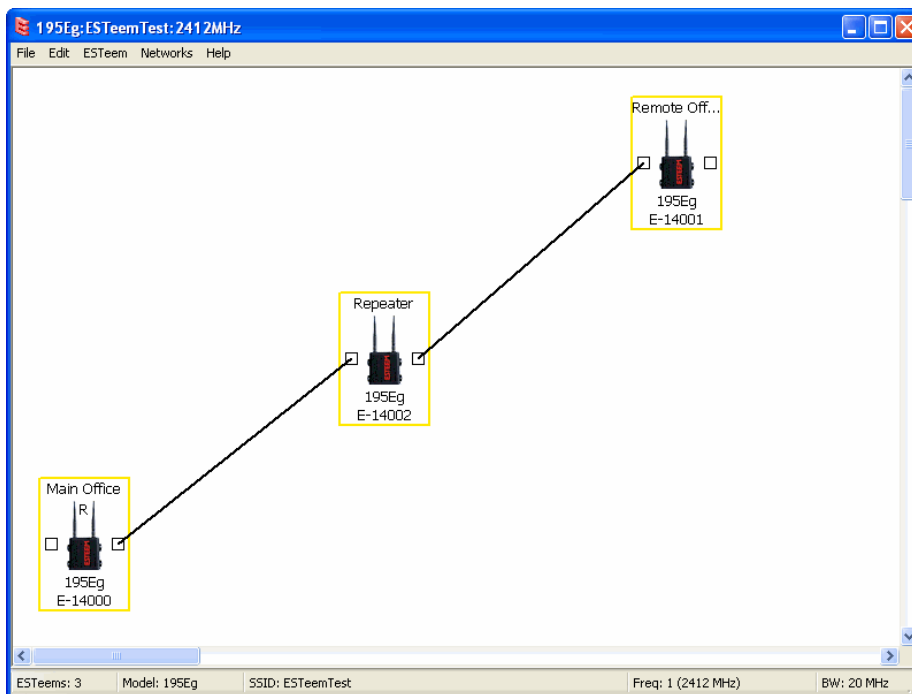


Figure 15: Example 2 Layout

Ethernet Bridge Mode Example 3 (Figure 3)

Point to Multipoint with Mesh Repeater Links

(6) ESTeem Model 195C/M

Serial Numbers:

E-14000 (Main Office)

E-14001 (Remote Office)

E-14002 (Repeater)

E-14003 (Remote Site 1)

E-14004 (Remote Site 2)

E-14005 (Remote Site 3)

1. Using the above procedure for adding ESTeem Model 195C/Ms, add the six ESTeem 195C/Ms for this example and rename by location. Your layout should appear like Figure 16.
2. Move the ESTeem 195C/M icons on the screen to simulate the layout of the diagram. Draw connection lines between the primary wireless links modems in the same order as the network layout (Figure 17).

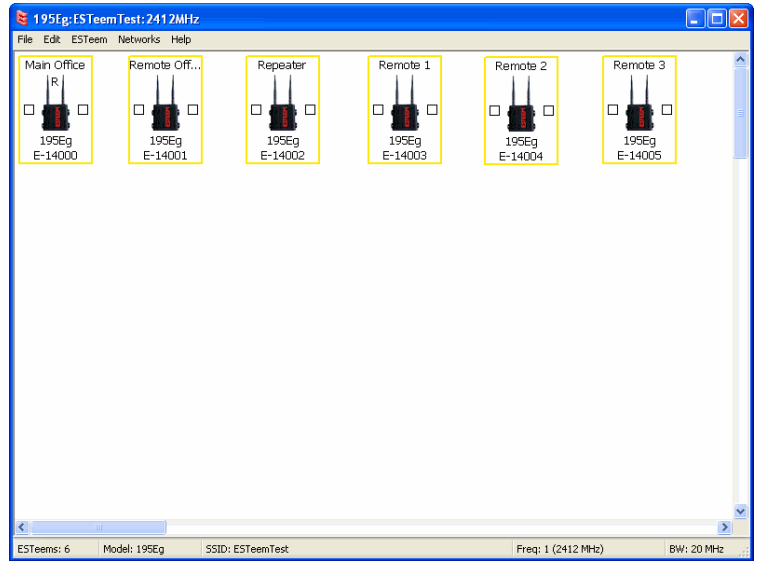


Figure 16: Example 3 Modems

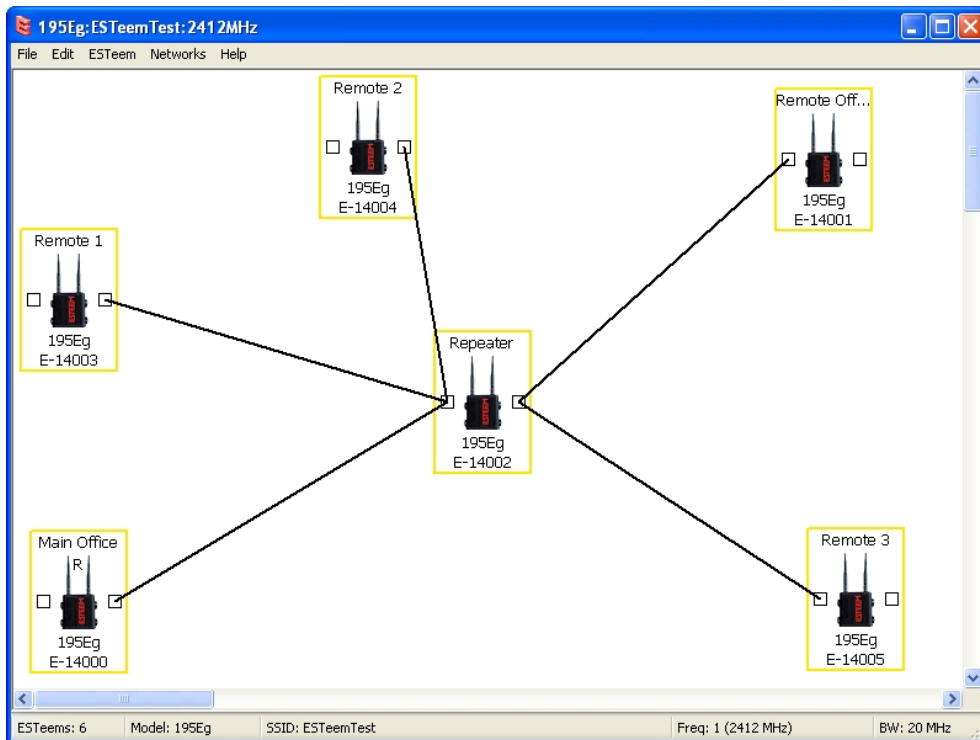


Figure 15: Example 2 Layout

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

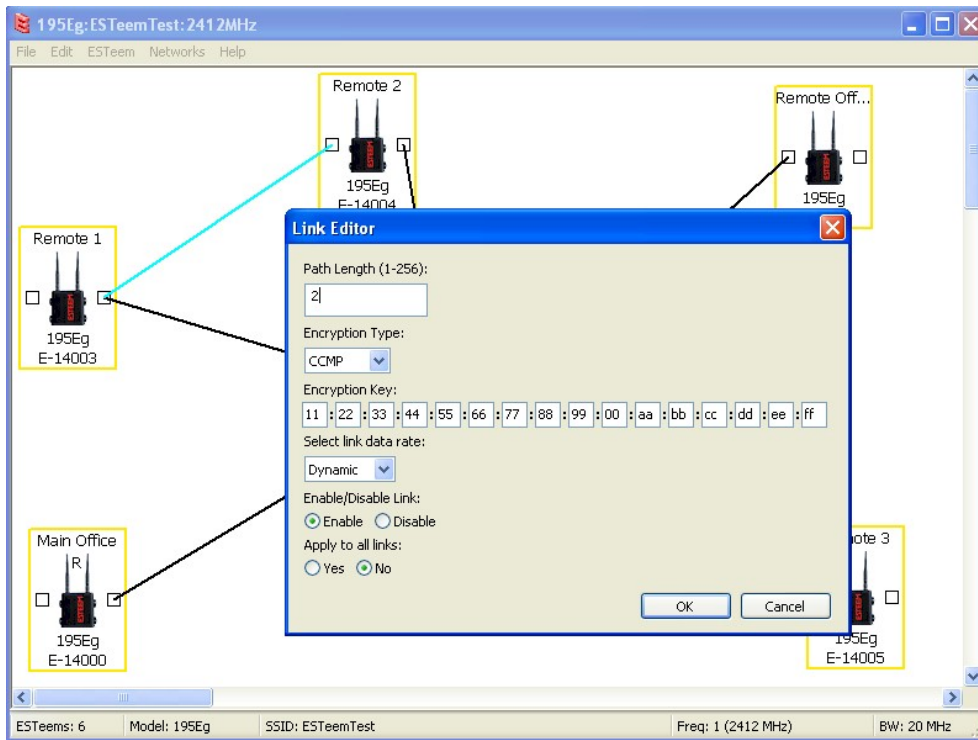


Figure 16: Backup Link Configuration

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

4. Verify all ESTeem modems are connected to the same switch as the computer running the ENC Utility and send the configuration to all modems at the same time by selecting ESTeem>ESTeem Configuration>Send Configuration to All ESTeems. Once the ENC Utility has downloaded the configuration for both ESTeem 195C/M's, the status box around the ESTeem's will change from yellow to blue. This indicates that the configuration was completed successfully and the ESTeem 195C/M's are ready to be installed in the application.

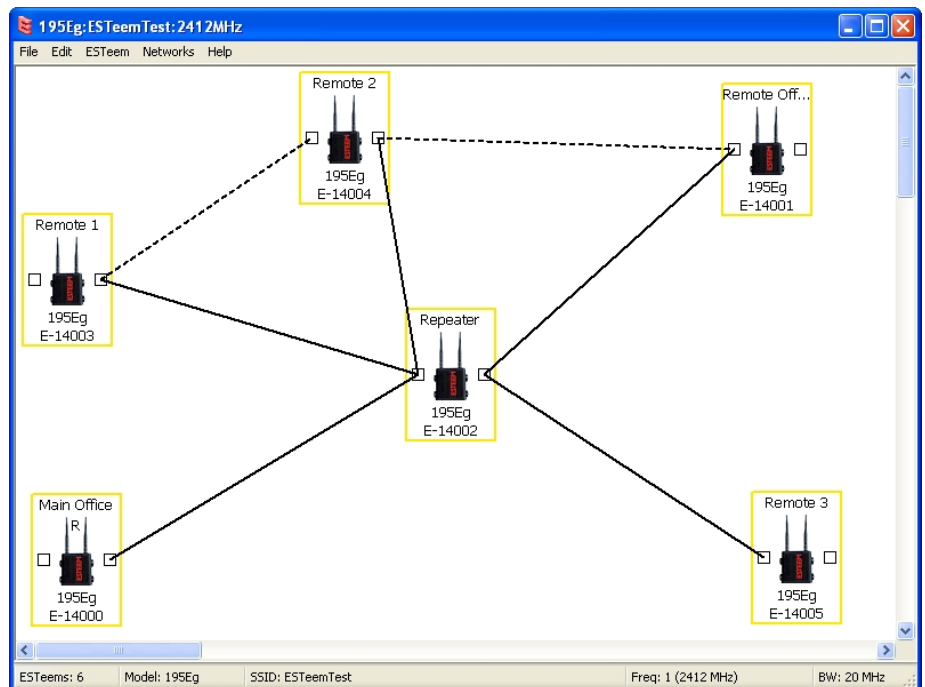


Figure 17: Mesh Network Configuration

Ethernet Router Mode Example (Figure 4)

Point to Multipoint Router Mode

(4) ESTeem Model 195C/M

Serial Numbers:

E-14000 (Router at Network)

E-14001 (Remote Site 1)

E-14002 (Remote Site 2)

E-14003 (Remote Site 3)

1. Using the above procedure for adding ESTeem Model 195C/Ms, add the four ESTeem 195C/Ms for this example and rename by location. Your layout should appear like Figure 18.
2. Move the ESTeem 195C/M icons on the screen to simulate the layout of the diagram. Draw connection lines between the wireless links modems in the same order as the network layout (Figure 19).

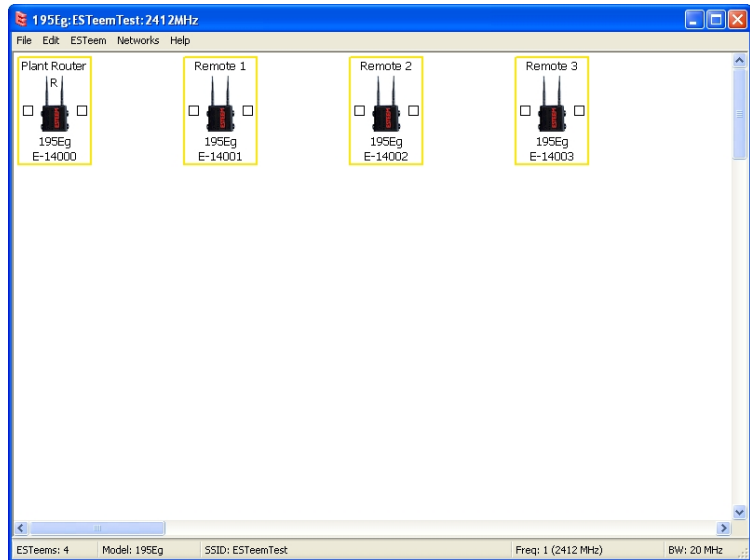


Figure 18: Router Mode Example Modems

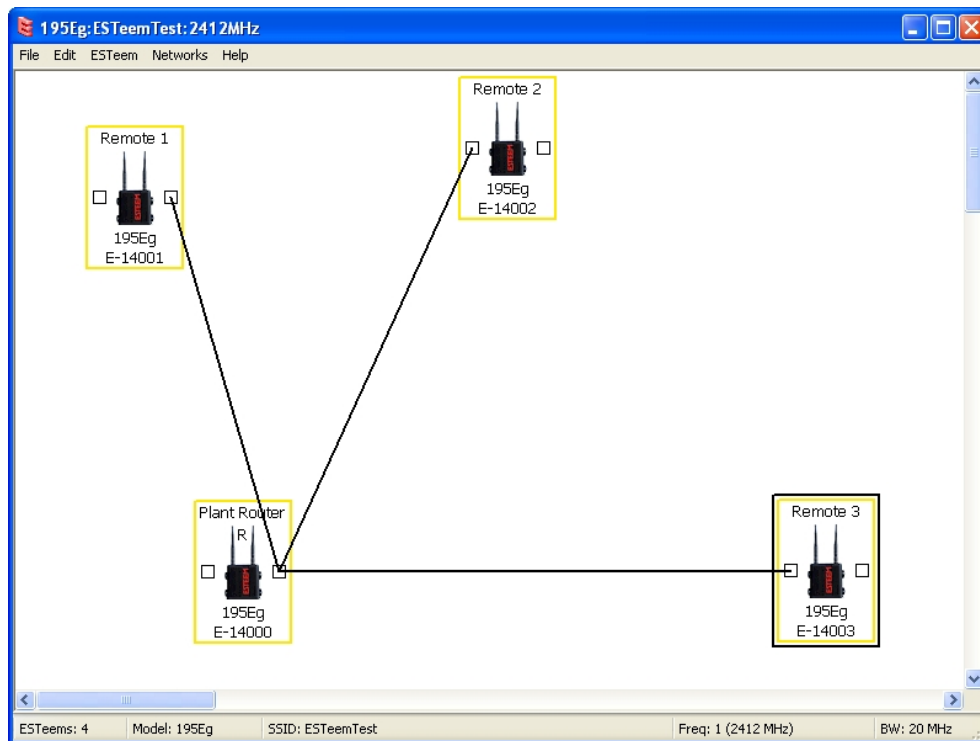


Figure 19: Router Example Layout

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

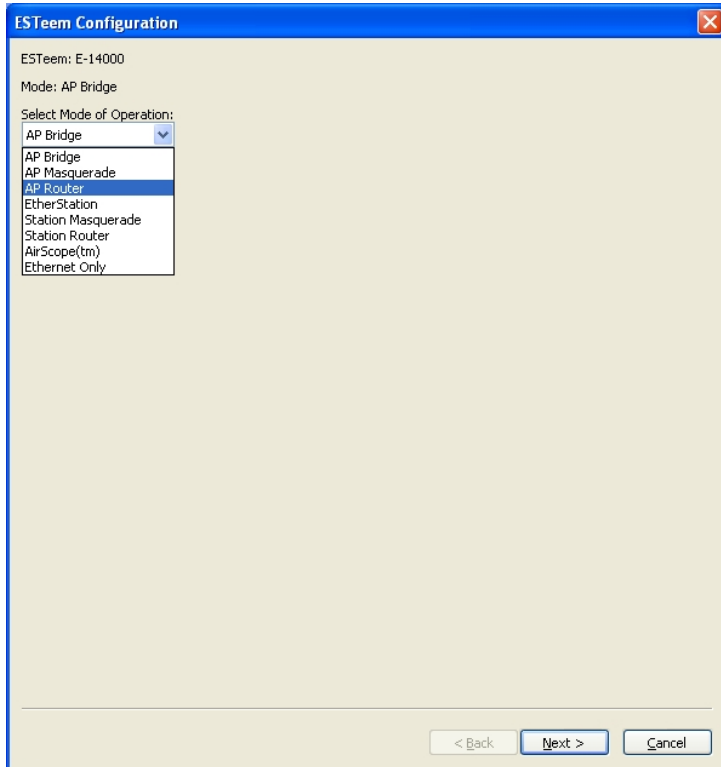


Figure 21: AP Router Configuration

- Continue through the configuration screens setting the AP Router addressing to match the IP address ranges for your network. For help with setting the router addressing please refer to Router Address Examples later in this chapter. You will end on the screen in Figure 22. Press the Finish button to return to the configuration page.
- Verify all ESTeem modems are connected to the same switch as the computer running the ENC Utility and send the configuration to all modems at the same time by selecting ESTeem>ESTeem Configuration>Send Configuration to All ESTeems. Once the ENC Utility has downloaded the configuration for both ESTeem 195C/Ms, the status box around the ESTeems will change from yellow to blue. This indicates that the configuration was completed successfully and the ESTeem 195C/Ms are ready to be installed in the application.

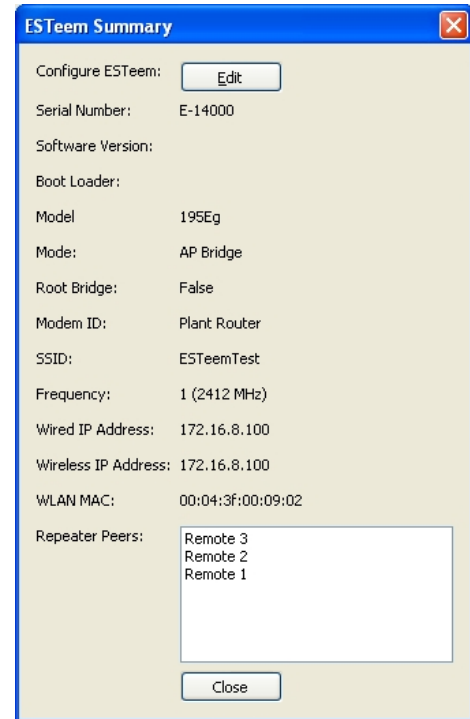


Figure 20: ESTeem Summary Page

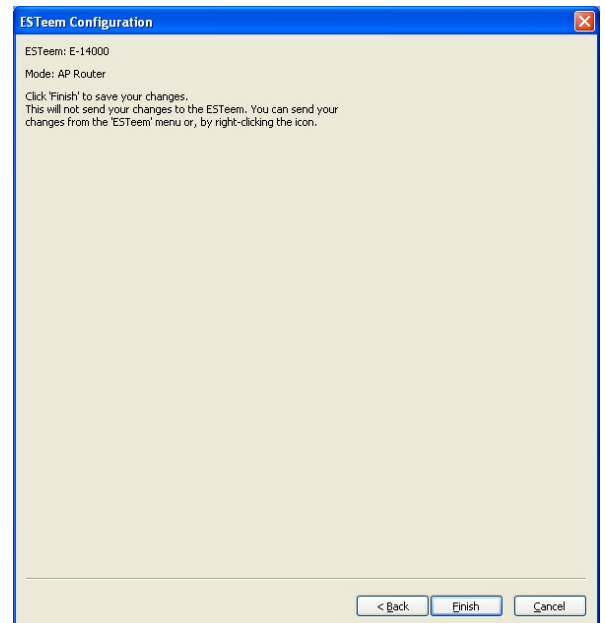


Figure 22: ESTeem Summary Page

Mobile Client Mode Example (Figure 5)

EtherStation, Station Router and Station Masquerade Modes

(3) ESTeem Model 195C/M

Serial Numbers:

E-14000 (EtherStation)

E-14001 (Station Router)

E-14002 (Station Masquerade)

Setting the ESTeem for Mobile Client (station) mode with the ENC Utility is different than the Bridge/Router or Access Point (AP) modes. ESTeem modems configured in as a Mobile Client will not link with a specific fixed modem; but will roam between any 802.11 Access Point with the correct Network Name (SSID) and Encryption. The ESTeem configured as a client is also not set on a specific operating frequency (channel) but will scan all channels looking for the AP. Use the following procedure to configure an ESTeem 195C/M in one of the three mobile client modes:

1. Starting a new network of ESTeem 195C/Ms in Mobile Client mode is the same as any of the Bridge modes except when you are asked for the frequency (channel) of operation, select “Station” (Figure 23).
2. Add the three mobile client modems to the ENC Utility configuration page as instructed above and set the Modem ID to match the three modes of operation. Your configuration will appear as in Figure 24.

Technical Tip: The ESTeem 195C/M’s in Mobile Client modes do not have a specific frequency of operation as can be seen in Figure 24.

EtherStation

3. By default, the ENC Utility sets all station mode ESTeem modems to EtherStation mode. The only adjustment necessary to the EtherStation modem in our example is to enter the connected Ethernet device’s MAC address. The ESTeem 195C/M will “clone” the Ethernet MAC address of the connected Ethernet device. To configure the EtherStation modem, double-click on the icon to bring up the ESTeem Summary window and press the Edit button (Figure 20).
4. EtherStation mode should be selected in the Mode of Operation. Press the Next button at the bottom of the window to continue. Enter the connected Ethernet device’s MAC address in the “Device MAC Address” box (Figure 25) and press the Next button at the bottom of the window to continue.
5. Verify the encryption settings are correct for the 802.11 AP network in which the EtherStation modem will be working and press the Finish button to return to the configuration page.

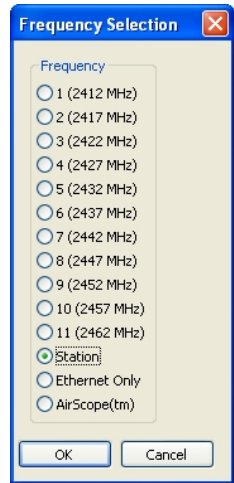


Figure 23: Station

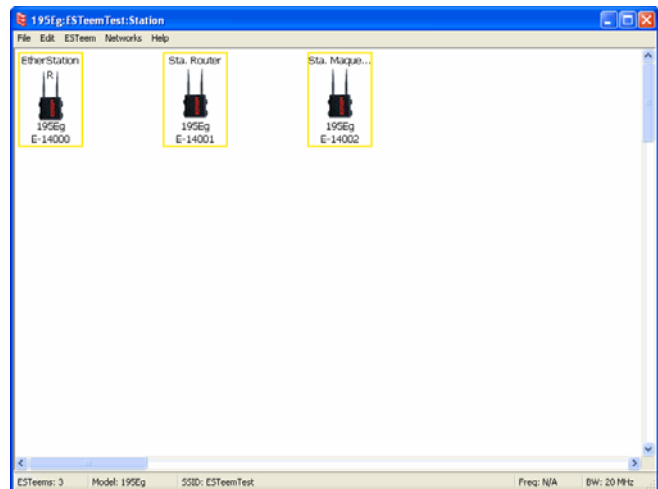


Figure 24: Station Mode Example Modems

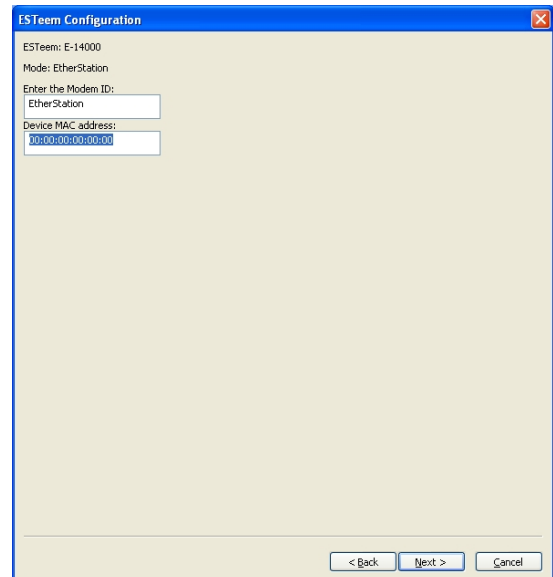


Figure 25: MAC Address Entry

Station Router and Station Masquerade

- To configure the two other modems, double-click on their icons to bring up the ESTeem Summary window and press the Edit button (Figure 20).
- Select Station Router for E-14001 and Station Masquerade for E-14002 in the Mode of Operation (Figure 26). Press the Next button at the bottom of the window to continue.
- Continue through the configuration screens setting the Station Router/Masquerade addressing to match the IP address ranges for your network. For help with setting the router addressing please refer to Router Address Examples later in this chapter.
- Verify the encryption settings are correct for the 802.11 AP network in which the EtherStation modem will be working and press the Finish button to return to the configuration page.
- Verify all ESTeem modems are connected to the same switch as the computer running the ENC Utility and send the configuration to all modems at the same time by selecting ESTeem>ESTeem Configuration>Send Configuration to All ESTeems. Once the ENC Utility has downloaded the configuration for both ESTeem 195C/Ms, the status box around the ESTeems will change from yellow to blue. This indicates that the configuration was completed successfully and the ESTeem 195C/Ms are ready to be installed in the application.

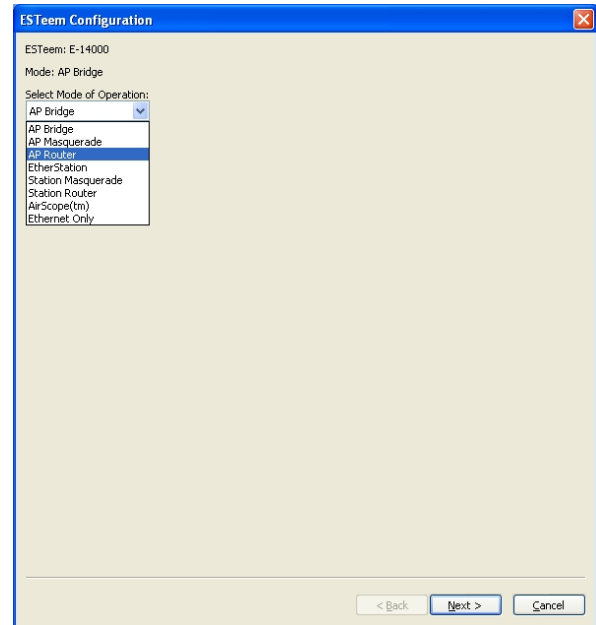


Figure 26: Mode of Operation Selection

ROUTER ADDRESSING EXAMPLES

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

Point to Point Access Point Router to Station Router

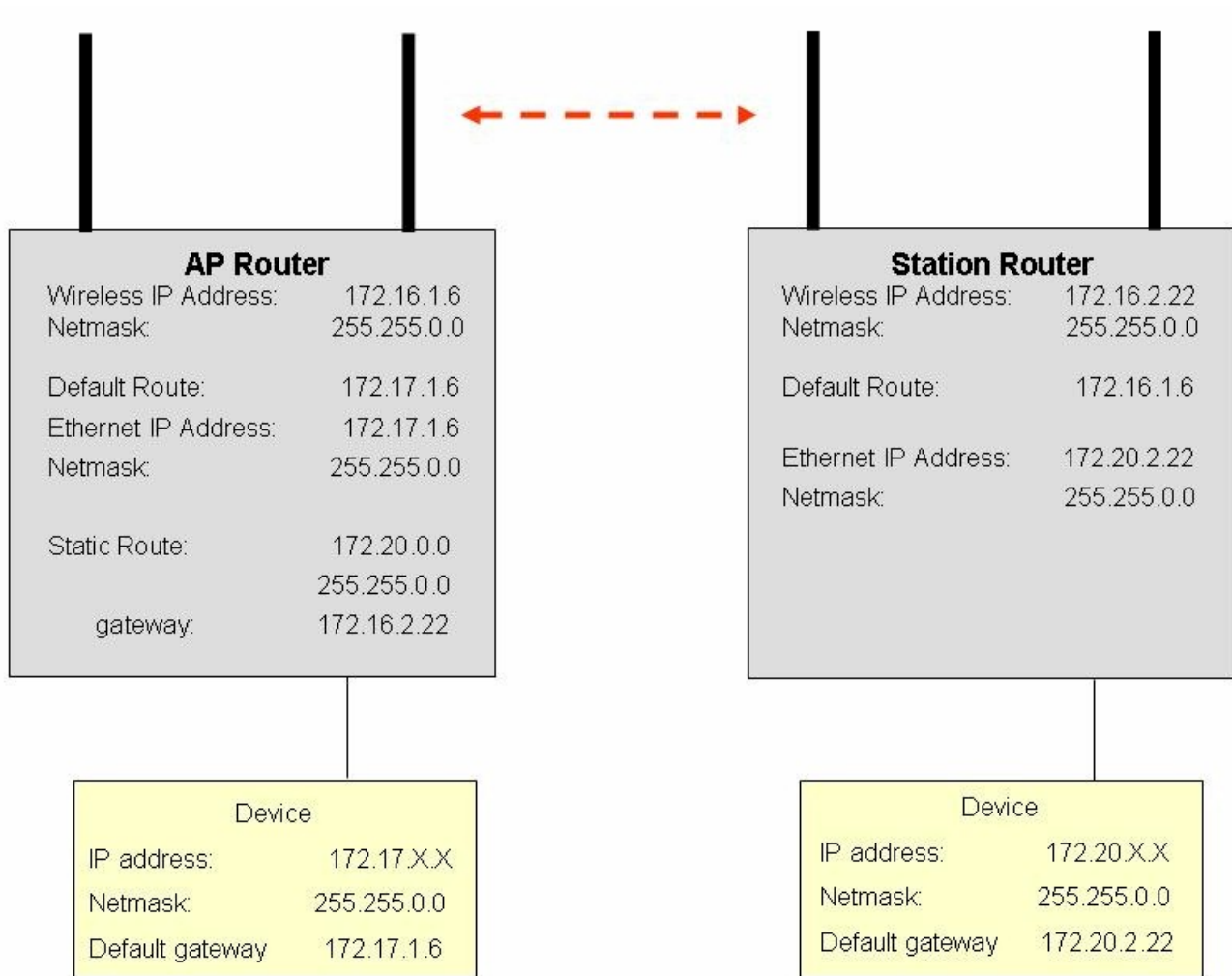


Figure 27: AP Router Addressing Example

Stand-Alone Access Point Router and Single Station Router

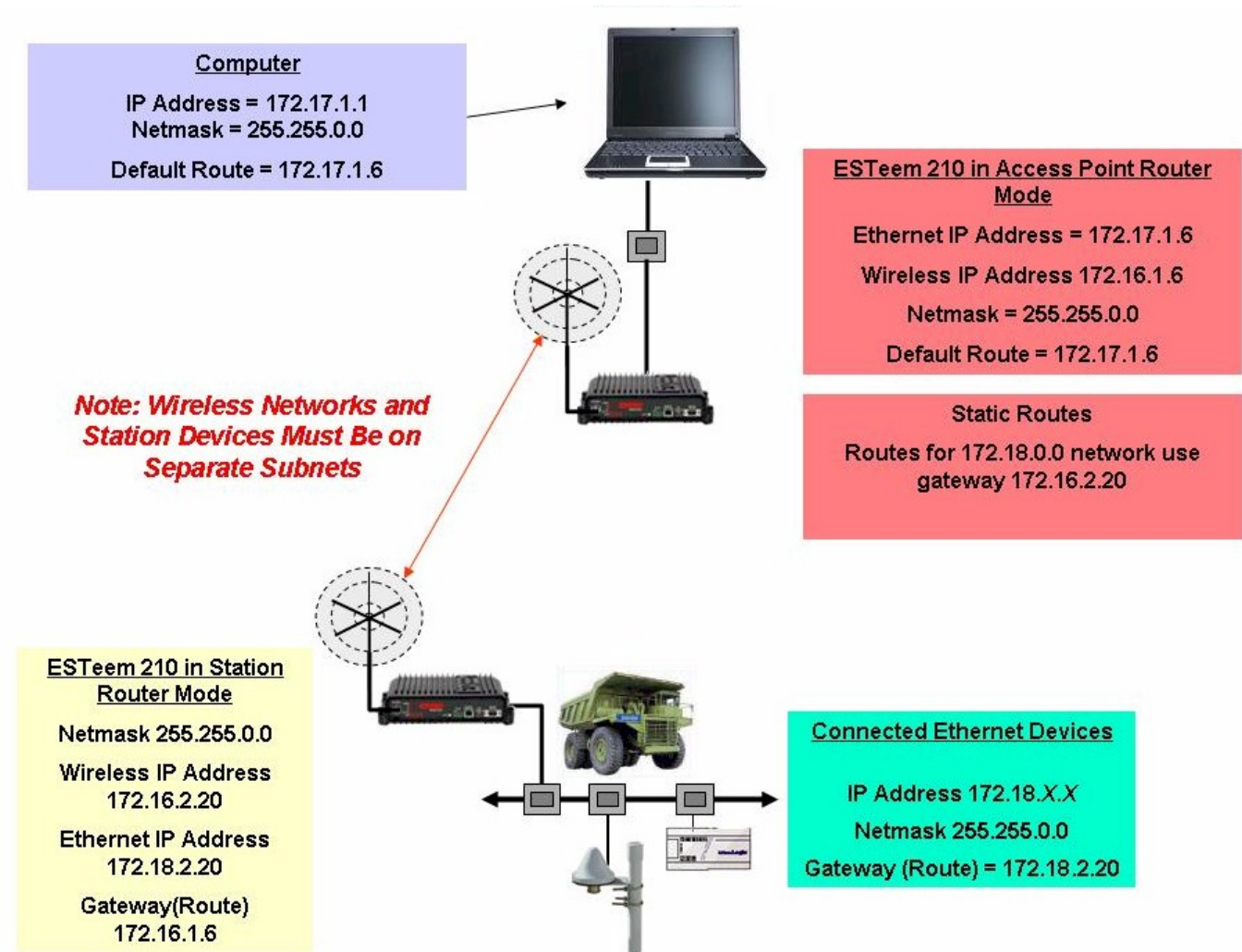


Figure 28: Station Router Addressing Example

Stand-Alone Access Point Router with Multiple Station Routers

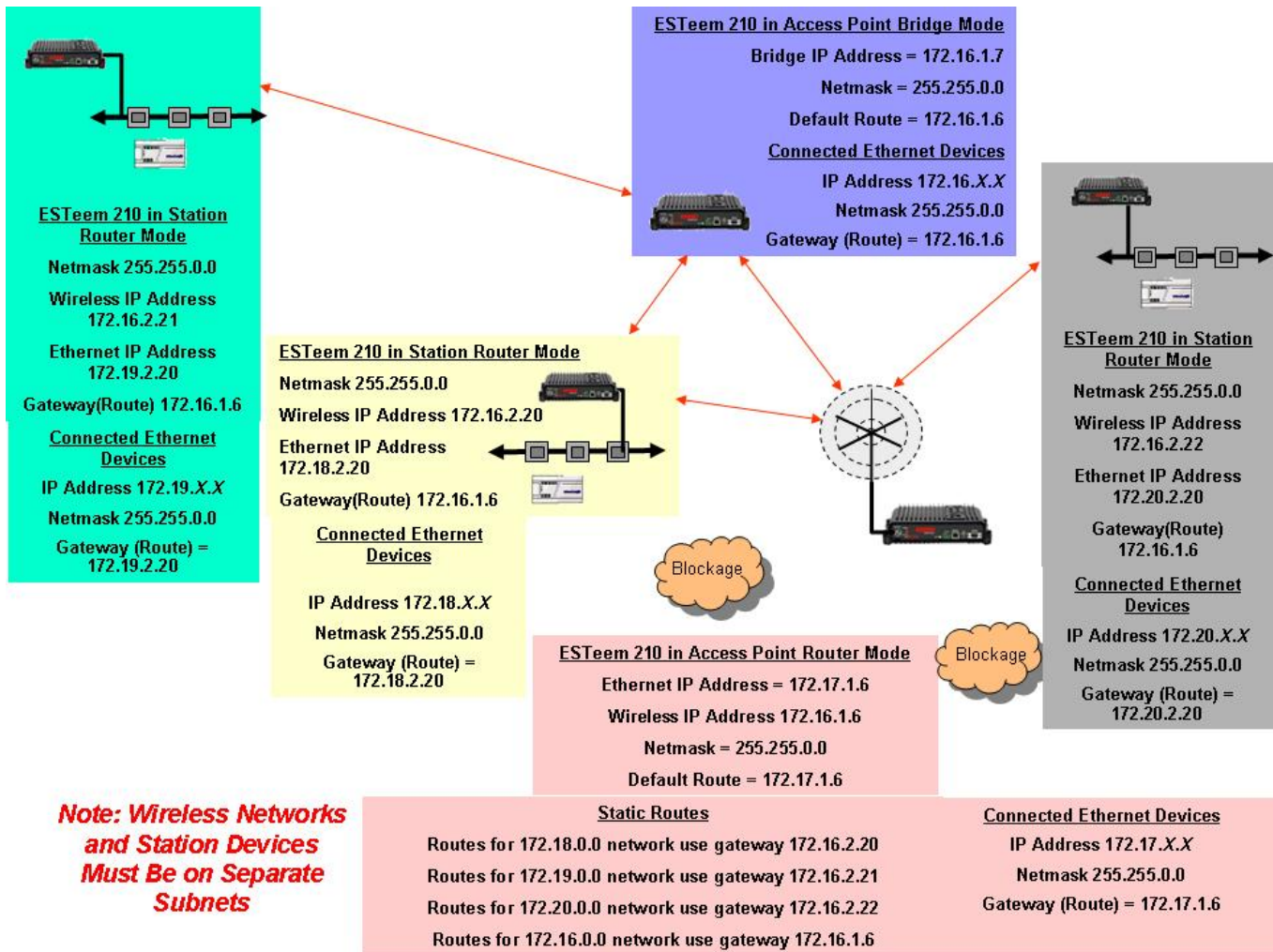


Figure 29: Complete Router Addressing Example

When programmed in any of the three Access Point (AP) Repeater Modes, the Model 195C/M will create a wireless network with other Model 195C/M 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 195C/M 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 195C/M. A manual path configuration is far superior to standard “self-discovery” networks, because you have direct control over the best RF paths and can easily identify any failed routes for easy troubleshooting. For example, Figure 1 shows a typical wireless Ethernet system used in the Water/Waste Water Industry. The problem with a standard “self-discovery” Mesh network is the selection of routes. Notice that the communication between the Water Plant (Site A) and Pump Site D has a marginal link, but it is the most direct route between the Ethernet devices.

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

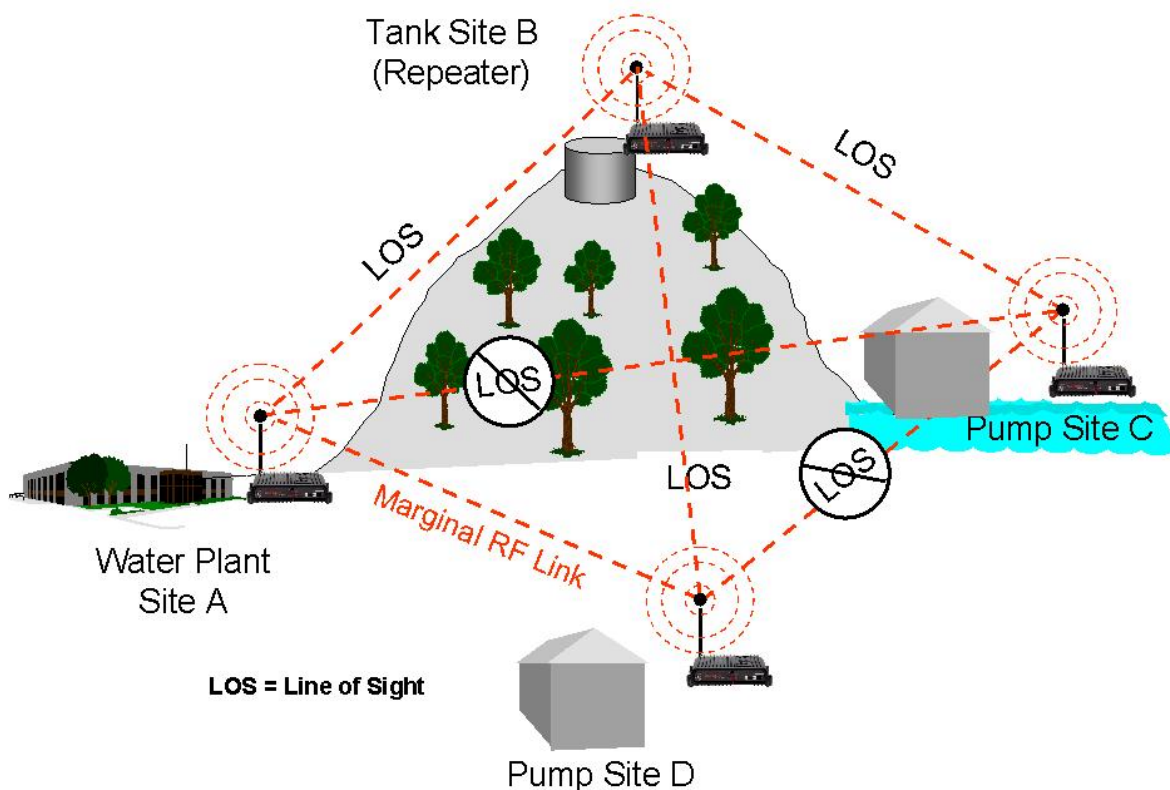


Figure 1: Small Mesh Network Diagram

Configuration

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

The screenshot displays the 'ESTEem 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 main content area is titled 'Setup - Add a Repeater Peer'. Below the title, there is a descriptive paragraph: 'To add a new repeater peer for the wireless LAN interface, enter the WLAN MAC address, the path length, the key type, the key and the rate set and click the "Create Repeater Peer" button.' The configuration fields are as follows: 'Enter the WLAN MAC address:' with a text box containing '00:04:3f00:09:05' and a note 'Enter a 48-bit MAC address containing 6 colon separated hex bytes'; 'Enter the path length (1-256):' with a text box containing '1'; 'Select the encryption type:' with radio buttons for None, WEP 64-bit, WEP 128-bit, TKIP, and CCMP (selected), and a note '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:' with a text box containing '11:22:33:44:55:66:77:88:99:00:aa:bb:cc:dd:ee' and a note 'Enter the encryption key as a sequence of hexadecimal bytes (e.g. 0a:0b:1c:2d:3e). Key length: None=0 bytes, WEP64=5 bytes, WEP128=13 bytes, TKIP=32 bytes, CCMP=16 bytes.'; 'Select link data rate:' with a dropdown menu showing 'Dynamic' (selected) and options for 1 Mbps, 2 Mbps, 5.5 Mbps, 6 Mbps, and 9 Mbps, and a note '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.'; and 'Enable/disable link:' with radio buttons for Enable (selected) and Disable, and a note 'Enable/disable the repeater peer link. Enable must be selected for the repeaters to communicate.' At the bottom, there are two buttons: 'Return to Repeater Setup' and 'Create Repeater Peer'.

Figure 2: Repeater Configuration Example

You can also configure the Mesh networking directly through the web configuration setup (Chapter 5). Figure 2 shows an example repeater peer table from the setup menus. For an ESTEem 195C/M to communicate with another ESTEem 195C/M, select **Yes** must at **Enable Repeater Capability**. Next, the Wireless LAN (WLAN) MAC address of each Model 195C/M that will have direct communications must be added to the Repeater Peer List. Finally, **enabling the link** allows the corresponding 195C/M to be included in the communication routing. Mobile clients do not require input in the repeater peer table. If multiple Mesh routes are configured, you will also need to set the values for Priority and Path Costs (explained in Spanning Tree below). For multiple examples of repeater configurations, please refer to Chapter 3 of this user's manual.

RAPID SPANNING TREE PROTOCOL (RSTP)

The ESTeem Model 195C/M uses Rapid Spanning Tree Protocol (RSTP - IEEE 802.1d) to determine the radio routing structure of the wireless network. This RSTP functions the same as standard Spanning Tree Protocol (STP) listed below, but the network recovery is three times faster. If the 195C/M is used in a network that has any older STP only modems, the entire network will be STP.

SPANNING TREE PROTOCOL (STP)

The ESTeem Model 195C/M uses standard Ethernet Spanning Tree Protocol (STP) or Rapid Spanning Tree Protocol (RSTP) to determine the radio routing structure of the wireless network. The primary purpose of STP/RSTP is to make sure that “network loops” are not created. A network loop is having two communication paths to the same destination where the remote device would receive the same data multiple times. If there were no way to control the data flow, this data would be constantly passed around this loop causing a “packet storm” that would shut down the entire network. The Spanning Tree Protocol will block all these redundant links.

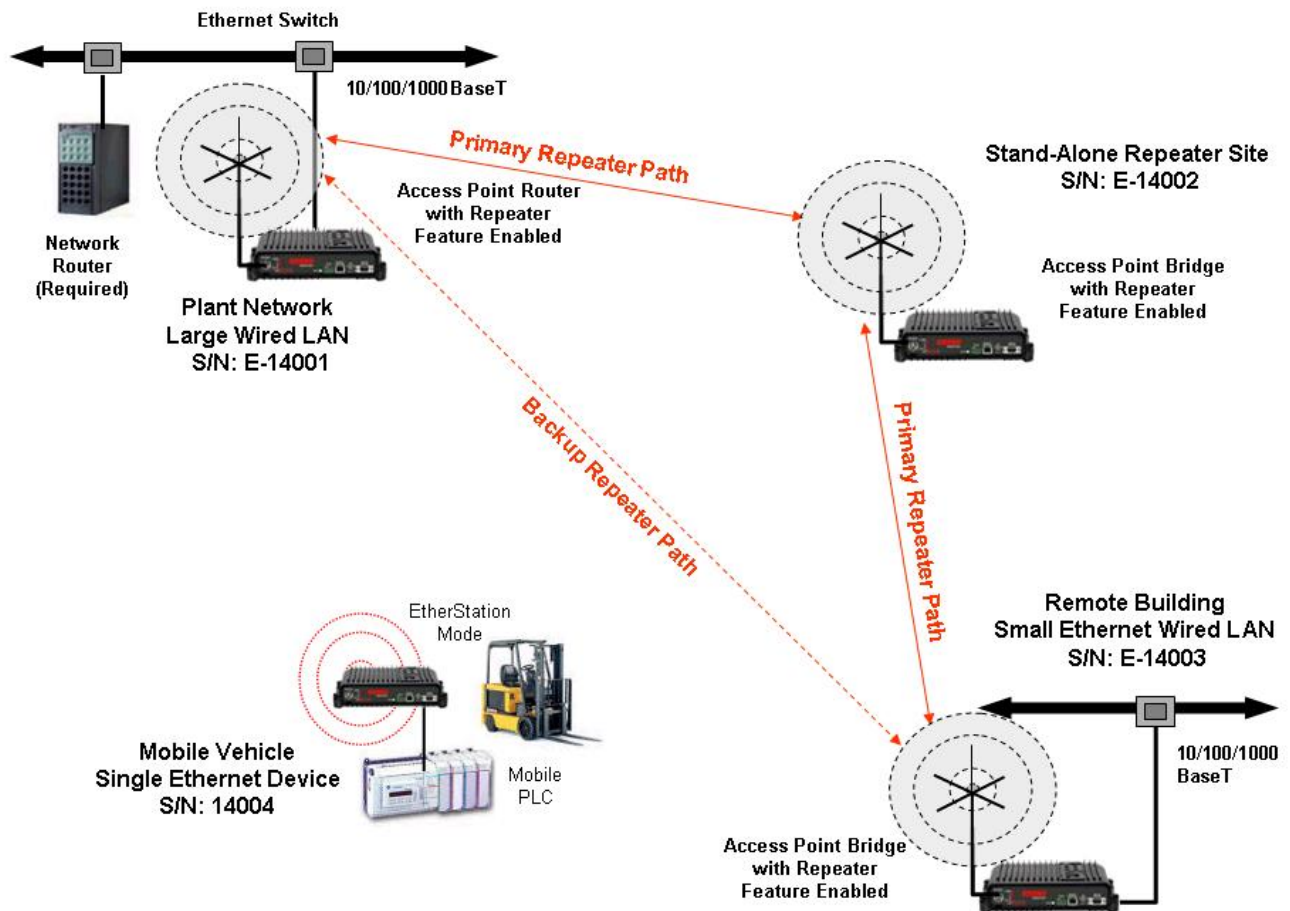


Figure 3: Programming Example #1 Diagram

The STP operation begins by determining which Ethernet device on the network will be the Root Bridge. All Ethernet networks have a Root Bridge that is selected by the lowest MAC address. All path costs are evaluated against this Root Bridge device to

determine routing and which paths will be blocked. On a wired Ethernet network, the location of the Root Bridge is not really important, but in a wireless network selection of the Root Bridge is critical to the wireless network routing. Let's use one of the Example network diagrams from Chapter 3 to continue the discussion (Figure 4).

STP Phases

The following sections describe the process of the STP in the ESTeem Model 195C/M as how it would happen in the above example.

Learning Phase - Once properly configured, each Model 195C/M will begin to search out the other Model 195C/M units in radio range that are programmed in the AP Repeater Peer table. All Model 195C/M's will calculate their routes to every Model 195C/M in the network based upon the lowest "path length" to the Root Bridge. Path length is the total number of wireless links (repeater peer links) to transmit a packet through the wireless network to the Root Bridge. **Note: The Root Bridge in a network should be the Model 195C/M 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 195C/M 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 195C/M will recognize and disable (block) one or more redundant links and provide back up links should the primary link fail. This establishes a wireless mesh network with a series of forwarding links, based upon the shortest path length to the Root Bridge.

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

Path Length

If more than one communication path to the Root Bridge is found, the 195C/M must determine which route to take based upon the lowest Path Length. The default path length to all links in the 195C/M network is 1. If the Path Lengths are equal then the lowest MAC address will determine the priority route. In the ESTeem Mesh Network we want to directly control all data flow so do **not** want the routes to be automatically determined.

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

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

To configure the 195C/M to select the repeater as the primary radio path, set the path length value for the direct link greater than 2 (such as a value of 3) to make this the primary radio path. The lowest path length will identify the highest priority. The Model 195C/M 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 195C/M should be designated as the Root Bridge. Only one Model 195C/M 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 195C/M's **NOT** configured as the Root Bridge will choose routing based upon the Path Length to the Root Bridge. If you have any question as to which site in your AP Repeater application should be the Root Bridge, contact ESTeem Customer Support at 509-735-9092 or e-mail your application to support@esteem.com.

The Root Bridge will be selected in one of two ways: the Root Bridge can be manually set (recommended) during the configuration of the Repeater Peer table (Figure 3) **or** the Root Bridge designation will default to the lowest MAC address of all the Model 195C/M's in the network. The manual Root Bridge configuration is located in the "Advanced Settings" section.

Redundant Backup

The ESTeem Model 195C/M configured in Access Point Repeater mode will automatically function as a redundant backup if two Model 195C/M's are installed at the same location (Figure 4). If two Model 195C/M's are connected to the same switch, one of the Model 195C/M'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 195C/M is detected and the second Model 195C/M will begin operation at that site.

Redundant Master Configuration

The configuration in Figure 4 will also provide a redundant backup for the Master Site (Root Bridge). Configure both Model 195C/M's as Root Bridges (see above) giving the primary Root Bridge a value of 1 and the secondary Root Bridge a value of 2.

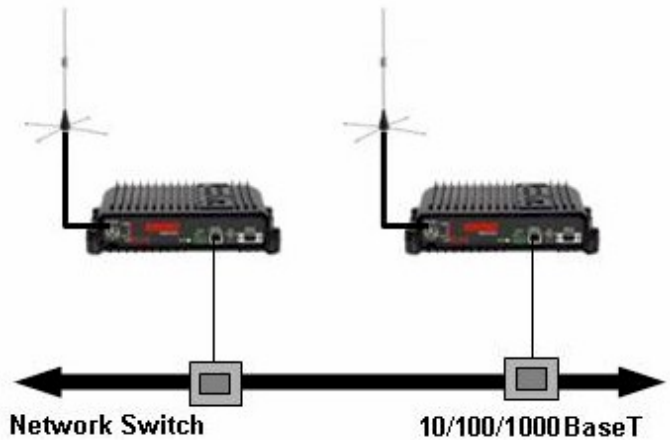


Figure 4: Redundant Backup Diagram

USING THE USB PROGRAMMING PORT

Any terminal emulation program can be used for this configuration of the ESTeem 195C/M through the USB port. Most Windows users will probably use either Hyper Terminal or the Terminal Emulation in the ESTeem Utility program.

Programming Using the USB Port

1. When configuring the Model 195C/M for the first time you can use the ESTeem Configuration Menu to setup the basic operating parameters such as assigning the IP Address, IP Net Mask, and Gateway IP Address.
2. Connect the USB cable between the USB connector on the Model 195C/M to an open USB port on the computer.
3. Plug the Model AA174 power supply into a wall socket and connect an Ethernet patch cable from the Model 195C/M Ethernet port to the J1 (Data&PWR) port on the power supply. The Power LED on the front of the ESTeem should be illuminated.
4. If your computer is configured properly, you will see the ESTeem Model 195C/M booting sequence on your Terminal Emulation program. Once the ESTeem boot sequence is complete (approximately 45 seconds) you will receive this message:

“Please press Enter to active this console.”

If you don't see this message press the Reset button on the front panel of the Model 195C/M and/or check the programming of your RS-232 port.

5. Press the Enter key and you will be at the Configuration Menu 195C/M login prompt. See Figure 1.
6. To enter the Model 195C/M Main Menu you will need to log into the system with a login name and password.
7. If this is not the first time configuration of the Model 195C/M, see your network systems administrator for the password.
8. At the 195C/M login prompt type **admin** for the login name and press the Enter key (<Enter>). *The login name is defined at the factory and is not changeable by the user. Note that all characters are lower case.*

If this is the first time the Model 195C/M has been programmed or the Password was not changed from the factory default values, the factory default password is also **admin**. Enter **admin** for the password and press the Enter key (<Enter>). The ESTeem Configuration Welcome Screen (Figure 2) will now be displayed. *Note that all characters are lower case.*

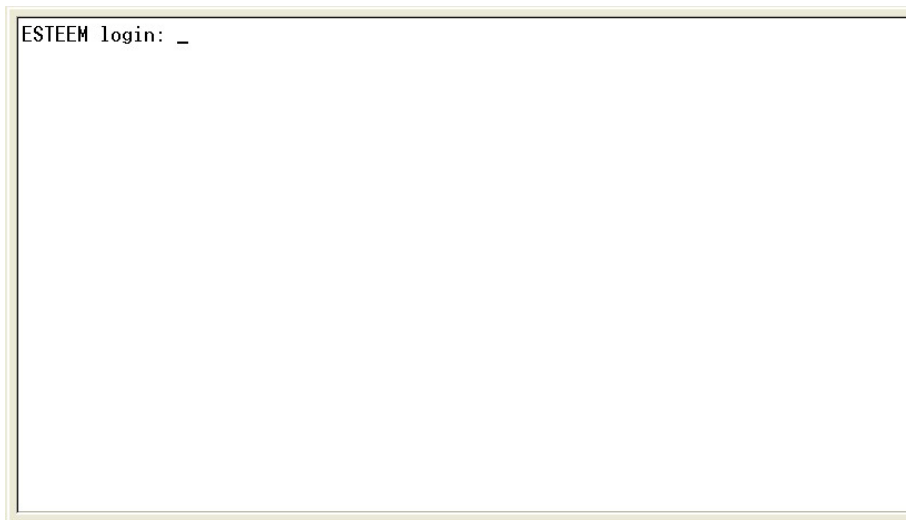


Figure 1: RS-232 Port Log-in Screen

9. To set the IP address in the ESTeem 195C/M, type the letter “A” and press the Enter key. Enter the value for the IP address, Netmask and default route pressing the Enter key after each entry.

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

Enter selection: _
```

Figure 2: RS-232 Welcome Screen

10. After the basic parameters have been entered into the Model 195C/M you will need to commit the changes to the Model 195C/M (Figure 3). Press the C key and then Enter. The changes will be saved to flash memory. You can use programming features in the ESTeem Web Configuration Manager to configure the unit for your application.

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

Enter selection: a

eth0      Link encap:Ethernet  HWaddr 00:04:3F:00:26:DC

Enter IP address: 172.16.38.8
Enter netmask: 255.255.0.0
Enter default route: 172.16.1.6
Commit/Redo/Undo [c/r/u]: c_
```

Figure 3: RS-232 Welcome Screen

USING THE RS-232 DATA PORT

The ESTeem 195C/M has a serial data port that can provide RS-232 communication between two or more serial devices using the wireless broadband link. The serial data is encapsulated and transferred as a standard Ethernet packet over an operating 195C/M wireless Ethernet system. The configuration for a serial 195C/M network will be the same as an Ethernet or a serial (RS-232) based communication network.

The serial interface option can be used to link two or more serial devices in a new or existing system. The serial data has very little impact on the network bandwidth and will allow for both Ethernet and serial applications simultaneously. A possible application would be installation of the 195C/M in an existing serial based network that was looking for future upgrade to an Ethernet based system. Another would be using the high-bandwidth Ethernet connections to provide a link to remote video hardware while also providing a serial link to the existing PLC in a SCADA type application.

SERIAL CONNECTIONS

The 9-pin Sub-D serial data port is located on the face of the 195C/M (Figure 4). Using the ESTeem AA062 interface cable, the 195C/M can be connected to a standard DTE-device (PC) with a male 9-pin Sub-D connector. The complete cable configuration is available in Appendix C – Interface Ports.

SERIAL CONFIGURATION

Configuration of the serial port is completed during the standard setup of the 195C/M. After completion of the Repeater Peer configuration screen, the Serial Port Setup screen (Figure 5) will be displayed. Each section in the Serial Port Setup screen is described in detail with the following:

Enable the RS-232 Data Port

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

Mode of Operation

There are two distinct modes of operation for the serial port in the 195C/M. The Redirector mode will provide two-way serial communication between two or more serial devices, while the Terminal Server mode will allow serial communication to a specific remote site by connecting through telnet or SSH. Select one of the following modes of operation:

Full Redirector Mode - This mode allows bi-directional RS-232 data communication with other ESTeem Model 195C/M's. The RS-232 data transmission will appear transparent to the connected devices as if a serial cable is connected between the two ports. This mode will also be used in a multi-point serial network were all serial devices will need bi-directional communication (Figure 6).

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

Baud Rate

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



Figure 4: 195C/M Front Panel Overview

EST195E Web Configuration Manager

ESTEEM
Wireless Modems

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

Setup

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

Enable the serial data port? Yes No [Help](#)

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Figure 5: Serial Configuration Screen

Data Bits

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

Stop Bits

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

Parity

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

Flow Control

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

Maximum Bridge Links for Multicast Packets

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

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

Destination IP Address

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

Note: If you are using the ESTeem 195C/M in a multipoint application (multicast), you must have default Gateway configured in the ESTeem set to the IP address of the Root Bridge modem.

Serial IP Port Number

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

Maximum Packet Size

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

Number of Milliseconds for Packetization

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

Delimiter Characters

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

Terminal Server Control Lines

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

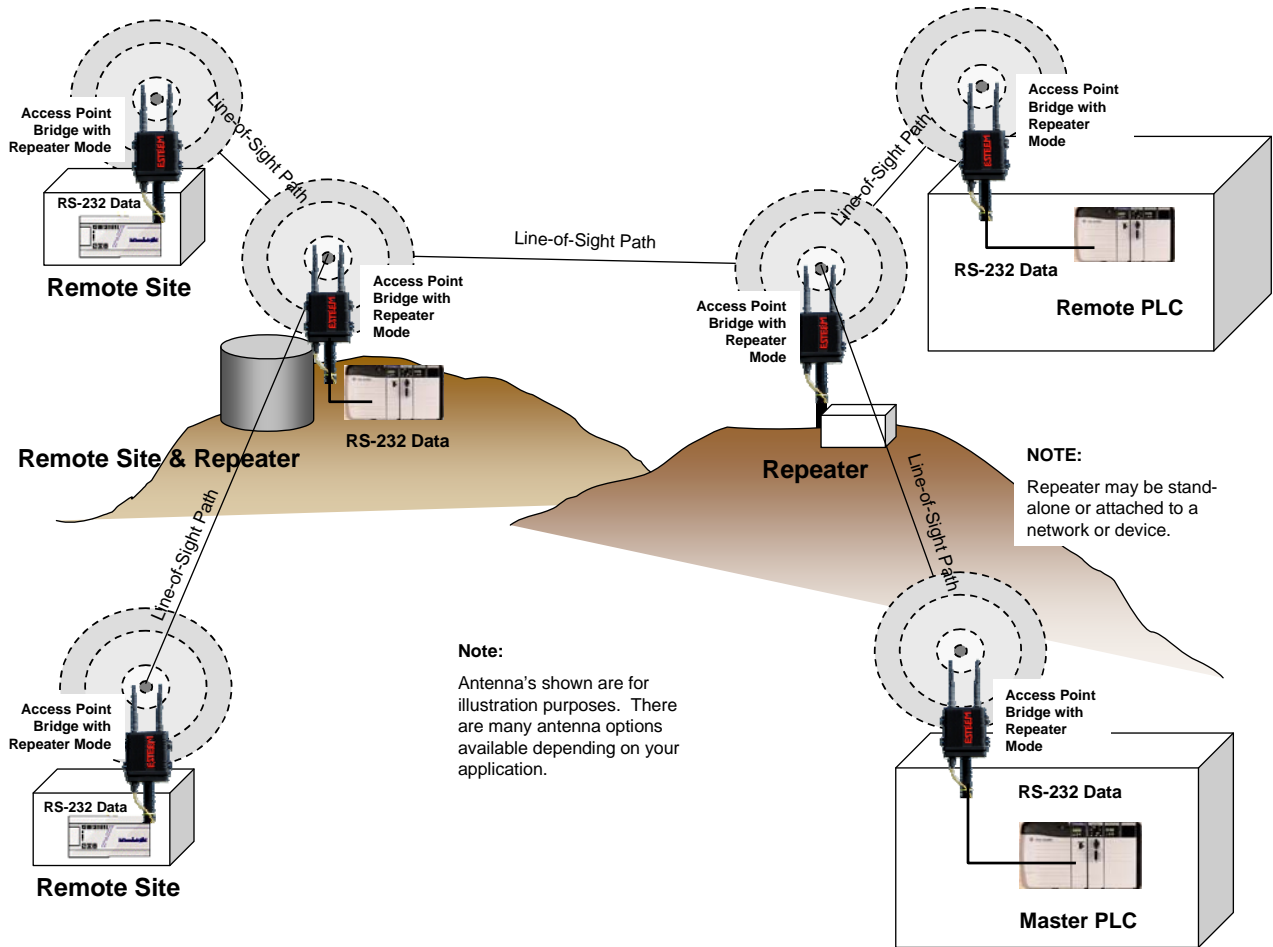


Figure 6: Serial Full Redirector Example

ESTeem Network Configuration Utility (ENC)

The ESTeem Network Configuration (ENC) Utility is a software program designed to greatly simplify the configuration of your ESTeem Model 195C/M wireless Ethernet network. The ENC Utility will allow graphical, point-and-click configuration of your network routing, then configure each ESTeem wireless modem for the network as designed (Figure 1). The ENC Utility will eliminate the need to program or update each ESTeem wireless modem individually. The ENC Utility can send all wireless modem configuration changes simultaneously to a new or existing network.

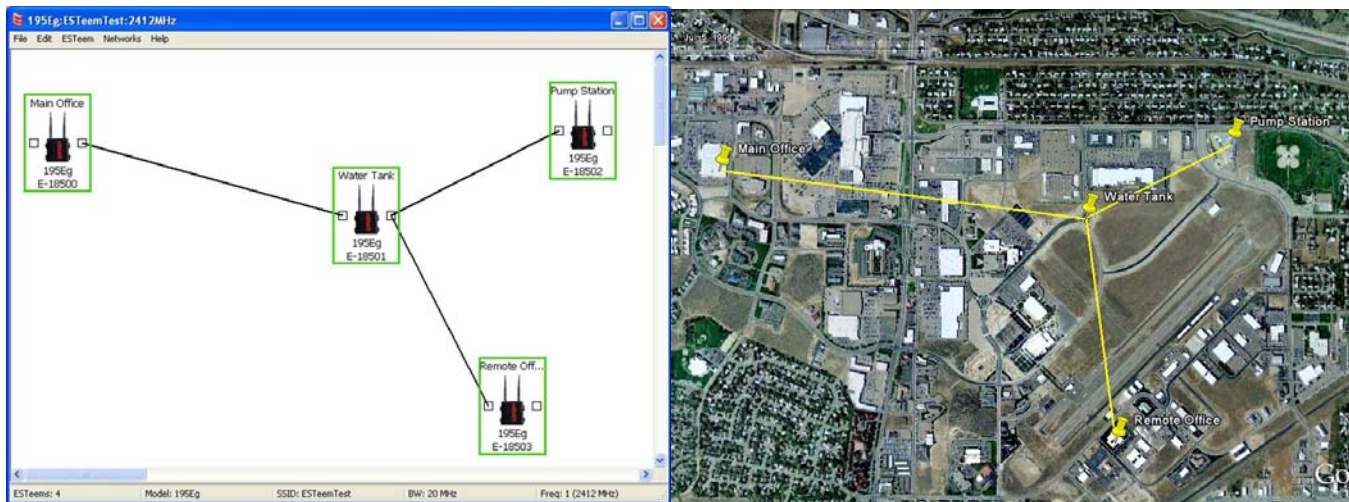


Figure 1: ESTeem Network Configuration Utility

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

ESTEEM DISCOVERY UTILITY

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

Installation

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

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

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

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

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



Figure 2: ESTeem Resource Main Page

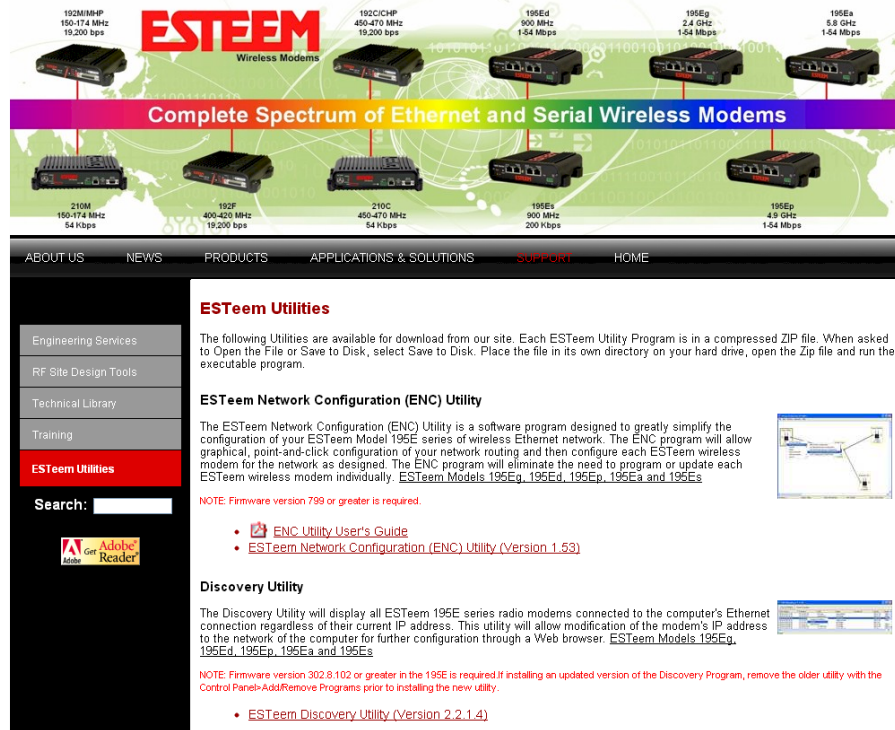


Figure 3: Discovery Utility Download

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

3. Double click on the 195C/MDiscoverySetup<Current Version>.exe file listed in the window to install the program.

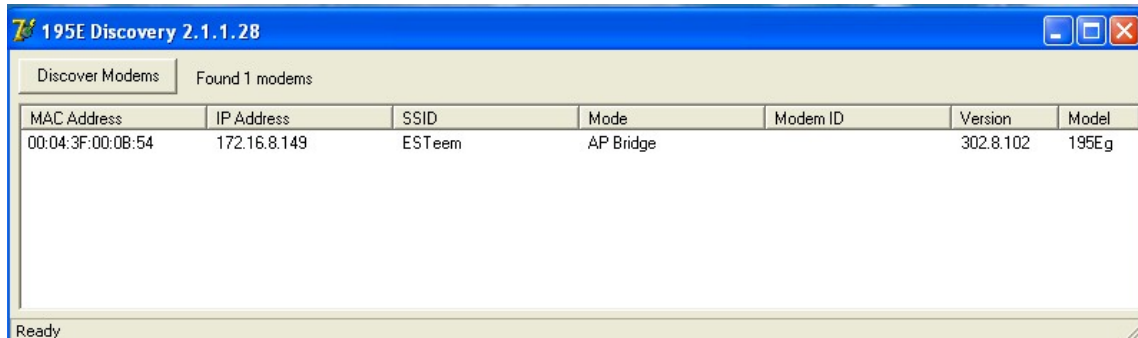


Figure 4: Discovery Program Main Page

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

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

5. Double-click on the 195C/M you want to program and the *Configure IP Address* window will be displayed (Figure 5). Enter an IP address and Subnet Mask for the 195C/M 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 195C/M will reboot.

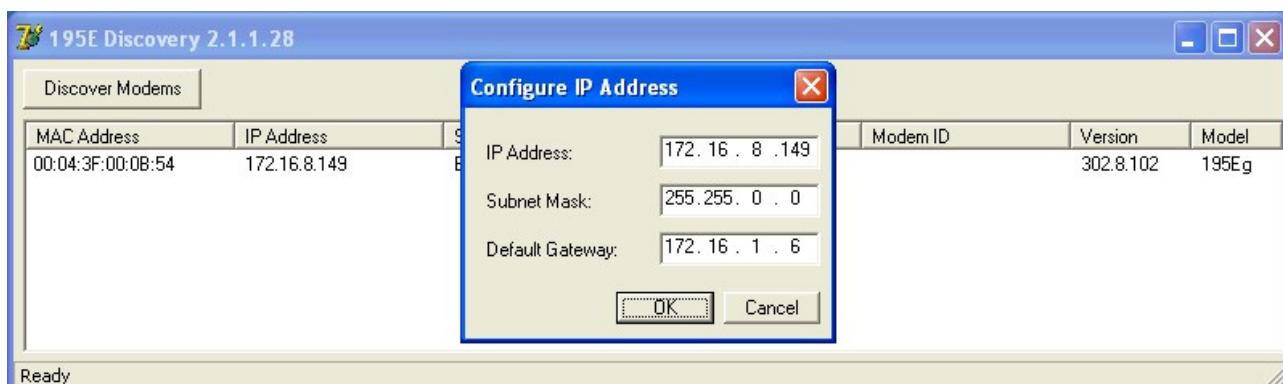


Figure 5: Change IP Address Window

Firmware Updates

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

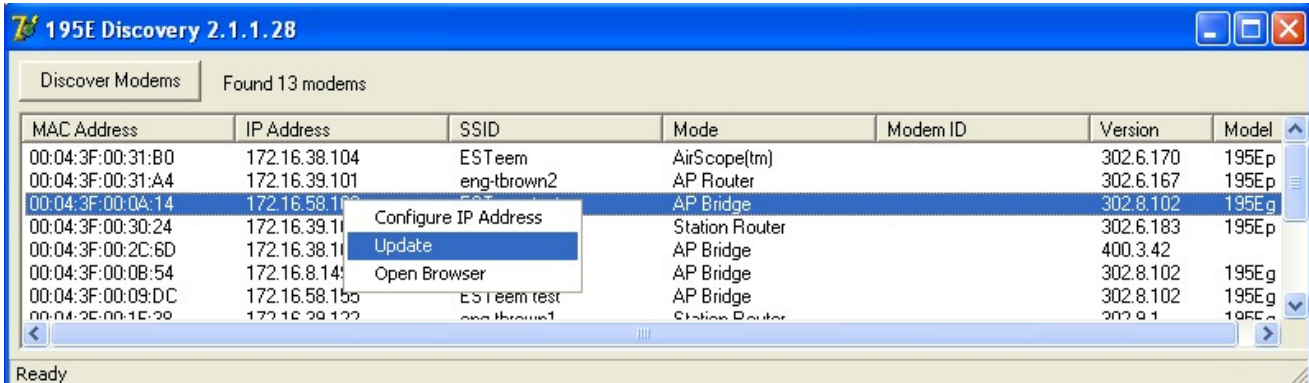


Figure 6: Discovery Features Menu

Opening Web Browser

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



Figure 7: ESTeem Web Page Log-on Screen

ETHERSTATION STATUS PROGRAM

When configured for EtherStation mode, the Web Configuration Manger is turned off. To gather information from the 195C/M on Access Point, link status and received signal strength you will need to install the ESTeem 195C/M Status Utility. The EtherStation Status Utility version 2.0.0.0 or greater provides a new feature that will automatically program the connected ESTeem 195C/M to match up with the computer running the software. This software requires the ESTeem 195C/M to have software version 302.8.102 or greater installed for this feature to function.

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

Installation

The ESTeem Discovery Utility will allow you to configure the IP address on the Model 195C/M to match your network. Install the Discovery Utility on your computer by inserting the Resource Disk in your CD drive.

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

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

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

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

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

3. Double click on the 195C/MStatusSetup.exe file listed in the window to install the program.
4. Connect the Model 195C/M to your computer either directly to the Ethernet card or through a Switch using a CAT-5e Ethernet cable. The Ethernet port on the 195C/M supports Auto-Negotiation so either a patch cable or crossover cable will work. Open the ESTeem Status Program. Status icons will appear in your system tray (Figure 8). When the status menu is opened from the system tray, the status window will be displayed (Figure 8) to show the Access Point MAC address and signal strength. The tray icon and Signal Strength bar will display the colors from Green, Yellow to Red on progressively poorer signal or will show Grey if roaming.

Note: *This Utility will only operate with an ESTeem Model 195C/M in EtherStation mode.*

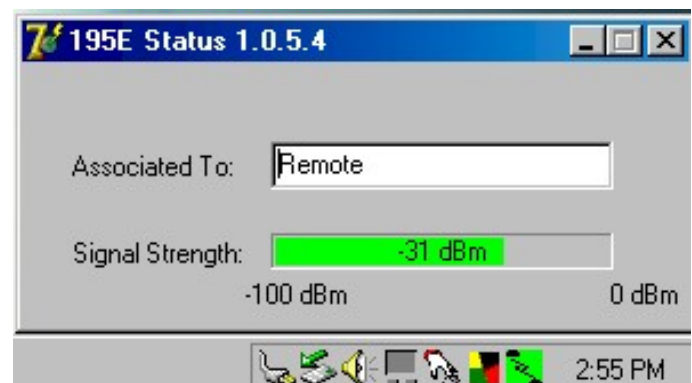


Figure 8: EtherStation Status Program

SETTING LOCAL TIME

The ESTeem Model 195C/M will be shipped from the factory with the internal real-time clock set to Pacific Time. To change the clock settings to the local time for accurate log file entries:

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

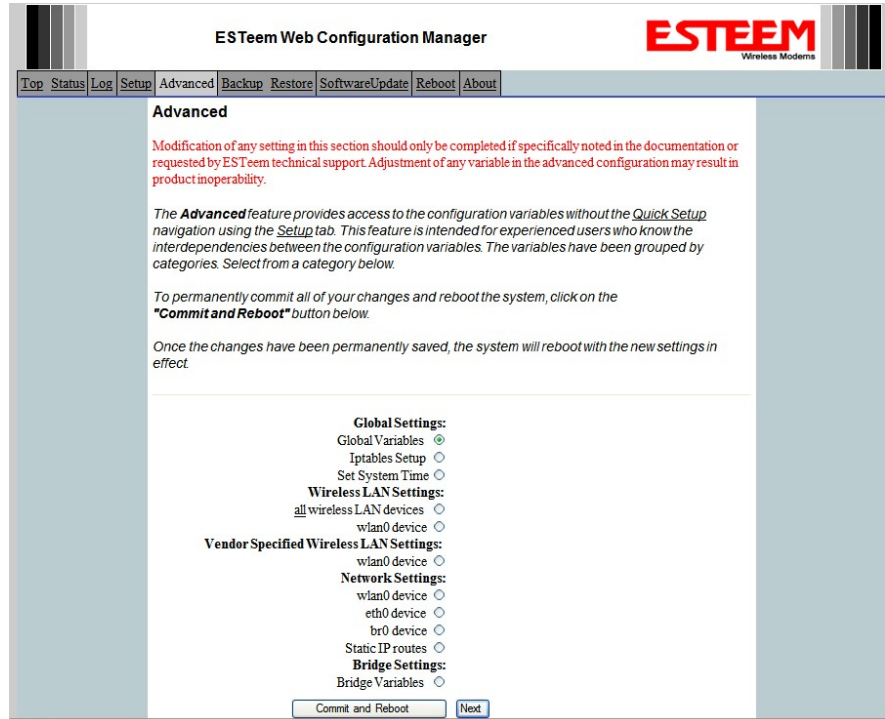


Figure 9: Advanced Features Screen

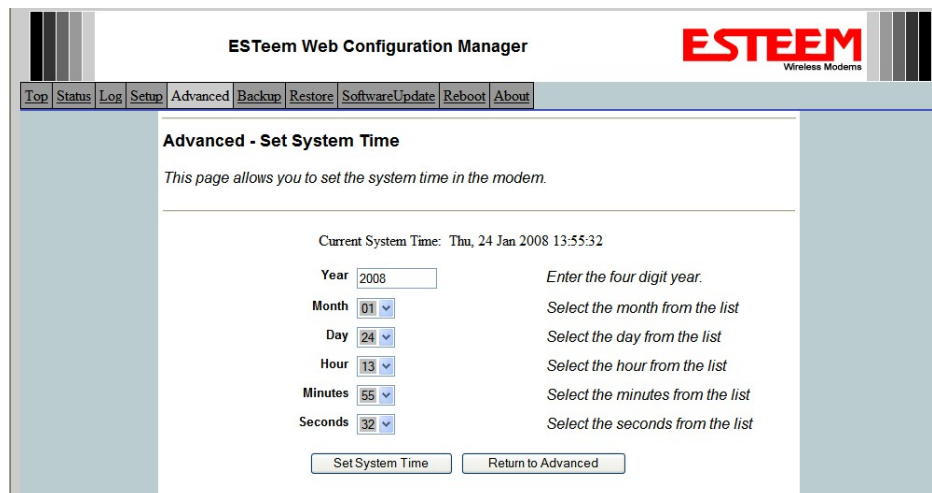


Figure 10: Advanced Features Screen

CONFIGURING TIME SERVER

Enabling NTP time synchronization services on the ESTeem 195C/M will allow usage of time services from upstream services to keep the time on the system accurate.

To allow time synchronization, the Model 195C/M must be configured with the NTP Daemon enabled and the appropriate IP address of the upstream network NTP server.

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

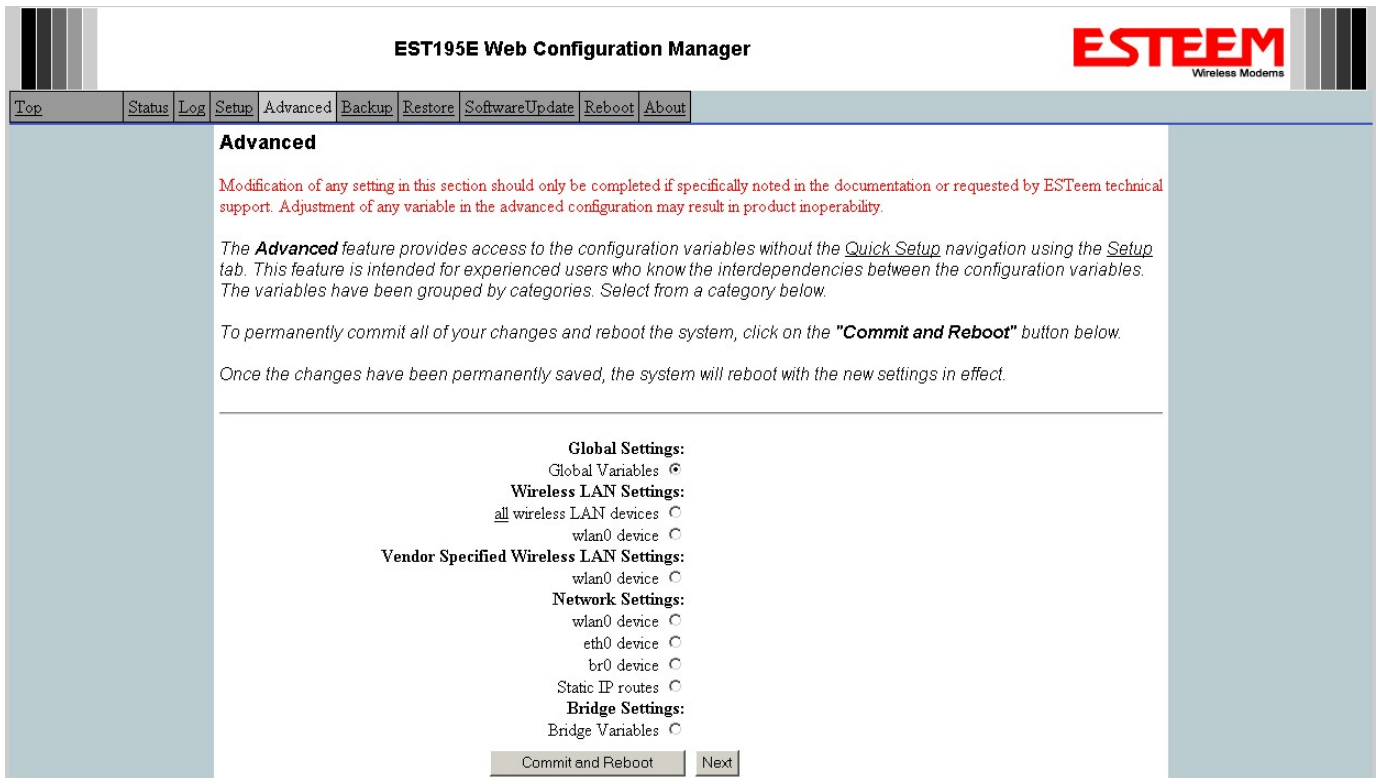


Figure 11: Advanced Settings Menu

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

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

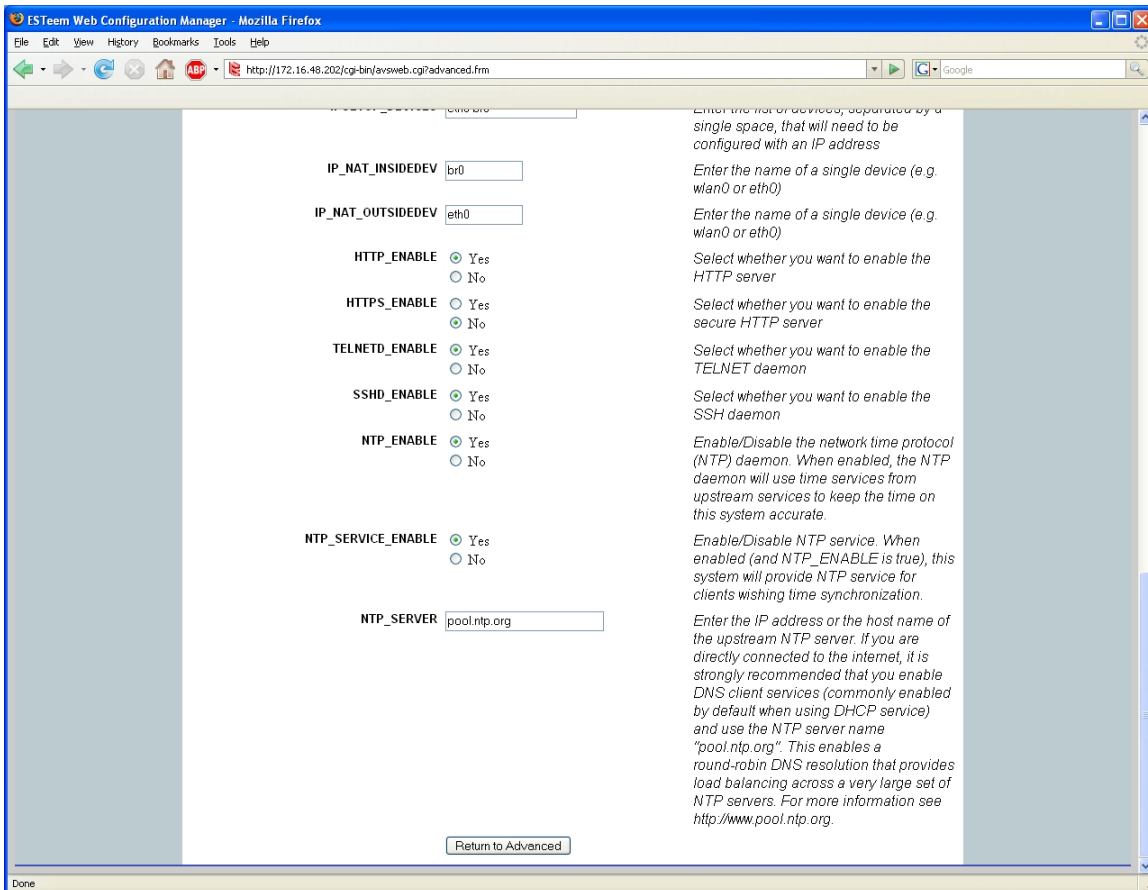


Figure 12: NTP Settings

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

6. Once configuration is complete, press the Return to Advanced button.
7. To complete the configuration, select “Commit and Reboot.” The ESTeem 195C/M will now commit the configuration changes and reboot. (Figure 13)

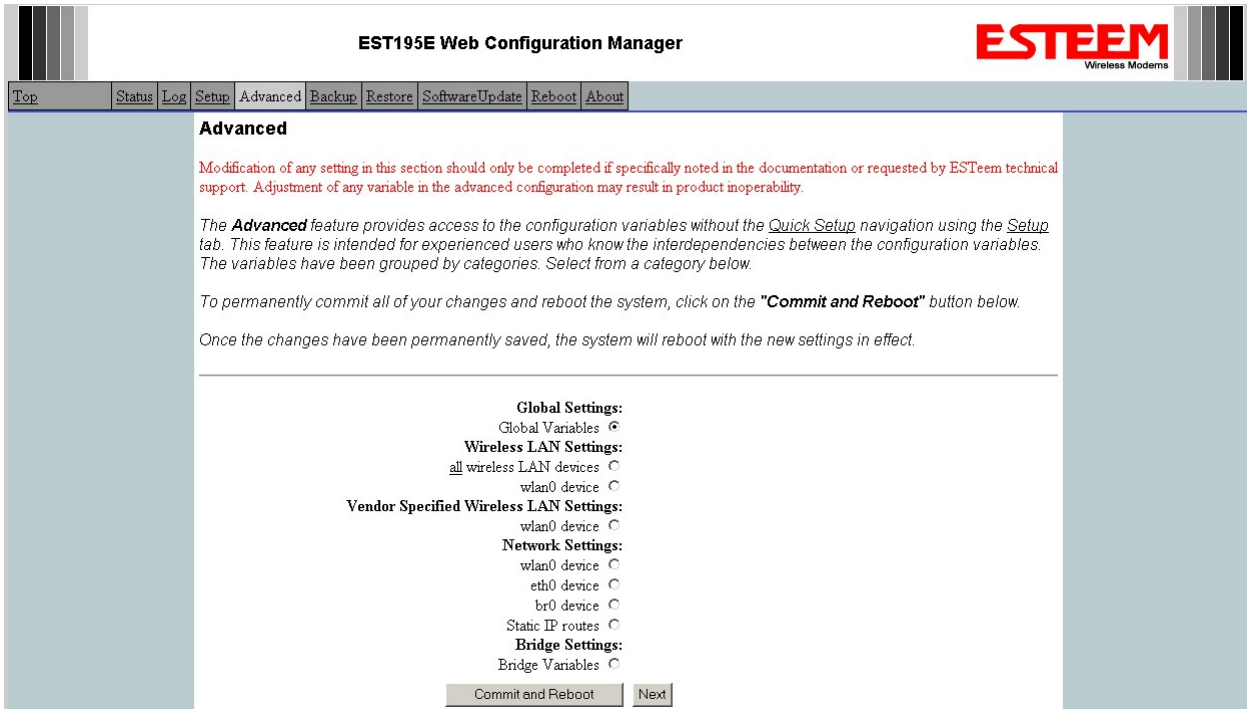


Figure 13: Advanced Settings Menu

Simple Network Management Protocol (SNMP)

The ESTeem 195C/M supports SNMP Version 1 (SNMPv1) and Version 2 (SNMPv2c) protocol. This protocol enables any SNMP server to view the status of the wireless network while the system is in operation. The following are a list of the Management Information Base (MIB) items that are supported in the ESTeem 195C/M and their MIB location:

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

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

Downloading MIB Tables

To download the MIB items listed above and import into your SNMP server, log into any ESTeem 195C/M and select the **About** page (Figure 20). Press the Download [MIB Files](#) hyperlink on the page and save the files to your computer.

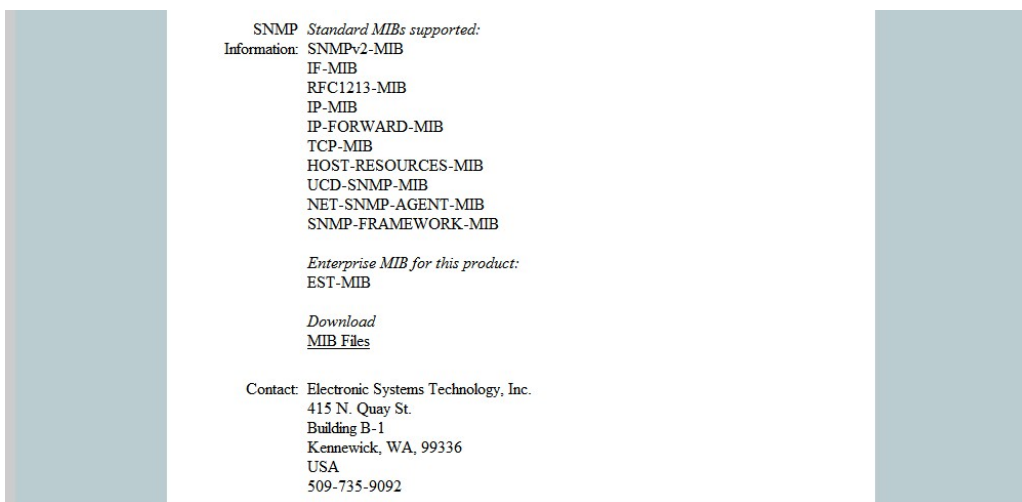


Figure 14: MIB Table Download

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

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

The Model 195C/MC products are allowed by the FCC to use high gain directional antennas.

It is noted that a 1/4 wave antenna that does not have ground plane radials requires a ground plane to operate at maximum efficiency. This can simply be a conducting surface under the antenna that is a 1/4 wavelength in diameter. For the Model 195C (450-470 MHz) this is approximately 6.5 inches. A conducting surface can be anything from the rooftop of an automobile to a file cabinet.

COAXIAL CABLES

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

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

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

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

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

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

WEATHER PROOFING COAX CONNECTIONS

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

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

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

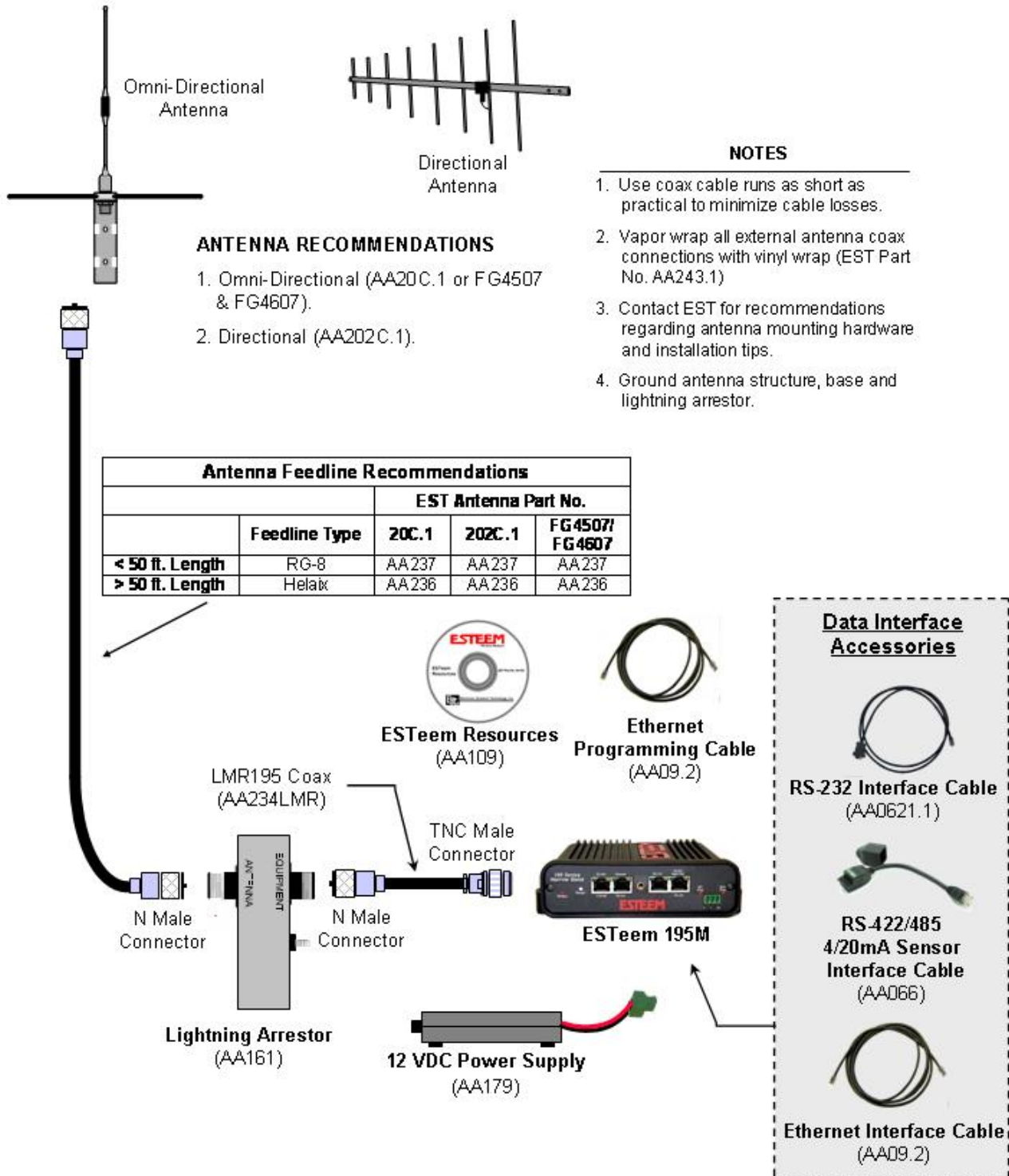
NOTES:

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



Figure 1: Installation Example

Model 195C Cabinet Mount Outdoor Fixed Base Hardware Diagram



195C/M FREQUENCIES OF OPERATION

In a wireless Ethernet network all of the ESTeem Model 195C/M must be set to the same radio frequency of operation. The frequency of operation is selectable when configuring the mode of operation of the 195C/M (reference Chapter 3).

SETTING RF POWER LEVEL

The ESTeem Model 195C/M peak power is adjustable in output power from the advanced configuration menu. The output power is adjusted on the **Advanced Menu>Wireless LAN Settings>Wlan0 Device** screen (Figure 4) of the Web Configuration Manager. Select the value and press the *Save Settings* button.

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

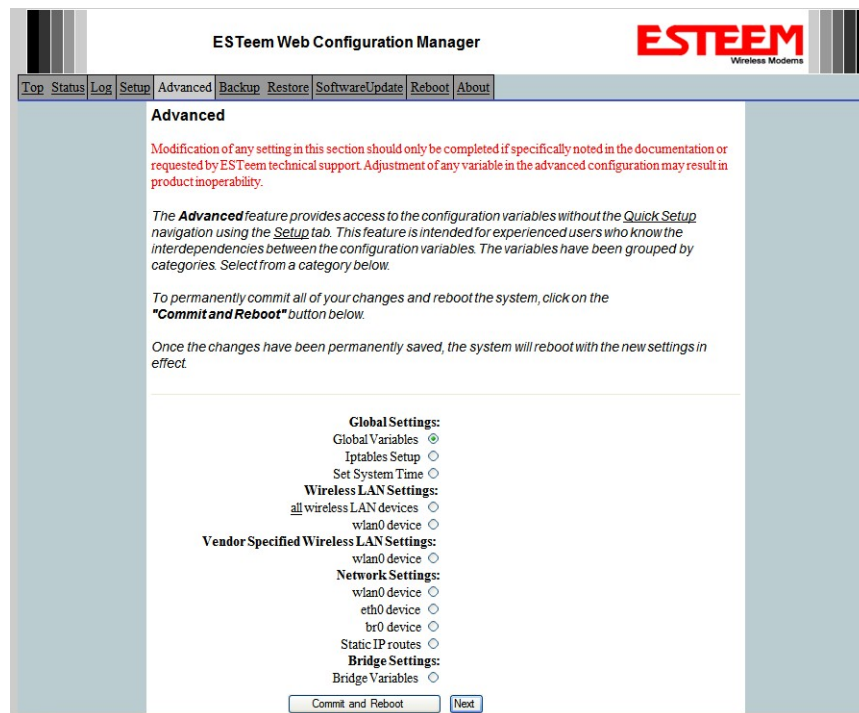


Figure 1: Advanced Global Variables

wlan0_POWER_LEVEL Max
 High
 Low
 Min

Select power level for wlan0 attenuator

wlan0 Radio On

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

Return to Advanced

Save Settings

Figure 2: Power Level Settings

ETHERNET INTERFACE

The ESTeem Model 195C/M's Ethernet Port is a Full and Half-Duplex Auto-negotiation interface supporting 10 Mbps, 100 Mbps and 1Gbps (10/100/1000BaseT). The port is compatible with TIA/EIA-568B cable configuration (Figure 1).



Figure 1: Ethernet Pin Layout

RJ45 Pin No.	Wire Color	Wire Diagram	10Base-T Signal 100Base-TX Signal
1	White/Orange		Transmit +
2	Orange		Transmit -
3	White/Green		Receive +
4	Blue		+ Power
5	White/Blue		+ Power
6	Green		Receive -
7	White/Brown		- Power
8	Brown		- Power

RS-232C DATA PORT CONFIGURATION

The ESTeem Model 195C/M has a 9-pin RS-232C data interface on the front panel. See Chapter 6 for further information on serial data port configuration. To interface the 195C/M to the serial port on the computer, you need serial cable with the following pin-out:

ESTeem Model 195C/M RS-232C Port Pin-Out Table

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

TESTING COMMUNICATION LINK

After you have configured at least two of the Model 195C/M wireless Ethernet modems for operation, you can verify communication with each the following steps:

Status Light

The quickest source of link status is to view the Status Light on the face of the 195C/M (Figure 1). If the Status light is solid, the Model 195C/M has a connection to another Model 195C/M listed in the Peer Table.

Status LED
Solid Red on Link



Figure 1: Connection Status Light

Status Screen/Peer Table

To view detailed information on the status of the communication link (such as connection speed, signal strength and last update time) you can open the Status Screen from the Web Interface. After press the Status tab at the top of the screen the Status: Summary will be displayed showing the status of all ports and memory in the 195C/M. Under the Wireless Status heading click on the [View Peer Table](#) (Figure 2). The Peer Table will list all other Wifi (195C/Mg and 195C/Ma only) or mobile client wireless activity seen by the 195C/M and how it is classified.

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

EST195E Web Configuration Manager

Top Status Log Setup Advanced Backup Restore SoftwareUpdate Reboot About

Status: Peer Table

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

[Return to Status Summary Page](#) **Opposite Modem's Wireless MAC**

Associated Stations	Receive Signal Strength (dBm)
None	

Repeater Peers **Last Packet Received**

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

Access Points

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

Figure 2: Repeater Peer Table

probes.

Repeater Peers - The Peer Table will display all connected 195C/Ms configured to repeat to this ESTeem by their Wireless (WLAN) MAC address.

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

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

Current Data Rate – This is the current speed the last data packet received by the Model 195C/M. This may not be the data rate between the radio modems. Note that the speed is listed in kbps, so that 11000 kbps is equal to 11 Mbps.

Note: The ESTeem Model 195C/M uses spread spectrum technology that analyzes each data packet for signal strength and data quality (strength vs. noise). The higher your signal, the more background noise you can sustain without causing degradation in the data transfer. This is also true for lower signal strengths with a very low background noise. These values are provided for guidance and if you have any questions about the values in your application, please contact ESTeem Customer Support at 509-735-9092 or e-mail your application to support@esteem.com.

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

Viewing RF Data Rates

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

The screenshot shows the ESTEEM 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 main content area is titled "Status: Peer Info Summary" and contains the following text: "This page is a summary view of a given WLAN peer. Click on the links below for more details about this peer." Below this is a link "Return to Peer Table Page". A section titled "Detail Links and Summary Data for Peer 00:04:3f:00:09:66" contains several links: "View Peer Counters", "View Peer Statistics", "View Peer Rate Control Information", "View Peer Crypto Information", "View Peer Last Beacon", and "View Peer Last Probe Response".

Figure 3: Peer Summary Table

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

The value of the Current TX rate is the RF data rate between the two ESTEem Model 195C/M.

The screenshot shows the ESTEEM 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 main content area is titled "Status: Peer Rate Control Info" and contains the following text: "This page shows the status of the transmit rate control state machine for a given peer." Below this is a link "Return to Peer Info Page". A section titled "TX Rate Control State for Peer 00:04:3f:00:09:66" contains the following information: "Rates and Rateset:" followed by a table of rates and rateset values. The table has two rows: "# Rates:" and "# Rateset:". The "# Rates:" row contains values: 1, 2, 5, 5, 6, 9, 11, 12, 18, 22, 24, 33, 36, 48, 54. The "# Rateset:" row contains values: X, X, X, X, X, X, X, X, X, X, X, X, X, X, X. Below the table, it says "Fixed on above rateset? : No" and "Current Tx rate : 54.0 Mbps". At the bottom, it says "Seconds since last change : 0".

Figure 4: Rate Control Information

SIGNAL STRENGTH VS DATA RATE

The average signal strength required to maintain a specific data rate will vary by ESTeem 195C/M model and bandwidth. To review the required signal level and its effect from distance and hardware selected, please use the ESTeem RF Design program available from our web site (www.esteem.com). Please note that the data rates can be greatly affected by overall activity on the radio channel and the total background noise. These values should be used as a guide, but testing after installation is required.

LONG RANGE POINT TO POINT APPLICATIONS

The factory configuration on the 195C/M is optimized for distances up to 10 miles. If your application has an RF link with a range greater than 10 miles, you will need to set the maximum range value on both ESTeem 195C/M's on this communication link. To access the Maximum Distance value select **Advanced** from the top Menu then **Wireless LAN Settings>wlan0 device** and press the **Next** button (Figure 5).

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

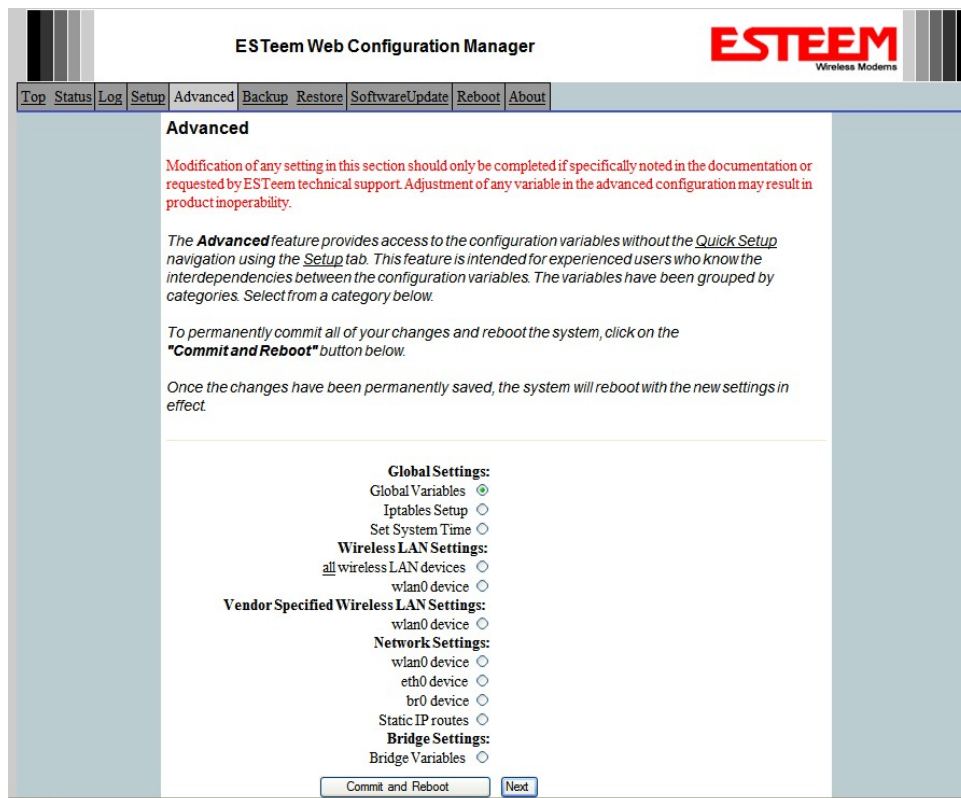


Figure 5: Advanced Features Screen



Figure 6: Maximum Distance Value Entry

TROUBLESHOOTING TIPS

General (Applicable to All Modes of Operation)

Where do I find the latest firmware version number? – We have the latest version number of the Model 195C/M firmware listed on the ESTeem Web site (www.esteem.com) under the Model 195C/M product page.

How and when do I update the Model 195C/M firmware? - You should only update the Model 195C/M firmware if you are having a specific problem and it is recommended that you do so by ESTeem Customer Support personnel. All the update instructions and files are located on the ESTeem FTP site at the following address:

<ftp://www.esteem.com/195C/M>

Do all firmware versions have to be the same to communicate between the Model 195C/M? – It is not necessary for all the firmware versions to be the same revision to communication, but the later version may have added features that the other versions will not recognize.

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

What ESTeem Utility version is required to program the Model 195C/M? – The ESTeem Utility program is not required to program the Model 195C/M. The 195C/M can be programmed using any Terminal Emulation program (such as Windows HyperTerminal) and any web browser program.

What is the speed and duplex configuration on the Model 195C/M – The Model 195C/M is an auto-negotiation full/half-duplex 10/100 Base-T interface. Either a cross-over or patch cable is supported.

Access Point Mode

Wireless LAN cards are not connecting – Verify that the wireless LAN cards are set to Infrastructure Mode, have a matching SSID (or ESSIS) set the same as the Model 195C/M and that all encryption codes are the same.

My Wireless LAN card shows a solid connection, but I can not pass any data – Verify the encryption and the ACL setting on the Model 195C/M match the wireless LAN card.

Access Point Repeater Mode

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

Should the AP Repeater Mode be used on mobile equipment? - The AP Repeater mode should be used on equipment that will not change the Repeater Route as it moves. For example, if a mobile device such as a crane can communicate directly to another ESTeem and will not lose the link in its travel, the AP Repeater Mode could be used. If the device requires two ESTeem Model 195C/M's (Base and Repeater) to maintain communication across its complete travel, the Station Modes should be used on the mobile device. The problem will be in the time that the mobile ESTeem will take to transfer between the two sites. In Access Point Repeater mode the transfer can take up to 30 seconds, while the EtherStation mode will transfer without a packet loss.

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

Correct configuration, but cannot establish communications. – In addition to the network configuration, all 195C/M modems configured in the AP mode must share the same SSID and be on the same frequency channel. The most likely cause of the error is the WLAN MAC address is not configured in **both** 195C/M's repeater tables. If only one side is configured, everything will appear to be correct but no communication will function.

EtherStation

How do I access the Model 195C/M web page in EtherStation Mode? The Model 195C/M does not have an active web browser when configured in EtherStation mode. You must access the ESTeem with the ESTeem Discovery Program or through the RS-232 port after configuration in this mode. To monitor the link status, you can use the EtherStation Status program.

What IP address do I configure the ESTeem in EtherStation mode? – The Model 195C/M will not have an IP address in EtherStation mode.

I can not link my device into the wireless network – Verify that the MAC address of the device is **exactly** the same as configured in the Model 195C/M. The MAC address must have colons between the values.

Can I connect my Model 195C/M in EtherStation mode to a HUB or Ethernet Switch? – No. The modem must be connected directly to the Ethernet device for which it is programmed. In EtherStation mode the Model 195C/M can only service ONE Ethernet device.

INFORMATION TO USERS

WARNING: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generated, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at their expense.

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

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

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

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

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

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

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

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

EXPOSITION RF AVERTISSEMENT: *Un minimum de séparation doit être maintenue entre l'utilisateur et à proximité antenne aux distances suivantes:*

Antenna AA19C:	1 meter (40 inches)
Antenna AA20C.1:	1.25 meters (50 inches)
Antenna AA202C:	2.5 meters (100 inches)
Antenna AA19M:	1 meter (40 inches)
Antenna AA20M:	2 meters (80 inches)
Antenna AA202M:	2 meters (80 inches)

Type Acceptance and RF Emissions Information

Model 195C

12.5 KHz Channel Spacing, 9,600 bps
FCC Type Acceptance No: ENPESTEEM195C
12.5 KHz Channel Emissions Designator: 8K59F1D
6.25 KHz Channel Emissions Designator: 4K37F1D

Industry Canada Type Acceptance: 2163A-192195C
12.5 KHz Channel Emissions Designator: 8K59F1DDN
6.25 KHz Channel Emissions Designator: 4K37F1DDN

Model 195M

12.5 KHz Channel Spacing, 9,600 bps
FCC Type Acceptance No: ENPESTEEM195M
12.5 KHz Channel Emissions Designator: 8K59F1D
6.25 KHz Channel Emissions Designator: 4K37F1D

Industry Canada Type Acceptance: 2163A-192195M
12.5 KHz Channel Emissions Designator: 8K59F1DDN
6.25 KHz Channel Emissions Designator: 4K37F1DDN

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Pleasanton, CA 94588-8543

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Lakewood, CO 80226-1544

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Miami, FL 33130

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Federal Building
Honolulu, HI

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Portland, OR 97204

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2300 E. Lincoln Hwy
Langhorne, PA 19047-1859

PUERTO RICO

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

TEXAS

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

5636 Federal Building
515 Rusk Avenue
Houston, TX 77002

WASHINGTON DC

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

WASHINGTON

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

ESTeem 195C Specifications	
Transmitter/Receiver	
Frequency of Operation (Software Selectable)	450 to 470 Mhz (6.25Khz / 12.5 Khz Channel Spacing)
Frequency Stability, -30C to +60C	+/- 1.5ppm
RF Data Rate @ 6.25Khz channel spacing	4.8Kbps
RF Data Rate @ 12.5Khz channel spacing	9.6Kbps
Tx Output Power (Software Adjustable)	0.5 to 4 Watts
Tx Output Impedance	50 ohms
Rx Sensitivity	-110 dBm
Rx Adjacent Channel Rejection	> 55 dB
Modulation	4-Level GFSK
Forward Error Correction	TCM, Coding Rate 3/4
Data Error Detection	32-Bit Cyclic Redundancy Check
FCC ID	ENPESTEEM195C
Industry Canada Type Acceptance	2163 192 195C
LED Indicators	Power (48VDC, 12V-Aux), Status Multi-Color LED (Tx, Rx, Rx-Valid, Rx-Error), RS-232 Tx/Rx, RS-485 Tx/Rx, RS-422 Tx/Rx, Ethernet Activity / Link
Data Packet Information	
Radio Addressing	1-254 Total Units, Digi-repeating allows up to 3 repeaters between end-points
Data Packet Size	1-2000 Bytes
Serial Data Interface Buffer Size	8Kbytes Tx / 8Kbytes Rx
Data Retry	Software Adjustable
Power Requirements	
Receive / Without Ethernet Link	120 ma @ 12 VDC
Receive / With Ethernet Link	160 ma @ 12 VDC
Transmit @ 4 Watts RF Output	1540 ma @ 12 VDC
External 48 VDC Power Supply, EST P/N (tba)	30 Watts, RJ-45 Connector, Cat 5 Cable (300 Ft Maximum)
External DC Power Input	10.8 to 15 VDC
Input/Output Connectors	
Ethernet Port (10/100)	RJ-45 Female
Serial Data Interfaces (One of four selectable)	Baud Rates 2400 to 115,200
1. RS-232 Port 1 (4-Wire) Tx,Tx-Gnd,Rx,Rx-Gnd	RJ-45 Female (Shared with 48VDC Port)
2. RS-232 Port 2 (With Handshaking Signals)	RJ-45 Female, Optional RJ-45 To DB9, 3-Wire Adaptor Available
3. RS-485 Port	RJ-45 (Shared With 4-20 mA Sensor Port)
4. RS-422 Port	RJ-45 (Shared With Ethernet Port)
4-20 mA I/O	RJ-45 Female (Shared With RS-485 Port)
Antenna Input/Output	TNC Female Connector
External DC Input Power	Mini-Combicon, 3 pin female
Protocols	
Serial Data Interface, Master PLC mode protocols supported by auto-digi-repeater function	Allen Bradley DF1, Opto22, Modbus RTU/ASCII, and Transparent protocols
Ethernet Interface protocols supported for remote access via ARP proxy on Master Gateway Unit	ICMP Echo (ping), Modbus/TCP (Aux Voltage, 4-20mA readings, RSSI, MCU Core Temperature), Remote Configuration
Ethernet Interface protocols (direct access only)	Telnet, IP Configuration, Firmware upgrades
Mechanical / Environmental	
Temperature Range	-30° to +60° C
Humidity	95% Non-condensing
Dimensions	1.9 in. H x 6.7 in. W x 6.2 in. L
Weight	1.25 lbs.
Product Warranty	1 Year
Options	
Outdoor Pole Mount Kit	AA195PM
48 VDC Power Supply	TBD
RJ-45 To DB9 Serial Adaptor	TBD
RJ-45 To Terminal Block Adaptor	TBD
Antennas/Surge Protectors/Cables, etc.	Contact factory for various options (market@esteem.com or 509-735-9092)

Antenna Specifications

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



Model AA19C

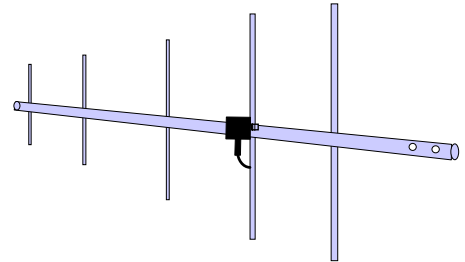
Model No: AA20C.1
Antenna Type: Omni-Directional, DC grounded, Collinear 5/8 wave over 1/2 wave.
Applications: Fixed base or mobile mounting. L shaped mounting bracket may be removed for panel mounting. Ground plane radials may be removed depending on application.
Frequency: 450 to 470 MHz - AA20C.1
Polarization: Vertical
Impedance: 50 ohms
Gain: 4.5 dB.
VSWR: < 1.5
Front To Back Ratio: n/a
Horizontal Beamwidth: n/a
Vertical Beamwidth: 30 degrees
Antenna Material: Stainless steel whip and ground plane radials. All other hardware anodized metal.
Mounting Hardware: Stainless steel clamps for mounting to 3/4 in. to 1/2 in. pipe with right angle mount or direct mount.
Antenna Connector: N-Type Female
Antenna Envelope: 37 1/2 in. length by 16 in width with ground plane radials.
Weight: 2 lbs.



Model AA20C.1

Antenna Specifications

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

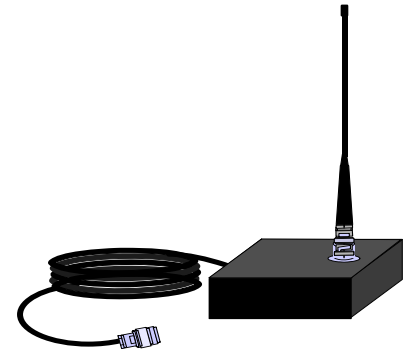


Model AA202C/F

ESTeem 195M Specifications	
Transmitter/Receiver	
Frequency of Operation (Software Selectable)	150 to 174 Mhz (6.25Khz / 12.5 Khz Channel Spacing)
Frequency Stability, -30C to +60C	+/- 1.5ppm
RF Data Rate @ 6.25Khz channel spacing	4.8Kbps
RF Data Rate @ 12.5Khz channel spacing	9.6Kbps
Tx Output Power (Software Adjustable)	0.5 to 4 Watts
Tx Output Impedance	50 ohms
Rx Sensitivity	-110 dBm
Rx Adjacent Channel Rejection	> 55 dB
Modulation	4-Level GFSK
Forward Error Correction	TCM, Coding Rate 3/4
Data Error Detection	32-Bit Cyclic Redundancy Check
FCC ID	ENPESTEEM195M
Industry Canada Type Acceptance	2163 192 195M
LED Indicators	Power (48VDC, 12V-Aux), Status Multi-Color LED (Tx, Rx, Rx-Valid, Rx-Error), RS-232 Tx/Rx, RS-485 Tx/Rx, RS-422 Tx/Rx, Ethernet Activity / Link
Data Packet Information	
Radio Addressing	1-254 Total Units, Digi-repeating allows up to 3 repeaters between end-points
Data Packet Size	1-2000 Bytes
Serial Data Interface Buffer Size	8K bytes Tx / 8K bytes Rx
Data Retry	Software Adjustable
Power Requirements	
Receive / Without Ethernet Link	120 ma @ 12 VDC
Receive / With Ethernet Link	160 ma @ 12 VDC
Transmit @ 4 Watts RF Output	1540 ma @ 12 VDC
External 48 VDC Power Supply, EST P/N (tba)	30 Watts, RJ-45 Connector, Cat 5 Cable (300 Ft Maximum)
External DC Power Input	10.8 to 15 VDC
Input/Output Connectors	
Ethernet Port (10/100)	RJ-45 Female
Serial Data Interfaces (One of four selectable)	Baud Rates 2400 to 115,200
1. RS-232 Port 1 (4-Wire) Tx, Tx-Gnd, Rx, Rx-Gnd	RJ-45 Female (Shared with 48VDC Port)
2. RS-232 Port 2 (With Handshaking Signals)	RJ-45 Female, Optional RJ-45 To DB9, 3-Wire Adaptor Available
3. RS-485 Port	RJ-45 (Shared With 4-20 mA Sensor Port)
4. RS-422 Port	RJ-45 (Shared With Ethernet Port)
4-20 mA I/O	RJ-45 Female (Shared With RS-485 Port)
Antenna Input/Output	TNC Female Connector
External DC Input Power	Mini-Combicon, 3 pin female
Protocols	
Serial Data Interface, Master PLC mode protocols supported by auto-digi-repeater function	Allen Bradley DF1, Opto22, Modbus RTU/ASCII, and Transparent protocols
Ethernet Interface protocols supported for remote access via ARP proxy on Master Gateway Unit	ICMP Echo (ping), Modbus/TCP (Aux Voltage, 4-20mA readings, RSSI, MCU Core Temperature), Remote Configuration
Ethernet Interface protocols (direct access only)	Telnet, IP Configuration, Firmware upgrades
Mechanical / Environmental	
Temperature Range	-30° to +60° C
Humidity	95% Non-condensing
Dimensions	1.9 in. H x 6.7 in. W x 6.2 in. L
Weight	1.25 lbs.
Product Warranty	1 Year
Options	
Outdoor Pole Mount Kit	AA195PM
48 VDC Power Supply	TBD
RJ-45 To DB9 Serial Adaptor	TBD
RJ-45 To Terminal Block Adaptor	TBD
Antennas/Surge Protectors/Cables, etc.	Contact factory for various options (market@esteem.com or 509-735-9092)

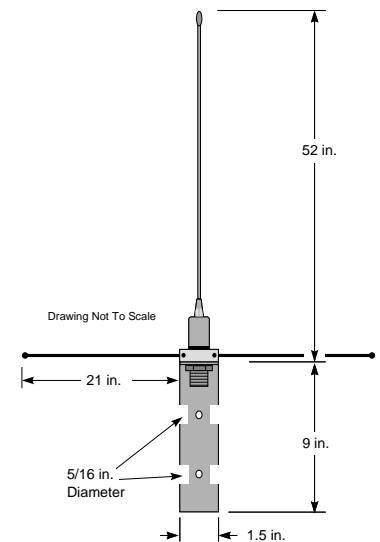
Antenna Specifications

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



Model AA19M

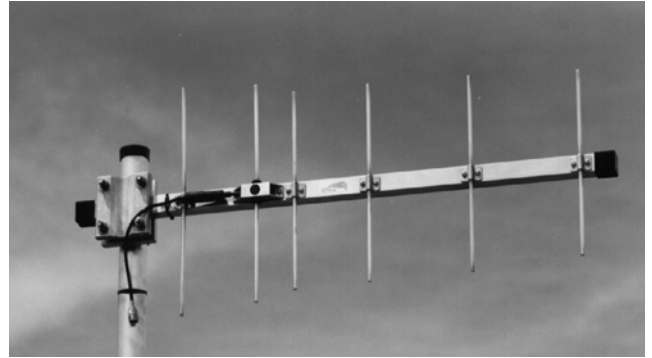
Model No: AA20M
Antenna Type: Omni-Directional, DC grounded, Collinear 5/8 wave
Applications: Fixed base or mobile mounting. L shaped mounting bracket may be removed for panel mounting. Ground plane radials may be removed depending on application.
Frequency: 150 to 175 MHz
Polarization: Vertical
Impedance: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



Model AA20M

Antenna Specifications

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



Model AA202M