ESTeem USER'S MANUAL

Models 195C – 195M

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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;

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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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CHAPTER 1 – Introduction

CHAPTER 2 – Starting Out

CHAPTER 3 – Example Applications

CHAPTER 4 – Repeating Features

CHAPTER 5 – Ethernet Applications

Wireless Modems

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.

Figure 2 – Pole Mount Configuration

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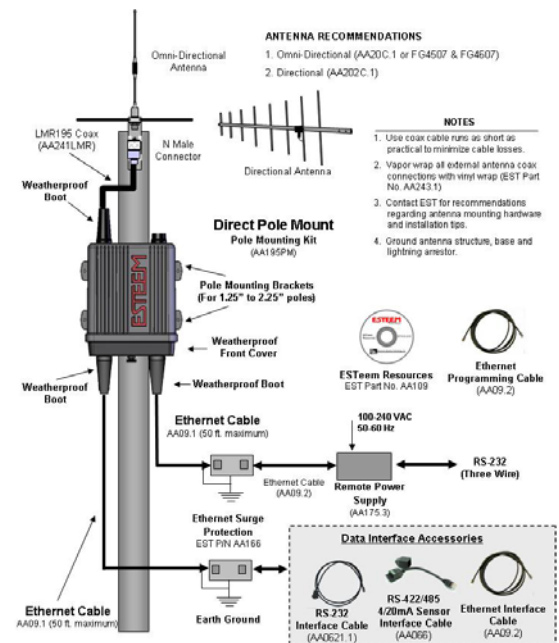
hardware handshaking through the request to send (RTS) and clear to send (CTS) lines. Both ports are software configurable from 2,400 to 115,000 bps.

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 configuration 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

**Antenna
(AA191C Displayed)**
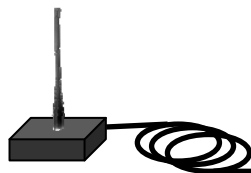
**Power Supply
(AA179 Displayed)**

AA109 Resource Disk

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.

Test Antenna (AA19C Shown)

TNC Female Antenna Connection

10/100BaseT Ethernet Cable (Patch or Cross Over)

AA179 Power Supply

AA109 Resource Disk

PC with Flash Software Installed
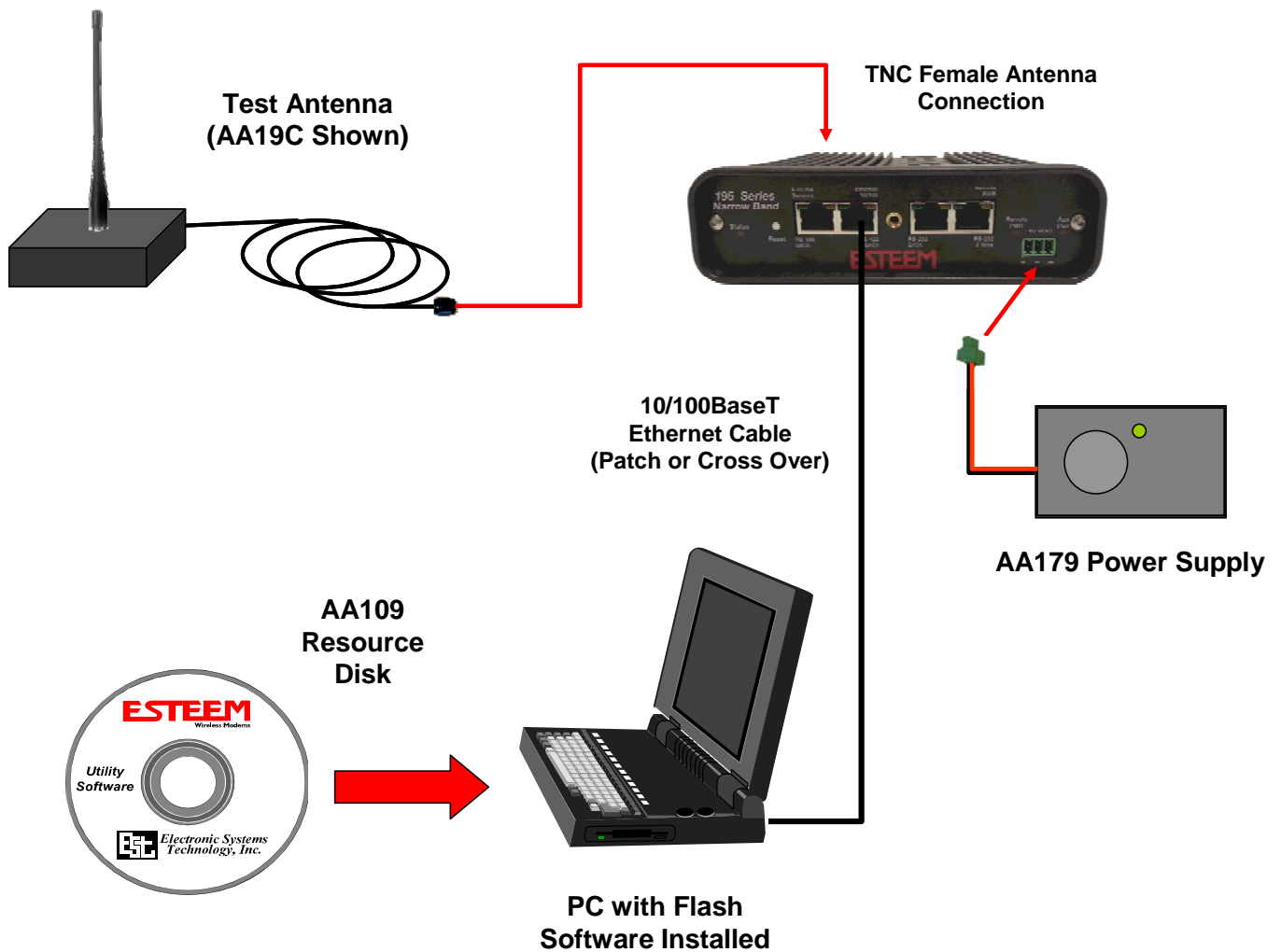
Figure 1 – Basic Configuration Diagram

Modes Of Operation

The ESTeem Model 195C and 195M are sophisticated wireless networking devices that can be configured for multiple serial and Ethernet interfaces. 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.

Transparent Point to Point Application

The most commonly used mode of operation with the ESTeem Model 195C/M is the transparent mode. Point to point operation is when two serial or Ethernet devices are transferring information between either other, directly or through a repeater (Figures 1 and 2). The type of serial data interface (RS-232, RS-422, RS-485 or Ethernet) on either end of the wireless link is configurable and can be independent on each side. For example, the Main Office in Figure 1 can be configured for RS-232 operation, while the serial port at the remote site can be configured for RS-485.

Example Applications

- Point to point serial interfaces (RS-232, RS-422 or RS-485)
- Point to point wireless Ethernet communication devices
- Remote Supervisory Control and Data Acquisition (SCADA) networks

Applications Where Transparent Mode Not Used

- Multiple Remote Locations
- PLC Emulation Networks (see PLC Emulation below)
- Connections to large Ethernet traffic networks such as large office buildings or plant networks
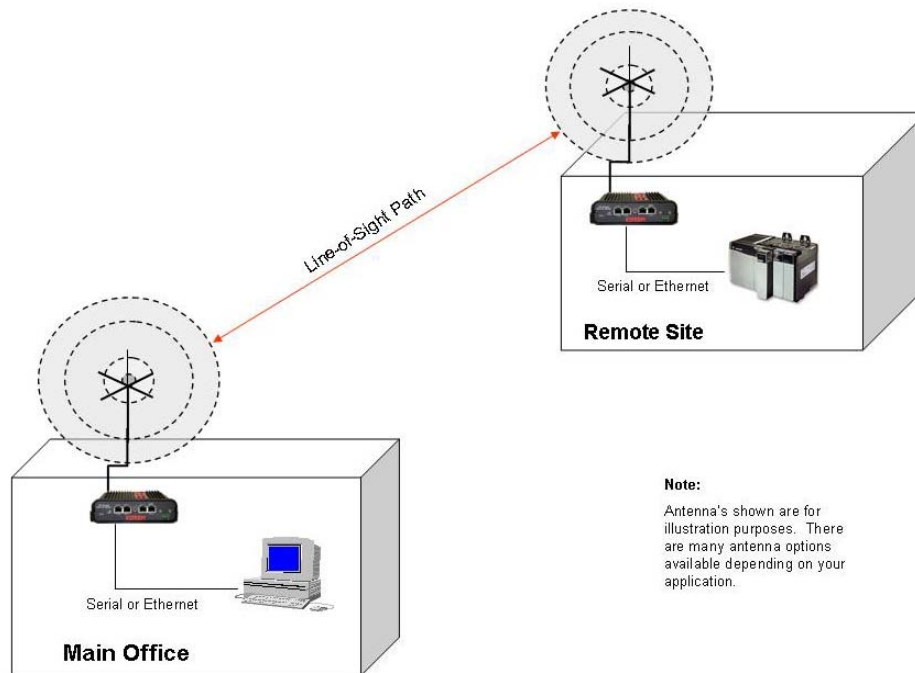
Figure 1: Point to Point Example
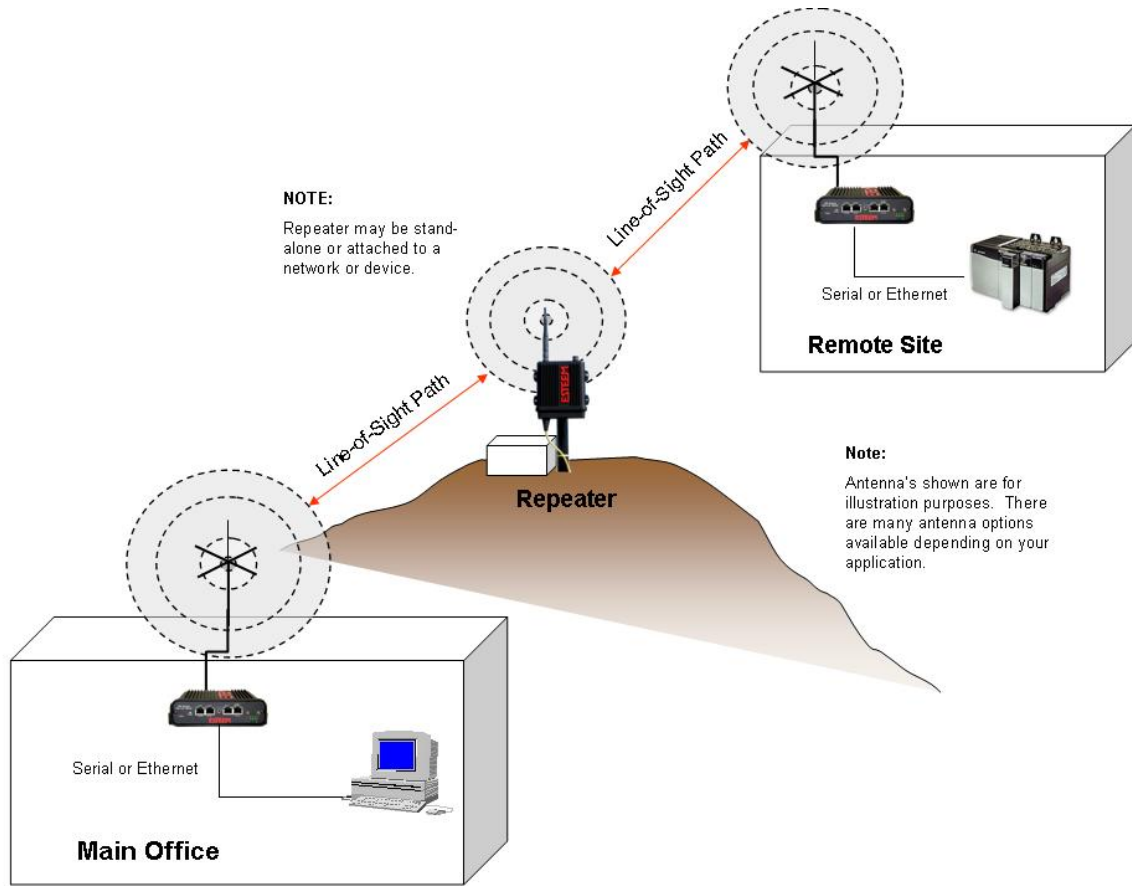
Figure 2: Point to Point with Repeater

Transparent Multipoint Application

The ESTeem 195C and 195M can be configured multipoint transparent operation (Figure 3). Similar to point to point applications, the 195C/M can support multiple serial data interfaces (RS-232, RS-422, RS-485 or Ethernet) on either end of the wireless link. These wireless links are independent of each other and configurable.

Example Applications

- Point to multipoint serial networks (RS-232, RS-422 or RS-485)
- Point to multipoint wireless Ethernet communication devices

Applications Where Transparent Mode Not Used

- PLC Emulation Networks (see PLC Emulation below)
- Simple network connections (see transparent point to point)
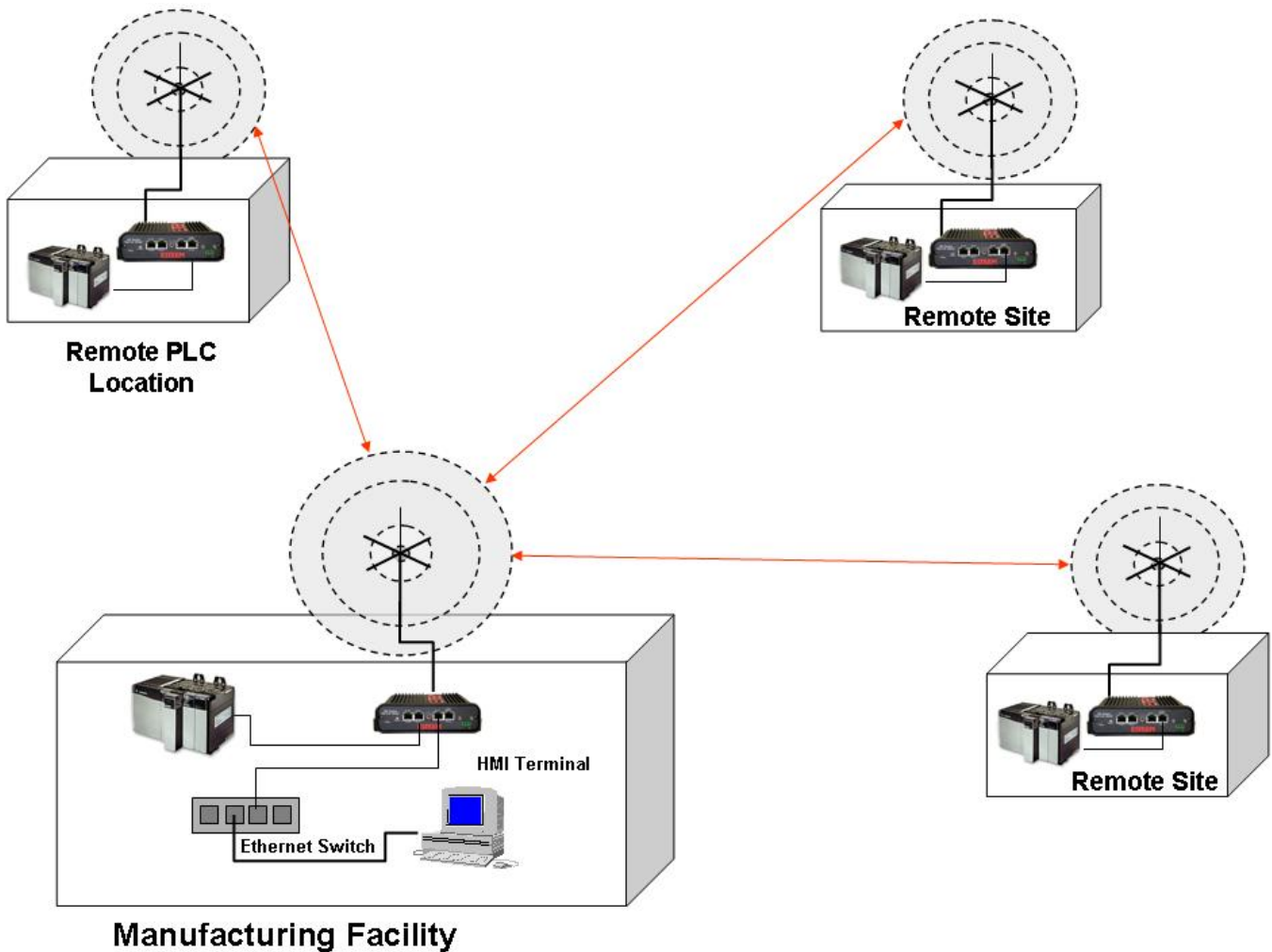
Figure 3: Point to Multipoint Transparent Example

PLC Emulation Applications

The ESTeem 195C and 195M can support PLC based networks in both point to point and multipoint applications. The PLC emulation driver allows the ESTeem to identify the destination address in the PLC message block and change the ESTeem destination address to match. This PLC emulation allows the ESTeem 195C/M to support multiple repeaters in a network (Figure 4). If repeaters are used with PLC emulation, the route and append table will also need configured (see Chapter 4 for complete details).

PLC Protocols Supported

- Rockwell Automation DF1 Full-Duplex
- Rockwell Automation DF1 Half-Duplex
- Rockwell Automation DF1 Radio Modem
- Rockwell Automation Ethernet/IP
- Modbus RTU
- Modbus ASCII
- ModbusTCP
- Opto-22
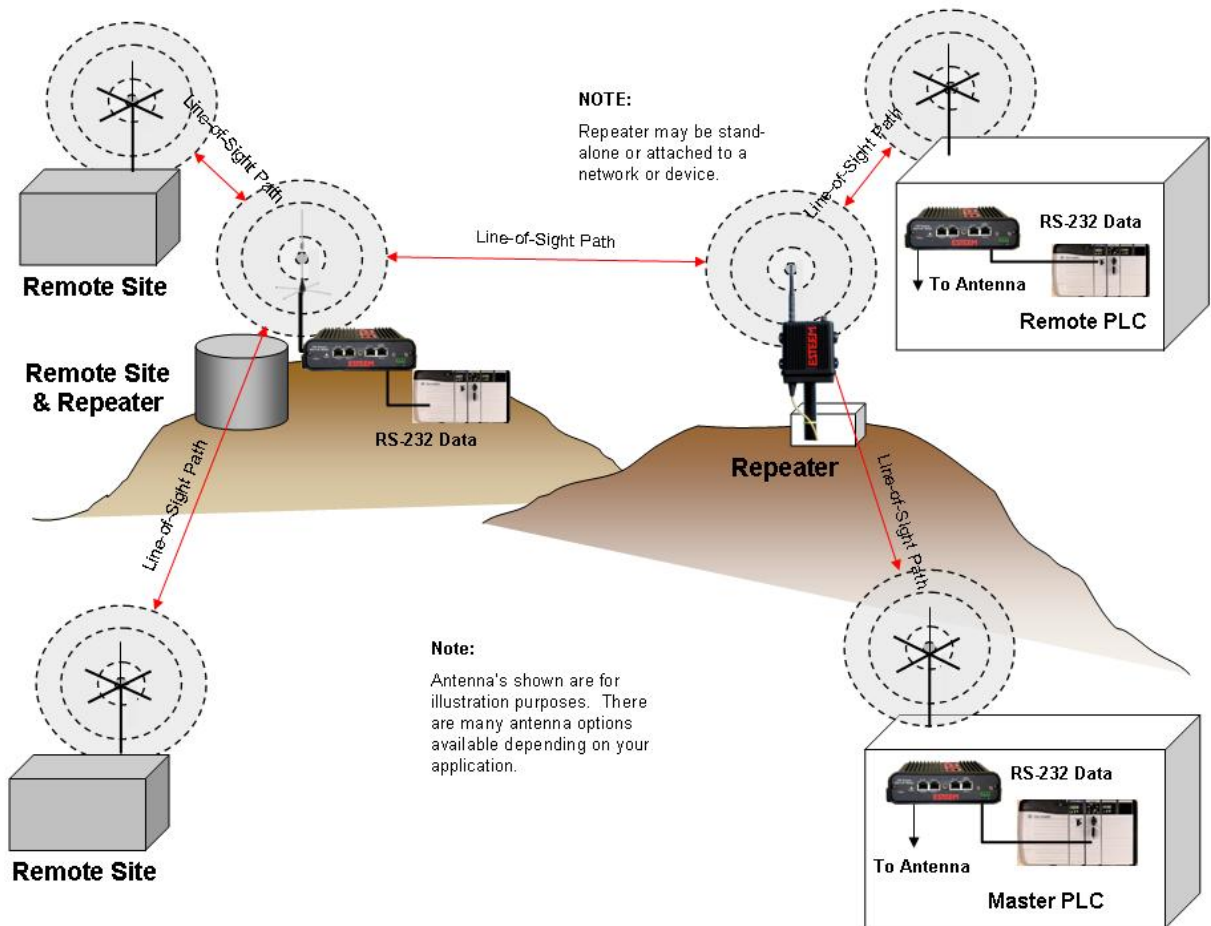
Figure 4: Multipoint PLC Emulation Example

Programming Examples

Once the mode of operation for the ESTeem has been determined, you are now ready to program the Model 195C or 195M for use. ESTeem has created a simplified programming utility call the 195 Narrow Band Configuration Tool. This configuration utility will be used in all the following programming examples. For detailed instructions on installing the configuration utility and advanced operation, please refer to Chapter 6 of this User's Manual.

> ***Technical Tip:*** The 195 Narrowband Configuration Tool communicates with the 195C and 195M through the Ethernet interface. If Ethernet or RS-422 (Shared ports with the Ethernet programming port) are the data interface for the wireless link, configure the 195C/M as shown, reset and then change the correct data cable.

Finding ESTeem 195C/M with Discovery

Each of the example applications will use the 195 Narrowband Configuration Utility and basic to program the ESTeem 195C and 195M. The modem's software commands can also be configured through any serial interface (RS-232, RS-422 or RS-485) or Telnet session. Please refer to Appendix-A (Software Commands) for a complete list of software commands and instructions on serial configuration.

1. Verify the basic hardware configuration from Chapter 2 and open the 195 Narrowband Configuration Utility (Figure 5). Press the *Discover EST Modems* button to continue.
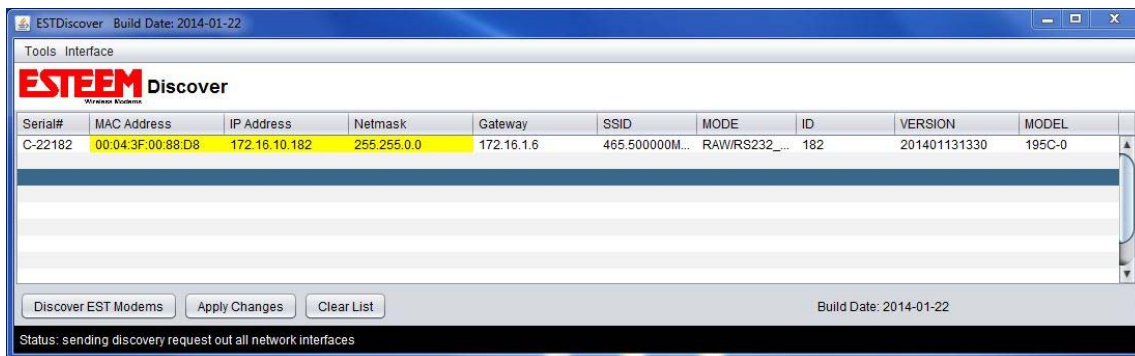
Figure 5: ESTeem Discovery Utility

2. The ESTeem 195C/M will be displayed (Figure 6). If the ESTeem 195C/M is not on the same IP subnet as the computer, double click on the IP, Netmask or Gateway and make the necessary changes. Press the *Apply Changes* button when complete.

3. If changes were made to the IP address you will need to press the *Discover EST Modems* button again to show the changes. Right-mouse click on the ESTeem 195C/M and select *Configure Radio* button to begin programming.

> ***Technical Tip:*** If your computer is configured for DHCP and not attached to the network, you will need to assign a static IP address to program the 195C/M.
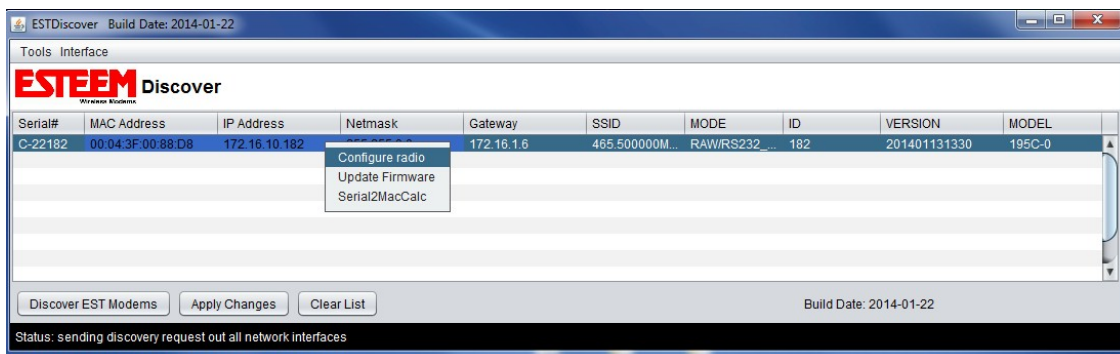
Figure 6: Opening Radio Configuration Software

Point to Point Transparent Example 1 (Figure 1)

(2) ESTeem Model 195C
Transparent RS-232 Wireless Link
465.500 MHz at 2 Watts Output
Main Office Address – 172.16.10.182
Remote Site Address – 172.16.10.183

> *Technical Tip:* The unit address of the ESTeem 195C or 195M is the last octet of the IP address. This single address is used when configuring the destination and routing. Example – Main Address IP = 172.16.10.182. Unit address = 182.

The 195 Series Narrow Band Configuration Tool provides a graphical interface to the individual software commands for the ESTeem 195C or 195M. On the Configuration tab the software commands can be displayed by their category. To display the status of all software commands select the "All" commands radial and press the *Read Config* button (Figure 7).
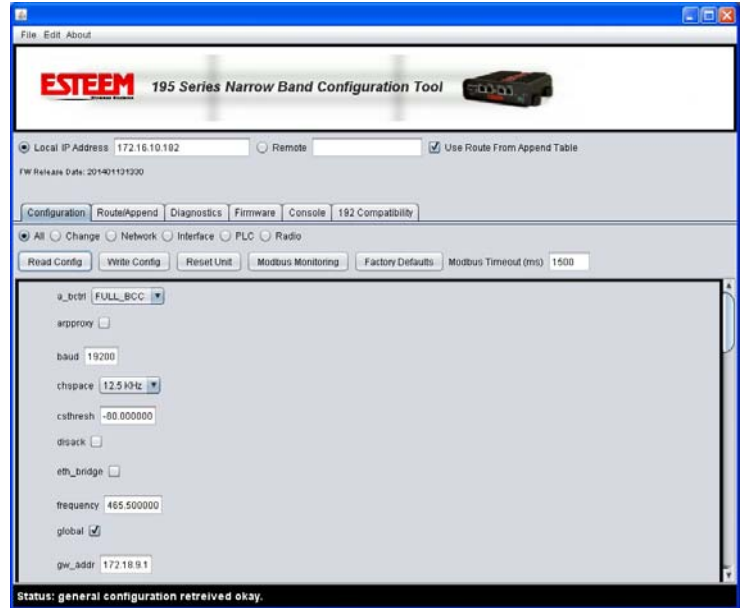
Figure 7: Model 195C/M Configuration Utility

The following are the software commands that need to be adjusted for point to point operation. For a complete list of software commands and their definition, please refer to Appendix A (Software Commands) of this User's Manual:

Main Office

Name	Command	Setting	Notes
IP Address	ip_addr	172.16.10.182	Set with Discovery Utility in setup above
Frequency	frequency	465.500	Listed in MHz and set to operating frequency of network
RF Power	rfpower	2 Watts	Drop down menu 0.5 to 4 Watts - Output power on FCC license
Serial Data Interface	sdi	RS-232 Full Handshake (port 3)	Drop down menu for configuring which port will transfer data
Baud Rate	baud	19200	Configure serial port data rate
Setconnect Address	setc	183	ESTeem address where data will be sent. Usually the unit address of remote ESTeem.
Terminal Timer	termt	10	Time gap in serial data before making RF packet and sending to remote ESTeem (milliseconds)

Remote Site

Name	Command	Setting	Notes
IP Address	ip_addr	172.16.10.183	Set with Discovery Utility in setup above
Frequency	frequency	465.500	Listed in MHz and set to operating frequency of network
RF Power	rfpower	2 Watts	Drop down menu 0.5 to 4 Watts - Output power on FCC license
Serial Data Interface	sdi	RS-232 Full Handshake (port 3)	Drop down menu for configuring which port will transfer data
Baud Rate	baud	19200	Configure serial port data rate
Setconnect Address	setc	182	ESTeem address where data will be sent. Usually the unit address of remote ESTeem.
Terminal Timer	termt	10	Time gap in serial data before making RF packet and sending to remote ESTeem (milliseconds)

The above software commands can be adjusted in the "All" commands radial or found in their individual sections such as "Interface" and "Radio" (Figure 8).
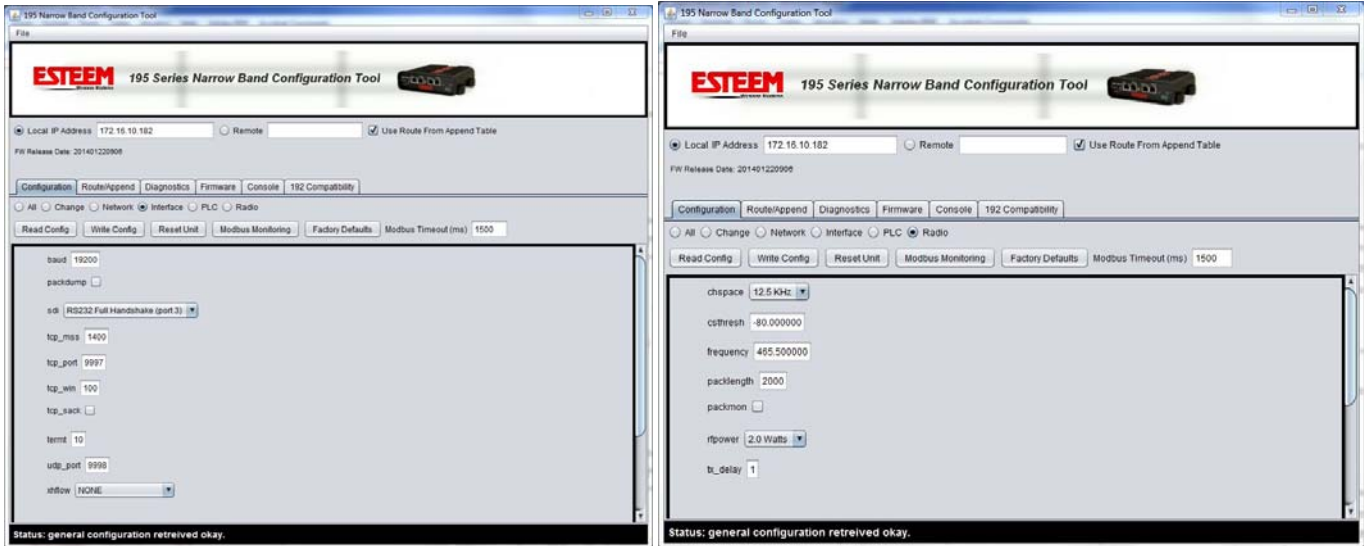
Figure 8: Interface and Radio Configuration Pages

Once all the above software commands are adjusted to their correct parameters, press the *Write Config* button to send the changes to the 195C or 195M. The modem will reset and be ready for operation on the selected serial port. Complete the above steps for both radio modems in the network and proceed to installation and testing.

Point to Point Transparent Example 2 (Figure 2)

(3) ESTeem Model 195C
Transparent RS-232 Wireless Link
465.500 MHz at 2 Watts Output
Main Office Address – 172.16.10.182
Remote Site Address – 172.16.10.183
Repeater Site Address – 172.16.10.200

> **Technical Tip:** The unit address of the ESTeem 195C or 195M is the last octet of the IP address. This single address is used when configuring the destination and routing. Example – Main Address IP = 172.16.10.182. Unit address = 182.

The following are the software commands that need to be adjusted for point to point operation with a repeater. For a complete list of software commands and their definition, please refer to Appendix A (Software Commands) of this User's Manual:

Main Office

Name	Command	Setting	Notes
IP Address	ip_addr	172.16.10.182	Set with Discovery Utility in setup above
Frequency	frequency	465.500	Listed in MHz and set to operating frequency of network
RF Power	rfpower	2 Watts	Drop down menu 0.5 to 4 Watts - Output power on FCC license
Serial Data Interface	sdi	RS-232 Full Handshake (port 3)	Drop down menu for configuring which port will transfer data
Baud Rate	baud	19200	Configure serial port data rate
Setconnect Address	setc	200,183	ESTeem address where data will be sent. Note the repeater site address in the communications path.
Terminal Timer	termt	10	Time gap in serial data before making RF packet and sending to remote ESTeem (milliseconds)

Remote Site

Name	Command	Setting	Notes
IP Address	ip_addr	172.16.10.183	Set with Discovery Utility in setup above
Frequency	frequency	465.500	Listed in MHz and set to operating frequency of network
RF Power	rfpower	2 Watts	Drop down menu 0.5 to 4 Watts - Output power on FCC license
Serial Data Interface	sdi	RS-232 Full Handshake (port 3)	Drop down menu for configuring which port will transfer data
Baud Rate	baud	19200	Configure serial port data rate
Setconnect Address	setc	200,182	ESTeem address where data will be sent. Note the repeater site address in the communications path.
Terminal Timer	termt	10	Time gap in serial data before making RF packet and sending to remote ESTeem (milliseconds)

Repeater Site

Name	Command	Setting	Notes
IP Address	ip_addr	172.16.10.200	Set with Discovery Utility in setup above
Frequency	frequency	465.500	Listed in MHz and set to operating frequency of network
RF Power	rfpower	2 Watts	Drop down menu 0.5 to 4 Watts - Output power on FCC license

The above software commands can be adjusted in the "All" commands radial or found in their individual sections such as "Interface" and "Radio" (Figure 8).

Once all the above software commands are adjusted to their correct parameters, press the *Write Config* button to send the changes to the 195C or 195M. The modem will reset and be ready for operation on the selected serial port. Complete the above steps for both radio modems in the network and proceed to installation and testing.

Multipoint Transparent Example 1 (Figure 3)

(4) ESTeem Model 195C
Transparent RS-485 Wireless Link
465.500 MHz at 2 Watts Output
Main Office Address – 172.16.10.182
Remote Site Addresses – 172.16.10.183-172.16.10.186

Technical Tip: The unit address of the ESTeem 195C or 195M is the last octet of the IP address. This single address is used when configuring the destination and routing. Example – Main Address IP = 172.16.10.182. Unit address = 182.

The following are the software commands that need to be adjusted for point to multipoint operation. The only difference from a point to point application is that a special global Setconnect Address (Address = 255) is required. Changing the setconnect address to 255 will all remote locations receive the data simultaneously and pass through the configured serial data interface.

Technical Tip: To send to multiple remote locations at once use a global Setconnect address of 255.

Main Office

Name	Command	Setting	Notes
IP Address	ip_addr	172.16.10.182	Set with Discovery Utility in setup above
Frequency	frequency	465.500	Listed in MHz and set to operating frequency of network
RF Power	rfpower	2 Watts	Drop down menu 0.5 to 4 Watts - Output power on FCC license
Serial Data Interface	sdi	RS-485 (port 1)	Drop down menu for configuring which port will transfer data
Baud Rate	baud	19200	Configure serial port data rate
Setconnect Address	setc	255	Global destination address that will all remote sites to receive data simultaneously.
Terminal Timer	termt	10	Time gap in serial data before making RF packet and sending to remote ESTeem (milliseconds)

Remote Sites

Name	Command	Setting	Notes
IP Address	ip_addr	172.16.10.xxx	Set with Discovery Utility in setup above
Frequency	frequency	465.500	Listed in MHz and set to operating frequency of network
RF Power	rfpower	2 Watts	Drop down menu 0.5 to 4 Watts - Output power on FCC license
Serial Data Interface	sdi	RS-485 (port 1)	Drop down menu for configuring which port will transfer data
Baud Rate	baud	19200	Configure serial port data rate
Setconnect Address	setc	182	ESTeem address where data will be sent.
Terminal Timer	termt	10	Time gap in serial data before making RF packet and sending to remote ESTeem (milliseconds)

Once all the above software commands are adjusted to their correct parameters, press the *Write Config* button to send the changes to the 195C or 195M. The modem will reset and be ready for operation on the selected serial port. Complete the above steps for both radio modems in the network and proceed to installation and testing.

PLC Emulation Example 1 (Figure 4)

(6) ESTeem Model 195C
Rockwell DF1 Half-Duplex (BCC) Emulation
465.500 MHz at 2 Watts Output
Main Office Address – 172.16.10.182
Remote Site Addresses – 172.16.10.183-172.16.10.187

> **Technical Tip:** The unit address of the ESTeem 195C or 195M is the last octet of the IP address. This single address is used when configuring the destination and routing. Example – Main Address IP = 172.16.10.182. Unit address = 182.

The following are the software commands that need to be adjusted for PLC emulation mode. The PLC emulation driver allows the ESTeem to identify the destination address in the PLC message block and change the ESTeem destination address to match. Only the ESTeem 195C/M connected to the PLC initiating the message instructions will have the PLC emulation identified. This PLC emulation allows the ESTeem 195C/M to support multiple repeaters in a network (Figure 4). If

> **Technical Tip:** The address of the ESTeem 195C and 195M **must match** the connected PLC when operating in PLC emulation mode.

repeaters are used with PLC emulation, the route and append table will also need configured (see Chapter 4 for complete details).

Main Office

Name	Command	Setting	Notes
IP Address	ip_addr	172.16.10.182	Set with Discovery Utility in setup above
Frequency	frequency	465.500	Listed in MHz and set to operating frequency of network
RF Power	rfpower	2 Watts	Drop down menu 0.5 to 4 Watts - Output power on FCC license
Serial Data Interface	sdi	RS-232 Full Handshake (port 3)	Drop down menu for configuring which port will transfer data
Baud Rate	baud	19200	Configure serial port data rate
PLC Emulation	plcproto	DF1	Drop down for setting the PLC protocol emulation
DF1 Protocol Type	a_bctrl	half_bcc	Sets the ESTeem for the type of DF1 emulation driver used

Remote Sites

Name	Command	Setting	Notes
IP Address	ip_addr	172.16.10.xxx	Set with Discovery Utility in setup above
Frequency	frequency	465.500	Listed in MHz and set to operating frequency of network
RF Power	rfpower	2 Watts	Drop down menu 0.5 to 4 Watts - Output power on FCC license
Serial Data Interface	sdi	RS-232 Full Handshake (port 3)	Drop down menu for configuring which port will transfer data
Baud Rate	baud	19200	Configure serial port data rate
PLC Emulation	plcproto	None	Drop down for setting the PLC protocol emulation

This example network uses repeaters which require configuration of the Routing and Append tables. For complete information on the configuration and use of repeater please refer to Chapter 4 of this User's Manual.

Once all the above software commands are adjusted to their correct parameters, press the *Write Config* button to send the changes to the 195C or 195M. The modem will reset and be ready for operation on the selected serial port. Complete the above steps for both radio modems in the network and proceed to installation and testing.

PLC Emulation Command Lists

When using the PLC emulation driver at the Master site, you may notice many of the software commands required for transparent operation are not required. The following are a summary of the software command necessary to configure the ESTeem 195C or 195M for specific PLC emulation drivers.

Figure 9 shows the drop down list of available PLC emulation drivers. Modbus RTU, Modbus ASCII and Opto22 have a single configuration type and do not require any additional software commands.

Rockwell Automation's DF1 driver supports DF1 Full-Duplex, DF1 Half-Duplex and DF1 Radio Modem protocols with BCC or CRC error checking on each. The following table list the required software command necessary for each of the above conditions:
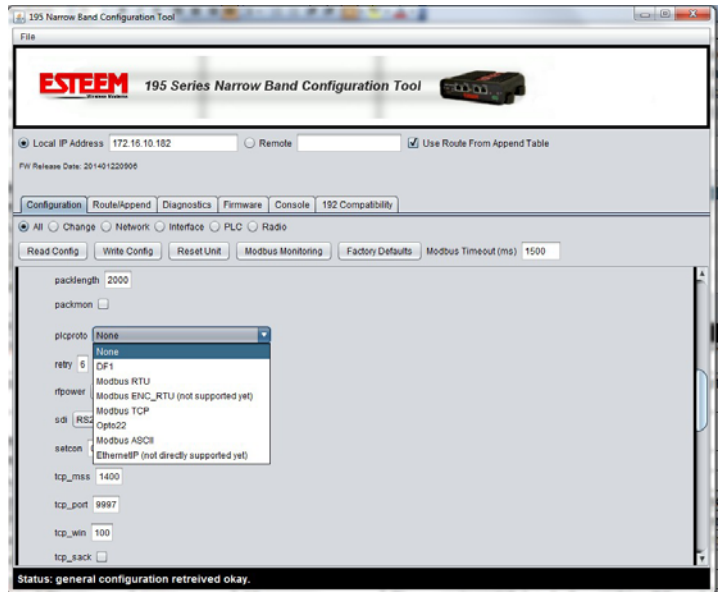
Figure 9: PLC Emulation Selection

Rockwell DF1 Emulation Software Settings

DF1 Protocol	Software Command	Disable Acknowledge (disack command)
Full Duplex using BCC	a_bctrl full_bcc	Yes (Checked)
Full Duplex using CRC	a_bctrl full_crc	Yes (Checked)
Half Duplex using BCC	a_bctrl half_bcc	Yes (Checked)
Half Duplex using CRC	a_bctrl half_crc	Yes (Checked)
Radio Modem Protocol - BCC	a_bctrl full_bcc	No (Unchecked)
Radio Modem Protocol - CRC	a_bctrl full_crc	No (Unchecked)

Figure 10 displays the Allen-Bradley (a_bctrl command) command settings and where to find the Disable Acknowledge (disack command) settings.

> *Technical Tip:* Only the ESTeem 195C/M connected to the PLC <u>initiating</u> the message instructions (Master Site) will have the PLC emulation configured.

Figure 10: PLC Emulation Selection

Any ESTeem Model 195C or 195M in the wireless network can be used as a repeater to reach a remote location. Manually entering repeater routes in a terminal for testing a connection (connect command) or remote programming (program command) is as simple as adding the routing in the address with the repeaters identified by commas. For example using Figure 1, if your computer is connected to the ESTeem 195C/M at the Master Station and you want to connect to address 21, your command would be "connect 3,21". Also if you wished to connect to address 30 from the Master Station your command would be "connect 3,20,40,30".

Configuring Route and Append Tables

When using the PLC emulation modes, the repeater configuration will be different for the Master and Remote locations in a network. You will need to configure the repeater routing table for the Master ESTeem only. The Master ESTeem is the ESTeem connected to the PLC that is initiating communication to remote PLC's through other remote stations. Do not program the repeater configuration in the repeating ESTeems or the remote ESTeems.
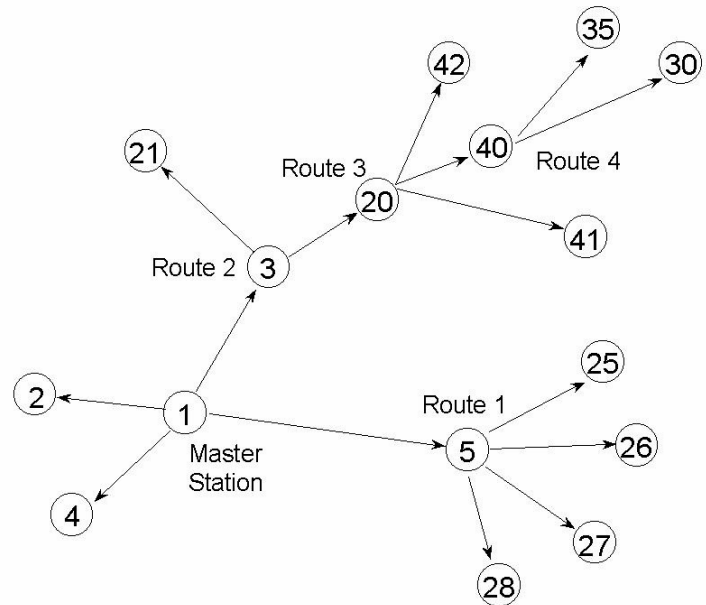
Figure 1: Repeater Example

Figure 1 shows a complex, 16 node site with four (4) repeater routes. This example will illustrate the terms used in the utility and how they correspond to the stations in your site.

Look in Figure 1 and note that four of the ESTeems will relay the radio signal for other ESTeems (addresses 3, 5, 20 and 40). These are the repeater routes. A total of four repeater routes will need to be completed for this site.

> **Technical Tip:** A repeater route consists of any ESTeem in the network that repeats information to another modem.

> **Technical Tip:** The maximum number of memory locations for any ESTeem is 32. When possible, try and group as many addresses together as you can to save available memory locations.

Route 1: To complete the first repeater route entry, refer to Figure 1 and find repeater address 5 (Route 1). The ESTeem/PLC addresses that use this route are addresses 25-28. In the 195C/M Configuration Utility select the Route/Append tab and press the *Edit Tables* button (Figure 2 will be displayed). In Route Entry 01 enter the

repeater address (Address 5). Scroll down the page and find Append Entry 01 and enter the Repeater Route and address group and will use this repeater site (Figure 3).

Note: *ESTeem addresses are input to the Append Entry section in blocks of two numbers. The two numbers represent a range of addresses for a given route. The numbers could be input to cover a range of addresses (such as 25,28 contain all addresses from 25 through 28) or input to cover a single address (such as 25,25 would only attach address 25 to this route).*
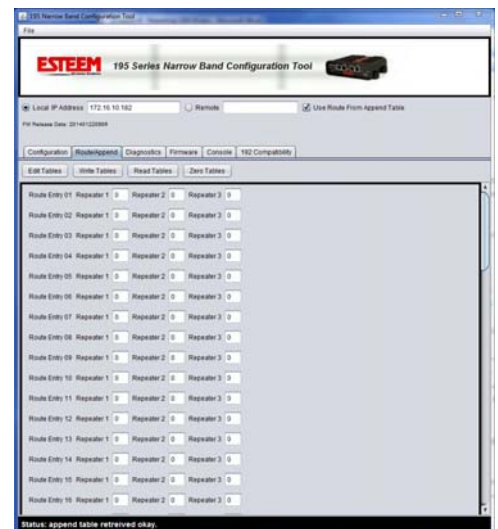
Figure 2: Route and Append Edit

Figure 3: Route 1 Configuration

Route 2: Refer to Figure 1 and find Route 2. This route has a repeater address of 3 and addresses 20 through 21 use this route. **Note***: Although address 20 is a repeater for another route, it requires an ESTeem address and needs to be counted.* Type 3 in the first repeater block, 20 in the first address field and 21 in the second (Figure 4).

Figure 4: Route 2 Configuration

Route 3: Refer to Figure 1, Route 3 and notice there are two repeaters in this route (addresses 3 and 20). A repeater route always follows the address path from the master station. The first repeater address from the master in this route is address 3. Type 3 in the first repeater block. The second repeater from the master is address 20. Type 20 in the second repeater block. Addresses 40 through 42 use this route. Type 40 in the first address field, 42 in the second (Figure 5).

Figure 5: Route 3 Configuration

Route 4: This fourth route uses a total of three repeaters. Follow the address route from the master and notice that the first repeater is address 3. Type 3 in the first repeater block. The second address from the master in this route is address 20. Type 20 in the second repeater block. The third repeater address from the master is address 40. Type 40 in the third repeater block. (Figure 6). Notice that the two addresses that use this repeater route are not sequential, by putting 30 in the first block and 35 in the second would allocate addresses 31-34 to this route. In this example we will input each address separately. On the first line type 30 in both blocks and on the second line use the same repeater route number and type 35 in both blocks (Figure 6).

Figure 6: Route 4 Configuration

Once all repeater routes are addressed, press the *Write Tables* button to save to the connected ESTeem 195C or 195M.

Reading Route and Append Tables

To find the saved route and append tables in an ESTeem 195C or 195M click on the Route/Append tab of the Model 195 Narrowband Configuration Utility and press the *Read Tables* button. Figure 7 displays the saved Routes and Appends for the wireless network shown in Figure 1.

Clearing Route and Append Tables

To clear route and append tables in an ESTeem 195C or 195M click on the Route/Append tab of the Model 195 Narrowband Configuration Utility and press the *Zero Tables* button.
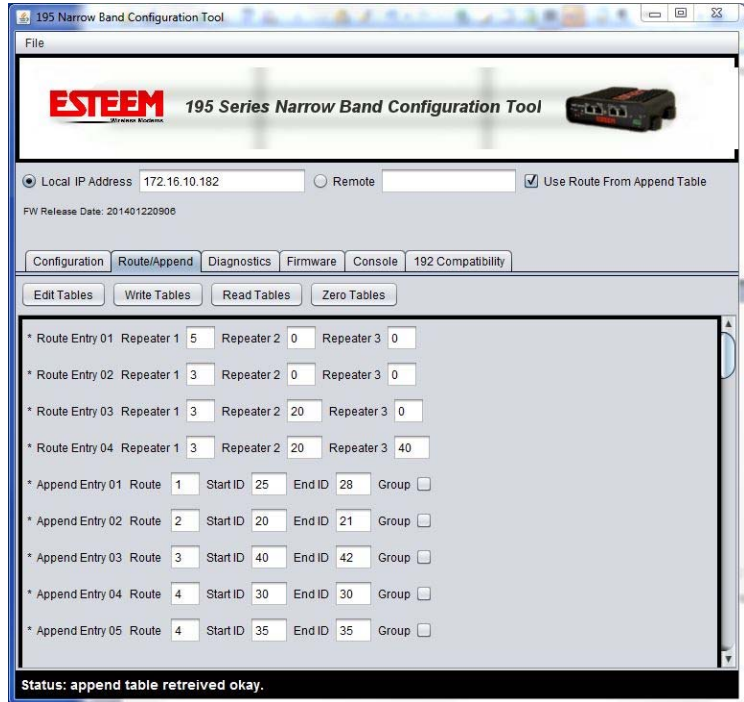
Figure 7: Saved Repeater and Route Data

The ESTeem Model 195C and 195M have a Full and Half-Duplex Auto-negotiation interface supporting both 10 Mbps and 100 Mbps (10/100BaseT). The port is compatible with TIA/EIA-568B cable configuration (Figure 1). The Ethernet port is used for both programming the Model 195C/M and data transfer.

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		Unused
5	White/Blue		Unused
6	Green		Receive -
7	White/Brown		Unused
8	Brown		Unused

Figure 1: Ethernet Interface

Programming Using the Ethernet Port

The Ethernet port on the 195C/M is used as the primary interface when programming with the 195 Narrowband Configuration Utility. For complete information on the use of the utility program, please refer to Chapter 6 (Utilities and Features) in the user's manual. You can also access the 195C/M via Telnet using the Ethernet port. The Telnet interface will open a console port to the ESTeem 195C/M (Figure 2).
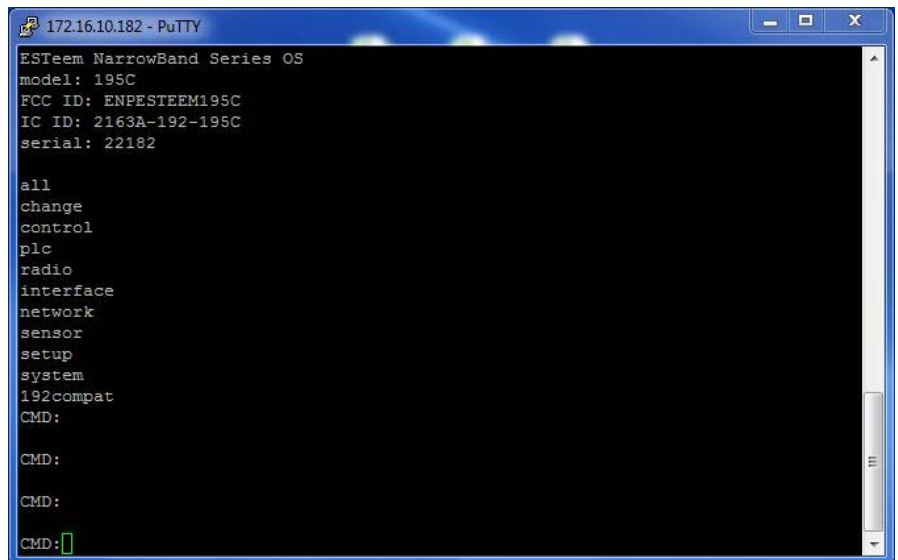
Figure 2: Telnet Console Session

Ethernet Bridge Mode

The mode of operation for transfer of Ethernet data over an ESTeem 195C or 195M wireless network is the Ethernet Bridge Mode. This mode is primarily used to gather data from remote Ethernet devices such as RTU's or PLC's in supervisory control networks (SCADA). Bridging Ethernet networks with these narrowband wireless modems will not work.

> *Technical Tip:* The ESTeem 195C/M do not support Spanning Tree Protocol (STP) on the Ethernet bridge so all network loops will have to be resolved by network layout.

> *Technical Tip:* The ESTeem 195C/M have a very low (9,600bps) RF data rate and can not be used to bridge large Ethernet networks.

There are two software commands that need to be enable to activate the Ethernet bridge mode:

Ethernet Bridge (eth_bridge on/off)– This command will enable or disable the bridge.
ARP Proxy (arpproxy on/off) – This command will instruct the ESTeem 195C/M to use the Route and Append table to control the Ethernet IP protocol destinations.

To control the Ethernet data flow in the wireless network, the Ethernet bridge mode uses the Route and Append tables discussed in detail in Chapter 4. Not only is the Route and Append tables used for any repeaters in the Ethernet network, it is also used to define where to find remote IP addresses in the wireless network. Figure 3 below shows an example wireless Ethernet network layout:

Remote 1

IP Addressing – Remote 1
ESTeem 195C/M – 172.16.10.20
Remote PLC – 172.16.10.21

Repeater Address = 10

Remote 2

IP Addressing – Remote 2
ESTeem 195C/M – 172.16.10.30
Remote PLC – 172.16.10.31
Remote PLC – 172.16.10.32

Master Site

IP Addressing – Master Site
ESTeem 195C/M – 172.16.10.5
HMI Terminal – 172.16.10.6
Master PLC – 172.16.10.7

Note: Netmask 255.255.0.0

HMI Terminal

*All Ethernet devices must be on same IP subnet

Remote 3

IP Addressing – Remote 3
ESTeem 195C/M – 172.16.10.40
Remote PLC – 172.16.10.41

Figure 3: Ethernet Bridge Example

The configuration of the Route and Append list for an Ethernet bridge is very similar to the configuration for repeaters. The main difference is that the last octet of IP addresses will be used in a "Group" in the append table to identify which address is the ESTeem 195C/M. The ESTeem address in the group will always be the lowest number (see examples below). Unlike a repeater configuration for serial PLC emulation modes, the return path from the remote to the master must also be configured in the route and append tables. If a repeater route is not used to communicate to a remote site a blank repeater route number is used.

Using Figure 3 for an example, the configuration of the Master Site's route and append table would look like Figure 4. Note that all IP addresses in the network are identified in the append table of the Master Site.

The return paths to the Master site must also be identified in all remote sites. Figure 5 show the return path entries from Remote 2 through the repeater. The route and append configuration for the return path from both Remote 1 and Remote 3 will be the same as shown in Figure 6.

| Route Entry 01 | Repeater 1 | 10 | Repeater 2 | 0 | Repeater 3 | 0 |
| Route Entry 02 | Repeater 1 | 0 | Repeater 2 | 0 | Repeater 3 | 0 |

Append Entry 01	Route	1	Start ID	30	End ID	32	Group	✓
Append Entry 02	Route	2	Start ID	40	End ID	41	Group	✓
Append Entry 03	Route	2	Start ID	20	End ID	21	Group	✓

Figure 4: Master Site Configuration

| Route Entry 01 | Repeater 1 | 10 | Repeater 2 | 0 | Repeater 3 | 0 |
| Append Entry 01 | Route | 1 | Start ID | 5 | End ID | 7 | Group | ✓ |

Figure 5: Remote 2 Configuration

| Route Entry 01 | Repeater 1 | 0 | Repeater 2 | 0 | Repeater 3 | 0 |
| Append Entry 01 | Route | 1 | Start ID | 5 | End ID | 7 | Group | ✓ |

Figure 6: Remotes 1 and 3 Configuration

Using the Ethernet Port as a Serial Data Interface

The Ethernet port on the 195C/M can be configured as the serial data interface (SDI) to be used by software applications to transport data. The configuration and operation of this mode is outside the scope of this User's Manual and is available in an Engineering Report. For specific information on this mode of operation and programming examples, please contact customer support at 509-735-9092.

195 Narrowband Configuration Utility

The ESTeem Narrowband Configuration Utility will allow easy access to the configuration, monitoring and diagnostics for the ESTeem Model 195C and 195M.

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 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.

Figure 1: ESTeem Resource Main Page

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).

Technical Tip: If your computer is configured for DHCP and not attached to the network, you will need to assign a static IP address to program the 195C/M.

2. From the Main Page select ESTeem Utilities>ESTeem Models 195C and 195M and click on ESTeem Discovery Suite (Figure 2). This will download a compressed file that contains the executable Configuration Utility. Extract the file to your desktop or any folder on your computer.
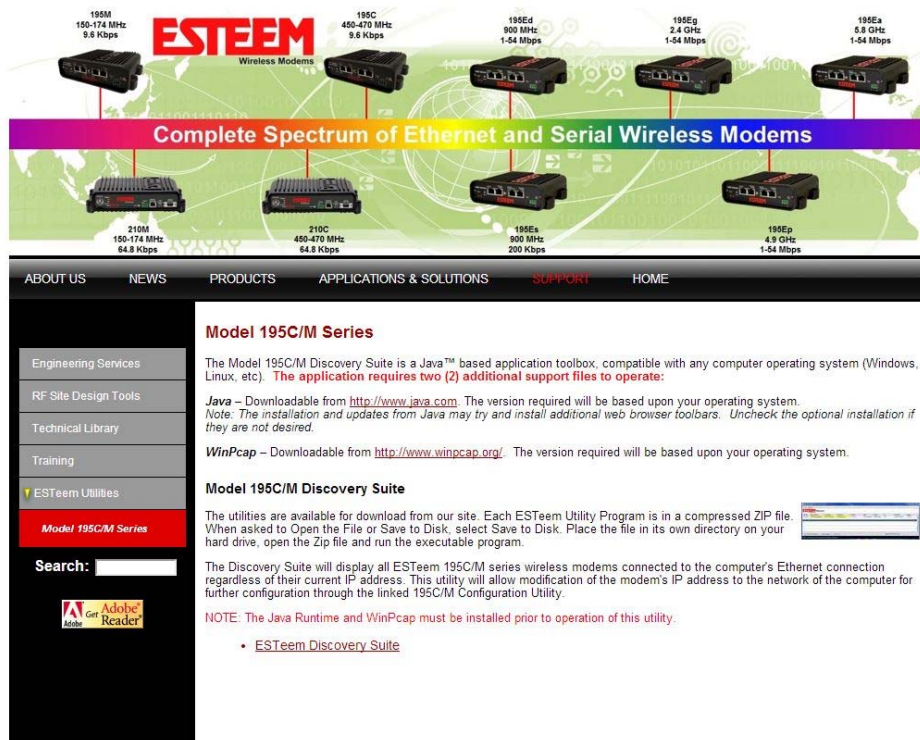
Figure 2: 195C/M Configuration Utility Download

3. The Configuration Utility is a Java™ based application compatible with any computer operating system (Window, Linux, etc). The application requires two (2) additional support files to operate:

    Java – Downloadable from http://www.java.com. The version required will be based upon your operating system.
    Note: The installation and updates from Java may try and install additional web browser toolbars. Uncheck the optional installation if they are not desired.
    WinPcap – Downloadable from http://www.winpcap.org/. The version required will be based upon your operating system.
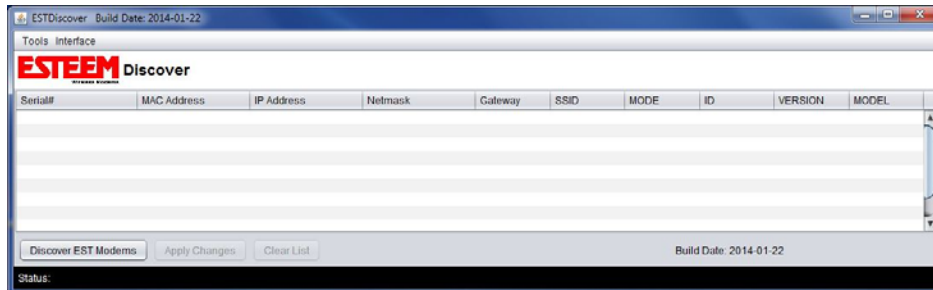
Figure 3: ESTeem Discovery Utility

4. Once both the above programs have been installed, click on the 195config.exe program (Step 2 above) and Figure 3 will be displayed.
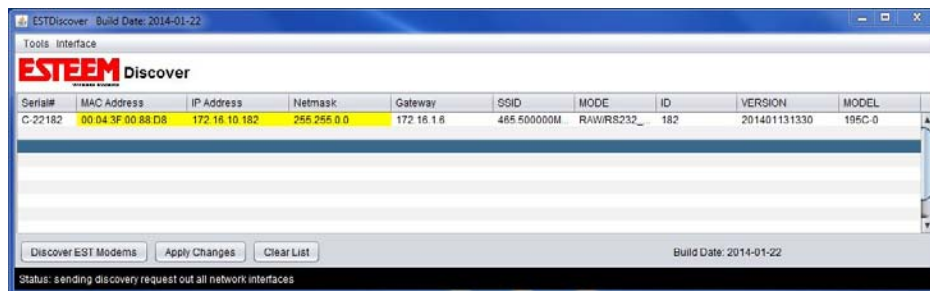
Figure 4: ESTeem Discovery Utility

5. 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. Press the *Discover EST Modems* button.
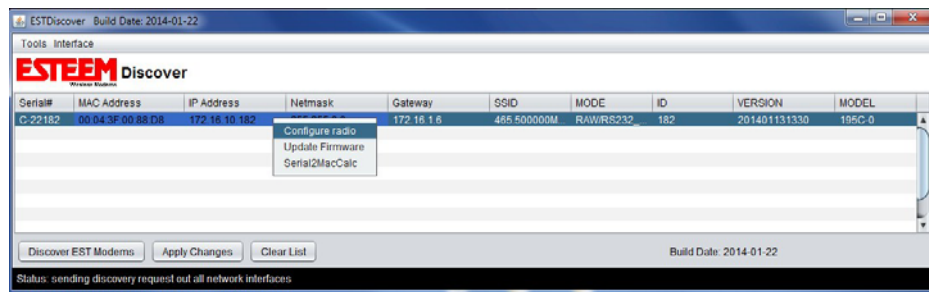
Figure 5: Opening Radio Configuration Software

6. The ESTeem 195C/M will be displayed (Figure 4). If the ESTeem 195C/M is not on the same IP subnet as the computer, double click on the IP, Netmask or Gateway and make the necessary changes. Press the *Apply Changes* button when complete.

7. If changes were made to the IP address you will need to press the *Discover EST Modems* button again to show the changes. Right-mouse click on the ESTeem 195C/M and select *Configure Radio* button to begin programming.

Read Configuration

The 195 Series Narrow Band Configuration Tool provides a graphical interface to the individual software commands for the ESTeem 195C or 195M. On the Configuration tab the software commands can be displayed by their category.

All - Display the status of all software commands (Figure 6)
Change – Display commands changed from factory default
Network – Ethernet network commands
Interface – Port configuration commands
PLC – PLC emulation commands
Radio – Radio configuration commands

Figure 7: Model 195C/M Configuration Utility

Pressing the *Read Config* button with any of the above radials selected will display the commands associated with the selection.

Read Remote 195C or 195M Configuration

The software commands can read in the same way from a remote ESTeem 195C/M through the wireless network. A direct path entry or repeater route can be used to read the configuration. For example in Figure 7, the commands listed were read from ESTeem address 184 using address 183 as a repeater (183,184). If the repeater routes are already defined for the network (using the Route/Append tables), you can just enter the destination address and check the Use Route from Append Table check box.

Write Configuration

Any software command displayed after reading the configuration can be modified. Once the commands have been changed, press the *Write Config* button. The modem will save the changes and reboot. The wire configuration can also be sent through repeaters. For example in Figure 7, the commands listed were written to ESTeem address 184 using address 183 as a repeater (183,184). If the repeater routes are already defined for the network (using the Route/Append tables), you can just enter the destination address and check the Use Route from Append Table check box.

Reset Unit

Pressing the *Reset Unit* button performs the same action as pressing the Reset button on the face of the 195C/M. The modem will discard any unsaved commands and read the program from the non-volatile memory. This can be performed on a remote ESTeem.

Factory Defaults

Pressing the *Factory Defaults* button will reset the software commands to factory default settings (see Appendix A for all default values). Factory defaults does not reset address, frequency or squelch settings.
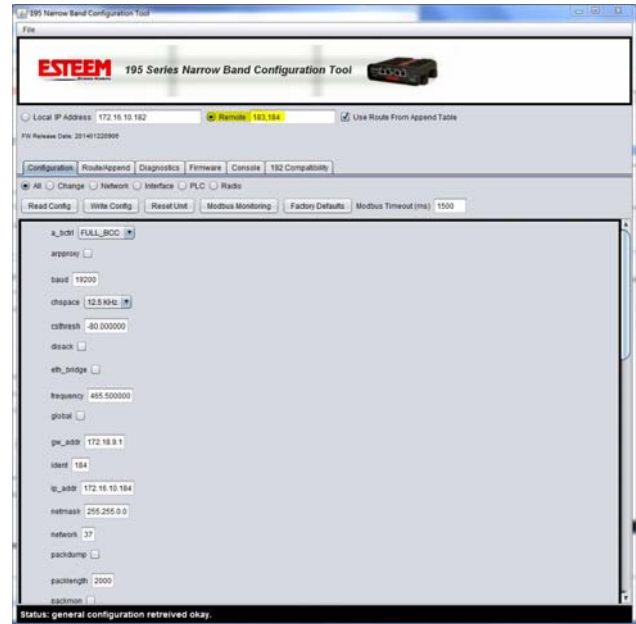
Modbus Monitoring

The ESTeem 195C/M support ModbusTCP protocol for access to multiple operating parameters in the wireless modem. Receive signal strengths, background noise, input voltage, and packet transmissions are a few of the parameter available though the open ModbusTCP protocol. There are multiple methods for extracting the data from the 195C/M, but the Configuration Utility has simple data interface on the Configuration Tab. Pressing the *Modbus Monitoring* button once will start the data monitor of either the local ESTeem 195C/M or the remote defined in the Route/Append tab (Figure 7).

Note: For remote Modbus Monitoring, the route to the remote locations MUST be defined in the Route and Append tables. See Chapters 4 and 5 for routing configuration.

The 195 Narrowband Configuration Utility will update the current status of the operating parameters until the *Modbus Monitoring* button is pressed a second time. If multiple repeaters are required to access a remote or the Modbus monitoring is used on a busy network, the Modbus Timeout parameter may need to be adjusted.

Figure 7: Modbus Monitoring Screen

The following are the Modbus registers supported in the ESTeem 195C and 195M on Port 502. Registers are mapped as 32-bit floating point numbers (2 registers each):

1000 (4-20 mA channel 1)
1002 (4-20 mA channel 2)
1004 (4-20 mA channel 3)
1006 (4-20 mA channel 4)
1008 (MCU temperature in F)
1010 (Auxiliary voltage - 0 if not connected)
1012 (Instantaneous RSSI dBm from non-ESTeem 192/195 radios)
1014 (Radio uptime in seconds)
1016 (Total RX bytes received)
1018 (Total TX bytes sent)
1020 (Number of header blocks / short packets (UA, SABM, etc) received)
1022 (Number of long packets received (> 1 block))
1024 (Number of transmitted packets)
1026 (Number of failed error correction on headers)
1028 (Number of failed error correction on data)
1030 (Number of re-transmits (if retries and acks enabled))
1032 (Average noise floor in dBm)
1034 (Power level of last valid packet received from ESTeem 192/195)
1036 (0/1 Ethernet link up/down)
1038 (Model Serial Number)

Example of using modpoll utility with 195 narrow band series

modpoll -l 2000 -o 2 -m tcp -r 1000 -c 19 -t3:float -a 101 172.18.9.5

-l 2000 = poll rate in milliseconds
-o 2 = timeout in seconds
-m tcp = modbus/tcp protocol
-r 1000 = start register
-c 19 = number of registers to read
-t3:float = 32-bit floating point type 3 -a = slave address (can be same as last octet of ip address to read over ethernet, otherwise look in append table to determine if this should be a wireless query) ip-address of unit to read from if slave address = last octet or act as gateway to access remote slave (wireless requires slave to be in gateway append/route tables)

reference:
http://www.focus-sw.com/fieldtalk/modpoll.html

Save and Load Configuration File

The 195C/M's configuration can be saved as a file to the computer. This file can then be later opened and saved to another 195C/M. To save the configuration of the selected ESTeem 195C or 195M modem, right-mouse click anywhere in the software command configuration window (Figure 8) and select "Save Configuration from Selected Modem to File".

To load a previously saved configuration to an ESTeem 195C/M, select "Load Configuration From File to Selected Modem" after the right-mouse click to write the program to the new ESTeem.

Figure 8: Save and Load Configuration

Update Firmware

The 195C and 195M firmware is updated by pressing the *Update Firmware* button on the Firmware tab of the utility. The firmware version is tied to the release version of the utility and is listed below the address (Figure 10). The release of any new firmware version will be listed on the products web site address:

http://www.esteem.com/products/195c-450-470-mhz-serial.html

http://www.esteem.com/products/195m-150-174-mhz-serial.html

Model 192 Compatibility

The 195C and 195M require "training" to operate with legacy ESTeem Model 192C, 192CHP, 192M or 192MHP wireless modems. The training process and network installation procedures are found in Appendix C (Model 192 Integration) of this User's Manual.

Figure 9: Save and Load Configuration

Programming Console

The 195 Series Narrow Band Configuration Utility has a console window to allow direct access to enter and modify software commands. The console uses Telnet to the 195C/M and will link to the modem when the Console tab is selected. If communication is lost to the modem (on reset) you may have to press the *Connect* button to again see the command prompt (CMD:).

Diagnostics

The diagnostic menu tests the wireless communication between multiple ESTeem 195C/M wireless modems. The diagnostic tab will test the receive signal strength both directions in the wireless link and display the data packet transmission statistics. Enter the destination ESTeem addresses separated by commas or you can enter a range (example 5-10 is all addresses 5 through 10) in the "Radios to Test" box (Figure 10). Pressing the *Start Tests* button once will begin the testing and pressing again will stop the testing.

The General Activity Log will show the instantaneous results of the testing such as which site is being polled and the current signal strength. The Signal Strength tab will show a running graph of all receive signal strengths (both local and remote). The signal strength graph can be copied, saved or printed for further analysis. All diagnostic information can be saved by pressing the *Generate Reports* button.

Figure 10: Save and Load Configuration

ESTeem offers different types of antennas ranging from ¼ 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 and 195M products are allowed by the FCC to use high gain directional antennas.

It is noted that a ¼ 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 ¼ 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.

Coax 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

Grounding

All building mount antennas require attachment to a good earth ground for optimum efficiency. Contact a reputable local communications shop for procedures for your area.

Lightning Arrestors

Lightning arrestors should be used on all external building mount antennas for personal protection and to minimize damage to the transceiver during lightning storms. The units should be installed as per manufacturers instructions provided with the device.

Enabling Transmitter for SWR Testing

The ESTeem 195C and 195M are packet burst wireless modems, so measurement of the forward and reflected power during operation is difficult. To enable the transmitter for measurement with a directional wattmeter, enter the following software command:

radio on/off – Transmitter enable command

Model 195C Cabinet Mount
Outdoor Fixed Base Hardware Diagram
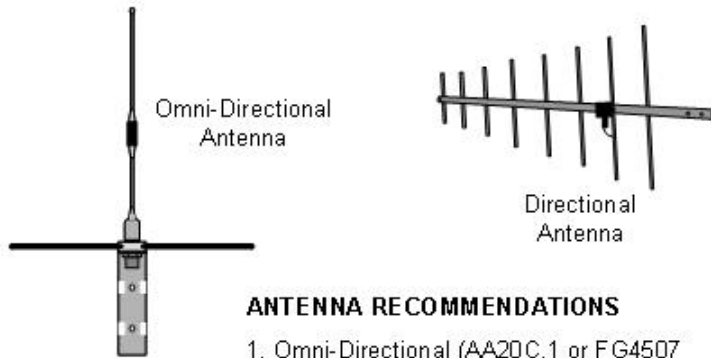
Omni-Directional Antenna

Directional Antenna

ANTENNA RECOMMENDATIONS

1. Omni-Directional (AA20C.1 or FG4507 & FG4607).

2. Directional (AA202C.1).

NOTES

1. Use coax cable runs as short as practical to minimize cable losses.

2. Vapor wrap all external antenna coax connections with vinyl wrap (EST Part No. AA243.1)

3. Contact EST for recommendations regarding antenna mounting hardware and installation tips.

4. Ground antenna structure, base and lightning arrestor.

Antenna Feedline Recommendations

		EST Antenna Part No.		
	Feedline Type	20C.1	202C.1	FG4507/ FG4607
< 50 ft. Length	RG-8	AA237	AA237	AA237
> 50 ft. Length	Helaix	AA236	AA236	AA236

ESTeem Resources (AA109)

Ethernet Programming Cable (AA09.2)

Data Interface Accessories

RS-232 Interface Cable (AA0621.1)

RS-422/485 4/20mA Sensor Interface Cable (AA066)

Ethernet Interface Cable (AA09.2)

LMR195 Coax (AA234LMR)

TNC Male Connector

N Male Connector

N Male Connector

ESTeem 195M

Lightning Arrestor (AA161)

12 VDC Power Supply (AA179)

Model 195C Pole Mount
Outdoor Fixed Base Hardware Diagram

ANTENNA RECOMMENDATIONS

1. Omni-Directional (AA20C.1 or FG4507 & FG4607)
2. Directional (AA202C.1)

Omni-Directional Antenna

Directional Antenna

NOTES

1. Use coax cable runs as short as practical to minimize cable losses.
2. Vapor wrap all external antenna coax connections with vinyl wrap (EST Part No. AA243.1)
3. Contact EST for recommendations regarding antenna mounting hardware and installation tips.
4. Ground antenna structure, base and lightning arrestor.

LMR195 Coax (AA241LMR)

N Male Connector

Weatherproof Boot

Direct Pole Mount
Pole Mounting Kit
(AA195PM)

Pole Mounting Brackets
(For 1.25" to 2.25" poles)

Weatherproof Front Cover

ESTeem Resources EST Part No. AA109

Ethernet Programming Cable (AA09.2)

Weatherproof Boot ← **Weatherproof Boot**

Weatherproof Boot

Ethernet Cable AA09.1 (50 ft. maximum)

100-240 VAC 50-60 Hz

Ethernet Cable (AA09.2)

Remote Power Supply (AA175.3)

RS-232 (Three Wire)

Ethernet Surge Protection EST P/N AA166

Data Interface Accessories

RS-232 Interface Cable (AA0621.1)

RS-422/485 4/20mA Sensor Interface Cable (AA066)

Ethernet Interface Cable (AA09.2)

Ethernet Cable AA09.1 (50 ft. maximum)

Earth Ground

Model 195M Cabinet Mount
Outdoor Fixed Base Hardware Diagram

Omni-Directional Antenna

Directional Antenna

ANTENNA RECOMMENDATIONS
1. Omni-Directional (AA20M or ANT150F6).
2. Directional (AA202M).

NOTES
1. Use coax cable runs as short as practical to minimize cable losses.
2. Vapor wrap all external antenna coax connections with vinyl wrap (EST Part No. AA243.1)
3. Contact EST for recommendations regarding antenna mounting hardware and installation tips.
4. Ground antenna structure, base and lightning arrestor.

Antenna Feedline Recommendations

	Feedline Type	EST Antenna Part No. 20M	202M	ANT150F6
< 50 ft. Length	RG-8	AA235	AA237	AA240RG8*
> 50 ft. Length	Helaix	AA238	AA236	AA240*

ESTeem Resources (AA109)

Ethernet Programming Cable (AA09.2)

LMR195 Coax (AA234LMR)

TNC Male Connector

ESTeem 195M

N Male Connector

Lightning Arrestor (AA161)

12 VDC Power Supply (AA179)

Data Interface Accessories
RS-232 Interface Cable (AA0621.1)
RS-422/485 4/20mA Sensor Interface Cable (AA066)
Ethernet Interface Cable (AA09.2)

Model 195M Pole Mount
Outdoor Fixed Base Hardware Diagram

Omni-Directional
Antenna

Directional Antenna

LMR195 Coax
(AA241LMR)

N Male
Connector

**Weatherproof
Boot**

**ANTENNA
RECOMMENDATIONS**
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2. Vapor wrap all external antenna coax
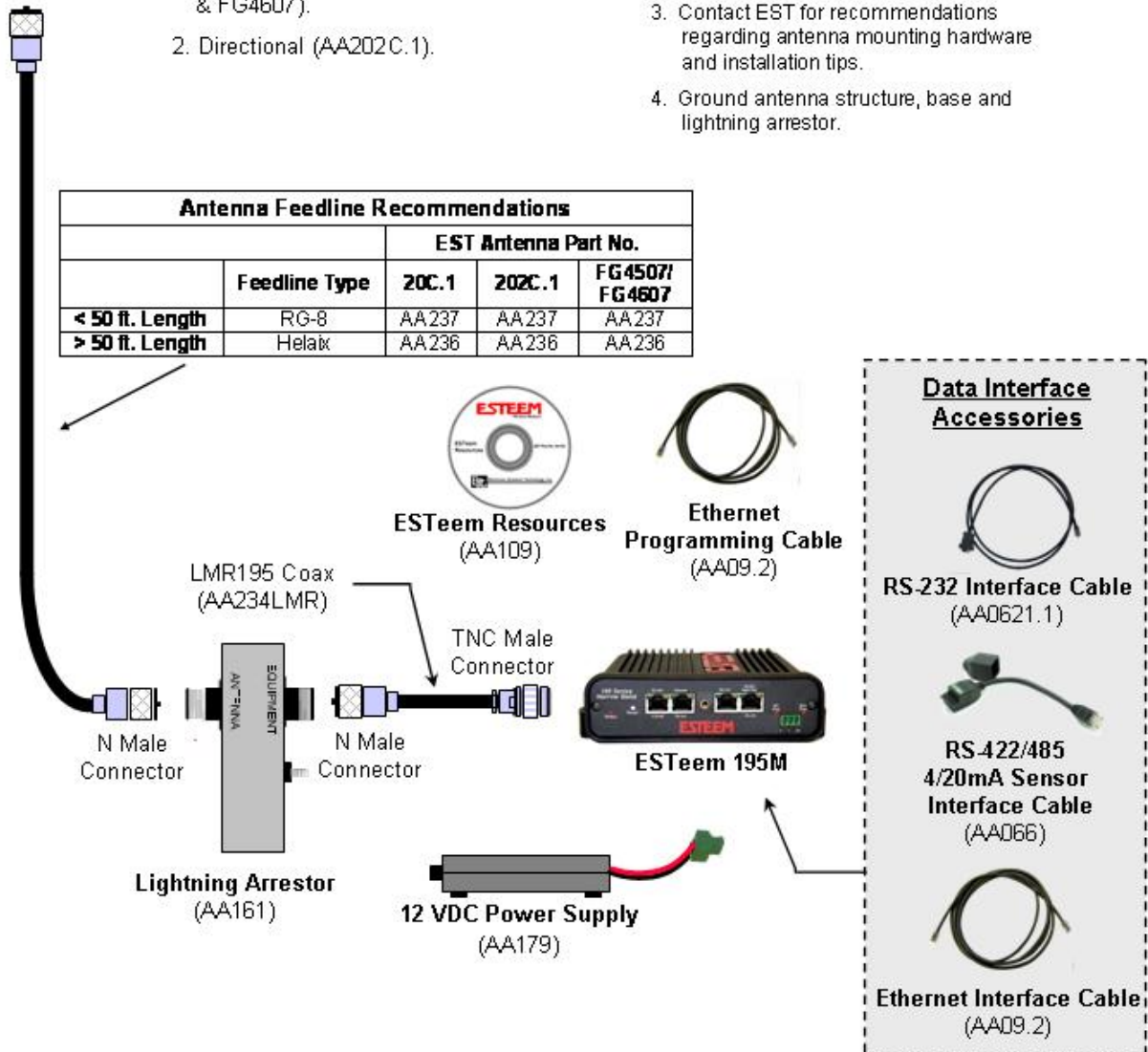   connections with vinyl wrap (EST Part
   No. AA243.1)

3. Contact EST for recommendations
   regarding antenna mounting hardware
   and installation tips.

4. Ground antenna structure, base and
   lightning arrestor.

Direct Pole Mount
Pole Mounting Kit
(AA195PM)

Pole Mounting Brackets
(For 1.25" to 2.25" poles)

**Weatherproof
Front Cover**

ESTeem Resources
EST Part No. AA109

**Ethernet
Programming Cable**
(AA09.2)

**Weatherproof
Boot**

Weatherproof Boot

Ethernet Cable
AA09.1 (50 ft. maximum)

100-240 VAC
50-60 Hz

RS-232
(Three Wire)

Ethernet Cable
(AA09.2)

**Remote Power
Supply**
(AA175.3)

**Ethernet Surge
Protection**
EST P/N AA166

Data Interface Accessories

RS-232
Interface Cable
(AA0621.1)

RS-422/485
4/20mA Sensor
Interface Cable
(AA066)

**Ethernet Interface
Cable**
(AA09.2)

Ethernet Cable
AA09.1 (50 ft. maximum)

Earth Ground

Listed below in alphabetical order are the definitions of the ESTeem software commands. All software commands are entered lowercase. The commands are displayed below with the full software command and the shorted command underlined.

? or help

help	Displays the modem information and sub help menus.
help all	Displays all commands switches and arguments.
help change	Displays only the commands that are changed from factory default.
help control	Displays control commands switches and arguments.
help plc	Displays plc commands switches and arguments.
help radio	Displays radio commands switches and arguments.
help interface	Displays interface commands switches and arguments.
help setup	Displays setup commands switches and arguments.
help system	Displays system commands switches and arguments.
help 192compat	Display commands for 192 compatibility

a_bctrl (1-4)

This function selects the Rockwell Automation (Allen-Bradley) DF1 controller protocol. Full emulation is enabled with the PLC Protocol (plcproto) software command

1 = Full Duplex DF1 with CRC Error Checking
2 = Full Duplex DF1 with BCC Error Checking
3 = Half Duplex DF1 with CRC Error Checking
4 = Half Duplex DF1 with BCC Error Checking

Factory default = 1.

address (1-255)

The command defines the ESTeem source address. The default value is the last octet of the stored IP address. For example is the IP address of the ESTeem 195C/M is 172.16.10.184, the address of the modem would be 184. Addresses 1 to 254 are usable for unit addressing. Address 255 is used for GLOBAL.

appendroute (l#,r#,a1,a2,g)

The appendroute command appends routes to a connect address that are defined by the ROUTE command.

l # = Location of route number in memory. Address locations 1 to 32.
r # = Appended route number. Route numbers 1 to 32.
a1 = Address of first destination node. Address numbers from 1 to 254.
a2 = Address of last destination node. . Address numbers from 1 to 254.
g = Group feature is enabled by inserting a 1 in this field.

Factory default = 0. APPEndru 0 disables this feature.

Note: *This command is used in conjunction with the ROUTE Command.*

arpproxy (on/off)

The arpproxy command enables the ARP Proxy for Ethernet communications. See Chapter 5 for full details on Ethernet communication. Factory default = off

on = Enabled.
off = Disabled.

baud (2400-115000)

This command sets the baud rate for the serial device interface (SDI). The other commands are the data bits, parity and stop bits

---

cert

This command will display the certification for the ESTeem 195C/M. The FCC ID, Canadian DOC ID and serial number of the modem will be displayed.

---

chspace (1-2)

This command will set the channel spacing for the ESTeem 195C/M.

1 = 6.25 kHz channel spacing
2 = 12.5 kHz channel spacing

Factory default = 2 (12.5 kHz channel spacing)

---

connect (r1,r2,r3,da)

This command performs the connect to a destination ESTeem. This function supports a direct connect or a connect through a maximum of three repeater nodes.

r1 = ESTeem address (1 to 254) of repeater 1.
r2 = ESTeem address (1 to 254) of repeater 2.
r3 = ESTeem address (1 to 254) of repeater 3.
da =Destination address (1 to 254).

---

csthresh (-150 through -50)

This command is the carrier sensed threshold for the receiver in the ESTeem 195C/M. The values are listed in dBm and must be entered with the negative (-) value before the command. Adjustment of this command is only necessary in very high noise environments. Factory default = -80dBm.

---

databits (7-8)

This command sets data bits in the serial device interface. This command used with baud, parity and stopbits commands. Factory default = 8.

---

disack (on/off)

This command when enabled instructs the modem to disable the acknowledgment request on the information packet. This is used when the designation device will respond with its own acknowledgment. Factory default = off.

on: Enabled
off: Disabled

---

disconnect

The disconnect command. The execution of this command immediately initiates a disconnect request with the currently connected node.

---

eth_bridge (on/off)

This command enables the Ethernet bridge on the ESTeem 195C/M. See Chapter 6 for full details. Factory default = off.

on: Enabled
off: Disabled

factory
The factory default command. The execution of this command causes the ESTeem to restore the command table values from factory values that are stored permanently in memory. This will allow the user the ability to restore the ESTeem to factory conditions during testing or set-up.

frequency (150.000-174.000) or (450.000-470.000)
This command programs the frequency of operation in the ESTeem 195C/M. The frequency is entered in MHz. Available frequency ranges for each model listed below:

Public Safety Pool
Model 195M =   150.000-159.472574.000 MHz
                163.250 MHz
                166.250 MHz
                169.000-172.000 MHz
                172.225-173.39625 MHz
Business Pool
                150.815-161.610 MHz
                169.000-172.000 MHz
                173.20375-173.36625MHz

Model 195C = 450.000-470.000 MHz

global (on/off)
This function will set the ability of the ESTeem to receive or not receive global messages (address = 255).   Factory default = off.

on =   Enabled.
off =   Disabled.

gw_addr (*IP Address)
This command sets the Gateway address in the ESTeem 195C/M.

ident
This command sets the modem identification for the ESTeem 195C/M. This is a simple alpha-numeric value set in the modem for easy identification in the network. This command can take up to 12 characters long and could be used for site name, location or any value to easily identify. Factory default = <blank>.

ip_addr (*IP Address)
This command sets the IP address for the ESTeem 195C/M. Factory default = 172.16.8.1xx (where xx is the last two numbers of the serial number).

model
Displays the product model of default firmware that is installed. Model should be the same as product being used.

netmask (*IP Address Netmask)

The netmask command sets the IP netmask for the ESTeem 195C/M. This command is used in conjunction with the ip_addr and gw_addr commands to complete IP address for the ESTeem. Factory default = 255.255.0.0

network (0-255)

Network identification code. This is used to program a common code for all modems in the customers network so that another facility on your frequency using the same addresses will not interfere with your equipment. Factory default = 37.

packdump (on/off)

This function enables monitoring of the data sent through the configured serial device interface (SDI). This troubleshooting tool can be used to verify the operation of the wireless network by looking at both serial devices exchanging data. Factory default = off.

on =   Enabled.
off =   Disabled.

packleng (1-2000)

This command defines the length of the data packet in bytes. Factory default = 2000.

packmon (on/off)

Places the ESTeem in the packet monitor mode. The packet monitor modem will allow the user to monitor all wireless packets by their source, destination and repeaters. Please refer to ESTeem Packet Monitor Engineer Report for complete details on the operation of this feature. Factory default = off.

parity (0-3)

This command defines the parity setting on the serial device interface. This command is used in conjunction with baud, databits, and stopbits to set the complete serial configuration. Factory default = 1 (None).

0 = None Parity
1 = Even Parity
2 = Odd Parity

plcproto (0-7)

This command defines the PLC protocol emulation used on the selected serial device inteface. Factory default = 0 (None).

0 = None
1 = Rockwell Automation DF1
2 = Modbus RTU Protocol
3 = Modbus ENC_RTU Protocol (Configuration Protocol)
4 = ModbusTCP
5 = Opto22 Protocol
6 = Modbus ASCII
7 = Rockwell Automation EthernetIP

program (1-254,1-254,1-254,1-254)

This command is used to remote program another ESTeem unit. Example prog 10 (Unit 10 is the address of the remote unit). Remote programming can be completed through repeaters. When a connection has been made with the remote ESTeem the RPG: prompt will appear. The RPG: prompt is the command prompt of the remote modem.

radio (on/off)

The radio transmitter enable command. The ESTeem radio transmitter will cycle on and off when enabled for tuning and antenna testing procedures. Factory default = off.

ON: Enabled.
OFF: Disabled.

reset

The software reset command for the ESTeem. The execution of this command resets the internal electronics in the ESTeem.

retry (0-99)

The retry command number. This is the number specifying the number of retries, retransmission of frames, that are not acknowledged. Frames are retransmitted RETRY times before operation is aborted. Factory default = 6.

rfpower (1-8)

This command sets the output power on the ESTeem 195C/M radio modem. Each increase in value represents 0.5 watts of output power. Factory default = 8 (4 Watts).

1 = 0.5 Watts
2 = 1.0 Watts
3 = 1.5 Watts
4 = 2.0 Watts
5 = 2.5 Watts
6 = 3.0 Watts
7 = 3.5 Watts
8 = 4.0 Watts

route (l#,r1,r2,r3,)

The route sets up the route table in the ESTeem. This command is used in conjunction with the append command to configure the routing table in the ESTeem 195C/M wireless modem. See Chapter 4 (Repeating) for complete details.

l #   =   User defined route number. Route numbers 1 to 32 may be used.
r1   =   Address of first repeater. Address numbers from 1 to 254 may be used.
r2   =   Address of second repeater. Address numbers from 1 to 254 may be used.
r3   =   Address of third repeater. Address numbers from 1 to 254 may be used.

rssi

This command will display the status of the received signal strength indication (rssi). The values displayed in dBm.

instantaneous, noise floor, last valid (dBm)

save

The save command. The execution of this command stores the current command values and switches.

Note: *Please wait approximately two seconds **after** executing the SAVE command before turning off power to the ESTeem.*

s/n

Serial Number command. When executed from the Command Model will output the ESTeem serial number of the unit that is defined at the time of manufacturer.

sdi

Sets the serial device interface (sdi) for the ESTeem 195C/M. Any serial port not configured as the sdi can be used as a console port for programming. The sdi can also be placed in console mode by entering three pluses (+++) in the port within three seconds of a reboot of the ESTeem 195C or 195M. Factory default = 2 (Port 3 –RS-232 with Full Handshake Lines)

0 = No serial data interface (All console ports)
1 = RS-232 Port 4 (3 wire RS-232 only with remote power)
2 = RS-232 Port 3 (Full RS-232 with hardware handshaking)
3 = RS-485 Port 1
4 = RS-422 Port 2
5 = TCP Socket Port 2 (Custom software interface required)
6 = UDP Socket Port 2 (Custom software interface required)

> **Technical Tip:** A three second delay is added after a reset before the ESTeem 195C or 195M will process any data through the serial interface. This time allows entry of the console break sequence to program (+++).

Note: Port pin-out information found in Appendix B (Interface Ports)

setcon (r1,r2,r3,da)

This command defines the destination address for the ESTeem to perform a connect when data arrives in the configured serial device interface (sdi). This function supports a direct connect or a connect through a maximum of three repeaters.
r1 = ESTeem address (1 to 254) of repeater 1.
r2 = ESTeem address (1 to 254) of repeater 2.
r3 = ESTeem address (1 to 254) of repeater 3.
da = Destination address (1 to 255).

sread

This command will complete an instantaneous read of the values in the four 4/20mA sensors.

stopbits (1-2)

This command sets the number of stop bits for the serial device interface. This command is used with baud, parity, databits to configure the serial port on the ESTeem. Factory default = 1.

termt (0-5000)

The serial device interface, receive termination timer value. This value is the time after the last serial data bit is received in the serial buffer that the modem will wait for further data. If additional data is received from the device, the ESTeem will make an RF packet and send to the remote ESTeem. This value can be 0 to 5000 milliseconds. Factory default = 6O.

txdelay (0-500)

Number of milliseconds the ESTeem 195C/M will wait after receiving serial or Ethernet data packet before transmitting to remote. Factory default = 1.

xhflow (0-1)

This command enables hardware flow control. Factory default = 0 (Disabled).

0 = Disabled.
1 = Enabled.

version

This command will display the current firmware version, boot loader version and firmware CRC.

vinaux

This command will display the DC voltage input in the auxiliary power is used.

zerotables

This software command will reset the Routes and Append commands to factory defaults (All blank).

Interface Ports

The ESTeem Model 195C and 195M have multiple data ports available for use. Each data interface is accessible through one of the four RJ-45 ports in the front panel of the Model 195C/M (Figure 1). During the configuration of the modem, one of these ports is configured as the serial data interface (SDI). All data ports not configured as the SDI are available for console programming. This chapter will provide the pin-outs and configuration of each communication and sensor port.

4/20mA Sensor (Port 1)

RJ-45 Pin	Signal
1	Sensor 1
2	Sensor 2
7	Sensor 3
8	Sensor 4
3	Sensor 12VDC 50mA

Ethernet (Port 2)

RJ-45 Pin	Signal
1	Transmit +
2	Transmit -
3	Receive +
6	Receive -

RS-232-Remote Power (Port 4)

RJ-45 Pin	Signal
1	TXD - Transmit Data (Input)
3	RXD - Receive Data (Output)
2 & 6	Signal Ground (GND)
4 & 5	Remote Power + (48VDC)
7 & 8	Remote Power – (48VDC)

RS-485 (Port 1)

RJ-45 Pin	Signal
5	RS-485A (-)
6	RS-485B (+)
4	Ground

RS-422 (Port 2)

RJ-45 Pin	Signal
4	RS-422-A (RX-)
5	RS-422-B (RX+)
7	RS-422-Z (TX-)
8	RS-422-Y (TX+)

RS-232 (Port 3)

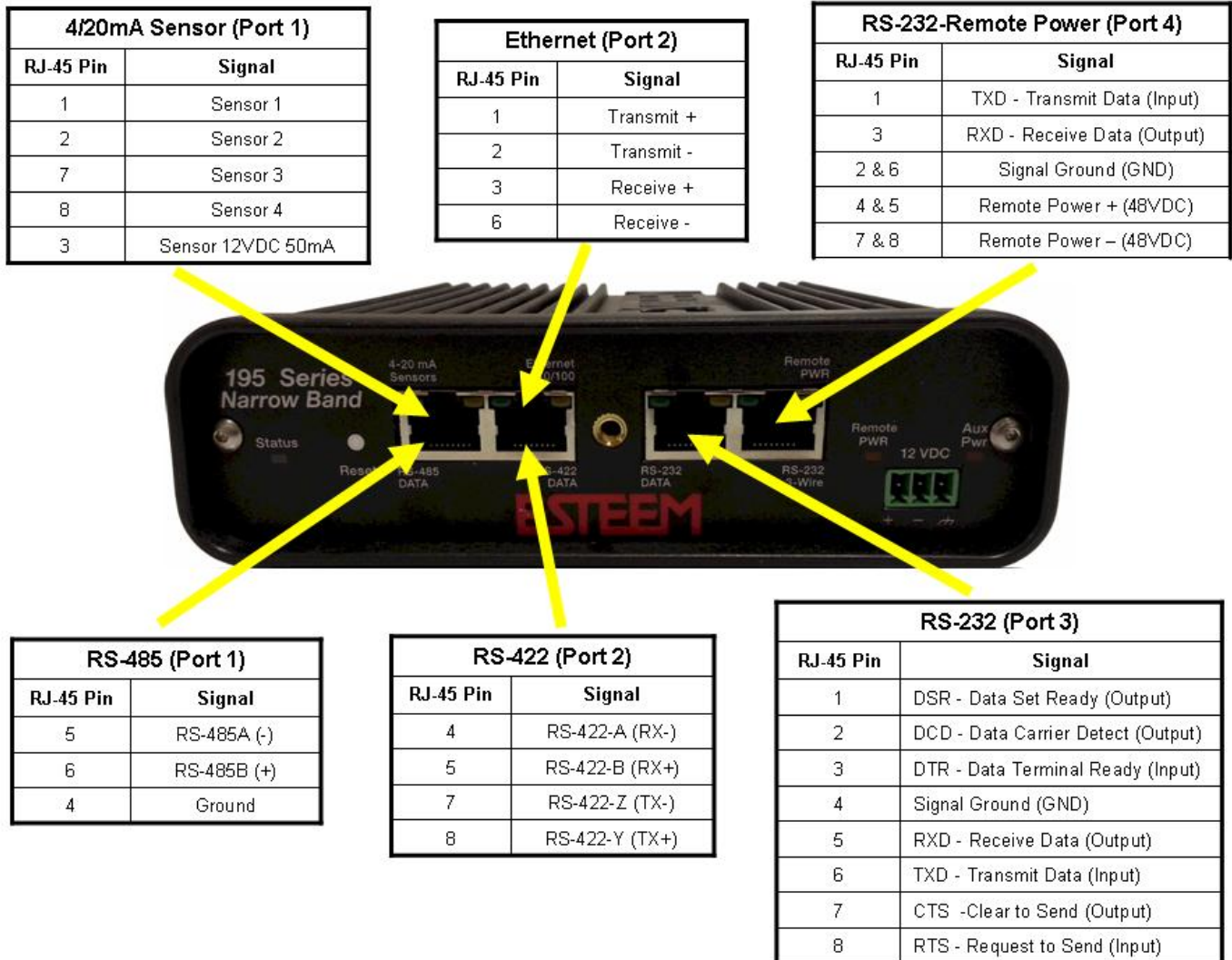| RJ-45 Pin	Signal
1	DSR - Data Set Ready (Output)
2	DCD - Data Carrier Detect (Output)
3	DTR - Data Terminal Ready (Input)
4	Signal Ground (GND)
5	RXD - Receive Data (Output)
6	TXD - Transmit Data (Input)
7	CTS -Clear to Send (Output)
8	RTS - Request to Send (Input)

Figure 1: Model 195C/M Data Interfaces

Ethernet Port (Port 2)

The ESTeem Model 195C and 195M have a Full and Half-Duplex Auto-negotiation interface supporting both 10 Mbps and 100 Mbps (10/100BaseT). The port is compatible with TIA/EIA-568B cable configuration (Figure 2). A standard Ethernet patch cable (AA09.2) can be used to interface the 195C/M to a computer. The Ethernet port is used for both programming the Model 195C/M and data transfer.

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		Unused
5	White/Blue		Unused
6	Green		Receive -
7	White/Brown		Unused
8	Brown		Unused

Figure 2: Ethernet Interface

RS-232C Data Ports (Ports 3 and 4)

The ESTeem Model 195C/M has two RS-232C data interfaces on the front panel. Port 3 has a full RS-232 interface with handshake, while Port 4 has only Transmit, Receive and Ground. Port 4 will generally be used only when the 195C/M is pole mounted with remote power. To interface the 195C/M to the serial port on the computer, you will need serial cable (AA0621) with the following pin-out:

ESTeem Model 195C/M Port 3
(ESTeem Model AA0621 Cable)

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

RS-485 and RS-422 Data Ports (Ports 1 and 2)

The ESTeem Model 195C/M have a single, two-wire RS-485 interface in Port 1 and a single, four-wire RS-422 interface in Port 2. To ease access to these ports the AA066 (Figure 3) cable adapter is available. The RJ-45 interface can be inserted into either Port 1 (RS-485) or Port 2 (RS-422) and the corresponding signal lines (Figure 1) can be inserted in the screw terminals.
Note: Verify the screw terminal cover is attached to the cable before termination.

Figure 3: AA066 Cable Adapter

4/20mA Sensor Inputs (Port 1)

The ESTeem Model 195C/M have four independent 4/20mA inputs sensors that can be read through either ModbusTCP protocol (See Chapter 6) or through the "sread" software command from a serial port. For detailed information on scaling or modifications to sensor reading, please contact ESTeem customer support at 509-735-9092.

Model Series 192 Integration

The ESTeem Model 195C and 195M were designed to be downward compatible with the legacy ESTeem Model 192 series of wireless modems. The Model 192 series had been in production since 1996 with several generational changes in the product lifespan. The manufacturing variations throughout this time require that a new ESTeem Model 195C/M be "trained" to communicate with an existing Model 192 network. This training process (described below) will allow the Model 195C/M to recognize any change in deviation in the older radios and adjust accordingly.

> **Technical Tip:** The ESTeem Model 192 network **MUST** be configured for narrow band (12.5 kHz) operation before Model 195C/M integration.

If an ESTeem 195C/M is added to an existing Model 192 network, it is highly recommended the Model 195C/M is installed at a remote location and not the Master or Repeater location of the Model 192 network (Figure 1). If the 195C/M is required to be used as the Master or Repeater site, "train" the radio modem to one of the remote locations and then test all wireless links from that location.
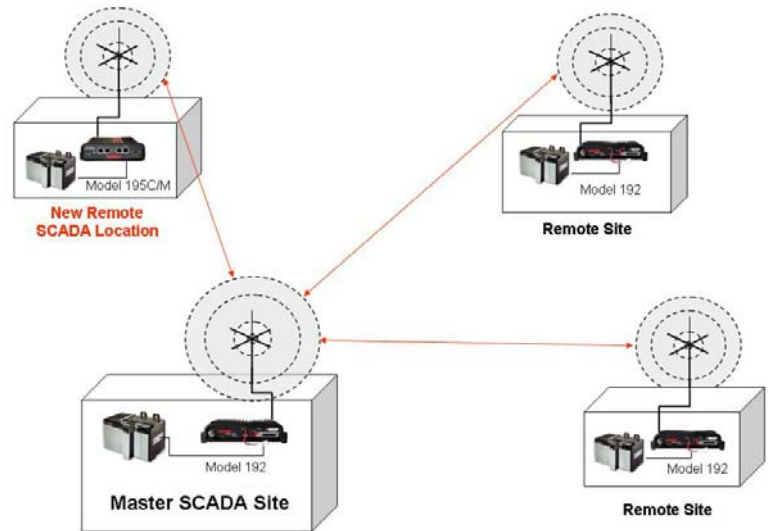
The Model 195C/M configuration utility can be used to provide local signal strength (RSSI) information but can not gather information from a Model 192 because the process uses ModbusTCP protocol only available in the 195C/M. The ESTeem Model 192 configuration utility's diagnostic can be used to test the operation of the wireless network but must be run from the Model 192 side of the wireless network. For example in Figure 1, the diagnostic utility (Polling Test) must be run from the Master SCADA location.

Figure 1: Model 192 Integration Diagram

Configuring Model 195C/195M for Model 192

The ESTeem Model 195C and 195M must be "trained" to communicate with an ESTeem Model 192. The training completed using the 195 Series Narrow Band Configuration Utility and selecting the "192 Compatibility" tab. Select Remote and enter the remote address of the ESTeem Model 192 in the utility and press the *Train to Remote* button (Figure 2). The Model 195C/M will begin training to the remote ESTeem and will save the configuration once complete (Figure 2). Verify the communication using both the 195C/M and Model 192 configuration utilities.

Figure 2: Training Model 195C/M

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 assists 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:*

Radio Model	Antenna Model/Gain	FCC Minimum Separation Distance Controlled Environment	Industry Canada Minimum Separation Distance Controlled Environment	FCC Minimum Separation Distance Uncontrolled Environment	Industry Canada Minimum Separation Distance Uncontrolled Environment
195C 9 Watts Max	AA19C (0 dBd)	35 cm	0.35 m	77 cm	0.77 m
195C 9 Watts Max	AA20C.1 (3.2 dBd)	50 cm	0.5 m	111 cm	1.11 m
195C 9 Watts Max	AA202C.1 (9 dBd)	97 cm	0.97 m	216 cm	2.16 m
195M 7 Watts Max	AA19M (0 dBd)	31 cm	0.31 m	68 cm	0.68 m
195M 7 Watts Max	AA20M (3.0 dBd)	43 cm	0.43 m	96 cm	0.96 m
195M 7 Watts Max	AA202M (8 dBd)	76 cm	0.76 m	170 cm	1.7 m

Terms
P = RF Power milliwatts
Gi = Antenna gain relative to isotropic = Gd + 2.15
Gd = Antenna gain relative to dipole = Gi - 2.15
N = Numerical gain of antenna
D = Distance in centimeters
Pd = Power density in mW/cm²

Max Power Density Calculation
(Numerical power gain divided by the spherical area around the separation distance)

Pd = (P * N) / (4 * Pi * D²)

Example: The 195M has a maximum conducted output power close to 7 Watts. The highest gain antenna EST currently offers for use with this modem is specified with a gain factor of 8 dBd (10.15 dBi). Therefore, ignoring cable and connector losses, the maximum power density for the specified minimum safe separation distance of **170 cm** (uncontrolled environments):

Pd = (7000 * 10.351) / (4 * 3.14 * 170 * 170) = **0.198 mW/cm² = 1.98 W/m²**

Please contact EST technical support if you need assistance with calculations for various power levels, antennas and minimum safe separation distances.

North American Power Density Limits

FCC Part 47 Section 1.1309 Limits (Controlled Environments / Occupational Exposure)
150-174 MHz (195M)   1 mW/cm²
450 MHz (195C) 1.5 mW/cm²

FCC Part 47 Section 1.1309 Limits (General Population / Uncontrolled exposure)
150-174 MHz (195M)   0.2 mW/cm²
450 MHz (195C) 0.3 mW/cm²

Canadian Safety Code 6 Limits (Controlled Environments)
150-174 MHz (195M)   10 W/m²
450 MHz (195C) 15 W/m²

Canadian Safety Code 6 Limits (Uncontrolled Environments)
150-174 MHz (195M)   2 W/m²
450 MHz (195C) 3 W/m²

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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18000 Studebaker Rd., Room 660
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5636 Federal Building
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Houston, TX 77002

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Columbia Office (CF)
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Capitol Heights, MD 20743

WASHINGTON
Seattle Office (ST)
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Room 312
Kirkland, WA 98034-6927

FEDERAL COMMUNICATIONS COMMISSION FIELD OFFICES

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ESTeem 195C Specifications	
Transmiter/Receiver	
Frequency of Operation (Software Selectable)	450 to 470 Mhz (6.25Khz / 12.5 Khz Channel Spacing)
Frequency Stability, -30C to +60C	+/- 0.4ppm
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	AA175.3
RJ-45 To DB9 Serial Adaptor	AA0621.1
RJ-45 To Terminal Block Adaptor	AA066
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, ½ Wave
Applications: Mobile Mount.
Frequency: 450 to 470 MHz - AA19C
400 to 420 MHz - AA19F
Polarization: Vertical
Impedance: 50 ohms
Gain: 0 dBd
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.
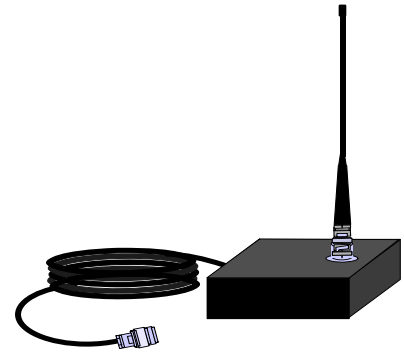
Model AA19C

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: 3.2 dBd
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 ¾ in. to 1 /2 in. pipe
with right angle mount or direct mount.
Antenna Connector: N-Type Female
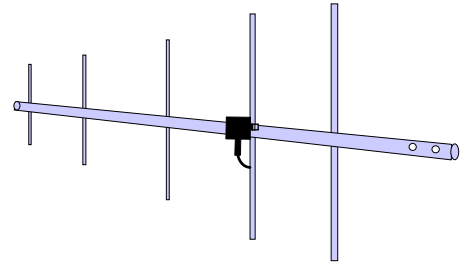**Antenna Envelope:** 37 ½ in. length by 16 in width with ground plane radials.
Weight: 2 lbs.

Model AA20C.1

Antenna Specifications

Model No:	AA202C.1
Antenna Type:	Directional, DC grounded, 5 element yagi.
Applications:	Fixed base.
Frequency:	440 to 470 MHz
Polarization:	Vertical or Horizontal
Impedance:	50 ohms
Gain:	9 dBd
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	
Transmiter/Receiver	
Frequency of Operation (Software Selectable)	150 to 174 Mhz (6.25Khz / 12.5 Khz Channel Spacing)
Frequency Stability, -30C to +60C	+/- 0.2ppm
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	AA175.3
RJ-45 To DB9 Serial Adaptor	AA0621.1
RJ-45 To Terminal Block Adaptor	AA066
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: 0 dBd
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.
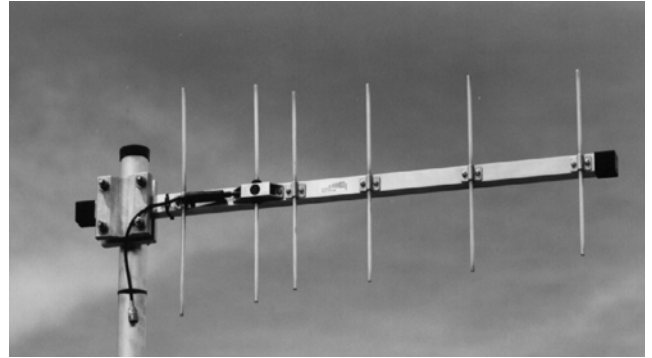**Weight:** 1 lb. 5 oz.
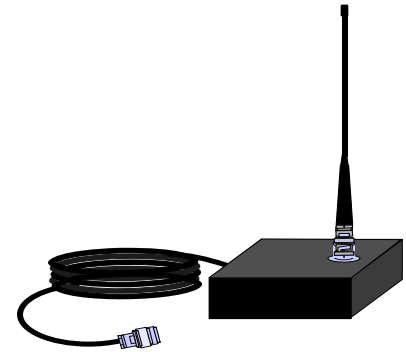
Model AA19M

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.

52 in.

Drawing Not To Scale

21 in.

9 in.

5/16 in. Diameter

1.5 in.
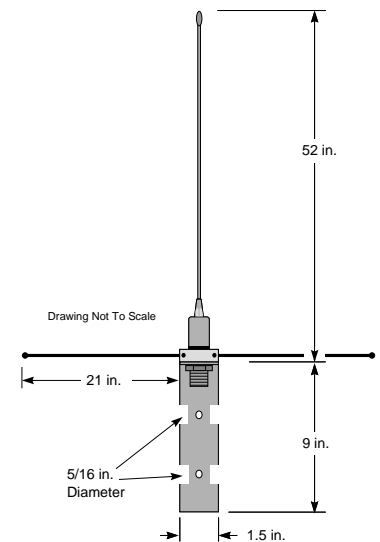
Model AA20M

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