WIRELESS MODEM

PULSE ‘S’ USER MANUAL

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Warnings and Precautions

The following symbols indicate important safety warnings and precautions throughout this manual.

They are defined as follows:

	**WARNING** indicates that serious bodily harm or death may result from failure to adhere to the precautions.

	**CAUTION** indicates that damage to equipment may result if the instructions are not followed.

	**NOTE** suggests optimal conditions under which the equipment will operate effectively and safely.

Table of Contents

Introduction

Overview

This manual is a reference for the ENCOM PULSE ‘S’ Wireless Modem.

It contains instructions, suggestions and information which will help you set up your equipment.

Product Description

ENCOM manufactures the PULSE family of Wireless Modems that are used to provide reliable wireless communications between serial devices.

The PULSE ‘S’ is equipped with a standard RS232 DB9 connector, which you connect to your serial device. Data from your serial device is transparently sent to other ENCOM PULSE Wireless Modems using license free 900 MHz technology. LED indicators on the front panel provide serial and RF status information.

The USB connector on the front panel is reserved for our Windows based PULSE Link software application. ENCOM PULSE Link is used to configure the PULSE family of modems, and also allows you to optimize and diagnose PULSE deployments.

Typical applications for ENCOM PULSE Wireless Modems include:

- SCADA
- Remote Telemetry
- Surveillance
- Traffic Control
- Industrial Controls
- Remote Monitoring
- Security
- Display Signs
- Railway Signs

Network Concepts

Mode of Operation

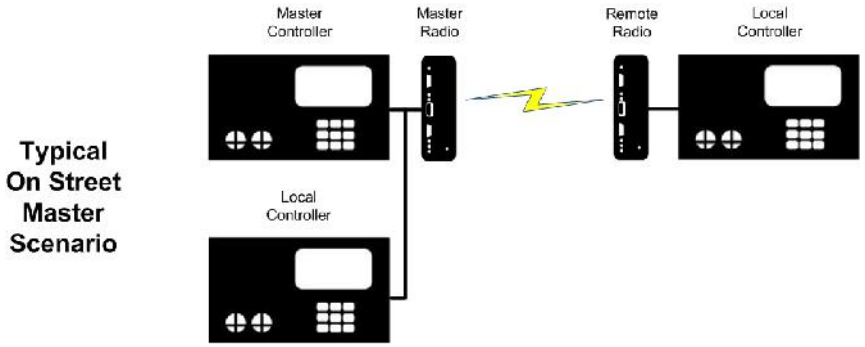
ENCOM supplies a PC based software application that you will use to define the mode of operation for each ENCOM PULSE modem. A PULSE modem can be configured as one of the following:

- Master
- Repeater
- Remote

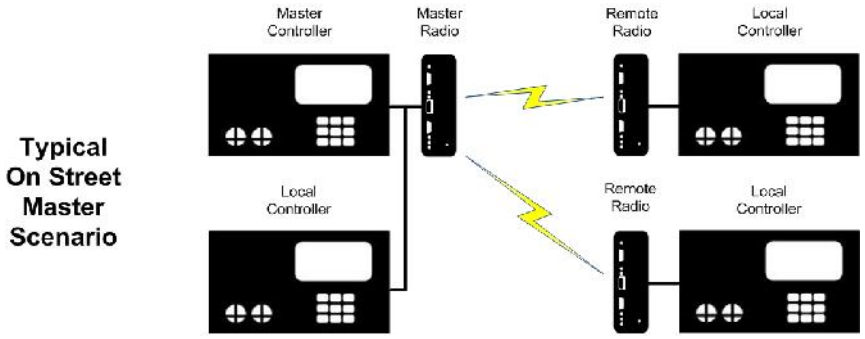
ENCOM PULSE modems are deployed in networks. Each network typically consists of one Master radio, and one or more Remote radios. Repeaters are optional, and when included in the network they are physically positioned between the Master and Remote radios. In effect, they are used to extend the network range.

Supported Network Topologies

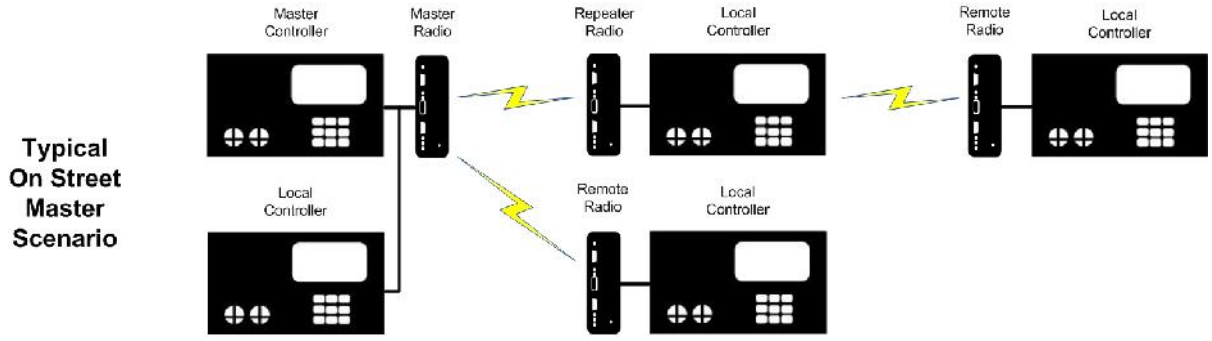
The simplest network consists of one Master and one Remote. This is referred to as a Point-to-Point deployment. The example below shows a Point-to-Point Traffic Control application.



It is possible to have a Master directly communicate with more than one Remote. This is referred to as a Point-to-Multipoint deployment.

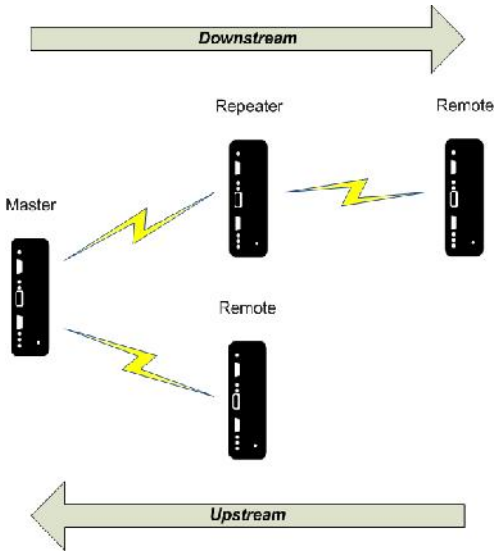


Repeaters can be included in a network and can be deployed as required. However, it is important to note that using Repeaters will increase your packet latency. ENCOM recommends that you determine whether Repeaters are suitable for your application during system design.



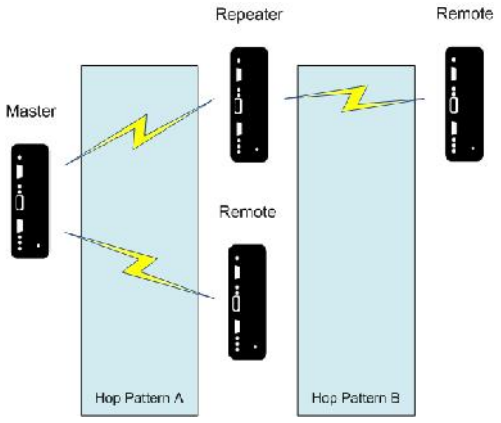
Upstream and Downstream

This document uses the terms upstream and downstream when describing the relative orientation of Wireless Modems in a network. Data travelling from the Master towards the Remotes is said to be flowing ***downstream***. Conversely, data travelling towards the Master from the Remotes is said to be flowing ***upstream***.



Hop Patterns

ENCOM radios communicate using Frequency Hopping Spread Spectrum (FHSS) technology. A predefined sequence of channel numbers is called a hop pattern. All radios that need to communicate directly with one another must share the same hop pattern. Accordingly, Repeaters must be configured to use two different hop patterns; one for communicating upstream and one for communicating downstream.



Hardware

Power

A barrel connector on the back of the Wireless Modem accepts 8-30 VDC, center positive.

ENCOM supplies a wall transformer with the Wireless Modem that converts 120 VAC to 12 VDC.

Antenna Connection

The ENCOM PULSE ‘S’ Wireless Modem is equipped with a Reverse Polarity TNC Female antenna connector.

Please note that an antenna is not supplied with this product. Refer to the instructions provided by the antenna manufacturer and comply with all installation instructions and recommendations.

The antenna and antenna cable should be installed before the Wireless Modem is powered on.

	Always ensure that the radio equipment is powered down when installing the antenna.
	The installation, removal or maintenance of all antenna components must be carried out by qualified and experienced personnel.
	Do not operate the Wireless Modem without an antenna connected, as this can damage the transmitter.

	Never work on an antenna system when there is lightning in the area.
	Direct human contact with the antenna is potentially unhealthy when the radio is generating RF energy.

Serial Connection

The Wireless Modem has a single DB9 female data port on the front panel, labeled DATA.

Connector Pins

The DATA port follows the RS232 DCE convention, although some pins are unused.

Pin	Description		Direction
1	DCD	Data Carrier Detect	Output
2	RXD	Receive Data	Output
3	TXD	Transmit Data	Input
5	GND	Signal Ground	
7	RTS	Ready to Send	Input
8	CTS	Clear to Send	Output

Supported Formats

Baud Rates:	1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200
Data Bits:	7, 8
Parity:	None, Odd, Even
Stop Bits:	1, 2

RTS/CTS Operation

The RTS/CTS control lines can be configured so they are:

- Disabled
- Used for conventional flow control
- Used to frame data sent from your serial device to the Wireless Modem

DCD Operation

The DCD control line can be configured so it is:

- Always ON
- Only ON when the RF radio is synchronized
- Used to frame data sent from the Wireless Modem to your serial device

USB Connection

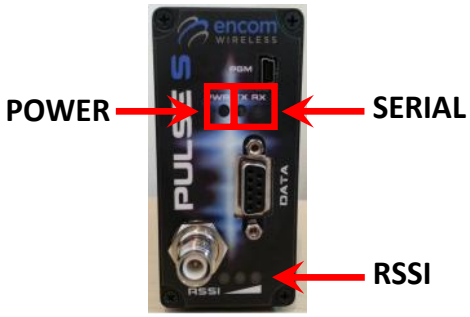
The USB connector on the front panel accepts a Mini B cable.

ENCOM can provide a standard cable to connect the PULSE Wireless Modem to a PC.

LED Indicators

There are several LEDs present on the front panel of the Wireless Modem.

- Power indicator
- Serial data indicators
- RSSI indicators



Each of these is described below.

Power Indicator

When this LED is ON, it indicates that the Wireless Modem has power and is operational.

Serial Data Indicators

There are two LEDs, one labelled TX and one labelled RX. The behaviour of these LEDs depends on the radio mode, as described in the following table.

Radio Mode	LED	Description
Master, or Remote	TX	• Blinks when the radio is transmitting data
	RX	• Blinks when the radio is receiving data
Repeater	TX	• Blinks when the radio is transmitting data from an attached serial device • Does not blink when the radio is repeating data sent by other serial devices
	RX	• Blinks when the radio is receiving data from an upstream radio (Master, or another Repeater)

Note that when the ENCOM PULSE Link application is used to configure or test a Wireless Modem, the serial data indicators actually show when the Wireless Modem is communicating with the computer.

RSSI Indicators

Three LEDs, stacked in a column, are used to present the RSSI (Received Signal Strength Indication). When more LEDs are ON, this generally means the signal strength is greater, resulting in more reliable communications.

- One LED indicates that the link is weak
- Two LEDs indicate that the link should be acceptable
- Three LEDs indicate that the link should be strong and very reliable

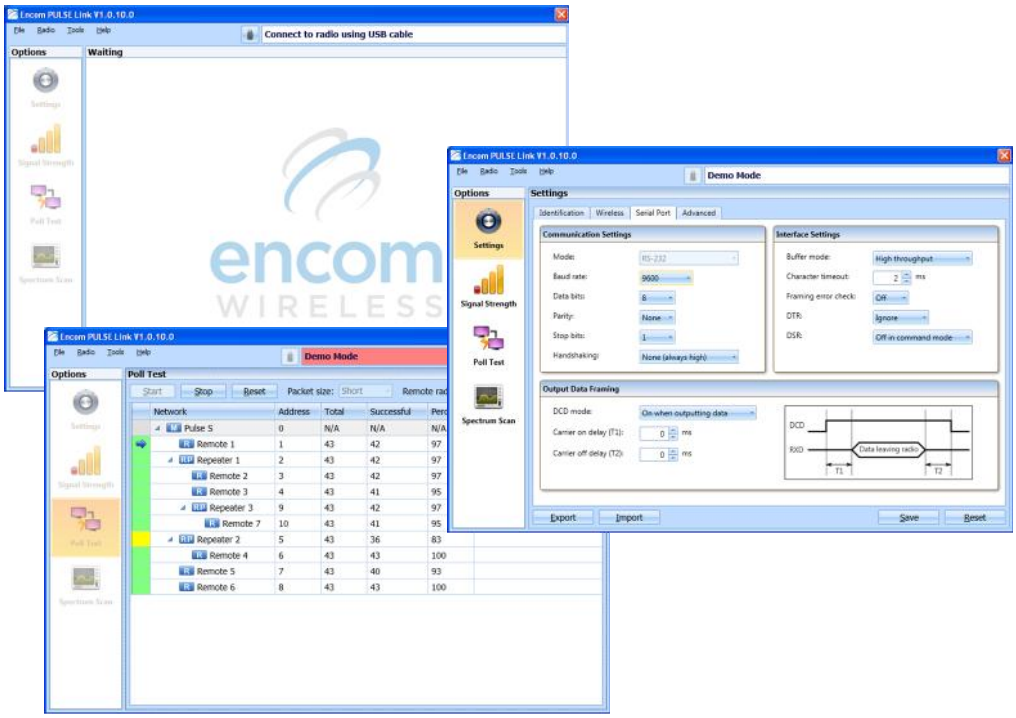
The LEDs provide feedback on the health of the RF link. If the LEDs are OFF or blinking, you do not have reliable RF communications. Please refer to the Troubleshooting section in this document for more information.

Software

Overview

ENCOM supplies an application called PULSE Link that can be used to:

- Configure your ENCOM Wireless Modems
- Optimize the performance of your wireless network
- Diagnose network and communication issues



Installation

The PULSE Link installation package can be downloaded from the ENCOM website. This package will install both an application and a USB driver on your PC.

Please refer to the PULSE Link User Manual if you require additional assistance.

Connecting the Modem to a Computer

The ENCOM PULSE modem has a USB connector on the front panel that is reserved for interaction with the PULSE Link application.

Once the PULSE modem has been installed and powered up:

- Start the PULSE Link application on your PC
- Connect the USB cable to your PC and your Wireless Modem

PULSE Link will detect the PULSE modem and will automatically retrieve the current settings.

Operation

The PULSE Link manual describes how the application can be used to configure modems, optimize performance, and troubleshoot issues.

Please refer to the PULSE Link User Manual if you require additional assistance.

Troubleshooting

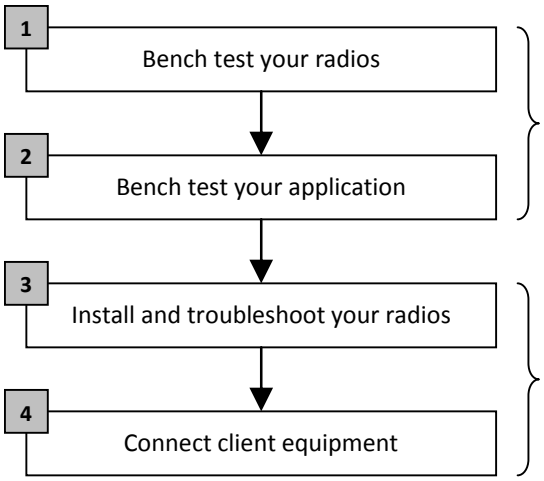
General

This section describes basic troubleshooting procedures for PULSE deployments. By way of example, we describe the steps that would be followed when interconnecting Traffic Controllers. However, the principles are the same for any type of serial device.

NOTE	**ENCOM includes diagnostic facilities in the PULSE Link application that allow you to confirm the RF link integrity from the Master to each and every Remote. Please refer to the Poll Test section of the PULSE Link manual for more information.** **ENCOM is not responsible for client equipment configuration or data cabling issues, unless we provide the complete solution.**

There are two distinct scenarios that are addressed in this manual. The first section provides tips and hints that are useful when deploying a new system. The second provides hints and tips in the event that you need to resolve performance degradation or failure issues in an existing deployment.

New Deployments



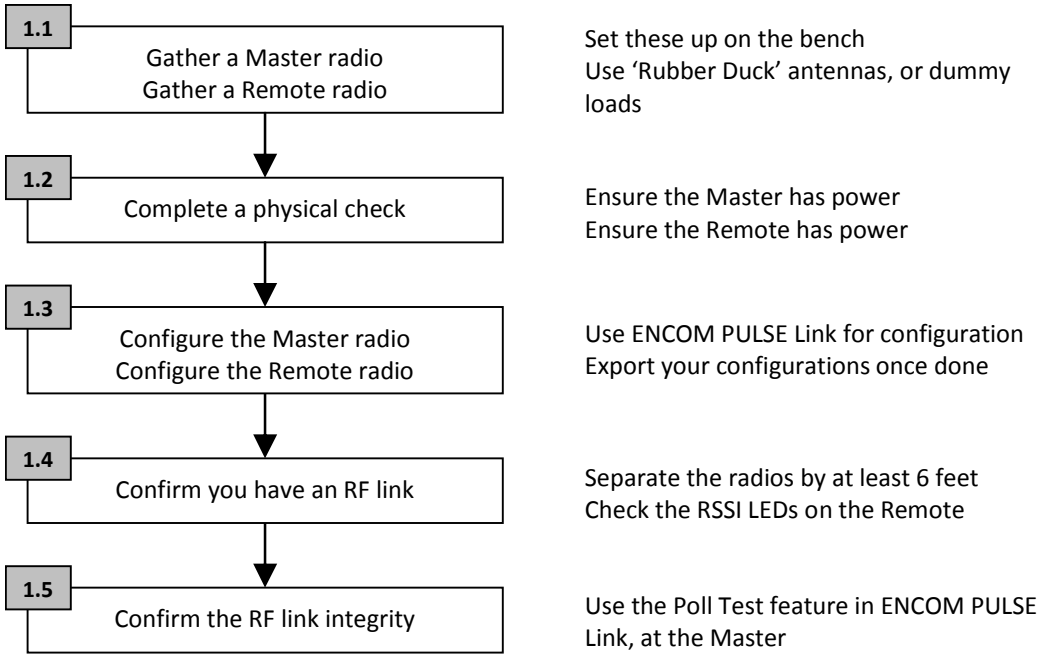
This will save you countless hours of troubleshooting in the field

Use the same configurations that were proven on the bench. Also, prove your radios before connecting equipment.

Bench Test Your Radios

When working on the bench, your first task is to confirm that the radios communicate reliably with one another. The steps below will help you create your first link.

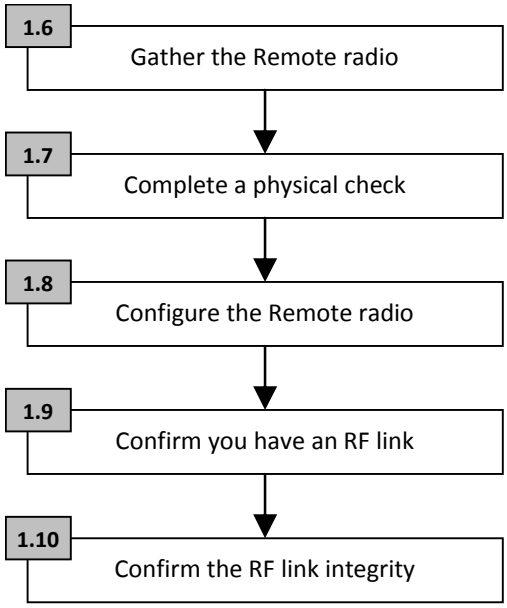
Note: Do not connect data cables from the radios to your client equipment at this time.



If you are having difficulty establishing a reliable RF link, ENCOM recommends that you:

- Double check the configuration of the radios
- Increase antenna separation
- Check for sources of interference (other radios in the vicinity)

Once the first link is working perfectly, add radios to your network one at a time. The steps below need to be performed for each additional radio.



Set this up near the other radios
Use a 'Rubber Duck' antenna

Ensure the Remote has power

Use ENCOM PULSE Link for configuration
Import your saved Remote configuration
Ensure you have a unique Unit Address

Ensure the Master is at least 6 feet away
Check the RSSI LEDs on the Remote

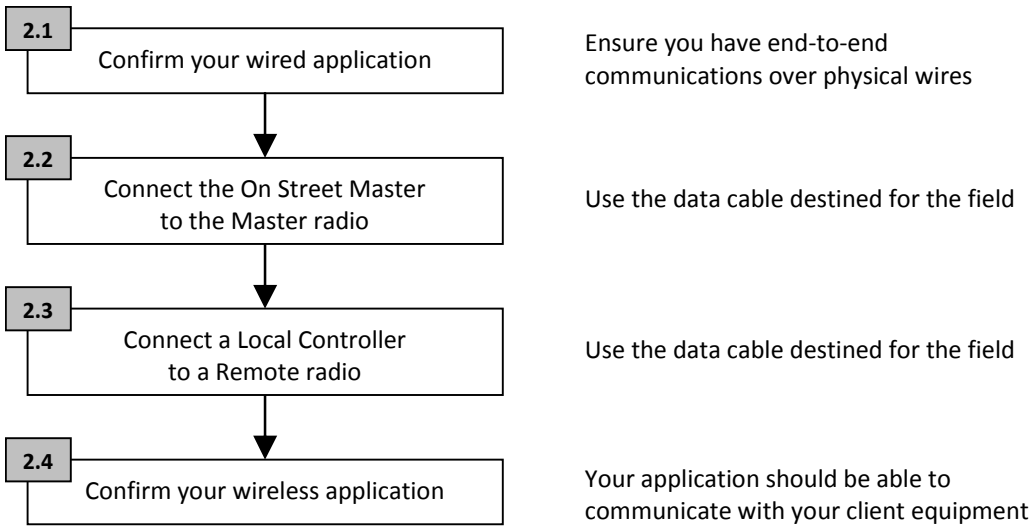
Use the Poll Test feature in ENCOM PULSE Link, at the Master, to check all radios

Once the RF link integrity has been confirmed, **all of your ENCOM PULSE modems are working correctly**. You can now focus on end-to-end serial communications.

Bench Test Your Application

The intent of bench testing your application is to confirm end-to-end, Master Controller to Remote Controller communications. When complete, you will have proven your radio configuration, your data cables, and your system timing. This is much easier to do on the bench than in the field.

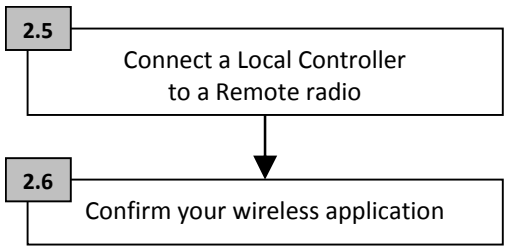
Initially, you only want to connect enough client equipment to communicate over one wireless link. This is described in the steps below.



If you are having difficulty communicating reliably with your client equipment, the issue is most likely related to the serial interfaces. Also note that since the RF link integrity has already been confirmed, the issue is probably outside of ENCOM's control. Common issues are listed in the table below.

Possible Problem	Recommendations
Serial data cables	Check for proper signal direction with the help of a 'break-out' box The Tx and Rx LEDs on the modem are invaluable, and can help diagnose your issue
PULSE modem configuration	Confirm that the serial settings in the Master and Remote are consistent with the serial settings in the client equipment You may need to adjust the serial settings and timing parameters in the PULSE modems depending on your application

Once the application is working over the first wireless link, you can add client equipment incrementally. For each additional Controller you would like to test:



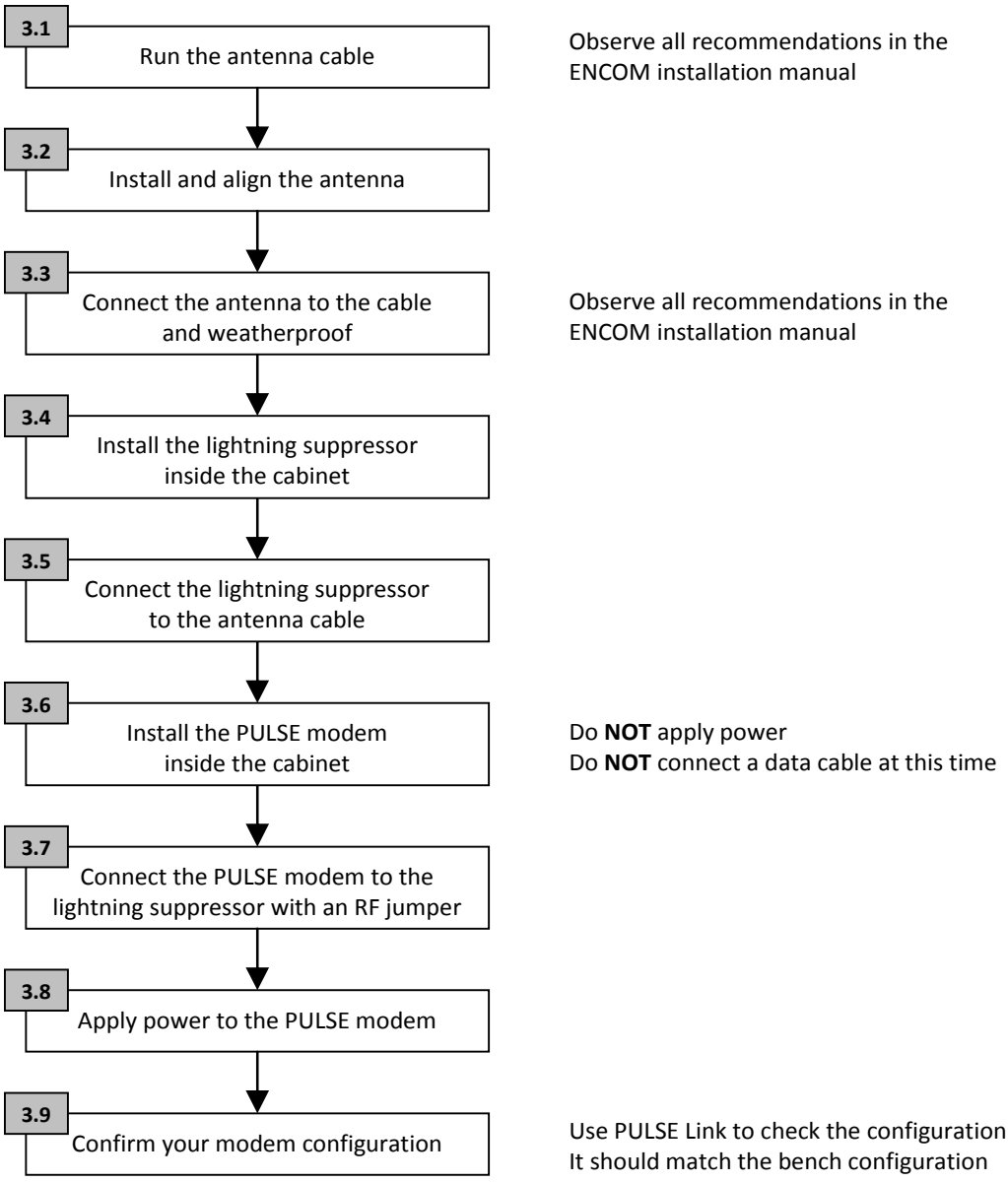
Use the data cable destined for the field

Your application should be able to communicate with your client equipment

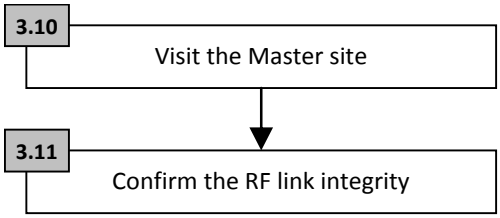
Install and Troubleshoot Your Radios

You need to confirm that your radios communicate reliably in the field before connecting your client equipment. This is same strategy that was applied on the bench.

All PULSE modems and antennas need to be installed first. **Note that it is presumed all sites were qualified with site surveys**. The following steps need to be performed at each site.



At this point, all PULSE modems and antennas are in the field. They should all have power, and should all have valid configurations. The next task is to troubleshoot your wireless network.



Use the Poll Test feature in PULSE Link to confirm you can reach all Remotes

Everything should work reliably, without issue, if you configured and tested your network on the bench. However, if you are having difficulty establishing reliable RF communications, ENCOM recommends that you:

- Confirm the PULSE modems are powered, and antenna cables are connected
- Double check the modem configurations
- Check the antenna alignment
- Consider changing antennas or antenna cables, at problematic sites

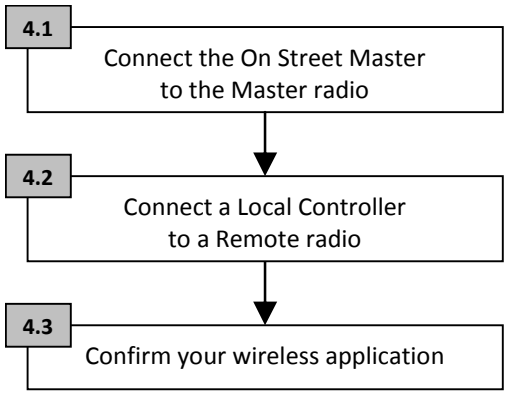
Once the RF link integrity has been confirmed, **all of your ENCOM PULSE modems are successfully deployed and are working correctly**.

Connect Client Equipment

Once your ENCOM PULSE modems are successfully configured and deployed, your client equipment can be attached to the modems. This final stage of the deployment should be the simplest, given that:

- You have already confirmed your wireless application on the bench
- All ENCOM PULSE modems are successfully deployed and proven

Initially, you only want to connect enough client equipment to communicate over one wireless link. This is described in the steps below.

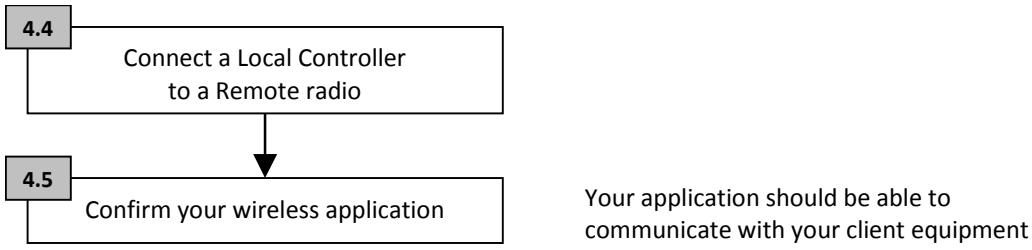


Your application should be able to communicate with your client equipment

If you are having difficulty communicating reliably with your client equipment, the issue is most likely related to the client equipment or the serial interfaces. Also note that since the RF link integrity has already been confirmed, the issue is probably outside of ENCOM's responsibility. Common issues are listed in the table below.

Possible Problem	Recommendations
Client equipment	Ensure the telemetry ports are enabled Ensure Controllers are correctly configured
Serial data cables	Ensure you are using the same cables that were tested on the bench You can try swapping cables from known working locations
PULSE modem configuration	Confirm you have the same serial settings that were used on the bench

Once the application is working over the first wireless link, you can add remaining client equipment incrementally.



Existing Deployments

If a deployed network no longer performs as it once did, start by assessing if there is anything in your system that has recently changed:

- Application software upgrades
- Client equipment upgrades
- IT changes (new equipment, policy changes, etc.)

Check for environmental changes:

- Construction
- Foliage

Determine if you are able to reach no Controllers, all Controllers except one, or some Controllers.

- If all Controllers are unreachable, the problem is likely at or near the Master
- If one Controller is unreachable, the problem is likely at or near that Controller
- If some Controllers are unreachable, check a network map to see if unreachable Controllers are all downstream from a Repeater

Visit each site that you suspect may have an issue.

- Perform a physical check (confirm power, cables, antenna)

Always debug the RF links before debugging the serial connections.

- Connect a PC to the Master radio and use the Poll Test feature in PULSE Link to confirm if all PULSE radios are communicating
- If you do not have a reliable RF link, try swapping one or more radios for known good ones

If the RF links are operating reliably, check the serial connections

- Check the Controller configuration, and cabling
- If a Controller cannot be reached, try swapping the radio at that location for a known good one
- Try swapping the Controller as a last resort

Appendix A: RF Exposure

FCC

This equipment has been designed to comply with FCC RF exposure requirements outlined in Parts 2.1091, 2.1093, and 15.247(b)(4). Deviation from the recommended installation may violate RF exposure requirements.

To comply with FCC RF exposure requirements for mobile transmitting devices, only use or install this transmitter at locations where there is at least 23cm (9") separation distance between the antenna and all persons.

Health Canada

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from Health Canada's website www.hc-sc.gc.ca.

Appendix B: Declaration of Conformity

FCC

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference

(2) This device must accept any interference received including interference that may cause undesired operation.

Warning (Part 15.21)

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Industry Canada

This device complies with Industry Canada RSS-210 specifications

ENCOM Wireless, based in Calgary, Canada, provides field-proven, cost-effective wireless data solutions for municipal and industrial clients, with applications in the areas of:

* Intelligent Transportation Systems
* Public safety communications
* Municipal corporate security and IT networks
* Water and waste water management
* Electrical utilities
* Oil and gas

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