HOME

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# Cylink VoiceXtender Modem

## Installation Guide

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CYLINK

## PRODUCT COMPATIBILITY

While every effort has been made to verify operation of this product with many different communications products and networks, Cylink Corporation makes no claim of compatibility between its products and other vendors’ equipment. It is assumed that users have thoroughly evaluated this product’s performance in the communications environment in which it will be used.

## SAFETY

The following general safety precautions must be observed during all phases of operation and service of this product. Failure to comply with these precautions or with specific warnings elsewhere in this Manual willfully violates standards of design, manufacture, and intended use of the product. Cylink Corporation assumes no liability for the customer's failure to comply with these requirements.

This product must be grounded. In the event of a short circuit, grounding reduces the risk of electrical shock by providing an escape wire for the current.

The product's AC power cord ends in a three-pole grounding plug. **Do not** use a three-pole to two-pole adapter with the plug. Verify that the outlet you intend to use is properly installed and grounded; the outlet used must comply with the local electric code.

Do not install or operate this product in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

No user maintained or adjustable components are present within this product. The covers should not be removed by anyone other than authorized Cylink service personnel. The potential for electrical shock exists within the cabinet at all times unless it is unplugged.

Do not install substitute parts or perform any unauthorized modification to the VoiceXtender modems. Return the product to Cylink Corporation for service and repair to ensure that safety features are maintained. Prior to returning any product(s) for repair, contact Cylink at the telephone numbers or address located on the front of this Manual, and obtain a Return Material Authorization (RMA) number.

Changes or modifications not expressly approved by Cylink Corporation can void the user’s authority to operate the equipment.

TOWER CONSTRUCTION

Compliance with local zoning and tower construction regulations is recommended when VoiceXtender digital modem radios require a tower. These regulations generally mandate that permits be obtained before any tower construction begins. Check with local zoning and aviation authorities for more information.

## FCC PART 68 INFORMATION

Federal Communications Commission (FCC) Rules on spread spectrum devices, such as the VoiceXtender, require that you be notified of the following:

This equipment complies with Part 68 of the FCC Rules. The FCC Part 68 label is located on the bottom of the enclosure. This label contains the FCC Registration Number for this equipment. If requested, this information must be provided to your telephone company.

The REN is useful to determine the quantity of devices you may connect to your telephone line and still have all of those devices ring when your telephone number is called. In most, but not all areas, the sum of the RENs of all devices connected to one line should not exceed five (5.0). To be certain of the number of devices you may connect to your line, as determined by the REN, you should contact your local telephone company to determine the maximum REN for your calling area.

Connection to the telephone network should be made by using standard modular telephone jacks, type RJ11C or RJ11W. The RJ11C or RJ11W plug and/or jacks used must comply with FCC Part 68 rules.

If this telephone equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in it's facilities, equipment, operations or procedures that could affect the proper functioning of your equipment. If they do, you will be notified in advance in order for you to make necessary modifications to maintain uninterrupted service.

This equipment may not be used on coin service provided by the telephone company. Connection to party lines is subject to state tariffs.

## REPAIR INSTRUCTION

Repairs to this equipment can only be made by the manufacturer or its authorized agents. If this equipment is causing harm to the telephone network, the telephone company may request that it be unplugged from the modular outlet until the problem has been corrected. To obtain repair service or warranty information contact:

Cylink Corporation
1350 Bordeaux Drive
Sunnyvale, CA 94089
Attn: Repair and Return Department
1-800-545-6608

FCC regulations require that this device be professionally installed by a person knowledgeable in electronics and trained in the correct installation of this device.

All interface cables must be shielded.

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

## INDUSTRY CANADA NOTICE

Notice: The Industry Canada label identifies certified equipment. This certification means the equipment meets telecommunications network protective, operational. And safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements documents(s). The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect this equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precautions may be particularly important in rural areas.

| ***CAUTION*** | Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate. |
|---|---|

Notice: The Ringer Equivalence Number (REN) assigned to each terminal device provides an indication of the maximum number of terminals to be connected to a telephone interface. The combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed 5.

## RADIO FREQUENCY INTERFERENCE

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications

## STATEMENT OF WARRANTY

CYLINK products, except as stated otherwise in an applicable price list, are warranted against defects in workmanship and material for a period of one (1) year from date of delivery as evidenced by CYLINK's packing slip or other transportation receipt.

CYLINK's sole responsibility under this warranty shall be to either repair or replace, at its option, any component which fails during the applicable warranty period because of a defect in workmanship and material, provided PURCHASER has promptly reported same to CYLINK in writing. All replaced Products or parts shall become Cylink's property.

CYLINK shall honor the warranty at CYLINK's repair facility in Sunnyvale, California. It is PURCHASER's responsibility to return, at its expense, the allegedly defective Product to CYLINK. PURCHASER must obtain a Return Materials Authorization (RMA) number and shipping instructions from CYLINK prior to returning any Product under warranty. Transportation charges for the return of the Product to PURCHASER shall be paid by CYLINK within the United States. For all other locations, the warranty excludes all costs of shipping, customs clearance and other related charges. If CYLINK determines that the Product is not defective within the terms of the warranty, PURCHASER shall pay CYLINK all costs of handling, transportation and repairs at the then prevailing repair rates.

All the above warranties are contingent upon proper use of the Product. These warranties will not apply (i) if adjustment, repair or parts replacement is required because of accident, unusual physical, electrical or electromagnetic stress, negligence of PURCHASER, misuse, failure of electric power environmental controls, transportation, not maintained in accordance with CYLINK specifications, or abuses other than ordinary use (ii) if the Product has been modified by PURCHASER or has been repaired or altered outside CYLINK's factory, unless CYLINK specifically authorizes such repairs or alterations; (iii) where CYLINK serial numbers, warranty data or quality assurance decals have been removed or altered.

CYLINK also reserves the right to make product improvements without incurring any obligation or liability to make the same changes in Products previously manufactured or purchased. In no event shall CYLINK be liable for any breach of warranty in an amount exceeding the net selling price of any defective Product. No person, including any dealer, agent or representative of CYLINK is authorized to assume for CYLINK any other liability on its behalf except as set forth herein. Nonpayment of any invoice rendered within the stated payment terms automatically cancels any warranty or guarantee stated or implied. If any payment is due CYLINK for services performed hereunder, it shall be subject to the same payment terms as the original purchase.

CYLINK HEREBY DISCLAIMS ALL IMPLIED WARRANTIES ON PRODUCTS INCLUDING WITHOUT LIMITATION, ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. The warranties expressly stated herein are the sole obligation or liability on the part of CYLINK arising out of or in connection with the sale or performance of the products.

Products Manufactured by Others - For products not manufactured by CYLINK the original manufacturer's warranty shall be assigned to PURCHASER to the extent permitted and is in lieu of any other warranty, express or implied. For warranty information on a specific product, a written request should be made to CYLINK.

IN NO EVENT WILL CYLINK BE LIABLE TO PURCHASER FOR (i) REPROCUREMENT COSTS; (ii) SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES; (iii) ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS ARISING OUT OF OR IN CONNECTION WITH THIS AGREEMENT, OR THE USE OF PERFORMANCE OF CYLINK PRODUCTS, REGARDLESS OF WHETHER THE CAUSE OF ACTION IS IN CONTRACT, TORT, INCLUDING NEGLIGENCE, OR ANY OTHER FORM.

No action, whether in contract or tort, including negligence, arising out of or in connection with this Agreement, may be brought by either party more than eighteen (18) months after the cause of action has accrued, except that an action for nonpayment may be brought within eighteen (18) months of the date of last payment.

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# PREFACE
# About This Manual

The *VoiceXtender Modem Installer's Guide* provides information to install, configure, monitor, and test the VoiceXtender. This section describes the intended audience for this manual, summarizes the contents, explains the conventions, and provides customer support and reader response information.

**Inside this section:**

# Who Should Read This Manual

This manual is for people who will install, configure, and operate Cylink's VoiceXtender modems. The manual provides general guidelines on how to prepare for and configure the AirLink modems for use in a typical environment, including system planning, antenna options, and path analysis. We assume that you have experience with and an understanding of the concepts underlying telecommunications systems, as well as some familiarity with radio equipment. You must also have knowledge of all radio frequency and electrical safety practices and regulations that apply to the installation site.

# How to Use This Manual

Each of the chapters and appendices in this manual begin with an introduction to the contents of that portion of the manual. Before beginning the installation process, you should read the introductions to each chapter so that you know what each portion provides.

When you come to a procedure, skim through the entire procedure before performing the step-by-step instructions. By doing this, you can prepare with the appropriate information, equipment, and tools.

The information in this manual is organized according to the sequence of tasks necessary to plan for unpacking, installing, and configuring, as well as operating and maintaining the VoiceXtender modem.

| Title | Description |
|---|---|
| Chapter 1<br>Introduction | Provides a general description of VoiceXtender modems, including features and front and rear panel information. |
| Chapter 2<br>System Planning | Provides information on configuration planning, path analysis, and typical applications. |
| Chapter 3<br>Installation and Setup | Provides instructions on how install modems, configure the DIP switches, cable the equipment, and align the antenna. |
| Chapter 4<br>Troubleshooting | Provides information on troubleshooting and possible operational problems when using modems. |
| Appendix A<br>Specifications | Provides information on general specifications and radio interface specifications. |
| Appendix B<br>Worksheets | Assists in the system planning process by providing a means to note VoiceXtender configuration settings and maintain a record of the settings. |
| Appendix C<br>Glossary | Provides definitions for the terms commonly used throughout the manual. |
| Index | Provides a quick reference to assist you in locating important terms in the manual. |

# Manual Conventions

The procedures and instructions in this manual use the following conventions:

- The two configuration switches on the unit are referred to as SW1 and SW2. Each switch consists of 8 individual ON / OFF switches that are referred to as SW1-1, SW1-2, SW2-1, SW2-2, etc.

- The following notes are used to add information, point to other important considerations, or alert you to possible risks to you, your equipment, or your data.

| | |
|---|---|
| ***NOTE*** | These standard text notes highlight important or additional information for you to consider. |

| | |
|---|---|
| ***CAUTION*** | These notes warn you of situations that could result in damage to your equipment or loss of data if you do not heed the instructions. |

| | |
|---|---|
| ***WARNING*** | These notes warn you of situations that could endanger your health or safety if you do not heed the instructions. |

# Customer Support

If after reading this guide you encounter any trouble installing or using the VoiceXtender modem, please contact your local distributor. If problems are not resolved, you can call Cylink's Customer Service for assistance. The telephone numbers are:

Domestic (U.S.):

| | |
|---|---|
| 1-800-545-6608 | Sunnyvale, CA |

International:

| | |
|---|---|
| 1-408-735-5822 | Sunnyvale, CA |
| +65-297-6196 | Singapore |
| +44-1256-841919 | United Kingdom |
| +91-11-301-0090 | India |
| +92-21-215-7264 | Pakistan |

Domestic and International Customer Service fax:

| | |
|---|---|
| 1-408-735-6641 | Sunnyvale, CA |
| +65-297-6195 | Singapore |
| +44-1256-24156 | United Kingdom |
| +91-11-379-3584 | India |
| +92-21-587-0065 | Pakistan |

You can also contact Cylink's Customer Support through the Internet at the following email address:

**support@cylink.com**

If you need to return equipment, call Customer Service to obtain a return material authorization (RMA) number prior to returning the equipment. The RMA number must be on the outside of the shipping carton. When you call, please be prepared to provide the unit serial number, software version, and a detailed description of the problem.

Return all equipment to:

Cylink Corporation
1350 Bordeaux Drive
Sunnyvale, CA 94089

Attn: Repair and Return Department
RMA No: xxxxxxxxxx

# Reader Response

Cylink's technical publications department wants its documents to meet your requirements. To this end, your ideas about the documentation are valuable. After you have had a chance to read and use the guide, we encourage you to submit your comments to

Manager, Technical Publications
Cylink Corporation
910 Hermosa Court
Sunnyvale, CA 94086

You can also submit your comments through the Internet at the following address:

**techpubs@cylink.com**

Cylink may use or distribute any of the information you supply in any way it believes appropriate without incurring any obligations whatsoever.

# CHAPTER 1
# Introduction to the VoiceXtender

This chapter contains an overview of the features and applications of Cylink's VoiceXtender modems, and includes descriptions of the front and rear panels.

**Inside this chapter:**

# Product Overview

Cylink's family of modems provide a wireless solution for data and voice connectivity using spread spectrum technology (902 to 928 MHz frequency band). VoiceXtender modems support 2-wire voice.

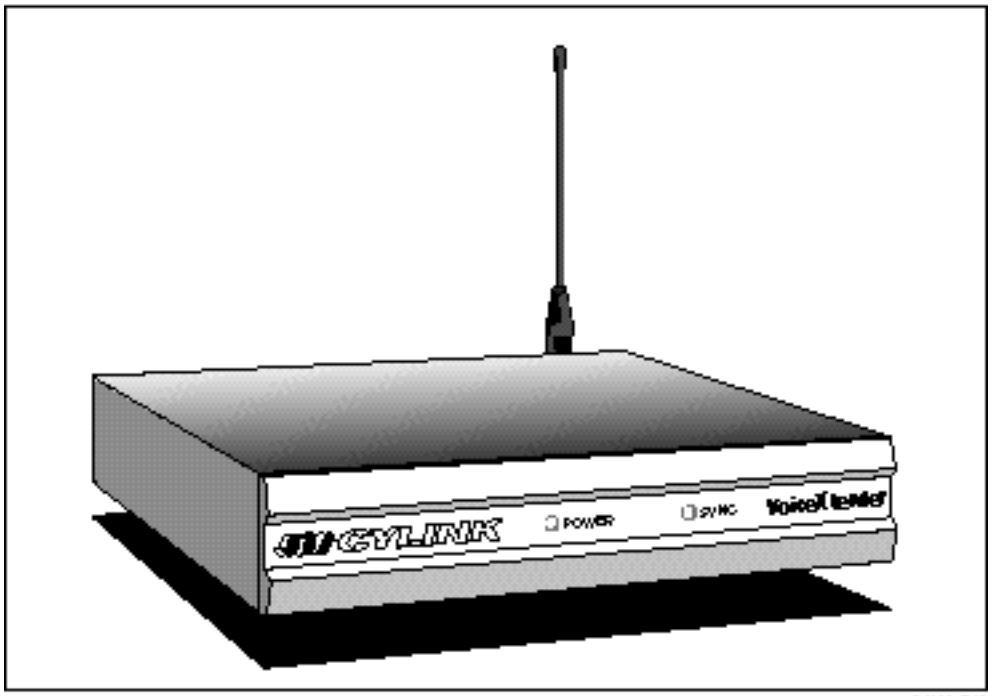



**Figure 1-1**
VoiceXtender

## Features

VoiceXtender (VX) modems provide the following features:

- Increased modem data rate to 28.8 Kbps
- Enables the maximum performance through a voice modem-CODEX connection
- Caller Number Delivery and Signaling
- 902 to 928 MHz operating frequency
- Selectable channels
- Selectable output power
- Optional omnidirectional or directional antennas
- Power on and radio synchronization status indicators
- Hub (several co-located terminals) configurability
- Adjustable audio receive (ear piece) level.

The VoiceXtender replaces the wired connection between a standard telephone and the on-premises switch or centrex with a radio link. Both foreign exchange station (FXS) and foreign exchange office (FXO) loop-start signaling are supported. The VoiceXtender provides a standard ringer current for the telephone ringer.

With the Caller Number Delivery feature, modulation is digitized by the VX 64 and converted at the receiving end within the specified three seconds.

# Applications

VX modems can be configured for point-to-point applications to provide a radio link between telephone devices. Several VX modems can be connected in a hub configuration to allow even greater flexibility in the arrangement of telephone equipment.

# Front Panel Description

The front of the VoiceXtender modem contains two green visual indicators:

- POWER—this indicator illuminates when the modem is plugged into the power outlet and is receiving power.
- SYNC—this indicator illuminates when the channel is ready for transmission (the RF link is up). When this indicator is flashing, the RF link is not well established. When this indicator is off, the RF link is down.

Figure 1-2 shows the front panel of an VoiceXtender modem. For more information on indicators, refer to the section entitled "System Startup" in Chapter 3, "Installation and Setup."

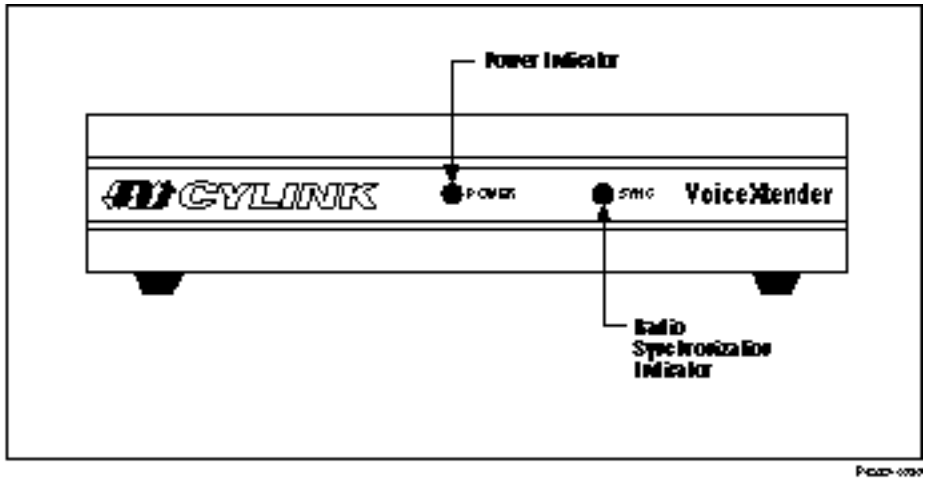



**Figure 1-2**
VoiceXtender (VX) Modem - Front Panel

# Rear Panel Description

The VoiceXtender modem is easily configured using the configuration switches located at the rear of the modem. All connections are also located at the rear as shown in Figure 1-3.

The following list describes the items on the rear panel:

- Antenna connector (ANT) is a female N-type connector for connection to either an omnidirectional or directional antenna
- Female BNC connector for burst synchronization signal (SYNC) to connect the synchronizing unit to synchronized modems in a hub configuration or slave unit to master unit in a repeater application
- Two configuration switches, each consisting of eight individual ON / OFF switches
- RJ11-type modular connector for the line or phone connection
- 5-pin female DIN connector for the external power supply
- System grounding stud

For information on applications, refer to Chapter 2, "System Planning." For information on cabling and switch settings, refer to Chapter 3, "Installation and Setup." Information on specific cable pin signals can be found in Appendix A, "Specifications."

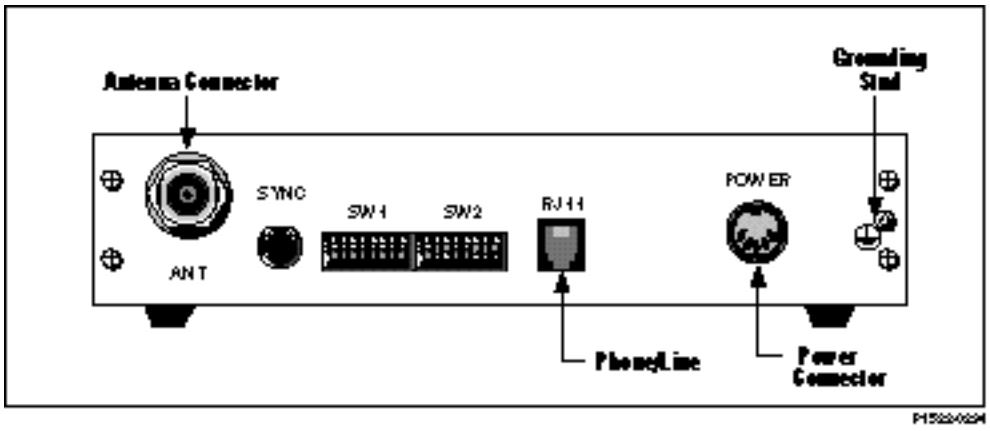



**Figure 1-3**
VoiceXtender Modem - Rear Panel

# CHAPTER 2
# System Planning

This chapter contains some general planning requirements and considerations to prepare for a quick and efficient installation of your VoiceXtender modems, including antenna options, path analysis, and sample applications.

**Inside this chapter:**

# Introduction

The installation procedure and effectiveness of the radio link vary depending upon the following items:

- Type of antenna used
- Distances, height, and line-of-sight between the antennas
- Distance between the modem and antenna.

The following sections provide guidelines on how to prepare for the installation and successful operation of VoiceXtender (VX) modems, and include examples of typical applications.

# Antenna Options

VX modems can be used with omnidirectional or directional antennas. These antennas are typically mounted on the roof of a building and are connected to the VX modem with 50 Ohm coaxial cable.

## Omnidirectional Antennas

An omnidirectional antenna is capable of transmitting or receiving signals from all directions in a horizontal plane, with equal power in each direction. It is similar to dropping a stone in a pool and seeing rings emanating from the center. Refer to Figure 2-1.

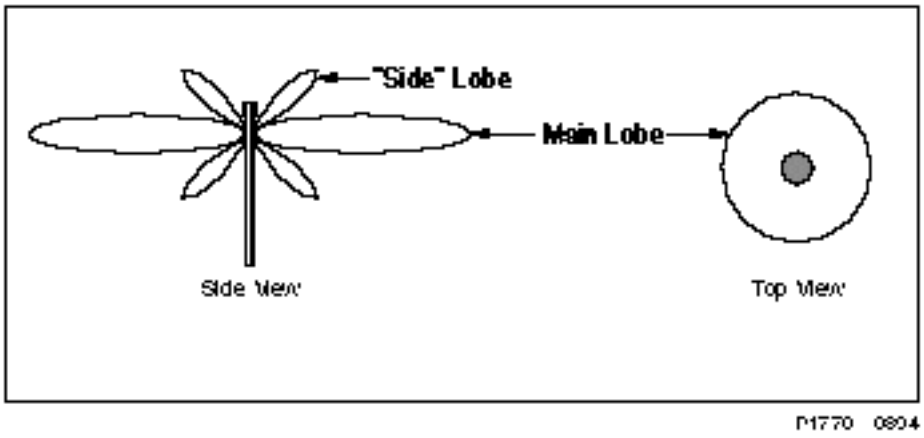



**Figure 2-1**
Omnidirectional Antenna

## Directional Antenna

A directional antenna focuses the RF energy in a specific direction. When using a directional antenna, it should be properly directed toward the opposite end of the link.

***NOTE*** In many countries, interference from cellular phones and pagers can be present in many environments. Because these interfering signals exist in a vertical plane, an efficient method to reduce their effect is to position the directional antenna in a horizontal plane (horizontal polarization). The interference rejection will be 15 - 20 dB.

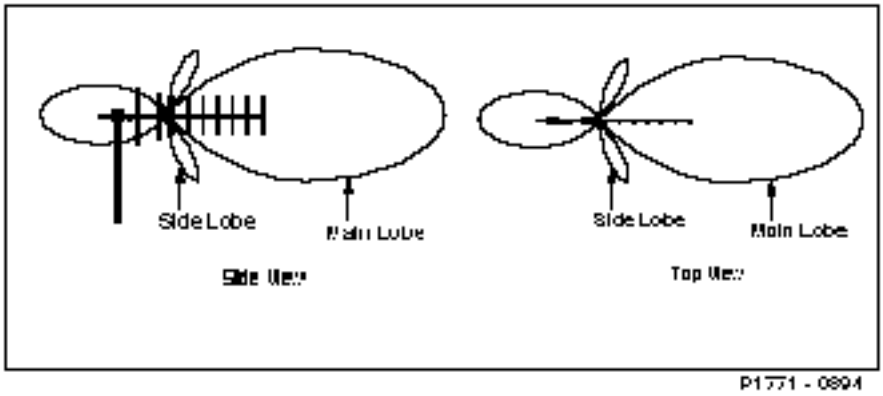



**Figure 2-2**
Yagi Directional Antenna

***NOTE*** Antennas are described in the accessory list available from your distributor, and can be purchased from Cylink or a Cylink distributor.

# Path Analysis

Path analysis examines the direction and length of a desired line-of-sight path, the equipment being considered, antenna gain, cable loss, and the environmental context (terrain and climate). It also determines the projected path loss. In situations where a clear line-of-sight path of less than five miles exists, path analysis might not be necessary. Otherwise, it is recommended that a path analysis be performed.

If a complete path analysis is necessary, Cylink Customer Support can help with the calculation as long as exact coordinates of the location are known (U. S. only).

## Determining the Fade Margin

To achieve reliable communication, the radio link must have an average received signal level high enough to protect the link against fluctuations in the signal power due to multipath fading and other anomalous propagation conditions. This safety factor is referred to as the fade margin.

The fade margin is a measure of how much additional signal attenuation the system can endure without dropping below the required Bit Error Rate (BER) level. A fade margin of 15 dB or more is sufficient in most situations.

Use the following formula to calculate the fade margin (see Figure 2-3):

$$\text{Fade Margin} = G_{SG} + G_{ANT} - L_{CL} - L_{PL}$$

where $G_{SG}$ is the total system gain (measured in dB), $G_{ANT}$ is the total antenna gain of both antennas (measured in dBi), $L_{CL}$ is the total connector / cable loss of all cables (measured in dB), and $L_{PL}$ is the path loss (measured in dB). These are described in more detail below.

The reliability of the link is related to the fade margin and is stated as Availability (in percent) or annual outage time (in minutes).

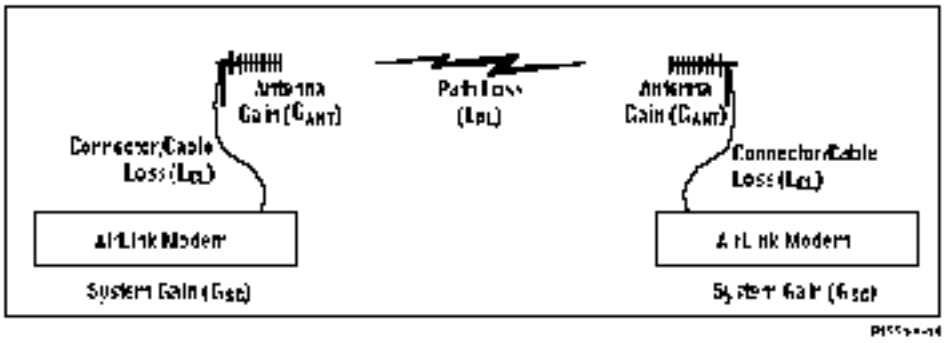



**Figure 2-3**
Fade Margin Calculation

### System Gain

System gain is the total gain of the *radio* system, without any consideration of the antennas or cables. It is the arithmetic difference between the transmitter's output power and the receiver's sensitivity threshold. System gain ($G_{SG}$ in the formula) is measured in dB. To calculate the system gain, subtract the receiver sensitivity from the transmitter power:

(Transmit Power) - (Receiver Sensitivity) = (System Gain)

For example, the system gain for the VX at maximum power is 127 dB.

(+29 dBm) - (-98 dBm) = 127 dB

### Antenna Gain

Antenna gain is the measure of the antenna's ability to focus the radio frequency (RF) energy into a preferred direction. Antenna gain ($G_{ANT}$ in the formula) is measured in dBi—the ratio between the power radiated by the antenna in a specific direction over the power radiated to that direction by an isotropic antenna fed by the same transmitter. An isotropic antenna radiates a signal evenly in all directions.

Refer to the antenna manufacturer's information to determine the antenna gain for the antenna you will be using. Some antennas are specified in dBd. This number can be converted to dBi by adding 2 dB.

### Cable/Connector Loss

A directional antenna is connected to the VX modem with a coaxial cable. The cable loss ($L_{CL}$ in the formula) is measured in dB, and depends on the cable length and the type of cable you are using. You can use any 50 ohm coaxial cable whose loss in dB per hundred feet is low enough (3 - 15 dB) so as not to contribute significantly to the total link loss. Quality cables with less than 7 dB loss per hundred feet are sold by Cylink and Cylink distributors.

### Free Space Path Loss

Due to reflections from the ground and other objects, the actual path loss between the transmitting and receiving antennas might differ significantly from the calculated path loss when both antennas are placed in a "free space" environment. Unfortunately, the additional loss due to these effects is difficult to calculate and requires precise knowledge of the geometry of the link and surrounding materials which, in most cases, is not available.

Typically, the largest contributor to "link loss" is the loss of power as the signal travels through space. This contribution, called Free Space Path Loss, can be easily calculated as follows: To determine the free space path loss, determine the distance between the VX modems for your application and refer to Table 2-1, or use the following formula:

attenuation in dB = [96. 6 + 20 LOG (distance in miles)
+ 20 LOG (frequency in GHz)]

**Table 2-1**
Free Space Path Loss Between Two Isotropic Radiators

| Distance (Miles) | Path Loss @ 915 MHz (L-Band) |
|---|---|
| 1 | 96 dB |
| 2 | 102 dB |
| 3 | 105 dB |
| 4 | 108 dB |
| 5 | 110 dB |
| 6 | 111 dB |
| 7 | 113 dB |
| 8 | 114 dB |
| 9 | 115 dB |
| 10 | 116 dB |
| 15 | 120 dB |
| 20 | 123 dB |
| 25 | 125 dB |
| 30 | 126 dB |

**Table 2-2**
Free Space Path Loss Between Two Isotropic Radiators

| Distance (kilometers) | Path Loss @ 915 MHz (L-Band) |
|---|---|
| 1 | 92 dB |
| 2 | 98 dB |
| 3 | 101 dB |
| 4 | 104 dB |
| 5 | 106 dB |
| 6 | 107 dB |
| 7 | 109 dB |
| 8 | 110 dB |
| 9 | 111 dB |
| 10 | 112 dB |
| 15 | 115 dB |
| 20 | 118 dB |
| 25 | 120 dB |
| 30 | 121 dB |
| 35 | 123 dB |
| 40 | 124 dB |
| 50 | 126 dB |

***NOTE*** The calculation for attenuation using kilometers is:
attenuation in dB = [92. 4 + 20 LOG (distance in kilometers) + 20 LOG (frequency in GHz)]

# Application Examples

VoiceXtender modems can be used in point-to-point or hub configurations. The following subsections show typical examples of each of these applications, and include configuration information for the modems.

For detailed information on configuration parameters and switch settings, refer to Chapter 3, "Installation and Setup. "

## Example 1: Point-to-Point Application

In this application, a remote telephone is connected to the main Public Switched Telecommunications Network (PSTN) network. This allows the remote telephone to communicate with any telephone connected to the PSTN network. As shown in Figure 2-4, the VoiceXtender provides a point-to-point radio voice link between the remote telephone and the PSTN network.

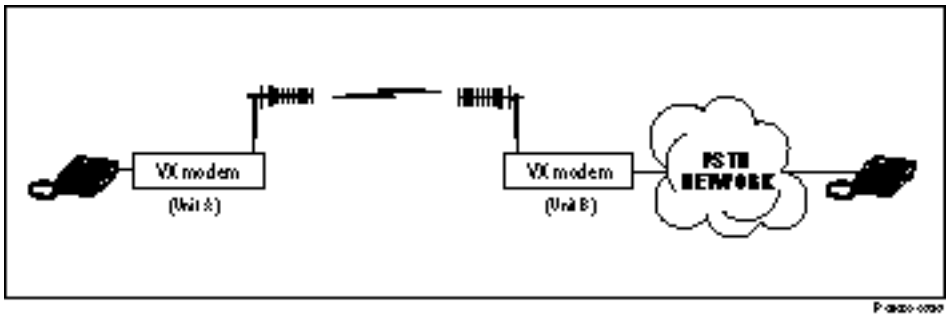



**Figure 2-4**
Point-to-Point Application

You will only need to configure the parameters on each modem. The following list describes the parameters for this particular application.

- RF Channel: Any of the ten available channels can be used. Choose a channel that is not being interfered with. The channel selected for master and slave units must be the same.
  (SW1-1, 1-2, 1-3, 1-4)

- Transmit Output Power: Typically, the minimum necessary power is recommended for most applications. Both units in a link need not be set to the same power level.
  (SW1-5, 1-6, 1-7)

- Burst Synchronization Timing: The master and slave are both configured for internal burst synchronization.
  (SW1-8 ON)

- Phone / Line: The switch must indicate which AirLink modem is connected to the phone and which modem is connected to the line. In this example, Unit A would be set to Phone and Unit B would be set to Line.
  (SW2-1)

- Master / Slave: One AirLink modem must be specified as a master and one as a slave.
  (SW2-2)

- Sleep / Normal: Set both modems to Normal.
  (SW2-3 OFF)

- Pseudo-Random Noise Sequence: Specify the same pseudo-random noise (PN) sequence on both AirLinks. PN sequence numbers range from 1 to 8.
  (SW2-6, 2-7, 2-8)

## Example 2: Point-to-Point Intercom Application

In this application, two telephones are connected in an intercom configuration. In this configuration, when either phone is taken off-hook, the other telephone will ring. The two telephones can only communicate with each other, and are not connected to any networks. As shown in Figure 2-5, VoiceXtender modems are used to provide a point-to-point radio voice intercom link between the two telephones.

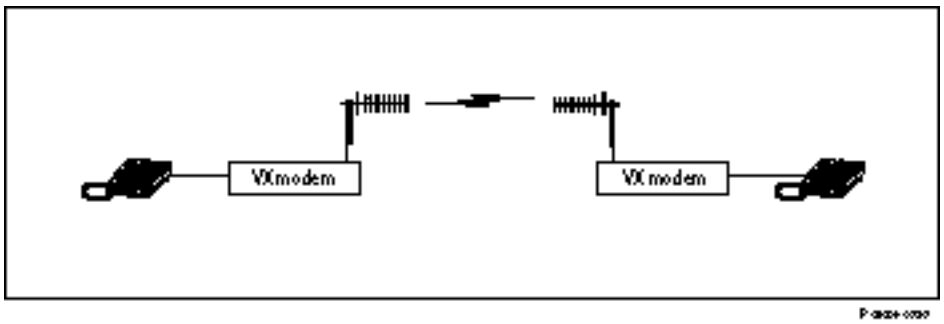



**Figure 2-5**
Point-to-Point Intercom Application

You only need to configure the parameters on each modem. The following list describes the parameters for this particular application.

- RF Channel: For the VoiceXtender, any of the ten available channels can be used. Choose a channel that is not being interfered with. The channel selected for master and slave units must be the same.
  (SW1-1, 1-2, 1-3, 1-4)

- Transmit Output Power: The minimum required power is typically recommended for most applications. Both units in a link need not be set to the same power level.
  (SW1-5, 1-6, 1-7)

- Burst Synchronization Timing: The master and slave are both configured for internal burst synchronization.
  (SW1-8 ON)

- Phone/Line: The switch must be set to the Phone position on both AirLink modems.
  (SW2-1 OFF)

- Master/Slave: One modem must be specified as a master and one as a slave.
  (SW2-2)

- Sleep/Normal: Set both modems to Normal.
  (SW2-3 OFF)

- Pseudo-Random Noise Sequence: Specify the same pseudo-random noise (PN) sequence on both modems. PN sequence numbers range from 1 to 8.
  (SW2-6, 2-7, 2-8)

## Example 3: Hub Application

In this application, several telephones are connected to the switch or centrex in the same building. As shown in Figure 2-6, VoiceXtender modems are used in a hub configuration. Because the telephones and switch are located in the same building, the low-gain omnidirectional antenna provided with the unit can be used. No path analysis is required with an omnidirectional antenna and short distances.

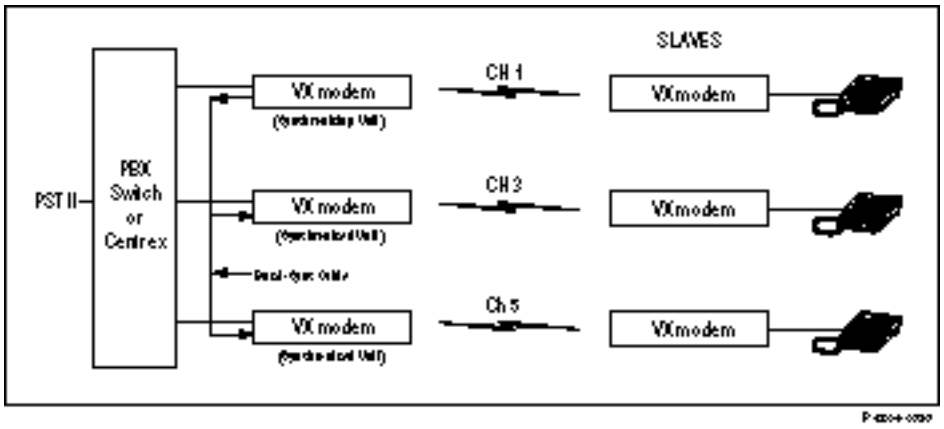



**Figure 2-6**
Hub Application

You need to configure each modem. The following list describes the parameters for this particular application.

- RF Channel: Each AirLink modem pair is assigned a unique channel to avoid interference. In this example, channels 1, 3, and 5 are recommended. (SW1-1, 1-2, 1-3, 1-4)

- Transmit Output Power: Typically, the minimum required power is recommended for most applications. However, the transmit power for the slave modems must be set to minimize the adjacent channel interference at the hub units.
  (SW1-5, 1-6, 1-7)

- Burst Synchronization Timing: In a hub configuration where there are multiple modem pairs, it is critical that all the master modems transmit and receive at the same time to minimize inter-channel interference.

  In this case, one modem (the synchronizing unit) is configured for internal burst timing. All other master modems (the synchronized units) are configured for external burst timing and synchronize their transmit bursts to the signal from the synchronizing master. The slave modems are configured for internal burst timing and derive their burst synchronization from their received RF signal.
  (SW1-8)

- Phone/Line: On the master modems, the Phone/Line switch must be set to the Line position. On the slave modems, the Phone/Line switch must be set to the Phone position.
  (SW2-1)

- Master / Slave: The modems connected to the switch or centrex (all in one location) are configured as masters, and the modems connected to the telephones are configured as slaves.
  (SW2-2)

- Sleep / Normal: Set all modems to Normal.
  (SW2-3 OFF)

- Pseudo-Random Noise Sequence: For each modem pair, specify a unique pseudo-random noise (PN) sequence to help separate adjacent channels. In this example, channel 1 uses PN sequence 1, channel 3 uses PN sequence 2, and channel 5 uses PN sequence 3.
  (SW2-6, 2-7, 2-8)

***NOTE*** VoiceXtender modems can be burst synchronized with other VoiceXtender VX64modems and with AirLink model 64MP, 128 and 256 data modems. If VX64 modems are burst synchronized with data modems, one of the data modems must be configured as the synchronizing unit.

# CHAPTER 3
# Installation and Setup

This chapter contains information on how to install, configure, and cable your VoiceXtender modem. The procedures and descriptions in this chapter assume you have read Chapter 2, “System Planning.”

**Inside this chapter:**

# System Setup

Ensure that each shipping container includes these items:

- One AirLink VoiceXtender modem
- One external power supply with cord
- Omnidirectional antenna
- RJ11 cables
- This document.

Depending on your specific application, you may need to purchase the following additional items from Cylink or your distributor to install the modem at your site.

- For hub applications, a coaxial cable (RG-58 is recommended) and BNC "Tee" connectors to connect the modems designated as synchronizing and synchronized units.
- A high-gain omnidirectional or directional antenna, and coaxial cable to connect the antenna to the modem

***NOTE*** Save the shipping cartons and packing materials. You will need the carton and materials if you ever need to ship the equipment elsewhere.

Check the materials against the packing list to make sure that you have received everything. If something is missing or if you discover shipping damage, contact your distributor.

# Switch Settings

The modem is configured through two configuration switches (each with a block of eight ON / OFF switches) located at the rear of the modem.

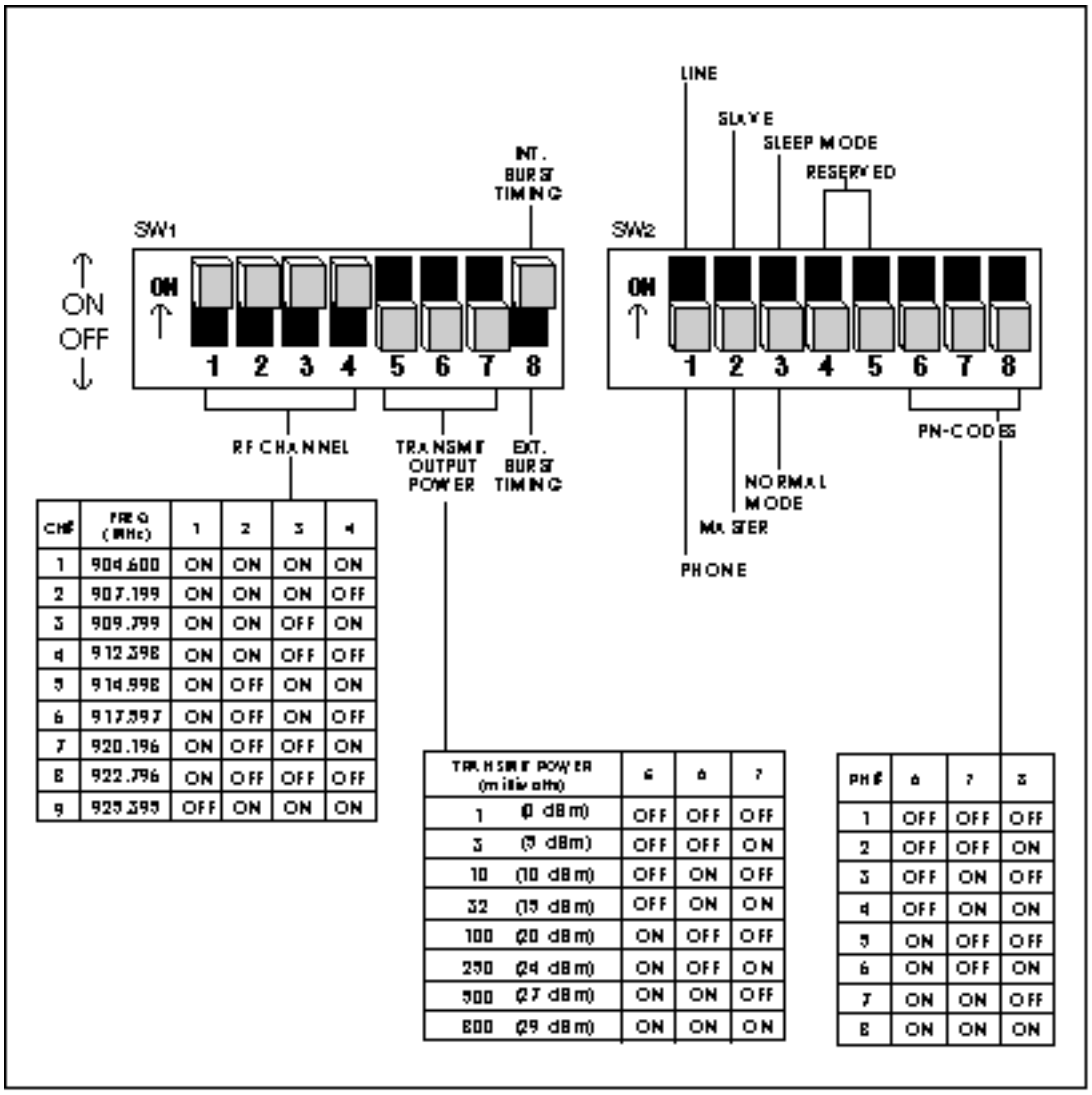
***NOTE*** A label showing the configuration switch settings is attached to the bottom of the modem. The label provides a quick reference of the switch settings. .

To set the switch to the "ON" position, push the switch up, toward the top cover of the modem. To set the switch to the "OFF" position, push the switch down, toward the bottom of the modem.

***NOTE*** Settings not specified on this chart are reserved for future use, and should not be used.

To assist you in setting the configuration switches, use the Switch Configuration Worksheets provided in Appendix B to record the appropriate settings for your application.

## VoiceXtender Switch Settings




| CH# | FREQ (MHz) | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| 1 | 904.600 | ON | ON | ON | ON |
| 2 | 907.199 | ON | ON | ON | OFF |
| 3 | 909.799 | ON | ON | OFF | ON |
| 4 | 912.398 | ON | ON | OFF | OFF |
| 5 | 914.998 | ON | OFF | ON | ON |
| 6 | 917.597 | ON | OFF | ON | OFF |
| 7 | 920.196 | ON | OFF | OFF | ON |
| 8 | 922.796 | ON | OFF | OFF | OFF |
| 9 | 925.395 | OFF | ON | ON | ON |

| TRANSMIT POWER (milliwatts) | | 6 | 6 | 7 |
|---|---|---|---|---|
| 1 | (0 dBm) | OFF | OFF | OFF |
| 3 | (5 dBm) | OFF | OFF | ON |
| 10 | (10 dBm) | OFF | ON | OFF |
| 32 | (15 dBm) | OFF | ON | ON |
| 100 | (20 dBm) | ON | OFF | OFF |
| 250 | (24 dBm) | ON | OFF | ON |
| 500 | (27 dBm) | ON | ON | OFF |
| 800 | (29 dBm) | ON | ON | ON |

| PN# | 6 | 7 | 8 |
|---|---|---|---|
| 1 | OFF | OFF | OFF |
| 2 | OFF | OFF | ON |
| 3 | OFF | ON | OFF |
| 4 | OFF | ON | ON |
| 5 | ON | OFF | OFF |
| 6 | ON | OFF | ON |
| 7 | ON | ON | OFF |
| 8 | ON | ON | ON |

P1T9T-0T9T

**Figure 3-1**
AirLink VoiceXtender VX64 Switch Settings

## VoiceXtender Switch Parameters

### RF Channel Switches (SW1-1 through SW1-4)

These switches set the center frequency of each RF channel used by the modem. The frequency ranges from 902 to 928 MHz and is divided into ten channels. The

center frequency assigned to each channel has been chosen to provide the greatest flexibility of use. The VoiceXtender VX64 modem requires a segment of bandwidth that is only one channel wide. Therefore, all nine channels are available for voice applications.

Each modem used in a "logical" application (e.g., the master and slave units of a single point-to-point link) must be configured with the same channel.

### Transmit Output Power Switches (SW1-5 through SW1-7)

These switches set the power level for the VX modem. The transmit level you select depends on local regulations and your application; however, the minimum required power normally is recommended for most applications. Depending upon the application, the setting selected as the transmit output power is also used to determine the system gain. For more information, refer to Path Analysis in Chapter 2, "System Planning."

### Burst Synchronization Timing Switch (SW1-8)

This switch sets the timing used to synchronize the communication between modems - either Internal Burst Timing or External Burst Timing.

When an modem pair operates independently (point-to-point application), the slave and master modems are configured for internal burst timing. (Slave units are always configured for internal burst timing.)

In a hub configuration where there is more than one modem pair, it is critical that all the modems transmit and receive at the same time to minimize inter-channel interference. In this case, the synchronizing modem is configured for internal burst timing and the synchronized modems are configured for external burst timing. The burst synchronization signal is derived from the transmit clock source of the synchronizing modem through the sync connection.

See the hub configuration is illustrated in Chapter 2, "System Planning."

***NOTE*** VoiceXtender modems can be burst synchronized with other VoiceXtender modems and with model 64MP, 128 and 256 AirLink data modems. If VoiceXtender modems are burst synchronized with AirLink data modems, one of the data modems must be configured as the synchronizing unit.

### Phone/Line Switch (SW2-1)

This switch sets the modem connection to the phone or the line. When the modem is set for Phone, it provides a standard ring current to ring the phone. (The current is sufficient to ring at least five phones.)

### Master/Slave Switch (SW2-2)

This switch sets the modem to be a master unit or slave unit. One modem in the pair must be the master and the other modem must be the slave. The master modem transmits continuous bursts while the slave transmits only in response to the master as long as the slave's RTS is activated.

### Sleep/Normal Mode Switch (SW2-3)

This switch sets the modem's communication status. When set to Normal mode, the modems can communicate and the green SYNC light will be illuminated. When set to Sleep mode, the green SYNC light is off and the modems cannot communicate until the switch is returned to the Normal (OFF) position.

### Pseudo-Random Noise Sequence Switches (SW2-6 through SW2-8)

These switches set the pseudo-random noise (PN) sequence (1 through 8) for the modem. This is the bit sequence that actually spreads the spectrum.

The modem pair (the master and slave) must be configured for the same PN sequence. Different PN sequences are used to reduce inter-channel and co-channel interference between modem pairs. All PN codes are equally effective.

# Cabling the Modem

How the modem is cabled depends on your application. Use the guidelines in the following subsections to assist you in cabling the modem.

Before cabling the modem, ensure that the configuration switches (described in the previous sub-section) are set correctly for each modem.

## Installing the Antenna

As shown in Figure 3-2, the antenna is connected to the rear of the modem through the antenna connector (labeled ANT).

***CAUTION*** When testing the radios prior to installation, do not connect the antenna connector of one radio to the antenna connector of another radio. Doing so can cause severe damage to the receiver.

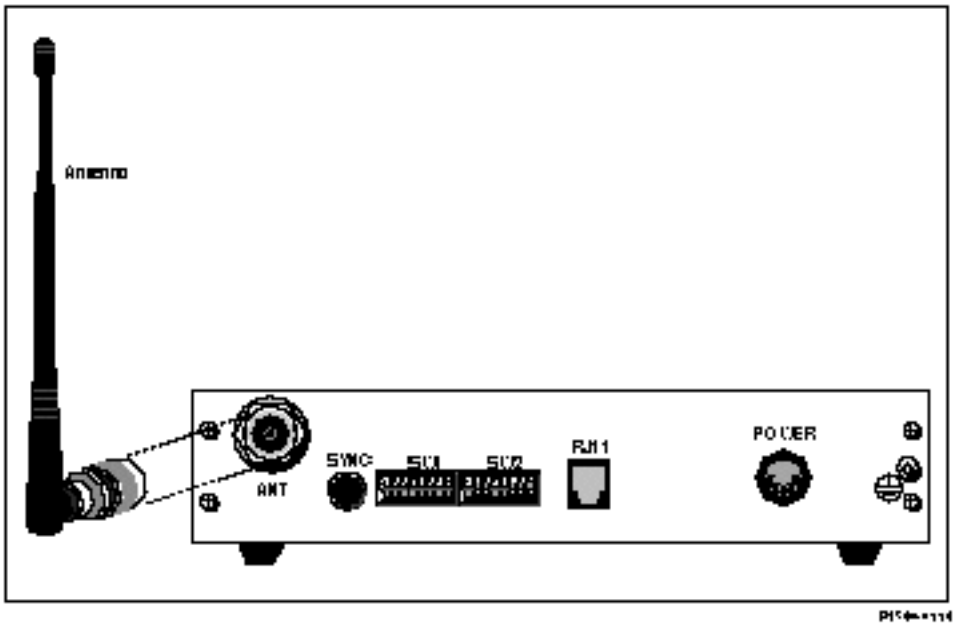



**Figure 3-2**
Connecting a Low-Gain Omnidirectional Antenna

When using a high-gain omnidirectional or directional antenna, a coaxial cable is used to connect the antenna to the modem. For more information on antenna installation, refer to "Antenna Alignment" in this chapter and the manufacturer's documentation that accompanies the antenna.

### System Grounding

Direct grounding of the antenna, mast, and tower provides some protection against lightning strikes and static buildup. A direct electrical connection should be made to a suitable grounding rod at the base of the tower or mast using at least #10 AWG ground wire, or its equivalent, and non-corrosive hardware. For details and safety standards, consult the appropriate electrical code or a similar document. Use lightning arrestors in appropriate places.

## Connecting the Line/Phone Interface

The RJ11-type modular connector (labeled RJ11 on the modem) is provided to connect your phone or the line from the network (Figure 3-3).

The slave modem typically is connected to the phone and the master modem is connected to the line because in a hub configuration the master modems must be centrally located for burst synchronization. It is possible, however, that several master modems connected to a combination of phones or lines can also be hub configured, as long as they are co-located.

The switch settings determine whether the connector is used for a phone or a line. Ensure that the switch settings correspond to the correct cabling for the line and phone.

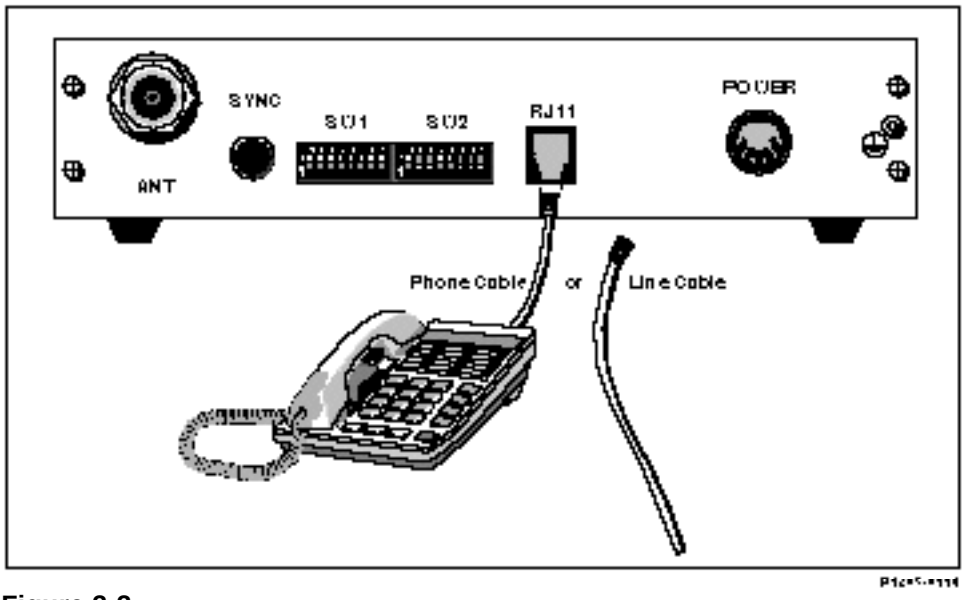



**Figure 3-3**
Connecting the Line and Phone Interface

For an intercom application (private line), connect only the phones to the master and slave modems. When you pick up one phone, the modem automatically rings the other phone (you will hear a clicking sound on your phone that indicates that the other end is ringing).

Signal assignments for the RJ11 can be found in Appendix A, "Specifications."

## Cabling a Hub Application

If you have a hub application where more than one pair of AirLink modems is required, you must cable the co-located modems together with a coaxial cable so that all the modems transmit and receive synchronously.

Cable the Burst Sync connector (labeled SYNC on the modem) of the synchronizing modem to the Burst Sync port of the synchronized master modem (see Figure 3-4). When connecting more than one synchronized master modem, attach BNC "Tee" adapters to the Burst Sync connector of all but the last of the downstream master modems. For most applications, up to 20 meters total of cable can be used between AirLink modems and up to 16 master modems can be connected.

***NOTE***

Ensure that all cable connections are secure.
VoiceXtender modems can be burst synchronized with other VoiceXtender modems and with model 64MP, 128 and 256 AirLink data modems. If VoiceXtender modems are burst synchronized with AirLink data modems, one of the data modems must be configured as the synchronizing unit.

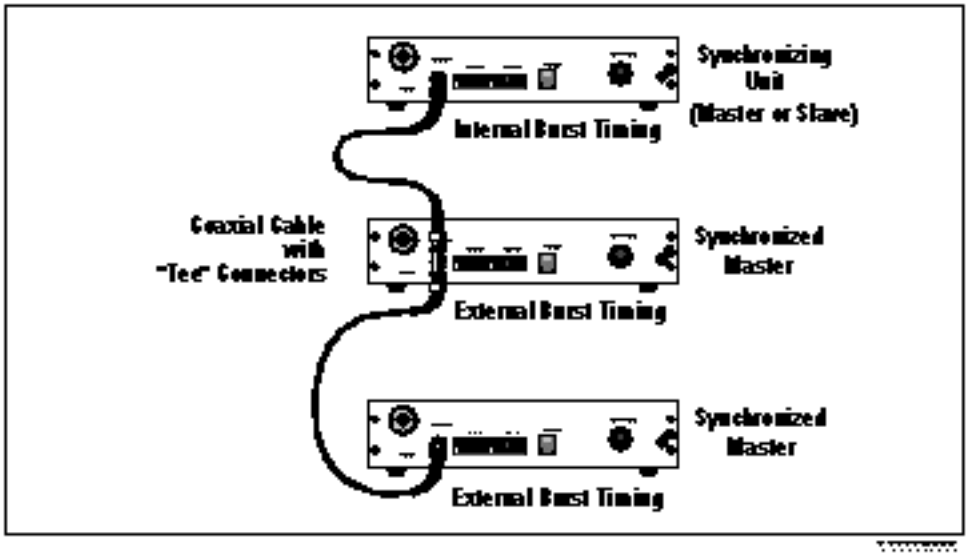



**Figure 3-4**
Burst Synchronization Cabling

***NOTE*** Burst synchronizing cable and tee connectors are available from Cylink and Cylink distributors. RG-58 coaxial cable is recommended.

## Connecting the Power

The VX uses an external power supply that is provided with the modem (Figure 3-5). To apply power to the modem, plug the five-pin DIN connector of the power supply cable into the modem (labeled POWER). Next, plug the AC power cord into the power supply, then into the grounded electrical outlet.

Connect the ground stud on the back of the modem to the radio system ground.

***WARNING*** To avoid the danger of electrical shock or power loss, ensure that the power cord is securely seated in the receptacle on the modem. This equipment is designed to work with electrically grounded systems. The product's AC power cord ends in a three-pole grounding plug. Do not use a three-pole to two-pole adapter with the plug.

Verify that the outlet you intend to use is properly installed and grounded; the outlet used must comply with the local electrical code for the country it is installed in. To ensure your safety, only connect the power cable to a properly grounded outlet.

Pin assignments for the DIN connector can be found in Appendix A, "Specifications."

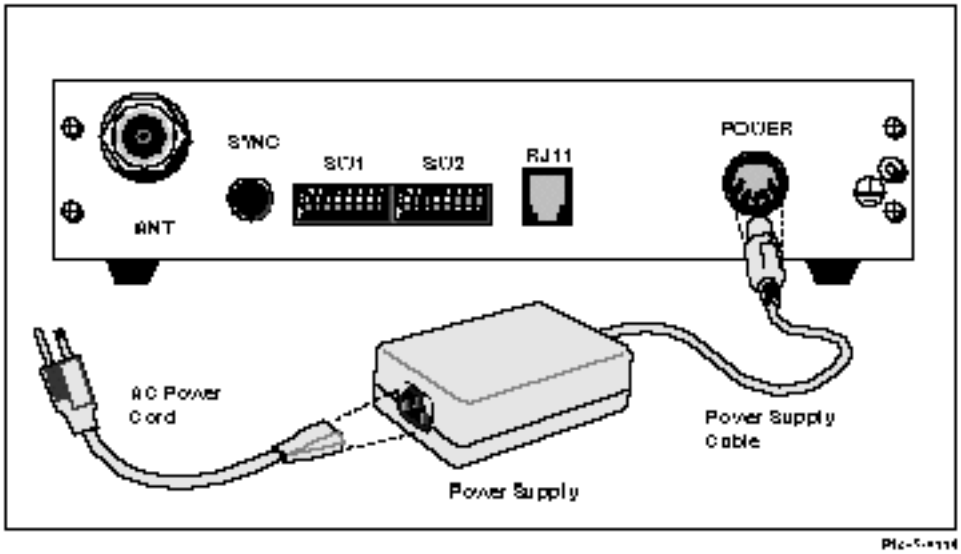



**Figure 3-5**
Connecting the Power

***NOTE*** DC power supplies are available from Cylink or Cylink distributors.

# System Startup

After configuring and cabling the modems (master and slave), the green POWER indicator on the front of the modem will be illuminated. If the POWER indicator is not on, ensure that the connection is secure.

If the modems are communicating, the SYNC indicator on the front of each modem will be illuminated. If the SYNC indicator is not illuminated, it is possible that the fade margin was not accurately determined or the antennas are not properly aligned. See the following section about properly aligning the antennas.

## Directional Antenna Alignment

To ensure that the modems are operating optimally when directional antennas are used, it is important that the antennas are aligned properly. Coarsely align the antenna to ensure that you are on the peak of the main lobe, then fine tune the alignment. In addition to physically adjusting the direction of the antenna, you might need to adjust the transmit power level, using the configuration switches on the unit.

To align the antenna, use the following two procedures and refer to the flow chart shown in Figure 3-6.

### Procedures to Coarsely Align the Antenna

The first step in the antenna alignment process is to coarsely align the antenna on each unit using the following steps:

1. **With the configuration switch located on the rear of the modem, set the Transmit Level to full power on both modems.**

   See the Switch Configuration section in this chapter for more details.

2. **Move each antenna until the SYNC indicator on the modem is illuminated.**

   When the SYNC indicator is illuminated, it indicates that the link is established; however, the antenna can be aligned on a side lobe rather than the main lobe.

### Procedures for Fine Tuning the Antenna Alignment

The second step in the antenna alignment process is to fine tune the antenna to ensure that the link is operating at the center of the main lobe. To fine tune the antenna alignment, systematically adjust the transmit power by using the following steps:

1. **Set the master modem Transmit Level to 1 milliwatt.**

   The link will go down, and the SYNC indicator will go out. The slave modem should still be at full power.

2. **Increment the Transmit Level on the master modem, then slowly rotate the antenna to attempt to illuminate the SYNC indicator on the slave. Continue to cycle through the Transmit Levels and rotate the antenna at each cycle until the SYNC indicator is illuminated.**

   When the SYNC indicator is illuminated, it indicates that the antenna is correctly aligned on the main lobe.

3. **Once the SYNC indicator is illuminated, note the Transmit Level, and repeat steps 1 and 2 on the other modem.**

4. **Once both antennas have been finely tuned, the effective fade margin can be calculated using the ratio of full power to the minimum power necessary to illuminate the SYNC indicator.**

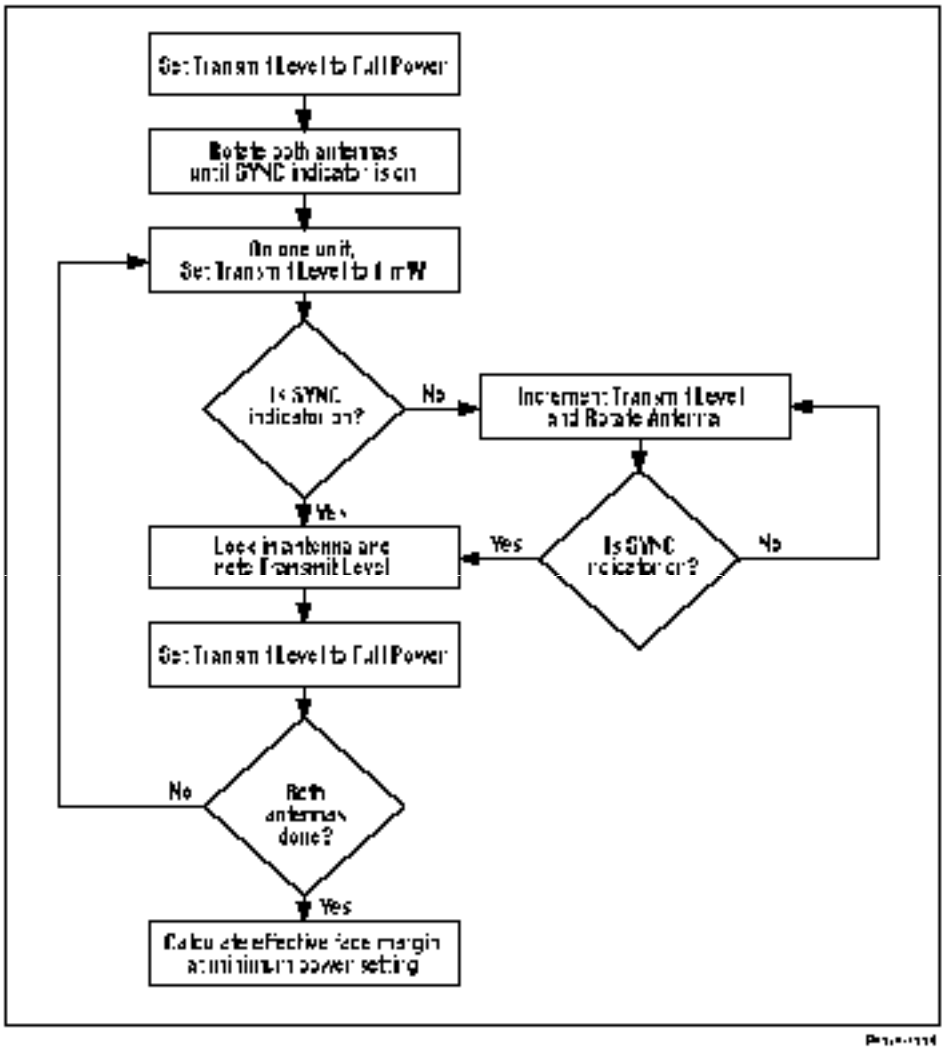



**Figure 3-6**
Antenna Alignment Flow Chart

## Adjusting the Audio Receive Level

The audio and listening volume of a telephone (or line) connected to the VoiceXtender modem can be adjusted using the Audio Receive Level control on the bottom of the AirLink modem (see Figure 3-7).

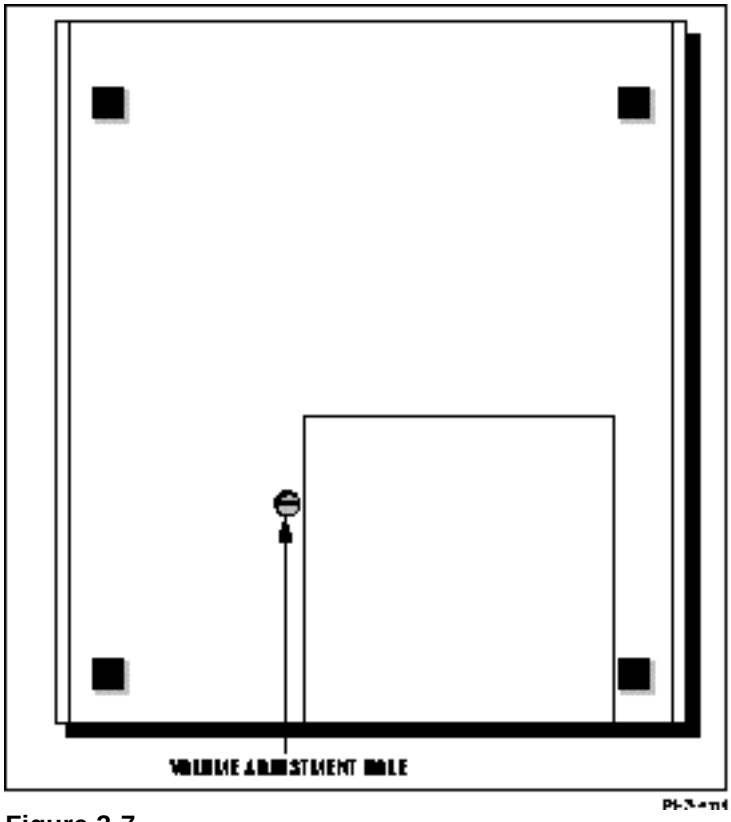


**Figure 3-7**
Volume Adjustment

Using a small blade-type screwdriver, turn the control clockwise to increase the level, or counter-clockwise to decrease it.

***NOTE*** This adjustment is completely independent of the RF system and does not affect the transmit power level.

# CHAPTER 4
# Troubleshooting

This chapter contains information on solving possible operational problems when using VoiceXtender modems.

**Inside this chapter:**

# Operational Problems

Following are some possible operational problems you might encounter when using the modem. If you encounter any of these problems, we recommend going through the following check list to resolve the problem before contacting Cylink Customer Support.

The primary tool used to troubleshoot the modem is the SYNC indicator on the front panel of the modem.

### SYNC INDICATOR is OFF, and was never ON before

- Is the POWER light ON? Verify correct input power.
- Are both modems set to the same channel?
- Are both units set to the same PN code?
- Is the burst timing switch in the correct position?
- Is the master/slave switch in the correct position?
- Check cable connections.
- Check antenna connection and alignment.

### SYNC INDICATOR is OFF, but was ON before

- Is the POWER light ON? Verify correct input power.
- Check switch settings. Have they been changed?
- Check the cable connections.
- Check antenna connection and alignment.

### SYNC INDICATOR is ON, but there is no voice transmission

- Check phone and line connections.
- Check that audio level control is not turned completely down.

### AUDIO VOLUME is too low.

- Adjust audio receive level on the bottom of the modem.

# Maintenance

When cleaning the unit, use a soft, moist, lint-free cloth. DO NOT USE abrasive or chemical cleaners. Cylink will perform any other necessary maintenance, including component replacements and internal adjustments.

# APPENDIX A
# Specifications

This appendix contains the specifications for VoiceXtender modems.

**Inside this appendix:**

# General Specifications

**Table A-1**
General Specifications

| **General** |
|---|
| Operates as a cordless phone or as an intercom. |
| 2-wire loop start signaling<br>Cordless phone: FXO (Interfacing phone), FXS (Interfacing line) (see Tables A-2 and A-3.)<br>Intercom: Both units set FXO (Interfacing phone) (see Table A-2.) |
| Operates with standard DTMF (EIA-470) phones |
| 600 Ohm termination impedance, tolerance ± 5% |
| End to End SINAD of 30-36 dB over the voice band (200-3400 Hz) |
| End to End Audio Loss/Gain: Adjustable to maximum of + 3 dB |
| Audio muting during link fades |
| DTMF Address Signaling (Dial Pulse optional) |
| Meets FCC Part 68 Compliance |

**Table A-2**
FXO Specifications

| **FXO (Interfacing Phone) Signaling** |
|---|
| Battery feed circuitry maintains loop current of 16 mA into maximum of 1.0 kilohm Loop resistance (this includes phone load). Maximum Feed Current 100 mA |
| Rings maximum of 5 REN-B Loads.<br>Ring signal is a filtered squarewave with nominal voltage 86Vp and nominal frequency 20 Hz. |
| Ring cadence of 2 sec ON and 4 sec OFF |
| Ring tripping in less than 200 msec |

**Table A-3**
FXS Specifications

| FXS (Interfacing Line) Signaling |
|---|
| Maximum Holding current of 100 mA without audio distortion |
| Detects ring signals of 40 - 110 Vrms @ 17-34 Hz |
| Ringer equivalence (REN): 0.3A (U.S.)<br>Load Number: 7 (Canada) |

**Table A-4**
Physical and Environmental Specifications

| Parameter | Specification |
|---|---|
| Dimensions | Height 2.125 inches (55 mm)<br>Width 8.5 inches (215 mm)<br>Depth 10.5 inches (265 mm) |
| Weight | 4 pounds (2 kg) |
| Construction | Aluminum outer housing and inner chassis |
| User Interface | Front Panel indicators<br>POWER: Power On/Off<br>SYNC: Radio Link OK/Down<br>Rear Panel<br>External Switches for configuration |
| Operating Temperature | -34° to 74° C |
| Storage Temperature | -40° to 80° C |
| Relative Humidity | Up to 95% non condensing |
| Shock and Vibration | NSTA Project 2A compliant |

**Table A-5**
Connector Specifications

| Parameter | Specification |
|---|---|
| Antenna Connector | N-Type (female) |
| Burst Synchronization Connector | BNC (female), used for Hub Synchronization |
| Phone/Line Connector | RJ11-type, 6-position modular jack |
| Power Connector | 5-pin DIN Connector (female) |

**Table A-6**
Power Specifications

| Parameter | Specification |
|---|---|
| External AC Power Supply: | |
| Input | 100-250 VAC @ 50/60 Hz, 0.3-0.7A |
| Power Cable | According to model ordered |
| Output | +5, ± 12 VDC, cable terminated with 5-pin male DIN Connector |
| Dimensions | Height 2.00 inches (50.8 mm)<br>Width 3.40 inches (86.4 mm)<br>Length 5.87 inches (149.1 mm) |
| Weight | 1.3 pounds (.6 kg) |
| Maximum Power Consumption: (power supply plus AirLink) | AC Power Supply - 23 Watts<br>DC Power Supply - 21 Watts |

**Table A-7**
User Interface Configuration Switches
(See Chapter 3, "Installation and Setup" for details.)

| Switch | Setting |
|---|---|
| SW1-1 through SW1-4 | Radio Frequency Channel |
| SW1-5 through SW1-7 | Transmit Output Power |
| SW1-8 | Internal Burst Timing or External Burst Timing |
| SW2-1 | Phone or Line |
| SW2-2 | Master Unit or Slave Unit |
| SW2-3 | Sleep Mode or Normal Mode |
| SW2-4 and SW2-5 | Not Used |
| SW2-6 through SW2-8 | PN Sequence |

**Table A-8**
General Radio Frequency Specifications

| Parameter | Specification |
|---|---|
| Frequency Range | 902 - 928 MHz |
| Radio Technology | Spread Spectrum using Direct Sequence |
| PN Sequence Length | 32 bits |
| Modulation Technique | Bi-Phase Shift Keying (BPSK), Non-Coherent Receiver |
| Channel Bandwidth | 5.1 MHz |
| Transmission Delay | 5.1 msec |
| Sync Word Length | 16 bits |
| Processing Gain | 12 dB |
| System Gain (not including antenna gain) | 127 dB |
| Transmission Distance | Up to ~10 miles with 2 Yagi directional antennas and a direct line-of-sight. |

**Table A-9**
Transmitter Specifications

| Parameter | Specification |
|---|---|
| Number of RF Channels (switch selectable) | 10 ( all non-overlapping) |
| Frequency Source | Synthesized |
| Bandwidth | 2.6 MHz |
| Carrier Frequency Stability | ± 10 ppm |
| Output Power (switch selectable) | 29 dBm (800 mW) maximum with 29 dB of dynamic range |
| Tolerance | ± 1dB over all RF channels<br>± 1 dB from 0 to 50° C |

**Table A-10**
RF Channel Frequencies - AirLink VoiceXtender VX64

| Channel Number | Frequency (MHz) |
|---|---|
| 1 | 904.600 |
| 2 | 907.199 |
| 3 | 909.799 |
| 4 | 912.398 |
| 5 | 914.998 |
| 6 | 917.597 |
| 7 | 920.196 |
| 8 | 922.796 |
| 9 | 925.395 |

**Table A-11**
Receiver Specifications

| Parameter | Specification |
|---|---|
| Acquisition Time | during preamble bits |
| Noise Figure | 5 dB maximum |
| Receive Sensitivity | -98 dBm (@ SINAD 30-36 dB over 200-3400 Hz) |
| Receive Overload Threshold | > -10 dBm |
| C/I (Carrier Over Interference) Tolerance | 0 dB* |

*This number is an average value for 9 uniformly spaced discrete frequencies in the band defined by: $f_c - f_{chip}$ to $f_c + f_{chip}$ where $f_{chip}$ is 2.56 Mbps.

***CAUTION*** When testing the radios prior to installation, do not connect the antenna connector of one radio to the antenna connector of another radio. Doing so can cause severe damage to the receiver.

# Interface Specifications

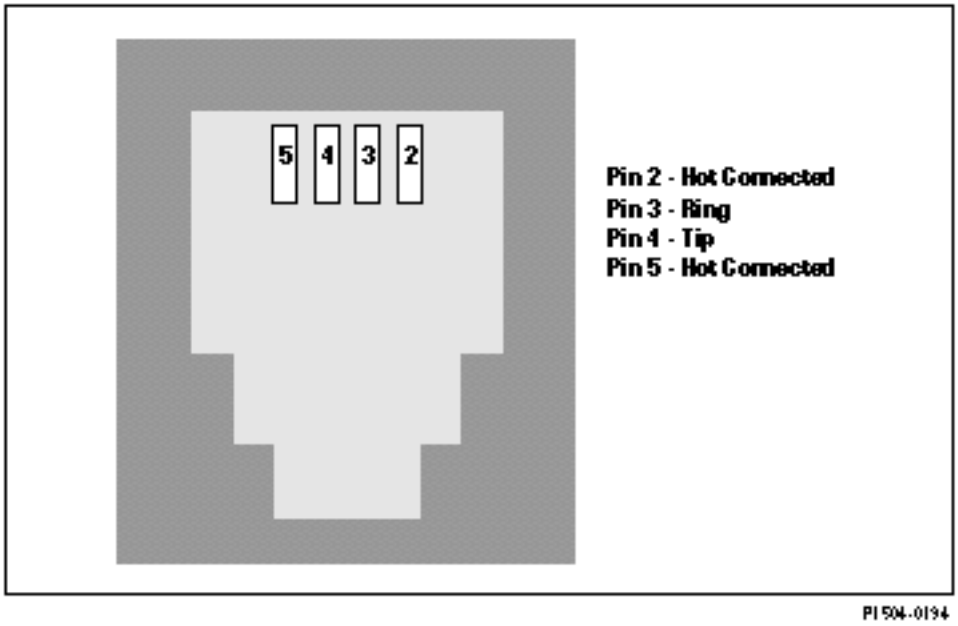



**Figure A-1**
Rear Panel RJ11-Type Modular Jack

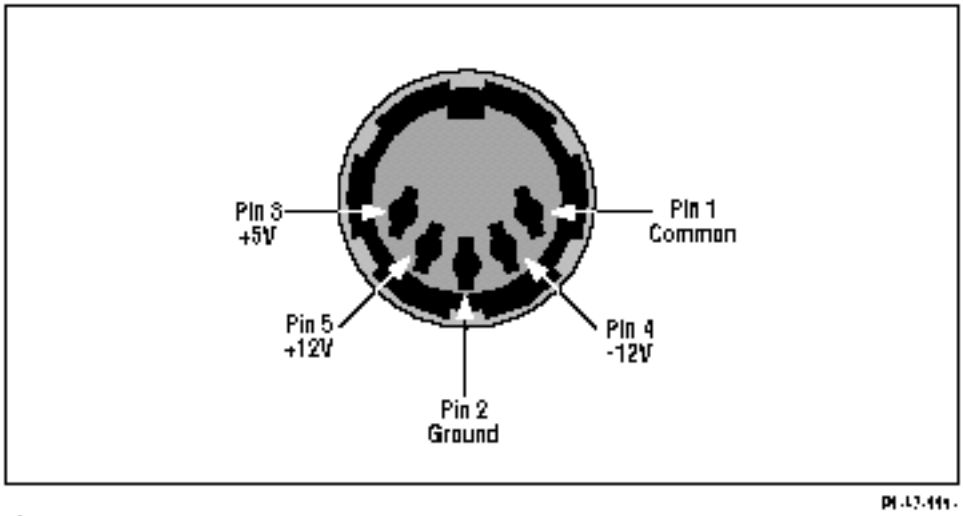



**Figure A-2**
Rear Panel Power Input Connector (Female DIN)

# APPENDIX B
# Worksheet

This appendix contains a Configuration Worksheet to use to record the configuration settings for your modems. Before installing and configuring the modem, read Chapter 2, “System Planning.”

**Inside this Appendix:**

## VX Switch Configuration Worksheet

| **ID/Name:** | | **Serial Number:** | | | | | |
|---|---|---|---|---|---|---|---|
| **Location:** | | **Antenna Type:** | | | | | |
| **SWITCH** | **PARAMETERS** | **VALUES** | | | | | **SETTING** |
| **SW1-1 through SW1-4** | **RF Channel** | (MHz) | **1** | **2** | **3** | **4** | |
| | | 1 (904.600) | ON | ON | ON | ON | |
| | | 2 (907.199) | ON | ON | ON | OFF | |
| | | 3 (909.799) | ON | ON | OFF | ON | |
| | | 4 (913.398) | ON | ON | OFF | OFF | |
| | | 5 (914.998) | ON | OFF | ON | ON | |
| | | 6 (917.597) | ON | OFF | ON | OFF | |
| | | 7 (920.196) | ON | OFF | OFF | ON | |
| | | 8 (922.796) | ON | OFF | OFF | OFF | |
| | | 9 (925.395) | OFF | ON | ON | ON | |
| **SW1-5 through SW1-7** | **Transmit Power** | (milliwatts) | | **5** | **6** | **7** | |
| | | 1 (0 dBm) | | OFF | OFF | OFF | |
| | | 3 (5 dBm) | | OFF | OFF | ON | |
| | | 10(10 dBm) | | OFF | ON | OFF | |
| | | 32(15 dBm) | | OFF | ON | ON | |
| | | 100(20 dBm) | | ON | OFF | OFF | |
| | | 250(24 dBm) | | ON | OFF | ON | |
| | | 500(27 dBm | | ON | ON | OFF | |
| | | 800(29 dBm) | | ON | ON | ON | |
| **SW1-8** | **Burst Synchronization Timing** | | | | | **8** | |
| | | Internal Burst Timing | | | ON | | |
| | | External Burst Timing | | | OFF | | |
| **SW2-1** | **Line/Phone** | | | | | **1** | |
| | | Line | | | | ON | |
| | | Phone | | | OFF | | |
| **SW2-2** | **Master/Slave Unit** | | | | | **2** | |
| | | Slave Unit | | | | ON | |
| | | Master Unit | | | | OFF | |
| **SW2-3** | **Normal/Sleep Mode** | | | | | **3** | |
| | | Sleep | | | ON | | |
| | | Normal | | | | OFF | |
| **SW2-4 and SW2-5** | **Reserved** | N/A | | | | | N/A |
| **SW2-6 and SW2-8** | **PN Sequence** | | | **6** | **7** | **8** | |
| | | 1 | | OFF | OFF | OFF | |
| | | 2 | | OFF | OFF | ON | |
| | | 3 | | OFF | ON | OFF | |
| | | 4 | | OFF | ON | ON | |
| | | 5 | | ON | OFF | OFF | |
| | | 6 | | ON | OFF | ON | |
| | | 7 | | ON | ON | OFF | |
| | | 8 | | ON | ON | ON | |

# APPENDIX C
# Glossary

This appendix contains an alphabetical list and description of technical terms used in this document.

| | |
|---|---|
| **Antenna** | A transmitting or receiving device for radiated waves. The antenna acts as a form of matching transformer for waves along a line and waves in space so that the maximum transfer of energy can be achieved. |
| **Antenna Gain** | Antenna gain is a measure of the efficiency of an antenna compared with the efficiency of a standard reference antenna. The efficiency is measured in terms of the power radiated or received in a given direction as compared with the standard under the same conditions. |
| **Asynchronous Data Transmission** | The transmission of data in which each character is a self-contained unit with its own start and stop bits and intervals between characters may be uneven. |
| **Bit Error Rate (BER)** | The measure of the frequency of errors in a digital transmission. |
| **Burst Timing** | A form of timing in which the receiving device is synchronized to the transmitting device by receiving bursts of data. |
| **Cable Loss** | The amount of signal attenuation (loss) for a particular type of cable of a given length. |
| **Channel** | A specified frequency slot within the specified frequency band used for transmission. |
| **DCE** | *Data Circuit Equipment*—a communications device that establishes, maintains, and terminates a session on a network. |
| **DTE** | *Data Terminating Equipment*—a communications device that is the source or destination of signals on a network. |
| **Fade Margin** | The measure of how much signal attenuation the system can endure without dropping below the minimum desired BER level. |
| **Free Space Path Loss** | The loss of power of a radiated signal as it travels through space. |
| **Full Duplex** | Transmission in two directions simultaneously. |
| **Half Duplex** | A circuit designed for data transmission in both directions, but not at the same time. |
| **Handshake Signal** | The series of signals between a computer and another peripheral device (for example, a modem) that establishes the parameters required for passing data. |

| | |
|---|---|
| **Hub Configuration** | A system configuration in which several master AirLinks and terminals are co-located. Usually, one acts as the synchronizing modem to the others at the site. |
| **Indicator** | A device that emits a visible light on the front of the AirLink modem. |
| **Line-of-Sight** | An unobstructed view from the transmit antenna to the receive antenna. |
| **Master Modem** | The master modem is the modem which controls the slave modem. The master modem always transmits the initial burst to which the slave modem must respond. The master modem is the only modem capable of initiating any activity on its own. |
| **Modem** | An acronym for MOdulator - DEModulator. A device used to convert digital signals into a form suitable for long distance transmission, and to reconvert received signals. |
| **Omnidirectional Antenna** | An antenna with a radiation pattern that is the same in all horizontal directions. |
| **Over Sampling** | The process of sampling a signal at a higher than the minimum acceptable rate to ensure greater accuracy. |
| **Overlapping Channels** | A situation in which the operating channel frequency bandwidth of one transmitting device shares part of the frequency bandwidth of another transmitting device. |
| **Path Loss** | The total amount of radio signal attenuation (loss) between the transmitting antenna and the receiving antenna; the sum of attenuation caused by obstacles located in the path and the free space path loss. |
| **Point-to-Point Configuration** | A system configuration in which only one master modem communicates with its one slave modem between the two sites. |
| **Point-to-Multipoint Configuration** | A system configuration in which one master modem communicates with one or more slave modem. |
| **Pseudo-Random Noise Sequence** | An operation in which a random stream of data bits is generated within limited parameters. The stream (sequence) is typically used for encoding data for communication. |
| **Receiver Sensitivity** | The measure of the ability of a receiver to differentiate between the selected signal and background noise for a specific performance. |

| | |
|---|---|
| **REN** | *Ringer Equivalent Number*. Older model phones typically have a REN=1. Some electronic phones and other devices have a lower REN. |
| **RF** | *Radio Frequency*. Electromagnetic waves propagated without guide (wire or cable) in free space. |
| **Send Timing** | A timing mode where the transmit timing is provided internally by the modem. |
| **Simplex** | Operating a channel in one direction only with no ability to operate in the other direction. |
| **Slave Modem** | The slave modem is the modem which is under control of the master modem. The slave modem always transmits a burst in reaction to a received burst from the master modem. The slave modem is incapable of initiating any activity of its own. |
| **Synchronous Data Transmission** | The transmission of data in which both stations are synchronized. Timing codes are sent from the transmitting station to the receiving station to establish the synchronization. The data is then transmitted in continuous streams. |
| **System Gain** | The overall signal gain from input to output of a device or several devices connected as a system. |
| **Terminal Timing** | A timing mode where the transmit timing is provided to the modem via an externally wired path. Generally, this path is a loop through the DTE. |
| **Transmitter Output Power** | The amount of transmitted signal strength measured at the antenna post of the modem. |

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