Wireless to the MAX

PacketMax 100/300

Regulatory Information

CE Notice

Declaration of Conformity

Aperto Networks Inc. of 598 Gibraltar Drive, Milpitas CA 95037, USA, declare under our sole responsibility that the product PacketMax 3.5 GHz system (3.4-3.7 GHz operation) to which this declaration relates, is in conformity with the following standards and/or other normative documents.

- EN 301 753
- EN301 489-4
- EN60950

We hereby declare that all essential radio test suites have been carried out and that the above named product is in conformity to all the essential requirements of Directive 1999/5/EC.

The conformity assessment procedure referred to in Article 10 and detailed in Annex [III] or [IV] of Directive 1999/5/EC has been followed with the involvement of the following Notified Body: Compliance Certification Services, 561F Monterey Road, Morgan Hill, CA 95037

$C\epsilon\,0984$ Ⓘ

UL Information

CAUTION: For the CATV system, the CATV installer should install in accordance with Article 820-40 of the NEC which provides guidelines for proper grounding and, in particular, specifies that the cable ground shall be connected to the grounding system of the building, as close as possible to the point of cable entry as practical.

CAUTION: The external exposed (outdoor) run of the cables, from the exit of the building to the antenna/radio assembly, should be less than 140ft, while the total cable run is as described in this manual.

CAUTION: For Model 100/300, the Power Over Ethernet box is intended to be installed indoor only and the Radio/Antenna is intended to be installed outdoors.

Waste Electrical and Electronic Equipment (WEEE) Directive Compliance

Aperto Network products sold within the European Union (EU) are subject to the requirements of the Waste Electrical and Electronic Equipment (WEEE) Directive; as implemented by national legislation in each EU country.   The objective of the Directive is to reduce the environmental impacts of WEEE by promoting re-use and recycling, as an alternative to disposal.

From 13 August 2005, product placed on the EU market is required to be marked with the symbol shown below.   This symbol indicates that end-of-life electronic equipment generated within the EU should not be mixed with other types of waste or placed in the general waste stream; but should be segregated for the purpose of re-use or recycling.
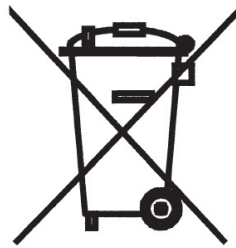
CERTIFICATION CERTIFICATE

COMPANY NAME	**Aperto**
CERTIFICATION DATE	**July 6, 2006**

Air 1

PRODUCT NAME	PacketMAX
PRODUCT MODEL	PM100 and PM300
DEVICE TYPE	Subscriber Station
CERTIFICATION NUMBER	01-0000000023
CERTIFICATION WAVE RELEASE	1.0
PROFILE	3.5GHz 3.5MHz TDD
HARDWARE VERSION	DVT 03
SOFTWARE VERSION	1.0
TESTED BY	CETECOM Laboratories, Malaga, Spain

Ron Resnick, President
WiMAX Forum

Ed Agis, Chair
Certification Working Group
WiMAX Forum

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Appendix F. Troubleshooting

Appendix G. LIMITED EQUIPMENT WARRANTY ("Agreement")

Preface

This manual is part of the documentation for the PacketMax broadband wireless system for delivering high-speed subscriber services.

Scope of This Manual

This manual documents the installation and operation of the PacketMax 100/300 Series subscriber equipment with software version 2.3.

This manual provides the following information:

- **Chapter 1 Overview of Subscriber Station**: Provides an overview of the Aperto Subscriber Station, its components, and functions.

- **Chapter 2 Installation of Subscriber Station**: Provides step-by-step procedure for installing the Aperto Subscriber Station.

- **Chapter 3 Aperto Installation Manager**: Walks you through the steps of installing and using Aperto Installation Manager (AIM) tool.

- **Appendixes**: Provide additional information on System Specifications, Events and Alarms, Cables, Spares, and Accessories, Command Line Interface, VLAN, and Troubleshooting tips.

Conventions Used in This Manual

PacketMax manuals represent special kinds of text as follows:

- Files names and URLs are represented in italics, with variables described inside angle brackets. For example, if the URL *http://<IP address>/BS.htm* is referenced, you will replace the variable *<IP address>* with the appropriate real IP address.

- Management interface text is represented in a bold font: for example, the **Generate Config File** button.

- Labels on equipment are represented in a bold font: for example, the **Control connector.**

WARNING: This format is used to indicate the possibility of personal injury or damage to equipment.

CAUTION: This format is used to indicate the possibility of system or equipment operation problems.

NOTE: Items of special importance will be marked by a pointing-hand icon, as this paragraph is.

For conceptual discussions, PacketMax 100/300 is used interchangebly with SS or Subscriber Stations in many places of this user manual. Similarly, PacketMax 5000 and PM 3000 is used interchangebly with BS or Base Station in may places of this user manual.

Further, Subscriber Station and Subscriber Equipment have been used interchangeably.

Intended Audience for this Manual

This manual is intended primarily for subscriber equipment installers. It also presents information of use to subscribers, including a discussion of tools used for configuration.

Installation of radio equipment involves numerous factors requiring considerable expertise. It is assumed that equipment installers are professionals with a full understanding of the principles, standard practices and procedures of cell site installation, with all relevant safety requirements, and with applicable local building codes.

General Cautions and Warnings

Observe the following when installing or operating any PacketMax System components.

Carefully follow all local building and electrical codes, especially the latest revision of the National Electrical Code (NEC) and standard safety procedures for installing and working with this type of equipment. Improper procedures or installation can result in damage to the equipment or the building, and injury or death. If you

are not sure about whether the installation follows these codes, contact a licensed building inspector or electrician in the area for assistance.

Always use quality components—including cables, connectors, mounts, etc.—specifically rated for your particular environmental conditions and system performance requirements.

Always use appropriate tools, and follow the instructions of the tool manufacturers.

All outdoor installation, including equipment mounting and cabling, should be performed by trained microwave radio technicians familiar with usual and customary practices and procedures.

Take extreme care to avoid contacting any overhead power lines, lights, and power circuits while you are installing the Outdoor Unit. Contact with any of these objects could cause injury or death. Do not install the Outdoor Unit near power lines.

Make sure that the outdoor radio/antenna is grounded in accordance with local, state, federal, and National Electrical Code (NEC) requirements. Pay special attention to NEC sections 810 and 820. See the instructions in Chapter 4 of this manual.

For the PacketMax 100 Series Indoor Unit, use an outlet that contains surge protection and ground fault protection, or use a surge protection device. This will protect the Indoor Unit and equipment connected to it from damage resulting from AC current surges, lightning, etc. For complete protection, all connections to the Indoor Unit (i.e., from radio/antenna and PC/hub) should be connected to a surge protection device. To ensure the best signal, use surge protectors designed for the specific application.

RF Exposure Guidelines

In order to comply with FCC and Industry Canada requirements for maximum RF exposure levels to persons, the antenna must be mounted in such a way that during operation, a minimum separation distance of 21 cm is maintained between the antenna and all persons.

Prohibition against Unauthorized Modifications

The user is cautioned that changes or modifications not expressly approved by Aperto Networks could void the user's authority to operate the equipment.

Units sold in the United States can only be used in the FCC specified band of 5.725 to 5.850 GHz.

Because Aperto Networks cannot be responsible for improper installation or use of its equipment, failure to follow these and other published cautions and warnings may void your equipment warranty.

List of References

WaveCenter EMS Pro User Manual

PacketMax 5000 Installation and Operation User Manual

PacketMax 3000 Installation and Operation User Manual

1

Overview Of Subscriber Station

As part of Aperto Networks' PacketMax Broadband Multiservice Wireless Access System, the PacketMax 100/300 Series Subscriber Station delivers high-speed, always-on Internet access to small and medium-sized businesses, small offices/home offices (SOHO), and residences. The PacketMax System can be deployed in the standard frequency bands, licensed or unlicensed, for wireless broadband networking. The PacketMax products operate in 3.3/3.5/5.8 GHz Fixed Wireless Access (FWA) currently.

This Chapter covers the following topics:

- ♦ PM 100/300 Package Contents
- ♦ Subscriber Station
- ♦ VLAN Mode
- ♦ Management, Configuration and Diagnostic Functions

1.1 PM 100/300 Package Contents

❖ PM 100 or PM 300 Radio (ODU) with either an integrated antenna or Type-N connector

❖ Power-over-Ethernet Injector (IDU) and User Guide

❖ Pole Mount Bracket Kit 1.0 to 3.0 inches (2.54 to 7.62 cm)

❖ Weatherproof Connector

❖ Cat5 indoor Ethernet Cable (5 ft/150 cm)

❖ AC Power Cord

❖ Quick Installation Guide and Warranty Card

1.2 Subscriber Station

PacketMax 100/300 Series subscriber stations consists of an Outdoor Unit (radio/antenna), and a Power over Ethernet (PoE).
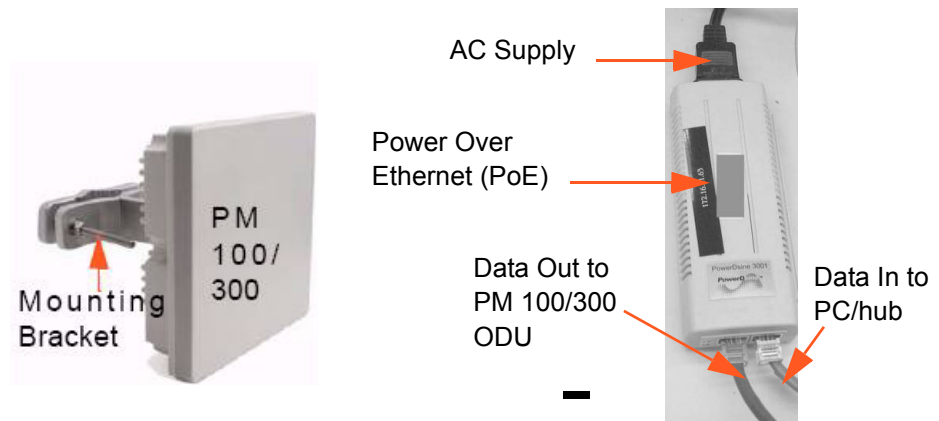
Figure 1-1   PacketMax Subscriber Equipment

1.2.1 PacketMax 100/300 Outdoor Unit (ODU)

The outdoor unit integrats all communication, networking, RF and antenna functions. The ODU has a maximum average power output of 20 dBm at 64QAM modulation and it supports variable channel widths 3.0, 3.5, 5.0, 5.5 and 7.0 MHz. The bandwidth Management is handled by service flows such as CBR, CIR and BE.

The internal antenna has the following specifications:

❖ 15 dBi gain

❖ Vertical Polarization

PacketMax 100/300 ODU connects to the user's Local Area Network and power source (Power Over Ethernet block) through a single CAT 5e cable (RJ-45 connector). This cable carries data as well as power to the ODU.

NOTE: *You must use Aperto's UV-protected CAT 5e cable with a rubber boot to ensure compliance to the weather-proof IP-67 Standard.*

1.2.2 PacketMax Indoor Unit - PoE (IDU)

The PacketMax 100/300 IDU is a PoE consisting of AC-DC convertor. Being a small, free-standing unit, it can be placed anywhere within the subscriber's premises. The Indoor Unit has two interfaces, one connecting to the Outdoor Unit and the other connecting to subscriber's LAN.

The IDU must meet the following basic requirements:

- ❖ The unit must have access to AC power.
- ❖ The cable connecting the IDU to the Outdoor Unit can be up to 100 m (330 ft).
- ❖ The PoE must be upright, with adequate air flow around it.

The IDU (Power Over Ethernet) features consists the following:

- ❖ Power cord that plugs into a standard AC wall plug (**110-240 VAC**).
- ❖ **10/100Base-T** Ethernet port used to carry signal and power to ODU.
- ❖ **Auto-sensing 10/100 Base-T Ethernet port** for customer network equipment.

The Indoor Unit is a bridge which, together with the Outdoor Unit, connects the subscriber's computer(s) to the wireless service.

NOTE: *For management purposes, all Indoor Units—including those operating in bridge mode—require an IP address.*

The IDU provides a visual indication of the power status, which will show:

- ❖ **Solid Green** when the device is On.
- ❖ **Blinking Green** overload or short circuit.
- ❖ No display when the Power supply is off or there is no load present**.**

1.2.2.1 Automatic Frequency Selection

The PacketMax 100/300 Series supports Automatic Frequency Selection (AFS), which helps to ensure optimal performance in less-than-optimal conditions. A total of up to 20 frequencies within the unit's frequency band can be selected. With AFS, when interference degrades performance on the primary frequency, the BS will automatically shift the link to a frequency providing satisfactory performance using QPSK.

The AFS parameters (candidate channels, reselection thresholds and time-outs) can be configured from the WaveMax Element Management System (EMS). AFS is available for all frequency bands, licensed or unlicensed.

1.3 VLAN Mode

The way SS operates in VLAN mode has been discussed in Virtual Local Area Network. Please refer to Virtual Local Area Network, for information on SS in VLAN Mode and different user scenario examples.

1.4 Management, Configuration and Diagnostic Functions

The PacketMax 100/300 includes a number of features which provide management, configuration, and diagnostic functions. They range from front-panel LEDs to an user interface (through CLI), and include:

❖ LEDs — LED indicators on the front of the Indoor Unit show status of the LAN and wireless interfaces as well as power to the unit.

❖ Aperto Installation Manager — This utility initializes newly-installed subscriber equipment and allows antenna alignment for optimal wireless communication. Use of the Aperto Installation Manager (AIM) is described in Chapter 5.

❖ SNMP Agent — Each PacketMax 100/300 includes an SNMP agent which can be accessed via a standard SNMP manager, either directly or through the Base Station Unit's proxy agent.

❖ Command Line Interface — For basic diagnostics, a limited command line interface (CLI) to the PacketMax 100/300 can be accessed via telnet.

1.4.1 Upgrades

There are two types of upgrades that can be done using the EMS, and they are:

❖ Bulk Upgrade : The bulk upgrade feature of EMS allows the users to upgrade the BS/SS efficiently.

❖ LAN Upgrade: When there is network connectivity to the BS, users can upgrade the SS using the LAN upgrade tool in EMS. This implies that LAN Upgrade can be used typically in a laboratory environment.

1.4.2 SS Configuration

SS configuration can be done in server mode or in local mode:

❖ In local mode, the SS's configuration is performed using the Aperto Installation Manager (AIM).

❖ In server mode, subscriber equipment is provisioned using the WaveCenter Configuration Manager, as described in the *Element Management System Installation, Configuration, and Operation* manual. On boot-up, after getting address and file information from its assigned DHCP server, the Packetmax 100/300 downloads its configuration file from the base station's TFTP server.

Configuration of the Packetmax 100/300 can be performed via the EMS or CLIs.

1.4.3 MIB

Each PacketMax 100/300 includes a SNMP agent supporting the following MIBs:

- ❖ MIB II (RFC 1213)
- ❖ Aperto private MIB
- ❖ Wimax-IF-MIB (objects for 802.16 based SS and BS)

The complete MIBs are provided on the PacketMax CD-ROM.

SNMP can be used to read configuration, status, and performance data from Sub-scriber Units. In addition, SNMP can be used to change some configuration parame-ters (those which can be changed via the Configuration Manager in EMS), and to upload the configuration changes to the TFTP server (if the TFTP server is configured to accept uploads).

The SNMP agents support trap reporting. Trap-reporting parameters can be specified via the Configuration Manager as well as via SNMP.

1.4.4 Event Reporting

PacketMax 100/300 Series Subscriber Units offer several means of reporting sub-scriber equipment events:

- ❖ E-mail messages — The Subscriber Unit can be configured (via the Element Management System, or SNMP) to report events via e-mail to specified addresses.
- ❖ SNMP traps — The Indoor Unit's SNMP agent supports trap reporting. Trap-reporting parameters can be specified via the EMS ((WaveCenter Configuration Manager), or SNMP.
- ❖ Syslog — The Indoor Unit supports logging of event messages to a designated server according to the Syslog protocol. If Syslog is employed, the Syslog server must be identified in the Subscriber Unit configuration file created using the WaveCenter Configuration Manager.

☞ NOTE: *Use of Syslog is strongly recommended as a means of providing a record of system events for performance management and troubleshooting.*

- ❖ Event log — A historical event log can be displayed on request via the Faults section in EMS.

1.4.5 3 DES Encryption

Security is a required feature in the current network, to ensure that the Base Station and Subscriber Station communicate with each other. An encryption scheme is used to secure the BS and SS communication channel by encrypting the data between the two.

The Encryption procedure is as follows:

1. At first, the SS initiates the authorization process and sends message to the BS indicating that it is capable of encryption.

2. The BS authorizes the SS by verifying the device and Vendor Certificate of the SS during the Privacy Key Management (PKM) Message Exchange.

3. An Authorization Key (AK) is used to decrypt the Traffic Encryption Keys (TEKs) using PKM protocol. The AK is periodically refreshed and is encrypted using 3DES.

4. In the BS, the TEKs are generated and send to SS using the 3DES encryption format. The SS decrypts these TEKs using a Key Encryption Key (KEK) generated from the AK. If the BS encrypts the TEK using the RSA Public Key of SS, then the SS decrypts it using its Private Key.

5. The TEKs are used for encrypting data on different Service Flows (SF) between the BS and SS.

6. All the Service Flows for one SS will have the same key in both upstream and downstream.

NOTE: To enable encryption on every service flow, please refer to the WaveCenter EMS User Manual.

7. The traffic between the BS and SS can now be encrypted/decrypted using the TEK keys.

8. If the CPE fails authentication, the CPE can re-try authentication.
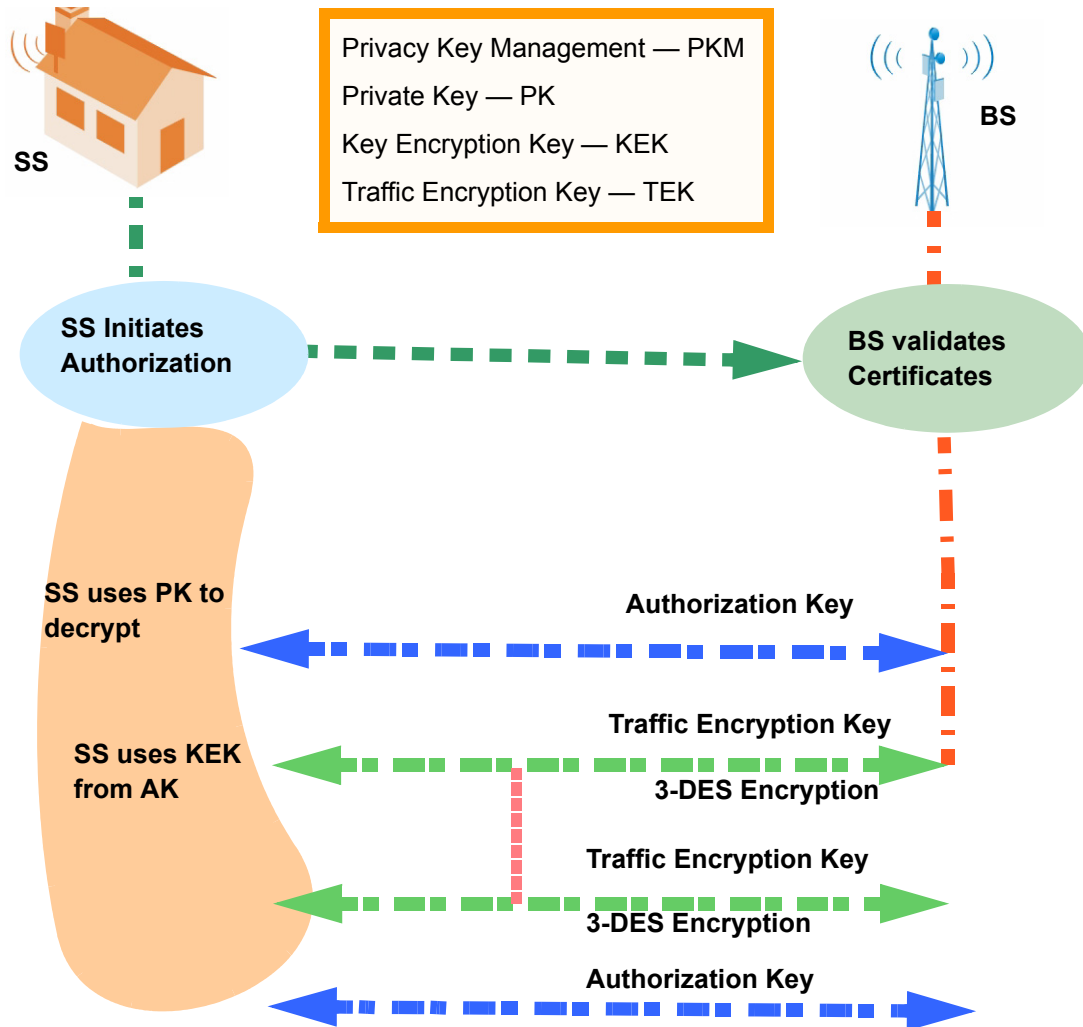
Figure 1-2   3-DES Encryption

NOTE: TEK is encrypted using KEK derived from Authorization key and 3DES Algorithm, while data is encrypted using TEK and DES Algorithm.

1.4.6 Certificates and Management

WiMax forum prescribes X.509 based digital-certificate for authorization process. which is part of the negotiation process as described in the above section. The certificates are used to strengthen the security process.

The Aperto WiMax Root Certificate, is a Self-Signed certificate issued by the Aperto Certifying Authority (CA). The CA is stored in the BS. The X.509 certificates are injected into the base station devices at manufacturing time and can later be upgraded from the EMS.

The Root Certificate is the same across all Base Stations and shall be available on MSC, as the Certificate Verification happens on MSC. In the case, when primary and redundant MSCs are installed, the Certificates need to be available on both the MSC

Cards (Primary and Redundant). Currently we are upgrading the Primary MSC with the Wimax Root Certificate during the Upgrade Process.

1.4.6.1 Certificate Upgrades

Some important factors that users should take a note of, for certificate upgrades are:

❖ In a redundant BS configuration, the certificates need to be installed using the LAN upgrade tool.

❖ Once the user has a device which is certified, the LAN upgrade and Bulk Upgrade tool has to be used to upgrade the certificates.

2

Installation of Subscriber Station

This chapter outlines the basic procedure for installing the PacketMax 100/300 Series Subscriber Station. It identifies the minimal requirements for getting the equipment up and running.

> NOTE: *It is assumed that configuration using DHCP and WaveCenter™ Configuration Manager has been performed as described in the Configuring an SS section in Chapter 4 Configuration of PacketMAX Devices of the Wave-Center* Element Management System (EMS) User M*anual.*

⚠ WARNING: Outdoor installation procedures should be performed by qualified professionals following all safety and other requirements and acting in accordance with standard practices and procedures. Failure to meet safety requirements and/or non-standard practices and procedures could result in personal injury and/or damage to equipment.

This chapter covers the following topics:

♦ Installation Requirements

♦ Installation Process

2.1 Installation Requirements

2.1.1 Hardware and Software Requirements

❖ Aperto Installation Manager (AIM). AIM is a software utility that helps to config-
ure PacketMAX 100/300 devices, optimize antenna alignment, perform ping
tests, and pre-provision PacketMAX 100/300 devices for later deployment.

❖ Laptop/desktop that has Aperto Installation Manager installed.

2.1.2 Cables and Connector Requirements

You will also need the following cables and connectors:

❖ Shielded Cat 5 cable (outdoor rated), long enough to run between Indoor and
Outdoor Units, and two shielded RJ45 male connectors

❖ Ethernet cable with RJ45 male connectors (straight-through for connection to
hub, or crossover for connection to computer)

Table 2-1   Subscriber Site Cable Requirements

Connection	Qty	Cable Type	Max. Length	Connectors
Radio Con-trol	1	Shielded Cat 5, Outdoor-rated	50 m (100 ft)	RJ45 male
	1	Shielded Cat 5E, Outdoor-rated	100 m (330 ft)	RJ45 male

Please refer to the Cable Specs for further details under section C.1.2, in Appendix C.

2.1.3 Tools requirements

You will need the following tools and supplies when installing the Subscriber Equipment:

❖ Drill (for cable entry through walls, etc.)

❖ Phillips screwdriver

❖ Cabling tools

❖ Cable tester (capable of testing 10Base-T and EIA/TIA 568B)

❖ Cable ties, staples, or clamps for dressing cables

❖ Silicone sealant

2.1.4 Before Installation

1. Make sure that the PM 100/300 is pre-configured using the Element Management System (EMS) software application and then provision and configure the unit. Generate the Subscriber Unit configuration file using Configuration Manager in Element Management System (EMS) [Please refer to WaveCenter EMS User Manual for reference]. This configuration file should be either saved on the BS's TFTP server, or (for local configuration mode) is already saved on a disk and provided to the installer.

2. Make sure that the EMS software application is able to communicate with the PM5000 or PM3000.

3. Make sure that the Aperto Installation Manager (AIM) software application is installed on the computer (notebook) that will be used to configure and align the PM100/300.

CAUTION: Make sure that the Indoor Unit is installed in a room with temperature between 32 and 104 °F (0 and 40 °C) and the humidity between 10% and 90% noncondensing.

4. Identify location for mounting the PM 100 ODU: In most cases, the unit should be pointed at the base station with the least possible obstruction. For optimal wireless channel performance, it is advantageous to locate the Outdoor Unit (radio/antenna) where it has the least-obstructed path to the base station antenna. If a line-of-site path is available, locate the Outdoor Unit where the path is least likely to be affected by such obstructions as blowing branches, seasonally changing foliage, etc. If a clear line-of-site path is not available, choose a path that minimizes obstructions.

Other factors to consider when choosing a location for the Outdoor Unit include:

❖ Distance to the Indoor Unit — Locate the Outdoor Unit so that cables to the Indoor Unit will be within the maximum cable length limit. See Appendix E for cable details.

❖ Cable routing — Consider how cables from the Outdoor Unit cables will enter the building.

❖ Accessibility — If possible, choose a location that is relatively accessible, which will simplify installation and any adjustment or repair that might be necessary in the future.

5. Mounting method — The antenna/receiver includes an adjustable bracket for mounting the unit on a pole that is 1.5 inches (3.8 cm) or 2 inches (5.1 cm) in diameter. For other mounting options (under an eave or on a chimney, for example), mounting hardware may be adapted as desired. Any alternate mounting method should allow adequate adjusting of the antenna direction, both horizontally and vertically.

2.1.4.1 Safety Requirements

❖ Outdoor installation procedures should be performed by qualified professionals following all safety and other requirements and acting in accordance with standard practices and procedures. Performance of non-standard practices and procedures or failure to meet safety requirements could result in personal injury and/or damage to equipment.

❖ Lightning protection is recommended for subscriber equipment. Provide a service loop for the cable. Instructions are covered in the 1-Port Power over Ethernet Midspan User Guide.

❖ Lightning damage is not covered by the product warranty.

WARNING: Always power OFF the PM 100/300 IDU before connecting or disconnecting the PM 100/300 ODU.

2.2 Installation Process

Step 1. Assemble and mount the Outdoor Unit.

The Outdoor Unit (ODU) includes a rear-mounted bracket. This standard mounting bracket allows the ODU to be mounted on a pole with a diameter of 1.5 or 2 inches (3.8 or 5.1 cm).
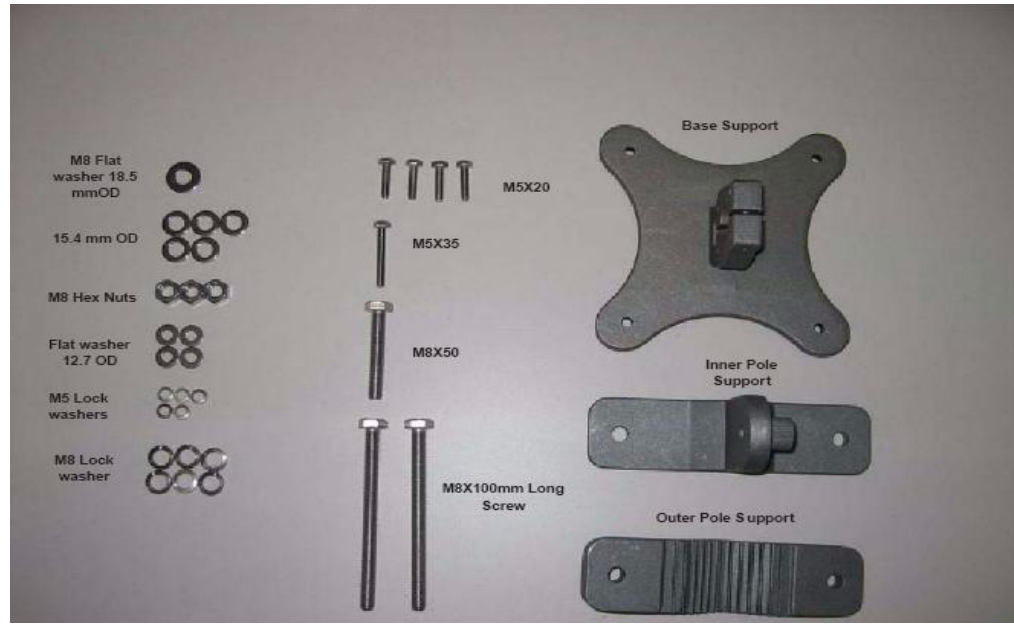
Figure 2-1   Mounting Hardware Parts
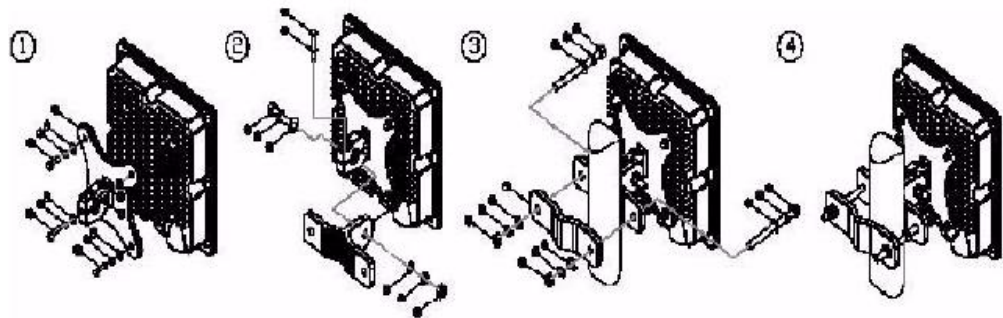
Figure 2-2   Mounting the PM 100/300-ODU

To mount an Outdoor Unit on a pole using the bracket, follow the instructions below:

1. Locate the appropriate mounting holes for the bracket on the back of the ODU.

2. Attach the mounting bracket (Base Support) to the ODU using four M5X20 screws provided. Place the Flat washers and M5 Lock washers on the Base Support and then insert M5X20 screw. Tighten the screw. Figure 2-3 shows the M5x20 screws securing the Base Support to an ODU.

3. Attach the Inner Pole Support and Outer Pole Support with M8X100mm Long Screws. Place one Flat washer and one M8 Lock washer each (both ends of the pole supports) before inserting the screw from the inner pole support to the outer pole support. Attach a M8 Hex Nut on the other end of each M8 Long Screw. Do not tighten the M8 Hex Nuts yet. Figure 2-4 displays a pole support assembly.

4. Attach the Base Support on to the Inner pole support by inserting a M8x100 mm Screw. Place a Flat washer and a M8 lock washer before inserting the

screw. Attach a Hex Nut on the other end to secure the ODU to the Inner pole support. Figure 2-5 shows insertion of the M5x35 Screw.

5. Position the clamp around the pole in the desired location. Install and tighten the clamp bolts enough to secure the clamp to the pole. Tighten these screw only after antenna pointing.

NOTE: *The polarization of the BS antenna should match that of the cpe.*

6. Adjust the azimuth and elevation orientation of the radio/antenna as necessary by loosening the appropriate nuts, repositioning the ODU (refer to section 1.2), and finally tightening the nuts. Figure 2-6 shows an installed PacketMax 100.
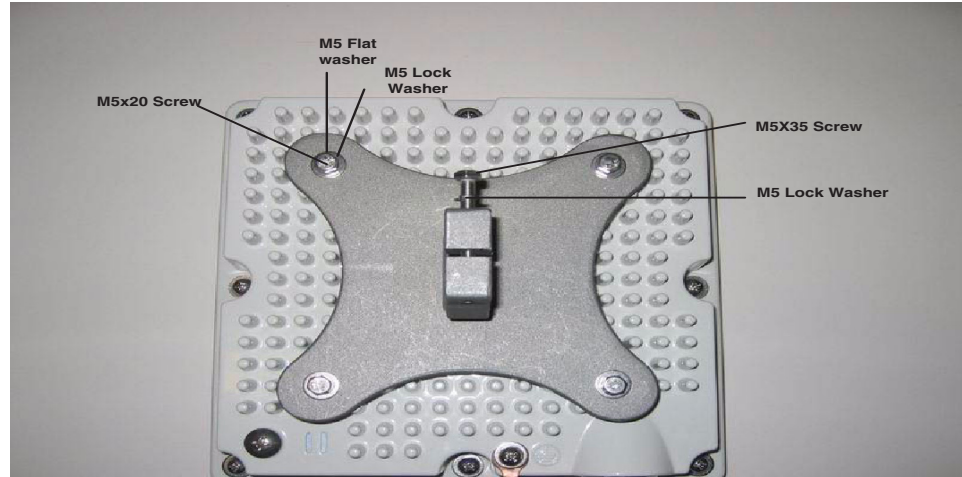
Figure 2-3   Attaching Base Support to ODU
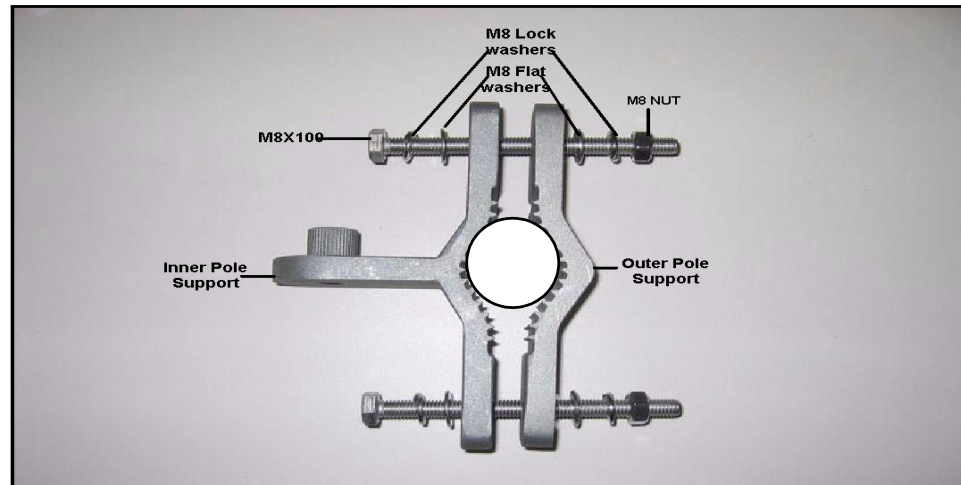
Figure 2-4   Pole Support Assembly
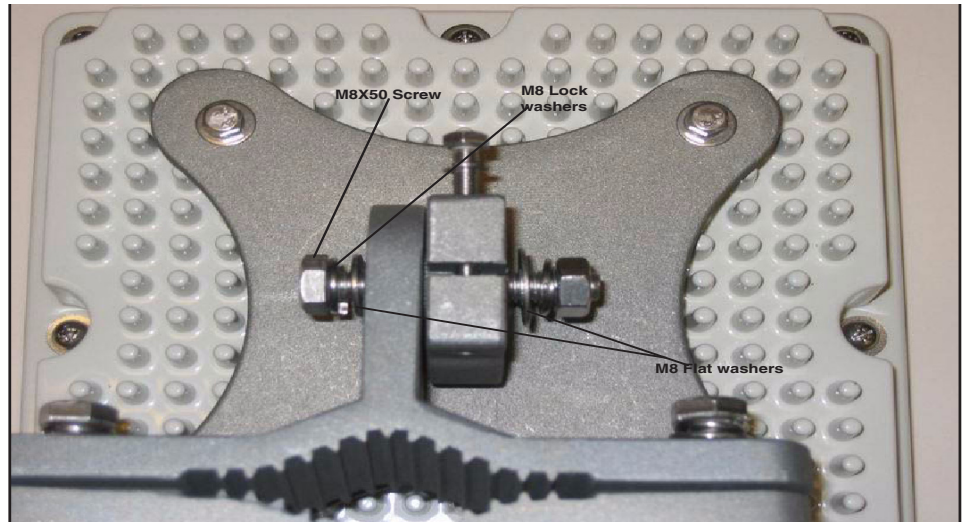
Figure 2-5   Attaching Base Support of the ODU to Inner Pole Support

Figure 2-6   Installed PacketMax 100-ODU

Step 2. Position the Outdoor Unit.

To achieve correct polarization, it is not possible to switch polarization using software. This can be done only by making physical changes to the subscriber station installation.

Vertical Polarization

Under normal circumstances the Subscriber station will be installed in a vertical polarization format. The orientation of the PM 100/300 is so that the CAT5e cable connection is located at the bottom of the PM 100/300 as can be seen in Figure 2-7.
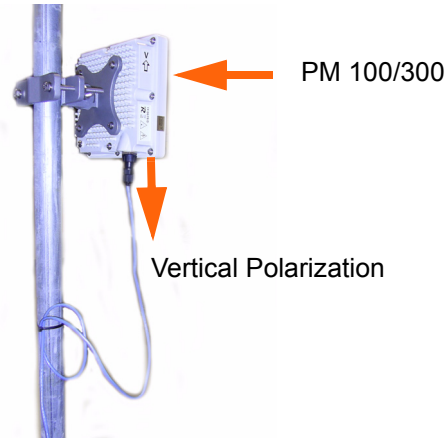
Figure 2-7   PM100/300 installed in vertical polarization (Default)

Horizontal Polarization

As the PM 100/300 only has one antenna array, in order to use horizontal polarization, it must be turned through 90 degrees so that the antenna array can receive RF signals that have been transmitted in a horizontal polarization (Figure 2-8). This can be achieved when attaching the pole mounting kit so that the orientation is that the CAT5 cables are attached at the side of the PM 100/300. While PM 100/300 is in horizontal polarization, then all the weather protection precautions must be taken.

NOTE: *Please use CAT5 cover that is supplied with the PM 100.*
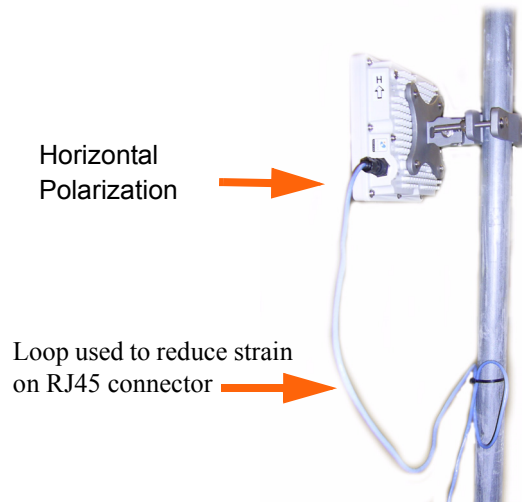
Figure 2-8   PM100/300 installed in horizontal polarization

Reducing strain

No strain should be put onto the RJ45 connector of the SS otherwise it is possible that the connection between IDU and ODU is intermittent or, in extreme cases, damage to the RJ45 connector may occur. To ensure that this does not happen a loop in the cable should introduced, as shown in Figure 2-8, so as to reduce any chance of inflicting pressure onto the connectors.

NOTE: *In Aperto WaveCenter EMS, During WSC and SS configuration, the parameters that refer to polarization should be left at Vertical.*

Step 3. Ground the Outdoor Unit (Radio/Antenna)

Grounding of the outdoor radio/antenna is an essential part of the installation process. A proper grounding circuit is illustrated in Figure 2-9.

Connection to
Radio/Antenna
Ground Lug

Grounding Conductor
(NEC Section 810-21)

Grounding Clamp
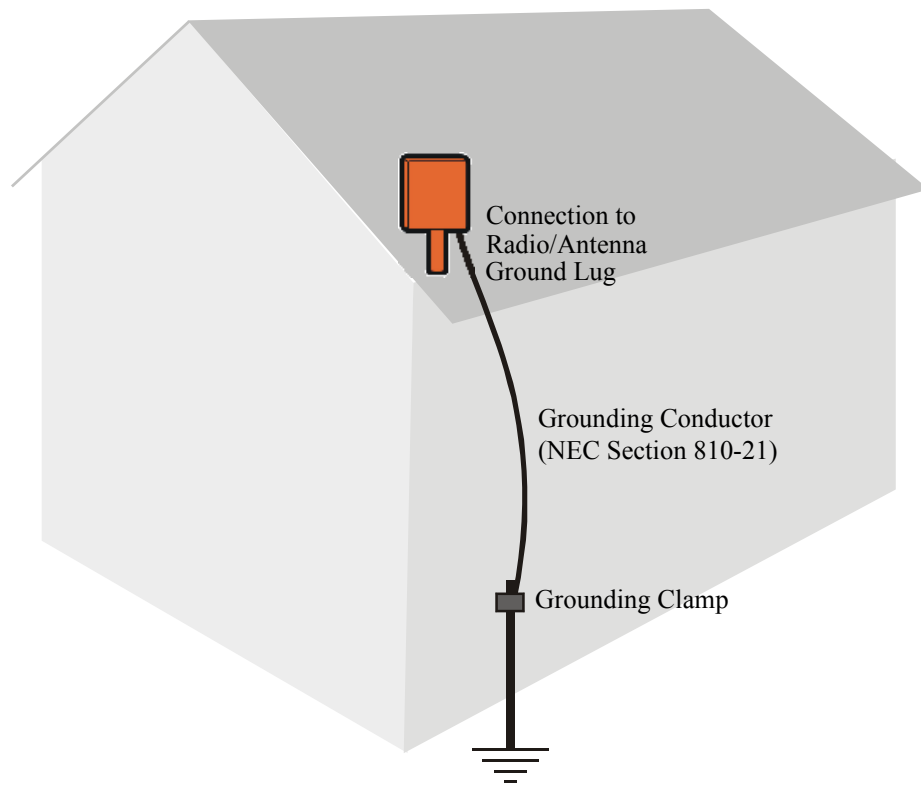
Figure 2-9   Grounding the Outdoor Unit (Radio/Antenna)

WARNING: Lightning protection is recommended for subscriber equipment. Instructions and an example are contained in the document titled *Surge Protection for PacketMax Products*, included on the Packet-Max CD that accompanies the equipment. (If the CD or document were not provided, contact Aperto Customer Service.) Lightning damage is not covered by the product warranty.

To properly ground the Outdoor Unit:

1. Locate the grounding lug on the ODU, as illustrated in Figure 2-10. The Grounding lug is located on the back panel of the outdoor unit.

2. Provide a proper grounding conductor (NEC Section 810-21) long enough to reach from the Outdoor Unit to the earth ground.

3. Crimp one end of a grounding cable to the suitable cable lug.

4. Connect the cable lug of the grounding cable to the grounding screw and tighten the grounding the grounding screw firmly.

5. Route the other end of the grounding cable to a good ground (earth or building) Connection. See Figure 2-11. Connect the AWG #10 grounding wire and route to the central building ground, as shown in Figure 2-12

6. Connect the AWG #10 grounding wire and route to the grounding Bar.

NOTE: *If you install a grounding electrode separate from the power service grounding electrode system, connect the separate electrode to the grounding system in accordance with the National Electrical Code (NEC) and local electrical codes.*

Figure 2-10   Location of Groundin1g Lug on Outdoor Unit (Radio/Antenna)

Refer to the table below for the grounding wire specification.

NOTE: *Please do not directly connect to the lighting rod.*

Grounding Wired

Grounding Bar

Earth Termination
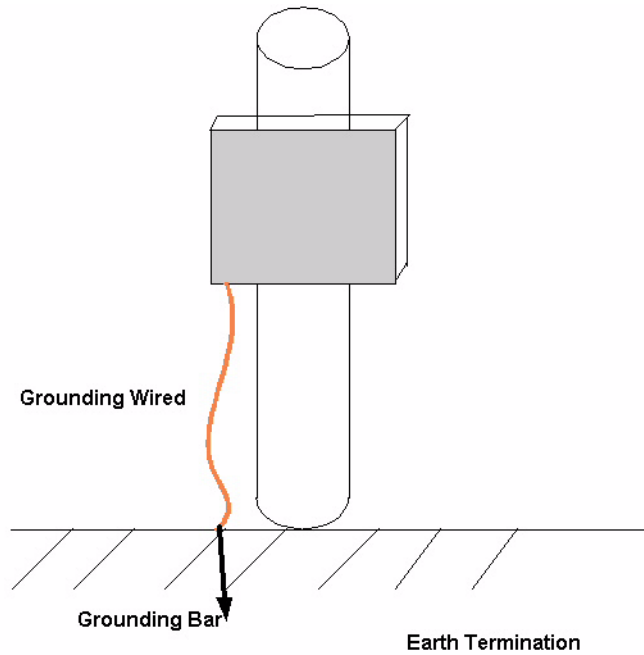
Table 2-B   Grounding Wire Specifications

AWG unit (mm)		Max length of 0.25 ohm
AWG10	2.588	65.53m
AWG8	3.264	104.24m
AWG6	4.166	141.43m
AWG4	5.189	256.03m

Figure 2-11   Earth Grounding
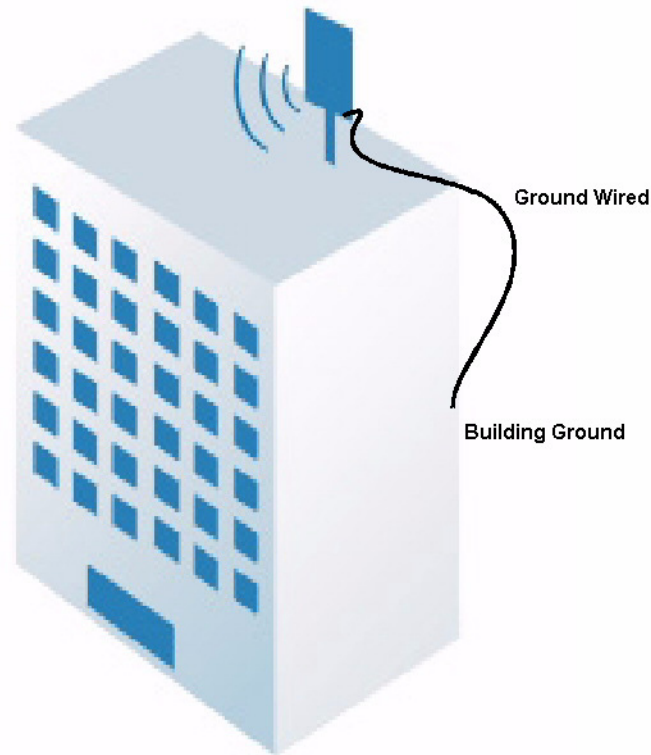
Figure 2-12   Building Grounding

Step 4. Connect the Outdoor Unit to the Power Over Ethernet

The PoE cable transports ethernet data and power and is a 1P67 compliant, weatherproof CAT5 cable with a rubber boot. Aperto recommends industrial CAT 5e cable which meets the ANSI/TIA/EIA 568B.2 Category 5eStandard. In the case that the users don't buy this CAT 5e cable with rubber boot, Aperto recommends the use of the rubber boot that can be used with any CAT5 cable (Please refer to Appendix for details on installing the rubber boot).

1. Identify the location of PoE (bridge).

2. Move the Indoor Unit to its permanent location.

3. Connect the power cable (Cat-5 cable) between the Power over Ethernet and an AC outlet (100-240 VAC).[See Appendix E for cable details, in this manual].

☞   NOTE: *It is highly recommended that the Cat-5 cable be verified using a cable tester before connection and power-up.*

4. At the Outdoor Unit, use an 1P67 compliant weatherproof cat-5 cable (provided by Aperto) to connect to the **Data Out** jack on the Power over Ethernet (inside the building).

5. Connect the unit **Data in** jack (input) using a straight cable, to the remote Ethernet network switch(LAN/hub switch) Patch panel or Connect the unit **Data in** jack (output) to the computer, using a crossover Ethernet cable connection.

Data Out

Data In

Power cable

PoE-AC outlet

Cat 5 cable

PoE- PM 100 ODU

Cat 5 cable

PoE- PC or hub
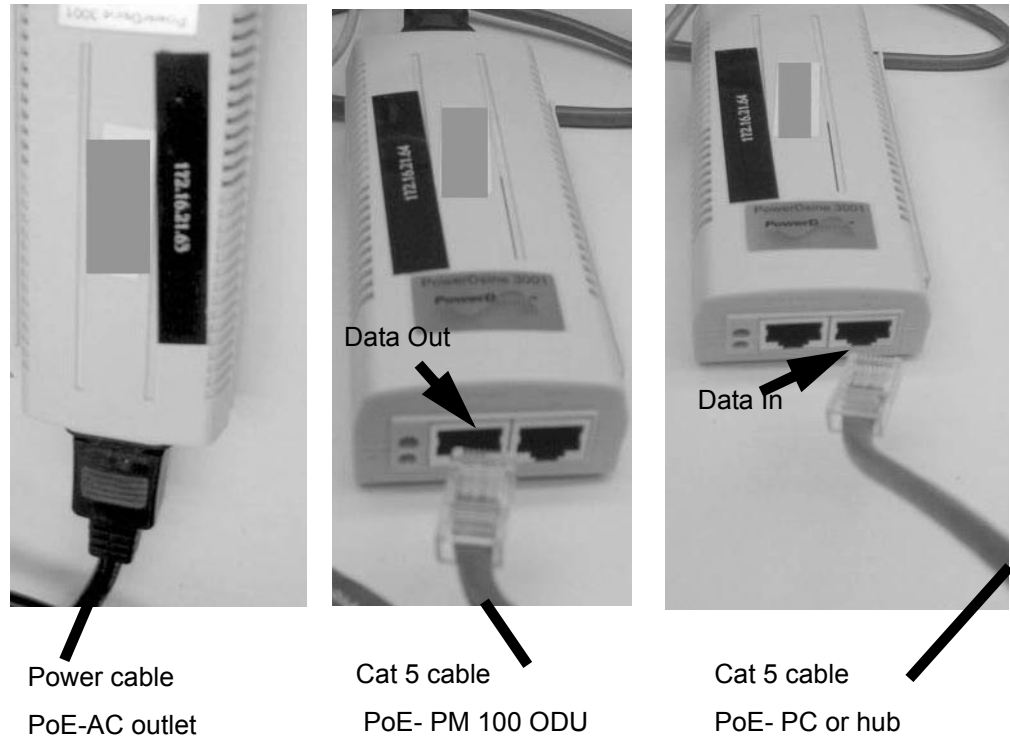
Figure 2-13   Power Over Ethernet Connections

Table 2-3   Ethernet Cable Pinouts

Straight Cable (to Hub)		Crossover Cable (to PC)	
Pin 1: Tx+	Pin 1: Rc+	Pin 1: Rc+	Pin 3: Tx+
Pin 2: Tx-	Pin 2: Rc-	Pin 2: Rc-	Pin 6: Tx
Pin 3: Rc+	Pin 3: Tx+	Pin 3: Tx+	Pin 1: Rc+
Pin 6: Rc-	Pin 6: Tx-	Pin 6: Tx-	Pin 2: Rc-

Step 5. Align the Outdoor Unit

There are two techniques to aid you in the CPE installation.

❖   Using the AIM software tool. Temporarily mount the IDU close to the ODU to facilitate a direct reading (fined-tuned alignment technique).

❖   Using the ODU's built-in pitch and tone capability (rough alignment technique).

Aligning the Outdoor Unit Using Aperto Installation Manager (AIM)

1. Launch AIM by double-clicking the AIM destop icon. When promted, enter the default password (isp).

2. In the Install Option window, select Setup > Next.

3. At the General tab, enter the Frequency band value (3.5 GHz, 3.3 GHz, 5.8 GHz) and WSS ports field (12 supported). If the PM 100/300 is in Server mode, a DHCP server must be configured to provide the information for its subnet mask, IP Address, etc.

4. Select Advanced tab. Enter BS ID, Channel Width Value, Management VLAN ID, and Management VLAN Priority.

5. Click Next. Wait for initialization. A message box displays confirming the initialization. Click Next.

6. Click the View CINR checkbox. The Buzzer checkbox is automatically selected. Make smaller adjustments on the physical orientation of the Subscriber Station until the highest CINR is deployed by AIM.

7. Click Finish. Wait for the PM 100/300 to initialize and for the ping test to finish.

Aligning the Outdoor Unit Using ODU's Built-in Adio Aligment Capability

The ODU has a buzzer that generates audible beeps whose frequency and tone can be used to help with aligning the CPE to achieve the best possible signal from the Base Station.

Beeps become louder as the CINR improves. The beeps occur more frequently as the RSSI (local signal strength) improves. The longest beep delay between State changes (see table) is approximately 1 second, while the shortest delay has no delay (constant tone). Hearing loud beeps with little delay indicates the best CINR/RSSI positioning.

There are three tone levels associated with CINR:

❖ >20dB (highest tone)

❖ 13.8-20dB (medium tone)

❖ <13.8dB (lowest tone)

There are two beeping rates associated with RSSI:

❖ -65dB (fastest rate/constant tone)

❖ -90dB (slowest rate).

After you have reached your strongest signal, for approximately 15-30 seconds, the tone remains in a steady state. Then the automatic alignment completes, and the following six states and their related number of beeps occur.

A delay/pause occurs among the following six state changes.

Table 2-4   *Audio Alignment*

States	No. of Beeps
Wait for sync	1
Wait for uplink parameters	2
Wait for link establishment	3
SBC request sent	4
Reg Req Sent	6
Establish Prov Connection	10

NOTE: *The above-listed states will **not** beep until you click the **Next** button at the CINR screen (AIM).*

Step 6. Reboot the subscriber station and connect to the PacketMAX network

The EMS is the connection to the PacketMax network. When the Subscriber Unit reboots at the end of the installation/antenna alignment process described above, it performs an initialization procedure that brings it up as part of the PacketMax network. During this procedure:

❖   The Subscriber Unit requests an IP address from the system's DHCP server. (The DHCP request is passed along by the BS's DHCP relay agent.)

❖   The DHCP server responds with the IP address and other information, including the name of the Subscriber Unit's configuration file. The Base Station Unit and the Subscriber Unit both learn the new IP address.

❖   The Subscriber Unit downloads its configuration file (as previously created using the WaveCenter Configuration Manager) from the TFTP server.

❖   The Subscriber Unit configures itself according to the received configuration file and activates for subscriber traffic.

3

Aperto Installation Manager

This chapter provides instructions for using the Aperto Installation Manager (AIM) utility. The AIM can be used to perform any of the following functions:

❖   Initially configure the PacketMax 100/300 and optimize antenna alignment.

❖   Re-align the antenna of a previously-installed PacketMax 100/300.

❖   View wireless link status.

❖   Perform ping tests of the wireless link between the PacketMax 100/300 and the base station.

❖   Pre-provision (pre-configure) a PacketMax 100/300 for later installation.

This chapter covers the following topics:

☞   NOTE: *The instructions and screenshots in this chapter showing PacketMax 100 applies to PacketMax 300 as well. Please ensure that the correct model number is chosen during AIM installation*

3.1 Aperto Installation Manager Requirements

The Aperto Installation Manager is a software utility which uses graphs of signal strength and signal-to-noise ratio to identify the best direction for the subscriber antenna to be pointed. It runs on PCs meeting the following requirements:

❖ Operating System: MS Windows 98/2000 Professional, and Linux.

❖ Minimum of 128 MB RAM

❖ Java Runtime Environment (JRE 1.5)

❖ Ethernet port

NOTE: *Aperto recommends a laptop PC with 256 MB RAM, 10 GB disk drive, Pentium processor, and Ethernet LAN connection. Systems as small as 128 MB RAM and a 386 processor have been used, but their performance is not satisfactory.*

The PC connects to the Indoor Unit through the Ethernet port. Radio signal and control cables must connect the Indoor Unit to the Outdoor Unit.

Also, when you run AIM, ensure the following:

❖ A cross over cable is used

❖ The PC/laptop has static IP address

❖ There is no firewall

3.2 Installing the AIM Software on the PC

To install Aperto Installation Manager

1. Obtain the PacketMax CD distributed with your PacketMax Series 100 equipment, which includes the PacketMax Aperto Installation Manager (AIM) software plus Java software from SUN Microsystems.

2. If the Java Runtime Environment is not present on the PC, install it from the PacketMax CD (bs/Software/Application/Support directory) or the java.sun.com web site.

3. Install the Aperto Installation Manager (AIM) software by running the file *setup.exe* from the \Customer_CD\WaveCenter EMS Pro 1.1\Software\Installation Manager\ directory of the PacketMax CD. At the end of this installation, an AIM icon will be placed on the Windows desktop.

3.3 Connecting to the PacketMax 100

Please refer to *Chapter 1* for Installation of PM 100/300 and pinout connections for the cables used in AIM.

To connect AIM with PacketMAX 100/300

1. Ensure that the Interface Box is connected to the Outdoor Unit as described under Connecting the ODU to the Interface Box section.

2. Connect the computer to the Interface Box LAN port using a crossover Ethernet cable.

3. Ensure that there is only one active Ethernet interface on the computer. (If there are multiple active Ethernet interfaces, the AIM cannot determine which to use.)

4. Ensure that the computer has a fixed IP address, and not one set by a DHCP server. Figure 3-1 gives an example of setting a fixed IP address on Windows 2000; be sure to select **Use the following IP address**. It does not matter what IP address, network mask, and gateway are used.
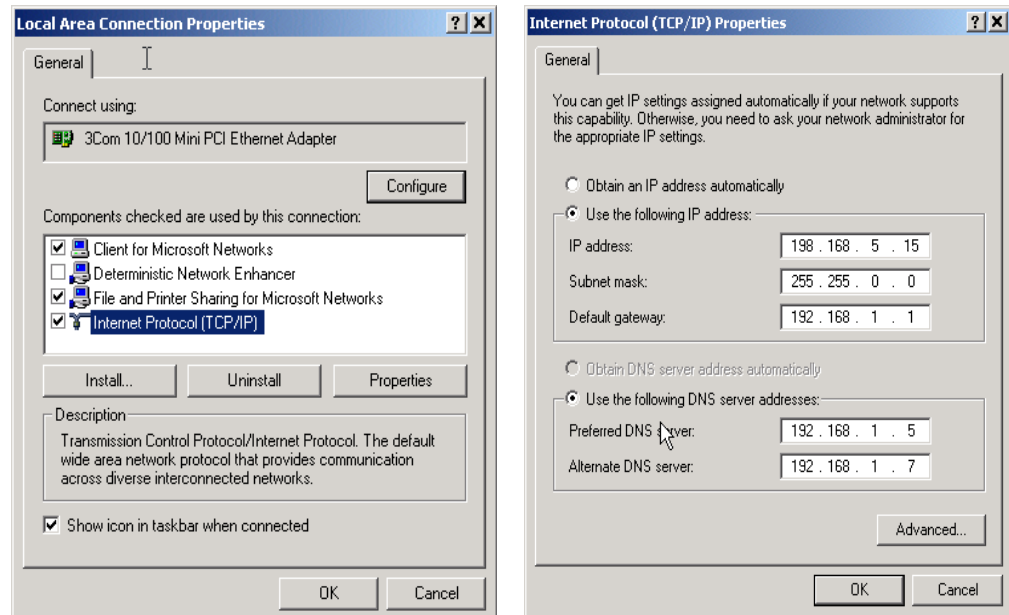
Figure 3-1   Windows 2000 IP Address Setting

3.4 Working with the Aperto Installation Manager

3.4.1 Logging into Aperto Installation Manager

To log into AIM

1. Double-click on the Aperto Installation Manager icon on the PC's desktop. This will cause the Authentication window to be displayed, as shown in Figure 3-2.

Figure 3-2   AIM Login Window

2.   Enter the AIM login name and password and click **Login**. The default login name and password is **isp**.

Once you are logged in, the AIM main window is displayed as shown below:
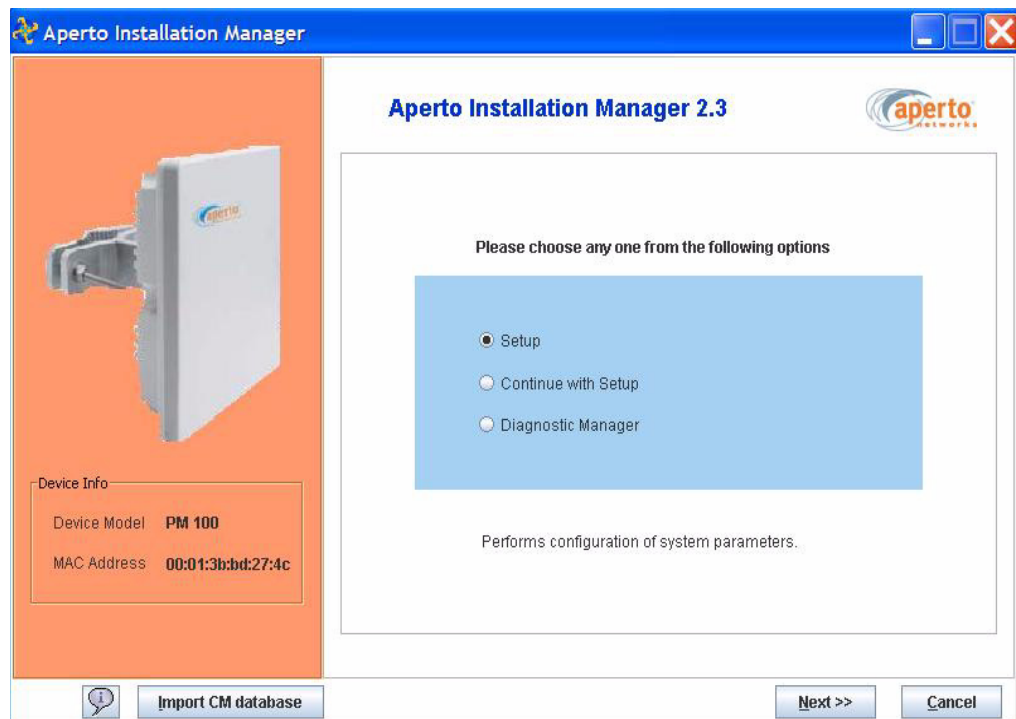
Figure 3-3   AIM Main Window

3.4.2 AIM Options

The main AIM window lists the following four options:

❖ Import CM Database: Allows the BS xx.DAT file to be copied from the computer to the PacketMAX device.

❖ Setup: Provides basic configuration, antenna alignment, and throughput testing.

❖ Continue with Setup: Allows to align antenna when basic configuration has already been completed.

❖ Diagnostic Manager:

3.4.3 Importing the BS XX.DAT File

When BS configuration is performed using the Server Configuration Tool in Element Management System (EMS) the xx.DAT (where "xx" is the specific BS name) database file is generated. This file records basic parameters for all configured BSs:

❖ BS name

❖ Sector name

❖ Channel width

❖ Channel frequency

❖ Broadcast polarization

❖ BS diversity

❖ CINR ratio

❖ Frequency band

The Configuration Manager has an option to copy the data file to a diskette.

The Installation Manager allows the data (xx.DAT) file to be downloaded from the computer to the PacketMax 100. The PacketMax 100 will then load all of its configuration parameters automatically from the xx.DAT file once the SS's BS and sector are selected.

To download the xx.DAT file to the PacketMax 100:

1. Click on the **Import CM database** button on the main screen of the Aperto Installation Manager.

2. Choose the file and click on **Open**. A successfully imported dialog box shows up

3.4.4 Basic Configuration

1. In the Install Option window, select **Setup**; then click on the **Next>>** button. The Configuration Window will be displayed, as shown in Figure 3-5. The Configuration Window shows the configuration retrieved from the PacketMax 100. The MAC address should be the same as recorded on the label on the unit.

NOTE: *If the data file has been downloaded as described under Downloading the BS.DAT file section below, the only parameters you need to configure are*

the BS's **WSS number** *and the* **BS ID** *(name); the others will be determined automatically using the BS.DAT file. Steps 2 to 3 may be skipped.*

2. In the Configuration Window, if a configuration file has been imported then a different screen will show up, as in Figure 3-4. If a file has not been imported earlier, select the frequency band of the wireless link from the drop-down menu, as in Figure 3-5. (This selection must match the frequency band of the Packet-Max 5000.)
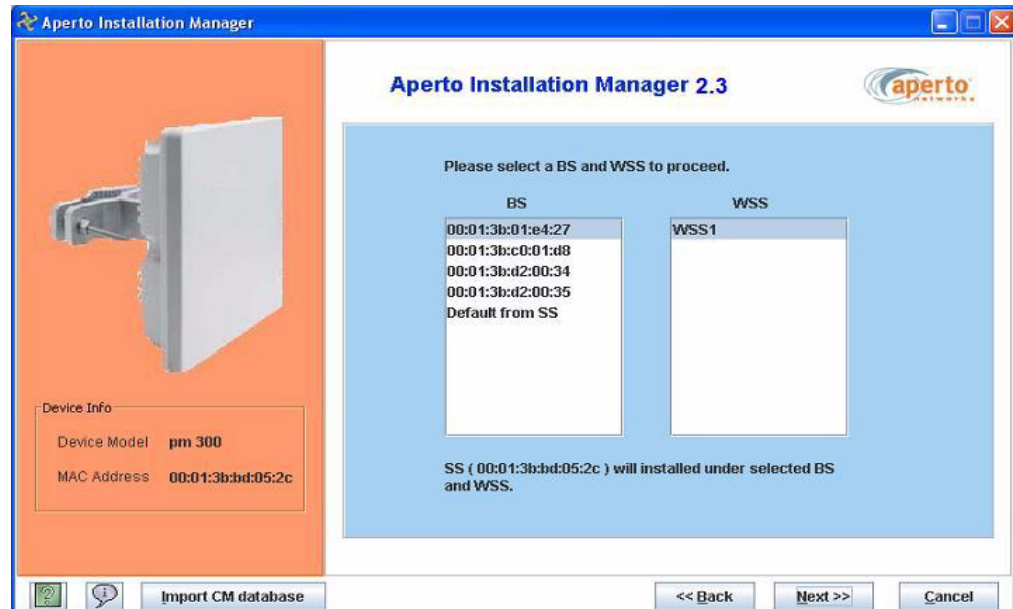
Figure 3-4   BS and WSS selection

.
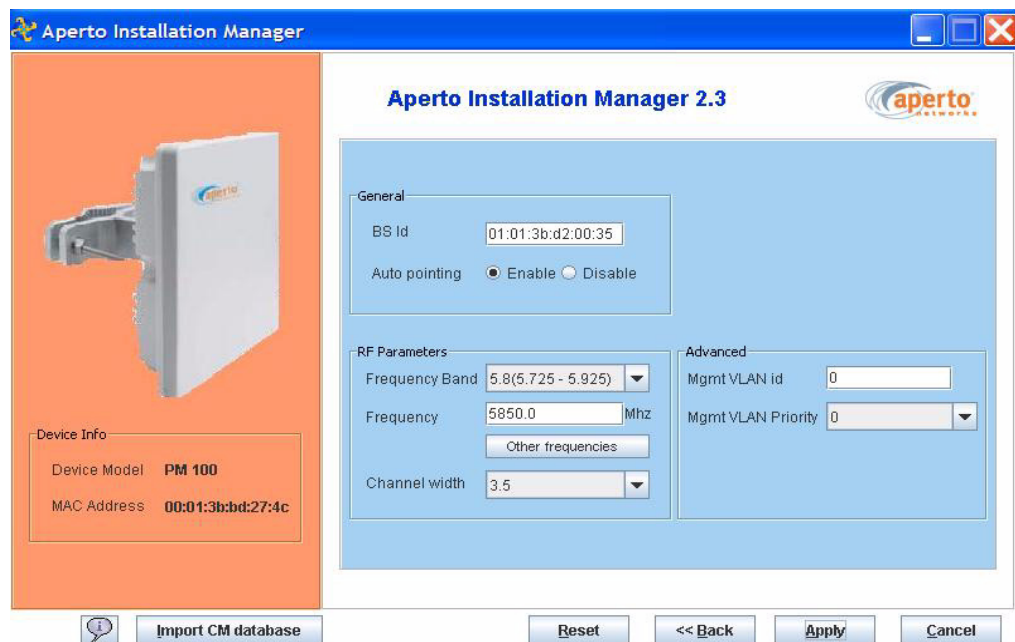
Figure 3-5   Configuration Window: General

NOTE: *The frequency band of PacketMax 100 is 3.5 GHz, by default. It is important to note this difference when configuring the frequency band in a Base Station and Access Point. If units of both types are to be used within a sector, the frequency band must be compatible with the range of both devices.*

3. In the **BS ID** field, enter the name of the PacketMax 100's Base Station Unit, as specified in the configuration of the BS. Remember that the **BS ID** is case-sensitive.

CAUTION: Since the BS and SS both use the BS name and wireless port in the signal scrambling algorithm, the BS and SS will not be able to communicate if the BS name is not entered correctly.

4. In the **Frequency (MHz)** field, select the center frequency for the wireless link from the pull-down menu. 3.3, 3.5 and 5.8 GHz are supported.

NOTE: *You will need to determine an appropriate center frequency prior to performing this configuration. Aperto has no way of suggesting a default value appropriate to your area. As soon as you finish configuring the PacketMax 100, it will begin transmitting on the selected frequency.*

NOTE: *PM 5000 should be configured in Server mode and receive their IP address and configuration information from a EMS server. The Aperto equipments should be configured with infinite leases. This is appropriate since the same IP address should not be given to another device in the network.*

5. If Automatic Frequency Selection (AFS) is desired, you can click on the **Other Frequencies** button to open the AFS Frequencies window shown in Figure 3-6. AFS will be enabled if you specify at least one alternate frequency.

CAUTION: Enabling AFS during initial setup using the AIM will mean that the PacketMax 100 will be likely to switch frequencies every 2 minutes during antenna alignment, making the procedure very difficult.
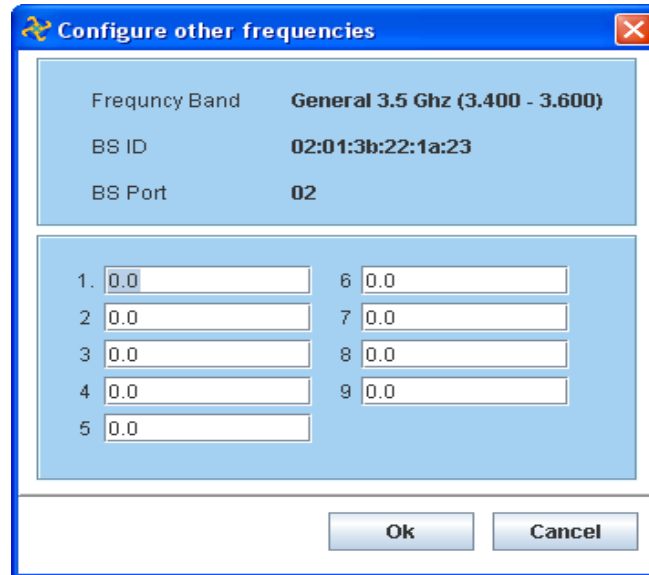
Figure 3-6   *Configure Other Frequencies Window*

6. Use the drop-down menu to select the **Channel Width**. If you are unsure, stick with the default selection. 3.0, 3.5, 5.0, 5.5 and 7.0 MHz are supported.

7. For VLAN applications, specify the **Management VLAN ID** and **Management VLAN priority**. Usually, the Management VLAN ID should be the same for the SS and BS. If you leave the value at the default of 0, the SS will automatically learn and use the BS's Management VLAN ID.

☞   NOTE: *VLAN configuration is performed primarily using the Configuration Manager. Only the VLAN management ID and priority can be set locally using the AIM.*

8. When the restart is finished, the AIM will go into antenna alignment mode, displaying the Alignment Window shown in Figure 3-7.
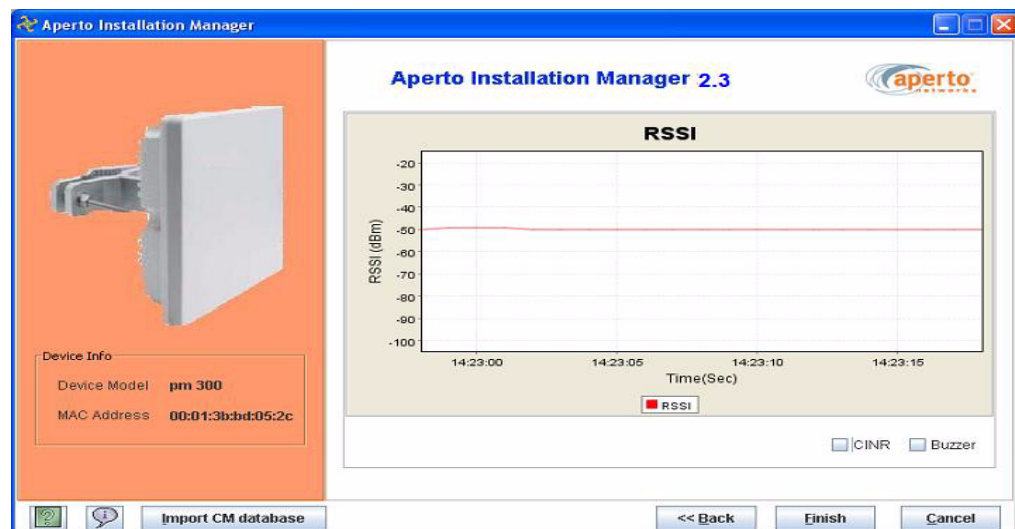
Figure 3-7   *Alignment Window*

3.4.5 Aligning the Antenna

To align the antenna, perform the steps in this section.

1. While viewing the graph shown in Figure 3-7, move the antenna to maximize the signal strength as shown on the graph. For 3.5 MHz channel bandwidth, values greater than -92.1 dBm will work in QPSK -1/2. Values greater than -86.6 dBm will work in 16QAM -1/2. Also, values greater than -77.1 will work in 64 QAM -1/2.

If the signal does not move up from the bottom of the Local Signal Strength graph (i.e., shows -100 dBm), do the following:

- Verify that the frequency and BS ID were correctly configured.

- If the link has line-of-sight between the antennas, you should know the general direction to align the antenna. Start in that direction. Move the antenna every few seconds until the Local Signal Strength line rises at lease once. Once it rises, slow the movement of the antenna. If the Signal Indicator line has not risen after 2 to 3 minutes, it is best to click the **Previous** and then the **Next** buttons to reset sequence.

- If the installation is not line-of-sight, either search for a first synchronization (as indicated by the rise of the Signal Indicator line) or just pick a direction to align the antenna.

2. Once the Local Signal Strength value is maximized, click on the **View CINR** button to display the full window as shown in Figure 3-8. To achieve a link 16QAM 1/2 or better, make sure the receive signal level is -87 dBm and the CINR is greater than 8dBm.

Aperto products have adaptive modulation and error correction. As data is transferred and high CINR is achieved, the system will automatically adjust to the highest modualtion (64QAM 3/4).

AIM automatically transfers data following antenna alignment and reports the throughput values attained, which will be less than actual since the system is adjusting for the best throughput values.
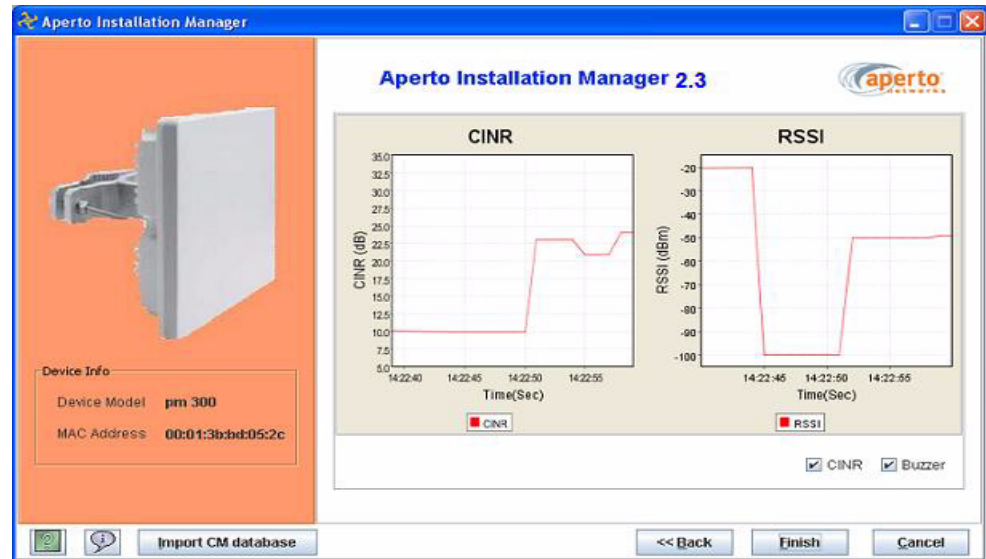
Figure 3-8   Alignment Window with CINR Graph

3. Adjust the antenna again until the Local Signal Strength and CINR are the best you can get.

4. Click on the **Finish** button in the Alignment window. A series of pop-up windows will display, showing the progress of the application. Figure 3-13 shows the Installation Results Window.

☞ NOTE: *.In scanning mode of AIM, the Subscriber Unit also adjusts the synchronization. The synchronization is necessary to match that of the Base Station. It is normally carried in the wireless frame. Since it is possible that the SS has not yet found the appropriate signal as it is scanning, it is also possible that the synchronization adjustment may be misaligned. To ensure proper antenna alignment, do not spend more than 10 minutes in the alignment phase of AIM. Use the previous and next buttons to restart the process at least every 10 minutes.*

5. It is important to check the RF and IP transmission results to see if you have the best possible wireless connection. If the results are not acceptable, perform the steps described under Re-aligning the Antenna (Continue with Setup Mode) to repeat the alignment process.

6. If you are ready to close the AIM, click on the **Done** button of the Installation Results window. The AIM will prompt for confirmation that you really want to exit.

☞ NOTE: *Aperto Installation Manager (AIM) performs radio checks following the antenna alignment. This will allow the installer to check radio cables during alignment testing if no signal or a weak signal is being shown on the alignment screen. This may cause confusion in detecting the difference between a radio not properly connected and no coverage. Click on the finish button from the antenna alignment screen, if in any doubt. The radio will be checked and the user will be informed about the radio connectivity.*

3.4.6 Re-aligning the Antenna (Continue with Setup Mode)

The **Continue with Setup** option on the Install Option window provides direct access to the antenna alignment function (Alignment page) without going through the configuration steps.

To align the antenna using the **Continue with Setup** mode:

1. Go to the Install Option window (Figure 3-4) and select Continue with Setup and click Next. The Subscriber Station reboots and the AIM displays the Alignment Window, as shown in Figure 3-7.

2. Perform the steps under Aligning the Antenna.

3.5 Aperto Installation Manager Troubleshooting

This section offers solutions for problems related to the use of the Aperto Installation Manager (AIM) utility.

3.5.1 Problems Connecting to the Subscriber Unit

If the Aperto Installation Manager fails to connect with the PacketMax 100 after MAC address/frequency configuration, a **"Host unreachable"** message will result. Possible causes and solutions include the following:

❖ Cabling problem — Verify that a crossover cable is being used, and that it is securely connected at both ends.

❖ Incorrect MAC address — Check the MAC address entered against the MAC address on the PacketMax 100, and correct if necessary.

❖ Computer does not have fixed IP addresses — On the computer running the AIM, ensure that the Ethernet connection is configured with a fixed IP address, subnet mask, and gateway.

❖ Multiple Ethernet connections enabled — On the computer running the AIM, verify that only the Ethernet connection to the PacketMax 100 is enabled. If multiple Ethernet connections are enabled, the AIM will not be able to determine the correct connection to use.

❖ Another application using the port — Close any application that might be using the computer port employed by the AIM. Use the Windows task manager or LINUX/UNIX process status as appropriate, and remove the task or reboot the computer as necessary. (Sometimes Windows will have an extra Java task that is using the port.)

3.5.2 Problems Communicating with the Base Station Unit

After antenna alignment is finished, the Aperto Installation Manager (AIM) establishes communication with the Base Station Unit, downloads configuration and IP information, and performs ping and throughput tests with the Base Station Unit. The SS state during establishment of the communication link and initialization of the SS is indicated by messages in a pop-up window. If the Aperto Installation Manager hangs at a particular state, that state will help identify the nature of the problem.

If establishment of the communication link and initialization of the SS succeed, but the ping and throughput tests are not successfully completed, the Aperto Installation Manager indicates installation failure in the Results Window.

Possible causes and solutions for a failure in communication with the Base Station Unit include the following:

❖ Incorrect frequency entered — Verify that the frequency information specified for the SS matches the BS. (Typically, the AIM will have hung at the "searching for sync" or "link establishment" state.)

❖ Incorrect BS ID entered — Verify the BS ID, which is case-sensitive and must match the ID as entered on the BS.

❖ Incorrect WSS port number entered — Verify that the SS is in the correct sector and that the correct port number is being used.

❖ Cable problems — Ensure that the signal and control cables between the Interface Box and the Outdoor Unit are properly and securely connected; that cables meet the requirements given in this manual; and that cables do not exceed 100 m (330 ft) in length if Cat 5E, or 50 m (165 ft) if Cat 5. (Typically, the AIM will have hung at the "searching for sync" or "link establishment" state.)

❖ Incorrect antenna alignment — Try re-running the AIM and aligning the antenna again, making sure to secure the Outdoor Unit in the position where the strongest signal is being received. (Typically, the AIM will have hung at the "searching for sync" or "link establishment" state.)

❖ BS wireless failure — Confirm that the BS's wireless interface to the SS is operating correctly. (Typically, the AIM will have hung at the "searching for sync" or "link establishment" state.)

❖ DHCP failure — If the Installation Manager hangs in the "DHCP request sent" state, the communication link has been successfully established but there has been a problem with DHCP or configuration downloading. Ensure that:

  - The DHCP server has a proper entry for the SS's MAC address.

  - The DHCP server has an established route to the SS.

  - The TFTP server has a valid configuration file for the SS.

❖ Noisy or bad communication link — If the throughput test is inordinately slow, the communication link's error rate may make it inappropriate to put the SS into service. Experience has shown that the test can take up to ten minutes and still be completed without errors. If the throughput rate is not appropriate, try aligning the antenna in its current location or relocating the antenna. If this does not solve the problem, perhaps the sensitivity of the antenna at the base station should be adjusted (depending on performance of other SUs in the sector).

❖ Signal too strong — If the base station antenna is adjusted for communication with distant SSs, an SS near the base station may not be able to turn its transmit power low enough to avoid overdriving its signal to the base station. (Typically, the AIM will have hung at the "searching for sync" or "link establishment" state.) If this occurs, align the subscriber antenna for the maximum signal; then adjust the antenna alignment upward ("detuning" the antenna to decrease transmit power) until the transmit signal strength is appropriate for the base station antenna.

☞ NOTE: *Please be sure to have the correct frequency, BS ID, sector number, and channel width when running AIM. Without these correct entries, the unit will not be able to synchronize with the Base Station and you will not be able to align the antenna. The lack of signal will appear the same as a non-covered area. Either use a "Have Disk" file generated by the Configuration Manager or use the correct WSS number.*

3.6 Buzzer in AIM

The buzzer beeps (if enabled) at the time of Antenna Pointing and is based on RSSI and CINR. The better the CINR, louder the beeps. The better the RSSI, faster the beeps (lesser delay between beeps). The longest delay between beeps is "1second" and the least delay is "no delay at all".

If the installer moves the antenna where the CINR is getting better, then the beeps will get louder. If the installer is moving the antenna in the opposite direction, then the beeps get softer. Likewise, if the delay between beeps is becoming less, the RSSI is getting better. If the delay between beeps is becoming more, the RSSI is getting worse. If you're hearing loud beeps and there is very little delay between beeps, it indicates Good CINR and RSSI.

After the installer ensures that the CINR and RSSI are good, the PM 100 goes through the beeping sequence mentioned in "Buzzer under Normal Operation" (see above) while it is going operational.

Following is the sequence of buzzer sounds on the PM100:

1. The buzzer sounds 2 times when PM 100 is powered on.

2. There are different beep sounds/counts depending on the various states, as listed in Table 4-A. The beep sounds come on as many times as the state number that it is going through (1, 2, 3, 4, 6, 10). There is a delay after each state change as well.

3. Finally, when the PM 100 becomes operational. There are 6 distinct beeps (different from the beeping as it goes thru the states) to indicate this. Table 3-A displays this.

Table 3-A   ***State and Number of Beeps***

State	No. of Beeps
Wait for sync	1
Wait for uplink parameters	2
Wait for link establishment	3
SBC request sent	4
Reg Req Sent	6
Establish Prov Connection	10

A

Specifications

A.1 General Specifications

1.1.1 Models

PacketMax 10X/30X — Bridging mode ;VLAN; up to 5/250 hosts and 8/14 unidirectional traffic service flows per subscriber.

1.1.2 Interfaces

The PacketMax 100/300 CPEs provide data and/or voice connectivity to the user through its internal unit (IDU). The internal interface between IDU and ODU uses Power over Ethernet (PoE) to provide data as well as power to the external ODU.

❖   Network interface (IDU): 10/100 Base T (RJ45), PoE (802.3af compliant)

❖   External antenna Connector (ODU): N-connector (for extended range models only)

1.1.3 Power requirements

100 to 240 V AC, 47 to 63 Hz

Consumption: 15.4 W (maximum)

1.1.4 RF and antenna specifications

Characteristics	PacketMax 100 series
RF transmit power	20 dBm
Antenna gain	18 dBi
Azimuth and elevation	22 deg
Polarization	Vertical
Noise figure (max)	6 dB
Integrated phase noise	36dBc
Adjacent Channel Rejection	16 dB at 16QAM 13 dB at 64QAM
Receive sensitivity	Up to -100 dBm

1.1.5 Performance and capacities

Characteristics	PacketMax 100 series	PM 300 series
Max number of hosts	5	250
Supported service flows (uni-directional)	8 (managed)	14
DHCP clients	0	0
Max net throughput* (net per 3.5 MHz channel)	8.2 Mbps	8.2 Mbps
Packets per Second	5,000 pps	5,000 pps

1.1.6 Receive Threshold Specifications

Sensitivity	PM-100-33 3.5 GHz	PM-100-33 5.5 GHz	PM-100-33 7.0 GHz
BPSK-1/2	-95.1	-93.0	-92.0
QPSK-1/2	-92.1	-90.0	-89.0
QPSK-3/4	-89.6	-87.5	-86.5
16QAM-1/2	-86.6	-84.5	-83.5
16QAM-3/4	-83.1	-81.0	-80.0
64QAM-2/3	79.1	-77.0	-76.0
64QAM-3/4	-77.1	-76.0	-74.0

Sensitivity (dBm @ BER 10-6)	PM-100-35 3.5 GHz	PM-100-35 5.5 GHz	PM-100-35 7.0 GHz
BPSK-1/2	-95.1	-93.0	-92.0
QPSK-1/2	-92.1	-90.0	-89.0
QPSK-3/4	-89.6	-87.5	-86.5
16QAM-1/2	-86.6	-84.5	-83.5
16QAM-3/4	-83.1	-81.0	-80.0
64QAM-2/3	79.1	-77.0	-76.0
64QAM-3/4	-77.1	-76.0	-74.0

Sensitivity (dBm @ BER 10-6)	PM-100-33 3.5 GHz	PM-100-33 5.5 GHz	PM-10033 7.0 GHz
BPSK-1/2	3.5 MHz	5.5 MHz	7.0 MHz
QPSK-1/2	-88	-86.0	-85.0
QPSK-3/4	-85	-83.0	-82.0
16QAM-1/2	-82	-80.0	-79.0
16QAM-3/4	-79	-77.0	-76.0
64QAM-2/3	-76	-74.0	-73.0
64QAM-3/4	-73	-71.0	-70.0

Sensitivity (dBm @ BER 10-6)	PM-100-33 3.5 GHz	PM-100-33 5.5 GHz	PM-10033 7.0 GHz
	-70	-68.0	-67.0

1.1.7 Mechanical and environmental specifications

Models	Dimensions (W x H x D)	Weight
PacketMax 100 Outdoor Unit (3.5 GHz)	205x205x67 mm^3	2.2 Kg*
Indoor units	Dependent on model	

PacketMax 100/300 IDU: 0 degC to 40 degC – 10% to 90% relative humidity

PacketMax 100/300 ODU: -35 degC to 60degC – 5% to 95% relative humidity

Environmental: IP67 compliance (If using Aperto cables).

1.1.8 Mounting and Brackets

The Outdoor Units can handle pole diameters between 3.7 cm to 5.1 cm.

1.1.9 Regulatory Standards

Safety Standards : IEC 60951-1 (UL 60950-1 & EN 60950)

EMI Standards : EN5022 and FCC Part 15 Class B

B

Event Reporting

The PacketMax subscriber equipment can be configured to report events by any of several means:

- ❖ E-mail event messages.
- ❖ SNMP traps.
- ❖ Logging to a Syslog server.

Reportable alarms and events are identified in Table B-1.

☞   NOTE: Events are highlighted in brackets in the following tables.

B.1 ALarms and Events

Table B-1   SS related Alarms

Alarm Type	Alarm Message in EMS	Cause	Resolution
Memory	System RAM Free : LOW System RAM Free : NORMAL **[Event]** /RAM0 Space Free: LOW /RAM0 Space Free: NORMAL **[Event]**	This indicates the memory status of the system.	Contact Aperto
Ethernet Port Link Change	SS Uplink Ethernet Port Change	Change in Ethernet settings	Check Network connections
Radio Frequency Error	Radio Frequency Configuration Error Radio Frequency Properly Configured **[Event]**	Incorrect Frequency Programmed	Reconfigure the radio & check radio
Cfg File Parse Status	SS Cfg File Parse Failure SS Cfg File Successfully Parsed **[Event]**	Config file is not generated correctly.	Re-check your configuration.

☞   NOTE: Events are highlighted in brackets in the following tables.

B.2 PacketMax 100/300 and PacketMax 5000 Events

Table B-2   SS Events

CPE Mac Addr:<Mac Addr>	Wait for DSA/DSC Acknowledge Timer Expired
CPE Mac Addr:<Mac Addr>	Initial Ranging Success
CPE Mac Addr:<Mac Addr>	Ranging Aborted
CPE Mac Addr:<Mac Addr>	Re Range Request
CPE Mac Addr:<Mac Addr>	SS search for preamble Timer expired

Table B-2   *SS Events*

CPE Mac Addr:<Mac Addr>	Wait for DCD Timer expired
CPE Mac Addr:<Mac Addr>	Wait for Broadcast Ranging Timer expired
CPE Mac Addr:<Mac Addr>	Wait for Ranging Response Reception Timer expired
CPE Mac Addr:<Mac Addr>	Wait for Unicast Ranging Opportunity Timer expired
CPE Mac Addr:<Mac Addr>	Wait for UCD descriptor Timer expired
CPE Mac Addr:<Mac Addr>	SS Wait for DL-MAP on given channel Timer expired
CPE Mac Addr:<Mac Addr>	DBPC-REQ retry Timer expired
CPE Mac Addr:<Mac Addr>	RNG-REQ/DBPC-REQ retry Timer expired
CPE Mac Addr:<Mac Addr>	DBPC-RSP reception Timer expired
CPE Mac Addr:<Mac Addr>	DSA_REQ MAX Retries exceeded
CPE Mac Addr:<Mac Addr>	DSA_RSP Re-Sent
CPE Mac Addr:<Mac Addr>	MAX DSA RSP retries exceeded
CPE Mac Addr:<Mac Addr>	SBC RSP received
CPE Mac Addr:<Mac Addr>	REG RSP received
CPE Mac Addr:<Mac Addr>	DSA REQ received
CPE Mac Addr:<Mac Addr>	DSA ACK received
CPE Mac Addr:<Mac Addr>	DSC REQ received
CPE Mac Addr:<Mac Addr>	DSC ACK received
CPE Mac Addr:<Mac Addr>	DSD REQ received
CPE Mac Addr:<Mac Addr>	DSD RSP received
CPE Mac Addr:<Mac Addr>	SBC REQ queued
CPE Mac Addr:<Mac Addr>	REG REQ queued
CPE Mac Addr:<Mac Addr>	Establishing provisioned connection
CPE Mac Addr:<Mac Addr>	Wait for DSA, DSC, DSD Response Timer Expired
CPE Mac Addr:<Mac Addr>	Wait for Trasaction End Timer Expired
CPE Mac Addr:<Mac Addr>	Wait for DSA/DSC Acknowledge Timer Expired
CPE Mac Addr:<Mac Addr>	Wait for Registration Response Timer Expired
CPE Mac Addr:<Mac Addr>	Wait for registration response Timer expited
CPE Mac Addr:<Mac Addr>	Wait for SBC-RSP Timer Expired
CPE Mac Addr:<Mac Addr>	Wait for SBC-RSP Timer Expired

C

Cables, Spares and Accessories

This appendix provides complete Subscriber Station products, accessories and cable details for various PacketMax installation requirements.

PacketMax Subscriber Station ODU, cables, spares and their Part numbers are listed in Table C-1 to Table C-3.

C.1 PacketMax 100/300 CPEs, Cables and Spares

☞ NOTE: The last two digits in the CPEs part number "-XX" specifies the power cord option where XX is equal to: :
    01 = North AM Pwr Cord Option
    02 = EU(FR,DE,PL)Pwr Cord Option
    03 = EU(CL,IT)Pwr Cord Option
    04 = EU(UK,IE)Pwr Cord Option
    05 = AUST Pwr Cord Option
    06 = South Africa and India Pwr Cord Option
  All PacketWave CPE's are AC powered.

3.1.1 PacketMax 100/300 CPEs

Table C-1   PacketMax 100/300 Subscriber Stations ODUs

PacketMax	Part Number	Product Description
PM 100	PM100-35-A-0X	Consumer Subscriber Unit with 3.5GHz Transceiver, integrated antenna
	PM100-35-N-0X	Consumer Subscriber Unit with connectorized 3.5GHz Transceiver
PM 300	PM300-35-A-0X	Consumer Subscriber Unit with 3.5GHz Transceiver, integrated antenna
	PM300-35-N-0X	Consumer Subscriber Unit with connectorized 3.5GHz Transceiver

3.1.2 PacketMax 100 Cables

Aperto recommends these cables to ensure IP67 weather protection for PM100 and PM300 series

Table C-2   PacketMax 100 Weather Proof Ethernet Cable

Part Number	Product Description
IP67 Weather Proof, UV protected 50ft Ethernet Cable	PM-IP67-CABLE-50
IP67 Weather Proof, UV protected 100ft Ethernet Cable	PM-IP67-CABLE-100 AND PM-IP67-CABLE-300
IP67 Weather Proof, UV protected 250ft Ethernet Cable	PM-IP67-CABLE-250

3.1.3 PacketMAX Subscriber Station Spares and Surge Protector

Table C-3   *Cable Specs*

Part Number	Product Description
Spare Pole Mounting Kit for PM100 and PM300 CPE	PM100/300-POLEMOUNT

C.2 Rubber Boot

As mentioned in the Installation chapter, Aperto recommends industrial CAT 5e cable which meets the ANSI/TIA/EIA 568B.2 Category 5eStandard. In the event that the above mentioned cable is not available, you must use the included rubber boot, and use only Industrial CAT5e cable which meets or exceeds ANSI/IIS/EIA 568B.2 Category 5e standards that do not exceed 7.8 mm 0D. Product warranties will be void if these specifications are not met. Figure C-1 displays the parts of the rubber boot in an assembly, while Table C-4 lists the name and description of the parts,

The procedure for installing the rubber boot is:

1. As shown in Figure C-1, slide the Sealing Nut (8), Seals (7), Clams Ring (6), Gasket (5), Screw Nut (4) and Body (3) in to the CAT 5e cable.

2. Strip the cable and crimp in to the Plug (ethernet connector, 2) after attaching the Gasket (1) to the Body (3).

3. Plug the ethernet connector (2) and then turn the Screw Nut (4) to tighten.
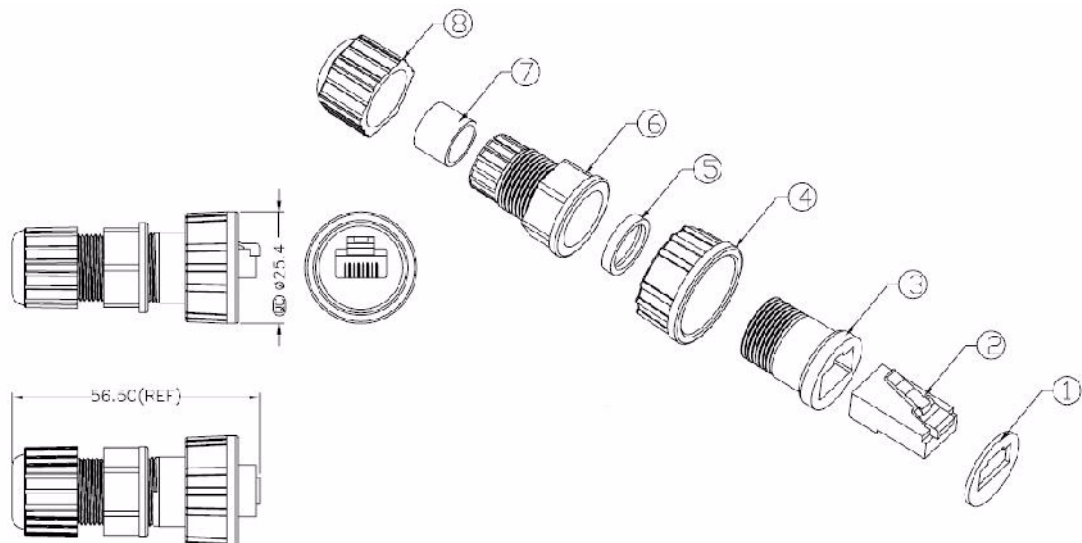
Figure C-1   Rubber boot for CAT5 Cable

Table C-4   Rubber Boot parts

No. QTY	Name	Color	Specification	QTY
8	Sealing Nut	Black	Nylon	1
7	Seals	Black	EPDM	1
6	Clams Ring	Black	Nylon	1
5	Gasket	Black	EPDM	1
4	Screw Nut	Black	Nylon +GF	1
3	Body	Black	PC+ABS	1
2	Plug		8P8C	1
1	Gasket	Black	EPDM	1

D

Command Line Interface (CLI)

Each Subscriber Station includes a simple command line interface (CLI) accessible via telnet. The CLI is intended primarily for troubleshooting and debug use under direction of Aperto personnel.

☞   NOTE: *CLI is not a supported management interface.*

D.1 Accessing and Using the CLI

To access and use the Subscriber Unit's command line interface:

1. Telnet to the Subscriber Unit's IP address.

2. At the **Login:** prompt, enter the desired logon level: **ISP**. (There is also a **Debug** logon level, which is reserved for Aperto use.)

    ☞   NOTE: *All CLI entries, including user name and password, are case-sensitive.*

3. At the **Password:** prompt, enter the correct password for the specified logon level.

    ☞   NOTE: *The default password is* **isp**. *Passwords can be changed via the WaveCenter Configuration Manager, SNMP, and the CLI.*

4. When the **CLI#** prompt appears, you are in the CLI.

    a. For a list of commands, type **?** (the **?** will not appear on the screen; pressing **[Enter]** is not necessary). The CLI will respond with a list of the available commands groups.

    b. To see the specific commands in a group, type the group name followed by **?** (again, the **?** will not appear, and pressing **[Enter]** is not necessary).

ipx

c. To display information about the use of a specific commands, including command parameters, enter the command followed by **?**.

5. When you are finished with the CLI, end the Telnet session by entering the **logout** command or simply closing the Telnet application.

4.1.1 Commands

Some Subscriber Unit CLI commands are defined in Table D-1. All commands are case-sensitive. Please refer to the Command Line Interface Reference Manual Rev B, for further CLI details.

4.1.2 Error Messages

Error messages which may be returned by the Subscriber Unit CLI include the following:

❖ **Error: Bad Command** — command has been entered incorrectly.

❖ **Error: Invalid Parameter** — command has been entered incorrectly.

❖ **Verification failed: Invalid use/current password** — when setting a password, user-name or password entries do not match.

Table D-1   Subscriber Unit CLI Commands

Command	Function
killTelnet	Causes the CLI to terminate all current Telnet sessions connected at port 5000.
reboot	Reboots the Subscriber Unit.
config dhcp params	Configures dhcp params
config vlan params	Sets vlan parameters.
config password	These commands set passwords for any login CLI prompts for old and new password.
show dhcp params	Shows the DHCP parameters, including IP address, subnet mask, and gateway, TFTP servers, and config file name.
show device running config file	Generates the Subscriber Unit's configuration file in text format. File is stored in /ram0 directory.
show frequency params	Displays frequency of SS.
show vlan params	Does not apply to Subscriber Unit.
show config vlan	Shows the management VLAN parameters.
show system	Displays system parameters, for e.g.:, location, memory-info and ss-model, etc.
show wimax status	Displays some status parameters, for e.g:, currentTXpower, Ds-modulation and tffso-free-bytes, etc.

E

Virtual Local Area Network

This chapter provides the Virtual Local Area Network connection on Subscriber Station, it use and examples of user scenarios.

This chapter covers the following topics:

- ♦ Bridge and VLAN Mode
- ♦ Out of band Management with Management VLAN
- ♦ Inband Management with Management VLAN
- ♦ VLAN Classifiers
- ♦ VLAN Application Example
- ♦ Looping Prevention
- ♦ Subscriber Station scenarios

E.1 Bridge and VLAN Mode

PacketMax products may be deployed in following modes of operation:

❖ Bridge Mode: In the bridge mode, data and management traffic is forwarded.

❖ VLAN Mode: Virtual Local Area Networks (VLANs) is a method that allows network administrators to create logical broadcast domains, which implies division of local area network by software rather than using cables. The broadcast domains can span across one switch or multiple switches. Thus VLANs:

- Reduces the size of broadcast domains

- Reduces network traffic

- Increases Network security

- Reduces the need to create subnetworks

- Enables network to be logically separated and not physically.

For the Data Traffic in the VLAN Mode, the VLAN IDs are configured when provisioning SS using EMS.

E.2 Out of band Management with Management VLAN

Outbound Management traffic adds security, when the management VLAN is enabled. The outbound management is tagged with this VLAN ID. Both BS and SSs should use same VLAN ID as Management VLAN ID. For example, if VLAN ID number is 1 on BS, it has to be the same (VLAN ID 1) on SS as well. The management VLAN ID needs to be set:

❖ On the PM5000 BS, manually.

NOTE: Changing Management Port in VLAN requires MSC reboot.

❖ On the SS, using the Installation Manager.

Please refer to Chapter 6 "Commissioning the Base Station", for setting up Management VLAN ID on the BS and refer to the PacketMax 100/300 User Manual for setting up the Management VLAN ID on the SS.

Typically management port is used for sending/receiving management traffic (Ping/TFTP/DHCP packets from/to BS or SS). Figure E-1 displays DHCP/TFTP over management port (a management interface set-up).
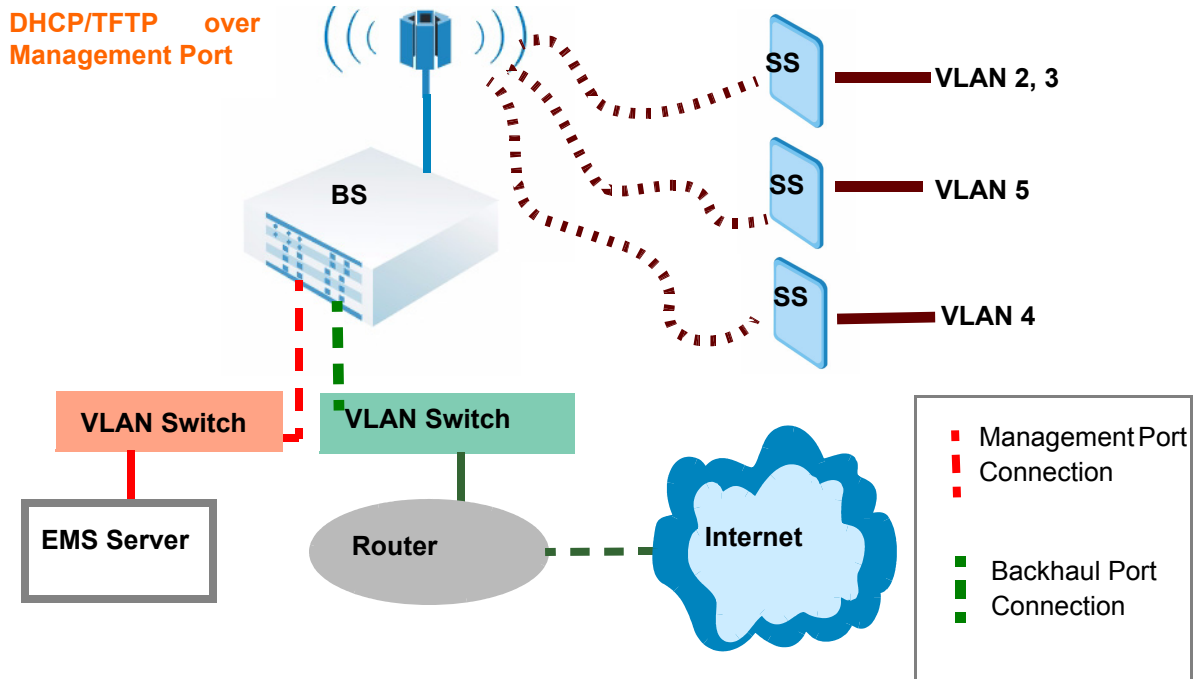
Figure E-1   Out of band Management

E.3 Inband Management with Management VLAN

The date/traffic are segmented by traffic VLANs and is implemented by the backhaul ports (**Inband management**). This VLAN carries inbound traffic.

The Backhaul Interface can be either Fast Ethernet or Gigabit interfaces. Backhaul port could be used for sending/receiving data traffic. Figure E-2 displays DHCP/TFTP over backhaul port (a backhaul interface set-up).
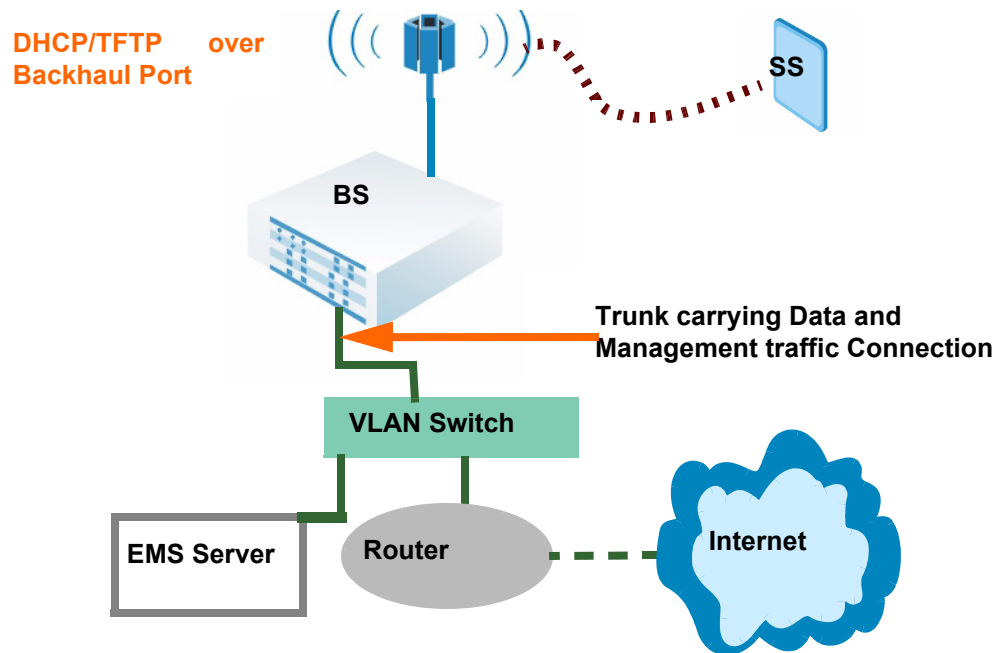
Figure E-2   Inband Management

It is recommended to connect EMS server and Base station unit in the same VLAN, for the ease of management and quick troubleshooting incase of any failures.

E.4 VLAN Classifiers

The VLAN switch identifies traffic corresponding to each LAN interface by attaching a VLAN tag to the Ethernet frame as the traffic is switched to its WAN interface. The Ethernet switch provides isolation of one customer LAN traffic from another customers. As each customer's traffic can be identified with a VLAN ID, it can be mapped onto an individual Service Flow enabling individualized QoS on a per customer basis.

A VLAN Classifier is a set of rules that determine how the PM 100/PM 300 assigns a VLAN ID and priority to a packet based on a wide range of packet parameters such as:

❖ Source or destination IP address(es).

❖ Source or destination MAC address(es).

❖ IP TOS.

❖ TCP/UDP Port numbers.

NOTE: VLAN classifiers are applied only when the unit is configured with them enabled. This is configured in EMS, and is described in the WaveCenter EMS User manual.

NOTE: IP addresses used for VLAN classifiers do not warn the user when the resulting address is the broadcast or network address.

E.5 VLAN Application Example

An example (Figure E-3)using the Point-to-Multipoint PacketMax 5000 Product with two SSs (Subscriber Station) and a Cisco 2950 Series VLAN switch is described in this section.

❖ The Base Station Backhaul Fast Ethernet Port is Trunked, via the MSC (Main System Controller), to the Cisco 2950 Series VLAN Switch.

❖ Two ports on Cisco VLAN Switch are configured in Access mode to tag all incoming packets. The first port is configured with VLAN ID 101 and the second VLAN ID 102; these ports are used to connect non VLAN enable devices.

❖ Two PacketMax SSs are configured in VLAN mode to tag all incoming packets. One SS is configured to tag all incoming packets with ID 101 and the other with ID 102.

❖ The PacketMax products (MSC and SS) are configured to be managed using VLAN ID 100. Hence, another Port on the VLAN switch is configured to tag all packets coming from the EMS Server with VLAN ID 100 to the Base Station Management interface on the MSC.
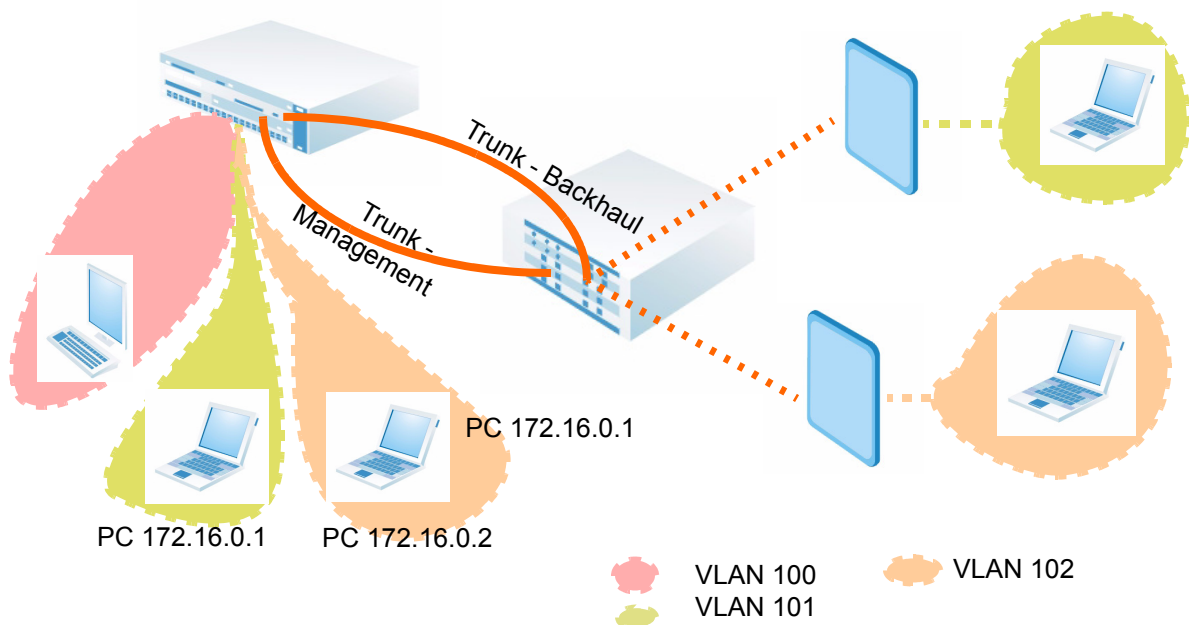

PC 172.16.0.1

PC 172.16.0.1   PC 172.16.0.2

VLAN 100
VLAN 101

VLAN 102

Figure E-3   VLAN Application

E.6 Looping Prevention

The communication between SS and PM 5000 and the communication between SS and EMS server occurs over the management VLAN. The management traffic destined to EMS server from SS is sent out only on management port of PM5000 and it will not be sent out of backhaul port.

Also, if backhaul port receives any management traffic, it will drop it. Hence, if you try to ping PM5000 (which is in VLAN Mode) using management VLAN ID through backhaul, it will not work. Ping will work if it is tagged with appropriate management VLAN ID and it is sent through management port.

> NOTE: Base Station Unit and Subscriber Stations need to be configured in the VLAN Mode to avoid any configuration issues. It is not recommended to run the base station in the Bridge Mode and Subscriber station in the VLAN Mode. However, this combination might work but we do not guarantee and Aperto does not support in this mode.

E.7 Subscriber Station scenarios

There are a few scenarios in which Base Station and Subscriber Station behave and this depends on the mode they are in. These scenarios are captured in the Table E-1:

Table E-1 *Subscriber Station behavior in different scenarios*

	Device	Mode	Management VLAN ID
Scenario 1	Base Station	Bridge	Should not be set
	Subscriber Station	Bridge	should not be set
	Device	**Mode**	**Management VLAN ID**
Scenario 2	Base Station	VLAN	Data is tagged, whether or not set
	Subscriber Station	VLAN	Data is tagged, whether or not set
	Device	**Mode**	**Data Traffic**
Scenario 3	Base Station	N/A	N/A
	Subscriber Station	VLAN	See Table E-2
	Device	**Mode**	**Network Management**
Scenario 4	Base Station	N/A	N/A
	Subscriber Station	VLAN	No Set-up. See Table E-3

Table E-1   *Subscriber Station behavior in different scenarios*

Scenario 5	Device	Mode	Network Management
	Base Station	N/A	N/A
	Subscriber Station	VLAN	Set-up. See Table E-4.

Table E-2   *VLAN behavior - Data traffic only*

VLAN Mode	Network Management (Set)	
	Allow-all	**Tag Only**
Set	Allowed	Allowed
Not Set [Default VLAN]	Allow	*N/A * This is not applicable as, for the Tag Only option, Default VLAN cannot be set in EMS.

Table E-3   Management traffic with no Network Management (NM) Set-up

VLAN Mode	Allow-all	Tag Only
Set	Drop	Drop
Not Set [Default VLAN]		

Table E-4   Management traffic with NM

VLAN ID	Allow-all	Tag Only
Set	Drop	Drop
Not Set [Default VLAN]		

5.7.1 Behavior of SS VLAN

The following tables have depicted a matrix of the behavior of SS VLAN particularly from LAN, under different cases:

Case 1 : When Network Management VLAN ID is equal to "0" and all Packets are allowed.

Case 2: When Network Management VLAN ID is not equal to "0" and all Packets are allowed.

Case 3: When Network Management is "0" and only Tagged Packets are allowed.

Case 4: When Network Management VLAN ID is not equal to "0" and only Tagged Packets are allowed.

Table E-5   *SS VLAN on LAN side for Packet Traffic*

S.No	FROM LAN	Case 1	Case 2	Case 3	Case 4
1	Tagged Packet (Configured VlanId)	Allowed	Allowed	Allowed	Allowed
2	Tagged Packet (Not Configured VlanId)	Dropped	Dropped	Dropped	Dropped
3	Tagged Packet (with NM VlanId)	Allowed (Untagged)	Dropped	Dropped (Untagged)	Dropped
4	Untagged Packet		Allowed		Dropped

Table E-6   *SS VLAN on LAN side for Ping*

S.No	FROM LAN	Case 1	Case 2	Case 3	Case 4
1	Ping Using NM VlanId	Dropped (Ping Reply is dropped at vlasnTkOutput of iProEth)	Dropped * (at vlanTkInput of iProEth)	Dropped * (at vlanTkInput of iProEth)	Dropped * (at vlanTkInput of iProEth)
2	Ping Using Untagged Packet		Dropped * (at vlanNmInput-function)		Dropped * (at vlanTkInput of iProEth)

☞   NOTE: "*" implies that Ping Request is dropped.

Table E-7   *SS BRIDGE on LAN side for Ping*

S.No	FROM LAN	Network Management = 0	Network Management is not "0"
1	Ping Using NM VlanId	Working	Working
2	Ping Using Untagged Packet		Dropped * (at vlanNmInputfunction)

F

Troubleshooting

F.1 Troubleshooting Issues and Tips

Please refer to the following table for symptoms and possible solutions for both the Subscriber Station and Base Station.

SYMPTOM/PROBLEM	WHAT IT MAY MEAN	WHAT TO DO
Subscriber Station		
Subscriber Station is having issues synching up with Base Station	Incorrect Frequency	Check AIM has the correct values for all these factors and if they are correct, then check the settings in WSS config file, under EMS.
	Incorrect Channel Width	
	Incorrect BS ID	
	BS wireless port is not operational	
	SS Indoor Unit (PoE) failed to detect the Outdoor Unit	Check if all the cabling is in place.
	The SS is out of range from the BS and is not able to receive any signal from the BS	Check the Base Station Radio connectivity.
SS is not receiving IP address from the EMS server.	The EMS Server may not have the correct reservation for the SS.	Check the MAC address which might be wrong.
	The EMS Server may be not operational.	Check the EMS server on the machine on which it was installed and confirm if the process is running.

SS cannot register all its service flow.	If the number of SSs registering exceeds the number of supported SSs configure in the BS.	Move the SS to another sector.
	If the SS's configuration file specifies a larger number of Classifiers.	Reduce number of Classifiers.
	The SS's configuration file specifies Service Flows for which the BS does not have any reserved bandwidth.	Install more capacity or move the SS to another sector.

F.2 Booting SS from network

Symptoms

SS does not come up during installation of AIM. This happens when the installation process in on the last screen of AIM, which has the CINR and RSSI graph. AIM reports that SS is not connected and you will see that your Ethernet link of PC is going up and down continuously. After that you cannot telnet to SS IP Address. There will be no long beep for ARM1 bootup.

Resolution

This usually happens because AIM tool tries to write the value of frequency and other parameters, that the user has configured, into NVRAM. While writing to NVRAM if there is some weak signal received, than ARM1 causes MPI error and that results in ARM0 also being rebooted. If ARM0 is in middle of writing parameters to NVRAM and ARM1 made ARM0 reboot itself, than NVRAM gets corrupted. Also the bootline on SS is corrupted and it falls back to default bootline, which is to boot from network. To restore bootline back to original values, follow the procedure as below:

1. Connect the Ethernet port of your laptop to the SS using a crossover cable.

2. Change the IP address of your Ethernet card to 192.168.2.55.

To achieve this, follow the instructions below :

a. Double click on the Network Connections icon in the control panel.

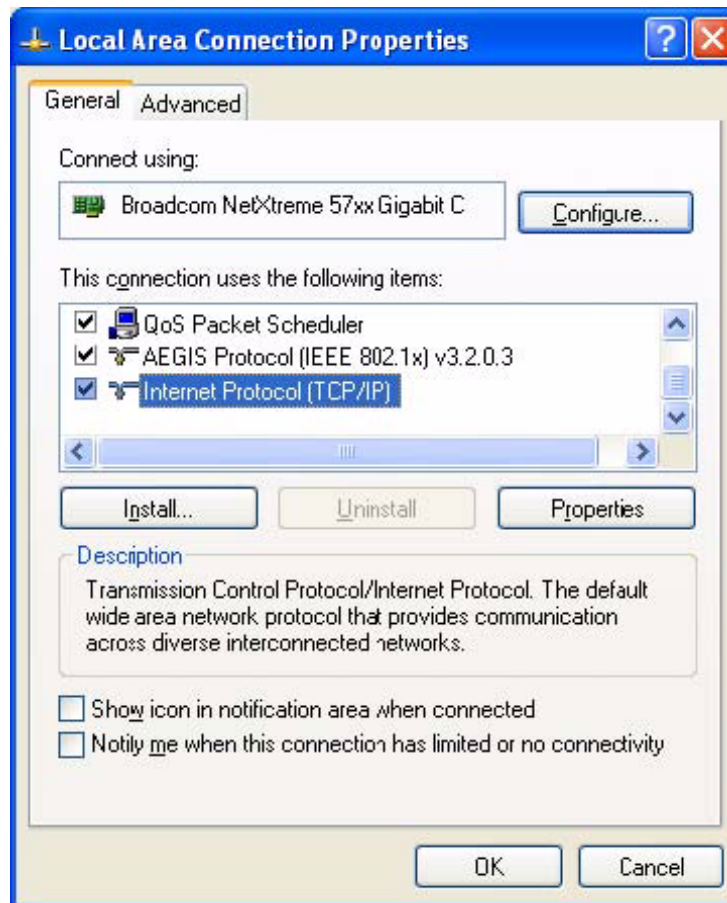b. Double click on Network card to which SS is connected and a screen as displayed in Figure F-1 appears.

Figure F-1   Network Connections Properties screen

c.   Select Internet Protocol (TCP/IP) and click on properties. Change the properties to value as in Figure F-2. Change the value of the TCP/IP properties as shown below
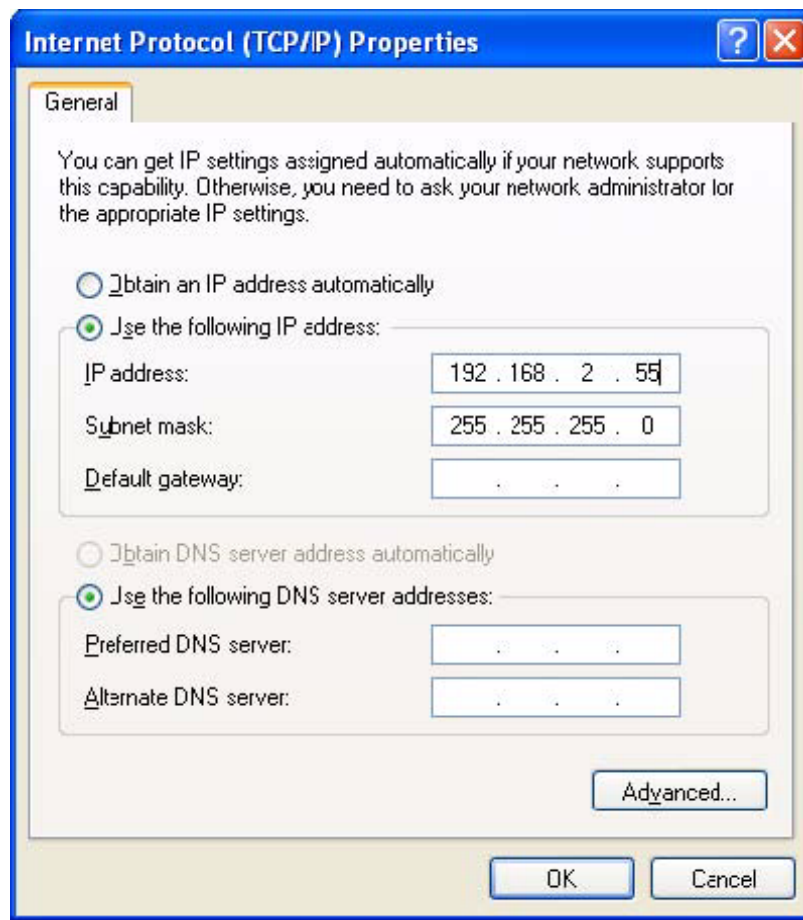
Figure F-2   IP settings page

d.   Copy the following files from build 72 to a temporary directory:

-   c:\temppm-100_upgrade\arm0_ss1_0_0.D

-   c:\temppm-100_upgrade\arm1_vxWorks.D

-   c:\temppm-100_upgrade\ arm1_bootrom.bin

e.   Start ftp server and create user called **vxuser** and password **vxuser** with home directory pointing to c:\temp. If you are using tornado's ftpd server start ftpserver by running wftpd32.exe.

f.   Select the Security menu item and than Users/rights and the sub menu under that. Create new user called vxuser with password of vxuser and home directory c:\temp (Figure F-3).

Figure F-3   Security dialog box

g. Power off the SS and start it again.

h. Now the SS boots up from your PC and you will hear the beep for ARM1 bootup.

i. Telnet to SS and change the boot parameters as below:

telnet <ss_ip_address> 5000

login:- isp

password:- isp

SS Main> bootChange

'.' = clear field; '-' = go to previous field; ^D = quit

boot device   : tffs=0,0

processor number   : 0

host name   : host

file name   : /tffs0/arm0_ss1_0_0.D

inet on ethernet (e) : 192.168.2.100:ffffff00

inet on backplane (b): 127.0.1.1:ffffff00

host inet (h)   : 192.168.2.55

gateway inet (g)   : 192.168.10.1

user (u)   : vxuser

ftp password (pw) (blank = use rsh): vxuser

flags (f)   : 0x2008

target name (tn)   :

startup script (s)   :

other (o)   :iProEth0

value = 0 = 0x0

SS Main>

j. Shutdown the ftp server on your laptop by closing the wsftp32.exe

k. Reboot SS by disconnecting the power supply to power brick and con-necting it back

l. Check if SS comes up on its own by doing a telnet to 192.168.2.100 on port 5000 by typing the following commands information on the dos prompt of your PC after you hear the long beep sound of ARM1 reboot.

- telnet 192.168.2.100 5000

- login:- isp

- password:- isp

m. If your telnet session lets you login you have successfully set the bootpa-rameters.

F

LIMITED EQUIPMENT WARRANTY ("Agreement")

G.1 WARRANTY COVERAGE

Aperto Networks, Inc. ("Aperto") warrants that this equipment ("**Product**") shall be free from physical defects in material and workmanship under normal use, is manufactured solely from new parts, and substantially conforms to published specifications for a period of one (1) year from the date of purchase (the *"Warranty Period"*). This Agreement only applies to end customers who purchase the Product directly from Aperto or from an Aperto authorized reseller (*"End Customers"*).   End Customers that obtain this Product as part of a service from a third party service provider should contact the service provider for their respective warranty and repair policies.

If the Product proves defective during the Warranty Period, contact Aperto or the authorized Aperto reseller, as applicable, who is providing support for the Product. Be prepared to provide the Product model number, description and serial number along with a description of the problem. Please have proof of purchase and serial number available. In the event the problem can be corrected with a software update, you may be instructed to download the software from the Aperto ftp site.

No Product will be accepted for repair or replacement by Aperto or its authorized resellers without a Return Material Authorization ("**RMA")** number. End Customers must complete and submit an RMA request in order to obtain an RMA number. RMA request forms can be obtained by request to Aperto and also on Aperto's website at http://www.apertonet.com/support. Once the request is completed and submitted by the End Customer and validated by Aperto, Aperto will issue End Customer an RMA number by email. When returning a Product, mark the RMA number clearly on the outside of the package and include a copy of the

proof of purchase. End Customers are responsible for shipping and handling charges incurred in returning a Product to Aperto.

LIMITATIONS OF WARRANTY

The express warranties set forth in this Agreement will not apply to defects caused; (i) through no fault of Aperto during shipment to or from customer, (ii) by the use of software other than that provided with or installed in the Product, (iii) by the use or operation of the Product in an application or environment other than that intended or recommended by Aperto, (iv) by modifications, alterations, or repairs made to the Product by any party other than Aperto or Aperto's authorized repair partners, (v) by the Product being subjected to unusual physical, electrical, or environmental stress, or (vi) by failure of customer to comply with any of the return procedures specified in this Agreement.

WARRANTY DISCLAIMER

EXCEPT AS SET FORTH EXPRESSLY IN THIS DOCUMENT, APERTO MAKES NO WARRANTY OR REPRESENTATION, EXPRESSED, IMPLIED, OR STATUTORY, WITH RESPECT TO ITS PRODUCTS OR THE CONTENTS OR USE OF THIS DOCUMENTATION AND ANY ACCOMPANYING SOFTWARE. WITHOUT LIMITATION, APERTO DISCLAIMS ALL IMPLIED WARRANTIES, INCLUDING IMPLIED WARRANTIES OF QUALITY, PERFORMANCE, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE. APERTO RESERVES THE RIGHT TO REVISE OR UPDATE ITS' PRODUCTS, SOFTWARE, AND DOCUMENTATION WITHOUT OBLIGATION TO NOTIFY ANY INDIVIDUAL OR ENTITY.

7.1.1 REMEDIES

Subject to End Customer's compliance with Aperto's return policies and subject also to the limitations of Aperto's warranty as described above, Aperto will repair or replace any defective Product during the Warranty Period. Once repaired or replaced, Aperto will pay for return shipment back to End Customer. In case of replacement, the replacement Product need not be new or of an identical make, model or part; Aperto may at its discretion replace the defective Product or any part thereof with any recon-ditioned product that Aperto reasonably determines is substantially equivalent or superior in all material respects to the defective Product. Aperto warrants any replaced or repaired Product or part for ninety (90) days from shipment or the remain-der of the initial Warranty Period whichever period is longer. Aperto does not provide refunds for its Products. End Customer's sole and exclusive remedy and Aperto' sole and exclusive liability during the Warranty Period shall be the repair or replacement of the defective Product at no charge. THESE EXCLUSIVE REMEDIES SHALL NOT BE EXPANDED TO INCLUDE ANY OTHER REMEDIES, EVEN IF THE REMEDIES PROVIDED HEREIN FAIL OF THEIR ESSENTIAL PURPOSE.

G.2 LIMITED LIABILITY

TO THE FULL EXTENT ALLOWED BY LAW, APERTO EXCLUDES, AND END CUS-TOMER ACCEPTS THE EXCLUSION OF, ANY LIABILITY, WHETHER BASED IN CONTRACT, TORT (INCLUDING NEGLIGENCE OR ANY OTHER CAUSE OF ACTION), FOR ANY INCIDENTAL, CONSEQUENTIAL, INDIRECT, SPECIAL, OR PUNITIVE DAMAGES OF ANY KIND OR FOR LOSS OF REVENUE OR PROFITS, LOSS OF BUSINESS, LOSS OF INFORMATION OR DATA, OR OTHER FINANCIAL LOSS ARISING OUT OF OR IN CONNECTION WITH THE SALE, INSTALLATION, MAINTENANCE, USE, PERFORMANCE, FAILURE, OR INTERRUPTION OF ITS' PRODUCTS, ACCOMPANYING SOFTWARE, AND DOCUMENTATION, EVEN IF APERTO HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, AND LIMITS ITS LIABILITY TO REPAIR OR REPLACEMENT AT APERTO'S OPTION. APERTO FURTHER DISCLAIMS ALL LIABILITY FOR PERSONAL INJURY OR DEATH, OR PROPERTY DAMAGE ARISING FROM CUSTOMER'S NEGLIGENT USE OF THE PRODUCTS OR THEIR COMPONENTS, INCLUDING BUT NOT LIM-ITED TO CUSTOMER'S FAILURE TO PROPERLY INSTALL THE PRODUCTS OR THEIR COMPONENTS.

Please direct all inquiries regarding this warranty to Aperto at: rma@apertonet.com