



Quantum 1000 Base Station User Guide

Revision History

Rev No.	Issue Date	Summary of Change	Author
1.0	July 09	Initial Draft	Sajed Saeed
1.1	24 Jul 09	Significant Changes Added	Steven Chaganis



NOTICE

It is hoped that this document will be useful in understanding and using the PureWave System. Please note that the information provided herein is subject to change without notice.

Always refer to the current set of Release Notes for the most upto date information and a description of the current features as they relate to the PureWave system. These may be different to the information contained within this User Guide.



REGULATORY NOTICE

It is the intention of PureWave Networks to ensure that this equipment is tested to comply with the limits for a class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Shielded cables and I/O cords must be used for this equipment to comply with the relevant FCC regulations.

Changes or modifications not expressly approved in writing by PureWave Networks may void the user's authority to operate this equipment.

Note: This device must be professionally installed.



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WARRANTY STATEMENT

Hardware

PureWave Inc ("PureWave" or the "Company") warrants to the end-user ("Customer") that this hardware product will conform in all material respects to the specifications provided with the hardware and will be free from defects in workmanship and materials, under normal use and service, for a period of 365 days from the date of original shipment by PureWave.

PureWave's sole obligation under this limited warranty shall be, at PureWave's option, to repair the defective product or part, deliver to Customer an equivalent product or part to replace the defective item, or if neither of the two foregoing options is reasonably possible, refund to Customer the purchase price paid for the defective product. All products that are replaced will become the property of PureWave. Replacement products may be new or reconditioned. PureWave's obligations hereunder are conditioned upon the returned of affected articles in accordance with PureWave's Return Material Authorization (RMA) procedures.

Subject to the limitations and conditions herein and in the Supply Agreement, after Customer has completed the steps outlined below in Section 2, PureWave will evaluate each returned Product and will use reasonable commercial efforts to either, in its discretion, repair or replace products confirmed by PureWave as non-conforming that are covered under the warranty provided in the Supply Agreement. PureWave shall be responsible for shipping the repaired or replaced Product to Customer. PureWave will use reasonable commercial efforts to ship repaired or replacement Product within twenty (30) business days of its receipt, however, the allegedly non-conforming Product must be received by PureWave before any replacement unit will be shipped.

The above warranty will apply to any replaced or repaired product or part for 90 days from shipment, or the remainder of the initial warranty period, whichever is longer.

Software

PureWave warrants to the Customer that for a period of ninety (90) days from your receipt of the Product (the "Warranty Period") the Software will perform substantially in accordance with the Documentation. If the Software fails to comply with the warranty set forth above, your exclusive remedy will be, at the option of PureWave (i) a reasonable effort by PureWave to make the Software perform substantially in accordance with the Documentation, or (ii) return of the purchase price. This limited warranty applies only if you return all copies of the Product, together with proof of purchase, to PureWave during the Warranty Period.

This limited warranty is VOID if failure of the Software is due to modification of the Software not made by PureWave, or the abuse or misapplication of the Software. PureWave does not warrant that the Software is error free, that the Customer will be able to operate the Software without problems or interruptions or that the Software or any equipment, system or network on which the Software is used will be free of vulnerability to intrusion or attack.



Additional Conditions

Notwithstanding anything else herein or otherwise, PureWave reserves the right to establish amendments to this RMA Policy from time to time. Further, PureWave Technical Support may prefer to troubleshoot the wireless link with an onsite Customer technician while the Products are in their original non-conforming state. This process might assist Customer in understanding and troubleshooting the issue. If PureWave was not afforded the opportunity to troubleshoot an allegedly non-conforming Product in original non-conforming state, PureWave may approve or reject the RMA request in its sole discretion, and such Products are not eligible for advance replacement.

No Fault Found

Notwithstanding Sections 2 and 3 above, if PureWave cannot duplicate any alleged non-conformity, the Product will be returned to the Customer, at Customer's expense, as "No Fault Found." PureWave reserves the right to charge a testing fee in addition to all shipping costs incurred by PureWave in connection with a returned product that PureWave determines as "No Fault Found," and any such payment must be received by PureWave prior to return shipment of the applicable Product to Customer.

Warranty Limitations

PureWave's warranties do not apply to any product (hardware or software) which has (a) been subjected to abuse, misuse, neglect, accident, or mishandling, (b) been opened, repaired, modified, or altered by anyone other than PureWave, (c) been used for or subjected to applications, environments, or physical or electrical stress or conditions other than as intended and recommended by PureWave, (d) been improperly stored, transported, installed, or used, or (e) had its serial number or other identification markings altered or removed.

Warranty Disclaimer

PUREWAVE'S SPECIFIC WARRANTIES SUMMARIZED ABOVE ARE THE ONLY WARRANTIES GIVEN BY PUREWAVE WITH RESPECT TO ITS PRODUCTS (HARDWARE AND SOFTWARE) AND ARE GIVEN IN LIEU OF ANY AND ALL OTHER WARRANTIES, WHETHER EXPRESS, IMPLIED, STATUTORY, OR ARISING BY CUSTOM, TRADE USAGE, OR COURSE OF DEALING, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, AND PUREWAVE DISCLAIMS ANY AND ALL OTHER WARRANTIES TO THE MAXIMUM EXTENT PERMITTED BY LAW. Without limiting the generality of the foregoing sentence, PureWave makes no warranty or representation, either expressed or implied, as to, and disclaims all liability and responsibility for, (a) the operation, compliance, labeling, or packaging of any of its products under the laws of any jurisdiction outside of the United States of America and (b) the regulatory compliance of any products in any jurisdiction in which it has not specifically identified compliance or the use of any product in any jurisdiction in any manner other than as contemplated in the regulatory certifications and approvals for that product in that jurisdiction. To the extent an implied warranty cannot be excluded, such warranty is limited in duration to the warranty period. The disclaimer and exclusion applies even if the express warranty fails of its essential purpose.

OBTAINING WARRANTY SERVICE

RMA Number

Customer must contact the Company, by sending an e-mail to rma@pwnets.com to obtain warranty service authorization. When contacting PureWave for support, please be prepared to provide the product description and serial number and a description of the problem. The Customer will be expected to complete a "Return Material Authorization (RMA)" form to initiate the request. Full instructions as to how to complete and where to send the form are provided on the form. Date of proof of purchase from PureWave will be required.



Products returned to PureWave Inc must be pre-authorized by PureWave with a Return Material Authorization (RMA) number and sent prepaid and packaged appropriately for safe shipment. The Customer requesting the RMA will be the exporter. The exporter is responsible to ship RMA equipment to PureWave's address and has to bear the cost and risk involved in bringing the goods to PureWave's location.

Risk of loss in return shipment will be borne by Customer, and it is recommended that returned goods be insured and/or sent by a method that provides for tracking of the package. Responsibility for loss or damage does not transfer to PureWave until the returned item is received by PureWave. Provided that PureWave determines that the item is actually defective, the repaired or replaced item will be shipped to Customer, at PureWave's expense, (1) not later than thirty (30) days after PureWave receives the defective product or (2) to the terms of a separate written agreement with PureWave.

If the allegedly non-conforming Product is not received by PureWave within thirty (30) days of Customer initiating the RMA request, the RMA process for that Product will be deemed cancelled.

RMA Status

Customer may also obtain the status of its RMA request by sending an e-mail to rma@pwnets.com and referencing Customer's assigned RMA Number.

Customer Obligations

No product will be accepted for repair or replacement by PureWave without a RMA number. The product must be returned to PureWave, properly packaged to prevent damage, shipping and handling charges prepaid, with *the RMA number prominently displayed on the outside of the container*. If PureWave determines that a returned product is not defective or is not covered by the terms of the warranty, the Customer will be charged a service charge and return shipping charges

Out of Box Failure (OBF) / Dead on Arrival (DOA)

In the event a product becomes entirely inoperable within the first forty-eight (48) hours of the initial installation of the product, and such installation takes place within ninety (90) days after the date of shipment from PureWave, upon verification of the condition by PureWave, it will be considered as an "Out Box Failure (OBF) or "Dead on Arrival (DOA). A replacement shall be provided by advance replacement.

The replacement product will be shipped within five (5) business days after PureWave's verification of the DOA product, subject to availability and other shipping restrictions. The shipment of advance replacement products is subject to local legal requirements and may not be available in all locations.

When an advance replacement is provided and Customer fails to return the original product to PureWave within fifteen (15) days after shipment of the replacement, PureWave will charge the Customer for the replacement product, at list price.

Advance Replacement

In some unique situations, PureWave may consider, at its sole discretion on a case-by-case basis, an advance replacement for a non-conforming Product during its warranty period.

The following conditions apply to advance replacements:

- (i) PureWave has a suitable "equivalent" replacement unit available
- (ii) Customer's network is experiencing a severe degradation or a complete outage.
- (iii) Customer has complied with the RMA procedures provided herein



- (iv) Customer pays for all over-night shipping and handling charges for shipments to and from PureWave and provides a credit card number and signed credit card authorization form to secure the transaction (or, upon PureWave's approval, an Order may be used to secure the transaction and pay all associated charges)
- (v) When an advance replacement is provided and Customer fails to return the original product to PureWave within fifteen (15) days after shipment of the replacement, PureWave will charge the Customer for the replacement product, at list price.

PureWave will use reasonable commercial efforts to ship advance replacement Products within five (5) business days after PureWave's confirmation that advance replacement is appropriate. PureWave shall not be responsible for shipping delays if any of conditions herein are not met.

Out of Warranty

Repair of products that are out of warranty will be subject to a repair fee. PureWave does offer extended warranties and enhanced service options for its direct and indirect customers who desire those enhanced features. Please contact a PureWave Customer Service Center either by telephone or via the Internet if you would like more information about these options

ASSISTANCE

For assistance, contact your nearest PureWave Networks Sales and Service office. Additional information is available on the PureWave Networks website at <http://www.pwnets.com>.

For Customer Service call: 650-528-5200, or Email: support@pwnets.com.

SAFETY PRECAUTIONS

When installing this equipment, observe the following precautions to minimize the danger of personnel injury:

Danger:

- NEVER install equipment if there is a chance of lightning or other adverse weather conditions.
- NEVER install in a wet location unless the equipment is specifically designed for wet locations.
- NEVER touch uninsulated wires or terminals unless the wire has been disconnected at the Network interface.
- ALWAYS use caution when installing or modifying cables.

ESD Warning:

- WARNING: Always assume that all components and assemblies are static sensitive and always follow local ESD-prevention guidelines to prevent equipment damage.

EXTERNAL POWER – SOURCE:

- WARNING: For any external power supply that provides the power source for the PureWave equipment, replace any power supply fuse with the same rating or equivalent, otherwise PureWave Networks will not be responsible for any subsequent damage to its equipment.
- Use normal caution when installing or modifying cables. Dangerous voltages may be present. It is also considered imprudent to install during a lightning storm.
- Always disconnect all lines and power connections before servicing or disassembling this equipment.
- For performance and safety reasons, only power supplies listed for use with telephone equipment by a Nationally Recognized Testing Laboratory (NRTL) should be used with equipment.
- Refer to the installation section of the appropriate instruction manual for the unit you are installing for:
 - Cabling information
 - Proper connections
 - Grounding information
- All wiring external to the product(s) should follow the provisions of the current edition of the National Electrical Code.

WARNING:

These units contain no user serviceable components. Only authorized Service Personnel should service or repair these units. "Use only isolated Class 2 Power Source, Rated 48V dc 5.0A Minimum."

TABLE OF CONTENTS

1. Introduction	10
1.1 Overview	10
1.2 System Components.....	11
1.3 Scope	12
2. Base Station	13
2.1 Overview	13
2.2 Hardware.....	14
2.3 MAC Software Architecture.....	15
2.4 Enclosure	16
2.5 External Connections.....	18
2.6 Power	20
2.7 GPS.....	23
2.8 Antenna	24
2.8.1 Antenna Mounting Kit.....	26
2.9 Ethernet.....	32
2.9.1 Weather Protection of the Ethernet Connector.....	34
3. Grounding and Lightning Requirements	38
3.1 Lightning Protection Installation Components.....	38
3.2 Lightning Rod	39
3.3 Down Conductor	40
3.4 Co-axial and/or Cat 5 Cable Shield Grounding.....	40
3.5 Grounding and Bonding	40
3.6 Recommended Connection of a Bonded Ground	40
3.7 Single Point Grounding Concept.....	41
3.8 Lightning and Surge Protection.....	42
4. Weather Protection	46
4.1 Weather Sealing.....	46
4.2 Anti-Seize	49
5. Base Station Bring-up.....	51
5.1 Overview	51
5.2 Connect to the Base Station	51
5.3 Configure the Base Station	52

1. Introduction

1.1 Overview

PureWave Networks develops carrier-class WiMAX 802.16e compliant Base Station equipment. PureWave's use of advanced multi-antenna technologies with software radio architecture enables delivery of quadruple-play services (voice, video, data, and mobility) that are competitive with DSL and Cable services. This equipment is the most spectrally-efficient, range-extending, wireless broadband metropolitan-area-networking equipment in its class available in the world today.

The PureWave solution consists of four major elements:

- PureWave Quantum 1000 Base Station Sector (BSS)
- Subscriber customer premises equipment (CPE)
- Quad Antenna panel
- Element management system (EMS).

The Architecture Reference Model is shown in figure 1. The Base Station Sector supports the wireless transfer of IP (Internet Protocol) packet data and communicates wirelessly to customer premise equipment (CPE) terminals. The interface to the ASN-GW (access service network gateway) adheres to IETF RFCs, and Ethernet standards. The Element Management System (EMS) supports operations, commissioning and network performance and characterization functions.

The Quantum 1000 Base Station provides standard WiMax smart antenna support:

- AAS processing (beam forming and null steering)
- AMC-like subchannel assignments

The system uses advanced technology to realize exceptional performance gains:

- Fast transmit/receive compensation necessary for channel reciprocity for mobility,
- Complexity-reducing algorithms that allow more than 2 antennas per sector,
- Processing algorithms that virtually eliminate interference instead of beam steering algorithms that provide limited benefits and do not scale to multi-cell deployments, and
- Flexibility to grow coverage by adding sectors in a compact and modular fashion.

A Quantum 1000 Base Station Sector provides 8 times the spectral efficiency and significant link gain relative to standard WiMax Wave-2 solutions.

The benefits are:

- High capacity deployments using fewer channels,
- Reduced or no cell planning,
- Fewer base stations are needed to cover a region, and
- Improved user performance.

The base station is highly modular. The key components are power units, Linux processing card, network processing cards, and RF modules for interfacing to available frequency bands. The Base Station connects to multiple single-antenna units or a multi-antenna radome.

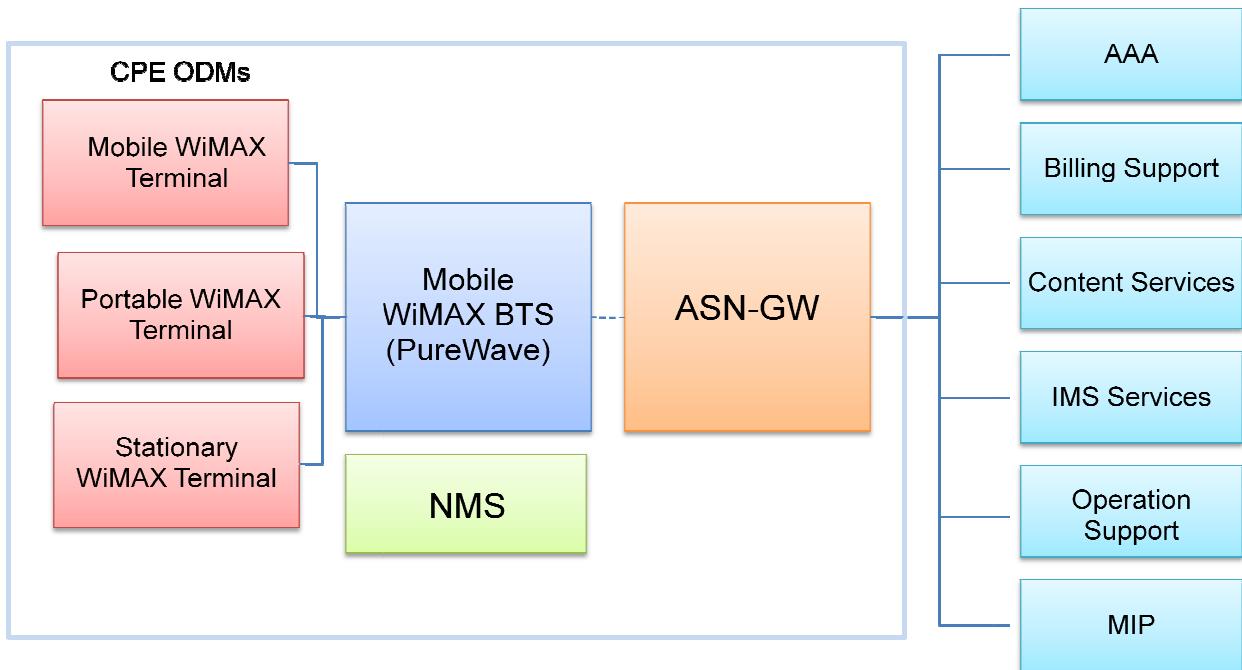


Figure 1 - Architecture Reference Model.

The base station is highly modular. The key components are power units, baseband processing cards, and RF modules for interfacing to available frequency bands. The Base Station Sector connects to multiple single-antenna units or a multi-antenna radome.

1.2 System Components

The PureWave System is composed of a Base Station Sector (which is itself connected to an antenna or antenna array) and subscriber stations (also known as customer premises equipment (CPE)), which connect to each other through an air interface (airlink) and to their respective networks (figure 2). Base Station connect to their customer or provider networks, also known as backhaul networks, via a provider interface, whereas CPE connect to their subscriber or user networks through a subscriber interface.

Base Station have hardware, software, and mechanical characteristics that support their functional and performance requirements. Base Station and CPEs interconnect with each other and their respective networks via sets of network, MAC, and PHY protocols.

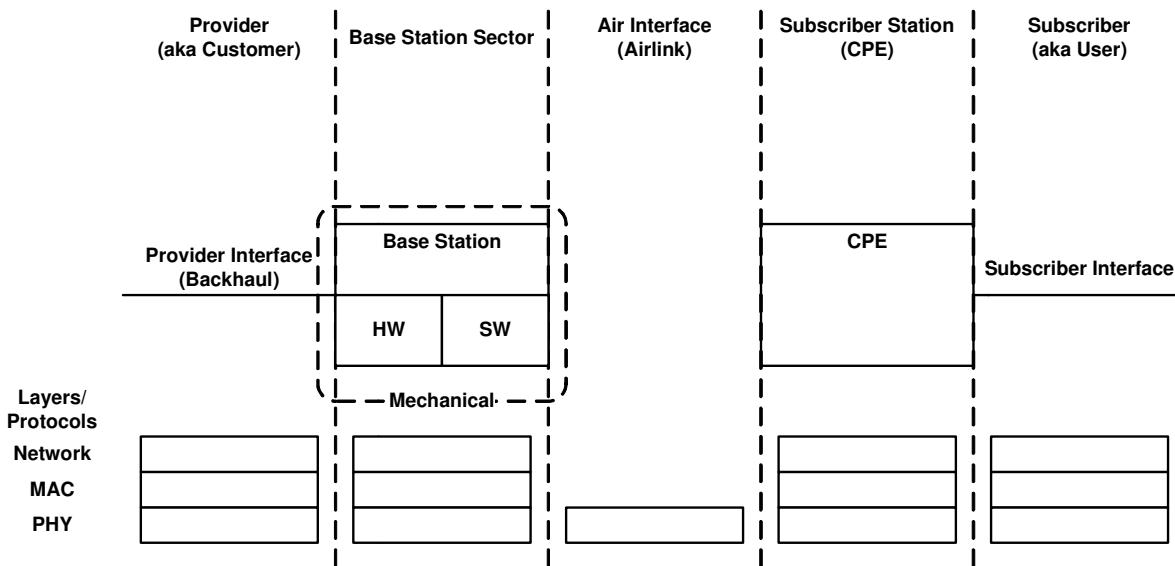


Figure 2 - General View of System Components

1.3 Scope

This document is intended to be used by wireless broadband installation engineers. It contains information needed to install and connect a Quantum 1000 Base Station and Antenna Assembly.

The Quantum 1000 Base Station Sector is designed to be “plug-and-play” direct from PureWave Networks; however, guidance is given as to how to assess general system integrity and operational readiness upon initial power-up.

2. Base Station

2.1 Overview

The Quantum 1000 employs an extremely flexible and versatile hardware architecture. The heart of the base station is a sophisticated and highly integrated ASIC that combines 6 DSP and general purpose processor cores along with specialized DSP hardware. A Linux-based subsystem supports applications, SNMP and other management functions. Finally, the Quantum 1000 includes 2 RF transmitters and associated PAs, and 4 RF receivers (refer to figure 3).

Important characteristics of the Quantum 1000 Base Station Sector are:

- Board-to-board communications for scaling up to 16 antennas.
- 10 MHz profile
- WiMAX OFDMA compliance
- All layers implemented in software.
- 2.3 – 2.7 GHz and 3.3 – 3.7 GHz operations.

PureWave has implemented a scalable architecture that lets service providers upgrade their Base Stations by:

- Adding more Base Station Sector to a location
- Adding antennas (and corresponding RF module sets) within a sector
- Adding processing capability in order to process traffic within additional spectrum
- Upgrading software to allow for changes in features and standards.

Figure 3 - Base Station Functional Components

2.2 Hardware

This section describes the hardware characteristics for a Quantum 1000 Base Station Sector. Figure 4 shows the block diagram for the Base Station digital section.

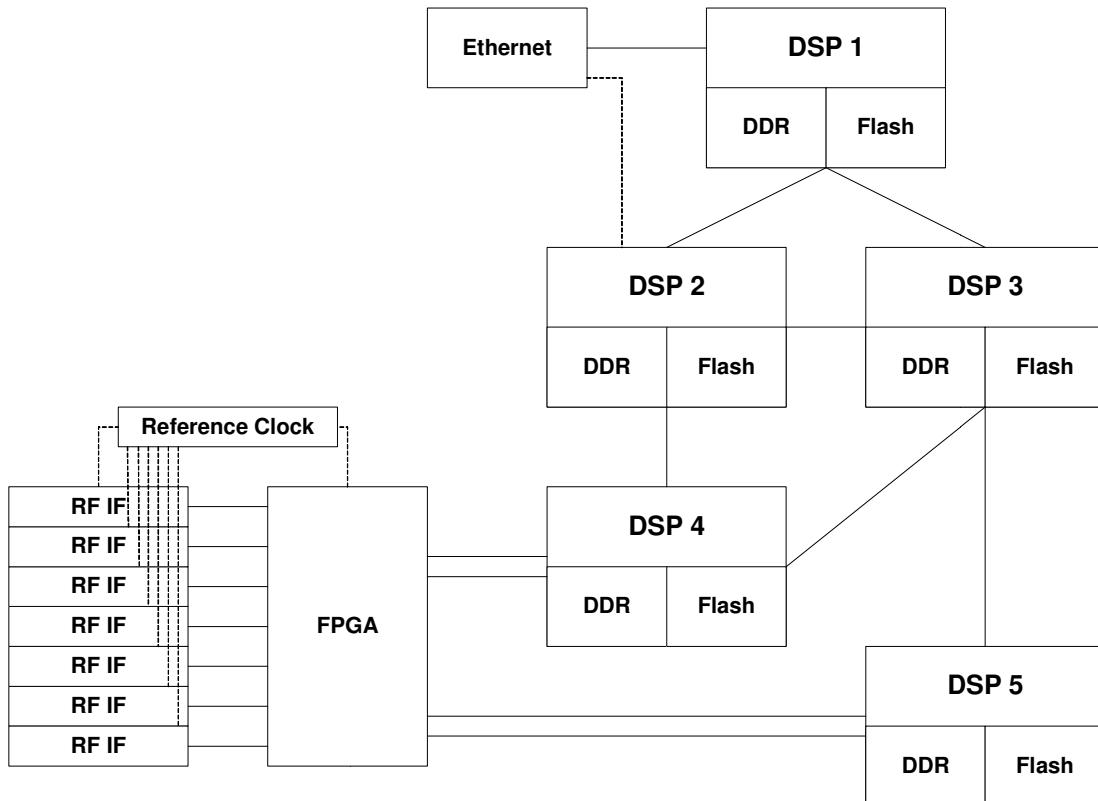


Figure 4 - Base Station Digital Block Diagram

2.3 MAC Software Architecture

This section describes the high level software characteristics for a Quantum 1000 Base Station. Figure 5 shows the block diagram for the Base Station software architecture.

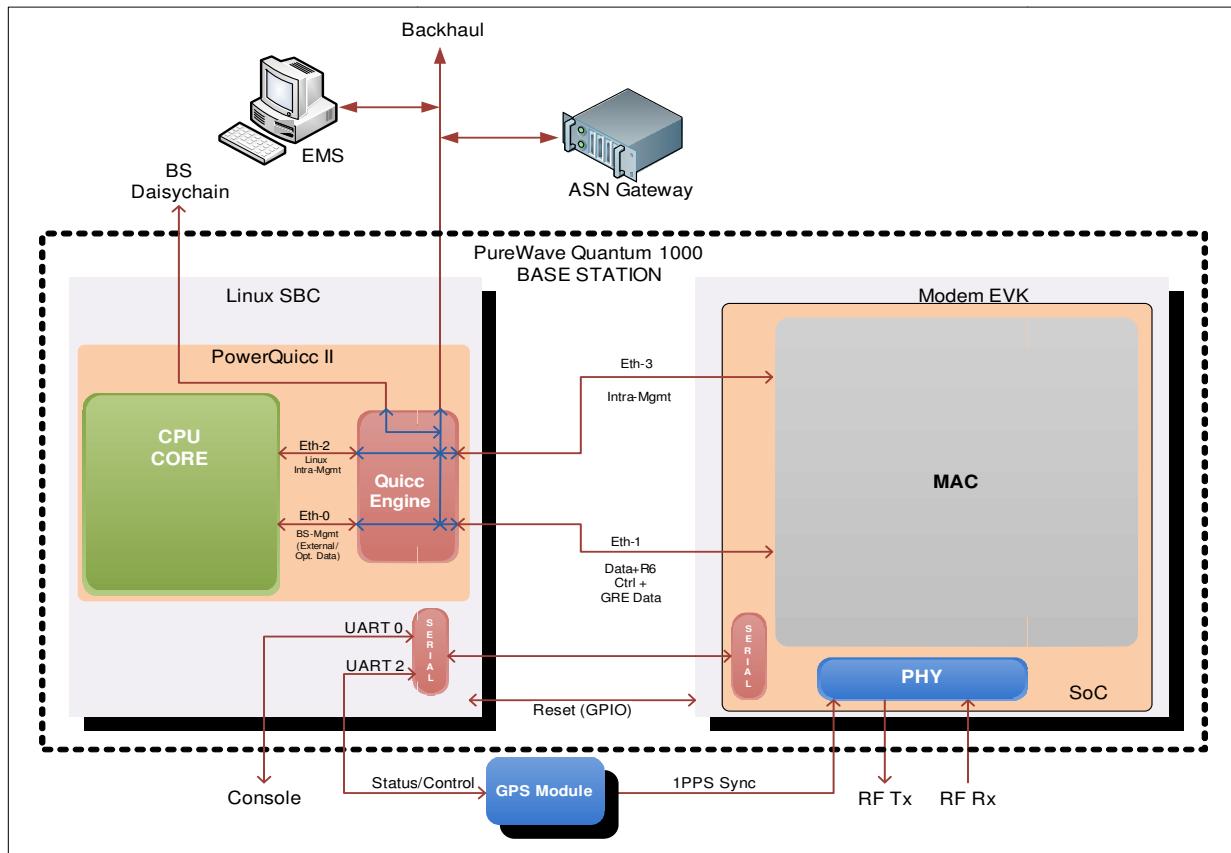


Figure 5 – High Level SW Architecture

The PureWave Quantum is an 802.16e WiMAX base station. It contains two major silicon devices, one comprising the Network and Management processor (sometimes referred to as “the PowerQuicc or “the Linux”), and the other comprising the baseband PHY and MAC processors. The Network Processor is the system Manager and the baseband SoC (sometimes called the “Modem” or the “Modem”) is essentially a high-powered signal processor. See Figure 3.

The Network Processor is based on a Freescale PowerQuicc II, which contains a standard PowerPC core plus a “Quicc” engine for packet processing. The PowerPC runs Linux and hosts many highly complex applications including an SNMP device management agent, multiple databases, web server, CLI, logging and other system services. The other SoC is a WiMAX baseband processor. It contains three ARM9 cores, four general Tensilica cores and a fifth tensilica-based DSP core. Together these perform network processing, MAC and PHY tasks. The ARMs run the ThreadX operating system; the other cores do not have a traditional RTOS.

The Network Processor connects to the external backhaul through a pair of gigabit Ethernet ports, and to the Modem through two 100/1000MB Gigabit Ethernet ports. These ports carry a mix of traffic and management/control messages. Various protocols carried over the two Ethernets link the applications, including TCP/IP, UDP and custom Ethernet frames.

2.4 Enclosure

The Quantum 1000 Base Station Sector is made up of a single, weather-resistant cabinet with the overall dimensions of: 24" W x 17" H x 5" D (figures 6 and 7). The unit has 4 mounting "ears", each one located near a corner of the rear of the enclosure. Each "ear" will accommodate a M10 bolt. The mounting holes are spaced 37cm apart (center-to-center), horizontally, and 44.3cm apart, vertically (figures 8 and 9).



Figure 6 – Quantum 1000 Base Station Sector



Figure 7 - Pole Mounted Quantum 1000 Base Station Sector



Figure 8 - Quantum 1000 Base Station Sector Rear View

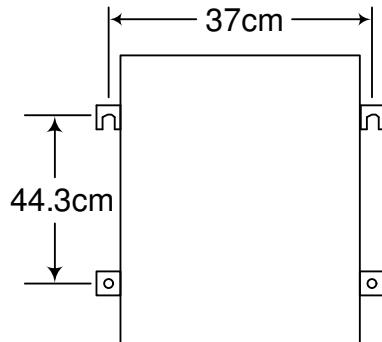


Figure 9 – Quantum 1000 Base Station Mounting Hole Pattern

The Base Station unit can be installed either as an entire outdoor unit (ODU) or as an entire indoor unit (IDU). The antenna must always be installed outdoors.

Note: It is recommended that the Base Station Enclosure is mounted upright such that the antenna N-type connectors face down towards the ground. Please ensure that there is adequate air flow around the Base Station heatsinks (refer to figure 8).

Table 1 lists the mechanical, electrical and environmental properties of Quantum 1000 Base Station:

Physical & Environmental	Specifications
Dimensions	24.6" (H) x 17.4" (W) x 4.5" (D)
Weight	23 pounds
Power	-48V DC, 65 Watts
Temperature	-33 to +55 degrees C
Humidity	5 to 95% non-condensing
Surge Protection	UL497B
Lightning Protection	10kA IEC 6100-4-5 (optional via external kit)
Weatherproofing	IP67

Table 1 – Physical and Environmental Properties

2.5 External Connections

There are basically 4 types of connections that need to be made to the Base Station unit (see figures 10 and 11).

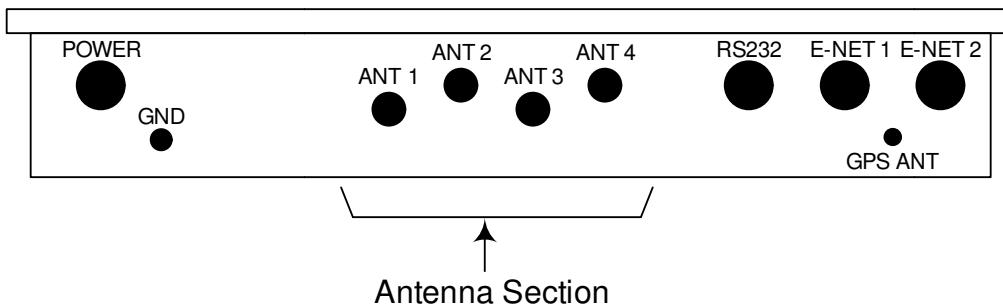


Figure 10 - Base Station Connections (Bottom View)



Figure 11 - Base Station Connected

Once the Base Station enclosure has been mounted, the following connections must be made.

- POWER: Provides the DC power source for the Base Station unit.
- GND: This provides a ground connection point for the Base Station. It is important to ensure that the Base Station is professionally grounded and complies with all local relevant grounding electrical codes.
- GPS ANT: This port provides the connection between the GPS antenna (external) and the GPS receiver module (internal). GPS is used by the Base Station Sector to synchronize its TDD gate to those of Base Stations in neighboring cells.
- ANT 1 – ANT 4: This is where the Base Station is physically connected to an antenna. The 4 antenna ports are described as:
 - ANT 1: This is a transmit (Tx) and a receive (Rx) port.
 - ANT 2: This is a transmit (Tx) and a receive (Rx) port.
 - ANT 3: This is a receive (Rx) port only.
 - ANT 4: This is a receive (Rx) port only.
- RS232: This is the serial interface to the Base Station. This interface will be primarily used for "out of the box" configuration and debug purposes when directed by PureWave Technical Support Engineers.
- E-NET 1: This Gigabit Ethernet port provides the data traffic backhaul interface that should be connected to the Service Provider's network equipment. This port allows in-band management of the Base Station.

- E-NET 2: This Gigabit Ethernet port provides an out-of-band management interface. In addition, this port can be used for daisy chaining to another base station or to connect to an external device such as a web Camera. The traffic coming from the daisy chain connector shall be aggregated and passed through the backhauling connector.

NOTE:

DO NOT POWER ON THE BASE STATION OR REMOVE THE BASE STATION POWER UNLESS THE TWO TRANSMITTING ANTENNA PORTS (ANT 1 AND ANT 2) ARE EITHER TERMINATED BY A SUITABLE RF LOAD OR AN ANTENNA. A FAILURE TO ENSURE THIS, AT ALL TIMES, COULD RESULT IN INTERNAL DAMAGE TO THE BASE STATION (FIGURE 12).



Figure 12 - Base Station Connected

Connect the two transmitting ports (ANT 1 and ANT 2) to the two outer most elements of the actual antenna thus ensuring that the transmission paths are as far apart as possible on the 4 available antenna ports.

It is also important that while the base station is operating at maximum power levels, the transmitting antenna ports remain terminated. Removal of the transmitter load while operating at high output powers is not recommended and may result in damage to the base station.

2.6 Power

The Base Station DC power requirements is such that the external DC source needs to be capable of delivering up to 4 Amps of current at -48 VDC. The Base Station nominally runs at approx 2 Amps at -48VDC. PureWave provides the power connector to the Base Station (Tyco P/N 796094-2) as part of the Installation kit (figure 13).

The "Tyco" power connector that is used on the Base Station will accommodate 14 to 18 gauge wire. Remember to take account of the voltage drop when running long power cable runs. For example, for 18 AWG, for a cable length of 100 feet, a nominal 48VDC supply delivering into a 2A load will lead to a voltage drop of 2.7 volts.

Please ensure that the DC power source is powered off and solder the -48 VDC wires to connector pins 1 and 2. Solder the 48 VDC Return wires to pins 3 and 4 (figures 14 to 16).



Figure 13 - Base Station Power Input Connector (Conxall P/N 4280-5PG-300)



Figure 14 - Base Station Power Input Connector



Figure 15 - Base Station Power Input Connector

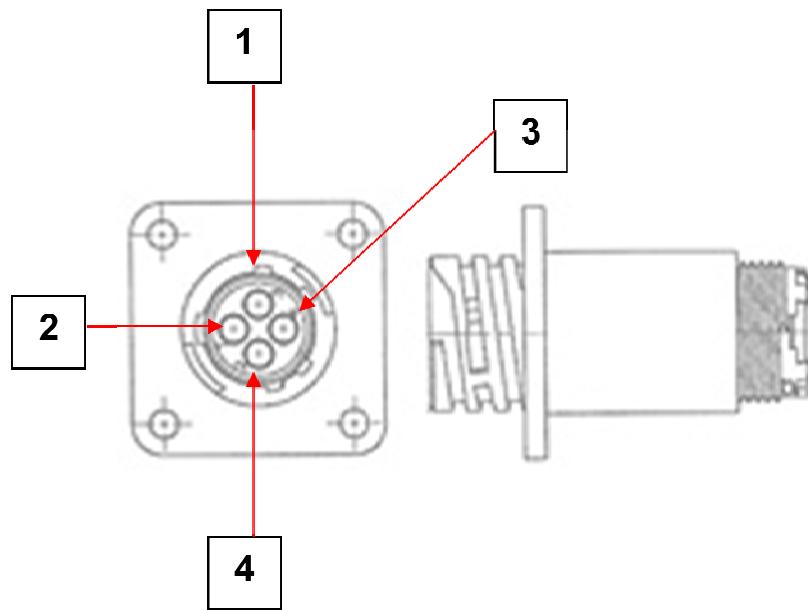


Figure 16 - Base Station Power Input Connector

The following table 2 indicates the connector pin-outs.

Pin #	Signal
1	-48V DC
2	-48V DC
3	48v DC Return
4	48v DC Return

Table 2 – Power Pin-out connections

Figure 17 is an expanded view of the connector onto which is attached the actual cable of wires.



Figure 17 - Base Station Power Input Cable Connector Expanded View

2.7 GPS

This port provides the connection between the GPS antenna (external) and the GPS receiver module (internal). GPS is used by the Base Station to synchronize its TDD gate to those of Base Stations in neighboring cells. Connect the coaxial cable from the external GPS antenna to the SMA-type female connector marked “GPS” on the bottom right corner of the Base Station unit (refer to figure 18). Typical GPS antennas are shown in figure 19.

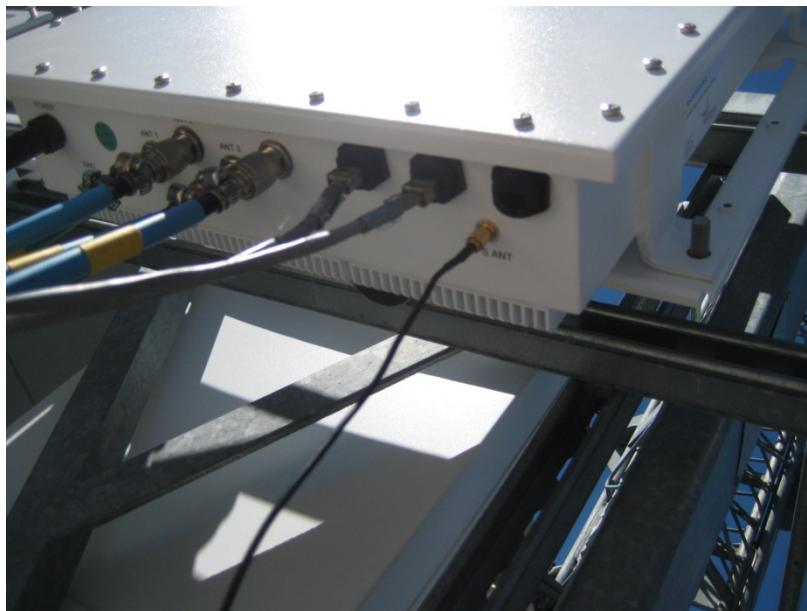


Figure 18 - Base Station Underside View of GPS Antenna Connection



Figure 19 - Typical Base Station Sector External GPS Antenna's

No software pre-configuration is required and all that is needed is to connect the Base Station to a GPS. When the Base Station detects that a 1 pps GPS signal is present then it will synchronize its TDD gate to the GPS and if it does not detect a 1 pps GPS signal then it will synchronize to its own internal source.

In the event that there are co-located multiple Base Stations, it is important to synchronize all the Base Station to a 1 pps GPS such that this will co-ordinate all Base Station to transmit and receive concurrently. This is especially important if neighboring Base Stations are set to operate on overlapping or identical frequency channels.

2.8 Antenna

A low-loss, coaxial cable has to be connected to each of the N-type female connectors located on the back of the antenna panel and the respective antenna port on the base of the Base Station Sector. The co-axial cable must be capable of propagating the relevant RF frequency and therefore it is recommended to use any high-performance, low-loss 400-series coaxial cable (i.e. Hyperlink Technologies P/N CA3N100 or Times Microwave LMR 400). The order of antenna connections is unimportant.

The important consideration is the length of the co-axial cable as this will affect the amount of signal loss and thus effective range of the system. In the case that the Base Station unit is installed outdoors and close to the antenna, then the co-axial cable runs can be kept short and thus loss is minimized. If the Base Station unit is installed indoors with long cable runs up the tower to the antennas then the amount of signal loss will need to be calculated to ensure that adequate range will still be achieved. As an example, a Times Microwave LMR400 cable has an attenuation loss of 6.8dB per 100 feet at a frequency of 2.5GHz.

For your information, the procedure to install co-axial connectors is provided in Appendix A.

Note: It is strongly recommended that appropriate lightning surge protection devices are installed (refer to section 3). Please ensure that appropriate weather protection is applied to all outdoor N-type coaxial connections.

One antenna panel is used for each Base Station. The antenna panel is populated with a number of directional patch-element strips. All elements are enclosed within a single radome and common, rear mounting plate. Access to each element (antenna) is provided by a dedicated N-type female coaxial RF connector. Thus, for a 4-element antenna panel configuration there are a total of 4 exposed RF connectors protruding from the rear mounting plate (refer to figures 20 and 21).

The specifications for the 2.5GHz and the 3.65GHz antenna's are detailed in Appendix A.



Figure 20 - Base Station Antenna



Figure 21 – Typical Antenna Deployment

The antenna panel will be mounted to a pole having an outer diameter (OD) between 1" and 4", via the provided mounting kit.

2.8.1 Antenna Mounting Kit

The procedure to install the antenna mounting kit is detailed below. It is recommended that that mounting kit is attached to the antenna prior to hoisting up the tower.

Figure 22 is an illustration of the components that are included in the antenna mounting kit.



Figure 22 – Antenna Mounting Kit

- 1) Lay down the antenna, designating which way is “up” (figure 23).

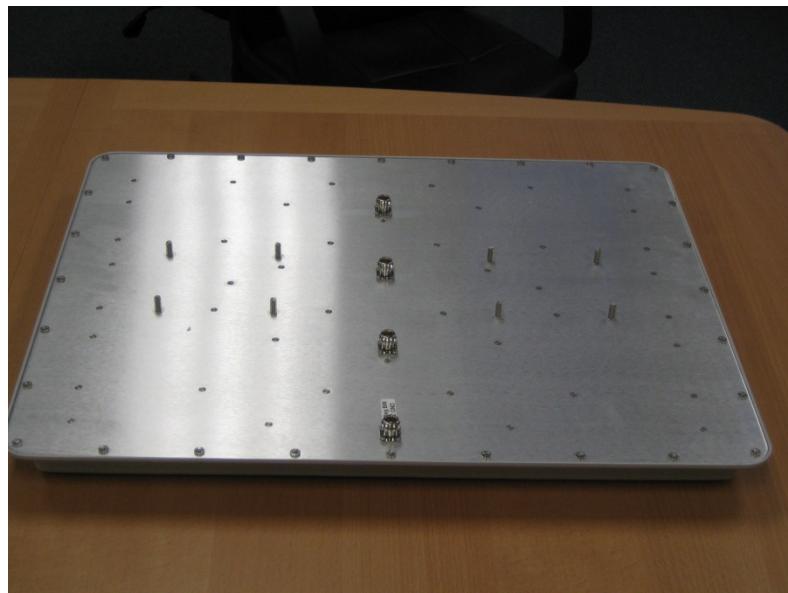


Figure 23 – Rear Antenna Face

- 2) Take the large U-bracket with the cut-out slot and insert over the 4 bolts (figure 24). Ensure that the slot is pointed towards the bottom of the antenna. This is to allow for the angular displacement.

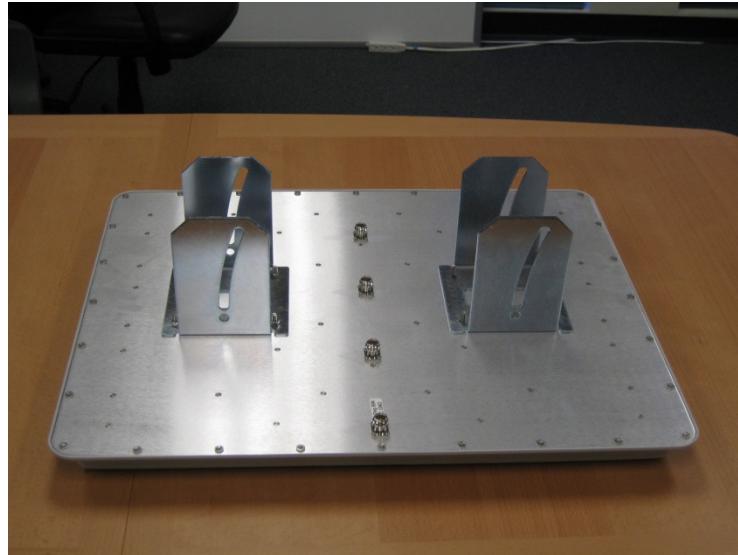


Figure 24 – Attached U-brackets

- 3) Tighten and secure the U-Brackets using the appropriate nut (figure 25)

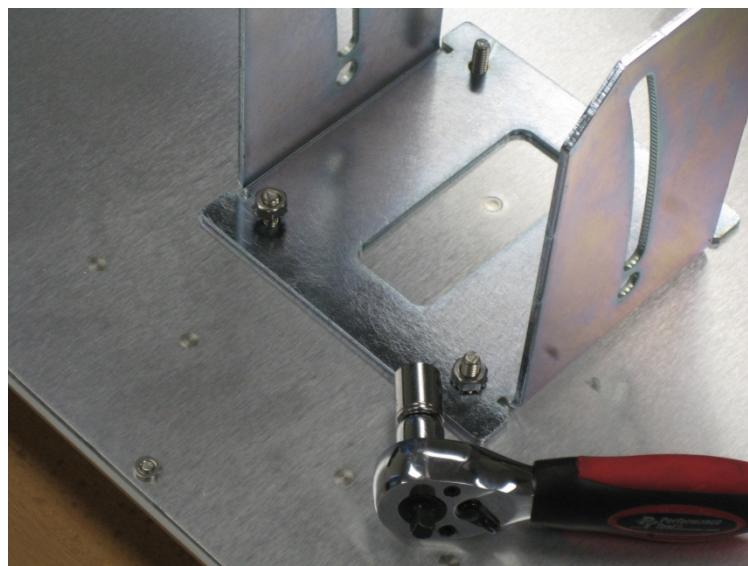


Figure 25 – Secure U-brackets

- 4) Take the pole clamp section with the bolt hole and secure to the U-Bracket using the bolt and lock washer (figure 26). Secure a pole clamp section to each U-Bracket.

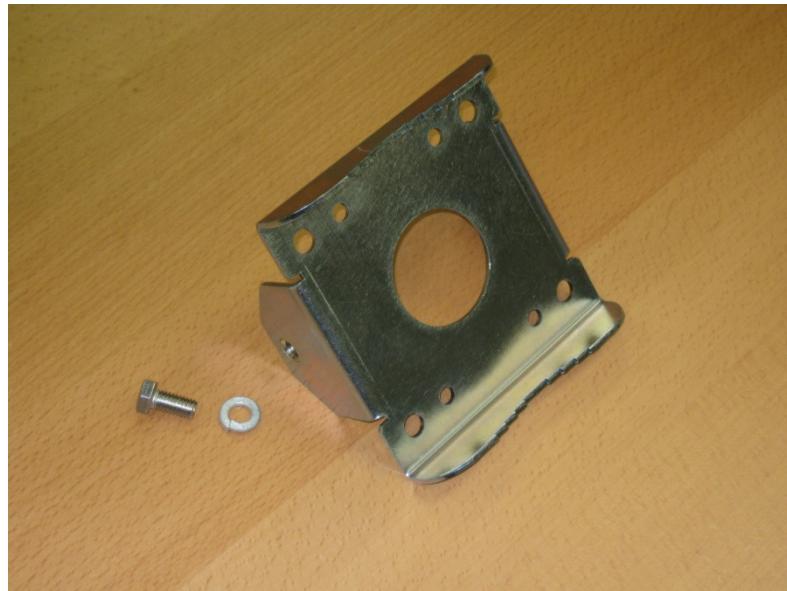


Figure 26 – Pole Clamp half section

- 5) Depending on the intended angle of elevation and degree of down/up tilt will determine whether to lock one end and have flexibility on the other. This is the intent of the slots. Figure 27 is for a dountilting antenna and therefore the bottom bracket is "fixed" and movement is allowed in the upper bracket.

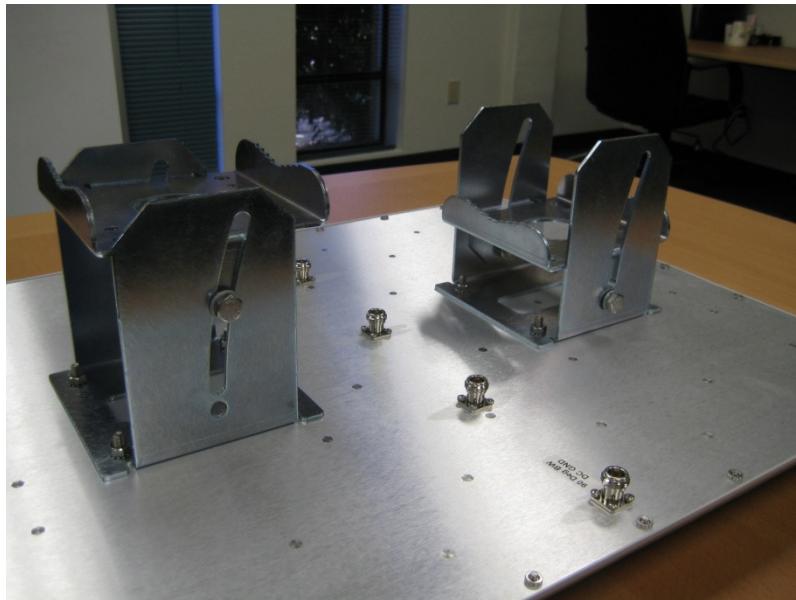


Figure 27 – Pole Clamp to U-bracket

- 6) The other half of the pole clamp section can now be attached using the M4 by 25 bolts plus the lock washer and lock nut (figure 28). These will be adjusted to provide the necessary clamp depending on the thickness of the pole (figure 29).

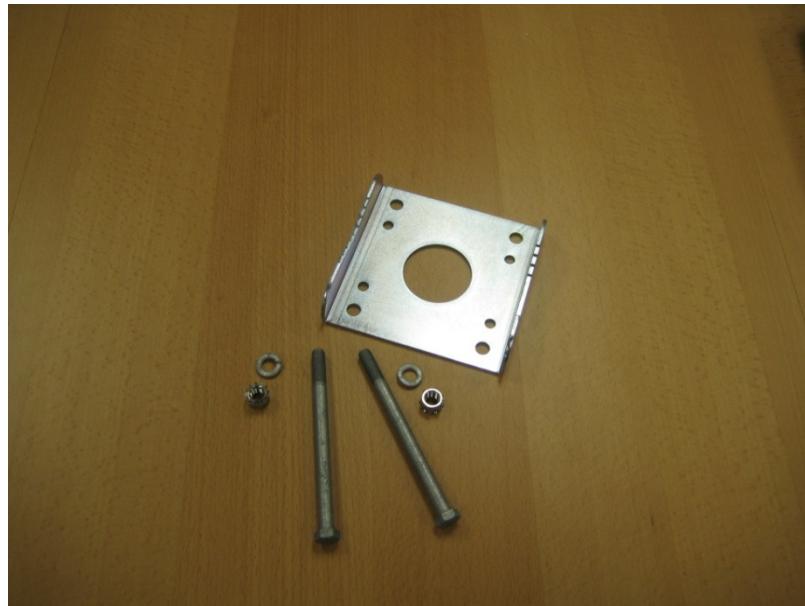


Figure 28 – Pole Clamp half section

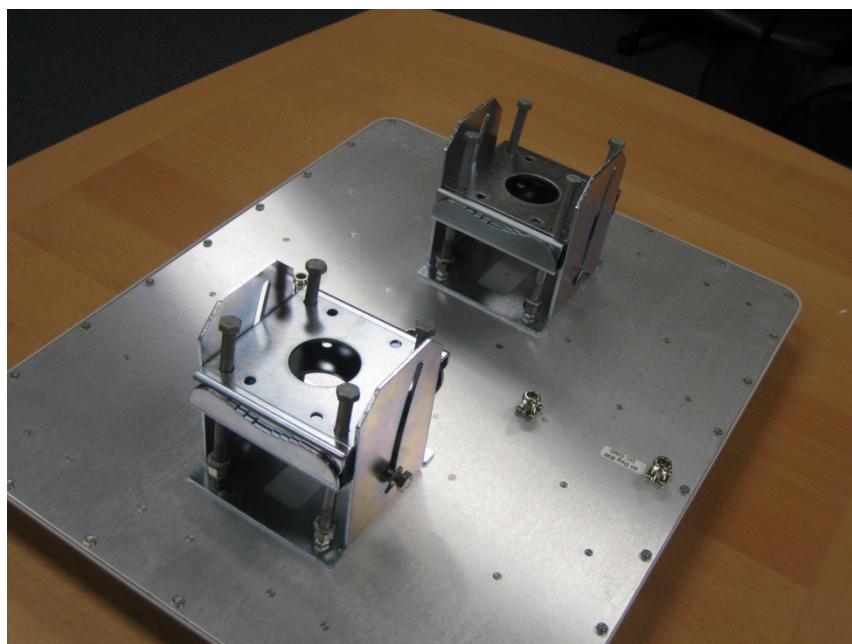


Figure 29 - Mounting Kit final assembly

- 7) The final assembly can now be attached to the pole (figure 30).

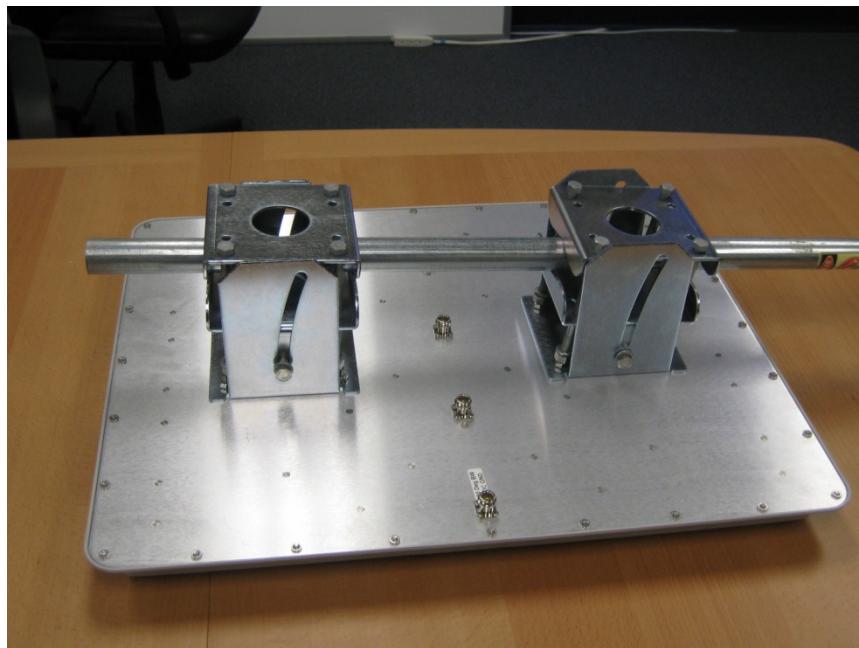


Figure 30- Antenna Mounted to Pole

Diagrams that demonstrate the vertical angular displacement and a visual concept of how the antenna can be aligned are outlined in figures 31 and 32.

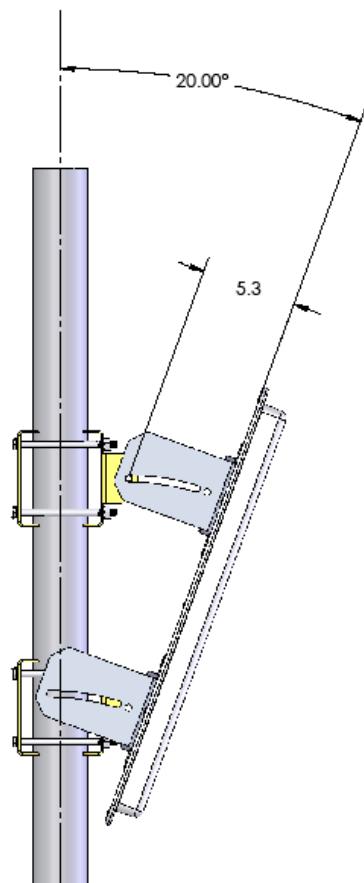


Figure 31 – Antenna Vertical Angular Displacement

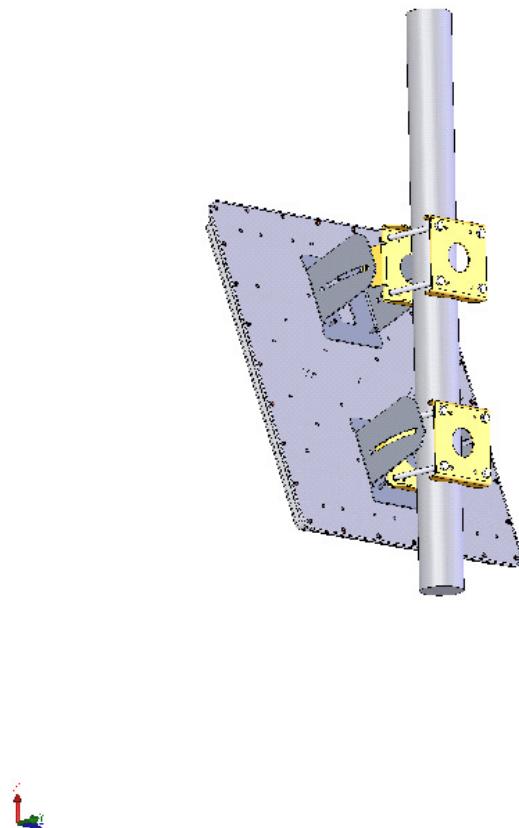


Figure 32 – Antenna Alignment

2.9 Ethernet

This port allows remote command and control of the Base Station and also provides the data traffic backhaul interface that should be connected to the Service Provider's network equipment. The cable connection is a straight-through 568-B standard as shown below in figure 33.

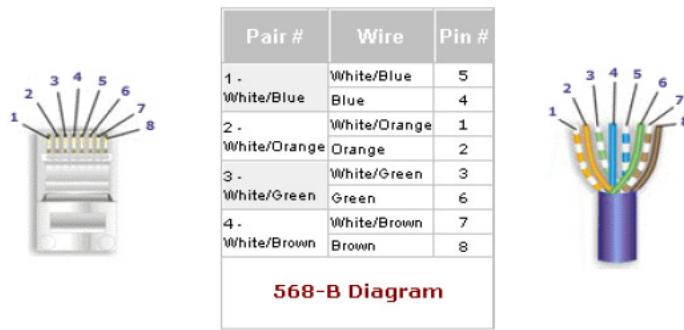


Figure 33 – Ethernet 568-B Straight Connection

In the case that the Base Station is mounted outdoors care it is important to ensure that the following points are followed.

- 1) You must install an appropriate outdoor rated, shielded Category-5 (Cat 5) 100 Mbps Ethernet cable.
- 2) You must install a shielded outdoor rated metal RJ45 cable connector.
- 3) You must use shielded Cat 5e cables and make certain that the drain wire has a good contact with the metal RJ-45 connector
- 4) A weatherized Ethernet connector backshell must be installed (Molex P/N 813969556) to weather protect the connector.
- 5) The maximum distance from the Base Station to the Service Provider's network equipment is limited to 100m.

One recommendation for an outdoor rated Cat 5 Ethernet cable is:

Name: Commscope 2003 Cat 5e
 Description: Outdoor rated, UV protection, shielded Cat 5e cable
 Manufacturer: Commscope
 Distributor: Anixter (<http://www.anixter.com>)

For your information, the procedure to install Ethernet connectors is provided in Appendix C.

2.9.1 Weather Protection of the Ethernet Connector

An IP67 compliant weather protection connector is provided along with the Base Station Sector. This will provide the means to weather protect the RJ45 Ethernet connection.

Figure 34 is an illustration of the components that are included in the protection connector.



Figure 34 – Ethernet Weather Connection

Note: Please remember to install all the pieces of the connector onto the cable before the RJ45 connector is crimped.

The procedure to install the connector is given below. The instructions are provided assuming that one of the ends of the cable is accessible and does not have a RJ connector fitted.

- 1) Crimp the RJ45 connector to the cable (figure 35).



Figure 35 – Cable RJ45 Connector

- 2) Take the plastic RJ45 holder and ensure that the rubber RJ45 cut out is stuck onto the RJ45 holder (figure 36)



Figure 36 – Plastic RJ45 Holder

- 3) Pull the cable plus RJ45 connector through the RJ 45 holder and ensure that the RJ45 connector is pulled tight into the holder. Ensure that the connector flap is locked in place (figure 37).



Figure 37 – Plastic RJ45 Holder plus RJ45 Cable

- 4) Install the rubber ring around the cable and the other components as shown in figure 38.



Figure 38 – All Components Assembled

- 5) Tighten the end cable locks and the assembly is complete (figure 39).



Figure 39 – Complete Assembly

- 6) The assembly can now be attached to the Base Station Sector thus creating a weather protected connection (figure 40).



Figure 40 – Complete Assembly connected to Base Station