



**ATLAS5010**

**Point-to-Point**

**Wireless OFDM Ethernet Bridge**

**USER MANUAL**

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Revision xx

for Firmware 0. 9pa2

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## Preface

This manual covers the basic configuration and installation of the ATLAS5010 Wireless Point to Point Broadband System, and applies to the following radio part numbers:

P5010M-INT                      Unit with internal patch antenna

The ATLAS5010-INT consists of two P5010M-INT radios which have internal 23 dBi antennas with electronically selectable polarization. The ATLAS5010M-INT package also contains universal power adapters and mounting hardware for a pole. This device requires professional installation.

### ***FCC Information***

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

This equipment has been tested and found 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 these instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in any 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 correct the interference by one of more of the following measures:

- 1) Reorient the antenna.
- 2) Increase the separation between the affected equipment and the unit.
- 3) Connect the affected equipment to a power outlet on a different circuit from that which the receiver is connected to.
- 4) Consult the dealer and/or experienced radio/TV technician for help.

### **FCC ID: NCYP5010M**

#### **IMPORTANT NOTE:**

Intentional or unintentional changes or modifications must not be made unless under the express consent of the party responsible for compliance. Any such modifications could void the user's authority to operate the equipment and will void the manufacturer's warranty. To comply with FCC RF exposure requirements, the following antenna installation and device operating configurations must be satisfied. The antenna for this unit must be fixed and mounted on outdoor permanent structures with a separation distance of at least two meters from all persons. Furthermore, it must not be co-located or operating in conjunction with any other antenna or transmitter.

### ***Warranty Information***

Radios from Trango Broadband Wireless are warranted for one year from date of purchase. Please see [www.trangobroadband.com](http://www.trangobroadband.com) for a complete description of warranty coverage and limitations.

## Chapter 1 Overview

The ATLAS5010 is a point-to-point (PtP) wireless Ethernet transmission system provides network connectivity at speeds up to 45 Mbps depending on the transmission distance, noise floor, and the antenna configuration. The Atlas5010 uses OFDM technology and is designed for use in long range backhaul and wide area data networking applications. The Atlas system is comprised of the following items:

- 1) P5010M-INT (Configured as Master Unit with integrated 23 dBi panel antenna)
- 2) P5010M-INT (configured as Remote Unit with integrated 23 dBi panel antenna)
- 3) Two 24 Volt power adapters for use with 100 to 240 VAC, including various plug adapters
- 4) Two Power over Ethernet Junction Boxes
- 5) Port plug cover
- 6) Mounting hardware

Key points about the system are it's ability to operate in the new 5.47 to 5.725 GHz frequency band as well as the 5.25 to 5.35 and 5.725 to 5.85 GHz bands, allowing a large number of non overlapping channels to ease installation. As of February 2005, however, the 5.47 – 5.725 GHz band is not yet approved for use in the United States.

The Atlas5010-INT consists of two P5010M-INT units and uses a common hardware/firmware platform for each end of the wireless link. Users are required to simply specify one unit type as master unit (MU) and one unit as remote unit (RU). The hardware consists of a high gain dual polarization panel antenna with the radio portion integrated into a cast aluminum case on the back of the antenna. The unit utilizes Power-over-Ethernet (PoE) and is designed for outdoor environments. The cable entry point can accommodate both Shielded twisted pair Cat5 (STP), Unshielded twisted pair Cat5 (UTP), with the addition of conduit for tower mounting.

### **Range vs. Throughput**

The following table shows approximate maximum ranges (at recommended fade margins) achievable with the ATLAS5010 system using various antenna configurations. Longer ranges are achievable, but will result in lower fade margins.

**ISM (5725 MHz to 5875 MHz) Range & Throughput**

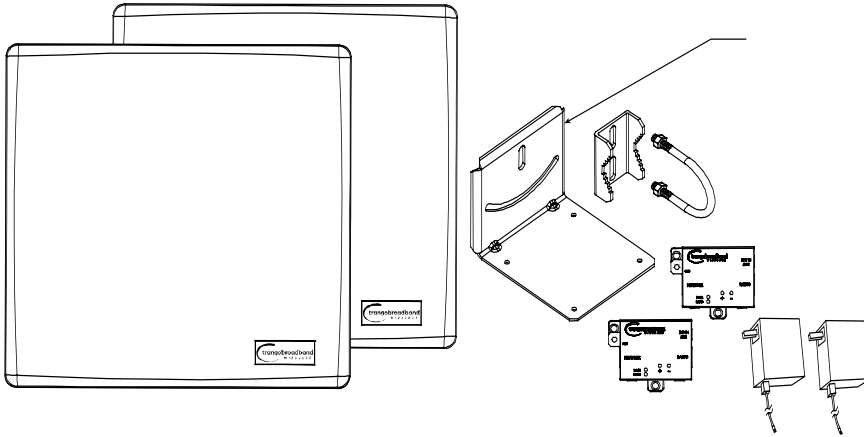
Antenna	6 miles	20 miles	30 miles
<b>Integrated 23 dBi 15" Flat Panel</b>	<b>45 Mbps (10db fade margin)</b>	<b>11 Mbps (20db fade margin)</b>	<b>6 Mbps (19db fade margin)</b>
<b>Line-of-sight range</b>			

**U-NII (5250 MHz to 5350 MHz) Range & Throughput**

Antenna	6 miles	10 miles	15 miles
<b>Integrated 23 dBi 15" Flat Panel</b>	<b>20 Mbps (10 db fade margin)</b>	<b>11Mbps (12db fade margin)</b>	<b>6Mbps (9db fade margin)</b>
<b>Line-of-sight range</b>			

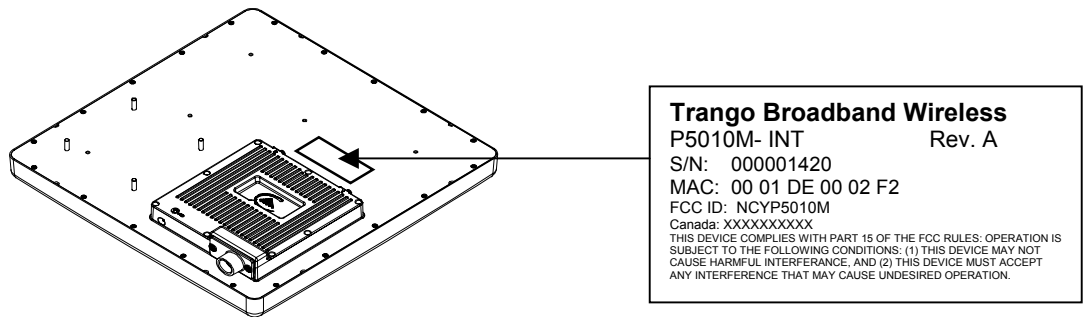
## System Contents

Each ATLAS5010 kit consists of two radios, two power-over-Ethernet (PoE) injectors, two AC adapters, port covers, and mounting hardware. A dual-polarized integrated antenna is located behind the radome of the P5010M-INT.



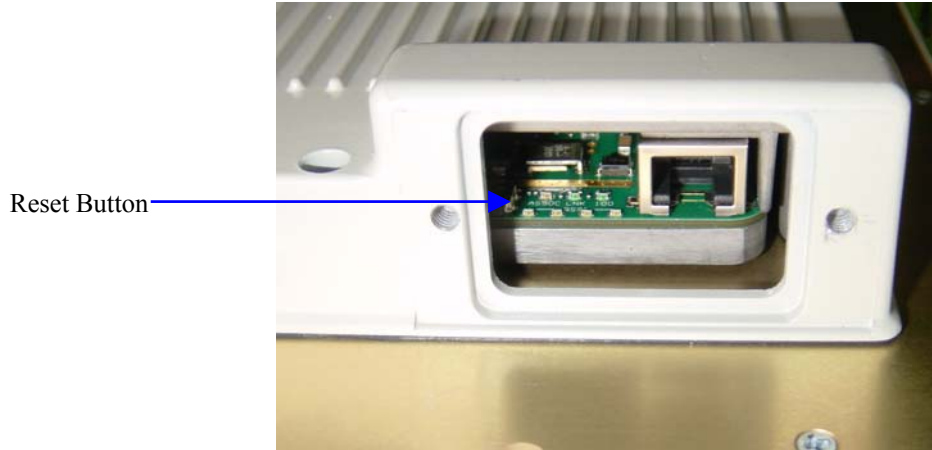
## Location of Serial Number & MAC Address

The serial number and MAC address label can be found on the back of each radio. The serial number and MAC address is also provided on the system information screen.



### ***Location of RJ-45/LED Port***

The RJ-45 connector, diagnostic LEDs, and reset button are located at the bottom of the radio. Functionality of the LEDs is described later in this text. The reset button resets all configuration settings (including IP address and password) back to factory default. Hold the reset button down for 5 seconds (until amber lights flash) while unit is powered on.





## Chapter 2 Getting Started

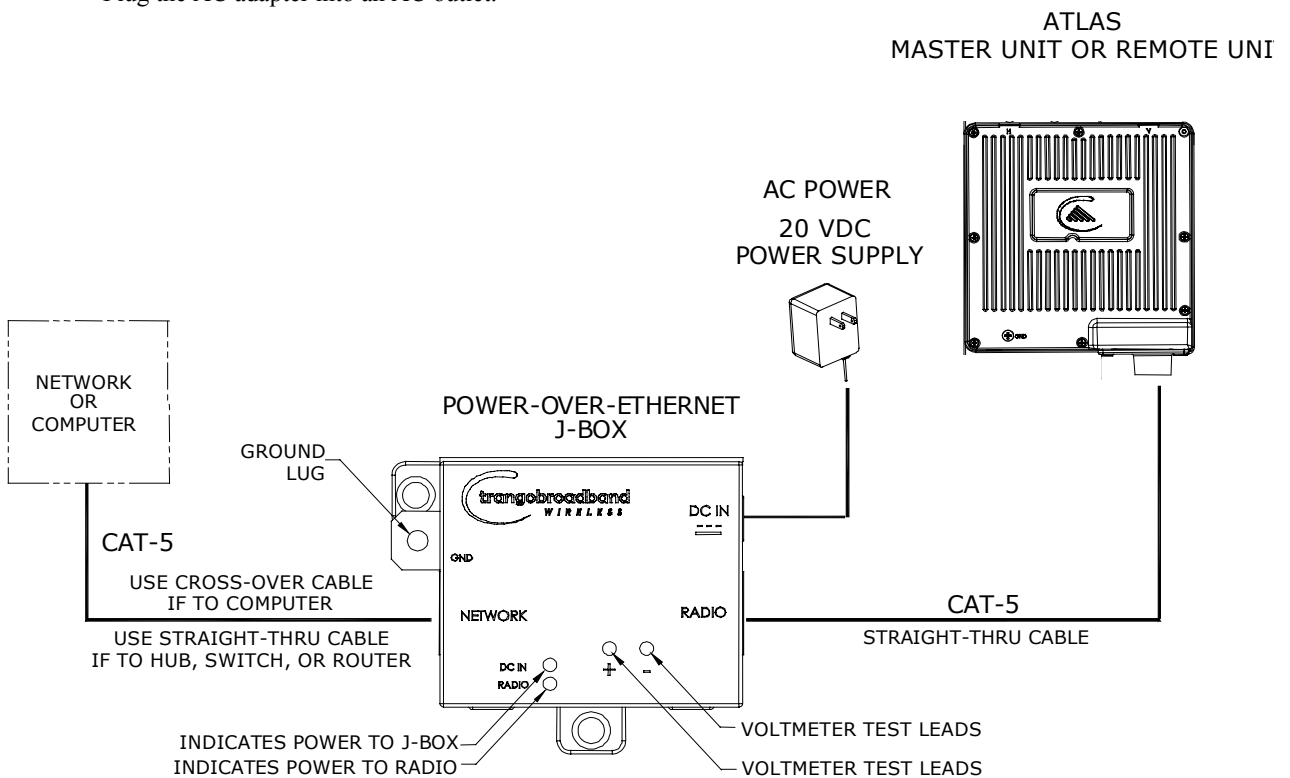
It is recommended that you first provision and test your the radios on the bench before deploying them in the field. This is a particularly useful exercise for the novice user.

### Connections and Power

- Connect a Cat-5 (straight through) Ethernet cable (we recommend shielded twisted pair) between the ODU (out door unit) port of the J-box and the RJ-45 connector on the radio. Note that this cable will carry power-over-Ethernet (PoE).
- If connecting to a COMPUTER, use a Cross-Over Ethernet cable from the NET port of the J-box to the computer's Ethernet port.

If connecting to a HUB, SWITCH, or ROUTER, use a Straight-Thru cable.

- Plug the AC adapter into an AC outlet.



Both green LEDs on the J-box should be lit, indicating power is present at the Power-over-Ethernet box as well as at the radio. You are now ready to configure the radio via the Ethernet port. The Radio Power LED may take several seconds before lighting. The radio requires approximately 45 seconds to boot.

### Configuration Tools

ATLAS5010 radios can be configured using either the Command Line Interface (CLI), or the Web Browser (HTTP) interface. Although both methods are comprehensive and powerful, the CLI method provides slightly more functionality.

This text covers configuration through the CLI. For HTTP configuration please see Appendix A.


## Telnet

Open a command prompt (DOS) session on your PC. Open a Telnet session by typing:

*telnet <ip address of radio>*


Example:


```
C:>telnet 192.168.100.100
```

 Note: All Trango radios are pre-configured at the factory with a default IP address of 192.168.100.100.

You will be greeted with current hardware and firmware information and prompted for a password. Type in the password and press enter. The factory default read/write password is **trango**.

```
Welcome to Trango Broadband Wireless, Atlas PtP-P5010M 0p9a2D05020401
Password:
Login as read/write.
#>
```

 Note: Type **help** for a listing of all CLI commands. Type **help [<command>]**, for the syntax of a particular command.

 Note: If you cannot access the radio management functions via the Ethernet port, check all cable connections and ensure that your PC is set up with a properly routable subnet.

## Troubleshooting Ethernet Connections

If you cannot telnet into the radio or open an HTTP browser session, check your cable connections to ensure proper use of cross-over vs. straight-through cable, and ensure your PC's subnet is routable to the radio's IP address.

## System Information (sysinfo) Page

To display system configuration and status information type the command **sysinfo**.

The sysinfo screen is divided into 7 sections (0–7)

Section	Description
0	Hardware/Firmware versions & system uptime (since reboot)
1	Mac, serial number, and IP configuration information
2	RF, speed, ARQ status, encryption, and connection status
3	RF channel table
4	Region Code information denotes which channels and power limits are available based on region code of the radio. Region code is set by the factory and can not be altered by the user.
5	Auto-rate shift, remarks, and LED RSSI function
6	Ethernet TX/RX statistics.

Sysinfo Example:

```
#> sysinfo

***** 0 *****

[Model] P5010M
[Unit Type] MU
[Hardware Version] 0810
[Firmware Version] 0p9a2D05020401
[System Up Time] 0 day(s) 01:21:16

***** 1 *****

[MAC] 00 01 DE 1B 78 42
[S/N] 3726342210
[IP] 192.168.100.100 [Subnet Mask] 255.255.255.0 [Gateway] 0.0.0.0

***** 2 *****

[Opmode] off [Default Opmode] off
[Active Channel] 1 h [Freq] 5260 MHz
[Speed] 24 Mbps [Tx Power] 0 dBm [Power Range] -4..19 dBm
[Tx MIR] 50000 Kbps
[ARQ] on
[Encrypt] off [Key] 0011 2233 4455 6677 8899 AABB CCDD EEFF
[Peer ID] DE1B7850 [Status] disconnected [RSSI] -49 dBm

***** 3 *****

Channel Table: (MHz, n/a: not available in current area)
[Ch#01] 5260 [Ch#02] 5280 [Ch#03] 5300 [Ch#04] 5320
[Ch#05] 5340 [Ch#06] 5480 n/a [Ch#07] 5500 n/a [Ch#08] 5520 n/a
[Ch#09] 5540 n/a [Ch#10] 5560 n/a [Ch#11] 5580 n/a [Ch#12] 5600 n/a
[Ch#13] 5620 n/a [Ch#14] 5640 n/a [Ch#15] 5660 n/a [Ch#16] 5680 n/a
[Ch#17] 5700 n/a [Ch#18] 5720 n/a [Ch#19] 5735 [Ch#20] 5755
[Ch#21] 5775 [Ch#22] 5795 [Ch#23] 5815 [Ch#24] 5835

***** 4 *****

[Area Code] 0
RF Band #1 (5150..5250 MHz) Disabled
RF Band #2 (5250..5350 MHz) [Power Range] -4..7/7/7/7/7 dBm
RF Band #3 (5470..5725 MHz) Disabled
RF Band #4 (5725..5850 MHz) [Power Range] -4..20/20/20/19/18 dBm

***** 5 *****

[Auto Rate Shift] off
[RSSI LED] on

[Remarks] Remarks

***** 6 *****

[Eth In] 31,117 bytes [Eth Out] 54,391 bytes
[RF In] 39,574 bytes [RF Out] 54,391 bytes

Success.
#>
```

To view only a particular section of the sysinfo screen, type sysinfo followed by the desired section number.

Example:

```
#> sysinfo 2
```

```
***** 2 *****
```

```
[Opmode] off [Default Opmode] off  
[Active Channel] 1 h [Freq] 5260 MHz  
[Speed] 24 Mbps [Tx Power] 0 dBm [Power Range] -4..19 dBm  
[Tx MIR] 50000 Kbps  
[ARQ] on  
[Encrypt] off [Key] 0011 2233 4455 6677 8899 AABB CCDD EEFF  
[Peer ID] DE1B7850 [Status] disconnected [RSSI] -49 dBm
```

Success.

```
#>
```

## Chapter 3 Configuration

### **Key Concepts**

Prior to configuring the radios it is important to understand several key concepts:

Master Unit (MU)	The MU is typically considered the primary radio within the link. For management purposes it is recommended to install the MU closest to the head-end of the network.
Remote Unit (RU)	The RU is typically installed at the remote end of the link. The primary distinction between the MU and RU is that when the radios are not associated, the MU will transmit and the RU will listen until the wireless link is established.
Peer ID	Authentication is controlled by the MAC address of each radio. The Peer ID is defined as the MAC address of the opposite radio. In other words, the Peer ID of the MU is the RU's MAC address and the Peer ID of the RU is the MU's MAC address.
Opmode	Operation mode (on or off). The radio will only transmit while set to Opmode ON.
Default Opmode	Opmode (on or off) which the radio enters after reboot. Note: if you telnet into a radio within 30 seconds after reboot, the radio will remain in opmode OFF even if the default opmode is ON.

### **Essentials to Establish a Wireless Link**

Configuration of the Atlas system is simple and at a minimum requires the following settings:

1. Designate one radio as the Master Unit (MU) and one unit as the Remote Unit (RU).
2. Program Peer ID in each radio.
3. Set MU and RU to same channel and antenna polarization
4. Set default Opmode to "ON" so that radio will automatically enter opmode after reboot.
5. Turn radios Opmode "ON".

If all of these parameters are met, and if the MU and RU are within range and properly aligned, the wireless link will automatically establish itself and Ethernet traffic will begin to pass between the radios.

### **Master Unit Configuration**

Start a telnet session with one of the radios. Follow these steps for configuration.

1. Set the Unit Type (utype) to MU in one radio. (default for all radios is RU)  

```
#> utype mu  
Success.  
#>
```
2. Set the Peer ID with the MAC address of the RU. Only use the last 8 digits of the MAC address.  

```
#> peerid de1B7850  
Success.  
#>
```
3. Set channel and polarization. (in this example set the channel to 23 and polarization to H).  

```
#> freq 23 h
```

- ```
Ch# 23 h (5815 MHz)
Success.
```
4. Set default Opmode to ON.  
#> defaultopmode on  
Success.
  5. Turn Opmode ON.  
#> opmode on  
Success.

### **Remote Unit Configuration**

Configure the RU in the same manner as the MU. Since the default unit type (utype) is RU, you do not need to set this parameter.

1. Set the Peer ID with the MAC address of the MU. Only use the last 8 digits of the MAC address.  
#> peerid delB7842  
Success.  
#>
2. Set channel and polarization. (in this example set the channel to 23 and polarization to H).  
#> freq 23 h  
Ch# 23 h (5815 MHz)  
Success.
3. Set default Opmode to “ON.”  
#> defaultopmode on  
Success.
4. Turn Opmode “ON.”  
#> opmode on  
Success.

### **Establishing a Wireless Link**

If the MU and RU are properly configured and in opmode “ON”, the two radios will automatically begin the authentication process and become connected. To determine if the two radios are connected, type the **sysinfo 2** command.

Example:

```
#> sysinfo 2
```

```
***** 2 *****
```

```
[Opmode] off [Default Opmode] off
[Active Channel] 1 h [Freq] 5260 MHz
[Speed] 24 Mbps [Tx Power] 0 dBm [Power Range] -4..19 dBm
[Tx MIR] 50000 Kbps
[ARQ] on
[Encrypt] off [Key] 0011 2233 4455 6677 8899 AABB CCDD EEFF
[Peer ID] DE1B7850 [Status] connected [RSSI] -49 dBm
```

```
Success.
#>
```

The [status] field indicates whether the MU and RU are connected or disconnected. If connected, the MU and RU will automatically start passing Ethernet traffic over the wireless link.

### **Changing IP Address**

Use the *ipconfig* command to change the radio's ip address, subnet mask and gateway.

Syntax: *ipconfig* [*<ip>* *<subnet>* *<gateway>*]

Example:

```
#> ipconfig 10.8.2.140 255.255.255.240 10.8.2.129
New configuration: [ip] 10.8.2.140 [subnet mask] 255.255.255.240 [gateway]
10.8.2.129
```

```
save and activate ? (y/n) [ATTN] Telnet session will be terminated in 30
seconds.
```

```
Success.
```

```
#>
```

### **LEDs**

LEDs are visible on the unit's PCB between the reset button and the RJ-45 connector. The function of each LED is described below:

#### **LNK (green)**

Green: On solid for an established 10BaseT or 100BaseT Ethernet Link.

#### **SPEED**

Green: Solid if 100BaseT, Blinks only if there is activity (TX or RX) on the network when a 100 MBit connection is established. Off if a 10BaseT connection is established or if there is 10BaseT activity.

#### **RSSI (4 LEDs)**

Amber: Four LEDs

In all modes except "Survey", the unit's four yellow LEDs indicate the level of RF signal being received from a VALID MU or RU as appropriate.

Yellow LED 1 : Begins blinking when RSSI is greater or equal to -90 dBm. On continuously at -85 dBm. This is the Leftmost LED

Yellow LED 2 : Begins blinking when RSSI is greater or equal to -80 dBm. On continuously at -75 dBm.

Yellow LED 3 : Begins blinking when RSSI is greater or equal to -70 dBm. On continuously at -65 dBm.

Yellow LED 4 : Begins blinking when RSSI is greater or equal to -60 dBm. On continuously at -55 dBm. This is the rightmost LED.

If no VALID MU or RU signal is detected the LEDs will not be on at all.

In addition, these 4 LEDs shall flash ON for 2 seconds, then OFF for 2 seconds to indicate the 'factory reset' button has been activated and the reset successful.

#### **ASSOCiation LED (green):**

The ASSOC led blinks at the following rates:

- Once every second when unit is powered on but opmode is OFF.

- Twice per second while in opmode ON and scanning for an MU or RU.
- Solid after unit is associated with the RU or MU.

### **RF Link Loopback Test (*linktest* command)**

The *linktest* command tests the throughput and packet error rate (PER) on the current channel for each direction at all speeds and reports results. This command also provides RSSI for both ends of the wireless link. The command can be run from either the MU or the RU.

In running the *linktest* command the user must specify the modulation speed for each end of the link.

Command format: **linktest <loc speed> <peer speed>**

Valid modulation speeds are: 6,12,18,24,36,48, and 54 Mbps. Lower speeds will result in fewer dropped packets.

Example:

```
# linktest 24 24
local tx rate = 24 Mbps
peer tx rate = 24 Mbps
packet size = 1600 bytes
# of packets per period = 1000
# of Cycle = 10
0> [tx] 1000 [rx] 1000 [rssi] -37 peer: [tx] 1000 [rx] 1000 [rssi] -40 -> 22.01 Mbps
1> [tx] 1000 [rx] 1000 [rssi] -37 peer: [tx] 1000 [rx] 1000 [rssi] -40 -> 22.01 Mbps
2> [tx] 1000 [rx] 1000 [rssi] -37 peer: [tx] 1000 [rx] 1000 [rssi] -40 -> 22.01 Mbps
3> [tx] 1000 [rx] 1000 [rssi] -37 peer: [tx] 1000 [rx] 1000 [rssi] -40 -> 22.01 Mbps
4> [tx] 1000 [rx] 1000 [rssi] -37 peer: [tx] 1000 [rx] 1000 [rssi] -40 -> 22.01 Mbps
5> [tx] 1000 [rx] 1000 [rssi] -37 peer: [tx] 1000 [rx] 1000 [rssi] -40 -> 22.01 Mbps
6> [tx] 1000 [rx] 1000 [rssi] -37 peer: [tx] 1000 [rx] 1000 [rssi] -40 -> 22.01 Mbps
7> [tx] 1000 [rx] 1000 [rssi] -37 peer: [tx] 1000 [rx] 1000 [rssi] -40 -> 22.00 Mbps
8> [tx] 1000 [rx] 1000 [rssi] -36 peer: [tx] 1000 [rx] 1000 [rssi] -40 -> 22.01 Mbps
9> [tx] 1000 [rx] 1000 [rssi] -37 peer: [tx] 1000 [rx] 1000 [rssi] -40 -> 22.01 Mbps

--> [tx] 10000 [rx] 10000 [rssi] -36 peer: [tx] 10000 [rx] 10000 [rssi] -40
--> [Local PER] 0.00 % [Peer PER] 0.00 %

Success.
#>
```

In this example the *linktest* was run at 24 Mbps at each end of the link. The results indicated 10 cycles of 1000 packets were transmitted and received from each end of the link without error. Actual achievable throughput is measured at 22 Mbps.

### **Link Speed & Power Settings**

Users may change the radio's over-the-air data rate and conducted output power using the *speed* and *power* commands. Keep in mind that the lower data rates offer higher receiver sensitivity and higher allowable conducted RF power in the ISM band. The following table shows the relation between speed settings, receiver sensitivity, and allowable maximum power settings for each band. The lowest power setting for all bands is -4 dBm.

| Speed Setting<br>(over-the-air rate)<br>(Mbps) | Receiver<br>Sensitivity<br>(dB) | Max Power<br>High (ISM) Band<br>(dBm) | Max Power<br>Low (U-NII)<br>(dBm) |
|------------------------------------------------|---------------------------------|---------------------------------------|-----------------------------------|
| 6                                              | -92                             | 20                                    | 7                                 |
| 12                                             | -87                             | 20                                    | 7                                 |
| 18                                             | -85                             | 20                                    | 7                                 |
| 24                                             | -84                             | 19                                    | 7                                 |
| 36                                             | -80                             | 19                                    | 7                                 |



|    |     |    |   |
|----|-----|----|---|
| 48 | -75 | 18 | 7 |
| 54 | -73 | 18 | 7 |

In this example the user sets the power to 19dBm and the speed to 24 Mbps:

```
#> power 19
Execution in progress...
.
19 dBm (-4..19)
Success.
#> speed 24
24 Mbps
Success.
#>
```

### Command Reference Listing

The complete command set reference is provided below. You can also view a complete listing of all CLI commands by typing *help*.

|                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| antenna [h v]                     | Set or display antenna setting. H=Horizontal polarity, V=vertical polarity.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| arq [on off]                      | Enable or disable Auto Retransmit Request (ARQ). With ARQ enabled, the Atlas system will retransmit packets which are detected as missing or corrupted. Default setting=ON.                                                                                                                                                                                                                                                                                                                 |
| autorateshift [on off]            | Enable or disable automatic rate shift feature. With autorateshift enabled, the radios will automatically renegotiate speed setting to maximize wireless link integrity. Default setting=OFF.                                                                                                                                                                                                                                                                                               |
| autoscanmu [on off]               | Enable or disable auto scan MU (RU only). Default setting=OFF. When autoscanmu is turned on, the RU will automatically scan all channels and polarizations searching for its peer MU. Once the RU detects the MU it will stop scanning and lock onto the channel of the MU. The autoscan feature is useful in cases where the user changes the channel at the MU because the RU will automatically search for the new channel of the MU. Note: auto-scanning may take as long as 5 minutes. |
| defaultopmode [on off]            | Set or display default opmode. Radio must be set to opmode ON to establish wireless link. Default setting=OFF                                                                                                                                                                                                                                                                                                                                                                               |
| encrypt [on off]                  | Enable or disable proprietary 128 bit tx encryption. Default setting=OFF                                                                                                                                                                                                                                                                                                                                                                                                                    |
| encrypt key <key>                 | Change encryption key (128 bits)<br><key> = xxxx xxxx xxxx xxxx<br>xxxx xxxx xxxx xxxx                                                                                                                                                                                                                                                                                                                                                                                                      |
| exit                              | Exit telnet session                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| freq [<ch#> <antenna>]            | Set or display channel and antenna selection                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| freq writechannel <ch#> <freq>... | Modify channel table, up to 6 channels at a time                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| freq writechannel default         | Restore factory default channel table                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| help [<command>]                                                                    | Display command usage and syntax                                                                                                                                                                                                                                                                                                                                                        |
| ipconfig [<ip> <subnet> <gateway>]                                                  | Change ip configuration<br><ip> = ip address<br><subnet> = subnet mask<br><gateway> = gateway ip address                                                                                                                                                                                                                                                                                |
| linktest <local tx rate> <peer tx rate><br>[<pkt size> [<# of pkt> [<# of cycle>]]] | RF link loopback test<br><br>This is the primary loopback test utility for evaluating over-the-air link quality. Provides link reliability information and dropped packet statistics. Standard linktest transmits 1600 byte packets, 1000 packets per second for 10 cycles. User can specify packet size, quantity of packets, number of cycles<br><tx rate> = 6,12,18,24,36,48,54 Mbps |
| mir [<kbps>]                                                                        | Set or display tx maximum information rate (MIR). MU and RU can be set with different mir for asymmetric upload and download.<br><kbps> = 100..50000                                                                                                                                                                                                                                    |
| opmode [on off]                                                                     | Set or display operation mode (on or off)                                                                                                                                                                                                                                                                                                                                               |
| password <ro rw upgrade>                                                            | Change password<br><ro> = for read-only<br><rw> = for read-write<br><upgrade> = for upgrading firmware                                                                                                                                                                                                                                                                                  |
| peerid [<peer device id>]                                                           | Set or display peer device id                                                                                                                                                                                                                                                                                                                                                           |
| power [<dBm>]                                                                       | Set or display tx power<br><dBm> is limited by area (ref: "sysinfo 4")                                                                                                                                                                                                                                                                                                                  |
| reboot                                                                              | Reboot unit                                                                                                                                                                                                                                                                                                                                                                             |
| remarks                                                                             | Enter user remarks up to 80 characters                                                                                                                                                                                                                                                                                                                                                  |
| reset                                                                               | Restore all factory defaults except ipconfig and passwords.                                                                                                                                                                                                                                                                                                                             |
| rsi                                                                                 | Display RF relative signal strength indication (rsi) from peer radio                                                                                                                                                                                                                                                                                                                    |
| rsiled [on off]                                                                     | Enable or disable rsi LED update                                                                                                                                                                                                                                                                                                                                                        |
| speed [<tx rate>]                                                                   | Set or display tx rate<br><tx rate> = 1,2,6,9,11,12,18,24,36,48,54 Mbps                                                                                                                                                                                                                                                                                                                 |
| survey [<sec>]                                                                      | Display noise floor for current channel<br><sec> = period 10..3600<br>default = 10                                                                                                                                                                                                                                                                                                      |
| survey <sec> all                                                                    | Display noise floor for all available channels                                                                                                                                                                                                                                                                                                                                          |
| survey <sec> [<ch#> [..]]                                                           | Display noise floor for selected channels                                                                                                                                                                                                                                                                                                                                               |
| sysinfo                                                                             | Display all system information                                                                                                                                                                                                                                                                                                                                                          |
| sysinfo [[<part #> [<part #> [..]]]                                                 | Display system information and status<br><part #> = 0..6<br>part 0: up time and version information<br>part 1: MAC address and IP configuration<br>part 2: RF link status<br>part 3: channel table<br>part 4: region code and power limitations<br>part 5: switch settings and remarks<br>part 6: statistics                                                                            |
| syslog                                                                              | Display system log                                                                                                                                                                                                                                                                                                                                                                      |

|                |                                                      |
|----------------|------------------------------------------------------|
| tftpd [on off] | Enable or disable tftpd (used for firmware upgrades) |
| utype [mu ru]  | Set or display unit type                             |

## Chapter 4 Deployment & Installation

Once you are familiar with the basic operation of the radios you are ready for deployment in the field. The deployment process consists of the following steps:

- Site Selection
- Site survey at MU and RU sites
- MU installation
- RU installation and antenna alignment
- Link test

### **Site Selection**

Proper site selection for your MU will help ensure a successful deployment. Site selection will depend on a wide variety of factors, but from the radio's performance standpoint, please consider the following:

- Path from MU to RU should provide unobstructed line-of-sight (LOS), thus it is advisable to place MU as high as possible on a tall building or tower.
- Ethernet cable limit is 100 meters from Ethernet device (router, switch) to radio.
- Radios should never be deployed without proper grounding.
- Consider nearby sources of interference that could degrade the performance of the radio. Mount radios as far from sources of interference as possible.

### **Site survey**

The radios provide an on-board site survey tool which measure the average and peak noise levels on any given channel.

To use the survey tool, the radio must be in Opmode "OFF." The survey can be performed for any specified amount of time (in seconds), and for either the horizontal or vertical polarization.

Prior to performing the site survey, place the radio in the installation spot, and aim the radio in the desired direction.

After the specified period, the results of this command will provide you with a listing of each channel in the band, the average signal received, and the maximum signal received during the survey period.

Example:

```
#> survey
```

```
Press any key to stop.
```

```
noise floor (peak/avg dBm)  rssi by pkt (peak/avg dBm)
0> -97 / -98      n/a
1> -97 / -98      n/a
2> -97 / -98      n/a
3> -97 / -98      n/a
4> -97 / -98      n/a
5> -97 / -98      n/a
6> -97 / -98      n/a
7> -97 / -98      n/a
8> -97 / -98      n/a
```

```
Ch 1 h 5260 --> -97 / -98  n/a
```

```
Success.
```

### **Channel Planning**

Based on the results of the site survey at each end of the link, choose a channel which offers the lowest noise floor. In order to reliably operate in the higher speed modes, clean spectrum is essential.

## **RSSI Command and Antenna Alignment**

Once the site survey is completed, you are ready to install your radios. Typically it is best to install the MU first. To properly align the radios, use the built-in RSSI tool to achieve maximum signal strength.

1. Ensure MU and RU are in Opmode "ON."
2. Connect to the RU.
3. Login and type the command *rssi*. As you read the RSSI, move the antenna in the horizontal and vertical planes until the maximum RSSI reading is achieved
4. If it is not possible to receive an adequate RSSI reading, it may be necessary to reorient the MU (up/down, left/right), to increase the output power of the MU, or to move the RU to a location with better line-of-sight conditions to the MU.
5. Once you are satisfied with the RSSI reading, tighten down the RU in the optimum position.

Example:

```
#> rssi
```

```
Press any key to stop.
```

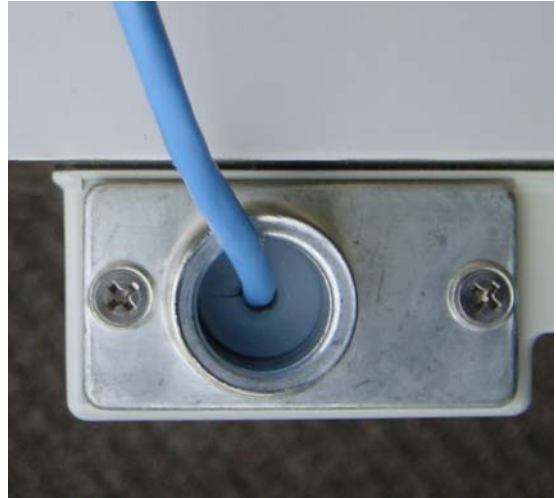
```
0> MU -75 dB      RU -75 dB      Connected
1> MU -75 dB      RU -75 dB      Connected
2> MU -73 dB      RU -73 dB      Connected
3> MU -72 dB      RU -71 dB      Connected
4> MU -70 dB      RU -70 dB      Connected
5> MU -70 dB      RU -69 dB      Connected
6> MU -69 dB      RU -70 dB      Connected
7> MU -70 dB      RU -70 dB      Connected
8> MU -70 dB      RU -70 dB      Connected
9> MU -67 dB      RU -68 dB      Connected
10> MU -67 dB     RU -67 dB      Connected
```

Success.

Users can also view the RSSI LEDs on the bottom of the radio. See the configuration section of this manual for more information.

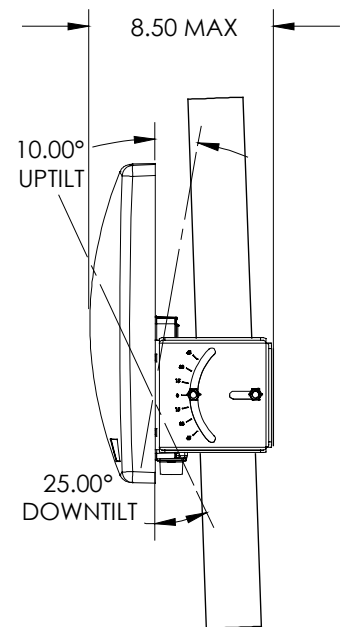
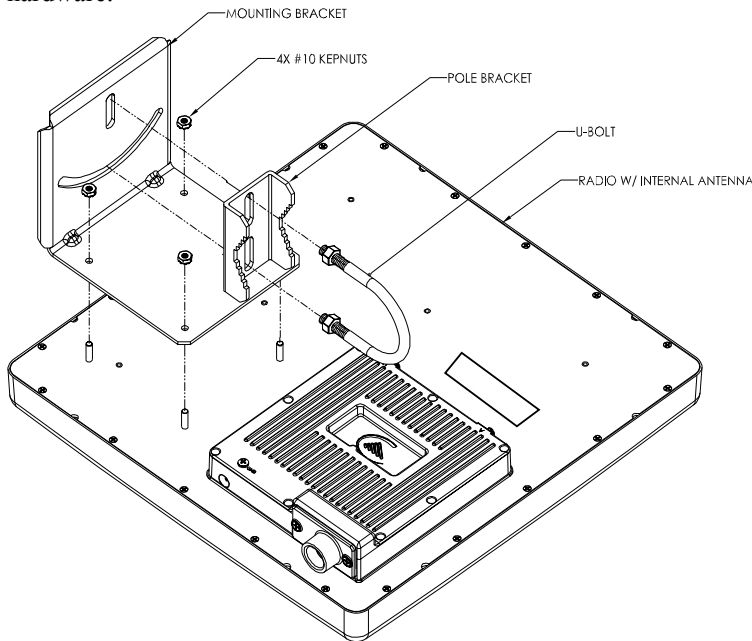
## Port Plug and Port Plate

Prior to deployment, insert the silicone port plug around the Cat-5 Cable and insert into the radio's port opening. Next, screw the port plate over the silicone plug as shown in the photographs below.



## Mounting Hardware

Radios are supplied with mounting hardware for pole installations. See diagram below for proper use of the mounting hardware.



## Mounting Hardware Assembly for Integrated Antenna P5010-INT

## ***Grounding***

Proper mounting of the radio includes consideration for grounding. Please note that if the radio is attached to a metal pole that is earth-grounded, no other grounding is necessary. If the radio is not earth-grounded via the mounting bracket, you must attach a grounding wire to the grounding stud on the radio as in the adjacent diagram.

## ***Cabling and Weather Considerations***

Shielded twisted pair Cat-5 cable is recommended for all installations. The shield within the Cat-5 cable does not need to be grounded if the radio itself is grounded. It is important to consider that most Cat-5 cable will deteriorate over time if exposed to the weather (especially direct sunlight). It is recommended that installers place all Cat-5 cables inside conduit. Plastic conduit is sufficient. If metal conduit is used, it is not necessary to use shielded Cat-5 cable.

## ***Weatherizing***



**Important! Please note that the silicon strain relief has a small gap when the cable is installed. This is normal .**



**It is important to provide strain relief and drip loop for STP Cat-5 cables. Do not mount the radio upside down as water will enter the bottom of the radio and cause permanent damage**



**Important! The Power-over-Ethernet injector is not a weatherized device and must be located either indoors or in a weather-protected cabinet.**

## Chapter 5 SNMP

TBA



## Chapter 6 Firmware Upgrade Procedure

TBA

## **Appendix A Using the HTTP Interface**

TBA

## Appendix B Specifications

### Data Parameters

|                                |                                                           |
|--------------------------------|-----------------------------------------------------------|
| Modulation Format              | Orthogonal Frequency Division Multiplexing                |
| Certification/Compliance       | FCC Part 15.247, 15.407: ETSI/EN301 489-1 (7.2) (pending) |
| Receiver Sensibility           | -73 dBm (54 Mbps) to -92 dBm (6 Mbps)                     |
| User Data Throughput           | 45 Mbps                                                   |
| Format 10/100 BaseT            | 10/100 BaseT                                              |
| Network Protocols              | All IEEE 802.3 / 802.3u compliant protocols               |
| Configuration and Management   | Telnet, SNMP, TFTP, HTTP                                  |
| Upstream/Downstream Throughput | Dynamic, automatically adjusts to suit demand             |

### Physical Interfaces

|                                    |                                                               |
|------------------------------------|---------------------------------------------------------------|
| Ethernet Speed (via RJ45 shielded) | 10/100 BaseT, Auto-sensing                                    |
| Ethernet Packet                    | Up to 3600 byte long packets (supports VLAN/VPN pass through) |

### POWER PARAMETERS

|                                     |                                                             |
|-------------------------------------|-------------------------------------------------------------|
| Power Method                        | Power-over-Ethernet (PoE). DC Voltage injected at PoE J-Box |
| Voltage input limits into PoE J-Box | 12 VDC - 24 VDC, 24 VDC Nominal                             |
| Voltage input limits into Radio     | 10.5 VDC - 24 VDC                                           |
| Standard Power Supply (included)    | 120 VAC to 24 VDC                                           |
| PoE Cat-5 Max Cable length          | 100 meters on 24 AWG STP Cat-5 Cable                        |
| Current Draw/Power                  | 750 mA max. (12 W), using 24V standard adapter              |

### Environmental

|                   |                                                                              |
|-------------------|------------------------------------------------------------------------------|
| Radio Enclosure   | All-weather, powder coated, aluminum case/back with UV stabilized ABS radome |
| Temperature Range | -40° to 60° C (-40° to 140° F)                                               |
| NEMA Rating       | NEMA 4                                                                       |
| Radio Dimensions  | 14.5 in. x 14.5 in. x 3.75 in.                                               |
| Radio Weight      | 7 Lbs. (INT)                                                                 |
| User Interfaces   | RJ45 (shielded)                                                              |