



Atlas5055™  
Point-to-Point  
Wireless Ethernet Bridge  
USER MANUAL

April 16, 2007  
Revision 1

Table of Contents	
Preface	iv
FCC Information	v
Warranty Information	v
Contact Information	vi
Chapter 1 Overview	7
OFDM	7
Adaptive Modulation	7
ARQ	7
Dual Polarity Antenna	8
Range vs. Throughput	9
System Contents	10
Location of Serial Number & MAC Address	11
Location of RJ-45/LED Port & IP Reset Button	11
Chapter 2 Getting Started	12
Connections and Power	12
Configuration Tools	13
Changing Password	13
Troubleshooting Ethernet Connections	14
System Information (sysinfo) Page	14
Chapter 3 Configuration	17
Key Concepts	17
Essentials to Establish a Wireless Link	18
Master Unit Configuration	18
Remote Unit Configuration	19
Establishing a Wireless Link	19
Changing IP Address	19
LEDs	20
RF Link Loopback Test (linktest command)	21
Link Speed & Power Settings	22
Command Reference Listing	23
Chapter 4 Deployment & Installation	28
Site Selection	28
Site survey	28
Channel Planning	29
RSSI Command and Antenna Alignment	29
Mounting Hardware	31
Cabling and Weather Considerations	32
Weatherizing	32
Chapter 5 SNMP	33
Chapter 6 Firmware Upgrade Procedure	34
Firmware File Names	34
Firmware Upgrade Password	34
Upgrade Procedure	34
Example 1 Upgrade main image firmware to 1.0a6	34
Example 2 Upgrade web firmware to 1.0a6	35
Appendix A Using the HTTP Interface	36
Configuration Screen – Minimum Required Settings to Establish a Wireless Link	41
Appendix B Specifications	45



## Preface

This manual covers the basic configuration and installation of the Atlas5055 Wireless Point to Point Broadband System, and applies to the following radio part numbers:

P5055M-19-xx	Radio unit with internal 19 dBi patch antenna array
P5055M-23-xx	Radio unit with internal 23 dBi patch antenna array
P5055M-EXT-xx	Radio unit with external antenna connectors

Where “xx” denotes the regulatory configuration of the unit as follows:

US: For use in the USA and Canada

EU: For use in the following EU member and non-member countries:

- Austria
- Belgium
- Cyprus
- Czech
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Iceland (Non Members)
- Ireland
- Italy
- Latvia
- Lithuania
- Luxembourg
- Malta
- Norway (Non Members)
- Poland
- Portugal
- Slovak Republic
- Slovenia
- Spain
- Sweden
- Netherlands
- United Kingdom
- Switzerland (Non Members)
- Bulgaria
- Romania

OE: OEM model

Each radio unit is supplied with the proper mounting hardware, a power adapter, and POE box with LED indicators. Cables must be supplied by the installer.

Two radio units are required to make a Atlas5055 link. The P5055M-EXT-xx must be used in conjunction with an approved external antenna (sold separately). Instead of an internal antenna, the P5055M-EXT-xx has two reverse polarity SMA RF Connectors for the attachment of external antenna cables. The P5055M-EXT-xx requires professional installation due to FCC limits on output power settings when operating in the UNII band. See Page 28 for special instructions on setting U-NII output power limits when installing the P5055M-EXT-xx

## ***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: NCYP5055M**

**IC: 2945A-P5055M**

### **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.

### **Contact Information**

Corporate Headquarters	Trango Broadband Wireless, a division of Trango Systems, Inc. 15070 Avenue of Science Suite 200 San Diego, CA 92128 USA
Web Sites	<a href="http://www.trangobroadband.com">www.trangobroadband.com</a> <a href="http://www.trangosys.com">www.trangosys.com</a>
Sales Inquiries	email: <a href="mailto:sales@trangobroadband.com">sales@trangobroadband.com</a> Telephone: 1-858-653-3900
Technical Support	email: <a href="mailto:techsupport@trangobroadband.com">techsupport@trangobroadband.com</a> Telephone: 1-858-653-3900
Firmware Update Notices Mailing List	<a href="http://www.trangobroadband.com/maillinglist/maillingListAdd.aspx">http://www.trangobroadband.com/maillinglist/maillingListAdd.aspx</a>

## Chapter 1 Overview

The Atlas5055 is a point-to-point (PtP) wireless Ethernet transmission system which provides network connectivity at speeds up to 45 Mbps depending on the transmission distance and noise floor. The Atlas5055 utilizes OFDM technology and is designed for use in long range backhaul and wide area data networking applications.

Users are required to simply specify one P5055M unit type as master unit (MU) and one unit as remote unit (RU) to establish a link. Each unit utilizes power-over-Ethernet (PoE) and is designed for outdoor environments. The cable entry point can accommodate both Shielded twisted pair Cat5 (STP) and unshielded twisted pair Cat5 (UTP), with the addition of conduit for tower mounting.

### **DFS**

One of the key features of the Atlas5055 is that it has Dynamic Frequency Selection (DFS) which allows it to be operated in the 5.25 to 5.35 GHz and 5.47 to 5.7 GHz frequency ranges depending upon the regulatory requirements. When operating in these frequency ranges the MU will monitor the channel for radar transmissions and switch to a new channel automatically if radar is detected. The RU will switch to the new channel as well and the link will be automatically reconnected, typically in about 1 minute.

Each radio unit has a different threshold for detecting radar that corresponds to the radio's antenna gain. For the P5055M-19-xx models, the threshold is -46 dBm. Any radar signal arriving at the antenna on the operating channel that has an amplitude greater than -46 dBm will cause the MU and its associated RU to switch to a randomly selected channel that is tagged as a DFS channel in the channel table. For the P5055M-23-xx units, the threshold is -42 dBm, and for the P5055M-EXT-xx units the threshold is -37 dBm.

**IMPORTANT NOTE:** When operating in the DFS frequencies, the radio units will use automatic transmit power control (ATPC) to maintain the RSSI at a level of approximately -62 dBm. For very short link distances it may not be possible for the transmit power to be reduced below the Radar detection threshold and the radio may not be able to establish a reliable link. **Trango recommends that careful link budget planning be done to ensure that this condition does not exist.**

### **OFDM**

The Atlas platform utilizes Orthogonal Frequency Division Duplex (OFDM) processing which offers link stability and performance in the presence of multipath interference.

### **Adaptive Modulation**

One of the key advantages of the Atlas series radio platform is utilization of multiple modulation schemes including the following:

- Binary Phase Shift Keying (BPSK)
- Quadrature Phase Shift Keying (QPSK)
- 16 Quadrature Amplitude Modulation (16QAM)
- 64 Quadrature Amplitude Modulation (64QAM)

The Atlas system allows individual selection of the upstream and downstream modulation schemes. The modulation schemes can be adjusted manually or automatically (automatic rate shifting) for changing propagation and interference conditions. The higher order modulation schemes (64QAM) are typically deployed at reduced ranges while lower order modulation schemes (BPSK) are implemented at long distances.

### **ARQ**

Another key advantage of the Atlas platform is its Automatic Repeat Request (ARQ) transmission correction scheme. The ARQ algorithm detects packet loss due to fading and interference conditions and requests the remote radio to re-transmit specific packets.

### ***Dual Polarity Antenna***

Atlas radios feature built-in dual polarity antenna functionality. Users may select either horizontal or vertical antenna polarity through the unit's software. Switchable antenna polarity provides greater spectral flexibility and ability to mitigate interference.



## Range vs. Throughput

The following table shows approximate maximum ranges (at recommended fade margins) achievable with the Atlas5055 system using various antenna configurations. Longer ranges are achievable, but will result in lower fade margins. To estimate theoretical throughput and fade margin for any distance, download the link budget / fade margin calculator tool from [www.trangobroadband.com](http://www.trangobroadband.com).

**ISM (5725 MHz to 5875 MHz) Line-of-Sight Range & Throughput**

<i>Antenna</i>	<i>5 miles</i>	<i>20 miles</i>	<i>30 miles</i>
Integrated 23 dBi 15" Flat Panel	45 Mbps (10 db fade margin)	11 Mbps (14 db fade margin)	6 Mbps (17 db fade margin)
External 27 dBi 2' Dish	45 Mbps (18 db fade margin)	20 Mbps (18 db fade margin)	10 Mbps (20 db fade margin)
External 30 dBi 3' Dish	45 Mbps (24 db fade margin)	26 Mbps (20 db fade margin)	18 Mbps (22 db fade margin)
External 34 dBi 4' Dish	45 Mbps (30 db fade margin)	32 Mbps (20 db fade margin)	30 Mbps (15 db fade margin)

**U-NII (5470 MHz to 5725 MHz & 5250 MHz to 5350 MHz) Line-of-Sight Range & Throughput**

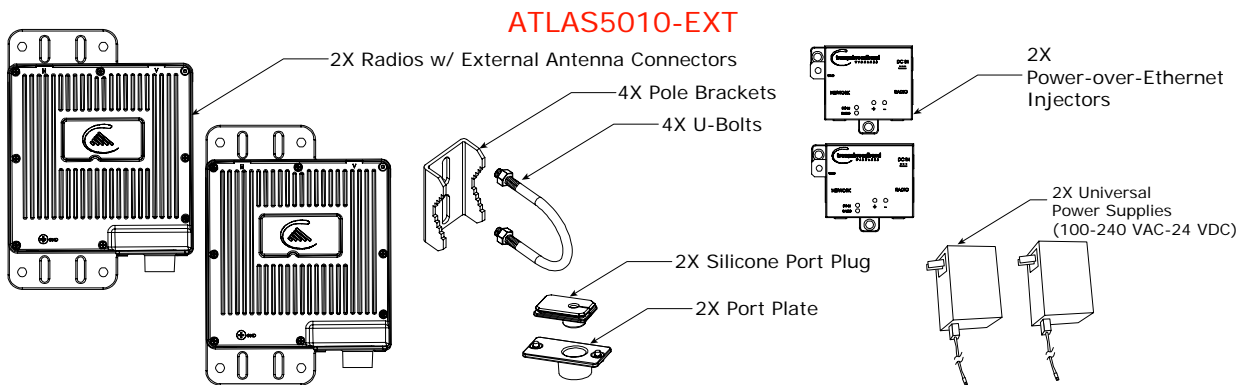
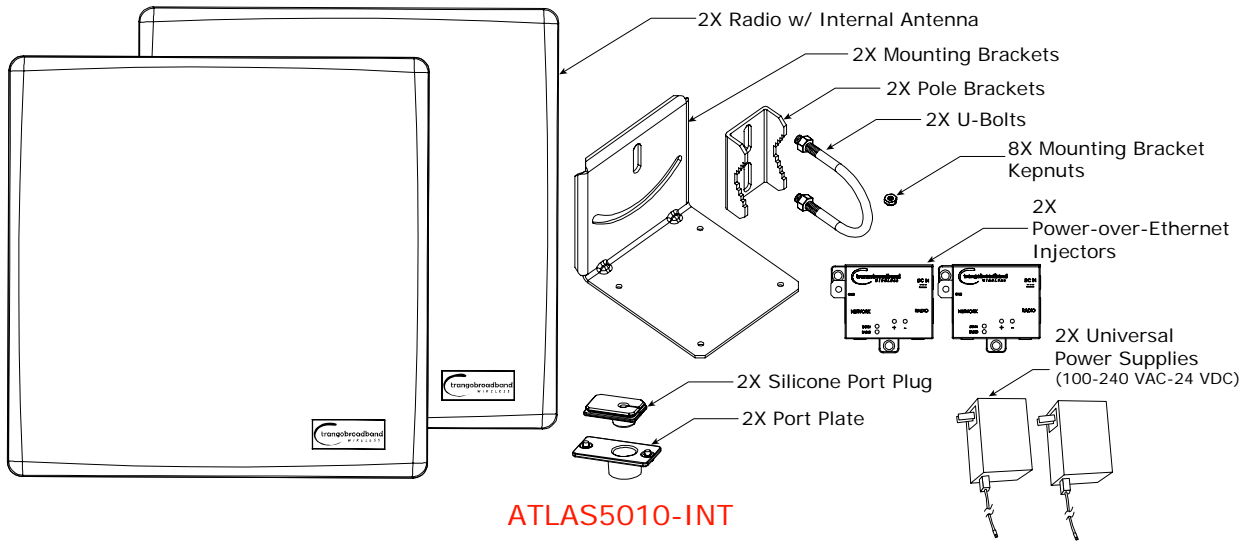
<i>Antenna</i>	<i>6 miles</i>	<i>10 miles</i>	<i>15 miles</i>
Integrated 23 dBi 15" Flat Panel	20 Mbps (10 db fade margin)	11Mbps (12 db fade margin)	6Mbps (9 db fade margin)
External 27 dBi 2' Dish	31 Mbps (11 db fade margin)	20 Mbps (10 db fade margin)	11Mbps (12 db fade margin)
External 30 dBi 3' Dish	31 Mbps (14 db fade margin)	20 Mbps (13 db fade margin)	16Mbps (12 db fade margin)
External 34 dBi 4' Dish	45 Mbps (10 db fade margin)	30 Mbps (13 db fade margin)	20Mbps (14 db fade margin)

## System Contents

The Atlas5055 system is available in two versions:

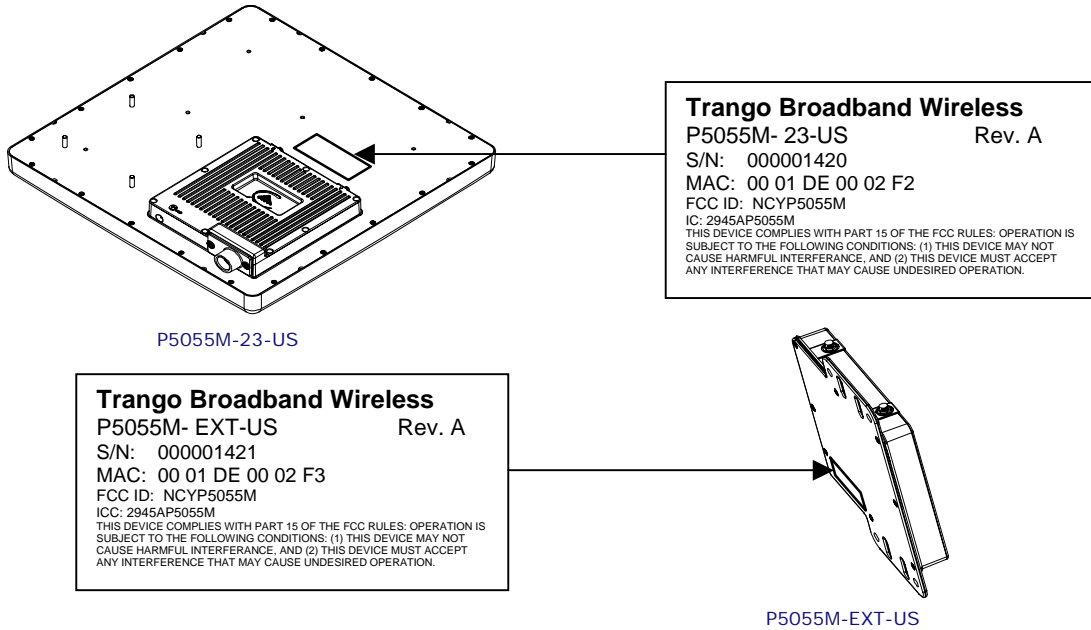
- Atlas5055-19-xx - Radios with integrated 19 dBi antennas (part numbers P5055M-19-xx)
- Atlas5055-23-xx - Radios with integrated 23 dBi antennas (part numbers P5055M-23-xx)
- Atlas5055-EXT-xx - Connectorized radios (part numbers P5055M-EXT-xx)

Each Atlas5055 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 P5055M-19-xx and P5055M-23-xx units.



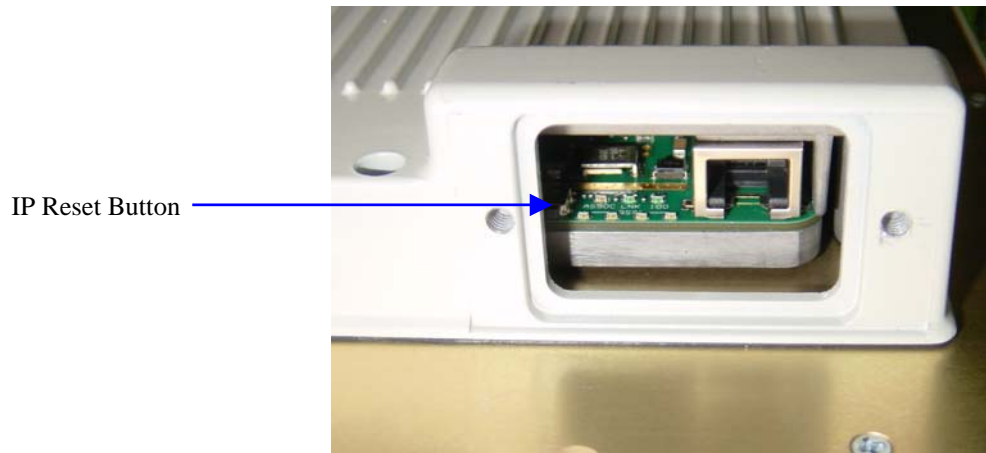
### Location of Serial Number & MAC Address

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 within the system information (sysinfo) screen.



### Location of RJ-45/LED Port & IP Reset Button

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 IP reset button resets IP configuration and password back to factory default. The reset button does not reset any other parameters other than IP configuration and password. Typically a user would only press the reset button when the IP configuration or password is unknown. Reset button must be held down for approximately 10 seconds.



## Chapter 2 Getting Started

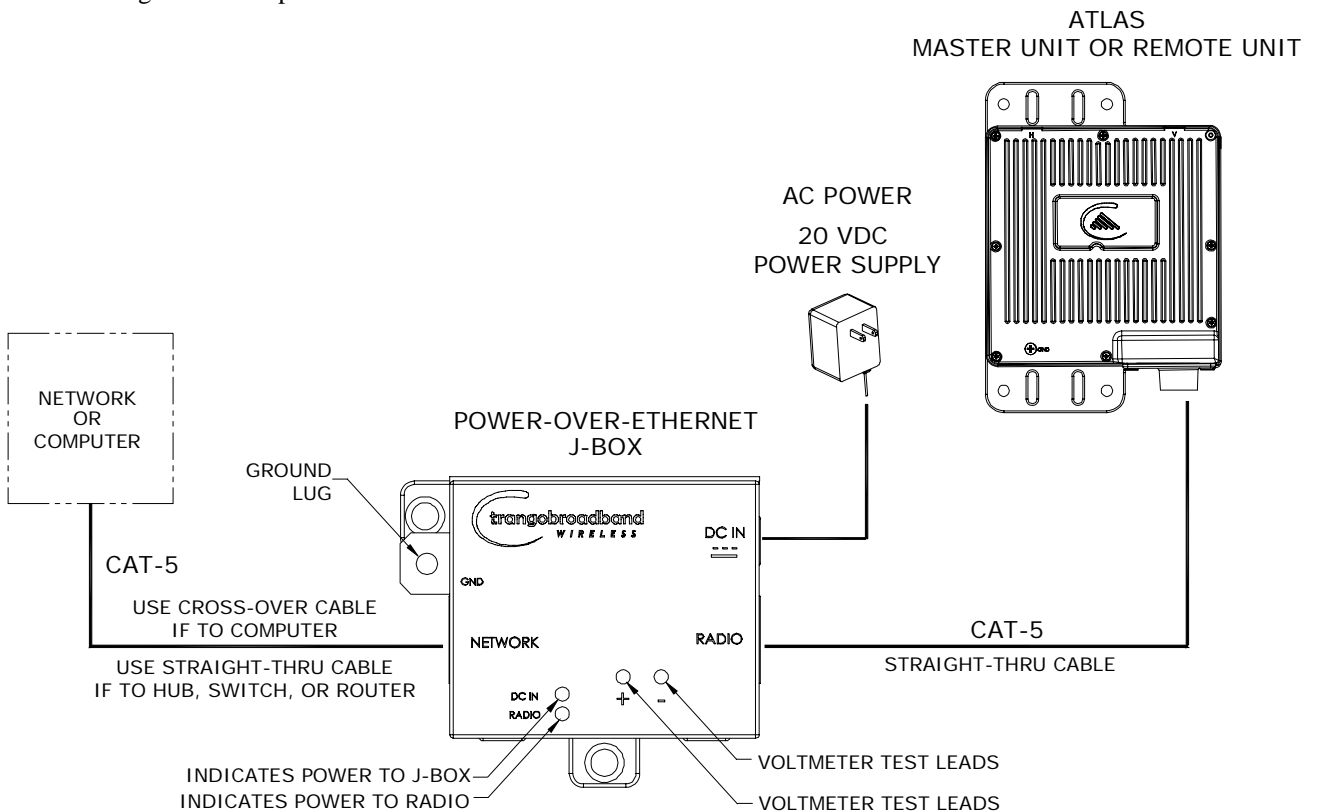
It is always a good idea to first provision and test the radios on the bench before deploying them in the field. This is a particularly useful exercise for the novice user.

### 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. After reboot, the Radio Power LED may take several seconds before lighting. The radio requires approximately 45 seconds to boot.

## Configuration Tools

Atlas5055 radios can be configured using either the Command Line Interface (CLI), or the Web Browser (HTTP) interface. 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-P5055M 1p0D05032202
      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.

## Changing Password

Three types of passwords are used in the Atlas system:

rw	read write password. User can view and update all system parameters
ro	read only password. User can view system information only
Upgrade	Firmware upgrade password. This password must be included in the file name of the main image and web browser firmware files during the TFTP upload process.

Use the **password** <ro/rw/upgrade>command to change the various passwords.

Examples:

```
#> password rw
New Password (4 to 16 characters): *****
Confirm Password: *****
Success.
```

```
#> password ro
New Password (4 to 16 characters): *****
Confirm Password: *****
Success.
```

## **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	Opmode, RF info, speed, and peer connection status
3	RF channel table
4	Area code information denotes which channels and power limits are available based on region code of the radio. Area code is set by the factory and can not be altered by the user.
5	ARQ status, encryption, Auto-rate shift, remarks, and LED RSSI function
6	Ethernet TX/RX statistics.

Sysinfo Example:

```
#> sysinfo

***** 0 *****

[Model] P5055M <INT>
[Unit Type] RU
[Hardware Version] 5010
[Firmware Version] lp0D05032202
[System Up Time] 0 day(s) 03:19:18

***** 1 *****

[MAC] 00 01 DE 1B 78 52
[S/N] 1800274
[IP] 10.254.1.2 [Subnet Mask] 255.255.255.248 [Gateway] 10.254.1.1

***** 2 *****

[Opmode] on [Default Opmode] on
[Active Channel] 2 h [Freq] 5280 MHz
[Speed] 36 Mbps [Tx Power] 7 dBm [Power Range] -4..7 dBm
[Peer ID] DE1B784B [Status] connected [RSSI] -75 dBm
[Peer IP Config] 10.254.1.3 255.255.255.248 10.254.1.1

***** 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 n/a [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 (5180..5240 MHz) Disabled
RF Band #2 (5260..5325 MHz) [Power Range] -4..7/7/7/7 dBm
RF Band #3 (5480..5720 MHz) Disabled
RF Band #4 (5735..5835 MHz) [Power Range] -4..21/19/18/17 dBm

***** 5 *****

[Tx MIR] 50000 Kbps
[ARQ] on
[Encrypt] off [Key] 0011 2233 4455 6677 8899 AABB CCDD EEFF
[Auto Rate Shift] on
[Auto Scan MU] off
[RSSI LED] on

[Remarks] atlas ru

***** 6 *****
```

```
[Eth In] 2,162,862 bytes 0 Kbps
[Eth Tx] 1,098,403 bytes 4 Kbps
[RF Rx] 471,841 bytes 0 Kbps
[RF Tx] 2,233,369 bytes 0 Kbps
```

```
Success.
#>
```

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

Example:

```
#> sysinfo 2
```

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

```
[Opmode] on [Default Opmode] on
[Active Channel] 2 h [Freq] 5280 MHz
[Speed] 36 Mbps [Tx Power] 7 dBm [Power Range] -4..7 dBm
[Peer ID] DE1B784B [Status] connected [RSSI] -75 dBm
[Peer IP Config] 10.254.1.3 255.255.255.248 10.254.1.1
```

```
Success.
#>
```

Each of the parameters within the sysinfo screen is defined below

### Section 0

[Model]	Radio Model # (P5055M)
[Unit Type]	User defined Unit Type (MU or RU)
[Hardware Version]	Hardware version set by factory (5010)
[Firmware Version]	Current firmware version loaded in radio
[System Up Time]	Time since last reboot or power cycle

### Section 1

[MAC]	MAC address of radio
[S/N]	Serial Number of Radio
[IP]	User defined IP Address of radio
[Subnet Mask]	User entered IP Subnet Mask
[Gateway]	User entered IP address of the default router or gateway on the local Ethernet segment

### Section 2

[Opmode]	Operation mode of the radio: ON = transmitting, OFF= not transmitting
[Default Opmode]	Opmode which the radio defaults to after reboot.
[Active Channel]	Active RF Channel and Antenna polarization
[Freq]	Frequency of active channel
[Speed]	Modulation Speed (6,12,18,24,36, 54 Mbps)
[Tx Power]	Transmit Power
[Power Range]	Allowable power range for chosen Frequency (dBm)
[Peer ID]	MAC Address of remote radio
[Status]	Connection status of remote radio (connected or disconnected)
[RSSI]	Measured signal strength from remote radio (dBm)



[Peer IP Config]

Remote radio's IP subnet, and default Gateway configuration

Section 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 n/a [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

Section 4

[Area Code]

Region (country code). Defines allowable frequencies. Area code is set by the manufacturer and can not be altered by the user.

RF Band #1 (5180..5240 MHz)

Disabled

RF Band #2 (5260..5325 MHz)

[Power Range] -4..7/7/7/7 dBm

RF Band #3 (5480..5720 MHz)

Disabled

RF Band #4 (5735..5835 MHz)

[Power Range] -4..21/19/18/17 dBm

Section 5

[Tx MIR]

Maximum Information Rate (Mbps). User may set Tx MIR in MU and RU to different values.

[ARQ]

Automatic Retransmit Request (On or Off)

[Encrypt]

Encryption (On or Off)

[Key]

Hexidecimal Encryption Key (must match in MU and RU)

[Auto Rate Shift]

Automatic Rate Shift (adaptive modulation) (On or Off)

[Auto Scan MU]

Auto Scan MU (RU setting only). (On or Off)

[RSSI LED]

Enable or disable RSSI LEDs on bottom of radio. Disabling RSSI LEDs improves system performance.

[Remarks]

User entered remarks up to 256 characters. Field accepts alpha numerics only. Special characters (!@#%&\*(\)/?) require quotations.

Section 6

[Eth In]

Counter for Ethernet packets which entered via the Ethernet port

[Eth Tx]

Counter for Ethernet packets which exited via the Ethernet port

[RF Rx]

Counter for Ethernet packets which entered via the wireless link

[RF Tx]

Counter for Ethernet packets which exited via the wireless link

## 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	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. Authentication is controlled by the MAC address of each radio.
Opmode	The radio has two modes of operation:  1) Opmode OFF – The radio is in a state which will not allow the establishment of a link with another radio. This state is mainly used for administration and pre-installation site survey  2) Opmode ON – The radio is in a state which allows it to establish a link to another radio if the proper settings are made. This is the normal “in service” state of the radio.
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's unit type (utype) 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 2 and polarization to H).  

```
#> freq 2 h
Ch# 23 h (5280 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 de1B7842  
Success.  
#>
2. Set channel and polarization. (in this example set the channel to 2 and polarization to H).  
#> freq 2 h  
Ch# 2 h (5280 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] on [Default Opmode] on
[Active Channel] 2 h [Freq] 5280 MHz
[Speed] 36 Mbps [Tx Power] 7 dBm [Power Range] -4..7 dBm
[Peer ID] DE1B784B [Status] connected [RSSI] -75 dBm
[Peer IP Config] 10.254.1.3 255.255.255.248 10.254.1.1
```

```
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 is the primary tool to assess the quality of the link when *opmode* is on. 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. . The *linktest* uses FEC but does NOT use ARQ, so all errors on the link are reported. Throughput numbers represent the absolute maximum bi-directional capacity including the management header (which is not available for user payload) so actual user throughput measurements will be slightly less.

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, modulation scheme, receiver sensitivity, and allowable maximum power settings for each frequency band. The lowest power setting for all bands in -10 dBm.

#### - US MODELS

Speed Setting (over-the-air rate) (Mbps)	Modulation Scheme	Receiver Sensitivity (dB)	Max Power 5.18 to 5.24 GHz (dBm)	Max Power 5.265- 5.325, 5.5 to 5.7 GHz (DFS-UNII) (dBm)	Max Power 5.735 to 5.84 GHz (ISM) (dBm)
6	BPSK	-92	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+21
12	QPSK	-87	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+19
18	QPSK	-85	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+19
24	16QAM	-84	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+18
36	16QAM	-80	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+18
48	64QAM	-75	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+17
54	64QAM	-73	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+17

#### - EU MODELS

Speed Setting (over-the-air rate) (Mbps)	Modulation Scheme	Receiver Sensitivity (dB)	Max Power 5.18 to 5.24 GHz (ETSI) (dBm)	Max Power 5.26- 5.32, 5.5 to 5.7 GHz (ETSI) (dBm)	Max Power 5.725 to 5.85 GHz (dBm)
6	BPSK	-92	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA
12	QPSK	-87	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA
18	QPSK	-85	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA
24	16QAM	-84	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA
36	16QAM	-80	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA
48	64QAM	-75	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA
54	64QAM	-73	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA

#### - OE MODELS

Speed Setting (over-the-air rate) (Mbps)	Modulation Scheme	Receiver Sensitivity (dB)	Max Power 5.18 to 5.24 GHz (ETSI) (dBm)	Max Power 5.26- 5.32, 5.5 to 5.7 GHz (ETSI) (dBm)	Max Power 5.725 to 5.85 GHz (dBm)
6	BPSK	-92	+14	+14	+21
12	QPSK	-87	+13	+13	+19
18	QPSK	-85	+13	+13	+19
24	16QAM	-84	+12	+12	+18
36	16QAM	-80	+12	+12	+18
48	64QAM	-75	+11	+11	+17
54	64QAM	-73	+11	+11	+17

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.
#>
```

### ***MU Autoscan Feature Description***

This feature allows the RU to actively search all channels and polarizations for its peer MU in the event of a disassociation. This feature is useful if the user frequently changes the channel/polarization of the MU . If enabled, the *autoscanmu* routine in the RU performs a search for the peer MU by actively scanning all available channels and polarizations. NOTE: Autoscanning is always active when operating on DFS channels.

Notes regarding the autoscanmu feature:

- The RU will not activate the autoscan process after first 60 seconds of turning on opmode.
- The RU will start the auto scan process If RU loses association for more than 10 seconds,.
- The whole process will scan all available frequencies and polarizations in channel tables. The radio will spend 10 to 12 seconds for each frequency.
- For each frequency, radio will survey both polarizations, H and V. It will record the following information:
  - association
  - average RSSI of receiving P5055M packets
- After scanning all available frequencies in channel plan, the radio will select the channel based on the strongest average RSSI for receiving packets.
- If no channel is selected after completing the cycle, the process will start again.

Example:

```
#> autoscanmu on
Success.
#>
```

### ***Automatic Rate Shifting Feature Description***

With autorateshift feature enabled, the radios will automatically renegotiate the modulation method and speed to maximize wireless link integrity. The link speed will vary depending on two factors: 1) the number of ARQ errors received, 2) successful processing of special link assessment packets sent in both the current and next higher speed. The radio will shift to the next higher in speed when no errors are detected. The radio will shift down in speed if error rate is excessive.

Notes regarding the autorateshift feature:

1. The radio will begin initial speed test when upon association to peer radio. There are 40 steps and around 50 seconds to complete this initial test. The radio will send link assessment packets (3600 byte packets at a rate of 100 packets per second) at the highest speed (54 Mbps). The radio will deliver payload at the speed which is specified before association. If the assessment packet dropping rate is higher than 10 percent, the speed test will decrease the speed for assessment packets. If the current payload speed is higher than the speed of assessment packet, the radio will set the current payload speed to be the same as the assessment packet's speed. If the current payload speed is lower than the assessment packet's speed and more than 500 assessment packets have been transmitted, the radio will set the payload speed to be the same as assessment packet's speed.

2. After completion of initial speed test, the radio will set the payload speed to be the same as the final speed of initial speed test.
3. The radio will check link quality and adjust payload speed periodically.
  - a. The radio will increase payload speed every 60 seconds, if
    - i. Speed test which is running at higher speed is successful. –and–
    - ii. Payload’s ARQ retransmit rate is less than 10 percent.
  - b. Radio will decrease payload speed every 10 seconds, if
    - i. Speed test which is running at payload speed is failure. –and–
    - ii. Payload’s ARQ retransmit rate is higher than 10 percent.
4. Payload speed can be changed manually when auto rate shift is on. But the speed setting will not be sustained.

Example:

```
#> autorateshift on
Success.
#>
```

### ***Encryption Feature Description***

The Atlas system offers 128 bit proprietary encryption which may be turned on or off by the user. The HEX encryption key must be set in both the MU and RU. Users can expect faster payload speeds with encryption turned off as compared to with encryption turned on.

Example:

```
#> encrypt on
Success.
#> encrypt key 1111 2222 3333 4444 5555 6666 7777 8888
argc = 10
Success.
#>
```

### ***MIR Feature Description***

Maximum Information rate is configurable on both the MU and RU. The MIR function is performed on the transmit side only and is based on a one second timing interval. During each one second timing interval, the total bits transferred is compared to the MIR limit configured by the user. When the limit is exceeded, no more data is sent and the packets in the queue will be dropped. This function is useful for reserving more bandwidth in one direction than the other. If left wide open, the system will respond to bandwidth demand as needed, allowing the full bandwidth of the channel to be used by either direction.

Example:

```
#> mir 10000
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*.

Command Syntax	Description
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]	<p>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.</p> <p>Notes:</p> <ul style="list-style-type: none"> <li>• Radio will start to perform diagnostic speed test approximately 50 seconds after association.</li> <li>• Radio will set new speed after finishing speed test.</li> <li>• Radio will check link quality for increasing speed every 60 seconds.</li> <li>• Radio will check link quality for decreasing speed every 10 seconds.</li> <li>• Link quality is based on ARQ retransmit statistics and speed assessment packets.</li> <li>• Radio's speed can be changed manually when auto rate shift is on, however the speed will not be sustained.</li> <li>• If auto rate shift is turned on after association, the radio will not perform speed test.</li> <li>• If auto rate shift is turned off after associated, radio will not perform regular link quality assessment.</li> </ul>
autoscanmu [on off]	<p>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.</p> <p>Notes:</p> <ul style="list-style-type: none"> <li>• RU will not perform auto scan during the first 60 sec after opmode is turned on.</li> <li>• RU will initiate auto scan cycle after losing sync for 10 seconds.</li> <li>• RU will scan all "available channels" and antenna polarizations.</li> <li>• After finishing scan cycle, RU will pick the best channel and antenna by a) has sync and b) has highest packet rssi. Afterwards RU will change to that channel with max power.</li> <li>• If no channel is selected after finishing scan cycle, RU will initiate auto scan cycle again after 10 seconds.</li> </ul>

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) <key> = xxxx xxxx xxxx 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. <ip> = ip address <subnet> = subnet mask <gateway> = gateway ip address
linktest <local tx rate> <peer tx rate> [<pkt size> [<# of pkt> [<# of cycle>]]]	RF link loopback test .  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 <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. <kbps> = 100..50000
opmode [on off]	Set or display operation mode (on or off)
password <ro rw upgrade>	Change password. <ro> = for read-only <rw> = for read-write <upgrade> = for upgrading firmware
peerid [<peer device id>]	Set or display peer device id.
power [<dBm>]	Set or display tx power.. <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.
rss	Display RF relative signal strength indication (rssi) from peer radio.
rssiled [on off]	Enable or disable rssi LED update.
speed [<tx rate>]	Set or display tx rate <tx rate> = 1,2,6,9,11,12,18,24,36,48,54 Mbps
survey [<sec>]	Display noise floor for current channel . <sec> = period 10..3600 <span style="float: right;">default = 10</span>
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 <part #> = 0..6 part 0: up time and version information part 1: MAC address and IP configuration part 2: RF link status part 3: channel table part 4: region code and power limitations part 5: switch settings and remarks part 6: statistics
syslog	Display system log.
tftpd [on off]	Enable or disable tftpd (used for firmware upgrades).
uniimaxpower [<-4..7, dBm>]	Set or display max power allowed in UNII band.
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 specific channels or for all channel/antenna polarization combinations.

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

The survey command will display the average and peak noise floor for each channel as well as average and peak RSSI received during the same period for 802.11 packets.

Users may run any of the following variations of the survey command:

survey	display noise floor for current channel based on 10 second scan.
survey [<sec>]	display noise floor for current channel for period <sec> 10..3600 seconds
survey <sec> all	display noise floor for all available channels where <sec> = period per channel
survey <sec> [<ch#> [..]]	display noise floor for selected channels (max 4) where <sec> = period per channel <ch#> = channel number

Example:

```
#> survey 10 all
Press 'q' to stop.
  noise floor (peak/avg dBm)  rssi by pkt (peak/avg dBm)
Ch 1 h 5260 : -97 / -98    n/a / n/a
Ch 1 v      : -96 / -98    n/a / n/a
Ch 2 h 5280 : -97 / -98    n/a / n/a
Ch 2 v      : -97 / -98    n/a / n/a
Ch 3 h 5300 : -97 / -98    n/a / n/a
Ch 3 v      : -82 / -98    n/a / n/a
Ch 4 h 5320 : -97 / -98    n/a / n/a
Ch 4 v      : -97 / -98    n/a / n/a
Ch 19 h 5735 : -55 / -89   n/a / n/a
Ch 19 v      : -42 / -89   n/a / n/a
```

```
Ch 20 h 5755 : -82 / -96    n/a / n/a
Ch 20 v      : -76 / -85    n/a / n/a
Ch 21 h 5775 : -97 / -98    n/a / n/a
Ch 21 v      : -95 / -98    n/a / n/a
Ch 22 h 5795 : -75 / -81    n/a / n/a
Ch 22 v      : -89 / -90    n/a / n/a
Ch 23 h 5815 : -90 / -91    n/a / n/a
Ch 23 v      : -87 / -88    n/a / n/a
Ch 24 h 5835 : -78 / -79    n/a / n/a
Ch 24 v      : -84 / -86    n/a / 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.

## **Setting Maximum RF Power for Legal Operation in the U-NII Bands (-EXT only)**

**Due to FCC restrictions the professional installer must manually set the maximum power for the 5.25 to 5.35 GHz and 5.47 to 5.725 GHz U-NII bands based upon which external antenna antenna is being used.**

In all cases, EIRP cannot exceed +28 dBm.  $\text{Antenna Gain} + \text{Radio Max Power Setting} = 28 - \text{Antenna gain} + \text{cable loss}$ . As an example, if the radio is being installed with a 34 dBi antenna with a 1 dB loss cable, then the radio max U-NII power must be fixed to -5 dBm. The following chart provides additional details.

Antenna Gain -cable loss	Maximum Allowed U-NII Tx Power
26	+2 dBm
30	0 dBm
33	-5 dBm

The Max Power Setting command is only accessible from the command line and is not available on the HTTP Browser interface.

The telnet command to change the maximum power is:

***uniimaxpower <max power in dBm>***

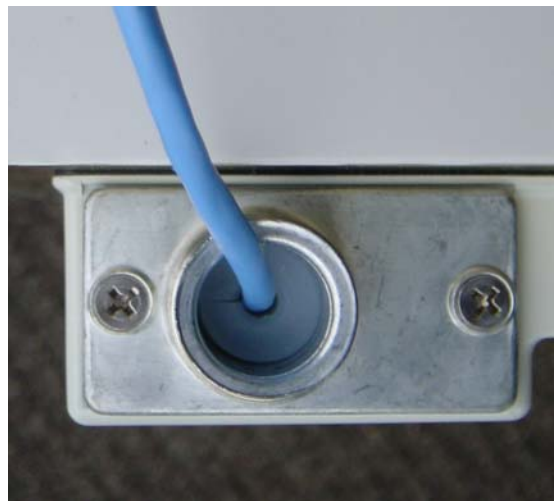
The command must be run on each P5055-EXT prior to installing the antenna and while the Opmode is OFF.

Example: To set the max power setting for the 34 dBi antenna use the following command:

```
#> Uniimaxpower -5  
success.
```

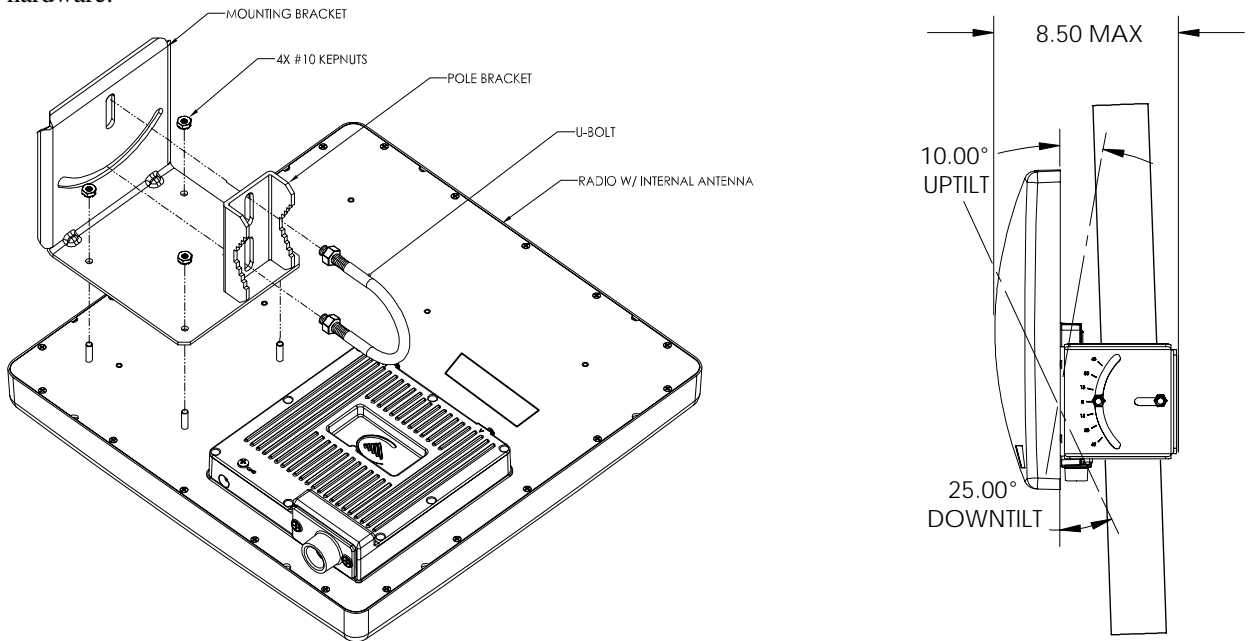
### Port Plug and Port Plate (Hardware)

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.

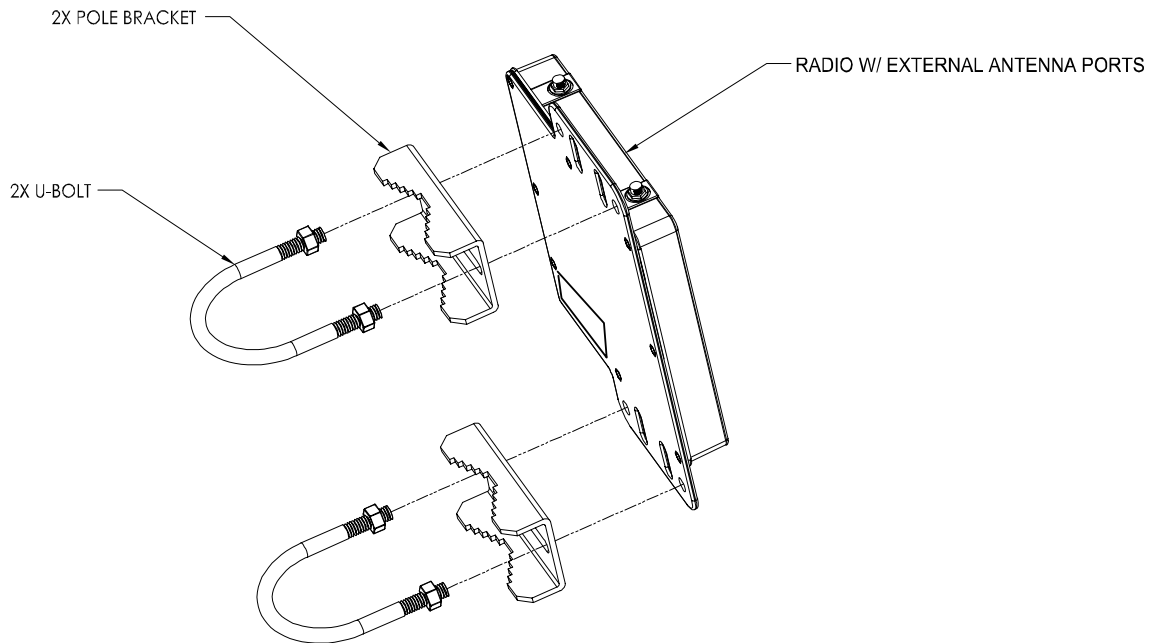


## Mounting Hardware

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 P5055-23-xx



### Mounting Hardware Assembly for P5055M-EXT-xx

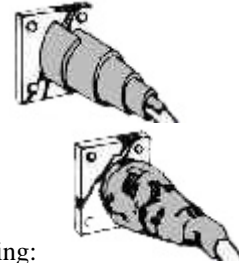
#### Connecting External Antenna on EXT Model

The P5055-EXT-xx is equipped with two reverse-polarity SMA connectors on the top for attachment to an external antenna. Each SMA connector is labeled with either “V” for Vertical or “H” for Horizontal polarization. Connect each cable to the appropriate “H” and “V” ports on both the antenna and the radio.

It is important to properly seal each antenna connection to protect against moisture and corrosion. Each Atlas radio is shipped with a packet of Coax-Seal® connector sealant which should be applied over each of the SMA connectors. Coax-Seal is a gum-like tape which is applied by wrapping around the connector and then compressed/molded to form a single cohesive protective covering over the connector.

**NOTE: IT IS IMPORTANT THAT THE COAXSEAL IS OVERLAPPING THE CASE TO PREVENT WATER FROM COLLECTING IN THE RECESSED AREA OF THE CONNECTOR**

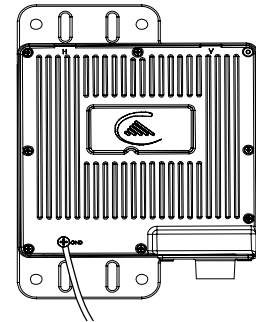
To properly apply the Coax-Seal product first wrap the connector/case as shown:



Secondly, compress the Coax-Seal product to mold into a single protective covering:

### **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.



### **Cat-5 Cabling 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

The Atlas supports SNMP (Simple Network Management Protocol). Network management consists of the following 3 categories: configuration, Link and Association monitoring and Alarms. Besides this proprietary Management Information Base (MIB) the Atlas also supports a large part of the MIB-II OIDs.

Review the Trango MIB (TRANGO-P5M-MIB.mib) available on our website for the complete listing of all MIB objects available.

These capabilities allow the system administrator to provide superior service through higher network accessibility and integrated performance monitoring.

Depending on your Network Node Manager (NNM) it may be necessary to append a “.0” onto the end of each of the OIDs listed below for proper operation.

<b>Objects for Configuration</b>	<b>Name</b>	<b>Description</b>
1.3.6.1.4.1.5454.1.40.1.1.1	verUnitType	Returns radios unit type (0 = RU, 1= MU)
1.3.6.1.4.1.5454.1.40.1.8.3	sysswAutoScanMUSignal	Returns value of Auto Scan switch (0 = off, 1 = on)
1.3.6.1.4.1.5454.1.40.1.3	sysDefaultOpmode	Returns defaultOpmode setting (0 = off, 1 = on)
1.3.6.1.4.1.5454.1.40.1.4	sysCurrentOpmode	Returns current opmode setting (0 = off, 1 = on)
1.3.6.1.4.1.5454.1.40.1.5	sysActivateOpmode	Turns opmode on
1.3.6.1.4.1.5454.1.40.1.13.1	sysipconfigIpAddress	Sets IP address
1.3.6.1.4.1.5454.1.40.1.13.2	sysipconfigSubnet	Sets subnet
1.3.6.1.4.1.5454.1.40.1.13.3	sysipconfigDefaultGateway	Set default gateway
1.3.6.1.4.1.5454.1.40.1.13.4	sysipconfigChange	Activates IP address change
1.3.6.1.4.1.5454.1.40.2.1	rfPeerDeviceID	Configure PeerID
1.3.6.1.4.1.5454.1.40.2.2	rfActiveChannel	Displays current channel
1.3.6.1.4.1.5454.1.40.2.3	rfActivePolarization	Displays current antenna polarization
1.3.6.1.4.1.5454.1.40.2.4	rfSpeed	Displays current Speed setting
1.3.6.1.4.1.5454.1.40.2.5	rfTxPower	Displays current transmit power (dBm)
1.3.6.1.4.1.5454.1.40.1.14	sysRemarks	Display radios remarks
<b>Objects for Link and Association Monitoring</b>		
1.3.6.1.4.1.5454.1.40.2.12	rfRSSI	Displays RSSI value (dBm)
1.3.6.1.4.1.5454.1.40.2.13	rfAssociated	Displays current association status (0 = disassociated, 1 = associated)
1.3.6.1.4.1.5454.1.40.3.2	ruReboot	Reboots RU
1.3.6.1.4.1.5454.1.40.3.3	ruDistance	Displays current ru distance
<b>Objects for Bandwidth Monitoring</b>		
1.3.6.1.4.1.5454.1.40.1.9.1	systrafficEthInOctets	Displays Ethernet in (bytes)
1.3.6.1.4.1.5454.1.40.1.9.2	systrafficEthOutOctets	Displays Ethernet out (bytes)
1.3.6.1.4.1.5454.1.40.1.9.3	systrafficRfInOctets	Displays RF in (bytes)
1.3.6.1.4.1.5454.1.40.1.9.4	systrafficRfOutOctets	Displays RF out (bytes)
<b>Objects for Alarm Monitoring</b>		
1.3.6.1.4.1.5454.1.40.3.4.1.1	trapTrapDstEntry	
1.3.6.1.4.1.5454.1.40.3.4.1.2	trapTrapDstEnabling	Enable/Disable trap
1.3.6.1.4.1.5454.1.40.3.4.2	trapTrapIpAddress	Set destination trap IP
1.3.6.1.4.1.5454.1.40.3.4.3	trapTrapCommStr	Set trap community string

## Chapter 6 Firmware Upgrade Procedure

Trango Broadband Wireless will from time to time release firmware upgrades for the Atlas series radios. The latest released firmware can be downloaded from <http://www.trangobroadband.com/support/downloads.htm>.

Firmware releases consists of two files: Main image firmware and Web (HTTP interface) firmware.

### ***Firmware File Names***

Firmware files are released in the format shown below. This example consists of main image and web firmware versions 1.0a6.

Main Image:     p5m\_1p0a6D05031505\_Pupgrade  
                  Firmware Version: 1p0a6D05031505  
                  File Size: 1868288 bytes

Web               web\_1p0a6D05031505\_Pupgrade  
                  File Size: 131584 bytes

### ***Firmware Upgrade Password***

The firmware filenames include the upgrade password (the characters after the ‘\_P’ in the file name) The default upgrade password in the Atlas radios is *upgrade*. Users may change the upgrade password within the radios using the *password upgrade* command. Firmware release files from Trango Broadband Wireless will always be names with the default upgrade password of *upgrade*. If the user changes the upgrade password in the radio, then the firmware file name must be changed as well in order to upgrade the radios.

### ***Upgrade Procedure***

1. Place firmware files in easily accessible path in your computer.
2. In order to provide the most stable wireless conditions possible during the upgrade process it is recommended to set the radio speed to the minimum (6 Mbps) in both the MU and RU. Turn autorateshifting off during the upgrade.
3. Turn on the radio’s tftp daemon
4. From computer’s command prompt, tftp the firmware file into the radio using binary mode.
5. After file is successfully tftp’d to the radio, the radio will automatically reboot itself and load the new firmware

**IMPORTANT: DO NOT POWER CYCLE OR INTERRUPT THE REBOOT PROCESS IN ANY MANNER. WAIT AT LEAST THREE MINUTES TO ENSURE AUTOMATIC REBOOT COMPLETION. LOSS OF POWER DURING THE REBOOT SEQUENCE WILL RESULT IN A CORRUPTED/INCOMPLETE FIRMWARE LOAD WHICH WILL REQUIRE REFLASHING AT THE FACTORY.**

6. Repeat process for other radio
7. Repeat process for web file.

### ***Example 1 Upgrade main image firmware to 1.0a6***

FROM RADIO TELNET SESSION

```
Welcome to Trango Broadband Wireless, Atlas PtP-P5055M 1p0a4D05030303
Password:
Login as read/write.
```

```
#> tftpd on
Success.
#>
```

**FROM COMPUTER COMMAND PROMPT SESSION**

```
C:\Atlas>dir
Volume in drive C is Local Disk
Volume Serial Number is 7802-AAF7

Directory of C:\Atlas

03/16/2005  08:29a      <DIR>          .
03/16/2005  08:29a      <DIR>          ..
03/15/2005  04:34p             1,868,288  p5m_1p0a6D05031503_Pupgrade
03/15/2005  04:33p             131,584  web_1p0a6D05031505_Pupgrade
                2 File(s)          1,999,872 bytes
                2 Dir(s)   20,217,208,832 bytes free
```

```
C:\Atlas>tftp -i 10.254.1.2 put p5m_1p0a6d05031503_Pupgrade
Transfer successful: 1868288 bytes in 9 seconds, 207587 bytes/s
```

```
C:\Atlas>
```

**NOTE: AT THIS POINT WAIT THREE MINUTES BEFORE PROCEEDING*****Example 2 Upgrade web firmware to 1.0a6*****FROM RADIO TELNET SESSION**

```
Welcome to Trango Broadband Wireless, Atlas PtP-P5055M 1p0a6D05031505
Password:
Login as read/write.
#>
#> tftpd on
Success.
#>
```

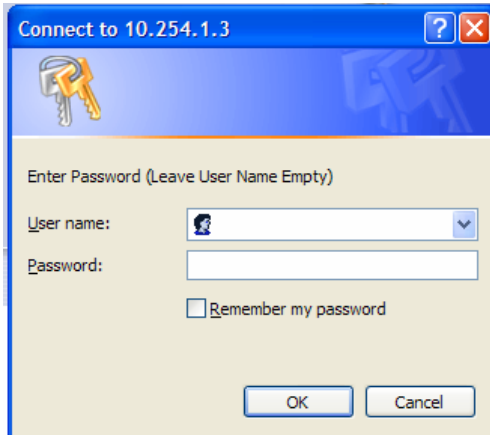
**FROM COMPUTER COMMAND PROMPT SESSION**

```
C:\Atlas>tftp -i 10.254.1.2 put web_1p0a6d05031505_Pupgrade
Transfer successful: 131584 bytes in 1 second, 131584 bytes/s
```

```
C:\Atlas>
```

## Appendix A Using the HTTP Interface

Open a browser session and type in the IP address of one of the radios. Default IP address is 192.168.100.100.



Leave the User name field blank and enter read write or read only Password. Press OK. Default password is trango. After logging on, the system information screen will be displayed.

**Atlas PtP RU** Trango Broadband Wireless

**System Information**

\*\*\*\*\* 0 \*\*\*\*\*

Model P5010M  
Unit Type RU  
Hardware Version 5010  
Firmware Version 1p0D05032202  
System Up Time 02:41:15  
\*\*\*\*\* 1 \*\*\*\*\*

MAC 00 01 DE 1B 78 52  
IP 10.254.1.2 Subnet Mask 255.255.255.248 Gateway 10.254.1.1  
\*\*\*\*\* 2 \*\*\*\*\*

Opmode on Default Opmode on  
Peer ID DE1B784B Status connected RSSI -74 dBm  
Channel 2 h Tx Power 7 dBm  
\*\*\*\*\* 3 \*\*\*\*\*

Channel Table (MHz)  
Ch#01 5260 Ch#02 5280 Ch#03 5300 Ch#04 5320  
Ch#05 5340 Ch#06 5400 Ch#07 5500 Ch#08 5520  
Ch#09 5540 Ch#10 5560 Ch#11 5580 Ch#12 5600  
Ch#13 5620 Ch#14 5640 Ch#15 5660 Ch#16 5680  
Ch#17 5700 Ch#18 5720 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 (5180..5240 MHz) Disabled  
RF Band #2 (5260..5325 MHz) Power Range -4..7/7/7 dBm  
RF Band #3 (5480..5720 MHz) Disabled  
RF Band #4 (5735..5835 MHz) Power Range -4..21/19/18/17 dBm  
\*\*\*\*\* 5 \*\*\*\*\*

Tx MIR 50000 Kbps  
[ARQ] on  
[Encrypt] off [Key] 0011 2233 4455 6677 8899 AABB CCDD EEFF  
[Auto Rate Shift] on  
[Auto Scan MU] off  
[RSSI LED] on  
Remarks atlas ru  
\*\*\*\*\* 6 \*\*\*\*\*

Eth In 2,129,612 bytes Eth Out 846,248 bytes  
RF In 448,136 bytes RF Out 2,223,859 bytes

Trango Broadband Wireless, a division of Trango Systems, Inc.  
<http://www.tranqobroadband.com>  
Email: [techsupport@tranqobroadband.com](mailto:techsupport@tranqobroadband.com)

Navigation links are shown on the left side of the browser screen. Navigable links include:

[System Information](#)

[Configuration](#)

[Site Survey](#)

[Link Control](#)

[Help](#)

The lower left portion of the screen shows the unit's current opmode, connection, channel, and antenna status.

The main body of the System Information displays most of the key parameters. To alter these parameters use the [Configuration](#) page.

To log off of the web browser interface, close the browser and the HTTP session will be automatically terminated.

Description of System Information entries. To view this information within the radio, click the [Help](#) link.

---

<b>Model:</b>	Model number.
<b>Unit Type:</b>	Atlas unit type either MU (master) or RU (remote).
<b>Hardware Version:</b>	Hardware version is factory-set and can not be changed by user.
<b>Firmware Version:</b>	Current firmware version loaded in the radio.
<b>System Up Time:</b>	Time since radio was last rebooted or powered.
<b>MAC:</b>	MAC address of the radio.
<b>IP, Subnet Mask, Gateway:</b>	IP, subnet mask, and gateway of radio
<b>Opmode:</b>	Current operation of the radio. \"On\" indicates transmitting. \"Off\" indicates not transmitting.
<b>Default Opmode:</b>	Opmode which radio enters after reboot or power cycle.
<b>Peer ID:</b>	User entered MAC address of the peer unit. In the MU, Peer ID is the MAC address of the RU. In the RU, Peer ID is the MAC address of the MU.
<b>Status:</b>	Status of Remote Unit. Connected (wireless link established) or disconnected (wireless link not established).
<b>RSSI:</b>	Relative Signal Strength Indicator. Displays signal strength received from the Remote Unit. 'n/a' indicates Remote Unit is not connected.
<b>Tx MIR:</b>	Transmit Maximum Information Rate to the peer unit.
<b>Channel:</b>	RF Channel
<b>Tx Power:</b>	Transmit power
<b>Channel Table:</b>	Set of channels based on the area code setting. Channels which are lined-out are not available for use based on area code setting.
<b>Area Code:</b>	Country code – defines set of available channels and maximum power based on regulatory restrictions. Setting can not be changed by user.
<b>Auto Rate Shift:</b>	See definition in Configuration section .
<b>Auto Scan MU:</b>	See definition in Configuration section.
<b>RSSI LED:</b>	See definition in Configuration section.
<b>Remarks:</b>	See definition in Configuration section.
<b>Eth In:</b>	Counter for Ethernet packets which entered via the Ethernet port of the radio.
<b>Eth Out:</b>	Counter for Ethernet packets which exited via the Ethernet port of the radio.
<b>RF In:</b>	Counter for Ethernet packets which entered over-the-air into the radio.

---

<b>RF Out:</b>	Counter for Ethernet packets which exited over-the-air out the radio.
<a href="#">Configuration Page</a>	
<b>IP Address:</b>	The IP address of this radio; used to manage the radio's application layer.
<b>Subnet Mask:</b>	The subnet mask of the radio.
<b>Gateway:</b>	The default gateway of the radio.
<b>Default Opmode:</b>	Operation mode of the radio after power cycle. When Opmode is \"On\" the radio will attempt to make a wireless connection. When Opmode is \"Off\" the radio is not transmitting, but can be managed from the wired side. In addition to setting Default Opmode to \"Off\", Opmode can be set to \"Off\" by interrupting the radios boot-up cycle in the first 30 seconds after power up
<b>Peer ID:</b>	User entered MAC address of the partner unit.
<b>Switch:</b>	Checked means active
Auto Rate Shifting	When enabled, radio will automatically shift TX rate up or down depending on link quality.
Autoscan MU	(RU Only). If this switch is enabled, when not connected to MU, the RU will automatically scan all available channels and frequencies
RSSI LED	Enables and disables RSSI LEDs. Disabling the LEDs provides slight improvement to radio performance. Typically RSSI LEDs should be enabled during alignment and disabled during normal operation.
<b>Active Channel/Polarization:</b>	The current channel and polarization of the radio when Opmode is \"On\".
<b>Speed:</b>	Transmit over-the-air raw data rate.
<b>Power:</b>	Transmit RF power setting.
<b>Range:</b>	Allowable range of the transmit power based on the current settings of the active channel and the speed.
<b>Remarks:</b>	A descriptive text field for general use (i.e. the location of the unit). It does not affect system performance.
<b>MIR:</b>	Set Maximum Information Rate for network traffic.
<b>ARQ: .</b>	Auto Retransmit Request. When enabled, dropped packets are detected at the receiver and retransmitted by the transmitter.
<b>Encrypt: .</b>	Encryption. Enables and disables proprietary 128 bit over-the-air encryption.
<b>Key: .</b>	128 Encryption Key. Must match in both MU and RU.
<b>Activate Opmode On:</b>	Activates radio's Opmode to "On"-transmitting.
<b>Activate Opmode Off:</b>	Activates radio's Opmode to "Off" not-transmitting.

**Reboot:** Reboot the unit.

**Close All Telnet Sessions:** Close all the active telnet sessions.

## Configuration Screen

The screenshot displays the configuration interface for an Atlas P1P RU unit. The browser window shows the URL `http://10.254.1.3/trango/hw/config.shtml`. The page is titled "Atlas P1P RU Configuration" and includes a sidebar with navigation options: System Information, Installation, Configuration, Site Survey, Management, Link Control, and Current Status. The main configuration area is divided into several sections:

- Unit Type:** Radio buttons for RU (selected) and RU.
- IP Address:** Text input field containing 10.254.1.2.
- Subnet Mask:** Text input field containing 255.255.255.248.
- Gateway:** Text input field containing 10.254.1.1.
- Default Opmode:** Radio buttons for On (selected) and Off.
- Peer ID:** Text input field containing DE10704E.
- Switch:** Checkboxes for Auto Rate Shifting Enable (checked), Auto Scan Master Unit Signal Enable (RU Only) (unchecked), and RSSI LED Flashing Enable (checked).
- Active Channel:** Dropdown menu set to Ch#2 5280.
- Polarization:** Radio buttons for V (selected) and H.
- Speed:** Text input field containing 36 Mbps.
- Power:** Text input field containing 7 dBm, with a Range of -4.7.
- Remarks:** Text input field containing atlas ru.
- MIR:** Text input field containing 50000 Khps.
- ARO:** Radio buttons for On (selected) and Off.
- Encrypt:** Radio buttons for On (selected) and Off.
- Key:** Text input fields containing 0011, 2233, 4455, 6677, 8899, AADB, CCDD, and EEFF.

At the bottom of the configuration area, there are buttons for "Save and Activate Settings", "Activate Opmode On", "Activate Opmode Off", "Reboot System", and "Close All Telnet Sessions". The footer of the page includes the text: "Trango Broadband Wireless, a division of Trango Systems, Inc. <http://www.trangobroadband.com> [krstf\\_techsupport@trangobroadband.com](mailto:krstf_techsupport@trangobroadband.com)".

All user configurable parameters can be entered from the Configuration Screen and this is the only screen used to provision a wireless link between the two radios.



### **Configuration Screen – Minimum Required Settings to Establish a Wireless Link**

To configure a wireless link, user must (at a minimum) enter the following information:

Unit Type:	Set one radio as the MU and one radio as the RU. Click on “Change Unit Type” to save the setting.
IP Configuration:	Each radio should be set up with a unique IP address to enable remote management. Click on “Change IP Config” to save the setting.
Default Opmode:	Should be “On”. Radio will enter default opmode approximately 30 seconds after complete reboot cycle. Opmode must be “On” for radios to transmit and wirelessly connect.
Peer ID:	Enter the last 8 digits of the peer units MAC address. Atlas radios will only wirelessly connect to the peer ID with the specified MAC address.
Active Channel:	Select a channel & antenna polarization. Both MU and RU should be set to the same channel unless RU’s “Auto Scan Master Unit Signal Enable” is enabled. If Auto Scan is enabled, the RU will automatically scan all channels and polarizations searching for it’s peer MU. Once the MU is detected, the RU will automatically set its active channel and antenna polarization to that of the MU.

Click “Save and Activate Settings” to save settings.

If all settings are entered correctly, and if radios are within operating range – the MU and RU will automatically wirelessly connect and Ethernet traffic will begin to pass across the wireless link.

To verify connection status, refer to the System Information page. Status of “connected” in section 2 of the system information screen will indicate that a wireless link is established between MU and RU. Connection status can also be viewed in the left-hand margin portion of all HTTP screens. Signal strength (RSSI) received from the peer radio is also provided on this screen.

## Connection Status

Atlas PtP RU

System Information Trango Broadband Wireless

Model P5010M  
 Unit Type RU  
 Hardware Version 5010  
 Firmware Version 1p0D05032202  
 System Up Time 02:41:15

MAC 00 01 DE 1B 78 52  
 IP 10.254.1.2 Subnet Mask 255.255.255.248 Gateway 10.254.1.1

Opmode on Default Opmode on  
 Peer ID DE1B784B Status connected RSSI -74 dBm  
 Channel 2 h Tx Power 7 dBm

Channel Table (MHz)  
 Ch#01 5260 Ch#02 5280 Ch#03 5300 Ch#04 5320  
 Ch#05 5340 Ch#06 5400 Ch#07 5500 Ch#08 5520  
 Ch#09 5540 Ch#10 5560 Ch#11 5580 Ch#12 5600  
 Ch#13 5620 Ch#14 5640 Ch#15 5660 Ch#16 5680  
 Ch#17 5700 Ch#18 5720 Ch#19 5735 Ch#20 5755  
 Ch#21 5775 Ch#22 5795 Ch#23 5815 Ch#24 5835

Area Code 0  
 RF Band #1 (5180..5240 MHz) Disabled

System Information  
 Installation  
 Configuration  
 Site Survey  
 Management  
 Link Control  
 Help  
 Current Status  
 Opmode on  
 Channel 2 h  
 Peer ID DE1B784B  
 connected RSSI -74 dBm  
 Web Ver 1p0D05032202

## Site Survey Page

The site survey function measures overall noise floor as well as in-band noise containing data packets. Noise is reported in terms of average and peak dBm for the period tested. The user specifies duration of the test in minutes as well as the antenna port. To run a site survey, the radio must be in Opmode OFF.

The screenshot shows the 'Atlas PIP RU' web interface. The main content area is titled 'Site Survey' and includes the following elements:

- Navigation Menu (Left):** System Information, Installation, Configuration, Site Survey, Management, Link Control, Help, Current Status.
- Current Status (Left):** Opmode: off; Channel: 2 h; Peer ID: DE1B784B; disconnected RSSI: n/a; Web Ver: 1p0a6D05031401.
- Site Survey Controls:** Duration: 1 min(s) (1 to 10); Polarization: V (selected); Start Survey button.
- Status:** Finished.
- Table:** A table with columns for Ch#, Freq, [Noise Floor] (Avg dBm, Peak dBm), [rssi-by-packet] (Avg dBm, Peak dBm), and Clear.

Ch#	Freq	[Noise Floor]		[rssi-by-packet]		Clear
		Avg dBm	Peak dBm	Avg dBm	Peak dBm	
1	5260	-97	-98	n/a	n/a	
2	5280	-97	-98	-74	-74	
3	5300	-96	-98	n/a	n/a	
4	5320	-97	-98	n/a	n/a	
5	5325	-55	-90	n/a	n/a	
19	5735	-82	-95	n/a	n/a	
20	5755	-97	-98	n/a	n/a	
21	5775	-75	-84	n/a	n/a	
22	5795	-90	-91	n/a	n/a	
23	5815	-83	-85	n/a	n/a	
24	5835	1	undefined	undefined	undefined	

In this example the site survey function was performed for 1 minute on the vertical polarity. The lower band (5250 – 5340 MHz) is reported to be relatively clean with a noise floor in the range of –97 to –98 dBm. The noise floor in the upper band (5735 – 5835 MHz) is higher and ranges from –58 dBm (at 5735 MHz) to –90 dBm (at frequency 5775 MHz). In this example, channel 19 is the noisiest and should be avoided.

## Link Control

The Link Control page features the RF Link Loopback / Speed Test. In this test, the user specifies the transmission rate (in Mbps) in both the local radio and the peer radio as well as the duration time (in minutes) for the test. During the test, the local radio will transmit packets across the wireless link. The peer radio will retransmit equivalent packets back to the local radio. The test will measure and report error rate and actual throughput as measured in Mbps. The following link test was run for 60 seconds with a specified TX rate of 12 Mbps per end.

To run a link loopback test, both radios must be in Opmode ON and status “Connected”

The screenshot displays the 'Link Control' page for 'Atlas PtP RU' on the 'Trango Broadband Wireless' system. The interface includes a navigation sidebar on the left with links for System Information, Installation, Configuration, Site Survey, Management, Link Control, and Help. The main content area shows the 'RF Link Loopback / Speed Test' configuration. The Local Tx Rate and Peer Tx Rate are both set to 12 Mbps, and the Duration is 1 minute. A 'Loopback Test' button is visible. Below the configuration, the 'Test Results' section shows a table with the following data:

	Tx Rate	Tx Bytes	Error Rate
MU to RU	12	20800000	0.00
RU to MU	12	20800000	0.00

The aggregated bandwidth is 11.9 Mbps. The current status shows Opmode on, Channel 2 h, Peer ID DE1B784B, connected RSSI -74 dBm, and Web Ver 1p0D05032202. Contact information for Trango Broadband Wireless is provided at the bottom.

In this example, the error rate was 2 packets from MU to RU and 0 packets from RU to MU. Measured aggregate bandwidth is 10.93 Mbps.

## Appendix B Specifications

### RF Parameters

RF Conducted Power and Receiver sensitivity for  $1 \times 10^{-3}$  Frame error rate with ARQ active:

#### - US MODELS

Speed Setting (over-the-air rate) (Mbps)	Modulation Scheme	Receiver Sensitivity (dB)	Max Power 5.18 to 5.24 GHz (dBm)	Max Power 5.265- 5.325, 5.5 to 5.7 GHz (DFS-UNII) (dBm)	Max Power 5.735 to 5.84 GHz (ISM) (dBm)
6(5)	BPSK	-92	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+21
12(11)	QPSK	-87	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+19
18(16)	QPSK	-85	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+19
24(20)	16QAM	-84	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+18
36(31)	16QAM	-80	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+18
48(40)	64QAM	-75	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+17
54(45)	64QAM	-73	NA	+2 (-EXT) ,+6 (-23), +10(-19)	+17

#### - EU MODELS

Speed Setting (over-the-air rate) (Mbps)	Modulation Scheme	Receiver Sensitivity (dB)	Max Power 5.18 to 5.24 GHz (ETSI) (dBm)	Max Power 5.26- 5.32, 5.5 to 5.7 GHz (ETSI) (dBm)	Max Power 5.725 to 5.85 GHz (dBm)
6(5)	BPSK	-92	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA
12(11)	QPSK	-87	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA
18(16)	QPSK	-85	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA
24(20)	16QAM	-84	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA
36(31)	16QAM	-80	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA
48(40)	64QAM	-75	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA
54(45)	64QAM	-73	NA (-EXT) ,+0 (-23), +4(-19)	+3 (-EXT) ,+7 (-23), +11(-19)	NA

#### - OE MODELS

Speed Setting (Max Tput) (Mbps)	Modulation Scheme	Receiver Sensitivity (dB)	Max Power 5.18 to 5.24 GHz (ETSI) (dBm)	Max Power 5.26- 5.32, 5.5 to 5.7 GHz (ETSI) (dBm)	Max Power 5.725 to 5.85 GHz (dBm)
6(5)	BPSK	-92	+14	+14	+21
12(11)	QPSK	-87	+13	+13	+19
18(16)	QPSK	-85	+13	+13	+19
24(20)	16QAM	-84	+12	+12	+18
36(31)	16QAM	-80	+12	+12	+18
48(40)	64QAM	-75	+11	+11	+17
54(45)	64QAM	-73	+11	+11	+17

NOTE: Numbers in parentheses are actual max user aggregate throughput speeds

RF Data Rate:	6, 12, 18, 24, 36, 48, 54 MBPS User selectable
Error Correction:	FEC & ARQ
Modulation:	6 MBPS DBPSK OFDM for header, 6-54 MBPS OFDM for payload

### **Channels of Operation**

Storable Channels: 24 memory locations

Center frequency ranges:

(-US models)

Band 1:	NA
Band 2:	5.265 to 5.325 GHz (DFS)
Band 3:	5.500 to 5.700 GHz (DFS)
Band 4:	5.735 to 5.840 GHz

(-EU models)

Band 1:	5.180 to 5.240 GHz
Band 2:	5.260 to 5.320 GHz (DFS)
Band 3:	5.500 to 5.700 GHz (DFS)
Band 4:	NA

(-OE models)

Band 1:	5.180 to 5.240 GHz
Band 2:	5.260 to 5.320 GHz (DFS)
Band 3:	5.500 to 5.700 GHz (DFS)
Band 4:	5.735 to 5.840 GHz

Tuning resolution: 5 MHz increments

Default Channel assignments:

(-US Models)

Channel 1:	5.265 GHz
Channel 2:	5.285 GHz
Channel 3:	5.305 GHz
Channel 4:	5.325 GHz
Channel 5:	5.500 GHz
Channel 6:	5.520 GHz
Channel 7:	5.540 GHz
Channel 8:	5.560 GHz
Channel 9:	5.580 GHz
Channel 10:	5.600 GHz
Channel 11:	5.620 GHz
Channel 12:	5.640 GHz
Channel 13:	5.660 GHz
Channel 14:	5.680 GHz
Channel 15:	5.700 GHz
Channel 16:	5.735 GHz
Channel 17:	5.755 GHz
Channel 18:	5.775 GHz
Channel 19:	5.795 GHz

Channel 20: 5.815 GHz  
Channel 21: 5.835 GHz  
Channel 22: 5.840 GHz  
Channel 23: 5.840 GHz  
Channel 24: 5.840 GHz

(-EU Models)

Channel 1: 5.180 GHz  
Channel 2: 5.200 GHz  
Channel 3: 5.220 GHz  
Channel 4: 5.240 GHz  
Channel 5: 5.260 GHz  
Channel 6: 5.280 GHz  
Channel 7: 5.300 GHz  
Channel 8: 5.320 GHz  
Channel 9: 5.500 GHz  
Channel 10: 5.520 GHz  
Channel 11: 5.540 GHz  
Channel 12: 5.560 GHz  
Channel 13: 5.580 GHz  
Channel 14: 5.600 GHz  
Channel 15: 5.620 GHz  
Channel 16: 5.640 GHz  
Channel 17: 5.660 GHz  
Channel 18: 5.680 GHz  
Channel 19: 5.700 GHz  
Channel 20: Disabled  
Channel 21: Disabled  
Channel 22: Disabled  
Channel 23: Disabled  
Channel 24: Disabled

(-OE Models)

Channel 1: 5.180 GHz  
Channel 2: 5.200 GHz  
Channel 3: 5.220 GHz  
Channel 4: 5.240 GHz  
Channel 5: 5.260 GHz  
Channel 6: 5.280 GHz  
Channel 7: 5.300 GHz  
Channel 8: 5.320 GHz  
Channel 9: 5.500 GHz  
Channel 10: 5.520 GHz  
Channel 11: 5.540 GHz  
Channel 12: 5.560 GHz  
Channel 13: 5.580 GHz  
Channel 14: 5.600 GHz  
Channel 15: 5.620 GHz  
Channel 16: 5.640 GHz  
Channel 17: 5.660 GHz  
Channel 18: 5.680 GHz  
Channel 19: 5.700 GHz  
Channel 20: 5.740 GHz  
Channel 21: 5.760 GHz  
Channel 22: 5.780GHz

Channel 23: 5.82 GHz  
 Channel 24: 5.840 GHz

## **Data Parameters**

Format: 10/100 BaseT IEEE 802.3 Ethernet compliant  
 Ethernet packet: Up to 1518 byte packets

## **Regulatory Compliance**

### FCC Standards

FCC 15.109  
 FCC 15.203 Antenna  
 FCC 15.207  
 FCC 15.209  
 FCC 15.401 through 15.407(2) U-NII Band transmitter –  
 FCC 15.247 ISM transmitter

### ETSI

EN 301-489-17 EMC  
 EN 301 893 Radio Compliance  
 EN 60950 Safety  
 EN 50385

### Canada Standards

RSS-210  
 RSS-102  
 ICES-003

## **Mechanical**

Material: Powdercoated Aluminum case/back with UV Stabilized ABS radome (P5055-19,-23)

Size: 8.5" x 7.75" for P5055M-19-xx  
 15" x 15" for P5055M-23-xx  
 5" X 5" for P5055M-EXT –xx

Weight: P5055M-19-xx: 4 lb  
 P5055M-23-xx: 7 lb  
 P5055M-EXT-xx: 4 lb

Mounting: Custom pole/flat surface mounting with elevation adjustment.

## **Environmental**

Operating Temp: -40 to 60 deg C  
 Storage: -40 to 85 deg C  
 Humidity: 100 % when sealed properly  
 NEMA Rating: NEMA 4  
 Shock: Sustain 3 axis drop from 5 feet



## Power Parameters

Input Voltage:	Input voltage range at unit is 15 VDC to 24 VDC max. Power is supplied on Ethernet cable using junction box provided with up to 330 foot 24 AWG STP cable.
Current Cons.:	Max 600 mA in transmit and receive modes using 24 V standard adapter (12 W) with short Ethernet cable from Junction box to radio.

## Power Supply

Type:	Switch mode wall mount transformer
Safety:	PSE, UL, CUL, GS
EMI:	FCC Class B, VCC-II, CE
Input:	90 – 255 VAC
Plug Type:	Includes 4 plug blades for to allow use in US, Europe, UK and Australia
Output:	24 VDC +/- 1 V
Max current:	1000 mA

## Antennas

### Integrated 19 dBi Antenna (for P5055M-19-xx)

Frequency range:	4950-5850 MHz
Gain:	19 dBi +/- 1 dB
Front/Back Ratio	>30 dB
E-Plane Beamwidth:	> 18 degrees typical
H-Plane Beamwidth:	> 18 degrees typical
Polarization:	Vertical and Horizontal
Port/Port Isolation:	20 dB typ
Cross Pol Rejection:	20 dB typ
VSWR:	<1.7:1
Package:	Aluminum backplate with plastic radome.
Dimensions:	8.5" x 7.75" x 1.25" (216mm x 197mm x 32mm)
Weight:	2 lbs (.91Kg)
Mounting Provisions:	Mounting kit supplied for up to 3" diam pole or flat surface
Azimuth/El Adjust:	+/-30 degrees
Sealing:	Water tight to 1 meter IEC 529/IP67
Temp Range:	-40 deg F to +160 deg F (-40 deg C to +60 deg C)
Wind speed operational:	100 mph (160 km/hr)
Wind speed survival :	140 mph (220 km/hr)

### Integrated 23 dBi Antenna (for P5055M-23-xx)

Frequency range:	4950-5850 MHz
Gain:	23 dBi +/- 1 dB
Front/Back Ratio	>35 dB
E-Plane Beamwidth:	> 9 degrees typical
H-Plane Beamwidth:	> 9 degrees typical
Polarization:	Vertical and Horizontal
Port/Port Isolation:	40 dB typ
Cross Pol Rejection:	25 dB typ
VSWR:	<1.7:1
Package:	Aluminum backplate with plastic radome.
Dimensions:	14.6"x 14.6"x 1.58" (371mm x 371mm x 40mm)
Weight:	5.5 lbs (2.5 kg)
Mounting Provisions:	Mounting kit supplied for up to 3" diam pole or flat surface
Azimuth/El Adjust:	+/-30 degrees

Sealing: Water tight to 1 meter IEC 529/IP67  
Temp Range: -40 deg F to +160 deg F (-40 deg C to +60 deg C)  
Wind speed operational: 100 mph (160 km/hr)  
Wind speed survival : 140 mph (220 km/hr)

FCC Certified External Antennas (for P5055M-EXT-xx)

Radiowaves models: SPD4-5.2, SPD3-5.2, SPD2-5.2, SPD1-5.2

See Radiowaves, Inc. for specifications and details .