
# TrangoLINK-10

# Point to Point

# Wireless Ethernet Bridge

# USER MANUAL

June 11, 2003

-DRAFT-

Rev. A for Firmware ver. 1.0

# Table of Contents



# Table of Figures

# Preface

This manual covers basic configuration and installation of the TrangoLINK-10 Wireless Broadband System and applies to the following radio part numbers:

| | |
|---|---|
| P5830S-MU | Master Unit with internal sector al patch antenna |
| P5830S-RU | Remote Unit with internal patch antenna |

Also available is the TrangoLINK-10-EXT, which does not include an internal antenna. The TrangoLINK-10-EXT which consists of a P5830S-MU-EXT and a P5830S-RU-EXT, must be used in conjunction with an FCC certified external antenna (sold separately). Instead of an internal antenna, the P5830S-RU-EXT has two Reverse Polarity SMA RF Connectors for attachment of external antenna cables. The installation of the P5830S-RU-EXT requires professional installation due to FCC limits on output power settings when using the 5.3 GHz U-NII band. Contact your sales person for more information regarding "Professional Installation Guide."

## *FCC Information*

This device complies with Part 15 of 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: NCYM5830SSU**
**FCC ID: NCYM5830SSUEXT**

**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 for complete description of warranty coverage and limitations.

# Chapter 1 Welcome!

Your TrangoLINK-10 radio system provides the latest innovations in high speed fixed wireless broadband. TrangoLINK -10 is a point-to-point (PtP) system which provides network connectivity at speeds up to 10 Mbps with a range of 40 miles depending on antenna configuration. TrangoLINK-10 is unique in that it can operate in either the 5.8 GHz ISM band or the 5.3 GHz U-NII band. In this document and within the radio configuration itself, the designators of "ISM" and "U-NII" are used to distinguish between the two bands.

The following table shows approximate maximum ranges (at recommended fade margins) achievable with the TrangoLINK-10 system using various antenna configurations. Longer ranges are achievable, but will result in lower fade margins.

| Antenna | ISM 5725 – 5850 MHz | U-NII 5250 – 5350 MHz |
|---|---|---|
| Integrated / Internal Antenna (18 dBi) | 10 Miles (w/ 10 dB fade margin) | 3 Miles (w/ 10 dB fade margin) |
| 18" Dish Antenna (24 dBi) | 20 Miles (w/15 dB fade margin) | 5 Miles (w/ 10 dB fade margin) |
| 15" Patch Antenna (24 dBi) | 20 Miles (w/15 dB fade margin) | 5 Miles (w/ 10 dB fade margin) |
| 36" Dish Antenna (31 dBi) | 40 Miles (w/21 dB fade margin) | 10 Miles (w/ 10 dB fade margin) |

TrangoLINK-10 system consists of two types of radios: Master Units (MU) and Remote Units (RU). With careful channel planning, (and adequate spacing and shielding) network operators can co-locate up to 22 MUs at a single cell site.

The MU and RU conform to maximum radiated power limits as established by the FCC.

## *Getting to Know Your Radio*

### Contents

Each TrangoLINK-10 kit comes equipped with two radios, two power-over-Ethernet (PoE) J-Box, two AC adapters, a serial programming cable, and mounting hardware. Dual-polarized internal antennas are included within the Radomes of both the M5830S-MU and M5830S-RU.

**Figure 0-1 Components of an TrangoLINK System**

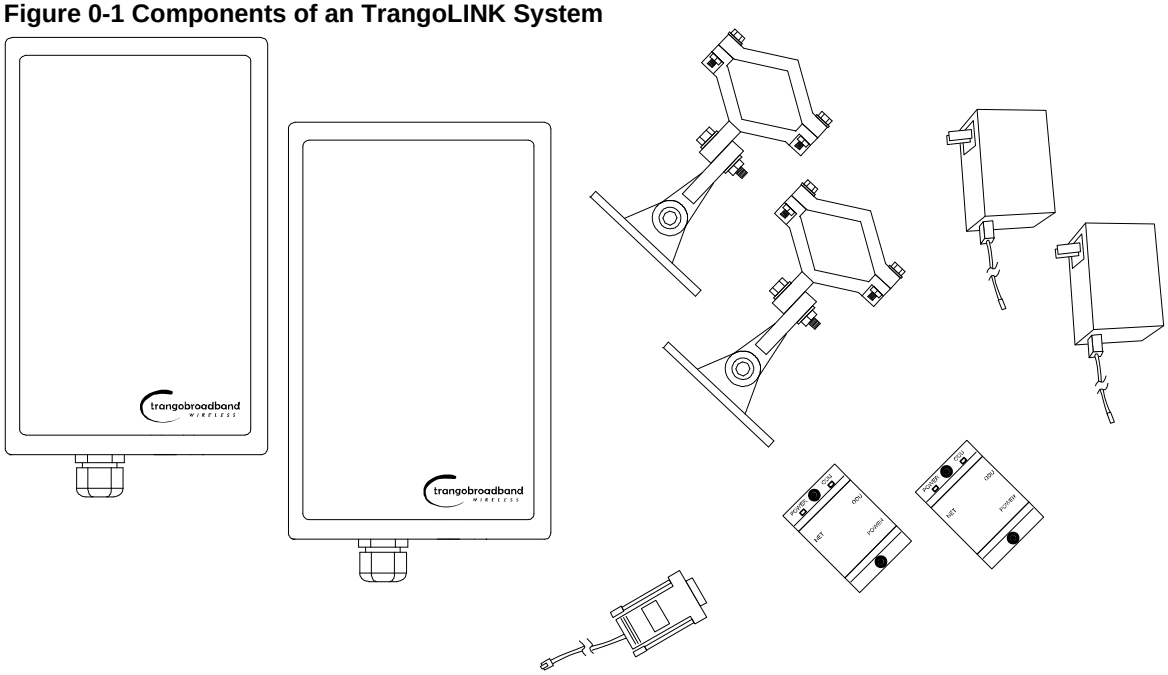
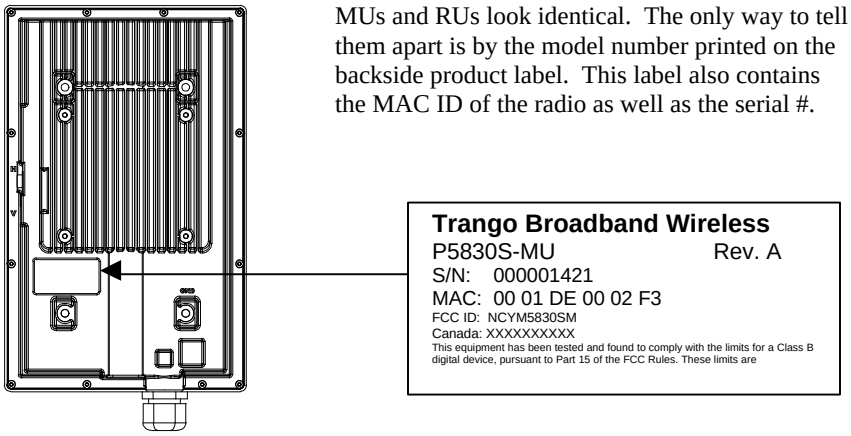


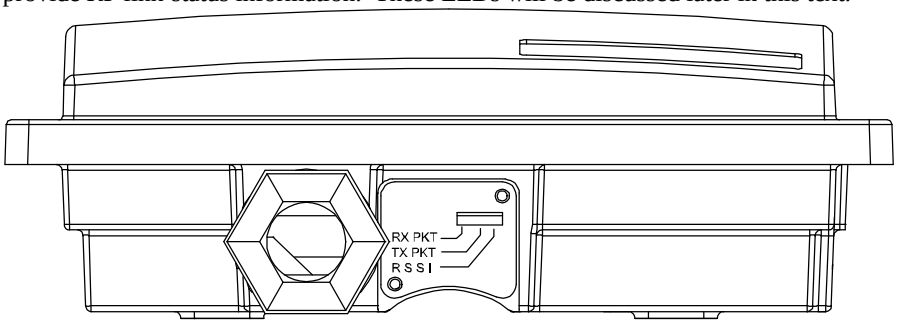
**Figure 0-2 Back of Radio Showing where MAC address can be Found**




MUs and RUs look identical. The only way to tell them apart is by the model number printed on the backside product label. This label also contains the MAC ID of the radio as well as the serial #.

## Ethernet and Serial Ports

At the bottom of the radio are two access ports: a twist-on weatherproof cable port for RJ-45 Ethernet (and PoE), and an access cover (with two screws) for RJ-11 serial port. Most configuration and management tasks can be performed through the Ethernet jack. The access cover also contains a small window which reveals three LEDs. These LEDs provide RF link-status information. These LEDs will be discussed later in this text.




## Antennas

The M5830S-MU and M5830S-RU each include dual polarized antennas. The M5830S-MU-EXT and M5830S-RU-EXT are designed to work with FCC certified external patch style or dish antennas. All of these antennas can be electronically switched between horizontal (H) and vertical (V) polarization.

# *MU/RU Operational Overview*

TrangoLINK MU is a sophisticated broadband wireless device which provides a host of comprehensive tools and functions. The MU typically resides at the managing end of the network and performs all management functions for the associated RU.

In order to make a link more secure, prior to an RU communicating with a MU, the system administrator must first add the MAC address and ID number of the RU to the user database in the MU.

When power is first applied to a properly installed RU, it will scan all the channels in its Scantable, searching for an MU. The RU will then stop on that channel and respond to the MU using maximum RF power. Before the MU can wirelessly connect to the RU, it must authenticate the RU by verifying the MAC address, and performing a ranging operation to the RU.

Upon successfully locating and ranging the RU, the MU will adjust the RF transmit power in the RU based on the Target RSSI parameter in the MU. This process is referred to as “power leveling”.

# Chapter 2 Getting Started

First unpack your MU and RU. It is recommended to first provision and test the radios on the bench before deploying in the field. This is a particularly useful exercise to the novice user.

## *Connections and Power*

Connection and powering of radios is the same for MUs and RUs.

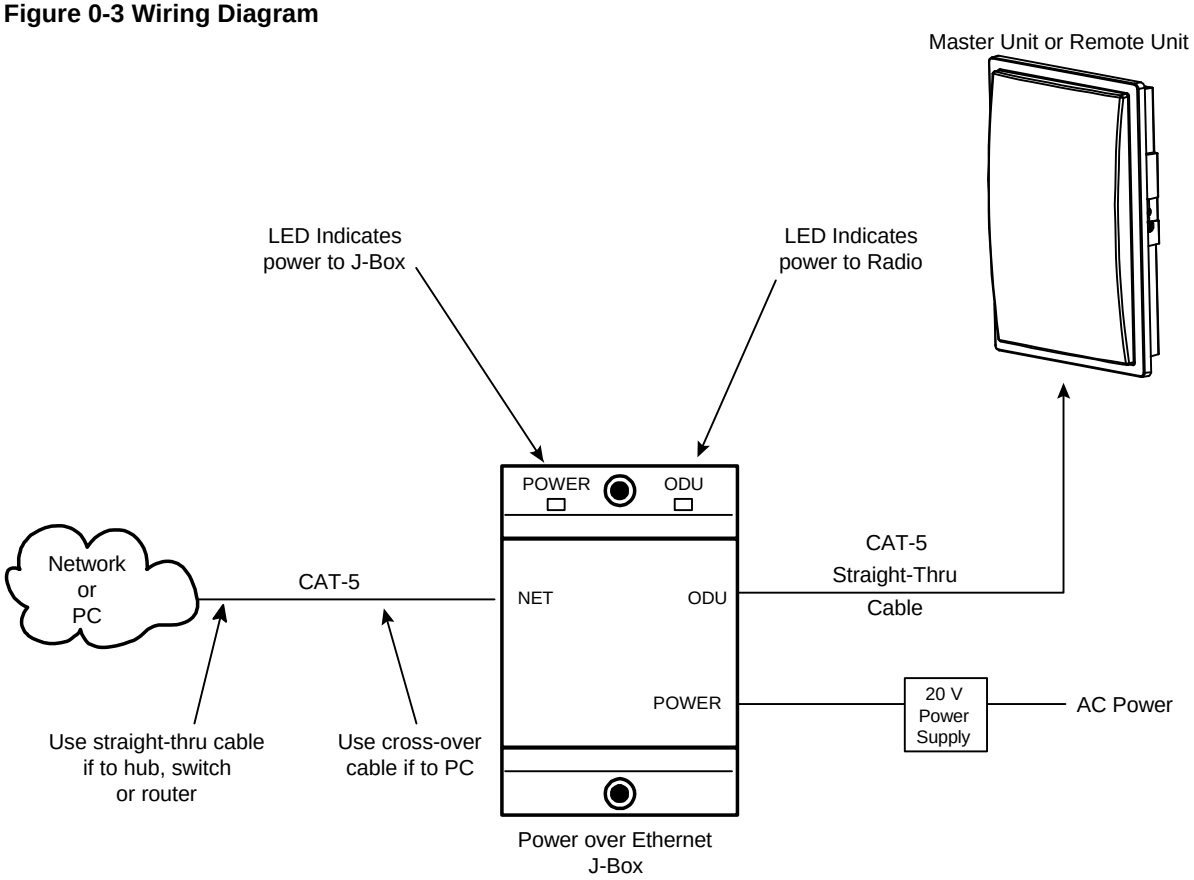
?? Connect a Cat-5 (straight through) Ethernet cable (we recommend shielded twisted pair) between the ODU (out door unit) port of the J-box and the RJ-45 connector on the radio. Note that this cable will carry power over Ethernet (PoE).

?? 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.

**Figure 0-3 Wiring Diagram**




Both green LEDs on the J-box should be lit, indicating power is present at the J-box as well as the radio.
You are now ready to configure the radio via the Ethernet port.

✍ Note: If you can not access the radio management functions via the Ethernet port, it is possible that your PC is not set up with a properly routable subnet. If you forget the radio's IP address, or for some other reason can not access the radio via the Ethernet port, use the Serial Programming cable (supplied with each TrangoLINK kit) and attach to RJ-11 located behind access cover on bottom of radio.

# *Basic Configuration - Concepts and Tools*

The TrangoLINK-10 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.

Both methods of radio configuration require an understanding of the concept of Operation Mode or "Opmode".

## Opmode Concept

Before logging on to a radio, it is important to understand the "opmode" concept of the TrangoLINK system. MUs and RUs can be in one of two Opmodes; OFF and ON. When in "OFF," Opmode the radio is not transmitting, and it is not attempting to make a wireless connection. Alternatively, when in "ON," opmode the radio is transmitting, and is attempting to make a wireless connection.

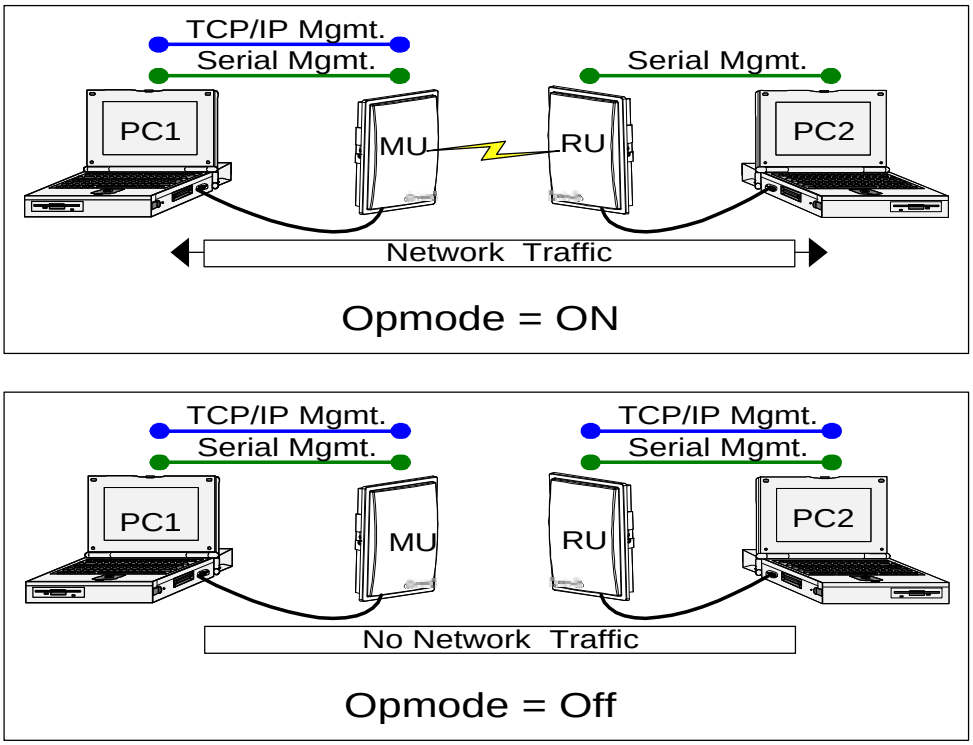
**Why is Opmode Important?**
TCP/IP management access (via the Ethernet port) to a **Remote Unit** is only possible in opmode "OFF". However TCP/IP management of a **Master Unit** is possible in either opmode, On or Off.

Also, certain functions, such as the site survey function and the RU RSSI function can only be performed while the radio is in opmode "OFF". See Appendix – Command Set Reference for a complete listing of commands, and the appropriate opmode(s) for each command.

✍ Note: Factory Default opmode for both MUs and RUs is "ON". Default opmode should be changed before radios are deployed.

✍ Note: Serial management (via the RJ-11 port) is possible on both MUs and RUs regardless of opmode.

**Figure 0-4 How Opmode Effects Management**




## Command Line Interface

Although most radio functions can be managed via the browser interface, the command line interface (CLI) does provide slightly more functionality. Logging on to the radio via command line interface is covered here briefly, but for a complete listing of all CLI commands, see the Appendix - Command Line Interface.

**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 (MU and RU) come factory pre-configured with a default IP address 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.

✍ Note: The factory default password is *trango.*

✍ Note: If you can not telnet into the radio, check cable connections, ensure proper use of cross-over vs. straight-through cable, ensure PC's subnet is routable to radio's IP address. To Telnet to an RU, ensure that its opmode is "off".

**Serial**
A Terminal Emulation program (such as HyperTerminal on the Windows operating system) can be used to access the radio's CLI via the radio's serial port which is located behind the RJ-11 access cover on the bottom of the radio. A serial programming cable has been provided with each MU for this purpose. The same cable may be used for Remote Units. **The terminal program settings are 8-N-1, and Flow control: None.**

✍ Note: To terminate a CLI session (Telnet or Serial) type the command ***logout***.

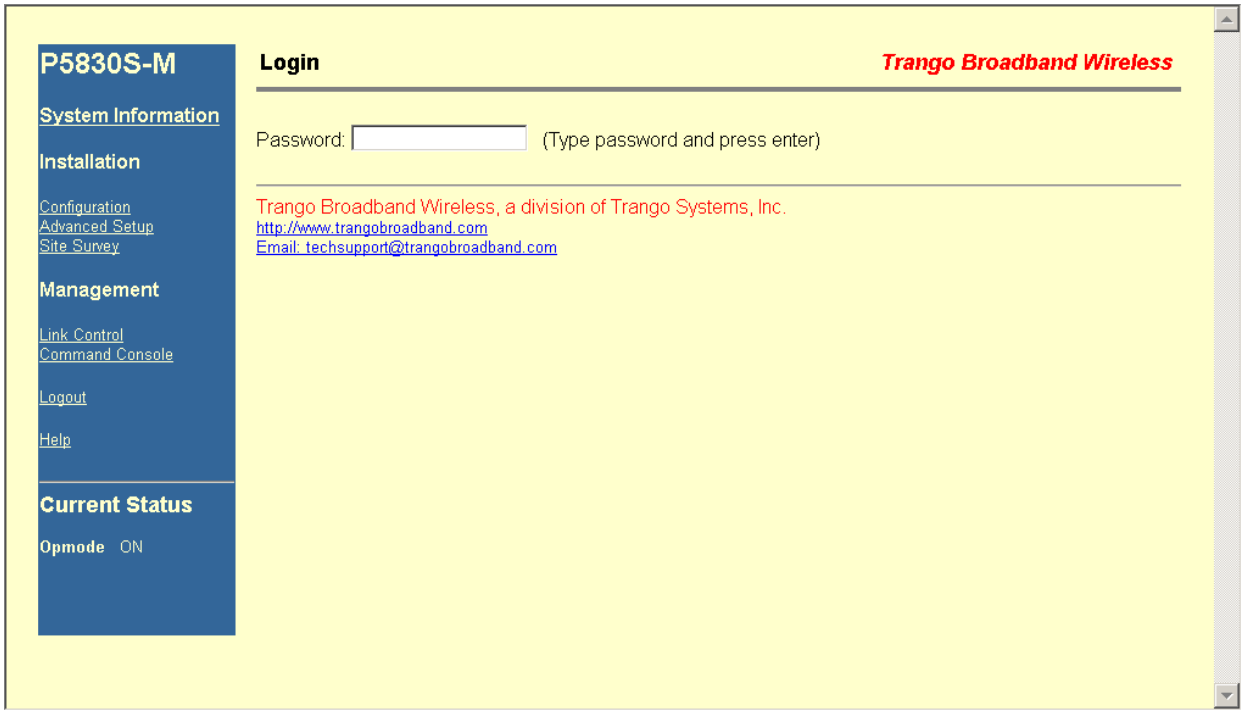
✍ Note: Type ***help***, or ***?*** for a listing of all CLI commands. Type ***help <command>*** for the syntax of a particular command.

## Browser Interface

The Web browser interface is a powerful and easy-to-use configuration and management tool. Its functionality is a subset of the commands available in the CLI. To use the browser interface – you must have the following:

- ?? An Ethernet connection between a PC and the radio
- ?? Setup your Ethernet PC connection to the subnet that is routable to the radio (default IP address=**192.168.100.100**)
- ?? A web browser (i.e. Microsoft Internet Explorer)

In order to use the browser interface – simply connect the radio to a PC, and type the radio's IP address into the web browser (i.e. Microsoft Internet Explorer). This will bring up a logon page.



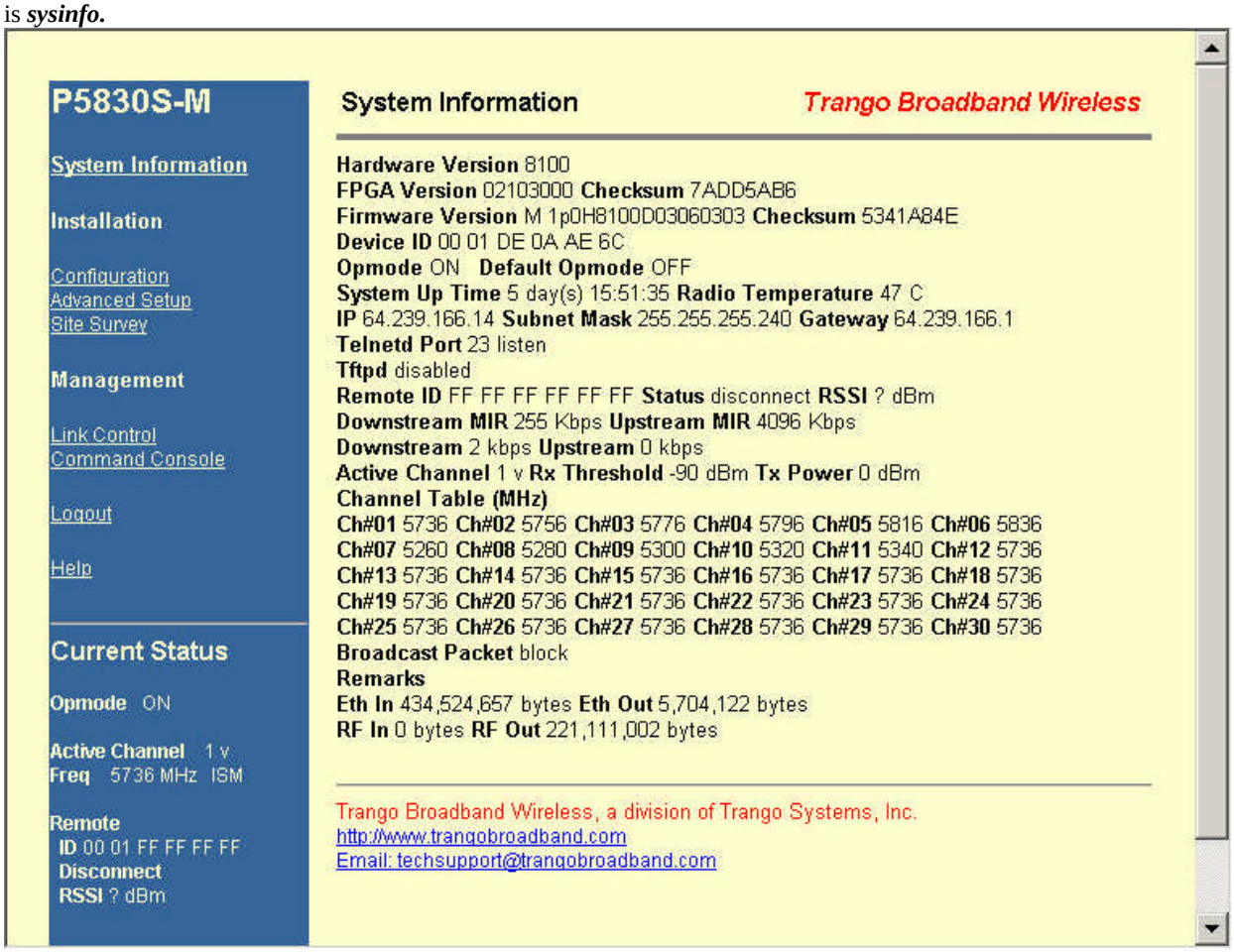

Type the password (default **trango**) and continue. This will bring up the radio's system information page.

The Browser Interface features useful Help pages which explain all listed parameters. To access the help pages click on the Help link.

This particular Login Page is for Master Unit, which can be seen by the **P5830S-M** in the top left. The panel on the left is the same for all Browser pages. All navigation can be performed from this panel. Items in bold, such as **Installation**, **Management**, and **Current Status** are general headings. The underlined words, such as Link Control, Site Survey, and Help lead to the other pages in the Browser Interface for the radio. Basic configuration can be performed from the Configuration page, and RF related parameters are configured through the Advanced Setup page.

## *Master Unit Basic System Information*

Logon to the MU and the System Configuration page with info and status appears. The equivalent command for the CLI is ***sysinfo.***




Many of these parameters can be changed by the user. Basic configuration can be performed from the Configuration page, and RF related parameters are configured through the Advanced Setup page.. A description of each of these changeable parameters, along with the related command for the CLI is shown in the tables below.

✍ Note: When changing settings, it is usually necessary to click the Save and Activate Button in order to update the radio's flash memory. If you do not, the setting will be lost the next time the radio is rebooted.

**Figure 0-5 Reference Table of Basic MU System Information**

| MU SYSTEM INFORMATION PARAMETERS AND RELATED COMMANDS | | |
|---|---|---|
| **Parameter** | **Description** | **Related CLI Command** |
| Device ID | Mac ID of MU | N/A |
| Remote ID | Mac ID of the RU that is going to be associated to the MU. | N/A |
| Opmode | Current Opmode of radio | ***opmode*** **<*on* or *off*>** to change the opmode from Off to On. Note: in order to change radio from opmode on to opmode off, you must change the default opmode to off and reboot the radio. |
| Default opmode | Determines the opmode ("on" or "off") of the radio after reboot/power cycle. When the parameter is set to "on", the radio will progress into "on" opmode automatically after reboot/power cycle. | ***set defaultopmode*** **<*on*** or ***off*>**<br><br>Example:<br>`#>set defaultopmode on` |
| [IP]<br>[subnet]<br>[gateway] | IP, subnet, and Gateway address of radio | ***ipconfig [<new ip> <new subnet mask> <new gateway>]***<br><br>Example:<br>`#>ipconfig 192.168.100.101 255.255.255.0 192.168.10.10` |
| Tftpd status | Tftpd status (on or off). Tftpd should be turned on to import file into radio (such as new firmware). Default is off. | ***tftpd on tftpd off*** |
| Active Channel | Current RF channel and polarization (v)ertical or (h)orizontal. | ***freq writescan [<ch#><v\|h>]***<br>`Example:`<br>`#>freq writescan 5 v`<br>This command will change the channel of the MU to 5, vertical. |
| RF Rx Threshold | Specifies the receiver sensitivity of the MU. It is a powerful tool when the radio is in a noisy environment. MU will block out any signal received which is below the RF Rx threshold. **Separate settings exist for both ISM and UNII bands.** | ***rfrxth <ism\|unii><-90\|-85\|-80\|-75\|-70\|-65>***<br>`examples:`<br>`#>rfrxth ism –70`<br>`#>rfrxth unii -90` |
| RF Tx Power | Current transmit power of the MU not including antenna gain. | ***power <setism\|senunii> <min\|max\|<dBm>>***<br>`Examples:`<br>`#>power setism 10`<br>`#>power setunii 4` |
| Channel Table | Lists each of the assigned frequencies to each channel. Note that default channels 1 – 6 are assigned to ISM band and channels 7 – 11 are assigned to U-NII band. All channels may be re-assigned as desired by the user. | ***freq writechannel [<ch#><freq>]***<br>Example:<br>#>Freq writechannel 2 5785<br>`This command will change channel 2 to 5785 Mhz.` |
| Broadcast Packet Filter | This switch (0) enables/disables the blocking of Ethernet control packet except ICMP and ARP to reduce the amount of unnecessary overhead introduced to the wireless link | ***sw 0 [on\|off]*** (default is on)<br>(See the Command Set Reference) |
| Remarks | User definable radio information (i.e. customer name, address of installation, and so on). Maximum 28 characters can be stored. | ***remarks [remarks]***<br>Example:<br>`#>remarks 123 Elm Street` |

✍ Note: If you make any changes to system settings, don't forget to click the Save and Activate Button..

## *Remote Unit Basic System Information*

Logon to the RU (while it is in opmode "OFF") and the System Information page will appear. In the CLI, type the command ***sysinfo*** to receive a comprehensive snapshot of the system's configuration info and status. Many of these parameters can be changed by the user. A description of each of these changeable parameters, along with the related command is shown in the table below.

✍ Note: When changing settings, it is usually necessary to click the Save and Activate Button in order to update the radio's flash memory. If you do not, the setting will be lost the next time the radio is rebooted.

**Figure 0-6 Reference Table of Basic RU System Information**

| **REMOTE SYSTEM INFORMATION PARAMETERS AND RELATED COMMANDS** | | |
|---|---|---|
| **Parameter** | **Description** | **Related CLI Command** |
| Device ID | Mac ID of RU, this is used as the Remote ID on the MU. | N/A |
| Opmode | Current Opmode of radio. | ***opmode <on* or *off>*** to change the opmode from Off to On. Note: in order to change radio from opmode on to opmode off, you must change the default opmode to off and reboot the radio. |
| Default opmode | Determines the opmode ("on" or "off") of the radio after reboot/power cycle. When the parameter is set to "on", the radio will progress into "on" opmode automatically after reboot/power cycle. | ***set defaultopmode <on*** or ***off>***<br><br>Example:<br>`#>set defaultopmode on` |
| Opmode Start | Determines the amount of time the radio will remain in opmode OFF after reboot before progressing to the default opmode. | ***set default opmode <time (secs)>*** |
| [IP]<br>[subnet]<br>[gateway] | IP, subnet, and Gateway address of radio | ***ipconfig [<new ip> <new subnet mask> <new gateway>]***<br>Example:<br>`#>ipconfig 192.168.100.101 255.255.255.0 192.168.10.10` |
| Tftpd | Tftpd status (on or off). Tftpd should be turned on to import file into radio (such as new firmware). Default is off. | ***tftpd on*** ***tftpd off*** |
| RF Tx Power | Current transmit power of the RU not including antenna gain. This is controlled during the association process. | Informational Parameter |
| Channel Table | Lists each of the assigned frequencies to each channel. | ***freq writechannel [<ch #> freq>]…**** |
| Channel Scan Sequence | Shows the various channels (in sequence) which the RU will scan while search for a MU. | ***freq writescan [<ch #> <h\|v>… <ch #>=1..30]*** |
| Active Channel | Shows the channel used in the current association. | Information Parameter |
| Broadcast Packet Filter | This switch (switch 0) enables/disables the blocking of Ethernet control packet except ICMP and ARP to reduce the amount of unnecessary overhead introduced to the wireless link. | ***sw 0 [on\|off]*** (default is on)<br>(See the Command Set Reference) |
| MU Autoscan | This switch (switch 1) is to turn MU autoscan on or off. | ***sw 1 [on\|off]*** (default is on)<br>(See the Command Set Reference) |
| TCP/IP for MU | This switch (switch 2) when on, allows users at the MU side of the network to telnet or http into the RU. | ***sw 2 [on\|off]*** (default is off)<br>(See the Command Set Reference) |
| Remarks | User definable radio information (i.e. customer name, address of installation, and so on). Maximum 28 characters can be stored. | ***remarks [remarks]*** |

# Chapter 3 Establishing a Wireless Link

This section describes how to establish a wireless link between MU and RU, using the command line interface.

## *Procedure to Establish Wireless Link*

In order to establish a wireless link, the following parameters must be set.

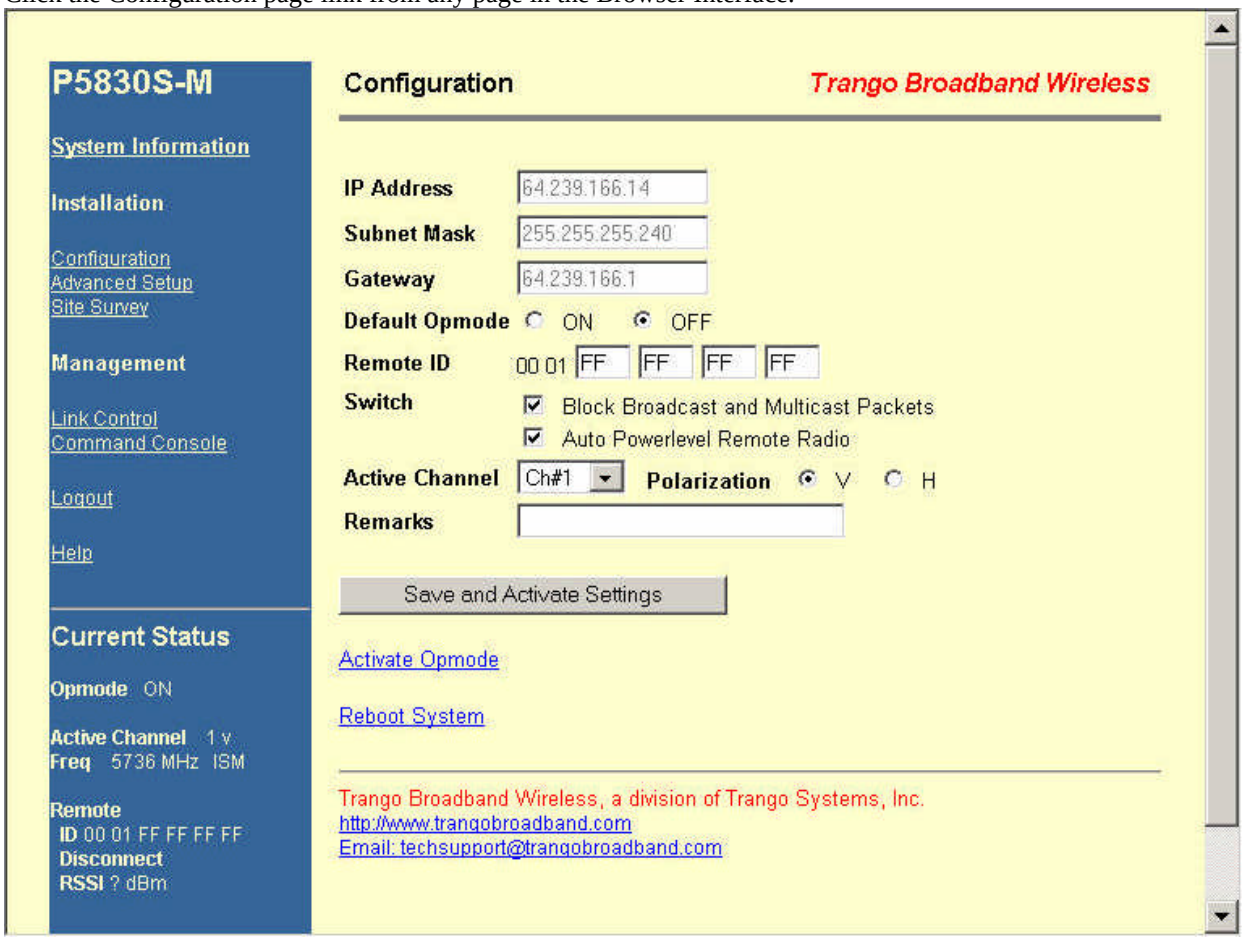
1. The Remote ID, the MAC ID of the RU, must be set in the MU.
2. The MU's RF Channel and Polarization must exist in the RU's channel scan table.
3. The Opmode of the MU is on.
4. The Opmode of the RU is on.
5. Adequate signal strength received at each radio.

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.

To ensure each of these parameters is met, perform the following steps:

## Master Unit

Click the Configuration page link from any page in the Browser Interface.




1. Set IP, subnet, and gateway
2. Fill in the Remote ID with the MAC address of the RU
3. Set channel and polarization
4. Set default opmode to On
5. Update system setting flash memory by clicking Save and Activate Settings

At this point the MU will begin actively searching for the RU. Once the RU is detected, the authentication and association process will begin. The RU by default is ready to establish a link. Only the RF channel and polarization need to be chosen. By default it is on channel 1 with horizontal polarization. The default opmode is on.

The RED LED on the bottom of the MU should be lit, indicating that the radio is in the on opmode and is radiating RF energy.

## Association Concept (MU to RU communications)

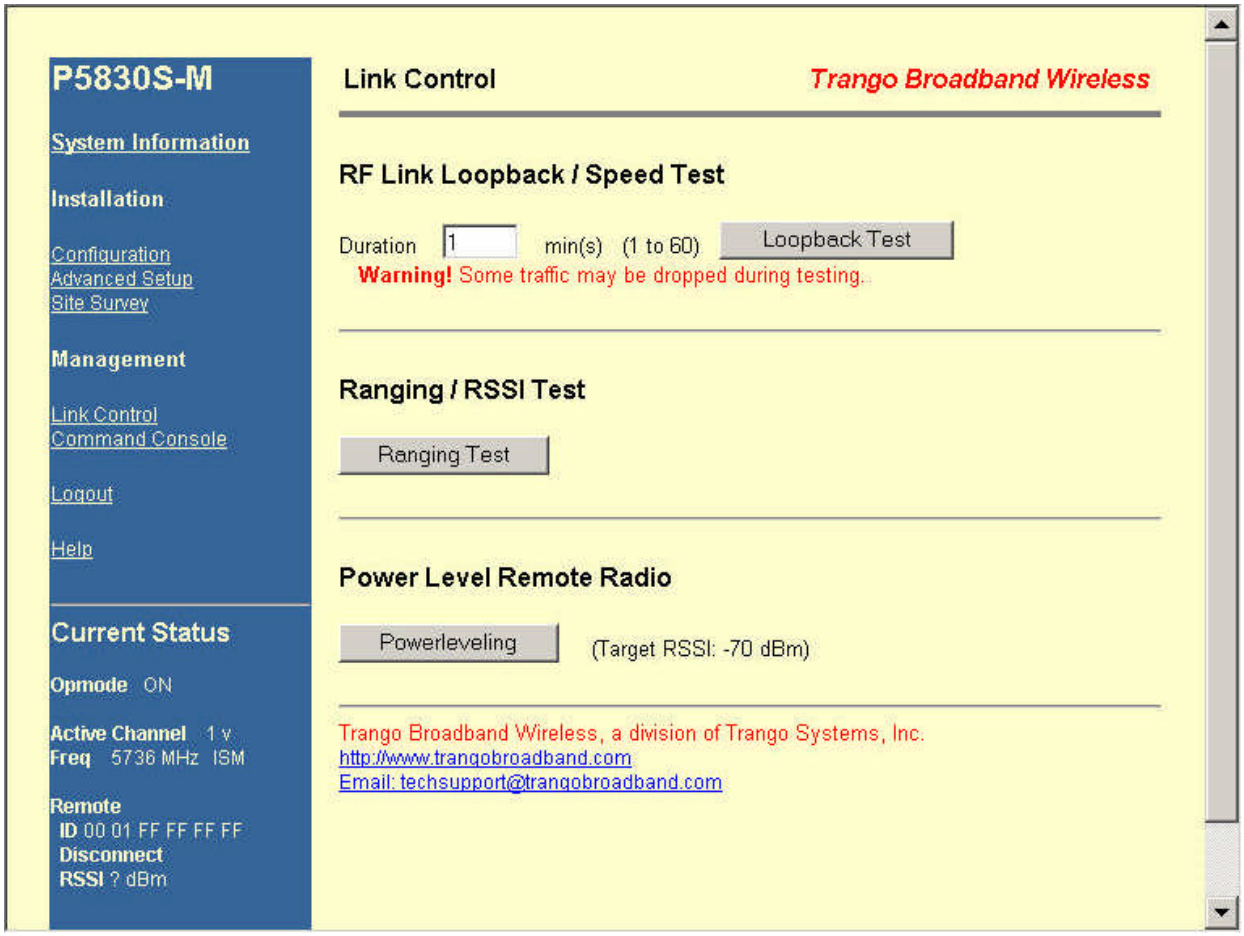
TrangoLINK uses the concept of "association" to indicate that the MUs and RUs are communicating. If all parameters are properly set, the MU will begin actively searching for the RU. Once an active RU is detected, the authentication and association process will begin.

✍ Note: The RED LED on the bottom of the MU should be lit, indicating that the radio is in opmode "MU" and is radiating RF energy.

✍ Note: The amber light on the bottom of the RU indicates the relative signal strength (rssi) of the signal received. A steady light indicates a strong signal. A blinking light indicates weaker (although perhaps sufficient) signal strength.

## *Basic Diagnostics*

In establishing and diagnosing the quality of the link, there several devices on the Link Control page that are especially useful.



**Remote:** The bottom left side of any page in the Browser Interface, under the heading Remote, shows the connection status of the RU. It will also show the Relative Signal Strength (RSSI) of the link

**RF Link Loopback Test:** Sends 1600 byte packets to the RU at 50 millisecond intervals over the time specified and reports the success rate of the packets in bytes.

**Ranging/RSSI Test:** Reports the distance of the link, and the RSSI from the MU to the RU.

**Power Level Remote Radios:** Adjusts the transmit power of the RU to attempt to bring the MU RSSI as close as possible to the Target RSSI. Target RSSI can be adjusted on the Advanced Setup page.

# Chapter 4 Deployment

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
- ?? Carefully note the antenna coverage pattern for type of MURU deployed
- ?? Consider nearby sources of interference which could degrade radio performance. Mount radios as far from sources of interference as possible

## *Site survey*

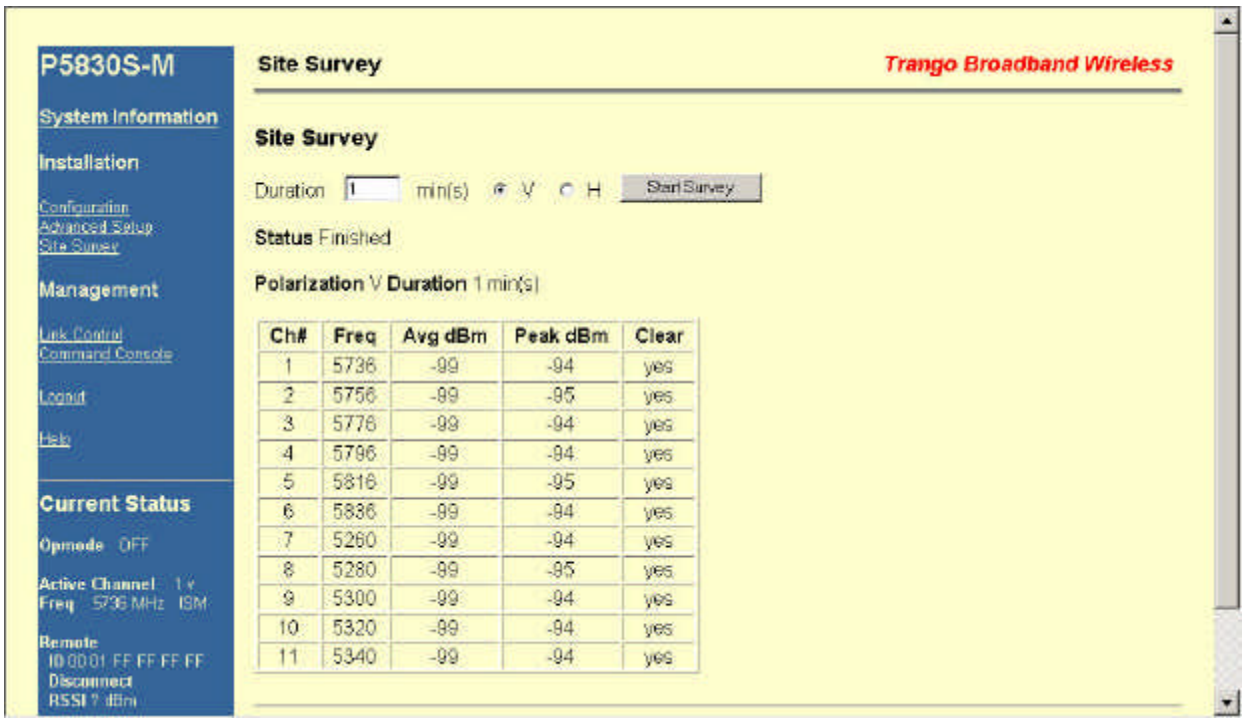
Both the MU and RU provide a powerful on-board site survey tool. This tool will tell you if there is interference present in the 5.8 GHz or 5.3 GHz band.

In order 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.

In general you will be looking for frequencies with signal strength of –85 dBm or lower. If interference is present on various channels, it is recommended that you chose clean channels or alternate polarizations for your deployment. If it is not possible to use a clean channel/polarization combination, there are various methods available to mitigate the affects of interference. These methods include the use of the RFRX THRESHOLD settings, or the use of external shields on the MU. See Example on following page:




## *Channel Planning*

For installations involving co-location of MU's, channel planning is of paramount importance. For maximum MU co-location quantities, it is important to assign frequencies of maximum spacing and alternating polarizations for adjacent MUs. Use of the 5.3 spectrum U-NII band as well as the 5.8 spectrum ISM band will allow maximum co-location potential. For very dense deployments of multiple MUs, it may be necessary to use the optional MU Shielding kit in order to mitigate interference from nearby MUs.

**Figure 0-7 Default Channel Table (MHz)**

```
[Ch#01]5736 [Ch#02]5756 [Ch#03]5776 [Ch#04]5796 [Ch#05]5816 [Ch#06]5836
[Ch#07]5260 [Ch#08]5280 [Ch#09]5300 [Ch#10]5320 [Ch#11]5340 [Ch#12]5736
[Ch#13]5736 [Ch#14]5736 [Ch#15]5736 [Ch#16]5736 [Ch#17]5736 [Ch#18]5736
[Ch#19]5736 [Ch#20]5736 [Ch#21]5736 [Ch#22]5736 [Ch#23]5736 [Ch#24]5736
[Ch#25]5736 [Ch#26]5736 [Ch#27]5736 [Ch#28]5736 [Ch#29]5736 [Ch#30]5736
```

Various MU channel plans can be implemented and many of the factors will depend on the unique circumstances at each particular site. See www.trangobroadband.com for additional information on channel planning schemes.

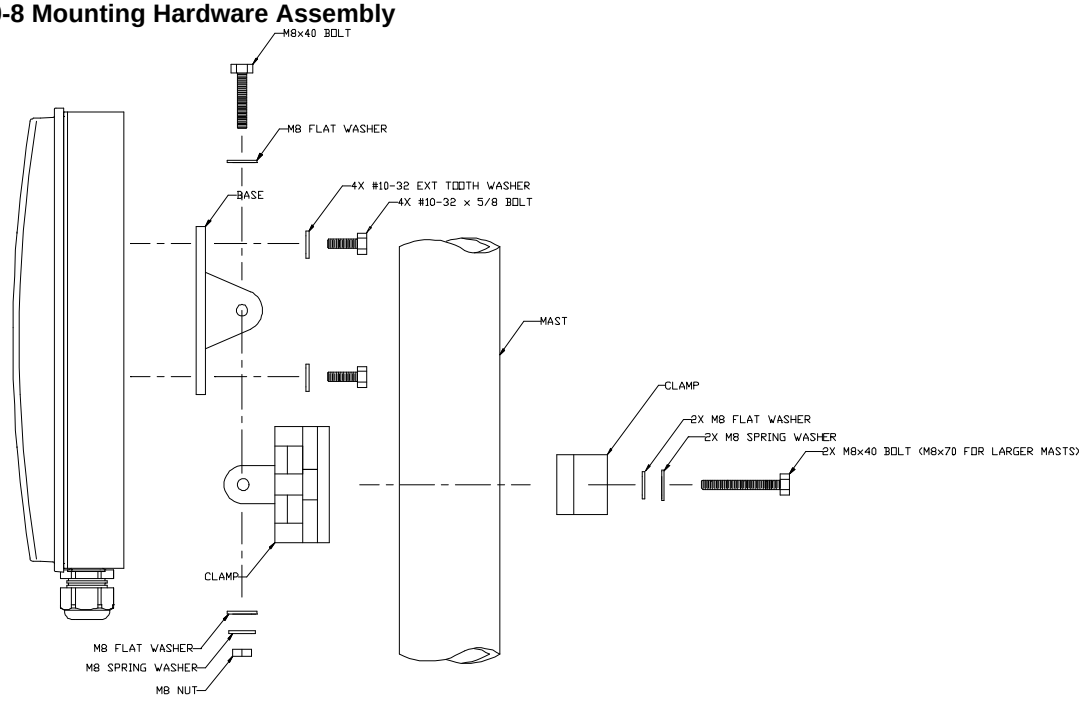
## *Installation*

Once the site survey is completed, you are ready to install your radios. It is recommended that MUs be installed first. The reason for this is that the RU has a built-in RSSI tool which will help you properly aim the RU at the MU to achieve maximum signal strength.

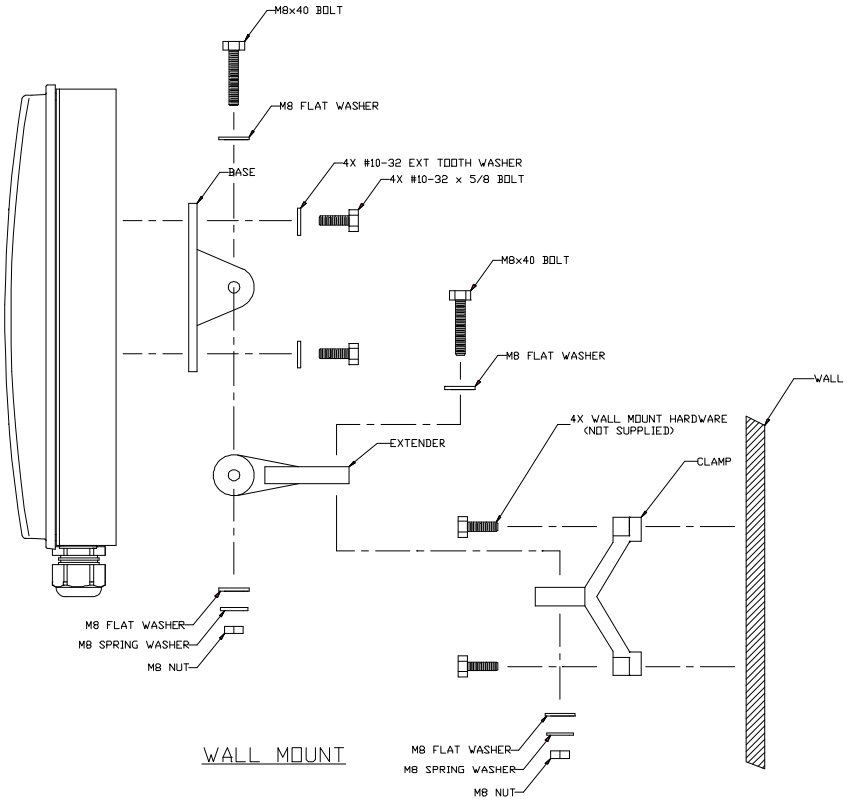
### Mounting Hardware

Both MUs and RUs are equipped with a universal mounting bracket which can be used for wall or pole installations. See diagram below for proper use of the mounting bracket.

**Figure 0-8 Mounting Hardware Assembly**




POLE MOUNT




WALL MOUNT

**Figure 0-9 Mounting Options**

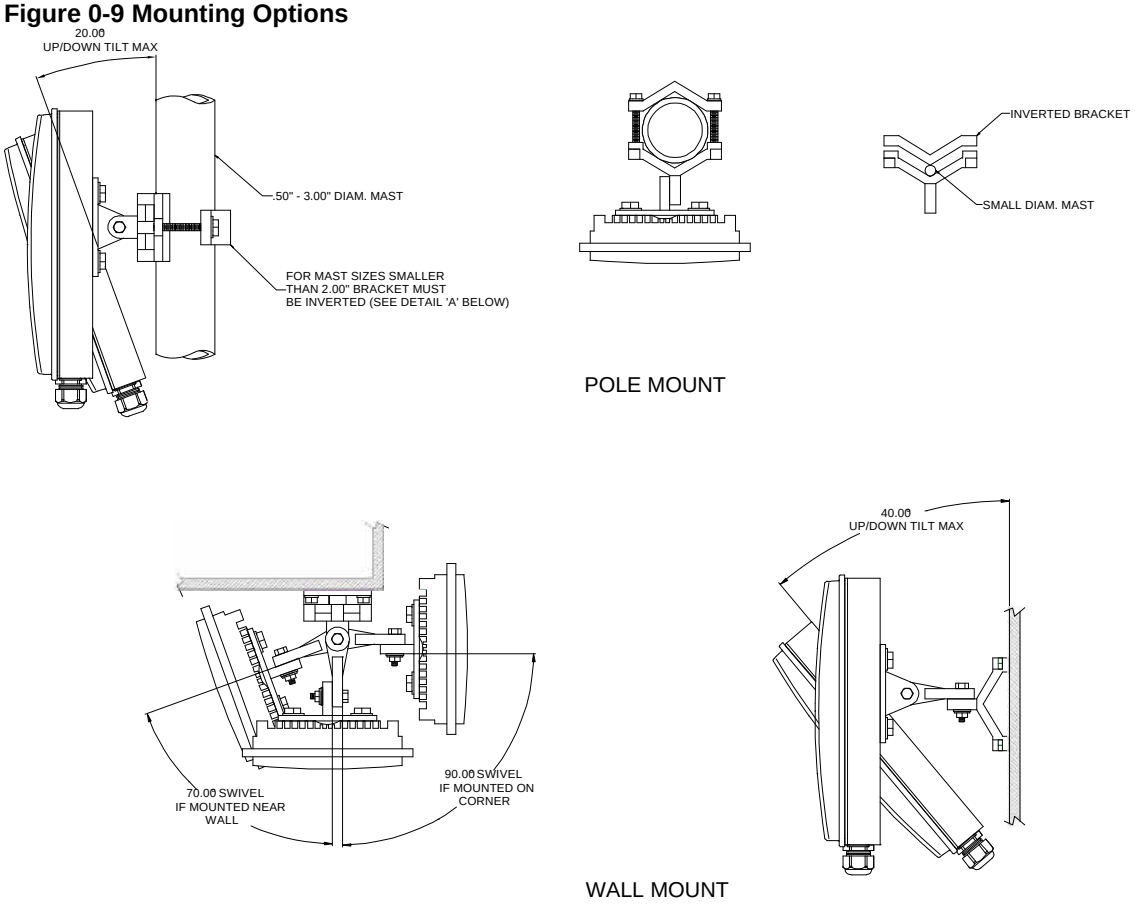
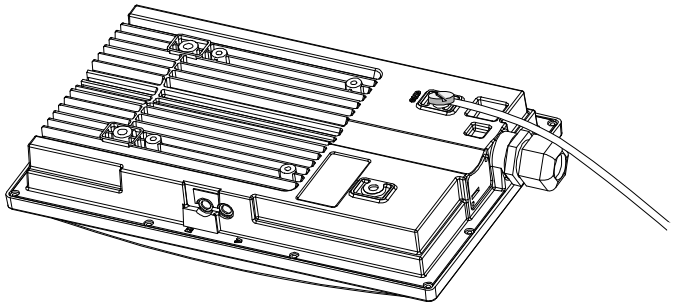



**Figure 0-10 Grounding Example**

Proper mounting of the radio includes consideration for grounding. Please note that if the radio is attached to a metal pole which 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 back of the radio as per 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 or conduit is sufficient. If metal conduit is used, it is not necessary to use shielded Cat-5 cable.

**It is imperative that the radio be COMPLETELY SEALED at both the Ethernet port as well as the Serial Port access cover.** The contracting weather-proofing clamp at the bottom of the Ethernet port must be securely tightened around the cable if conduit is not used. Proper sealing of the radio will ensure that moisture will not enter the enclosure of the radio. **Without proper sealing, moisture may enter the radio and potentially cause damage which will not be covered under warranty.**

The cable ports are purposely located at the bottom of the radio to minimize the risk of water intrusion. **Do not mount the radios upside down.**

✍ Note: The J-Box is not a weatherized device and must be located either indoors or in a weather-protected cabinet.

✍ Note: It is important to provide strain relief and drip loop for STP Cat-5 cables.

## *RU Installation and Antenna Alignment*

Once the MU is installed, and aligned in the correct general direction, it is time to install the RU. The hardware installation of the RU is identical to the MU, including considerations for line-of-sight, cable distances, cable type, weather sealing, and grounding.

Once the RU is installed and aimed in the general direction of the MU, it is time to perform an RSSI test to determine the signal strength from the MU, and to precisely align the RU antenna for maximum signal strength.

## RU Antenna Alignment Procedure

1. Ensure MU is in opmode "ON"
2. Connect to the RU from the Ethernet side via the Browser Interface (while in opmode "OFF")
3. Login and observe the RSSI indicator on the bottom left of the page. As you read the RSSI reading, move the antenna in the horizontal and vertical planes until the maximum RSSI reading is achieved. For short links you can expect an RSSI of –60 dBm or better. For longer links and RSSI of –75 dBm is acceptable. Any RSSI of less than –80 dBm may be too weak for the radios to reliably associate and pass data.
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.

✍ Note: The amber light on the bottom of the RU will also indicate RSSI according to the following parameters:

| | |
|---|---|
| RSSI≤ -80dBm | not lit |
| RSSI > -80dBm | blinking. |
| RSSI ? -65dBm | solid. (blink rate increases with signal strength.) |

## *Link Test*

Ensure the RU's default opmode is "ON" and that all configuration parameters are correct.

Reboot the radio. Once the radio enters opmode "ON", the authentication process will occur with the MU, and the two radios will begin to associate. From the MU side, use the Link Control page to assess the quality of the link. This was discussed earlier in the Basic Diagnostics section.

**If all tests show favorable results, the wireless link will automatically begin passing Ethernet traffic between the radios.**

# Chapter 5 Management

In the TrangoLINK system the MU controls most functions of its associated RU. For this reason it is important to consider that you will manage your TrangoLINK system primarily through the MU.

Network management can be performed by three methods

- ?? Browser Interface
- ?? CLI — Appendix – Command Set Reference
- ?? SNMP Manager — Discussed in this section, below.

## *RU Management*

Most management functions of the RU can be performed by issuing commands from the MU. Presented below are a few examples of these commands:

Change the RUs IP, subnet, and gateway: ***re ipconfig <new ip> <new RUbnet> <new gateway>***
Example: `re ipconfig 192.168.10.10 255.255.255.0 192.168.10.1`

A complete description of these commands and many others can be found in Appendix – Command Set Summary.

## Managing MU from RU side of Network

As a security feature, TrangoLINK was designed to prevent users on the RU side of the network from accessing the MU via telnet or HTTP interface. If it is necessary for network administrators to access a MU from the RU side of the network the user must first telnet into a router, or similar device, located behind the MU. Then telnet from the router into the MU.

## *SNMP*

TrangoLINK supports Simple Network Management Protocol (SNMP) for network management. Network management consists of the following 4 categories: configuration, accounting, alarm, monitoring, and control. These capabilities allow the network operator to provide superior services through higher network availability and integrated accounting system. For more information on SNMP and its uses, you can visit http://www.faqs.org/faqs/snmp-faq/.

The Trango SNMP solution supports MIB-II (system only) and the Trango proprietary Management Information Base (MIB). The SNMP agent resides on the MU ONLY. It gathers health and status, performance statistics from all RUs locally, then responds back to the SNMP manager upon request.

Users interested in using the SNMP functionality should review the entire TrangoLINK MIB for a complete understanding of its features.

The following is an overview of a few of the more commonly used SNMP objects in the TrangoLINK system.

## Objects for Monitoring and Control

**su Bandwidth Monitoring**

- ?? **suEthRxAvgThroughputLog** – Average payload data throughput (in Kbits/sec) received on the Ethernet port over the period specified by suStatisticsSamplePeriod (1 ~ 60 minutes).
- ?? **suEthTxAvgThroughputLog** - Average payload data throughput (in Kbits/sec) transmitted on the Ethernet port over the period specified by suStatisticsSamplePeriod (1 ~ 60 minutes).
- ?? **suRfRxAvgThroughputLog** - Average payload data throughput (in Kbits/sec) received on the RF link over the period specified by suStatisticsSamplePeriod (1 ~ 60 minutes).
- ?? **suRfTxAvgThroughputLog** - Average payload data throughput (in Kbits/sec) transmitted on the RF link over the period specified by suStatisticsSamplePeriod (1 ~ 60 minutes).
- ?? **suRfInOctets** – Number of octets of payload transmitted from MU's RF port.
- ?? **suRfOutOctets** – Number of octets of payload received from MU's RF port.

**MU Bandwidth Monitoring**

- ?? **aptrafficEthRxAvgThroughputLog** – Average payload data throughput (in Kbits/sec) received on the Ethernet port over the period of 1 minute.
- ?? **aptrafficEthTxAvgThroughputLog** – Average payload data throughput (in Kbits/sec) transmitted on the Ethernet port over a period of 1 minute.
- ?? **aptrafficRfRxAvgThroughputLog** – Average payload data throughput (in Kbits/sec) received on the RF link over a period of 1 minute.
- ?? **aptrafficRfTxAvgThroughputLog** – Average payload data throughput (in Kbits/sec) transmitted on the RF link over the period of 1 minute.
- ?? **aptrafficEthInOctets** – Number of octets of payload received on the Ethernet port
- ?? **aptrafficEthOutOctets** – Number of octets of payload transmitted on the Ethernet port
- ?? **aptrafficRfInOctets** – Number of octets of payload received on the RF port
- ?? **aptrafficRfOutOctets** – Number of octets of payload transmitted on the RF port

**Link Status Monitoring** –Various traps are defined as follows:

- ?? Cold start – when SNMP agent starts running
- ?? Link Up – when the MU enters opmode "MU"
- ?? Link Down – when the MU reboots
- ?? SU Link Up – when su associates to the MU
- ?? SU Link Down – when RU disassociates from the MU
- ?? "MU" opmode Failure – when MU fails to enter opmode "MU"

**MU and RU Control** – SNMP also provides several control capabilities. The majority of the features available on the CLI are also available via SNMP. Here are a few of these features:

- ?? Add/delete RUbscriber
- ?? Change channel
- ?? Set power
- ?? Set radio sensitivity

Review the Trango MIB (trango_P5830Sap_1p0.mib) for the complete listing of MIB Objects.

## SNMP Setup

Trango Broadband provides only the MIB portion of the SNMP Management system. The radios act as individual agents, and it is up the user to provide an SNMP Manager software from a third party vendor. Below is an example of the setup process for SNMPc from Castle Rock™.

1. Unzip trangopkg.zip file to a local temporary directory.
2. Go to your local temporary directory, you will see 4 files shown below.
   a. `trango_P5830Sap_1p0.mib` – M5800S AP MIB file
   b. `trango.ico` – P5830S AP icon
   c. `autoico.txt` – instruction file (Selects Trango icon automatically during initial set-up.)
3. Copy trango_P5830Sap_1p0.mib file to C:\Program Files\SNMPc Network Manager\mibfiles
4. Copy autoico.txt file to C:\Program Files\SNMPc Network Manager\mibfiles
5. Copy trango.ico file to C:\Program Files\SNMPc Network Manager\bitmaps
6. The MIB needs to be compiled into the SNMPc database

By default, the Read Community is set to "**`public`**", and Write Community is set to "**`private`**" in the MU. The Trap Community is "**`SNMP_trap`**". The manager needs to have the same settings in order to communicate with the MU successfully.

✍ Note: The Trap Community can not be set via HTTP, and CLI.

To send traps from the MU, set the following:

- ?? trap destination IP (Trango MIB object `trapconfig–trapconfigInfo`)
- ?? trap community string (Trango MIB object `trapconfig–aptrpTable-AptrpEntry`)
- ?? enable each trap (Trango MIB object `traponfig–aptrpTable-AptrpEntry`)

For all the set operations, set object `SaveAndActivate` at `apsystem-apsystemInfo` to write the information to FLASH.

# Command Set Summary

?? OFF = opmode off, ON = opmode on
?? s = serial, e = Ethernet
?? M = Master Only, R = Remote Only
?? + It may not work properly through http's command console.
?? good for Master/Remote 1p0

| ***Command*** | ***Description*** | ***OFF*** | ***ON*** | | ***Remark*** |
|---|---|---|---|---|---|
| !+ | redo the last command | s | s | | |
| ? | same as "help" | se | se | | |
| ? <command> | same as "help" | se | se | | |
| _password <new password> <new password> | specify new password (max 15 octs) | se | se | | |
| baud [9600 \| 115200] | display or set console baud rate | se | se | | default = 9600 bps |
| bye | same as "logout" | | | | |
| exit | same as "logout" | | | | |
| freq | display current channel | se | se | | |
| freq <ch#> <h \| v> | change current channel and polarization | se | se | | |
| freq channeltable | display channel table | se | se | | |
| freq writechannel [<ch #> <freq>]… | build channel and write to flash<br><ch #> = 1..30 | se | se | | |
| help | display complete help page except "eng" | se | se | | |
| help <command> | search and display command's help | se | se | | |
| ipconfig [<new ip> <new subnet mask> <new gateway>]+ | assign radio's ip, subnet mask and gateway ip | se | se | | |
| logout | log out console | se | se | | |
| opmode [on\|off] | set or display current opmode | se | se | | |
| password | specify new password (max 15 octs) | s | s | | |
| ping <ip address> | ping local Ethernet device | se | se | | It only works for local Ethernet devices, not SU or any device behind SU. |
| power | display default and current tx power level | se | se | | default = +18 dBm |
| power <setism\|setunii> <min\|max\|<dBm>>* | specify tx power for both band | se | se | | SU's power will be adjusted by AP when association |
| re ipconfig <new ip> <new subnet> | assign Remote ipconfg | | se | M | |

| | | | | | |
|---|---|---|---|---|---|
| <new gateway> | | | | | |
| re ping | ping Remote Radio | | se | M | |
| re reboot | reboot Remote Radio | | se | M | |
| re speedtest [<pkt len> <file size>] | perform speedtest<br><pkt len> = 64..1760 bytes<br><file size> = 10..100 Mbytes | | se | M | default:<br><pkt len> = 1760 bytes<br><file size> = 10 MBytes |
| re sysinfo | request Remote's system information | | se | M | |
| re testrflink [<pkt len>] | perform RF loopback test testrflink<br><pkt len> = 64..1760 bytes | | se | M | defaukt:<br><pkt len> = 1760 bytes |
| reboot | reboot unit | se | se | | |
| remarks [<str>] | string length should be 1 to 28 characters | se | se | | not 31 characters |
| reset [all \| <n1> <n2> ..] | reset radio to be firmware default<br>n# = 0..2<br>Master:<br>0 - Channel Table, Active Channel = 1 h, Switches and Remarks<br>1 - Tx Power = Max, RF Threshold = -90 dBm, Target RSSI = -60 dBm, MIR Downstream = 10000 kbps, Upstream = 10000 kbps<br>2 - SNMP Community String (Read/Write) = (public/private)<br><br>Remote:<br>0 - Channel Table, Active Channel = 1 h, Switches, and Remarks<br>1 - Tx Power = Max, RF Threshold = -90 dBm<br>2 - SNMP Community String (Read/Write) = (public/private) | se | | | |
| rfrxth <ism\|unii> <-90\|-85\|-80\|-75\|-70\|-65>* | specify RF rx threshold | se | se | | default = -90 for both band |
| rfrxthreshold … | same as "rfrxth" | | | | |
| rssi | display current Rx rssi | se | | | |
| save | same as "updateflash" | se | se | | |
| save mm | same as "updateflash mainimage" | se | se | | |
| save ss | same as "updateflash systemsetting" | se | se | | |
| set defaultopmode [on\|off] | set or display default opmode | se | se | | |
| set httpport [<port #>] | set or display HTTPD port number | se | se | | default = 80 |
| set mir [<downstream,kbps> <upstream,kbps>] | set or display MIR<br><kps> = 100..10000 | se | se | M | |
| set rssitarget <dB> | set Target RSSI threshold | se | se | M | |

| | | | | | |
|---|---|---|---|---|---|
| | It must be in -45 to -75 and +5 dB higher than RF Rx Threshold | | | | |
| set snmpcomm [<read\|write>] | display or assign snmp community string | se | se | | |
| set telnetport [<port #>] | specify telnet port, <port #> = 1..65534 | se | se | | default = 23 |
| ssrssi <ch #> <v \| h> | display rssi on the current channel | se | | | |
| survey <sec> | spectrum analysis pf the entire band | se | | | |
| sw 0 [on \| off] | set sw #0 – packet filter for broadcast/multicast | se | se | | default = on |
| sw 1 [on \| off] | set sw #1 – HTTPD service | se | se | | default = on |
| sw 2 [on \| off] | set sw #2 – Auto scan Master signal | se | se | R | default = on |
| sysinfo | display system configuration | se | se | | |
| temp | display current temperature | se | se | | |
| tm | display current time mark | se | se | | |
| uniimaxpower [<dBm>] | set max tx power limit<br><dBm> = -30..30 | se | | | |
| updateflash <mainimage \| fpgaimage> <* \| <current chscksum>> <* \| <new checksum>> | get image from tftp buffer, verify checksum and write to flash memory at main or fpga image section.<br>*: skip checksum verification | se | se | | |
| updateflash systemsetting | write current configuration into flash memory at system configuration section | se | se | | |
| ver | display<br>1. version number and date code<br>2. firmware and fpga version code<br>3. firmware and fpga image checksum | se | se | | |

# Chapter 6 Specifications

**All specifications apply to P5830S-R and P5830S-M unless otherwise noted.**

| **Radio Parameters** | High Band (ISM) | | Low Band (U-NII ) | |
|---|---|---|---|---|
| Frequency of Operation | 5725 MHz to 5850 MHz<br>6 non-overlapping channels | | 5250 MHz to 5350 MHz<br>5 non-overlapping channels | |
| Antenna Gain | Internal Antenna<br>18 dBi ISM Band<br>17 dBi U-NII Band | DSS Dish<br>24 dBi | 15" Patch<br>24 dBi | 36" Dish<br>30 dBi |
| Max Range / Fade Margin (5.8 Ghz ISM Band) | 10 Miles | 20 Miles | 20 Miles | 40 Miles |
| Max Range / Fade Margin (5.3 Ghz U-NII Band) | 4 Miles | 6 Miles | 6 Miles | 10 Miles |
| Antenna Beamwidth (azimuth) | $18^o$ | $9^o$ | $9^o$ | $4^o$ |

| | |
|---|---|
| **Data Parameters** | |
| Modulation Format | Direct Sequence Spread Spectrum (DSSS) with RAKE |
| Certification/Compliance | FCC Part 15.247, 15.407 AP only: ETSI/EN301 489-1 (7.2) |
| Receiver Sensibility | (1E10-6 BER) 1600 byte packets: -83 dBm, 64 byte packets: -87 dBm |
| User Data Throughput | 10 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, Serial |
| Upstream/Downstream Throughput | Dynamic, automatically adjusts to suit demand |
| **Physical Interfaces** | |
| Ethernet Speed (via RJ45 shielded) | 10/100 BaseT, Auto-sensing |
| Serial Speed | (via RJ11) 9600 baud |
| Ethernet Packet | Up to 1600 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, 20 VDC Nominal |
| Voltage input limits into Radio | 10.5 VDC - 21 VDC |
| Standard Power Supply (included) | 120 VAC to 20 VDC |
| PoE Cat-5 Max Cable length | 100 meters on 24 AWG STP Cat-5 Cable |
| Current Draw/Power | 670 mA max. (13.4 W), using 20V standard adapter |
| **Environmental** | |
| Radio Enclosure | All-weather, powder coated, cast aluminum w/polycarbonate radome |
| Temperature Range | -40 o to 60 o C (-40 o to 140 o F) |
| NEMA Rating | NEMA 4 |
| Radio Dimensions | 12.5 in. x 8 in. x 2 3/4 in. |
| Radio Weight | 4 Lbs. |
| User Interfaces | RJ45 (shielded) and RJ11 |

# Chapter 7 Glossary

## A

**Antenna Gain** The gain of an antenna is a measure of the antenna's ability to direct or focus radio energy over a region of space. High gain antennas have a more focused radiation pattern in a specific direction.
**AP** Access Point. A wireless LAN data transceiver that uses radio waves to connect a wired network with wireless stations. It is the Point in a Point-to-Multipoint system.
**AP-Centric** The Access5830 is a Point to Multipoint system with the access point being the single point and Subscriber Units being the multi-points. It is sometimes referred to as a cell system. See also Base Station.
**Associated** A station is configured properly to allow it to wirelessly communicate with an Access Point.

## B

**Base Station**
**Broadcast Packet** A single data message (packet) sent to all addresses on the same subnet.

## C

**CCK** Complementary code keying. A modulation technique used by IEEE 802.11b-compliant wireless LANs for transmission at 5.5 and 11 Mbps.
Cell The area of radio range or coverage in which the wireless devices can communicate with the base station. The size of the cell depends upon the speed of the transmission, the type of antenna used, and the physical environment, as well as other factors.

## D

**Data Rates** The range of data transmission rates supported by a device. Data rates are measured in megabits per second (Mbps).
**dBi** A ratio of decibels to an isotropic antenna that is commonly used to measure antenna gain. The greater the dBi value, the higher the gain, and the more acute the angle of coverage.
**DHCP** Dynamic host configuration protocol. A protocol available with many operating systems that automatically issues IP addresses within a specified range to devices on the network. The device retains the assigned address for a specific administrator-defined period.
**Domain Name** The text name that refers to a grouping of networks or network resources based on organization-type or geography; for example: name.com— commercial; name.edu— educational; name.gov— government; ISPname.net— network provider (such as an ISP); name.ar— Argentina; name.au— Australia; and so on.
**DNS** Domain Name Server. A server that translates text names into IP addresses. The server maintains a database of host alphanumeric names and their corresponding IP addresses.
**DSSS** Direct sequence spread spectrum. A type of spread spectrum radio transmission that spreads its signal continuously over a wide frequency band.

## E

**Ethernet** The most widely used wired local area network. Ethernet uses carrier sense multiple access (CSMA) to allow computers to share a network and operates at 10, 100, or 1000 Mbps, depending on the physical layer used.
**EIRP** Effective Isotropic Radiated Power

## F

**File Server** A repository for files so that a local area network can share files, mail, and programs.
**Firmware** Software that is programmed on a memory chip.

## G

**Gateway** A device that connects two otherwise incompatible networks together.
**GHz** Gigahertz. One billion cycles per second. A unit of measure for frequency.

# I

**IEEE** Institute of Electrical and Electronic Engineers. A professional society serving electrical engineers through its publications, conferences, and standards development activities. The body responsible for the Ethernet 802.3 and wireless LAN 802.11 specifications.
**Infrastructure** The wired Ethernet network.
**IP Address** The Internet Protocol (IP) address of a station, or the layer three address used in routing packets.
**IP Subnet Mask** The number used to identify the IP subnetwork, indicating whether the IP address can be recognized on the LAN or if it must be reached through a gateway. This number is expressed in a form similar to an IP address; for example: 255.255.255.0.
**ISM** Industrial Scientific Medical — FCC designation for various parts of the radio spectrum oridinally allocated for unlisenced use. For Access5830 it refers to the 5.725 to 5.850 frequency band.
**Isotropic** An antenna that radiates its signal 360 degrees both vertically and horizontally in a perfect sphere.

# M

**MAC** Media Access Control address. A unique 48-bit number used in Ethernet data packets to identify an Ethernet device, such as an access point or your client adapter.
**Modulation** Any of several techniques for combining user information with a transmitter's carrier signal.
**Multipath** The echoes created as a radio signal bounces off of physical objects.
**Multicast Packet** A single data message (packet) sent to multiple addresses.

# O

**Omni-directional** This typically refers to a primarily circular antenna radiation pattern of certain antennas.

# P

**Packet** A basic message unit for communication across a network. A packet usually includes routing information, data, and sometimes error detection information.

# R

**Range** A linear measure of the distance that a transmitter can send a signal.
**Receiver Sensitivity** A measurement of the weakest signal a receiver can receive and still correctly translate it into data.
**RF** Radio frequency. A generic term for radio-based technology.

# S

**Spread Spectrum** A radio transmission technology that spreads the user information over a much wider bandwidth than otherwise required in order to gain benefits such as improved interference tolerance and unlicensed operation.

# T

**Transmit Power** The power level the radio transmits from its antenna port.

# U

**UNII** Unlicensed National Information Infrastructure— regulations for UNII devices operating in the 5.15 to 5.35 GHz and 5.725 to 5.825 GHz frequency bands.
**UNII-1** Regulations for UNII devices operating in the 5.15 to 5.25 GHz frequency band.
**UNII-2** Regulations for UNII devices operating in the 5.25 to 5.35 GHz frequency band.
**UNII-3** Regulations for UNII devices operating in the 5.725 to 5.825 GHz frequency band.
**Unicast Packet** A single data message (packet) sent to a specific IP address.

# W

**Workstation** A computing device with an installed client adapte