DRAFT 1.1 **RapidLink 54** Wireless Point-to-Point Bridge

Installation Guide/Users Manual

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Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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Section 1: For Your Safety

WARNING

Use extreme care when installing equipment or working near power lines.

CAUTION

When the unit is in operation, avoid standing directly in front of the antenna. Strong RF fields are present when the transmitter is on.

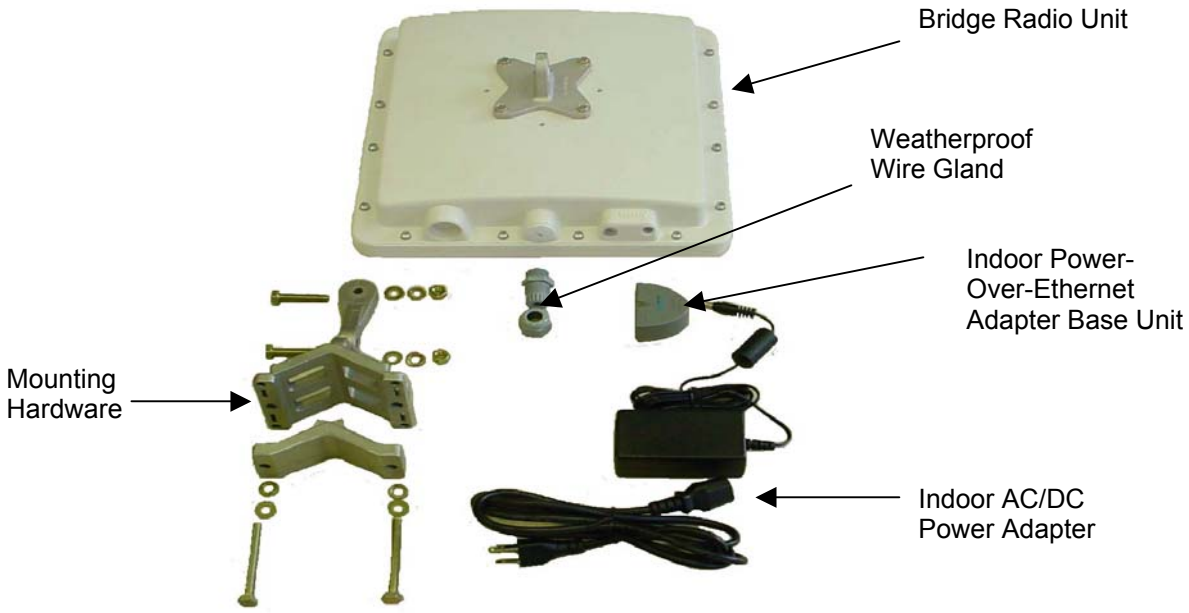
The antenna used for this transmitter must be installed to provide a separation distance of at least 150 cm from all persons.

This Point-to-Point device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Model RL54-BR-23 comes with an integrated 23dBi gain antenna, installed from the manufacturer.
Model RL54-BR-26 comes with an integrated 26dBi gain antenna, installed from the manufacturer.
ALL OTHER COMPONENTS ARE IDENTICAL.

Section 2: Components



TWO SETS OF EACH SHOWN

Section 3: Installation

3.1 Connecting the Outdoor Units

NOTICE To meet regulatory restrictions, RapidWaves'external antenna bridge configuration and any external antenna must be professional installed.

Step 1: Select optimal locations for the two outdoor units. Consider the following criteria to ensure maximum performance and stability of your wireless connection:

- Best signal path possible, ideally with visual line of sight
- Fresnel zone clearance
- The shortest distance possible between the Bridge
- Less than 320 feet from either bridge to the indoor Power-Over-Ethernet adapter
- Optimal transmission range (visit the online range calculator at http://www.rapidwaveinc.com)

Step 2: Set up your poles in the two locations you ascertained in step 1.

Perform the following steps (3-4) for the Master Bridge first, and then repeat these steps for the Partner Bridge.

Step 3: Attach the outdoor units mounting brackets.

Tip Only use the supplied extension bracket if necessary, otherwise it is recommended to mount the antenna-mounting bracket directly to the female pole-mounting bracket as depicted below. If the extension bracket is required for appropriate installation, than it will also be necessary to remount the antenna bracket on the back of the antenna, to maintain an upright and vertical position.

Step 4: Install "User Supplied" CAT5 Weatherized Ethernet straight-through cable.

------ Do not exceed 320 feet (100 Meters) of cable per link------

Step 6: Determine the appropriate routing length for your Ethernet cable and cut to length.

Step 7: Splice and crimp indoor mounting side of the CAT5 Ethernet Cable with an RJ-45 connector.

Step 8: The RL54 mounting side of the Ethernet cable must first be routed through the supplied weatherized wiring gland, than spliced and crimped with a RJ-45 connector. It is Highly recommended that you test the cable with an RJ-45 wiring tester before installing.

Step 9: Connect the RJ-45 to the female connecter located directly inside the enclosure, make sure the connection is locked in place before tightening the gland.

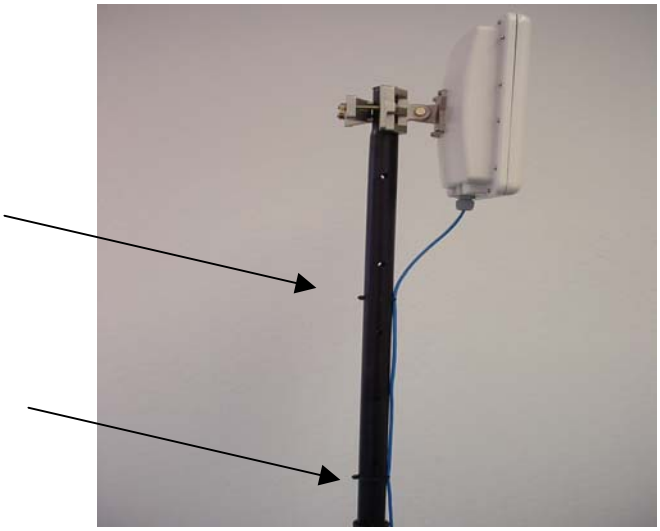
Step 10: Tighten the gland to the enclosure and than tighten the compression nut around the Ethernet Cable

Step 5: Mount the outdoor units to the poles you set in step 2

Tip After mounting the outdoor unit, loosen its pole mounting clamp just enough to maneuver the antenna vertically and horizontally. Point the antenna toward the remote device. If you are close enough to see the remote location, visually align the antenna toward the Partner Bridge location as accurately as possible. If you cannot see the remote location, use binoculars, a telescope or laser pointer.

Do not completely tighten the screws immediately because you will later perfect the alignment with the RapidLink 54 antenna alignment tool.

Step 6: Secure the outdoor unit's Ethernet cable (that you attached to the bottom of the outdoor unit) along the length of the pole using tie-wraps, run the cable toward the inside of the building.



Tip For best results, secure this cable to the pole at least every 10 feet with tie-wraps.

3.2 Connecting the Indoor Units (Power-over-Ethernet Injectors)

The indoor unit is the point at which the outdoor units connect with your indoor LAN. More specifically, the indoor unit connects your wireless bridge to the network and transmits both data and power to the outdoor unit.

Perform the following steps (1-6) to connect the indoor unit of the Master Bridge first, and then repeat these steps for the Partner Bridge.

Step 1: Place the indoor unit in an appropriate location that meets the following criteria:

- The distance from the outdoor unit to the indoor Power-Over-Ethernet adapter must not exceed the length of your Ethernet cable after attached to the bottom of the outdoor unit
- The distance from the indoor unit to the Ethernet network backbone device (e.g., hub or switch) must not exceed 320 ft (100 meters)
- The distance from the indoor unit to an available AC outlet must not exceed the length of the supplied power cable

Step 2: Bring the Ethernet cable into to the wiring closet (where the indoor unit is located), and plug the RJ-45 connector into the combined Ethernet/power output port (**P + Data Out**) on the front panel of the indoor unit.

Caution Connecting any device other than the outdoor unit to the indoor unit may cause permanent hardware damage. Do not confuse the RJ-45 connector of the outdoor unit's with that of the Ethernet cable connected to your backbone device.

Step 3: Connect one end of the brick style power adapter cable to the power jack (**Power In**) on the rear panel of the indoor unit, and plug the other end of the power cable into the AC wall outlet.

Step 4: Check the front panel of the indoor unit to make certain that the power LED is on**.** If the power LED is not on, confirm that the power cable is securely connected and that your power source is operational.

Step 5: Plug your Ethernet patch cable into the Ethernet input port (**Data In**) of the indoor unit and into the data port of your backbone device.

Caution Do not confuse the Ethernet input port with the Ethernet/Power output port. To avoid permanent hardware damage, make certain that you connect your backbone device to the Ethernet input port (not the Ethernet/Power output port).

Step 6: Check the link LED on your backbone device to confirm that it is on.

Congratulations! At this point, you have completed all the hardware related steps necessary to establish your point-to-point wireless link. However, your wireless link is not yet operational. The next section will describe basic software configuration and antenna alignment procedures necessary to activate the wireless link.

Section 4: Basic Configuration

4.1 Overview of the RapidLink 54 Web Interface

All configuration parameters are accessible through an embedded web server interface called the Wireless Link Manager (WLM). Using a web browser, you can easily log into the web server of the Master and Partner Bridge. From this user-friendly interface, you can communicate with any RapidLink 54 unit and perform configuration, management and trouble-shooting tasks.

4.2 Setting Basic Network Parameters

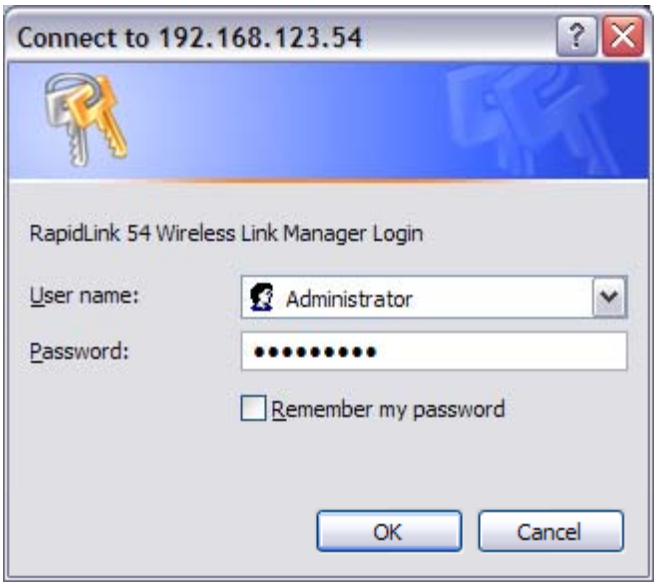
In this section, you will log into the RapidLink 54 WLM for the first time and identify your bridges. After performing steps 1-9 for the Master Bridge, repeat these steps for the Partner Bridge.

Step 1: Load your web browser.

Step 2: Type the factory default IP address: **192.168.123.54** into the address field of your browser and press **Enter**. This will load the RapidLink 54 WLM.

NOTICE When Setting up the Partner Bridge, type in IP address: **192.168.123.55**

Step 3: Enter the default (Case Sensitive) **Login: Administrator** and **Password: RapidLink** when prompted and click **Enter**.



Tip It is strongly recommended that you change the **Password** and **Login** as soon as you have completed the basic configuration by clicking on the **Security** tab. See section 5.2 under Security for full details on changing password.

Now you will see the RapidWave 54 WLM. Along the top of the page, you will find five tabs that contain all the configuration options available for RapidLink 54. These tabs are: **Setup**, **Advanced**, **Security**, **Antenna Align** and **Upgrade**. You will use the **Setup** page to set network parameters and establish your wireless link. The other tabs will be described in later sections.

Step 4: Enter a new **IP Address** for the Master Bridge (the IP address of each device must be unique) and write it down for future reference.

Step 5: Enter a **Subnet Mask** (if different than the default value).

Step 6: Enter the current **Gateway Address** of the Master Bridge to which you are connected.

Step 7: Enter the **Name** of your Master Bridge.

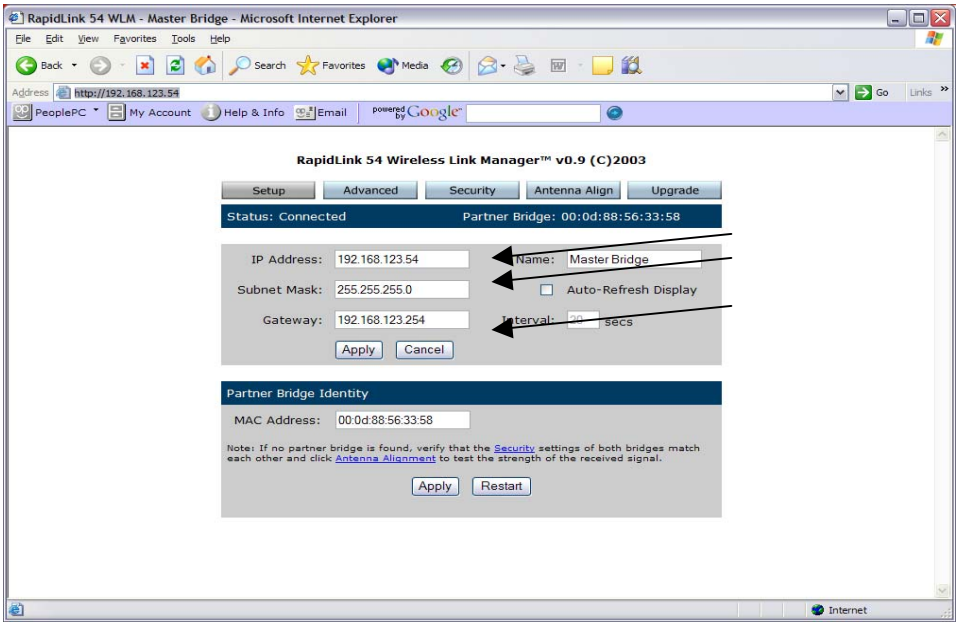
Step 8: Click **Apply**.

Step 9: To put the changes into effect, click on **Restart**, a dialog box will appear, click **OK**. The bridge will then restart.

4.3 Establishing a Wireless Link

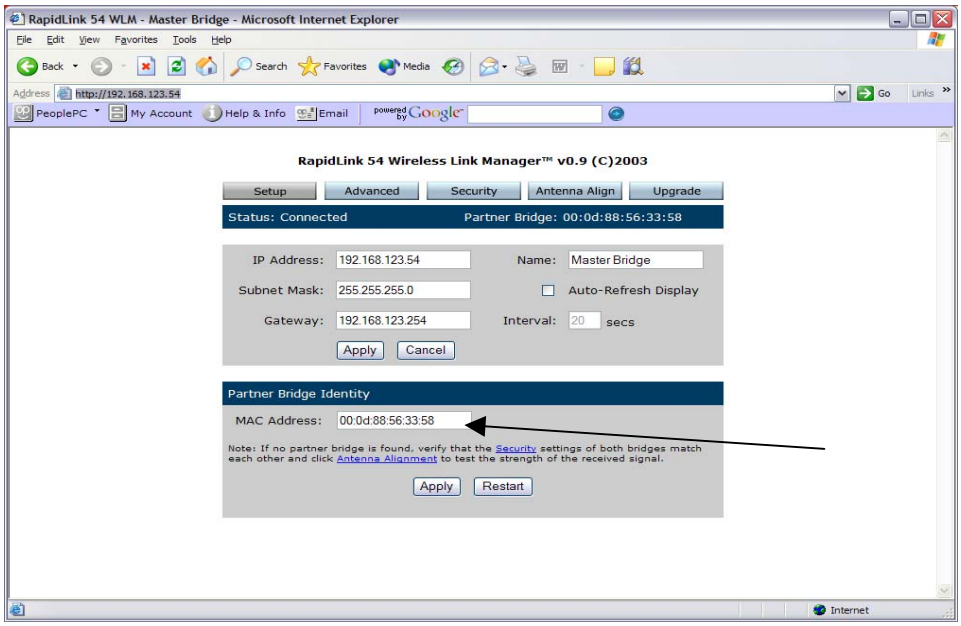
The following steps will help you establish a wireless connection between the Master and Partner Bridge:

Step 1: Type the new IP address that you created in previous steps in the address field of your browser and press **Enter** to load the web interface of the Master Bridge. Login with your user name and password. Before moving on to the next step, make certain that the **Setup** page shows the new settings you initiated in the previous section.



Tip Now that you have assigned the final IP address, it is a good time to bookmark your user interface for easy access as you manage your wireless link.

Step 2: The MAC address of the Partner Bridge is listed under Partner Bridge Identity. If the desired connection partner is available, the two radios initiate the association process and establish a wireless link. After this link is established, the correct status will be reported on the status bar of the web interface, and any association requests by other stations will be blocked.

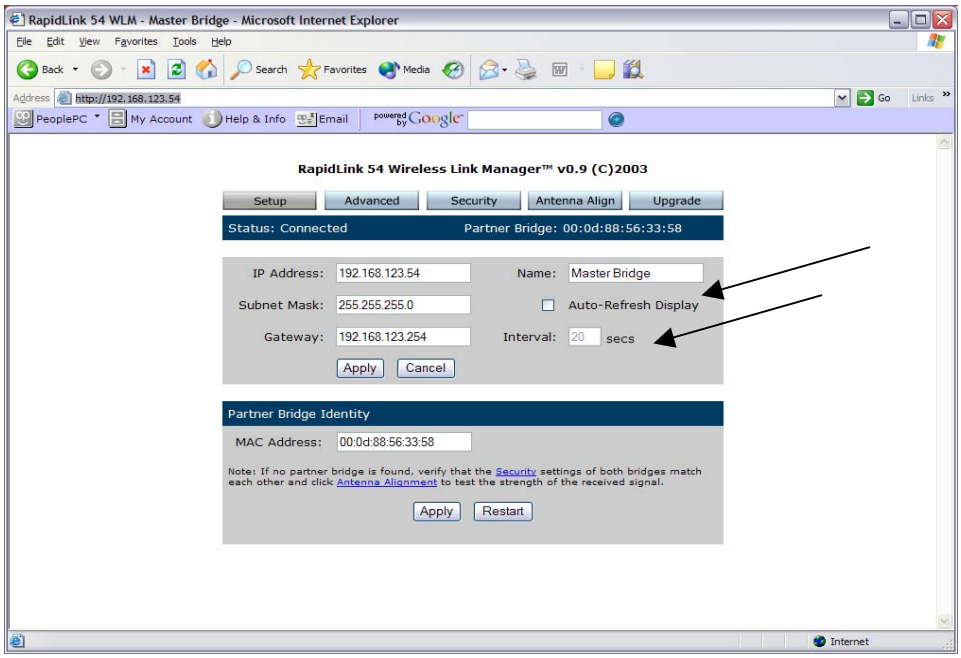


Tip You will not be able to connect if certain Master and Partner Bridge settings are not identical. By factory default, the Master and Partner Bridge are configured to match. If you have changed any of the following parameters: **Transmit Mode**, **Data Rate**, **Channel**, **SSID**, **Encryption Mode** and **Active Encryption Key**, ensure that the configurations of both the Partner and Master Bridge are compatible. In cases where the settings match
and **Connect** is still unsuccessful, ensure that:

- The Partner Bridge is not out of transmission range
- The antennas are in alignment

If any of these issues have caused the **Connection** process to fail, skip the rest of section 4.3 and solve the issues by referring to the instructions corresponding to the issue. When you have solved the problem, go back to step 2 and continue the steps in this section.

Step 3: You should now have an active link. In order to monitor your link status on an ongoing basis, enable the **Auto-Refresh Display** option and specify the time **Interval** in which the screen updates the status information.

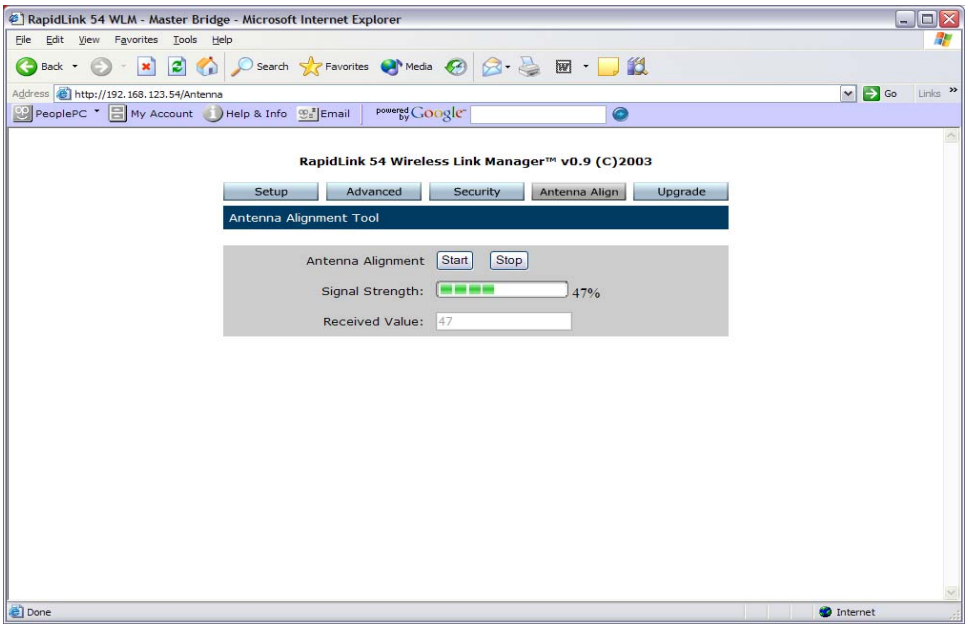


4.4 Aligning the Antennas

Now that you have activated the wireless link between the Master and Partner Bridge, you can adjust your antenna alignment to maximize performance. Depending upon the characteristics of your antennas and the distance between them, antenna alignment can be performed visually or you may opt to use more sophisticated tools and methods of aiming such as telescopes or laser pointers. The WLM provides a tool designed to help you optimize antenna alignment, ensuring the highest signal quality and stability possible. The longer the distance, the greater the need for this tool. As you make physical adjustments to the antenna, the antenna alignment tool will show the resultant transmission quality between the two devices in the form of signal strength and RSSI value. Follow the procedures below for the Master Bridge, and then repeat these steps for the Partner Bridge:

Step 1: Take a laptop computer to the antenna location and load the RapidLink 54 user interface.

Step 2: Select the **Antenna Align** tab and click **Start** to enable the antenna alignment tool. The **Signal Strength** and **Received Value** indicators will now show dynamically updated measurements until you click **Stop**.



Step 3: Monitor the **Signal Strength** indicator as you align the antenna vertically (if antennas are not on the same elevation). When the signal quality reaches an acceptable level, tighten the screws.

Step 4: Repeat step 3 for horizontal alignment.

Congratulations! You have now completed all the steps to set up an operational wireless link. The next section will describe the various configuration options and walk you through the process of changing system settings to meet your specific requirements.

Section 5: Advanced Configuration Options and Tools

Now that you have established a functional link, you may wish to customize parameters according to your needs and preferences. From radio-related parameters and security algorithms to diagnostic tools and firmware upgrade utilities, the WLM offers numerous options that help you effectively manage the system and achieve the highest performance possible. This section describes RapidLink 54's advanced configuration options, which you can find in the following categories:

▪Advanced ▪Security ▪Antenna Align ▪Upgrade

Accessing the advanced options is simple. From the RapidLink 54 WLM, simply click on the tab corresponding to the category you need. The following sub-sections will explain how to configure each parameter within these categories.

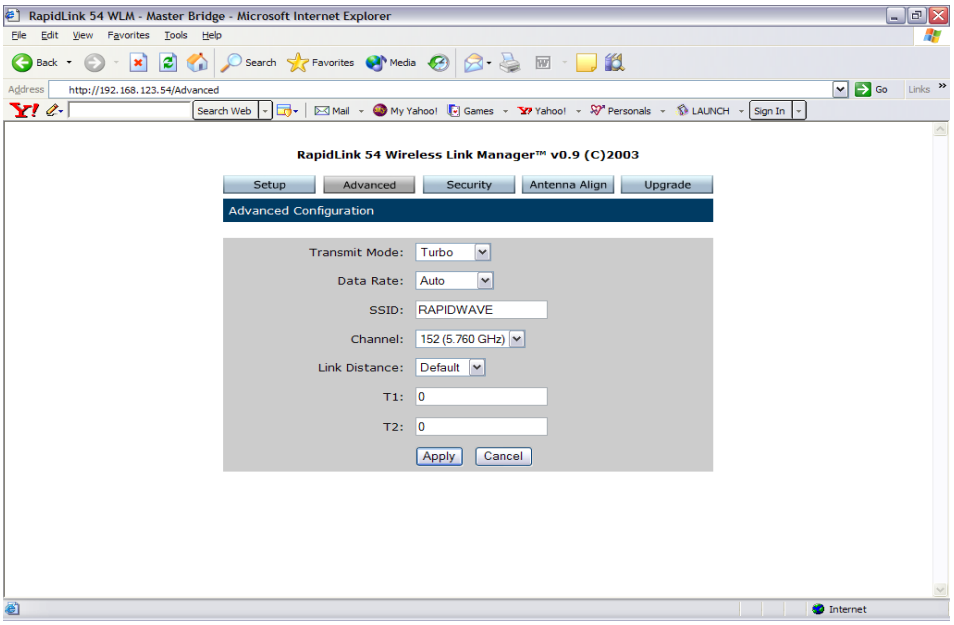
Tip While the options differ, each page functions similarly. As you read the next subsections, keep in mind that regardless of the page, any change you make can only go into effect if you click **Apply**. If you do not click **Apply** before moving to the next page, your changes will be lost.

Also be advised that certain parameters in the **Advanced** and **Security** pages require you to restart the system in order to take effect. In such cases, go back to the setup page and click on **Restart**. If you know that you will be making more changes, you can complete all other changes, and restart the system later.

5.1 Advanced Page

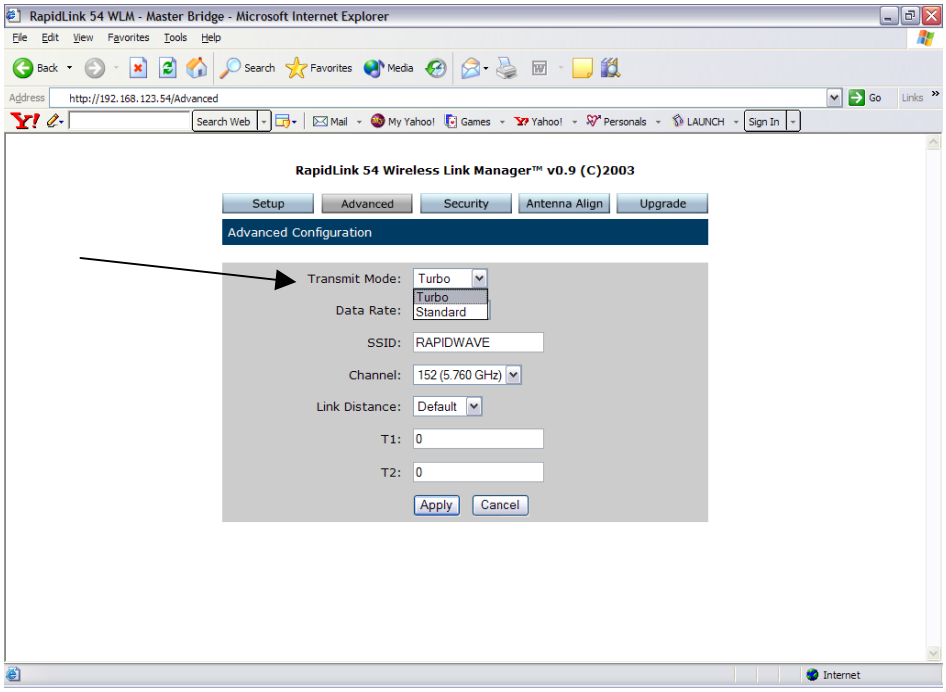
This page allows you to control radio-related parameters, including **Transmit Mode**, **Data Rate**, **SSID**, **Channel and Link Distance.** As mentioned in section 4.3, step 2, these parameters must be identical on both sides of the wireless link. Therefore, any change on the Master Bridge should also be executed for the Partner Bridge. This sub-section explains the options in each field of the **Advanced** page.

Tip **Transmit Mode**, **Data Rate**, and **Channel** settings are interdependent. **Data Rate** and **Channel** are always updated according to the **Transmit Mode** setting. It is therefore recommended that you select the **Transmit Mode** first and follow the instructions below in the order that they are presented.



Set Transmit Mode:

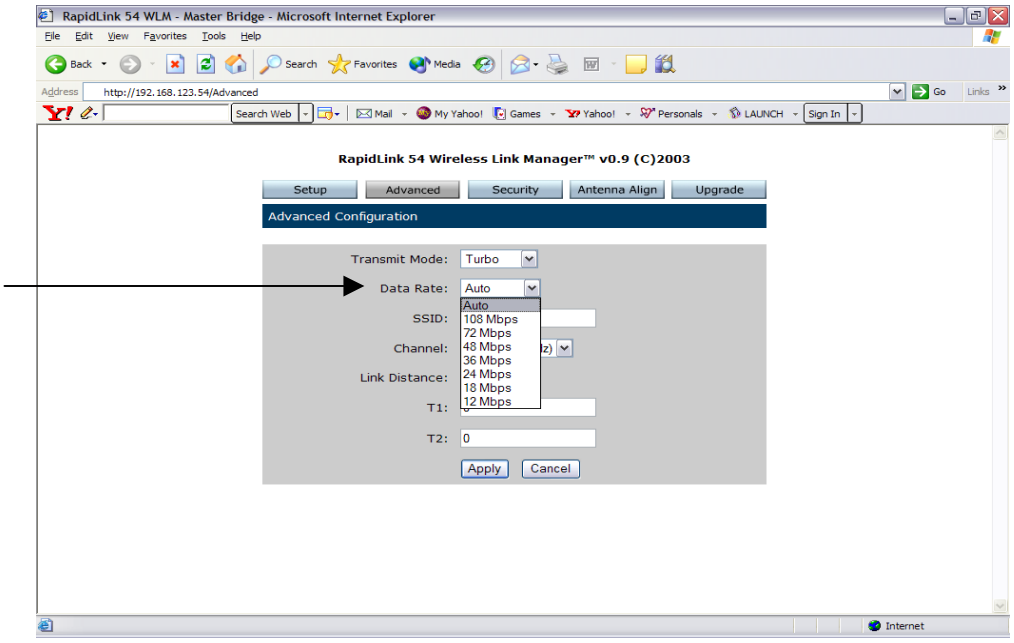
Simply click the drop-down menu in the **Transmit Mode** field and select either **Turbo** or **Standard Mode**. **Data Rate** and **Channel** options will then update according to the new setting.



Set Data Rate:

RapidLink 54 supports several possible data rates ranging from 6 to 108 Mbps. The highest transmission rate is 108 Mbps, with automatic fallback rates that allow the unit to operate in the most efficient manner. By default, the system automatically switches between these rates to maximize coverage. However, you may wish to select a fixed **Data Rate** based on your specific objectives or needs.

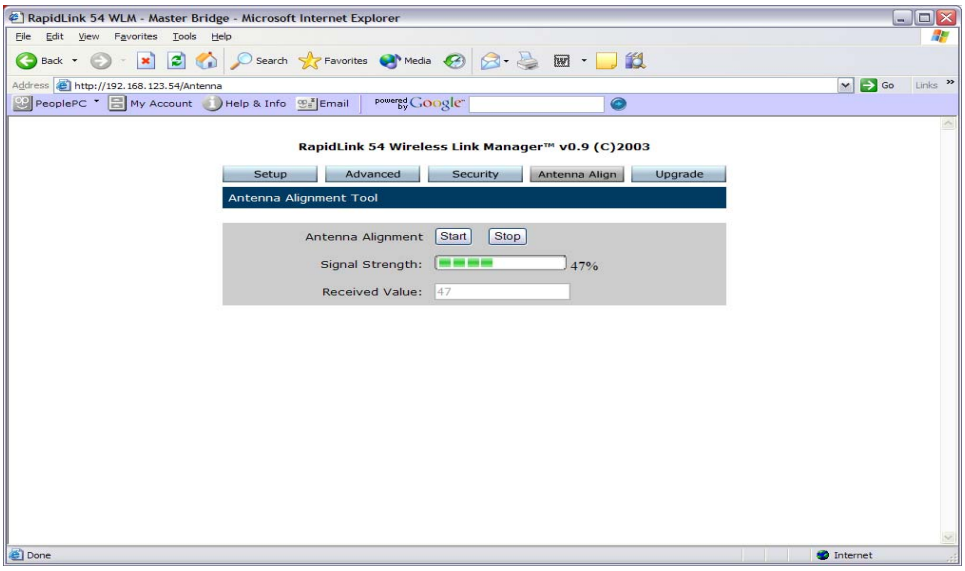
Step 1: To adjust this parameter, click the drop-down menu in the **Data Rate** field and select the desired rate.



Note The default setting, **Auto**, is recommended.

- **Auto:** When the **Data Rate** is set to **Auto**, the Master Bridge will follow an algorithm to determine the highest bit rate possible for communication with its Partner Bridge.
- **Fixed Bit Rate:** The **Auto** setting is disabled by selecting a specific bit rate to be used for the wireless link. This would be appropriate when operating in a well-understood environment, and when full rate operation is not possible. It is recommended that you start with the lowest bit rate.

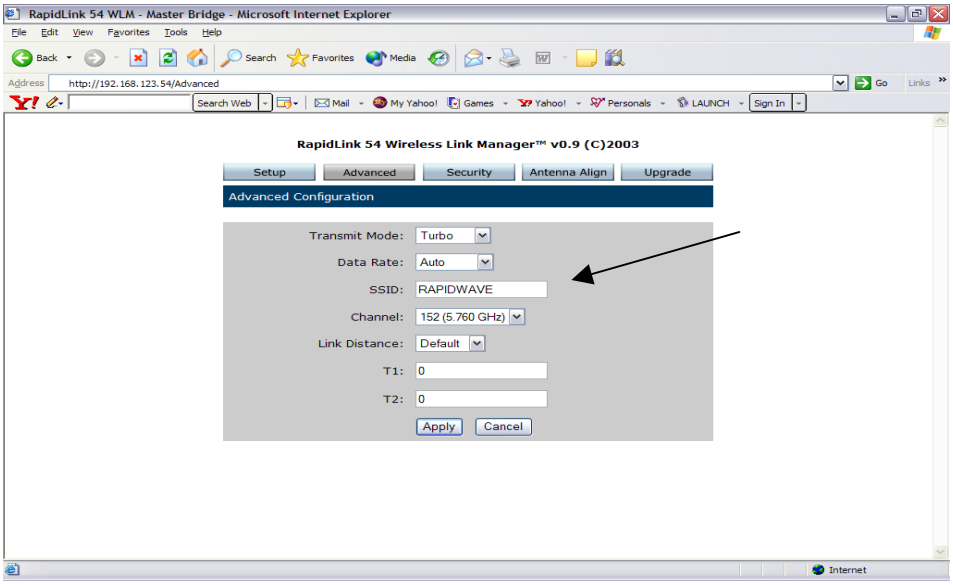
Step 2: Click on **Antenna Align** to check signal strength. Be advised that different data rates have different sensitivities, which impact range.



Tip Make certain that you still have a good signal. If the **Received Value** is not high enough, then scale down the **Data Rate**.

Enter SSID:

The SSID is a service set identifier that uniquely describes your bridge pair. Always use the same **SSID** for both bridges.

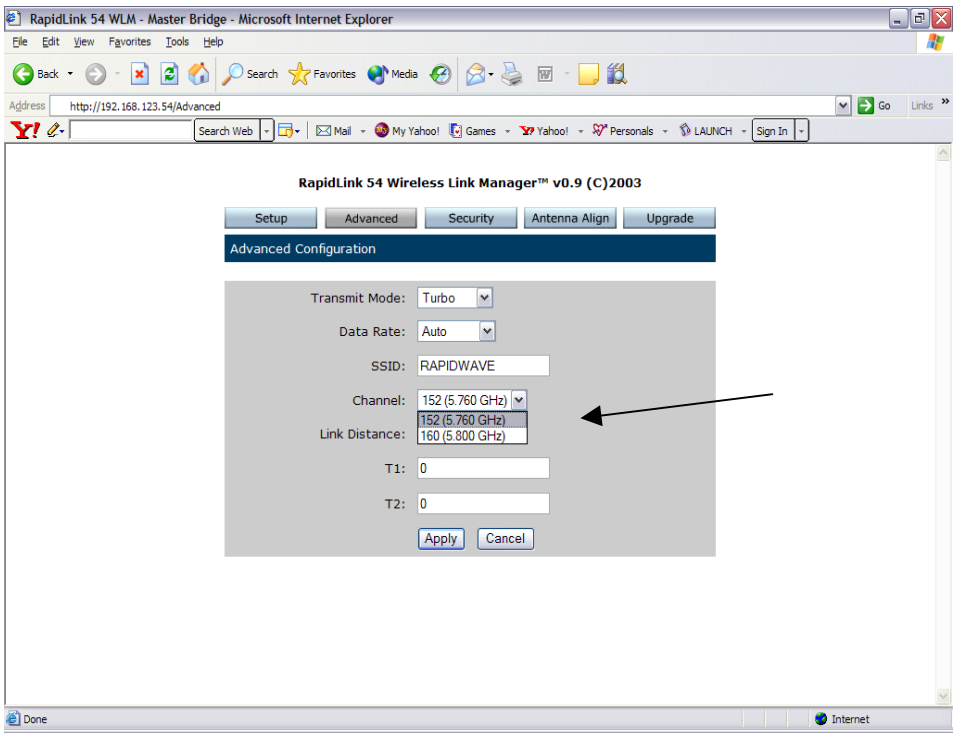


Set Channel:

Channels are used to set the center frequency used to transmit data over the wireless bridge link. You can avoid active interference by switching channels if you suspect interferers operating on the same frequency. Available channels shown in the drop-down menu are based on local regulatory requirements.

To set the **Channel**: Click the drop-down menu in the **Channel** field and select the desired frequency.

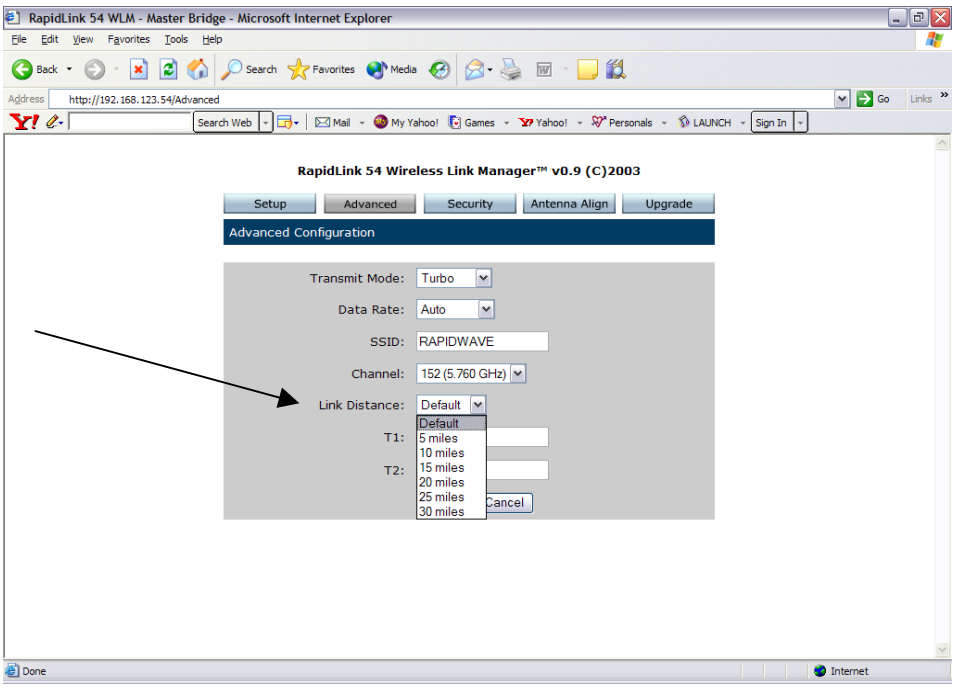
- Five channels are available in **Transmit Mode Standard**
- Two channels are available in **Transmit Mode Turbo**



Tip If active interference is not an issue, it is recommended that you choose the default **Channel** (lowest frequency) in order to maximize range.

Set Link Distance:

Entering the correct **Link Distance** maximizes performance by ensuring that the system is ideally tuned to the distance between the Master and Partner Bridge. You can change this anytime by clicking the drop-down **Link Distance** menu and selecting the desired setting.



5.2 Security

This section describes the parameters available through the **Security** menu. RapidLink 54 provides two forms of security, access control and privacy. Access control is achieved by MAC address authentication, which allows only known devices to associate with the Master Bridge and establish a wireless connection (refer to section 4.3, step 2). Another component of access control is the password protected user interface, which can be configured on the **Security** page. Privacy is accomplished by enabling encryption that prevents rogue stations or wireless sniffers from decoding any captured data. RapidLink 54 provides 128-bit WEP encryption option on the **Security** page.

Changing your Password

We recommend that you change your **Login** and **Password** from the factory default setting to authenticate the identity of the RapidLink 54 administrator and ensure that no unauthorized users gain access to the WLM.

To change your **Login** and **Password**, type a new **Login** name (16 characters maximum). Next, enter a new **Password**, (16 characters maximum) and enter it again to confirm.

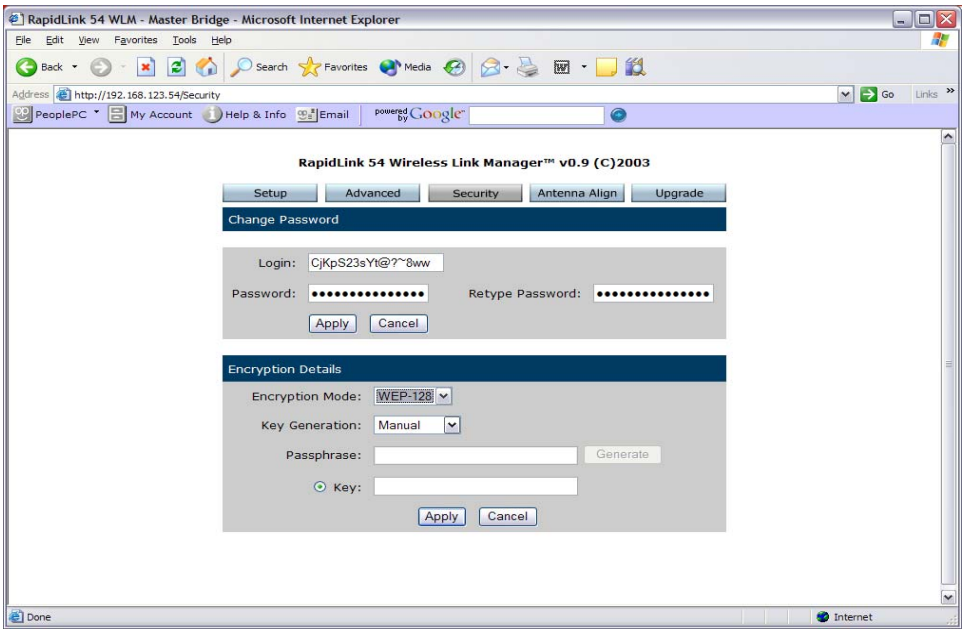
Tip Create passwords according to the following guidelines:

Do Not

- Share passwords with unauthorized users
- Use personal information easily obtained, such as your actual first or last name, system name, etc.
- Use words commonly used as passwords
- Use dictionary words or names

Do

- Base passwords on non-dictionary words, combined with obscure character substitutions
- Use the maximum number of characters
- Change passwords regularly



Privacy

You can enhance link privacy by setting the **Encryption Mode** to **WEP-128** and entering a valid encryption key. You have the option of either creating keys manually or having the system generate a key for you automatically.

By default, the **Encryption Mode** is **Off**. If you wish to increase link privacy, perform the following steps for the Master Bridge, then repeat these steps for the Partner Bridge.

Step 1: If you wish to enable encryption, select **WEP-128**.

Step 2: Click the **Key Generation** drop-down menu and select either **Manual** or **Automated.** If you select **Manual**, you are required to manually enter each key as described below. If you prefer, you can select **Automated**, and the system automatically generates four distinct keys based on a passphrase that you enter.

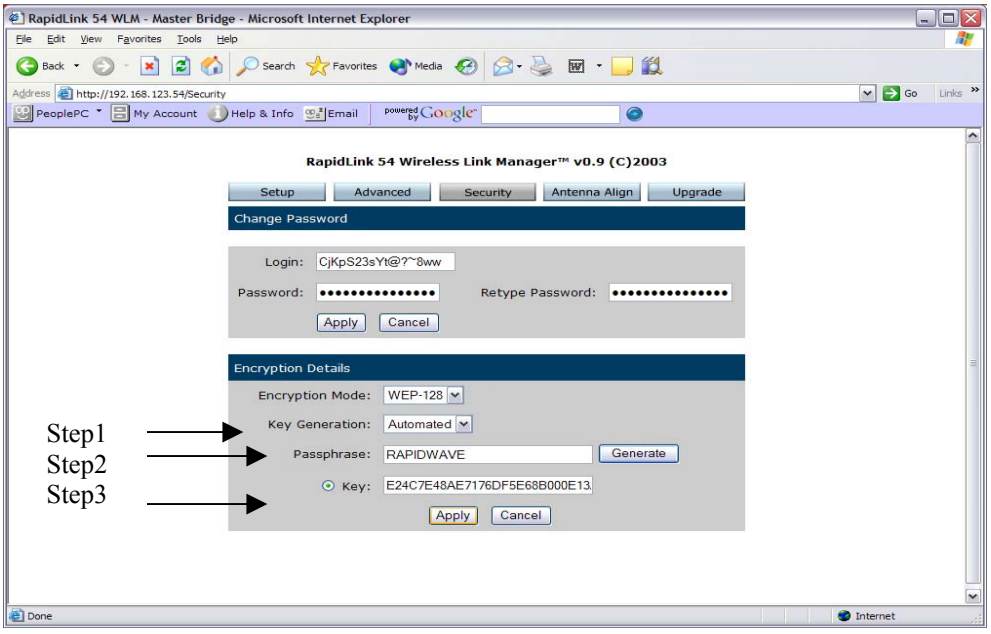
Step 3: Generate at least one valid encryption key. The steps are as follows:

- If the **Key Generation** field is set to **Manual**, enter keys directly into the fields. Each key must be composed of 32 hexadecimal characters in the range of A-F and 0-9.
- If **Key Generation** is set to **Automated,** the **Passphrase** field and **Generate** button are enabled.

  a. Type a **Passphrase** (no more than 32 characters) that you can easily memorize.

  b. Click **Generate**, and a one-way hash algorithm will be applied to hash the **Passphrase** using the specified character encoding and copy the results into the encryption key field.

Note The passphrase is not exchanged over the air. It is as secure as a manually generated key, but easier to remember.



5.3 Antenna Alignment

The **Antenna Align** page is typically used for initial antenna alignment (see section 4.4 for details). However, you can also use it as a tool to monitor the quality of the wireless link in real-time. This is especially helpful if you have made any changes to the system. Click **Start** and the tool runs continuously until you click **Stop**. Once the antenna alignment tool has started, you will see the **Signal Strength** and **Received Value** measurements updated in short intervals.

5.4 Firmware Upgrade

Periodically, RapidWave, Inc. will release firmware updates that enhance various aspects of RapidLink 54. After registering on http://www.rapidwaveinc.com, you will have access to all the firmware upgrades available. If you have questions about upgrading your firmware, please contact RapidWave's support team.

> **Caution** Upgrading the firmware of RapidLink 54 may overwrite some of your configuration parameters. It is therefore important to save a copy of your current settings before performing firmware upgrades so you can re-enter your current settings at the end of the upgrade process. To document your current settings, access and print each of the following screens: **Setup**, **Advanced** and **Security**. Make certain that you do this for both the Master and Partner Bridge.

The steps involved in performing a firmware upgrade are as follows:

Step 1: Obtain firmware image from RapidWave and save it to a directory on your computer or network drive.

Step 2: Start an FTP Server on your computer. Configure an entry for the user name "rapidwave", with the password "rapidwave". The home directory for the "rapidwave" user should be set to the directory where the firmware image is stored.

Step 3: From the Master side browser interface select Upgrade.

Step 4: Specify your FTP Server address in the space provided.

Step 5: Click browse to open the Windows browse file dialog.

Step 6: Click **Upgrade** to upload the image to the Master Bridge.

Step 7: Click **OK** when you see the pop-up with a warning and **OK**/**Cancel** options.

Step 8: When you have successfully loaded the new firmware, the system must be restarted**.**

Step 9: Repeat steps 2-7 for the Partner Bridge.

> **Tip** For greatest interoperability, upload the same firmware image or revision for the Master and Partner Bridge. Make sure that the firmware revisions match on both sides.

Section 6: Notes

Section 7: Warranty

RapidWave - Limited Warranty

RapidWave Inc. warrants that hardware products will be free from material defects in materials and workmanship for the term of one year from product shipment date. RapidWave Inc. warrants that software media will be free from material defects in materials and workmanship for a period of one year from shipment date.
This Hardware Product warranty covers all RapidWave Inc. parts, accessories, and upgrades sold with your RapidWave Inc. Hardware Product. Unless otherwise set forth, RapidWave Inc. accessories and upgrades purchased and added on to the Hardware Product after the initial Hardware Product purchase assume the warranty deliverables and term of the system into which they are installed.

Limitations

NEITHER PARTY WILL BE LIABLE FOR ANY INDIRECT, PUNITIVE, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH OR ARISING OUT OF THIS WARRANTY (INCLUDING, WITHOUT LIMITATION, LOSS OF BUSINESS, REVENUE, PROFITS, GOODWILL, USE, DATA, ELECTRONICALLY TRANSMITTED ORDERS, OR OTHER ECONOMIC ADVANTAGE), HOWEVER THEY ARISE, WHETHER IN BREACH OF CONTRACT, BREACH OF WARRANTY OR IN TORT, INCLUDING NEGLIGENCE, AND EVEN IF THAT PARTY HAS PREVIOUSLY BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. LIABILITY FOR DAMAGES WILL BE LIMITED ADND EXCLUDED, EVEN IF ANY EXCLUSIVE REMEDY PROVIDED FOR FAILS OF ITS ESSENTIAL PURPOSE. SOME STATES AND JURISDICTIONS DO NOT ALLOW LIMITATIONS UPON CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

YOUR SOLE AND EXCLUSIVE REMEDY AND RAPIDWAVE INC.'S ENTIRE LIABILITY FOR BREACH OF WARFRANTY WILL BE: (A) THE REPAIR OR, AT RAPIDWAVE INC.'S OPTION AND EXPENSE, REPLACEMENT OF THE DEFECTIVE PRODUCT, OR, IF SUCH REPAIR OR REPLACEMENT IS NOT REASONABLY ACHIEVABLE, THE REFUND OF THE PURCHASE PRICE. ALL EXPRESS OR IMPLIED CONDITIONS, REPRESENTATIONS, AND WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OR CONDITION OF MERCHANTABILITY, SATISFACTORY QUALITY, FITNESS FOR A PARTICULAR PURPOSE AND NON-INFRINGEMENT, ARE HEREBY EXCLUDED TO THE MAXIMUM EXTENT PERMITTED BY LAW. SOME STATES AND JURISDICATIONS DO NOT ALLOW LIMITATIONS UPON IMPLIED WARRANTIES, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

Founded in July 2002, RapidWave Inc. is a privately held company headquartered in San Jose, California. RapidWave is focused on designing and manufacturing high-performance point-to-point and point-to-multipoint fixed wireless access solutions to address the needs of building communication infrastructures in the emerging economies of the world. RapidWave's product line offers end-to-end solutions for service providers, government organizations, universities, and businesses to quickly and cost-effectively solve their voice and data communication needs – without wires. For more information, visit the RapidWave web site at http://www.rapidwaveinc.com.