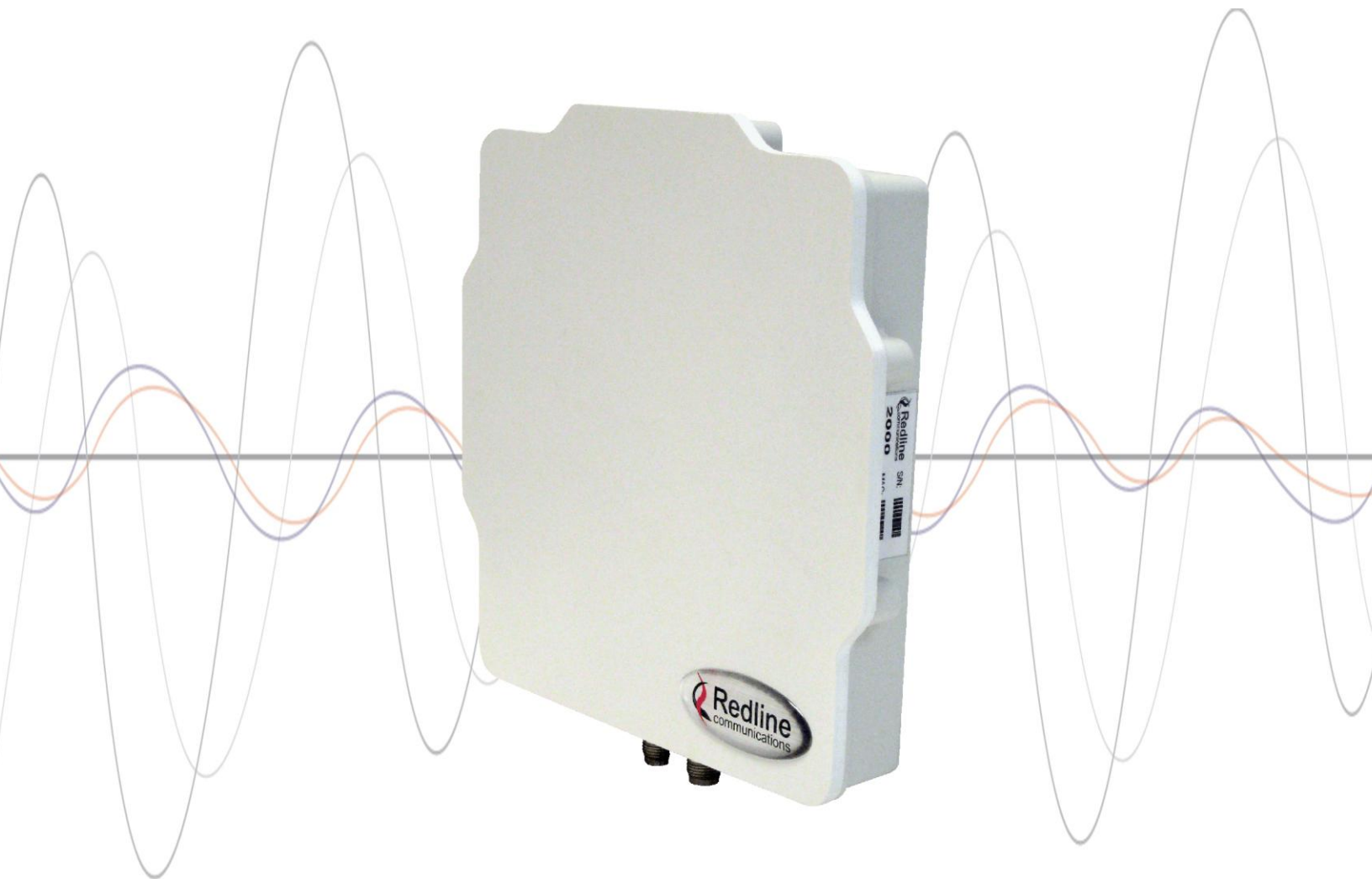# RDL-2000

Advanced Broadband Wireless Infrastructure Solutions

User Manual

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1. ⚠ PoE power adapter for RDL-2000:

___Warning to Service Personnel___: _48 VDC_
Customer equipment including personal computers, routers, etc., must be connected only to the INPUT (DATA) port on the PoE unit.
Only the outdoors Ethernet interface cable connecting to the unit can be safely connected to the OUTPUT (DATA & POWER OUT) connector. Connecting customer premises Ethernet equipment directly to the OUTPUT (DATA & POWER OUT) connector on the Power-over-Ethernet power adapter may damage customer equipment.

2. Installation of the system must be contracted to a professional installer.
3. The installer and operator are responsible for ensuring that the system is used exclusively for fixed, point-to point operations.
4. Read this user manual and follow all operating and safety instructions.
5. Keep all product information for future reference.
6. The power requirements are indicated on the product-marking label. Do not exceed the described limits.
7. Disconnect the power before cleaning. Use only a damp cloth for cleaning. Do not use liquid or aerosol cleaners.
8. Disconnect power when unit is stored for long periods.
9. The unit must not be located near power lines or other electrical power circuits.
10. The system must be properly grounded to protect against power surges and accumulated static electricity. It is the user's responsibility to install this device in accordance with the local electrical codes: correct installation procedures for grounding the unit, mast, lead-in wire and discharge unit, location of discharge unit, size of grounding conductors and connection requirements for grounding electrodes.

1.2 Warning Symbols

The following symbols may be encountered during installation or troubleshooting. These warning symbols mean danger. Bodily injury may result if you are not aware of the safety hazards involved in working with electrical equipment and radio transmitters. Familiarize yourself with standard safety practices before continuing.

Electro-Magnetic Radiation   High Voltage

1.3 Service & Warranty Information

1. Refer all repairs to qualified service personnel. Do not remove the covers or modify any part of this device, as this action will void the warranty.

2. Locate the serial numbers and record these on your registration card for future reference. Use the space below to affix serial number stickers. Also, record the MAC address identified on the unit product label.

3. Redline does not endorse or support the use of outdoor cable assemblies: i) not supplied by Redline, ii) third-party products that do not meet Redline's cable and connector assembly specifications, or iii) cables not installed and weatherproofed as specified in the Installation Guidelines manual (70-00073-01-XX). Refer to the Redline Limited Standard Warranty and RedCare service agreements.

1.4 Lightning Protection

WARNING: The following notes are general recommendations for the system. The wireless equipment should be installed by a qualified professional installer who is knowledgeable of and follows local and national codes for electrical grounding and safety. Failure to meet safety requirements and/or use of non-standard practices and procedures could result in personal injury and damage to equipment.

All outdoor wireless equipment is susceptible to lightning damage from a direct hit or induced current from a near strike. A direct lightning strike may cause serious damage even if these guidelines are followed. Lightning protection and grounding practices in local and national electrical codes serve to minimize equipment damage, service outages, and serious injury. Reasons for lightning damage are summarized as:

a) Poorly grounded antenna sites that can conduct high lightning strike energy into equipment.

b) Lack of properly installed lightning protection equipment can cause equipment failures from lightning induced currents.

A lighting protection system provides a means by which the energy may enter earth without passing through and damaging parts of a structure. A lightning protection system does not prevent lightning from striking, and instead provides a means for preventing damage to equipment by providing a low resistance path for the discharge of energy to travel safely to ground. Improperly grounded connections are also a source of noise that can cause sensitive equipment to malfunction.

A good grounding system disperses most of the surge energy from a lightning strike away from the building and equipment. The remaining energy on the Ethernet cable shield and conductors can be directed safely to ground by installing a lightning arrestor in series with the cable.

If you have determined that it is appropriate to install lightning protection for your system, the following general industry practices are provided as a guideline only:

1. The AC wall outlet ground for the indoor POE adapter should be connected to the building grounding system.

2. Install a lightning arrestor in series with the Ethernet cable at the point of entry to the building. The grounding wire should be connected to the same termination point used for the tower or mast.

3. Install a lightning arrestor in series with the Ethernet cable as close to the outdoors unit as practical. The grounding wire should be connected to the same termination point used for the tower or mast.

4. Provide direct grounding from the unit, the mounting bracket, the antenna, and the Ethernet cable surge protection to the same ground bus on the building. Use the grounding screws provided for terminating the ground wires.

1.5 FCC and IC Notices (USA & Canada)

1. The Model RDL-2000 and its antenna must be professionally installed.

2. FCC regulations governing deployment of 5.8 GHz band PTP systems in the USA require that device transmit power is a maximum peak conducted power of +30 dBm.

3. ⚠WARNING -- FCC & IC RF Exposure Warnings

   To satisfy FCC and IC RF exposure requirements for RF transmitting devices, the following distances should be maintained between the antenna of this device and persons during device operation:

Table 1: Notices: FCC & IC RF Recommended Safe Separation Distances		
Frequency (GHz)	**Mode**	**Separation Distance**
5.8 Band	PTP	354 cm (140 in) or more

   To ensure compliance, operation at closer than these distances is not recommended. The antenna used for this transmitter must not be collocated in conjunction with any other antenna or transmitter.

4. High power radars are allocated as primary users (meaning they have priority) of 5.650 - 5.850 GHz and these radars could cause interference and/or damage to LE-LAN devices.

5. FCC Information to Users @ FCC 15.105:

   NOTE: 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 the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

   - Reorient or relocate the receiving antenna.

   - Increase the separation between the equipment and receiver.

   - Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

   - Consult the dealer or an experienced radio/TV technician for help.

   Where DFS is required by regional regulations, this function is permanently enabled at the factory and can not be disabled by the installer or end-user.

6. FCC Information to Users @ FCC 15.21:

   Warning: Changes or modifications not expressly approved by Redline Communications could void the user's authority to operate the equipment.

1.6 UL Information

1. The suitability of the supplied Ethernet cable is subject to the approval of Authority Having Jurisdiction and must comply with the local electrical code.

2. The equipment must be properly grounded according with NEC and other local safety code and building code requirements

3. To meet the over-voltage safety requirements on the telecommunications cables, a minimum 26 AWG telecommunication line cord must be used.

4. "Pour être en conformance avec les exigences finies de sûreté de sur-tension sur les câbles de télécommunications un fil de télécommunication ayant un calibre minimum de 26 AWG doit être utilisé."

5. Reminder to all the BWA system installers: Attention to Section 820-40 of the NEC which provides guidelines for proper grounding and, in particular, specifies that the cable ground shall be connected to the grounding system of the building, as close to the point of cable entry as is practical.

6. RDL-2000 must be installed in compliance with relevant articles in National Electrical Code-NEC (and equivalent Canadian Code-CEC) including referenced articles 725, 800 and 810 in NEC.

7. RF coaxial cable connecting an antenna to the RDL-2000 must comply with the local electrical code.

1.7 Product Information

Use the following table to record important system information:

Product Information
RDL-2000 SN: _____ MAC Address_____
PoE SN: _____ Model #: _____
Antenna Model No.: _____ Antenna SN: _____
Serial Number Stickers

2　System Overview

The RDL-2000 is a high-performance, high-speed wireless Ethernet bridge for use in a commercial, industrial, business, or government environment. The system includes a 5.4 - 5.8 GHz radio using a time division duplexing (TDD) RF transceiver to transmit and receive on the same channel.
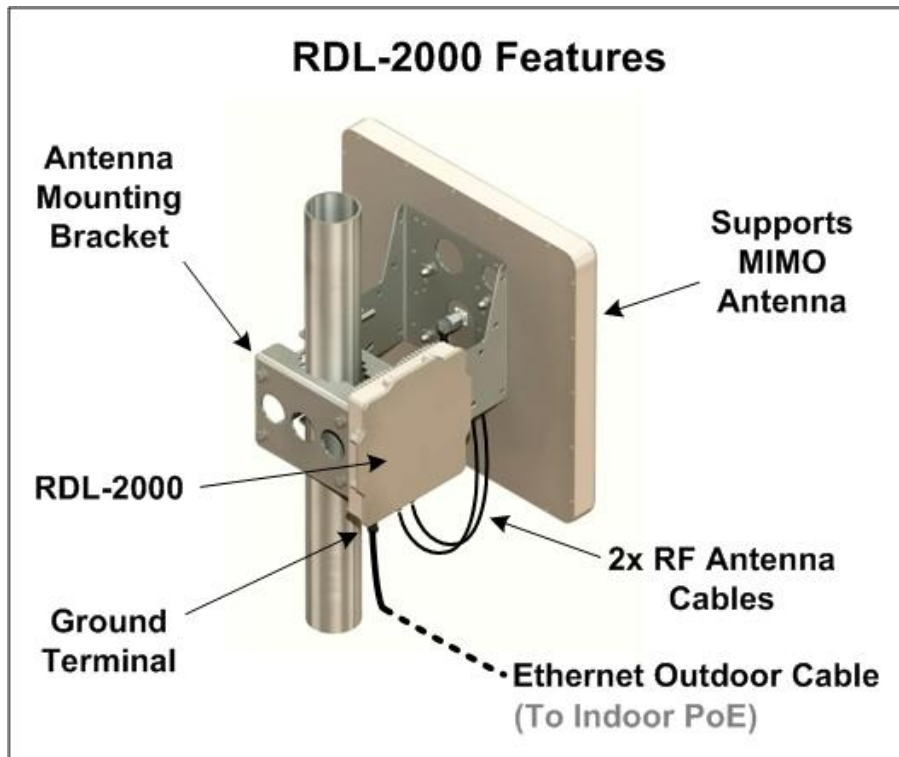
Figure 1: **System - RDL-2000 System Components**

The all-outdoor radio is housed in a weatherproof aluminum alloy case and can be used with external flat panel or parabolic antennas. When equipped with a narrow beam antenna the RDL-2000 supports long-range operations in clear line of sight (LOS) conditions. An indoor PoE power adapter provides operational power for the RDL-2000 and connectivity to the local Ethernet network using a standard outdoor approved Ethernet cable.

For each PTP link, one RDL-2000 is configured as Master Unit (MU) and controls the wireless link. This function is transparent to all Ethernet operations. The Master uses a scheduled request/grant mechanism to arbitrate bandwidth requests from the remote Slave Unit (SU) to provide non contention based traffic with predictable transmission characteristics. A unique identifier (MU ID) can be specified to ensure wireless links are established only between designated pairs of RDL-2000 units. Encryption can be enabled for secure data transmission over the air.

2.1 Ethernet Ports

The RDL-2000 has two Ethernet ports (female RJ-45 connectors) to receive DC power from the PoE and exchange data with the local Ethernet network. Connection for the Ethernet port to the PoE Adapter is made using an outdoor CAT-5e Ethernet cable. The maximum total length of the Ethernet cable is 91.5 m (300 ft). For example, 90 m (295 ft) from the RDL-2000 to the PoE and 1.5 m (5 ft) from the PoE to the network equipment.
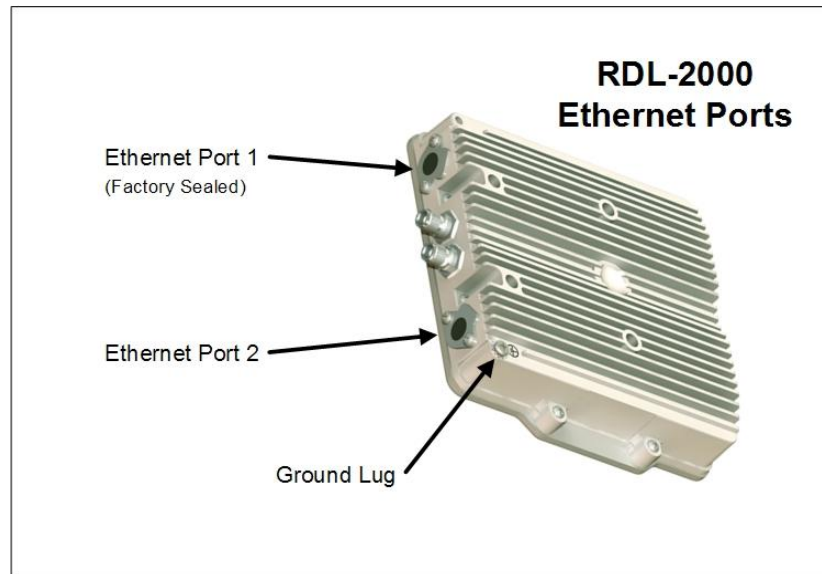
Figure 2: System - RDL-2000 Ethernet Ports

The RDL-2000 Ethernet port uses a custom pinout for the PoE signals. All Ethernet cables from the indoor PoE to the outdoor RDL-2000 <u>must</u> be terminated to match the specifications in the following table.

RJ-45 Conn.	Signal	Color Code [1]	Wire Identification
1	Rx +		White / Orange
2	Rx -		Orange
3	Tx +		White / Green
4	No Connection [2]		
5	No Connection [2]		
6	Tx -		Green
7	+Ve		Blue
8	-Ve		Brown

Table 2: System - Ethernet Port Wiring

1. Color codes are provided for convenience only -- signals <u>must</u> match the RJ-45 connector assignments.

2. Do <u>not</u> terminate wires to these pins on the RJ-45 connector terminating at the RDL-2000 outdoor unit.

Notes:

1. Ethernet port 1 is factory sealed. Do not removed the factory seal unless both Ethernet ports are required for this deployment (see following notes).

2. The two Ethernet ports connect to a single internal switch and connection of both ports to external network equipment must be configured to avoid layer 2 loops.

3. The dual Ethernet ports can also be used to implement a full-redundancy (data + power) solution. Use a standard Ethernet crossover cable to interconnect two RDL-

2000 units. Power from a PoE connected to either unit is conducted over the interconnecting cable.

4. Refer also to the **Enable Security (VLAN)** field in section 3.5: Advanced Screen on page 24.

2.2 Indoor PoE Power Adapter

The RDL-2000 is powered using a PoE power adaptor. The Redline supplied PoE power adaptor source is auto-sensing 110-240 VAC (nominal). The RDL-2000 is shipped with a power cord compatible with the North American power system.

Important -- PoE Equipment
The Ethernet outdoor cable is supplying a protective ground connection for the Ethernet cable. Customer supplied PoE devices must have metal-lined RJ-45 sockets providing a protective ground connection to the cable shield.

Use a straight-through cable when connecting to a PC or router, or a cross-over cable to connect the PoE "Data" port directly to a switch.

Note: The RDL-2000 Ethernet port uses a custom pinout for the PoE signals. All Ethernet cables from the indoor PoE to the outdoor RDL-2000 must be terminated to match Table 2: System - Ethernet Port Wiring on page 11.
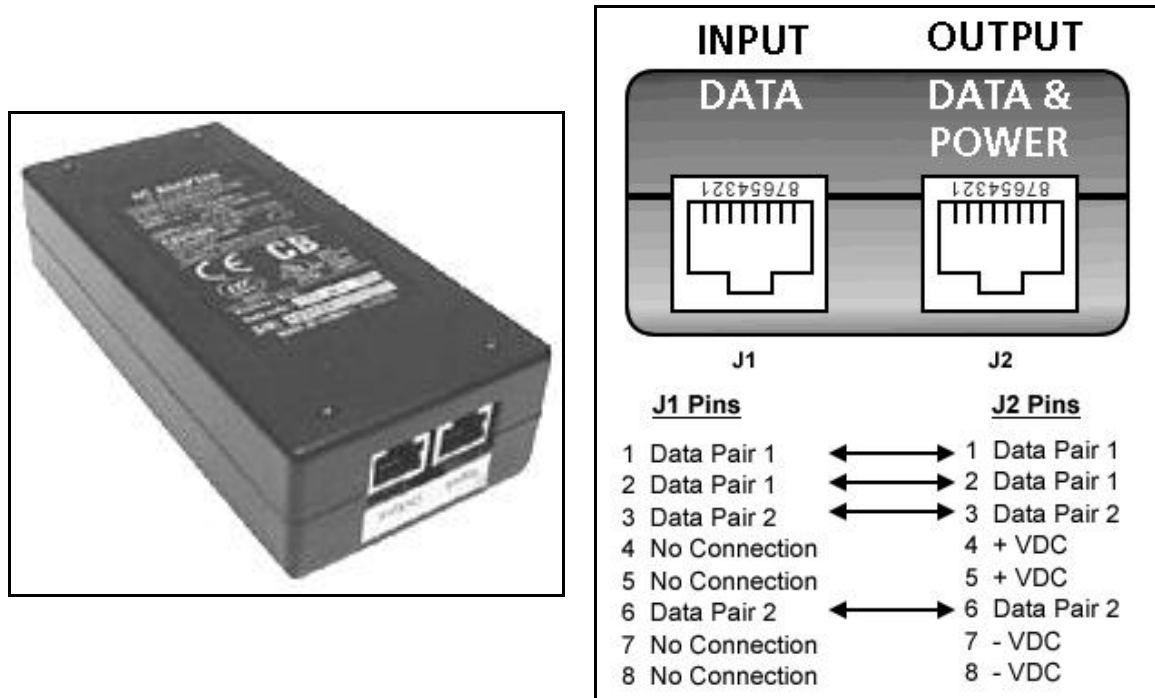
Figure 3: **System - PoE Power Adaptor**

Table 3: System - PoE Ports	
Port	**Description**
INPUT DATA	10/100Base-T Ethernet port (RJ-45 socket) for connection to the local network equipment.
OUTPUT DATA & POWER	10/100Base-T Ethernet port (RJ-45 socket) and 48 VDC power for connection to the RDL-2000.

> ⚠️ **DANGER** _Warning to Service Personnel_: _48 VDC_
>
> Customer equipment including personal computers, routers, etc., must be connected only to the INPUT (DATA) port on the PoE unit.
>
> Only the outdoors Ethernet interface cable connecting to the RDL-2000 can be safely connected to the OUTPUT (DATA & POWER) connector. Connecting customer premises Ethernet equipment directly to the OUTPUT (DATA & POWER) connector on the PoE power adapter may damage customer equipment.

2.3   Ground Connection

A ground-lug is provided on the RDL-2000 chassis for connection to the local grounding system.

2.4   Mounting Brackets

The heavy-duty (four-point) mounting bracket can be used to mount the RDL-2000 and a flat panel antenna. The RDL-2000 can also be mounted using just the mounting adapter plate and the supplied hose clamps when used with parabolic antennas or other antenna not compatible with the heavy duty mounting bracket. Refer to the RDL-2000 Installation Guidelines manual for a detailed description of mounting options.

2.5   RF Ports

The RF ports (2x female TNC connectors) conduct RF signals between the RDL-2000 and external antenna system. RF Port 0 is always enabled and should be used if operating in SISO mode (single antenna). RF Port 1 is enabled by checking the MIMO selection during system configuration. A pair of N-to-TNC coaxial jumper cables are provided to connect the RDL-2000 antenna system.
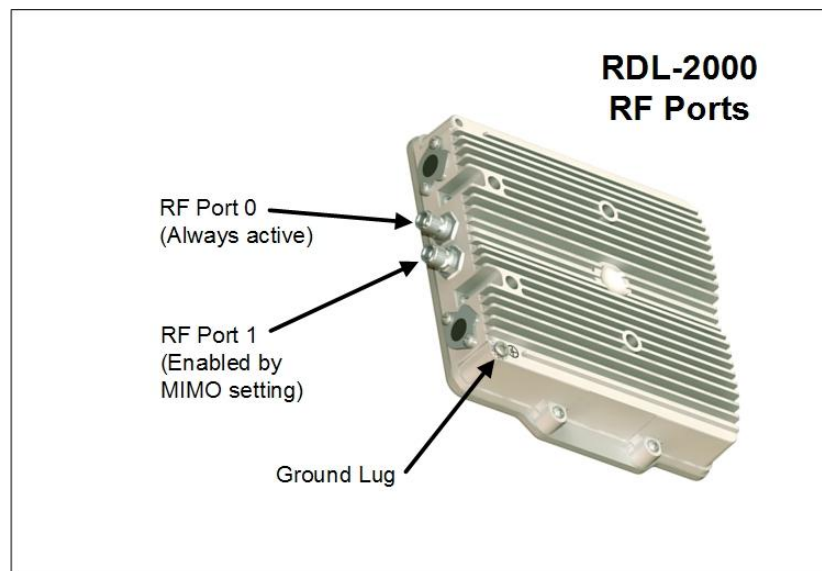
Figure 4: System - RDL-2000 RF Ports

2.5.1　RF Cable Connections

Two RF jumper cables are provided with each RDL-3000 unit. The RF cables conduct RF signals between the RDL-2000 and antenna system. Each 75 cm (29.5 in) cable is terminated female N to BNC.

Figure 5: System - RF Jumper Cable

2.6　Antenna Alignment

The RDL-2000 features a built-in audible alignment tool to assist with pointing the antenna. The Link Manager application or Telnet interface can provide assist in fine alignment based on displaying real-time RSSI readings.

3 Link Manager

This section describes the system configuration and monitoring options available when using the Redline Link Manager application. This application provides all settings necessary to configure, monitor, and troubleshoot operation of the RDL-2000 wireless link. The operator can access and control the RDL-2000 locally or remotely using IP connectivity over the network connection.

Note: The CLI interface is a general monitoring tool and does <u>not</u> include all commands necessary to setup and monitor the RDL-2000.

3.1 Link Manager Overview

The Redline Link Manager application is included on the CD-ROM shipped with each RDL-2000 system. The Link Manager can be run on most Windows-based PCs, providing the portability to perform setup, monitoring, and diagnostics in the field.

The Redline Link Manager provides a comprehensive user-friendly interface to configure and monitor the RDL-2000 Master and Slave units. This application can configure all required parameters and provide monitoring and statistics for antenna alignment and troubleshooting. Configuration of the Master and Slave units is similar, and requires that most parameter settings match on both units.

The Link Manager application can be used to monitor both ends of the wireless link by being connected to either the Master or Slave unit. An operator at the Master can adjust settings for both units, but system security prevents an operator connected at the Slave location (logged in over-the-air) from changing the configuration on the Master.

3.1.1 Installing the Link Manager Application

The Link Manager application must be installed using the installer provided on CD-ROM.

1. Insert the CD-ROM into the PC, browse to the CD and double-click on the program:

    Link_Manager_V1_000x.exe

2. Follow the on-screen instructions to install the Link Manager and the WinPcap application.

Note: Windows™ 7 users must download and install WinPcap v4.1.1.

3.1.2 Connecting Locally

The operator may access and control the RDL-2000 by connecting an Ethernet cable directly to the PoE, or through a switch on the network segment connected to the RDL-2000.

1. Use a standard Ethernet cable to connect the PC directly to the PoE Data In port. It is not required to know the IP address of the RDL-2000.

2. Click **S** on the command bar to start a session. Select the RDL-2000, select user type **Admin,** enter the (default) password *admin*, and click **Login** to begin a session.

    The Link Manager should login to the RDL-2000. It the login is not successful, refer to the Link Manager event log for status messages.

3. Click **E** on the command bar to end the session.

3.1.3 Connecting Through a Gateway

The operator may also connect to a remote network with a routable connection (gateway) to the RDL-2000.

1. Click on the menu item **Action->Select Adapter**. Click to highlight the desired adapter card, enter the **Default Gateway** IP address, and click **OK**.

2. If the Login Bar is not displayed, click on the menu item **View->Login Bar**.

3. Enter the **Unit IP** address (default is *192.168.25.2*), select the user to be **Admin**, enter the **Password** (default is *admin*), and check the box ☑.**Use Gateway**.

4. Click **Login** to begin a session. The Link Manager should connect to the RDL-2000. It the connection is not successful, refer to the Link Manager event log.

5. Click **E** on the command bar to end the session.

3.2 Menu Commands

This section provides an overview of features and parameter settings.

3.2.1 File Menu

Save Configuration: Save a configuration summary of the connected RDL-2000 unit. The data is saved in HTML format (filename.htm). Refer to the following example.

> **IP: 192.168.30.227 / 255.255.255.0**
> **MAC: 00-09-02-02-5F-E9**
> **Status**: Online - Link Up
> **Unit Configuration:**
> - ATPC: True
> - MU ID: 00-09-02-02-60-00
> - Tx Power: 30
> - Buzzer: False
> - DFS: False
> - Band: 5.350 - 5.470 GHz
>
> **Link Configuration:**
> - Pre-Shared Key: SharedKey
> - AES: False
> - MIMO: True
> - Channel BW: 20 MHz
> - Vlan: 0
> -

Figure 6: **Link Mgr - Save Configuration Example**

Exit: Close the Link Manager application.

3.2.2 View Menu

Toolbar: Display (✔) or hide the main toolbar.

Status Bar: Display (✔) or hide the status toolbar (bottom of screen). The status bar displays tooltips and the status or result of Link Manager actions.

Login Bar: Display (✔) or hide the login toolbar. Refer to 3.2.6: Login Bar on page 18.

Unit Status Bar: Display (✔) or hide the unit status bar. Refer to 3.2.8: Unit Status Bar on page 20.

3.2.3 Action Menu

Start Session: Start a session with an RDL-2000 (CTRL-S). Choose an RDL-2000 unit discovered by the Link Manager, enter the required credentials, and click **Login** to begin a session.

The Start Session function scans the entire subnet on the local network to identify RDL-2000 units. It is <u>not</u> required to specify the IP address.
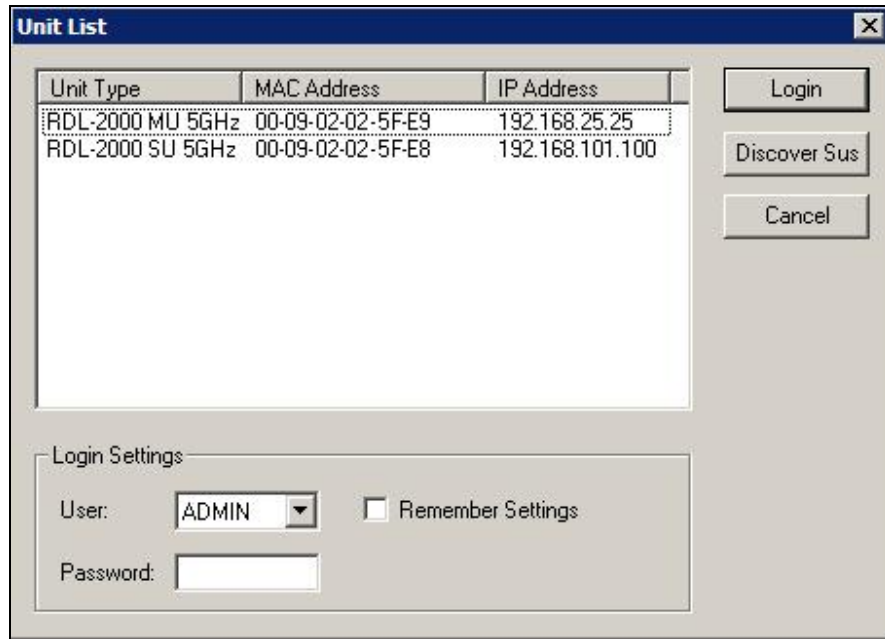
Figure 7: **Link Mgr - Select Ethernet Adapter and Default Gateway**

<u>Unit List</u>

Unit Type: Identifies unit, Master/Slave configuration, and region setting.

MAC Address: MAC address of detected unit.

IP Address: IP address of detected unit.

<u>Controls</u>

Login: Login to the selected RDL-2000 using the current login settings (below).

Discover Sus: Query a Master to discover the remote Slave.

Cancel: Close this dialog.

<u>Login Settings</u>

User: Select the user account type.

    Admin: Authority to change configuration.

    User: Allowed only to view configuration and monitor operation.

Password: Enter password for the selected user type.

Remember Settings: Check this box ☑ to always use these login parameters.

End Session: Terminate the current RDL-2000 session (CTRL-E).

Refresh Unit Parameters: Retrieve settings from the connected RDL-2000 (CTLR-U).

Get Reset Text: Retrieve the recorded cause of the last reset for the connected RDL-2000 and display this text in the log window (CTRL-T). Refer to Table 6: Maintenance - Causes of System   on page 40. This includes the total uptime (seconds) from the previous reboot.

Reset Unit: Reboot the connected RDL-2000 (CTRL-R).

Clear Log: Clear the Link Manager log window (CTRL-L). This operation does not affect messages logged to a file.

Clear Reset Text: Clear the recorded cause of the last reset on the connected RDL-2000. Refer to Table 6: Maintenance - Causes of System on page 40.

3.2.4 Tools Menu

Select Adapter: Choose a network interface card (NIC) on the computer running the Link Manager application. The selected interface is used to scan the local network for connected RDL-2000 units. The operator may also specify a network gateway (see the **View** menu item **Login Bar**.
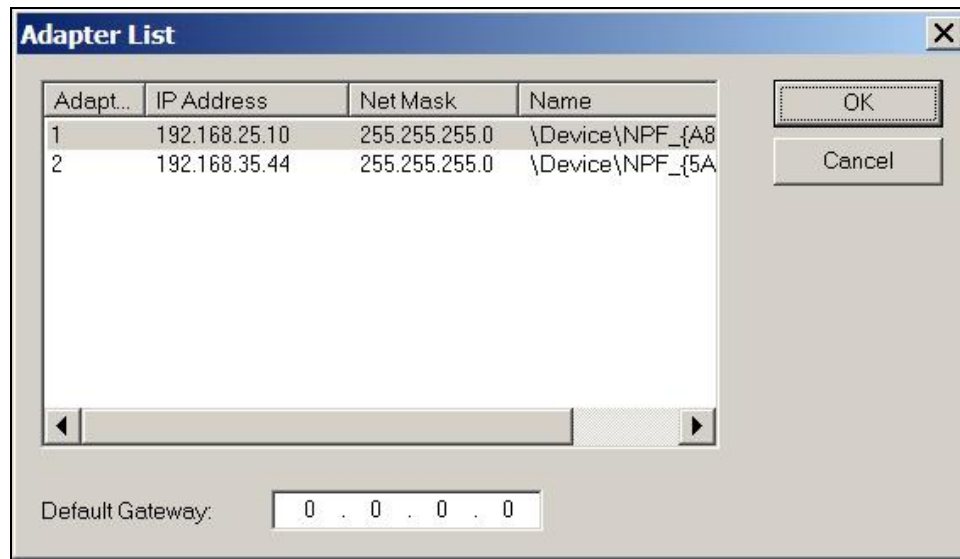
Figure 8: **Link Mgr - Select Ethernet Adapter and Default Gateway**

<u>Adapter List</u>

Adapter: Unique number for this adapter.

IP Address: IP address of detected unit.

Network Mask: Network IP address mask.

Name: Logical name of detected adapter.

3.2.5 Help Menu

About Link Manager: Display the Link Manager software version.

3.2.6 Login Bar

Use this toolbar to login to a specific unit or when a gateway must be specified.
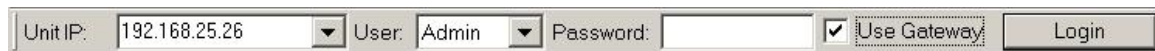
Figure 9: **Link Mgr - Login Toolbar**

Unit IP: Enter the IP address of the RDL-2000.

User: Select the user account type.

    Admin: Authority to change configuration.

    User: Allowed only to view configuration and monitor the link status.

Password: Enter password for the selected user type.

Use Gateway: Check this box ☑ to use the gateway. Valid only if a gateway IP address has been specified using the menu item: **Tools** -> **Select Adapter**.

Login: Click this button to start a session with the RDL-2000.

3.2.7 Toolbar

Use this toolbar to access shortcuts to many common Link Manager functions.

Figure 10: **Link Mgr - Main Toolbar**

S: Start a new session. Clicking this button initiates a discovery scan to locate all RDL-2000 units located on the selected network interface, Refer to menu item: **Tools** -> **Select Adapter**).

E: Terminate the current session.

: Retrieve current settings from the RDL-2000.

: Reconnect automatically to the RDL-2000 if the session is lost for any reason (e.g., RDL-2000 reboots). Clicking this button toggles between enabled and disabled state.

Notes:

1. It is recommended to disable this feature when changing the unit IP address, or the master/slave mode.

2. While active, no other users are able to login to this RDL-2000.

3. There is no timeout for this function.

4. This selection is not altered by manually cycling the connection status.

EL: Enable logging of RDL-2000 event message.

Master Log Messages

Sec: Time (seconds) from last Master reboot.

C: PHY CRC errors (1 second sample time).

SN0/SN1: SNR values for RF port 0 and RF port 1 (located closest to grounding terminal).

a: Current IIS value.

Peer: RSSI and PHY CRC errors (C) of the SU (5 second sample time).

s: Adaptive modulation sample number (UL/DL).

p: Total number of UL/DL CRC errors (C) during sample period (PER).

r: Current modulation: 0=BPSK, 1=QPSK 1/2, 2=QPSK 3/4, 3=16QAM 1/2, 4=16QAM 3/4 , 5=64QAM 2/3 , 6=64QAM 3/4, 7=64QAM 5/6

Slave Log Messages

Channel changed to CH#: Slave has changed the RF channel.

Channel # online MUID #: Slave has located a Master with the same link ID and is changing mode to online.

Sec: Time (seconds) from last Slave reboot.

C: PHY CRC errors (1 sec sample).

SN0/SN1: SNR values for RF port 0 and RF port 1 (located closest to grounding terminal).

        a: Current IIS value.

        Peer: RSSI and PHY CRC errors (C) of the Master (5 sec sample).

DL: Disable logging of RDL-2000 event messages.

X: Delete all on-screen log items for this session. This action does not affect the log file (if active).

⬛↓: Save log events to file. Clicking this button toggles between enabled and disabled state. All new event messages are saved to a file.

> **Important**: The previous log file is overwritten. Use View Log 🔲 to (view and) save the current log file using a different filename.

🔲: View the current log. The ⬛↓ (save log events to file) selection must be disabled to view the log file.

> **Important**: The existing log file is overwritten when the ⬛↓ (save all event to file) function is enabled. If required, save the viewed log file using a different filename.

RT: Send a reboot command to the connected RDL-2000.

RU: Clear the log window. This operation does <u>not</u> affect the log file.

?:   Display version information.

3.2.8 Unit Status Bar

Display or hide the unit status bar.

| Op Mode | Online - Link Up | Channel: | CH22 5.835 GHz | RSSI: | ▮▮▮▮ | -49dbm | PER: | 0% |

Figure 11: **Link Mgr - Status Toolbar**

Op Mode: Indicates the current status of the wireless data link.

    <u>Master</u>:

    Not Available: The Link Manager is <u>not</u> communicating with the RDL-2000.

    Online: The wireless link has <u>not</u> been established with the Slave unit.

    Online link-up: The wireless link has been established.

    Spectrum Sweep: The sweep function is active (wireless link is offline).

    <u>Slave</u>:

    Not Available: The Link Manager is <u>not</u> communicating with the RDL-2000.

    Online: The wireless link has not been established with the Master unit.

    Online link-up: The wireless link has been established.

    Scanning: The Slave is scanning frequencies in the RF channel list to locate a Master with the matching MU ID.

    Spectrum Sweep: The sweep function is active (wireless link is offline)

Channel: Indicates the RF channel in-use.

RSSI: Received signal strength for this link.

PER: Wireless packet errors for this link (after ARQ).

Note: When the connection to an RDL-2000 is closed, the Link Manager continues to display the last received RSSI and PER values.

3.3   System Menu

The screens are accessible using the menu located on the left side of the screen.
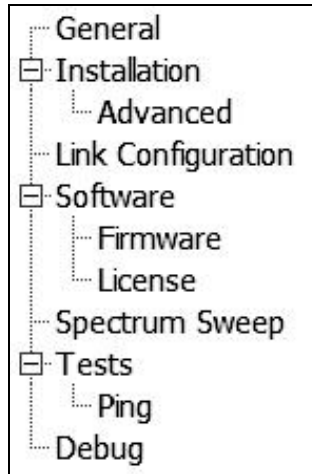
Figure 12: **Link Mgr - Screen Menu**

3.4   Installation Screen - Basic

Use this screen to enter addressing information and monitor the wireless link. Different information is displayed for the Master and Slave.

Figure 13: **Link Mgr - Basic Installation Screen - Master**

Figure 14: **Link Mgr - Basic Installation Screen - Slave**

MAC Address: Hardware (MAC) address of the connected RDL-2000. This address is also recorded on the RDL-2000 chassis label.

IP Address: IP address for this RDL-2000. The IP address is routable through the Ethernet port and over the wireless interface.

Note: The default gateway setting can not be viewed or modified by the operator. The default gateway IP and MAC address is learned automatically during network discovery following a system rebooted.

Subnet Mask: IP subnet mask.

MU ID: (Slave only) Enter the identification number for this wireless link. The ID structure is the same format as a MAC address.

A wireless link can be established only between pairs of RDL-2000 systems having identical ID settings. This feature ensures that following power-up, reboot, and DFS events, a wireless link is established only between designated pairs of RDL-2000 units.

For the Master setting, refer to the **MU ID** setting in section 3.5: Advanced Screen on page 24.

Important: If an RDL-2000 is replaced for any reason, the replacement unit must be programmed with the same link identification number.

Operational Mode: Indicates the current status of the RDL-2000.

> **Master**:

> **Not Available**: The Link Manager is not communicating with the RDL-2000.

> **Online**: The wireless link has not been established with the Slave unit.

> **Online link-up**: The wireless link is operational.

> **Spectrum Sweep**: The sweep function is active (wireless link is offline).

> **Slave**:

> **Not Available**: The Link Manager is not communicating with the RDL-2000.

> **Online**: The wireless link has not been established with the Master unit.

> **Online link-up**: The wireless link is operational.

> **Scanning**: The Slave is scanning frequencies in the RF channel list to locate a Master with the matching MU ID.

> **Spectrum Sweep**: The sweep function is active (wireless link is offline)

Channel: Indicates the RF channel (frequency) in use.

RF Channel Scan: (Slave only) Lists all available RF channels to be monitored by the Slave. Click to enable/disable channels for auto scan and DFS operations.

RSSI: Received signal strength indication. This chart is updated in real time and can be used for fine alignment of the system antennas.

Note: When the connection to an RDL-2000 is closed, the Link Manager continues to display the last measured RSSI value.

PER: This chart displays the measured PER (Packet Error Rate), calculated after ARQ. This chart is updated in real time and can be used for fine alignment of the system antennas. PER on a stable link should indicate 0%.

Note: When the connection to an RDL-2000 is closed, the Link Manager continues to display the last calculated PER value.

Submit: Click this button to send the current parameter settings on this screen to the RDL-2000. The RDL-2000 will save these settings in non volatile RAM. All unsaved changes are discarded when the operator changes to another screen.

3.5   Advanced Screen

Use this screen to configure the Ethernet and RF settings. Different information displayed for the Master and Slave.

Figure 15: **Link Mgr - Advanced Installation Screen - Master**

Figure 16: **Link Mgr - Advanced Installation Screen - Slave**

General Configuration

Admin Login Password: Use this field to change the Admin password on the connected RDL-2000. You must be logged in as Admin to change the password.

User Login Password: Use this field to change the User password on the connected RDL-2000. You must be logged in as Admin to change the password.

Enable Buzzer: Check this box ☑ to enable the audible antenna alignment tool. The rate of the single tone pulses indicate the received signal strength (RSSI):

    Fast - Highest signal strength (RSSI) detected since enabling the buzzer.

    Medium - Signal strength is lower than the highest measured RSSI.

    Slow - Signal strength is <u>much</u> lower than the highest measured RSSI.

    No sound - Signal strength is below the minimum threshold for alignment.

Adaptive Modulation: (Master only) When enabled, the modulation/coding is set automatically to achieve the highest UBR possible under the current operating conditions on the Master and the Slave. The modulation is decreased quickly when fading or interference is detected, and increased incrementally after the condition clears. The Tx power on the Master and the Slave is adjusted automatically based on the current modulation setting (overrides ATPC settings).

DFS: Check this box ☑ to enable the DFS feature. When the license file (refer to section 3.9: License Screen on page 34) designates ETSI or FCC regulations, DFS is permanently enabled for the required bands.

    Master: When DFS is enabled. On power up, the Master monitors the selected channel for one minute. If radar signals are detected, the Master switches to the next channel and resumes monitoring. If no radar signals are detected on a channel for the duration of the monitoring period, the unit reboots and begins transmitting using that channel. If radar signals are detected while online, or a 'DFS Alarm' message is received from the Slave, the Master immediately stops transmitting and returns to the monitoring cycle.

    Slave: When DFS is enabled and radar signals are detected, the Slave will transmit a 'DFS Alarm' message to the Master and then begin monitoring to detect the new RF channel.

<u>**Ethernet Configuration**</u>

See Figure 4: System - RDL-2000 RF Ports on page 13 for port identification.

Port 1 Configuration: Select the operating mode of port 1.

Note: This port is sealed at the factory. Do not remove this seal -- use Ethernet port 2 for normal operation.

Port 2 Configuration: Use this Ethernet port for connecting to the PoE power adapter. Specify the port speed and duplex:

    Auto Negotiation - Automatically negotiate the connection speed and duplex.

    10M Half Duplex - Operate at 10Base-T, half-duplex only.

    10M Full Duplex - Operate at 10Base-T, full duplex only.

    100M Half Duplex -.Operate at 100Base-T, half-duplex only.

    100M Full Duplex - Operate at 100Base-T, full duplex only.

Important: The auto-negotiate feature does <u>not</u> detect the speed and duplex of manually set Ethernet equipment. The auto-negotiate function works correctly only when <u>both</u> communicating Ethernet devices are configured for auto-negotiate. Duplex mismatches may result in an unexpected loss of communications. It is recommended to manually configure Ethernet devices to operate at full duplex 100Base-T.

Enable Security (VLAN): Check this box ☑ to enable VLAN tagged management for this RDL-2000 unit.

Disabled (☐): RDL-2000 unit does not recognize VLAN tagged management traffic.

Enabled (☑): RDL-2000 unit can be managed using VLAN traffic tagged with the VID specified in the **Mgmt. VID** field (see Installation->Link Configuration screen). Ethernet traffic is blocked between Ethernet Port 1 and 2.

Note: Enabling VLAN management does not disable management using non tagged traffic (e.g., operator can use all Link Manager and CLI features over no VLAN connections).

<u>Power Control (ATPC)</u>

Activate ATPC: (Master Only) Check this box ☑ to enable the Master to achieve optimum performance by automatically adjusting the transmit power levels for the wireless link. Identical settings must be used on the Master and Slave.

Notes:

1. When ATPC is enabled, best results are obtained by also enabling Adaptive Modulation on the Master.

2. When Adaptive Modulation is enabled, the Tx power is adjusted automatically (overriding ATPC if enabled).

3. When DFS is enabled, the Slave transmit power may be automatically adjusted to avoid false DFS triggering (overriding ATPC if enabled).

Expected Rx Power: (Master Only) Set the desired Rx power threshold. This value is used to adjust the Tx power for both ends of the wireless link (valid only when ATPC enabled).

Current Tx Power: (Slave Only) Set the default Tx power for the Slave when performing initial ranging (valid only when ATPC enabled).

<u>TX Power Configuration</u>

Antenna Gain: Select the gain value for the antenna system.

Cable Loss: Select the cable attenuation. Select 1 dBm when using the supplied Redline antenna jumper cables.

M. Tx Power(dBm): Select the maximum transmit power level (-22 to 22 dBm). This setting is for the transmitter output only. The actual EIRP depends on the gain of the connected antenna and cable losses.

Table 4: System - Maximum TX Power Settings (dBm)								
Modulation	**BPSK**	**QPSK**		**16 QAM**		**64 QAM**		
Code Rate	1/2	1/2	3/4	1/2	3/4	2/3	3/4	5/6
Max. Tx Power	22	21	21	20	18	17	16	14

Important: Where required by local regulations, the maximum operational power per channel for a specific antenna must <u>not</u> exceed the maximum allowable EIRP levels. See the notices in this manual. The RF output power settings <u>must</u> be professionally programmed by the manufacturer or a trained professional installer.

Note: There is no operator control to disable the transmitter.

Total: Displays calculated EIRP based on the selected settings for Tx power, cable loss, and antenna gain.

<u>**Regulation**</u>

(Master only) The regional regulation for this deployment (if applicable). This feature is controlled by the license file (See 3.9: License Screen on page 34). The DFS feature is permanently enabled for the required bands when FCC or ETSI regulations are enabled by the license file.

Factory: Allowed band is 5.8 GHz (default)

None: No operating restrictions. Allowed bands are 5.4 and 5.8 GHz.

FCC: FCC region. Allowed band is 5.8 GHz.

ETSI: ETSI region. Allowed bands are 5.4 and 5.8 GHz.

Band: Select the band of operation. Identical settings must be used on the Master and Slave. Changing the RF band will automatically change the following:

Channel Scan list (Slave only)

DFS (Master and Slave)

<u>**Fixed Frame Mode**</u>

(Master only) Choose the TDD framing mode.

Mode: Use this setting to enable or disable fixed frame mode.

Enable: Use TDD fixed size frame. The UL/DL ratio is fixed at 50/50.

Disable: Use TDD dynamic size frame. The UL/DL ratio is adjusted dynamically based on current traffic requirements.

Signal Count: Factory test only.

IIS Level: Set the default level at power-on. This value is adjusted automatically during normal operation. Valid only when IIS is enabled (see 3.6: Link Configuration Screen on page 28.

Set Default: Click this button to reset the IIS value to the factory default value.

Submit: Click this button to send the current parameter settings on this screen to the RDL-2000. The RDL-2000 will save these settings in non volatile RAM. All unsaved changes are discarded when the operator changes to another screen.

3.6   Link Configuration Screen

Use this screen to configure advanced features including encryption and channel size. This screen is displayed only when a session is active to the RDL-2000. The information displayed is different for the Master and Slave.

Figure 17: **Link Mgr - Link Configuration Screen - Master**

Figure 18: **Link Mgr - Link Configuration Screen - Slave**

MU ID: (Master only) Enter the identification number for this wireless link. Identical settings must be used on the Master and Slave.

A wireless link can be established only between pairs of RDL-2000 systems having ID identical settings. This feature ensures that following power-up and reboot, or a DFS event, the wireless link will be established only between designated pairs of RDL-2000 units.

For the Slave link ID setting, refer to section 3.4: Installation Screen - Basic on page 22.

Channel: (Master only) Select the center frequency for the RF channel. This field is active only when ACS is disabled. Identical settings must be used on the Master and Slave.

SU MAC Address: (Master only) Enter the MAC address of the Slave. The Master will only establish a wireless connection with the RDL-2000 deveice having this MAC address.

Master Parameters

Pre-Shared Key: Enter the cryptographic key to be shared between the Master and Slave when AES encryption is enabled. The key must be a maximum of 16 bytes, and include only alphanumeric characters (a-z, 0-9). This field is used only when AES is enabled.

Notes:

1. The Master and Slave RDL-2000 units <u>must</u> have identical encryption settings or the system <u>will not establish a wireless link</u>.

2. The default key is the text "SharedKey".

Enable AES: Check this box ☑ to enable AES encryption.

> **Important:** The Master and Slave RDL-2000 units <u>must</u> have identical encryption settings or the system <u>will not establish a wireless link</u>.

Enable IIS: Check this box ☑ to enable IIS (Intelligent Interference Sensing). The IIS (Intelligent Interference Sensing) feature monitors the RF channel and automatically adjusts the Rx threshold to be above the detected noise level. This increases RF robustness by eliminating false receptions caused by interference.
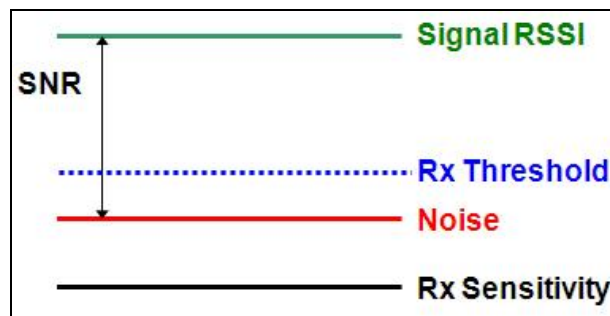
Figure 19: **Link Mgr - IIS (Intelligent Interference Sensing) Function**

Note: The IIS feature is permanently enabled in the current version of software.

Enable ACS: (Master only) Check this box ☑ to enable the ACS (Automatic Channel Selection) feature.

When ACS is enabled on power-up, the RDL-2000 performs a spectrum sweep of the selected band and chooses a channel based on the lowest measured interference. The spectrum sweep requires approximately one second. The RDL-2000 then reboots and begins transmitting using the selected channel.

Perform ACS: (Master only) Click this button to cause the RDL-2000 to immediately perform a spectrum sweep of the selected band and choose a channel based on the lowest measured interference. The spectrum sweep requires approximately one second. The RDL-2000 then reboots and begins transmitting using the selected channel.

Note: Activating the Perform ACS function disrupts all data traffic on the wireless link.

Vlan ID: Enter the VLAN ID (0-4095) for management traffic. Field is valid only when **Enable Security (VLAN)** is enabled (☑). See **Enable Security (VLAN)** in section 3.5: Advanced Screen on page 24.

Channel Parameters

DL Rate: (Master only) Select the DL modulation/coding for the wireless link, The RDL-2000 will transmit using only using the selected modulation/coding. Identical settings must be used on the Master and Slave. When Adaptive Modulation is enabled, this setting is ignored

UL Rate: (Master only) Select the UL modulation/coding for the wireless link. The RDL-2000 will receive using only the selected modulation/coding. Identical settings must be used on the Master and Slave. When Adaptive Modulation is enabled, this setting is ignored.

Channel BW: Select the RF channel bandwidth. Settings include 5, 10, 20, and 40 MHz (based on Regional setting). Identical settings must be used on the Master and Slave.

Enable MIMO: Check this box ☑ to enable the MIMO feature (and the transceiver for RF Port 2). This setting must be enabled for use of a 2 x 2 MIMO antenna system. Identical settings must be used on the Master and Slave.

<u>Current Rate</u>

Displays the current DL and UL modulation/coding.

Get Parameters: Click this button to read the current settings from the RDL-2000.

Submit Parameters: Click this button to send the current parameter settings on this screen to the RDL-2000. The RDL-2000 will save these settings in non volatile RAM. All unsaved changes are discarded when the operator changes to another screen.

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3.7   Software Screen

Use this screen to view information about the software files loaded on the RDL-2000. The RDL-2000 contains non-volatile RAM storage for two versions of system software. The active software banks (versions loaded at power-up/reboot) are highlighted in yellow. The designation 'N/A' in the bank's field indicates that no (valid) software is loaded in that bank. Both banks may contain the same version of RDL-2000 software.

Use the Firmware screen to upload new software and to change the selected active software bank.

Bank	Size[bytes]	Version	Date	Time	Checksum
Boot Loader	4956	1.0000	26/02/2008	17:55:58	0x3A428632
Firmware Bank 1	237812	3.0232	17/02/2010	09:56:52	0xEC55C52D
Firmware Bank 2	N/A	N/A	N/A	N/A	N/A
PCB Version	230				
PCA Revision	2.00				

Figure 20: **Link Mgr - Software Screen**

Bank: Identifies the memory bank where the binary file is saved.

Boot Loader: General program to validate and load the RDL-2000 system-specific software at power-up/reboot.

Firmware Bank 1: First memory bank for software file (SW1 in Firmware screen).

Firmware Bank 1: Second memory bank for software file (SW2 in Firmware screen).

Size (bytes): The size of the file.

Version: The software version of the stored file.

Date: The date the file was created.

Time: The time the file was created.

Checksum: The checksum (hex) for the file.

PCB Version: The version number of the printed circuit board.

PCA Version: The version number of the hardware assembly.

3.8   Firmware Screen

Use this screen to upload new software files to the RDL-2000 and to change the software being loaded at power-up/reboot. The RDL-2000 contains non-volatile RAM storage for two copies of the system software, allowing updated software to be uploaded without interrupting the current operation. New software may be uploaded at any time, and switchover can be performed during a maintenance window. Use the Software screen to view information about the software files loaded on the RDL-2000. The alternate bank may also be used to store a redundant copy of the current software.
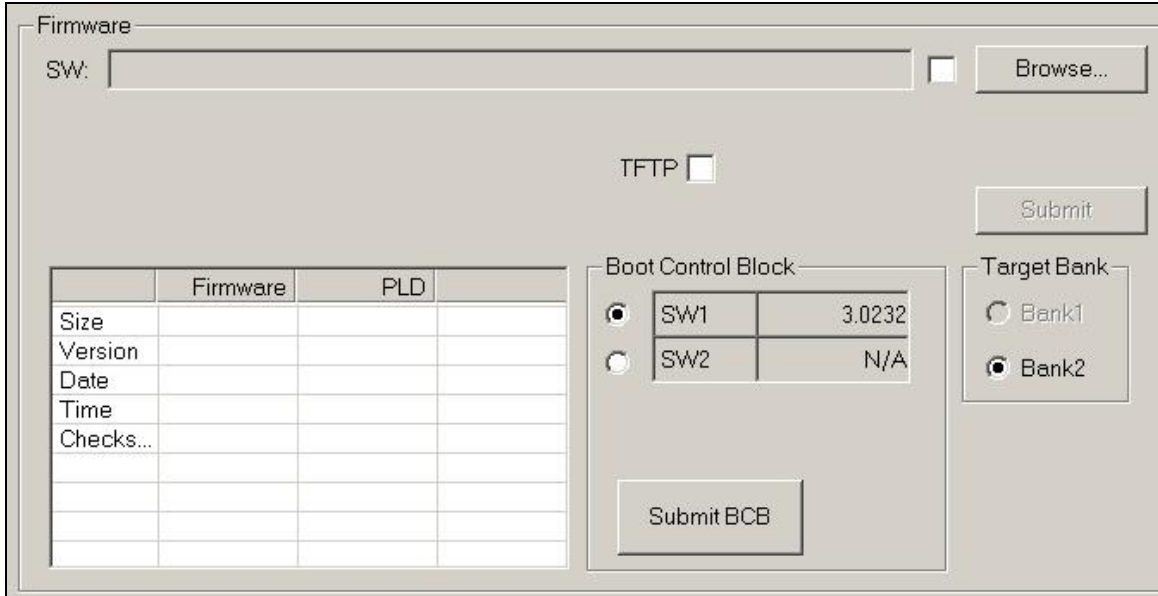
Figure 21: **Link Mgr - Firmware Screen**

<u>**Firmware**</u>:

SW: Name of the selected software file.

Browse: Click this button to use the system file browser to locate the file on a PC or network drive. The operator may also drag & drop the file (from a file browser) onto this screen.

Submit: Click this button to start the file upload. The file will be uploaded to the inactive target bank.

TFTP: Check this box ☑ to use TFTP to transfer the software file from the local PC or network drive to the RDL-2000. When unchecked (☐), the binary file is transferred using a proprietary protocol.

<u>**Target Bank**</u>:

Indicates the destination for the software file being uploaded to the RDL-2000. The uploaded file always overwrites the inactive software bank (see **Software** screen).

   Bank 1: Store uploaded software file in **Firmware Bank 1** (**SW1**).

   Bank 2: Store uploaded software file in **Firmware Bank 2** (**SW2**).

<u>**Boot Control Block**</u>

Select the software to load on the next power-up/reboot.

   SW1: Boot the RDL-2000 using the software in **Firmware Bank 1**.

   SW2: Boot the RDL-2000 using the software in **Firmware Bank 2**.

Submit BCB: Click the BCB (Boot Control Block) button to register the selection for the software bank to load on the next system power-up/reboot.

<u>**Upload Procedure**</u>

Use the following procedure to upload a software file.

1. Login to the RDL-2000 and click **Firmware** in the main menu (left side of screen).

2. Use one of the following methods to select the file:

   a) Drag & drop the file on this screen, or

   b) Click the Browse button to locate the file.

3. Check the TFTP box ☑ to transfer the file using TFTP.

4. Click **Submit** to begin the file transfer. The transfer may require a few minutes based on the data transfer rate. <u>Do not interrupt the transfer process</u>.

5. When the transfer is complete, the RDL-2000 checks the integrity of the uploaded file and registers a status message in the event log. If errors were introduced during the transfer process, the software file is discarded and the upload must be repeated.

6. When the transfer has been completed successfully, the operator is prompted to switch to the new bank. If it is not desired to change immediately, the **Boot Control Block** selection may be changed at a later time.

7. Repeat this procedure for the remote RDL-2000.

Important: RDL-2000 units communicating over a wireless link should always operate using the identical version of software.

It is recommended to upgrade the software version at the remote end unit first, and then the upgrade the local unit.

3.9   License Screen

Use the License screen to register the license for the RDL-2000. The license feature controls the band settings based on regulatory requirements (e.g., ETSI, FCC, etc). See the **Band** setting in section 3.5: Advanced Screen on page 24. Without a license file installed, the default settings are: 10 MHz channel, 5.8 GHz band, and DFS enabled.

Before entering a license file, the RDL-2000 is operating in a restricted mode and allows operation only in the 5.8 GHz band. License files are created using the MAC address of a specific RDL-2000 unit, and the license will be accepted only by an RDL-2000 having this MAC address. This operation requires a system reboot.

Important: The RDL-2000 must be rebooted at the end of this procedure. This function should be performed only during installation or a scheduled maintenance window.
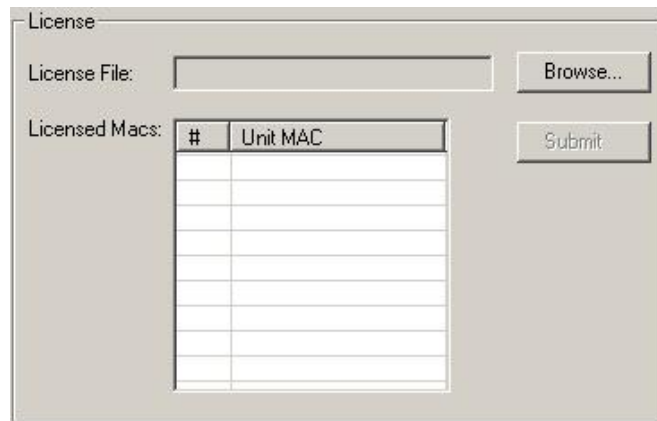
Figure 22: **Link Mgr - License Screen**

License File: Name of the selected license file.

Browse: Click this button to use the system file browser to locate the file on a PC or network drive. The operator may also drag & drop the file on this screen.

License File Upload Procedure

Use the following procedure to upload a new license file:

1. Login to the RDL-2000 and click **License** in the main menu (left side of screen).

    a) Drag & drop the file onto this screen, or

    b) Click the Browse button to locate the file.

2. Verify the MAC address displayed in the **Licensed Macs** table matches the MAC address of the connected RDL-2000. The license file is accepted only by an RDL-2000 having the matching MAC address.

3. Click **Submit** to upload and activate the license file.

4. Reboot the RDL-2000 to activate the new license file.

5. Close and then re-open the Link Manager application before re-connecting to the RDL-2000. Confirm the Regulation field (Installation->Advanced screen) indicates the correct designation (e.g., FCC)

Important: If the license is updated on a remotely located unit (e.g., over the air), the wireless connection may be lost and not be re-established (e.g. if the allowed operating bands are changed).

3.10 Spectrum Sweep

Use this feature to determine if interference is present in the selected band. When the sweep is completed, the graph displays the average RSSI (black) and maximum RSSI (red) RSSI measured for each channel (currently selected channel is displayed in blue).

Note: This feature is provided as a general diagnostic and troubleshooting tool only and is not a valid test for benchmarking performance of the wireless interface.

Important: This feature will halt all data traffic on the wireless link. The RDL-2000 must be rebooted at the end of the test period. This function should be performed only during installation or a scheduled maintenance window.


This test can only be performed using a local connection to the RDL-2000. No user data is transmitted over the wireless link while this test is running. This operation requires a system reboot.
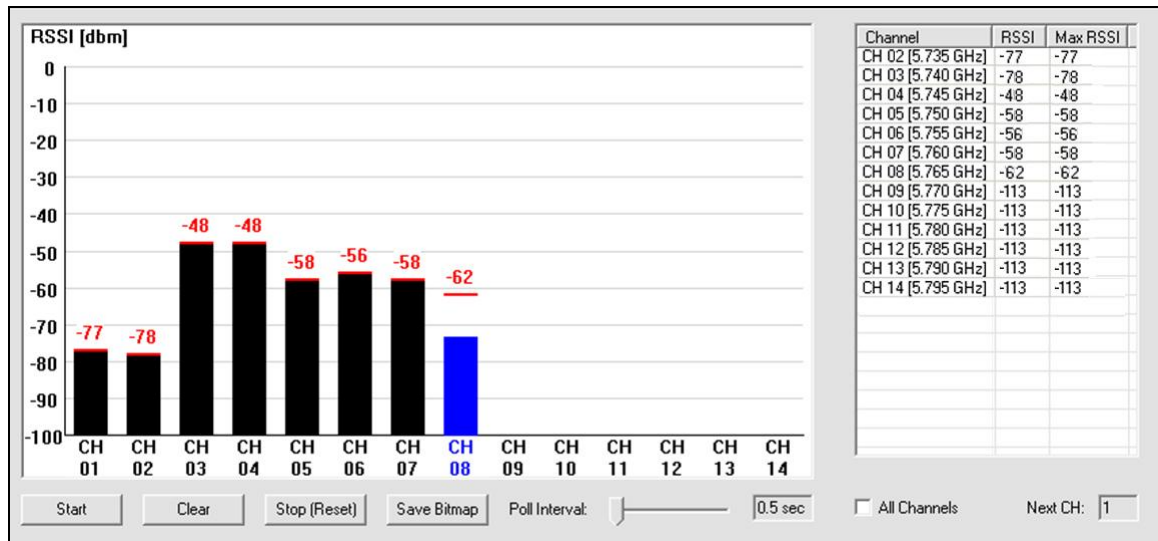
Figure 23: **Link Mgr - Spectrum Sweep Screen**

Start: Click this button to start scanning the selected band.

Clear: Click this button to clear the display and RSSI readings.

Stop: Click this button to stop scanning.

Save Bitmap: Save the graph as a bitmap (Windows™ .bmp) file.

Poll Interval: Adjust the slider to specify the time to scan each selected channel.

All Channels: When enabled, the unit will scan all channels in the list. To scan a single channel, uncheck this box and check the box ☑ adjacent to each required channel.

3.11 Tests

Use the Tests screen to conduct a unidirectional throughput test of the wireless link.

Note: This feature is provided as a general diagnostic and troubleshooting tool only and is not a valid test for benchmarking performance of the wireless interface.

Important: This feature may disrupt all data traffic on the wireless link. This function should be performed only during installation or a scheduled maintenance window.
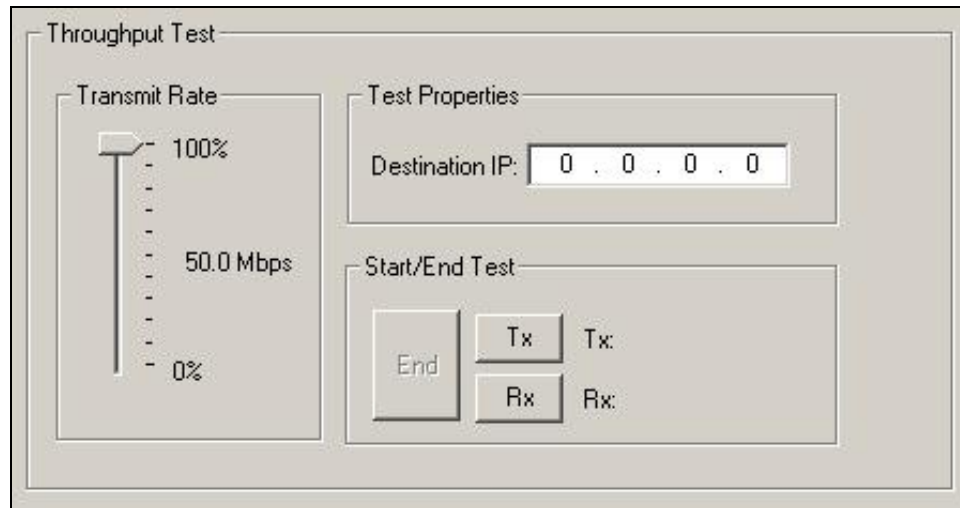
Figure 24: **Link Mgr - Tests Screen - Throughput test**

Transmit Rate: Click & hold to move the slider and adjust the transmit rate. The rate can be modified while the test is running.

IP Address: Enter the IP address of the PC connected to the remote end RDL-2000.

Tx: Click this button to start transmitting.

Rx: Click this button to start receiving.

End: Click this button to stop transmitting/receiving.

Using the Throughput Test

This test requires an available Windows-based computer to be connected to the network side of the RDL-2000 wireless link. The Link Manager application must be installed and running on both computers. During the test, one computer is transmitting and the other computer is receiving.

1. Disconnect the Link Manager sessions from the RDL-2000 units being tested.

2. On the transmitting computer, open a Link Manager and select the **Test** screen. Enter the IP address of the 'receiving' computer in the **Destination IP** field. Use the slider to specify a transmit rate, and click the **Tx** button to begin sending traffic. The slider can be adjusted while the traffic generator is running.

3. On the receiving computer Select the **Test** screen and click the **Rx** button to begin receiving test traffic. The field adjacent to the Rx button displays the Rx traffic rate.

4. Click the **End** button to stop the sending or receiving application.

Note: Traffic throughput will be affected by the user settings for DL Rate, UL Rate, Adaptive Modulation, channel bandwidth, etc.

3.12 Ping

Use this test to check connectivity to a remote IP device.

Note: This feature is provided as a general diagnostic and troubleshooting tool only and is <u>not</u> a valid test for benchmarking performance of the wireless interface.
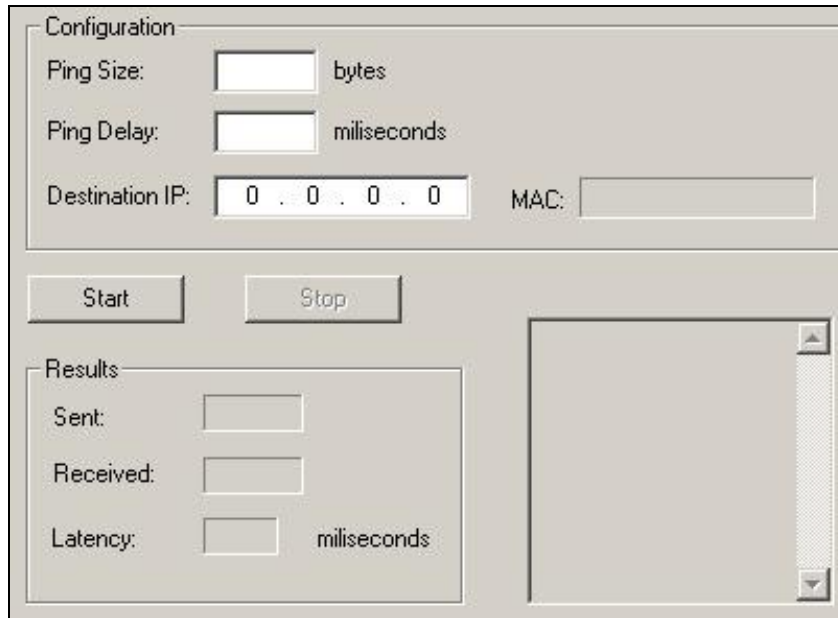
Figure 25: **Link Mgr - Tests Screen - Ping Test**

<u>Configuration</u>

Ping Size: Enter the size (bytes) of the ping message.

Ping Delay: Enter the period (milliseconds) between sending ping messages.

IP Address: Enter the IP address of the target device.

MAC Address: Enter the MAC address of the target device.

Start: Click this button to start the ping test.

Stop: Click this button to stop the ping test.

<u>Results</u>

Send: Number of ping messages transmitted during the test.

Received: Number of ping responses received during the test.

Latency: Average round trip response time during the test.

3.13 Debug

Use this screen to observe operating statistics for the wireless link.

Note: This feature is provided as a general diagnostic and troubleshooting tool only and is <u>not</u> a valid test for benchmarking performance of the wireless interface.

<div style="border:1px solid black; padding:5px;">

Important: This feature may halt all data traffic on the wireless link. This test should be performed <u>only</u> during installation or a scheduled maintenance window.

</div>
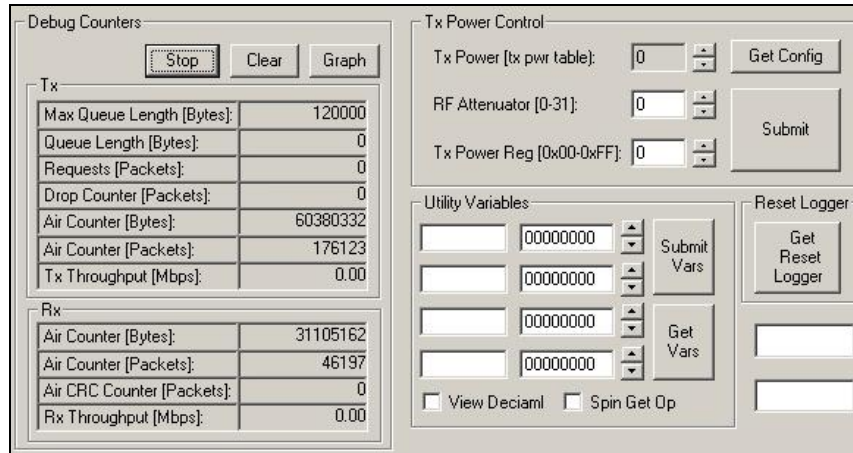
Figure 26: **Link Mgr - Debug Screen**

<u>Debug Counters</u>

Common controls for the transmitter and receiver statistics.

Start / Stop: Click this button to start and stop collecting statistics.

Clear: Click this button to reset all counters.

Graph: Click this button to display a graph of the Tx and Rx throughput.

Figure 27: **Link Mgr - Debug Screen Throughput Graph**

<u>Tx</u>

Statistics for the transmitter section of the air interface.

Max Queue Length (Bytes): Maximum amount of data that can be queued for transmission.

Queue Length (Bytes): Maximum amount of Tx data that has been saved in the Tx queue. Tx packets are dropped if this length exceeds the Max Queue Length.

Requests (Packets): Number of ARQ requests received.

Drop Counter (Packets): Number of ARQ timeouts.

Air Counter (Bytes): Total number of bytes transmitted over the wireless interface.

Air Counter (Packets): Total number of packets transmitted over the wireless interface.

Tx Throughput (Mbps): Current transmitted throughput.

<u>**Rx**</u>

Statistics for the receiver section of the air interface.

Air Counter (Bytes): Total number of bytes received.

Air Counter (Packets): Total number of packets received.

Air CRC Counter (Packets): Total number of packets received with CRC errors.

Rx Throughput (Mbps): Current received throughput.

<u>**Tx Power Control**</u>

Use these settings to manually adjust the output characteristics of the RDL-2000.

Note: These manual settings override automatic system adjustments for modulation settings and may result in over-the-air errors. Changes are not saved permanently and the saved configuration is restored on the next system reboot.

Tx Power (tx pwr table): Use this control to manually adjust the Tx power setting. Changes made using these controls are sent to the RDL-2000 by clicking the **Submit** button.

RF Attenuator (0-31): Use this setting to attenuate the signal. Changes made using the up/down controls are sent immediately to the RDL-2000. Values entered in this field are sent to the RDL-2000 by clicking the **Submit** button.

Tx Power Reg (0x00-0xff): Changes made using the up/down controls are sent immediately to the RDL-2000.

Get Config: Click this button to load the saved Tx power settings from the RDL-2000.

Submit: Click this button to send the **RF Attenuator** and **Tx Power Reg** settings to the RDL-2000. Changes made in this screen are not saved in the RDL-2000.

<u>**Utility Variables**</u>

These settings are for factory test only.

<u>**Reset Logger**</u>

This control is for factory test only.

Chapter

4

4　Troubleshooting

4.1　Reset Text Messages

The following table lists causes that may be logged in the Reset Text description. This description includes the duration of uptime (seconds) since the previous reboot.

Table 5: Maintenance - Reset Text	
DFS Detected	Master detected DFS.
DFS Detected by SU	Master received DFS detection message from Slave and switched channel.
Link type changed	Change mode between Master/Slave.
Reset text cleared by PC	Link Manager has sent command to clear the Reset Text field (Action->Clear Reset Text).
Reset text corrupted	The RDL-2000 has been power cycled.
Resetting the unit to perform ACS	User selected Perform ACS.
Scan stopped	Spectrum sweep stopped by operator.
Scanning watchdog expired	Slave will reboot automatically every three minutes while in scanning mode (searching for Master).
Signal lost	Slave has switched to scanning mode.
Telnet reset command	Reset command from Telnet.

4.2　Reset Causes

The unit will perform a (normal) reset when the following operating parameters are modified:

Table 6: Maintenance - Causes of System Reboot	
Operation	**Cause(s)**
AES mode	Operator action [1].
Channel	Operator action [1], license file [2], DFS action [3].
Channel BW	Operator action [1], license file [2].
DFS mode	Operator action [1], license file [2].
MIMO mode	Operator action [1].
MU ID	Operator action [1].
RF Band	Operator action [1], license file [2].
Fixed Frame Mode	Operator action [1]

1. Operator has changed a parameter setting.

2. Operator has loaded a new license file.

3. DFS action has changed channel.

4.3   Recovering From a Lost IP Address

If the password is known, the RDL-2000 can easily be recovered from the lockout causes listed below.

Table 7: Maintenance - Recovery from System Lockout	
Symptom	**Recovery**
IP address is unknown.	Connect Link Manager on local subnet and start session (S).
Security is enabled and VLAN ID is unknown or VLAN services are not available.	Connect Link Manager on local subnet and start session (S).
Subnet mask set incorrectly.	Connect Link Manager on local subnet and start session (S).
Password is unknown.	Contact Redline for service.

Recovery Procedure:

1. Use an Ethernet cable to connect the PC (with Link Manager installed) directly to the PoE or to the network segment (subnet) connected to the PoE.

2. Click the **S** button (or press CTRL-S) to start a session. The Link Manager will automatically discover the RDL-2000 unit. Choose the required RDL-2000 from the list to start a session.

3. Modify the IP address and submit the new settings to restore normal access to the RDL-2000 unit.

5 CLI Interface

This section describes the RDL-2000 operations available when using the Command Link Interface (CLI) over a Telnet Connection. All commands are case-sensitive. The user is not required to login for basic access.

Note: The CLI does not support all features necessary to configure and operate the RD-2000. Use the Link Manager applications to deploy and monitor the RDL-2000 units.

5.1 CLI Command Summary

The following table contains a summary of available CLI commands.

Table 8: CLI -Command Summary			
Master	**Slave**	**Command**	**Description**
√		**aes**	Activate/deactivate AES (encryption)
√	√	**atpc**	Set ATPC mode and power level
√		**autorate**	Activate/deactivate auto rates
√		**extsync**	Set/show ext/GPS sync (*not supported in this release*)
√	√	**firmware**	Upgrade firmware
√	√	**help, ?**	Show all available commands
√		**id**	Set/show id (MAC address format)
√	√	**ip**	Set/show IP
√	√	**logger**	Activate/deactivate Ethernet logger
√		**mgmtvid**	Set/show Mgmt VLAN tag
√	√	**power**	Set/show tx power
√	√	**pwd**	Set password
√	√	**quit**	Exit shell
	√	**rate**	Set/show peer downlink/uplink rates
√	√	**reset**	Reset unit and exit shell
√	√	**rssi**	Activate/deactivate RSSI collection
√	√	**rtext**	Show last reset text
	√	**set**	Set/show link peer with this MAC address
√	√	**sweep**	Perform spectrum sweep
√	√	**switchbank**	Switch firmware banks and reset
√		**update**	Program non volatile flash with parameter changes
√	√	**[user pass]**	Login to modify parameters

5.2   Starting a Telnet Session

Telnet provides the operator with basic monitoring capabilities from a remote workstation (platform independent).

1. Configure the PC Ethernet adapter (NIC) to be in the same subnet as the RDL-2000. For example, if the RDL-2000 is using the default address 192.168.25.2, set the PC to address to 192.168.25.10.

2. Use an Ethernet cable to connect the PC to the DATA IN port of the PoE power adapter.

> **Important**: Do <u>not</u> connect the PC directly to the Ethernet cable from the RDL-2000 -- this may result in damage to the Ethernet interface card in the PC.

3. Power-on the RDL-2000 by connecting AC power to the PoE power adapter.

4. On a PC, open the Run command (Start->Run) and type 'telnet' followed by the IP address of the RDL-2000.

> telnet 192.168.25.2 [Enter]

The system should respond with a prompt similar to the following example:

> *RDL-2000   MU 5GHz 00:09:02:02:5F:FF 192.168.25.2*

This prompt provides the following information:

Unit type: RDL-2000

Configuration: MU - master, SU - slave

RF Frequency: *e.g., 5 GHz*

MAC Address: *e.g., 00:09:02:02:5F:FF*

IP Address: *e.g., 192.168.25.2*

5.3   Login Procedure

The user is <u>not</u> required to login for basic CLI access to view current settings. A login is required to change any parameter setting. The CLI interface is always waiting for the operator to login. Simply type the username and password on a single line and then press Enter.

For example, login using the default username and password:

> *[192.168.25.2] >> admin admin [Enter]*
>
> admin authorized

5.4   Telnet Commands

Use the **update** command to activate and permanently save changes to the RDL-2000 settings. Saving changes to some parameters will automatically reset the RDL-2000. Refer to section 4.2: Reset Causes on page 40.

> **Important**: Parameter changes made using CLI commands are effective immediately!

Table 9: CLI - Command Summary
aes <off> <on> <SharedKey>   View or change the AES encryption mode.   **[blank]** - Display current mode/setting.   **off** - Disable AES.

Table 9: CLI - Command Summary

on - Enable AES.

SharedKey - View or enter the cryptographic key to be shared between the Master and Slave when AES encryption is enabled. The key must be a maximum of 16 bytes, and include only alphanumeric characters (a-z, 0-9). This field is used only when AES is enabled. Identical encryption settings must be used on the Master and Slave.

Example: Use the following command to enable AES on the Master.

[192.168.25.2] >>:aes on SharedKey123

   aes on SharedKey123

Important: The Master and Slave RDL-2000 units <u>must</u> have identical encryption settings or the system <u>will not establish a wireless link</u>.

---

atpc <off> <on> <power>

View or change the automatic transmit power control (ATPC) mode settings.

[blank] - Display current mode/setting.

        Master: Display current ATPC RSSI level.

        Slave: Display current Tx power level.

off - Disable ATPC.

on - Enable ATPC.

power - Enter the target Rx power threshold (dBm).

Example: Use the following command to enable ATPC on the Master and set the RSSI threshold of the link to -60 dBm.

[192.168.25.2] >>:atpc on -60

---

autorate <off> <on>

View or change the adaptive modulation settings. When adaptive modulation is disabled, the RDL-2000 will transmit using only using the selected modulation/coding (see **rate** command). When adaptive modulation is enabled, the modulation/coding is adjusted automatically based on current link conditions.

[blank] - Display current mode/setting.

off - Disable adaptive modulation.

on - Enable adaptive modulation.

Example: Enable adaptive modulation on the master:

[192.168.25.2] >>:autorate on

   MU autorate

   autorate on

---

extsync

    This function not supported in this release.

---

firmware <[blank] | file.brn>

View the firmware versions or upload a new binary file. The RDL-2000 contains non-volatile storage for two versions of the software. The upload function overwrites the non-operational version.

[blank] - Display current software versions. The text 'FFFF FFFF' indicates that no software is loaded in the alternate bank.

binary - Full name of binary file (including the .bin extension).to upload to the RDL-2000. A TFTP server must be installed and running on the computer running

Table 9: CLI - Command Summary
the Telnet session. To upgrade the firmware, the computer hosting the Telnet session must also have a TFTP server. The firmware file must be located in the TFTP servers default directory (can not specify a path). When the transfer has completed successfully, use the **switchbanks** command to enable the new software version. *Example: Upload the software binary file abc.brn to the inactive bank on the RDL-2000:* *[192.168.25.2] >>: firmware abc.brn*
id <id_value> View or modify the RDL-2000 Master identifier (MU ID). This identifier ensures the slave established a link only with the designated Master. The identifier is in MAC-address format. **[blank]** - Display current ID. **id_value** - Specify the ID for this unit. *Example: Set the RDL-2000 ID to 0050c24f7fd2:* *[192.168.25.2] >>: id 0050c24f7fd2*
ip <address> View or modify the RDL-2000 IP address. **[blank]** - Display current IP address. **address** - Specify the new IP address for this unit. *Example: Set the RDL-2000 IP address to 192.168.20.25:* *[192.168.25.2] >>: ip 192.168.20.25*
logger <off> <on> Change the logger settings. When enabled, the logger feature sends all RDL-2000 event messages directly to the screen running the CLI session. All CLI commands remain available while the logger feature is enabled. **off** - Disable the logger. **on** - Enable he logger. *Example: Enable the logger:* *[192.168.25.2] >>: logger on*
mgmtvid <VID> View or modify the RDL-2000 management VLAN ID setting. When security is enabled, the RDL-2000 can be managed only using VLAN traffic tagged with the value specified in the mgmtvid field. **[blank]** - Display current VLAN ID. **address** - Specify the new VLAN ID for this RDL-2000. *Example: Set the RDL-2000 VLAN ID to 12:* *[192.168.25.2] >>: mgmtvid 12*
power View the current RDL-2000 TX power output. When automatic controls are enabled, the displayed value may be different than the TX Power setting in the Link Manager Installation->Advanced screen. *Example: Display the current Tx power setting:* *[192.168.25.2] >>: power*

Table 9: CLI - Command Summary
Current power = 15 dBm

pwd <new_pswd> <new_pswd>

Change the password of the current user (must be logged-in)

new_pwd - Enter the new password twice (second entry is for confirmation).
Password changes are saved immediately and do not require the **update** command.

Example: Change password to Az123:

[192.168.25.2] >>: pwd Az123 Az123

---

quit

Exit from this Telnet session.

Important: If required, save parameters before exiting (see **update** command). All unsaved changes are discarded.

Example: Exit from this session:

[192.168.25.2] >>: quit

　　　　Connection to host has been lost.

---

rate <dl_rate> <ul_rate>

View or modify the RDL-2000 downlink and uplink rates.

Rate settings are: 0 = BPSK 1/2, 1 = QPSK 1/2, 2 = QPSK 3/4, 3 = 16 QAM 1/2, 4 = 16 QAM 3/4, 5 = 64 QAM 2/3, 6 = 64 QAM 3/4, and 7 = 64 QAM 5/6

dl_rate: Enter the desired maximum downlink modulation/coding for the link. When Adaptive Modulation is disabled, the RDL-2000 downlink rate is fixed at this modulation/coding. When Adaptive Modulation is enabled, this setting is ignored.

ul_rate: Select the desired maximum uplink modulation/coding for the link. When Adaptive Modulation is disabled, the RDL-2000 uplink rate is fixed at this modulation/coding. When Adaptive Modulation is enabled, this setting is ignored.

Example: Set the RDL-2000 rate to downlink = 64 QAM 5/6 and uplink = 64 QAM 2/3:

[192.168.25.2] >>: rate 7 5

---

reset

Reboot the RDL-2000. The current Telnet session will be closed. Unsaved changes will be discarded.

Example: Reset the RDL-2000:

[192.168.25.2] >>: reset

　　　　Connection to host has been lost.

---

rtext [clear]

View or clear the recorded cause of the last system reset.

[blank] - Display cause of last reset.

clear - Delete the cause of the last reset.

Example: Clear the cause of the last reset*:*
[192.168.25.2] >>: rtext clear

---

rssi [clear]

View or enable/disable the RSSI collection settings.

[blank] - Display current mode/setting.

| Table 9: CLI - Command Summary |
|---|
| **off** - Disable RSSI.
 on - Enable RSSI.
 Example: Read current RSSI value:
 [192.168.25.2] >>:rssi
 　　rssi -59 [dBm] |
| **sweep <start \| stop> <all \| channel(s)>**
 Perform an RF scan for interference. No user data is transmitted over the wireless link while this test is running. A reboot is required to restore normal operation.
 Start: Begin scanning the selected channels. The wireless link is offline.
 Stop: Stop scanning channels. Reboot and resume normal operation.
 all: Scan all available channels
 channel(s): Enter one or more RF channel frequencies to be scanned.
 Example: Scan all enabled channels:
 [192.168.25.2] >>:sweep start all
 RF Analyzer: CH = #1 rssi = -77 dBm
 RF Analyzer: CH = #2 rssi = -78 dBm
 RF Analyzer: CH = #3 rssi = -48 dBm |
| **switchbank [soft \| pld \| both]**
 Switch between the active and inactive banks of the software. A system reboot is required to activate the selected software version.
 soft or **[blank]**: Switch the software load.
 pld: Switch the firmware load (e.g., bootloader).
 both: Switch the software and firmware load.
 Example: Switch to the alternate software load and reboot:
 [192.168.25.2] >>: switchbank |
| **update**
 Activate and permanently save (non volatile RAM) all changes to the system parameters. Saving changes to some parameters will automatically reset the RDL-2000.
 Example: Activate and save all parameter changes:
 [192.168.25.2] >>: update |

Chapter

6

6　Reference Information

Table 10: Reference - RDL-2000 Technical Specifications
System Capability:　　　LOS, optical-LOS, and non-LOS (OFDM)
RF Band:　　　　　　4.940 to 5.850 GHz [1, 6],   TDD, 2x2 MIMO
Channel Size:　　　　5, 10, 20, and 40 MHz (software selectable) [1]
Center Freq. Steps:　　5 MHz [1, 2]
Max Tx Power:　　　22 dBm [1, 3, 7] (-22 dBm min.)
Rx Sensitivity:　　　　-95 dBm (BPSK)
Data Rate:　　　　　300 Mbps wireless data rate [4]
PoE Cable:　　　　　Up to 91 m (300 ft) [5]
Network Attributes:　　Transparent bridge   DHCP pass-through
Modulation:　　　　BPSK to 64 QAM   Bi directional dynamic adaptive
Dynamic Control:　　DFS, ATPC:
MAC:　　　　　　PTP, Fast ARQ (Automatic Retransmit)   IIS (Intelligent Interference Sensing)   ACM (Adaptive Coding & Modulation)   FEC (Forward Error Correction)   Fragmentation, Concatenation
System Configuration:　Telnet,   Link Manager Application (Windows-based)
Network Connection:　2x 10/100 Ethernet (RJ-45)
PoE Cable:　　　　　Up to 91 m (300 ft) [5]
Wireless Encryption:　AES-128
Operating Temp:　　-35 C to 60 C
Power Consumption:　Max 6 W, PoE
Power Supply:　　　110/220/240 VAC 50/60 Hz
Compliance:　　　Safety:　IEC, and EN 60950 　　　　　　EMC:　EN 301 489-1, EN 301 489-17 　　　　　　RF:　FCC: part 15 　　　　　　　　Industry Canada: RSS 210 　　　　　　　　ETSI: EN 302 502, EN 301 893
[1]　Restricted by regional regulatory certification: ETSI 5.4-5.8 GHz, FCC/IC 5.8 GHz, Other 5.4-5.8 GHz   [2]　Center frequency is dependent on region.   [3]　Maximum power based on modulation and coding.   [4]　Actual Ethernet data throughput is dependent on factors including: protocols, packet size (1916 bytes max.), burst rate, transmission latency, and link distance.   [5]　Total distance from RDL-2000 port to PoE port.   [6]　Determined be factory installed hardware.   [7]　RMS power.
All specifications are subject to change without notice.
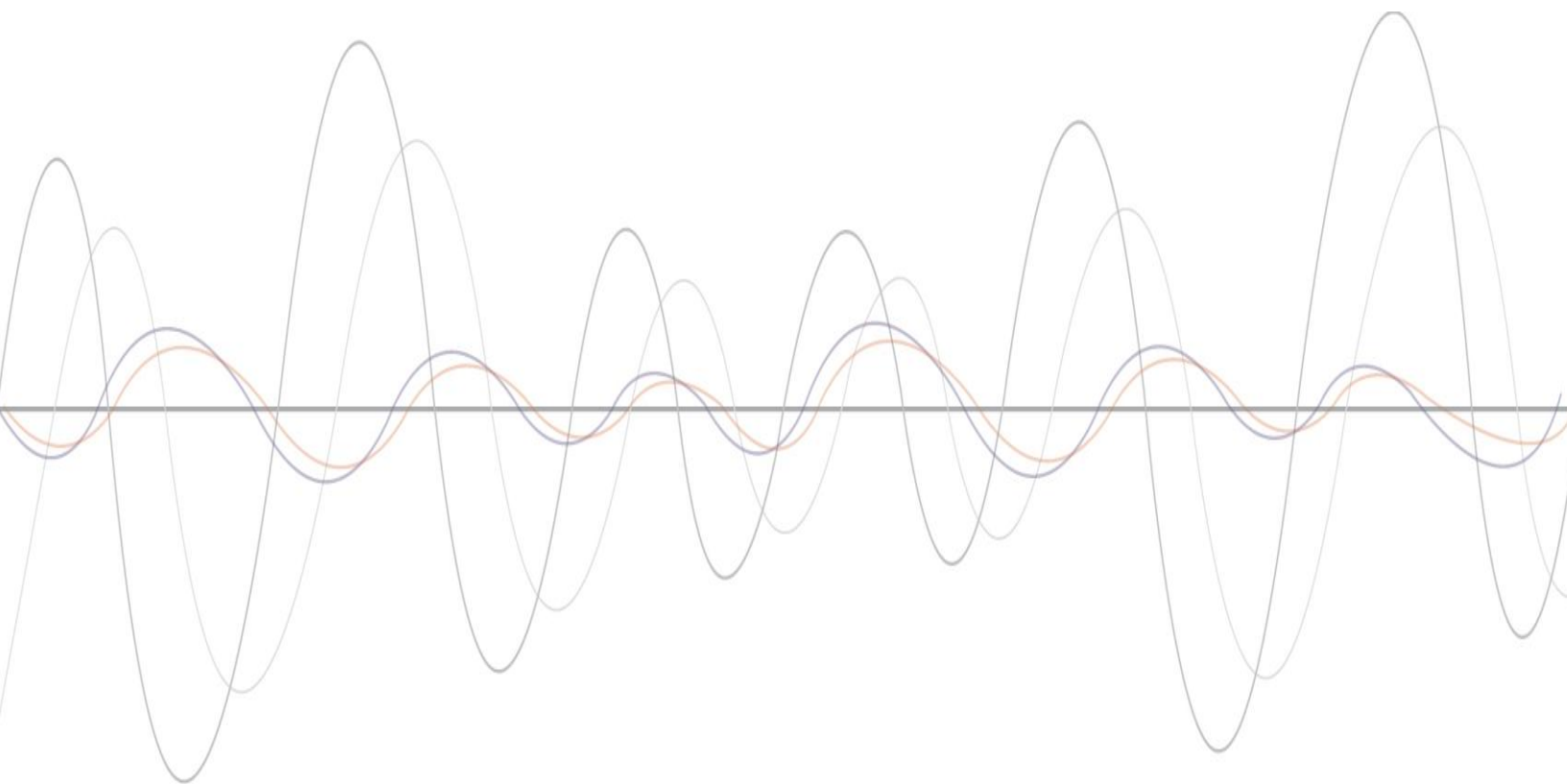
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