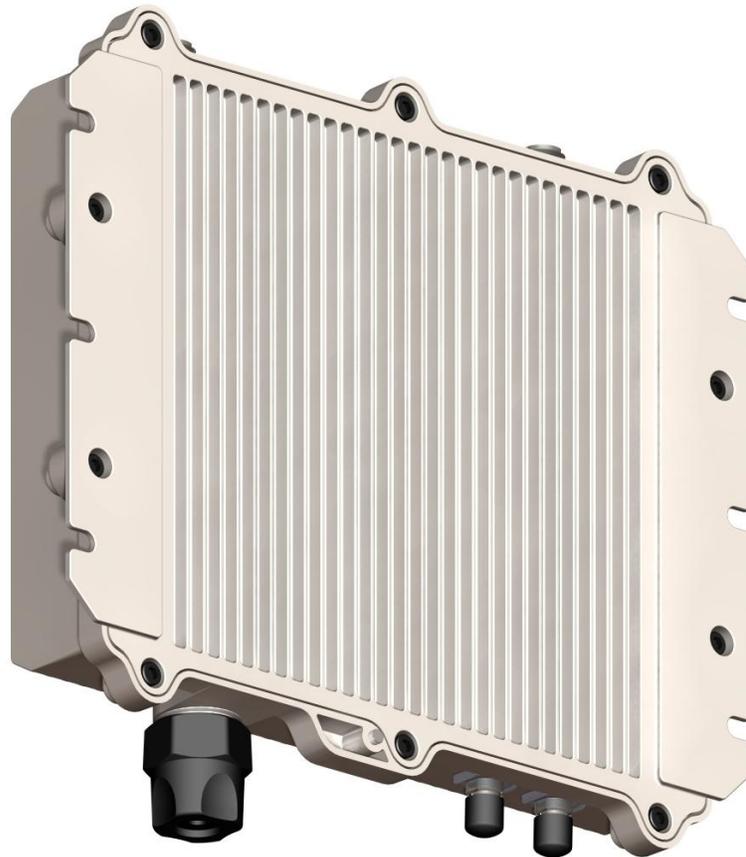


# RDL-3000

## *Broadband Wireless Radio Platform*



# Installation Guidelines

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## Software Versions

This manual describes operation using software release v1.1x. This document may include references to features that are different or unavailable in previous software releases. Refer to the product Release Notes for information about specific software releases.

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# 1 Important Notices

## 1.1 Service & Safety

### 1.1.1 Safety Warnings

1. Read this manual and follow all operating and safety instructions.
2. Installation of the system must be contracted to a professional installer.
3. The unit must not be located near power lines or other electrical power circuits.
4. 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.
5. Do not exceed the described limits indicated on the product label.
6. PoE power adapter caution:

**⚠ 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 the RDL-3000 can be safely connected to the PoE OUTPUT (DATA & POWER) port. Customer premises Ethernet equipment may be damaged if connected directly to the PoE OUTPUT (DATA & POWER) port.

7. Disconnect the power before cleaning, or when the unit is not in-use for an extended period.
8. Keep all product information for future reference.

### 1.1.2 Warning Symbols

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

## 1.2 Regulatory Notices

### 1.2.1 FCC & IC Notices: Deployment in USA and Canada

Read the following notices about deployment in the USA and Canada:

1. The model RDL-3000 and its antenna system must be professionally installed.

2.  **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)	Deployment	Separation Distance
4.9 - 5.3	PTP or PMP	270 cm (107 in) or more
5.8	PMP	20 cm (8 in) or more
	PTP	270 cm (107 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.

3. 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 attempt 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.

4. 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.

## 1.2.2 Avis de la FCC et IC: Déploiement aux Etats-Unis et le Canada

Lisez les mentions suivantes sur le déploiement aux Etats-Unis et le Canada:

1. Le modèle RDL-3000 et son antenne doivent être installés par un professionnel.

2.  **AVERTISSEMENT** - FCC et IC avertissements d'exposition RF

Pour satisfaire les exigences d'IC et du FCC en ce qui a trait aux expositions aux RF pour RF dispositifs de transmission, les distances suivantes doit être maintenue entre l'antenne de ce dispositif et des personnes pendant le fonctionnement du dispositif:

Table 2: Notices - FCC & IC RF Distances de séparation sécuritaire recommandées		
Fréquence (GHz)	Déploiement	Distance de Séparation
4.9 - 5.3	PTP ou PMP	270 cm (107 in) ou plus
5.8	PMP	20 cm (8 in) ou plus
	PTP	270 cm (107 in) ou plus

Pour assurer la conformité, l'opération à une distance moindre que celles-ci n'est pas recommandé. L'antenne utilisée pour ce transmetteur ne doit pas être co-localisé avec une autre antenne ou transmetteur.

3. Informations de la FCC aux utilisateurs @ FCC 15.105:

NOTE: Cet équipement a été testé et démontré conforme aux exigences pour un dispositif numérique de classe B, conformément à la partie 15 des règles FCC. Ces exigences sont conçues pour fournir une protection raisonnable contre les interférences nuisibles dans une installation résidentielle.

Cet équipement génère, utilise et peut émettre des fréquences radio et, s'il n'est pas installé et utilisé conformément aux instructions, peut causer des interférences nuisibles aux communications radio. Toutefois, il n'existe aucune garantie que des interférences ne se produiront pas dans une installation particulière. Si cet équipement provoque des interférences nuisibles à la réception radio ou télévision, ce qui peut être déterminé en mettant l'équipement hors tension, l'utilisateur est encouragé à essayer de corriger l'interférence par un ou plusieurs des mesures suivantes:

- Réorienter ou déplacer l'antenne de réception.
- Augmenter la distance entre l'équipement et le récepteur.
- Alimenter l'équipement par un circuit différent de celui du récepteur.
- Consulter le revendeur ou un technicien radio / TV pour assistance.
- 

Lorsque DFS est requis par les règlements régionaux, cette fonction est activée en permanence à l'usine et ne peut pas être désactivé par l'installateur ou l'utilisateur final.

4. Informations de la FCC aux utilisateurs @ FCC 15.21:

Avertissement: Les changements ou modifications non expressément approuvées par Redline Communications peut annuler l'autorisation de l'utilisateur à utiliser cet équipement.

### 1.2.3 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. 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.
4. 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.
5. RDL-3000 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.
6. RF coaxial cable connecting an antenna to the RDL-3000 must comply with the local electrical code.

### 1.2.4 WEEE Product Return Process



**Figure 1: Notices - WEEE Logo**

In accordance with the WEEE (Waste from Electrical and Electronic Equipment) directive, 2002/96/EC, Redline Communications equipment is marked with the logo shown above. The WEEE directive seeks to increase recycling and re-use of electrical and electronic equipment. This symbol indicates that this product should not be disposed of as part of the local municipal waste program. Contact your local sales representative for additional information.

### 1.2.5 Service & Warranty Information

1. Refer all repairs to qualified Service personnel. Removing the covers or modifying any part of the RDL-3000 will void the warranty.
2. Locate the serial numbers and MAC address for each RDL-3000 and record these for future reference. This information may be required when requesting assistance from the Redline technical support team.
3. Redline does not endorse or support the use of outdoor Ethernet 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 RDL-3000 Installation Guidelines manual. Refer to the Redline Limited Standard Warranty and RedCare Service agreements.

## 2 Site Survey Information

It is recommended to perform a site survey before installing the RDL-3000 equipment. The data accumulated during this process is necessary to understand the operating characteristics and obtain the best performance from the wireless system.

### 2.1 Planning Activities

#### 2.1.1 RF Interference

Frequency planning is an essential component of installation and it is very important to test for RF interference at every installation site. The RDL-3000 will not achieve full operational capability if there is excessive interference on the same or adjacent RF channel. Use the RDL-3000 built-in spectrum sweep feature to determine if a selected RF channel is generally free from interference.

#### 2.1.2 Path Profile

The path profile should include the following information:

Table 3: Site Survey - Path Profile Data	
Antenna	Description
Location	Instructions that identify the location to install the antenna. May include blueprints and specify material list.
Height	Mounting height for antenna.
Azimuth	Horizontal aiming direction for the antenna (magnetic or GPS compass)
Elevation angle	Vertical aiming for antenna (spirit level).
Expected RSSI	The expected RSSI value can be determined using the Link Budget Tool from Redline Communications.

The site survey should identify the optimum location for mounting the RDL-3000. For maximum performance, there should be a direct line of sight between all communicating wireless systems.

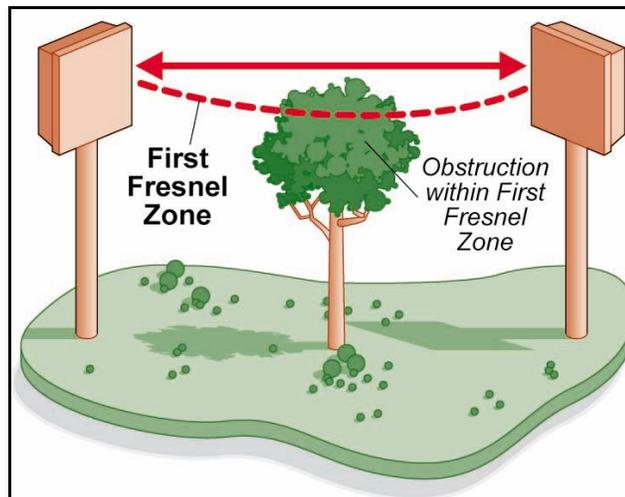
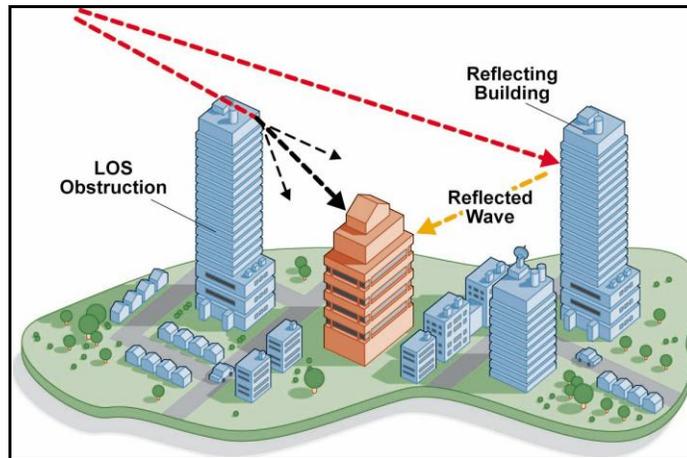


Figure 2: Site Survey - Fresnel Zone Radius

A clear line-of-sight (LOS) path requires clearance above natural and man-made objects by at least 60% of the First Fresnel zone. Each antenna should be positioned to provide maximum clearance in the first Fresnel zone of the direct signal path.

The RDL-3000 also functions under optical line-of-sight (OLOS) conditions; where a clear straight line path exists between the two end points, but the first Fresnel zone is not clear of obstacles. If the optical path is completely blocked, it may be possible to establish a non line-of-sight (NLOS) path using RF signal reflections, such as a common reflective structure (e.g., office building) that is LOS for the antennas of communicating units.



**Figure 3: Site Survey - Non-Line of Sight Deployment**

### 2.1.3 Link Budget Tool

The Link Budget Tool developed by Redline calculates the expected link budget based on the link distance, RF channel, power gain, antenna height, etc. This calculation is necessary to determine if a proposed location is suitable for the intended application. Contact your Redline sales representative to obtain a copy of the Link Budget tool.

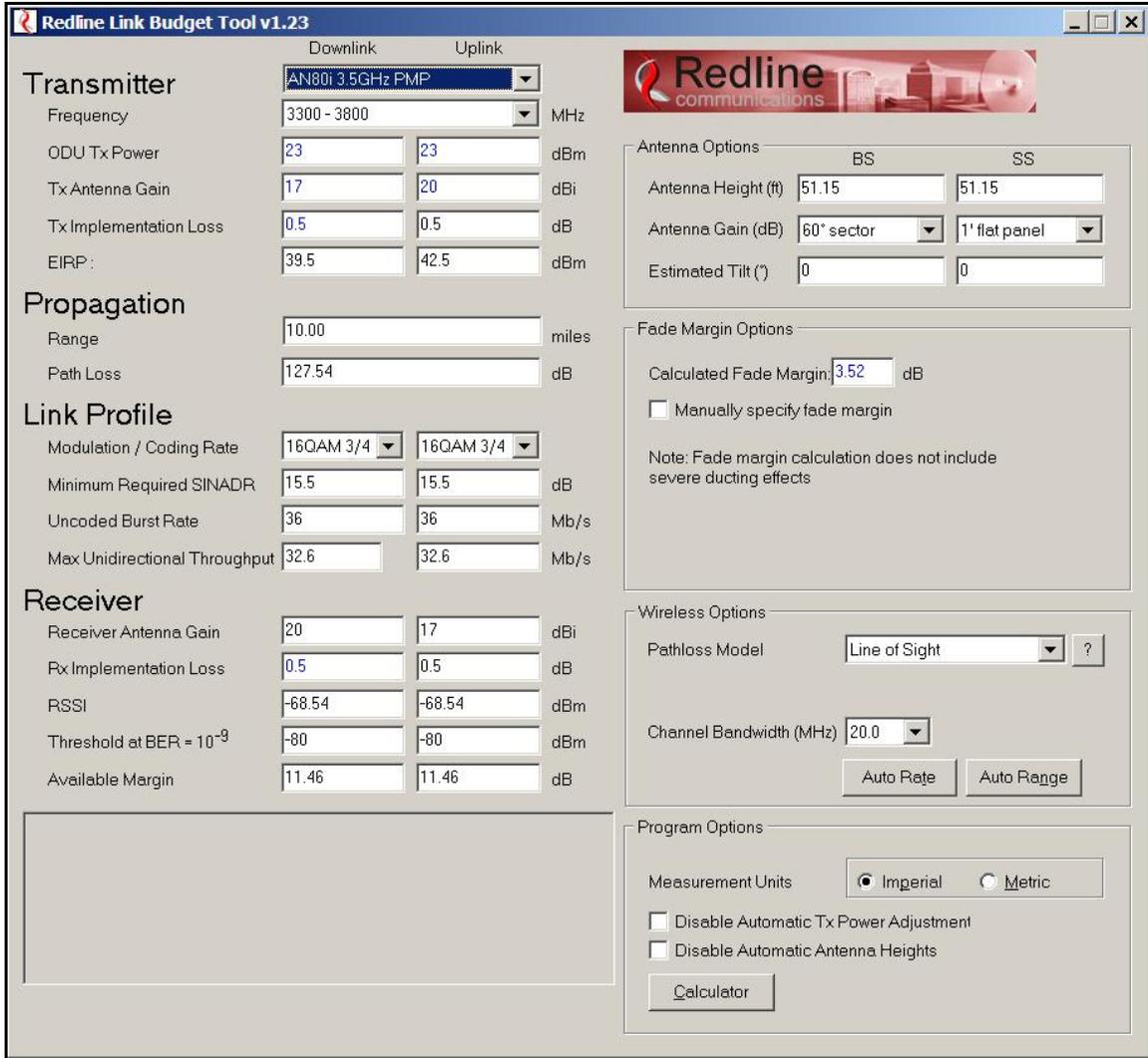


Figure 4: Site Survey - Redline Link Budget Tool

### 2.1.4 RF and Network Information

The following table contains the minimum set of parameters required to configure an RDL-3000 sector controller and subscriber. Parameters should be configured in the order listed. Enter values for all required settings on each screen and then click **Apply & Save** to activate and save these changes.

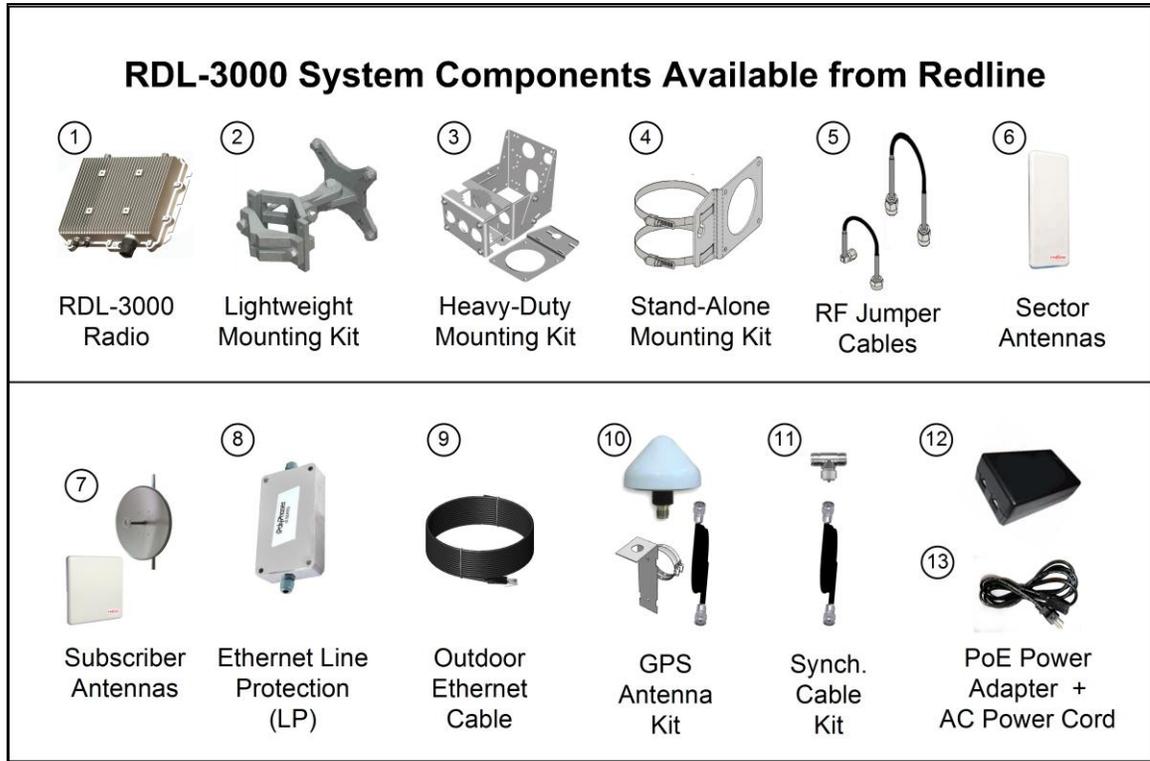
Table 4: Site Survey - RF and Network Information					
Step	Screen	Parameter	Ref.	Sector Controller	Subscriber
1	Utilities -> <a href="#">Product Options</a>	Options Key	RF Plan	Enable PMP SC mode, RF freq., etc.	Enable PMP SS mode, RF freq., etc.
2	Configuration -> <a href="#">System</a>	System Name	Net. Plan	Name for SC	Name for SS
		IP Address	Net. Plan	IP address for SC	IP address for SS
3	Configuration -> <a href="#">Wireless</a>	System Mode	RF Plan	PMP SC	PMP SS
		Channel Width	RF Plan	Use the same setting for SC and SS.	
		RF Freq.	RF Plan	Use the same setting for SC and SS.	
		Tx Power	RF Plan	Refer to RF Plan	Refer to RF Plan
		Max. Distance	RF Plan	Refer to RF Plan	N/A
		Antenna Gain <sup>1</sup>	RF Plan	See Mfg. Spec. <sup>1</sup>	See Mfg. Spec. <sup>1</sup>
4	Provisioning -> <a href="#">Subscriber Links</a>	Subscriber MAC	RF Plan	MAC address of each subscriber in the sector.	N/A

Notes: 1. DFS enabled systems only. 2. Required in step 3.

## 2.2 Materials

### 2.2.1 Redline Components

The components in the following illustration are available for each RDL-3000 system.



**Figure 5: Site Survey - Redline Supplied Components**

Table 5: Site Survey - System Components Available from Redline	
1	RDL-3000 radio. Model T502 (4.940 - 4.850 GHz)
2-5	Mounting kit for RDL-3000: 2. Lightweight mount: bracket, assembly hardware, and two 230 mm (9 in) RF cables. Fits 44.5 to 76.2 mm (1.75 to 3.00 in) mast or mounts to flat surface. 3. Heavy-duty mount: bracket, assembly hardware, and two 400 mm (16 in) RF cables. Fits 44.5 to 117.3 mm (1.75 to 4.62 in) mast. 4. Stand-alone mount: bracket, assembly hardware, and two 400 mm (16 in) RF cables. Fits 70 to 120 mm (2.75 to 4.75 in) mast. 5. All mounting kits (items 2 - 4) include two RF cables with male N-type termination.
6	Sector controller sector antenna (wide beamwidth).
7	Subscriber antenna (narrow beamwidth).
8	Ethernet cable line protection (LP) unit.
9	Cat-5e shielded outdoor Ethernet cable terminated with RJ-45 connectors. Available in 30 m (100 ft) or 90 m (300 ft).
10	GPS Antenna with mounting bracket, and 6 m (19.5 ft) antenna cable.
11	Synchronization cable and T-connector. Cable is 6 m (19.5 ft) with TNC/M connectors.
12	PoE power injector with single AC 110/220 VAC input, single 10/100 Ethernet data port, and single 10/100 powered Ethernet port.
13	Power cord for PoE power injector. Available terminated as NA, EU, or UK type.

*Note: All items must be specified individually as part of each system order.*

### 2.2.2 Customer Supplied Materials

Installation of the RDL-3000 equipment requires additional equipment and materials supplied by the customer and/or installer. The following list is provided as a guideline only, and additional materials may be required based on local conditions at each installation site. This list is not comprehensive and is provided as a guide only.

Table 6: Site Survey - Customer-Supplied Items		
1	Equipment Rack	Mounting space allocated for the PoE power adapter. Must accommodate 2 m (6') AC power cable and routing of Ethernet cable from PoE to local Ethernet network access point.
2	120/240 VAC Power	Reliable 120/240 VAC. Total power requirements must be evaluated based on individual site configurations.
3	Cat-5 Ethernet Cables	Connect from PoE power adapter to core network.
4	Cable Installation Materials	Materials for securing cables to mast, protecting cables from abrasion, etc. including suggested weatherproofing materials: Scotch 2200 series of vinyl mastic rolls Scotch 130C linerless rubber splicing tape 3M Scotch super 88 electrical tape Rubber mastic putty or duct sealing putty
5	Radio/Antenna Mast	Mast or tower location as required by site survey. Equipment must be rated for weight and wind loading of all installed radios and antennas.
6	Ground Block	Termination for grounding and shield of all conductive cables entering the building.
7	Grounding Wire	Master grounding system for all indoor and outdoor equipment, with #2 AWG through #6 AWG as required and eye-terminals for connection to RDL-3000 chassis and mounting bracket.
8	Tools	i) Precision set of screwdrivers, cutter pliers, and other common installation tools. ii) Portable computer (Windows™) for RDL-3000 configuration, antenna alignment, and troubleshooting as required..

## 3 Installation Procedures

This section describes recommendations for grounding and line protection equipment, mounting the RDL-3000, RF and Ethernet connections, basic wireless configuration, and alignment of the antenna.

### 3.1 General Guidelines

All outdoor wireless equipment is susceptible to lightning damage from a direct hit or current induced from a near strike. Surge protection and grounding practices described in local and national electrical codes are intended to prevent serious injury, minimize damage to equipment, and reduce service outages.



**CAUTION:** The following are general recommendations for system installation. This equipment **must** be installed by a qualified professional installer and follow 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. A direct lightning strike may cause injury or serious damage regardless if all recommendations are observed during system installation.

#### 3.1.1 Grounding

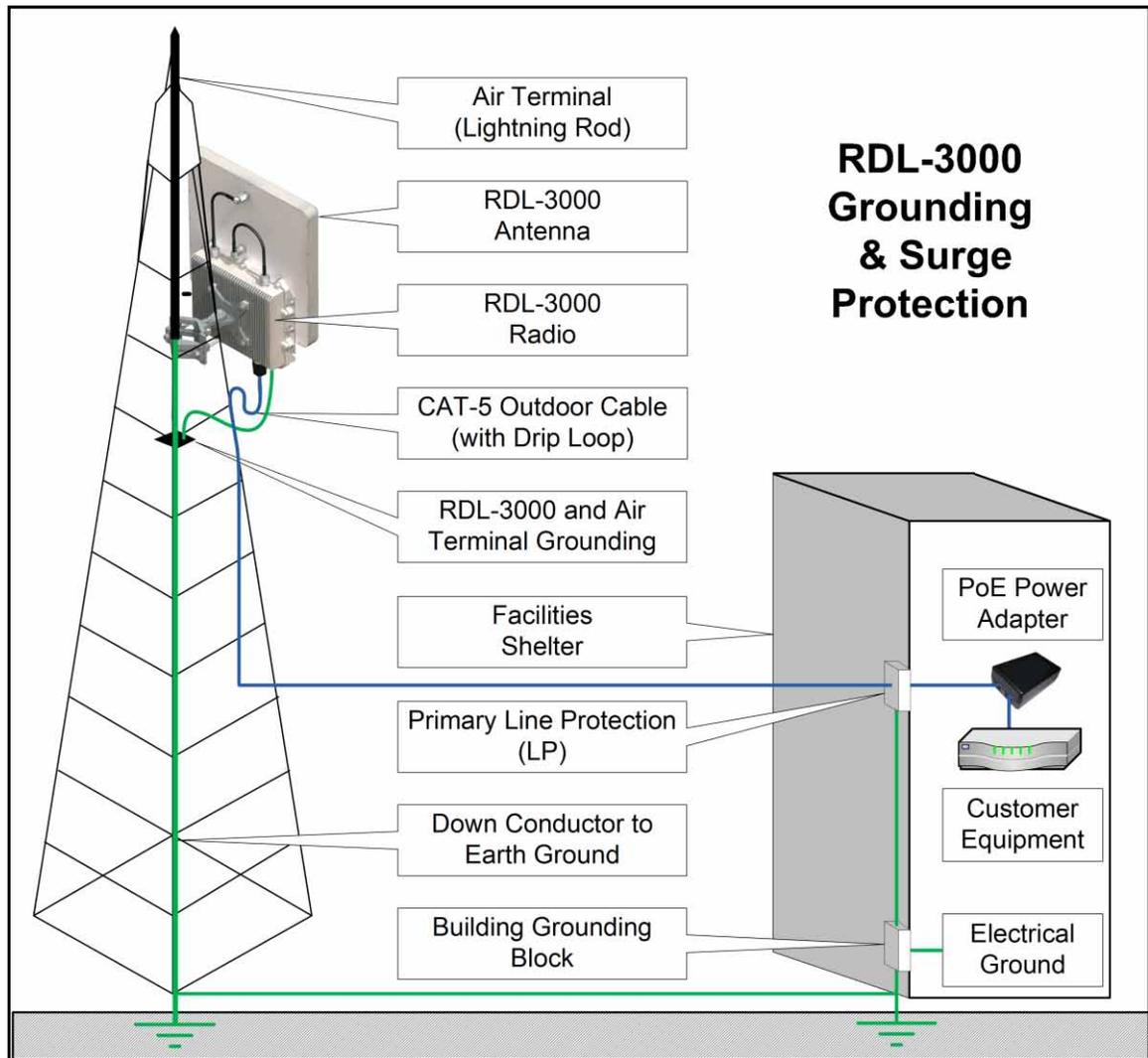
A good grounding system disperses most of the lightning strike surge energy away from the building and equipment.

1. Provide direct grounding connections from the RDL-3000, mounting bracket, and antenna (if mounted separately) to the master ground for the tower or mast. Use the grounding screws provided for terminating the ground wires.
2. The AC wall outlet ground for the indoor POE adapter should be connected to the master ground bus for the building.
3. The following general industry practices are provided as a guideline only:
  - All grounding connections must conform to local/national standards.
  - Above ground wire must be #2-6 AWG when interconnecting ground rings and #6 AWG (minimum) for grounding equipment and metal objects
  - Below ground wire must be #2 AWG (minimum).
  - Ground rods must be 8 feet long (minimum) and 5/8-inch in diameter and extend 3 feet below any adjacent basement/vault.
  - A grounding block should be installed where cables enter the building.
  - Painted or dirty surfaces should be cleaned thoroughly down to bare metal and screws well tightened.
  - Ground wires should not have sharp bends.
  - The installation site should have an external ground ring or bus bar.

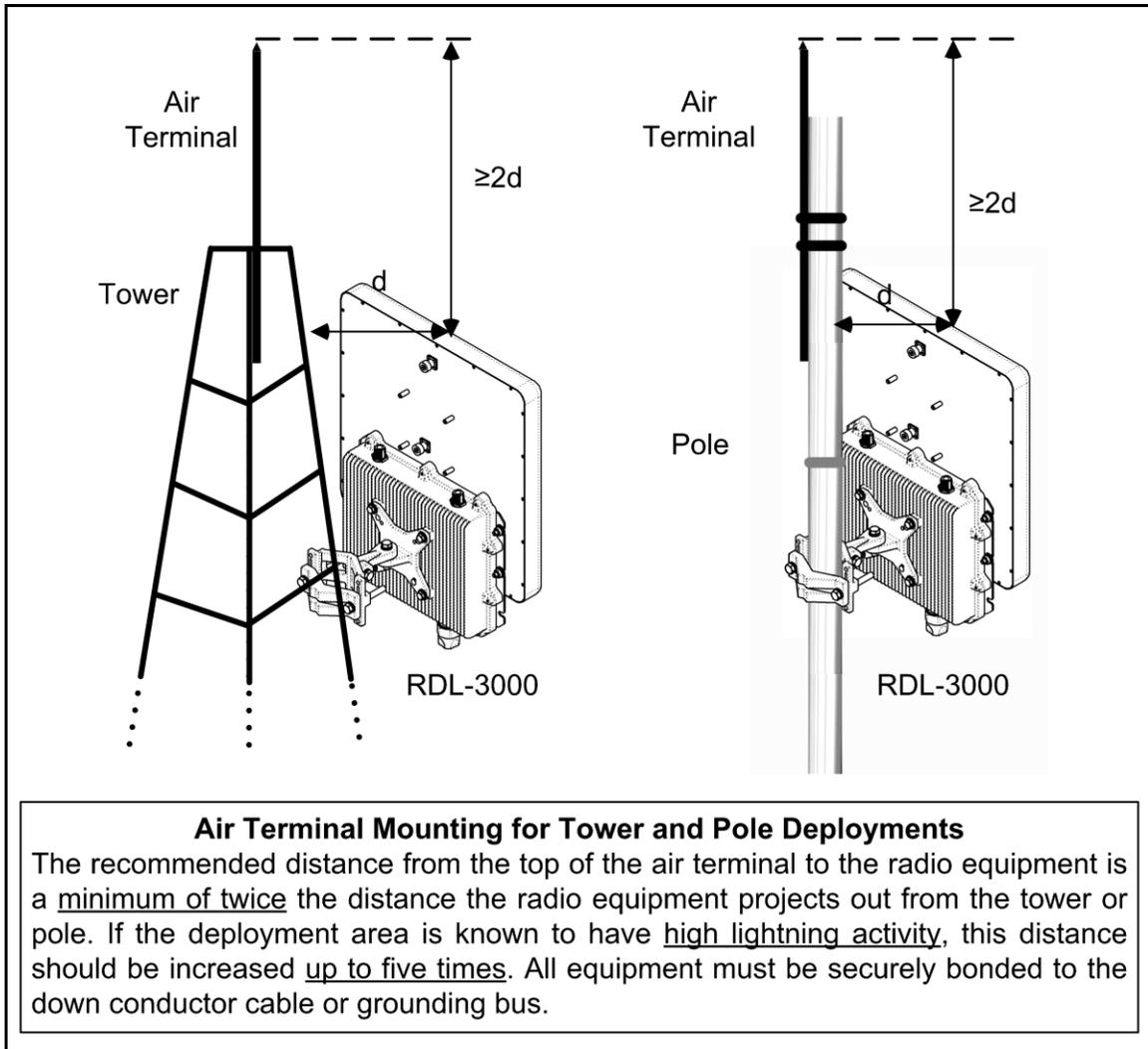
### 3.1.2 Surge Protection

The tower grounding system disperses most of the surge energy from a tower strike away from the building and equipment. The remaining energy induced on the Ethernet cable can be directed safely to ground by using a surge arrester in series with the Ethernet cable at the point of entry to the building.

1. A surge protection device should be installed in series with the Ethernet cable at the point of entry to the building. The surge protection ground terminal should be connected to the building master ground bus.
2. The AC wall outlet ground for the indoor POE adapter should be connected to the building master ground bus.



**Figure 6: Procedures - Installing Surge Protection**



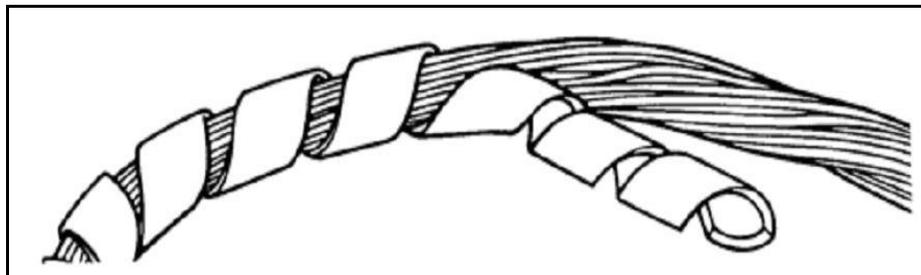
**Figure 7: Procedures - Air Terminal for Tower and Pole Deployments**

**3.1.3**

**Protecting Cables from Abrasion and Temperature**

Redline recommends the use of suitable diameter spiral bound sleeve (generically called 'spiroband') to protect the outdoor Ethernet cable. These products are generally available from most local electrical suppliers. This use of sleeves protects against excessive abrasion from wind and heat damage in locations where the temperature of the metal tower structure may exceed the cable specification.

The cable should be protected for a distance of at least 300 mm (~12 in) in each direction from any point of contact with the metal tower. Use the standard approved method to secure the cable (e.g., cable ties).



**Figure 8: Procedures - Cable Protection - Spiroband**

3.1.4 Ethernet Cable Drip-Loop

It is recommended to include a drip loop when installing the outdoor Ethernet cable. This feature reduces mechanical strain on the Ethernet port connector and reduces water flow near or at the weatherproof seal.

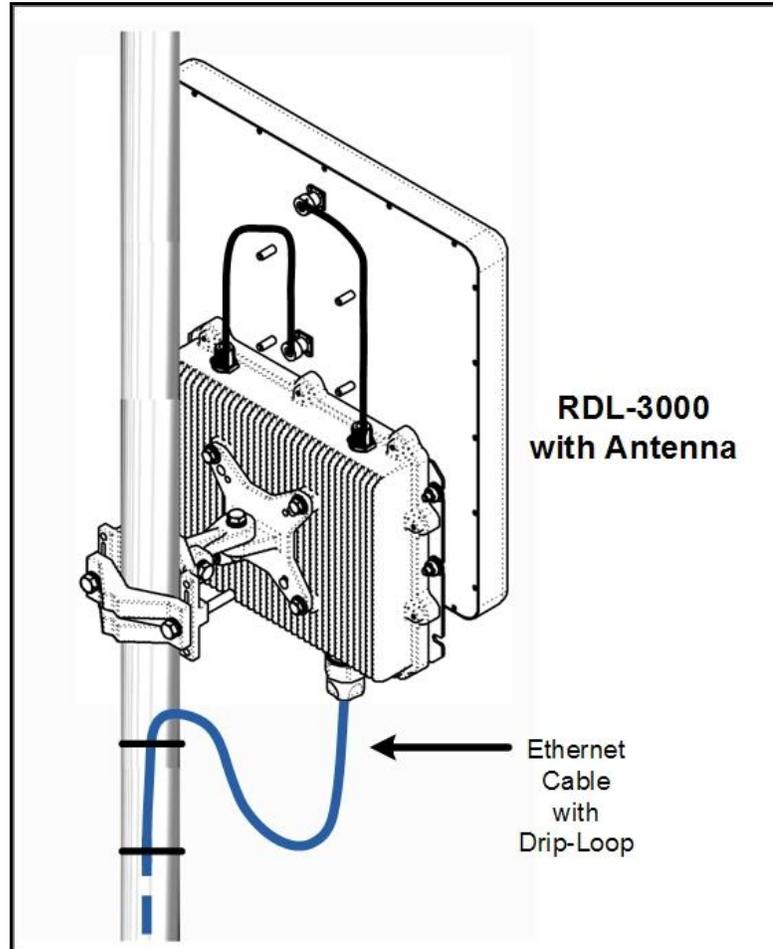


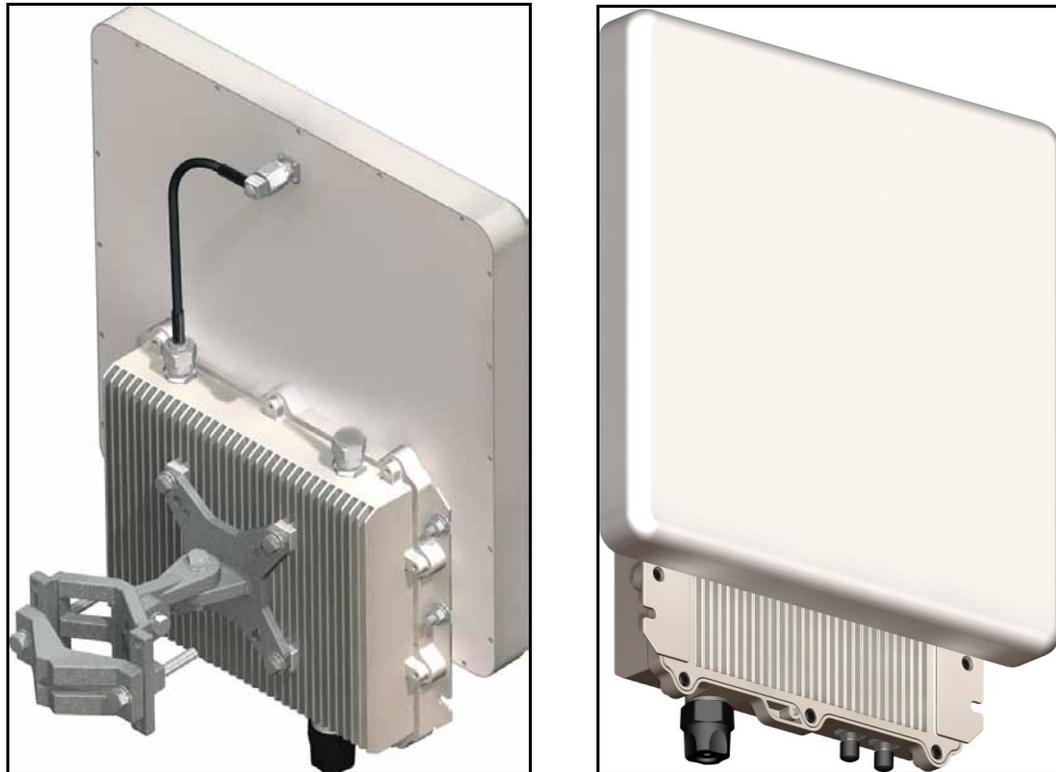
Figure 9: Procedures - Ethernet Cable Drip Loop

## 3.2 Mounting Kits

Redline offers a selection of mounting kits for the RDL-3000 system. Kit selection is based on the antenna type, the method of mounting (e.g., mast or wall) and the mast size if applicable. Assembly instructions for each mounting bracket are provided in this section.

### 3.2.1 Lightweight Mounting Kit

The RDL-3000 lightweight mounting kit general-purpose adapter allows the RDL-3000 to be mounted on a mast pipe or flat surface. This bracket can be used with Redline flat panel antennas that mount directly to the radio or with antennas that are mounted separately (e.g., parabolic antenna).



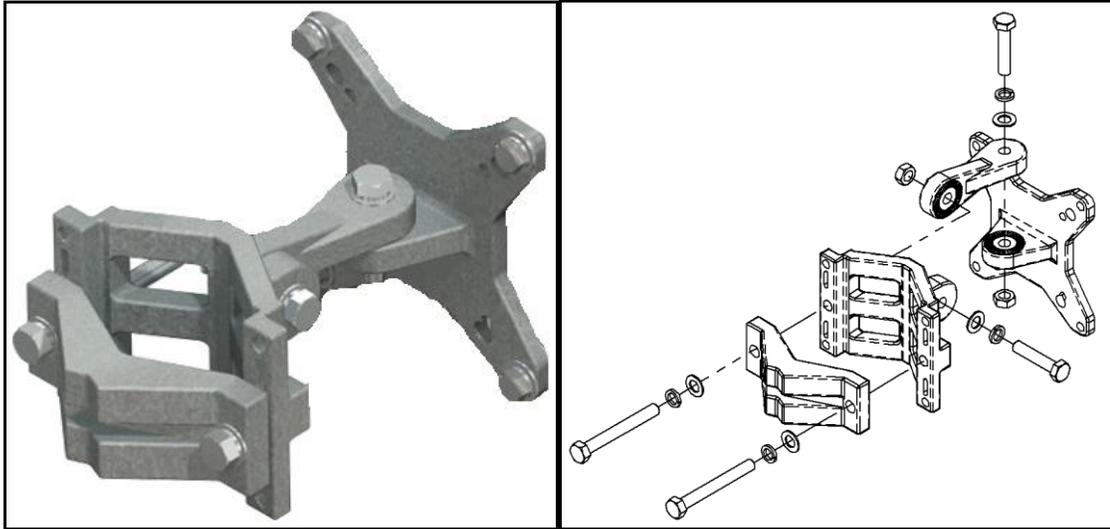
**Figure 10: Procedures - Lightweight Mounting Kit - Installed View**

The lightweight installation kit includes:

1. Universal mounting bracket with assembly hardware. Bracket adjusts for a 44.5 mm to 76.2 mm (1.75 in to 3.00 in) mast pipe or mounts directly to a flat surface. Assembly is required.
2. Two 406 mm (16 in) RF jumper cables (N-type connectors, 50 Ohm).

Use the following parts list and diagram to assemble the mounting bracket and attach the RDL-3000 radio and antenna.

1. Assemble the lightweight mounting bracket. See the following assembly drawings.
2. Attach the RDL-3000 unit directly to the antenna (if applicable).
3. Attach the lightweight mounting bracket to the RDL-3000.



**Figure 11: Procedures - Lightweight Mounting Kit - Bracket Arm**

Table 7: Procedures - Lightweight Mounting Bracket - Parts List			
Item	Qty	Description	Torque
1	1	RDL-3000 Radio*	
2	1	Mount Bracket Arm Kit	
3	1	Antenna*	
4	4	Bolt 1/4-20 UNC X 3/4	13.56 N-m (10 ft-lb.)
5	4	Nut, 1/4-20 UNC	13.56 N-m (10 ft-lb.)
6	8	Washer, 1/4 flat	
7	8	Washer, 1/4, split	
8	2	230 mm (9 in) RF cables. N-type connectors, 50 Ohm	12 lb-in (1.35 N-m)

\* Item not included in the mounting bracket kit.

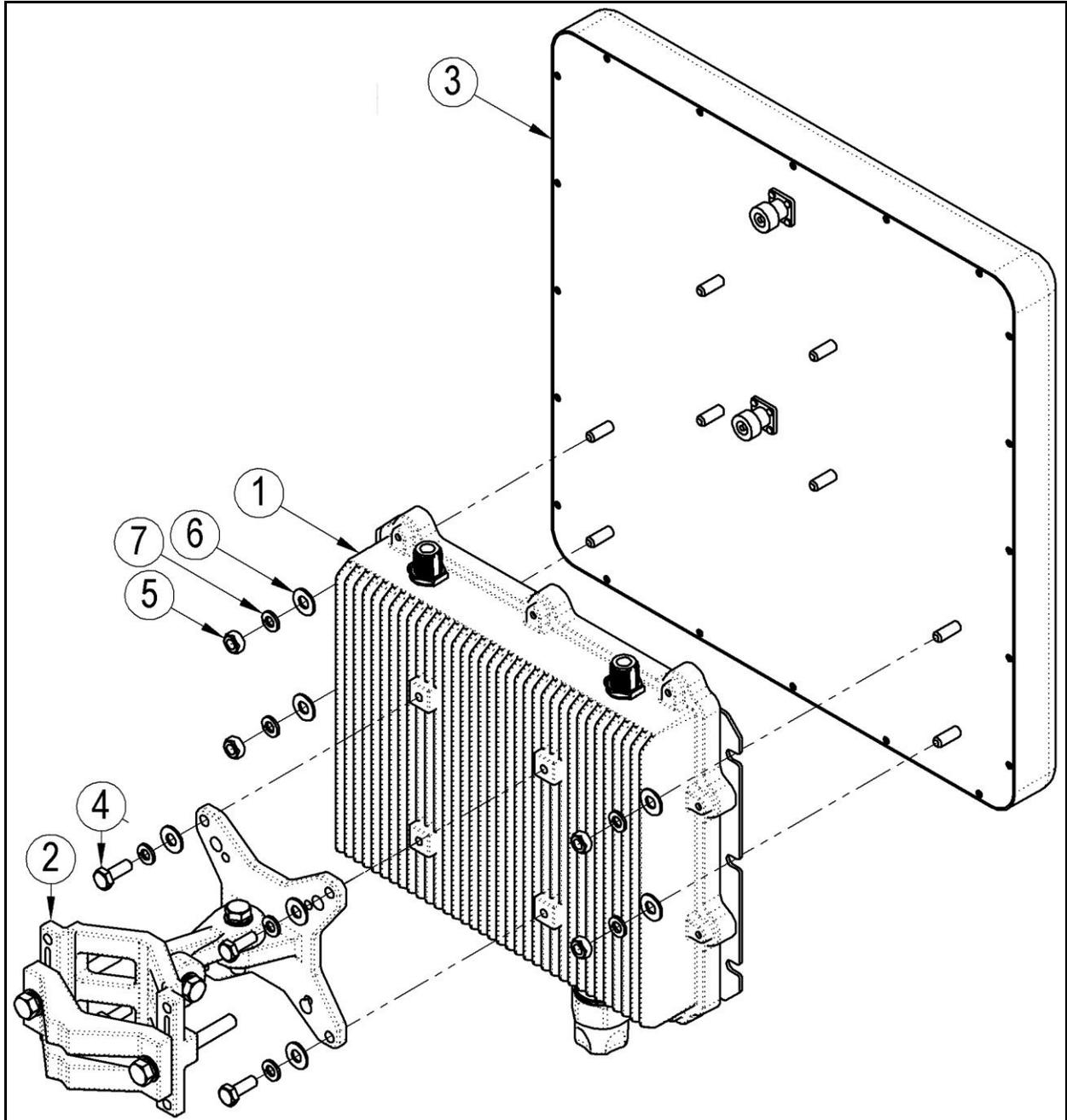


Figure 12: Procedures - Lightweight Mounting Kit - Assembly Drawing

### 3.2.2 Heavy-Duty Mounting Kit

The RDL-3000 heavy-duty mounting kit provides a 4-point system for maximum stability. The heavy-duty bracket may be used with antennas up to 600 mm (2 ft) square where the RDL-3000 is installed on towers or similar locations.



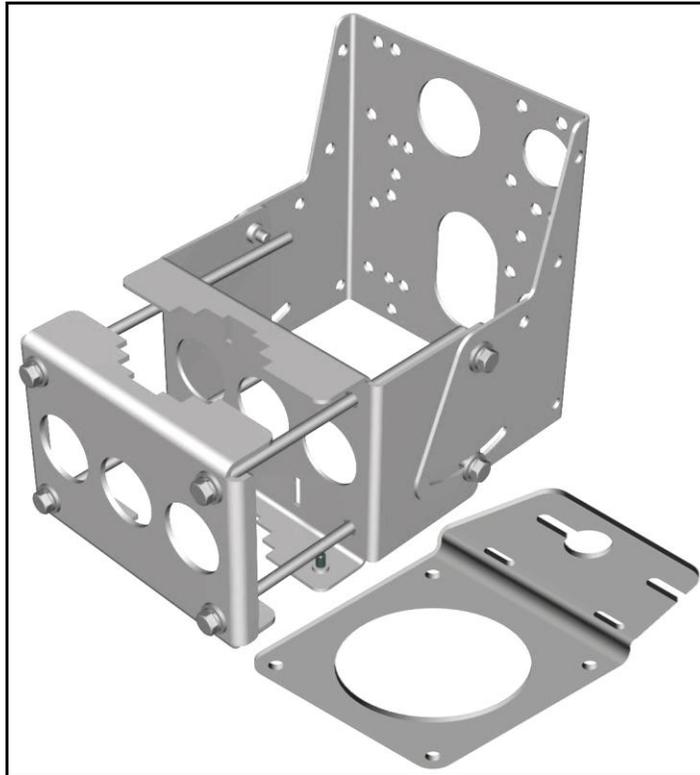
**Figure 13: Procedures - Heavy-Duty Mounting Kit**

The heavy-duty installation kit includes:

1. Heavy-duty mounting bracket with assembly hardware: adjusts for 44.5 to 117.3 mm (1.75 to 4.62 in) mast pipe (assembly required).
2. Adapter bracket attaches the RDL-3000 to the heavy-duty mounting bracket.
3. Two 406 mm (16 in) RF jumper cables (N-type connectors, 50 Ohm).

Use the following parts list and diagram to assemble the mounting bracket and attach the RDL-3000 radio and antenna.

1. Assemble the heavy duty mounting bracket. See the following assembly drawings.
2. Attach the antenna directly to the heavy duty mounting bracket.
3. Attach the RDL-3000 to the adapter bracket.
4. Attach the radio/adapter bracket to the heavy duty mounting bracket.



**Figure 14: Procedures - Heavy Duty Mounting Kit - Assembled View**

Table 8: Procedures - Heavy Duty Mounting Bracket - Parts List			
Item	Qty	Description	Torque
1	1	RDL-3000 Radio*	
2	1	Antenna Bracket	
3	1	Mast Clamp Bracket	
4	1	Mast Bracket	
5	1	Adapter Bracket	
6	8	Bolt 1/4-20 UNC X 3/4	13.56 N-m (10 ft-lb.)
7	1	Screw, 10-32 UNF X 1/2	4.07 N-m (3 ft-lb.)
8	4	Bolt 1/4-20 UNC X 7	13.56 N-m (10 ft-lb.)
9	12	Washer, 1/4 flat	
10	1	Lockwasher, #10	
11	12	Lockwasher, 1/4, split	
12	2	406 mm (16 in) RF cables N-type connectors, 50 Ohm	12 lb-in (1.35 N-m)

\* Item not included in the mounting bracket kit.

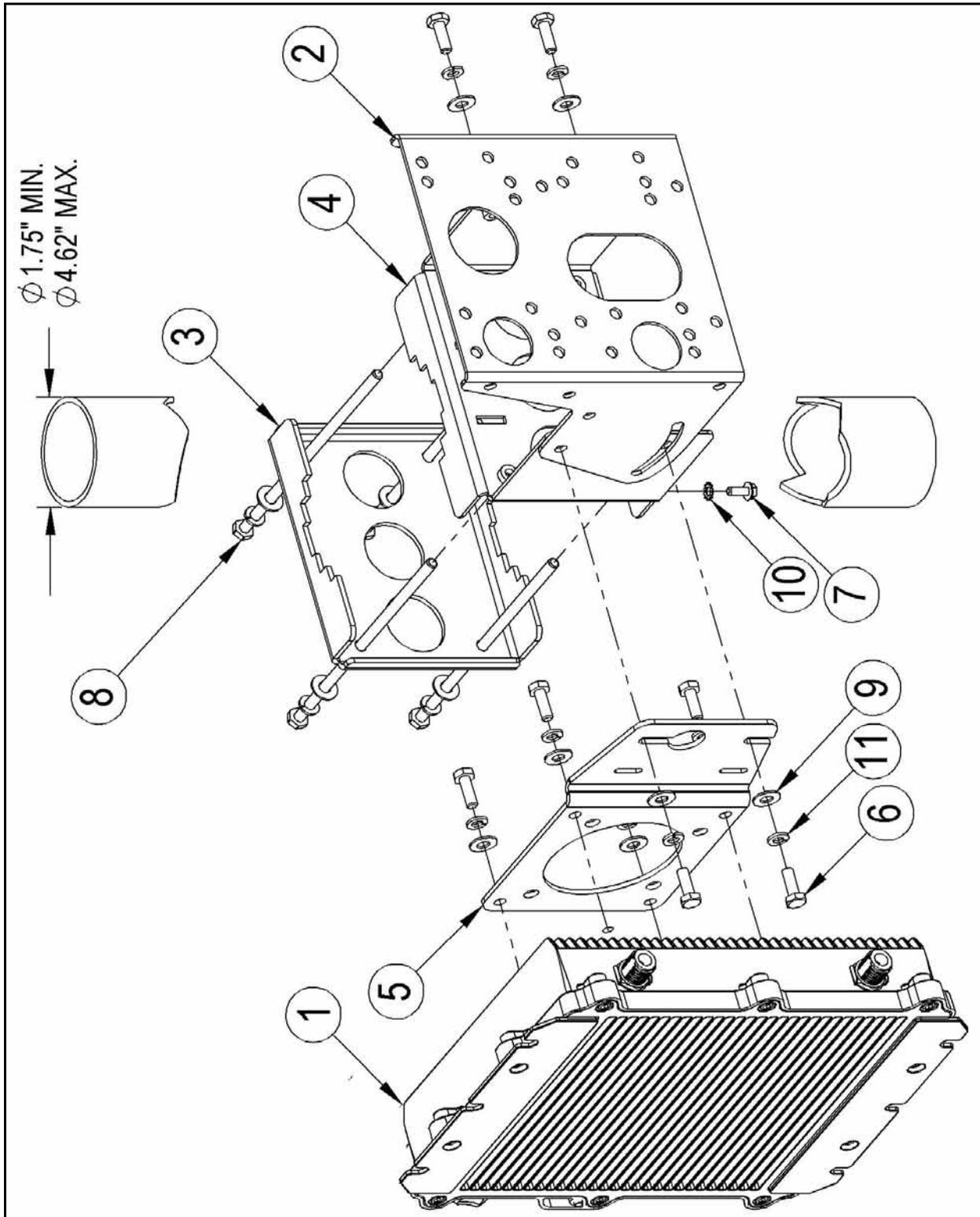
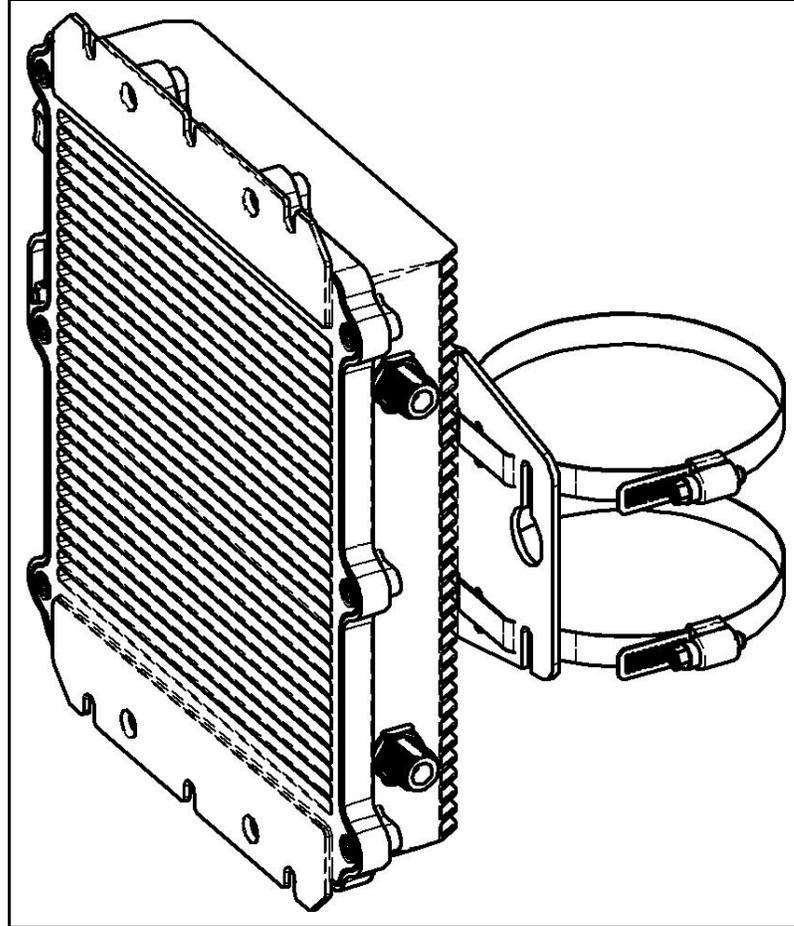


Figure 15: Procedures - Heavy Duty Mounting Kit - Assembly Drawing

### 3.2.3 Stand Alone Mounting Kit

The stand-alone bracket can be used to mount the RDL-3000 directly to a mast. The antenna must be mounted separately. The stand-alone mounting bracket adjusts to a 70 to 120 mm (2.75 to 4.75 in) mast pipe.



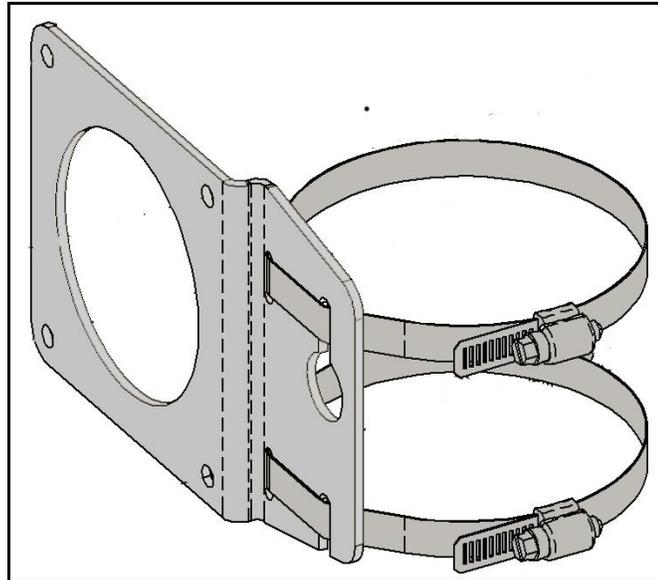
**Figure 16: Procedures - Stand Alone Mounting Kit**

The stand-alone installation kit includes:

1. Adapter bracket with assembly hardware and two metal clamps. Assemble required.
2. Two 406 mm (16 in) RF jumper cables (N-type connectors, 50 Ohm).

Use the following parts list and diagram to assemble the mounting bracket and attach the RDL-3000 radio.

1. Attach the stand-alone bracket to the RDL-3000.
2. Use the flexible metal clamps to attach the RDL-3000 to a mast.



**Figure 17: Procedures - Stand Alone Mounting Kit - Assembled View**

Table 9: Procedures - Stand-Alone Mounting Bracket - Parts List			
Item	Qty	Description	Torque
1	1	RDL-3000 Radio*	
2	1	Adapter Bracket	
3	4	Bolt 1/4-20 UNC X 3/4"	13.56 N-m (10 ft-lb.)
4	4	Lockwasher, 1/4" split	
5	4	Washer, 1/4" flat	
6	2	Adjustable Hose Clamp	
7	2	406 mm (16 in) RF cables N-type connectors, 50 Ohm	12 lb-in (1.35 N-m)

\* Item not included in the mounting bracket kit.

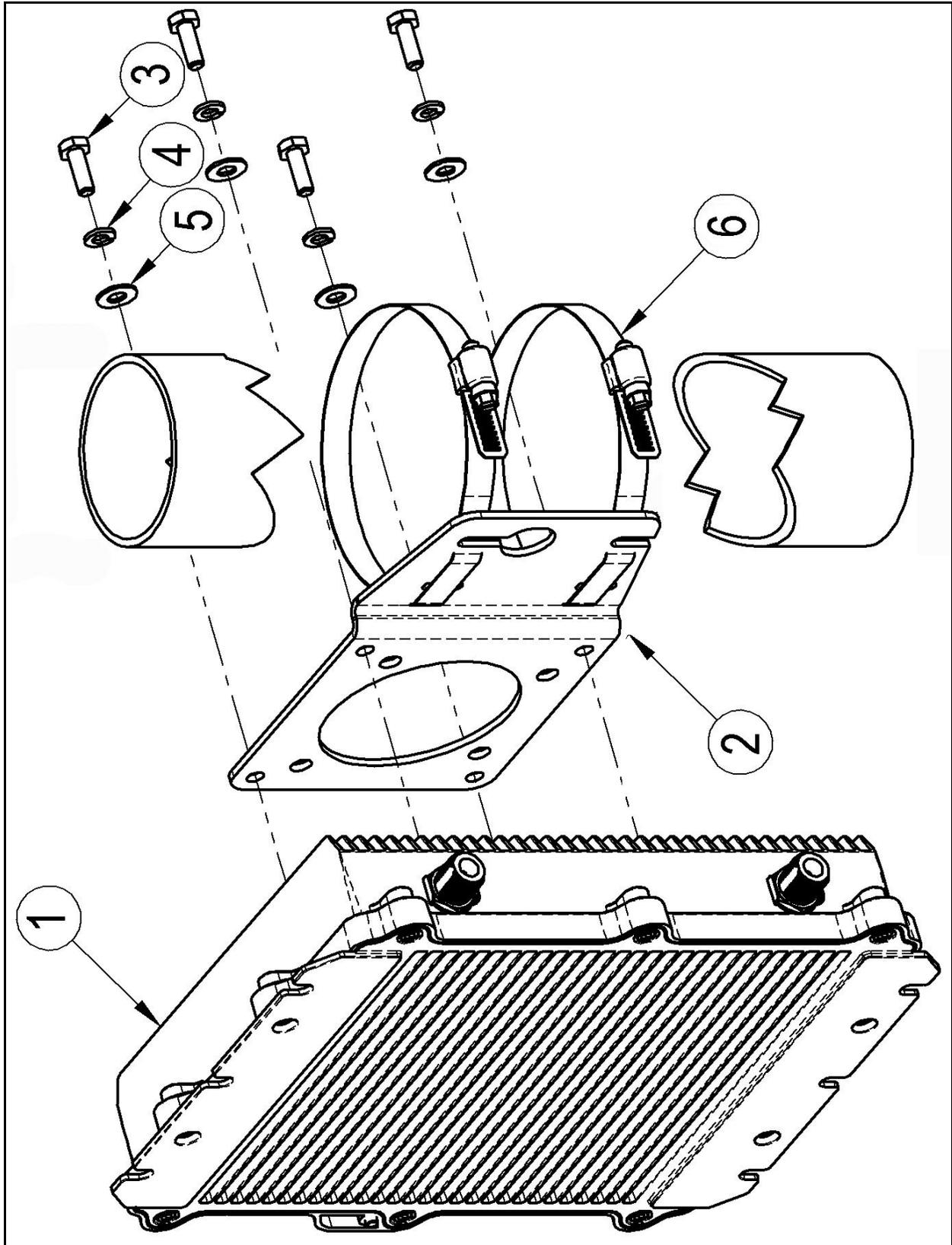


Figure 18: Procedures - Stand Alone Mounting Kit - Assembly Drawing

### 3.3 RF Ports

The two RF ports (N-type / F connectors) conduct RF signals between the RDL-3000 and the antenna system (ordered separately). The RDL-3000 can be operated using a SISO (single antenna) or MIMO (multiple antenna) system.

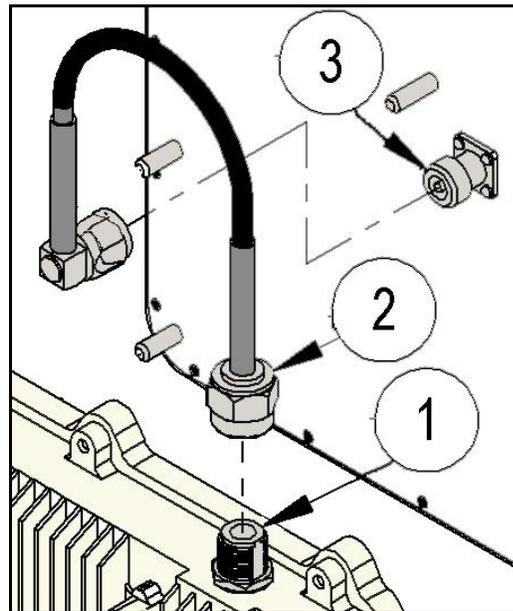
**Important:** Version 1.xx operation is limited to port RF-1. Port RF-2 must be electrically terminated (connect antenna or RF terminating device) and must be weatherproofed.

**Important:** A factory-installed protective weatherproof plastic cap is installed on the RF ports. When a cap is removed to install an antenna cable, the port must be adequately weatherproofed.

#### 3.3.1 RF Cable Connections

RF jumper cables with type-N/M connectors are provided to connect the RDL-3000 unit to the antenna system. The cable length supplied (230 mm or 400 mm) is based on the mounting kit.

Apply a small amount of weatherproofing grease to the nut threads at both ends of the RF cable (2). Connect the RF cable between the RDL-3000 RF port (1) and the antenna RF port (3).



**Figure 19: Procedures - RF Cable - Installation Drawing**

The connectors must be tightened to the required specifications (Table 10: Procedures - RF Port - Connector Torque Specifications). RF connectors must be finger-tight plus 1/8th turn only (N-type: 12 lb-in / 135 N-cm). Use the proper tool for final tightening. Using excessive force (over-torque) or the incorrect tools will damage the connectors on the antenna and RDL-3000 and may defeat the connector weatherproofing features.

Table 10: Procedures - RF Port - Connector Torque Specifications	
Connection	Torque Specification (Max.)
RF Jumper Cable	12 lb-in (1.35 N-m)
RF Port Connector Jam Nut	20 lb-in (2.25 N-m)

**Important:** The N-type connectors on the RDL-3000 must be weatherproofed. The following section provides a pictorial primer on correct weatherproofing procedures.

### 3.3.2 Weatherproofing RF Ports

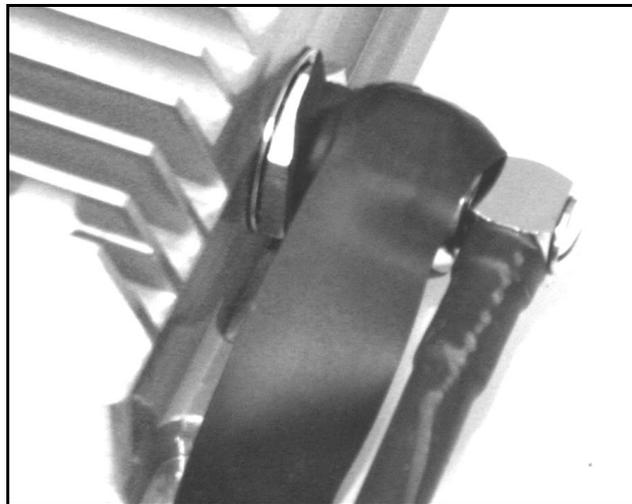
***The importance of proper weatherproofing can not be overstressed. Both ends of the RF cable must be weatherproofed.***

Redline recommends sealing tapes designed for outdoor use:

- Scotch 2200 series of Vinyl Mastic rolls
- Scotch 130C Linerless Rubber Splicing Tape
- 3M Scotch Super 88 Electrical Tape

These heavy-duty tapes, which are weather, abrasion, and UV resistant, can be purchased at most hardware stores. Rubber mastic putty or duct sealing putty must also be used to complete the weatherproofing. The professional installer may use his own weatherproofing materials provided they are not silicon-based Redline does not recommend silicon seal or glue as these materials are difficult to apply accurately, can leave gaps, and are difficult to remove. Do not use PVC tape.

1. Begin to wrap the splicing tape. Start as close to the RDL-3000 body as possible.



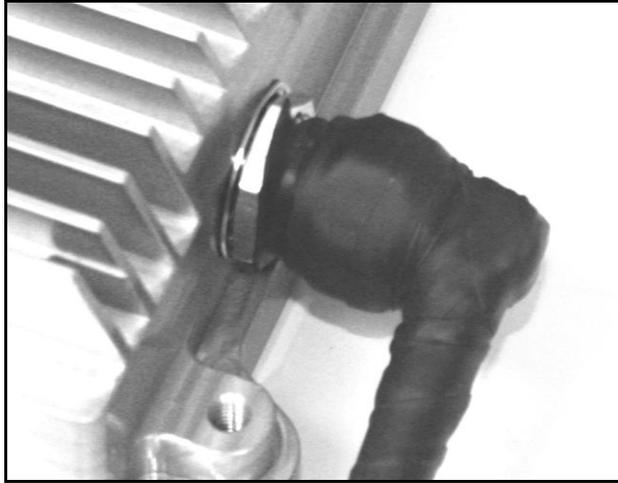
**Figure 20: Procedures - RF Port - Weatherproofing Pt-1**

2. Stretch and wind the tape back along the connector housing making very sure there are no gaps in the tape.



**Figure 21: Procedures - RF Port - Weatherproofing Pt-2**

3. Continue to wrap the tape tightly along the cable.



**Figure 22: Procedures - RF Port - Weatherproofing Pt-3**

4. Work the mastic putty well into the area between the connector and the body of the radio. Continue working the putty to make a watertight seal.



**Figure 23: Procedures - RF Port - Weatherproofing Pt-4**

5. The connection is now weatherproofed. Repeat this procedure for the antenna RF connector.

## 3.4 Ethernet Port

This section describes installation and weatherproofing of the outdoor Ethernet cable.

*Note: The maximum total length of the Ethernet cable is 100 m (328 ft). For example, 95 m from the RDL-3000 to the PoE and 5 m from the PoE to the local network equipment.*

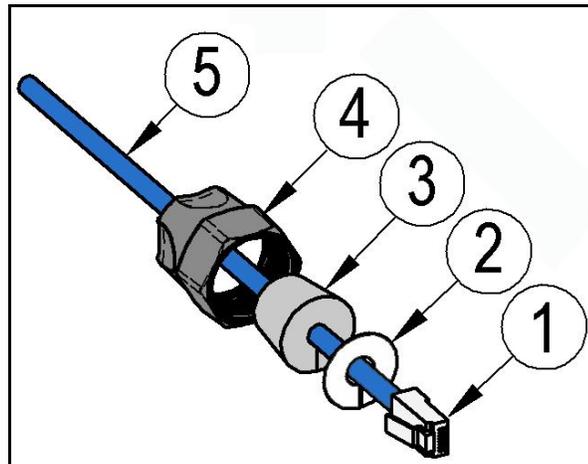
### 3.4.1 Ethernet Cable Connections

The Redline outdoor Ethernet cable is terminated with a non-hooded RJ-45 connector. This connects to the mating RJ-45 connector located inside the RDL-3000 enclosure. When connecting the outdoor Ethernet cable to the RDL-3000, ensure the RJ-45 plug is fully inserted and locked into the socket.

When inserting the RJ-45 plug into the mating socket, you should hear an audible click from the locking mechanism. Ensure the connector is locked before sealing and weatherproofing the RDL-3000 Ethernet port.

#### Assembling the Ethernet Weatherproof Connector

The Ethernet port is protected by a weatherproof connector. The Ethernet cable must be threaded through the connector components and the connector re-assembled. When assembled correctly, the Ethernet port seal is water-resistant.



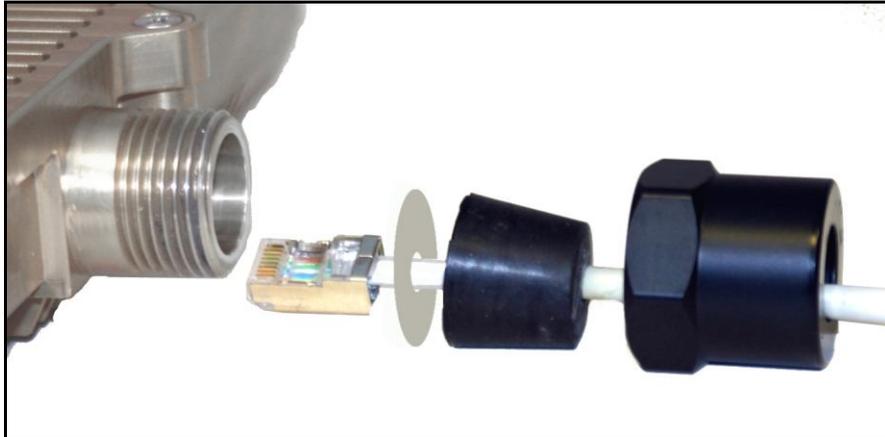
**Figure 24: Procedures - Ethernet Port - Weatherproof Connector Assembly Drawing**

Use the following steps to connect the Ethernet cable to the RDL-3000 unit.

1. Remove the large threaded nut (4) and split rubberized gasket (3) from the RDL-3000 Ethernet port.
2. Thread the Ethernet cable (5) through the large nut. The threaded end of the nut (4) must be oriented towards the connector end of the Ethernet cable.
3. Fit the split rubberized gasket (3) over the Ethernet cable (5) about 15 cm (6 in) from the end of the cable. The larger end of the gasket must be oriented towards the connector end of the Ethernet cable.
4. Fit the split metal washer (2) over the Ethernet cable (5) about 15 cm (6 in) from the end of the cable and position against the rubberized gasket.
5. Connect the RJ-45 connector (1) to the mating connector on the RDL-3000. This connector is located inside the Ethernet port opening.
6. Slide the split rubberized gasket and metal washer along the Ethernet cable and position tightly against the RDL-3000 port.

7. Apply a small amount of grease to the nut threads (4) and replace the nut on the RDL-3000. The threaded nut (4) must be finger-tight plus 1/8th turn only -- excessive force may damage the connector or defeat the waterproof seal.
8. Waterproof the Ethernet port (see instructions on following page).

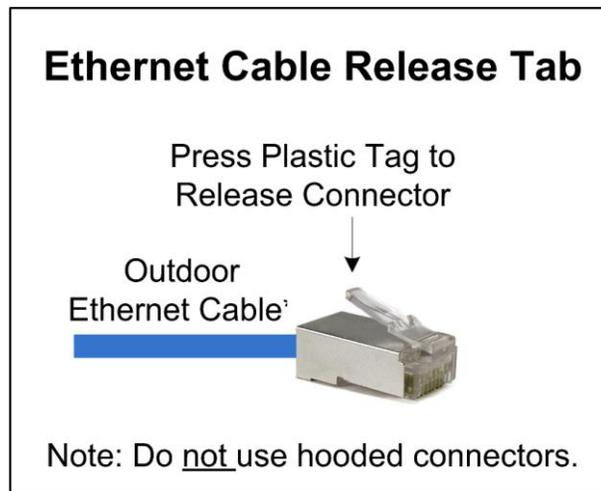
**Important:** The assembled connector must be finger-tight plus 1/8th turn only. Use the correct tool for final tightening.



**Figure 25: Procedures - Ethernet Port - Weatherproof Connector Components**

### Disconnecting the Ethernet Cable

The RJ-45 connector is recessed within the RDL-3000 chassis. To disconnect the Ethernet cable from the RDL-3000, you must release the locking tab located in the chassis recess. Carefully lift the tab to release the RJ-45 connector.



**Figure 26: Procedures - Ethernet Port - Ethernet Connector Locking Tab**

#### **⚠ CAUTION Ethernet Cable Removal**

- Use of excessive force when removing the Ethernet cable will damage the RJ-45 connector and the RDL-3000 printed circuit board.
- Do not insert any tool more than 1/2 inch into the port opening.
- Apply only very light upward pressure to disengage the plastic tab
- Use only a light pull (two fingers) to remove the Ethernet cable.

### Weatherproofing the Ethernet Port

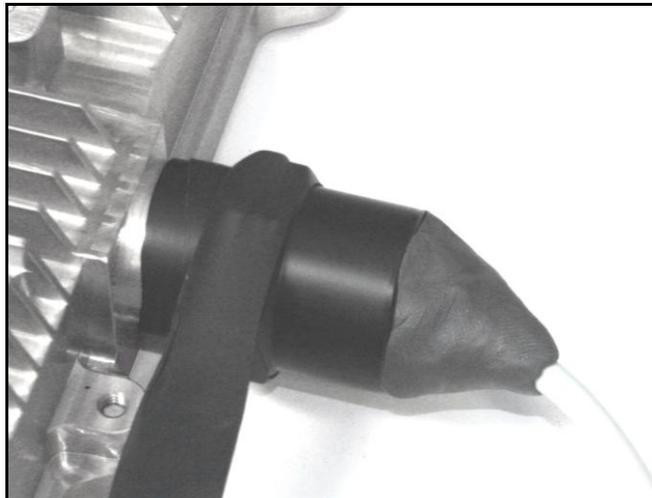
While the Ethernet connection is weatherproof, it is always advisable to provide additional weatherproofing as follows:

1. Work mastic putty well into the end of the nut covering the Ethernet port. This provides strain-relief and an regular surface for applying weatherproofing tape.



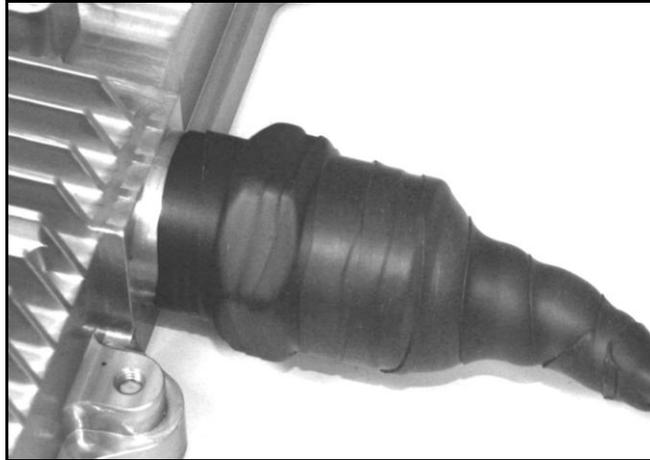
**Figure 27: Procedures - Ethernet Port - Weatherproofing Pt-1**

2. Wrap the splicing tape over the connector and cable. Start as close as possible to the RDL-3000 body. Stretch and wind the tape back along the Ethernet port nut, ensuring there are no gaps in the tape.



**Figure 28: Procedures - Ethernet Port - Weatherproofing Pt-2**

Continue to wrap the tape tightly along the cable complete the seal.



**Figure 29: Procedures - Ethernet Port - Weatherproofing Pt-3**

This completes the weatherproofing procedure.

### 3.4.2 Ethernet Surge Protection

This section describes the steps required to install the Ethernet line protector. The primary unit should be mounted as close as possible to where the Ethernet cable enters the building/shelter, on a plate or bulkhead panel that is bonded to an earth-ground system. It is recommended to pre-wire the LP device and test all connections before final outdoor installation.

**CAUTION** Do not install during adverse weather conditions when the threat of a lightning strike is possible.

#### Installing the Ethernet Line Protector (LP) Unit

Connect the LP unit according to the direction it is labeled:

SURGE: Connection to outdoor RDL-3000

PROTECTED: Connection to indoor PoE.

Do not switch Ethernet wires coming in and going out. For –IG (isolated ground) units, the connections are marked 2 X FEED and 2 X RTN (RETURN). The LP unit may be mounted/grounded on a nearby plate or bulkhead panel that is bonded to an earth-ground system.

1. Ground the chassis of the line protector with the provided 2 X 8-32 screws.
2. Terminal Block:
  - Wire gauge: 22-26 AWG
  - Wire strip length: 0.25"
  - Impact Tool (110 Connect): AMP 569994-1, AT&T D-814, or Krone universal wire insertion tool.
  - Screw-type terminal block: Use tightening torque 0.25 N-m (2.21 lb-in).
3. Lid:
  - Gasket: Ensure neoprene gasket is not loose and is properly fitted in groove.
  - Fasteners: 4 X M4 X 20 mm screws
  - Tightening torque 1.24 N-m (11 lb-in).

4. Outdoor Units:

Ensure all conduit fittings are correctly torqued and have O-rings to ensure environmental seal.

**CAUTION** For correct operation, it is very important that the line protector is properly connected to a low impedance (low R and low L) ground system.

Table 11: Procedures - Ethernet Line Protector - Wiring Diagram				
Terminal.	Signal	Color Code	Pair	Identification
1	Rx +		2	White / Orange Stripe
2	Rx -		2	Orange (/White Stripe)
3	Tx +		3	White / Green Stripe
4	Tx -		3	Green (/ White Stripe)
5	48 (+)		1	Blue (/ White Stripe)
6	48 (+)		1	White / Blue Stripe
7	48 (-)		4	White / Brown Stripe
8	48 (-)		4	Brown (/ White Stripe)

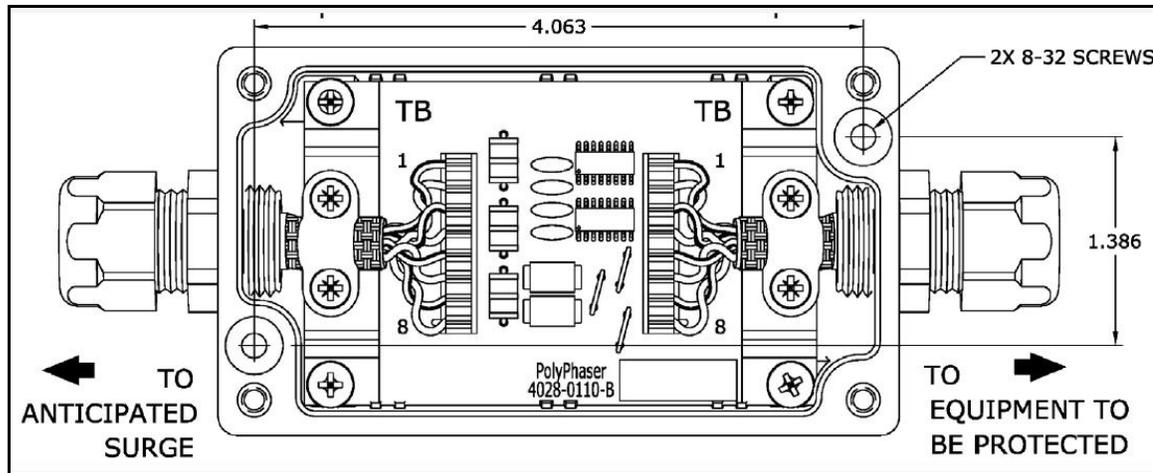


Figure 30: Procedures - Ethernet Line Protector - Identifying Terminal Connectors

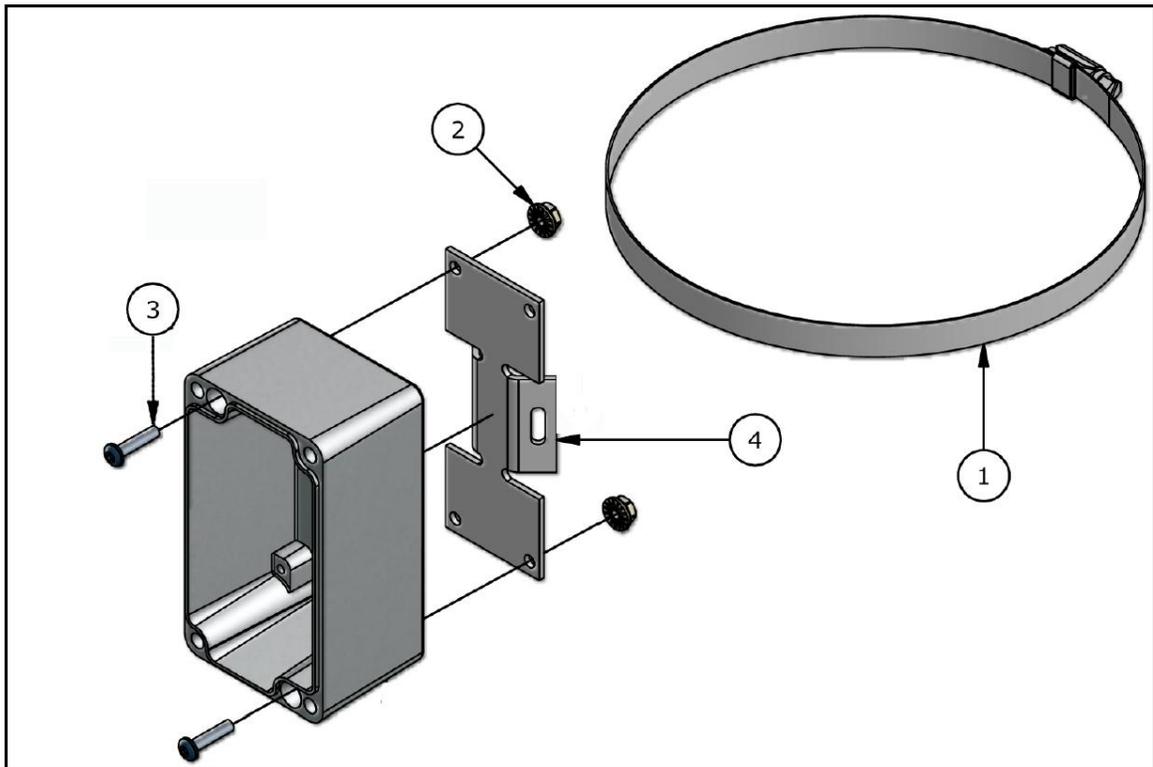
Note: Terminal block assignment is identical for both screw-type and 110Connect.

### Installing the LP Mast Mount Kit

The LP mast mount kit can be used to mount the surge protector device to a 51 to 177 mm (2 to 7 in) mast.

*Note: The Polyphaser IX-PLMNT Pole-Kit kit is not available directly from Redline, and must be ordered separately (if required) from a telecom equipment distributor.*

1. Align assembly bracket (4) mounting holes with mounting holes at the bottom of the mounting box.
2. Insert screws (3) through the mounting box, and assembly bracket (4) and secure with #8 flange nut (2).
3. Slide hose clamp (1) through both slotted grooves of bracket (4), secure hose clamp to mast.



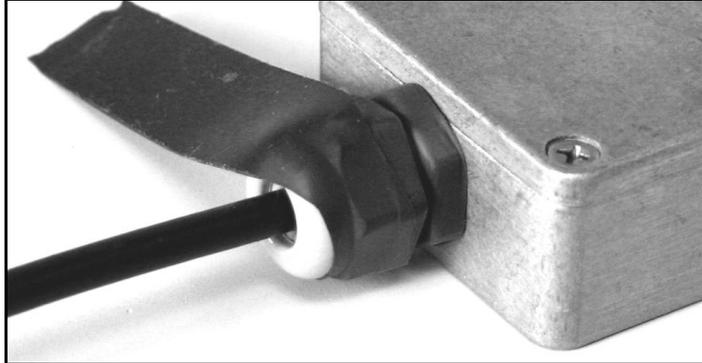
**Figure 31: Procedures - Ethernet Surge Protection - Mast Mounting Kit**

Table 12: Procedures - Ethernet Line Protector - Mounting Kit Parts List		
Item	Qty	Description
1	1	Metal Hose Clamp: 51 to 177 mm (2 to 7 in)
2	2	8-32 Hex HD Flange Nut 18-8 SS
3	2	8-32 Screw 3/4" Phillips Pan SS
4	1	Mounting Bracket Al

### Weatherproofing the LP Ports

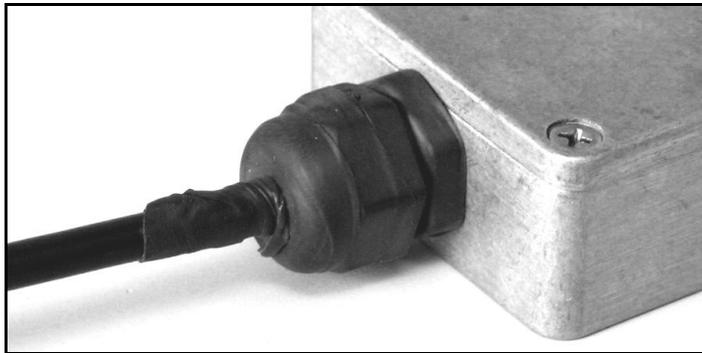
It is important to weatherproof both ends of the line protection unit.

1. Begin to wrap the splicing tape. Start as close to the LP housing as possible. Stretch and wind the tape back along the connector housing making very sure there are no gaps in the tape.



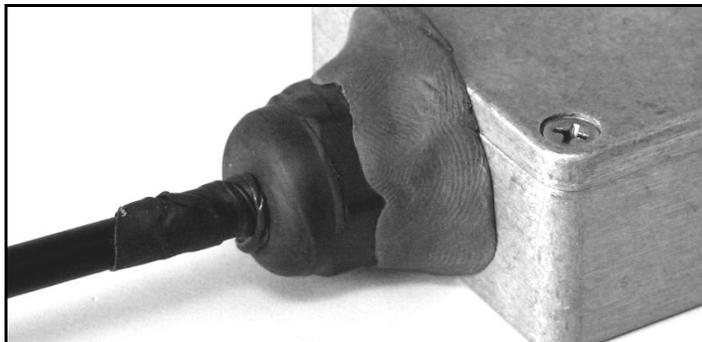
**Figure 32: Procedures - Ethernet Surge Protector - Weatherproofing Pt-1**

2. Continue to wrap the tape tightly along the cable.



**Figure 33: Procedures - Ethernet Surge Protector - Weatherproofing Pt-2**

3. Work the mastic putty into the area between the connector and the body of the LP. Continue to work the putty to ensure a watertight seal.



**Figure 34: Procedures - Ethernet Surge Protector - Weatherproofing Pt-3**

4. Repeat this procedure for both cable connections to the LP.

**3.4.3 Indoor PoE**

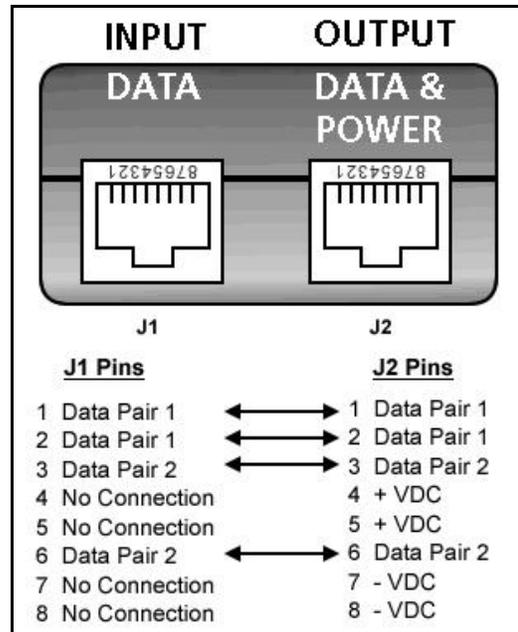
The PoE adapter provides operational power for the RDL-3000 and the Ethernet connection to the wireless interface.

1. Connect the Ethernet outdoor cable from the RDL-3000 to the OUTPUT (DATA & POWER) port on the PoE power adapter.
2. Connect the test PC or network connection to the INPUT (DATA) port of the PoE power adapter.
3. Connect the PoE power adapter to a compatible power source.

**⚠ 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 the RDL-3000 can be safely connected to the PoE OUTPUT (DATA & POWER) port. Customer premises Ethernet equipment may be damaged if connected directly to the PoE OUTPUT (DATA & POWER) port.



**Figure 35: Procedures - Ethernet PoE - Indoor Power Module Pinout**

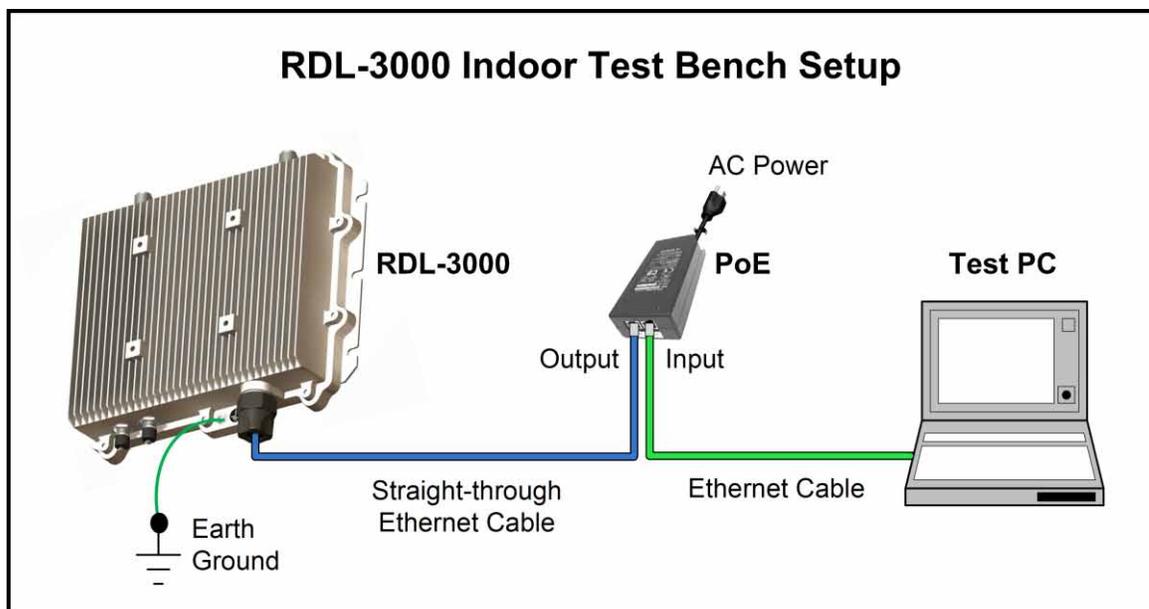
## 3.5 Configuration

Use the following steps to setup a basic link between the PMP sector controller and a single subscriber:

1. Setup the test PC and login to the Web or CLI management interface.
2. Factory reset the RDL-3000
3. Enter the options keys
4. Configure the basic wireless parameters
5. Provision a Link, Service, and Service Group

### 3.5.1 Step 1: Login to RDL-3000

The RDL-3000 can be configured and monitored using Telnet or a standard Web browser (e.g., Internet Explorer 6.0 or higher). The following procedures require a PC equipped with a Web browser, Ethernet port, and an Ethernet Cat-5e crossover cable for connecting the PC to the PoE power adapter.



**Figure 36: Procedures - Basic Wiring Configuration for Web/Telnet Access**

The IP address of the test PC must be on the same subnet as the RDL-3000. For example:

IP address = 192.168.25.11

Net Mask = 255.255.255.0

## Telnet Access

Use the following steps to establish a Telnet session with the RDL-3000. Refer to the *RDL-3000 User Manual* section 5: *CLI Interface* for a description of the CLI commands.

1. On the PC, open a Telnet client and enter the unit IP address. The RDL-3000 factory default IP is '192.168.25.2'.
2. Login to the RDL-3000 using the assigned username and password. The default username is 'admin', and the default password is 'admin'.

For example,

```
telnet 192.168.25.2
username: admin
password: *****
```

## Web Browser

Use the following steps to establish a Web session with the RDL-3000. Refer to the *RDL-3000 User Manual* section 4: *Web Interface* for a complete description of the available screens and features.

1. On the PC, open a browser and enter the unit RDL-3000 IP address in the browser address bar. The factory default IP address is 192.168.25.2.
2. Login to the RDL-3000 using the assigned username and password. The default username is 'admin', and the default password is 'admin'.



**Figure 37: Procedures - Configuration - Login Screen**

### 3.5.2 Step 2: Restore Default Settings

When first deploying an RDL-3000, it is recommended to perform a factory reset to initialize the system parameters. Refer to the '*Diagnostics and Troubleshooting*' chapter of the *RDL-3000 User Manual* for information about the default settings.

#### Factory Reset

##### Web:

1. Login to the RDL-3000 Web interface
2. Click [Configuration->Factory Defaults](#)

##### Telnet:

1. Login to the RDL-3000 Telnet interface
2. Enter the command:  
save defaultconfig

### Long Reset

If the IP address, username or password of the RDL-3000 is unknown, use the 'long reset' procedure to access the Web or Telnet interface:

1. Power-cycle the unit on for 10 seconds, off for 5 seconds, and then on.
2. Wait 75 to 80 seconds and then use a browser or Telnet to login. Use the default user account 'admin' and password 'admin'.
3. Modify settings as required and reboot the RDL-3000 to restore normal operation.

### 3.5.3 Step 3: Install Options Key

Options keys (a string of numbers, letters, and dashes) enable RDL-3000 features including the maximum uncoded burst rate (UBR) and frequency ranges. Options keys are encoded based MAC address, making each key unique to a specific RDL-3000. The options key enables specific system parameters and must be entered before the RDL-3000 can be fully configured.

#### Operation with No Options Key

Prior to installing an options key, the RDL-3000 will only operate in PMP SS mode (subscriber). At a minimum, the operator must obtain and install at least one permanent or temporary options key before it is possible to deploy and test a wireless link. For example:

Table 13: Procedures - Operation with No Options Key	
Parameter	Setting
Mode	PMP SS
Channel	10 MHz
UBR	3 Mbps
DFS	Permanently enabled
Max PIR	1 Mb/s
VLAN Data	Disabled
VLAN Mgmt	Disabled
Encryption	Disabled
RF Frequency* (MHz)	T502: 3300-3800, 3650-3700, 4400-5000, 4940-4990, 5150-5250, 5495-5600, 5650-5725, 5725-5795, 5815-5850

*Note: The factory default setting for Auto Scan is 'disabled'.*

### Enter Permanent Options Key

A permanent options key must be installed before the RDL-3000 is placed in-service.

1. Use a Web browser to login to the RDL-3000. You must login as administrator.
2. Click **Utilities** -> **Product Options** to display the Product Options screen.
3. Enter a valid permanent or temporary options key in the Options Key 1 field.
4. Click **Activate** to enable the new features (does not require reboot).

Telnet may also be used to install an options key. Refer to the *CLI Interface* section of the *RDL-3000 User Manual* for a description of the commands.

Figure 38: Procedures - Configuration - Product Options Screen

3.5.4 Step 4: Required Wireless Settings

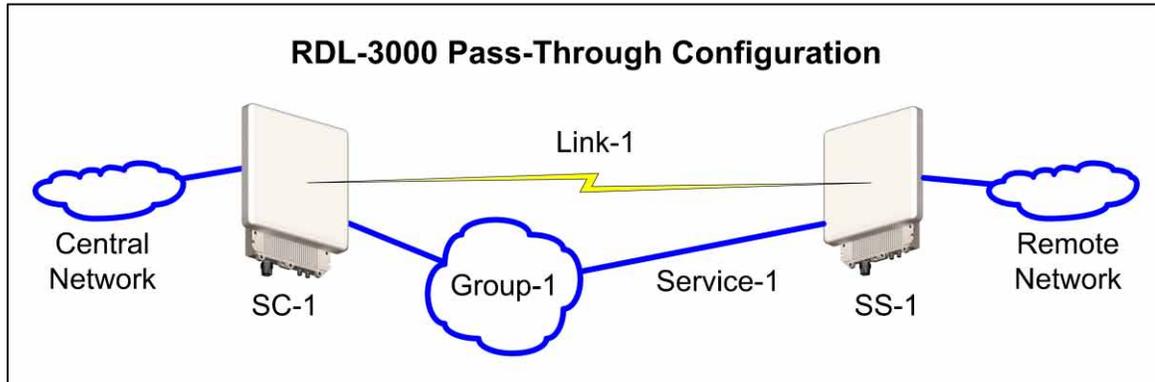
Review and adjust the following parameters as required. Refer to the site survey information.

Table 14: Procedures - RDL-3000 Parameter Settings					
Step	Screen	Parameter	Ref.	Sector Controller	Subscriber
1	Utilities ->Product Options	Options Key	RF Plan	Enable PMP SC mode, RF freq., etc.	Enable PMP SS mode, RF freq., etc.
2	Configuration ->System	System Name	Net. Plan	Name for SC	Name for SS
		IP Address	Net. Plan	IP address for SC	IP address for SS
3	Configuration ->Wireless	System Mode	RF Plan	PMP SC	PMP SS
		Channel Width	RF Plan	Use the same setting for SC and SS.	
		RF Freq.	RF Plan	Use the same setting for SC and SS.	
		Tx Power	RF Plan	Refer to RF Plan	Refer to RF Plan
		Max. Distance	RF Plan	Refer to RF Plan	N/A
		Antenna Gain <sup>1</sup>	RF Plan	See Mfg. Spec. <sup>1</sup>	See Mfg. Spec. <sup>1</sup>
4	Provisioning ->Subscriber Links	Subscriber MAC	RF Plan	MAC address of each subscriber in the sector.	N/A

Notes: 1. DFS enabled systems only.

### 3.5.5 Step 5: Create and Enable a Wireless Link

Using the Provisioning menu, the operator must configure at least one Link, Service, and Service Group before the sector controller can establish a wireless link, measure signal strength (e.g., RSSI and SINADR), and pass Ethernet traffic. All provisioning settings are made on the sector controller (PMP SC).



**Figure 39: Procedures - RDL-3000 Basic Pass-Through Configuration**

Use the following steps to set up a 'Pass through' configuration (no VLAN support) and have the RDL-3000 system transparently pass all Ethernet traffic. The steps must be performed in the order they are listed.

#### Add a Subscriber Link

Create a Subscriber Link named 'Link-1' and configure the wireless link.

1. Click Provisioning->New Subscriber Link in the main menu.
  2. Enter data for the following fields:
  3. Link Name: Link-1
  4. **Peer MAC:** [Subscriber MAC address]
  5. Use defaults for all other fields.
  6. Click **Apply** to activate these settings.
  7. Click **Save All** in the main menu to save changes to the provisioning configuration.
- Repeat these steps to add additional links if required.

#### Add a Service Group

Create a Service Group named 'Group-1' to forward all Ethernet traffic received on the sector controller Ethernet port.

1. Click **Configuration->Service Group** in the web page main menu.
2. Click the **Add New** button and enter data for the following fields:
3. **Name:** Group-1
4. **Tagging mode:** Pass-through
5. **SC Ethernet Enable:** Click to check the box .
6. Use defaults for all other fields.
7. Click **Apply** to activate this Service Group.
8. Click **Save All** in the main menu to save changes to the provisioning configuration.

### Add a Service

This step enables the subscriber to forward all Ethernet traffic received on the subscriber Ethernet port.

1. Click **Provisioning -> New Service** in the web page main menu.
2. Enter data for the following fields:
3. **Name:** Service-1
4. **Tagging mode:** Pass-through
5. Use defaults for all other fields.
6. Click **Apply** to activate this Service.
7. Click **Save All** in the main menu to permanently save all changes to the provisioning configuration.

The system is now configured to transparently pass Ethernet traffic over the wireless interface.

**Note:** *If additional Links and Service Groups are added, it will be necessary to choose the parent Link and parent Service Group when adding each new Service.*

## 3.6 Antenna Alignment

This section describes fine alignment of the RDL-3000 antennas using the RSSI readings available from the sector controller and the subscriber. It is recommended that subscribers, especially those using high-gain antennas, be fine-adjusted using the RSSI measurements. The sector controller antenna requires only general alignment.

 **Important:** The RDL-3000 can measure the RSSI only after a wireless link has been established with a subscriber. To establish each wireless link, the operator must configure a Link, Service Group, and Service for that subscriber.

### 3.6.1 Coarse Antenna Alignment

Antenna alignment is essential to obtain maximum performance from a wireless link. Antenna misalignment results in weaker receive signal strength and it may not be possible to establish the wireless link.

The alignment must be performed in both the azimuth and elevation planes. Before installing the equipment, obtain accurate antenna pointing azimuth and elevation angles for each installation site (see page 12). This will allow approximate alignment of antennas by using GPS or magnetic compass.

*Note: A metal tower will affect the accuracy of a magnetic compass. There is also a difference between true North and Magnetic North (magnetic declination).*

#### Azimuth Alignment

Use a magnetic or GPS compass to obtain the approximate azimuth direction. The azimuth is aligned by loosening the bolts on the pipe bracket and rotating the antenna around the pole.

#### Elevation Alignment

Most link budget plans will specify an elevation of zero degrees. The antenna can be set to vertically using a bubble (spirit) level as shown in Figure 40 below. This method is not accurate for elevation settings of greater than 5 degrees. To adjust the elevation, loosen the appropriate bolts of the mounting bracket.



**Figure 40: Procedures - Antenna Alignment - Zero the Antenna Elevation Plane**

### 3.6.2 Antenna Medium Adjustment Using the Audible Adjustment Tool

Following the basic (coarse) antenna alignment, additional adjustment can be made using the audible alignment buzzer in the RDL-3000. A faster repetition rate of the buzzer sound indicates a stronger signal being received from the remote-end transmitter. Adjust the RDL-3000 antenna using relatively small changes in first the elevation, and then in the azimuth to obtain the fastest repetition rate. The audible alignment buzzer is normally turned off and must be enabled using a Web browser or Telnet session. Use the following steps to enable or disable the buzzer.

#### Web:

1. Start a Web browser on the test PC, enter the RDL-3000 IP address in the address bar, and login to the RDL-3000.
2. Click **Configure** -> **Wireless** in the left hand menu.
3. Locate the field **Antenna Alignment Buzzer Enable** (bottom of screen) and click in the box to enable this feature. A checkmark () indicates the buzzer is enabled.
4. Click the **Apply** button (bottom of screen) to activate this change. The audible alignment signal will remain active until this field is disabled (click to uncheck), or the RDL-3000 is rebooted/power-cycled.

#### CLI:

1. Open a Telnet session on the test PC and login to the RDL-3000.
2. Use the following command to enable the audible alignment tool. The audible alignment signal remains active until this field is disabled.  
set buzzer on  
apply
3. When alignment is complete, use the following command to disable the audible alignment tool or reboot/power-cycle the RDL-3000.  
set buzzer off  
save config

### 3.6.3 Antenna Fine Alignment Using RSSI and SINADR

Fine antenna adjustments can be made based on RSSI and SINADR measurements reported by the RDL-3000. This information is available on the RDL-3000 Web interface:

Sector Controller: Subscriber Links Summary screen

Subscriber: System Link Status screen or Web Alignment Tool screen

#### **Alignment Procedure**

While monitoring the RSSI readings, slowly adjust the antenna elevation and then azimuth in a broad sweeping pattern. While sweeping the antenna, the RSSI value will rise when aligned to a sidelobe, and then fall and rise to the highest reading when the receiver is properly aligned to the main beam. Further movement of the antenna will cause the RSSI to fall and then rise to a lower peak when aligned to another sidelobe. When the alignment is complete, tighten each bolt in a cross-pattern to minimize shifts in the antenna alignment. Tighten all bolts to the recommended torque.

When the alignment sweep has been completed, the measured RSSI value should be checked against the estimated value obtained from the link budget. If the wireless link is line-of-sight (LOS), the measured RSSI value should be within 5 dBm of the calculated value. A lower or fluctuating RSSI value may indicate that the antenna is aligned to a sidelobe. If the RSSI value is much lower than the link budget prediction, this may indicate an optical LOS or non-LOS path.

Note: For non-LOS deployments, a suitable reflecting surface such as a building or billboard must be used. It is necessary to perform vertical and horizontal sweeps of the antenna to determine if the required throughput can be achieved.

**Subscriber Link Status Screen (Subscriber Only)**

Click **Link Status** in the main menu to view the status of the wireless link for this subscriber. Click to expand or to hide fields.

**RSSI:** Received signal strength indicator.

**SINADR:** Average signal to interference, noise, and distortion ratio.

**Subscriber Link Status** Reset

---

**General**

Subscriber Link Name	link1
Subscriber Link ID	6
Subscriber MAC	00:09:02:01:55:3d
Active	Yes
Link Up Time	2 days, 1 h, 15 min, 3 sec
Link Lost Count	0
Status Code	0x0000
Active Subscriber Services	2
Data Link Condition	On

**Wireless**

	Downlink	Uplink
Burst Rate	54 Mb/s	54 Mb/s
RSSI	-45 dBm	-35 dBm
SINADR	28	27
Lost Frames	0	245
PIR	50000	50000

**Wireless Packets**

	Downlink	Uplink
Total	2976107	3157676
Retransmitted	0	5
Lost	0	0

Refresh

**Figure 41: Procedures - Subscriber Link Status Screen**

**Subscriber Links Summary Screen (Sector Controller Only)**

Click **Links Summary** in the main menu (SC) to view the status of all wireless links. This screen is available only on subscriber units.

**Subscriber Links Summary**

Name	ID/Status	SINADR [dB]		RSSI [dBm]		BurstRate [Mb/s]		Total Wireless Packets		Retransmitted Wireless Packets	
		DL	UL	DL	UL	DL	UL	DL	UL	DL	UL
link-171	4	0	0	-88	-88	54	54	0	0	0	0
link1	6	28	28	-46	-36	54	54	2970960	3152496	0	5

**Figure 42: Procedures - Subscriber Links Summary Screen**

**SINADR [dB]:** Ratio of the average RF signal strength to interference, noise, and distortion.

**DL:** SINADR reported by the remote end unit.

**UL:** Received signal strength to noise measured by this unit.

**RSSI [dBm]:** Received signal strength indicator.

**DL:** RSSI reported by the remote end unit.

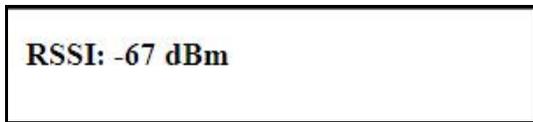
**UL:** Received signal strength measured by this unit.

**Using the Web Alignment Tool (SS Only)**

The Web Alignment Tool HTML page provides continuous RSSI updates to the Web browser on a laptop computer or a Web-enabled handheld device.

1. Start a Web browser on the test PC, enter the RDL-3000 subscriber IP address in the address bar, and login to the RDL-3000.
2. Click **Utilities->Antenna Alignment** to display the RSSI value.

The Web screen is updated automatically at one second intervals.

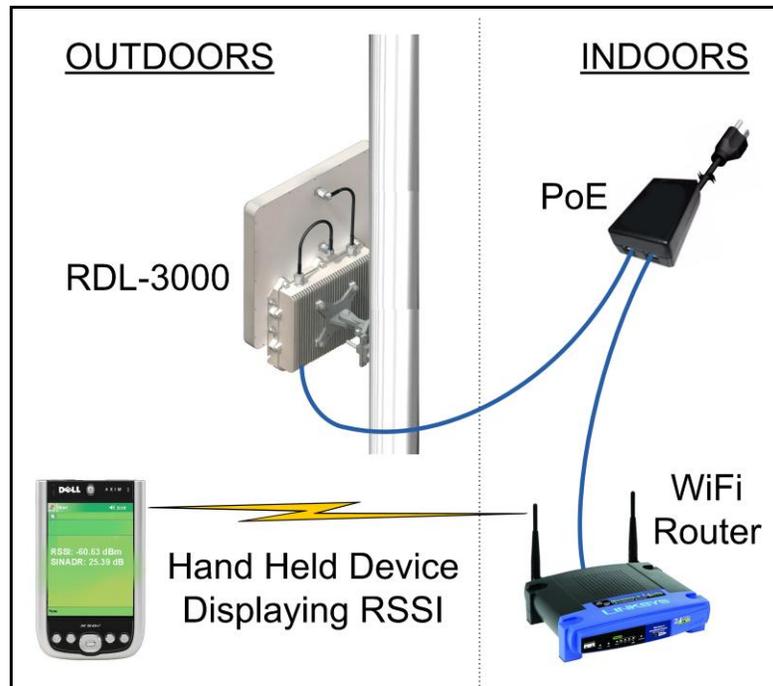


**Figure 43: Procedures - Antenna Alignment Tool Screen**

If Wi-Fi service is available, you may also be able to access the web alignment page directly from a laptop computer and most web-enabled handheld devices using the following URL:

[http://\[RDL-3000 IP Address\]/usr/aa.html](http://[RDL-3000 IP Address]/usr/aa.html)

For example: <http://192.168.20.25/usr/aa.html>



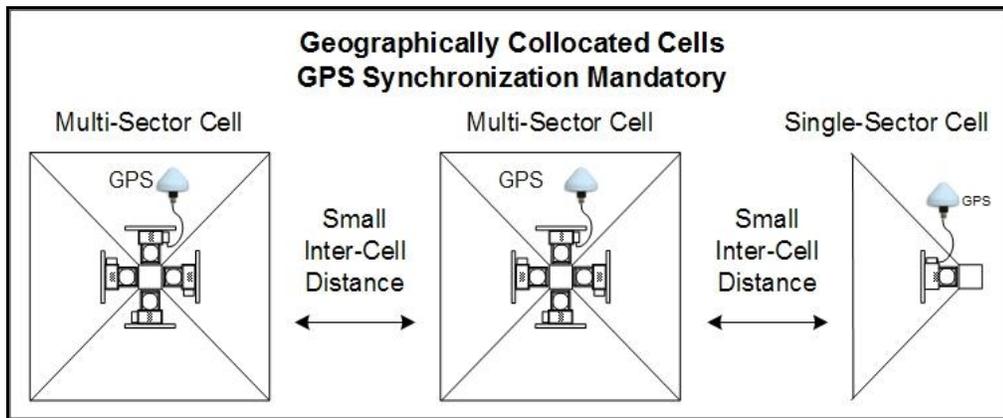
**Figure 44: Procedures - Web Antenna Alignment Tool Using Wi-Fi**

## 4 Synchronization

The RDL-3000 built-in GPS receiver (factory equipped units only) provides an highly accurate clock signal derived from the Navstar Global Positioning System (GPS) satellites. The GPS receivers synchronize the clocks of sector controllers that can not be interconnected directly using the synchronization port.

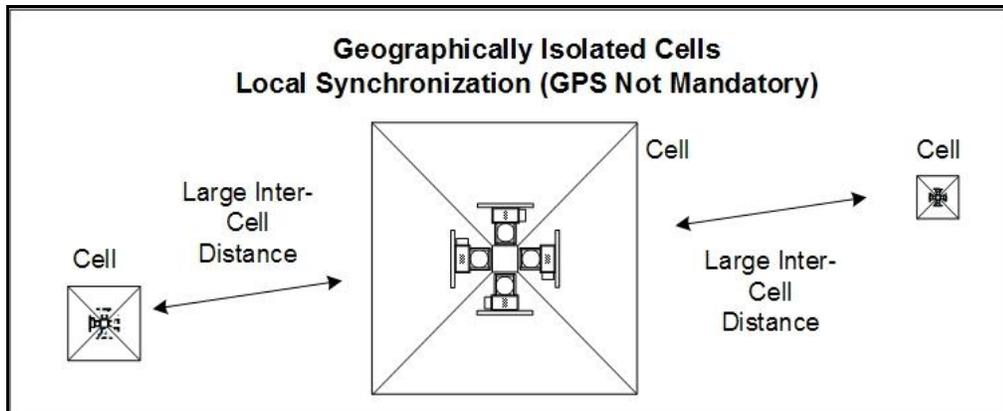
Synchronization is an essential component of a multi-sector wireless deployment. Sector controllers deployed at a common site (collocated), or otherwise operating in close geographical proximity, can produce inter-sector RF interference if the transmit and receive cycles are not synchronized (e.g., one unit is transmitting while another is receiving). This type of RF interference degrades the wireless system performance and may cause service outages.

*Important: A GPS receiver is mandatory at each site that is part of a network of geographically collocated cells (located close enough to introduce RF interference).*



**Figure 45 - Sync - Geographically Collocated RF Cells**

GPS clocks may not be required when adjacent cell sites are sufficiently isolated by distance or geographical features (e.g., mountains).



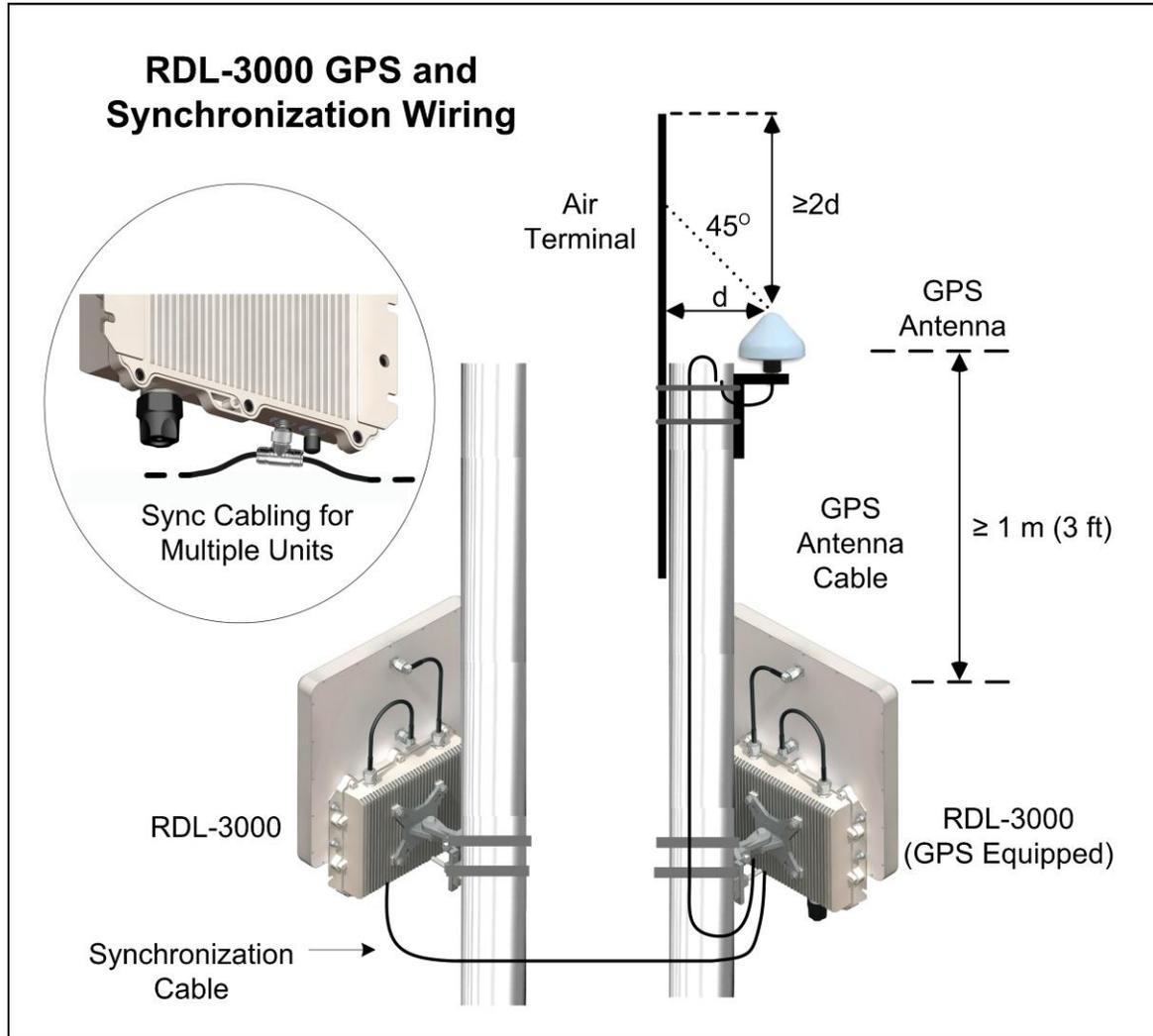
**Figure 46 - Sync - Geographically Isolated RF Cell**

*Note: The GPS module does not set the RDL-3000 internal date/time clock.*

## 4.1 GPS Antenna Installation

The GPS antenna is installed with a standard antenna thread-mounted to an L-shaped bracket, which is strap-clamped to a roof mast or bolted to a flat surface.

An LMR-195 (or equivalent) coaxial cable is used to connect the GPS antenna to the GPS antenna port. The GPS antenna can be located remotely from the RDL-3000 unit by using up to 46 m (~150 ft) of high quality antenna cable.



**Figure 47 - Sync - Collocated RDL-3000 Units**

### 4.1.1 Choosing the GPS Antenna Location

It is important to conduct a site survey before installing the GPS antenna. A poorly installed or badly located GPS antenna may not maintain accurate timing and can also introduce interference into the wireless network and may cause service outages.

Prior to installing the GPS equipment, it is recommended to use a small handheld GPS device to perform a survey for three to six hours. Check readings at regular intervals to confirm that a minimum of three satellites, each having signal levels above 36 dB (post correlation signal to noise (CNo)), are visible at all times

To provide the best coverage, a GPS antenna should be installed at the highest point available at the site. If the GPS antenna is mounted on the same tower as the sector controller, the antenna must be located above the RDL-3000 wireless antenna.

The GPS antenna must have a clear view to approximately ten degrees of the horizon in all directions. Surrounding obstacles such as trees, buildings, etc should not exceed a 20 degree elevation angle. Blockage due to buildings, mountains, etc. should be less than 50% of the sky.

### RF Interference

To avoid the influence of reflected waves, the antenna must not be installed less than 2 m (~6.5 ft) away from metallic objects having dimensions greater than 0.2 m (~8 in). Grounded metal structures may block or reduce the signal from a satellite.

To minimize susceptibility to radio interference, the GPS antenna should generally be located at least 1 m (~3.25 ft) away from antenna systems for any another high frequency system (e.g., microwave, GSM, CDMA, 3G). Avoid mounting the GPS antenna within the main beamwidth of any active (radiating) antenna system.

#### 4.1.2 GPS Antenna Kit

The Redline GPS antenna kit is designed to accommodate most installations. This kit includes the following items:

- GPS Antenna
- 6 m (19.5 ft) LMR-195 50 ohm antenna cable with TNC / M connectors.
- Mounting Hardware

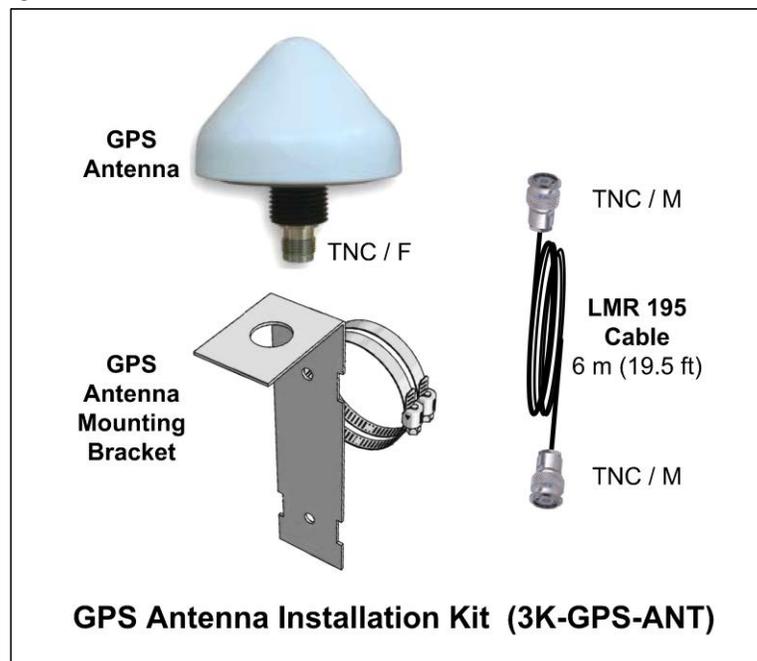


Figure 48 - Sync - GPS Antenna Installation Kit

## 4.2 Synchronize RDL-3000 Units

Sector controllers deployed at a common site (collocated) can produce inter-sector RF interference. All sites where two or more RDL-3000 systems are deployed must use the synchronization feature to minimize potential inter-sector RF interference. This feature minimizes inter-sector interference by synchronizing the transmit cycles of collocated RDL-3000 sector controllers.

A GPS receiver is mandatory for each sector controller site where each site is part of a network of geographically collocated cells that are located close enough to potentially introduce RF interference.

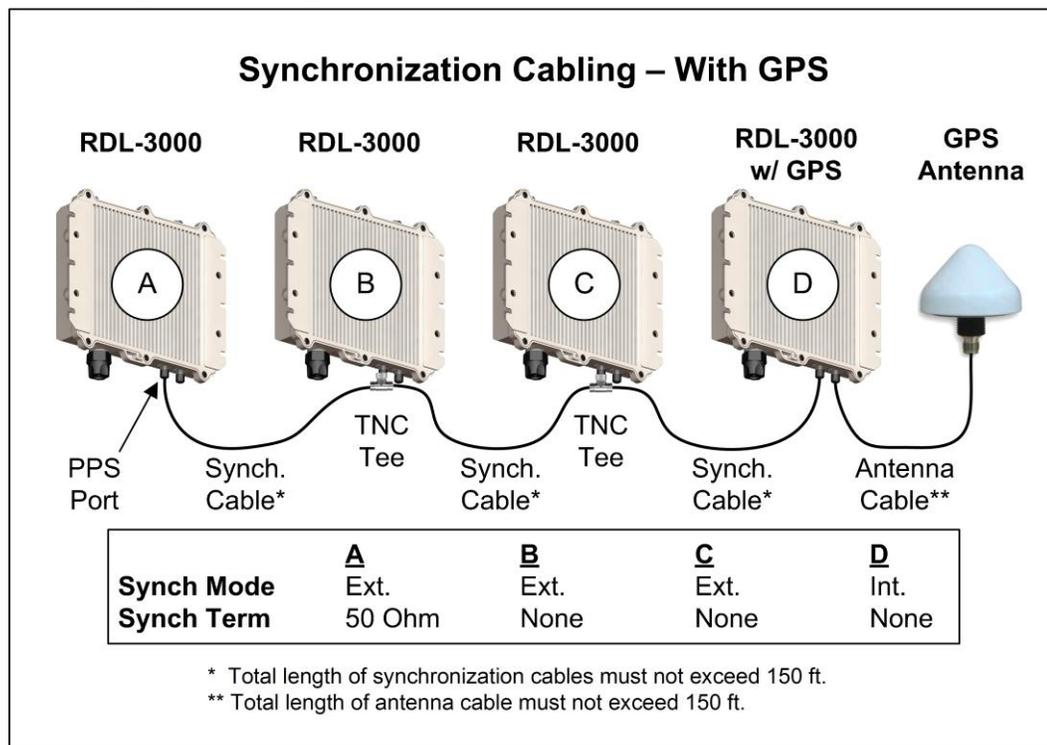
### 4.2.1 Wiring the RDL-3000 for Synchronization

Full synchronization of RDL-3000 sector controllers on an installation site can be achieved only when synchronization cabling is installed between all collocated sector controllers.

*Note: The synchronization wiring is identical for GPS and non GPS installations.*

#### Cables and Connectors

The RDL-3000 PPS ports have TNC / F connectors. The PPS port of all collocated RDL-3000 units must be interconnected using LMR-195 (or equivalent) coaxial cable terminated with TNC / M connectors. Use TNC Tee adapters to connect the RDL-3000 units in a daisy-chain configuration.

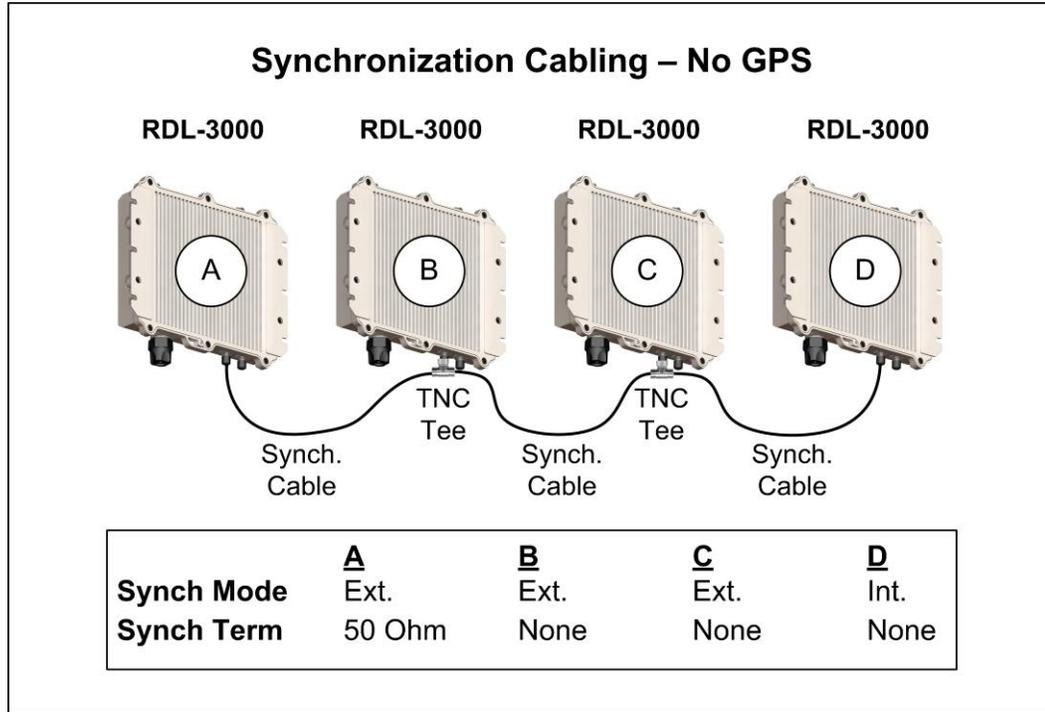


**Figure 49 - Sync - Synchronization Cabling Example - With GPS**

**Important:** Multiple RDL-3000 units can be synchronized using up to 46 m (~150 ft).of interconnecting synchronization cable.

**Termination**

The RDL-3000 has software programmable termination for the PPS port and does not require an external terminator to be installed at the end of the daisy-chain (see configuration information following).

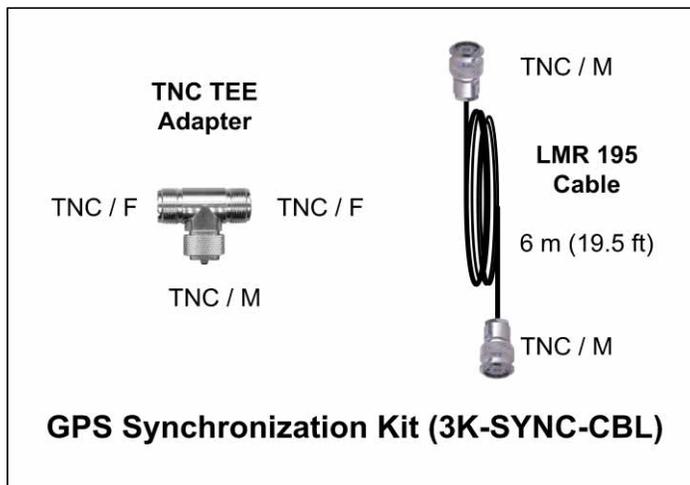


**Figure 50 - Sync - Synchronization Cabling Example - Without GPS**

**Synchronization Cable Kit**

One GPS Synchronization (Cable) Kit is required for each 'sync listener' sector controller. For example, installing four collocated bases stations requires three GPS synchronization cable kits -- one kit for each 'sync listener'. The Redline Synchronization kit is designed to accommodate most installations. This kit includes the following items:

- TNC Tee Adapter
- 6 m (19.5 ft) LMR-195 50 ohm synchronization cable with TNC / M connectors.



**Figure 51 - Sync - Synchronization Cable Kit**

## 4.2.2 Configure Synchronization Settings

Installing the synchronization cabling does not automatically synchronize the RDL-3000 sector controllers. The port settings for the 'sync talker' and each 'sync listener' must be set correctly. Also, all geographically collocated sites must be operating using identical wireless frame and downlink ratio settings. Table 15: Sync - Synchronization Settings describes the configuration settings for each sector controller.

The PPS port (TNC / F) connector is software configurable. Configuration settings can be used to enable or disable the port, set operation as input or output, and set the port termination impedance.

### Sync Talker

Configure one RDL-3000 as the 'sync talker' by enabling the PPS port and setting the synchronization mode to 'internal'. This unit will now transmit synchronization pulses on the PPS port. If GPS is required, the RDL-3000 unit with the GPS receiver installed must be the 'sync talker'.

### Sync Listeners

Configure all other collocated RDL-3000 units as 'sync listeners' by enabling the PPS port and setting the synchronization mode to 'external'.

### Sync Cable Termination

The RDL-3000 'sync listener' that is last in the daisy-chain (no Tee connector) must be set to match the synchronization cable impedance (50 ohm for LMR-195).

Table 15: Sync - Synchronization Settings			
Setting	Sync Talker	Sync Listener	Comment
Fixed Frame	Enabled (☑)		All sector controllers being synchronized <u>must</u> operate in fixed frame mode using the identical settings for the frame size and downlink ratio.
Frame Size	Same for all sector controllers (1 - 20 ms).		
Downlink Ratio	Same for all sector controllers (20 to 80%)		
Synchronization Output	Enabled (☑)		Enable the PPS port on sector controllers collocated at the same site.
Synchronization Mode	Internal	External	Internal: This is the 'sync talker'. The RF transmitter and PPS output are synchronized to the RDL-3000 internal clock. If a GPS module is installed (and tracking) the RF transmitter and PPS output are synchronized to the GPS receiver. External: This is the 'sync listener'. The RF transmitter is synchronized to the signal received on the PPS port.
Synchronization Output Termination	None	See comment	Unit with Sync. Mode = External: None Unit(s) with tee: None Listener without tee: 50 Ohms

## 5 AN-80i Replacement with RDL-3000

This section describes issues related to replacing an in-service AN-80i sector controller with an RDL-3000.

### 5.1 Link IDs

The ID assignments for Links, Service Groups, and Services are restricted to specific ranges. The values are assigned automatically by the RDL-3000 when using the Web interface or CLI to create new entries.

If replacing an in-service AN-80i sector controller with an RDL-3000, it is recommended to save the current AN-80i configuration using the CLI 'script' command, and then load this configuration into the RDL-3000 replacement unit. The RDL-3000 will automatically map the Group and Connection ID numbers to valid Service Group and Service numbers. The AN-80i sector controller must have a maximum of 351 connections.

**Table 16: AN-80i Replacement - RDL-3000 ID Ranges**

Description	ID Range	Total
Links	4-127	123
Service Groups	128-159	31
Services	160-511	351

**Table 17: AN-80i Replacement - AN-80i ID Ranges**

Description	ID Range	Total
Links	4-63	59
Groups	64-95	31
Connections	95-511	416

## 5.2 Other Configuration Settings

The following RDL-3000 parameters require settings that are different from the AN-80i, or do not exist on the AN-80i.

Table 18: AN-80i Replacement - New RDL-3000 CLI Commands				
Description	RDL-3000 CLI Command	Values	AN-80i CLI Command	Values
<b>RDL-3000 Only</b>				
Service DL CIR	set dlcir	50 - 50000	N/A	N/A
Service DL PIR	set dlpir	50 - 50000	N/A	N/A
Downlink Ratio (%)	set dlratio	20 - 80	N/A	N/A
	set encmode	64-bit Redline encryption	1	N/A
Fixed Frame Mode	set fixframe	on, off	N/A	N/A
Framing Cycle (ms)	set framesize	1 - 20	N/A	N/A
Group CIR	set grpcir	50 - 50000	N/A	N/A
Pre-shared key	set pskey	(based on AES option)	N/A	N/A
Scheduling Cycle (ms)	set schcycle	1 - 20	N/A	N/A
Synchronization mode	set syncmode	none, int, ext	N/A	N/A
Sync port mode	set syncout	on, off	N/A	N/A
Sync port impedance (ohms)	set syncterm	none, 50, 75	N/A	N/A
Service UL CIR	set ulcir	50 - 50000	N/A	N/A
Service UL PIR	set ulpir	50 - 50000	N/A	N/A
<b>Modified</b>				
Channel Size	set chsize	5, 10, 20	chwidth	5, 10, 20
<b>Common</b>				
SNMP	set snmp	none, v2, v3	snmp	on, off
Radio	set radio	off, rf1, rf2	radio	on, off

