redline communications

SU-I

RedMAX™ Subscriber Unit Indoors

Installation Guidelines

Copyright Information

Disclaimer

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Software Versions

This user manual describes operation using software release v2.3x and may include references or features that are different or unavailable in previous software releases (refer to product release notes).

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Chapter 1

1 Important Safety & Service Notices

1.1 Models

Models This manual describes the SU-IIR indoor subscriber (SU-I).

1.2 Safety Warnings

1. Do not exceed the described limits on product labels.
2. Position power cords to avoid damage.
3. Use only properly grounded power receptacles.
4. Do not overload wall outlets.
5. Do not place equipment on or near a direct heat source or operate near water or in a wet location.
6. Disconnect power before cleaning and use only a damp cloth for cleaning (no liquid / aerosol cleaners).
7. Disconnect power when product is not in use.
8. It is the user's responsibility to install this device in accordance with the local electrical and building codes.
9. Refer to the subscriber User Manual for a complete description of safety notices and regulatory information for this product.

Attention:
The SU-I front grill is used to dissipate heat and may feel quite warm during normal operation. Avoid direct contact with this feature when handling the SU-I.

1.3 Important 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

1.4 Frequency Selection

1.4.1 General

Operation in the FWA band is subject to license. The radio power and channel frequency selections must be set correctly before the installed system is allowed to transmit. The installed system must comply with all governing local, regional, and national regulations. Contact authorities in the country of installation for complete information regarding the licensing regime and operating restrictions for that regulatory domain.

1.4.2 R&TTE Directive 1999/5/EC Statements

Installation

The transceiver and antenna equipment must be installed by a qualified professional installer and must be installed in compliance with regional, national, and local regulations. It is the responsibility of the system installer and/or system operator to ensure the installed system does not exceed any operational constraints identified by local regulations. Refer to the sections in this product User Guide for detailed information about the correct installation steps to ensure power and frequency settings are set correctly before connecting the antenna. Operation in the 3.4-3.6 GHz band is subject to license. Authorities within the country of installation can provide information regarding the licensing regime and restrictions.

Community Language Declarations

Table 1: Notices - R&TTE: Countries of Use (3.4 GHz & 3.6 GHz)

Country	3400-3600 MHz	Country	3400-3600 MHz	Country	3400-3600 MHz
Austria	✓	Hungary	✓	Poland	✓
Belgium	✓	Iceland	✓	Portugal	✓
Bulgaria	✓	Ireland	✓	Romania	✓
Cyprus		Italy		Slovakia	✓
Czech Republic	✓	Latvia	✓	Slovenia	✓
Denmark	✓	Liechtenstein	✓	Spain	✓
Estonia	✓	Lithuania	✓	Sweden	✓
Finland	✓	Luxembourg	✓	Switzerland	✓
France	✓	Malta	✓	United Kingdom	✓
Germany	✓	Netherlands	✓		
Greece	✓	Norway	✓		

The following table contains community language versions of informal statement in accordance with Article 6.3 of Directive 1999/5/EC.

Table 2: R&TTE - Community Language CE Declarations	
Community language versions of informal statement for inclusion in user information in accordance with Article 6.3 of Directive 1999/5/EC	
Danish	Undertegnede Redline Communications erklærer herved, at følgende udstyr subscriber overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF
Dutch	Hierbij verklaart Redline Communications dat het toestel subscriber in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG
	Bij deze verklaart Redline Communications dat deze subscriber voldoet aan de essentiële eisen en aan de overige relevante bepalingen van Richtlijn 1999/5/EC.
English	Hereby, Redline Communications, declares that this subscriber is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
Finnish	Redline Communications vakuuttaa täten että subscriber tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
French	Par la présente Redline Communications déclare que l'appareil subscriber est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE
	Par la présente, Redline Communications déclare que ce subscriber est conforme aux exigences essentielles et aux autres dispositions de la directive 1999/5/CE qui lui sont applicables
German	Hiermit erklärt Redline Communications, dass sich dieser/diese/dieses subscriber in Übereinstimmung mit den grundlegenden Anforderungen und den anderen relevanten Vorschriften der Richtlinie 1999/5/EG befindet". (BMWi)
	Hiermit erklärt Redline Communications die Übereinstimmung des Gerätes subscriber mit den grundlegenden Anforderungen und den anderen relevanten Festlegungen der Richtlinie 1999/5/EG. (Wien)
Greek	ΜΕ ΣΗΝ ΠΑΡΟΤΣΑ Redline Communications ΔΗΛΩΝΕΙ ΟΣΙ subscriber ΣΤΜΜΟΡΦΩΝΕΣΑΙ ΠΡΟΣ ΣΙΣ ΟΤΣΙΩΔΕΙΣ ΑΠΑΙΣΗΣΕΙΣ ΚΑΙ ΣΙΣ ΛΟΙΠΕΣ ΣΥΕΣΙΚΕΣ ΔΙΑΣΑΞΕΙΣ ΣΗΣ ΟΔΗΓΙΑΣ 1999/5/ΕΚ
Italian	Con la presente Redline Communications dichiara che questo subscriber è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
Portuguese	Redline Communications declara que este subscriber está conforme com os requisitos essenciais e outras provisões da Directiva 1999/5/CE.
Spanish	Por medio de la presente Redline Communications declara que el subscriber cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE
Swedish	Härmed intygar Redline Communications att denna subscriber står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.

1.5 CSA Information

1. The equipment must be properly grounded according with NEC, ICEC, CEC, and others, and other local safety code and building code requirements.
2. 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 caliber minimum de 26 AWG doit être utilisé.

1.6 Information for Use in Canada

Operation is subject to the following two conditions:

1. This device may not cause interference, and
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Usage of this subscriber modem is subject to license within Canada. Operation is restricted to the 200 MHz band from 3.450-3.650 GHz. More information regarding licensing requirements is available from Industry Canada (www.ic.gc.ca).

This device has been designed to operate with an antenna having a maximum gain of 11.3 dBi. Antennas having a higher gain is strictly prohibited per regulations of Industry Canada. The required antenna impedance is 50 ohms.

IMPORTANT NOTE: IC Radiation Exposure Statement

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance. To maintain compliance with IC RF exposure compliance requirements, please avoid direct contact to the transmitting antenna during transmitting.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

SU-IIR (SU-I with integrated antenna): A separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation.

1.7 Important Service Information

1. Refer all repairs to qualified service personnel. Do not remove the covers or modify any part of this device, as this voids the warranty.
2. Disconnect the power to this product and return it for service if the following conditions apply:
   - i) The unit does not function after following the operating instructions outlined in this manual.
   - ii) Liquid has been spilled or a foreign object is inside.
   - iii) The product has been dropped or the housing is damaged.
3. Record the serial number on your registration card for future reference.

1.8 FCC Notice

1. ⚠WARNING -- FCC RF Exposure Warnings

   To satisfy FCC RF exposure requirements for RF transmitting devices, a minimum distance of 25 cm should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operation at closer than this distance is not recommended. The antenna used for this transmitter must not be collocated in conjunction with any other antenna or transmitter.

2. Operation is restricted to the 25 MHz band 3.650-3.675 GHz (restricted contention based protocol for WiMAX devices).

3. FCC Information to Users @ FCC 15.21 & 15.105:

   This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

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

1.9 FCC: Antenna/Tx Power Setting Combinations

FCC regulation part 90.1321 (governing operation in the 3650-3700 MHz band in the US) states that mobile station transmissions are limited to a maximum transmit power of 40 milliwatts/MHz (peak EIRP). The SU-I has been certified for use with the maximum transmit power settings listed in the following table:

Table 3: Notices - FCC: Antenna/Tx Power Setting Combinations

Order Number	Antenna Description	Max. Tx Power GUI Setting (dBm)	
		3.5 MHz Channel	7 MHz Channel
SU-I Integrated	80 degrees, 10.5 dBi, 3.3 - 3.8 GHz, 162 x 88 mm Flat Panel, Vertical or Horizontal Polarization	11	13

Adjustments to the transmit power settings must be made using the Tx power control settings in the rfConfig section of the command line interface (CLI).

1.10 WEEE Product Return Process

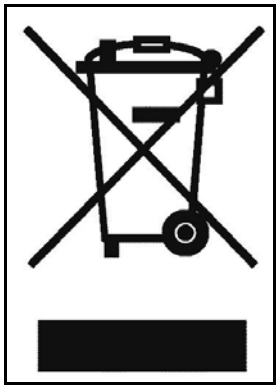

Figure 1: Notices - WEEE Logo

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.

Chapter 2

2 Site Survey Information

Before the installation of the equipment, a site survey should be completed and this data should be available to the installation team. This data will assist the installer to correctly install the SU-I, and to understand the operating characteristics of the SU-I system during configuration and testing.

2.1 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 SU-I will not achieve full operational capability if there is excessive interference on the same or adjacent RF channels.

RF interference may be caused by another wireless system operating on the same or adjacent RF channels. A simple test may be performed using the RF monitoring tool available from Redline. This tool will determine if a selected RF channel is generally free from interference.

2.2 Path Profile

The site survey should identify the optimum location for mounting the SU-I. For maximum performance, there should be a direct line of sight to the receiving wireless system.

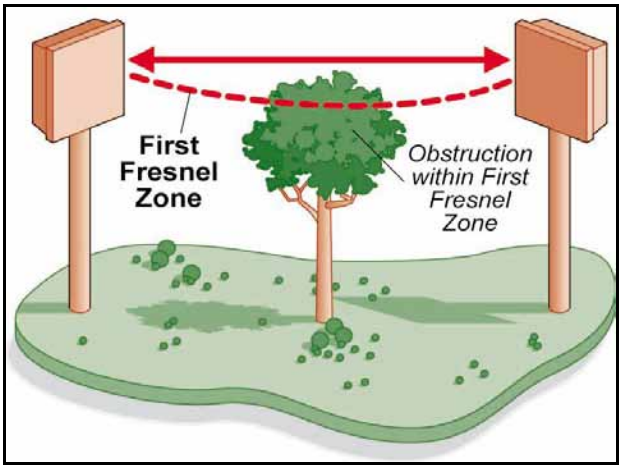

Figure 2: Site Survey - Fresnel Zone Radius

The antenna should be positioned to provide maximum clearance within the first Fresnel zone of the direct path (as high as possible, on either a tall building or tower). A clear line-of-sight (LOS) path requires clearance above natural and man-made objects by at least 60% of the First Fresnel zone.

The SU-I will also function 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.

If the optical path is completely blocked, it may still be possible to establish a non line-of-sight (NLOS) path using reflections and diffraction. A satisfactory multipath RF signal may be obtained by directing the SU-I antenna towards a reflective structure that is also within sight of the sector controller.

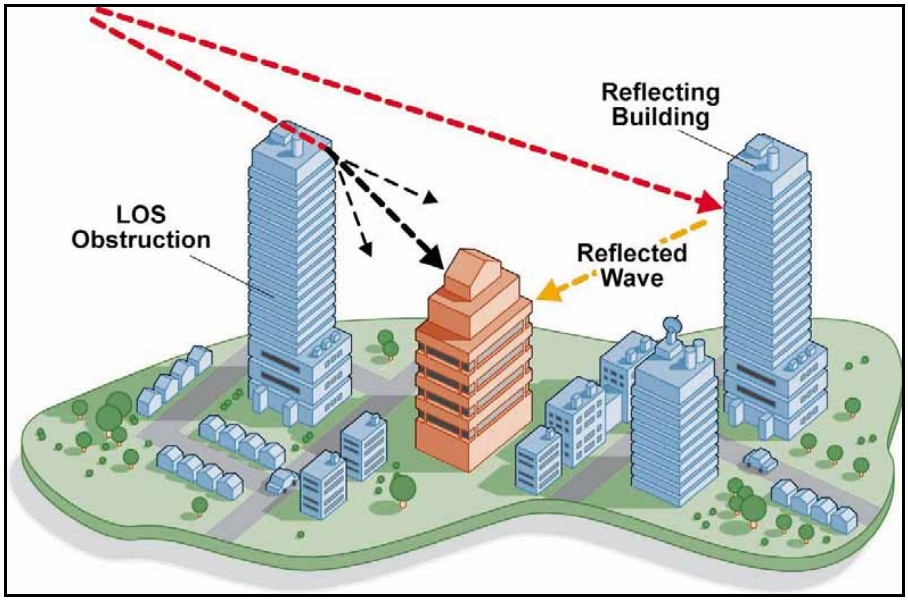

Figure 3: Site Survey - Non-Line of Sight Deployment

The path profile should include the following information:

Table 4: Site Path Profile Data

Antenna	Description
Location	Instructions to identify the location for installing 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	Use the Link Budget tool to determine the expected receive signal strength indication (RSSI).

The expected RSSI value can be determined using the Link Budget Tool from Redline Communications Inc. See the following section for more details.

2.3 Link Budget Tool

After potential mounting locations have been determined, the RF path and link distance are known. The Link Budget Tool developed by Redline will calculate expected performance of the link for a specified range based on the selection of RF channel, power gain, antenna height, etc. This is useful to determine if the proposed locations are suitable for the intended application.

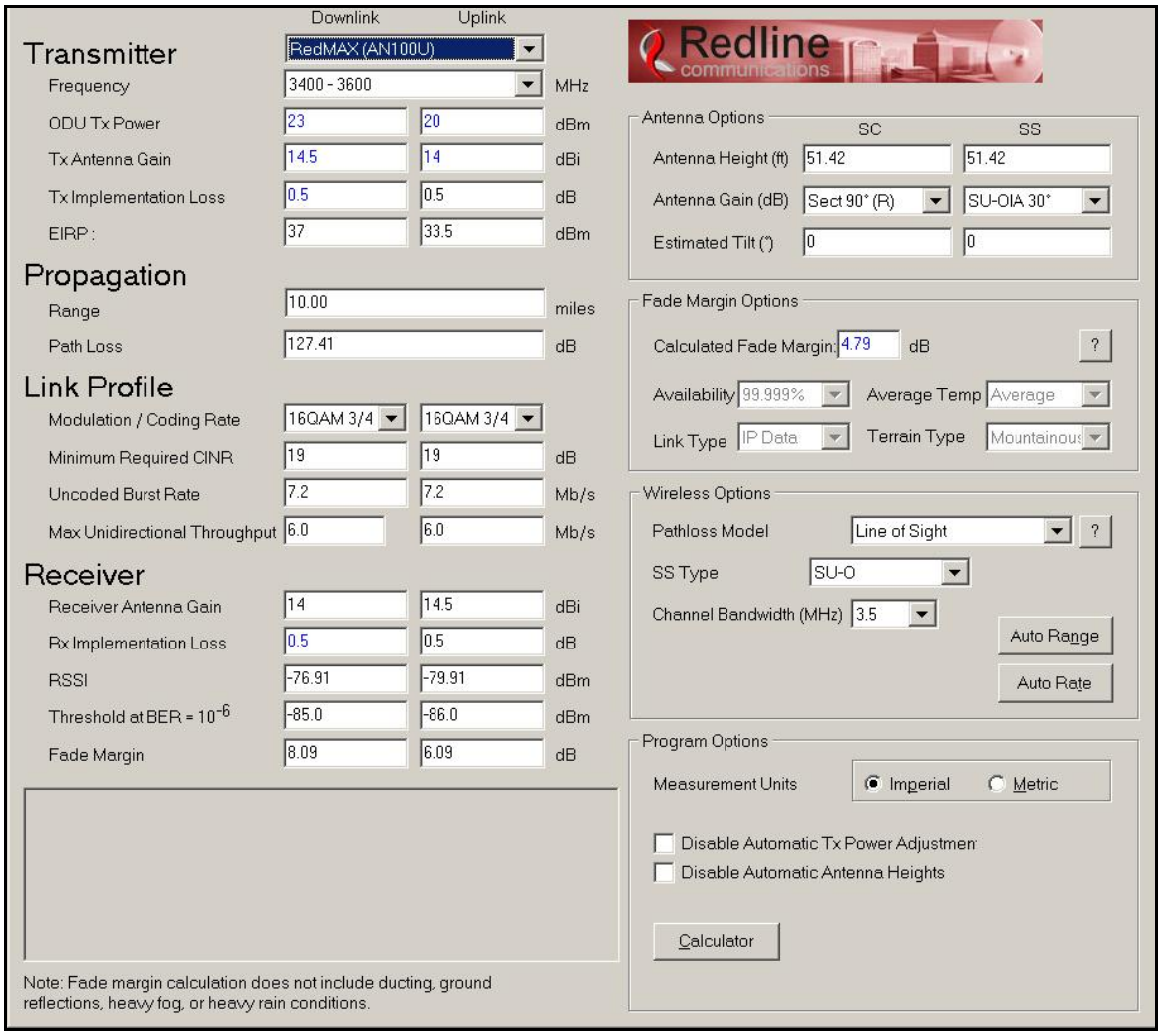

Figure 4: Site Survey - Sample Link Budget Calculation

Chapter 3

3 Installing the Indoor Subscriber

3.1 Introduction

The indoor subscriber is a fully integrated WiMAX Forum Certified™ subscriber unit incorporating an Ethernet interface and wireless interface to a WiMAX base station. Mounting options are available to accommodate desktop, windowsill, and wall mount.

The indoor subscriber is pre-configured for easy self-install. Following proper installation, the WiMAX base station providing coverage for that area will automatically contact the subscriber and configure subscribed services.

Figure 5: Subscriber System Features

3.2 Installation Procedure

Use the steps outlined in the following sections to assemble and commission the subscriber:

1. Unpack subscriber components from the shipping box.
2. Connect power to the subscriber
3. Test for the strongest signal strength:

Vertical  and horizontal  orientation

4. Determine final location for installation.
5. Choose mounting option (desk, window, or wall mount).
6. Connect subscriber to the local network device (PC, router, etc).

3.2.1 Step 1: Unpack Subscriber Components

The following components are supplied with each subscriber:

- subscriber equipped with standard vertical mount base and non-slip feet for tabletop and windowsill mounting.
- Auto-sensing 110-240 VAC (nominal) power supply adapter for indoor use only.
- Horizontal desk mount bracket (assembly required).
- Universal wall mount bracket (optional).

3.2.2 Step 2: Connect Power to subscriber

1. Connect the power adapter to the DC IN port (bottom of subscriber).
2. Connect the power adapter to a 110-240 VAC (nominal) grounded receptacle. The subscriber is not equipped with a power switch and activates immediately when connected to a power source.

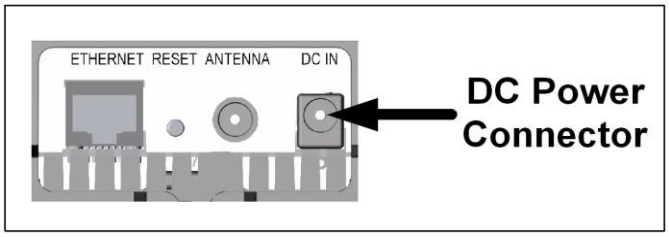

Figure 6: Subscriber System Connections - Power Connector

Note: You do not need an Ethernet cable attached to the subscriber when testing signal strength.

3.2.3 Step 3: Test for Best Signal Strength

The most important factor when installing the subscriber is to find the location where maximum signal strength is detected.

Importance of Strong WAN Signal

Correct antenna alignment is essential in obtaining the maximum performance from the wireless link. A misaligned antenna will decrease the receive signal and can result in a total loss of the connectivity with the base station. Use these procedures to test signal strength at various locations in the room before deciding on the final location to install the subscriber.

Base Station Location

For each subscriber installation, the base station antenna will be located on a tower or building in the area. Knowledge of this location can assist in setting up the SU-I.

The SU-I requires visual line-of-sight (LOS) to receive the best signal, and must typically be located as close as possible to a window. When LOS is not possible from that location, the SU-I may detect base station signals reflected from nearby buildings, or a wall in the room where the SU-I is located.

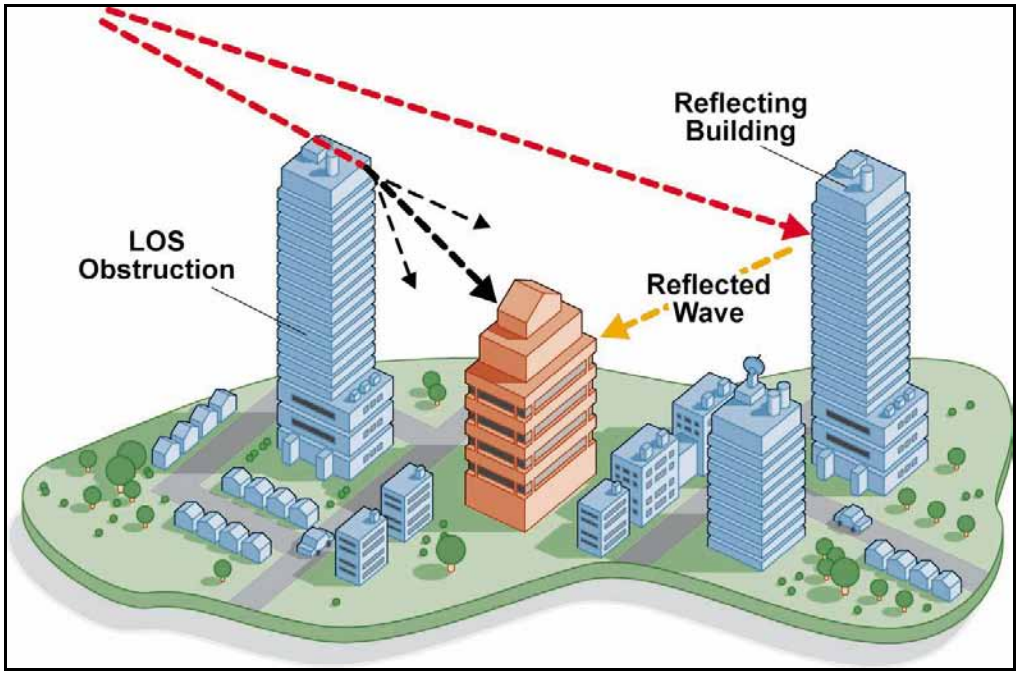

Figure 7: Non-Line of Sight Signal from Base Station

Find the Best Room Location

The SU-I antenna is integrally mounted on the back of the unit. The SU-I must be oriented to have the antenna (rear) pointed towards the signal source or towards a reflecting wall or building.

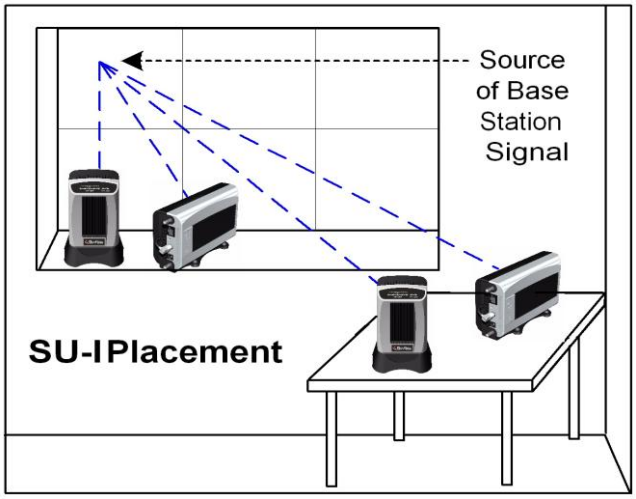

Figure 8: SU-I LED Display

The WAN signal LEDs indicate signal strength. A strong signal is indicated by all WAN signal LEDs being lit. When no signal or a weak signal is detected, only the left LED (-) will be lit. More than 2 LEDs must be lit to exchange information with a base station.

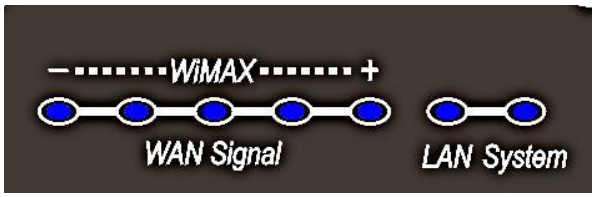

Figure 9: SU-I LED Display

The SU-I is shipped with vertically aligned table mount. Use this orientation first to find the location with the best signal strength.

Find the Best Antenna Position

The SU-I antenna is sensitive to horizontal and vertical orientation (polarized). For the best signal reception, the polarity of the SU-I antenna must match the base station antenna.

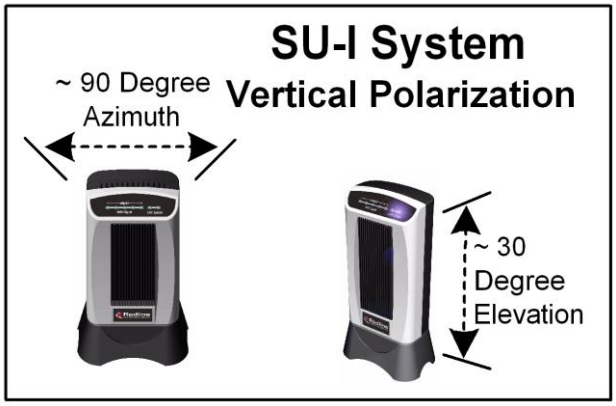

Figure 10: Vertical Antenna Polarization

When you have located the position in the room with the strongest WAN signal, change the orientation of the SU-I from vertical to horizontal and observe the effect (if any) on signal strength. If increased signal strength is detected in the horizontal position, it is recommended to mount the SU-I horizontally.

3.2.4 Step 5: Connect SU-I to Network (LAN Cable)

The final step is to connect a CAT-5E Ethernet cable RJ-45 connector to the Ethernet port located on the bottom of the SU-I. It is recommended to use a flexible Ethernet cable.

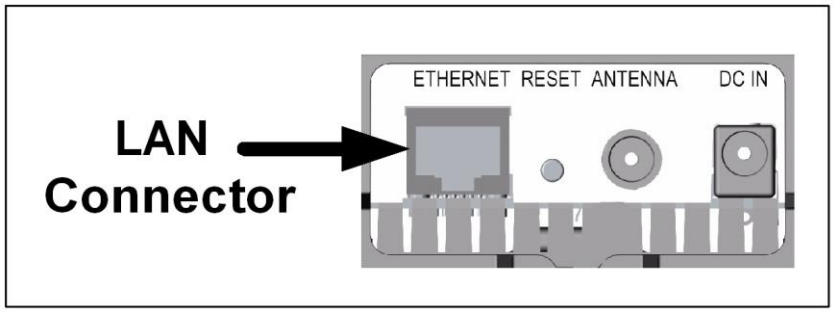

Figure 11: SU-I Ethernet Connector (Under Base)

The Ethernet cable connects the SU-I to the local network device. This can be a laptop PC, router, or other supported network device.

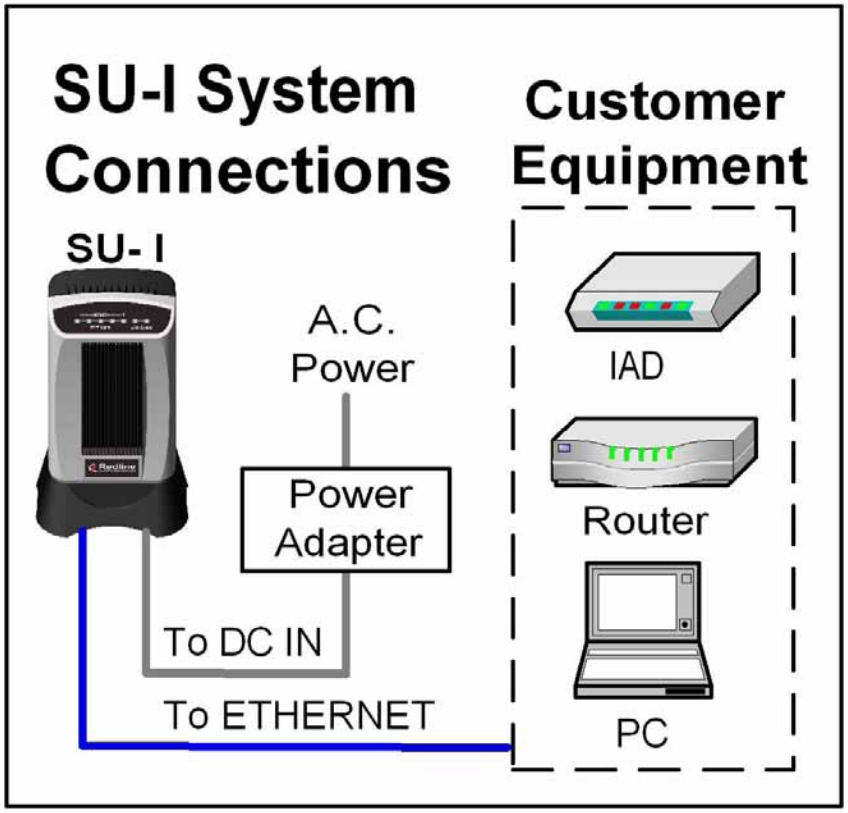

Figure 12: SU-I Power and Network Connections

3.3 Change Mounting Option

The SU-I is shipped with a vertical mounting foot and can be located on any flat level surface such as a windowsill, shelf or table top. Accessory hardware includes options to mount the SU-I horizontally on a flat surface, or on a convenient wall or window frame.

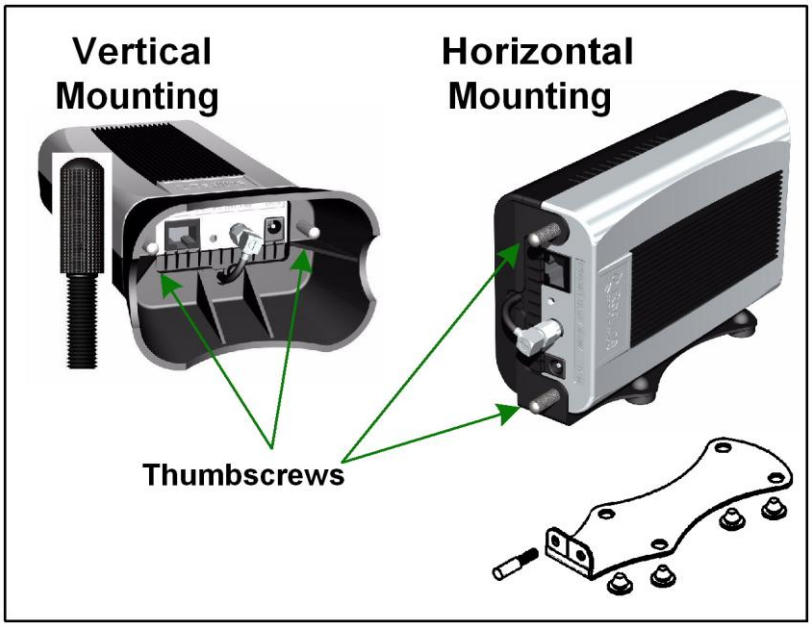

Figure 13: SU-I Table Mounting Components

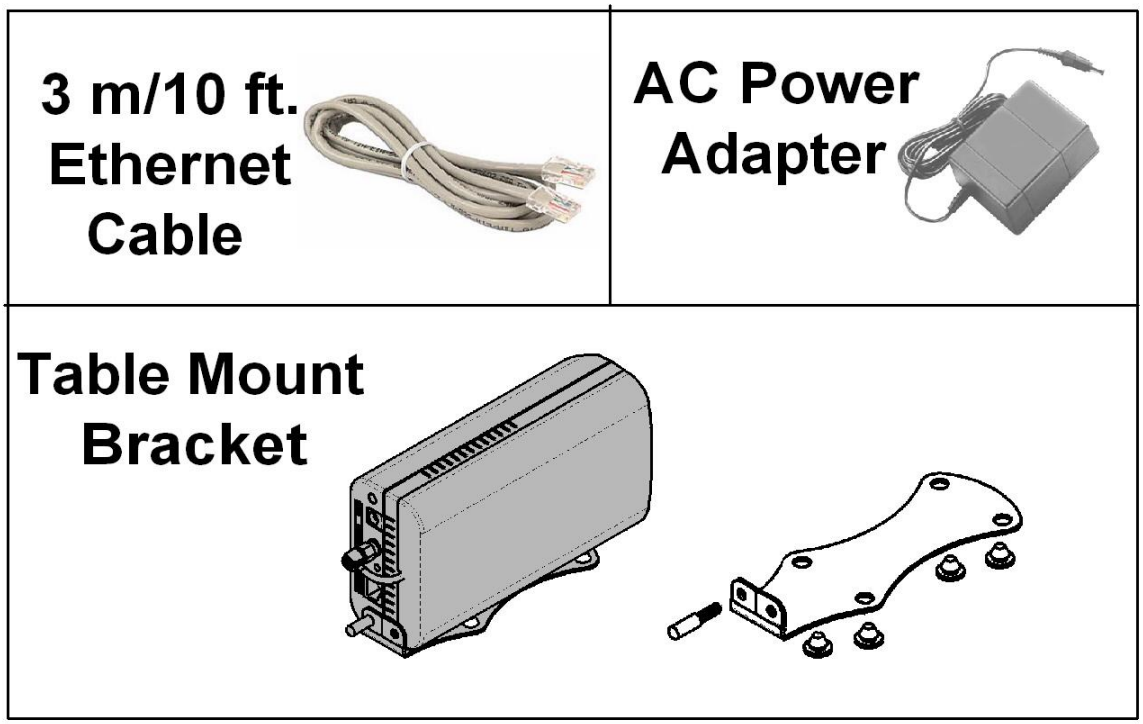

Figure 14: SU-I Accessories

Chapter 5

4 Troubleshooting

4.1 Low Signal / No Connection to Base Station

i) The SU-I requires visual line-of-sight (LOS) to receive the best signal, and must typically be located as close as possible to a window.

ii) Some office buildings use tinted windows to reduce heat. If the tinting uses metal embedded in the glass, this may act as an RF shield and greatly reduce the available signal level.

iii) For the best signal reception, the polarity of the SU-I antenna must match the base station antenna. Test the signal strength with the SU-I standing upright and also on its side.

iv) The SU-I is self-install and cannot be configured by the user. Verify with your service provider that your SU-I is correctly registered. The SU-I serial number is located on the back of the unit.