

SkyGateway And SkyExtender



Installation And Configuration Manual

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FCC Radio Frequency Interference Statement

SkyGateWay/SkyExtender FCC Number: RV7-GW-SD1010

This equipment has been tested and found to comply with the limits for the class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed, and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one or more of the following measures:

This equipment has been certified to comply with the limits for a class B computing device, pursuant to FCC Rules. In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of manufacturer could void the user's authority to operate this equipment.

Maximum Permissible Exposure

In order to meet the FCC's requirement of 1 mW/cm² for Maximum Permissible Exposure (MPE) at 5.8 GHz, the SkyGateway/SkyExtender units must be located a minimum of 1 meter (39.4 inches) from all persons. This distance is determined based upon the aforementioned 1 mW/cm² limit, measured data, and the far-field peak power density equation below:

$$d = \frac{0.282 \left[10^{((P+G)/20)} \right]}{\sqrt{S}}$$

where:

d = MPE distance in cm

P = Power in dBm (peak)

G = Antenna Gain in dBi

S = Power Density Limit in mW/cm² (1 mW/cm²)

Certified laboratory measurements indicate that the FCC's Power Density Limit of 1 mW/cm² is met at a distance of 39 cm (15.4 inches). However a distance of 1 meter is recommended in order to introduce a margin of safety equivalent to 6.6 times the FCC's Power Density Limit. This margin of safety compensates for the assumption of a point source antenna in the far-field equation.

1301 Shoreway Road, Suite 211
Belmont, CA 94002-4106
Phone 650-413-8000
email: support@skypilot.com
Web: www.skypilot.com

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CHAPTER 1 INTRODUCTION

A SkyPilot System is made up of the following components:

SkyGateWay. This network element provides an interface between the network and the Internet or WAN via a 10/100BASE-T connector. A minimum of one SkyGateway unit is required for a SkyPilot System; additional units provide redundancy in case of a power failure or other problem at the main gateway.

SkyExtender. These nodes connect directly to a SkyGateway device, to other SkyExtender nodes, and to SkyConnector Indoor and SkyConnector Outdoor subscriber units. They provide the framework of the network. A SkyExtender is typically installed on a roof, tower, light or utility pole, or other fixed location. In a rooftop installation, a 10/100BASE-T Ethernet connection is available for subscriber usage.

SkyConnector Indoor and SkyConnector Outdoor. These units are installed in subscribers' homes or offices. A SkyConnector provides an interface between the subscriber's computer and the network. The interface between the SkyConnector and the network is via a wireless connection to a SkyExtender. The interface to the subscriber's computer is via an Ethernet cable. The outdoor unit typically provides greater range than the indoor unit and is normally installed on an eave or roof. The indoor unit is installed on a windowsill or in a window frame by the subscriber without a truck roll and offers simple plug-and-play configuration.

This manual provides instructions for installing and maintaining SkyGateWays and Sky Extenders. See the *SkyConnector Indoor Unit* and *SkyConnector Outdoor Unit Installation Guides* for information about those products.

System Overview

SkyGateWay basestations and SkyExtender nodes form the backbone of a SkyPilot System.

Both devices feature:

- A compact, lightweight design that permits easy installation in a wide range of locations.
- High-power, 360° coverage.
- An efficient single connection for both power and data.

SkyGateWay and SkyExtender units are virtually identical, differing only in their software. SkyGateWay basestations use a superset of the SkyExtender software that includes the necessary programming to communicate with an external network.

The SkyExtender is comprised of five separate modules: baseband motherboard, mPCI radio module, switchboard, and antenna array.

Physical Specifications and Installation

Each SkyGateWay or SkyExtender is only 18 inches high, 12 inches in diameter, and 14 pounds in weight. The compact size and light weight mean that these units can be installed on existing structures such as utility poles, commercial buildings, homes, billboards, and water towers. Each unit comes with a mounting bracket that fits over a standard 1.25-inch-diameter pole. Operating temperatures can range from -40°C to 55°C (-40°F to 130°F).

Power

Because they use Power over Ethernet (PoE) and draw only about 10 watts, the only cabling these units require is CAT-5 Ethernet cable. There is no need to lease dedicated poles or run power cables, and no special tools are required for installation.

Antennas

The eight antennas in a basestation or node provide sectorized 360° coverage. Each antenna has a horizontal beamwidth of 45°, a vertical beamwidth of 6.5°, and a gain of 18 dBi.

Modules

The motherboard has a PowerPC CPU, volatile and non-volatile memory, a DC power interface, and interfaces to other system components.

An mPCI radio enables a SkyGateWay or SkyExtender to transmit and receive in the 5.8GHz band using modulation rates of 6 to 54Mbps, providing a peak EIRP of 44.5 dBm (28.2W). The radio currently supports a range of center frequencies from 5745MHz-5805MHz. Each channel is 20MHz wide and can be configured on 5MHz frequency granularity. Up to 4 non-

overlapping channels can be supported. In an environment free from significant interference in the UNII band, as many as four SkyGateWay or SkyExtender units can be installed at a single location, each configured to use a different channel.

The radio module also contains the wireless MAC and Physical Layer logic, implementing the 802.11a hardware specification via an Atheros chipset. The radio module connects to the motherboard for data and to the switchboard for RF.

A switchboard provides the connection between the radio and the antenna array. It provides antenna selection and amplifies the radio signal.

An integrated GPS receiver in both SkyGateWay and SkyExtender basestations is used by SkyControl software to synchronize transmissions within the network. It connects directly to the motherboard. The GPS antenna is positioned on top of the antenna array assembly inside the SkyGateWay enclosure.

Connectors

A RJ-45 jack enables a SkyGateWay to receive power and connect to an external network. The same jack on the SkyExtender is normally only used for power, but can also be used to connect directly to a subscriber's network or computer. (Both units come with a Power over Ethernet injector module that combines incoming data and power onto one Ethernet jack that connects to the SkyGateWay or SkyExtender device.)

An optional serial adapter (RJ-45 connector) permits local access to a command-line interface (CLI) to change the unit's settings.

Network Architecture

The SkyPilot system software manages communications protocols at all levels, from RF to routing. It carefully manages SkyGateWay, SkyExtender, and subscriber nodes to create the best possible network performance.

SkyProvision software is used to configure the system.

The SkyPilot System operates as a Layer 2 network. All subscriber traffic goes to and from the network via an external switch or router attached to the Ethernet bridge in a SkyGateWay basestation. Peer-to-peer communication is not permitted within a SkyPilot System.

Physical and Link Layers

Physical Layer. At the RF layer, the components of a SkyPilot System use standard 802.11a modulation operating in the 5.8GHz range. The Physical Layer SkyPilot protocol conforms to the 802.11a specifications with the addition of a synchronous one-second frame. The timing of this frame is derived from a GPS receiver in each SkyGateWay and SkyExtender. The frame's signal is used to control transmission and reception in the network, and also provides a reference for the "hello message" exchange (a beacon/response sequence that allows nodes and gateways to establish connections).

Data Link (MAC) Layer. At the MAC layer, SkyPilot implements a synchronization protocol that takes advantage of the one-second RF frame to establish links and exchange secure, rate-controlled data between devices.

Routing

Above the MAC layer, SkyControl brings into play a dynamic routing protocol that ensures the most efficient utilization of network resources and provides for rapid rerouting around link and device failures. SkyControl allows SkyExtender nodes and SkyConnector subscriber units to join the network automatically.

When a SkyExtender node connects to the network, it selects an optimum route to a SkyGateWay. The route selection considers link capacity (modulation rate), and the number of hops between the node and the gateway. Once a route is selected, all user traffic is forwarded via this path unless conditions change. Rerouting is necessary (and automatic) when a link or node is lost. The SkyPilot system also automatically reroutes traffic when it determines that a lower cost route is consistently available. (A connection's "cost" is determined by the number of hops it requires and the modulation rates on each of the connection's component links.)

Scheduling and Bandwidth Management

As mentioned, the SkyPilot System supplements the 802.11 protocol with sophisticated synchronization. By transmitting over different antennas in different 100us mini-slots of the one-second synchronization frame, a SkyPilot basestation or node provides 360° coverage through multiple high-power point-to-point connections. In addition, highly accurate traffic rate control and jitter control are enabled.

Bandwidth management within a network presents a particular challenge due to the high number of interconnections, with each SkyExtender node typically communicating with a multitude of others. The SkyPilot system ensures that mini-slots are provided over each link, with the number of mini-slots used by each pair of nodes varying as subscriber bandwidth demand changes.

The SkyPilot system provides rate control for subscriber traffic both in the downstream (SkyGateWay to SkyConnector) and upstream (SkyConnector to SkyGateWay) directions. Maximum upstream and downstream rates can be specified for each subscriber. In conditions of oversubscription, when the overall bandwidth demand is higher than system capacity, the individual subscriber data rates will be reduced proportionately.

CHAPTER 2 *INSTALLATION*

This chapter provides steps for installing the units as follows:

1. Plan The Installation
2. Unpack The Equipment
3. Mount The Unit
4. Install Cabling

Plan The Installation

Site Survey

In a typical wide-area wireless network utilizing SkyPilot units, the SkyGateWay is installed on the roof of a tall building or tower. The direct coverage area of the SkyGateWay is generally proportionate to the height of the installation.

A SkyGateWay may also be used in smaller scale networks. Examples include high-capacity business or academic campus interconnection, or a localized access network. In this case, the SkyGateWay could be installed on a local, medium height building or utility pole.

The SkyExtender may be installed on home rooftops, tall buildings, or on light or utility poles.

Refer to the *Site Planning* document for more information.

Frequency

SkyPilot recommends that an operator utilize a spectrum analyzer to scan the UNII spectrum prior to installing one or more SkyGateWays. This information will be necessary later when configuring the frequency. See the *SkyPilot Network Management Guide* for more information about frequency.

Unpack The Equipment

The SkyGateWay and SkyExtender are each shipped separately. Each box contains the installation kits described in the tables below. Prior to opening the box(es), inspect the unit(s) for damage. If damage is present, contact the shipping company immediately. Additionally, contact SkyPilot if an advanced replacement is required. After the equipment is unpacked, it is recommended that you keep the shipping box(es). This ensures proper packaging of the equipment in the event that a unit must be returned to the factory for any reason.

Equipment Inventory:

SkyPilot is supplied with the following components:

Table 2-1 : Installation Kit

Part	Description	Qty
	SkyGateWay Unit	1
	Clamp Mount	1
	Clamp	1
	Cover	1
	Cover With Serial Adapter (SkyGateway Only; can be purchased for SkyExtender)	1

Table 2-1 : Installation Kit (Continued)

Part	Description	Qty
	Power Injector	1
	Power Supply	1
	DB-9 Serial Adapter	1
	Hardware Kit	
	CD with software and product manuals	1

Table 2-2 : Tools Required For Installation

Tool	Purpose
Magnetic Level	Pole Mounting
1.25-inch Diameter Steel Pole	Pole Mounting
7/16-inch combo wrench with open and close ends	Unit Mounting
Phillips Screwdriver	Unit Mounting
Spool of Category 5 cable	Unit Configuration
RJ-45 Connectors: SkyPilot recommends using CAT5 cables with RJ-45 connectors that do not have a protective “boot” on the RJ-45 clip. These booted connectors will fit in the RJ-45 ports (serial and ethernet/power), but the extra plastic makes them difficult to remove.	Unit Configuration
RJ-45 Crimp Tool	Unit Configuration
Laptop PC w/Terminal Emulator Software, Network Interface Card, and Web Browser	Unit Configuration



WARNING

Failure to follow equipment installation instructions could damage the assembly and render the unit inoperable. Read the entire procedure before installing. Contact SkyPilot or your reseller with any technical questions.

Wind Loading Requirements

The unit is designed to withstand wind speeds of up to 100mph while mounted on up to a four-foot long 1.25 inch steel pole.

Grounding

In accordance with NEC (National Electric Code), the grounding conductor must be a minimum wire gage of 10 AWG, Cu, solid.

Lightening

A primary lightening protector is not provided but is recommended. Lightening protectors must be installed and grounded as set forth in the NEC. If a primary protection is not used, the cabling is limited to 140 feet and must be installed in accordance with NEC section 725-54 (c) and 800-30.

Mount The Unit

A mounting bracket is provided with the units. This bracket fastens to a standard 1.25-inch diameter steel pole. Any mounting system that meets local wind-loading regulations and provides a 1.25-inch diameter by 5-inch long connecting surface will be satisfactory. Attach the magnetic level to the pole to make sure the pole and unit are aligned properly. The photograph below shows a possible unit installation.



Figure 2-1 Possible Unit Installation



WARNING

All bolts on the antenna assembly and mounting bracket must be tightened to the proper torque specifications. The unsupported pole length should be no greater than four feet.

Install Cabling

NOTE: Cables must be installed in accordance with NEC Article 725 and 800, and all requirements must meet in relationship to clearances with power lines and lighting conductors. All cabling must be category 5e per TIA/EIA-568-B.2.

Both units support Power over Ethernet (PoE) utilizing the Power Injector provided, as shown in Figure 2-2.



Figure 2-2 Power Injector



WARNING

The units should be installed with the *SkyPilot-provided Power Injector only*. The use of other PoE Power Injectors could result in damage to the unit. Also do not plug a computer, switch, etc. into the CPE connector on the PoE injector.

Both units provide a 10/100bT connector and the SkyGateWay provides a serial interface. The 10/100bT Ethernet port provides interconnectivity for user and network traffic, while the serial port is used for local access to the Command Line Interface.

To install SkyGateWay, see “SkyGateWay Installation” on page 2-8.

To install SkyExtender, see “SkyExtender Installation” on page 2-12.

Figure 2-3 below shows the Ethernet port on the right and the serial port to the left.

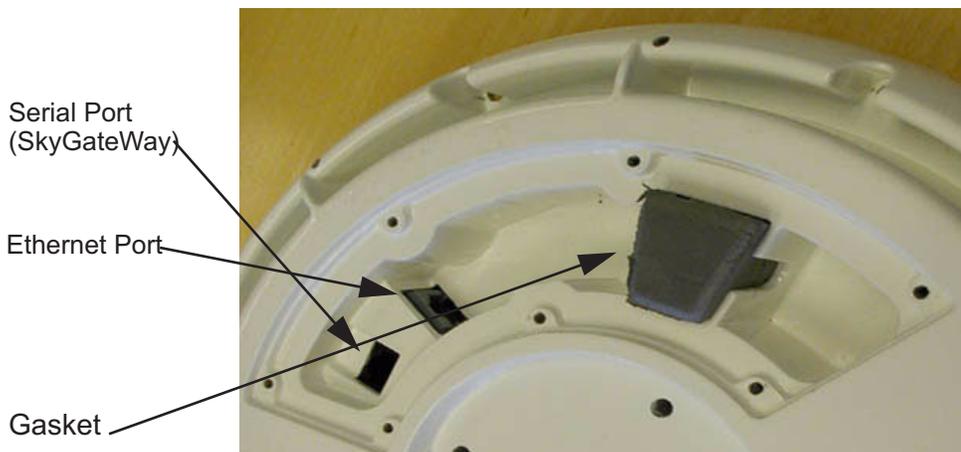


Figure 2-3 Ethernet and Serial Ports

SkyGateWay Installation

SkyGateWay installation involves connecting the unit to the backhaul by doing the following:

1. Installing the Ethernet cable
2. Installing the optional serial cable.
3. Installing the optional serial cable adapter cover
4. Connecting the unit to the backhaul

Install Ethernet

1. Connect the Ethernet cable and push it into the gasket, as shown in Figure 2-4.

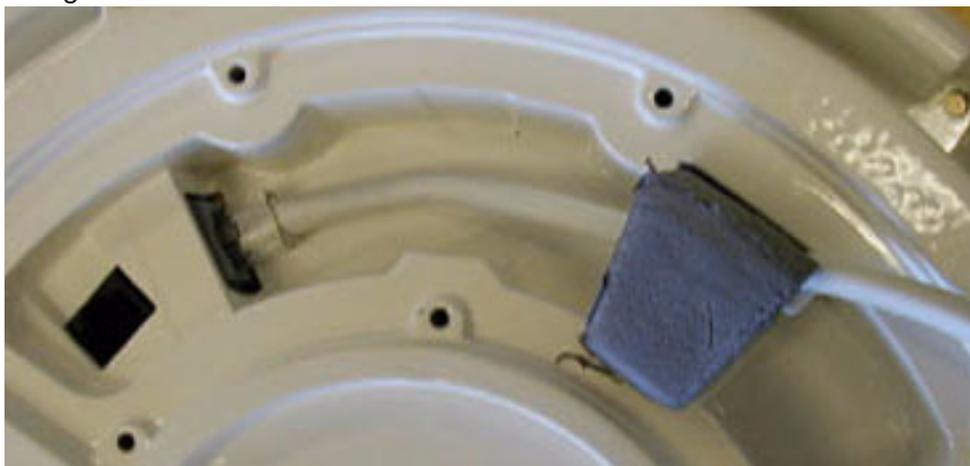


Figure 2-4 Install Ethernet Cable

If you are not installing the optional serial connection, proceed to Step 5 and then Step 9. If you are installing the optional serial connection, proceed to Step 6.

5. Install the cover using the provided screws. The Ethernet cable is positioned to pass through the insert in the cover, as shown in Figure 2-5.

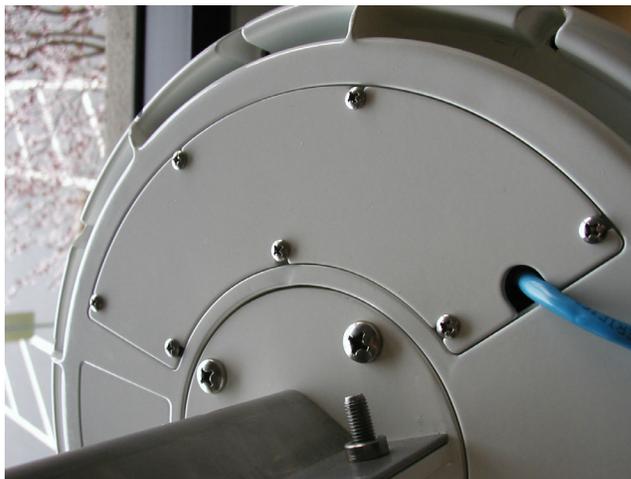


Figure 2-5 Cover Installed

Installing Optional Serial Adapter Cover

If you are using a serial cable, do the following:

6. Thread the serial cable through the serial cable cover and slide the weather gasket around the cable, as shown:

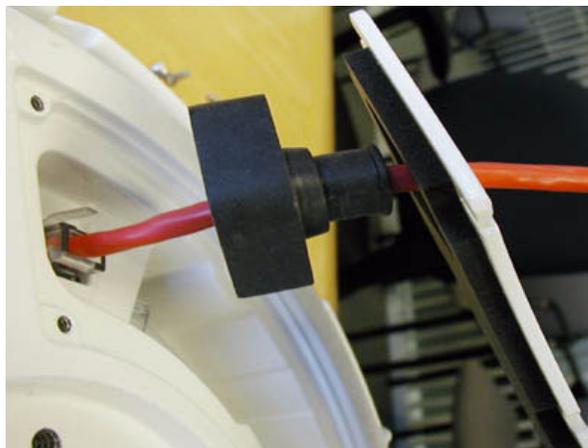


Figure 2-6 Connecting Serial Cable

7. Fit the weather gasket down into the unit, securely surrounding the serial port, as shown:



Figure 2-7 Serial Weather Gasket

8. Slide the cover down over the gasket and secure the cover using the screws provided. Make sure the Ethernet cable passes through the insert in the cover as shown in Figure 2-8. Use the ty-wrap to further weather-proof the gasket. Cut the excess ty-wrap off.

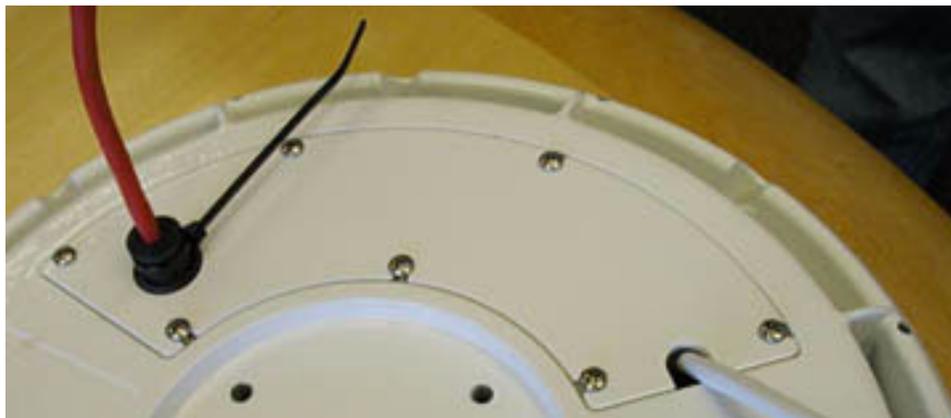


Figure 2-8 Serial Adapter Cover Installation

9. Secure the Ethernet cable and, if applicable, serial cable to prevent strain (particularly installations exposed to high wind conditions). Figure 2-9 shows an example of the cable secured to the mounting pole.



Figure 2-9 Secure Ethernet Cable

Powering Up

To power up the unit, perform the following steps:

1. Plug the Power Supply into a power source.
2. Connect the Ethernet cable to the *CPE* port of the Power Injector and the Power Injector to the power supply, as shown in Figure 2-10.



Figure 2-10 Connection To Power Injector

3. Connect a second Ethernet cable from the *Computer* port of the Power Injector to the router and the router to the T1 line.

Checking LEDs

Once power is on, the unit begins the boot process. The Link LED is green and the Activity LED is yellow.

Table 2-3 : LED States

Process	Link LED	Activity LED
During Boot	Slow Blink	Slow Blink Staggered
Boot Failed	LED Off	LED On
Image Initalizing	Slow Blink	Slow Blink Synchronous
Initialization Failure	Initialization Failure	Fast Blink Synchronous
Initial Success but no auth	LED On	LED Off
SkyGateWay connected	LED On	LED On

The LEDs operate as follows:

- **State-Based Blinking:**
 - Slow blink = 4 Blinks per second;
 - Fast blink = 16 Blinks per second.
- **RSSI Based Blinking:**
 - $RSSI = 0$ blink/2Sec
 - $0 < RSSI \leq 10$ blink/2Sec
 - $10 < RSSI \leq 20$ blink/2Sec
 - $20 < RSSI$ 16 blink/2Sec

NOTE: If anything fails, refer to Chapter 3, *Troubleshooting*.

SkyExtender Installation

SkyExtender installation involves the following steps:

- Installing the Ethernet cable.
- Installing the cover.

Install Ethernet

1. Connect the Ethernet cable and push it into the gasket. Figure 2-11 below shows this installation.



Figure 2-11 Ethernet Cable

2. Install the cover using the provided screws. The Ethernet cable is positioned to pass through the insert in the cover, as shown in Figure 2-12.

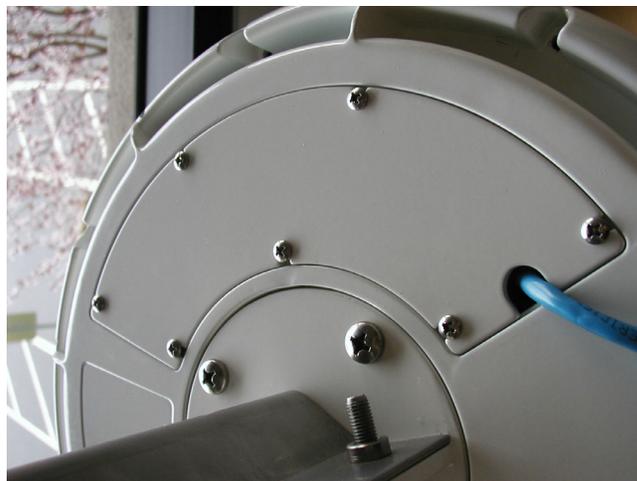


Figure 2-12 Cover Installed

3. Secure the Ethernet cable to prevent strain (particularly installations exposed to high wind conditions). Figure 2-13 shows an example of the cable secured to the mounting pole.



Figure 2-13 Secure Ethernet Cable

Powering Up

1. Connect the Ethernet cable to the *CPE* Ethernet Port on the Power Injector, as shown in Figure 2-14.



Figure 2-14 Connect To Power Injector

2. Connect the power supply to a power source and then connect it to the Power Port of the Power Injector.
3. Connect a second Ethernet cable from the *Computer* port of the Power Injector to the router and the router to the T1 line.

Checking LEDs

Once power is on, the unit begins the boot process. The Link LED is green and the Activity LED is yellow.

Table 2-4 : LED States

Process	Link LED	Activity LED
During Boot	Slow Blink	Slow Blink Staggered
Boot Failed	LED Off	LED On
Image Initalizing	Slow Blink	Slow Blink Synchronous
Initialization Failure	Initialization Failure	Fast Blink Synchronous
Initial Success but no hello	LED On	LED Off
Heard Hello	LED Off	Blink Based On RSSI
Link preauth, non-op, or op-link	Slow Blink	Blink Based On RSSI
Link Standby	Fast Blink	Blink Based On RSSI
SkyExtender connected	LED On	LED On

The LEDs operate as follows:

- **State-Based Blinking:**
 - Slow blink = 4 Blinks per second;
 - Fast blink = 16 Blinks per second.
- **RSSI Based Blinking:**
 - RSSI = 0 blink/2Sec
 - 0<RSSI<=10 blink/2Sec
 - 10<RSSI<=20 blink/2Sec
 - 20<RSSI 16 blink/2Sec

NOTE:If anything fails, refer to Chapter 3, *Troubleshooting*.

RJ-45 Pins

Table 2-5 : RJ-45 Pin Assignment

Pin	Assignment
1	Ethernet
2	Ethernet
3	Ethernet
4	Power
5	Power
6	Ethernet
7	Power
8	Power

Serial Port Signaling and Cabling Using a DB-9 Adapter

Table 2-6 shows the connecting pins for the SkyGateWay/SkyExtender's RJ-45 Serial Port and a standard PC Computer Serial Port.

Table 2-6 : RJ-45 Serial Port And PC Pins

SkyPilot SkyGateWay/ SkyExtender Console Port	RJ-45 Pin	PC Computer Serial Port	DB-9 Pin	Signal
Signal				
TxD	3		2	RxD
GND	4		5	GND
RxD	6		3	TxD

Figure 2-15 shows the breakdown of the cabling connections.

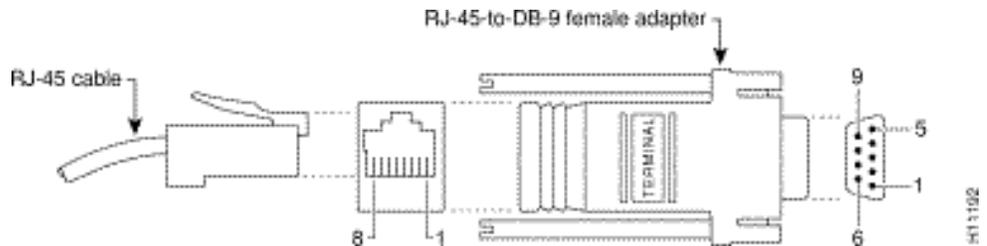


Figure 2-15 RJ-45-to-DB-9

Figure 2-16 shows DB-9 pinouts.

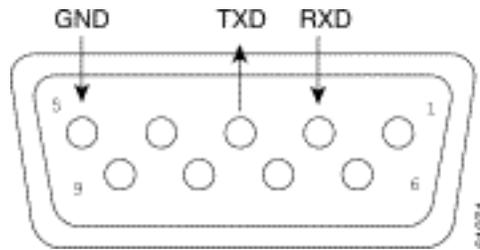


Figure 2-16 DB-9 Pins

If using a straight-through cable, the connection can be visualized as follows:

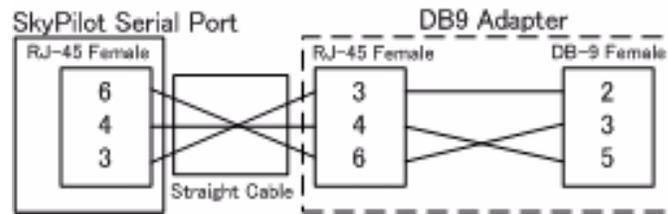


Figure 2-17 Straight-through Cabling

The key is to ensure that the colored wire inside the DB-9 adapter, which is hard wired to Pin 3 on the RJ-45 side, is plugged into the #2 hole on the DB-9 side, etc. SkyPilot has found that in general, the following colors in Table 2-7 can be used.

NOTE: You should verify that the wire color and connected RJ-45 pin are correct as there is no official industry standard.

Table 2-7 : DB-9 Wire Colors

Color	DB-9 Hole To Connect To
Black (Assuming RJ-45 Pin 3)	2
Yellow (Assuming RJ-45 Pin 6)	3
Red (Assuming RJ-45 Pin 4)	5

CHAPTER 3 *TROUBLESHOOTING*

This section covers problems encountered during installation and configuration.

Connecting Via a Serial Link

SkyGateway signals its presence through the use of a periodic beacon message transmitted on the configured frequency. When a SkyExtender or SkyConnector is installed, it listens for this network beacon message. When a beacon is received, the SkyGateway responds and attempts to establish a link. In the event you need to troubleshoot the SkyGateway from the console, perform the following steps.

1. Connect a DB-9 cable to the Serial Port.
2. Connect to a laptop.
3. Set baud settings at 38,400 and N81 and run the terminal emulation program. The unit will begin to search in a circular pattern for a nearby SkyExtender or SkyGateway. This can take up to two minutes. Once the unit has found a nearby SkyExtender or SkyGateway, text will start appearing on the screen as it outputs log messages, as shown in Figure 3-1.

```
sending ASB commands

asbClear: 49 unread bytes - hex dump: 31 31 31 31 31 31 31 31 31 31 31 31
31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31

31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31 31

asbClear: 1 unread bytes - hex dump: 01

0xefffdf8 (tRootTask): TS: 00:00:00:00

0xefffdf8 (tRootTask): asb.c:236 (SP_DRIVER_COMPONENT_ID)
asbSend: returned: 0xd

0xefffdf8 (tRootTask): TS: 00:00:00:00

0xefffdf8 (tRootTask): asb.c:238 (SP_DRIVER_COMPONENT_ID) 0: 0xff

0xefffdf8 (tRootTask): TS: 00:00:00:00
```

Figure 3-1 Sample Screen Display

1. The main SkyPilot boot screen displays, as shown in Figure 3-2. Enter your name and password.

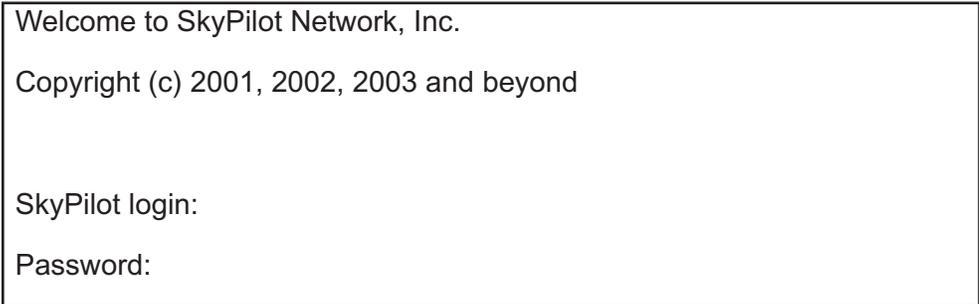


Figure 3-2 Login Screen Display

2. Continue installing the unit.

Troubleshooting Procedures

Table 1: Troubleshooting

Problem	Possible Cause	Solution
LEDs do not turn on after power connected	<ul style="list-style-type: none"> • No power at source • Bad Cat5 Cable • Bad Power Injector • Bad Power Adapter • Plugged into wrong port • LEDs not functioning • Bad unit 	<ol style="list-style-type: none"> 1) Check outlet to ensure power 2) Double check Cat5 cable pinout; recrimp connectors 3) Check for red LED on Power Injector; if there is no light, replace Power injector 4) Ensure adapter is connected to Power Injector and check for red LED on Power Injector; if there is no light, replace Power Adapter 5) Double check the Cat5 cable is connected into the horizontal (Grey) RJ45 port; if plugged into the vertical then the unit has been damaged and will need to be replaced Double check Cat5 cable is connected to RJ45 port on Power Injector that is labeled CPE and not Computer. 6) Connect straight through Cat5 cable from Computer port on Power Injector to switch or hub. If you are using a computer, connect it with an Ethernet crossover cable; verify Ethernet Link on switch/hub or computer. 7) Replace unit via SkyPilot support procedures.

Table 1: Troubleshooting (Continued)

Problem	Possible Cause	Solution
SkyGateway LEDs indicate power-on diagnostics failed (synchronous fast-blinking LEDs)	<ul style="list-style-type: none"> • Diagnostics failing during Boot process. • Bad unit 	<ol style="list-style-type: none"> 1) Connect a PC/laptop to the serial port and watch the unit boot to determine at which point unit ceases to boot; contact SkyPilot support to troubleshoot further. 2) Replace unit via SkyPilot support procedures.
Cannot establish a link (Green LED on, Yellow LED off)	<ul style="list-style-type: none"> • No signal reaching location due to obstruction and/or distance. • Interference at similar frequency too high in local area and direction that unit must be listed to receive signal. • Unit is in manual provision mode and required frequency is not in allowable list. • Bad unit 	<ol style="list-style-type: none"> 1) Move device to alternate locations, changing both elevation and position. 2) Confirm whether other signals of similar frequencies are present; consider alternate frequencies if possible. 3) Log into unit locally and confirm frequency is in list; add to list if missing. 4) Replace unit via SkyPilot support procedures.
Cannot optimize a link (Green LED off or blinking slowly, but never begins to blink fast)	<ul style="list-style-type: none"> • Insufficient signal reaching the unit that the device is attempting to optimize with. • Interference at similar frequency too high in local area and direction of unit that the device is attempting to optimize with. • Bad unit 	<ol style="list-style-type: none"> 1) Move device to alternate locations, changing both elevation and position. 2) Confirm whether other signals of similar frequencies are present at location of remote unit; consider alternate frequencies if possible. 3) Replace unit via SkyPilot support procedures.

Table 1: Troubleshooting (Continued)

Problem	Possible Cause	Solution
Cannot authorize device (Green LED off or blinking slowly, but never begins to blink fast)	<ul style="list-style-type: none"> • Network keys are different. • Device is set for manual provisioning but not configured properly. • Device is set for auto provisioning but is not receiving an IP through DHCP. • Device is set for auto provisioning but is not receiving a configuration file. • No network connectivity to provisioning server. • Device is set for auto provisioning but is receiving incorrect provisioning information through its configuration file. • Bad unit 	<ol style="list-style-type: none"> 1) Verify Network Key on remote unit and reset if necessary. Configure correct network key on device. 2) Verify needed configuration and set through local connection to device. 3) Verify DHCP configuration exists and is correct. Verify DHCP server is running. 4) Verify configuration file exists for device and is correct. 5) Verify requests are reaching Provisioning Server through log messages. Troubleshoot network connectivity. 6) Confirm that configuration file contains correct settings, such as Domain ID, allowed frequencies, etc. 7) Replace unit via SkyPilot support procedures.
Device is online and active in Network but data cannot be passed from end-user computer.	<ul style="list-style-type: none"> • Eth not enabled in configuration. • Problem with cable between unit and end-device • Bad unit 	<ol style="list-style-type: none"> 1) Confirm eth state set up in configuration. 2) Confirm there is a link on device using show eth command. Test cable on both ends to confirm all copper pairs are in place. Re-terminate cable if needed. 3) Replace unit via SkyPilot support procedures.
Device is active in network but cannot be accessed	Access list on device not configured to allow access	Confirm Access list in Node Profile allows access from source IP.

APPENDIX A

SPECIFICATIONS

Product Specifications

Interface

Wireless	802.11a
LAN/Power	RJ-45 (Power over Ethernet)
Console (SkyGateWay only)	RJ-45 (RS-232 Serial Port)

Radio Characteristics

PHY standard	IEEE 802.11
Operating Channels	Four 20 MHz channels with 5-MHz frequency control
WLAN Architecture	SkyPilot enhanced 802.11
Media Access Control	SkyPilot Synchronous Protocol
Wireless Medium	802.11a – Direct Sequence Spread Spectrum (DSSS)
Frequency Band	5.725 - 5.825 GHz ISM
Modulation technique	OFDM

Antenna Characteristics

Antenna	8 sector 16 dBi
Receive Sensitivity	-90 dBm @ 6 Mbps modulation
Field of view	SkyGateWay/SkyExtender/Roof top: 8 x 45° horizontal x 12° vertical SkyConnector Indoor/Outdoor: 30° horizontal x 12° vertical
Modulation	6-54 Mbps
EIRP	44.5 dBm

Hardware Specifications

Processor	266 MHz PowerPC
Memory	16 MB SDRAM, 16 MB Flash

LEDs	2 LEDs: Wireless Activity, Wireless Link
Mounting	tower, utility pole, building, or other infrastructure
Meshing	yes
Antenna	360° (8 x 45°) horizontal x 6° vertical, 18 dBi
Range LOS	up to 20 miles (32 km)
Range near-LOS	up to 4 miles (6.4 km)
Dimensions	25.0" (63.5 cm) H x 12.2" (31.0 cm) diameter (w/ mounting bracket)
Weight	14.0 pounds (6.3 kg)
Operating temperature	-40° to 131° F (-40° to 55° C)
Wind loading	greater than 100 mph (161 km/h)
Enclosure/ humidity	NEMA-4X
Power	24VDC; 10 Watts
Certifications	FCC Part 15, FCC 47 CFR Part 15, Class B USA; compliance with UL safety standards
EMI and susceptibility	FCC Part 15.107 and 15.109
Warranty	one-year limited warranty on hardware; 90-day limited warranty on software

Security

Authentication	MD5-based certificates
Encryption	AES
Filtering	Based on protocol type, IP port ID, and configurable IP address list

Network Management

Command Line Interface	Console via RS-232 Serial Port or SSH
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NMS Integration	SNMP v2c XML
GUI Configuration	SkyProvision software
GUI EMS	SkyControl software
IP Address	DHCP or Static
Firmware	Multiple versions of firmware stored in non-volatile memory; updated via FTP
Configuration File	XML over HTTP

Quality Of Service

Prioritization	802.1p-based; also supports diff-serv mechanism based on protocol type, IP port ID, and configurable IP address list
Traffic Shaping	Per-user rate limits upstream and downstream

Monitoring & MIB Support

Supported MIBs	MIB-II (RFC 1213); EtherLike (RFC 2665); Bridge (RFC 1493); SkyPilot private MIB
Local Management	RS-232 Serial Console Port
Remote Management	CLI via Telnet, SNMP 2c

Network Attributes

Architecture	Layer 2
Interface	Transparent bridge
802.1q	VLANs

Topology

Mesh, point-to-multipoint, point-to-point
