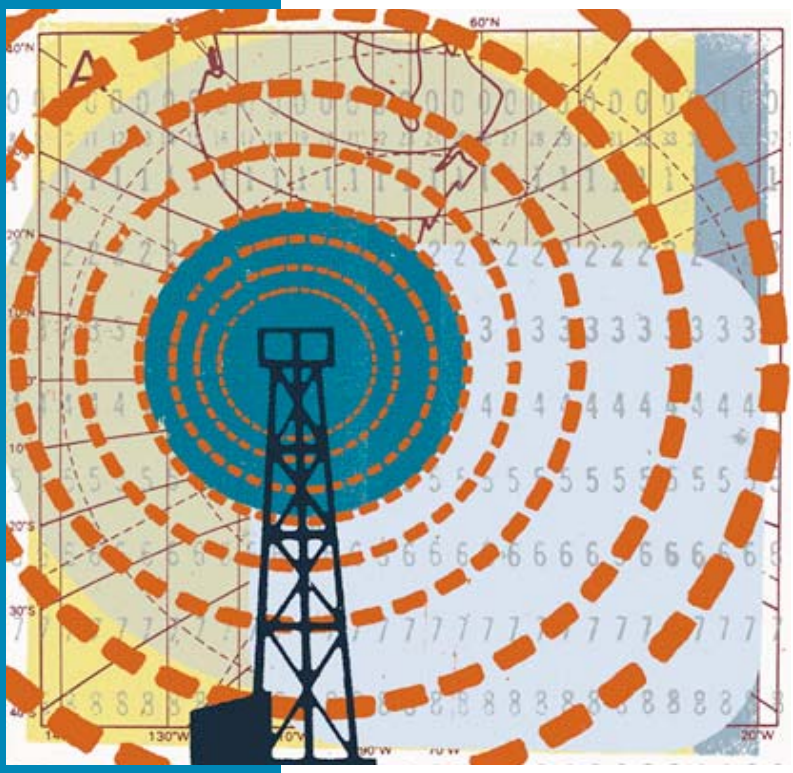
SkyExtender TriBand Installation and Setup



SkyPilot™ NETWORKS

671-00006-01 Rev B

SkyPilot Firmware 1.3
Document Last Revised: June 12, 2006

Contents

About This Guide v
Audience and Purpose vi
How This Guide Is Organized vi
Conventions Used in This Guide vii

Chapter 1 Introduction 1
TriBand Topologies 2
Default Access Point Configuration 2

Chapter 2 Your SkyExtender TriBand Kit 3
Kit Contents 4
Before You Begin 4
Getting Help 5

Chapter 3 Installing SkyExtender TriBand 7
Planning Your Installation 8
Mounting and Cabling 8
Powering Up 10

Chapter 4 Configuring a SkyExtender TriBand 13
Before You Begin 14
Choosing a WLAN Configuration 14
Automatic vs. Manual Configuration 16
Preparing Software Images 17
Automatic Provisioning Procedure 17
Manual Provisioning Procedure 21

Appendix A FCC Statements 23

About This Guide

This guide provides directions for installing and setting up a SkyPilot™ SkyExtender™ TriBand which can provide access point services to users of 802.11b/g wireless (Wi-Fi) networks.

Chapter Highlights

- Audience and purpose
- How this guide is organized
- Conventions used in this guide

Audience and Purpose

This guide provides directions for installing and setting up a SkyPilot™ SkyExtender TriBand that can provide access point services for users of 802.11b/g wireless (Wi-Fi) Networks.

This guide assumes administrator-level knowledge of IP networks and a familiarity with configuring wireless devices.

How This Guide Is Organized

This guide is organized as follows:

- Chapter 1, "Introduction," provides an overview of the SkyExtender TriBand, including its topologies and default access point configuration.
- Chapter 2, "Your SkyExtender TriBand Kit," provides information you need before you begin your installation.
- Chapter 3, "Installing SkyExtender TriBand," provides instructions for the physical installation of the TriBand.
- Chapter 4, "Configuring a SkyExtender TriBand," explains how to use SkyPilot EMS software to configure the TriBand for both mesh networking and Wi-Fi operation.
- Appendix A, "FCC Statements," provides the FCC radio frequency interference statements for the SkyGateway, SkyExtender, SkyExtender DualBand, and SkyExtender TriBand devices.

Conventions Used in This Guide

This section describes the text and syntax conventions used throughout this guide.

Text Conventions

This guide uses the following text conventions:

- *Italic* is used to introduce new terms.
- **Bold** is used to indicate what you click or type in a graphical user interface (for example, commands names or text being entered). In examples showing user interaction with the command-line interface, bold is used to indicate user input as opposed to command output.
- A `monospace` font is used for code elements (variable names, data values, function names, and so forth), command lines, scripts, and source code listings.
- *`Italic-monospace`* is used for replaceable elements and placeholders within code listings.

Syntax Conventions

This guide uses the following conventions when showing syntax:

- Angle brackets, "<" and ">", enclose mandatory elements. You must enter these elements. For example:
  `ping <IP-address>`
- Square brackets, "[" and "]", enclose optional elements. You can omit these elements. For example:
  `show filter [filter-table-number]`
  Square brackets are also used to show the current value of parameters in the output of some commands.
- A vertical bar, "|", separates choices. For example:
  `show bridge [cache | port]`

1

Introduction

SkyExtender TriBand is a dual-radio solution that combines SkyPilot's long-range, high-capacity 5 GHz mesh backhaul with high-powered 2.4 GHz 802.11b/g and 4.9 GHz 802.11a access points that allow service providers and municipalities to offer standard Wi-Fi services over great distances—for targeted hot zones or dense, ubiquitous coverage patterns. With the ability to create multiple WLANS, each with its own VLAN and security policy, the SkyExtender TriBand can support several business models with a single service installation.

Chapter Highlights

- TriBand topologies
- Default access point configuration

TriBand Topologies

SkyExtender TriBand provides a unique opportunity for WISPs (wireless ISPs) looking to combine scalable Wi-Fi capacity with the seamless coverage of a wireless mesh network.

TriBand nodes on a wireless mesh network offer a basis for multi service networks capable of providing end-to-end security and quality of service for a variety of bandwidth-hungry applications and services, including VoIP and video surveillance solutions.

The auto-discovery and rapid provisioning features of a SkyPilot wireless mesh network can greatly reduce deployment and maintenance costs. Multiple topology options and network scalability create intriguing options for rapidly growing a metro Wi-Fi customer base.

Default Access Point Configuration

The SkyExtender TriBand access point is set up to provide Wi-Fi access right out of the box. The access point includes a preconfigured WLAN with the SSID (Service Set Identifier) `SkyPilotTriBand`, providing WPA-PSK (Wireless Protected Access–Pre-Shared Key) protection. The first time that users attempt to connect to the `SkyPilotTriBand` WLAN, they must provide a public password, `publicpublic`.

You have the option of leaving the default configuration in place or creating a new configuration for the access point.

NOTE A wireless network protected by WPA-PSK is vulnerable. To provide a more secure level of protection, configure the WLAN for WPA authentication, in which each user is authenticated separately.

2

Your SkyExtender TriBand Kit

Your SkyPilot SkyExtender TriBand kit provides everything you need to install the device and configure it as both an extender for your wireless mesh network and an integrated 802.11b/g Wi-Fi access point.

Chapter Highlights

- Kit contents
- Before you begin
- Getting help

Kit Contents

The SkyPilot SkyExtender TriBand kit includes:

- The SkyPilot SkyExtender TriBand
- One 2.4 GHz antenna
- One 4.9 GHz antenna
- A PoE (Power over Ethernet) adapter for powering the SkyExtender TriBand

Before You Begin

Before starting installation, you need the following:

- A computer connected to the same network as the SkyExtender TriBand (which by default is IP address 192.168.0.2).
- A CAT-5 straight-through Ethernet cable for connecting the TriBand to a power source.
- Setup information for the access point:
  - A (case-sensitive) wireless SSID for each virtual WLAN Wi-Fi network.
  - A unique IP address for the management of the access point if it's not connected to a DHCP server.
  - A default gateway and subnet mask for the management network if the access point is not on the same subnet as your PC.
  - MAC addresses for the TriBand and for the WLANs you set up for the access point.

    Each TriBand has 32 MAC addresses assigned to it. The MAC address of the TriBand's 5 Ghz radio (as seen from the SkyGateway™) is printed on the label affixed to the bottom of the TriBand. The MAC address for the access point is 1 less than the MAC address of the 5 GHz radio. The MAC addresses reserved for use by WLAN BSSIDs begin with the MAC address of the 5 GHz radio minus 31.

    For example, if the MAC address of the TriBand is 000ADB01319F (hexadecimal), the reserved addresses start at 000ADB013180 (the difference being 1F hexadecimal, or 31 decimal).

NOTE Plan to configure the SkyExtender TriBand before mounting it. Some steps, such as those requiring a serial cable, are easier if the SkyExtender TriBand is more accessible.

Getting Help

For technical assistance during the beta release period, contact SkyPilot support by logging in to customer support at www.skypilot.com/support/.

3

Installing SkyExtender TriBand

This chapter provides instructions for the physical installation of the SkyExtender TriBand.

Chapter Highlights

- Planning your installation
- Mounting and cabling
- Powering up

Planning Your Installation

When choosing a site for the SkyExtender TriBand, consider the radio frequency (RF) environment and the physical layout of the area.

Trees, buildings, and hills can impede a wireless signal. When assessing a site, examine the overall topology of the wireless path for possible obstructions—both existing and planned. The RF environment is dynamic and can deteriorate over time as structures appear or are relocated.

Plan to use test signals to determine the suitability of the link topology for target applications. Interference on your desired frequency results in overlapping signals, causing outages or intermittent drops in throughput.

Once you've identified a potential site, use a topographic map or path profile software to ensure that terrain or obstacles will not interfere with the links.

The site survey process should be ongoing. To verify that a site is interference-free, make site audits every six to twelve months, scheduling regular maintenance visits to coincide with the site audits.

Mounting and Cabling

The section provides instructions for physically installing the SkyExtender TriBand.

To install the SkyExtender TriBand:

1 Mount the SkyExtender TriBand.

Follow the instructions provided in the *SkyGateway/SkyExtender Installation and Setup* document.

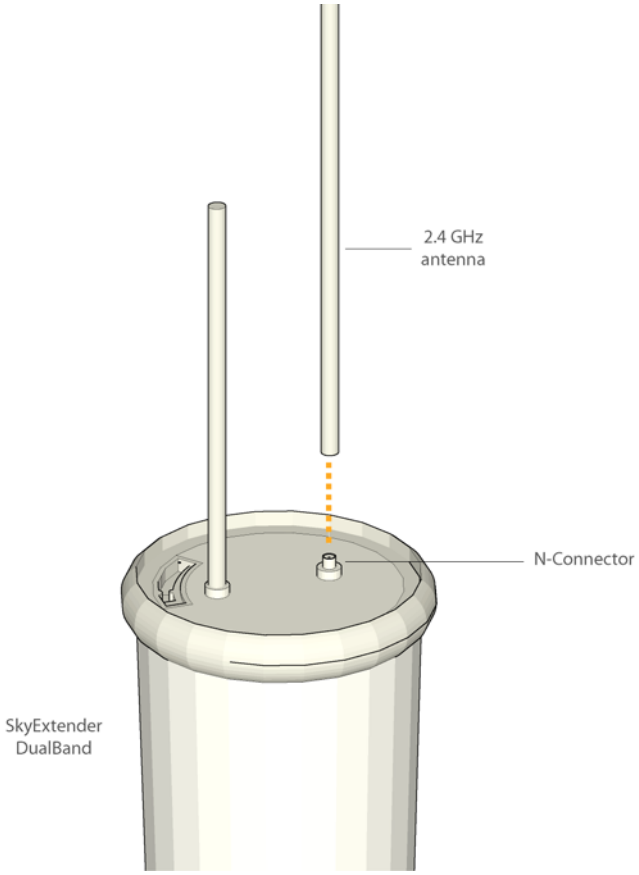
Make sure that you allow enough clearance for the 2.4 GHz antennas you attach to the bottom of the TriBand.

2 Connect the antennas.

The access point requires attachment of the antennas provided with the device. Screw the antennas onto the standard N-connectors on the bottom of the TriBand:

- 4.9 GHz antenna onto Ant1
- 2.4 GHz antenna onto Ant2

Figure 3-1. Attaching the antennas

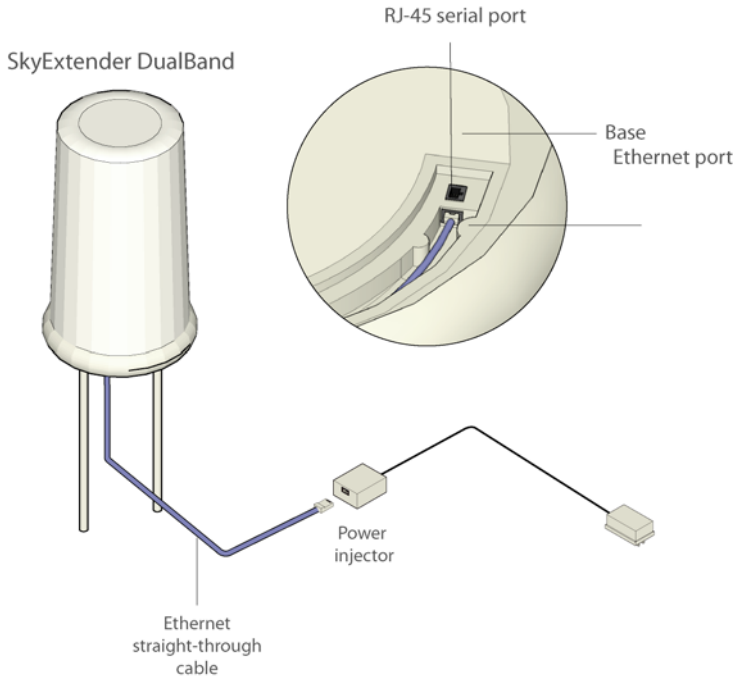


3 Connect the TriBand to the power supply.

As shown in Figure 3-2, connect the Ethernet straight-through cable (provided) between the power injector and the Ethernet port on the bottom of the TriBand.

Plug the AC adapter into the power injector.

Figure 3-2. Providing power to the SkyExtender TriBand



NOTE The Ethernet port on the TriBand is used to provide power and Ethernet over a single CAT-5 cable. To use the Ethernet port, connect a CAT-5 cable from the power injector port marked "Computer" to a network switch or other device.

Powering Up

When power is supplied to the SkyExtender TriBand, it starts a routine power-up sequence which you can monitor by observing the pair of LED lights on the bottom of the device.

While the device is initializing and searching for a GPS signal, both LED lights blink four times in a repeating cycle. (The SkyExtender TriBand *must* have access to a GPS signal to complete its power-up sequence.)

When the Link LED turns steady green and the Activity LED is off, the TriBand is initialized and listening for hello signals from other devices.

When both LEDs are steady, the TriBand is successfully connected to the wireless network.

The sequence takes about 15 minutes to complete (while waiting to acquire a GPS signal).

NOTE Depending on your SkyPilot network configuration, the SkyExtender TriBand may be unable to connect to the network until the device has been configured as described in Chapter 4, "Configuring a SkyExtender TriBand."

4

Configuring a SkyExtender TriBand

After installing the SkyExtender TriBand™, you need to provide the device's SkyExtender and access point components with the configuration information they need for network operations.

This chapter explains how to use SkyPilot EMS software to configure the TriBand for both mesh networking and Wi-Fi operation.

Chapter Highlights

- Before you begin
- Choosing a WLAN configuration
- Automatic vs. manual configuration
- Preparing software images
- Automatic provisioning procedure
- Manual provisioning procedure

Before You Begin

Before starting configuration, make sure the SkyExtender TriBand is powered up and capable of receiving a signal from a SkyGateway or SkyExtender.

Additionally, make sure the EMS software is installed (on both a central server and a client) and set up for configuring SkyPilot devices. Detailed procedures for using EMS software are provided in *SkyPilot Network Administration*, available from the SkyPilot website at www.skypilot.com/support/.

Choosing a WLAN Configuration

Before starting configuration, decide on the type of Wi-Fi network you want to configure at the access point location.

Most WLAN deployments use one of two common types of WLAN configurations:

- **Open**—Allows anyone with Wi-Fi capability to connect to the wireless network via the SkyExtender TriBand access point. An open WLAN does not authenticate users at the network layer, nor does it depend on authentication by a backend system.

  An open configuration raises obvious security concerns. The lack of encryption other than SSL/TLS (which is available only during login) makes the network vulnerable to unauthorized access and malicious actions (including denial-of-service attacks).

  You can provide backend authentication at the application layer through a *captive portal* mechanism operating outside your wireless mesh network. A captive portal forces all HTTP traffic from an unauthenticated user to a login Web page and blocks the traffic until the user successfully logs in. (For more information about captive portal mechanisms, refer to the following Web page: http://en.wikipedia.org/wiki/Captive_portal.)

  An additional disadvantage of open configurations is that users must begin each session from a Web browser before they can use other Internet applications, such as `email`, `ssh`, `ftp`, and chat clients.

- **Protected**—A Wi-Fi Protected Access (WPA) network which uses standards-based client authentication and encryption. Users are authenticated via a Radius server (which you'll need to implement using a third-party solution).

  WPA uses the IEEE 802.11b/g and IETF EAP protocols to give users a secure connection with both the access point and the Radius server, allowing the exchange of credentials (`username@domain` and `password`) and keys for encrypting all traffic between the client and the access point—even after authentication.

  WPA encryption is by WEP, with the addition of keys that are unique to each session and client. This additional keying mechanism eliminates the security problems of the original WEP. You can use AES encryption with the TriBand for even stronger encryption capabilities.

  For more information about WPA, refer to the following Web page: http://en.wikipedia.org/wiki/Wi-Fi_Protected_Access.

As you follow the procedure for configuring the TriBand, it will refer you to the appropriate steps depending on the WLAN configuration you've chosen.

Setting Up a Radius Server for Authenticating Users

If you plan to configure your SkyExtender TriBand access point for WPA, you must first configure a Radius server with the following:

- The IP address and shared secret of the TriBand access point.
- EAP-PEAP/MSCHAPv2 and EAP-TTLS/PAP or MSCHAPv2 (not EAP-TLS) suitable for WPA. (Your Radius supplier can provide instructions.)
- A Users database with user names and passwords. (You may also need to identify a proxy Radius if you're delegating some domains to other service providers.)

Automatic vs. Manual Configuration

The SkyExtender and its contained access point require network configurations to operate on the wireless mesh network. SkyPilot gives you a choice of two modes for provisioning devices with configurations:

- **Automatic provisioning**—Requires the use of SkyPilot EMS software to create configurations that an unattended central server can distribute to devices on the wireless mesh network. Although automatic provisioning requires more setup time than manual provisioning, it greatly simplifies the administration of a growing network.

  After getting a configuration from the provisioning server, the SkyExtender TriBand will establish a link to the SkyGateway (or to a SkyExtender or another TriBand) and use DHCP to retrieve an IP address and instructions for downloading configuration information stored on the server.

  For automatic provisioning instructions, see "Automatic Provisioning Procedure" on page 17.

- **Manual provisioning**—Usually performed in the field, manual provisioning permits the configuration of only a single device at a time, creating the minimum settings required for a wireless link and storing them in the device's flash memory.

  For manual provisioning instructions, see "Manual Provisioning Procedure" on page 21.

For more information on provisioning modes, see *Getting Started with the SkyPilot Network*, available from the SkyPilot website at www.skypilot.com/support/.

Preparing Software Images

EMS Software

Before you use the SkyPilot EMS software to set up the automatic configuration of the SkyExtender TriBand, make sure the most current software images are available to the EMS program.

To provide the EMS program with access to software images, copy the images to the folder `/var/ftp/pub/images` on the provisioning server.

Access Point Firmware

You can update the firmware in a SkyExtender TriBand access point either before or after TriBand configuration. All you need is the IP address of the TriBand access point and FTP installed on the host computer that contains the desired firmware image. For detailed procedures, refer to "Updating Access Point Firmware" in *SkyPilot Network Administration*.

Automatic Provisioning Procedure

Table 4-1 summarizes the steps required to configure a SkyExtender TriBand device operating in automatic provisioning mode.

Table 4-1. Automatically Provisioning a SkyExtender TriBand (Page 1 of 4)

	Step	Refer to
1	Make sure the most current software images are available to the EMS client software.	"Preparing Software Images" on page 17
2	Start the EMS client.	"Starting the EMS Client" in *SkyPilot Network Administration*
3	Choose the software images the provisioning server will use to configure the new device.	"Configuring Software Images" in *SkyPilot Network Administration*

Table 4-1. Automatically Provisioning a SkyExtender TriBand (Page 2 of 4)

	Step	Refer to
4	Specify a domain for the TriBand that is consistent with the domain assigned to the SkyGateway operating as a hub for the wireless mesh network.	"Configuring Domains" in *SkyPilot Network Administration*
5	Confirm that an appropriate node profile exists for the TriBand. If no appropriate profile exists, create one. **NOTE** This node profile is separate from the one you'll later use for the TriBand access point.	"Configuring Node Profiles" in *SkyPilot Network Administration*
6	Add the TriBand as a new node on the wireless mesh network, using the node profile you identified or created in step **5**. When you add a node and identify its type as SkyExtender TriBand, an access point node is automatically created (but not assigned an access point profile), and access point operations become available on the EMS client taskbar.	"Configuring Nodes" in *SkyPilot Network Administration*
7	Confirm that an appropriate AP security profile exists for Telnet communications with the SkyExtender TriBand Access Point. If no appropriate profile exists, create one.	"AP Security Profile Operations" in *SkyPilot Network Administration*

Table 4-1. Automatically Provisioning a SkyExtender TriBand (Page 3 of 4)

	Step	Refer to
8	Decide which type of Wi-Fi network you want to configure for the device's access point: • Protected access (WPA) • Open access	"Choosing a WLAN Configuration" on page 14
9	If you're configuring an open access network, skip this step. For protected access (WPA) configurations, confirm that an appropriate AP Radius profile exists to provide the WAN with information about the Radius server that will be used to authenticate users. If no appropriate profile exists, create one.	"AP Radius Profile Operations" in *SkyPilot Network Administration* **NOTE** The steps to configure a Radius server vary depending on the vendor solution, and are outside the scope of SkyPilot documentation.
10	Confirm that an appropriate AP WLAN SSID profile exists for the desired network configurations (protected or open). The profile should be set up as follows: • If you're setting up multiple WLAN SSIDs with different security policies and/or multiple IP address spaces, the use of VLANs is highly recommended. • Broadcast SSID should be enabled. • SSID Status should be active. • An appropriate security policy should be set: WPA for protected networks, None for open networks. If no appropriate profile exists, create one.	"AP WLAN SSID Profile Operations" in *SkyPilot Network Administration*

Table 4-1. Automatically Provisioning a SkyExtender TriBand (Page 4 of 4)

	Step	Refer to
11	Confirm that an appropriate access point node profile exists. (Remember that this profile is separate from the one that's assigned to the TriBand node you added in step **6**.) The profile's attributes should include the access point profiles you created in the previous steps: AP security, AP Radius (for protected networks), and WLAN SSID. If no appropriate profile exists, create one.	"Access Point Node Profile Operations" in *SkyPilot Network Administration*
12	Complete the configuration of the access point node that was automatically created when you added its associated TriBand node to the network (step **6**). Modify the access point node, assigning to it the access point node profile you identified or created in step **11.**	"Access Point Node Operations" in *SkyPilot Network Administration*
13	Verify that the newly configured TriBand is configured as a node on the mesh network.	"Domain Map" function in SkyControl, described in *SkyPilot Network Administration*
14	(Optional) Set TriBand polling intervals and other provisioning parameters.	SkyControl and SkyProvision functions, described in *SkyPilot Network Administration*

Manual Provisioning Procedure

To configure a TriBand that's in manual provisioning mode, you first configure its SkyExtender portion (following the same procedure as for SkyExtenders), and then you configure its access point.

To manually provision a SkyExtender TriBand:

1. Log in to the SkyExtender portion of the TriBand.

   You can connect to a TriBand and access its command-line interface via a terminal session from a console connected to the TriBand's RJ-45 serial port. After logging in (by supplying a password), you can enter commands at the command prompt. For detailed cabling and access instructions for the command-line interface, refer to the *SkyPilot Command-Line Interface Reference*.

2. Configure the SkyExtender by using the `set prov batch` command.

3. Enter the `set prov manual` command so that the SkyExtender uses manual provisioning mode when it next starts.

4. Log in to the TriBand's access point.

   You can connect to an access point and access its Web-based interface via a network connection to the SkyExtender portion of the TriBand or by a direct Wi-Fi connection to the access point. After logging in (by supplying a password), you can configure the access point through its Web-based interface. For detailed network setting requirements and access instructions for the Web-based interface, refer to the *SkyPilot Web Interface Reference*.

5. Using the Access Point Configuration page, configure the access point's global configuration parameters.

6. Using the WLANs Settings page, configure the SSIDs.

7. Optionally, configure any additional access point settings that you want.

A

FCC Statements

FCC Radio Frequency Interference Statement
SkyExtender TriBand FCC Number: RV7-DBE1010

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 90 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:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Connect the equipment to 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.

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 4.9 GHz, the SkyGateway/SkyExtender units must be located a minimum of 36 cm (14 inches) from all persons. This distance is determined based upon the aforementioned 1 mW/cm2 limit, measured data, and the following far-field peak power density equation:

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

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 much less than 36 cm (14 inches). However the minimum distance for fixed or mobile transmitters is 36 cm even if calculations indicate the MPE distance is much less.

FCC 15.203 statement

Because this device uses standard RF connectors for the external removable antennas, professional installation is required.

IC RSS-210 statement

This device has been designed to operate with the antennas listed below. Antennas having a gain greater than those on this list are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

Approved antennas:

Manufacturer	Model
Comet	SF245
Comet	SF245+12
Comet	SF245+12x
Comet	SF495+9x