



# SkyPilot Extender

## Relay Node of the SkyPilot Mesh Network

SkyPilot® Extender products are elements of the SkyPilot network, a low-latency, high-bandwidth radio system operating in the 5 GHz band as a self-forming, self-balancing, and self-healing wireless mesh network. Each SkyPilot Extender acts as a relay node of the SkyPilot network and provides Ethernet connectivity for client devices. As a relay node, each Extender dynamically routes packets to other nodes of the SkyPilot network. Mesh networking then allows coverage to be extended beyond each node's radio range, avoiding buildings, terrain, and other obstacles to deploy SkyPilot connectivity exactly where it is needed. Route diversity provided by the mesh acts as a failover mechanism in the event that a SkyPilot node fails or a link's quality degrades. Adding more Extenders readily expands the coverage of the SkyPilot mesh network -- simply install an additional Extender and it automatically discovers the network and self-configures, using dynamic best-path routing to become a node of the resilient multi-hop SkyPilot mesh network.

The SkyPilot Extender uses a dynamically switched high-gain antenna array of eight separate 45° beams to provide omni-directional coverage and a range between mesh nodes of up to 10 miles (16 km). The intelligent, self-forming SkyPilot mesh technology manages traffic across the mesh network to mitigate interference, maximize available bandwidth and support the prioritization of voice and data for improved Quality of Service performance. The SkyPilot mesh architecture improves network reliability and link integrity by creating a self-healing infrastructure with a best-path, vector-based routing algorithm. Automatic link discovery and dynamic adjustment of modulation and Forward Error Correction (FEC) parameters further optimize the quality of the link. These system capabilities enable throughput rates of up to 20 Mbps (UDP) and 12 Mbps (TCP) with a two-way latency of < 10 ms per hop on the SkyPilot network.

SkyPilot Extenders are also available in a DualBand model, providing an integrated 802.11b/g Wi-Fi access point that allows for simultaneous wireless access to the SkyPilot wireless mesh network.

### Flexible Broadband Point-to-Multipoint Relay Node

- Flexible point-to-multipoint node with multi-hop relay capabilities
- Automatically and dynamically switches among other SkyPilot mesh nodes

### Layer 2 Ethernet Transport

### Reliable Mesh Networking

- Traffic management to maximize available bandwidth
- Best-path, vector-based routing algorithm to create a self-forming, self-healing mesh network
- Automatic link discovery
- Adaptive link optimization through dynamic adjustment of modulation type and FEC

### Optional Access Point

2.4 GHz 802.11b/g Wi-Fi (unlicensed)

### SkyPilot Network

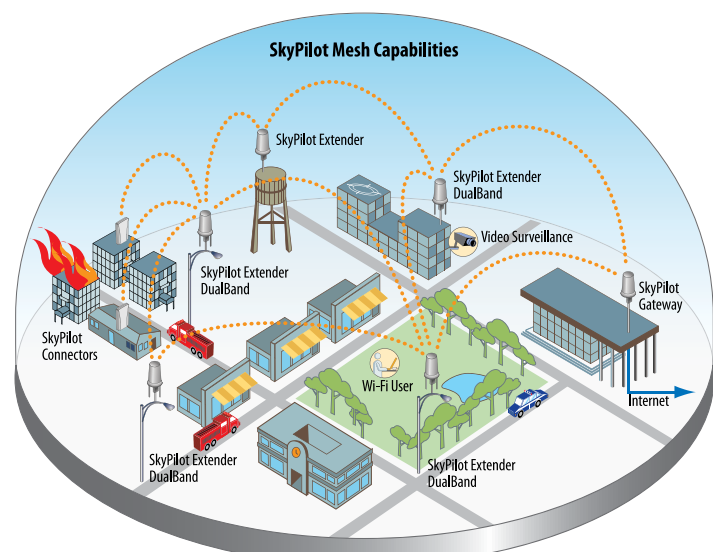
- Low latency: < 10 ms per hop (round-trip)
- High capacity: throughput of up to 20 Mbps (UDP) and 12 Mbps (TCP)
- Superior communications performance: supports end-to-end QoS on a per-application or per-client basis, allowing differentiated service offerings
- Mesh network topology allows deployment across entire service area, supporting applications such as:
  - Fixed broadband Internet services
  - Public Wi-Fi access
  - Other public or private communications network initiatives

### Traffic Management

- VLAN support with IEEE 802.1Q
- Traffic prioritization using IEEE 802.1p, protocol type, IP Port, IP DiffServ/ToS field, and/or IP address
- Traffic filtering using protocol type, IP port and/or IP address
- Traffic shaping with upstream and downstream per-user rate control

### Configuration, Management & Monitoring

- SkyPilot Element Management System (EMS) using SNMPv2c
- Dynamic or static IP addresses
- Firmware is "over-the-air" upgradeable
- Manual or automated provisioning
- Local management via an RS-232 serial console port
- Remote management via Telnet, SNMPv2c, or web interface
- Remote logging



SkyPilot Extenders expand the reach and coverage of the SkyPilot network to create a resilient, multi-hop mesh topology that serves many broadband wireless applications

# SkyPilot Extender Specifications



Models	SkyPilot Extender	SkyPilot Extender DualBand
<b>SkyPilot Mesh Network Frequency Band</b>	4.940 – 6.075 GHz	4.940 – 6.075 GHz
<b>Wireline Local Access</b>	10/100 Mbps Ethernet	10/100 Mbps Ethernet
<b>Wireless Local Access</b>	None	802.11b/g (2.4 GHz)

## 5 GHz Mesh Specifications

<b>Frequency Band</b>	4.940 to 6.075 GHz, including: <ul style="list-style-type: none"> <li>• US: 4.940 - 4.990 GHz public safety</li> <li>• US: 5.250 – 5.350 GHz U-NII mid</li> <li>• US: 5.470 – 5.725 GHz U-NII worldwide</li> <li>• US: 5.725 – 5.850 GHz U-NII upper</li> <li>• World: 5.850 – 6.075 GHz extended range</li> </ul>
<b>Transmit Power</b>	<ul style="list-style-type: none"> <li>• 30 dBm (maximum at radio antenna port)</li> <li>• Reduced as needed for regulatory compliance</li> </ul>
<b>Antenna</b>	8 integrated antennas, 360° coverage <ul style="list-style-type: none"> <li>• Gain per antenna: 18 dBi</li> <li>• Beamwidth per antenna: 45° azimuth, 6° elevation</li> </ul>
<b>Media Access</b>	Time Division Duplex (TDD)
<b>Modulation</b>	OFDM with adaptive modulation
<b>Data Rates</b>	6 / 9 / 12 / 15 / 18 / 24 / 36 / 48 / 54 Mbps
<b>Receive Sensitivity</b> (3% FER @ antenna port)	<ul style="list-style-type: none"> <li>• -90.0 dBm @ 6 Mbps</li> <li>• -87.5 dBm @ 9 Mbps</li> <li>• -86.0 dBm @ 12 Mbps</li> <li>• -84.0 dBm @ 18 Mbps</li> <li>• -80.0 dBm @ 24 Mbps</li> <li>• -78.0 dBm @ 36 Mbps</li> <li>• -70.0 dBm @ 48 Mbps</li> <li>• -68.0 dBm @ 54 Mbps</li> </ul>
<b>Channel Width</b>	20 MHz
<b>Channel Resolution</b>	5 MHz frequency control
<b>Range</b>	Up to 10 miles/16 kilometers
<b>Network Security</b>	<ul style="list-style-type: none"> <li>• AES-128 encryption</li> <li>• Certificate-based authentication</li> </ul>

## Physical Specifications

<b>Connectivity</b>	<ul style="list-style-type: none"> <li>• 10/100BaseT port to/from client device(s) and as Power-over-Ethernet (PoE) power input</li> <li>• To/from SkyPilot Gateways, Extenders, and/or Connectors as a relay node of the SkyPilot 5 GHz mesh network</li> <li>• RS-232 serial console port for maintenance</li> <li>• Optional access point for 802.11b/g (2.4 GHz)</li> </ul>
<b>Input Voltage</b>	<ul style="list-style-type: none"> <li>• 24 VDC proprietary PoE</li> <li>• 8P8C connector</li> </ul>
<b>Power</b>	<ul style="list-style-type: none"> <li>• SkyPilot Extender: maximum 14 Watts</li> <li>• SkyPilot Extender DualBand: maximum 25 Watts</li> </ul>
<b>Surge Protection</b>	<ul style="list-style-type: none"> <li>• Requires Trilliant part 620-00705-01 or equivalent</li> <li>• Weatherproof PoE-compatible 10/100Base-T CAT5 lightning protector (8P8C or unterminated)</li> </ul>
<b>Dimensions</b>	<ul style="list-style-type: none"> <li>• Height               <ul style="list-style-type: none"> <li>- without access point antennas: 25" / 63.5 cm</li> <li>- with access point antennas: 37" / 94.0 cm</li> </ul> </li> <li>• Base diameter: 12" / 30.5 cm</li> </ul>
<b>Weight</b>	15.0 pounds / 6.75 kilograms
<b>Operating Temperature</b>	-40 to +158 °F / -40 to +70 °C
<b>Humidity</b>	5 to 95% non-condensing
<b>Wind Loading</b>	Up to 150 mph / 242 km/h
<b>Installation</b>	Mast, tower, utility pole, streetlight pole arm, or building (optional mounting kits available)
<b>Enclosure</b>	NEMA Type 4X / IP66

## Compliance Specifications

<b>Unlicensed Radio Operation</b>	<ul style="list-style-type: none"> <li>• FCC Part 15 Subpart E (Subpart C for Wi-Fi)</li> <li>• Industry Canada RSS-210</li> <li>• EN 301-893 (EN 300-328 for Wi-Fi)</li> <li>• Other regulatory domains</li> </ul>
<b>Device IDs</b>	5.250-5.350 GHz; 5.470-5.850 GHz <ul style="list-style-type: none"> <li>• FCC: RV7-SD1085</li> <li>• IC: 5550A-SD1085</li> </ul> 4.940-4.990 GHz <ul style="list-style-type: none"> <li>• FCC: RV7-SD1087</li> <li>• IC: na</li> </ul> Wi-Fi Access Point: 2.400-2.4835 GHz <ul style="list-style-type: none"> <li>• FCC: SWX-SR2</li> <li>• IC: 6545A-SR2</li> </ul>
<b>EMI/EMC</b>	<ul style="list-style-type: none"> <li>• FCC Part 15 Subpart B (Class A)</li> <li>• Industry Canada ICES-003 (Class A)</li> <li>• EN 301-489</li> </ul>
<b>Safety</b>	<ul style="list-style-type: none"> <li>• UL 60950-1</li> <li>• CSA C22.2 No. 60950-1</li> <li>• EN 60950-1</li> </ul>
<b>Environmental</b>	RoHS

## Optional Wireless Access Point Specifications

Access Point	
<b>Frequency Band</b>	2.400-2.483 GHz
<b>Transmit Power</b>	<ul style="list-style-type: none"> <li>• 28 dBm (maximum at antenna port)</li> <li>• Reduced as needed for regulatory compliance</li> </ul>
<b>Antennas</b>	7.4 dBi omni
<b>Protocol</b>	IEEE 802.11b/g
<b>Modulation</b>	<ul style="list-style-type: none"> <li>• 802.11b: DSSS</li> <li>• 802.11g: OFDM</li> </ul>
<b>Channel Width</b>	20 MHz
<b>Receive Sensitivity</b> (3% FER @ antenna port)	<ul style="list-style-type: none"> <li>• 802.11b: -97 dBm @ 1 Mbps; -92 dBm @ 11 Mbps</li> <li>• 802.11g: -94 dBm @ 6 Mbps; -74 dBm @ 54 Mbps</li> </ul>
<b>Security</b>	WPA, WPA2, multiple SSIDs, MAC address Access Control List, MAC address filter, 802.1x EAP-TLS, EAP-TTLS, RADIUS support



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