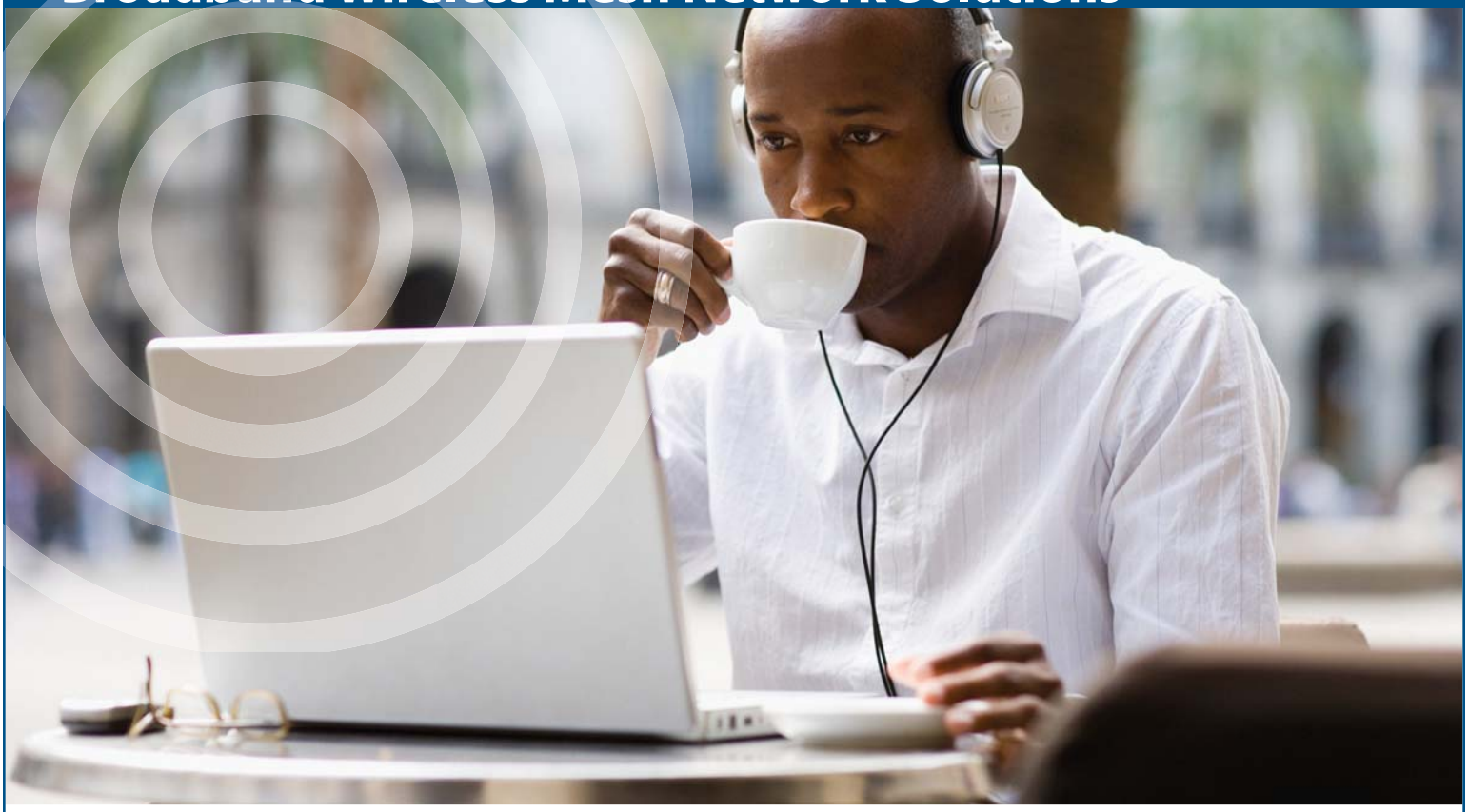
Broadband Wireless Mesh Network Solutions



Changing the Economics of Wireless Broadband Connectivity

Broadband connectivity has become an essential utility to individuals and communities, yet many small communities and rural areas still have limited access to broadband services. Cost has also made it difficult for local governments and public safety agencies to justify dedicated deployments of wireless infrastructure.

Today however, innovative broadband wireless solutions from SkyPilot Networks change the economics of delivering wireless broadband connectivity. Based on patent-pending wireless mesh technology, SkyPilot solutions allow service providers, public service agencies, and municipalities to cost-effectively deploy wireless broadband data, Wi-Fi, video surveillance, and voice-over-IP (VoIP) applications. With SkyPilot, there is no more "last-mile" problem. No more digital divide. Just tremendous flexibility and an easily managed way to provide a new level of broadband connectivity.

SkyPilot deployments require a minimal footprint, taking advantage of existing municipal assets such as building rooftops or streetlight poles for cost-effective deployment. No other wireless mesh solution can support the range of applications in demand by municipalities and service providers today with this combination of affordability and flexibility.

Rapid Deployment and High Scalability

Deployments eliminate the need to lease lines or excavate civil infrastructure for cabling, thereby delivering broad coverage in just days. Coverage can be expanded by simply adding mesh nodes—built-in multi-hop and near line of sight (NLOS) coverage capabilities ensure reliable high performance. SkyPilot deployments can operate in available, 5 GHz license-free radio spectrum and the 4.9 GHz public safety radio band.

Reduced Operating Expenses

SkyPilot solutions eliminate the need for ongoing antenna adjustments to optimize signals, reducing management and operational costs. Automatic discovery, self-provisioning, and intelligent routing features eliminate the need for specialized expertise and costly provisioning or management systems, further reducing total cost of ownership. Customers can scale their deployments, support multiple groups of subscribers and deliver multiple applications, such as Wi-Fi HotZones and public safety applications—easily and securely.

SkyPilot™ NETWORKS

Leading the Mesh Revolution

Next Generation Mesh Networking for Citywide Scalability and Performance

Unlike other broadband wireless systems, SkyPilot broadband wireless mesh solutions are highly flexible. They support concurrent data, voice, and video applications; mixed-use networks; and multiple tiers of service. Based on synchronous protocols and an advanced switched antenna array, SkyPilot solutions enable unmatched scalability and performance for all broadband wireless applications.

SkyPilot SyncMesh Architecture

The SkyPilot SyncMesh™ architecture is specifically designed to maximize packet throughput, enable Quality of Service (QoS), and deliver high scalability while preserving the resiliency and flexibility of wireless mesh communications. Based on the foundational SyncMesh protocol, the SkyPilot SyncMesh architecture automatically manages many wireless mesh operations that would otherwise require specialized IT expertise or complex management systems.

Automatic Link Discovery and Creation

SkyPilot mesh nodes automatically locate and authenticate all neighboring mesh nodes and fixed-wireless customer premise equipment (CPE) using the 360° beaconing capability of the SkyPilot advanced SectorSwitch antenna array. Nodes communicate through a synchronized protocol. When a node is identified, it is authenticated, encrypted using 128-bit Advanced Encryption Standard (AES), and a directional link is established for passing traffic. Network administrators can centralize and automate delivery of configuration files and IP addresses, making it easy to add mesh nodes and expand network coverage as needed.

Adaptive Link Optimization

Point-to-point links established individually by each sector of the SkyPilot antenna array can operate at higher power levels than those utilized by standard omni-directional antennas. SkyPilot networks use this additional power to improve signal-to-noise ratios, better penetrate obstacles, and transmit up to 10 miles/16 kilometers between nodes. SyncMesh also continuously and automatically optimizes each link modulation for higher packet throughput.

Mesh Route Optimization

SkyPilot mesh nodes route traffic using a best-path, vector-based routing algorithm. If a primary link experiences reduced throughput, the lowest-cost standby link is automatically converted to a primary link. In the unlikely event of a sudden, complete outage, SkyPilot nodes employ self-healing failover to automatically route around the failure. With route calculation and selection operating continuously in real-time throughout the network, SkyPilot solutions automatically balance capacity and enable effective scalability.

Traffic Management

Customizable packet analysis rules enable network administrators to prioritize, shape, and filter traffic, as well as create customized Virtual LANs (VLANs). SkyPilot SyncMesh traffic management features support multiple tiers of services, multiple groups of users, and enhanced security strategies.

Bandwidth Scheduling

A Bandwidth Scheduling Engine enables traffic prioritization at each node to minimize latency and jitter, achieve high QoS, and maximize throughput. This ensures that high-priority traffic, such as public safety or VoIP traffic, takes precedence over lower priority traffic.

Transmission Coordination

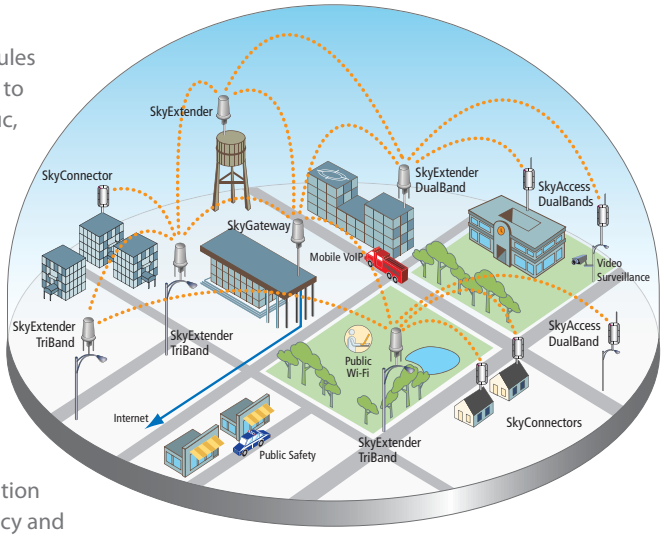
Using Time-Division Duplex (TDD) protocol, SkyPilot SyncMesh technology synchronizes all transmissions to maximize throughput. Using a Global Positioning System (GPS)-based common clock, SyncMesh technology coordinates simultaneous transmissions across the entire mesh network.

SkyPilot SectorSwitch Advanced Antenna Array

SkyPilot mesh infrastructures incorporate a sophisticated antenna array composed of eight 45° (18 dBi) antennas that deliver 360° coverage and industry-leading RF capabilities.

• Sectorization—each sectorized antenna focuses energy in a directional, 45° horizontal beam for greater signal strength and significantly longer range than omnidirectional antennas. This enables the array to deliver superior RF management features such as interference mitigation and spectral reuse.

• High gain—achieved through a narrow vertical beam that increases antenna receptivity while maintaining high modulation rates and mitigating interference.



• High power—SyncMesh technology switches a 450 mW radio to the antenna array up to 10,000 times/second, providing extended reach up to 10 miles/16 kilometers. As power output regulations vary by country of operation, SkyPilot custom-matches the output power requirements for each installation.

• Superior RF management—directional beams penetrate common obstructions, such as foliage, walls, and windows. Using orthogonal frequency-division multiplexing (OFDM), SkyPilot solutions mitigate interference and reduce the need for line-of-sight connections. In addition, any single node can communicate on different frequencies to other nodes.

Embedded Security Features

Security is a concern for all broadband wireless mesh networks, especially for public safety agency and government applications. Wireless mesh nodes are authenticated using certificate-based mesh authentication. Once established, links are encrypted with 128-bit AES. Wi-Fi subscriber connections can be secured using AES, Wi-Fi Protected Access (WPA), and dynamic wired equivalent privacy (WEP) encryption.

SkyPilot Broadband Wireless Mesh Products

SkyPilot provides complete solutions for deploying a wide range of broadband wireless applications. With SkyPilot, customers gain a high-capacity mesh backhaul network and a variety of integrated local access options, which enables a range of services for fixed broadband access subscribers, roaming Wi-Fi users, public safety professionals, mobile municipal staff, and public works agencies.

SkyGateway Series

The SkyGateway™ series is a carrier-class mesh base station that provides capacity injection by connecting the wireless mesh network to the Internet. Deploying SkyGateways easily scales the network to meet application demands. Highly intelligent failover capabilities support network self-healing by automatically triggering the rerouting of traffic and bandwidth distribution between SkyGateways in the event of a path disruption.

SkyGateway is available in DualBand and TriBand models to support integrated local access for enhanced application support. Dedicated high power access points are available for 2.4 and 4.9 GHz.

SkyExtender Series

The SkyExtender™ series is a highly scalable mesh device that provides an easy, elegant way to expand coverage of the wireless mesh. Simply add a SkyExtender and it automatically discovers the network and self-configures, forming a resilient multi-hop mesh with dynamic best-path routing and self-healing.

Like the SkyGateway series, SkyExtender is available in DualBand and TriBand models that enable the wireless mesh to support multiple applications over a common infrastructure. Dedicated high power access points are available for 2.4 GHz public Wi-Fi HotZones and 4.9 GHz support public safety communications.

SkyAccess DualBand

Achieving ubiquitous Wi-Fi coverage is not always practical as a result of natural and built obstacles that obstruct reception. SkyAccess™ DualBand is specifically designed to cost effectively expand 2.4 GHz coverage at the edge of a public Wi-Fi network, and infill to optimize modulation performance where a full mesh node is not justified.

SkyAccess DualBand is typically deployed with SkyExtender DualBands, and makes reaching a larger subscriber area more affordable while providing an effective way to improve subscriber satisfaction. SkyAccess DualBand includes a high power 2.4 GHz access point for local Wi-Fi access, and an integrated 5 GHz backhaul to connect with the SkyPilot mesh. An Ethernet connection allows SkyAccess DualBand to support video cameras and other local IP devices.

SkyConnector

SkyConnector™ is a cost effective outdoor customer premise equipment (CPE) for service providers deploying last mile services to business or residential broadband subscribers. Network administrators can create multiple subscriber service tiers using per-subscriber rate limiting features, and manage everything centrally. SkyConnector utilizes a high power integrated 5 GHz backhaul to wirelessly connect to the mesh infrastructure and provides the subscriber with an Ethernet connection for the local access.

SkyControl

SkyControl™ is a comprehensive element management system (EMS) that offers network administrators a robust range of provisioning and monitoring management options, including fault management, performance tuning and monitoring, reporting, and alarming. These essential tools help SkyPilot customers sustain subscriber satisfaction when deploying complex citywide broadband wireless networks.

SkyControl integrates Google Earth™ mapping service to provide unparalleled dynamic network visualization that greatly enhances the preparation and updating of network diagrams. Mesh network designers and administrators can avoid the time consuming step of manually preparing deployment maps. And SkyControl is highly accurate, utilizing GPS coordinate data available from SkyPilot infrastructure devices to populate node locations direct to the Google Earth map. No other wireless mesh solution offers an EMS application with this level of automated network visualization.

Broadband Wireless Mesh Applications

Service providers and municipalities in more than 50 countries are using SkyPilot wireless mesh networking products for applications including:

- Broadband data
- Wi-Fi HotZones
- Video surveillance
- Voice-over-IP
- 4.9 GHz public safety applications
- Transparent mobility from vehicles
- Automatic meter reading and control systems

SkyPilot Product Specifications

	SkyGateway Series	SkyExtender Series	SkyAccess	SkyConnector
Models	SkyGateway SkyGateway DualBand SkyGateway TriBand	SkyExtender SkyExtender DualBand SkyExtender TriBand	SkyAccess DualBand	SkyConnector
Function	Capacity Injection	Mesh Expansion	Mesh Edge and Infill	Customer Premise Equipment (CPE)
Mesh Backhaul				
Type	SyncMesh – 4.9 or 5 GHz	SyncMesh – 4.9 or 5 GHz	Link to SkyGateway and SkyExtender series – 5 GHz	Link to SkyGateway and SkyExtender series – 5 GHz
Antennas	SectorSwitch antenna array with 360° coverage	SectorSwitch antenna array with 360° coverage	Integrated panel with 28° horizontal beam	Integrated panel with 28° horizontal beam
Peak EIRP[1]	44.5 dBm/28.2 W	44.5 dBm/28.2 W	42.5 dBm/17 W	42.5 dBm/17 W
Throughput	Up to 20 Mbps (UDP); Up to 12 Mbps (TCP)	Up to 20 Mbps (UDP); Up to 12 Mbps (TCP)	Up to 20 Mbps (UDP); Up to 12 Mbps (TCP)	Up to 20 Mbps (UDP); Up to 12 Mbps (TCP)
Frequencies[1]	4.940-5.850 GHz	4.940-5.850 GHz	4.940-5.150 GHz 5.150-5.350 GHz 5.470-5.725 GHz 5.725-5.850 GHz	4.940-5.150 GHz 5.150-5.350 GHz 5.470-5.725 GHz 5.725-5.850 GHz
Modulation	OFDM	OFDM	OFDM	OFDM
Maximum Range	Up to 10 miles/16 kilometers	Up 10 miles/16 kilometers	Up to 7.5 miles/12 kilometers	Up to 7.5 miles/12 kilometers
Local Connectivity				
Wired	10/100 Ethernet (all models)	10/100 Ethernet • SkyExtender • SkyExtender TriBand	10/100 Ethernet	10/100 Ethernet
Wireless	DualBand and TriBand options • 2.4 GHz Wi-Fi • 4.9 GHz public safety	DualBand and TriBand options • 2.4 GHz Wi-Fi • 4.9 GHz public safety	DualBand • 2.4 GHz Wi-Fi	
Antennas	Two – omnidirectional	Two – omnidirectional	One – omnidirectional	
EIRP[1]	2.4 GHz – 2.2 W / 33.4 dBm 4.9 GHz – 3.5 W / 35.5 dBm	2.4 GHz – 2.2 W / 33.4 dBm 4.9 GHz – 3.5 W / 35.5 dBm	2.4 GHz – 2.2 W / 33.4 dBm	
Frequencies[1]	2.400-2.483 GHz 4.940-4.990 GHz	2.400-2.483 GHz 4.940-4.990 GHz	2.400-2.483 GHz	
Dimensions	H: 18 inches (45.7 cm) W: 12.2 inches (31.0 cm) diameter	H: 18 inches (45.7 cm) W: 12.2 inches (31.0 cm) diameter	H: 13 inches (33 cm) W: 7 inches (17 cm) D: 4 inches (10 cm)	H: 13 inches (33 cm) W: 7 inches (17 cm) D: 4 inches (10 cm)
Deployment	NEMA outdoor enclosure for mounting on tower, utility pole, building, or other structure	NEMA outdoor enclosure for mounting on tower, utility pole, building, or other structure	NEMA outdoor enclosure for mounting on tower, utility pole, building, or other structure	NEMA outdoor enclosure for mounting on eave, roof, or chimney

[1]Other EIRP and frequency specifications are available to meet local regulatory standards.

About SkyPilot

SkyPilot Networks is the leading provider of carrier-class wireless mesh solutions that enable service providers, municipalities, and public safety agencies to rapidly deploy cost-effective broadband access, voice over IP, public and private Wi-Fi access, video surveillance, and other wireless applications. SkyPilot has more than 300 customers in 50 countries.

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