

OVERCOMING BORDER SECURITY CHALLENGES WITH CAMBIUM PTP SOLUTIONS

CAMBIUM NETWORKS' POINT-TO-POINT (PTP) FIXED WIRELESS BACKHAUL SOLUTIONS EXCEL AT TURNING SENSOR, RADAR AND VIDEO DATA INTO ACTIONABLE INTELLIGENCE THAT HELPS MAXIMIZE BORDER SECURITY.

HOW FAR AND HOW FAST

Fixed wireless PTP backhaul networks have become a mission-critical mainstay in border environments. As your agency or department evaluates network technology, your most basic questions will always be: **"How far will the network transmit our data?"** and **"How fast will it get there?"**

As important as speed and distance are, however, there are a great many other criteria to evaluate: from reliability to redundancy, from latency to throughput, and from network management to security. As the worldwide leader in fixed wireless broadband, Cambium Networks offers innovative PTP solutions that have been vetted — and proven extensively in theater — to deliver superior performance. This paper addresses challenges that are consistent with border environments across the globe from North America to the Middle East to Eastern Europe to Southeast Asia.



It is 1:00 a.m., Thursday morning. An intelligent sensor located near the southernmost U.S. border, detects movement northward across the border. Analyzing the vibration rates, the sensor determines that the movement is neither an animal nor a single individual, but a heavily loaded pickup truck rumbling across the desert. A high-speed wireless point-to-point microwave based backhaul network immediately sends the data to the command and control center. Agents are dispatched and infrared video surveillance cameras track the vehicle's movements, pinpointing its location as agents pursue. When the vehicle moves out of the sector, the live video feed is automatically transferred to the new sector's command and control center, resulting in the quick apprehension and arrest of more than a dozen illegal immigrants.

In the U.S., our 8,000 miles of international borders — from the cold windy plains of Montana to the forbidding desert landscapes of West Texas — can be harsh and dangerous places. These extreme conditions make providing the sophisticated security that protects our country against intrusion — by drug traffickers, illegal immigrant smugglers and potential terrorists — as demanding as it is critical.

WIRELESS TECHNOLOGY ON THE BORDER

Playing a pivotal role in assuring border security is wireless technology. In today's border patrol, you depend on real-time sensor, radar and video data to help detect and locate possible illegal activity and border intrusion. But to make this data actionable, you have to wirelessly backhaul the information in real time to the field agents, investigators and supervisory and command personnel who need it. That's not often a simple task.

Border environments present significant challenges for wireless communications. There are vast expanses of wasteland. Remote locations with unreliable or non-existent power grids. Densely populated urban areas. Heavily forested mountains; irregular hills; stark, solitary mesas; erratic rock formations. Rivers and lakes. Unpredictable weather. All of these add up to a demanding RF environment that makes it crucial to select your wireless backhaul network carefully.

THE CAMBIUM FIXED WIRELESS DIFFERENCE

What's the ideal technology for backhauling this mission-critical data? Although there are many competitors in the marketplace, Cambium fixed wireless broadband networks are emerging as the preferred solution for many government organizations. It's easy to understand why.

Our PTP solutions are UC APL certified, FIPS 140-2 validated and available in the 4.5/4.8 GHz (PTP 600) and 7/8 GHz (PTP 800) bands set aside for U.S. Federal, military and NATO agencies. They're highly valued for their proven track record of reliably backhauling data over the long distances and harsh conditions of border environments, and because of their inherent low latency and high bandwidth.

Cambium PTP solutions also help maximize border security through their broad range of frequencies: from 2 GHz to 5 GHz in the licensed-exempt bands on the PTP 600 and 6 to 36 GHz on the PTP 800. This range can be crucial when faced with often-substantial RF interference on borders between states, provinces and/or countries. Just as important, Cambium PTP solutions provide for flexibility of deployment.

OUR STRONG COMMITMENT TO GOVERNMENT

As an industry leader and technological innovator in fixed wireless broadband solutions, Cambium Networks, formerly part of Motorola Solutions, is committed to helping optimize government communications at the local, municipal, regional and federal levels. This report is one in a series examining best practices for using fixed wireless broadband communications to increase network performance, flexibility and security while lowering total cost of ownership in a variety of government agencies and applications.



WHY CAMBIUM SHOULD BE YOUR BORDERLINE DECISION

MISSION-CRITICAL RELIABILITY

On a remote stretch of the U.S.-Canadian border, a multiple-site video surveillance network continues operating even while enduring an early spring blizzard with two feet of snow and wind gusts of over 70 mph that disrupt power for several hours.

When you're depending on wireless technology to help guard against potential criminal and terrorist activities, your network has to be available when you need it. Cambium PTP solutions deliver 24/7 availability in harsh conditions.

The Cambium reliability difference begins with sophisticated RF planning tools for designing everything from a single link to the highly complex, redundant backhaul networks demanded by difficult and diverse border conditions. Cambium also makes use of sophisticated technology including adaptive modulation, which automatically adjusts processing speed to ensure that difficult RF paths will not cause dropped links or loss of data. This is in stark contrast to competing products where an encounter with interference causes the link to completely drop and all communications lost. In addition, our unique blend of Orthogonal Frequency Division Multiplexing (OFDM) and 2x2 Multiple Input/Multiple Output (MIMO) technologies is proven to deliver line-of-sight (LOS) and near-line-of-sight (nLOS) connectivity in remote border environments in the U.S. and around the globe.

Cambium has an industry-leading track record in reliable performance in the most demanding outdoor environments from Arctic cold to Saharan heat. Even under harsh conditions, our mean time between failure (MTBF) rates — which measure the projected elapsed time between equipment failures — are outstanding: 441 years for the PTP 600 series and 80 years for the PTP 800 series. Currently being used in thousands of networks in more than 150 countries and totaling more than 3 billion field hours, Cambium fixed wireless technology is proven to deliver 99.999% reliability in some of the most extreme weather and topographic conditions around the world.

In areas with unreliable or non-existent power availability, the efficiency of Cambium radios allows them to be powered by solar energy for use as primary or backup networks. Our radios have exceptionally low power consumption requirements — similar to a 50-watt light bulb — and require fewer solar panels than competing vendors.



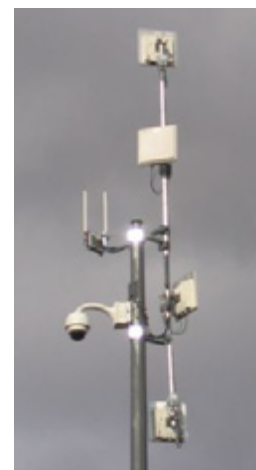
NETWORK CONFIGURATION AND REDUNDANCY

Near the U.S.-Mexican border, one site covering an extensive sensor network is knocked out of service by a lightning strike. Because the network is deployed in a multiple link ring configuration, the failure of this single installation does not affect the performance of the overall network.

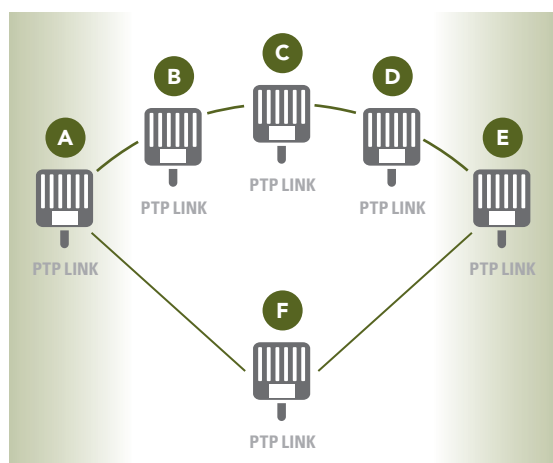
Border Patrol environments are faced with numerous difficulties to wireless backhaul reliability; two of the most problematic are extreme weather and sabotage. Weather emergencies — hurricanes and tornados, desert deluges and snowstorms, high winds and extreme temperatures — threaten communications networks in virtually every type of border location. Your backhaul networks can also face sophisticated jamming of radio signals perpetrated by a variety of criminal or terrorist elements. The solution is to create a sophisticated network with built-in redundancy.

To deliver mission-critical network continuity, our networks are deployable in multiple link configurations that ensure no single point of failure. Getting information from Point A to

Point B in perfect conditions is a fairly straightforward task. Rarely, however, are these conditions present. Our solutions offer exceptionally flexible redundancy options. You can deploy our PTP networks in complex network designs such as co-located links in a redundant self-healing ring configuration, traditional star topologies, or in combination networks using both architectures. All of these designs can take advantage of 1+1 hot standby from critical links and 2+0 double capacity deployments. When joining adjacent rings together, higher levels of redundancy are realized. Cambium's unparalleled configuration flexibility and self-healing capabilities ensure that if one node or site goes down, your network will remain in operation and no data will be lost.

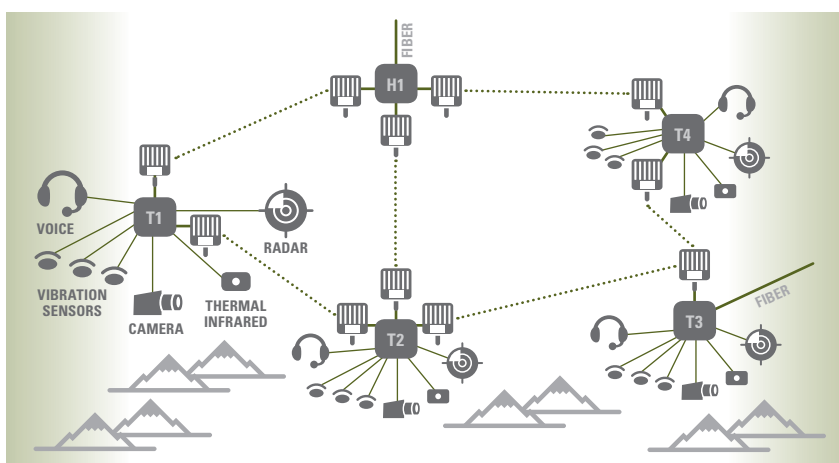


REDUNDANT SELF-HEALING RING CONFIGURATION



A Cambium fixed wireless network deployed in a “ring” configuration. If an outage occurs in a ring segment, the network's self-healing capabilities automatically bypass the affected link and communications are restored.

COMBINATION RING AND STAR NETWORK DESIGN



Cambium PTP fixed wireless networks can be easily deployed in combinations utilizing both rings and stars. Single link redundancy/capacity can be ensured with configurations such as 1+1 hot standby, and 2+0 load balancing parallel links.

LOW LATENCY, HIGH THROUGHPUT

A Border Patrol command center is using video surveillance cameras to monitor a potentially dangerous incident in which an agent has stopped a suspicious truck near the Canadian line. The command team must be able to see high-quality, non-jittery video images or safety can be compromised.

Video surveillance is playing an increasingly important role in guarding our borders. With networks of video cameras placed in strategic locations, agents can leverage real-time visual intelligence from remote border zones. But network users quickly discover that video image quality is critical, and insufficient throughput and high latency can cause jerky, jittery, low-quality images that are all but unusable. For example, when you're attempting to track illegal immigrants or drug traffickers, if the video is buffered or distorted you can lose them in a millisecond. If it takes too long to send commands back to pan/tilt/zoom cameras, the benefits of multiple views are lost and the image quality may suffer.

Cambium PTP modules are optimized for live video with inherent low latency and high throughput that increase video quality. The PTP 600 has a latency of less than 2 milliseconds, the PTP 800's less than 100 microseconds, helping to eliminate choppy, low-quality images. In addition, our adaptive modulation capabilities enable our radios to speed up or slow down to adapt to RF fading or interference, helping maintain the lowest bit-error rate and highest throughput.



EXTENDED RANGE

A remote radar installation in Idaho detects an unidentified low-flying aircraft approaching the U.S.-Canadian border. Backhauling that information is crucial to national security, and it must be transported over more than 100 miles of rough terrain and uneven topology.

Extensive segments of many international borders are located in sparsely populated plains and desert areas. That means long distances between technology sites, agents and command and control centers.

Cambium PTP solutions offer ranges of well over 100 miles. But sheer distance is not the only obstacle a wireless network must overcome. Cambium makes use of Intelligent Orthogonal Frequency Division Multiplexing (iOFDM) technology to overcome multipath fading and cancellation that can cause either dropped signals or low signal quality. Our networks also feature MIMO that minimizes signal fading due to path obstructions or severe weather. In addition, our spatial diversity technology enables communications to travel across large expanses of open terrain, over water and in non-line of sight environments...using the smallest possible antennas.

HIGH SPECTRAL EFFICIENCY

In remote and rugged terrain near the California border, video cameras pick up two illegal immigrants crossing the line. The wireless backhaul network must be able to deliver communications through a gauntlet of interference and RF obstacles without distorting or delaying signals.

High quality real-time voice and video communications are one of the most important foundations of border security. To deliver them, you need a combination of high spectral efficiency and low frequency bandwidth requirements. Cambium fixed wireless backhaul networks maximize the amount of actual throughput your network can deliver while utilizing the smallest channel assignments and frequency bandwidth. This ensures voice and video of superior quality,

clarity and fidelity. Our networks also enable you to use that speed more efficiently. Our Proactive Channel Select technology automatically scans to find the channel with the least amount of interference, helping to substantially increase throughput. Our PTP 800 technology also supports X-PIC functionality that allows you to use two radios in parallel, enabling you to double throughput capacity without increasing channel bandwidth.

NETWORK MANAGEMENT

On the border, wireless communications networks are constantly expanding to increase coverage and capacity. Real-time network operations management is paramount, and the ideal expansion strategy is to select networks that can integrate with existing network management systems.

In a remote border environment, a communications network is almost never static. You are constantly adding sensor sites and video cameras to add coverage areas, increase capacity and optimize situational awareness. At the same time, this additional equipment adds to the complexity of your network — and your network management. Unfortunately, in many cases, fixed wireless providers will not permit integration with your existing management system, requiring you to use their own proprietary system instead.

Cambium solutions are different. We allow for full management system integration by making our management information base (MIBs) available online and downloadable at no cost, making network element monitoring, troubleshooting and maintenance easier and more effective. In addition, our Wireless Manager is a highly effective network monitoring tool with northbound capabilities that integrates with your existing SNMP management systems.



VALIDATED SECURITY

In border environments, drug trafficking and terrorist organizations possess advanced capabilities for hacking into Border Patrol communications networks. Standing in their way, and preventing them from benefitting from access to classified and critical surveillance information, are sophisticated security certification standards, notably FIPS 140-2.

Secure borders depend on secure border communications. Cambium Networks' fixed wireless PTP solutions maximize protection of your mission-critical video, voice and data transport. Our PTP 600 and PTP 800 networks are among the world's most trusted fixed wireless broadband networks. They are the only PTP microwave products with FIPS 140-2 security that have earned inclusion on the Department of Defense's

Unified Capabilities Approved Product List (UC APL). Both also offer high-level AES 128- and 256-bit encryption, and both have JF-12 and SPS certification. Even more critical is the fact that Cambium PTP technology has earned Federal Information Processing Standards 140 Level 2 (FIPS 140-2) validation for cryptographic algorithms, key security and tamper evidence. *(See sidebar.)*

With these and other innovative and unique capabilities, Cambium fixed wireless PTP backhaul networks are optimized for the long distances and difficult environments faced by border security personnel every day of the year. To learn more about the crucial role Cambium technology can play in strengthening border security, contact us at 888.863.5250 or visit us on the web at www.cambiumnetworks.com.



FIPS 140-2: THE CLAIM OF COMPLIANCE VS. THE PROOF OF VALIDATION

Cambium Networks is committed to providing the highest levels of network security, including FIPS 140-2 validation. Although some providers say their technology is FIPS 140-2-compliant, there's a big difference between the claim of compliance and the proof of validation. Cambium has earned FIPS 140-2 validation by submitting our technology for rigorous government testing, and our networks are *proven* to meet FIPS 140-2 standards. The PTP 600's FIPS validation number is 1761; the PTP 800's FIPS validation number is 1763.