WHITE PAPER

Meeting the Growing Demand for Cost-Effective Backhaul in Public Safety

Contents

Summary

Technology will continue to play a crucial role in helping public safety agencies meet the vital informational demands that enable police officers, firefighters, medical teams, dispatchers and other public safety officials to protect their citizens and meet Homeland Security requirements. However, at a time when budgets and resources are being stretched, the ideal solutions will provide the bandwidth and reliability needed to transport critical data, voice and video information while offering maximum value and cost efficiency.

A Motorola point-to-point wireless broadband solution can help agencies achieve their strategic goals by deploying a backhaul system that disseminates timely information dependably, securely and cost effectively. Designed for public safety applications, a PTP 49600 wireless system offers adequate bandwidth for today's converged data, voice and video applications, while enabling a smooth and efficient migration to tomorrow's IP-based network. Recognizing Motorola's market leadership in two-way radio systems and the Company's long-term commitment to serving the public safety marketplace, the PTP 49600 was specifically engineered to provide a reliable and cost-effective backhaul solution for Motorola's ASTRO® 25 networks.

Introduction

Too many needs…too few resources! The amount of information and services demanded from today's public safety officials has increased significantly over the past few years, while operational budgets and staffing have decreased or remained flat. With more Homeland Security responsibilities, a proliferation of natural disasters and an increase in crime, resources have been stretched nearly to the breaking point. As a result, public safety agencies are turning to technology to help close the gap.

In addition, the growing demand for converged data, voice and video communications and mobile applications has accelerated the migration to IP-based networks and wireless broadband connectivity. IP-based networks and wireless technologies can empower public safety officials by providing the communication tools they need to:

- Establish intra- and inter-agency collaboration
- Improve emergency response
- Protect citizens and personnel
- Increase productivity
- Better utilize existing resources

With real-time access to vital data, voice and video information, police officers, firefighters, emergency medical teams, dispatchers and other public safety officials in organizations such as schools, universities and hospitals can decrease incident response time, make better on-scene decisions and reduce operational costs.

However, the technology to support these objectives has to be affordable, operate with existing legacy systems, meet stringent reliability, throughput and security requirements, and scale to handle future needs. One of most critical components of a successful public safety network is the backhaul component which transfers communications traffic from a base station to the core network. This paper focuses on that aspect of public safety communications, analyzing the technologies available and how they impact public safety backhaul applications.

Applications

Any communications network deployed must be able to serve the rigorous needs of a wide range of public safety agencies. With mounting budget pressures, escalating security demands and growing public apprehension, agencies have formidable challenges.

Typical agencies protecting people and property:
- Law enforcement agencies
- Fire departments
- Emergency medical teams (EMTs)
- 911 departments
- Highway safety divisions
- Criminal justice divisions
- Medical examiners
- Local and state departments of Homeland Security
- Schools and universities
- Hospitals
- Departments of Transportation (DOTs)

IP-based and wireless technologies are readily available to deliver the high quality of service and security required for public safety functions while providing cost efficiencies. In addition, public safety officials have a variety of devices that can be used to send and receive information to and from base stations, including radios, personal digital assistants (PDAs), laptop computers, digital cameras and fingerprint scanners.

Wireless broadband technologies running over high-performance networks can serve as real partners to accomplish a wide variety of public safety tasks. The following applications represent a sampling of the many operations that can be enabled using such networks to help officials protect and serve citizens while helping to ensure their own safety.

- **Real-Time Database Access:** Whether responding to a fire or reacting to a natural disaster or a bomb threat, police officers, firefighters, medical personnel, dispatchers and other officials need immediate access to vital information to help them respond quickly and make the best on-scene decisions. Through the use of two-way radios, laptop computers and in-vehicle information systems, officials can access the information needed in real time.

On-scene access to vital information:
- Mug shots
- Aerial imagery and maps
- DMV records
- Medical files
- Missing-person images
- Amber Alert briefings
- FBI Most-Wanted records
- Arrest warrants
- Firearm permits
- Evacuation routes
- Road closures
- Building floor plans
- Fire hydrant locations
- …and more

- **Intra- and Inter-Agency Collaboration:** With land mobile radios, first responders, dispatch centers and command centers within the same agency and/or between multiple agencies can discuss situational issues and response options to facilitate faster, more effective incident response.

- **Enhanced Situational Awareness:** Dispatchers and first-responders can increase situational awareness by accessing historical data that answers questions such as:
  - Where is the incident?
  - Who is responding?
  - Where are the vehicles, equipment and other resources located?
  - What are the location's attributes (e.g., crime rate, demographics, potential site hazards, etc.)?
  - What previous incidents have occurred at this location?

Applications (continued)

- **Expanded Video Surveillance:** As crime rates and gang violence increase, video surveillance systems are proliferating to monitor both indoor and outdoor spaces and facilitate quick response from patrol officers. Recent advances in video surveillance software not only capture the image of what the camera sees, but also provide the precise camera location, object detection intelligence and object tracking until an intruder is out of view. These advances have contributed to greater situational awareness for public safety officials.

- **On-Scene Video Monitoring:** On-demand video monitoring is dramatically effective to increase officer and citizen safety. Once enabled, streaming video can transmit the incident in progress so that additional help can be dispatched as needed. Post-event, the video provides a valuable incident record for any subsequent legal actions as well as training.

These and other communications are vital to help public safety officials respond efficiently. Once the information is captured, the communications traffic has to be transmitted from the originating site to a base station and ultimately to the core network. The speed, reliability and security of these backhaul transmissions are absolutely critical to the overall effectiveness of the public safety network. Otherwise, the backhaul component will become a bottleneck to the whole system.

Current Backhaul Technologies

Whether transporting voice traffic from two-way radios or streaming on-scene video, backhaul is one of the most important operations in the overall communications network – and it has to perform flawlessly. Bandwidth must be adequate to deliver the information in real time, or officials will not receive the information fast enough to take the appropriate actions. Reliability is crucial to give officials complete confidence in the information's completeness and accuracy. Plus, the security of transmissions has to be bullet-proof.

Today, there are three key technologies that can be deployed to backhaul public safety communications – T1/E1 lines, fiber and microwave radio. The following information provides a brief overview of each method.

- **T1/E1 Lines:** Developed by Bell Labs, T1 lines are used in North America, Japan and Korea. Conversely, E1 leased lines are used in most regions outside North America, Japan and Korea. With 1.544 Mbps, T1s can support up to 24 voice channels per line, while E1s operate at 2.048 Mbps and support up to 32 channels per line. Typically, traditional copper T1/E1 lines require span repeaters every 6,000 feet (1,829 meters).

  There are very small up-front costs to deploy T1/E1 lines since millions of lines have been installed over time. However, monthly usage fees are paid as long as the service continues. Due to the ongoing charges, the per-megabit cost of T1/E1 lines can become expensive over time. Additional limitations of T1s and E1s can include:

  > Unacceptable availability and Bit Error Rates

  > Forced symmetry – T1s and E1s provide 1.5 or 2.0 Mbps, respectively, each way for a total of 3.0 or 4.0 Mbps aggregate. If the requirement is for 2.0 Mbps one way and 1.0 Mbps the other, a T1 line will not meet that requirement.

Because T1/E1 lines were designed to backhaul TDM (Time Division Multiplexing) traffic, they are well suited to backhaul voice communications. However, the marketplace has been steadily migrating to Ethernet – and many organizations are moving to an all-Ethernet network. In addition, the shift to true diversity and hybrid networks is being driven by the need to optimize today's networks for growth. While network operators can add extra T1/E1 lines to accommodate the added bandwidth requirements for these networks, the costs to accommodate the needed throughput can become prohibitive. Instead of adding extra T1/E1 lines, a microwave system can be a more cost-effective alternative, while meeting the performance criteria for Ethernet migration and network growth.

Regardless, T1/E1 lines are not going away anytime soon because millions of telephone systems operate on those networks. In organizations where T1/E1 lines exist, the shift to Ethernet and IP networks means that the agencies will probably utilize multiple backhaul technologies, combining their existing T1s and E1s with fiber and/or microwave.

- **Fiber:** Fiber-optic communications enable transmissions over longer distances and at higher data rates than T1/E1 lines – as high as 100 Gbps or more. Optical fibers are used to transmit data instead of wires. Because fiber cables are less prone to signal attenuation, signals travel farther with less loss and are immune to electromagnetic interference. That means they can support longer-distance connections, requiring repeater sites every 31-50 miles (50-80 km).

  While fiber's capacity is virtually unlimited and the technology is considered "future proof," deployment costs are extraordinarily high. In addition to the ongoing monthly service charges, public safety agencies incur costs to obtain permits and construction costs to trench and lay cable. It is not uncommon for costs to exceed $100,000 just to install fiber. The high up-front costs, ongoing monthly usage fees and time to deploy can make fiber cost prohibitive.

- **Microwave:** Increasing bandwidth demands can leave agencies with basically two backhaul options: run their own, expensive fiber or deploy wireless microwave systems. With microwave links, data, voice and video traffic is transported between two points via radio waves. The majority of microwave backhaul operates in radio frequencies (RF) from 2 GHz to 40 GHz. While there are frequencies above 40 GHz (e.g., 60, 70, etc.), the 2-to-40-GHz bands accommodate many radios from various vendors. However, some of those radios are TDM-based at a time when many agencies are shifting to Ethernet networks.

  Under 6 GHz, there are several microwave systems that operate in 2, 4 and 5 GHz bands, many of which are unlicensed frequencies. A few of these systems have the ability to transmit around obstructions and interference. However, microwave systems operating in the 6, 11, 15, 18, 23 GHz and above licensed frequencies are designed to communicate in only line-of-sight environments. That means that these systems cannot work around manmade or natural obstacles which may be obstructing a path's visual line of sight.

  A licensed frequency requires that an organization obtain a license from a regional regulatory body to operate in a specific frequency. Typically, equipment for licensed 6 GHz-and-above systems is expensive, and installation costs can be high. Although expensive, many organizations utilize these licensed systems because they enjoy exclusive rights to a specific RF band. Having exclusive rights to a slice of spectrum ensures virtually interference-free communications, although some interference still can be experienced.

  To empower public safety officials with highly available and reliable communication capabilities, the U.S. Federal Communications Commission (FCC) designated 50 MHz of the 4.9 GHz frequency band for communications to ensure public safety for both catastrophic and day-to-day initiatives. Any organization that provides for the safety of people or property can apply for and obtain a license, providing they receive the endorsement of the local Public Safety organization.

  Licensed public safety agencies can utilize the 4.9 GHz licensed frequency for backhaul communications. Although most licensed RF bands give the licensee exclusive rights to use a specific frequency band, the 4.9 GHz band is a shared band, meaning that several public safety agencies can be operating in the 50 MHz of spectrum at the same time. In some cases, this frequency-sharing results in congestion in the band.

  In addition to 4.9 GHz systems, public safety agencies can use systems that operate in other frequencies as well, including the unlicensed 5.4 and 5.8 GHz radio frequencies. This gives agencies access to additional spectrum as needed. In all cases, local regulatory conditions for radio frequency bands should be confirmed prior to purchasing any backhaul system.

  Microwave systems can transmit data, voice and video at data rates up to several hundred megabits-per-second and at distances up to 100 miles or more. The systems are cost-efficient because there are no ongoing fees, other than maintenance costs. Upfront costs consist of purchasing the equipment and deploying the radios. Unlike fiber, deployment is much simpler because the systems are wireless. Installation consists of installing radios and antennas on towers or walls and aligning the antennas to optimize the radio signals. As a result, the per-megabit cost over time can be significantly less than that of T1/E1 lines and fiber.

  With the capacity to carry data, voice and video traffic over the same connection, the simplicity of deployment and the high-bandwidth capabilities, wireless systems can provide considerable performance and cost advantages for IP-based networks and mobile communications.

The Future Now: Motorola PTP Wireless Backhaul

While there are many manufacturers of wireless backhaul systems today, Motorola is one of the leading manufacturers of such systems. Motorola's portfolio of point-to-point (PTP) wireless broadband solutions includes several PTP Wireless Ethernet Bridges within its PTP 600 Series family of products that are well suited to public safety applications, including:

Table 1:
Products within the PTP 600 Series Solutions

PTP Model	RF Band	Max. Ethernet Data Rate	Distance
PTP 49600	4.9 GHz (licensed)	125 Mbps	Up to 124 mi (200 km)
PTP 54600	5.4 GHz (unlicensed)	300 Mbps	Up to 124 mi (200 km)*
PTP 58600	5.8 GHz (unlicensed)	300 Mbps	Up to 124 mi (200 km)

Because these solutions can provide up to 99.999% link availability even in non-line-of-sight and high-interference environments, over water and open terrain, and through extreme weather conditions, the systems offer significant technological advantages for point-to-point, public safety connectivity and backhaul.

System Components

Each end of a Motorola PTP 49600 link consists of an outdoor unit (ODU) and a power indoor unit (PIDU Plus). The outdoor unit is a small, durable, lightweight radio that contains all the radio and networking elements, including the multiple transceivers required for Multiple-Input, Multiple Output (MIMO) capability. The radios are available in two versions – Integrated and Connectorized. The Integrated version includes built-in antennas, while the Connectorized version connects to an external antenna (purchased separately). An external antenna increases signal gain, and, therefore, the range and robustness of the link.

Motorola PTP 49600 Integrated Radio and Motorola PTP 49600 Connectorized Radio

* In certain cases, FCC power limits may reduce the maximum range achievable

Motorola PIDU Plus (Power Indoor Unit)

At each end of the link, a PIDU Plus (indoor unit) connects to its outdoor unit via a powered CAT-5e cable. The PIDU Plus carries both power and Ethernet data to the outdoor unit, has a rugged metal case that fits into a 1U high, rack mount tray and supports both DC (-48 V) and AC (110/240 V) powering. A second PIDU can be used for redundant powering

PTP 49600 – Designed for Public Safety

Operating in the 4.9 GHz band at Ethernet data rates up to 125 Mbps, PTP 49600 Wireless Ethernet Bridges are specifically designed to meet the stringent demands of public safety communications for both point-to-point connectivity and wireless backhaul. The systems deliver the high-throughput, reliability and security needed to transport vital data, voice and video communications in real time. In addition, they are flexible enough to support legacy voice systems, while providing a smooth, cost-effective migration to IP-based networks.

PTP 49600 Key Features:
> 4.940 GHz to 4.990 GHz RF band
> Configurable 5, 10 and 20 MHz channel widths
> Dynamically variable up to 125 Mbps at the Ethernet:
• 41 Mbps - 5 MHz channel
• 84 Mbps – 10 MHz channel
• 125 Mbps – 20 MHz channel
> Low latency – as low as 2 ms or less (one way)
> Single or dual T1/E1 ports
> Up to 124 miles (200 km) range
> Robust security – unique scrambling plus optional FIPS-197 compliant 128/256-bit AES Encryption
> 10/100/1000 Base T (RJ-45), optional 1000 Base SX
> Wind survival up to 202 mph (325 kph)
> Small footprint
> Easy to deploy and use

Powerful Technologies for Unshakeable Performance

PTP 49600 radios are based on Motorola's unique combination of technologies that enable highly available, reliable connectivity even in the most challenging environments. These key features include:

- **Higher Spectrum Efficiency:** Because the PTP 49600 channel width is configurable to 5, 10 or 20 MHz, the bridges are very spectrally efficient in the 4.9 GHz band. As a result, network performance is significantly improved due to less crowding within the public safety band.

- **Interference Mitigation:** While the 4.9 GHz band is a licensed band, several public service agencies within a municipality or geographic region may share the same 50 MHz of available spectrum. As a result, agencies can experience congestion in the band, especially during events in which several agencies must respond at the same time. In the event a PTP 49600 radio does encounter such interference, it automatically applies interference-mitigation techniques to vastly increase link availability. The system's spectrum management capabilities can automatically change channels within the band to avoid interference and combat link fading. At power-up and throughout operation, the radio scans the band up to 1,200 times a second and automatically switches to the clearest channel. This means the bridge is likely to find a clear channel even in a congested space without operator intervention. You can also manually lock the frequency (in either direction) and restrict each link to specified frequencies.

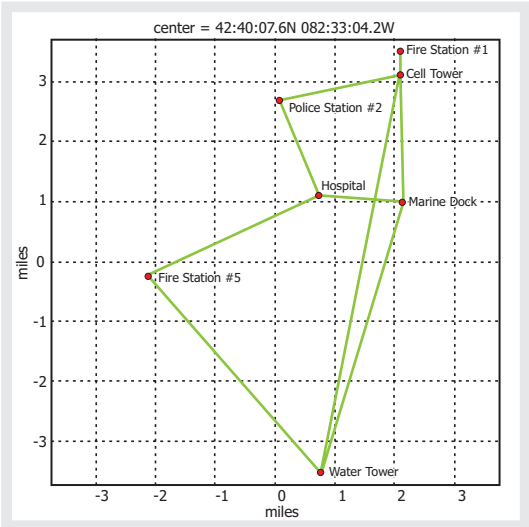
- **Carrier-Class Link Availability:** PTP 49600 links have class-leading sensitivity and power output, which enable the links to go farther, regardless of conditions. Motorola is the only manufacturer to combine Multiple-Input Multiple-Output (MIMO) and *intelligent* Orthogonal Frequency Division Multiplexing (*i*-OFDM) with advanced signal-processing algorithms. This combination allows the links to create four simultaneous channels between pairs of transceivers at each end of the link and greatly improves system availability. In fact, PTP 49600 systems can be optimized to provide up to five 9's of link availability.

Predict Performance Before Purchase

If only we could know which alternative was best before purchase! With Motorola's PTP LINKPlanner, you can. The PTP LINKPlanner is a link design and optimization tool that lets users quickly and easily project link performance before purchasing a system. By entering path-specific information such as geography, distance, antenna height and transmit power, this tool allows public safety agencies to accurately predict performance for PTP 49600 links.

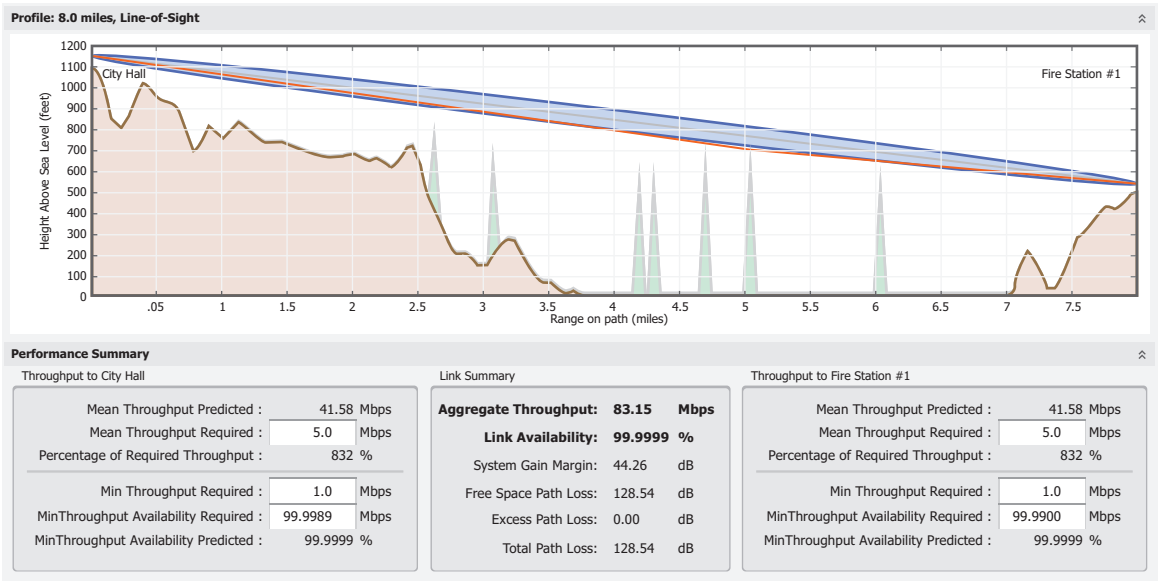
Organizations can plan one link or multiple links simultaneously and obtain a comprehensive overview of the wireless network via Google™ Earth. During the link-planning process, link performance can be optimized by changing input data to see the effect on performance and throughput. As an example, if a link calculation indicates low throughput, then a number of factors can be changed to improve throughput. Thousands of Motorola PTP links have been designed using the PTP LINKPlanner tool with in-operation performance matching or exceeding the predicted performance.

The PTP LINKPlanner is especially valuable when designing a link to deliver five 9s of availability. As long as accurate and complete path information is entered and link characteristics are optimized for maximum availability, public safety officials can be assured the output reports will accurately predict the link availability that will be realized after deployment.



Sample PTP LINKPlanner Network Overview Page

Sample PTP LINKPlanner Results Page



The PTP LINKPlanner is a free system-design tool that is available as a stand-alone tool or as part of the Motorola One Point Wireless Suite. When used in conjunction with the One Point Wireless Suite MeshPlanner and LANPlanner, wireless networks of virtually any size and complexity can be easily and holistically designed for optimal deployment and cost effectiveness.

Public Safety Use Cases

PTP 49600 systems offer exceptional capabilities to support police officers, firefighters, emergency medical teams, dispatchers and other public safety officials with point-to-point connectivity for:

- Cost-effective wireless backhaul from video surveillance cameras, 4.9 GHz hot spots and command centers, Motorola Canopy™ point-to-multipoint systems and Motorola ASTRO® 25 networks
- Timely, uninterrupted Internet and database access, streaming video and historical data to enhance situational awareness
- Intra- and inter-agency communications and coordination
- Communications between sites that are located in previously inaccessible locations – for example, connect fire houses and police stations to a central data or command center
- Leased line replacement to reduce operating costs or improve performance on poorly performing lines
- Video surveillance beyond the confines of a wired network
- Quick deployment for disaster recovery, emergency services and special events

Additional connectivity opportunities exist when integrating the PTP 49600 bridges with Motorola ASTRO 25 networks:

- Backhaul voice traffic from ASTRO 25 base stations
- Provide last-mile access
- Deploy capacity overlay for broadband access at tower sites
- Equip pre-mounted mobile RF sites (pre-mounted on a trailer, for example) with PTP 49600 links for quick backhaul deployment in emergencies
- Install a high-bandwidth IP network overlay "underneath" an existing 6 GHz licensed microwave link
- Provide wireless broadband connectivity between ASTRO 25 base sites

Cost Effectiveness

While informational demands continually increase, the shift to IP-based Ethernet networks escalates, and the need for greater bandwidth grows exponentially, budgets are flat or shrinking. Technology can help public safety agencies achieve their important communication objectives. However, costs can potentially be a barrier to implementation. The PTP 49600 can provide significant cost savings over alternative solutions as shown in the following Table.

Table 2:
Cost Comparisons

Features	T1/E1	DS3	Microwave (6 GHz and Up)	PTP 49600 (4.9 GHz)
Throughput	3.10 Mbps	90 Mbps	Up to 310 Mbps	Up to 125 Mbps
Typical Cost*	$300 to $1,300/Mo. $3,600 to $15,600/Yr.	$3,000 to $5,000/Mo. $36,000 to $60,000/Yr.	$42,000 to $138,400 Per Hop (one-time cost)**	$29,655 to $35,655 Per Hop (one-time cost)**
Costs Per Megabit (first year)	$1,161 to $5,032/Mb	$400 to $667/Mb	$135 to $446/Mb	$285 to $723/Mb

In addition to deployment costs, all systems require ongoing management and maintenance. Recognizing that most wireless networks contain various types of technologies – point-to-point, point-to-multipoint, mesh and wireless LANs – Motorola developed the One Point Wireless Suite to provide design, deployment and management capabilities for each layer of the network. The One Point Wireless Suite offers a set of advanced, integrated tools that enable public safety agencies to cost-effectively design, monitor and manage all aspects of a Motorola wireless communications network from the earliest stages through ongoing operations. Guesswork and expensive manual operations are virtually eliminated using these powerful tools.

* Because prices can vary by vendor, time and geography, these prices should be viewed as general guidelines for comparison purposes only.

** The typical microwave cost is based on a 6 GHz link installed with radios, rack, waveguide, panels, cables and two antennas. The typical cost for the PTP 49600 is based on a 4.9 GHz link installed with 5 MHz radios at 41 Mbps for $29,655 or 20 MHz radios at 125 Mbps for $35,655, with each option including two lightning protection devices, cable and two antennas.

PTP 49600 Advantages

When compared to T1/E1 lines, fiber and 6 GHz-and-over microwave systems, PTP 49600 wireless links offer compelling advantages for public safety agencies. The information provided below details the key advantages as they relate to point-to-point connectivity and backhaul.

Table 3:
PTP 49600 Advantages

PTP 49600 Advantage	Rationale
Connect the Unconnectable	Motorola PTP 49600 bridges can reliably transport data, voice and video over obstructed paths, in high-interference environments, over water and open terrain and in severe weather conditions. This means that public safety officials can establish connectivity in virtually any environment. Conversely, 6 GHz-and-over microwave systems are designed to operate exclusively in line-of-sight (LOS) environments. When deploying these systems in a NLOS path, network operators must find a different path and/or deploy repeater sites to work around the obstructions. This approach can increase equipment and deployment costs significantly. However, a PTP 49600 can be deployed in the same NLOS path without any repeaters or deployment workarounds.
Superb Voice Quality	The integrated T1s/E1s in PTP 49600 radios experience very low latency (as low as 4 ms round trip) and jitter, allowing PTP 49600 radios to deliver the best possible link conditions for excellent voice quality.
Unmatched Reliability	With MIMO, *intelligent* OFDM, the highest system gain in the industry, adaptive modulation and Advanced Spectrum Management with *intelligent* DFS, PTP 49600 bridges can supply up to 99.999% link availability. This level of reliability gives public safety officials the confidence that on-demand, vital information is accurate, complete and accessible when they need it.
Flexible, Cost-Effective Antenna Configurations	Typically, 6 GHz-and-above microwave systems require the use of large antennas (4-feet in diameter and greater) which adds to the cost of the equipment. In addition, antennas of these sizes may not fit on a tower, may be too heavy for the tower and/or may be susceptible to wind loading. On the other hand, PTP 49600 Connectorized systems can be fitted with external antennas as small as one or two feet in diameter. As a result, the antennas are less expensive and are small and light enough to fit on most towers with little wind loading.
High Throughput	With up to 8.4 bps/Hz and up to 256 QAM modulation, PTP 49600 bridges create high-throughput links (up to 125 Mbps in a 20 MHz channel width) with minimal spectrum usage and without diminishing the T1/E1 audio quality. For video applications, this level of throughput enables high-quality video backhaul and streaming video.
Robust Security	PTP 49600 bridges have a unique, built-in scrambling mechanism that provides excellent over-the-air security. Plus an added layer of security can be applied with FIPS-197 compliant 128-bit or 256-bit AES encryption (optional). Together the proprietary scrambling and AES encryption provide powerful, multi-layered security for sensitive public safety communications.
Efficient Collocation	The PTP 49600's TDD (Time Division Duplex) synchronization capability, high receiver sensitivity and ability to limit channel width to as small as 5 MHz allow network operators to maximize the number of links at a hub site.
Price Performance	The adage, *"You get what you pay for,"* truly applies when deploying connectivity and backhaul for the critical nature of public safety applications. Accessibility, voice quality, reliability, high throughput, robust security and collocation capabilities are all vital to public safety communications – not mere niceties. PTP 49600 bridges offer all these vital capabilities. Plus, PTP 49600 bridges provide extremely cost-effective backhaul solutions when used in place of leased lines, fiber and 6 GHz-and-over microwave options. Additional value and cost savings can be realized by: • Deploying a solution that offers a cost-effective, smooth migration to an IP-based network • Replacing or augmenting leased lines • Reducing man-hours and travel and equipment costs with fast, easy deployments – typically, PTP 49600 systems are deployed in a day or less • Supplying connectivity quickly for disaster recovery or emergencies

Motorola PTP Wireless Broadband Case Studies

Included in the PTP 600 Series family of solutions, PTP 49600 products are based on the same unique combination of technologies that earned Motorola the number one market share in the global unlicensed Ethernet market. It is these technologies working together that enable the exceptional performance and reliability that is the hallmark of Motorola PTP wireless solutions. With more than 20,000 successful links installed worldwide, the systems are proven to deliver a quality of service that consistently outperforms comparable solutions. Below is a sampling of customers who have deployed PTP systems that exceeded their expectations.

United State Coast Guard

Requirements:

To increase Maritime Domain Awareness (MDA) within U.S. ports and waterways, the United States Coast Guard (USCG) embarked on an initiative called Project Hawkeye, which monitors the waters 20 miles (32 km) from the coast. The Hawkeye system consists of long-range optical cameras, RADAR, a Geographic Information System, a vessel identification system and a web portal for sharing information with port partners.

The USCG needed to interconnect Hawkeye's surveillance equipment that is distributed across seaports located in Portsmouth, Virginia; Boston, Massachusetts; Charleston, South Carolina; Key West and Miami, Florida. One of the most critical elements of the network was a system to backhaul the traffic from the remote sites to the command centers. The individual links would be exposed to extreme conditions. As examples, the Key West links would have to function in salty, hot, tropical conditions, while links in Boston would encounter extreme winters and icy conditions. In addition, the links would have to adhere to the USCG's security standards and transport information over water where shipping traffic continuously blocks the communications path.

Results:

The system configuration includes several Motorola 5.8 GHz PTP bridges with Integrated antennas and Connectorized systems with external antennas that interconnect the five East Coast Hawkeye networks to command centers. The links exceeded the USCG's throughput requirements with maximum capacities of 35-43 Mbps, depending on the path. All systems operate dependably amidst high interference, severe weather conditions and water motion. To adhere to the security standards from the Department of Homeland Security, systems were equipped with 128-bit FIPS-197 compliant AES encryption.

Testimonial:

"We were in need of a solution that could provide us with high-bandwidth without compromising reliability. For Hawkeye to be successful, our system needed to maintain Maritime Domain Awareness at all times via real-time live data. We are now able to maintain a watchful eye on the Port of Miami because of the reliability and security that Motorola's PTP systems give us, even in extremely high-interference paths," says Lieutenant Rothberg, USCG, Miami.

City of Santa Barbara

Requirements:

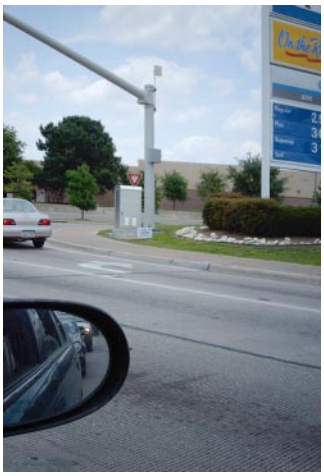
The City of Santa Barbara Fire Department needed to upgrade its T1 network for Voice-over-IP applications and add more bandwidth for a video conferencing application to train fire personnel. The network had to overcome significant interference from nearly hospitals and universities and provide connectivity across hilly terrain and around city buildings. In addition, communications had to be reliable and provide business continuity in the event of natural disasters such as earthquakes.

Results:

They deployed eight Motorola 5.8 GHz PTP bridges – six Integrated systems with internal antennas and two Connectorized systems with external antennas. The network provides consistent performance while delivering 22 Mbps throughput in six fire stations and 45 Mbps throughput in the airport and headquarters stations. The City estimates their annual savings at $106,000.

Testimonial:

Perry Blacken, information systems supervisor, states, *"Our new Motorola point-to-point wireless network is incredibly reliable. In fact, we had so much confidence and trust in its stability that we have removed our existing leased vendor-supplied fiber optic cable and now solely rely on Motorola for all our data communications to the Santa Barbara airport fire station. Furthermore, the increased amount of bandwidth we have gained has allowed us to begin to implement new applications, while saving us money on fire fighter training."*



City of Dallas

Requirements:

As part of the "SafeLight, Dallas Stops on Red" program, the City of Dallas needed to deploy a secure reliable network to backhaul red-light violation information from a network of 60 cameras. The backhaul equipment would have to be installed on existing traffic control poles and towers that were dispersed across the city. Communications would have to contend with interference and many obstructions (trees and buildings). In addition, the system would have to be deployed quickly with minimal disruption to traffic and infrastructure.

Results:

The City deployed 140 Motorola 5.8 GHz PTP bridges with Integrated antennas. The bridges were installed on existing towers, with deployments completed in three to fours hours per tower. The bridges were able to interconnect all cameras in the red-light violation system and deliver the data to the main processing facility in downtown Dallas while overcoming areas of high interference and obstructions. The backhaul system is operating flawlessly.

Testimonial:

The City's assistant director of public works, Zaida Basora, states, *"The Motorola point-to-point wireless technology has enabled us to meet our goals, while keeping costs low. We were also quite impressed with how fast the network was up and running and have already begun to see the results of such a secure, reliable system in an environment full of connectivity challenges."*

About Motorola

Motorola is known around the world for innovation and leadership in wireless and broadband communications. Inspired by our vision of seamless mobility, the people of Motorola are committed to helping you connect simply and seamlessly to the people, information, and entertainment that you want and need. We do this by designing and delivering "must have" products, "must do" experiences and powerful networks – along with a full complement of support services. A Fortune 100 company with global presence and impact, Motorola had sales of US $36.6 billion in 2007. For more information about our company, our people and our innovations, please visit http://www.motorola.com.

Motorola Wireless Broadband

Motorola's comprehensive portfolio of reliable and cost-effective wireless broadband solutions together with our WLAN solutions provide and extend coverage both indoors and outdoors. The Motorola Wireless Broadband portfolio offers high-speed Point-to-Point, Point-to-Multipoint, Mesh, Wi-Fi and WiMAX networks that support data, voice and video communications, enabling a broad range of fixed and mobile applications for public and private systems. With Motorola's innovative software solutions, customers can design, deploy and manage broadband networks, maximizing uptime and reliability while lowering installation costs.

Additional Information

For more information about PTP 49600 solutions, go to www.motorola.com/ptp.

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