

PTP 600 MULTIPLE-POINT-TO-POINT RAPID DEPLOYMENT SOLUTIONS

Delivering the right information to the right parties at the right time is absolutely essential to the success of any government, military, or public safety initiative. What may seem to be a mundane task is not as simple as it first appears. Content is always changing and growing. It's frequently in more than one repository, and multimedia (voice and video) accounts for an ever-increasing percentage of the content mix. Ongoing growth and change present challenges for the timely and efficient dissemination of information, especially when the people who need the information are on the move. Our Cambium PTP 600 Multiple-Point-to-Point (M-PTP) solutions are designed to overcome these challenges.

Sample M-PTP Application:

High-speed communications from a limited number of subscribers to a fixed command center and/or mobile command post. An M-PTP network enables rapidly-deployed emergency links as nomadic subscribers move from one site to another within the network.

TRAFFIC FLOW ISSUES

Getting vital information to and from mobile workforces such as military personnel, police officers, fire fighters, and field technicians is crucial to situational awareness, astute decision-making, and prompt task completion. The need for broadband access may be driven by an impromptu event requiring short-term connectivity in a location where no fixed infrastructure exists. In other cases, personnel may be deployed in areas that present major connectivity challenges, including manmade and natural obstructions, water, desert terrain, long distances, interference, and weather extremes.

While technology can enable communications to support mobile workforces, environmental challenges can significantly reduce the number of solutions that perform reliably in such conditions.

HUB-AND-SPOKE

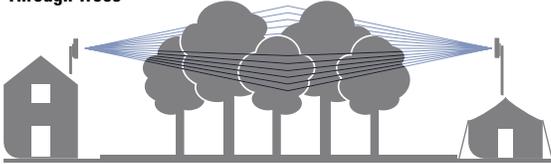
Many hub-and-spoke applications need long-distance and high-throughput connectivity over line-of-sight (LOS) and non-line-of-sight (NLOS) paths. They also may require that communications be established quickly and with a minimum of effort. Such requirements are typical of tactical broadband networks where hub sites must support nomadic "subscribers" who may be located anywhere within a 360° footprint. Typically, personnel are using vehicles to move from one location to another as they perform various tasks. This creates a specific need for high-performance communications to support nomadic teams where:

- Network topologies are typically hub-and-spoke
- Some combination of high-throughput, long-range, and NLOS performance with carrier-class reliability is essential

MULTIPLE-POINT-TO-POINT (M-PTP)

PTP 600 Series solutions can be deployed in a hub-and-spoke configuration and can meet range, throughput, NLOS, reliability, and rapid-deployment requirements to support real-time information sharing. To specifically address the needs of nomadic applications, we have taken our premier PTP 600 Series solutions one step further by providing a PTP 600 M-PTP Group Access solution. This solution leverages the performance and capacity of discrete PTP 600 links with the deployment ease typical with point-to-multipoint solutions.

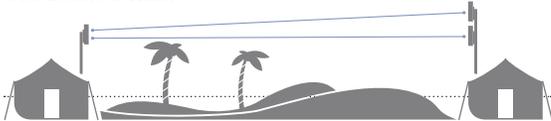
Through Trees



Around Buildings



Over Desert or Water



M-PTP: POWER WITH SIMPLICITY

In its most basic configuration, a single PTP master hub radio is deployed with an omni-directional antenna and automatically associates with an authorized subscriber radio within range on any azimuth. Once the master and subscriber radios are associated, the link performs as a dedicated PTP link without having to establish and align the master radio.

There can be up to four physically dedicated PTP links in an M-PTP configuration. Each physical PTP link comprises a PTP 600 Connectorized radio and omni-directional antenna at the hub site, with a PTP 600 Integrated radio or a Connectorized radio paired with a directional antenna at the subscriber end. With a M-PTP solution, the association between subscriber and available hub site is automatic. Field personnel only need to apply power and orient the subscriber radio toward the hub site to make a connection. Then, the M-PTP link will provide highly reliable, high-capacity performance even in challenging environments and severe weather conditions

M-PTP: GROUP ACCESS

Classically deployed, discrete PTP links require that master and subscriber radios are pre-matched via software configuration. "Group Access" is a unique, software-enabled feature which allows the network operator to associate any PTP 600 subscriber radio in a defined group to any master radio in the group. Group Access is particularly useful in nomadic hub-and-spoke applications as deployment tasks are reduced to powering and orienting the subscribers at the collective hub. As each hub and subscriber associate, they establish a traditional PTP 600 link and deliver traditional PTP performance.

RIGHT SOLUTION, BETTER RESULTS

Our PTP 600 systems offer major performance advantages for deployments in challenging radio frequency (RF) conditions. By design, directional antennas used with PTP systems can provide maximum channel (transmit and receive) antenna gain as compared with wider-beam antennas. Moreover, PTP radios direct their full data-rate capacity to only one target radio. In contrast, a PMP hub radio shares its aggregate data rate across all of its subscribers.

Cambium PTP 600 Series solutions are optimized for best-in-class performance. The PTP 600's highly sensitive receivers and high-gain transmitters, deliver a system gain that is at least 10 dB greater than other commercial-off-the-shelf (COTS) radios. The strong system gain is uniquely combined with Adaptive Modulation, 1024-point Orthogonal Frequency Division Multiplexing (OFDM) and Multiple-Input Multiple-Output (MIMO) technology to outpace comparable COTS radios in both line-of-sight (LOS) and non-line-of-sight (NLOS) conditions.

IMPORTANCE OF SYSTEM GAIN

High system gain is a major advantage that allows communications to go farther and faster. While M-PTP systems simplify hub deployment by using an omni-directional antenna with each hub radio, an omni-directional antenna will offer lower gain when compared to a directional antenna. As an example, 9 dBi gain is typical for a 4 GHz omni-directional antenna. This is 12 dBi less than the 21 dBi delivered by a PTP 45600's Integrated directional antenna. With an intrinsic system gain that is at least 10 dBi greater than other COTS radios in the 4.5 GHz band, our PTP 45600 radios can deliver sufficient gain for an M-PTP configuration and make up for the 12 dBi lost by using an omni-directional antenna.

IMPORTANCE OF TDD SYNCHRONIZATION

Depending on the number of subscribers to be supported, interference between adjacent radios at the hub site is likely since multiple radios may be deployed on a single

Typical applications:

- Nomadic communications
- On-scene access to vital information
- Disaster recovery and special events
- Persistent awareness
- Border security
- Tactical communications for military operations

PTP 600 M-PTP SYSTEMS

Three systems within the PTP 600 Series family of products offer M-PTP Group Access capabilities:

- PTP 45600 – 4.5 GHz band
- PTP 48600 – 4.8 GHz band
- PTP 49600 – 4.9 GHz band

tower or rooftop. The PTP 600's TDD synchronization capability times and synchronizes all hub radios to eliminate or greatly reduce the interference between hub radios. An M-PTP hub site can support up to four simultaneous subscriber associations. If more than four subscriber associations are required in a fixed deployment, then a PMP solution may be more appropriate.

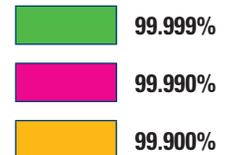
PLANNING FOR FAST DEPLOYMENT

Prior to purchase, our Cambium PTP LINKPlanner tool lets the operator optimize an M-PTP network's performance for a planned coverage area, based on variables specific to the deployment such as geography, distance, antenna height, and hub-and-subscriber locations. After installation, it is not necessary to use LINKPlanner each time that a subscriber is associated with a hub site.

Range	Fade Margin	Mean Aggregate Throughput Per Subscriber (Mbps)							
		30 MHz Channel		15 MHz Channel		10 MHz Channel		5 MHz Channel	
		M-PTP	PTP	M-PTP	PTP	M-PTP	PTP	M-PTP	PTP
1 (0.62)	3.6	282	282	123	123	82	82	39	39
3 (1.8)	3.6	262	282	123	123	82	82	39	39
10 (6.2)	4.5	193	275	107	123	79	82	39	39
30 (18.6)	5.8	88	182	63	99	48	74	29	37
60 (37.3)	10	28	115	22	75	24	58	16	28
90 (55.9)	14	10	55	11	49	10	39	7	21

PTP utilizes Integrated 21 dBi antennas at both the master and subscriber sites. M-PTP utilizes a 9 dBi omni-directional antenna at the hub and a 3-foot 30 dBi dish at the subscriber site.

Link Availability:



PTP 45600: M-PTP Throughput Compared With PTP Configuration

PERFORMANCE EXPECTATIONS

The table shows the range and data throughput of a PTP 45600 solution in an M-PTP configuration as compared to a PTP 45600 in a standard PTP configuration. From the subscriber's 282 Mbps data rate at one kilometer (0.62 mi), 193 Mbps at 10 kilometers (6.2 mi), or even 88 Mbps at 30 kilometers (18.6 mi), performance is unmatched by many PMP solutions in which the aggregate data rate is shared across all of the subscribers.

M-PTP: MAKING THE BEST CHOICE

PTP 600 M-PTP solutions are designed to support up to four simultaneous subscribers in a network where links must be deployed rapidly and redeployed frequently. Nomadic hub-and-spoke applications that require high data rates, extended ranges, and/or NLOS performance with the least amount of configuration and alignment efforts are a natural fit for a PTP 45600, 48600 or 49600 M-PTP system. With high system gain, high throughput, TDD synchronization, and group association capability, the PTP 600's M-PTP functionality offers an excellent wireless broadband alternative. Even in challenging environments, an M-PTP system can enable mission-critical communications to and from personnel, as they move from one operational site to another.

SECURE COMMUNICATIONS

To protect wireless communications, PTP 600 M-PTP solutions include:

- **Encryption:** PTP 600 radios include our proprietary air interface. Optionally, the systems can be configured with FIPS-197 compliant 128-bit or 256-bit AES encryption.
- **FIPS 140:** PTP 600 systems meet FIPS 140-2 validation for cryptographic algorithms, key security and tamper evidence.
- **Management Interface Protection:** HTTPS/TLS has been implemented on PTP 600 M-PTP systems to protect the system's management interface. The radios also support installation of user-provided X.509 digital certificates. Simple Network Management Protocol (SNMP) version 3 adds security and remote configuration enhancements to SNMP. A license key may be required for these features.
- **Identity and Event Management:** Identity-based user accounts can be enabled with configurable password rules to control user access to the radios. Remote Authentication Dial In User Service (RADIUS) can help to authenticate users and their levels of access.

PTP 45600, 48600, 49600:

- NATO band IV (4.4 to 5.0 GHz)
- FIPS 140-2 validated
- UC-APL
- PTP 45600 - J/F-12 approved
- PTP 45600/48600 – NTIA approved
- Up to 300 Mbps
- 5, 10, 15, 20 or 30 MHz channels
- Up to 124 miles (200 km)
- High system gain
- Multiple-Input Multiple-Output (MIMO)
- 1024-pt. OFDM
- LOS and NLOS performance
- M-PTP Group Access
- TDD synchronization

- **Auditing and Event Management:** Security and other events are logged locally and optionally can be sent to a centralized logging server using syslog.
- **Disaster Recovery:** The operator can back up a radio's operating configuration file. Then, the file can be restored quickly and easily if a unit must be reset or replaced.
- **Vulnerability Management:** Using commercially available tools, PTP 600 systems are regularly scanned for vulnerabilities, and those that pose significant risk are resolved.

In addition, we have obtained these important certifications:

- **UC APL:** PTP 600 solutions are listed on the DoD UC APL (Unified Capabilities, Approved Products List), indicating that the systems comply with requirements for interoperability and information assurance.
- **IP66/67 Rating:** PTP 600 ODUs with aluminum casings are IP66 rated against intrusion as a result of testing with dust and powerful water jets aimed at the enclosure from any direction and IP67 rated for the effects of water intrusion as a result of being immersed in water.

PTP 600 CONNECTORIZED AND PTP 600 INTEGRATED

