# PTP Solutions Guide
# Motorola Fixed Point-to-Point
# Wireless Bridges

# Contents

# Introduction

The purpose of this document is to equip Motorola account teams and sales channel with the information needed to communicate the features and benefits of the Motorola Fixed Point-to-Point Wireless Solutions.

This is a living document that acts as a central point of reference for all marketing collateral. It is permissible to extract certain sections or subsections that apply to specific customer situations and incorporate them into sales collateral materials. This document should not be used for contracts or proposals in lieu of an official Motorola customer document.



PTP 100 with a Reflector

PTP 200 Radio

Motorola PTP 300, 400, 500 and 600 Series Integrated Radio

Motorola PTP 300, 400, 500 and 600 Series Connectorized Radio

**DIRECTORY OF ACRONYMS**

This directory will help you interpret the acronyms used within this Solutions Guide:

**OFDM**   Orthogonal Frequency Division Multiplexing – a method of digital modulation in which a signal is split into several narrowband channels at different frequencies

**QAM**   Quadrature Amplitude Modulation – a method of combining two Amplitude-Modulated (AM) signals into a single channel, thereby doubling the effective bandwidth

**LoS**   Line-of-sight (clear line-of-sight, and Fresnel zone is clear)

**nLoS**   Near-line-of-sight (clear line-of-sight, but Fresnel zone is blocked)

**NLoS**   Non-line-of-sight (no line-of-sight, and Fresnel zone is blocked)

**ODU**   Outdoor Unit (Integrated or Connectorized Radio)

**PIDU**   Powered Indoor Unit

**DFS**   Dynamic Frequency Selection

**PMP**   Point-to-Multipoint

**PTP**   Point-to-Point

**PoE**   Power over Ethernet

**RF**   Radio Frequency

# Solutions Overview

**Fixed Point-to-Point Wireless Ethernet Bridges:**
Currently, there are several families of products within the Fixed Point-to-Point (PTP) bridge offerings:

- PTP 100 Series (formerly the Canopy® 10 and 20 Mbps Backhaul Modules)
- PTP 200 Series
- PTP 300 Series
- PTP 400 Series
- PTP 500 Series
- PTP 600 Series

All PTP radios, except the PTP 100 Series, are available in two versions: Integrated and Connectorized. The Integrated systems have built-in antennas, while the Connectorized versions offer the gain advantage of external antennas. In extremely adverse environments, Connectorized solutions enable connections over greater distances with a higher level of reliability and speed than many comparable solutions.

PTP 100 and PTP 200 systems are based on the same technology as the Canopy® PMP systems. The only difference is that the PTP 100 and 200 Series systems are configured as point-to-point solutions, rather than point-to-multipoint. The PTP 100 Series products provide line-of-sight (LOS) connectivity, while the PTP 200 OFDM (Orthogonal Frequency Division Multiplexing) products provide LOS and near-line-of-sight (nLOS) connectivity.

PTP 300, 400, 500 and 600 Series systems use a unique combination of innovative technologies that earned Motorola the market leadership in the global unlicensed Ethernet market. It's these Orthogon-legacy technologies working together that enable the PTP 300, 400, 500 and 600 bridges to deliver exceptional range, capacity, reliability and performance – especially over water and long distances, in non-line-of-sight (NLoS) or near-line-of-sight (nLos) conditions, and in areas where there is significant radio-frequency (RF) interference such as a city. This unique technology combination includes:

- Multiple-Input Multiple-Output (MIMO)
- *Intelligent* Orthogonal Frequency Division Multiplexing (*i*-OFDM)
- Advanced Spectrum Management with *Intelligent* Dynamic Frequency Selection (*i*-DFS)
- Adaptive Modulation
- Inherent Spatial Diversity
- Best-in-class radios with the highest system gain in their class

**Accessories:**
In addition to its point-to-point radios, Motorola offers the following accessory items for use with PTP 300, 400, 500 and 600 bridges:

- **Point-to-Point Lightning Protection Unit (PTP-LPU):** The cost-effective PTP-LPU is designed to shield PTP 300, 400, 500 and 600 radios from sudden power surges induced by electromagnetic activity (lightning). Motorola strongly recommends including PTP-LPUs as an integral part of a PTP 300, 400, 500 or 600 Series link. While purchasing the Motorola PTP Link Guard All Risk Extended Warranty will cover the cost of replacing a radio damaged by lightning, deploying lightning protection initially will help the operator avoid the delays and costs associated with taking down damaged radios and installing replacement units. When correctly installed, the Motorola PTP-LPU gives a PTP 300, 400, 500 or 600 radio the best protection from the harmful effects of lightning. However, 100% protection is neither implied nor possible.

- **GPS Synchronization Unit:** Motorola partners with Memorylink to deploy the Memorylink UltraSync™ GPS-100M Synchronization Unit. The UltraSync GPS-100M generates a precise timing reference signal that is used by the PTP 600 radios as the timing reference for the PTP 600's TDD Synchronization functionality. A Memorylink UltraSync GPS-100M is required for each TDD-enabled PTP 600 link.

**Motorola Wireless Broadband:**
All Fixed Point-to-Point Wireless Ethernet Bridges are part of Motorola's portfolio of Wireless Broadband solutions that help service providers and network operators improve communications, increase efficiency and enhance customer and public service. All point-to-point Wireless Ethernet Bridges can operate as stand-alone systems or integrate easily with the other solutions in the Wireless Broadband portfolio to provide the right solution or combination of solutions for the individual applications and environment. Delivering IP coverage to virtually all spaces, the Wireless Broadband portfolio includes Fixed, Mesh, Indoor and WiMAX solutions for high-speed connectivity over private and public networks.

**Choice and Flexibility:**
While there are a number of internal and external factors (e.g., infrastructure complexities, budget, bandwidth requirements, path obstructions, applications, etc.) that will influence the decision about which Motorola solution best fits a specific customer situation, all Motorola point-to-point products offer exceptional advantages. As a general guideline, solutions are recommended for a wide variety of applications as described below.

**PTP 100 Series Solutions:**
Delivering data rates up to 14 Mbps at distances up to 35 miles (56 km), these cost-effective systems offer consistent throughput, interference mitigation capabilities, weather resistant operations and a compact, rugged design. Operating in the 2.4, 5.2, 5.4 and 5.8 GHz frequencies, the systems are designed to provide reliable, line-of-sight connectivity for a variety of applications, including rural, remote or campus connectivity, temporary services, emergency communications, video surveillance, distance learning, telemedicine, banking and backbone operations for Metro WiFi networks. The PTP 100 is an excellent choice for WISPs and ISPs with low-capacity requirements. Models within the PTP 100 family of products include:

| PTP 100 Series Products | | Maximum Data Rate | |
|---|---|---|---|
| PTP 24100 – | 2.4 GHz Bridge | 14 Mbps | Although PTP 100 Series Point-to-Point solutions are included in the Motorola portfolio of Point-to-Point Wireless Ethernet Bridges, they utilize unique Motorola technology and do not share the same technology provided in the PTP 300, 400, 500 and 600 Series solutions. |
| PTP 24100 Lite – | 2.4 GHz Bridge | 7.5 Mbps | |
| PTP 52100 – | 5.2 GHz Bridge | 14 Mbps | |
| PTP 52100 Lite – | 5.2 GHz Bridge | 7.5 Mbps | |
| PTP 54100 – | 5.4 GHz Bridge | 14 Mbps | |
| PTP 54100 Lite – | 5.4 GHz Bridge | 7.5 Mbps | |
| PTP 58100 – | 5.8 GHz Bridge | 14 Mbps | |
| PTP 58100 Lite – | 5.8 GHz Bridge | 7.5 Mbps | |

**PTP 200 Series Solutions:**

Operating in the 5.4 GHz band, PTP 200 solutions are designed to cost-effectively transport data, voice and video communications in nLOS and LOS environments.  The current models available within the PTP 200 family of products are:

| PTP 200 Series Products | | Max. Ethernet Data Rate | |
| --- | --- | --- | --- |
| PTP 54200  – | 5.4 GHz Bridge with 56-bit DES | 21 Mbps | PTP 200 bridges are available in Integrated and Connectorized versions. The Integrated systems have a built-in antenna, while the Connectorized systems can be fitted with external antennas. |
| PTP 54200  – | 5.4 GHz Bridge with 128-bit AES | 21 Mbps | |

Previously, many service providers and enterprises could not provide wireless broadband connectivity for their subscribers and users because of obstacles that disrupted communications. As a result, their connectivity options were limited to expensive and restrictive wired solutions. With the PTP 200 Series bridges, enterprises of all types and sizes can have a reliable, secure alternative that performs well in paths where foliage and buildings partially block the radio line-of-sight (Fresnel zone) but not the visual line-of-sight. With a very low cost of ownership, the PTP 200 solutions bring the speed and bandwidth advantages of wireless broadband connectivity to virtually any enterprise and service provider – regardless of budgetary constraints.

**PTP 300 Series Solutions:**

Operating in the 5.4 and 5.8 GHz bands, the PTP 300 solutions provide reliable, cost-effective connectivity for data, voice and video communications in virtually any environment and weather conditions.  The current models available within the PTP 300 family of products are:

| PTP 300 Series Products | | Max. Ethernet Data Rate | |
| --- | --- | --- | --- |
| PTP 54300* – | 5.4 GHz Bridge | 25 Mbps | PTP 300 bridges are available in Integrated and Connectorized versions. The Integrated systems have built-in antennas, while the Connectorized systems can be fitted with external antennas. |
| PTP 58300  – | 5.8 GHz Bridge | 25 Mbps | |

* The 5.4 GHz version of this device has not been authorized as required by the rules of the Federal Communications Commission (FCC). That device is not, and may not be, offered for sale or lease, or sold or leased in the United States, until authorization is obtained.

Until now, many emerging companies and government agencies have had to choose between performance and price when expanding their communication capabilities. The challenges of meeting bandwidth and environmental requirements while staying within budgetary guidelines frequently resulted in having to buy less than needed, pay more than desired, or postpone purchase. That has all changed with the PTP 300 Series bridges. Now growing and budget-constrained service providers and enterprises have an affordable, high performance alternative for obstructed and high interference environments. With the same award-winning combination of technologies that made Motorola the leader in the unlicensed Ethernet bridge market, PTP 300 bridges provide class-leading connectivity, even in obstructed and high-interference environments. The PTP 300 Integrated systems are an excellent choice to deliver carrier-class, reliable and secure connectivity for distances up to 50 miles (80.5 km). With up to 155 miles (250 km) reach, the Connectorized model offers the high-gain advantage of external antennas, providing high-performance connectivity across extremely long distances and challenging environments.

**PTP 400 Series Solutions:**

The PTP 400 Series wireless Ethernet bridges operate in the 4.9 GHz licensed band and the 5.4 GHz unlicensed frequencies, delivering proven, cost-effective, secure, carrier-grade broadband access when and where it is needed. There are several models available within the PTP 400 Series to meet a variety of customer requirements:

| PTP 400 Series* Products | | Max. Ethernet Data Rate | |
| --- | --- | --- | --- |
| PTP 49400 – | 4.9 GHz Bridge | 35 Mbps | The PTP 400 bridges are available in Integrated and Connectorized versions. The Integrated systems have built-in antennas, while the Connectorized systems can be fitted with external antennas. Plus, the Lite models are software upgradeable to 43 Mbps (PTP 54400) or 35 Mbps (PTP 49400). |
| PTP 49400 Lite – | 4.9 GHz Bridge | 17 Mbps | |
| PTP 54400 – | 5.4 GHz Bridge | 43 Mbps | |
| PTP 54400 Lite – | 5.4 GHz Bridge | 21 Mbps | |
| * The PTP 58400 has been removed from this document because the PTP 58400 models are being retired effective October 7, 2008. | | | |

The Integrated versions of the PTP 400 Series solutions are recommended for near- and non-line-of-sight environments and over long distances. The Connectorized versions offer the high-gain advantage of external antennas, enabling reliable connections in extremely adverse environments, including deep non-line-of-sight and long-range line-of-sight. The Integrated Lite and Connectorized Lite versions of the PTP 400 bridges are excellent choices for growing WISPs and ISPs, and for any budget constrained organization that needs a robust solution to overcome interference and navigate obstructions.

For public safety officials with 4.9 GHz licenses, PTP 49400 solutions provide the mission-critical reliability, throughput, bandwidth and quality of service they require for applications such as on-scene streaming video, Internet and database access, and transfers of maps, blueprints, medical files and missing-person images.

**PTP 500 Series Solutions:**

Operating in the 5.4 and 5.8 GHz bands, a PTP 500 solution is an excellent choice when the PTP 400 does not provide enough throughput and the PTP 600 provides more than is needed. The current models available within the PTP 500 family of products are:

| PTP 500 Series Products | | Max. Ethernet Data Rate | |
| --- | --- | --- | --- |
| PTP 54500* – | 5.4 GHz Bridge | 105 Mbps | PTP 500 bridges are available in Integrated and Connectorized versions. The Integrated systems have built-in antennas, while the Connectorized systems can be fitted with external antennas. Plus, the PTP 500 Lite is software upgradeable from 52 to 105 Mbps as throughput requirements increase. |
| PTP 54500* Lite – | 5.4 GHz Bridge | 52 Mbps | |
| PTP 58500 – | 5.8 GHz Bridge | 105 Mbps | |
| PTP 58500 Lite – | 5.8 GHz Bridge | 52 Mbps | |
| * The 5.4 GHz version of this device has not been authorized as required by the rules of the Federal Communications Commission (FCC). That device is not, and may not be, offered for sale or lease, or sold or leased in the United States, until authorization is obtained. | | | |

When connectivity requirements call for mid-range throughput, the PTP 500 Integrated systems are an excellent alternative for service providers and enterprises, delivering carrier-class, high-speed performance at distances up to 50 miles (80.5 km) in virtually any environment. With up to 155 miles (250 km) reach, the Connectorized model combines all the innovative technology found in the Integrated version with the high-gain advantage of external antennas, providing high-performance connectivity across extremely long distances and challenging environments.

With all the same robust capabilities as the "full speed" models, the Lite versions of the PTP 500 solutions offer an excellent option where budgets are somewhat restricted, yet high throughput and reliability are key to supporting the customer's requirements.

### PTP 600 Series Solutions:

The PTP 600 Series wireless Ethernet bridges operate in the 2.5 and 4.4 to 4.6 GHz licensed bands plus the 5.4 and 5.8 GHz unlicensed bands. These solutions deliver high-throughput, secure, carrier-grade connectivity virtually anywhere and are available in several models to meet a variety of requirements:

| PTP 600 Series Products | | Max. Ethernet Data Rate | |
|---|---|---|---|
| PTP 25600 – | 2.5 GHz Bridge | 300 Mbps | The PTP 600 bridges are available in Integrated and Connectorized versions. The Integrated systems have built-in antennas, while the Connectorized systems can be fitted with external antennas. Plus, the Lite models of the PTP 600 5.4 and 5.8 GHz bridges are software upgradeable to 300 Mbps as throughput requirements increase. |
| PTP 45600 – | 4.5 GHz Bridge | 300 Mbps | |
| PTP 54600 – | 5.4 GHz Bridge | 300 Mbps | |
| PTP 54600 Lite – | 5.4 GHz Bridge | 150 Mbps | |
| PTP 58600 – | 5.8 GHz Bridge | 300 Mbps | |
| PTP 58600 Lite – | 5.8 GHz Bridge | 150 Mbps | |

All models within the PTP 600 family of products offer selectable channel sizes and varying data rates to provide even greater flexibility to meet the needs of solutions providers and end-user customers

| Channel Sizes* for 45600, 54600 and 58600 Full Versions | Max. Ethernet Data Rate | Channel Sizes* for 54600 and 58600 Lite Versions | Max. Ethernet Data Rate |
|---|---|---|---|
| 5 MHz Channel | Up to 41 Mbps | 10 MHz Channel | Up to 42 Mbps |
| 10 MHz Channel | Up to 84 Mbps | 15 MHz Channel | Up to 63 Mbps |
| 15 MHz Channel | Up to 127 Mbps | 30 MHz Channel | Up to 150 Mbps |
| 30 MHz Channel | Up to 300 Mbps | * Local regulations should be confirmed prior to system purchase. | |

The PTP 600 "full" solutions are the perfect choice for any environment where high throughput is a major requirement and/or dual T1/E1 capability is needed. With up to 150 Mbps Ethernet data rate and the same high-performance technology of the full-speed systems, the PTP 54600 and PTP 58600 Integrated Lite and Connectorized Lite are the right solutions where the application needs more speed and bandwidth than is provided by the PTP 400 and PTP 500 Series bridges and/or single T1/E1 capability is required.

Operating in the 4.4 to 4.6 GHz licensed frequencies, the PTP 45600 bridges are designed to support U.S. Federal and NATO licensees with cost-effective, high-throughput connectivity for a variety of applications such as battlefield communications, public safety, video surveillance, border security, tactical military operations, training and simulation networks, building-to-building and campus communications and robust traffic backhaul. While the PTP 45600 bridges are available in Integrated and Connectorized versions, there is no Lite version because PTP 45600 systems offer selectable channel sizes with varying data rates based on the channel width selected.

In 2004, the U.S. Federal Communications Commission (FCC) instituted the Educational Broadband Service (EBS), formerly known as the Instructional Television Fixed Service (ITFS), with the primary purposes being high-speed Internet access and the transmission of instructional material utilizing low-power broadband systems. Designed for 2.5 GHz license holders with EBS programs, the PTP 25600 solutions provide network operators with high-throughput, low-latency and high-availability connectivity to deliver even the richest educational applications flawlessly. Like the PTP 45600, the PTP 25600 bridges are available in Integrated and Connectorized versions, but no Lite version.

| Channel Sizes* for 25600 Full Versions | Max. Ethernet Data Rate | |
|---|---|---|
| 5 MHz Channel | Up to 48 Mbps | |
| 10 MHz Channel | Up to 100 Mbps | |
| 15 MHz Channel | Up to 151 Mbps | * Local regulations should be confirmed prior to system purchase. |
| 30 MHz Channel** | Up to 300 Mbps | ** 30 MHz is not FCC compliant. |

**Power Restrictions for 5.4 GHz Solutions:**
It is important to note that governmental authorities in the US, Canada and EU have imposed power restrictions on 5.4 GHz radios. Motorola's PTP 54300, PTP 54400, PTP 54500 and PTP 54600 bridges comply with those power restrictions, providing solutions that are particularly well suited for:
- Line-of-sight hops – up to 12 miles (20 km)
- Non-line-of-sight links – up to 3 miles (5 km)
- Backhaul for point-to-multipoint and mesh networks

In regions where power restrictions are not imposed, as well as for U.S. Federal Government agencies that are exempt from the power restrictions, network operators can request an Alternate License Key to set their systems to operate at full power, thereby achieving long-distance line-of-sight communications.

The PTP 54200 bridges also comply with these power restrictions, providing cost-effective solutions for nLOS and LOS hops of up to 5 miles (8 km) in distance.

# Motorola PTP 100 and 200 Warranties

The PTP 100 and PTP 200 Series solutions are manufactured to meet our high quality standards. Even with such attention to quality, hardware components can fail sometimes due to a variety of severe situations. In response to such situations, Motorola provides the following hardware and software warranties to support its PTP 100 and 200 solutions:

| | |
|---|---|
| **12-Month Hardware Warranty** | A one-year limited warranty is included in the purchase price of a PTP 100 or PTP 200 Series radio. Motorola warrants that its PTP 100 or PTP 200 radios will conform to the current published specifications and will be free from defects in material and workmanship under normal use and service. In the event of a hardware failure, the warranty provides repair or replacement of the defective unit. Plus Motorola pays shipping from Motorola's repair center to the customer's location.<br><br>Under this warranty, Motorola also warrants that its PTP 100 and PTP 200 Series software will perform in accordance with its published specifications for the release level of the software and will be free from defects in material and workmanship under normal use and service. Under this 12-month warranty, Software Warranty, Motorola will correct or replace software to fix significant, demonstrable program or documentation errors and/or replace defective media. |

# Motorola PTP 300, 400, 500 and 600 Warranties

While our PTP 300, 400, 500 and 600 Series products are engineered and quality-tested to withstand severe conditions, occasionally hardware components can fail as a result of extreme situations. Therefore, Motorola offers the following equipment coverage and repair-and-replacement options to support its PTP 300, 400, 500 and 600 solutions:

| | |
|---|---|
| **12-Month Standard Warranty** | The purchase price of a PTP 300, 400, 500 or 600 Series radio includes a one-year limited warranty on all hardware components, plus minor software enhancements as they become available. The hardware warranty provides a 30-day repair-and-return program for damaged parts. Each product must be registered online to activate the free 12-month warranty period and receive notification of software updates. To activate a standard warranty, go to www.motorola.com/ptp. |

At the time of equipment purchase or prior to the end of the 12-month standard warranty, Motorola recommends that organizations purchase one of the following Extended Warranties to receive upgraded and/or extended equipment coverage:

| | |
|---|---|
| **Link Guard All Risk Extended Warranty** | The Motorola PTP Link Guard All Risk Extended Warranty upgrades the initial 12-month warranty to the 24-hour Advanced Replacement program and All Risk equipment coverage for virtually any type of equipment damage, including lightning damage, dropped units, vandalism, fire or other hardware damage. The All Risk coverage with 24-hour Advanced Replacement can be extended through the second, third or fifth years of ownership. |
| | This warranty option ensures that replacement product will be shipped from the United Kingdom on the next business day after receipt of a confirmed Return Material Authorization (RMA). All shipping materials are provided when the RMA is approved, and Motorola picks up shipping costs in both directions. While the replacement shipping process will be started immediately, delivery time will be dependent upon customs and ship-to location. |
| **Link Protector Extended Warranty** | The Motorola PTP Link Protector Extended Warranty extends the initial 12-month standard equipment warranty with 30-day repair-and-replacement terms through the second, third or fifth years of ownership. This option is typically chosen when an organization purchases one or more spare PTP links to use as replacement units, and fast repair and return for damaged hardware components is not required. |
| **PTP Software Maintenance Contract** | After the initial 12-month standard warranty, an annual Software Maintenance Contract must be obtained to continue receiving software updates and technical support. The contract includes minor software enhancements as they become available and 24/7 telephone support. Technical support is provided under an assigned Customer Contract Number (CCN) or the MAC address of the unit that is covered under the initial 12-month standard warranty. Contracts are available through Motorola's authorized reseller partners or directly from the Technical Support Center using a credit card. |

# PTP Portfolio Summary

Motorola PTP products have an array of features that enable network architects to meet service requirements at the lowest cost. These families of products complement Motorola's Point-to-Multipoint (PMP), WiMAX, Mesh and Indoor solutions, giving network operators a wide variety of solutions that can be tailored to meet specific requirements.

| Features | PTP 100 | PTP 200 | PTP 300 | PTP 400 | PTP 500 | PTP 600 |
|---|---|---|---|---|---|---|
| Radio frequencies | 2.4, 5.2, 5.4 5.8 GHz | 5.4 GHZ | 5.4, 5.8 GHz | 4.9, 5.4 GHz | 5.4, 5.8 GHz | 2.5, 4.5, 5.4, 5.8 GHz |
| Ethernet throughput* (maximum) | 14 Mbps | 21 Mbps | 25 Mbps | 5.4-43 Mbps 4.9-35 Mbps | 105 Mbps | 300 Mbps |
| Latency (average round trip) | | 5-7 ms | < 6 ms | 5.4 < 7 ms 4.9 < 6 ms | < 6 ms | 5.4 < 1 ms 5.8 < 1 ms 2.5 2-4 ms 4.5 2-4 ms |
| LOS range (maximum with external antennas) | 35 mi (56 km) | Integrated – 5 mi (8 km) | 155 mi (250 km) | 124 mi (200 km) | 155 mi (250 km) | 124 mi (200 km) |
| nLOS range (maximum with external antennas) | | Integrated – 5 mi (8 km) | 20 mi (32 km) | 25 mi (40 km) | 20 mi (32 km) | 20 mi (32 km) |
| NLOS range (maximum with external antennas) | | | 5 mi (8 km) | 6 mi (10 km) | 5 mi (8 km) | 5 mi (8 km) |
| Channel Width | | 10 MHz | 15 MHz | 4.9-10 MHz 5.4-12 MHz | 15 MHz | Selectable 5, 10, 15, 30 MHz |
| System gain (maximum with integrated antennas) | | | 123 dB | 4.9-163 dB 5.4-167 dB | 167 dB | 5.4-162 dB 5.8-162 dB 2.5-154 dB 4.5-165.9 dB |
| Security | | 56-bit DES 128-bit AES | Scrambling & optional 128-bit AES 256-bit AES | Scrambling & optional 128-bit AES | Scrambling & optional 128-bit AES 256-bit AES | Scrambling & optional 128-bit AES 256-bit AES |
| DFS | | ✔ | ✔ | ✔ | ✔ | ✔ |
| ODFM | | ✔ | ✔ | ✔ | ✔ | ✔ |
| MIMO | | | ✔ | ✔ | ✔ | ✔ |
| MSRP (USD – per link) | | DES $3,595 AES $4,095 | $5,995 | Full $11,995 Lite $7,200 | Full $12,995 Lite $8,995 | 5.4, 5.8 GHz Full $19,995 Lite $15,995 |
| | | | | | | 2.5 $15,995 4.5 $24,995 |

\* Data rates are dynamically variable with modulation. Due to the power restrictions imposed by U.S., Canadian and EU authorities on systems operating in the 5.4 GHz band, lower ranges will be realized with systems operating in the 5.4 GHz band within power-restricted regions. Use the Motorola PTP LINKPlanner to provide accurate link performance estimates for all systems.

# Key PTP 100 and 200 Selling Points

**PTP 100 Series:**
- Data rates up 14 Mbps at distances up to 35 miles (56 km)
- 2.4, 5.2, 5.4 and 5.8 GHz RF bands
- Extremely cost effective solutions
- Reliable LOS connectivity for applications such as rural, remote or campus connectivity, temporary services, emergency communications, video surveillance, distance learning, telemedicine, banking and backbone operations for Metro WiFi networks
- Excellent alternative for WISPs and ISPs with low-capacity requirements
- Easy and quick deployment
- Proven, time-tested Motorola technology

**PTP 200 Series:**
- Data rates up to 21 Mbps
- Integrated models connect at distances up to 5 miles (8km)
- Reliable, secure connectivity for cost-conscious organizations
- Transports data, voice and video in nLOS and LOS environments for applications such as building-to-building and campus connectivity, high-speed Internet access, Voice-over-IP and video surveillance
- Robust, cost-effective backhaul for PMP, Mesh and WiMAX networks in nLOS and LOS environments
- Wireless broadband communications in previously inaccessible locations
- Quick and easy deployment with built-in deployment assistance features
- OFDM technology to reach around obstacles that partially block a path's radio line-of-sight (Fresnel zone) while leaving the visual line-of-sight clear
- GPS synchronization capabilities that greatly reduce self-interference, allowing network operators to collocate multiple radios on a tower or rooftop and collocate backhaul links with existing Canopy networks
- Network design that complements existing networks and integrates easily with Web-based and SNMP-based management systems as well as Prizm and CNUT
- Compatible with existing Canopy® power supplies, surge suppressors, brackets and software

# Key PTP 300, 400, 500 and 600 Selling Points

**Remove System Bottlenecks in the Network with Increased Throughput**
**PTP 54300 and 58300:**
- Up to 25 Mbps – aggregate throughput

**PTP 54400 Lite:**
- Up to 21 Mbps - aggregate throughput (30 Mbps - signaling rate)
- Software upgradeable to 43 Mbps

**PTP 54400:**
- Up to 43 Mbps - aggregate throughput (60 Mbps - signaling rate)

**PTP 49400 Lite:**
- Up to 17 Mbps - aggregate throughput
- Software upgradeable to 35 Mbps

**PTP 49400:**
- Up to 35 Mbps - aggregate throughput

**PTP 54500 and 58500 Lite:**
- Up to 52 Mbps – aggregate throughput
- Software upgradeable to 105 Mbps

**PTP 54500 and 58500:**
- Up to 105 Mbps – aggregate throughput

**PTP 54600 and 58600 Lite:**
- Up to 150 Mbps - aggregate throughput
- Selectable 10, 15 and 30 MHz channel sizes
- Software upgradeable to 300 Mbps

**PTP 25600, 45600, 54600 and 58600:**
- Up to 300 Mbps - aggregate throughput
- Selectable 5, 10, 15 and 30 MHz* channel sizes
  * For the PTP 25600, the 30 MHz channel size is not FCC compliant

**Establish Robust Links to Challenging Locations**
- Single-hop, long-range LoS links – up to 124 miles (200 km) with PTP 400 and PTP 600 bridges or 155 miles (250 km) with PTP 300 and PTP 500 bridges
- Previously impossible or marginal links can now be established in:
  - > nLoS – up to 25 miles (40 km)
  - > NLoS – up to 6 miles (10 km)
  - > An area already saturated with RF
- Disaster recovery connectivity in a matter of hours

**Reduce Capital and Deployment Costs**
- Connect previously inaccessible locations in nLoS and NLoS conditions:
  - > Reach around buildings, trees, hills and over water
  - > Establish long-range LoS links with a single hop
- Meet the growing bandwidth requirements of voice, video and data
- Expand video surveillance applications beyond the constraints of an existing wired infrastructure
- Replace a wired connection with a higher-capacity, less expensive wireless connection

**Eliminate Monthly Recurring Costs Associated with Leased T1/E1 Voice Circuits**
- Built-in T1/E1 in PTP 600 systems:
  - > Single port on PTP 54600 and PTP 58600 Lite bridges
  - > Dual ports on PTP 54600 and PTP 58600 bridges
  - > Single port on PTP 25600 and PTP 45600 bridges with 10 and 15 MHz channel sizes
  - > Dual ports on PTP 25600 and PTP 45600 bridges with 30 MHz channel sizes
- Pair PTP 300, 400 and 500 Series bridges with a T1/E1 Multiplexer
- Provide Secure Communications
  - > Pre-programmed to communicate only with a user-configured partner to eliminate "man-in-the-middle" attacks
  - > Utilize a complex proprietary scrambling mechanism for data transmission
  - > Another layer of security is available with 128-bit and 256-bit AES encryption (optional)

**Easy Link Planning**
- Perform path calculations for PTP 300, 400, 500 and 600 Series solutions using the PTP LINKPlanner which simulates a link's performance and allows variables to be changed to instantly see the effects on performance
- Quickly and easily optimize a single link or multiple links simultaneously

**Reduce Overall Operating Costs**
- Operators can remotely manage, monitor and optimize link performance via comprehensive web-based management
- Small form factor reduces the costs of leasing tower space
- More links can be collocated without creating excess interference:
  > Narrow 8° antenna beam width – dual polarized antennas
  > Narrow Channels:
    - 12 MHz Channel for 5.4 GHz PTP 400 Series bridges
    - 10 MHz Channel for 4.9 GHz PTP 400 bridge
    - 15 MHz Channel for 5.8 and 5.4 GHz PTP 300 and 500 Series bridges
- Selectable 5, 10, 15 and 30 MHz channels for PTP 600 Series bridges

**Deliver High Availability in Noisy and Constantly Changing RF Environments**
- Unique combination of interference mitigation techniques:
  > **Multiple-Input Multiple-Output (MIMO)** transmits multiple signals which are de-correlated temporarily and spatially; being de-correlated, each path fades at different times, and the receiver is able to select the best signal at any time, resulting in better performance and link availability.
  > **Advanced Spectrum Management with *i*-DFS** (*intelligent* Dynamic Frequency Selection) automatically changes channels to avoid interference and combat fading.
  > **Adaptive Modulation** ensures maximum throughput optimized for the radio path even as path characteristics change.
  > **Time Division Duplex (TDD) Synchronization (PTP 600 Series radios):** Using a timing reference from the Memorylink UltraSync™ GPS-100M synchronization unit, the PTP 600's TDD Synchronization capability synchronizes transmit and receive signals to minimize interference and promote optimal spectral reuse. By timing and synchronizing transmit and receive signals, network operators can collocate multiple PTP radios on a rooftop or tower with greatly reduced interference.

**Bring Reliable, High-Capacity Connectivity to a Wide Variety of Applications**
- Deliver high bandwidth for demanding applications, such as Voice-over-IP, IP gaming, video surveillance, distance learning and telemedicine
- Support public safety officials with high-bandwidth, super-reliable connectivity for voice, video and data communications (PTP 49400 4.9 GHz systems)
- Connect buildings in a campus setting
- Create a seamless local-area-network between a company headquarters and a warehouse, branch office, service center or other facility
- Backhaul more local loops using a single link
- Extend T1/E1 PBX circuits
- Support sophisticated convergent, multimedia applications
- Backhaul traffic from multiple wireless LAN access points to a point of presence
- Fast, cost-effective deployment for disaster recovery and temporary services
- Combine T1/E1 and Ethernet ports in a single radio
- Backhaul traffic from Motorola Point-to-Multipoint, WiMAX and Mesh networks
- Provide 2.5 GHz license holders with high-throughput, spectrally-efficient connectivity to deliver the richest educational applications reliably (PTP 25600 2.5 GHz system)
- Provide U.S. Federal and NATO agencies with 4.4 to 4.6 GHz licenses the high-performance, reliable connectivity they need to support tactical communications in difficult RF environments and geographies (PTP 45600 4.5 GHz system)

**Offer Network Design Flexibility**
- Choose from several platforms – PTP 300 Series, PTP 400 Series, PTP 400 Series Lite, PTP 500 Series, PTP 500 Series Lite, PTP 600 Series, PTP 600 Series Lite – each available in two versions – Integrated or Connectorized
- PTP 300, 400, 500 and 600 Series systems integrate with Motorola's Fixed Point-to-Multipoint (Canopy®), Mesh, WiMAX and Indoor networks
- Migration path to higher bandwidths:
  - > 21 Mbps to 43 Mbps (PTP 54400)
  - > 17 Mbps to 35 Mbps (PTP 49400)
  - > 52 Mbps to 105 Mbps (PTP 54500 and PTP 58500)
  - > 150 Mbps to 300 Mbps (PTP 54600 and PTP 58600)
  - > Selectable channel widths and data rates with PTP 600 bridges
- Dual powering options (±48V DC and AC) provide several different power supply configurations such as wind or solar power and redundant configurations

**Easy, Flexible System Management**
- Web or SNMP V1/2c using MIB-II or private PTP MIB
- Canopy® Prizm

# PTP 300, 400, 500 and 600 Value Proposition

Motorola PTP 300, 400, 500 and 600 Series solutions deliver unique and exciting opportunities to different markets.

| MARKET | OPPORTUNITY |
|---|---|
| Rural Carriers | Grow subscriber networks by establishing service in distant locations with a single, wireless backhaul link. |
| Enterprise Network Operators | Provide high throughput point-to-point links to connect buildings to branch offices and other facilities that may not be reached cost-effectively with a wired connection. While a wired solution may take weeks to provision, a PTP 300, 400, 500 or 600 Series solution offers more bandwidth for less money and can be up and running in hours or a few days. |
| Urban Carriers | Remove network bottlenecks and eliminate monthly leased wire/fiber connections with a high throughput wireless backhaul that works well in nLoS and NLoS environments and high interference environments that are typical in urban settings. |
| Municipalities, Education, Healthcare | Establish cost-effective network redundancy or extend network reach to aggregate voice, video and data from remote locations without trenching new fiber. |
| Public Safety | Provide reliable, high-bandwidth voice, video and data communications for on-scene streaming video, Internet and database access, and large file transfers (maps, blueprints, medical files, missing person images, etc.), plus backhaul for wireless networks and temporary fixed point-to-point links. |
| 2.5 GHz EBS License Holders | Establish a dedicated broadband Internet connection to access library and laboratory research, online work assignments, media-rich content, slide, audio or video presentations, online testing and performance tracking, virtual field trips, individual tutoring or mentoring, and much more. |
| U.S. Federal and NATO Agencies | Support 4.4 to 4.6 GHz license holders with a wide variety of connectivity requirements such as battlefield communications, video surveillance, border security, public safety, training and simulation networks, building-to-building and campus communications and traffic backhaul. |

The features of the PTP 300, 400, 500 and 600 Series solutions deliver real, measurable value to customers.

| VALUE | DRIVER |
|---|---|
| Revenue Generation | Increased nLoS or NLoS and long range LoS performance enables links to be established in previously inaccessible locations. |
| Reduce Costs | Increased nLoS, NLoS and long range LoS performance reduces the number of hops, saving on equipment and associated tower costs.<br><br>Replace leased T1/E1 voice circuits by pairing a T1/E1 multiplexer with PTP 300, 400 and 500 Series systems or by activating the single or dual T1/E1 ports in PTP 600 Series systems.<br><br>The radio's small footprint and Power-over-Ethernet capabilities mean that operators can deploy in space-constrained and aesthetically-challenging environments, saving valuable tower space.<br><br>More "first pass" installs and less "truck rolls" after installation because each radio features an integrated web server which enables remote management to configure, monitor and upgrade a link via a remote browser. |
| Reliability and Performance | PTP 300, 400, 500 and 600 solutions offer exceptional interference mitigation techniques (Multiple-Input Multiple-Output [MIMO], Advanced Spectrum Management with *i*-DFS and Adaptive Modulation) that provide a reliable network connection in noisy RF environments. As conditions change, the radios will automatically change the channels (*i*-DFS) and dynamically "upshift" or "downshift" modulation to maintain a reliable connection without user intervention.<br><br>A single Ethernet drop cable transports both data and Power-over-Ethernet. Dual powering options enable both ±48 VDC and AC power plus the flexibility to configure the power supply in a standalone or redundant configuration.<br><br>*i*-OFDM technology combined with MIMO enables a highly reliable connection in challenging conditions – around buildings, through and over trees, around hills and over water. |
| Lower Risk | High-capacity throughput enables efficient backhaul connections between business locations or to reach multiple clusters. The PTP 400 Series Lite (17 Mbps or 21 Mbps) provides a migration path to PTP 400 Series (35 Mbps or 43 Mbps respectively) via a software activation key. The 5.4 and 5.8 GHz PTP 500 and 600 Series Lite models (52 Mbps or 150 Mbps) provide a migration path to the PTP 500 and 600 Series (105 Mbps or 300 Mbps respectively) via a software activation key.<br><br>Using the Motorola PTP LINKPlanner, an operator can simulate and optimize link performance before deploying a PTP 300, 400, 500 or 600 link by fine tuning a number of factors to instantly see the effect on link performance.<br><br>PTP 300, 400, 500 and 600 Series bridges use narrow RF channels which enable collocation with Motorola's Canopy® Access Point Clusters and provide the ability to function in crowded and challenged RF environments. |

# PTP 100 Products

Designed for line-of-sight applications, PTP 100 (previously known as the Canopy® BH10 and Canopy BH 20) solutions have an array of modules that enable network architects to meet service requirements at extremely low cost. The units complement the Canopy Point-to-Multipoint products, providing network operators a wide variety of line-of-sight solutions that can be tailored their specific requirements, including rural, remote and campus connectivity, temporary services, emergency communications, video surveillance, distance learning, telemedicine, banking and backbone operations for metropolitan WiFi networks.

PTP 100 with a Reflector

# PTP 200 Product Descriptions

For stand-alone systems, a PTP 200 link consists of a pair of PTP 200 radios, each fitted with a Canopy power supply and surge suppressor. For systems that will be used for backhauling a Canopy network, a link consists of two PTP 200 radios fitted with a Cluster Management Module 3 (CMM3) and surge suppressors.

PTP 200 Radio

Power Supply for
stand-alone systems
(EMEA power requirements)

Power Supply for
stand-alone systems
(U.S. power requirements)

Surge Suppressor 600

Cluster Management Module
for backhaul systems

Operating in the 5.4 GHz band at Ethernet data rates up to 21 Mbps, PTP 200 Series links are designed to securely transport data, voice and video communications across nLOS and LOS paths. The PTP 200's OFDM technology provides resistance to interference and fading, delivering reliable performance in the presence of multi-path interference caused by buildings and other obstructions that partially block the Fresnel zone. GPS synchronization capabilities significantly reduce self-interference, allowing operators to:

- Collocate multiple radios on a tower or rooftop
- Collocate a PTP 200 backhaul link with an existing Canopy® network
- Deploy a 5.4 GHz frequency band overlay network

DFS (Dynamic Frequency Selection) detects radar-based users in the 5.4 GHz band and automatically switches to a non-interfering channel.

# PTP 300, 400, 500 and 600 Product Descriptions

Included in a PTP 300, 400, 500 or 600 solution is the hardware for each end of the link (plus mounting hardware) and the software that allows operators to set up and manage the link. Each link consists of two outdoor units (ODUs) and two powered indoor units (PIDUs).

Motorola PTP 300, 400, 500 or 600 Series Integrated Radio

Motorola PTP 300, 400, 500 or 600 Series Connectorized Radio

*The small size and neutral color of the PTP 300, 400, 500 and 600 Series outdoor units make them unobtrusive almost anywhere.*



Each outdoor unit includes a pair of transmitters and a pair of receivers. The unit's small size and neutral color make it ideal for aesthetically restrictive areas. The PTP 300, 400, 500 and 600 Series outdoor units come in two versions – Integrated and Connectorized. The Integrated versions include built-in antennas. The Connectorized versions connect to an external antenna (purchased separately). An external antenna increases signal gain, and, therefore, the range and robustness of the link. Use the Motorola PTP LINKPlanner to see whether the Integrated or Connectorized version is more appropriate for a particular application.

Motorola PIDU Plus – PTP 400 Series

Motorola PIDU Plus – PTP 300/500/600 Series

*Each PIDU Plus device carries both power and data to the ODU.*



At each end of the link, the indoor unit connects to its outdoor unit via a powered CAT-5 (PTP 400 Series) or CAT-5e (PTP 300, 500 and 600 Series) cable. It communicates with the local area network via a standard RJ-45 connector or an optional LC connection for PTP 600 Series bridges.

# Key PTP 300, 400, 500 and 600 Technical Features

Regardless of the application, the Motorola PTP 300, 400, 500 and 600 systems create a wireless Ethernet link between two points. Each point consists of an indoor unit and an outdoor unit. The two endpoints communicate via radio waves over channels varying in bandwidth between 10 and 12 MHz (PTP 400 Series), 15 MHz (PTP 300 and PTP 500 Series) and 5 and 30 MHz (PTP 600 Series). The channel raster is designed to ensure maximum flexibility in deciding channel occupancy. This greatly increases the probability that customers can find at least one usable channel in an already crowded hub-site.

Each outdoor unit utilizes two transceivers coupled to a baseband converter. The two pairs of transceivers connect with one another, enabling four different transmitter/receiver combinations – and so four distinct transmission beams. This greatly reduces the effects of fading and increases the probability that data will get through.

PTP 300, 400, 500 and 600 Series bridges use a unique combination of innovative technologies to deliver exceptional range, capacity, reliability and throughput – especially in nLoS or NLoS conditions, and in areas where there is significant RF interference, such as a city. The nLoS and NLoS capabilities provide a high tolerance for obstructions and enable network operators to establish network connections over hills, around buildings, through trees and over water.

**PTP 300, 400, 500 and 600 Series Similarities:**
PTP 300, 400, 500 and 600 Series bridges share many feature characteristics, including:

- **Advanced Spectrum Management with *Intelligent* Dynamic Frequency Selection (*i*-DFS)** automatically changes channels to avoid interference and combat link fading without user intervention. At power-up and throughout operation, the radio samples the band up to 1,200 times a second (PTP 600 Series) or up to 400 times a second (PTP 300, 400 and 500 Series) and automatically switches to the clearest channel. The 30-day, time-stamped database alerts the network operator to any interference that does exist and provides statistics to help analyze these patterns. This Advanced Spectrum Management capability creates virtually interference-free performance in the band.

- **Adaptive Modulation** ensures maximum throughput optimized for the radio path, even as path characteristics change. The transmitter and receiver negotiate the highest mutually sustainable data rate – then dynamically "upshift" and "downshift" the rate as RF conditions change.

- **Dual Polarized Antennas** – two transmitters and two receivers are used to establish a link, enabling four different transmitter/receiver combinations. By creating four distinct transmission beams, the chances that data will get through increase significantly.

- **Multiple-Input Multiple-Output (MIMO)** transmits multiple signals which are de-correlated temporarily and spatially. Being de-correlated, each path fades at different times, and the receiver is able to select the best signal at any time, resulting in better performance and link availability. The radio radiates multiple beams from the antenna – the effect of which significantly protects against fading and increases the probability of making a connection and reading the transmitted data. Plus, the radio will intelligently switch to "Dual Payload" mode if RF conditions will support it. In this mode, different data can be transmitted in parallel on each transmitter, effectively doubling the bandwidth at the higher modulation rates.

- ***Intelligent* Orthogonal Frequency Division Multiplexing (*i*-OFDM)** – in addition to MIMO transmitting the data twice, *i*-OFDM sends transmissions over multiple frequencies, or sub-carriers. The multiple sub-carriers result in higher spectral efficiency and higher resistance to:
  (1) Multi-path interference which occurs when objects in the air gap split a beam into parts that travel different paths and interfere with each other at the receiver.
  (2) Frequency selective fading which occurs when amplitudes of arriving signals cancel each other out at the receiver.
  In typical radios this would be a problem, but with PTP 300, 400, 500 and 600 Series radios, *i*-OFDM actually helps the radios re-correlate the interfering signals, improving the chance of receiving the signal through reflective behavior.

- **Built-in Security** is provided via a complex proprietary-scrambling mechanism and matched-radios technique that provides excellent over-the-air security for data transmissions. At installation, each outdoor unit comes with the MAC address of the other outdoor unit to which it will connect. The preset addresses enable the system's security features and allow the two units to communicate only with each other. An added layer of security can be applied with FIPS-197 compliant, 128-bit or 256-bit AES Encryption (optional).

- **Physical Form Factor** – PTP 300, 400, 500 and 600 Series systems share the same form factor and are offered in Integrated or Connectorized* (external antennas) versions. The Powered Indoor Unit (PIDU Plus) supports ±48VDC and AC.

**PTP 300, 400, 500 and 600 Differences:**
The differences between PTP 300, 400, 500 and 600 Series systems provide the operator with a selection of choices based on features, bandwidth requirements and price points to cost effectively establish a long range LoS or a challenging nLoS or NLoS wireless link. The primary feature differences are:

- **Hardware**
  - > PTP 400 Series bridges use different hardware and electronics than PTP 300, 500 and 600 Series bridges
  - > There is no difference in hardware between PTP 400 and PTP 400 Lite bridges
  - > There is no difference in hardware between PTP 600 and PTP 600 Lite bridges
  - > The PTP 25600 and PTP 45600 models within the PTP 600 family of solutions are not available in Lite versions

- **Power Supply** (PIDU Plus) – key differences between the PTP 300, 400, 500 and 600 Series PIDU Plus are:
  - > PTP 400 Series PIDU Plus - powers the radio over CAT5 100 Base-T Ethernet; AC and ±48VDC; 100 Base-T PoE
  - > PTP 300 and PTP 500 Series PIDU Plus – powers the radio over CAT 5e 100 Base-T Ethernet; AC and ±48VDC; 100 Base-T PoE
  - > PTP 600 Series PIDU Plus - powers the radio over CAT 5e 1000 Base-T Gigabit Ethernet; AC and ±48VDC; 1000 Base-T PoE
  - > Power supplies are outdoor-temperature rated at -40° F (-40°C) to 140° F (+60°C) and require a weatherproof enclosure when mounted outdoors.

- **Spectrum**
  - > 5.4 GHz PTP 400 Series bridges use 12 MHz of spectrum
  - > 4.9 GHz PTP 400 Series (PTP 49400) bridges use 10 MHz of spectrum
  - > 5.4 and 5.8 GHz PTP 300 AND PTP 500 Series bridges use 15 MHz of spectrum
  - > PTP 600 Series bridges offer selectable 5, 10, 15 and 30** MHz channel widths

- **Modulation**
  - > PTP 400 Series bridges range from BPSK to 64 QAM
  - > PTP 300 and PTP 500 Series bridges range from BPSK to 64 QAM
  - > PTP 600 Series bridges range from BPSK to 256 QAM

- **Time Division Duplex (TDD) Synchronization in PTP 600 Series solutions**
  - > Times and synchronizes transmit and receive signals
  - > Improved frequency reuse enables collocation of multiple PTP radios on a single rooftop or tower with greatly reduced interference
  - > Requires a Memorylink UltraSync™ GPS-100M synchronization unit to provide a precise timing-reference signal that originates from the atomic clocks on GPS satellites orbiting the earth; this signal is fed to the PTP 600 radio and used as the timing reference for the PTP 600's TDD functionality

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 * Connectorized antennas are sold separately. See Appendix B for a list of compatible antennas.
 ** In the PTP 25600 system, the 30 MHz channel is not FCC compliant.

- **T1/E1 Capability**
  - > A PTP 300, 400 or 500 Series system must be paired with a T1/E1 multiplexer to transport TDM traffic over the bridge; each bridge has a "TDM Mode" that generates a new set of Adaptive Modulation margins, reducing the probability of code-word errors (and hence packet loss); the multiplexer converts the data stream from T1/E1 ports into packets for transmission over the bridge's Ethernet port; at the other end of the link, a second multiplexer converts the packets back into TDM traffic, carrying the traffic seamlessly and reliably from one location to another
  - > A PTP 600 Series system has built-in T1/E1 ports in the radio: PTP 600 Series Lite has one built-in T1/E1 port and PTP 600 Series has two; PTP 600 Series bridges can also be paired with a T1/E1 multiplexer to transport voice

- **Fiber Option**
  - > A PTP 600 Series bridge has an optional fiber conversion kit

- **Spectrum Management Control for PTP Bridges**
  - > PTP 300, 400 and 500 Series bridges include two Spectrum Management Options

  | Spectrum Management Control | ● i_DFS | ○ Fixed Channel |
  |---|---|---|
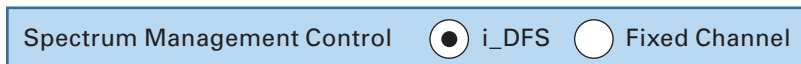
  - > PTP 600 Series bridges include three Spectrum Management Options

  | Spectrum Management Control | ○ i_DFS | ○ Fixed Channel | ● WiMAX |
  |---|---|---|---|

  - > Explanation of three options:
    - *i*-DFS – *Intelligent* Dynamic Frequency Selection continually monitors the spectrum looking for the channel with the lowest level of on-channel and co-channel interference
    - Fixed Channel – a fixed-frequency mode allows the installer to fix transmit and receive frequencies on the radio
    - WiMAX – WiMAX mode allows the installer to assign WiMAX-compatible configurations

**5.4 GHz and 5.8 GHz Differences:**

While the 5.8 and 5.4 GHz versions of the PTP 300, 400, 500 and 600 Series solutions share a great number of feature characteristics, there are a few differences between the systems.

| PTP MODELS | BAND | MAXIMUM THROUGHPUT | RANGE* |
|---|---|---|---|
| PTP 54300** – 5.4 GHz | UNII > 5.470 – 5.725 GHz | 250 MHz | LoS > Up to 12 mi (20 km) NLoS > Up to 3 mi (5 km) |
| PTP 58300 – 5.8 GHz | ISM > 5.725 – 5.875 GHz | 125 MHz | LoS > Up to 155 mi (250 km) NLoS > Up to 5 mi (8 km) |
| PTP 54400 – 5.4 GHz | UNII > 5.470 – 5.725 GHz | 250 MHz | LoS > Up to 12 mi (20 km) NLoS > Up to 3 mi (5 km) |
| PTP 54500** – 5.4 GHz | UNII > 5.470 – 5.725 GHz | 250 MHz | LoS > Up to 12 mi (20 km) NLoS > Up to 3 mi (5 km) |
| PTP 58500 – 5.8 GHz | ISM > 5.725 – 5.875 GHz | 150 MHz | LoS > Up to 155 mi (250 km) NLoS > Up to 5 mi (8 km) |
| PTP 54600 – 5.4 GHz | UNII > 5.470 – 5.725 GHz | 250 MHz | LoS > Up to 12 mi (20 km) NLoS > Up to 3 mi (5 km) |
| PTP 58600 – 5.8 GHz | ISM > 5.725 – 5.875 GHz | 125 MHz | LoS > Up to 124 mi (200 km) NLoS > Up to 5 mi (8 km) |

 * PTP 54300, 54400, 54500 and 54600 ranges are based on restricted power operation. Due to the power restrictions imposed by U.S., Canadian and EU authorities on systems operating in the 5.4 GHz band, lower ranges will be realized with 5.4 GHz systems in power-restricted regions than with systems operating in the 5.8 GHz spectrum.

** The 5.4 GHz version of this device has not been authorized as required by the rules of the Federal Communications Commission (FCC). That device is not, and may not be, offered for sale or lease, or sold or leased in the United States, until authorization is obtained.

# PTP 400 Series Bridges – Aggregate Ethernet Throughput Rates

The equipment capability of the PTP 400 Series system is given in Tables 1 and 2. These tables provide the Ethernet throughput rate versus link loss for the 5.4 GHz versions of the PTP 400 Series and the PTP 400 Series Lite bridges in both high-throughput and low-latency modes. The link loss is the total attenuation of the wireless signal between the two point-to-point radios. Adaptive modulation ensures that the highest throughput that can be achieved instantaneously will be obtained taking propagation and interference into account. When the link has been installed, the Status Page on the management interface provides information about the link loss currently measured by the equipment – both instantaneously and averaged. The averaged value will require maximum seasonal fading to be added, and then the radio reliability of the link can be computed.

**Table 1: 5.4 GHz PTP 400 Series Bridges**

| Aggregate Ethernet Throughput Rate (Mbps)[1] | | | | | | | | | 5.4 GHz Max Path Budget (dB)[2] |
|---|---|---|---|---|---|---|---|---|---|
| **Hi** = High Throughput Mode | | | | | | | | | |
| **Lo** = Low Latency Mode | | | | | | | | | |
| | 0-5km | | 0-40km | | 0-100km | | 0-200km | | |
| | Hi | Lo | Hi | Lo | Hi | Lo | Hi | Lo | |
| 64QAM⅞ | 42.5 | 39.7 | 39.5 | 34.7 | 35.2 | 28.5 | 29.8 | 22.0 | 139.8 |
| 64QAM¾ | 36.4 | 34.0 | 33.8 | 29.7 | 30.2 | 24.5 | 25.5 | 18.9 | 142.5 |
| 64QAM⅔ | 32.4 | 30.2 | 30.1 | 26.4 | 26.8 | 21.8 | 22.7 | 16.8 | 144.3 |
| 16QAM¾ | 24.3 | 22.7 | 22.6 | 19.8 | 20.1 | 16.3 | 17.0 | 12.6 | 150.9 |
| 16QAM½ | 16.2 | 15.1 | 15.0 | 13.2 | 13.4 | 10.9 | 11.3 | 8.4 | 153.5 |
| QPSK⅔ | 10.8 | 10.1 | 10.0 | 8.81 | 8.93 | 7.25 | 7.56 | 5.6 | 160.3 |
| QPSK½ | 8.1 | 7.55 | 7.52 | 6.61 | 6.7 | 5.44 | 5.67 | 4.2 | 162.8 |
| BPSK½ | 3.6 | 3.36 | 3.34 | 2.94 | 2.98 | 2.42 | 2.52 | 1.87 | 168.6 |

**Table 2: 5.4 GHz PTP 400 Series Lite Bridges**

| Aggregate Ethernet Throughput Rate (Mbps)[1] | | | | | | | | | 5.4 GHz Max Path Budget (dB)[2] |
|---|---|---|---|---|---|---|---|---|---|
| **Hi** = High Throughput Mode | | | | | | | | | |
| **Lo** = Low Latency Mode | | | | | | | | | |
| | 0-5km | | 0-40km | | 0-100km | | 0-200km | | |
| | Hi | Lo | Hi | Lo | Hi | Lo | Hi | Lo | |
| 64QAM⅞ | 21.3 | 19.8 | 19.7 | 17.3 | 17.6 | 14.3 | 14.9 | 11.0 | 139.8 |
| 64QAM¾ | 18.2 | 17.0 | 16.9 | 14.9 | 15.1 | 12.2 | 12.8 | 9.4 | 142.5 |
| 64QAM⅔ | 16.2 | 15.1 | 15.0 | 13.2 | 13.4 | 10.9 | 11.3 | 8.4 | 144.3 |
| 16QAM¾ | 12.1 | 11.3 | 11.3 | 9.9 | 10.1 | 8.2 | 8.5 | 6.3 | 150.9 |
| 16QAM½ | 8.1 | 7.6 | 7.5 | 6.6 | 6.7 | 5.4 | 5.7 | 4.2 | 153.5 |
| QPSK⅔ | 5.4 | 5.0 | 5.0 | 4.4 | 4.5 | 3.6 | 3.8 | 2.8 | 160.3 |
| QPSK½ | 4.1 | 3.8 | 3.8 | 3.3 | 3.4 | 2.7 | 2.8 | 2.1 | 162.8 |
| BPSK½ | 1.8 | 1.7 | 1.7 | 1.5 | 1.5 | 1.2 | 1.3 | 0.9 | 168.6 |

[1] These data rates are reduced when AES or ARQ is enabled.
[2] AMOD link margin of 1.5 dB applied.

# PTP 600 Series Bridges – Aggregate Ethernet Throughput Rates

The equipment capability of the PTP 600 Series system is given in Table 3. It gives the Ethernet throughput rate versus link loss for the 5.8 and 5.4 GHz PTP 600 Series and PTP 600 Series Lite bridges in all modes. Adaptive modulation ensures that the highest throughput that can be achieved instantaneously will be obtained taking propagation and interference into account. When the link has been installed, the Status Page on the management interface provides information about the link loss currently measured by the equipment both instantaneously and averaged. The averaged value will require maximum seasonal fading to be added, and then the radio reliability of the link can be computed..

**Table 3:** 5.8 and 5.4 GHz PTP 600 Series and PTP 600 Series Lite Bridges

| Modulation Mode – Payload Type | Maximum Aggregate Data Rate[1] (Mbps) | | Threshold Value[2] (dBm) | Output Power[3] (dBm) | Maximum Link Loss[4] (dB) |
|---|---|---|---|---|---|
| | **150 Mbps** | **300 Mbps** | | | |
| 256QAM 0.81 dual | 150.1 | 300.2 | -59.1 | +18 | 124.1 |
| 64QAM 0.92 dual | 126.5 | 252.9 | -62.0 | +18 | 127.0 |
| 64QAM 0.75 dual | 103.4 | 206.7 | -68.1 | +18 | 133.1 |
| 16QAM 0.87 dual | 80.4 | 160.8 | -71.0 | +20 | 138.0 |
| 16QAM 0.63 dual | 57.8 | 115.6 | -75.2 | +22 | 144.2 |
| 16QAM 0.63 single | 28.9 | 57.8 | -79.3 | +22 | 148.3 |
| QPSK 0.87 | 20.1 | 40.2 | -81.6 | +23 | 151.6 |
| QPSK 0.63 | 14.5 | 28.9 | -84.6 | +24 | 155.6 |
| BPSK 0.63 | 7.2 | 14.4 | -88.1 | +25 | 160.1 |
| 256QAM 0.81 single | 75.1 | 150.1 | -64.0 | +18 | 129.0 |
| 64QAM 0.92 single | 63.2 | 126.4 | -65.9 | +18 | 130.9 |
| 64QAM 0.75 single | 51.7 | 103.3 | -71.7 | +18 | 136.7 |
| 16QAM 0.87 single | 40.2 | 80.4 | -74.8 | +20 | 141.8 |

[1] Aggregate data rate in IP Traffic mode (running at maximum throughput) for a 1 km link length
[2] Thresholds for modes other than BPSK are for IP Traffic link-optimization AMOD thresholds. When operating in TDM mode with wayside T1/E1 enabled, thresholds are reduced by 2-3 dB.
[3] The output power shown is for a center channel in Region 1. The output power will be reduced on the edge channels and may vary if different region codes are selected.
[4] The maximum link loss for each modulation mode is derived from the AMOD threshold for that mode and the maximum Region 1 center channel output power. The figures assume integral antennas with 23.5 dBi gain are used.

# PTP Lightning Protection Unit (PTP-LPU) Product Description

Although Motorola's PTP 300, 400, 500 and 600 Series radios are designed to withstand extreme conditions, they are often mounted on high towers, frequently with external antennas, making the radios prime targets for lightning strikes. The Motorola Fixed Point-to-Point Lightning Protection Unit (PTP-LPU) is designed to protect a Motorola PTP 300, 400, 500 or 600 Series radio from the harmful effects of power surges induced in the cables by nearby lightning strikes. By grounding the power surges before they can harm the units, the Motorola PTP-LPU gives PTP radios the best protection from the harmful effects of lightning, although 100% protection is neither implied nor possible.

PTP-LPU
(Lightning Protection Unit)

The PTP-LPU is a high-speed, high-current, solid-state device that is encased in a rugged metal case designed to hold up against ice, snow and rain and withstand winds up to 150 mph (242 kph). The projected operational life of a PTP-LPU is 10 years, even when continually exposed to the elements. Because of its small form factor and minimum number of components, the cost-effective unit is easy to transport and install. As a replacement for the Transtector surge arrestor (ALPU-ORT), the PTP-LPU is priced for a fast return on investment.

Because the units can be installed with new deployments or easily added to existing PTP radios, current and prospective operators of a Motorola PTP network can reap the benefits of the PTP-LPU's lightning protection capabilities.

For more details, refer to the PTP-LPU's specifications at the end of this document.

PTP Lightning Protection Unit mounted on a tower or mast with a PTP radio



**Note:** Motorola strongly recommends purchasing the Motorola PTP Lightning Protection Unit (PTP-LPU) as an integral part of a PTP 300, 400, 500 or 600 Series link. While purchasing the Motorola PTP Link Guard All Risk Extended Warranty will cover the cost of replacing a radio damaged by lightning, deploying lightning protection initially will help the operator avoid the delays and costs associated with taking down damaged radios and installing replacement units. When correctly installed, the Motorola PTP Lightning Protection Unit gives the PTP radio the best protection from the harmful effects of lightning. However, 100% protection is neither implied nor possible.

### Installation with PTP 400 and PTP 600 Series Radios:

For the best possible protection, each PTP 400 and PTP 600 radio requires two Lightning Protection Units (PTP-LPUs), one installed adjacent to the radio on the wall, tower or mast, and one installed at the cable entry point of the building in which the network resides. The unit near the base of the wall or tower protects the LAN network inside the building. The following are main installation configurations that can be deployed with the Motorola PTP 400 and PTP 600 Series wireless Ethernet bridges:

- Tower/mast/wall configuration – uses two PTP-LPU units with each PTP 400 or PTP 600 radio
- Tower/mast/wall configuration with T1/E1 – uses two PTP-LPU units per radio and two additional PTP-LPU units per T1/E1
- Tower/mast/wall configuration with a Memorylink UltraSync™ GPS-100M Synchronization Unit – uses two PTP-LPU units per radio
- Tower/mast/wall configuration with T1/E1 and an UltraSync GPS-100M – uses two PTP-LPU units per radio plus two additional PTP-LPU units per T1/E1

### Installation with PTP 300 and PTP 500 Series Radios:

Because PTP 300 and PTP 500 radios have built-in lightning protection capability, there is no need to deploy an external lightning protection device on a tower or wall adjacent to the radio. The lightning protection built into the PTP 500 radio contains all the protection required at the top of the tower or wall. However, an external PTP-LPU is required near the base of the tower or wall at the cable entrance point leading to the network to protect the LAN equipment in the building. The Motorola PTP 300/500 LPU End Kit contains one lightning protection unit for use as the external unit to be installed near the base of the tower or wall. Together the lightning protection built into the PTP 500 radio and the external PTP-LPU offer excellent protection from the harmful effects of lightning.

### Product Requirements:

- Maximum Cable Lengths
  - > Ground connection: < 2 ft (0.6 meters)
  - > Upper tower grounds: within 1 ft (0.3 meters) of the ODU bracket and on the same metal
- When connected to the back of an ODU, the minimum pole diameter required is 2.5 inches (6.35 cm)
- Grounding stake (included)

For detailed installation instructions, refer to the PTP-LPU User Manual.

# Memorylink UltraSync™ GPS-100M Synchronization Unit

The Motorola Fixed Point-To-Point (PTP) 600 Series Wireless Ethernet Link consists of a pair of radios deployed one at each end of the link and operates on a single frequency channel in each direction using Time Division Duplex (TDD). In situations where a number of radios are installed on the same mast or where a large number of links are installed in a sizeable, dense network, it is possible that the performance or throughput of some of the links can be reduced. In some cases, a number of the links may not work at all. This is due to interference between the units, and the levels of interference can worsen when the links are operating on the same or adjacent channels.

Simple example of cross-interference when three links of different lengths are mounted on a mast and operating on the same or adjacent channels
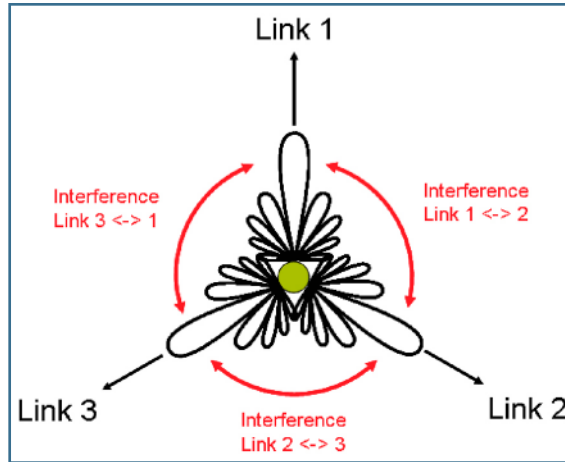


The effect of this cross interference between units can be reduced by ensuring that the radios are in synchronism, meaning that transmit and receive frames of the units are synchronized so they do not interfere with each other. TDD Synchronization introduces a fixed TDD framing mode and allows frame timing in a PTP 600 link to be synchronized with an external reference – a Global Positioning System (GPS) unit.

Before TDD Synchronization
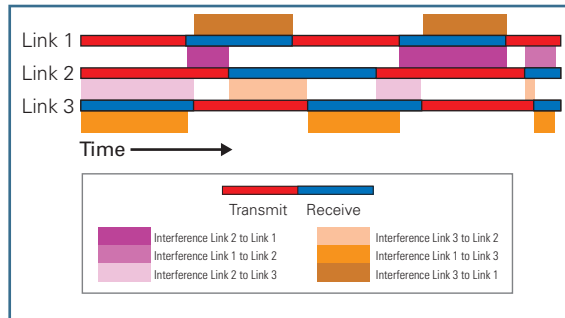


After TDD Synchronization
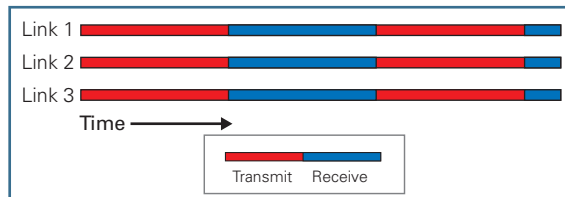


The result is that TDD synchronization minimizes the interference between links and promotes optimal spectral re-use while greatly enhancing link performance. By timing and synchronizing transmit and receive signals, network operators can collocate multiple radios on a rooftop or tower with greatly reduced interference.

Motorola has partnered with Memorylink to deploy the Memorylink UltraSync™ GPS-100M in a Motorola Fixed Point-to-Point (PTP) 600 Series network. With its integrated GPS receiver and internally-mounted antenna, the UltraSync GPS-100M generates a precise, time-reference signal that is used by the PTP 600 Series radios to time and synchronize transmit and receive signals.

Memorylink UltraSync GPS-100M Synchronization Unit

Memorylink UltraSync GPS-100M installed with a PTP radio and PTP Lightning Protection Unit

The reliable UltraSync GPS-100M generates a time-reference signal that originates from the atomic clocks on the GPS satellites that orbit the earth. The units come pre-wired for new systems and can be retrofitted for existing PTP 600 Series links.

### UltraSync GPS-100M Features:

- Integral GPS receiver – 12 channel
- Passes 1000 Base-T protocol
- Supports Ethernet cable lengths of up to 330 feet (100 meters) from the PTP 600 PIDU Plus to the UltraSync GPS-100M Eth1/PWR port
- Robust enclosure weighing approximately 23 ounces (650 grams)
- Small footprint – 5.92″ (150 mm) height, 3.95″ (100 mm) width and 2.79″ (71 mm) depth
- Includes internally mounted GPS antenna, mounting bracket, screws, Ethernet cables and cable glands for waterproof ingress/egress
- Connects via RJ-45 connector to PTP 600 Series radios equipped with a sync port
- Operates at temperatures to – 40°F to +140°F (-40°C to +60°C), even in high humidity

### Ordering

The Memorylink UltraSync GPS-100M can be ordered directly from Motorola under the following part number and product description:

**WB3001** – Memorylink UltraSync GPS-100M for PTP 600

# PTP LINKPlanner for
# PTP 300, 400, 500 and 600 Series Links

The PTP LINKPlanner is a new Motorola link planning and optimization tool designed for use with PTP 300, 400, 500 and 600 Series solutions. This tool allows customers to determine link performance characteristics prior to purchase, given certain assumptions about geography, distance, antenna height, transmit power and other factors. The PTP LINKPlanner software can be downloaded free at www.motorola.com/ptp.

Like its predecessor, the PTP Link Estimator tool, the new PTP LINKPlanner lets you quickly and easily predict link performance before purchase. However, PTP LINKPlanner includes enhancements that take link planning to a new level of RF sophistication, allowing you to:

- Plan one link or multiple links simultaneously – a real time saver
- Obtain a comprehensive overview of the entire network via Google™ Earth, enabling full optimization of your wireless network

Sample LINKPlanner
Results Page
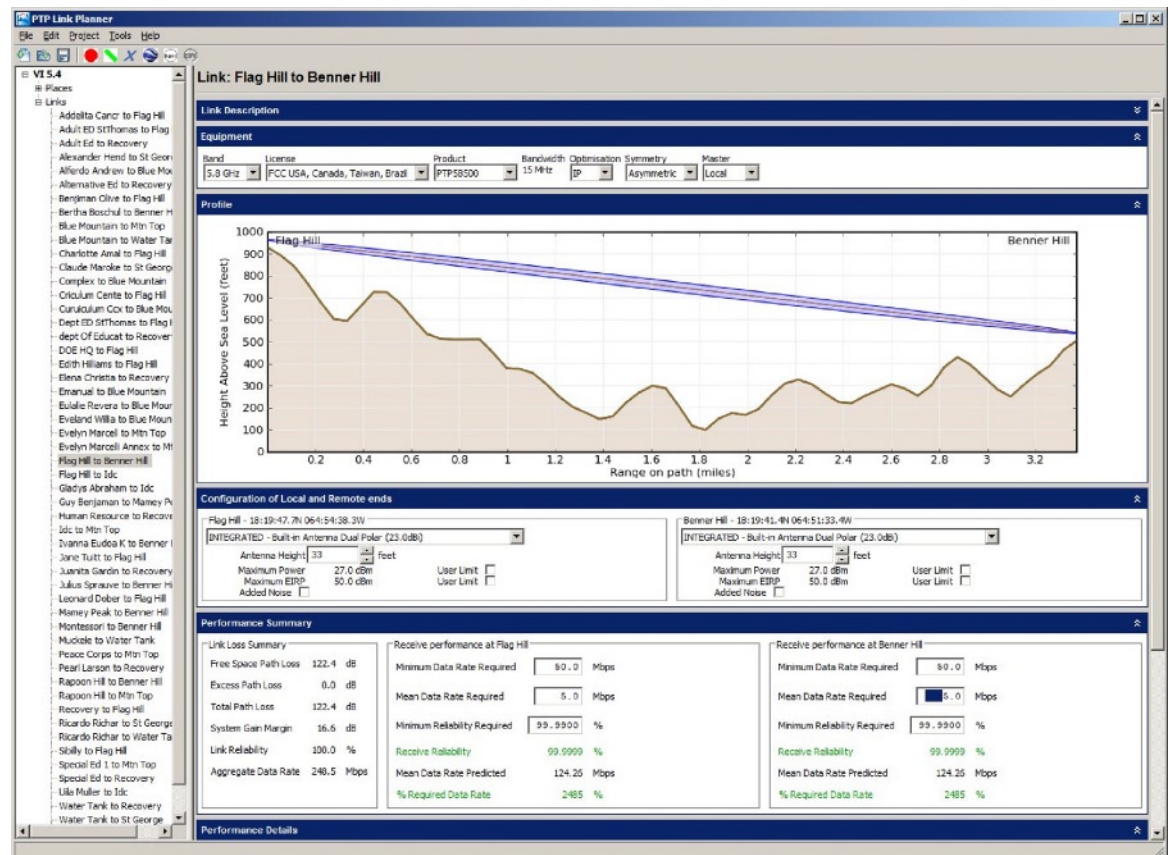
Sample Network
Overview Page
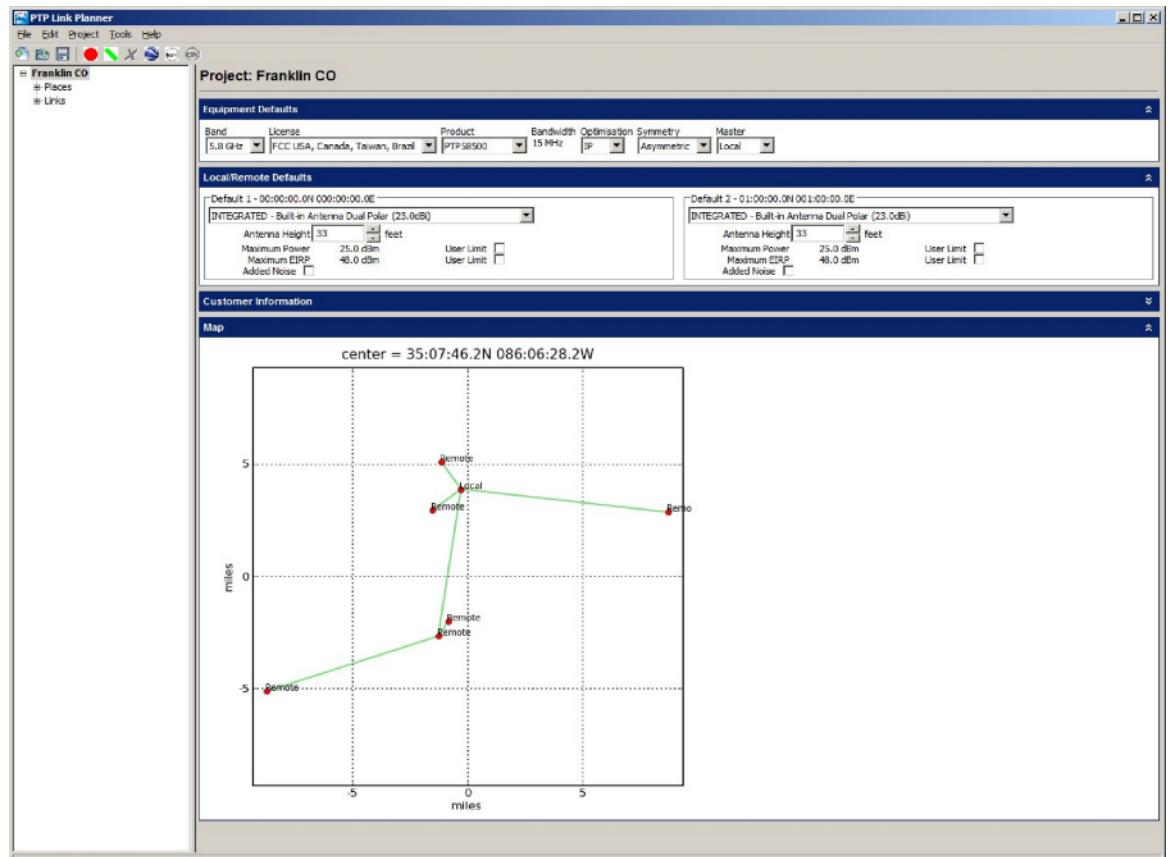


Operating range and data throughput are dependent on several factors, including:
- Path Length
- Antenna height on local or remote site
- Obstructions (height and distance)
- Antenna type - Integrated or Connectorized (with external antenna to provide additional system gain)
- Connectorized antenna options (choose from a selection of separately-purchased single and dual polar antennas; local regulations should be checked prior to purchase)
- Location of the link – site elevation and terrain

The benefit is that you can optimize a link before deployment by changing input data to see the effect on performance and throughput. For example, if a link calculation indicates low throughput, then a number of factors can be changed to see the improvement on link performance.

**Spatial Diversity with Connectorized Radios:** The PTP LINKPlanner can also be used to determine the effect of using external antennas with PTP 300, 400, 500 and 600 Series Connectorized systems which include inherent spatial diversity (each Connectorized radio has two built in N-type connectors). Spatial diversity is a method of transmission and/or reception in which the effects of fading are minimized by the simultaneous use of two or more physically separated antennas – ideally separated by one or more wave lengths. The following diagrams show two spatial diversity examples.

One Dual Pole and
Two Single Pole Antennas
Vertically Separated
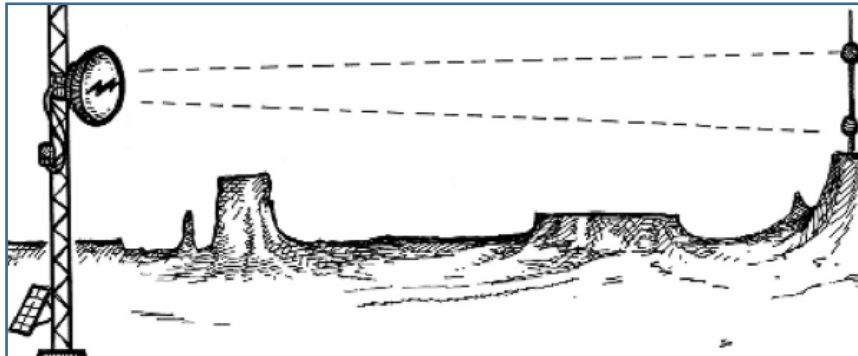
Two Single Pole Antennas
Vertically Separated
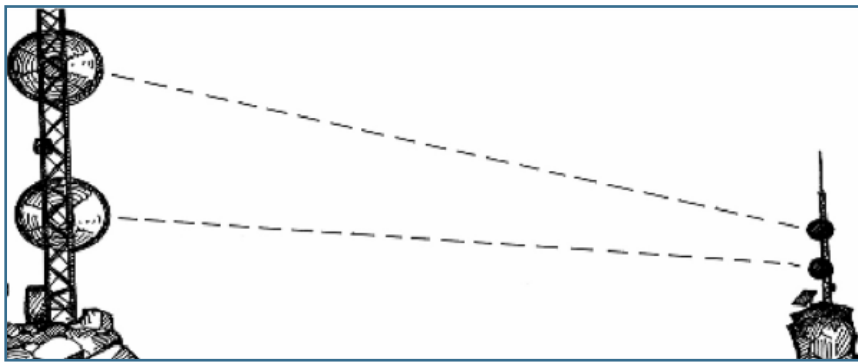
It is important to note that the PTP LINKPlanner will perform calculations for PTP 300, 400 500 and 600 Series links. While the PTP Link Estimator can still be used to plan and optimize PTP 400 and 600 Series links, everyone should migrate as quickly as possible to the PTP LINKPlanner tool to plan and optimize links. No future enhancements will be provided for the PTP Link Estimator, and shortly the PTP LINKPlanner will completely replace the Link Estimator.

If you have not done so already, you should complete one of Motorola's live or recorded tutorials as soon as possible, so you can begin using the PTP LINKPlanner tool. You can register for a session at www.motorola.com/ptp.

# Frequently Asked Questions

**1. What interference mitigation techniques are used in the PTP 300, 400, 500 and 600 Series radios?**

The Motorola PTP 300, 400, 500 and 600 Series radios deliver optimal network performance in challenging environments by uniquely combining five mitigation techniques including: dual polarized antennas, Multiple-Input Multiple-Output (MIMO), *intelligent* Orthogonal Frequency Division Multiplexing (*i*-OFDM), Adaptive Modulation  and Advanced Spectrum Management with *intelligent* Dynamic Frequency Selection (*i*-DFS). In addition, the PTP 600 radios add Time Division Duplex (TDD) Synchronization, enabling frequency reuse to permit collocation of multiple radios on a single rooftop or tower with greatly reduced interference. Because PTP 300, 400, 500 and 600 radios use less channel width than many comparable systems, they minimize the risk for RF interference and boost performance in noisy environments.

**2. What throughput do I get at maximum range?**

The unique design of the Motorola PTP 300, 400, 500 and 600 Series radios combats interference (leading to higher throughput) while maximizing signal range (through high system gain). Operating range and data throughput of wireless communications are dependent on conditions. The systems can support up to 6 miles (10 km) non-line-of-sight, up to 25 miles (40 km) near-line-of-sight and up to 155 miles (250 km) line-of-sight. In the PTP 300 Series, the PTP 54300 and 58300 systems provide up to 25 Mbps. Within the PTP 400 family of systems, up to 21 Mbps is the maximum throughput for the PTP 54400 Lite, up to 43 Mbps for the PTP 54400, up to 17 Mbps for the PTP 49400 Lite and up to 35 Mbps for the PTP 49400. In the PTP 500 Series, the PTP 54500 and PTP 58500 Lite systems provide up to 52 Mbps while the PTP 54500 and 58500 full-speed models deliver up to 105 Mbps. Within the PTP 600 family of solutions, maximum data rates vary between 41 Mbps and 300 Mbps based on the model and channel size selected. To best estimate throughput incorporating topographic variances and obstructions, Motorola provides link planning tools that will project case-specific link performance performance estimates. The PTP LINKPlanner software can be downloaded at www.motorola.com/ptp.

**3. How do the PTP 300, 400, 500 and 600 Series bridges provide security for data traffic?**

In order to ensure secure transmission, each PTP 300, 400, 500 and 600 Series radio is pre-programmed to communicate only with a user-configured matched radio. At installation, each link is programmed with the MAC and IP address of its partner. Then the two ends of the link will communicate only with each other, greatly reducing the risk of "man in the middle" attacks. The pre-pairing also allows fast deployment as all that is needed is power for the modules to start searching for each other. Over-the-air security is achieved through a proprietary scrambling mechanism that cannot be disabled or spoofed by commercial tools. Plus an additional layer of security can be applied with FIPS-197 compliant, 128-bit and 256-bit AES Encryption (optional).

**4. What comprises the PTP 300, 400, 500 and 600 solutions' built-in proprietary over-the-air security features?**

The unique combination of security techniques (scrambling and matched radios) provides excellent over-the-air security for the network. Each matched pair employs a built-in complex proprietary signal with scrambling applied to give an added security layer that protects the data being transmitted. On the transmission, the signal passes through the following processes:
1) Reed Solomon forward error correction where added bits are applied
2) Scrambling with a code that repeats every eight Reed Solomon code words (about 1 ms)
3) Interleaver where the signal is then changed in order
4) Convolutional Encoding where the signal is scrambled into two streams and then sent serially with some bits unsent
5) Then the signal is coded onto one of BPSK, QPSK, 16 QAM, 64 QAM or 256 QAM waveforms
6) Then the signal is interleaved across a 1024-carrier OFDM waveform

**5. What security measures should be used along with the built-in over-the-air security?**

In addition to the scrambling and matched-radio security included with all PTP 300, PTP 400, PTP 500 and PTP 600 Series radios, FIPS-197 compliant, 128-bit or 256-bit AES Encryption can be added as an option to meet specific security requirements. Motorola also encourages encryption of data before it is transmitted by using the security measures built into routers, network devices and web sites in order to ensure end-to-end protection of data.

**6. Are the PTP 300, 400, 500 and 600 Series radios 802.11a devices?**

The PTP 300, 400, 500 and 600 Series bridges use different encoding and radio transmission systems than 802.11a. In areas where 802.11a systems are operating, they will detect the 802.11a radio signals and choose a clear channel away from any interference.

**7. Will the PTP 300, 400, 500 and 600 Series radios interfere with my Canopy® access network?**

Flexibility is a key value driver of Motorola solutions. The PTP 300, 400, 500 and 600 Series systems have been designed to interoperate with Canopy AP clusters operating in the same frequency band. There are certain considerations that network operators must make during installation, including frequency allocation, vertical separation and angular direction of the modules. Refer to the User Guide for collocation information.

**8. How do PTP 300, 400, 500 and 600 bridges avoid interference from other devices nearby?**

At initialization, the systems monitor the available frequency channels to find a channel that is clear of interference. During operation each radio continuously monitors the spectrum, sampling the band up to 1,200 times a second for PTP 600 radios or up to 400 times a second for PTP 300, 400 and 500 radios. When interference is encountered, the radio automatically switches to the clearest channel.

**9. When do I use the PTP 300, 400, 500 and 600 Series solutions?**

PTP 300, 400, 500 and 600 Series point-to-point wireless Ethernet bridges have been developed to enable network design that meets the needs of service providers and network operators. Motorola has expertise that can help develop a profile of the current and estimated future demand of the network to provide sufficient capacity to meet service demands. Even in the most challenging environments, the unique combination of innovative technologies enables operators to achieve a reliable and high-throughput link for a wide variety of applications, including:
- Backhaul to connect clusters of users to the backbone without wires
- Long-distance connectivity to traverse geography (e.g., open terrain, water, etc.) without relays
- Non-line-of-sight (NLoS) or near-line-of-sight (nLoS) performance where other solutions often cannot make the connection
- Spectral efficiency to place more links at hub-sites without creating interference
- Redundancy and additional capacity for 6 GHz networks and wire-line circuits
- Cost-effective connectivity between buildings
- Video surveillance extensions beyond existing fiber/coax wired infrastructures
- Enterprise voice and data connectivity
- Disaster recovery and temporary deployments for activities such as tactical military operations, emergency services, security and surveillance, and short-term entertainment and sporting events
- Bandwidth-intensive communications such as distance learning, telemedicine, streaming video and multimedia
- U.S. Federal and NATO uses such as battlefield communications, tactical military operations, border security and video surveillance

**10. What are the differences between the PTP 300, 400, 500 and 600 Series Power over Ethernet?**

PTP 300, 400 and 500 Series radios support 100 BaseT while PTP 600 Series radios support 100/1000 BaseT. PTP 400 bridges are powered via two pairs of the Ethernet drop cable; the primary power is supplied on Pin 8 (Pin 7 return) while supplementary power for the longer cable runs is supplied on Pin 5 (Pin 4 Return). The supplementary pair is also used for ODU signaling. PTP 300, 500 and 600 bridges are powered via four data pairs of the Ethernet drop cable.

**11. Can I source and use my own PoE adapter with PTP 300, 400, 500 and 600 Series bridges?**

No. PTP 300, 400, 500 and 600 Series systems use a non-standard PoE configuration, and failure to use each system's Powered Indoor Unit (PIDU Plus) could result in equipment damage, will invalidate the safety certification and may cause a safety hazard. Note: The Motorola Canopy® CMM should not be used to power PTP 300, 400, 500 and 600 Series radios.

**12. How do PTP 300, 400, 500 and 600 Series bridges integrate into my data network?**

The system acts as a transparent bridge between two segments of your network. In this sense, each point-to-point wireless bridge can be treated as a virtual wired connection between the two points. The PTP system forwards 802.3 Ethernet packets destined for the other part of the network and filters packets that it does not need to forward. The system is transparent to higher-level management systems such as VLANs and Spanning Tree.  In addition, the PTP 300, 400, 500 and 600 Series systems integrate with Motorola's Canopy Point-to-Multipoint and MOTOMESH networks.

**13. Can I use Apple® Macintosh® OS X to control and monitor a PTP 300, 400, 500 and 600 Series radio?**

Yes, but there are some restrictions. Mozilla 1.6 or higher is recommended. There are some issues with Internet Explorer 5.2(IE) and Safari, which could mislead the user.

**14. What is unique about the PTP 300, 400, 500 and 600 Series radios?**

There are many unique features built-in to the radios such as Multiple-Input Multiple-Output (MIMO), *intelligent* OFDM, *intelligent* Dynamic Frequency Selection, Dual Polarized antennas, Adaptive Modulation and spatial diversity capability. The radios offer the highest system gain in their class through high-sensitivity antennas for improved signal recovery. The radios operate on ultra-fast digital signal processors and have a built-in web server for advanced management capabilities, including detailed radio signal diagnostics.

**15. What is Multiple-Input Multiple-Output (MIMO)?**

PTP 300, 400, 500 and 600 Series Series radios radiate multiple beams from their dual polarized antennas – the effect of which is to significantly protect against fading and to radically increase the probability that the receiver will decode a usable signal in the face of multi-path and interference conditions. The effects of MIMO combined with *intelligent* OFDM provide a best-in-class link budget with high reliability in LoS, nLoS and NLoS environments.

**16. What is Orthogonal Frequency Division Multiplexing?**

Orthogonal Frequency Division Multiplexing (OFDM) is a method of digital modulation in which a signal is split into several narrowband channels at different frequencies (or sub-carriers). Motorola takes this technology further by using more sub-carriers and pilot tones than comparable systems to handle multi-path dispersion and instant fade recovery.

**17. What is Time Division Duplex (TDD) Synchronization?**

Time Division Duplex (TDD) refers to a transmission scheme that times and synchronizes the flow of transmissions as they are sent and received so that interference between signals is greatly reduced. Motorola's TDD capability in PTP 600 Series solutions uses a timing reference signal provided by a Memorylink UltraSync™ GPS-100M synchronization unit. The UltraSync GPS-100M's timing reference originates from the atomic clocks on GPS satellites that orbit the earth.

**18. What do you mean by near- and non-line-of-sight**

A wireless connection between two points with obstructions that block the RF signal resulting in two scenarios:

Near line-of-sight – Optical line-of-sight between the two points, but the Fresnel zone is blocked
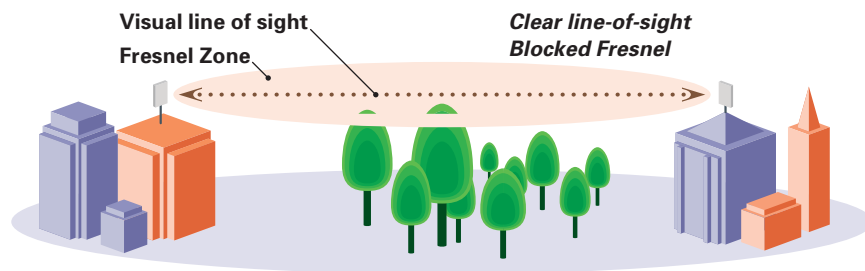


Non line-of-sight – No optical line-of-sight between the two points, plus the Fresnel zone is blocked.
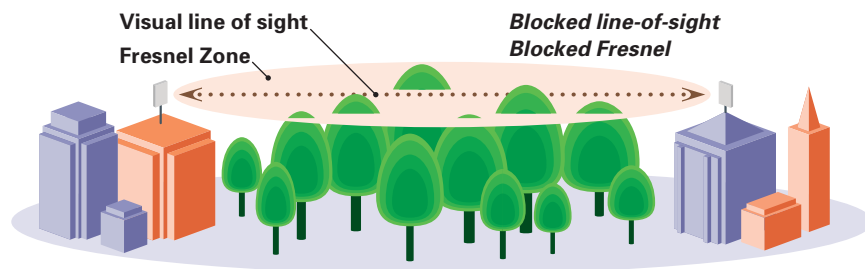


**19. Do the PTP 300, 400, 500 and 600 Series support Virtual LANs (VLANs)?**

Yes. All Ethernet frames tagged with a VLAN priority greater-than or equal-to a system-administrator-configured threshold (set on the VLAN Configuration web page) will be prioritized for transmission over the wireless link.

**20. Why is it important to install the PTP Lightning Protection Unit with PTP 300, 400, 500 and 600 Series wireless Ethernet bridges?**

The radio units are frequently installed on high towers and masts, often with external antennas, making them targets for nearby electro-magnetic surges (lightning) in the atmosphere. While 100% protection is neither possible nor implied, PTP Lightning Protection Units can provide the radios the best possible protection against damage resulting from sudden power surges induced in the cables by nearby lightning strikes.

**21. Doesn't my Link Guard All Risk Extended Warranty cover lightning damage to my PTP radios?**

Yes, the Link Guard All Risk Extended Warranty does cover the cost of replacement for a damaged PTP 300, 400, 500 or 600 radio in the event of a lightning strike. However, because the PTP-LPU can prevent the damage from occurring, you can eliminate the cost of taking down the damaged unit and installing the replacement unit, plus the downtime between the time the radio was damaged and when the replacement unit is installed. In addition, the attractive price point of the PTP-LPU means a fast return on investment, especially when you factor in higher service availability.

**22. Why does each PTP 400 or PTP 600 Series radio require two Lightning Protection Units?**

Each PTP 400 and PTP 600 radio requires one PTP-LPU installed near the radio on the wall, tower or mast, and one PTP-LPU installed at the cable entry point of the building in which the network resides. The PTP-LPU's two protection methods – line-to-line and line-to-ground – can stop a surge in power within 5 nanoseconds, ensuring maximum protection against damage. Each PTP-LPU End Kit (PTP 400/600) includes two LPUs, the required installation hardware and cables (excluding the drop cable and connection to the user's network). Two PTP-LPU End Kits are required for each link.

**23. Why does each PTP 300 or PTP 500 Series radio require only one Lightning Protection Unit?**

Each PTP 300 and PTP 500 radio has lightning protection capability built into the radio, so there is no need to install an external lightning protection unit on the tower or wall adjacent to the radio. You need only one external lightning protection unit (PTP-LPU) per radio, installed at the cable entry point of the building in which the network resides. Each PTP-LPU End Kit (PTP 300/500) provides one LPU, the required installation hardware and cables (excluding the drop cable and connection to the user's network). Together the lightning protection built into the PTP 300 or PTP 500 radio and the external PTP-LPU offer excellent lightning protection, although 100% protection is neither implied nor possible.

**24. If I already have a Transtector Surge Arrestor, the ALPU-ORT, should I replace it?**

If you already have Transtector ALPU-ORT units installed with your links and the units are working satisfactorily, you can continue to use the Transtector surge arrestors. However, as you add PTP 300, 400, 500 and 600 links to your network, you should deploy those new units with PTP-LPUs. In addition, the PTP-LPU has an improved design which provides excellent grounding, ruggedness and ease of use with a projected 10-year lifespan. If your Transtector units have been in place for a significant length of time, you may want to replace the Transtector surge arrestors with the newer PTP-LPUs to benefit from the units' advantages. PTP-LPUs can be added to existing deployments with relative ease.

**25. Do the PTP 100 and 200 radios share the same technology as the PTP 300, 400, 500 and 600?**

Because PTP 100 and 200 Series radios are based on Canopy® technology, they do not share the same technology that is found in the PTP 300, 400, 500 and 600 Series radios.

**26. Can I use the PTP-LPU with PTP 100 or PTP 200 radios?**

PTP 100 and PTP 200 Series radios use Canopy's surge suppressors. The PTP-LPU is designed for use with the PTP 300, 400, 500 and 600 Series radios.

**27. Can I use a PTP 300, 400, 500 or 600 Series Powered Indoor Unit (PIDU Plus) to power a PTP 200 Series radio?**

PTP 200 radios utilize Canopy's power supply units exclusively. You cannot use the PTP 300, 400, 500 or 600 PIDU Plus devices with PTP 200 Series radios.

# Motorola PTP 100 Series Products and Part Numbers

| Description | Typical Aggregate Throughput | Typical LOS Range | Part Number |
|---|---|---|---|
| **PTP 100 Series 2.4 GHz:** | | | |
| PPTP 24100 Full–AES, High Power | 14.0 Mbps | 2 mi (3.2 km) | 2401BH20 |
| PTP 24100 Full–AES, High Power, Reflector | 14.0 Mbps | 35 mi (56 km) | 2401BHRF20 |
| PTP 24100 Full–High Power | 14.0 Mbps | 2 mi (3.2 km) | 2400BH20 |
| PTP 24100 Full–High Power, Reflector | 14.0 Mbps | 35 mi (56 km) | 2400BHRF20 |
| PTP 24100 Lite–AES, High Power | 7.5 Mbps | 5 mi (8 km) | 2401BH |
| PTP 24100 Lite–AES, High Power, Reflector | 7.5 Mbps | 35 mi (56 km) | 2401BHRF |
| PTP 24100 Lite–High Power | 7.5 Mbps | 5 mi (8 km) | 2400BH |
| PTP 24100 Lite–High Power, Reflector | 7.5 Mbps | 35 mi (56 km) | 2400BHRF |
| **PTP 100 Series 5.2 GHz:** | | | |
| PTP 52100 Full–AES | 14.0 Mbps | 2 mi (3.2 km) | 5211BH20 |
| PTP 52100 Full–AES, Reflector | 14.0 Mbps | 5 mi (8 km) | 5211BHRF20 |
| PTP 52100 Full–Reflector | 14.0 Mbps | 5 mi (8 km) | 5210BHRF20 |
| PTP 52100 Lite | 7.5 Mbps | 2 mi (3.2 km) | 5200BH |
| PTP 52100 Lite–AES | 7.5 Mbps | 2 mi (3.2 km) | 5201BH |
| PTP 52100 Lite–AES, Reflector | 7.5 Mbps | 10 mi (16 km) | 5211BHRF |
| PTP 52100 Lite–Reflector | 7.5 Mbps | 10 mi (16 km) | 5210BHRF |
| **PTP 100 Series 5.4 GHz:** | | | |
| PTP 54100 Full | 14.0 Mbps | 1 mi (1.6 km) | 5400BH20 |
| PTP 54100 Full–Reflector | 14.0 Mbps | 5 mi (8 km) | 5400BHRF20 |
| PTP 54100 Lite | 7.5 Mbps | 2 mi (3.2 km) | 5400BH |
| PTP 54100 Lite–Reflector | 7.5 Mbps | 10 mi (16 km) | 5400BHRF |
| **PTP 100 Series 5.8 GHz:** | | | |
| PTP 58100 Full | 14.0 Mbps | 1 mi (1.6 km) | 5700BH20 |
| PTP 58100 Full–AES | 14.0 Mbps | 1 mi (1.6 km) | 5701BH20 |
| PTP 58100 Full–AES, Reflector | 14.0 Mbps | 35 mi (56 km) | 5701BHRF20 |
| PTP 58100 Full–Reflector | 14.0 Mbps | 35 mi (56 km) | 5700BHRF20 |
| PTP 58100 Lite | 7.5 Mbps | 2 mi (3.2 km) | 5700BH |
| PTP 58100 Lite–AES | 7.5 Mbps | 2 mi (3.2 km) | 5701BH |
| PTP 58100 Lite–AES, Reflector | 7.5 Mbps | 35 mi (56 km) | 5701BHRF |
| PTP 58100 Lite – Reflector | 7.5 Mbps | 35 mi (56 km) | 5700BHRF |

# Motorola PTP 200 Series Products and Part Numbers

| Motorola PTP 200 Series 5.4 GHz | Part Numbers |
|---|---|
| PTP 54200 Integrated Link – 56-bit DES Encryption | 5440BH* |
| PTP 54200 Integrated Link – 128-bit AES Encryption | 5441BH* |
| PTP 54200 Connectorized Link – 56-bit DES Encryption | 5440BHC* |
| PTP 54200 Connectorized Link – 128-bit AES Encryption | 5441BHC* |
| Canopy® Power Supply for U.S. (two required per link) | ACPSSW-13B |
| Canopy Power Supply for EMEA (two required per link) | ACPSSW-09B |
| Canopy Cluster Management Module3 (CMM3) with Power Supply and U.S. power cord | 1070CKDB |
| Canopy CMM3 with Power Supply and No Power Cord | 1070CK-02DB |
| Canopy CMM3 without Power Supply | 1070CK-03DB |
| Canopy Surge Suppressor (two required per link) | 600SSB |

* Each part number represents a single radio. Two radios are required per link.

# Motorola PTP 300 Series Products and Part Numbers

| Motorola PTP 300 Series 5.8 GHz | Part Numbers |
|---|---|
| PTP 58300 Full Integrated – Link Complete | WB3146 |
| PTP 58300 Full Integrated – End Complete | WB3147 |
| PTP 58300 Full Connectorized – Link Complete | WB3148 |
| PTP 58300 Full Connectorized – End Complete | WB3149 |

| Motorola PTP 300 Series 5.4 GHz* | Part Numbers |
|---|---|
| PTP 54300 Full Integrated – Link Complete | WB3150 |
| PTP 54300 Full Integrated – End Complete | WB3151 |
| PTP 54300 Full Connectorized – Link Complete | WB3152 |
| PTP 54300 Full Connectorized – End Complete | WB3153 |

## Warranties:

Purchase includes a 12-month limited equipment warranty and minor software enhancements as they are made available. The 12-month standard hardware warranty provides 30-day repair-and-return terms. Therefore, it is recommended that customers purchase an Extended Warranty to protect the hardware.

| PTP 300 Series Link Guard All Risk Extended Warranty with All Risk Coverage and 24-Hour Advanced Replacement Program** | Part Numbers |
|---|---|
| 1st Year Warranty Upgrade | WB3157 |
| 2nd Year Extended Warranty | WB3158 |
| 3rd Year Extended Warranty | WB3159 |
| 5th Year Extended Warranty | WB3160 |

| PTP 300 Series Link Protector Extended Warranty with 30-Day Repair-and-Return Terms | Part Numbers |
|---|---|
| 2nd Year Extended Warranty | WB3154 |
| 3rd Year Extended Warranty | WB3155 |
| 5th Year Extended Warranty | WB3156 |

## PTP Software Maintenance Contract:

An annual contract is required after the initial 12-month warranty period to continue receiving software updates and technical support. (Major software feature enhancements require the purchase of a license key and/or new hardware.)

| | Part Numbers |
|---|---|
| 1-Year Contract for 1-2 Links | WB3106 |
| 1-Year Contract for 3-5 Links | WB3107 |
| 1-Year Contract for 6+ Links | WB3108 |

* The 5.4 GHz version of this device has not been authorized as required by the rules of the Federal Communications Commission (FCC). That device is not, and may not be, offered for sale or lease, or sold or leased in the United States, until authorization is obtained.

** Replacement units are shipped the next business day after receipt of a confirmed RMA.

# Motorola PTP 400 Series Products and Part Numbers

### Motorola PTP 400* Series 5.4 GHz     Part Numbers

| | |
|---|---|
| PTP 54400 Full Integrated – Link Complete | BP5430BH-2 |
| PTP 54400 Full Integrated – End Complete | BP5430BH-1 |
| PTP 54400 Full Connectorized – Link Complete | BP5430BHC-2 |
| PTP 54400 Full Connectorized – End Complete | BP5430BHC-1 |
| PTP 54400 Lite Integrated – Link Complete | BP5430BH20-2 |
| PTP 54400 Lite Integrated – End Complete | BP5430BH20-1 |
| PTP 54400 Lite Connectorized – Link Complete | BP5430BHC20-2 |
| PTP 54400 Lite Connectorized – End Complete | BP5430BHC20-1 |

### Motorola PTP 400 Series 4.9 GHz     Part Numbers

| | |
|---|---|
| PTP 49400 Full Integrated – Link Complete | WB2623 |
| PTP 49400 Full Integrated – End Complete | WB2631 |
| PTP 49400 Full Connectorized – Link Complete | WB2624 |
| PTP 49400 Full Connectorized – End Complete | WB2635 |
| PTP 49400 Lite Integrated – Link Complete | WB2627 |
| PTP 49400 Lite Integrated – End Complete | WB2632 |
| PTP 49400 Lite Connectorized – Link Complete | WB2628 |
| PTP 49400 Lite Connectorized – End Complete | WB2636 |

* The PTP 58400 has been removed from this document because the PTP 58400 models are being retired effective October 7, 2008.

**Warranties:**

Purchase includes a 12-month limited equipment warranty and minor software enhancements as they are made available. The 12-month standard hardware warranty provides 30-day repair-and-return terms. Therefore, it is recommended that customers purchase an Extended Warranty to protect the hardware.

| **PTP 400 Series Link Guard All Risk Extended Warranty with All Risk Coverage and 24-Hour Advanced Replacement Program\*** | **Part Numbers** |
|---|---|
| 1st Year Warranty Upgrade | WB1940 |
| 2nd Year Extended Warranty | WB1950 |
| 3rd Year Extended Warranty | WB1960 |
| 5th Year Extended Warranty | WB2589 |

| **PTP 400 Series Link Protector Extended Warranty with 30-Day Repair-and-Return Terms** | **Part Numbers** |
|---|---|
| 2nd Year Extended Warranty | WB1920 |
| 3rd Year Extended Warranty | WB1930 |
| 5th Year Extended Warranty | WB2588 |

**PTP Software Maintenance Contract:**

An annual contract is required after the initial 12-month warranty period to continue receiving software updates and technical support. (Major software feature enhancements require the purchase of a license key and/or new hardware.)

| | **Part Numbers** |
|---|---|
| 1-Year Contract for 1-2 Links | WB3106 |
| 1-Year Contract for 3-5 Links | WB3107 |
| 1-Year Contract for 6+ Links | WB3108 |

| **Motorola PTP 400 Series Accessories** | **Part Numbers** |
|---|---|
| PTP 400 Series PIDU Plus with AUS Lead | WB3018 |
| PTP 400 Series PIDU Plus with EU Lead | WB3019 |
| PTP 400 Series PIDU Plus with UK Lead | WB3020 |
| PTP 400 Series PIDU Plus with US Lead | WB3021 |
| PTP 400 Series Mounting Kit (Smooth Enclosure) | WB2020 |
| PTP 400 Series Mounting Kit (Ribbed Enclosure) | WB2289 |
| EMC Cable Gland (10 Pack) | WB1811 |
| Grounding Lug Kit (20 Pack) | WB2022 |
| Mains Lead – US 2-pin to Fig 8 (PIDU Plus – 10 Pack) | WB1682 |
| Mains Lead – UK 3-pin to Fig 8 (PIDU Plus – 10 Pack) | WB1684 |
| Mains Lead – EU 2-pin to Fig 8 (PIDU Plus – 10 Pack) | WB1683 |
| Mains Lead – AUS 2-pin to Fig 8 (PIDU Plus – 10 Pack) | WB1673 |
| PTP 400 Series 128-Bit AES Encryption Key – Link | WB1910 |
| PTP 400 Series 128-Bit AES Encryption Key – End Only | WB2401 |
| PTP 400 Lite to PTP 400 Upgrade Key – Link | BPSGVNPL5730-2 |
| PTP 400 Lite to PTP 400 Upgrade Key – End Only | WB2404 |

\* Replacement units are shipped the next business day after receipt of a confirmed RMA.

# Motorola PTP 500 Series Products and Part Numbers

### Motorola PTP 500 Series 5.8 GHz

| | Part Numbers |
|---|---|
| PTP 58500 Full Integrated – Link Complete | WB2857 |
| PTP 58500 Full Integrated – End Complete | WB2861 |
| PTP 58500 Full Connectorized – Link Complete | WB2858 |
| PTP 58500 Full Connectorized – End Complete | WB2862 |
| PTP 58500 Lite Integrated – Link Complete | WB2859 |
| PTP 58500 Lite Integrated – End Complete | WB2863 |
| PTP 58500 Lite Connectorized – Link Complete | WB2860 |
| PTP 58500 Lite Connectorized – End Complete | WB2864 |

### Motorola PTP 500 Series 5.4 GHz*

| | Part Numbers |
|---|---|
| PTP 54500 Full Integrated – Link Complete | WB2874 |
| PTP 54500 Full Integrated – End Complete | WB2878 |
| PTP 54500 Full Connectorized – Link Complete | WB2875 |
| PTP 54500 Full Connectorized – End Complete | WB2879 |
| PTP 54500 Lite Integrated – Link Complete | WB2876 |
| PTP 54500 Lite Integrated – End Complete | WB2880 |
| PTP 54500 Lite Connectorized – Link Complete | WB2877 |
| PTP 54500 Lite Connectorized – End Complete | WB2881 |

### Warranties:

Purchase includes a 12-month limited equipment warranty and minor software enhancements as they are made available. The 12-month standard hardware warranty provides 30-day repair-and-return terms. Therefore, it is recommended that customers purchase an Extended Warranty to protect the hardware.

### PTP 500 Series Link Guard All Risk Extended Warranty with All Risk Coverage and 24-Hour Advanced Replacement Program**

| | Part Numbers |
|---|---|
| 1st Year Warranty Upgrade | WB3136 |
| 2nd Year Extended Warranty | WB3137 |
| 3rd Year Extended Warranty | WB3138 |
| 5th Year Extended Warranty | WB3139 |

### PTP 500 Series Link Protector Extended Warranty with 30-Day Repair-and-Return Terms

| | Part Numbers |
|---|---|
| 2nd Year Extended Warranty | WB3133 |
| 3rd Year Extended Warranty | WB3134 |
| 5th Year Extended Warranty | WB3135 |

### PTP Software Maintenance Contract:

An annual contract is required after the initial 12-month warranty period to continue receiving software updates and technical support. (Major software feature enhancements require the purchase of a license key and/or new hardware.)

| | Part Numbers |
|---|---|
| 1-Year Contract for 1-2 Links | WB3106 |
| 1-Year Contract for 3-5 Links | WB3107 |
| 1-Year Contract for 6+ Links | WB3108 |

* The 5.4 GHz version of this device has not been authorized as required by the rules of the Federal Communications Commission (FCC). That device is not, and may not be, offered for sale or lease, or sold or leased in the United States, until authorization is obtained.
** Replacement units are shipped the next business day after receipt of a confirmed RMA.

# Motorola PTP 600 Series Products and Part Numbers

| Motorola PTP 600 Series 5.8 GHz | | Part Numbers |
|---|---|---|
| PTP 58600 Full Integrated – Link Complete | ............................................. | BP5830BH-2 |
| PTP 58600 Full Integrated – End Complete | ............................................. | BP5830BH-1 |
| PTP 58600 Full Connectorized – Link Complete | ............................................. | BP5830BHC-2 |
| PTP 58600 Full Connectorized – End Complete | ............................................. | BP5830BHC-1 |
| PTP 58600 Lite Integrated – Link Complete | ............................................. | BP5830BH15-2 |
| PTP 58600 Lite Integrated – End Complete | ............................................. | BP5830BH15-1 |
| PTP 58600 Lite Connectorized – Link Complete | ............................................. | BP5830BHC15-2 |
| PTP 58600 Lite Connectorized – End Complete | ............................................. | BP5830BHC15-1 |

| Motorola PTP 600 Series 5.4 GHz | | Part Numbers |
|---|---|---|
| PTP 54600 Full Integrated – Link Complete | ............................................. | BP5530BH-2 |
| PTP 54600 Full Integrated – End Complete | ............................................. | BP5530BH-1 |
| PTP 54600 Full Connectorized – Link Complete | ............................................. | BP5530BHC-2 |
| PTP 54600 Full Connectorized – End Complete | ............................................. | BP5530BHC-1 |
| PTP 54600 Lite Integrated – Link Complete | ............................................. | BP5530BH15-2 |
| PTP 54600 Lite Integrated – End Complete | ............................................. | BP5530BH15-1 |
| PTP 54600 Lite Connectorized – Link Complete | ............................................. | BP5530BHC15-2 |
| PTP 54600 Lite Connectorized – End Complete | ............................................. | BP5530BHC15-1 |

| Motorola PTP 600 Series 4.5 GHz | | Part Numbers |
|---|---|---|
| PTP 45600 Integrated – Link Complete | ............................................. | WB3040 |
| PTP 45600 Integrated – End Only | ............................................. | WB3044 |
| PTP 45600 Connectorized – Link Complete | ............................................. | WB3041 |
| PTP 45600 Connectorized – End Only | ............................................. | WB3045 |

| Motorola PTP 600 Series 2.5 GHz* | | Part Numbers |
|---|---|---|
| PTP 25600 5 MHz Integrated – Link Complete | ............................................. | WB2782 |
| PTP 25600 5 MHz Integrated – End Only | ............................................. | WB2784 |
| PTP 25600 5 MHz Connectorized – Link Complete | ............................................. | WB2783 |
| PTP 25600 5 MHz Connectorized – End Only | ............................................. | WB2785 |
| PTP 25600 Software Key – 5→10 MHz Link Complete | ............................................. | WB2786 |
| PTP 25600 Software Key – 5→10 MHz End Only | ............................................. | WB2790 |
| PTP 25600 Software Key – 5→15 MHz Link Complete | ............................................. | WB2787 |
| PTP 25600 Software Key – 5→15 MHz End Only | ............................................. | WB2791 |
| PTP 25600 Software Key – X→30 MHz** Link Complete | ............................................. | WB2789 |
| PTP 25600 Software Key – X→30 MHz** End Only | ............................................. | WB2793 |

\* Currently, the 2.5 GHz model of the PTP 600 Series bridges is not available in Canada
\*\* 30 MHz channel size is not FCC compliant

**Warranties:**
Purchase includes a 12-month limited equipment warranty and minor software enhancements as they are made available. The 12-month standard hardware warranty provides 30-day repair-and-return terms. Therefore, it is recommended that customers purchase an Extended Warranty to protect the hardware.

| PTP 600 Series Link Guard All Risk Extended Warranty with All Risk Coverage and 24-Hour Advanced Replacement Program* | Part Numbers |
|---|---|
| 1st Year Warranty Upgrade | WB2532 |
| 2nd Year Extended Warranty | WB2533 |
| 3rd Year Extended Warranty | WB2534 |
| 5th Year Extended Warranty | WB2591 |

| PTP 600 Series Link Protector Extended Warranty with 30-Day Repair-and-Return Terms | Part Numbers |
|---|---|
| 2nd Year Extended Warranty | WB2530 |
| 3rd Year Extended Warranty | WB2531 |
| 5th Year Extended Warranty | WB2590 |

**PTP Software Maintenance Contract:**

| An annual contract is required after the initial 12-month warranty period to continue receiving software updates and technical support. (Major software feature enhancements require the purchase of a license key and/or new hardware.) | Part Numbers |
|---|---|
| 1-Year Contract for 1-2 Links | WB3106 |
| 1-Year Contract for 3-5 Links | WB3107 |
| 1-Year Contract for 6+ Links | WB3108 |

* Replacement units are shipped the next business day after receipt of a confirmed RMA.

# Motorola PTP 300, PTP 500 and PTP 600 Series Accessories

| Motorola PTP 300, PTP 500 and PTP 600 Series Accessories | | Part Numbers |
|---|---|---|
| PTP 300/500/600 Series PIDU Plus with AUS Lead | ................................... | WB3022 |
| PTP 300/500/600 Series PIDU Plus with EU Lead | ................................... | WB3023 |
| PTP 300/500/600 Series PIDU Plus with UK Lead | ................................... | WB3024 |
| PTP 300/500/600 Series PIDU Plus with US Lead | ................................... | WB3025 |
| PTP 300/400/500/600 Series Mounting Kit (Ribbed Enclosure) | ................................... | WB2289 |
| EMC Cable Gland (10 Pack) | ................................... | WB1811 |
| Grounding Lug Kit (20 Pack) | ................................... | WB2022 |
| PTP 300/500/600 Series Blanking Plug (10 Pack) | ................................... | WB2358 |
| PTP 600 Optical Conversion Kit (per end) | ................................... | TK22312 |
| Memorylink UltraSync™ GPS-100M for PTP 600 | ................................... | WB3001 |
| Mains Lead – US 2-pin to Fig 8 (PIDU Plus – 10 Pack) | ................................... | WB1682 |
| Mains Lead – UK 3-pin to Fig 8 (PIDU Plus – 10 Pack) | ................................... | WB1684 |
| Mains Lead – EU 2-pin to Fig 8 (PIDU Plus – 10 Pack) | ................................... | WB1683 |
| Mains Lead – AUS 2-pin to Fig 8 (PIDU Plus – 10 Pack) | ................................... | WB1673 |
| PTP 300/500/600 Series 128-Bit AES Encryption Key – Link | ................................... | WB2519 |
| PTP 300/500/600 Series 256-Bit AES Encryption Key – Link | ................................... | WB2511 |
| PTP 300/500/600 Series 128-Bit AES Encryption Key – End Only | ................................... | WB2402 |
| PTP 300/500/600 Series 256-Bit AES Encryption Key – End Only | ................................... | WB2607 |
| PTP 500 Series Lite to Full Upgrade Key – Link | ................................... | WB3127 |
| PTP 500 Series Lite to Full Upgrade Key – End Only | ................................... | WB3128 |
| PTP 600 Series Lite to Full Upgrade Key – Link | ................................... | BPSGVNPL5830-2 |
| PTP 600 Series Lite to Full Upgrade Key – End Only | ................................... | WB2405 |

# Motorola PTP-LPU Kits and Part Numbers

**Motorola PTP Lightning Protection Units**      **Part Numbers**

PTP-LPU End Kit PTP 400/600 (2 kits per link): ........................................................ WB2907

Kit includes:

- Two PTP-LPUs
- Mounting hardware
- Cables (excluding the drop cable and connection to the user's network

PTP-LPU End Kit PTP 300/500 (2 kits per link): ........................................................ WB2978

Kit includes:

- One PTP-LPU
- Mounting hardware
- Cables (excluding the drop cable and connection to the user's network

PTP-LPU Glands (package of 10 glands)      ........................................................ WB1811

# Appendix A: Specifications 5.4 GHz PTP 200 Series Solutions

| Technology | Remarks |
|---|---|
| RF band | 5470 MHz - 5720 MHz* |
| Channel size | 10 MHz |
| Channel spacing | Configurable in 5 MHz increments; up to 25 selectable adjacent channels (may vary by region) |
| Transmit power | Auto transmit power control by Master up to EIRP limit (-30 dBm to 10 dBm) |
| EIRP | 27 dBm |
| Antenna gain | Integrated: 17 dBi<br>Connectorized: Varies with antenna type; can operate with a selection of separately-purchased antennas; 50 ohm N-type (check local regulations prior to purchase) |
| Modulation | Adapting between QPSK, 16 QAM and 64 QAM |
| Error correction | ARQ; FEC (3/4 Reed-Solomon block coding) |
| Physical/MAC layer | OFDM 256 FFT / Motorola Canopy® proprietary |

| Performance | |
|---|---|
| User data throughput | 1X: 7 Mbps, 2X: 14 Mbps, 3X: 21 Mbps (aggregate) |
| Max. LOS range | Integrated: 1X: 5 mi (8 km), 2X: 2.5 mi (4 km), 3X: 1.25 mi (2 km) |
| Latency | 5-7 ms (round trip) |
| Encryption | DES; 128-bit AES |
| Receive sensitivity | 1X: -89 dBm, 2X: -78 dBm, 3X: -70 dBm (with FEC) |
| Integrated link budget | 1X: 133 dB (27 dBm EIRP + 17 dB Rx gain + 89 dBm Rx sensitivity)<br>2X: 122 dB (27 dBm EIRP + 17 dB Rx gain + 78 dBm Rx sensitivity)<br>3X: 114 dB (27 dBm EIRP + 17 dB Rx gain + 70 dBm Rx sensitivity) |

| Data | |
|---|---|
| Interface | 10 / 100 Base T |
| Duplex scheme | Half/full duplex, rate auto-negotiated (802.3 compliant) |
| Protocols used | IPv4, UDP, TCP, IP, ICMP, Telnet, SNMP, HTTP, FTP |
| QoS | DiffServ QoS |
| Network management | HTTP, Telnet, FTP, SNMPv2c; compatible with Prizm 3.1 or later and CNUT 3.1 and later |
| VLAN | 802.1Q with 802.1p priority |
| CIR / MIR | Committed Information Rate / Maximum Information Rate, with Canopy burst MIR |

| Physical | |
|---|---|
| DC power consumption | <12.6 W at 29.5 VDC |
| Dimensions | H-13.25" (33.6 cm), W-8.25" (21 cm), D-4.38" (11.1 cm) |
| Weight | 2.8 lbs. (1.3 kg) |
| Operating temperature | -40°F (-40°C) to +131°F (+55°C) |
| Wind speed survival | 118 mph (190 kph) |
| Wind loading | 45 lbs. (20.4 kg) |
| MTBF | >40 years |

| Standards | |
|---|---|
| CE | CE mark |
| FCC ID | ABZ89FT7629 |
| Industry Canada (IC) | 109W-5440 |
| DFS | EN 301 893 v1.4.1 for Europe, Brazil<br>FCC standard for US, IC for Canada |

* Regulatory conditions for RF bands may vary by geographic location and should be confirmed prior to system purchase

# Appendix A: Specifications 5.4 and 5.8 GHz PTP 300 Series Solutions

| Technology | Remarks |
|---|---|
| RF band | PTP 58300: 5.725 GHz – 5.875 GHz*<br>PTP 54300: 5.470 GHz – 5.725 GHz* |
| Channel size | 15 MHz |
| Channel selection | By *Intelligent* Dynamic Frequency Selection (i-DFS) or manual intervention; automatic detection on start-up and continual adaptation to avoid interference |
| Transmit power | Varies with modulation mode and settings from -18 dBm to 27 dBm** |
| System gain | Integrated: Varies with modulation mode; up to 167 dB with 23 dBi integrated antenna**<br>Connectorized: Varies with modulation mode and antenna type** |
| Receiver sensitivity | Adaptive, varying between -94.0 dBm and -69 dBm |
| Modulation | Dynamic; 8 modes adapting between BPSK and 64 QAM |
| Error correction | FEC |
| Duplex scheme | 5.4 GHz: Symmetric Fixed TDD; same frequency Tx/Rx<br>5.8 GHz: Symmetric Fixed TDD; same or split frequency Tx/Rx where regulations permit |
| Antenna type | Integrated: Integrated flat plate 23 dBi / 8°<br>Connectorized: Can operate with a selection of separately-purchased single and dual polar antennas through 2 x N-type female connectors (local regulations should be checked prior to purchase) |
| Range | Up to 155 miles (250 km)*** |
| Data rates | Dynamically variable up to 25 Mbps at the Ethernet (aggregate) |
| Security and encryption | Proprietary scrambling mechanism; optional FIPS-197 compliant 128-bit and 256-bit AES Encryption |
| Protocol | IEEE 802.3 |
| Interface | 10 / 100 BaseT (RJ-45) – auto MDI / MDIX |
| Latency | Less than 3 ms average each direction |
| QoS | 802.1p (2 levels) |
| System management | Web or SNMP v1/v2c using MIBII and a proprietary PTP MIB; Canopy® Prizm |
| Connection | Distance between outdoor unit and primary network connection: up to 330' (100 meters) |
| Lightning protection | Built into the ODU; an external PTP Lightning Protection Unit (PTP-LPU) end device is required near the base of the tower or wall at the cable entrance point leading to the network to protect the indoor LAN equipment |
| Dimensions | Integrated Outdoor Unit (ODU): Width 14.5" (370 mm), Height 14.5" (370 mm), Depth 3.75" (95 mm)<br>Connectorized ODU: Width 12.2" (309 mm), Height 12.2" (309 mm), Depth 4.1" (105 mm)<br>Powered Indoor Unit (PIDU Plus): Width 9.75" (250 mm), Height 1.5" (40 mm), Depth 3" (80 mm) |
| Weight | Integrated ODU: 11.8 lbs (5.35 kg) including bracket<br>Connectorized ODU: 10.4 lbs (4.7 kg) including bracket<br>PIDU Plus: 1.9 lbs (864 g) |
| Operating temperature | -40°F (-40°C) to +140°F (+60°C), including solar radiation |

 * Regulatory conditions for RF bands should be confirmed prior to system purchase.
 ** Gain, maximum transmit power and effective radiated power may vary based on regulatory domain.
*** In all cases the range limit is set by the latest software release.

# Appendix A: Specifications for 5.4 GHz PTP 400 Series Solutions

| Technology | Remarks |
|---|---|
| RF band | 5.470 GHz – 5.725 GHz* |
| Channel size | 12 MHz |
| Channel selection | By *intelligent* Dynamic Frequency Selection (*i*-DFS) or manual intervention; automatic detection on start-up and continual adaptation to avoid interference |
| Transmit power | Adaptive, varying between 25 dBm and -10 dBm according to modulation selected and radio path** |
| System gain | Integrated: Varies with modulation mode; up to 167 dB with 23 dBi integrated antenna**<br>Connectorized: Varies with modulation mode and antenna type** |
| Receiver sensitivity | Adaptive, varying between -96.0 dBm and -72 dBm according to modulation selected |
| Modulation | Dynamic; 8 modes adapting between BPSK and 64 QAM |
| Error correction | FEC, ARQ |
| Duplex scheme | TDD ratio 50:50, 66:33; same or split frequency Tx/Rx |
| Antenna type | Integrated: Integrated flat plate 23 dBi<br>Connectorized: Approved to operate with flat plate up to 28 dBi or parabolic dish up to 37.7 dBi; connected via 2 x N-type female |
| Range | Up to 124 miles (200 km)*** |
| Data rates | Integrated and Connectorized: Dynamically variable up to 43 Mbps at the Ethernet (aggregate)<br>Integrated and Connectorized Lite: Dynamically variable up to 21 Mbps at the Ethernet (aggregate) |
| Security and encryption | Proprietary scrambling mechanism; optional FIPS-197 compliant 128-bit AES Encryption |
| Protocol | IEEE 802.3 |
| Interface | 10 / 100 BaseT (RJ-45) – auto MDI / MDIX switching |
| Latency | Throughput Mode: Less than 7 mSec (default)<br>Latency Mode: Less than 6 mSec |
| System management | Web Server and/or SNMP; Canopy® Prizm |
| Connection | Distance between outdoor unit and primary network connection:<br>up to 330 feet (100 meters) |
| Dimensions | Integrated outdoor unit (ODU): Width 14.5″ (370 mm), Height 14.5″ (370 mm), Depth 3.75″ (95 mm)<br>Connectorized ODU: Width 12″ (305 mm), Height 12″ (305 mm), Depth 4.1″ (105 mm)<br>Powered indoor unit (PIDU Plus): Width 9.75″ (250 mm), Height 1.5″ (40 mm), Depth 3″ (80 mm) |
| Weight | Integrated ODU: 12.1 lbs (5.5 kg) including bracket<br>Connectorized ODU: 9.1 lbs (4.3 kg) including bracket<br>PIDU Plus: 1.9 lbs (864 g) |
| Operating temperature | -40°F (-40°C) to +140°F (+60°C) including solar radiation |

* Regulatory conditions for RF bands should be confirmed prior to system purchase.
** Gain and maximum transmit power may vary based on regulatory domain.
*** In all cases the range limit is set by the latest software release.

# Appendix A: Specifications for 4.9 GHz PTP 400 Series Solutions

| Technology | Remarks |
|---|---|
| RF band | 4.940 GHz–4.990 GHz* |
| Channel size | 10 MHz |
| Channel selection | By intelligent Dynamic Frequency Selection (i-DFS) or manual intervention |
| Transmit power | Adaptive, varying between 23 dBm and -10 dBm according to modulation selected and radio path** |
| System gain | Integrated: Between 163 and 134 dB**<br>Connectorized: Varies with modulation mode and antenna type** |
| Receiver sensitivity | Adaptive, varying between -96.0 dBm and -72 dBm according to modulation selected |
| Modulation | Dynamic; 8 modes adapting between BPSK and 64 QAM |
| Error correction | FEC, ARQ |
| Antenna type | Integrated:  Integrated flat plate 22 dBi / 8°<br>Connectorized:  Approved to operate with flat plate up to 28 dBi or parabolic dish up to 37.7 dBi; connected via 2 x N-type female |
| Range | Up to 124 miles (200 km)*** |
| Data rates | Integrated and Connectorized: Up to 35 Mbps at the Ethernet<br>Integrated and Connectorized Lite: Up to 17 Mbps at the Ethernet |
| Security and encryption | Proprietary scrambling mechanism; optional FIPS-197 compliant 128-bit AES Encryption |
| Protocol | IEEE 802.3 |
| Interface | 10 / 100 BASE-T (RJ-45) – auto MDI/MDIX switching |
| Latency | 5 ms typical |
| System management | Web Server and SNMP; Canopy® Prizm |
| Connection | Distance between outdoor unit and primary network connection: up to 330' (100 meters) |
| Dimensions | Integrated outdoor unit (ODU): Width 14.5" (370 mm), Height 14.5" (370 mm), Depth 3.75" (95 mm)<br>Connectorized ODU: Width 12" (305 mm), Height 12" (305 mm), Depth 4.1" (105 mm)<br>Powered indoor unit (PIDU Plus): Width 9.75" (250 mm), Height 1.5" (40 mm), Depth 3" (80 mm) |
| Weight | Integrated ODU: 12.1 lbs (5.5 kg) including bracket<br>Connectorized ODU: 9.1 lbs (4.3 kg) including bracket<br>PIDU Plus: 1.9 lbs (864 g) |
| Operating temperature | -40°F (-40°C) to +140°F (+60°C), including solar radiation |

* Regulatory conditions for RF bands should be confirmed prior to system purchase.
** Gain and maximum transmit power may vary based on regulatory domain.
*** In all cases the range limit is set by the latest software release.

# Appendix A: Specifications 5.4 and 5.8 GHz PTP 500 Series Solutions

| Technology | Remarks |
|---|---|
| RF band | PTP 58500: 5.725 GHz – 5.875 GHz*<br>PTP 54500: 5.470 GHz – 5.725 GHz* |
| Channel size | 15 MHz |
| Channel selection | By *Intelligent* Dynamic Frequency Selection (i-DFS) or manual intervention; automatic detection on start-up and continual adaptation to avoid interference |
| Transmit power | Varies with modulation mode and settings from -18 dBm to 27 dBm** |
| System gain | Integrated: Varies with modulation mode; up to 167 dB with 23 dBi integrated antenna**<br>Connectorized: Varies with modulation mode and antenna type** |
| Receiver sensitivity | Adaptive, varying between -94.0 dBm and -69 dBm |
| Modulation | Dynamic; 8 modes adapting between BPSK and 64 QAM |
| Error correction | FEC |
| Duplex scheme | 5.4 GHz: Symmetric Fixed TDD; same frequency Tx/Rx<br>5.8 GHz: Symmetric Fixed TDD; same or split frequency Tx/Rx where regulations permit |
| Antenna type | Integrated: Integrated flat plate 23 dBi / 8°<br>Connectorized: Can operate with a selection of separately-purchased single and dual polar antennas through 2 x N-type female connectors (local regulations should be checked prior to purchase) |
| Range | Up to 155 miles (250 km)*** |
| Data rates | Integrated and Connectorized: Dynamically variable up to 105 Mbps at the Ethernet (aggregate)<br>Integrated and Connectorized Lite: Dynamically variable up to 52 Mbps at the Ethernet (aggregate) |
| Security and encryption | Proprietary scrambling mechanism; optional FIPS-197 compliant 128-bit and 256-bit AES Encryption |
| Protocol | IEEE 802.3 |
| Interface | 10 / 100 BaseT (RJ-45) – auto MDI / MDIX |
| Latency | Less than 3 ms average each direction |
| QoS | 802.1p (2 levels) |
| System management | Web or SNMP v1/v2c using MIBII and a proprietary PTP MIB; Canopy® Prizm |
| Connection | Distance between outdoor unit and primary network connection: up to 330' (100 meters) |
| Lightning protection | Built into the ODU; an external PTP Lightning Protection Unit (PTP-LPU) end device is required near the base of the tower or wall at the cable entrance point leading to the network |
| Dimensions | Integrated Outdoor Unit (ODU): Width 14.5" (370 mm), Height 14.5" (370 mm), Depth 3.75" (95 mm)<br>Connectorized ODU: Width 12.2" (309 mm), Height 12.2" (309 mm), Depth 4.1" (105 mm)<br>Powered Indoor Unit (PIDU Plus): Width 9.75" (250 mm), Height 1.5" (40 mm), Depth 3" (80 mm) |
| Weight | Integrated ODU: 11.8 lbs (5.35 kg) including bracket<br>Connectorized ODU: 10.4 lbs (4.7 kg) including bracket<br>PIDU Plus: 1.9 lbs (864 g) |
| Operating temperature | -40°F (-40°C) to +140°F (+60°C), including solar radiation |

  * Regulatory conditions for RF bands should be confirmed prior to system purchase.
 ** Gain, maximum transmit power and effective radiated power may vary based on regulatory domain.
*** In all cases the range limit is set by the latest software release.

# Appendix A: Specifications for 5.4 and 5.8 GHz PTP 600 Series Solutions

| Technology | Remarks |
| --- | --- |
| RF band | PTP 58600: 5.725 GHz – 5.875 GHz* (ISM – USA, 5.8 GHz C Band – Europe)<br>PTP 54600: 5.470 GHz – 5.725 GHz* (UNII) |
| Channel size | Configurable to 5, 10, 15 or 30 MHz |
| Channel selection | By *Intelligent* Dynamic Frequency Selection (*i*-DFS) or manual intervention; automatic selection on start-up and continual adaptation to avoid interference |
| Transmit power | Varies with modulation mode and settings from 0 dBm to 25 dBm** |
| System gain | Integrated: Varies with modulation mode; up to 162 dB using 23 dBi integrated antenna**<br>Connectorized: Varies with modulation mode and antenna type** |
| Receiver sensitivity | Adaptive, varying between -98 dBm and -58 dBm |
| Modulation | Dynamic; adaptive between BPSK single and 256 QAM dual |
| Error correction | FEC |
| Duplex scheme | Dynamic or Fixed TDD; same or split Frequency Tx/Rx |
| Antenna type | Integrated: Integrated flat plate 23 dBi<br>Connectorized: Can operate with a selection of separately-purchased single and dual polar antennas through 2 x N-type female connectors (local regulations should be checked prior to purchase) |
| Range | Up to 124 miles (200 km)*** |
| Security and encryption | Proprietary scrambling mechanism; optional FIPS-197 compliant 128-bit and 256-bit AES Encryption |
| Protocol | IEEE 802.3 |
| User data throughput | Full:  Dynamically variable up to 300 Mbps at the Ethernet (aggregate): <br>5 MHz Channel: Up to 41 Mbps<br>10 MHz Channel: Up to 84 Mbps<br>15 MHz Channel: Up to 127 Mbps<br>30 MHz Channel: Up to 300 Mbps<br><br>Lite:  Dynamically variable up to 150 Mbps at the Ethernet (aggregate)<br>10 MHz Channel – Up to 42 Mbps<br>15 MHz Channel – Up to 63 Mbps<br>30 MHz Channel – Up to 150 Mbps |
| Interface | 10 / 100 / 1000 Base T (RJ-45) – auto MDI / MDIX, 1000 Base SX Option |
| Latency | Full: <2.7 ms each direction typical<br>Lite: <3.7 ms each direction typical |
| T1/E1 interface | Integrated and Connectorized: Dual T1/E1 ports<br>Integrated and Connectorized Lite: Single T1/E1 port<br>G703 / G704  G823/G824 (bandwidth determines port availability) |
| System management | Web and/or SNMP using MIBII and a private PTP MIB; Canopy® Prizm |
| Connection | Distance between outdoor unit and primary network connection: up to 330 feet (100 meters) |
| Dimensions | Integrated outdoor unit (ODU): Width 14.5″ (370 mm), Height 14.5″ (370 mm), Depth 3.75″ (95 mm)<br>Connectorized ODU: Width 12.2″ (309 mm), Height 12.2″ (309 mm), Depth 4.1″ (105 mm)<br>Powered indoor unit (PIDU Plus): Width 9.75″ (250 mm), Height 1.5″ (40 mm), Depth 3″ (80 mm) |
| Weight | Integrated ODU: 12.1 lbs (5.5 kg) including bracket<br>Connectorized ODU: 9.1 lbs (4.3 kg) including bracket<br>PIDU Plus: 1.90 lb (864 g) |
| Operating temperature | -40°F (-40°C) to +140°F (+60°C), including solar radiation |

  * Regulatory conditions for RF bands should be confirmed prior to system purchase.
 ** Gain, maximum transmit power and effective radiated power may vary based on regulatory domain.
*** In all cases the range limit is set by the latest software release.

# Appendix A: Specifications for 2.5 GHz PTP 600 Series Solutions

| Radio Technology | Remarks |
| --- | --- |
| RF band | 2.496 – 2.690 GHz* |
| Channel size | Configurable to 5, 10, 15 or 30 MHz (30 MHz Channel is not FCC compliant) |
| Channel selection | Fixed Frequency (US BRS/EBS Band Plan)<br>Lower Band – 2496 MHz to 2572 MHz<br>Middle Band – 2572 MHz to 2614 MHz<br>Upper Band – 2614 MHz to 2690 MHz |
| Transmit power | Varies with modulation mode and settings from 0 to 23 dBm** |
| System gain | Integrated: Varies with modulation mode; up to 154 dB using 18 dBi integrated antenna**<br>Connectorized: Varies with modulation mode and antenna type** |
| Receiver sensitivity | Adaptive; varying between -95 and -59 dBm |
| Modulation | Dynamic, adapting between BPSK and 256 QAM |
| Error correction | FEC |
| Duplex scheme | Time Division Duplex (TDD) and Half Duplex Frequency Division Duplex (HD-FDD), Dynamic or Fixed ratio |
| Antenna | Integrated: Integrated flat plate 18 dBi, 20 degree beam width<br>Connectorized: Can operate with a selection of separately-purchased single and dual polar antennas through 2 x N-type female connectors (local regulations should be checked prior to purchase) |
| Range | Integrated: Up to 30 miles (50 km)***<br>Connectorized: Up to 124 miles (200 km) |
| Security and encryption | Proprietary scrambling mechanism; optional FIPS-197 compliant 128-bit and 256-bit AES Encryption |
| Protocol | IEEE 802.3 |
| User data throughput | Dynamically variable up to 300 Mbps at the Ethernet (aggregate):<br>5 MHz Channel: Up to 48 Mbps<br>10 MHz Channel: Up to 100 Mbps<br>15 MHz Channel: Up to 151 Mbps<br>30 MHz Channel: Up to 300 Mbps (30 MHz Channel is not FCC compliant) |
| Interface | 10 / 100 / 1000 Base T (RJ-45), auto MDI/MDIX, optional 1000 Base SX |
| Latency one way | <1 ms typical in 30 MHz channels<br><1.2 ms typical in 15 MHz channels<br><1.5 ms typical in 10 MHz channels<br><2 ms typical in 5 MHz channels |
| T1/E1 Interface | G703 / G823 and G704 / G824<br>Single T1/E1 in 10 MHz channels<br>Single T1/E1 in 15 MHz channels<br>Dual T1/E1 in 30 MHz channels |
| System management | Web or SNMP V1/2c using MIB-II; WiMAX and private MIB; Canopy® Prizm |
| Connection | Distance between outdoor unit and primary network connection: up to 330' (100 meters) |
| Dimensions | Integrated Outdoor Unit (ODU): Width 14.5" (370 mm), Height 14.5" (370 mm), Depth 3.75" (95 mm)<br>Connectorized ODU: Width 12.2" (309 mm), Height 12.2" (309 mm), Depth 4.1" (105 mm)<br>Powered indoor unit (PIDU Plus): Width 9.75" (250 mm), Height 1.5" (40 mm), Depth 3" (80 mm) |
| Weight | Integrated ODU: 12.1 lbs (5.5 kg) including bracket<br>Connectorized ODU: 9.1 lbs (4.3 kg)<br>PIDU Plus: 1.9 lbs (864 g) |
| Operating temperature | -40°F (-40°C) to +140°F (+60°C), including solar radiation |

  * Regulatory conditions for RF bands should be confirmed prior to system purchase.
 ** Gain, maximum transmit power and effective radiated power may vary based on regulatory domain.
*** In all cases the range limit is set by the latest software release.

# Appendix A: Specifications for 4.5 GHz PTP 600 Series Solutions

| Radio Technology | Remarks |
|---|---|
| RF band | 4.4 – 4.6 GHz* |
| Channel size | Configurable to 5, 10, 15 or 30 MHz |
| Channel selection | By *Intelligent* Dynamic Frequency Selection (i-DFS) or manual intervention; automatic selection on start-up and continual adaptation to avoid interference; |
| Transmit power | Varies with modulation mode and settings from -10 dBm to +25 dBm** |
| System gain | Integrated: Varies with modulation mode; up to 165.9 dB using 21.5 dBi integrated antenna ** <br> Connectorized: Varies with modulation mode and antenna type ** |
| Receiver sensitivity | Adaptive; varying between -97.8 and -61.6 dBm |
| Modulation | Dynamic, adapting between BPSK and 256 QAM |
| Error correction | FEC |
| Duplex scheme | Time Division Duplex (TDD) and Half Duplex Frequency Division Duplex (HD-FDD), Dynamic or Fixed ratio |
| Antenna | Integrated: Integrated flat plate 21.5 dBi / 11° <br> Connectorized: Can operate with a selection of separately-purchased single and dual polar antennas through 2 x N-type female connectors (local regulations should be checked prior to purchase) |
| Range | Up to 124 miles (200 km)*** |
| Security and encryption | Proprietary scrambling mechanism; optional FIPS-197 compliant 128-bit and 256-bit AES Encryption |
| Protocol | IEEE 802.3 |
| User data throughput | Dynamically variable up to 300 Mbps at the Ethernet (aggregate): <br> 5 MHz Channel: Up to 41 Mbps <br> 10 MHz Channel: Up to 84 Mbps <br> 15 MHz Channel: Up to 127 Mbps <br> 30 MHz Channel: Up to 300 Mbps |
| Interface | 10 / 100 / 1000 Base T (RJ-45), auto MDI/MDIX, optional 1000 Base SX |
| Latency one way | <1 ms typical in 30 MHz channels <br> <1.2 ms typical in 15 MHz channels <br> <1.5 ms typical in 10 MHz channels <br> <2 ms typical in 5 MHz channels |
| QoS | 802.1p (2 levels) |
| T1/E1 Interface | ITU-T G.703 / G.704  G.823 / G.824 <br> Single T1/E1 in 10 and 15 MHz channels <br> Dual T1/E1 in 30 MHz channels |
| System management | Web or SNMP V1/2c using MIB-II; WiMAX and proprietary PTP MIB; Canopy® Prizm |
| Connection | Distance between outdoor unit and primary network connection: up to 330' (100 meters) |
| Dimensions | Integrated Outdoor Unit (ODU): Width 14.5" (370 mm), Height 14.5" (370 mm), Depth 3.75" (95 mm) <br> Connectorized ODU: Width 12.2" (309 mm), Height 12.2" (309 mm), Depth 4.1" (105 mm) <br> Powered indoor unit (PIDU Plus): Width 9.75" (250 mm), Height 1.5" (40 mm), Depth 3" (80 mm) |
| Weight | Integrated ODU: 12.1 lbs (5.5 kg) including bracket <br> Connectorized ODU: 9.1 lbs (4.3 kg) including bracket <br> PIDU Plus: 1.9 lbs (864 g) |
| Wind speed survival | 202 mph (325 kph) |
| Operating temperature | -40°F (-40°C) to +140°F (+60°C), including solar radiation |

  * Regulatory conditions for RF bands should be confirmed prior to system purchase.
 ** Gain, maximum transmit power and effective radiated power may vary based on regulatory domain.
*** In all cases the range limit is set by the latest software release.

# Appendix A: **Specifications for the PTP-LPU**

| Radio Technology | Remarks |
|---|---|
| Transfer rate | 1000 Base T |
| Connectors | RJ 45 |
| Protection mode | Line-to-line and line-to-ground |
| Response time | 5 nanoseconds |
| Dimensions | 6.3" Length (16 cm), 4" (10 cm) Width, 3.5" (9cm) Height |
| Weight | 1.5 lbs (700 g) |
| Mounting | Pole mount 1-3" (25-75 mm), or wall mount |
| Metal enclosure | Projected 10-year operational life |
| Operating temperatures | -40° F (-40° C) to +140° F (+60° C) |
| Wind loading | 150 mph (242 kph) |
| Humidity | 100% condensing |
| Tested to IEEE / ANSI C62.41 10/1000 long wave | 120 amp peak, peak power 14,000 watts |
| Environmental protection | IP65 / NEMA-3R |

# Appendix B: **External Antennas**

*Approved for deployment in USA and Canada*

| Manufacturer | Antenna Type | Gain (dBi) | Flat Plate | Parabolic Dish |
|---|---|---|---|---|
| Andrew | Andrew 1-foot Flat Panel, FPA5250D12-N (23.6dBi) | 23.6 | Y | |
| Andrew | Andrew 2-foot Flat Panel, FPA5250D24-N (28dBi) | 28 | Y | |
| Gabriel | Gabriel 1-foot Flat Panel, DFPD1-52 (23.5dBi) | 23.5 | Y | |
| Gabriel | Gabriel 2-foot Flat Panel, DFPD2-52 (28dBi) | 28 | Y | |
| MTI | MTI 17 inch Diamond Flat Panel, MT-485009 (23dBi) | 23 | Y | |
| MTI | MTI 15 inch Dual-Pol Flat Panel, MT-485025/NVH (23dBi) | 23 | Y | |
| MTI | MTI 2 ft Directional Flat Panel, MT-20004 (28dBi) | 28 | Y | |
| MTI | MTI 2 ft Flat Panel, MT-486001 (28dBi) | 28 | Y | |
| RFS | RFS 1-foot Flat Panel, MA0528-23AN (23dBi) | 23 | Y | |
| RFS | RFS 2-foot Flat Panel, MA0528-28AN (28dBi) | 28 | Y | |
| Teletronics | Teletronics 2-foot Flat Plate Antenna, ANT-P5828 (28dBi) | 28 | Y | |
| Andrew | Andrew 2-foot Parabolic, P2F-52 (29.4dBi) | 29.4 | | Y |
| Andrew | Andrew 2-foot Dual-Pol Parabolic, PX2F-52 (29.4dBi) | 29.4 | | Y |
| Andrew | Andrew 3-foot Parabolic, P3F-52 (33.4dBi) | 33.4 | | Y |
| Andrew | Andrew 3-foot Dual-Pol Parabolic, PX3F-52 (33.4dBi) | 33.4 | | Y |
| Andrew | Andrew 4-foot Parabolic, P4F-52 (34.9dBi) | 34.9 | | Y |
| Andrew | Andrew 4-foot Dual-Pol Parabolic, PX4F-52 (34.9dBi) | 34.9 | | Y |
| Andrew | Andrew 6-foot Parabolic, P6F-52 (37.6dBi) | 37.6 | | Y |
| Andrew | Andrew 6-foot Dual-Pol Parabolic, PX6F-52 (37.6dBi) | 37.6 | | Y |
| Gabriel | Gabriel 2-foot High Performance QuickFire Parabolic HQF2-52-N | 28.2 | | Y |
| Gabriel | Gabriel 4-foot High Performance QuickFire Parabolic HQF4-52-N | 34.4 | | Y |
| Gabriel | Gabriel 6-foot High Performance QuickFire Parabolic HQF6-52-N | 37.4 | | Y |
| Gabriel | Gabriel 2-foot High Performance Dual QuickFire Parabolic HQFD2-52-N | 28.1 | | Y |
| Gabriel | Gabriel 4-foot High Performance Dual QuickFire Parabolic HQFD4-52-N | 34.3 | | Y |
| Gabriel | Gabriel 6-foot High Performance Dual QuickFire Parabolic HQFD6-52-N | 37.3 | | Y |
| Gabriel | Gabriel 2-foot Standard QuickFire Parabolic, QF2-52-N | 28.5 | | Y |
| Gabriel | Gabriel 2-foot Standard QuickFire Parabolic, QF2-52-N-RK | 28.5 | | Y |
| Gabriel | Gabriel 2.5-foot Standard QuickFire Parabolic, QF2.5-52-N | 31.2 | | Y |
| Gabriel | Gabriel 4-foot Standard QuickFire Parabolic, QF4-52-N | 34.8 | | Y |
| Gabriel | Gabriel 4-foot Standard QuickFire Parabolic, QF4-52-N-RK | 34.8 | | Y |

| Manufacturer | Antenna Type | Gain (dBi) | Flat Plate | Parabolic Dish |
|---|---|---|---|---|
| Gabriel | Gabriel 6-foot Standard QuickFire Parabolic, QF6-52-N | 37.7 | | Y |
| Gabriel | Gabriel 2-foot Standard Dual QuickFire Parabolic QFD2-52-N | 28.4 | | Y |
| Gabriel | Gabriel 2.5-foot Standard Dual QuickFire Parabolic QFD2.5-52-N | 31.1 | | Y |
| Gabriel | Gabriel 2-foot Standard Dual QuickFire Parabolic QFD2-52-N-RK | 28.4 | | Y |
| Gabriel | Gabriel 4-foot Standard Dual QuickFire Parabolic QFD4-52-N | 34.7 | | Y |
| Gabriel | Gabriel 4-foot Standard Dual QuickFire Parabolic QFD4-52-N-RK | 34.7 | | Y |
| Gabriel | Gabriel 6-foot Standard Dual QuickFire Parabolic QFD6-52-N | 37.7 | | Y |
| RadioWaves | Radio Waves 2-foot Dual-Pol Parabolic, SPD2-5.2 (28.1dBi) | 28.1 | | Y |
| RadioWaves | Radio Waves 2-foot Parabolic, SP2-5.2 (29.0dBi) | 29 | | Y |
| RadioWaves | Radio Waves 3-foot Dual-Pol Parabolic, SPD3-5.2 (31.1dBi) | 31.1 | | Y |
| RadioWaves | Radio Waves 3-foot Parabolic, SP3-5.2 (31.4dBi) | 31.4 | | Y |
| RadioWaves | Radio Waves 4-foot Dual-Pol Parabolic, SPD4-5.2 (34.4dBi) | 34.4 | | Y |
| RadioWaves | Radio Waves 4-foot Parabolic, SP4-5.2 (34.8dBi) | 34.8 | | Y |
| RadioWaves | Radio Waves 6-foot Dual-Pol Parabolic, SPD6-5.2 (37.5dBi) | 37.5 | | Y |
| RadioWaves | Radio Waves 6-foot Parabolic, SP6-5.2 (37.7dBi) | 37.7 | | Y |
| RadioWaves | Radio Waves 2-foot Parabolic, SP2-2/5 (28.3dBi) | 28.3 | | Y |
| RadioWaves | Radio Waves 3-foot Parabolic, SP3-2/5 (31.4dBi) | 31.4 | | Y |
| RadioWaves | Radio Waves 4-foot Parabolic, SP4-2/5 (34.6dBi) | 34.6 | | Y |
| RadioWaves | Radio Waves 6-foot Parabolic, SP6-2/5 (37.7dBi) | 37.7 | | Y |
| RFS | RFS 2-foot Parabolic, SPF2-52AN or SPFX2-52AN (27.9dBi) | 27.9 | | Y |
| RFS | RFS 3-foot Parabolic, SPF3-52AN or SPFX3-52AN(31.4dBi) | 31.4 | | Y |
| RFS | RFS 4-foot Parabolic, SPF4-52AN or SPFX4-52AN(33.9dBi) | 33.9 | | Y |
| RFS | RFS 6-foot Parabolic, SPF6-52AN or SPFX6-52AN (37.4dBi) | 37.4 | | Y |
| RFS | RFS 2-foot HP Parabolic, SDF2-52AN or SDFX2-52AN (31.4dBi) | 31.4 | | Y |
| RFS | RFS 4-foot HP Parabolic, SDF4-52AN or SDFX4-52AN (33.9dBi) | 33.9 | | Y |
| RFS | RFS 6-foot HP Parabolic, SDF6-52AN or SDFX6-52AN (37.4dBi) | 37.4 | | Y |
| StellaDoradus | StellaDoradus 45 inch Parabolic Antenna, 58PSD113 | 33.8 | | Y |

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