

Product Overview : PTP 670



Sagar Deshpande Product Manager



Agenda

- Overview of PTP portfolio
- PTP 670 Introduction
 - HCMP

– OTAR

- PTP 670 vs PTP 650
- PTP 670 Benefits
- Product launch information and Strategy
- More Information



PTP Overview



Sub 6GHz PTP Portfolio





VERTICAL MARKETS

- Industrial (Energy / Oil & Gas / Mining/ Transportation)
- Service Providers
- Government Public Safety
- Utilities (Electricity/ Water Distribution)
- Enterprise Private Networks





WIRELESS SERVICE PROVIDERS

- Grow Services Profitably
- 2G, 3G, 4G/LTE macro-cell, and smallcell backhaul
- Add/overlay wireless backbone capacity
- Disaster preparation with resilient links
- Extend network quickly while license applications are pursued
- Supply last-mile access and service extensions
- Provide backhaul to temporary deployments (Cell On Wheels)
- Extend services into underserved and remote areas
- Reduce or eliminate leased-line fees
- Last mile access
- Wi-Fi offloading





GOVERNMENT

Collaborative e-Government Services

- Leased-line replacement
- Fiber extensions
- Emergency preparedness and disaster recovery
- Network redundancy
- Land Mobile Radio (LMR) backhaul
- Video surveillance extensions and backhaul





PUBLIC SAFETY

Protect and Serve While Staying Safe

- Leased line and fiber replacement
- Rapid-deployment communications for emergencies and special events
- Land-mobile radio (LMR) backhaul
- Real-time database access
- Video surveillance backhaul and extensions
- On-scene video monitoring
- Disaster preparation and recovery





OIL & GAS COMPANIES

Attain Operational Excellence

- Communications during turnarounds
- Process Control Systems (PCS) backhaul
- Offshore-to-onshore and offshoreto-offshore communications
- Long-distance backhaul even in extremely hostile environments
- Video surveillance for asset protection and personnel safety
- Network redundancy
- Extend back-office expertise and applications into field operations





UTILITIES

Reduce OPEX with Secure Private Networks

- Remote monitoring and control of SCADA systems
- Smart-meter backhaul
- Last-mile fiber extensions
- Analog-to-digital migration
- Increased backbone capacity
- Network redundancy and disaster recovery
- Wire-line replacement and extensions
- Remote, rural connectivity
- Video surveillance backhaul and extensions







Introducing PTP 670





4.9 to 6.05 GHz PTP 670 Integrated 4.9 to 6.05 GHz PTP 670 Connectorized



PTP 670



Support both PTP and HCMP (High Capacity MultiPoint)

Dynamic Spectrum Optimization (DSO) enables to continually scan the band for low interference channels

iOFDM (intelligent Orthogonal Frequency Division Multiplexing) transmits over 1024 subcarrier and results in high resilience to multi-path interference

Supports Non Line-of-Sight (NLOS) applications

Supports Synchronous Ethernet, 6 babaand 1967 TC

Frequency Bands/Channels

- 4 9 GHz to 6 05 GHz
- 5, 10, 15, 20, 30, 40, and 45 MHz channels
- Best in Class 10 bps/Hz spectral efficiency

Interfaces

- Physical layer 2x2 MINO / i-OFDM
- · Gigabit Ethernet interface
- Single-Mode & Multi-Mode Optical Interface
- 8xE1 TDM module (optional indoor unit)

Adaptive Modulation

BPSK to 256 QAM

Aggregate Capacity

- Up to 450 Mbps
- Processing power of 900k PPS

Power Output & Antenna Gain

- Up to 27 dBm @ BPSK, 23 dBm at 256 QAM
- 23 dBi integrated flat panel

Latency / Physical

1 – 3 ms one-direction latency

PTP 670 Performance

Feature	
Up to 450Mbps	\checkmark
10bps/Hz Spectral Efficiency	\checkmark
Line-rate packets per second (> 900K PPS)	\checkmark
High Link Budget even at 64/256QAM	\checkmark
45 MHz channel bandwidth	\checkmark
Fast Adaptive Modulation	\checkmark
Low, consistent latency (1-3ms)	\checkmark
Dynamic UL/DL ratio	\checkmark
nLOS/NLOS (2x2 MIMO; OFDM)	\checkmark
Up to 256QAM	\checkmark

Flexible Channel Size and Spectral Efficiency



Copyright 2017 Cambium Networks LTD. All Rights Reserved.

Cambium Networks[™]

PTP 670 Reliability

Feature	
Dynamic Spectrum Optimization (DSO)	\checkmark
Wide-band operation (4.9 GHz to 6.05 GHz)	\checkmark
TDD-SYNC	\checkmark
Split Frequency Operation (Tx/Rx)	\checkmark
Spatial Diversity	\checkmark
LINKplanner	\checkmark
Fast Adaptive Modulation	\checkmark
IP66/67 Mechanics	\checkmark
-40C to +60C	\checkmark



DSO - MITIGATE INTERFERENCE



- Automatically changes channels to avoid interference without dropping the link
- Narrow channels⁵ 5, 10, 15, 20, 30, 40, 45 MHz
- Spectrum analyzer scans the band continuously
- TDD synchronization for optimal collocation density
- Proactive channel planning
- Up to 2,500 channel combinations

⁵Channel width options depend on country of operation.



Always-on Wide-band Spectrum Analyzer

- Real-time and historical analytics
- Find available channels; identify sources of interference
- Scans all bands and channels from 4.9GHz to 6.05GHz
- Data available in GUI and exportable via SNMP

Cambium	Networks	erthogen diag	5
Hame	Link: PHN-16 to PH-7 Site: PHN-16		
Status	Spectrum Expert - Dynamic Spectrum Optimization		
« System		Higher Higher Higher	elp
» Configuration	Local Receive Spectrum (last 20 minutes) 🕕	5478 MHz Stu 6=96 dBm, Peak=-96 dBm	m
Spectrum Expert » Statistics	-40 m	Pmp450 AP	
» Diagnostics Plotter	-50 - / Place House	Place House Cident Field	
Cable Diagnostics Software Upgrade	-60 - 1/ Active Channel		
Reboot	-70		
» Installation	-80 -		
» Management	8 -90 -		
» Security	-100-17114444444444444444444444444444444		
Logout	490 494 494 550 550 550 550 550 550 550 551 551 551	$\begin{array}{c} 5 & 5 & 4 & 0 \\ 5 & 5 & 4 & 2 & 5 & 5 & 4 & 0 \\ 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5 & 5$	
	Chann	nel Center Frequency (MHz) Cricket Field Cricket Field	
	* Local Interference Waterfall 🚺		-
	now the second		
	0:10		
	0:30		
	0:40-		
	0.50		
	E 1:004		







Line-of-Sight (LOS) Up to **155 miles**



near-Line-of-Sight (nLOS) Up to **25 miles**





Uplink-Downlink Symmetry Ratios



PTP 670 Security

Feature	
128-bit AES Encryption	\checkmark
256-bit AES Encryption	\checkmark
Multi-level user authentication	\checkmark
Audit trail of security activity	\checkmark
RADIUS Authentication	\checkmark
OOBM (Out-of-Band Management)	\checkmark
SNMPv3	\checkmark
Remote Password Maintenance	\checkmark



HCMP: How does it work?

Application Requires: Four HD Camera clusters each requiring 60 Mbps





- HCMP uses:
 - 37% fewer radios
 - less tower load
 - less power
 - fewer antennas
- simplified alignment
 Copyright 2017 Cambium Networks LTD. All Rights Reserved.



HCMP Deployment Scenarios

Building to Building **Building to Street** • Street to Street • Point To Point (NLOS) Macro Cell PTP 670 Point To Point Aggregation (High Capacity Backhaul) Macro Cell Point **PTP 670 РТР 670 НСМР** PTP 670 Fiber to EPC Street Level Point to Point

Cambium Networks™

Copyright 2017 Cambium Networks, Inc. All Rights Reserved.

Point to Point (NLOS)



OTAR (Over the Air Re-keying)

- What it means ?
 - The secret key used to encrypt the over-the-air data is automatically generated, negotiated and apply seamlessly at pre-configured intervals without any user intervention
- Advantages
 - No need for user intervention
 - Simplifies and streamlines operations while virtually eliminating risk of compromise.
 - Fulfill corporate equipment of regular key updates
- Benefit: Save man-hours in manual updating network with latest security patches, which helps customers when they have been affected by the
 Calatest cyberattack





PTP 670 vs PTP650

	PTP 670	PTP650
PTP Radio Performance	San	ne
Radio Price	San	ne
Integrated Antenna	12x12 @23 dBi	14x14 @23 dBi
HCMP	Up to 8 Nodes	Not Support
Capacity Key	Full Capacity By Default	License Key
Hardware Variations	Connectorized Integrated	Connectorized Integrated PTP650S PTP650L
Bracket	New Bracket	





PTP 670 Integrate





PTP 670 Benefits

- Faster Processor with more memory
 - Roadmaps will have exciting new features
- HCMP compatible
 - High spectral efficiency
 - Up to 8 remote nodes
- OTAR support
- Simplified Licensing structure
- Backward compatible with PTP 650



PTP 670 : Pricing & Compatibility

- Pricing
 - Same hardware pricing as PTP 650
 - No Licensing fees for Full capacity key
- Compatibility with PTP 650
 - PTP 670 will be backward compatible with PTP 650 through special release version
 - Specific release version is scheduled around Q4 2017
 - All PTP 650 accessories are compatible with PTP 670



Product Launch and Strategy



PTP 670 Product Launch Dates

- PTP 670 4.9 to 6.05 GHz
 - Public Launch/Shipping Date: June 21th 2017
 - Available for order from June 21st 2017
 - Please contact <u>CambiumNetworks.com</u> for further information



More Information



CambiumNetworks.com



Point to Point Networking

Our proven Point-to-Point (PTP) series solutions are deployed worldwide, serving highly critical applications in formidable environments for the world's most demanding users. With best-in-



Community Forum

← → C 0 community.cambiumnetworks.com/t5/PTP-450/bd-p/forums_ptp_450

Cambium I	Networks [™]				_		■	SAGARGDESHPANDE
Home	Forums	Knowledge Base	Ide	as	Yours	Stories		
Cambium Networks Commu	unity > Forums > PTP > PTP 450							
PTP 450)						H	
					« Previous 1	2 3 Ne	xt » Nev	W MESSAGE OPTIONS V
SUBJECT			REPLIES	NEW	AUTHOR	KUDOS	VIEWS	LATEST POST
40MHz channel	l on PTP 450i		8	9	giuseppe4	4	718	by giuseppe4
How to physica	ly reset a Cambium PTP 450	0	4	5	KingRich	1	1120	Tuesday by NYAME joseph
PTP 450i Single	Polarization		2	3	CDB	1	75	3 weeks ago by CDB
PTP 450 900 M	Hz power options		3	4	KRather	1	312	4 weeks ago by Douglas Generous
PTP 450i: Can y	rou use a PMP 450i SM?		1	2	giuseppe4	0	70	02-17-2017 10:27 AM by Support_Sanjay
PTP 450i: How	to reduce jitter?		4	5	giuseppe4	4	92	02-17-2017 07:46 AM by giuseppe 4
PTP450i- SMS E	ES RESET, EACH DAY REGULA	AR INTERVAL O	1	2	cobra_50	0	52	02-10-2017 11:38 AM by Eric Ozrelic
450i 900 MHz b	ackhaul radio configs		2	3	tthomas	1	101	02-02-2017 10:42 AM by tthomas





For more information:

Contact : Community Link: https://www.community.cambiumnetworks.com





PTP 670

Service providers, government public safety agencies and critical infrastructure operators such as utilities and energy companies have experienced massive growth in bandwidth demands for reliable and secure broadband connectivity. The nature of these deployments for small-cell backhaul, disaster recovery, video surveillance and Wi-Fi backhaul drive variety of deployment topologies.

Now with the Point-to-Point (PTP) 670 Series solution, Cambium Networks combines best-in- class spectral efficiency and reliability with high-capacity multipoint (HCMP) deployment flexibility. With up to 450 Mbps aggregate throughput, PTP 670 systems let you flexibly, reliably and securely handle today's needs.

FLEXIBLE, SPECTRALLY-EFFICIENT, SELF-OPTIMIZING SUB-6GHZ SOLUTION

Based on our widely deployed, field-proven non-line-of sight (NLOS) technology, PTP 670 wireless Ethernet bridges offer an array of features that gives more capacity, greater operational flexibility and the highest spectral efficiency in the industry. PTP 670 systems provide 4.9 to 6.05 GHz, multiband flexibility in a single radio and operate in channel sizes from 5 to 45 MHz.

With Dynamic Spectrum Optimization (DSO), PTP 670 systems are constantly optimizing the channel of operation to maximize link reliability and performance. The systems can provide up to 99.999% availability in virtually any environment, including non-line-of-sight, long-distance line-of-sight, high interference, over water ,desert and through extreme weather conditions. As a result, you can

deliver more throughput with less spectrum and less investment in the most challenging environments.

HIGH-CAPACITY MULTIPOINT and POINT-TO-POINT IN SINGLE SOLUTION

With the PTP 670, operators now have the flexibility to deploy not only in Point to Point topologies but also in High-Capacity Multipoint (HCMP) Applications. HCMP allows up to eight remote nodes to connect to a single master radio. This opens up new deployment models that enable rapid deployment, simplify planning and by using the same hardware regardless of topology a rapid return on investment in equipment and training. Whether your organization is an enterprise, government agency or service provider, PTP 670 systems are ideal solutions for a wide array of applications such as T1/E1 and fiber replacements or extensions, video surveillance backhaul, LTE, macro-cell & small-cell backhaul, last-mile access, disaster recovery, network redundancy and building-to-building campus connectivity.

FIELD TESTED AND SECURITY FOR PERFORMANCE IN THE REAL-WORLD

PTP 670 radios meet industry standards with proven compliance to assure you of interoperability, security and ruggedization.

- FIPS-197 128/256-bit AES encryption
- IEEE 1588v2 and Synchronous Ethernet (SyncE)
- IPv6/IPv4 dual-stack management support
- Ingress Protection rated (IP66/67) protective aluminum radio enclosures



RADIO TECHNOLOGY	
MODEL	PTP 670
RF BANDS	Wide-band operation 4.9 to 6.05 GHz (Allowable frequencies and bands are dictated by individual country regulations)
CHANNEL SIZES	5, 10, 15, 20, 30, 40, and 45 MHz channels Channel sizes depend on individual country regulations
SPECTRAL EFFICIENCY	10 bps/Hz maximum
CHANNEL SELECTION	By Dynamic Spectrum Optimization or manual intervention
	Automatic selection on start-up and continual self-optimization to avoid interference
MAXIMUM TRANSMIT POWER	Up to 27 dBm
SYSTEM GAIN	Up to 164 dB with Integrated antenna
MODULATION / ERROR	Fast Preemptive Adaptive Modulation featuring 13 modulation / FEC coding levels ranging
CORRECTION	from BPSK to 256 QAM dual payload MIMO
DUPLEX SCHEME	Time Division Duplex (TDD)
	Adaptive or fixed transmit/receive duty cycles
	Split frequency operation allows separate transmit and receive frequencies where allowed by
	regulation.
	Optional TDD synchronization using PTP-SYNC Module
ANTENNA	Integrated Flat panel: 23 dBi
	Connectorized: operate with a selection of separately-purchased single and dual polarity
DANICE	antennas through 2 x N-type female connectors
RANGE	Up to 155 miles (250 km)
SECORITY	Identity based user accounts Configurable password rules
	User authentication and RADIUS support
	Event logging and management: optional logging via syslog
	Disaster recovery and vulnerability management
ETHERNET BRIDGING	
PROTOCOL	IEEE 802.3
LATENCY	1-3 milliseconds one direction
QOS	Extensive QOS supporting up to 8 Queues
PACKET CLASSIFICATION	Layer 2 and Layer 3 IEEE 802.1p, MPLS, Ethernet priority
PACKET PERFORMANCE	Line rate (>850K packets per second)
TIMING TRANSPORT	Synchronous Ethernet; IEEE 1588v2
	PTP Mode: Jumbo frame up to 9600 bytes
	HCMP Mode: 2000 bytes per frame
FLEXIBLE I/O	2 x Gigabit Ethernet copper ports:
,, _	- Gigabit Port 1: Data + PoE power input
	- Gigabit Port 2: 802.3at PoE output port
	1 x SFP port: single-mode fiber, multi-mode fiber or copper Gigabit Ethernet options available
T1/E1 TDM SUPPORT	8 x T1/E1 TDM (Network Indoor Unit (NIDU))
	G.823-compliant timing
	DC power input (compatible with AC+DC Power Injector output)
MANAGEMENT	
NETWORK MANAGEMENT	In-band and out-of-band management (OOBM)
SYSTEM MANAGEMENT	IPv6/IPv4 dual-stack management support
	Web access via browser using HTTP or HTTPS/TLS3 SNMP v1, v2c and v3, MIB-II & proprietary
	PTP MIB
	PTP MIB Online spectrum analyzer (no impact on payload traffic or network operation)

SPECFICATION SHEET: PTP670

HIGH CAPACITY MULTI POINT												
REMOTE MODULES	Up t	o 8 Nodes										
MASTER												
CHANNEL BANDWIDTH	20 N	20 MHz and 40 MHz										
DATA CAPACITY PER		Number of Remote Module										
REMOTE MODULE IN 1:1		@ 40 MHz	6	7	8							
SYMMETRY		Mbps	56	46	42							
SPECTRAL EFFICIENCY IN HCMP	8 bp	8 bps/Hz Max										
LINE RATE PACKET PER SECOND	850H	< pps										
LATENCY IN HCMP MODE	2 to	4 ms one way(typically)										
PHYSICAL												
DIMENSIONS	Integ Wi Coni Wi	Integrated Outdoor Unit (ODU): Width 305mm (12"), Height 305mm (13.5"), Depth 81mm (3.2") Connectorized ODU: Width 204mm (8.0") Height 318mm (12.5") Depth 90mm (3.5")										
WEIGHT	Integ	grated ODU: 4.1 kg (8.95 lbs)	including	bracket	t	· · ·	<u>.</u>					
	Coni	nectorized ODU: 3.1 kg (6.8 lk	os) includ	ing brac	ket							
OPERATING	-40°	-40° to +140° F (-40° to +60° C), including solar radiation										
TEMPERATURE												
DUST- WATER	IP66	IP66 and IP67										
INTRUSION PROTECTION												
WIND SPEED SURVIVAL	200	200 mph (322 kph)										
POWER SUPPLY	 AC power injector: 32° to 104° F (0° to +40° C); 35 W; 90-240 VAC, 50/60Hz Dimensions: Width 5.2"(132mm), Height 1.4"(36mm), Depth 2"(51mm) AC + DC power injector: -40° to 140° F (-40° to +60° C); 70 W; 90-240 VAC, 50/60 Hz Dimensions: Width 9.75" (250 mm), Height 1.5" (40 mm), Depth 3" (80 mm) 											
POWER CONSUMPTION	30 V	V maximum (up to 70 W with	802.3at (device o	n auxili	ary port)					
ENVIRONMENTAL &												
REGULATORY												
PROTECTION AND	UL60	0950-1; IEC60950-1; EN60950)-1; CSA-0	C22.2 NC	D. 6095	0-1; CB a	approva	al for Glo	bal			
SAFTEY												
RADIO	4.9 0	GHz: FCC Part 90Y, RSS-111										
	5.x C	GHz: FCC Part 15, sub-parts 15	5C and 15	5E; RSS 2	10 Issu	e 8;						
	EN 3	02 502; EN 301 893 Eire Com	Reg 02/7	'1R1, UK	Appro	val to IR	2007					
EMC	Europe – EN 301 489-1 and -4											

SPECFICATION SHEET: PTP670

RECEIVER SENSITIVTY AND TRANSMIT POWER dbm @ 5.8 GHz								Transmith
		(dBm)						
Modulation Mode	5 MHz	45 MHz	(dbiii)					
BPSK 0.63 Single	-96.8	-94.8	-93.0	-91.8	-90.0	-88.8	-88.3	27
QPSK 0.63 Single	-93.7	-91.7	-89.9	-88.7	-86.9	-85.7	-85.2	26
QPSK 0.87 Dual	-89.7	-87.7	-85.9	-84.7	-82.9	-81.7	-81.1	26
16QAM 0.63 Single	-87.4	-85.4	-83.6	-82.3	-80.6	-79.3	-78.8	25
16QAM 0.63 Dual	-83.4	-81.4	-79.6	-78.4	-76.6	-75.4	-74.9	25
16QAM 0.87 Single	-82.9	-80.8	-79.1	-77.8	-76.1	-74.8	-74.3	25
16QAM 0.87 Dual	-79.8	-77.8	-76.0	-74.8	-73.0	-71.8	-71.2	25
64QAM 0.75 Single	-79.8	-77.8	-76.0	-74.8	-73.0	-71.8	-71.2	24
64QAM 0.75 Dual	-76.7	-74.7	-72.9	-71.6	-69.9	-68.6	-68.1	24
64QAM 0.92 Single	-75.8	-73.8	-72.1	-70.8	-69.1	-67.8	-67.3	24
64QAM 0.92 Dual	-72.5	-70.5	-68.8	-67.5	-65.8	-64.5	-64.0	24
256QAM 0.81 Single	-72.5	-70.5	-68.7	-67.4	-65.7	-64.4	-63.9	23
256QAM 0.81 Dual	-68.8	-66.8	-65.0	-63.8	-62.0	-60.8	-60.3	23

THROUGHPUT (MBPS @ 5 km)											
	Channel Size										
Modulation Mode	5 MHz	10 MHz	15 MHz	20 MHz	30 MHz	40 MHz	45 MHz				
BPSK 0.63 Single	2.3	4.8	7.2	9.6	14.5	19.9	21.8				
QPSK 0.63 Single	4.7	9.6	14.5	19.3	29.1	39.7	43.5				
QPSK 0.87 Single	6.5	13.4	20.2	26.8	40.5	55.2	60.5				
16QAM 0.63 Single	6.5	13.4	20.2	26.8	40.5	55.3	60.6				
16QAM 0.87 Single	9.3	19.3	29.0	38.5	58.2	79.5	87.1				
64QAM 0.75 Single	12.1	25.1	37.7	50.0	75.6	103.2	113.1				
64QAM 0.92 Single	16.7	34.5	51.9	68.9	104.1	142.1	155.7				
256QAM 0.81 Single	24.2	50.1	75.4	100.1	151.1	206.3	226.1				
16QAM 0.63 Dual	13.0	26.8	40.4	53.6	80.9	110.5	121.1				
16QAM 0.87 Dual	18.6	38.6	58.0	77.0	116.4	158.9	174.1				
64QAM 0.75 Dual	24.2	50.1	75.4	100.0	151.1	206.3	226.1				
64QAM 0.92 Dual	33.3	69.0	103.8	137.8	208.1	284.1	311.3				
256QAM 0.81 Dual	48.4	100.2	150.7	200.1	302.2	412.6	452.2				