LigoWave Point-to-Point Product Guide

Content

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Introduction

This document describes the basic characteristics and key features of the LigoWave LigoPTP product line. For in-depth technical product information, please consult the product-specific data sheets.

Acronyms

AES   Advanced Encryption Standard – strong hardware based data encryption that prevents unauthorized access to data.

ARQ   Automatic Repeat reQuest is the error control method for data transmission which uses acknowledgments and timeouts to achieve reliability.

BER   Bit Error Ratio - the number of received data bits that have been altered due to noise or interference, divided by the total number of transferred data bits during a studied time interval.

BPSK   Binary Phase-Shift Keying – radio signal modulation technique that uses two phases which are separated by 180°.

FEC   Forward Error Correction – a system of error control for data transmission when sender adds redundant data to its messages so errors can be corrected at receiver side without the need to retransmit data.

GUI   Graphic User interface.

IP-67   Ingress Protection standard where digits mean that equipment is totally protected against dust and against the effect of immersion between 15cm and 1m.

MIMO   Multiple-Input Multiple-Output – radio system that uses several transmitters and several receivers at the same time to improve communication performance

PoE   Power over Ethernet

PPS   Packets per second

QAM   Quadrature Amplitude Modulation - radio signal modulation technique that uses combined phase and amplitude manipulation.

QPSK   Quadrature Phase-Shift Keying - radio signal modulation technique that uses four phases equidistant around a circle.

SISO   Single Input Single Output – radio system that use one transmitter and one receiver.

SNMP   Simple Network Management Protocol.

SSH   Secure Shell – network protocol that allows exchanging data over encrypted secure channel.

TDD   Time-Division Duplex – technique that achieve full duplex communication over half duplex data link allocating data over time.

W-Jet2   This is the LigoPTP proprietary wireless protocol which combines special techniques to achieve great performance and reliability without distance limitations.

LigoPTP product portfolio summary

The LigoWave LigoPTP product family offers proprietary and microwave technology wireless point to point bridges. LigoWave's proprietary PTP technology operates in licensed and unlicensed frequency bands (country dependent) including:

- 900 MHz;
- 2.4 GHz;
- 3.5 GHz;
- 4.9 GHz;
- 5.2 GHz;
- 5.4 GHz;
- 5.8 GHz.

All proprietary PTP technology products are designed for full outdoor use and are available with either an integrated antenna or N-type connector. These products are equipped with one 10/100 BaseT Ethernet interface which is used for data and for in-band management. Implementing the newest wireless technologies LigoPTP provides great value and quick return on investments for various service providers and private customers.

LigoWave's microwave products are designed for very high performance and reliability wireless communication networks. These PTPs operate in the following frequency bands:

- 7 GHz;
- 8 GHz;
- 11 GHz;
- 13 GHz;
- 15 GHz;
- 18 GHz;
- 23 GHz;
- 24 GHz (unlicensed);
- 26 GHz.

Most of the microwave PTP's consists from the main indoor unit, selectable outdoor unit and various diameters, and gains selectable antennas. LigoWave provides all mentioned components (see Purchasing Guide for details). Moreover these PTPs are suitable for Ethernet and TDM applications. One PTP model (PTP 24) is designed for full outdoor use. All products technical specifications are listed in the tables below.

Product / Feature/ Parameter	LigoPTP 900-13, LigoPTP 900-N	LigoPTP 2-19, LigoPTP 2-N	LigoPTP 3-18, LigoPTP 3-N	LigoPTP 4-19, LigoPTP 4-N	LigoPTP 5-23, LigoPTP 5-N	LigoPTP 5-N-MIMO, 5-23-MIMO
Radio specification						
Wireless standard	Proprietary	Proprietary	Proprietary	Proprietary	Proprietary	Proprietary
Operating mode	Point-to-point	Point-to-point	Point-to-point	Point-to-point	Point-to-point	Point-to-point
Radio frequencies, MHz	868 – 928	2400 – 2483	3400 – 3700	4940 – 4990	5150 – 5850	4920 – 5915
Radio channel size, MHz	5; 10; 20	5; 10; 20; 40	5; 10; 20; 40*	5; 10; 20	5; 10; 20; 40	20; 40
Max output power, dBm	25	24	25	25	25	2x25
Receive sensitivity at 20 MHz channel according to modulation, dBm	-92@BPSK -88@QPSK -79@16QAM -72@64QAM	-92@BPSK -87@QPSK -80@16QAM -74@64QAM	-92@BPSK -88@QPSK -81@16QAM -73@64QAM	-93@BPSK -90@QPSK -83@16QAM -76@64QAM	-94@BPSK -90@QPSK -83@16QAM -76@64QAM	-92@BPSK -88@QPSK -81@16QAM -75@64QAM
Error correction	FEC, Selective ARQ	FEC, Selective ARQ	FEC, Selective ARQ	FEC, Selective ARQ	FEC, Selective ARQ	FEC, Selective ARQ, STBC
Duplexing scheme	TDD	TDD	TDD	TDD	TDD	TDD
Link performance						
Max aggregated real data throughput, Mbps	40 20 full-duplex	70 35 full-duplex	70 35 full-duplex	40 20 full-duplex	70 35 full-duplex	180 90 full-duplex
Recommended link distance, km (mi)	20 (12.4) 13 dBi ant.	30 (18.6) 19 dBi ant.	25 (15.5) 18 dBi ant.	25 (15.5) 19 dBi ant.	40 (24.8) 23 dBi ant.	50 (31) 23 dBi ant.
Max packets per second	35,000	50,000	50,000	50,000	50,000	35,000
64 bytes packet latency, ms	2	2	2	2	2	2
Antenna						
Integrated antenna	• LigoPTP 900-13	• LigoPTP 2-19	• LigoPTP 3-18	• LigoPTP 4-19	• LigoPTP 5-23	• LigoPTP 5-23-MIMO
Integrated antenna gain, dBi	13	19	18	19	23	2x23
N-type connector for external antenna	• LigoPTP 900-N	• LigoPTP 2-N	• LigoPTP 3-N	• LigoPTP 4-N	• LigoPTP 5-N	• LigoPTP 5-N-MIMO
Data interface						
Ethernet interface and connector	10/100 BaseT (RJ45)	10/100 BaseT (RJ45)	10/100 BaseT (RJ45)	10/100 BaseT (RJ45)	10/100 BaseT (RJ45)	10/100 BaseT (RJ45)
Security						
AES encryption	128 bit	128 bit	128 bit	128 bit	128 bit	128 bit
Power						
Power supply over Ethernet	9-48V DC** passive PoE	9-48V DC** passive PoE	9-48V DC** passive PoE	9-48V DC** passive PoE	9-48V DC** passive PoE	9-48V DC passive PoE
Power adapter from 100-240V AC	included	included	included	included	included	included
Power consumption, W	12	12	12	12	12	15
Operating environment						
Temperature	-20C ~ +60C	-20C ~ +60C	-20C ~ +60C	-20C ~ +60C	-20C ~ +60C	-20C ~ +60C
Humidity (non-condensing)	0~90%	0~90%	0~90%	0~90%	0~90%	0~90%
Management						
Configuration via Web GUI, SSH	•	•	•	•	•	•
SNMP v1/2c/3 with traps support	•	•	•	•	•	•

*Country dependent
**Voltage range depends on hardware type

Product Feature/ Parameter	LigoPTP 24
Radio specification	
Wireless standard	Microwave
Operating mode	Point-to-point, 1+0, 2+0
Radio frequencies, GHz	24
Radio channel size, MHz	3.5; 7; 14; 28
Output power at 28 MHz channel according modulation, dBm	5@QPSK 4@16QAM 3@32QAM
Receive sensitivity at 28 MHz channel according to modulation, dBm	-87@QPSK -80@16QAM -77@32QAM
Error correction	LDPC
Duplexing scheme	FDD
Link performance	
Max aggregated real data throughput, Mbps	216 108 full-duplex
Recommended link distance, km (mi)	7 (4) 60 cm (2 ft) ant.
64 bytes packet latency, ms	1
Antenna	
Antenna type	Selectable
Antenna gain, dBi	35; 40
Antenna diameter, cm (ft)	30 (1); 60 (2)
Data interface	
Ethernet interface and connector	10/100 BaseT, RJ45
E1/T1 interface	18-pin connector
Power	
Power supply over Ethernet	48±10% V DC PoE
Power adapter from 100-240V AC	included
Power consumption, W	19
Operating environment	
Temperature	-33C (-27F) ~ +55C (+131F)
Humidity (non-condensing)	0~90%
Management	
Configuration via Web GUI, Telnet	•
SNMP with traps support	•
BNC connector for RSSI measurement	•
BNC connector for terminal access	•

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Product / Feature / Parameter	LigoPTP 620S 7/8 GHz	LigoPTP 620S 11 GHz	LigoPTP 620S 13 GHz	LigoPTP 620S 15 GHz	LigoPTP 620S 18 GHz	LigoPTP 620S 23 GHz	LigoPTP 620S 26 GHz
Radio specification							
Wireless standard	Microwave	Microwave	Microwave	Microwave	Microwave	Microwave	Microwave
Operating mode	Point-to-point, 1+0	Point-to-point, 1+0	Point-to-point, 1+0	Point-to-point, 1+0	Point-to-point, 1+0	Point-to-point, 1+0	Point-to-point, 1+0
Radio frequencies, GHz	7.125 – 7.725 7.9 – 8.5	10.7 – 11.7	12.75 – 13.25	14.4 – 15.4	17.7 – 19.7	21.2 – 23.6	24.2 – 26.5
Radio channel size, MHz	3.5; 7; 14; 28; 56	3.5; 7; 14; 28; 56	3.5; 7; 14; 28; 56	3.5; 7; 14; 28; 56	3.5; 7; 14; 28; 56	3.5; 7; 14; 28; 56	3.5; 7; 14; 28; 56
Max output power, dBm	25.5@QPSK 21.5@16/32QAM 18.5@64/128QAM 16.5@256QAM	24.5@QPSK 20.5@16/32Q. 17.5@64/128Q. 15.5@256QAM	24.5@QPSK 20.5@16/32Q. 17.5@64/128Q. 15.5@256QAM	24.5@QPSK 20.5@16/32Q. 17.5@64/128Q. 15.5@256QAM	22.5@QPSK 19@16/32Q. 17@64/128Q. 15@256QAM	22.5@QPSK 19@16/32Q. 16@64/128Q. 14@256QAM	23.5@QPSK 19.5@16/32Q 15.5@64/128Q 13.5@256QAM
Receive sensitivity at 56 MHz channel, BER 10-6, dBm	-82@QPSK -75@16QAM -73@32QAM -70@64QAM -66@128QAM -62@256QAM	-83@QPSK -76@16QAM -72@32QAM -70@64QAM -67@128QAM -64@256QAM	-82@QPSK -75@16QAM -73@32QAM -70@64QAM -66@128QAM -62@256QAM	-82@QPSK -75@16QAM -73@32QAM -70@64QAM -66@128QAM -62@256QAM	-82@QPSK -75@16QAM -73@32QAM -70@64QAM -66@128QAM -62@256QAM	-82@QPSK -75@16QAM -73@32QAM -70@64QAM -66@128QAM -62@256QAM	-82@QPSK -75@16QAM -73@32QAM -70@64QAM -66@128QAM -62@256QAM
Receive sensitivity at 28 MHz channel, BER 10-6, dBm	-84@QPSK -78@16QAM -74@32QAM -71@64QAM -68@128QAM -65@256QAM	-84@QPSK -78@16QAM -74@32QAM -71@64QAM -68@128QAM -65@256QAM	-84@QPSK -78@16QAM -74@32QAM -71@64QAM -68@128QAM -65@256QAM	-84@QPSK -78@16QAM -74@32QAM -71@64QAM -68@128QAM -65@256QAM	-84@QPSK -78@16QAM -74@32QAM -71@64QAM -68@128QAM -65@256QAM	-84@QPSK -78@16QAM -74@32QAM -71@64QAM -68@128QAM -65@256QAM	-84@QPSK -78@16QAM -74@32QAM -71@64QAM -68@128QAM -65@256QAM
Receive sensitivity at 14 MHz channel, BER 10-6, dBm	-86@QPSK -79@16QAM -76@32QAM -74@64QAM -70@128QAM -68@256QAM	-86@QPSK -79@16QAM -76@32QAM -74@64QAM -70@128QAM -68@256QAM	-86@QPSK -79@16QAM -76@32QAM -74@64QAM -70@128QAM -68@256QAM	-86@QPSK -79@16QAM -76@32QAM -74@64QAM -70@128QAM -68@256QAM	-86@QPSK -79@16QAM -76@32QAM -74@64QAM -70@128QAM -68@256QAM	-86@QPSK -79@16QAM -76@32QAM -74@64QAM -70@128QAM -68@256QAM	-86@QPSK -79@16QAM -76@32QAM -74@64QAM -70@128QAM -68@256QAM
Receive sensitivity at 7 MHz channel, BER 10-6, dBm	-89@QPSK -82@16QAM -79@32QAM -76@64QAM -74@128QAM	-89@QPSK -82@16QAM -79@32QAM -76@64QAM -74@128QAM	-89@QPSK -82@16QAM -79@32QAM -76@64QAM -74@128QAM	-89@QPSK -82@16QAM -79@32QAM -76@64QAM -74@128QAM	-89@QPSK -82@16QAM -79@32QAM -76@64QAM -74@128QAM	-89@QPSK -82@16QAM -79@32QAM -76@64QAM -74@128QAM	-89@QPSK -82@16QAM -79@32QAM -76@64QAM -74@128QAM
Error control	FEC, CRC, BER	FEC, CRC, BER	FEC, CRC, BER	FEC, CRC, BER	FEC, CRC, BER	FEC, CRC, BER	FEC, CRC, BER
Duplexing scheme	FDD	FDD	FDD	FDD	FDD	FDD	FDD
Link performance							
Max aggregated real data throughput, Mbps	620 310 full-duplex	620 310 full-duplex	620 310 full-duplex	620 310 full-duplex	620 310 full-duplex	620 310 full-duplex	620 310 full-duplex
64 bytes packet latency, ms	1	1	1	1	1	1	1
Antenna							
Antenna type	Selectable	Selectable	Selectable	Selectable	Selectable	Selectable	
Antenna gain, dBi	30 - 40	34 - 43	29 - 44	30 - 46	32 - 47	34 - 48	34 - 48
Antenna diameter, cm (ft)	30 (1); 60 (2); 90 (3); 120 (4); 180 (6)	30 (1); 60 (2); 90 (3); 120 (4); 180 (6)	30 (1); 60 (2); 90 (3); 120 (4); 180 (6)	30 (1); 60 (2); 90 (3); 120 (4); 180 (6)	30 (1); 60 (2); 90 (3); 120 (4); 180 (6)	30 (1); 60 (2); 90 (3); 120 (4); 180 (6)	30 (1); 60 (2); 90 (3); 120 (4); 180 (6)
Data interface							
Ethernet interface and connector	10/100/1000 BaseT(RJ45)	10/100/1000 BaseT(RJ45)	10/100/1000 BaseT(RJ45)	10/100/1000 BaseT(RJ45)	10/100/1000 BaseT(RJ45)	10/100/1000 BaseT(RJ45)	10/100/1000 BaseT(RJ45)
TDM	E1/T1 (RJ45)	E1/T1 (RJ45)	E1/T1 (RJ45)	E1/T1 (RJ45)	E1/T1 (RJ45)	E1/T1 (RJ45)	E1/T1 (RJ45)

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Power							
Power supply	48 VDC +/- 5%	48 VDC +/- 5%	48 VDC +/- 5%	48 VDC +/- 5%	48 VDC +/- 5%	48 VDC +/- 5%	48 VDC +/- 5%
Power adapter from 90-240 VAC	included	included	included	included	included	included	included
Power consumption, W	IDU: 22; ODU: 25	IDU: 22; ODU: 25	IDU: 22; ODU: 25	IDU: 22; ODU: 25	IDU: 22; ODU: 25	IDU: 22; ODU: 25	IDU: 22; ODU: 25
Operating environment							
Temperature, ºC	IDU:-5 ~ +55 ODU:-40 ~ +65	IDU:-5 ~ +55 ODU:-40 ~ +65	IDU:-5 ~ +55 ODU:-40 ~ +65	IDU:-5 ~ +55 ODU:-40 ~ +65	IDU:-5 ~ +55 ODU:-40 ~ +65	IDU:-5 ~ +55 ODU:-40 ~ +65	IDU:-5 ~ +55 ODU:-40 ~ +65
Humidity (non-condensing)	0~90%	0~90%	0~90%	0~90%	0~90%	0~90%	0~90%
Management							
Configuration via Web GUI, Telnet	•	•	•	•	•	•	•
SNMP with traps support	•	•	•	•	•	•	•
Management ports	10/100 Base-T; USB/RS232	10/100 Base-T; USB/RS232	10/100 Base-T; USB/RS232	10/100 Base-T; USB/RS232	10/100 Base-T; USB/RS232	10/100 Base-T; USB/RS232	10/100 Base-T; USB/RS232

LigoPTP product key features

LigoPTP bridges use proprietary technology to achieve great performance and reliability. The key features are listed below:

- Advanced proprietary W-Jet wireless protocol for legacy equipment;
- Advanced proprietary W-Jet2 wireless protocol for MIMO model: unlimited distance, great latency and throughput;
- High data throughput over various frequency bands;
- Flexible radio channel bandwidth selection (5, 10, 20, 40 MHz);
- MIMO technology increases data throughput up to 180 Mbps;
- High transmit power and high receive sensitivity ensure long range data links;
- With additional antenna and W-Jet2 protocol 100 km (62 mi) or longer distance is possible;
- Excellent packets per second value (up to 50,000);
- Low packet latency;
- Proven operating system;
- Advanced and user-friendly graphic user interface;
- Strong hardware based data encryption;
- Robust link in noisy (interfering) environments;
- Centralized management and monitoring system;
- IP-67 compliant;
- Easy mounting;
- Surge protector;
- Link planning tool.

LigoPTP microwave bridges key features are:

- Compact design;
- Very high reliability and performance wireless system;
- Licensed band, no interferences;
- Flexible radio channel bandwidth selection (3.5, 7, 14, 28, 56);
- Full-duplex data rate 310 Mbps;
- Selectable gain antennas for optimal link operation;
- Very long range connectivity (except PTP 24);
- Option for E1/T1 module (up to 2 E1/T1);
- Automatic transmit power control;
- Advanced operating system.

W-Jet protocol advantages

W-Jet protocol advantages are clearly seen in the table and charts below where performance parameters have great values.

Product / Parameter	Standard WLAN IEEE 802.11 a/g	LigoPTP W-Jet	LigoPTP MIMO W-Jet
Max real aggregate data throughput, Mbps	22	70	180
Max wireless data rate, Mbps	54	108	300
Max PPS	5,000	50,000	35,000
Channel bandwidth, MHz	20	5; 10; 20; 40	20; 40
Transmit power, dBm	20	25	2x25
Radio system	SISO	SISO	2x2 MIMO
Antenna	Single polarization	Single polarization	Dual polarization
Data bit/Hz	2.7	2.7	7.5
Real data (net) bit/Hz	1.1	2	4.5
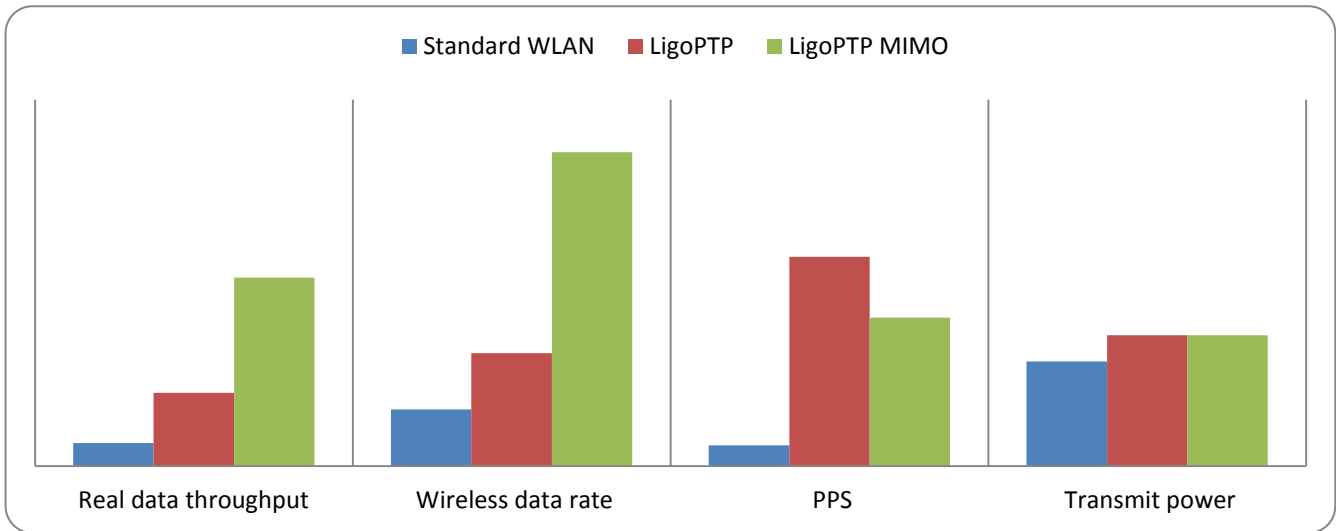
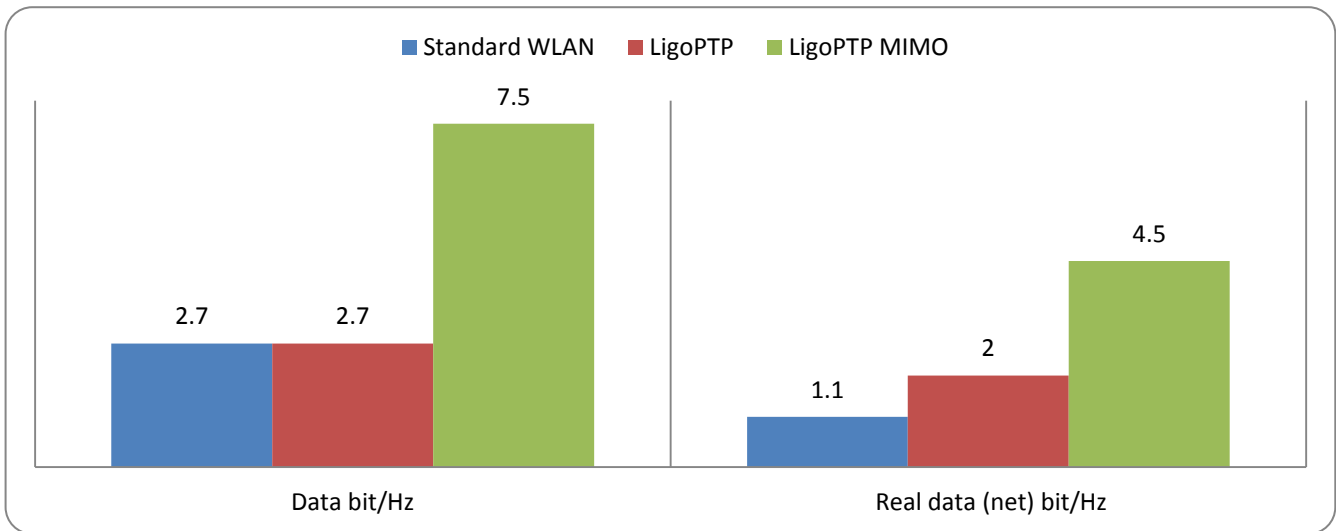Figure1. Features comparison

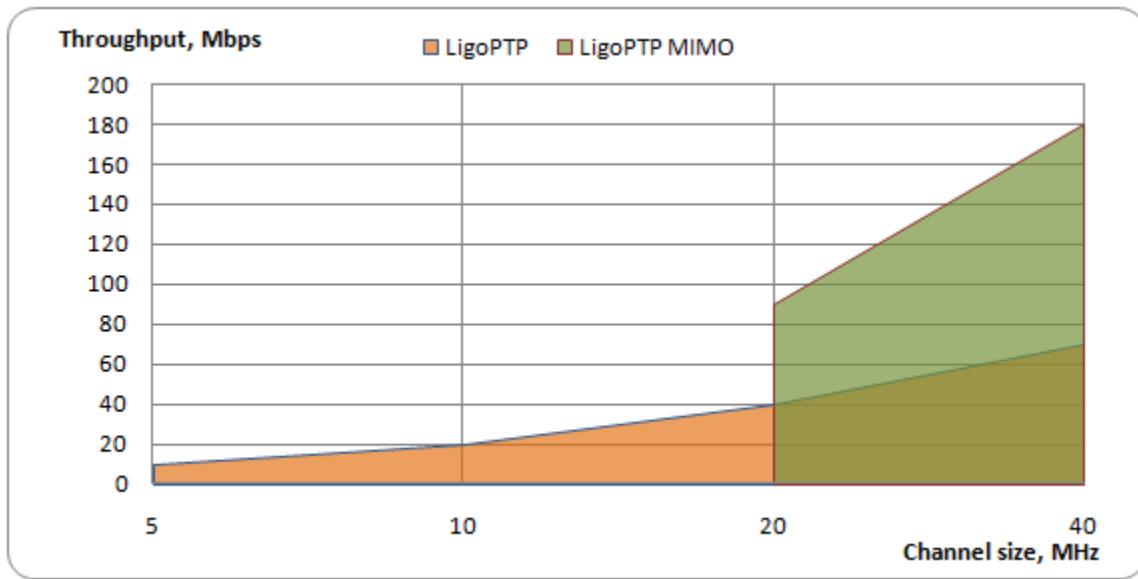Figure2. Data bits per hertz comparison

Figure3. Real aggregate data throughputs on different channel sizes

Real data throughput vs. distance comparison

Figure4 illustrates approximate real data throughput dependence on distance and may differ in real application scenario due to the interference, Fresnel zone clearance and other factors.
Configuration: 40 MHz channel width, TXpower 25 dBm, 32 dBi dual-pol dish antennas.
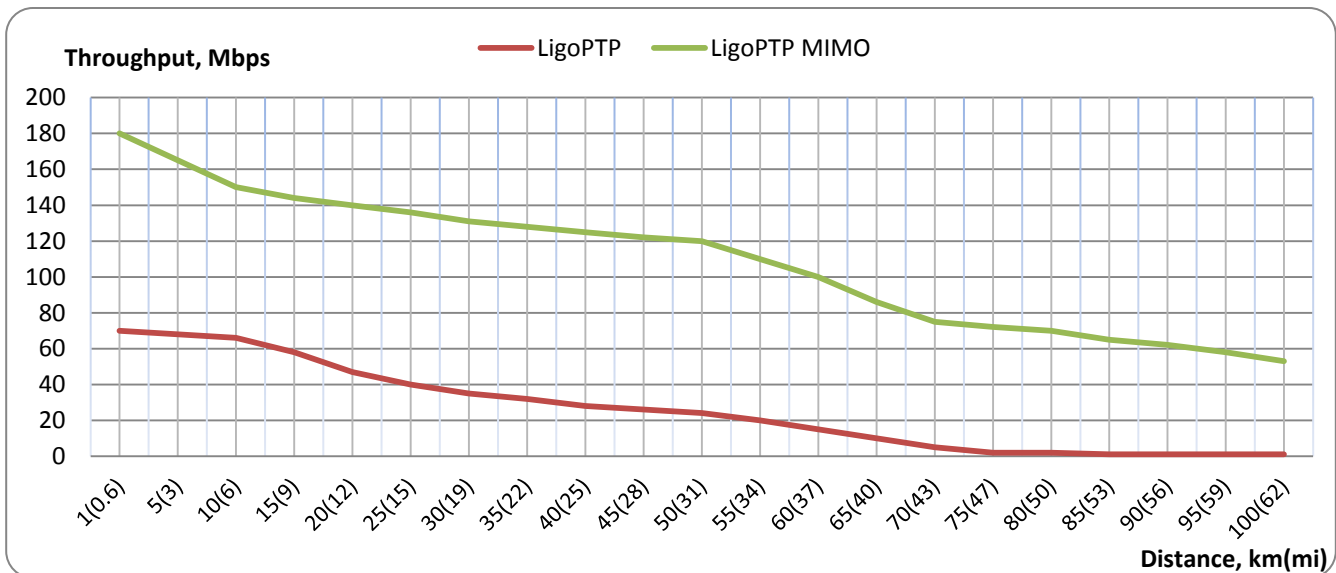

Figure4. Real aggregate data (net) throughput over distance

Microwave's PTP capacity

PTP's data throughput depends directly on channel width and modulation which is related with received signal level or fade margin. Microwave PTP depending on antenna can achieve very long distances, up to 100 km (62 mi) and more. For particular link performance estimation use LigoWave link calculator.
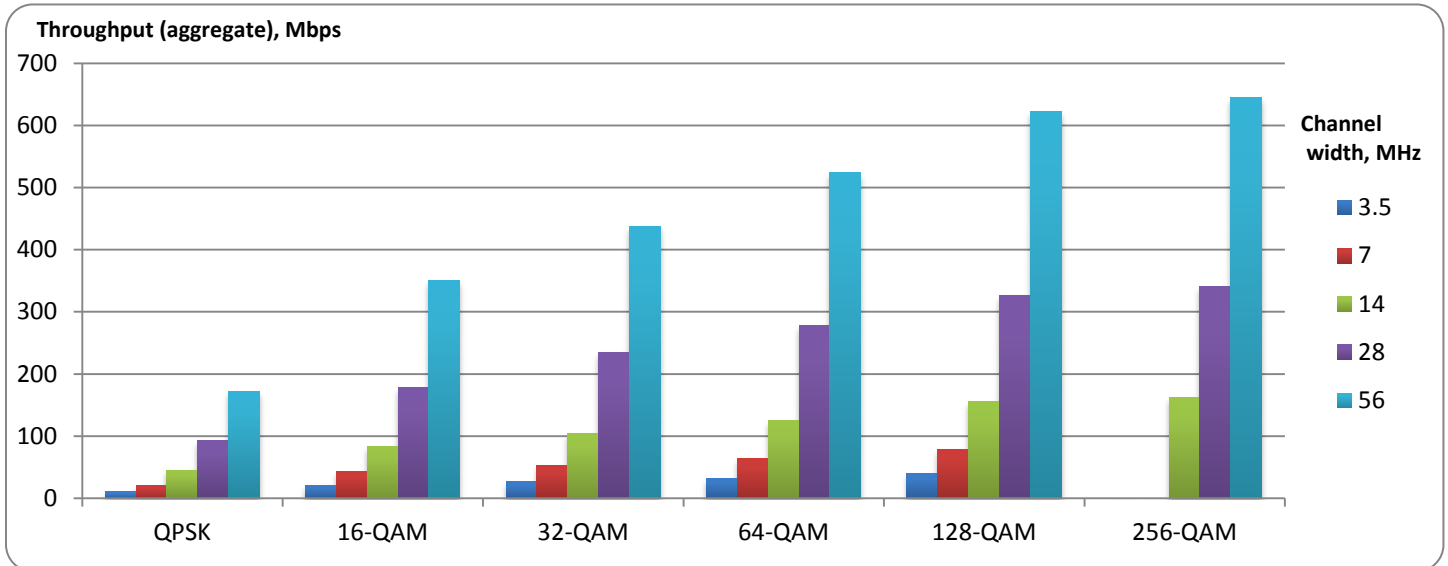

Figure5. PTP capacity according to different channel sizes and modulations

Microwave PTP capacity in Mbps

Channel width →	3.5	7	14	28	56
Modulation ↓					
QPSK	10	21	45	92	172
16-QAM	21	43	83	178	350
32-QAM	26	52	104	234	438
64-QAM	32	64	125	278	525
128-QAM	39	78	156	326	623
256-QAM	-	-	162	340	645

LigoPTP target markets

Market	General idea
Network operators	Our goal is to enable provisioning of high-throughput Point-to-Point connectivity for customers in places where required premises cannot be reached cost-effectively with a wired connection within a few hours of deployment. LigoWave is enabling operators to reach their new business and residential customers within the last mile using licensed and unlicensed bands. LigoPTP products provide reliable and high-speed internet connectivity together with a possibility to deliver value-added services including voice and video. No matter what the size of the operator, our products are an ideal and cost-effective solution offering ease of installation with a quick return on investment.
Healthcare, municipalities, education and public safety	Quick and cost-effective establishment of connections between new locations without the need to deploy additional wire/fiber lines. Our solutions permit government and municipal agencies to extend their networks and share their resources easily including safety problems like traffic monitoring and video surveillance.
Emerging markets and rural connectivity	Emerging markets and rural connectivity are among the top of the opportunities that need broadband communication, but normally the revenue per user is very low so there is a huge demand for cost-effective solutions. Despite bringing the quick return on investment, LigoPTP products ensure top level support, easy and quick installation of the units and reliable connectivity. Deployment of license-free products for the specific market brings the opportunity for operators to improve the quality of life for people living in more distant and unserved remote areas, at the same time extending their network coverage.
Video and surveillance	One of our missions is to provide backhaul connectivity for security projects that involve video monitoring where reliable and high-quality data transmission is required. Such projects usually involve traffic monitoring and video surveillance scenarios as the demand for safety and crime prevention is increasing. LigoPTP products make it easier to reach the destinations that are barely accessible with a wire line and help to reduce the crime rate and improve the safety of people living in the monitored area. Easy scalability, reliability and cost-effectiveness make LigoWave products ideal for video surveillance scenarios.
Oil and Gas	A good choice for backhaul of connectivity along the pipeline for various applications. LigoWave full outdoor units eliminate the requirement of additional building infrastructure for the repeater sites. In addition, there are many options to choose between licensed and unlicensed frequencies according to the market regulations and available budget.

LigoWave link calculator
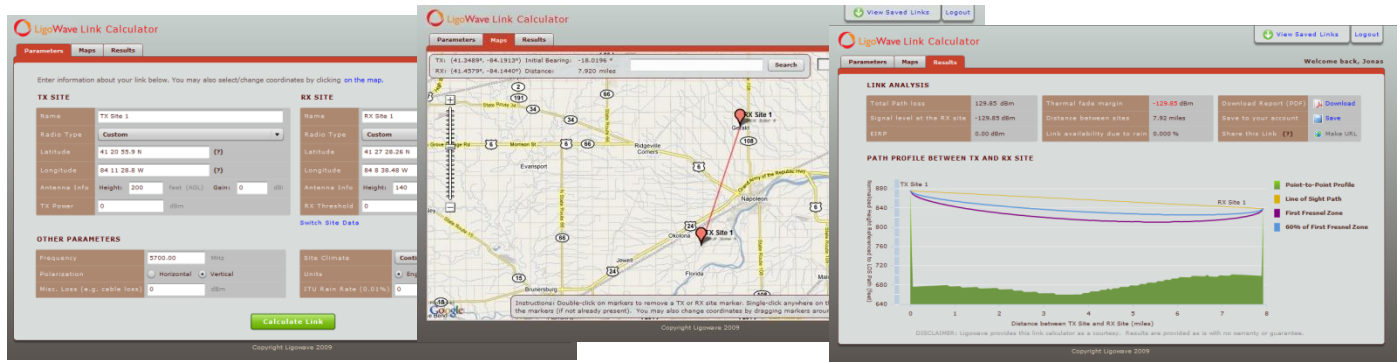
Picture1. Screenshots from LigoWave link calculator

LigoWave's link calculator is a link planning tool available online at http://www.ligowave.com/linkcalc/. The link calculator allows LigoPTP users to calculate link performance expectations taking into account geographical information, distance between the units, antenna height and gain, transmit power, and other factors in order to choose the most suitable product available from Ligowave's extensive product portfolio. In addition, custom calculations using other vendors' equipment specs can be used, making the Ligowave link calculator the ultimate link planning tool. At the same time, this tool is offered free of charge, and users only need to register to get quick and easy access to this very helpful tool. Additionally, each user is able to save and create a database of links, download a PDF document that contains all the necessary information about the link, and publish a hyperlink online so that it could be shown to other people during the evaluation process.

Summary:

- Easy and quick planning;

- Free online application and can be used with all wireless equipment;

- Has integration with Google maps;

- Allows storing, downloading and publishing data about the links online.

- PDF results can even be used by installation teams!

Warranty

All LigoWave LigoPTP equipment carries a 2 year warranty with full support – software updates and consultations.