LigoPTP series overview
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.
- 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.
LigoWave delivers high reliability and great performance point to point (PTP) solutions ideally suited to both small WISP and carriers, small companies and large enterprises, municipalities, public projects and others. LigoWave devices work in unlicensed and licensed frequency bands. Our equipment combines the latest wireless technologies (including microwave) and proprietary techniques to achieve best in the market results in a point to point scenario and with the quickest ROI.

LigoPTP product series is dedicated but not limited for following solutions:
• IP/Cellular backhaul
• Broadband access connectivity
• Rural connectivity
• Private networks
• Security and surveillance

### PRODUCT SUMMARY

<table>
<thead>
<tr>
<th></th>
<th>LigoPTP 1st gen.</th>
<th>LigoPTP PRO</th>
<th>LigoPTP 620S</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequencies, GHz</td>
<td>900 MHz, 2.4, 3.5, 4.9, 5</td>
<td>5 (5.1 - 5.9)</td>
<td>6, 7, 8, 11, 13, 15, 18, 23, 26</td>
</tr>
<tr>
<td>Channel size, MHz</td>
<td>5, 10, 20, 40</td>
<td>20, 40</td>
<td>7, 14, 28, 56</td>
</tr>
<tr>
<td>Capacity, Mbps</td>
<td>70 (35 full duplex)</td>
<td>220 (110 full duplex)</td>
<td>620 (310 full duplex)</td>
</tr>
<tr>
<td>PPS, k</td>
<td>50</td>
<td>60</td>
<td>&gt;1,000</td>
</tr>
<tr>
<td>Max distance</td>
<td>&gt;100</td>
<td>&gt;100</td>
<td>&gt;100</td>
</tr>
<tr>
<td>Duplexing system</td>
<td>Dynamic TDD</td>
<td>Dynamic TDD</td>
<td>FDD</td>
</tr>
<tr>
<td>Highest modulation</td>
<td>QAM 64</td>
<td>QAM 64</td>
<td>QAM 256</td>
</tr>
<tr>
<td>Data interface</td>
<td>10/100 Base-T</td>
<td>10/100/1000 Base-T</td>
<td>10/100/1000 Base-T</td>
</tr>
</tbody>
</table>
UNLICENSED BAND

1st generation LigoPTP products

- A wide range of frequency options (900 Mhz, 2.4 GHz, 3.5 GHz, 5 GHz)
- Flexible channel sizes (5, 10, 20, 40 Mhz)
- 70 Mbps of real capacity
- Advanced proprietary W-Jet protocol to enhance PTP communication
- High transmit power and high receive sensitivity ensure long range data links (up to 25 dB)
- Excellent packets per second value (up to 50,000)
- Low packet latency (<2 ms)
- External OLED screen for antenna alignment and throughput testing
- Advanced but easy to use operating system
- Professional articulating mounting bracket
- Integrated surge protection
- IP-67 standards compliant
- WNMS management system support

W-Jet protocol turns LigoPTP devices into extremely efficient wireless backhaul equipment

LigoPTP PRO

- 5.1-5.9 GHz frequency support (full 5 GHz spectrum)
- Flexible channel sizes (20, 40 Mhz)
- 220 Mbps of real capacity
- Advanced proprietary W-Jet 2 MiMo protocol to enhance PTP communication
- High transmit power and high receive sensitivity ensure long range data links (up to 30 dB)
- DFS 3 and ATPC support
- Excellent packets per second value (up to 60,000)
- Low packet latency (<2 ms)
- External OLED screen for antenna alignment and throughput testing
- Advanced but easy to use operating system
- Professional articulating mounting bracket
- Integrated surge protection (IEC standards compliant)
- IP-67 standards compliant
- WNMS management system support

W-Jet is LigoWave’s proprietary wireless protocol that combines special techniques to achieve superior performance and reliability even over long distances. The W-Jet protocol is the result of years of development and gives Ligowave PTP products the ability to outperform higher cost products on the market while improving the return on investment.
Wireless protocol comparison

The table and the graphs compare standard WLAN performance against W-Jet 2 protocol.

<table>
<thead>
<tr>
<th></th>
<th>WLAN 802.11n 1x1</th>
<th>WLAN 802.11n 2x2</th>
<th>W-Jet 2 / LigoPTP Pro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max data rate, Mbps</td>
<td>150</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>Max real throughput, Mbps</td>
<td>70 - 90</td>
<td>120 - 150</td>
<td>220</td>
</tr>
<tr>
<td>Max packet per second ratio, k</td>
<td>15 - 20</td>
<td>15 - 20</td>
<td>60</td>
</tr>
<tr>
<td>Max transmit power, dBm</td>
<td>20 - 25</td>
<td>20 - 25</td>
<td>30</td>
</tr>
<tr>
<td>Real data bit/Hz</td>
<td>1.75 - 2.25</td>
<td>3 - 3.75</td>
<td>5.5</td>
</tr>
<tr>
<td>Traffic symmetry</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The graph above represents LigoPTP 5-23 PRO and LigoPTP 5-N PRO throughput at different distances. The calculations were done with a 15 dB fade margin and no interference on the link.
**ADVANTAGES**

- **OLED screen for antenna alignment and link testing without a laptop on the tower.**
- **Best in class OS made for easy and reliable backhaul setup.** Smart auto-channel, auto-rate and automatic transmit power control makes link setup extremely easy.
- **Dynamic TDD protocol made for PTP applications delivers high PPS rate and low latency which are extremely important for reliable backhaul performance.**
- **Integrated spectrum analyzer.** It is a real-time spectrum scanning tool, which provides a graphical signal representation and displays maximum, average and current signal (noise) levels.
- **Internal link testing tool for on the spot link performance and PPS measurement.**

- **Grounding feature on the enclosure for ease in grounding the unit.**
- **Weather-proof IP-67 rated enclosure.**
- **External OLED screen for antenna alignment, link testing and statistical review.**
- **Integrated surge protection designed according to IEC standards.**
- **Professional N-connectors for external antenna (Note: all LigoPTP unlicensed band products come in an integrated antenna or N-connectorized version).**
- **Metal gland for Ethernet jack.**
- **Professional articulating mounting bracket for easy antenna alignment and reliable mounting.**
- **PoE adapter with a grounding option.**
**OLED screen overview**

During the antenna alignment procedure, current RSSI levels of the local and remote unit can be seen.

After link deployment, it can be tested with different packet sizes for additional performance optimization.

Various statistical information reviewing:
- Wireless settings
- TX/RX information
- Ethernet statistics
- Device information
- IP settings

External OLED screen allows easy rebooting and resetting the unit to defaults.

PIN code functionality is available for additional security of the LigoPTP units.

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**LinkCalc™**

Link calculator is a link planning tool available online. The link calculator allows 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 the LigoWave and Deliberant extensive product portfolios. In addition, custom calculations using other vendors' equipment specs can be used, making link calculator the ultimate link planning tool.

Available at: http://www.ligowave.com/linkcalc

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Google maps integration, Downloadable PDF reports, PTP and PTMP mode support, Online storage for saved calculations.
WNMS is a FREE enterprise grade Wireless Network Management system available for download at LigoWave’s website. A single software solution simplifies a large number of management and monitoring tasks for the network administrator. Comprehensive network management software supports several thousand devices. Main WNMS tasks:

- Supporting LigoWave, Deliberant and 3rd party equipment
- Multiple OS support (Windows, Virtual Machine, Linux)
- Network visualization on Google Maps
- Configuration and maintenance
- Monitoring and alerting
- Smart discovery and provisioning
- Statistical data collection and reporting

* For the control and monitoring of 3rd party equipment the SWEAP application is necessary

WNMS Cloud is a new mobile way to manage your network. The setup is as easy as 1-2-3 and you get your virtual WNMS server running online.

Highlights:
- Easy and quick WNMS server setup
- World-wide availability
- High reliability (based on Amazon cloud)
- Strong security (HTTPS and OpenVPN)
- No hardware and maintenance costs reducing CAPEX and OPEX
- Third party equipment monitoring through WNMS remote agent (SWEAP application)*

*Needs additional hardware, working as a data collector.
The LigoPTP 620S is a split architecture, 6-26 GHz product platform designed to provide high capacity transmission, flexibility, and convenience for wireless communication networks. The PTP 620S digital point-to-point radios represent a new microwave radio product line that is designed to address universal applications for both Ethernet and TDM platforms. This advanced technology platform is designed to provide a flexible, cost-effective platform for customers now and into the future.

The PTP 620S equipment is based upon a common platform to support a wide range of network interfaces and configurations, with capacities up to 2 E1 / T1 (optional) and Gigabit Ethernet Full Duplex capacity up to 310 Mbps (620 Mbps aggregate). The radio family is spectrum and data rate scalable, enabling service providers or organizations to employ appropriate system gain with spectral efficiency and channel availability for optimal network connectivity. The PTP 620S series digital radios enable network operators (mobile and private), government and access service providers to offer a portfolio of secure and scalable wireless applications for data, video, and voice services.

The PTP 620S digital radio family is composed of a LigoWave Software Controlled Smart IDU and an Outdoor Unit (ODU). The IDU is designed to be frequency independent, and the ODU is designed to be capacity independent. The PTP 620S IDU allows selection for multiple capacity options, modulation types, radio frequency channels and transmit output power levels to accommodate and adhere to world-wide regulatory and spectral efficiency requirements. The IDU supports 1 Gigabit Ethernet port for customer traffic as well as an additional Fast Ethernet port for management traffic. The IDU also supports an optional module for adding 2 E1 or 2 T1 ports to the unit for quick and easy provisioning of TDM traffic over the link.

The PTP 620S Digital Radio includes integrated Operations, Administration, Maintenance, and Provisioning (OAM&P) functionality and design features enabling simple commissioning when the radio network is initially set up in the field or at the customer’s premises.

Highlights:
• A total out of the box capacity of 620 Mbps (310 Mbps full duplex)
• Wide frequency range (6-26 GHz) and flexible channel sizes (7-56 MHz) made according ETSI and ANSI standards
• Multiple tools to simplify deployment and installation: spectrum analyzer, BER tester
• Adaptive coding modulation (ACM) and ATPC support
• Multiple interfaces: gigabit Ethernet and E1/T1 modules (optional)
• WNMS support for monitoring and alerting*

*LIGEAP application is necessary for WNMS support
**LigoPTP 620S capacity**

LigoPTP 620S data throughput depends directly on the channel size and modulation which is related to received signal level and fade margin. For a more detailed information on a specific link the LinkCalc should be used.

<table>
<thead>
<tr>
<th>Channel size -&gt;</th>
<th>3.5 MHz</th>
<th>7 MHz</th>
<th>14 MHz</th>
<th>28 MHz</th>
<th>56MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modulation</td>
<td>QPSK</td>
<td>16-QAM</td>
<td>32-QAM</td>
<td>64-QAM</td>
<td>128-QAM</td>
</tr>
<tr>
<td>QPSK</td>
<td>10 Mbps</td>
<td>21 Mbps</td>
<td>45 Mbps</td>
<td>92 Mbps</td>
<td>172 Mbps</td>
</tr>
<tr>
<td>16-QAM</td>
<td>21 Mbps</td>
<td>43 Mbps</td>
<td>83 Mbps</td>
<td>178 Mbps</td>
<td>350 Mbps</td>
</tr>
<tr>
<td>32-QAM</td>
<td>26 Mbps</td>
<td>52 Mbps</td>
<td>104 Mbps</td>
<td>234 Mbps</td>
<td>438 Mbps</td>
</tr>
<tr>
<td>64-QAM</td>
<td>32 Mbps</td>
<td>64 Mbps</td>
<td>125 Mbps</td>
<td>278 Mbps</td>
<td>525 Mbps</td>
</tr>
<tr>
<td>128-QAM</td>
<td>39 Mbps</td>
<td>78 Mbps</td>
<td>156 Mbps</td>
<td>326 Mbps</td>
<td>623 Mbps</td>
</tr>
<tr>
<td>256-QAM</td>
<td>-</td>
<td>-</td>
<td>162 Mbps</td>
<td>340 Mbps</td>
<td>645 Mbps</td>
</tr>
</tbody>
</table>

**Aggregate Throughput, Mbps**

![Aggregate Throughput Chart](chart.png)
### General idea to Solution

<table>
<thead>
<tr>
<th>Market</th>
<th>General idea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network operators</td>
<td>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 the 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.</td>
</tr>
<tr>
<td>Healthcare, municipalities, education and public safety</td>
<td>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.</td>
</tr>
<tr>
<td>Emerging markets and rural connectivity</td>
<td>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.</td>
</tr>
<tr>
<td>Video and surveillance</td>
<td>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.</td>
</tr>
<tr>
<td>Oil and gas</td>
<td>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.</td>
</tr>
</tbody>
</table>