# G.hn Technology Overview and Use Cases for Networking Solutions over Powerlines

**Gigabit Speeds Over Existing Wires**

1Gbps    1.7Gbps    1.7Gbps
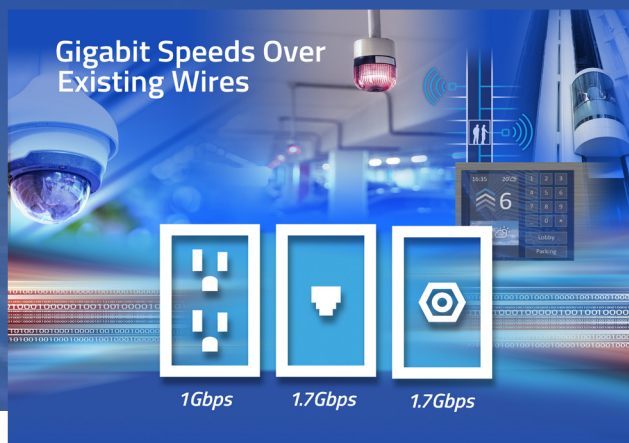
## Introduction

G.hn technology is a comprehensive standard for home networking that supports high-speed data transmission over various types of legacy wiring, including powerline, telephone wiring, coaxial cables, and plastic optical fiber. Developed under the International Telecommunication Union's Telecommunication Standardization sector (ITU-T), G.hn is specified in ITU-T Recommendations G.9960, G.9961. The HomeGrid Forum (HGF) plays a crucial role as the leading alliance for G.hn technology, supporting industry interaction, leading interoperability, driving certification, and promoting the technology.

This document focuses on the powerline communication (PLC) profile of G.hn, highlighting its speed, robustness, use cases, and the number of devices that can be connected. Additionally, this document explores the application of G.hn technology in power grids as a broadband over powerline (BPL) solution, industrial and automotive use cases. This document is intended for technology partners, providing a clear understanding of the technology's capabilities and benefits.

## Speed

G.hn technology offers impressive data transfer speeds, making it suitable for high-bandwidth applications. The PLC profile of G.hn can achieve speeds up to 1Gbps over powerlines. This high-speed capability ensures efficient data transmission for various applications, including streaming, gaming, and smart home devices.

## Robustness

One of the key strengths of G.hn technology is its robustness. The PLC profile provides reliable performance even in challenging environments.

G.hn includes advanced error correction mechanisms, such as low-density parity-check (LDPC) codes, which enhances data integrity and reduces the probability of transmission errors. Additionally, G.hn's ability to notch specific frequency bands helps avoid interference with other services, further improving its reliability. G.hn technology operates over a wide range of frequencies to optimize data transmission.

The PLC profile typically uses frequencies from 2MHz to 200MHz, but this can be reduced and adapted to maintain high performance across various environments. The technology also includes multiple-input multiple-output (MIMO) capabilities to increase data rates and signaling distance.

## Usage in Power Grid as BPL Solution

G.hn technology is being increasingly used in power grids, as a broadband over powerline (BPL) solution. This application leverages the existing powerline infrastructure to provide high-speed internet access and smart grid functionalities. G.hn can connect hundreds of devices in a multi-layer and self-organizing network based on advanced signal-to-noise ratio (SNR) algorithms. The GRID profile uses frequencies starting as low as 0.75MHz and up to 50MHz due to the nature of the power grid. For example, in Germany, G.hn is the technology of choice for smart metering gateways and other smart grid medium voltage power applications by E.ON Group.

## Industrial Use Cases

G.hn technology is well-suited for various industrial applications, operating over both DC (5V-48V) and AC powerlines. It provides a cost-effective way to enable digital transformation for traditional industrial businesses, by ensuring reliable connectivity, and maintaining the functionality of existing infrastructure. Some industrial use cases include:

- **Smart Lifting Systems:** G.hn can be used to connect and control smart lifting systems, ensuring real-time data transmission and operational efficiency.
- **Smart Traffic Lights:** G.hn enables the synchronization and control of smart traffic lights, improving traffic management and safety.
- **Smart Street Lighting:** G.hn provides a robust backbone for smart city lighting, enabling remote management and control, while adding HD surveillance cameras and high speed gateways.
- **Charging Stations:** G.hn can be used to manage and monitor charging stations for electric vehicles, ensuring efficient energy distribution and real-time data collection. For more information, refer to ITU-T GSTP-HNIA (2020-02)–Use of G.hn in Industrial Application.
  For a complete overview, refer to the HGF–White Paper G.hn Industrial IoT Use Cases.

## Automotive and Aviation Use Cases

G.hn technology can be applied in automotive and aviation use cases over DC power offering a viable alternative to single-pair Ethernet solutions and providing all required automotive-grade connectivity. Benefits include:

- **Reduced Weight:** By replacing traditional wiring with G.hn-based PLC, the overall weight of the vehicle can be reduced by 50kg-100kg, leading to improved fuel efficiency and performance.
- **Enhanced Connectivity:** G.hn provides robust and high-speed connectivity for various automotive applications, including infotainment systems, advanced driver-assistance systems (ADAS), and vehicle-to-everything (V2X) communication.
- **Automotive Grade Reliability:** G.hn technology meets the stringent requirements for automotive-grade connectivity, ensuring reliable performance in harsh environments.

## MaxLinear Contribution as the Leading Provider for G.hn

MaxLinear is currently the leading provider for G.hn Wave-2 solution, based on the successful acquisition of the Valencia based Marvell™ (DS2) team, driving innovation through significant R&D investment and the development of multiple profiles across the different use cases (for example, AC/DC powerlines, telephone wiring, coaxial cables, and plastic optical fibre).

MaxLinear is seeking to grow and expand the footprint of the G.hn technology through diversification into more challenging markets of automotive, industrial, and GRID. MaxLinear believes that the potential and scale is exponential, through collaboration with technology partners that pertain enhanced market knowledge and higher market penetration.

## Conclusion

G.hn technology, particularly its PLC profile, offers significant advantages in terms of speed, robustness, and flexibility. Its ability to deliver high-speed data transmission over existing powerlines, coupled with its robust performance and support for multiple profiles, makes it a valuable solution for modern networking needs based on current infrastructure. Combining the MaxLinear G.hn IP with the right technologies, it can create smart and effective solutions to expand into new markets.

Login/Register | Visit www.maxlinear.com and register for a myMxL account to access G.hn documentation and design tools

**MaxLinear, Inc.**
5966 La Place Court, Suite 100
Carlsbad, CA 92008
Tel.:+1 (760) 692-0711
Fax: +1 (760) 444-8598
www.maxlinear.com