

Powerline Modem Applications

Application Brief 5085

Introduction

Powerline modems utilize the ubiquitous power-line cables to transmit digital data.

The fact they use existing cabling infrastructure enables a communications link to be achieved without laying new cables.

The focus for powerline modems today is on low-speed less than 10kbps applications.

Powerline Modem Applications

Low-frequency power-line communication modems (PLMs) fit well into any application where a low data link is required where no communication infrastructure is in existence and where laying new/addition cables is either impossible or undesirable.

Examples of such applications are:

- Home appliance control
- Heating and ventilation control
- Lighting control
- Hotel entertainment systems

- Signs and information displays
- Vending Machines
- Laundromats
- Fire and security alarm systems
- Automatic meter Reading (AMR)

AMR is a particularly interesting (high volume) application in which many European utilities are actively engaged in developing or installing AMR meters utilizing power-line communications.

Powerline Modem Market

The TAM for AMR is 61 million units in 2003, with a forecasted compound annual growth rate of 20% until 2007. The SAM for Powerline Modem solutions in this market area is 14.7 million units, whereas Europe has the biggest share of 6 million units, followed by North America with 5.5 million, and Asia with 3 million units.

The market for Powerline Modems in Home Automation/ Networking applications is dominated by North America with 14 million node units in 2003 and a compound annual growth rate of 35%.

Agilent PLC Powerline DAA IC

Agilent Technologies is the world's leading provider of Opto Isolation products.

The HCPL- 800J is a galvanically isolated Powerline Data Access Arrangement IC. It provides the key features of isolation, Tx line driver and Rx amplifier as required in a powerline modem application.

Agilent's Powerline DAA IC serves as an Analogue Front End (AFE) in a Powerline Modem, and provides a high level of integration compared to traditional solutions for this application, and therefore enables board space reduction, as well as a significant reduction of the bill of materials.



Main Components of a Powerline Modem

1. Modem IC
2. Analog Front End (AFE)
3. Supplementary Microprocessor for error correction

1. Modem IC

The Modem IC traditionally carries out the modulation/demodulation function. In the transmit path the modem IC converts a serial data bit stream directly into a modulated signal which can be coupled onto the power-line.

In the receive path the modem IC converts the analog signal on the power-line to a serial bit stream.

2. Analog Front End (AFE)

To couple the Modem IC RX/TX signals onto the power-line an analog front end (AFE) is required.

The AFE provides voltage and current signal amplification and galvanic isolation to protect the user and equipment from both the normal 230 VAC line voltage and from much higher transient voltages frequently appearing on the lines. The AFE is traditionally a complex analog circuit requiring the use of many discrete components including bulky isolation transformers.

3. Error Correction

The digital data stream from the demodulator in the receiver of the modem IC is more often than not punctuated by frequent data bit errors caused by noise transients on the power line.

To counter these bit errors and ensure communication reliability, the modem IC is normally supplemented with a microprocessor, which is used to perform error correction such as forward error correction (FEC) together with cyclic redundancy check (CRC).

Reference Design: Agilent/Freescale (Motorola) Powerline Modem

Agilent's contribution to a Powerline Modem application lies in providing the AFE part of the solution. The Agilent HCPL-800J is designed to work with various Modem ICs. Figure 1 shows a reference design using a Freescale Modem IC as an example.

The Agilent/ Freescale solution offers a highly integrated alternative to traditional powerline modem solutions.

1. Freescale DSP56F801

The use of the Freescale DSP56F801 effectively combines the modem IC and microcontroller function into a single chip.

Furthermore the DSP processor has enough processing overhead to include additional error correction features further improving communication reliability.

The flash based program ensures that it can easily be modified to accommodate many variants of power-line modems standards, even potentially allowing for the user application to be integrated.

2. Agilent HCPL-800J

To couple the transmit/ receive signal onto the power-line an AFE based on the HCPL-800J is used.

The use of this highly integrated optical based solution in this application provides not just a large reduction in the bill of materials (BOM), it also provides significant performance advantages.

Value Proposition

The Agilent/ Freescale powerline modem solution provides a much higher level of integration than traditional solutions that leads to savings on board space, significant reduction of discrete parts used.

Performance advantages over traditional solutions are:

Freescale DSP56F801

- Meets CENELEC EN50065-1 Regulations
- 10kbs Raw data rate
- Forward Error Detection (FEC)
- Bit interleaving
- 16 bit Cyclic Redundancy Check (CRC) Data Encryption

Agilent HCPL 800J

- Compact AFE with inbuilt Power Supply
- Low distortion line driver- No external filter required to meet regulatory requirements. Resulting in very high coupling efficiency, which allows low signal attenuation under all line conditions.
- High power >1A line driver. Ensures low transmission attenuation under all line conditions.
- Highly efficient line driver significantly reduces PLM power requirements.
- High surge isolation - User application very well protected from power-line surges. Application robustness is not compromised with addition of PLM.
- High signal isolation - Common mode noise at receiver reduced. Improves communication performance.

Related Information

Related useful Information on Powerline Modem applications and related products

Application Note 5074

Data Sheet 5989-0402EN

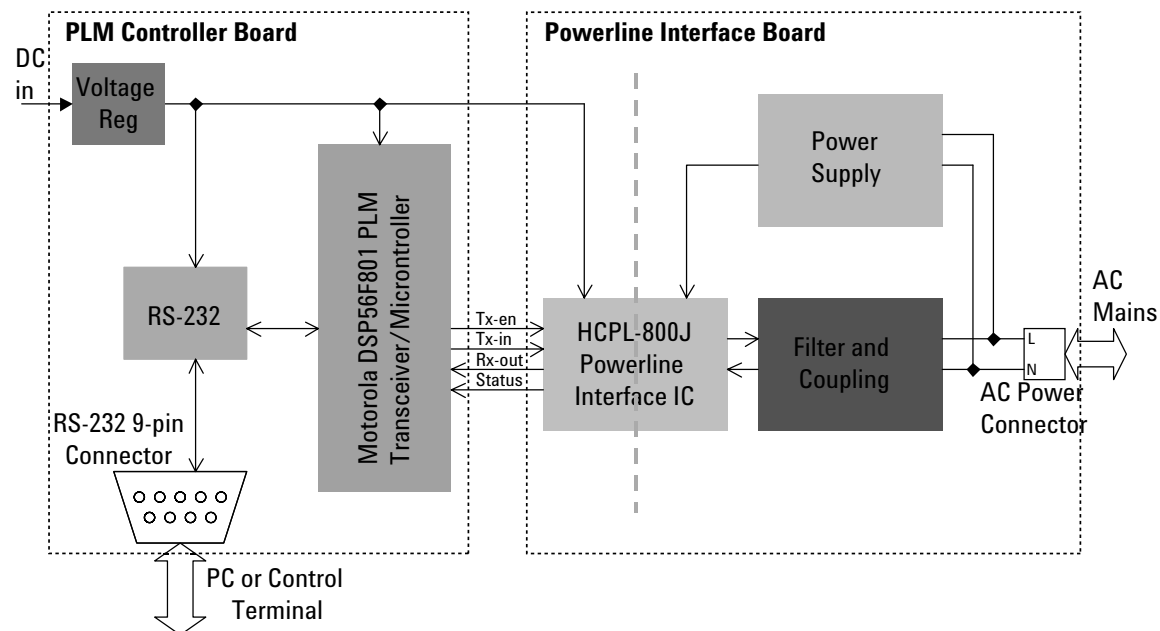


Figure 1. Reference Design – Powerline Modem Application

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