

How to Coupe with PLC Technology Barriers

General

The HomePlug standard dominates the Power-Line Communication (PLC) and gets its strong support from the HomePlug Alliance. Recently a new standard (and products) have been released trying to coupe with user's complains and to overcome major PLC problems – the HomePlugAV standard.

In order to install and use the PLC technology it is important to understand all factors that might affect the PLC communication performances and usability.

1. Many factors are behind the user ability to control them at all, such as: Powerline grid configuration, number of apartments per powerline transformer, apartment's main switch and counter in the building and the apartment powerline distribution per phase.
2. Some factors can be controlled to some extent:
 - A. Home appliances and electronic devices usages – the use of any kind of equipment generate some noise over the powerline wires. Simultaneously operation of many devices might generate a fundamental interference that could affect the PLC communication performance.
 - B. Adjacent apartment interferences - Interferences could leak via the powerline wires from adjacent apartments and to affect the communication performance (see further – privacy issue).
 - C. Apartment electrical junction boxes and power-outlets – In old apartments the wiring connections could have higher resistance that might affect the communication performance. It is a good safety measure to ask and electrician to check all wires connection status.
3. Factors that the under the end-user control:
 - A. Power Strips - The power strip issue is related to the fact that all electronic equipment/deviceschargers/power-adapters have a build in RF filter in order to suppress radiation or interference in frequencies above one megahertz. These filters are summing up (they are connected in parallel) and introduce a very low impedance to the PLC adapter. In other words – The PLC transmission is loaded by low impedance that affects the signal strength/amplitude dramatically. Unfortunately the end user requires a power-strip next to the PLC adapter since he needs to plug to the power his computer, monitor, printer, speakers and other stuff like smart phone, lamp or TV sets.

The solution is to plug the PLC adapter in a different power outlet or in the worst case to plug it next to the power-strip power cord.
 - B. Multi-Phase – The home electricity network is based today on multi-phase configuration in order to split loads, reduce current levels and assist power stations to be more efficient. In this arrangement the apartment is divided to zones where each zone is feed from a different phase. The PLC signal has to find a path how to cross between phases and usually it happened as a radiated signal between the phases. No one can predict how it will happen. The signal can radiate among adjacent wires, over multi-phase washing machines, air-conditions and even the multi-phase power meter. Therefore the signal might be too week for a reliable communication between the phases.

There is no a simple solution for this problem; each one is expensive in some ways and related to safety issues:

- Installing a multi-phase cross filter. The filter is not expensive but requires an electrician in order to install it.
- Adding PLC repeaters on each phase – this will boost the signal but it is expensive and consume bandwidth (increase interference).

C. Privacy – Since the electrical grid feeds many apartments/houses per one transformer, it means that signal from one apartment can easily leak to adjacent apartment (a similar phenomena like wireless where you can "collect" other users).

Two methods can be used in order o coupe with this issue:

- Using the build in PLC security key, where many people are not changing the factory default mode (similar to wireless problem).
- Adding a blocking filter at the circuit breakers box (or the power meter location). The filter is not expensive but it requires an official electrician in order to install it.

Conclusions

Today the HomePlug AV standard is more suitable for PLC communication. Beside relatively high price tag, the technology still can not assure a continuous and stable link for multi video channels. The usage of PLC is relatively convenient but other technologies such as HoempNA3 might be better for multimedia networks.