Abstract: HV Broadband Over Power Lines

The Transmission Smart Grid (TSG) will require broadband, low-latency, secure connectivity between transmission stations and from these stations to their control centers. With such a platform in place, faster and more reliable control, protection, and grid status information becomes possible. Broadband Over Power Line (BPL) has been identified as a viable communications platform to enable the Transmission Smart Grid. BPL has been implemented on medium voltage distribution lines, but not until now had it been applied to HV lines. Yet, HV transmission lines actually represent a far better medium for BPL because they are much more uniform and have none of the discontinuities inherent in the many devices installed on distribution lines.

Seeking ways to reliably couple HV BPL signals onto the HV wire and to repeat the signal as it attenuates with distance, Amperion and American Electric Power (AEP) conducted proof-of-concept testing in 2006 on a short 46 KV line in West Virginia. The results indicated that digital relaying and supervisory control and data acquisition (SCADA) could be supported using BPL on HV lines.

AEP and Amperion have now tested BPL over a 69 KV, 5-mile line connecting three AEP stations. Reliable communications at over 10 megabits/second, with typical latency of about 5 to 10 milliseconds, have been achieved. Distances range from approximately 4 miles without repeating, to more than 5 miles with just one repeater—all while complying with FCC emission limits. Deployment at 138 KV is scheduled to begin next month.

These results strongly indicate that high-speed, digital communications over HV transmission lines can often be a viable alternative to traditional optical communication approaches, and at a small fraction of the cost. Additionally, circuit deployment times are days rather than months.

HV BPL bandwidth, security, and latency are all expected to support the most demanding combination of Smart Grid applications. Testing in the lab and on the system is underway to integrate the most advanced TSG applications with HV BPL channels so that commercial deployments can begin next year.