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Simulation of low-voltage narrow-band power line communication networks to propagate openADR signals

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Abstract— This study analyzes the performance of power-line communications for sending open automated demand response (OpenADR) signals. In particular, we study main channel disturbances that can affect end-to-end communications and which have not been previously studied in detail. Our analysis takes into account physical phenomena, such as background and impulsive noise sources, channel attenuation, and multipath effects, and considers the physical, network, and applications layers of the communications structure. The performance of the physical layer is the basis for computing the packet error rate. In analyzing application performance, we focus specifically on the latency in several communication environments. If a channel is impaired only by background noise, latencies are less than 40 seconds. With the addition of impulsive noise in the channel, this value increases as long as 68 seconds. Using these figures, we find that power-line technology is more suitable for "slow" demand programs, such as day-ahead or day-of curtailments, rather than ancillary services markets, which require near-real-time communication.

Index Terms— Matlab, network performance, OMNeT++, OpenADR, power line communications, PRIME.

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