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Noise modeling for standard CENELEC A-band power line communication channel

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Abstract

Power line communications (PLC) usage of low-voltage electrical power supply network as a medium of communication provides an alternative for the telecommunication access and in-house communication. Historically, power lines were majorly used for controlling appliances, however, with recent technology advancements power lines are now able to compete favorably and successfully with other relatively stable home automation and networking technologies like fixed line and wireless.

Regardless of the advantages PLC has to offer, like every other communication technology, it has its own technical challenges it must overcome to be fully deployed and maximize its full potential. Such challenges includes noise, which can originate from appliances connected across the network or can be coupled unto the network. Harmful interference to other wireless spectrum users such as broadcast stations, and signal attenuation are other challenges faced by usage of the power line as a communication medium. PLC suffers the risk of not living up to its full development as a reliable means of communication if proper understanding of the channel potential and characteristic is not known. Therefore, understanding of the channel potential and characteristics can be obtained through measurement and modeling of the PLC channel. This model and measurements of the channel characteristics can then be utilized in designing a good PLC system which is able to withstand and mitigate the effect of the different kind of noise and disturbance present on the PLC network.

This research therefore aims at formulizing and modeling the error pattern/behavior of noise and disturbances of an in-house CENELEC A-band based on experimental measurements. This is achieved by carrying out a real time experimental measurement of noise over a complete day to show the noise behavior. Error sequences are then generated from the measurement for the different classes of noise present on the CENELEC A-band and the use of Fritchman model, a Markovian chain model, is then employed to model the CENELEC A-band channel. This involves the use of Baum-Welch algorithm (an iterative algorithm) to estimate the model parameters of the three-state Markovian Fritchman model assumed. This precise channel model can then be used to design a good PLC system and facilitate the design of efficient coding and/or modulation schemes to enhance reliable communication on the PLC network. Therefore, answering the question of "*how to formulize and model the error pattern/behavior of noise and disturbances of an in-house CENELEC A-band based on experimental measurements".*