Adaptive Frequency Offset Estimation for Practical Satellite Communication Channels

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***Abstract*—We have recently implemented a poly-polarization multiplexing (PPM) system as a hardware prototype in order to demonstrate its high spectral-efficiency in a satellite channel. The Luise and Reggiannini (L&R) algorithm is one of the frequency offset estimation methods suitable for use with the Digital Video Broadcasting - Satellite (DVB-S2) standard, and has also been implemented in our PPM receiver. In order to provide sufficient performance at the lowest SNR of about -2 dB, it is recommended to average the correlation estimates over 2048 frames. In higher SNR regions however, such a large averaging size is unnecessary and by reducing the size, the system can be made more responsive to changes in the channel state. In order to reduce the latency, we propose to measure the average noise power and select an efficient frame averaging length using a look-up-table. We show that the benefits of the proposed adaptive architecture can be extended to short UW lengths through increasing the separation of the UW symbols. Performance results show that the size of the averaging window can be substantially reduced whilst maintaining a target BER.**

***Keyword*—satellite communications, polarization multiplexing, frequency offset estimation, adaptive algorithm, latency reduction, performance investigation, hardware implementation.**

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