PAPR Reduction of FBMC Using Hybrid and k-Hybrid Techniques

Arun Kumar[1*]

[1]*JECRC University, Jaipur, India*
*ORCID: 0000-0001-7640-8975, e-mail: arun.kumar1986@live.com

Abstract—FBMC-OQAM is reflected as one of the most capable techniques for the next generation mobile communication namely 5G. It has several advantages as compared to orthogonal frequency division multiplexing (OFDM) but it also has some drawbacks like high peak power. Filter bank multi-carrier (FBMC) employs a group of filters at the transmitter and the receiver part of the system. The high peak power decreases the efficiency FBMC system. In this study, a joint (hybrid) peak to average power ratio (PAPR) reduction technique is carried out by using partial transmit sequence (PTS) and tone reservation (TR) for FBMC signals. The blocks of data signal are split into numerous segments and the blocks of each segment are decided on the basis of overlapping factor. In every part, we pick out the optimal block of data to transmit and mutually consider the contiguous coincided block to accomplish reduce peak signal. The simulation results reveal that the proposed technique is better than the conventional PAPR reduction technique. Additionally, k-hybrid PAPR reduction technique is carried out. It is observed that the performance of the proposed k-hybrid technique is better than the hybrid technique.

1. INTRODUCTION

Filter bank multi-carrier (FBMC) is one of the most promising transmission techniques for 5G mobile communication system. Orthogonal frequency division multiplexing (OFDM) is the latest modulation technique used in existed communication system. Insertion of cyclic prefix (CP) in OFDM results in wastage of bandwidth and also results in out band radiation.

To estimate the disadvantage of OFDM system FBMC has drawn the attention of many academic researchers. As a promising modulation technique for next generation mobile communication it uses the pulse shaping property of bank of filter and alternate Offset-QAM (OQAM) data, intrinsic signal double the information rate of FBMC, are weighted on the carrier of FBMC. Therefore, FBMC utilizes the bandwidth in an efficient manner. Moreover FBMC donor uses CP results in higher speed as compared to OFDM [1].

Peak average power ratio (PAPR) is one of the biggest problems in a multi carrier system. It normally takes place when an amplifier swings from linear region to nonlinear region due to high power peak. It drastically reduced efficiency of the FBMC system. High PAPR is one of the common problems for OFDM and FBMC system.

Several PAPR reduction techniques for OFDM system have been studied and suggested [2–4]. PAPR reduction techniques cannot be utilized in FBMC system due to its overlapping structure. Several PAPR reduction techniques have been suggested for FBMC system [5–7]. In [8] overlapping structure problem of FBMC has been held into the consideration of implementing a PAPR reduction technique based on SLM (selective mapping). The authors in [9] suggested an SLM and AS (alternate signal) PAPR reduction technique for FBMC system. Even so, it necessitates the additional bandwidth to achieve the peak reduction signals. In [10], the authors suggested a sliding window tone reservation (SWTR) PAPR reduction schemes. The proposed technique uses peak reduction signal of many continuous symbols to do away with the amplitude power of the FBMC system.

In [11] tone reservation (TR) PAPR reduction technique is suggested. It takes on a clipping distortion. The TR technique achieves the clipping noise by utilizing the superimposed arrangement of FBMC system. In [12], the authors proposed a segmental partial transmit sequence (S-PTS) technique which splits the

ADDITIONAL INFORMATION

REFERENCES

1. S. Ikni, D. Abed, S. Redadaa, M. Sedraoui, "PAPR reduction in FBMC-OQAM systems based on discrete sliding norm transform technique," *Radioelectron. Commun. Syst.* **62**, No. 2, 51 (2019). DOI: 10.3103/S0735272719020018.
2. Z. Tong, Y. Hu, W. Zhang, "PAPR reduction in CO-OFDM systems using IPTS and modified clipping and filtering," *Optoelectron. Lett.* **14**, No. 3, 209 (2018). DOI: 10.1007/s11801-018-7210-2.
3. H.-S. Joo, S.-J. Heo, H.-B. Jeon, J.-S. No, D.-J. Shin, "A new blind SLM scheme with low decoding complexity for OFDM systems," *IEEE Trans. Broadcast.* **58**, No. 4, 669 (2012). DOI: 10.1109/tbc.2012.2216472.
4. X. Qi, Y. Li, H. Huang, "A low complexity PTS scheme based on tree for PAPR reduction," *IEEE Commun. Lett.* **16**, No. 9, 1486 (2012). DOI: 10.1109/lcomm.2012.072012.121228.
5. A. Hasan, M. Zeeshan, M. A. Mumtaz, M. W. Khan, "PAPR reduction of FBMC-OQAM using A-law and Mu-law companding," *Proc. of 2018 ELEKTRO*, 21-23 May 2018, Mikulov, Czech Republic (IEEE, 2018), pp. 1-4. DOI: 10.1109/elektro.2018.8398246.
6. S. Hu, G. Wu, Q. Wen, Y. Xiao, S. Li, "Nonlinearity reduction by tone reservation with null subcarriers for WiMAX system," *Wireless Pers. Commun.* **54**, No. 2, 289 (2010). DOI: 10.1007/s11277-009-9726-z.
7. D. Na, K. Choi, "Low PAPR FBMC," *IEEE Trans. Wireless Commun.* **17**, No. 1, 182 (2018). DOI: 10.1109/twc.2017.2764028.
8. S. S. K. C. Bulusu, H. Shaiek, D. Roviras, "Potency of trellis-based SLM over symbol-by-symbol approach in reducing PAPR for FBMC-OQAM signals," *Proc. of IEEE Int. Conf. on Commun.*, 8-12 Jun. 2015, London, UK (IEEE, 2015), pp. 4757-4762. DOI: 10.1109/icc.2015.7249075.
9. Y. Zhou, T. Jiang, C. Huang, S. Cui, "Peak-to-average power ratio reduction for OFDM/OQAM signals via alternative-signals via alternative-signal method," *IEEE Trans. Veh. Technol.* **63**, No. 1, 494 (2014). DOI: 10.1109/tvt.2013.2273557.
10. Shixian Lu, Daiming Qu, Yejun He, "Sliding window tone reservation technique for the peak-to-average power ratio reduction of FBMC-OQAM signals," *IEEE Wireless Commun. Lett.* **1**, No. 4, 268 (2012). DOI: 10.1109/wcl.2012.062512.120360.
11. V. S. Kumar, S. Anuradha, "Notice of removal: Sliding window tone reservation using smart gradient projection method for PAPR reduction of FBMC signals," *Proc. of Int. Conf. Elect.*, *Electron.*, *Signals*, *Commun. Optim.*, 24-25 Jan. 2015, Visakhapatnam, India (IEEE, 2015), pp. 494-499. DOI: 10.1109/eesco.2015.7253695.
12. C. Ye, Z. Li, T. Jiang, C. Ni, Q. Qi, "PAPR reduction of OQAM-OFDM signals using segmental PTS scheme with low complexity," *IEEE Trans. Broadcast.* **60**, No. 1, 142 (2014). DOI: 10.1109/tbc.2013.2282732.
13. S. Vangala, S. Anuradha, "Hybrid PAPR reduction scheme with selective mapping and tone reservation for FBMC/OQAM," *Proc. of 3rd Int. Conf. on Signal Process.*, *Commun. Netw.*, 26-28 Mar. 2015, Chennai, India (IEEE, 2015), pp. 1-5. DOI: 10.1109/icscn.2015.7219877.