BER PERFORMANCE OF OQAM BASED CIRCULAR FILTER BANK MULTICARRIER COMMUNICATION

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Abstract - In this paper, filter bank-based multicarrier systems making use of a quick convolution method are explored. We reveal that making use of balanced out quadrature amplitude inflection allows us to execute FFT/IFFT-based convolution without overlapped handling, and also the round distortion can be disposed of as a component of orthogonal disturbance terms. This residential property has 2 benefits. Initially, it causes spooky effectiveness improvement in the system by getting rid of the model filter transients. Second, the intricacy of the system is considerably minimized as the outcome of utilizing effective FFT formulas for convolution. The brand-new plan is compared to the traditional waveforms in regards to out-of-band radiation, orthogonality, spooky effectiveness, as well as intricacy. The efficiency of the receiver as well as the equalization approaches are checked out as well as compared to various other waveforms via simulations. In addition, based upon the time-variant nature of the filter action of the recommended plan, a pilot-based network evaluation strategy with regulated transfer power is created as well as evaluated with lower-bound derivations. The recommended transceiver is revealed to be an affordable option for future cordless networks.

Keywords: *orthogonality, FFT, 5G wireless communication, brand-new plan, cordless networks .*

I. INTRODUCTION

Increasing demands for higher data rates in mobile communication and 5G new radio (NR) requirements such as Internet of Things (IoT), Gigabit wireless connectivity, and tactile Internet is an ultimate challenge to provide a uniform service experience to users. To this end, the new physical layer should provide two essential features. First, dynamic aggregation of non-adjacent bands to acquire higher bandwidths for data transmission. Second, asynchronous transmissions to reduce signaling overhead and handling sporadic IoT traffic. The features necessitate a new waveform which provides very low out of band radiation (OoBR), as well as immunity against synchronization errors. For years, single-carrier modulation was the dominant waveform for systems such as satellite communications, GSM, CDMA, etc. In such systems, the channel becomes more dispersive as the bandwidths increases, and the conventional time domain equalization methods are not effective. Multicarrier modulation with its appealing characteristics such as single-tap equalization and adaptive modulation techniques, presents the critical element in efficient spectrum usage by activating the subcarriers in the available frequency slots.

II. RELATED STUDY

The fifth generation (5G) of cellular networks is coming. One of the main requirements of 5G networks is to increase the data rate about 1000 times the current data rate of 4G networks. To support such a huge rate increase, intensive research on the physical layer – the waveform design has been carried out. Orthogonal frequency division multiplexing (OFDM), which is the dominant technology for 4G networks, can still be a good candidate for 5G networks since it has good qualities such as efficient implementation, single tap equalization for each subcarrier, and being easy to pair with MIMO. However, the high peak-to-average-power ratio (PAPR) and spectral side lobes of OFDM signals need to be addressed. Generalized frequency division multiplexing (GFDM) is proposed for the air interface of 5G networks. In GFDM, the information symbols are organized in an array of subcarriers and sub symbols. The complex symbols on each subcarrier are filtered with a filter that is circularly shifted in time and frequency of a prototype filter. Filtering helps to improve the spectrum localization of GFDM signals. However, it makes subcarrier signals no longer orthogonal, hence resulting in both inter-symbol interference (ISI) and inter-carrier interference (ICI). Nevertheless, efficient detection techniques can eliminate this interference. In particular, for an additive white Gaussian noise (AWGN) channel, a receiver based on the matched filter and iterative interference cancellation can achieve almost the same symbol error rate of an OFDM system. In a frequency selective channel (FSC), proposes a combination of GFDM with the Walsh-Hadamard transform (WHT) to achieve frequency diversity and improve the system performance.

III. AN OVERVIEW OF PROPOSED SYSTEM

Since C-FBMC is analogous to GFDM, several research works provide comparisons of the two techniques. Reference compares C-FBMC with GFDM in terms of the bit error rate and implementation complexity over an AWGN channel. The authors conclude that GFDM and C-FBMC perform more or less the same for small constellation sizes and when the number of symbols per packet is odd. As the constellation size increases, C-FBMC performs significantly better than GFDM. The authors provide extensive comparisons of C-FBMC and other candidate waveforms for 5G. The paper also proposes efficient implementations for the transceivers. However, to the best of the authors' knowledge there is no study on precoding techniques for C-FBMC to harvest frequency diversity in FSCs. This paper applies WHT to C-FBMC to improve its bit error rate (BER) performance over FSCs. In a FSC, the performance of C-FBMC might be severely affected by a few bad subcarriers, which experience deep fade. To address this issue, a unitary precoder is widely used so that the information symbols are distributed on all subcarriers and the information can still be recovered even when the channel severely attenuates a subset of subcarriers. Among many types of precoder, the WHT precoder is adopted in this paper since it has equal-magnitude elements and can be implemented with only additions. The theoretical approximation for the BER of the resultant scheme, WHT-C-FBMC, is derived. Its BER performance is also compared to the performance of precoded GFDM.

In the proposed WHT-C-FBMC system, the information symbols are processed in blocks, each involving K subcarriers and M time slots. Let sk,m = s R k,m + jsI k,m be the complex QAM data symbol associated with the kth subcarrier and mth time slot. To enable offset QAM (OQAM) modulation, the real and imaginary parts of a complex QAM symbol are separated and arranged in a K × 2M matrix as follows:

$$\mathbf{A} = \begin{bmatrix} a_{0,0} & a_{0,1} & \cdots & a_{0,2M-1} \\ a_{1,0} & a_{1,1} & \cdots & a_{1,2M-1} \\ \vdots & \vdots & \ddots & \vdots \\ a_{K-1,0} & a_{K-1,1} & \cdots & a_{K-1,2M-1} \end{bmatrix}$$

$$= \begin{bmatrix} s^R_{0,0} & s^I_{0,0} & \cdots & s^R_{0,M-1} & s^I_{0,M-1} \\ s^R_{0,0} & s^I_{0,0} & \cdots & s^R_{0,M-1} & s^I_{0,M-1} \\ \vdots & \vdots & \ddots & \vdots & \\ s^R_{0,0} & s^I_{0,0} & \cdots & s^R_{0,M-1} & s^I_{0,M-1} \end{bmatrix}.$$

In spite of advantages over OFDM, there are some open issues to be solved in order to make FBMC a viable solution in practical applications. Potentially, FBMC has better spectral efficiency compared to OFDM thanks to OQAM modulation and CP removal. However, the actual efficiency decreases due to the filter transients when passing the transmit signal through the polyphase filter. Assuming an unlimited transmission block, this overhead is negligible. Nevertheless, when the transmission data is divided to shorter blocks, significant overhead incurs due to the tail effect in FBMC.

The impact of CFO on the sub channels of the waveforms is shown in Fig. 12. In this simulation, one of the sub channels is shifted in frequency domain to evaluate the signal to interference ratio in the adjacent sub channels. As it can be seen, localization of FBMC in frequency domain enables it to minimize the interference on the sub channels, which is a pivotal advantage in separation of users in multiuser scenarios. While the performance of CFC-FBMC and WCP/COQAM is very close to FBMC, OFDM suffers from very high interference in the adjacent sub channels.

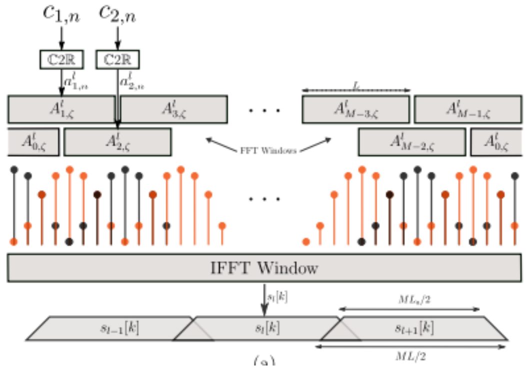

Fig.3.1. FBMC systems using fast convolution scheme.

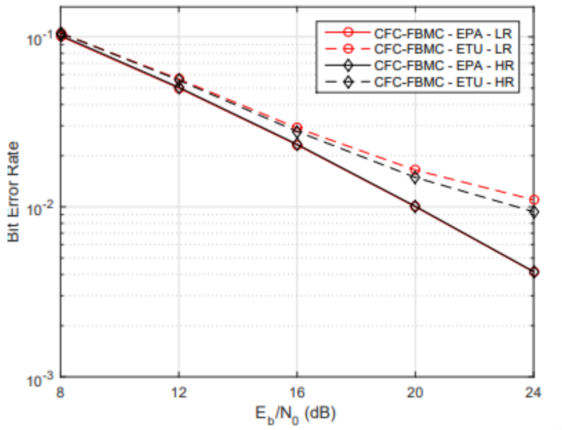

Fig.3.2. Output results.

IV. CONCLUSION

A unique framework for filter financial institution based multicarrier systems has actually been explored utilizing rapid convolution strategy. We revealed manipulating balanced out quadrature amplitude inflection, allows us to do FFT/IFFT based convolution without overlapped handling while the round distortion can be disposed of as a component of orthogonal disturbance terms. Making use of such home, considerable renovations was accomplished in regards to spooky effectiveness, orthogonality, intricacy and also the web link degree efficiency contrasted to traditional FBMC systems. Efficiency of the receiver as well as equalization approaches were checked out and also compared to various other waveforms complete simulations. Furthermore, based upon the moment alternative nature of the filter action of CFC-FBMC, a pilot based network estimate method with regulated transfer power was suggested and also evaluated versus reduced bound derivations. The suggested transceiver was revealed to be an affordable waveform handling for future cordless networks.

V. REFERENCES

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