Review of Emerging Techniques in 5G Communication Systems

Lukas Steiner, Anna Gruber, Felix Hofer, Maria Leitner*

Department of Materials Science, Graz University of Technology, Graz, Austria
Department of Mechanical Engineering, Graz University of Technology, Graz, Austria
Department of Industrial Engineering, Graz University of Technology, Graz, Austria
Department of Manufacturing Engineering, Graz University of Technology, Graz, Austria

ABSTRACT

The review of various multiplexing techniques which are used in different mobile communication networks and wireless system. The most emergent and used wireless communication technologies now a days are 3G and 4G, also termed as LTE technique. The most efficient multiple access for wireless technologies is OFDM system, which has been adopted for 3G and also 4G-LTE. Now as the technology is being advanced to fifth generation technique, there are some drawbacks of OFDM system so the new various filtering techniques are the emerging waveform contenders for 5G wireless technology which are FBMC, UFMC and OFDM. All the two techniques have been discussed here in this paper.

KEYWORDS: 5G, UFMC, FBMC, OFDM, etc.

I. INTRODUCTION

The mobile wireless communication technology has evolved from 1G to 5G generations. The Fifth generation technologies offer different new advanced features which makes it most powerful and in huge demand in the future. Now day's various wireless technologies are present such as third generation mobile networks, LTE, WiFi, WiMAX, as well as sensor networks, or personal area networks. The all wireless communication network and mobile networks implements all IP principle, means all data and signaling will be transferred via IP on network layer. Fifth generation technology provide facilities like camera, and large phone memory etc. Increasing Internet data traffic has driven the capacity demands for currently deployed 3G and 4G wireless technologies. The intensive research toward fifth generation wireless communication is progressing in many fronts. In this paper scratches the surface on various 5G activities through reviewing a wide range of European research projects, recent literature and fifth generation white papers from key players in the wireless technology.

Many equipment are there, which has to be controlled through wireless technology. Day by day, the accessibility of wireless devices are increasing since of the increased number of users. The increased number of users, the spectrum utilization becomes more. Time Division Multiplexing and Frequency Division Multiplexing modules have used in third generation technology, but the problem with this system is, if the number of users are more, then congestion of bandwidth will arise. This problem has got sorted out through introducing Code Division Multiple Access, which is the first multiple access technology, where in a single channel is capable of using multiple users.

Orthogonal frequency division multiplexing

Basically, OFDM is a modulation method of digital multiple carriers that is characterized through its ability to sustain adverse channel condition in wireless networks technique. It is also known to offer maximized spectral efficiency with implementation of fast Fourier Transforms. The different from convention frequency-division multiplexing, it doesn't require tuned receivers for sub channels. This technique is increased in high capacity, data-rate, and immune to Inter Symbol Interference. The while dividing the subcarriers, the response of the channel is flat which makes this system more efficient and hence it is preferred in 4G mobile also known as LTE. But when it comes for 5G generation, OFDM is not a suitable candidate due to several disadvantages such as cyclic prefix and PAPR. The symbols are so close to each other, it may cause a noise; hence, CP is inserted among the symbols due to which ISI is reduced. PAPR also significantly reduced the performance of the system which results in addition of data in subcarriers. PAPR of the system is 10 dB then it means that in order to transmit it to 1 dB of signal, and it needs a 10 watt of power which efficiently reduces the performance of the system. The OFDM is not suitable modulation technique for 5G. Therefore, researchers around the world are looking for the new modulation technique that satisfies the need of fifth generation.

Universal Filtered Multi Carrier

UFMC is abbreviated for Universal Filtered Multi Carrier. The FBMC, and UFMC method works on the basis of sub-bands which are created through grouping the subcarriers. The UFMC is a compromise technique among OFDM and FBMC. Fig3 shows the UFMC modulation block.

UFMC is the method that combines the advantages of orthogonality OFDM system and filter bank in FBMC. UFMC technique, the complex symbols generated from the base band modulator. The complex symbols are converted to parallel stream, make a block of streams and given as input to the IFFT of their respective.

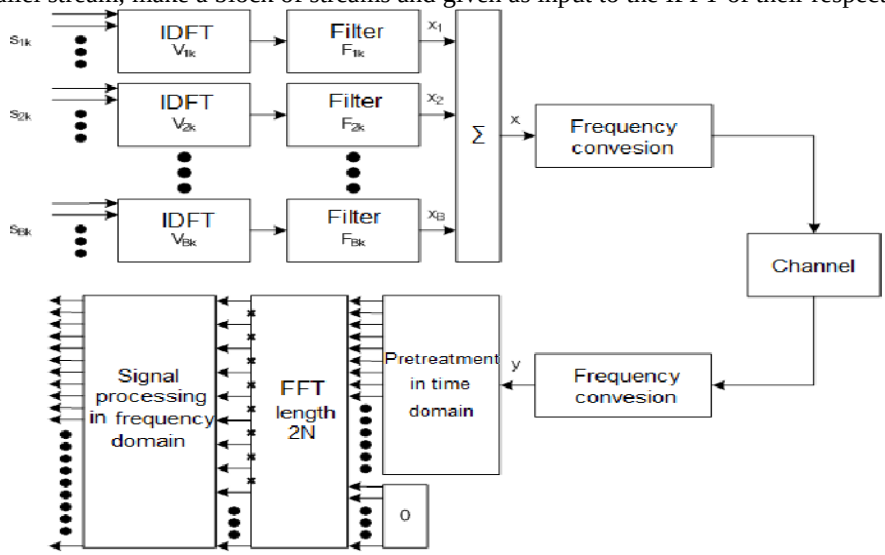

Fig.1 UFMC Block

II. RELATED WORK

Potnuru Praneeth Kumar, et.al. In this paper, Universal Filter Multi Carrier is recommended for 5G communications network and signal scrambling method is used to reduce PAPR in UFMC technique. The signal scrambling is a base method for reducing the crest factor, in multicarrier communication so we inherit the same method for UFMC with Particle Swarm Algorithm, Genetic Algorithm, optimizers which are natural inspired heuristic search algorithms. The UFMC method we acquire best Symbol Error Rate even Carrier Frequency Offset is applied and spectral re-growth also mitigated. The parameters used for investigation of UFMC were includes SER, Spectral re-growth, PAPR **[1].**

Boccardi et al. in this paper, list five disruptive viewpoints toward 5G communication technology. Conventional base station based cellular structures expected to give way to more agile device-centric architectures where diverse nature of traffic and network nodes can be handled better. Additional broad bandwidths are available in millimeter waves and should be taken into use. Massive MIMO system has potential for 5G as it is scalable technology at node level and enables new deployments and architectures. Devices are getting more intelligent and that should be reflected both at node and higher architectural level. As an example, D2D connectivity and mobile device caching have implications on 5G system design. An integral part of fifth generation should also be natural support for machine-to-machine communication where the number of connected devices can be extremely large and high reliability and low latency are required **[2].**

Changyoung An, et.al, in this paper are investigation UFMC, OFDM and FBMC based comparison and nonlinearity sensitivity. This paper evaluated the spectrum characteristic and Bit Error Ratio performance of the waveforms under the effect of nonlinear HPA. As simulation results the OOB power increase of FBMC system is the biggest. Additionally, we have confirmed that performance of every system is degraded by strength of HPA nonlinearity, and every system needs the PAPR reduction method for the nonlinear distortion compensation and power saving, even though it would be more complicated **[3].**

B. Bangerter, this paper following various observations key: the first is macrocellular capacity increase is likely to reach its limits, second is measures for mobile performance require updating, and last is the variety of both the radio access technologies is increasing. The fifth generation (5G) needs co-optimization of networks, devices, and applications to achieve required improvements in service performance and efficiency **[4].**

N. Bhushan, et.al, in this paper, fifth generation communication network densification is the main focus area of. The two dimensions in this trend are over space and over frequency. The spatial domain is mostly covered through dense deployment of small cells whereas frequency domain densification comprises of aggregating larger chunks of radio spectrum from diverse bands into effective use. In the parallel, high capacity low latency backhaul need to be developed to guarantee enhanced user experience **[5].**

C.-X. Wang, differentiates outdoor and indoor scenarios in 5G cellular architecture design to avoid high wall penetration losses. The distributed antenna and massive MIMO system help in this. Indoor coverage can be provided via such short range wireless technique as WiFi, visible light communication, and mm waves whereas outdoor users are served via heterogeneous architecture including large MIMO networks system, mobile femtocells and cognitive radio networks **[6].**

III. CONCLUSION

The various papers and literature has been studied for fifth generation technology. The paper has also reviewed several trends of 5G e.g. OFDM, Filter bank Multicarrier (FBMC), and Universal Filtered Multi-Carrier. Various evolutions of waveforms have been studied, which the research community claims to be supportive of 5G, but unfortunately all of the techniques for generating waveforms are found to possess significant pitfall.

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