Research on OFDM Technology in 4G

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Abstract. As 3G (third generation mobile communication systems) is at the stage of increasingly large-scale application in China, multimedia communication services is one of the most prominent features in 3G, the technology research of the next generation mobile communication systems (Beyond 3G-after 3G) or (4G- four-generation mobile communication systems) has long been expanded. This paper is mainly researched by how to use OFDM technology as the core technology to effectively improve the transmission rate, increase the capacity of system, and avoid various interferences caused by high speed in the 4G mobile communication system.

Keywords: 4G, OFDM technology, mobile communication system, interferences.

1 Introduction

Currently the data transfer rates of 3G are up to 2Mbps, the expected data rates of next-generation (4G) mobile communication systems can reach 50Mbps, or even higher [1-5]. In addition to substantially increase in transmission rate, as compared with 3G, 4G has the requirements of performance and functionality [6-11]: It has achieved as 10-20 times as 3G in capacity, the signal coverage of base station is much bigger than third-generation systems, the quality of communication is further to improve, the costs of network overall operating are lower than the third generation, and it supports the next generation internet and all of the information equipments, seamlessly links fixed communication network, and providing personalized service with definition and so on. To achieve this goal, it must realize the technological breakthroughs from exchanging, transmission, networking and access of the communication network and other aspects, particularly in the wireless mobile environment and the conditions of limited radio spectrum resources, how to support high-speed data transmission in the premise of guaranteeing certain quality of communication. Because of its characteristics of good noise immunity, the ability of anti-multipath fading characteristics and high spectrum efficiency, OFDM technology is generally regarded as the core technology of 4G. Many large communications companies and research groups are active in researching the application of OFDM. Currently the developed technologies will be applied for OFDM technology in 4G, that mainly have W-OFDM, V-OFDM and MIMO-OFDM.

Wireless and personal communications in just a few decades has experienced a huge development from analog to digital communications and from the frequency
division multiple access (FDMA) to a code division multiple access (CDMA) [12-14]. At present, there is also the emergence of new technologies, one of which is the orthogonal frequency division multiplexing (OFDM). Compared to Code Division Multiple Access (CDMA) as the core of the third generation mobile communication technology, its applications are more perfect and more advanced technology, which is called the "fourth generation mobile communication technology [15-19]." OFDM technology has great potential in the application of broadband field. Compared with the third generation mobile communication systems, 4G uses a variety of new techniques for OFDM systems, has higher spectral efficiency and good anti-multipath interference and improves the utilization of bandwidth, which can not only increase the capacity of systems, but also more better meets the requirements of multimedia communications that will include voice, data, video and other multimedia services through the wide broadband of information channels to high-quality send them out. In addition, the realization of OFDM technology is simple and its cost is low. With the rapid development of DSP technology, and use fast Fourier transform to bring about a large amount of mutually orthogonal sub-carriers, which provides a great convenience for the realization of high-speed broadband communications system. OFDM will become the mainstream way of realizing future broadband mobile communications, thus is caused to be paid more and more attention and research [20, 21].

2 The Main Contents of Research, Experiment and Trial

Research OFDM technology, and first need to start from studying OFDM, in essence, a form of OFDM follows the process [22-24]: First, fill up zeros behind the symbols that are digitally modulated in N1, constitute the N2 sequence of inputting samples, and then calculate an IFFT. Secondly, the last L1 sequences of outputting samples in IFFT is inserted into the front of the OFDM symbol, and the the most front L1 sequences of outputting samples in IFFT is inserted into the last of the OFDM symbol. Finally, OFDM symbols are multiplied by the promotion and demotion of cosine function in time domain, so the power of outside the broadband in system can be decreased rapidly. Then through the conversion from digital to analog, frequency modulation, and finally send them out. Study details as follows:

2.1 Determine the Parameters

Parameters need to be determined as follows: sub-channel, the number of sub-carriers, the length of FFT, the number of OFDM symbols each use, the level of modulation, symbol rate, bit rate, the length of guard interval, signal to noise ratio, and the number of inserted pilot (basic simulations can be without inserting a pilot and may be become zero).