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MIMO-OFDM Systems for the Development of 4G Wireless Networks by using Hermitian Encoding

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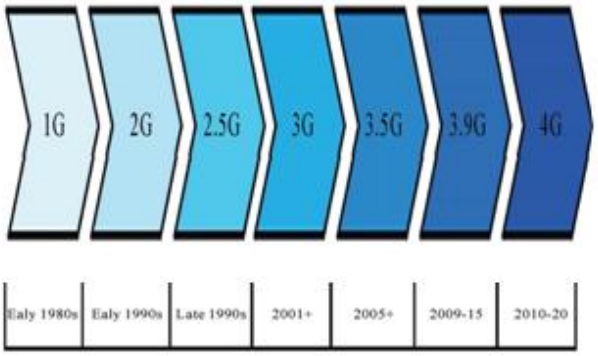
Abstract:
The employ of multiple antennas at both the sides, that is transmitting and receiving side can fulfil the requirement for a very high performance 4G wireless services. By using multiple antenna technologies, the capacities for high rate internet and multimedia facilities can be fulfilled and also boost the range and consistency of communication systems. For a very high data rate wireless broadcast over multipath fading, orthogonal frequency-division multiplexing (OFDM) method has been used. OFDM may be united with multiple antennas at equally the access point and mobile terminal to boost diversity gain and to develop system capacity on a time-varying multipath fading channel, giving a multiple-input multiple-output OFDM system. In this paper, we explain a multiple input multiple output OFDM wireless communication system, with compressed technique i.e.Hermitian Encoding. By this, enhanced capacity, coverage, and consistency of message systems are clearly evident from the results presented in this paper. Thus, the simulation outputs of BER plot demonstrate the usefulness of our proposed practical image transmission system. By using Hermitian Encoding the bit error rate has been decreased to 7*10-3 which occurred due to interference and fading effect.

Keywords: 4G Mobile communication, MIMO, OFDM, Hermitian encoding, multiple antennas, bit error rate.

1. INTRODUCTION:

4G is short for Fourth (4th) Generation Technology. 4G Technology is mostly the expansion in the 3G technology with supplementary bandwidth and services allows in the 3G. However at this time nobody accurately knows the accurate 4G description some individuals say that 4G technology is the outlook technologies that are mainly in their maturity period. The belief for the 4G technology is mainly the very high quality audio/video streaming over end to end Internet Protocol. If the Internet Protocol (IP) multimedia sub-system group fulfil what it going to do not anything of this probably will matter. Wi-MAX or mobile structural propose will become gradually more translucent, and then the getting of numerous structure by an exact network operator ever more familiar. The foremost character of 4G services of interest to users are application adaptability and high dynamism users traffic, radio environment, air interfaces, and excellence of service. Mobile networks have evolved through greater than three generations, opening with the analogue or first-generation (1G) networks deployed in the near the beginning 1980s, and moving towards the digital second-generation (2G) networks de-ployed in the near the beginning 1990s. Operators taking place to deploy 3 G networks in 2001-03, and 3.5G networks from approximately 2005. Systems still in the proposed stage consist of 3.9G and 4G systems, which are usual to be deployed in the 2008-10 and 2010-20 timeframes, respectively. The common principle after this grouping is that mo-bile technologies are in the similar generation if they have comparable network kind and deployment time-lines. The International Telecommunications Union (ITU), for example, uses a dissimilar proceed when significant 3G, it groups technologies based on theoretical maximum connection speeds. The 3G organization would have superior excellence voice channels, also broadband data capabilities, up to 2 Mbps. unluckily, the two groups could not settle their differences, and this decade will see the starting of two mobile principles for 3G. Also, China is on the edge of



Developing a third 3G system. An interim move is being engaged between 2G and 3G, the 2.5G. It is essentially development of the two key 2G technologies to make available better capability on the 2G RF (radio frequency) channels and to begin superior output for data facility, up to 384 kbps. An extremely key aspect of 2.5G is that the data channels are optimized for packet data, which allow the admittance to the Internet from mobile devices, which may be telephone, PDA (personal digital assistant), or laptop. However, the requirement for superior access speed multimedia communication in today's society, which deeply rely on computer communication in digital format, seems limitless. On the basis of the historical sign of a generation revolution happening once a decade, the in attendance appears to be the correct time to start the research on a 4G mobile communication system. The 2G technology will lead to an interim generation of 2.5G which shows 2G systems which implemented a packet switched domain too the circuit switched domain. General Packet Radio Service (GPRS) was

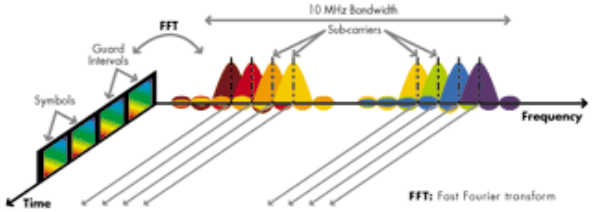
the 2.5G technology adopted by GSM.GPRS gives a packet switched service over GSM contributing data speeds between 56-114kbps. First generation (1G) a wireless system was mostly analog cellular systems by way of circuit switched system structural design. The core issues of these wireless networks were basic voice telephony, small capacity and restricted local and regional coverage. The amplified requirement for high frequency ranges in the telecommunications sector lead to development in analog to digital transmission techniques. In the 1990s, second generation (2G), here to fulfil the capacity demands of burgeoning voice plus telephony, text messaging and limited circuit switched data services. By using digital system, the signal can be packed in much more efficiently than analog system, allows transmitting more packets into the same bandwidth and propagates with less power. Over the years, series of hurdles have been encountered by wireless system designers in order to fulfil growing requirement of advanced data rates, fewer dropped calls, lesser signal fading, good excellence of service, higher network capacity also limited frequency problem. More so, the availability of smart phones at cheaper prices and the continuous growth of social networking websites have provide get higher requirement for advanced data rates thus need the constant advancement in wireless system. Prior to the usage of Third generation system (3G) all over the world, the scheme of wireless technology is after the idea of ordinary mobile users. The high performance wireless network is fulfilled by combining the present network with the new network using the core Internet protocol (IP) based network layer, thereby leading to the vision of the 4G and 5G generation. The existing wireless system is developed with the goal of given that transmission rates of up to 20Mbps with Quality of Service (QoS) features. Cellular and broadband multimedia services are in addition accessible all over the place with a data rate of up to 100 Mb/s and 1Gb/s for outdoor and indoor communication environments respectively [5]. The wireless system allows both frequency division multiplexing (FDM), time division multiplexing (TDM) and bandwidth suppleness up to 20 MHz.

2.SYSTEM MODEL

(A) MIMO-OFDM

A multiple input multiple output (MIMO) communication system is an antenna technology which makes use of multiple transmitters and multiple receivers over the channel. This scheme exploits spatial diversity by allowing the usage of multiple antennas at the transmitting and receiving ends of the scheme, to improve the performance. The MIMO communication system allows elevated spectral efficiency and link consistency facilitating significant boost in the data throughput. This far above the ground efficiency is because of the availability of an independent path in a scattering environment. MIMO channel is be changed into an corresponding channel model by means of the singular value decomposition (SVD) theorem, consists of a set of uncoupled similar sub-channels, where the quantity of sub-channels is given by the channel description and the quantity of antennas employed. Though, MIMO has capability to produce spatial multiplexing gain, resulting in increased system capacity but performs poorly with high data rate. Orthogonal Frequency Division Multiplexing(OFDM) is a mixture of modulation and multiplexing with high-speed transmission in wireless environment. OFDM technology is the process of separating the prominent data rate into a quantity of channels known as sub-channel or subcarriers, the subcarriers are orthogonal to one and any more making them to have parallel transmission [10], [11]. The subcarriers have the smallest amount frequency separation necessary to sustain orthogonally of their equivalent time domain waveforms. All signal spectra corresponds to its individual subcarriers, go beyond in the frequency spectra. Therefore, the present bandwidth is used incredibly efficiently [12]. OFDM has previously been used profitably in standards for digital audio broadcasting (DAB), terrestrial video broadcasting (DVB-T), and wireless local area networks (WLANs) [13]. Hence, it can only be used for high bit rate and not for improving QoS. This leads to the hybridization of MIMO-OFDM system. Orthogonal frequency division multiple access (OFDMA) has been freshly accepted as a brilliant multiple access technique for the coming generation of downlink receivers. A multi-carrier transmission technique for very superior speed bi-directional wireless data communication. All the proposals which have been measured for the fourth generation (4G) wireless technologies has taken by orthogonal frequency division multiple access. WiMAX and LTE are the two core techniques in the 4G marketplace. The two standards those are likely to dominate the 4G. Orthogonal Frequency Division Multiplexing (OFDM) not only gives clear benefits for physical layer performance, but also a framework for getting better layer 2 performance by proposing an additional degree of freedom. By using ODFM, it is probable to develop the time domain, the space domain, the frequency domain and even the code domain to optimize radio channel procedure. It can make sure of very robust transmission in multi-path surroundings with less receiver complexity.

Figure 5: OFDM principles



OFDM (Orthogonal Frequency Division Multiplexing) is most admired method for very high data rate transmission in wireless communication, robustness to multipath fading, a very high spectral capability and also a very high litheness in resource allocation. MIMO-OFDM scheme is very good for the coming 4G wireless communication systems. MIMO improve the capability and diversity and OFDM appropriate for high data rate transmission over multipath fading channels.
In MIMO systems, the data flow from a single user is de multiplexed into an amount of transmit antennas separate sub-streams. Each sub-layer is then encoded into channel symbols. It is familiar to inflict the similar data rate on all transmitters, but adaptive modulation rate can also be used on each sub streams. The signal are received by receive antennas [2]. The MIMO is that the transmit antennas at one point and the other point are associated in such a manner so that BER (Bit Error Rate) or data rate for used can enhanced. .

MIMO-OFDM:

OFDM is a multicarrier digital communication design. It consists of a bulky numbers of low data rate carriers to create a very high rate communication system. Orthogonally allows carriers to be personally spaced, even overlapped with no iter-carrier interference. Low data rate of each carrier will removes inter-symbol interference.

Benefits of OFDM systems are:

- High spectral efficiency.
- Simple implementation by fast Fourier Transform.
- Low receiver complexity.
- Suitability for a very high-data-rate transmission over a multipath fading channel.
- Higher flexibility in provisos of link adaptation.
- Low-complexity multiple access systems known as orthogonal frequency-division multiple access (OFDMA).

Drawbacks of OFDM systems are:

- Superior peak-to-average power ratio (PAPR). Compared to single-carrier modulation.
- Sensitivity to time and frequency synchronization errors.

OFDM signals have a very high peak-to-average proportion, hence it has high tolerance of peak power clipping due to transmission limitation. MIMO system supplya very high data rate, low error rate, simple to implement, little power consummation, small cost and efficient use of resources. I wireless communication system because of multipath interference the signal level at the receiver for no reason remains constant; it fluctuates or fades.

(B) WI-MAX

WIMAX or Worldwide Interoperability for Microwave access can be seen as the most important competition to UMB/Legit is a wireless broadband wide area network architecture mentioned in the IEEE standard 802.16. The standard 802.16dgives the standard for the fixed WIMAX while mobile WIMAX is defined in IEEE 802.16e. The stated peak data rate of WIMAX is nearly 74 Mbps covering a distance of 50 kms and allowing speed of 120 kmph. All these parameters are exclusive of each other meaning that each of them can be fulfilled only when the other factors are not extreme. The WIMAX forum is a group of nearly 300 companies who are concerned in building workable profiles from the IEEE standards to make sure of interoperability between devices manufactured by various vendors.

(3) LTE:

Long Term Evolution (LTE) is the mobile network technology for the coming up generation mobile communications, as defined by the 3rd Generation Partnership Project (3GPP). In adding up to description such as bigger data-rates, lesser latencies and superior spectral efficiency, one of the mainly interesting aspects is the radically novel all-IP core network structural design, known as Evolved Packet Core (EPC). LTE is usual to make use of user-installed femtocells, in order to accomplish its goals of spectral efficiency and high-speed for a superior number of users. It is obvious that the compassion and privacy of users and data transiting in such digital cellular networks is paramount together to public and private users.

3.PROPOSED METHODOLOGY

In this proposed model we have to use Hermitian encoding with 2-PSK and 4-PSK modulation at the place of IDFT and DFT. The AWGN channel is basically used for communication with cyclic prefix. Here first of all Hermitian encoding is completed by modulation then data. After OFDM modulation it comes the filtering of the data, which provides the orthogonally to the subcarriers. IFFT will convert time domain signal to the frequency domain. After going from side to side the channel on the signal FFT will be performed with Hermitian Encoding and Decoding Process.

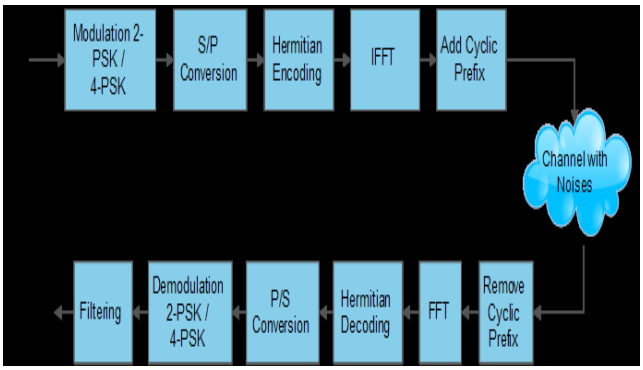


Figure.1. Block Diagram of the proposed method

The Above Block Diagram in the source section to begin with the data is modulated by 2- PSK/4-PSK modulator followed by Hermitian encoding and IFFT is practically for multiplexing then after adding the cyclic prefix with data signal throughout the channel here the noise is mixed with the receiver section cab be done for remove cyclic prefix by Fast Fourier Transform (FFT) is useful for de-multiplexing followed by Hermitian decoding then 2- PSK/The (4-PSK Demodulation) has also being then after moving average filtering have been adopted to decrease the BER.

4.SIMULATION RESULTS

In Fig.1 the simulation results with 256 symbols is displayed, and the presentation of the proposed with 2-PSK/4-PSK modulation and Hermitian encoding. So here filtered encoding planned technique for efficient 4G system.

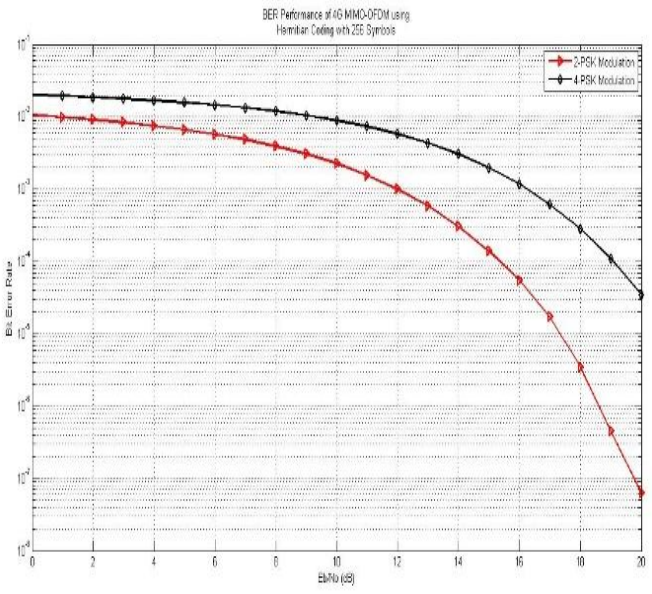


Figure.2. BER performance curve for 4G MIMO System using Hermitian Encoding with 256 number of symbols

In Fig.2 the simulation results with 512 symbols is displayed, and the presentation of the proposed with 2-PSK/4-PSK modulation and Hermitian encoding. So here filtered encoding projected technique for efficient 4G system.

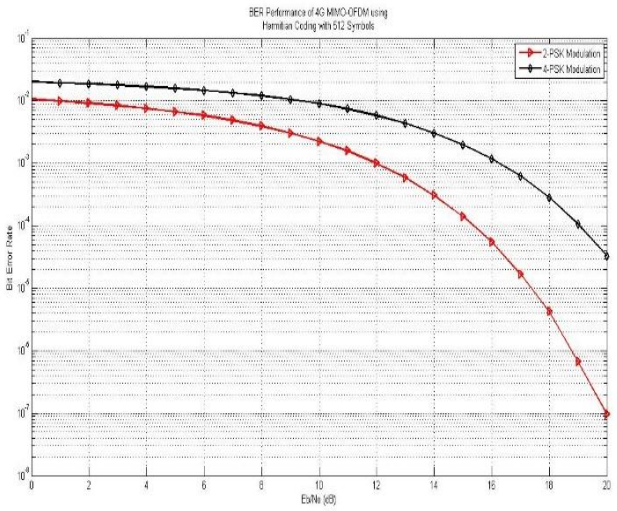


Figure.3. BER performance curve for 4G MIMO System using Hermitian Encoding with 512 number of symbols

In Fig.3 the simulation results with 1024 symbols is displayed, and the presentation of the proposed with 2-PSK/4-PSK modulation and Hermitian encoding. So here filtered encoding projected technique for efficient 4G system

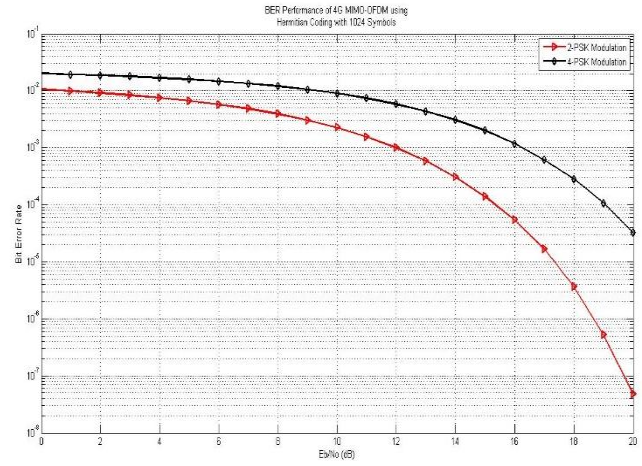


Figure.4. BER performance curve for 4G MIMO System using Hermitian Encoding with 1024 number of symbols

In Fig.4 the simulation results with 2048 symbols is displayed, and the presentation of the proposed with 2-PSK/4-PSK modulation and Hermitian encoding. So here filtered encoding projected technique for efficient 4G system

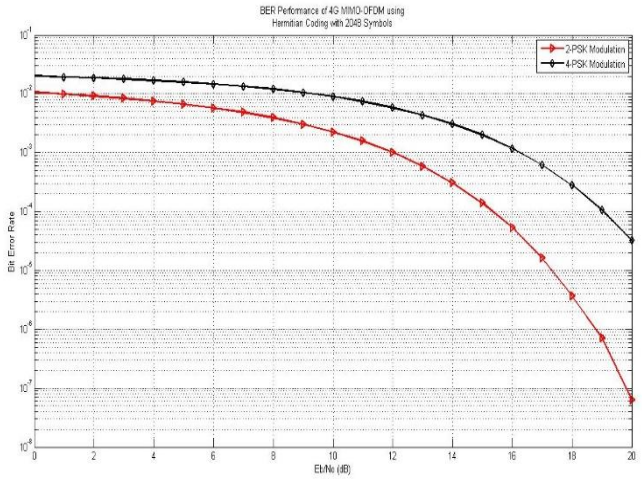


Figure.5. BER performance curve for 4G MIMO System using Hermitian Encoding with 2048 number of symbols

SNR	Existing System	Proposed System
0	$1*10^{-2}$	$1*10^{-3}$
4	$0.5*10^{-2}$	$7*10^{-3}$
8	$10*10^{-3}$	$3*10^{-4}$
12	$4*10^{-3}$	$9*10^{-4}$
14	$2*10^{-3}$	$10*10^{-4}$
16	-	$5*10^{-5}$
18	-	$3*10^{-6}$
20	-	$7*10^{-8}$

5.CONCLUSION AND FUTURE SCOPE

The proposed 4G wireless system is simulated and the outcomes are find out in terms of BER. The BER achieved is 7x10-8 better than the present work. The values of BER is varying with the changes in modulation techniques also symbols and can be say that the with 2048 symbols and 2-PSK modulation scheme the wireless Hermitian Encoding based MIMO-OFDM system outperform, the error rate is better than the previous techniques. As the symbol size increases the system also start performing better and better but more than 2048 symbols the performance start decreasing. Now there are several scopes for improvements in the 4G mobile wireless communication system work towards making this system better and better with the utilization of the detection methodologies at the receiver side. The recognition methods are better shield against the interferences and noises introduced during transmission. This research studies Physical layer presentation of LTE and Wi-MAX schemes used in fourth generation (4G) wireless communication systems when multiple antennas are employed in the receiver to give rise to diversity. Bit Error Rate (BER) plots obtained from simulation are accessible to evaluate system presentation with and without diversity and to do a side by side evaluation of the two core 4G wireless system.

6. FUTURE SCOPE:

In Industries and consumers similar are powerful to take mobile communications to the subsequently altitude and there is very much interest in 4G technology such as Mobile Wi-MAX and LTE .It can amplify the data rates and capacity radically. Both the different technologies are marketed as 4G in spite of not fulfilling the IMT Advanced needs. While Mobile Wi-MAX is by now accessible in some markets, employment of LTE is only starting, and pushing back the date when true 4G will be extensively accessible commercially like industries basis. The affluence of satisfied and mobile applications available to users global puts a strain on mobile networks. The Next generation technology like pre-4G and 4G with their assure of superior speed and spectral efficiency become all the more pleasing to the players concerned in the ICT value chain. However, the fact is that 85% of mobile associations are still on 2G networks and 3G links are only presented in some areas, even in urbanized countries, with the exemption of a few leading countries. The 4G scheme gives very promising but its success will eventually depend on the convenience of new spectrum and wide coverage. The many advantages of 4G may also be shattered except ICT companies

find business models that will not only make support but will also help them to raise revenue.

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