International Journal of Applied Engineering and Technology ISSN: 2277-212X
An Open Access, Online International Journal Available at http://www.cibtech.org/jet.htm
2022, Vol.12, pp.200-204/Rajaganapathi et al.
Research Article

HIGH SPEED MIMO OFDM TECHNOLOGY

R. Rajaganapathi[1], S. Shammera begam[2], R. Varshini[3], R. Srimathi[4], P. Yuvarani
Department of Electronics & Communication Engineering, Anjalai Ammal Mahalingam Engineering College, Kovilvenni, Thiruvarur
**Author for Correspondence: rajume1974@gmail.com*

ABSTRACT
This paper combines the Multiple input multiple output and orthogonal frequency division multiplexing. The claim for reliable communication at high data rates in wireless communication and mobile communication is dramatically hiking owing the manifold mobile data usage and services. In the today's scenario, high data rates are provided by WLAN, LTE, LTE-A(advanced). In wireless communications systems MIMO aims to attain high data rates and lower bit rate. This becomes reliable and efficient when it is coupled with OFDM to obtain high transmission rate terminate ISI and deliver highest capacity throughout with minimal.

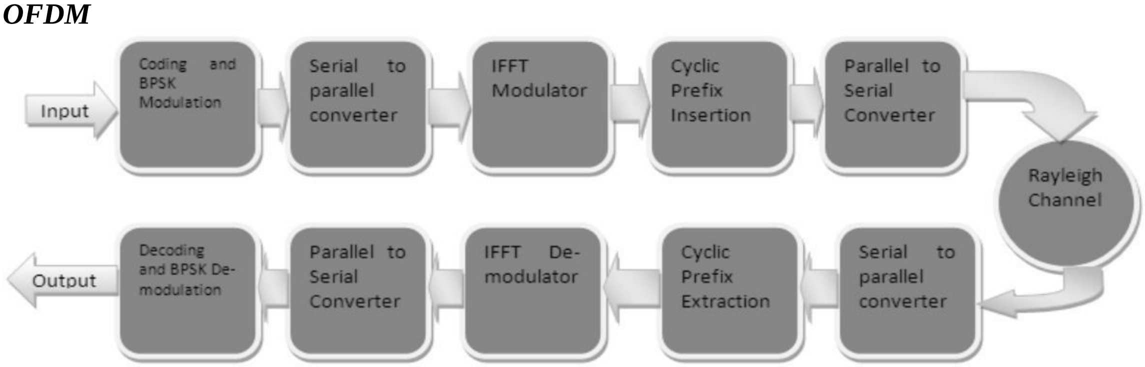
***Keywords**: MIMO, Bit Error Rate, Signal to Noise Ratio, of DM.Introduction*

The multipath propagation is vital characteristic of data transmission in wireless communication systems. Wireless channel contains different impairment to transmitted signal and channel response. It affects the signal to travel in multipath between transmitter and receiver. The receiver gets the reflection of same symbols in delay versions. Delays or fading occurs due to reflection, refractions, diffractions, shadowing etc. Because of buildings, trees, aircrafts, humidity, temperature etc. Delay or fading could be in result of changing phase or magnitude of signals. The multipath affects and delay profile reduce the channel efficiency, through put and cause corrupted information at receiver. Intelligently multipath effect of MIMO is used to increase capacity of system.

$$\begin{bmatrix} y1 \\ y2 \\ \vdots \\ yr \end{bmatrix} = \begin{bmatrix} h11 & h12 & \dots & h1t \\ h21 & h22 & \dots & h2t \\ \vdots & \vdots & \ddots & \vdots \\ hr1 & hr2 & \dots & hrt \end{bmatrix} \begin{bmatrix} x1 \\ x2 \\ \vdots \\ xt \end{bmatrix} + \begin{bmatrix} n1 \\ n2 \\ \vdots \\ nr \end{bmatrix}$$

Y(n) and h(n)and is output signal and its system function. There are two basic advantages of MIMO systems that are diversity and multiplexing. Spatial dimension can b exploited using MIMO. MIMO achieve high spectral efficiency and data rate, as in 802.11g and 802.11a data rate is 54 Mbps but in MIMO data rate, throughput rises to 108M.

OFDM



OFDM is simply defined as a form of multi-carrier modulation where the carrier spacing is carefully

selected so that each subcarrier is orthogonal to the other subcarriers. The architectures of a typical OFDM transmitter and receiver are shown as an OFDM transceiver.In the transmitting end, the incoming modulated serial bits are converted into parallel streams by using a serial to parallel converter. These parallel bit streams are subjected to Inverse Fast Fourier Transform (IFFT) block for baseband OFDM modulation. To prevent overlapping of the data at the receiver, Cyclic Prefix (CP) is inserted whose duration is one fourth of the total OFDM symbol duration. The modulated data are sent to the channel through a digital-to- analog converter. At the receiver side, firstly the data is received through N linear receivers followed by a linear combiner. This linear combiner is designed in such a way that the output SNR is maximized at each instant of time. Then this data is converted again to the digital domain by passing it through an analog to digital converter. After removing the cyclic prefix, data are again converted into serial to parallel by a serial-to-parallel converter. These parallel bit streams are demodulated using Fast Fourier Transform (FFT) to get back the original databy converting parallel bit streams into a serial bit stream.
To avoid this distortion, The bandwidth B is divided into N sub-bands. Bandwidth of each sub-band is $f_{0=}$B/N.
The kth subcarrier is $e^{j2\pi_k f}0t$. The symbol X(k) is modulated on the subcarrier $e^{j2\pi_k f}0t$. The transmitted signal is given as, The sum of signals for all the N subcarriers

$$x(t) = \frac{1}{N} \sum X(k) e^{j2\pi_k f}0t$$

Therefore, the subcarriers are ORTHOGONAL. Hence, this is termed Orthogonal frequency division multiplexing. Number of subcarriers chosen depends up on channel bandwidth, data rate, through put requirements and territory (ruler, urban etc.).

MIMO OFDM

Wireless MIMO channels have been recently attracting a great interest since they provide significant improvements in terms of spectral efficiency and reliability with respect to single input single-output (SISO) channels. The gains obtained by the deployment of multiple antennas at both sides of the link are the array gain, the diversity gain, and the multiplexing gain. The array gain is the improvement in signal-to-noise ratio (SNR) obtained by coherently combining the signals on multiple-transmit or multiple-receive dimensions while the diversity gain is the improvement in link reliability obtained by receiving replicas of the information signal through independently fading dimensions.
Consider an r x t **MIMO frequency** selective channel. The channel between receive antenna i and Tx antenna j is

$$h_{ij}(0), h_{ij}(1), \ldots, h_{ij}(L-1)$$

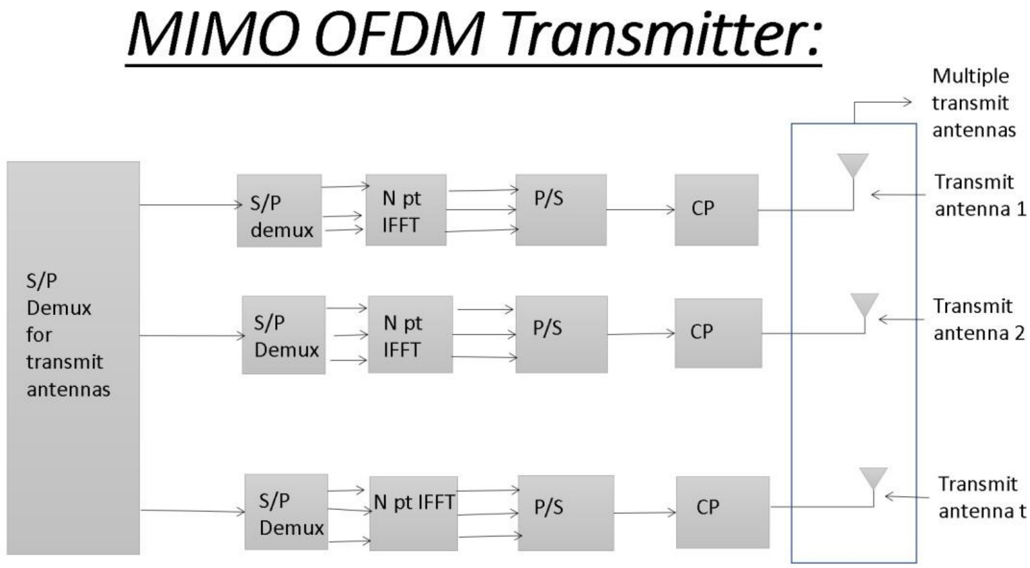
The samples on antenna j are generated

$$x_j(l) = \frac{1}{N} \sum_{k=1}^{N} X_j(k) e^{j2\pi k \frac{B}{NB} l} = \sum_{k=1} X_j(k) e^{j2\pi \frac{kl}{N}}$$

The i/o model between receive antenna i and Tx antenna j is

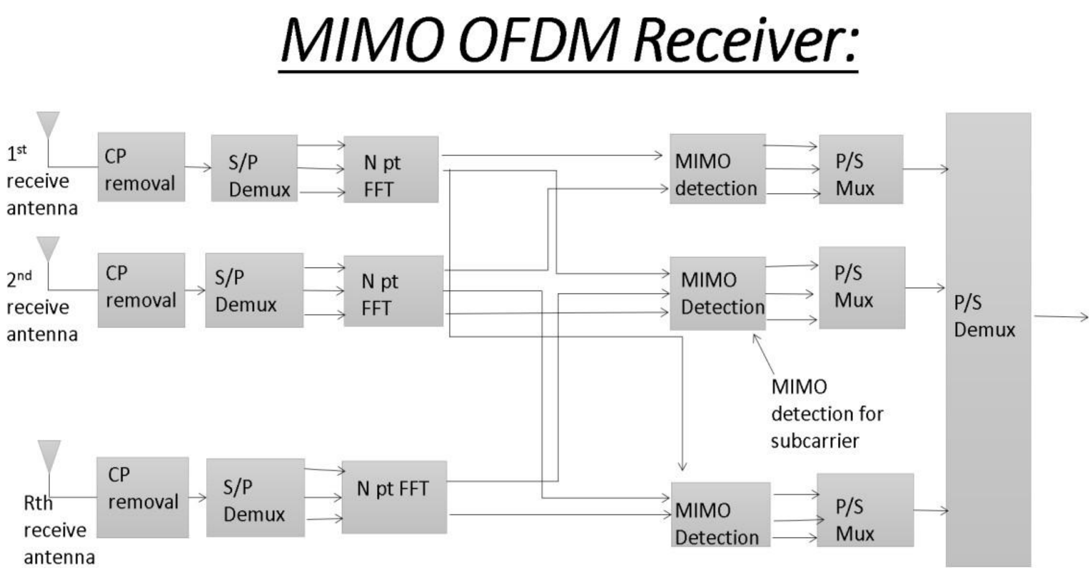
$$y_i(n) = \sum_{j=1}^{t} \sum_{i=0}^{L-1} h_{ij}(l) x_j(n-1) + v_i(n)$$

International Journal of Applied Engineering and Technology ISSN: 2277-212X
An Open Access, Online International Journal Available at http://www.cibtech.org/jet.htm
2022, Vol.12, pp.200-204/Rajaganapathi et al.
Research Article



CYCLIC PREFIX

In terrestrial systems the addition of cyclic prefix (CP) between two successive OFDM symbols is used to reduce the effect of multipath channel delay spread. To simplify the synchronization, before the data stream, a copy of the last end of the transmitted OFDM symbols is inserted, afterwards the IFFT operation. The length of the CP is adjustable andmust be set to maintain an effective bandwidth system.



BER

The BER is calculated by comparison the transmitted sequence of bits to the received bits and count the number of errors. The magnitude relation of what proportion bits received in error over the quantity of total bits received is that the BER. BER may be a unit less amount,usually expressed as a proportion or ten to the negative power. The BER of SISO-OFDM systems impaired by frequency offset is analyzed in, within which the frequency offset is assumed to be utterly glorious at the receiver, and, supported the lay

to rest carrier interference (ICI) analysis, the BER is evaluated for multipath weakening channels. Several frequency offset estimators are projected.
BER = number of errors / total number of bits sent

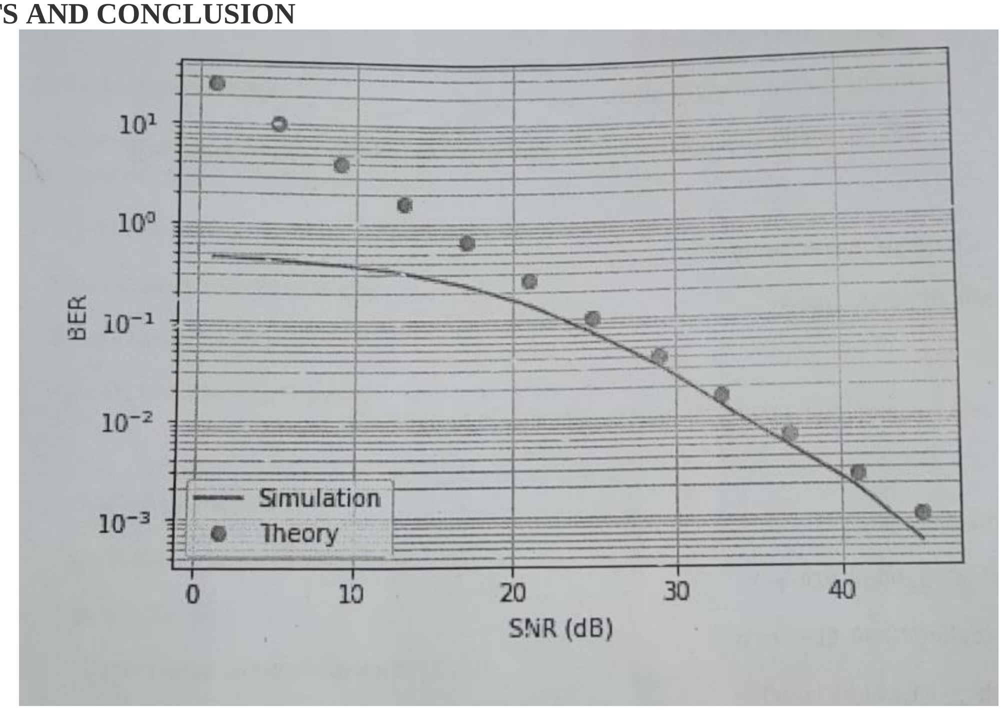
SNR

The SNR is ratio of the received signal power over the noise power in the frequency range ofthe process. The SNR is ratio between the wanted signal and the unwanted background noise.SNR= PSignal /Pnoise.
SNR formula in terms of diversity: BER α 1/SNR d

APPLICATIONS

It provides high speed internet services whose download speed will range from 100Mbps to1Gbps and also services like surveillance systems and intelligent transport system with highbandwidth applications.

RESULTS AND CONCLUSION



From the graph, we come to conclude that simulated values have lower bit rate and signal tonoise ratio than theoretical values. By increasing a greater number of antennas in MIMO andincreasing a greater number of channels in OFDM. As you can see the result, we are able to increase the data rates with the help of combining MIMO OFDM technology.

REFERENCE

A. Duel-Hallen, Equalizers for multiple input/multiple output channels and PAM systems with cyclostationary input sequences," IEEE J. Select. Areas Commun., vol. 10, pp. 630–639, Apr. 1992.

A. N. Mody and G. L. Stuber, Sampling frequency offset estimation and time tracking for MIMO OFDM systems," presented at the 8th OFDM Workshop 2003, Hamburg, Germany.

Gupta B and Saini DS (2012). BER performance improvement in MIMO systems using various equalization techniques," 2012 2nd IEEE International Conference on Parallel Distributed and Grid Computing (PDGC), 190- 194.

H. Yang, "A road to future broadband wireless access: MIMO-OFDM –based air interface", IEEE comm.mag., 43, 1, pp 53-60, jan-2005

P. Bansal and A. Brzinski," adaptive loading in MIMO-OFDM Systems", EEE359 project, Standford

University, Dec 2001

Tarokh V Seshadri N Calder bank AR (1998). "Space-Timecodes for High Data Rate Wireless Communications: Performance Criterion and Code Construction", IEEETrans. Of Inf. Th., **Vol 44,** No2, 1998, pp. 744-765

Weinstein SB and Ebert PM (1971). Data transmission by frequency-division multiplexing using the discrete Fourier transform. IEEE Trans. Commun., COM-19(5):628-634, Oct. 1971.

Y. (G.) Li, "Simplified channel estimation for OFDM systems with multiple transmit antennas," IEEE Trans. Wireless Commun., vol. 1, pp. 67–75, Jan. 2002.