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Analysis of Multi-Recieving Antenna Working in Nakagami-M Fading Channel

Sumit kumar Gupta[1], Ravi Jaiswal[2], Rahul Singh[3]
Electronics and Communication Engineering Department,
Bansal Institute of Engineering and Technology, Lucknow
rahulsingh603jnv@gmail.com

Abstract: The target of the paper to concentrate on the Rayleigh and Nakagami-m blurring channel to decide the single client multi-radio wire and multi-client radio wire choice and furthermore to find the typical transmission to clamor proportion (SNR) and blackout likelihood through Nakagami-m blurring channel as to change L (determination), yth (Edge) and y (SNR) or consistent yth (Edge) and to decide the blunder performance(bit mistake rate execution) of BPSK, QPSK and 8PSK (Through RAYLEIGH AND Nakagami-m blurring channel).

Keywords: Nakagami-m, SNR, QPSK, BPSK, Rayleigh Fading

1. Introduction:

In light of the IEEE 802.16 standard, overall interoperability for WiMAX is a developing global framework for broadband remote access. It is a brand-new wireless OFDM technology that provides high-quality broadband services to fixed, portable, and mobile users over long distances[1,2]. It is based on the IEEE.802.16 wireless MAN air interface standard. WiMAX commitments to solidify high data rate organizations with wide locale consideration (in repeat extent of 10 - 66 GHz (View) and 2 - 11 GHz (Non-View)) and colossal client densities with a collection of QoS essentials. WiMAX can provide BWA up to 30 miles (50 kilometers) for fixed stations and 3 to 10 miles (5-15 kilometers) for mobile stations, with theoretical data rates ranging from 1.5 to 75 Mbps per channel. The new standards for WiMAX are being made for expanding the flexibility further with updated consideration, execution and higher data paces (of the solicitation for 100 Mb/s) in a WiMAX Association. The WiMAX standard air interface defines the MAC and PHY layers of the subscriber station and base station, while the WiMAX Forum, a group of operators and equipment and component manufacturers, defines the operability of the access network. The WiMAX PHY layer's primary function is the actual physical transportation of data. When mobile environments are present in the wireless channel, the main performance becomes more challenging. The IEEE 802.16d/e standard supports a variety of PHY layer mechanisms with a variety of features in order to achieve maximum performance at low BER, high data rate transmission (in both fixed and mobile environments), high spectral efficiency, and a variety of QoS requirements. Because of the PHY's adaptability, framework developers can customize their framework to meet their needs.

The development of WiMAX began with the requirement of having remote Web access and other broadband services, which can work admirably in rural areas or in regions where it is difficult to establish a wired foundation and financially unfeasible. WiMAX is cutting-edge broadband remote innovation that provides high velocity, secure, and sophisticated broadband services. IEEE 802.16, also known as IEEE Wireless-MAN, is the standard for both mobile broadband applications and fixed wireless broadband. In order to develop equipment that will be compatible and interoperable, the WiMAX forum was established in 2001. Developed in accordance with the standard IEEE 802 16e [5], versatile WiMAX equipment received approval in 2007 and was released in 2008, offering migration access and versatility. IEEE 802.16e, which can perform better in environments that are not in line of sight, was built on OFDMA. Peak DL data rates of up to 63 Mbps in a 20 MHz channel were made possible by IEEE 802.16e technology through the Scalable OFDMA (S-OFDMA) system [2]. Furthermore, MIMO and AMC were added to the norm. It has a strong security architecture, a number of strong encryption algorithms, CMAC or HMAC-based message protection, and a shorter key lifetime because it uses EAP for mutual authentication [4].

2. Literature review:

The WiMAX forum's adaptive physical layer is based on 802.16d/e OFDM. The presentation of the WiMAX PHY layer is investigated in this paper for two PHY layer modifications: MCCDMA (cross breed OFDM framework with numerous entrance innovation, Code Division Different Admittance) and connect adaption calculation (Versatile Tweak and Coding, AMC) to provide high concealment against multipath blurring, high transfer speed effectiveness, high throughput, and high information rates for portable conditions. With lower BER and higher spectral efficiency, these modifications improve the PHY layer's performance in mobile environments, according to the findings [20].

Channel estimation under flat fading conditions and the evaluation of WiMAX system performance are the topics covered here. BPSK, QPSK, 16QAM, and 64 QAM are the modulation techniques utilized.

The type of channel and the type of fading, such as slow/fast and flat/frequency selective fading channels, are identified by

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channel estimation using a fuzzy logic system, which is the subject of the discussion. The Doppler spread and channel fading rate are directly related to the channel's coherence time and are determined by the mobile unit's speed [11]. We created WiMAX models with a variety of IQ mapping schemes to reduce the effect of multipath fading. BPSK1/2, QPSK1/2, QPSK3/4, and QAM 16 are the most popular IQ mapping schemes. For each IQ mapping, simulink models and a channel estimation subsystem are created.

The IEEE developed WiMAX, which has been given the standard designations 802.16d-2004 (for use in fixed remote applications) and 802.16e-2005 (for use in versatile remote applications) in order to provide microwave access with overall interoperability. The telecommunications industry currently has a major concern regarding the wireless transmission of data, which can utilize a variety of transmission modes, including point-to-multipoint links. It provides unlimited and adaptable web access. In developing nations, WiMAX has been utilized in WDSL and WLL, among other applications, as an alternative to 3G mobile systems. The versatile remote correspondence standard IEEE 802.16e-2005, in view of OFDM innovation, makes it conceivable to push toward 4G portable later on. In this thesis, we created a simulation model based on the 802.16e OFDM-PHY baseband and demonstrated that BPSK, QPSK, and QAM (16 and 64) simulations provided the best physical layer performance for WiMAX Mobile. The 802.16e OFDMA-PHY particular was followed while carrying out every one of the essential circumstances in the reenactment. The whole recreation process utilizes the clamor channel AWGN, Rayleigh blurring, SUI, information randomization strategies, FFT and IFFT, and versatile regulation. Based on BER, SNR, and Pe output, the performance has been determined through MATLAB simulation.

The pilot data that were added prior to transmission are extracted by the channel estimation subsystem and compared to the initial pilot data. During the comparison, the estimator determines the pilot symbol's change in gain and phase, and these estimated values are used to adjust the data's gain and phase.

3. Methodology:

In wireless communication, there are two common methods for moving reliable data in multiple copies from one location to another: recieving wire clusters and MIMO. Radio wire exhibits are regularly situated on the beneficiary side of the transmitter or collector in most of remote organizations. An alternative strategy for ensuring the accuracy of data transmission is to employ multiple antennas at both ends of the wireless network. Vahid Tarokh and his group thought of the thought in 1998 that STCs would have a lower blunder rate than a solitary radio wire framework [2]. There are two subcategories of STCs: [4] STTC and STBC Through STCs, numerous duplicates of a unique transmission are transmitted via various receiving wires at the transmitter and receiver, reducing blurring and other errors caused by remote medium transmission. Spreading the trellis code across multiple antennas to provide high diversity gain and coding was an old and complicated technique known as STTCs [6]. It requires a Viterbi decoder [7] to decipher unique data from multiple received duplicates at the beneficiary due to its complex encoding and disentangling. Sviash Alamouti proposed in 1998 that MIMO technology would provide the greatest diversity and coding gain in comparison to other coding schemes if the data streams that needed to be transmitted were encoded in the form of blocks and then distributed.

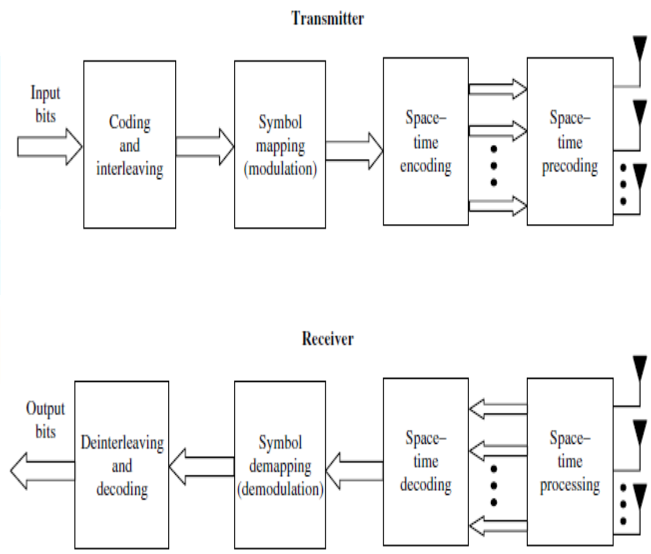

Fig 1: Block Diagram of MIMO System

4. Result and Discussion:

In this chapter we have discussed the results that are obtained by our analysis over the simulation results related to fading channels at different parametric values. We have developed MATLAB based simulations for Rayleigh and Nakagami – m channel for considering their performance measures on the terms of probability distribution function, bit error rate performance power and outage probability and selection at single and multiple antenna at the receive antenna.

We have considered Rayleigh and Nakagami–m fading channel under different scenarios for analyzing their performance in terms BER and outage probability at various combinations of modulation scheme and single/multi antenna systems. For the Nakagami – m fading channel MATLAB simulation are used to develop mathematical model of fading channel for computer channel performance. The outage probability for Rayleigh channel in equation 2:

$$P_\gamma(\gamma) = \frac{1}{\gamma} e^{\frac{-x}{\gamma}} \qquad Equation\ (1)$$

$P_\gamma(\gamma) = Pdf\ for\ Rayleigh\ fadinf\ channel.$

$\gamma = Instantaneus\ SNR$

$\bar{\gamma} = Average\ SNR\ per\ bit$

$$P_{out} = \int_{0}^{\gamma_{th}} P_{\gamma}(\gamma) d\ \gamma \qquad Equation\ (2)$$

$$P(\gamma)_{\gamma} = \frac{m^m \gamma^{m-1}}{\bar{\gamma}\ gamma(m)} e^{\left(\frac{-m\gamma}{\bar{\gamma}}\right)} \qquad Equation\ (3)$$

$m = \ Nakagami - mfading\ parameter$

After considering above equations we have derived the generalized equation for P_{out} of Nakagami –m fading channel given below:

$$P(\gamma)_{\gamma} = \frac{m^m}{\bar{\gamma}\ gamma(m)}\ \gamma^{th^{(-m)}} \gamma_{inc}\left(\frac{m}{\gamma}\gamma^{th}, m\right) \qquad Equation\ (4)$$

Where

γ^{th} $is\ SNR\ threshold\ which\ has\ been\ varied\ to\ analysze\ the\ Pout\ for\ fading\ channel$

γ_{inc} incomplete gamma function.

In the figure 2 we have shown the BER vs. SNR performance of Rayleigh fading channel for considering 1 bit symbol and at the SNR varying from 1 to 10dB.

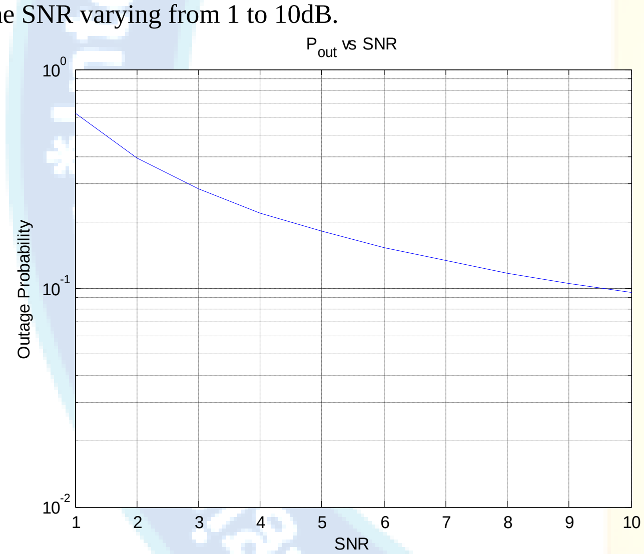

Figure 2: BER vs. SNR curve at 1 bit per symbol for Rayleigh fading channel.

In the figure 2 we can see that as the SNR is increased the noise power is reduced at as the noise decreases the error is also reduced hence the P_{out} is also reducing. At the SNR=10 the P_{out} reduces to 0.1.Similarly we have also kept the SNR fixed at 1 dB and vary the bit per symbol to find the effect of modulation scheme at different M-PSK methods. The bit per symbol is taken as 1 (BPSK), 2(QPSK), 3(8PSK) etc. In the figure 3 we can see that as the bit per symbol is increased the BER increases.

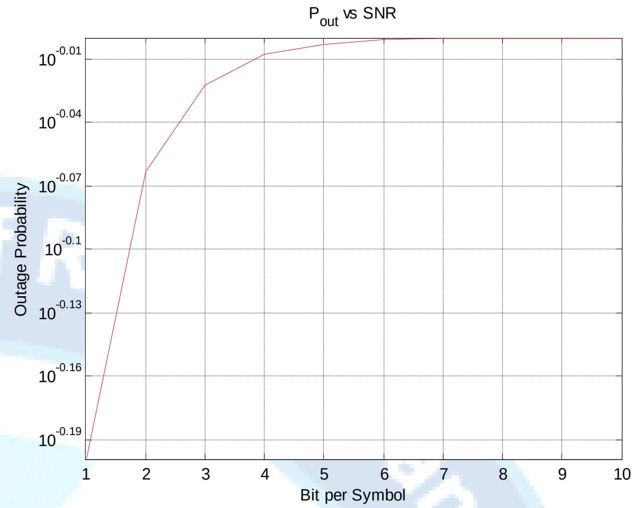

Figure 3: P_{out} performance of Rayleigh fading channel at different bits per symbols.

It can be observed that the P_{out} is least for BPSK i.e. bit per symbol =1 and as bit per symbol is increased P_{out} increases.

5. Conclusion:

This work focus on the performance analysis of fading channels in respect of SISO and MIMO systems for this purpose we have developed communication models of Rayleigh and Nakagami-m fading channels. The fading channel performance is observed for BPSK, QPSK and 8PSK schemes for the issues with multiple numbers of receiver channels. The outage probability and BER are evaluated and analyzed in terms of different SNR and threshold value of SNR. We have worked for MIMO system related fading because it unwanted effects over the received data in a multipath channel includes motion due to the frequency offset known as Doppler shift of the carrier and the time delay of the envelope.

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