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PERFORMANCE EVOLUTION OF COLOR IMAGE TRANSMISSION OVER MIMO WIMAX SYSTEM USING DEFERENT MODULATION

Swati Shandilya, Divyanshu Rao
Department of Electronics and Communication
Shriram Institute of Technology Jabalpur(M.P.),India

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ABSTRACT

The color image transmission over wireless channel is already explored by many researchers. Due to eye perception for only low frequency component the de-noising technique may be add at receiver end of the wireless device. In this paper, Mobile WiMAX system are used for color image transmission and de-noising method is used for improving the performance. RMSE, PSNR and Spectral efficiency are taken as two parameters for comparing the performance.

The multiple input multiple output technique is also used here with the 2x2 antenna systems and QAM-4, QAM-8, and QAM-16 for BER performance improvement. A clear improvement using de-noising technique is found and described in this project.

KEYWORDS: WiMAX, OFDM, MIMO, STBC, FEC, Modulation, PSNR, RMSE, etc.

INTRODUCTION

The color image transmission from one place to another place is most common since many decades. As requirement of communication goes up, in problem of channel behavior for data takes a major limiting role during communication technique. Today many wireless techniques such as Wireless LAN, WPAN, and WiMAX are in use for data communication. Due to wireless transmission communication channel fading and white Gaussian noise become important consideration in the transmission data. In this project are using mobile WiMAX communication for color image transmission.

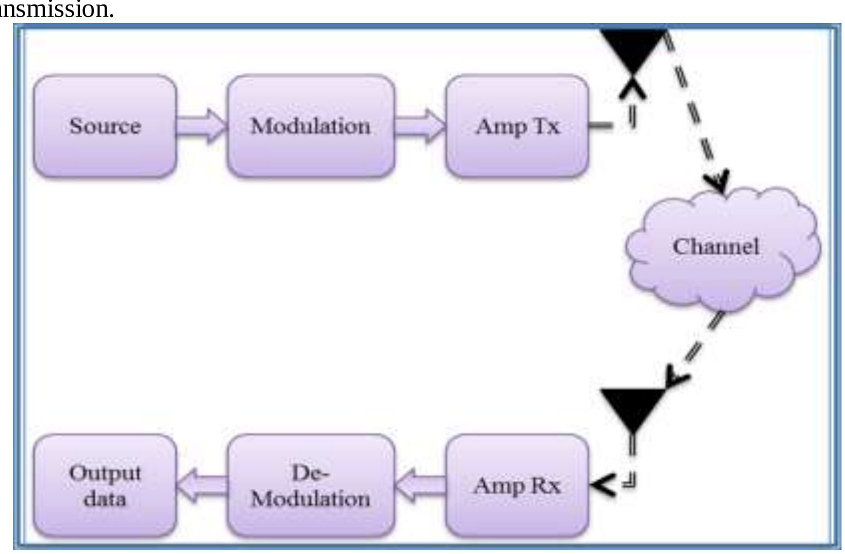

Fig: 1 Block diagram of wireless communication

MOBILE WIMAX COMMUNICATION

The IEEE 802.16-2005, also known as mobile WiMAX, uses Scalable OFDMA (SOFDMA), which divides the carrier up to 2048 subcarriers. This division of the carrier signal makes it possible to improve the signal penetration into the buildings and should enable cheaper products for the end subscriber such as PC and USB cards. It provides high data rate with large coverage and vehicular mobility support. The 802.16e standard carries all the features of 802.16d standard along with new specifications that enables full mobility at vehicular speed, and better QoS performance and power control but IEEE 802.16e devices are not compatible with 802.16d base stations as 802.16e based on TDD whereas 802.16d is on FDD.

802.16e

802.16e was an amendment of 802.16d standard which finished in 2005 and known as 802.16e-2005. Its main aim is mobility including large range of coverage. Sometimes it is called mobile WiMAX communication system. This standard is a technical updates of fixed WiMAX which has robust support of mobile broadband.

ORTHOGONAL FREQUENCY DIVISION MULTIPLEXING (OFDM)

Orthogonal Frequency Division Multiplexing (OFDM) is very similar to the well-known and used scheme of Frequency Division Multiplexing (FDM). OFDM uses the principles of Frequency Division Multiplexing to allow multiple messages to be sent over a single radio network. However in a much more controlled manner, is allowing an improved spectral efficiency.

The OFDM is different from FDM in several ways. In the conventional broadcasting of each radio station transmits on a different frequency, it effectively using FDM to maintain a separation between the stations. With an OFDM transmission such as DAB (Digital Audio Broadcasting), information signals from multiple stations are combined into a single multiplexed stream of data. All the subcarriers within the orthogonal Frequency Division Multiplexing signal are time and frequency synchronized to each other, the interference between subcarriers to be carefully controlled. Data is then transmitted using an orthogonal Frequency Division Multiplexing ensemble that is made up from a dense packing of many subcarriers system. These multiple subcarriers overlap in the frequency domain, but do not cause Inter-Carrier Interference due to the orthogonal nature of the modulation. A simple example of FDM is the use of different frequencies for each FM radio stations.

ORTHOGONALITY

Orthogonality: Two periodic signals are orthogonal when the integral of their product, are over one period, is equal to zero. This is true of certain sinusoids as illustrated in the equation 1 and 2.

a) Continuous Time

$$\int_0^T \cos(2\pi nft) * \cos(2\pi mft)\, dt = 0; n \neq m \qquad (1)$$

b) Discrete Time

$$\int_0^{N-1} \cos\left(\frac{2\pi kn}{N}\right) * \cos\left(\frac{2\pi km}{N}\right) = 0; n \neq m \qquad (2)$$

The carriers of an OFDM are sinusoids that meet this requirement because each one is a multiple of frequency. In each one has an integer number of cycles in the fundamental period. Another way to view the Orthogonality property of orthogonal Frequency Division Multiplexing signals is to look at its spectrum. In the frequency domain each Orthogonal Frequency Division Multiplexing subcarrier has a sin c, sin(x)/x, frequency response, this is a result of the symbol time corresponding to the inverse of the carrier spacing. The receiver is concerned each orthogonal Frequency Division Multiplexing symbol transmitted for a fixed time with no tapering at the symbol. This symbol time corresponds to the inverse of the subcarrier spacing of 1/TFFT these rectangular, boxcar, waveform in the time domain results in a sin c frequency response in the frequency domain. They have sinc shape has a narrow main lobe, with many side-lobes that decay slowly with the magnitude of the frequency difference away from the centre. In each carrier has a peak at the centre frequency and nulls evenly spaced with a frequency gap equal to the carrier spacing. The sampled spectrums are shown as '0's in the figure 2.

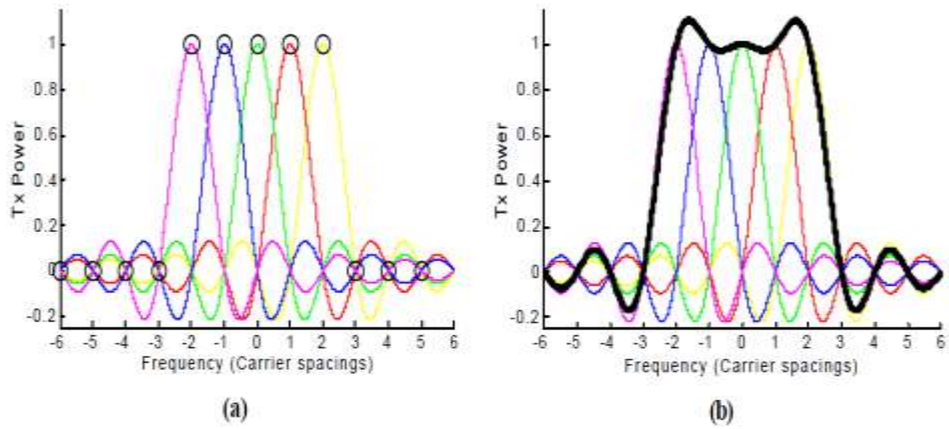

Fig: 2 In Frequency Responses of The Subcarriers in a 5 Tone OFDM Signal

MIMO SYSTEM

According to the number of transmit (TX) antennas and the number of receive (RX) antennas, wireless systems can be classified as single-input single-output (SISO), single input multiple-output (SIMO), multiple-input single-output (MISO) and multiple-input multiple-output (MIMO) systems, in which the input and output are with respect to the channel between the transmitter and the receiver, as shown in Figure 3. The advantages of employing multiple antennas and related signal processing include

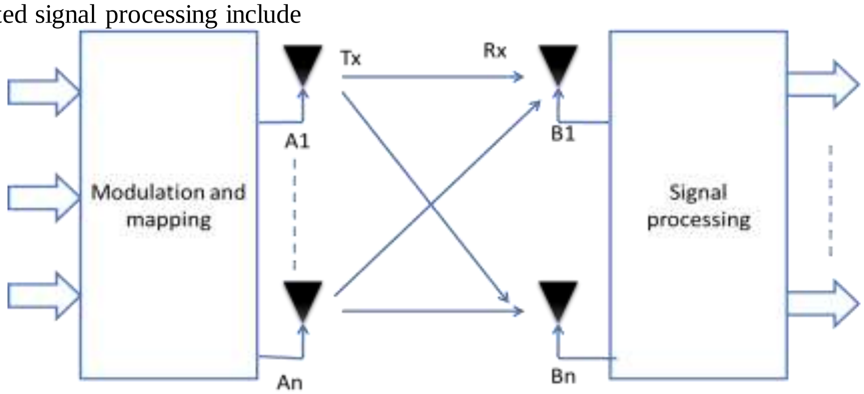

Fig: 3 Block Diagram of a generic MIMO system

BINARY PHASE SHIFT KEYING (BPSK)

This is also known as two-level PSK as it uses two phases separated by 180º represent binary digits (0, 1). This kind of phase modulation is very effective and robust against noises especially in low data rate applications as it can modulate only one bits/symbol. The principle equation 3 is.

$$s(t) = \begin{cases} A\cos(2\pi f_c t) & \text{for binary 1} \\ A\cos(2\pi f_c t + \pi) & \text{for binary 0} \\ A\cos(2\pi f_c t) & \text{for binary 1} \\ -A\cos(2\pi f_c t) & \text{for binary 0} \end{cases} \quad (3)$$

QUADRATURE AMPLITUDE MODULATION (QAM)

The QAM is popular modulation technique used in various wireless standards communication. It combined with ASK and PSK which has two different signals sent concurrently on the same carrier frequency but one should be shifted 90º with respect to the other signal. The principle equation 4 is.

$$s(t) = d_1(t)\cos 2\pi f_c t + d_2(t)\sin 2\pi f_c t \quad (4)$$

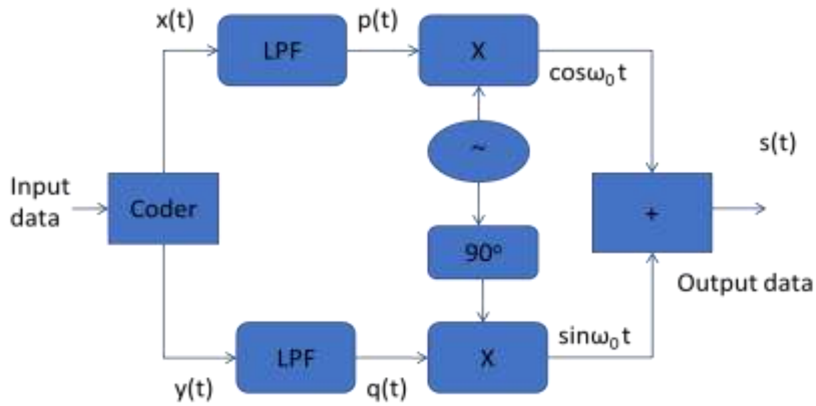

Fig. 4 QAM System

SIMULATION AND RESULTS

The simulation system is shown in figure below, the system will be developed the MIMO over WiMAX system using MATLAB. The adaptive modulation controller is receiving signal number of transmission and number of receiver and SNR, in control OFDM transmission and OFDM receiver signal. The graphs shown in simulation & result section of the thesis clarify the process shown in the system model.

Table 1 Simulation Parameter

S. No.	Parameter	Value
1	FFT Size	512
2	Modulation	BPSK. QPSK, QAM 8, QAM 16
3	Code Rate	1/2
4	Performance SM	BER, Spectral efficiency
5	Channel	Rayleigh channel

Performance of Mobile WiMAX With MIMO 2x2 channel and Deferent Modulation

Fig: 5 Received Image and De-Noising

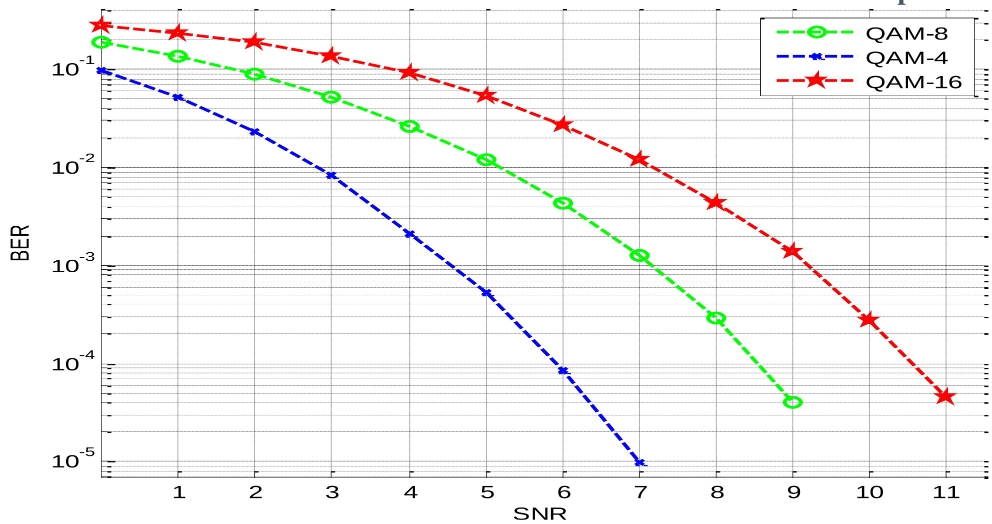

Fig: 6 Performance of SNR Vs BER for MIMO 2x2

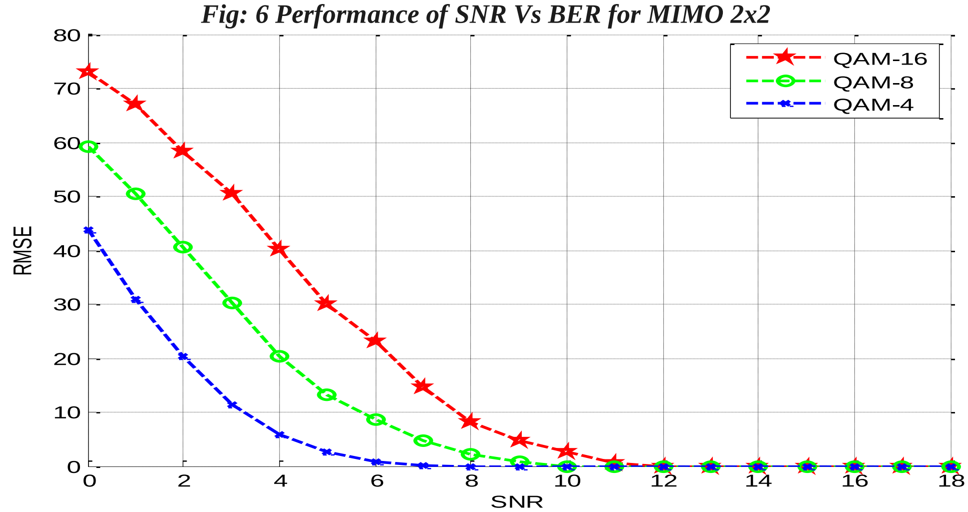

Fig: 7 Performance of SNR Vs RMSE for MIMO 2x2

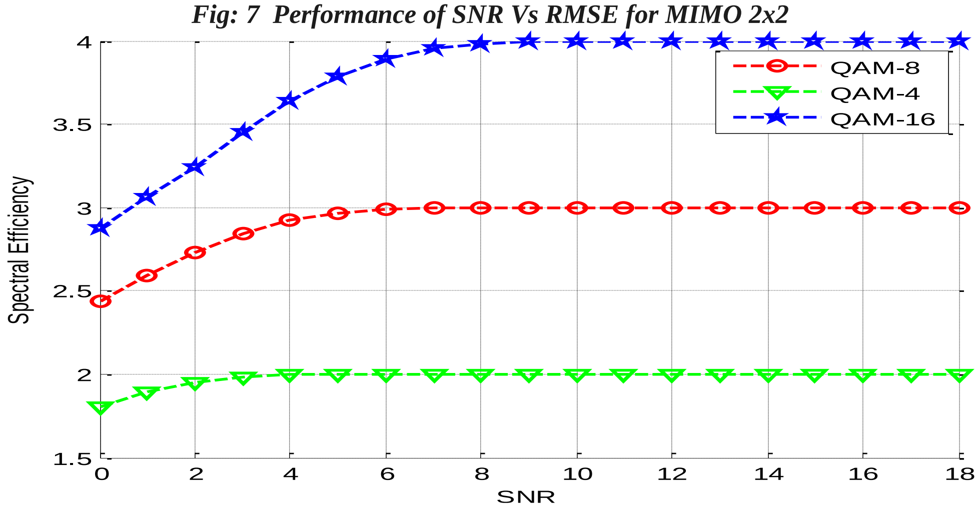

Fig: 8 Performance of SNR Vs Spectral Efficiency for MIMO 2x2

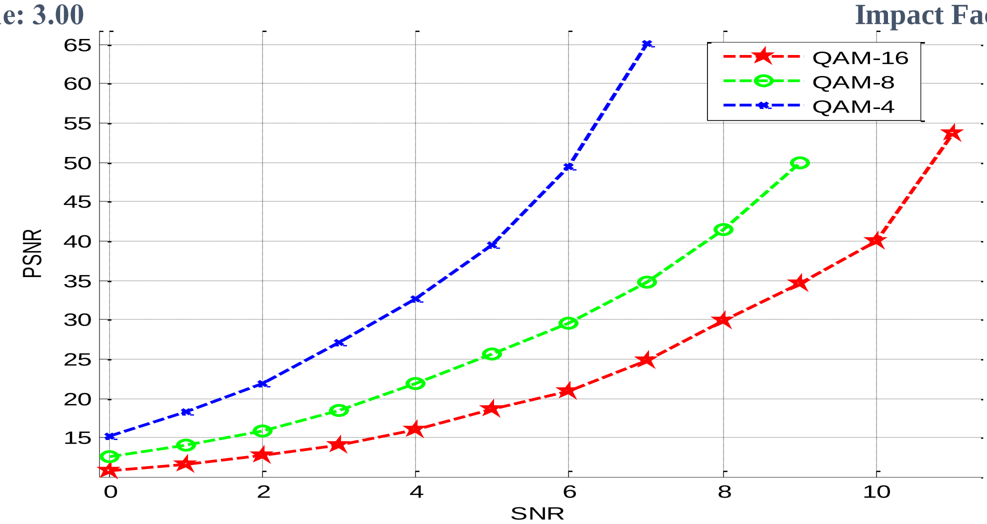

Fig: 9 Performance of SNR Vs PSNR for MIMO 2x2

Performance with Filter and without Filter using Modulation QAM-8

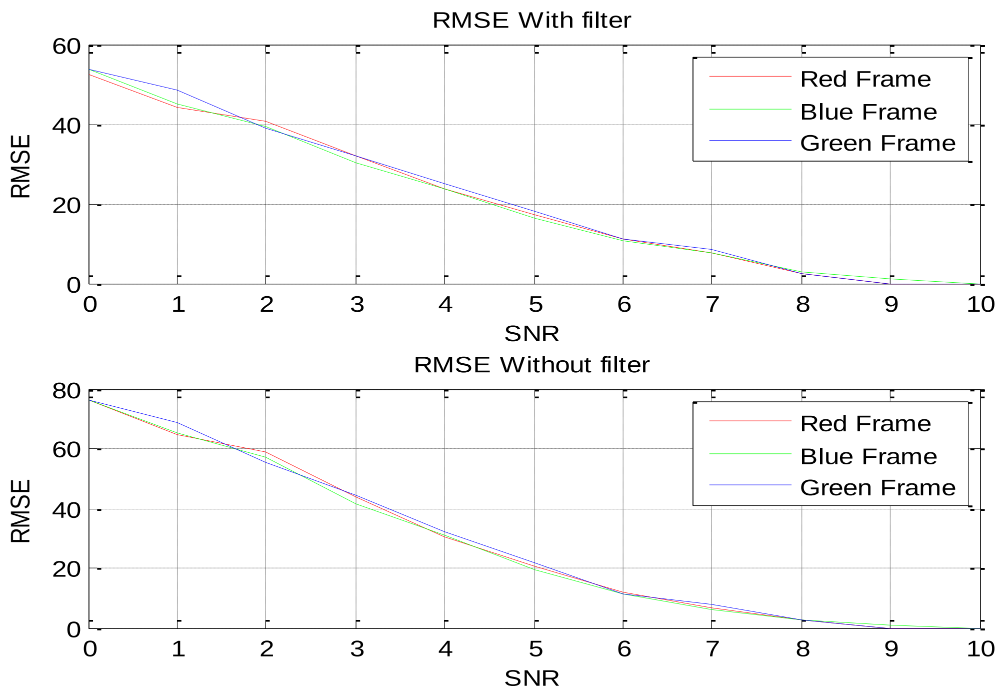

Fig: 10 Performance of With Filter And Without Filter

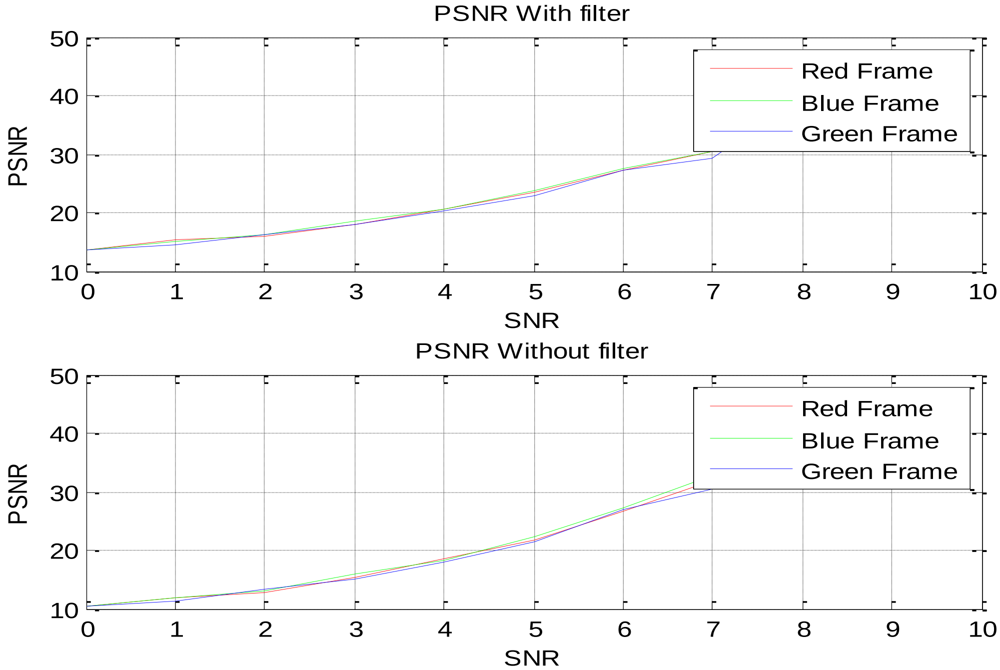

Fig: 11 Performance of With Filter and Without Filter

CONCLUSION

The simulation results shows that the use of MIMO-WiMAX system gives better performance for image transmission. The MIMO technique is also used here with the 2x2, antenna systems and modulation technique for BER improvement.It is found that with increase of modulation order the capacity enhancement is compare to SNR and BER and other parameter etc.

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