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PERFORMANCE ANALYSIS OF 2×2 MIMO-OFDM SYSTEM USING AWGN CHANNEL WITH ALAMOUTI SPACE-TIME CODING

Arun Jat[1], Prof. Mahesh Goud[2]
P.G. Student[1], Asst. Prof.[2]
Sagar Institute of Research and Technology (Truba College), Indore

ABSTRACT

Today, it may seem like Internet access is ubiquitous, but a new wireless broadband System called WiMAX (Worldwide Interoperability for Microwave Access) promises to revolutionize the utility and accessibility of the Internet. WiMAX technology has a longer range, higher spectral efficiency, and ability to connect multiple users at the same time. The range of services it can offer include voice, video, and data, as well as mobility. In this paper we are analysis the Alamouti Space-Time Coding technologies like 2×2 MIMO system under combination of digital modulation technologies like BPSK, QPSK, 8-QAM and 16-QAM with mobile communication channel AWGN used and the results shows under the Bit Error Rate versus Signal to Noise Ratio.

Keyword: - Alamouti Space-Time Coding, AWGN, MIMO, Modulation, BER, SNR, WiMAX.

INTRODUCTION

WiMAX is one of the hottest broadband wireless technologies around today. WiMAX systems are expected to deliver broadband access services to residential and enterprise customers in an economical way. The Forum promotes and certifies compatibility and interoperability of products based on the IEEE 802.16 standards [2]. As for technologies for community networks, all infrastructure options that are common in telecom networks are in principle suitable for building community network infrastructures. Fibber has been an attractive solution for many cities, first of all in North America, terms like “municipal fiber” or “condominium fiber” refer to Fibber infrastructure built by a municipality or an association of users such as school boards. While building a fiber network is technically viable where a local government or some of its utility companies own ducts and support structures which are “free” assets, for economical feasibility it is necessary to have a few large customers (e.g. ISPs) which buy the lion share of the fibber capacity from the local government. Wireless technologies, on the other hand, are almost always suitable for building community networks for several reasons: ease of installation and expandability, usually low costs, and the availability of a range of technologies, starting from the ubiquitous Wi-Fi through WiMAX and 3G mobile. The name "WiMAX" was created by the WiMAX Forum, which was formed in June 2001 to promote conformity and interoperability of the standard, including the definition of predefined system profiles for commercial vendors. The forum describes WiMAX as "a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL" or Wireless MAN-Advanced was a candidate for the 4G, in competition with the LTE Advanced standard.

WIMAX NETWORK CLASSIFIED

The functional distinctions between LANs, MANs, WANs, and GANs are blurring. This is due to several factors. The US Telecommunications Deregulation Act of 1996 allows long distance companies to enter the local telephone market, and at some point will allow the BOCs to enter the long distance market.

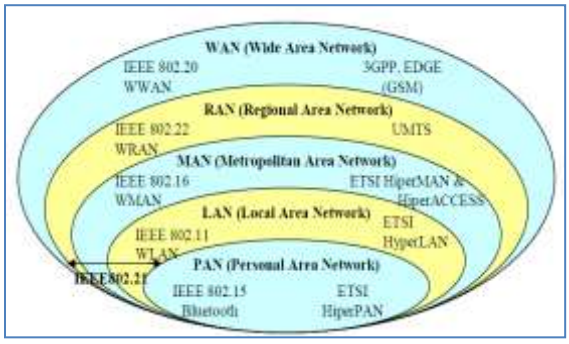

Fig. 1: WiMAX Network classification

MIMO SYSTEM

Multiple antennas systems can be used at the transmitter and at the receiver of a wireless communication system. Such systems are called multiple input and multiple output (MIMO) systems. MIMO systems may be implemented in several different ways and can be categorized into three types. The first type of MIMO system provides spatial diversity and enhances power efficiency. It includes space time block code (STBC), space frequency block code (SFBC), space time trellis code (STTC) and delay diversity systems. The second of MIMO system implements spatial multiplexing to increase its transmission rate. In the last type of MIMO system, some capacity gain can be achieved over non-MIMO systems by pre-processing the signals to be transmitted according to the channel characteristics and then decoding the received signals accordingly. MIMO has become an essential element of wireless communication standards including IEEE 802.11n (Wi-Fi), WiMAX (5G).

STC SCHEME

The Alamouti space-time coding scheme for the system with two transmission antennas and two reception antennas in a memory less channel. The transmission scheme is the same as with the 2×1 system.

Received signals at receive antenna 1 are:

$$R_0(t) = h_{11}(t)X_1(t) + h_{21}(t)X_2(t) + n_0(t) \quad (1)$$

$$R_1(t) = -h_{11}(t){X^*}_2(t) + h_{21}(t){X^*}_1(t) + n_0(t+T) \quad (2)$$

Where n_0 represents noise at receive antenna 1.

At receive antenna 2 the received signals are:

$$R_2(t) = h_{12}(t)X_1(t) + h_{22}(t)X_2(t) + n_1(t) \quad (3)$$

$$R_5(t) = -h_{21}(t){X^*}_2(t) + h_{22}(t){X^*}_1(t) + n_1(t+T) \quad (4)$$

At time instances t and $t+T$, respectively, where n_1 represents noise at receive antenna 2. Again, the estimates of the signals in the decoder/combiner are given as in equation 5 and 6.

$$\widehat{X_1} = {h^*}_{11}(t)R_0(t) + h_{21}(t){R^*}_1(t) + {h^*}_{12}(t)R_2(t) + h_{22}(t)R_5(t) \quad (5)$$

$$\widehat{X_2} = {h^*}_{11}(t)R_0(t) - h_{21}(t){R^*}_1(t) + {h^*}_{12}(t)R_2(t) - h_{22}(t)R_5(t) \quad (6)$$

MODULATION

This is the most popular modulation technique used in various wireless standards. It combined with ASK and PSK which has two different signals sent concurrently on the same carrier frequency but one should be shifted by 90º with respect to the other signal. At the receiver end, the signals are demodulated and the results are combined to get the transmitted binary input. The bandwidth efficiency of PAM/SSB can also be obtained by simultaneously impressing two separate k-bit symbols form the information sequence a_n on two quadrature carrier $2\pi f_c t$ and $2\pi f_c t$. The resulting modulation technique is called quadrature PAM or QAM, and the corresponding expressed as in equation 7 and 8 is.

$$S(t) = Re[(A_{mc} + jA_{ms})g(t)e^{j2\pi f_{ct}}] \quad (7)$$

Where m= 1, 2, 3, 4, 5……M. $0 \leq t \leq T$

$$S(t) = [A_{mc}g(t)cos2\pi f_c t - A_{ms}g(t)sin2\pi f_c t] \quad (8)$$

Where $A_{mc}\ and\ A_{ms}$ are the information- bearing signal amplitudes of the quadrature carriers and g (t) is the signal pulse.

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In this analysis we are used in AWGN (Additive White Gaussian Noise) and different modulation schemes used like BPSK, QPSK, 8-QAM and 16-QAM. The performance of used New scheme Alamouti with combination of MIMO (multiple input and multiple output). The simulation results are shown in figure 1.

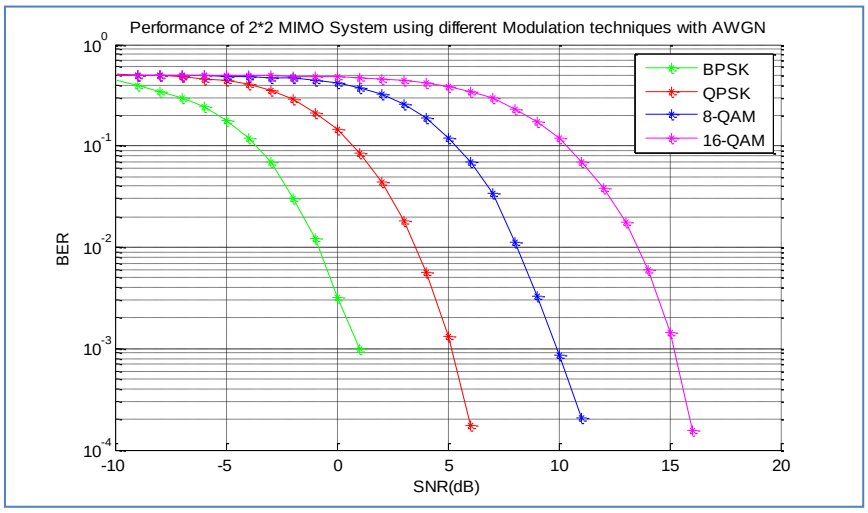

Fig. 2 Result analysis of 2 × 2 MIMO system with AWGN channel

Result Analysis: In this performance, we have used the Alamouti scheme with communication AWGN channel and different modulation techniques. The performance is displayed in figure 2 in terms of the BER verses SNR logarithmic plot. We developed a program in MATLAB, to study MIMO and MIMO-OFDM systems behavior under different conditions. We have used the parameters data rate1Mbps, number of transmitted bits 100000, AWGN channel, 64 subcarriers OFDM signal, four types of modulation BPSK, QPSK, 16QAM and 64QAM.

CONCLUSION

WiMAX technology seems to have everything in one package. It can provide access to the Internet, television streaming, and wireless phone connection, all while incorporating mobility. While WiMAX is still a new technology, as it becomes more commonly used, the technology will become more widely available and the price will decrease. WiMAX technology, this is possible. WiMAX, also known as Worldwide Interoperability for Microwave Access, is a wireless telecommunications system that enables users to take advantage of high-speed wireless data transfer, like Wi-Fi. WiMAX has a wide range of coverage and is renowned for its ability to provide mobility to its video, voice, and data services. As expected, the similar slopes of the BER curves for the modulation BPSK, QPSK, 16QAM and 64QAM systems indicate an 1.50, 5.00, 9.90 and 15.20 dB SNR differences for 2×2 MIMO with Alamouti systems.

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