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SNR Vs PER Performance of IEEE 802.11a for Different Wireless Environment over the Rayleigh Channel

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Abstract

The IEEE 802.11a is a physical layer protocol used in implementation of indoor allpication. In 802.11a,the data can speed up to 54 Mbps . It uses link adaptive scheme . As line of sight is less between the appliances in LAN environment , Rayleigh channel is used .The Rayleigh channel is modeled with 3 different channel condition. The percentage of packet error rate is measured under these condition for different SNR values. Out of total 8 transmission modes the parameters are measured for 5th,sixth,7th and eighth mode. The measured parameters helps us to understand the causes behind the attenuation of radio signal and proposes some guidelines to reduce the attenuation.

Keywords; *IEEE802.11a,ARA,SNR,PER,OFDM*

1.INTRODUCTION

The WLAN 801.11a standard consist of total 8 propagation modes.Every mode corresponds to a particular transmission speed,Modulation technique and code rate[1] .It is as follows.

Propagation mode	Modulation Technique	Code Rate	Transmission speed
1st	BPSK	½	6 Mbps
2nd	BPSK	¾	9 Mbps
3rd	QPSK	½	12 Mbps
4th	QPSK	¾	18 Mbps
5th	16-QAM	½	24 Mbps
6th	16-QAM	3/4	36 Mbps
7th	64-QAM	2/3	48 Mbps
8th	64-QAM	3/4	54 Mbps

Table I. PROPOGATION MODES OF IEEE 802.11a

Table No. 1 shows the mode of transmissions in IEEE 802.11a standard [1]. The large amount of digital data with transmission speed upto 54 Mbps is sent using OFDM concept. The selection of appropriate propagation mode(transmission rate) in ofdm based system is performed using link adaptation technique.

The paper is organized as follows: In the section 2 the orthogonality of multicarries and its advantages are described. In the section 3 efficient rate adaptation scheme using Advanced Rate Adaptation Algorithm (ARA) is studied. In the section 4 the spectral characteristics of radio signal under for gain condition are discussed. In the section 5 the results are presented .Finally the conclusion and future work are presented.

II. ORTHOGONALITY OF MULTICARRIRES

OFDM is multicarrier transmission scheme.The overall bandwidth of B is divided into no. of N subbands called as subcarriers.

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In conventional multicarrier transmission the subcarriers are not orthogonal to each other hence to avoid the the intercarrier interference the guard bands are required . But in OFDM the subcarrier spacing is such that they are orthogonal to each other which avoids the subcarrier interference .This orthogonality eliminates the need of expensive band pass filter as interference of the carriers does not take place[2] .Elimination of expensive bandpass filter makes the system cost effective and less complex.

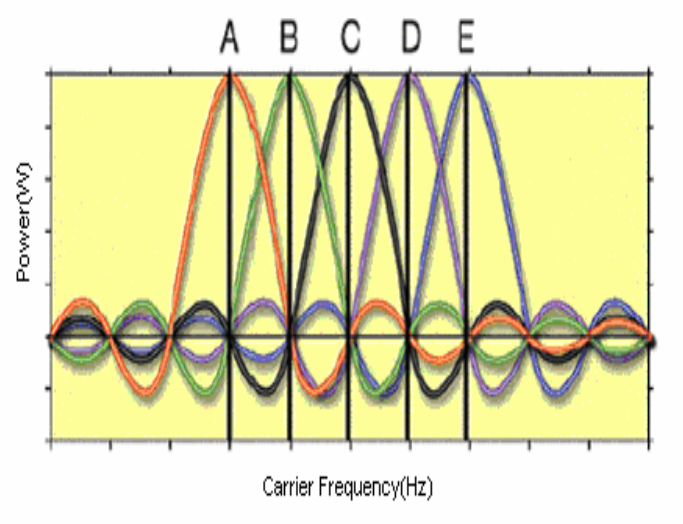

Figure 1: Orthogonal OFDM subcarriers

The data streams are transmitted at different frequencies to the receiver.

In IEEE 802.11a there are total N(52) sub-bands out of which N-4(48) sub-bands are used to send the data and 4 sub-bands are used as pilots.The pilots are are utilized for estimation of of the channel condition [2].

III. TRANSMISSION RATE ADAPTATION

The fixed propagation mode used in wireless communication system results in more packet loss reducing the quality of the system.To mitigate the quality related problem the different propagation modes are employed in 802.11a,which enhances the performance of the system. In real time application link adaption techniques are used.

The link adaptaion technique uses Advanced Rate Adaptation Algorithm (ARA) to select appropriate propagation mode.

Over the channel the conventional rate adaptaion schemes the packet loss may be due to degraded channel condition or collision of packets. The conventional link adaptation schemes were not able to decide the cause behind the packet loss[3].

The selection of efficient propagation mode is performed using RBAR ,Receiver Based Auto Rate mechanism. The channel condition indicator used in this mechanism is the SNR .It works as follows.Basically The transmitted packet is considered to be associated with the SNR value. This SNR value received at receiver side indicates the current state of the channel condition. Depending upon the SNR value sent by receiver the next transmission mode is selected. Thus SNR value sent by receiver is taken from previous transmission mode[3] .

IV.MODELING THE WIRELESS ENVIRONMENT

The different characteristics of the radio signal are discussed in this section. There are various factors which causes the attenuation of radio signal. Weekend radio signal can cause poor performance in a communication. The system with very week radio can create severe drop in the channel signal-to-noise ratio and this may cause the temporary failure of the communication.

To model the wireless environment of the Rayleigh channel with 3 different conditions the gain value of the channel is varied . In the first case/mode, channel is modeled with dispersed gain .This mode can be considered as dispersive fading mode. Since the gain is scattered the strength of the radio signal is weakened heavily over the distance .Under this condition the spectral characteristics of the signal cannot be preserved which causes heavy packet loss over the channel.

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In the second case/mode ,channel is modeled with less gain variation as compared to first case. This case/mode can be considered as flat fading mode..With this gain strength of the radio signal is weakened slowly over the distance. Spectral characteristics of the transmitted signal are preserved properly at the receiver side .Under this condition packet loss is very rare .

In the third case the channel gain is kept constant .As there is no fluctuations in the gain of the channel ,the strength and spectral characteristics of signal are very well retained as compared to above modes[4].The packet loss is negligible under this condition .This case can be referred as no fading mode.

V. PARAMETER SETTING AND RESULTS

The results for 5th,sixth,7th,eights The propagation mode are specified with modulation scheme, code rate and transmission speed.The setting of particular propagation mode is obtained by selecting particular SNR and Low SNR Threshold values.The packet error rate for different conditions are obtained in matlab workspace ..Figure 2,three ,4and five shows the calculated PER verses SNR for the propagation mode mentioned above.

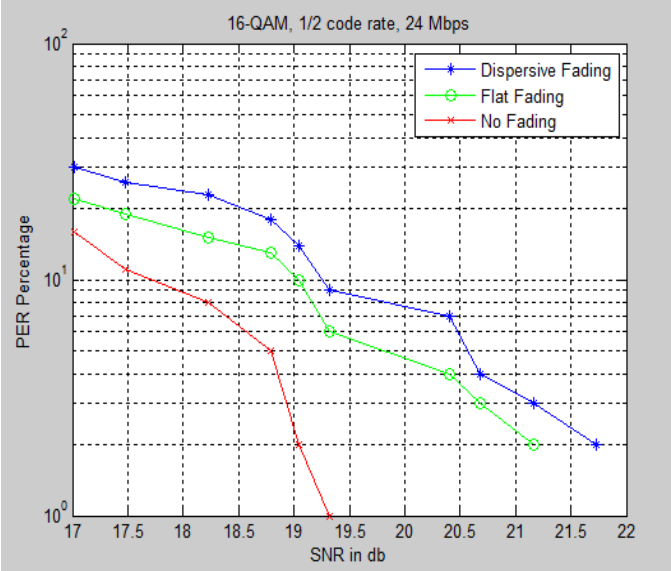

Fig.2

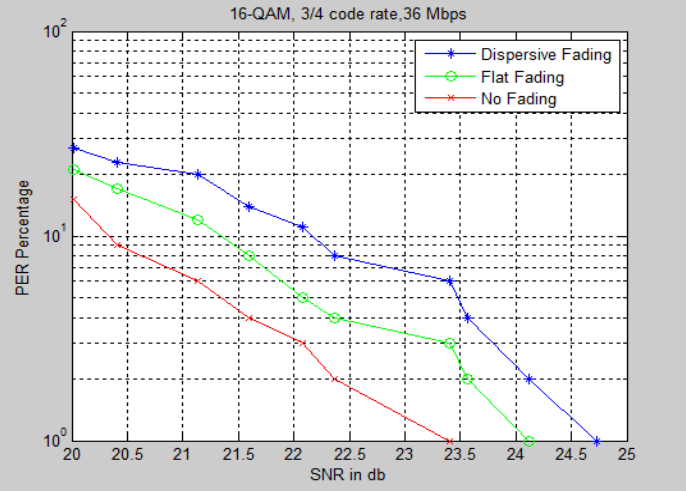

Fig.3

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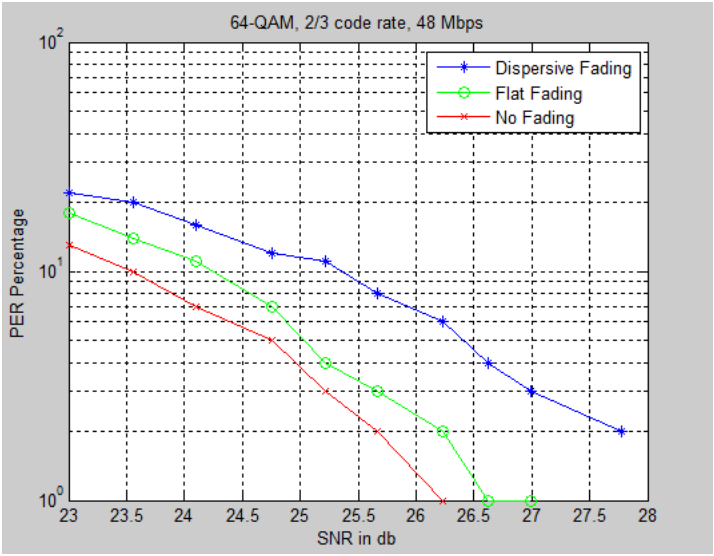

Fig.4

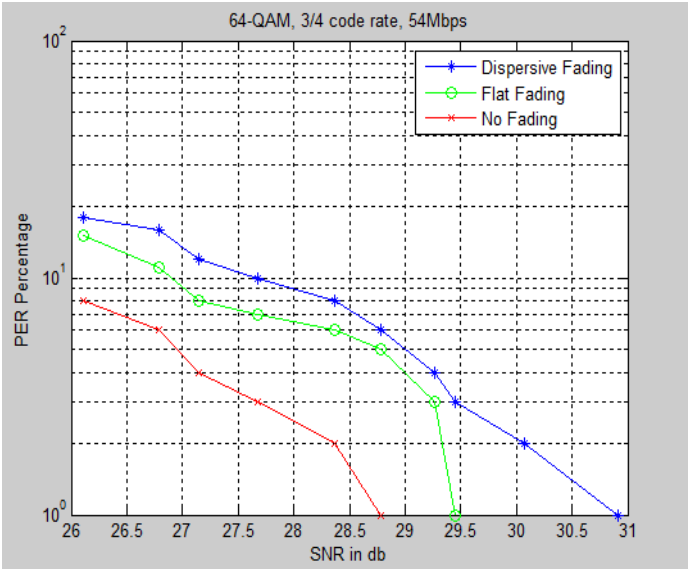

Fig.5

CONCLUSION

We can see that for the modes 5,six,7,eight the PER decreases with increase in SNR. From Figure 2 (16-QAM,1/2code rate,24Mbps) it is clear that for the SNR of 17.02 dB, the PER is 30% in dispersive fading mode ,it is 22 %in flat fading mode and 16% in no fading mode (PHY mode). Thus it can be concluded that each distinct propagation mode for the same value of SNR the PER is high in dispersive fading mode ,it is reducing in flat fading mode and highly reduced in no fading mode

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