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Performance Analysis of L-MRC Receiver over Nakagami –q (Hoyt) Flat Fading Channels

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Abstract:* *In this paper simulation of L-MRC (L branch maximum ratio combining) receiver over Hoyt fading channel has been done. Channel is assumed to be flat faded and band limited with the AWGN (additive white Gaussian noise) noise. The performance of MRC receiver is investigated for BPSK (binary phase shift keying), QPSK (quadrature phase shift keying)and DBPSK (differential binary phase shift keying) modulations.Comparison of these modulations is shown in the result in tabular form. The BER performances for different value of L (no of receiver branches) are also represented with the help of BER plots in the simulation results.

Keywords—Bit error rate, different modulation schemes, Nakagami-q(Hoyt) fading, MRC receiver

I INTRODUCTION

For the better quality of service, capacity analysis of communication systems along with outage and bit error probability is necessary. In wireless channels, performance of a communication system reduces mainly due to fading, among other known factors, which occurs because of multipath propagation of signals. Diversity combining is generally used to reduce the effect of fading in a wireless communication System. From all the Different diversity combining techniques, the maximal ratio combining (MRC) givesan optimum performance [2]

In [1] shows the result for BER for 16-QAM, 64-QAM and 16-DPSK, 64- DPSK over AWGN, Rayleigh, and Rician Channels. In [6] average bit error rate performance of M-Ary modulations over Hoyt fading channel without diversity is presented .In [10] analysis thePerformance of MRC diversity system in a correlatedNakagami fading environment with two correlated system models. In one correlation model theCorrelation coefficient in the middle of the quadrature components of the signals in the diversity branches isconstant, and in the other the correlation coefficient decreases exponentially as the separation between the branches increases.Performance of a dual and L branch maximal ratio combining receiverhas been analyzed for correlated Hoyt fading channels. Analytical expressions for the probability density function of the receiver output signal-to-noise ratio (SNR), average SNR, outage probability and average bit error rate performance for binary, coherent and non-coherent modulations have been presented in [7-8].In [11] the BER calculated for the MRC receiver diversity scheme in case of Nakagami-m fading generated by sum of sinusoidal method using Rayleigh and Rician channels. [4].ExaminedBER performance of M-QAM over correlated Nakagami-m fading channel. [9] Gives Average SEP expression for Cross 32-QAM and 128-QAM in Beckmann fading channel for different fading parameter have been derived by using MGF (moment generating function) approach.

This paper covers the system and channel model in next sub sections. Results discussed in section 2 and section 3 concludes the paper. References are in section 4

A SYSTEM MODEL:-

There are several techniques used to combine the signals from multiple diversity branches. In Maximum Ratio combining a weight factor which is proportional to the signal amplitudeis multiplied with each signal branch. That is, branches with strong signal are further amplified, while weak signals are attenuated. In general,

1) From each channel signalsare added together.
2) The gain of each channel is made proportional to the r.m.s signal level and inversely proportional to the mean square noise level in that channel.
3) Each channelused different proportionality constant.

Maximal-ratio combining is the most favorable combiner for independent AWGN channels. Maximum ratio combining which is a linear combining method, where all the input signals are combined to get an output which has weighted separately. A block diagram of a maximum ratio combining diversity is shown in Fig. 1[5]

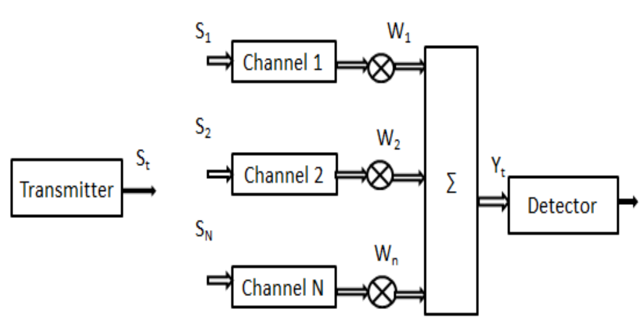

Figure 1-System with MRC Reception

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In [3] the output signal is a linear combination of a weighted replica of all of the received signals. It is given
$Y_t=\sum_{i=1}^{N} s_i w_i$ (1)

Where, S_i is the received signal at receive antenna i, and W_i is the weighting factor for receiver antenna. In maximum ratio combining, the weighting factor of each receive antenna is chosen to be in proportion to its own signal voltage to noise power ratio. Let Ai and φ_i be the amplitude and phase of the received signal S_i respectively. Assuming that each receiver antenna has the same average noise power, the weighting factor W_i can be represented as $W_i = A_i e^{-j\varphi} i$ This method is called optimum combining since it can maximize the output SNR

B NAKAGAMI Q (HOYT) FADING CHANNEL.

For the Nakagami-q (Hoyt) distribution with instantaneous SNR per bit PDF given as [2]

$$P_\alpha(x)= \frac{(1+q^2)x}{q\Omega} e^{-}(\frac{(1+q^2)^2x^2}{4q^2\Omega}) I_o(\frac{(1-q^4)x^2}{4q^2\Omega}) \qquad x\geq 0 \quad (2)$$

Where q is the fading parameter which ranges from 0 to 1 and Io (.) is modified the Bessel function of first kind and zero order. The Nakagami-q distribution extents the range from one-sided Gaussian fading (q = 0) to Rayleigh fading (q = 1).

II SIMULATION RESULTS

From above explain L-MRC receiver for Hoyt fading channel BER plot is shown in figures 2-4. In fig 2, BER performance for L-MRC receiver for BPSK modulation with q= 0.5 and Ω=1 are presented and observed that bit error rate is decreases as the value of L is increased.

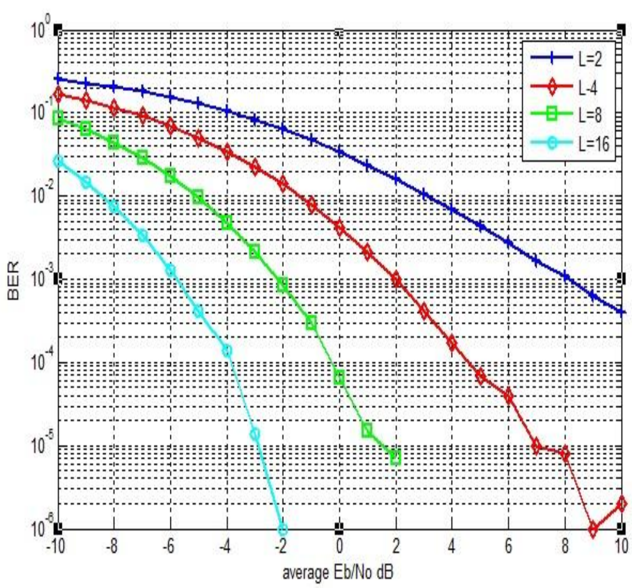

Figure:-2 BER plot for BPSK for different value of L withq=0.5 and Ω =1

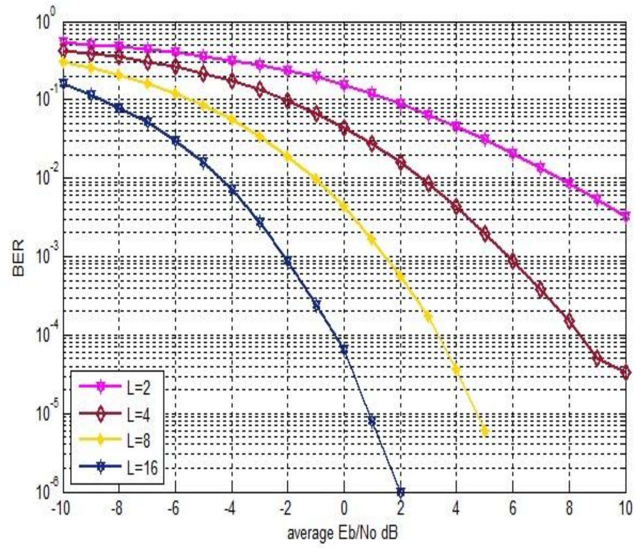

Figure 3:- BER plot for QPSK for different value of L with q=0.5and Ω=1

BER performance for L-MRC receiver for QPSK and DBPSK modulation with q=0.5 and Ω=1 are illustrated in figure 3 and 4 and it is notice that bit error rate is decreases as the value of L is increased.

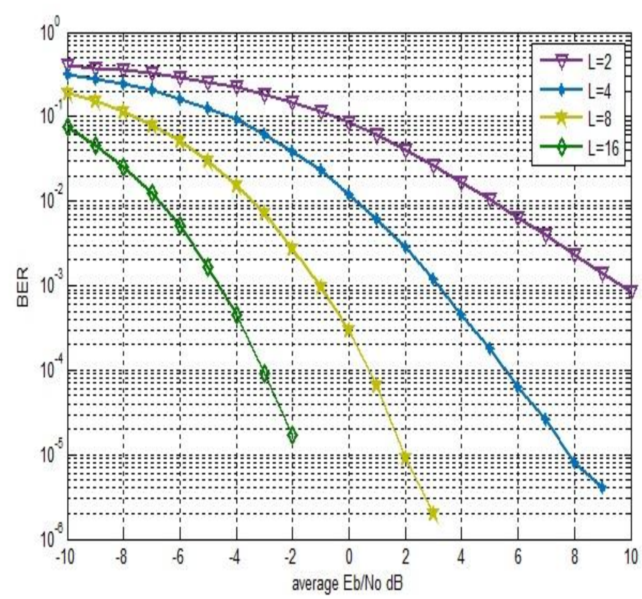

Figure 4:-BER plot for DBPSK for different value for L with q= 0.5 and Ω=1

Table 1:- BER for BPSK,QPSK,DBPSK for different value of L

SNR (dB)	L	Bit Error Rate		
		BPSK	**QPSK**	**DBPSK**
-8	L=2	0.2045	0.4734	0.354
	L=4	0.1164	0.3516	0.2431
	L=8	0.04377	0.2092	0.1155
	L=16	0.007617	0.08012	0.02536
-6	L=2	0.1536	0.4032	0.2926
	L=4	0.0698	0.2633	0.1642
	L=8	0.01738	0.122	0.0518
	L=16	0.001308	0.02988	0.05151
0	L=2	0.0342	0.1547	0.08457
	L=4	0.004141	0.04424	0.01215
	L=8	6.6e-05	0.00432	0.000292
	L=16	0	6.4e-05	0

III CONCLUSIONS-

In this paper Performance of L-MRC Receiver over Nakagami –q (Hoyt) Flat Fading Channels for different modulation schemes (BPSK, QPSK, DBPSK) arepresented. By analyzing the graphical and tabular representation of BER plots given in the results, it is observed of that the BER decreases with the increase in the number of receiver branches in all three cases of modulation. From the table shown in the results for L=4, SNR= -6dB the bit error rate for BPSK is 0.0698 for QPSK the BER is 0.2633 and for DBPSK the BER is 0.1642. Soit is cleared that BPSK gives the better result from DBPSK and DBPSK result is better than QPSK.

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