Recovering Weak Signal using Nakagami Fading Wireless Channel with Multiuser Diversity

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Abstract: - Propagation of new wireless technologies has regenerated an interest on the digital modulation system, analysis and implementation of suboptimal receiver designs that provide poor performance when the order of diversity is large. In this proposed system propose a new creation for causing the Nakagami Fading channel(NFC) which possess random and different fading figure *m* for each sub channel with Multiuser diversity is used to producing an acceptable average Signal to Noise Ratio(SNR) and best statistical reducing outage probability(P_{out}) or Bit Error Rate (BER) of multipath fading effect. The diversity is produced by the depolarization of the transmitted signal by reflection, diffraction, and scattering in the channel of Nakagami Fading channels. The result of this proposed system, a novel simple and high efficient generation method is developed to scrutinize an excellent accuracy in wireless media.

Key-Words: - **Multipath Fading; Nakagami Fading Channel; Fading Figure; Multiuser Diversity; Outage Probability**

1 Introduction

The wireless revolution was triggered and is being sustained by several important factors are advances in microelectronics, high-speed intelligent networks, positive user response and an encouraging regulatory climate worldwide. The largest obstacle facing designers of wireless communications systems is the nature of the propagation channel [1].

The wireless channel is non-stationary and typically very noisy due to fading and interference, while the most common type of fading is caused by multipath effects, in which multiple copies of a signal arrive out of phase at the receiver and destructively interfere with the desired signal. Although there are a large number of papers dealing with performance analysis of digital modulation with carrier frequency offset, the fading channels are all assumed Rayleigh distributed. However, another well-known channel statistical model called the Nakagami distribution, has been shown to be a more versatile model for such as urban, suburban radio multipath channel in wireless communication systems and Rician fading is just a special case, where the fading figure $m = 1$. The objective of this paper is to evaluate in Nakagami fading channels for $m > 1$, the performance of wireless transceiver system with carrier frequency offset and to explore the effect of imperfect channel fading estimation.

Diversity, where signal replicas are obtained through the use of either temporal, frequency, spatial or, polarization spacing is an effective technique to mitigate the multipath fading. There are three prevalent diversity combining techniques: Selection Combining (SC), Equal Gain Combining (EGC) and Maximal Ratio Combining (MRC). MRC weights the signals from different paths according to their respective SNRs and then takes their sum. Compared to the other two schemes, MRC has significantly better performance than SC and EGC [8].

The existing system, performance of transmission modes are evaluated by calculating the probability of Bit Error Rate (BER) versus the Signal Noise Ratio (SNR) under the frequently used three wireless channel models are AWGN, Rayleigh and Rician. Simulation of wireless channels accurately is very important for the design and performance evaluation of wireless communication systems and components. So, the proposed system is used to improve the performance of MRC over Nakagami fading channels. Section 2. Illustrating the wireless communication properties and explaining Nakagami fading channel compared with other flat fading channel are analyzed. In addition of Section 2.2, the Multiuser with MRC diversity technique used to improve the signal detection performance in noisy environments. Finally, Sections IV concludes the work and summarizes the important results.

2 PROPOSED SYSTEM

The unique nature of wireless channels presents many challenges as well as opportunities to the system designers. First of all, wireless channel exhibits fading of different scale, from the long-term path loss and shadowing to the more volatile multipath fading, which will greatly corrupt the received signal and degrade system performance if left untreated. Secondly, any wireless system must operate with the limited and usually expensive spectral resources. A major challenge is to propose the wireless system such that this limited resource can be utilized to the fullest extent [2]. In the end, it's evident from the preceding that Nakagami fading phenomenon in wireless channels is absolutely important to system design and performance analysis [11]. An additional challenge for system designers is how to accurately model and simulate the multipath fading channel.

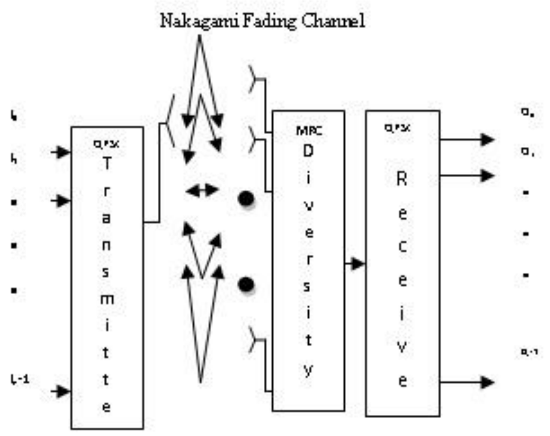

Fig.1. Block diagram of proposed system

For wireless applications, the fading channel represents the model that fits real world test measurements. If the channel frequency response is flat and linear in phase over whole signal bandwidth, the signal is said to undergo flat fading and the channel impulse response can be modelled as an impulse.

A proposed block diagram of a transmitter and receiver is shown in Fig.1. The unipolar binary input information stream (I_0, I_1… In_{-1}) has bit rate R_D and is first converted into bipolar information. The Quadrature Phase Shift Keying (QPSK) modulator is used to modulate this data stream. With QPSK, the binary data are converted into 2-bit symbols which are then used to phase modulate the carrier. Thus QPSK is twice as efficient as FSK, BPSK in this respect. However, more complex equipment is required to generate and detect the QSPK modulated signal. Therefore, the QSPK transceiver is used to design the proposed system. This resultant transmitting signal is transmitted over the Nakagami fading channel. The superimposition of waves coming from all the direction due to reflection, diffraction and scattering (Fig.1) caused by obstacles. This effect is known as Multipath Propagation. There are many radio channels in which fading in encountered that are basically Line Of Sight (LOS) communication links with multipath components arising from secondary reflection, or signal paths, from surrounding terrain [3]. In such channels the number of multipath components is small and hence, the channel may be modelled in a Nakagami fading channel form. At the receiver, receive an identical MRC diversity with the received signal, which is used to improve the output of the diversity. The MRC resultant signal is demodulated by means of QPSK demodulator. A signal for maintain signal strength of the diversity with QPSK received signal is usually extracted from the receiver signal [4].

In this proposed system, we propose a new framework for generating the Nakagami fading channels [9] which possess arbitrary and different m for each sub channel. In an advantage of the Nakagami over the Rayleigh and Rice distribution is the relatively an expression for the Probability Density Function (PDF) and received SNR was improved.

2.1 The Fading Channel Model

In a wireless communication system, the signals may travel through multiple paths between a transmitter and a receiver causing what is called multipath propagation [3]. Due to the multiple paths, the receiver observes variations of amplitude, phase and angle of arrival of the transmitted signal. These variations originate the phenomenon referred to as multipath fading. The variations are usually classified according to the fading scale. The fading scale is classified large-scale and small-scale fading. Large-scale fading refers to the degradation caused by the presence of physical objects of considerable size (like hills, buildings, forests) in the wireless signal path. The receiver is said to be shadowed by these obstacles. This type of fading can be modeled through the estimate of a path loss as a function of the distance between the transmitter and the receiver. This model can be divided into a mean loss and a Log-normal probability density function variation around this mean.

Small-scale fading events describe changes in the separation between a transmitter and a receiver. They can be caused by the mobility of the transmitter or the receiver as well as by the crossing by any physical object of the line of sight path stretching between them. The rate of change of the propagation conditions accounts for the fading rapidity. Small scale fading results into important variations of signal amplitude and phase. It shows itself in two distinct mechanisms: time-spreading of the signal or signal dispersion, and time variant behavior of the channel. When there is no predominant line of sight between the transmitter and receiver, the fluctuation of the signal envelope is Rayleigh distributed. Small-scale fading is then referred to as Rayleigh fading. When there is a predominant line of sight between the transmitter and the receiver the fluctuations are statistically described by a Rician pdf.

Any wireless radio signal transmitted over large physical distances is subject to both large as well as small-scale fading types. Since, large-scale fading affects only the average strength of the received signal, it will not be considered in the rest of our study. Thus, we will restrict ourselves to small-scale fading and precisely to at fading. The flat fading channel is a typical channel encountered in many wireless environments. The Rayleigh distribution is frequently used to describe the statistical fluctuations of signals received from multipath fading. This multipath fading is due to the constructive and destructive combination of randomly delayed, scattered, reflected, and diffracted signal components.

A versatile statistical model often used to model a wide range of fading environments which has shown to be quite appropriate in modeling multipath fading in mobile radio channels is the Nakagami-*m* distribution. Thus, we will restrict ourselves to small-scale fading and precisely to at fading. The flat fading channel is a typical channel encountered in many wireless environments. For instance, many systems such as WiFi, WiMax, Digital Audio Broadcasting (DAB) or Digital Video Broadcasting can be modeled as at fading channels, since they call for the Orthogonal Frequency Division Multiplexing (OFDM) technique that has the capability to transform frequency selective channels into parallel at fading channels.

2.1.1 Nakagami Distribution

The open flexibility, computational tractability, and experimental consistency of the Nakagami-m distribution (Nakagami, 1960) has made it popular as a distribution when analyzing the performance of wireless systems [14]. An important special case of the Nakagami distribution is the Rayleigh distribution, which arises in the situation of multipath transmission with no direct component, i.e., when all of the received power stems from scattered components.

The distribution of the amplitude and signal power can be used to find probabilities on signal outages consider by four factors. The first factor, if the envelope is Nakagami distributed, the corresponding instantaneous power is gamma distributed. Second factor is the parameter ‘m’ is called the 'shape factor' of the Nakagami distribution. Next factor followed by in the special case $m < 1$, Rayleigh fading is recovered, with an exponentially distributed instantaneous power [10]. Finally, Nakagami distribution of $m > 1$, the fluctuations of the signal strength reduces compared to Rayleigh fading.

2.1.2 Nakagami Fading Channel (NFC)

The first work of researching and developing of digital mobile communication system is to understand mobile channel characteristics itself. Rayleigh and Rician fading models have been widely used to simulate small scale fading environments over decades. Rayleigh fading falls short in describing long-distance fading effects with sufficient accuracy. M. Nakagami observed this fact and then formulated a parametric gamma function to describe his large-scale experiments on rapid fading in high frequency long-distance propagation. Although empirical, the formula is rather elegant and has proven useful. In any atmosphere in which fading is a present, wireless engineer must effort to predict the effect of such fading on the transmitted signal as it passes through the transmission medium to the receiver. A variety of statistical models derived from probability theory and actual field observations help us model channel behaviour and in so doing provide us with information essential to system design. If received signal amplitude levels can be predicted based on these models, then required transmitter power, system architecture, modulation technique, and a host of other parameters can be adjusted to compensate for the channel.

The Nakagami-m distribution is one such model, which can be used to emulate fading channel conditions is called as Nakagami Fading Channel (NFC). There is no direct way to generate an efficient and high quality Nakagami fading channel with the correct temporal correlation properties. There are two general approaches to generate the Nakagami fading with a known time correlation function [15]. The first method maps a Rayleigh fading channel into the required Nakagami channel using some transfer function. The Rayleigh fading channel could be generated using one of the well established methods mentioned below. However, the time correlation function for the Nakagami process should be also mapped to the one required for the Rayleigh process or for each of the in-phase and quadrature components of the Rayleigh process. The second method decomposes the Nakagami process into a sum of Gaussian Processes [3]. The probability density function of a Nakagami process is the amplitude of the sum of squared independent Gaussian processes when *m* is an integer or half integer. In the conducted simulation scenario, the receiver is constantly moving away from the transmitter. Thus plotting the power envelope versus distance is equivalent of plotting it versus the time. Each component of the power envelope is observed separately to confirm that each part of the model is correct. It shows clearly how the path loss exponent changes at the critical distance at 226 m (rural environment). The power at distance 1 m (reference distance) is calculated using the free space path loss model. From the graph it is shown to be around -53 dB. Figure 1 show the scatter superimposed on the path loss when fading is disabled. This scatter is modeled by the log normal distribution. In the rural environment the variance of the scatter after the critical distance is less than before the critical distance. The fading envelop when Nakagami fading is enabled and superimposed on the path loss model versus the log of distance. Detect that the fading severity increases as the distance increases, as expected according to Eq. 2. Figure 3 shows the fading power envelope resulting from the simulation.

The Nakagami fading model was initially proposed because it matched empirical results for short wave ionospheric propagation. In current wireless communication, the main role of the Nakagami model can be summarized as follows: It describes the amplitude of received signal after maximum ratio diversity combining. After k-branch maximum ratio combining (MRC) with Rayleigh-fading signals, the resulting signal is Nakagami with m = k. MRC combining of m-Nakagami fading signals in *k* branches gives a Nakagami signal with shape factor ' mk'. The sum of multiple independent and identically distributed (i.i.d.) Rayleigh-fading signals have Nakagami distributed signal amplitude. This is particularly relevant to model interference from multiple sources in a cellular system. The Rician and the Nakagami model behave approximately equivalently near their mean value.

2.1.2 NFC Probability Density Function

A specified a random variable R, consent to the event $\{R \leq r\}$, where r is any real number in the interval $(-\infty < r < \infty)$. The probability of this fading signal is $P(R \leq r)$, called the probability distribution function. The derivative of the $P(R \leq r)$ symbolized as p(r) is called as Probability Density Function (PDF) of the random variable R. The PDF is

$$p(r) = \frac{dP(R \leq r)}{dr} \quad (-\infty < r < \infty) \qquad (1)$$

The PDF for Nakagami distribution is

$$p_{R(r)} = \frac{2}{\Gamma(m)} \left(\frac{m}{\Omega}\right)^m r^{2m-1} \, e^{-\left\{\frac{mr^2}{\Omega}\right\}} \qquad (2)$$

Where Ω is defined as $\Omega = E(R^2)$. And the parameter 'm' is defined as the ratio of moments, called the fading figure, that is

$$m = \frac{\Omega^2}{[(R^2 \quad - \quad \Omega^2)]} \qquad ; m \geq \frac{1}{2} \qquad (3)$$

The n^{th} moment of R is $(x\sqrt{\ }\Omega)$; where X is the statistics of the sum of independent or correlated Nakagami-m Random Variables (RV's) is necessary to be known [13].

In Nakagami fading, m is a parameter that controls the severity of the fading. In this proposed system, present a highly accurate closed-form approximation for the PDF of the sum of non-identical arbitrarily Nakagami-m Random Variables (RV's) with identical (integer) fading parameters. Values of $0.5 \leq m < 1$ result in fading more severe than Rayleigh, and values of $m > 1$ result in Rician fading [5]. The probability density function (PDF) of the Nakagami distribution for different values of m tends to infinity, the Nakagami-m PDF tends to an impulse in multipath channel [7].

In this section, different random variables are considered to obtain PDF and the simulation results are shown in Section IV. It is necessary to explore what happens in the wireless channel, the input signal as it travels from the transmitter to the receiver.

2.2 Multiuser Diversity

In multiuser diversity the multiple channels are connected with various users and the system normally uses selection-diversity to select the user with the best channel in any given fading state. The multiuser diversity gain relies on different channels between users, so the larger the dynamic range of the fading, the higher the multiuser diversity gain [6]. In addition, as with any diversity technique, performance gets better with the number of independent channels. Thus, multiuser diversity is most effective in systems with a large number of users. This strategy exhibits significant power savings over constant transmit power while meeting the delay constraints of the traffic. The capacity regions in fading depend on what is known about the fading channel at the transmitter and receiver, analogous to single-user capacity in fading. Thus, multiuser detection methods that do not suffer from this type of error may work better in practice than successive cancellation. These adaptive transmission policies exploit multiuser diversity in that more resources (power, bandwidth, and timeslots) are allocated to the users with the best channels in any given fading state. This provides additional flexibility in the system since under severe fading conditions, maintaining a fixed rate in all fading states can consume a great deal of power. The goal of these techniques is to achieve the full range of diversity, multiplexing, and directivity tradeoffs inherent to multiuser systems. Multiuser diversity was surveyed by means to increase throughput and reduce error probability in uplink channels, and the same ideas can be applied to downlink channels.

Multiuser diversity takes gain of information that in a system with many users whose channels fade alone, at any given time some users will have better channels than others. By transmitting only to users with the best channels at any given time, systems resources are allocated to the users that can utilize them, which lead to improved system capacity and/or performance [18]. First, multiuser diversity provides improved channel quality since only users with the best channels are allocated system resources. In addition, multiuser diversity provides abundant directions where users have good channel gains, so that the users chosen for resource allocation in a given state not only have very good channel quality, but they also have good spatial separation, thereby limiting interference between them.

2.2.1 MRC Diversity

The Maximal Ratio Combining (MRC) algorithm mitigate fading is used to find the error rates in Nakagami channels in presence of Nakagami distributed interferers [9]. In this work, the error rates are estimated in presence of interference in shadowed fading channels, when the interfering channels besides go through fading and shadowing. Most combining techniques are linear. The output of the combiner is just a weighted sum of the different fading paths or branches, as shown in Fig.2 for M-branch diversity. Combining more than one branch signal requires co-phasing, where the phase θ_i of the i^{th} branch is removed through the multiplication by α_i for some real-valued $a_{ir.}$ In this output is a weighted sum of all branches, so α is in Fig.2 is all nonzero. Since the signals are cophased,

$$\alpha_i = a_i e^{-j\theta_i}$$

where θ_i is the α_i phase of the incoming signal on the i^{th} branch [3]. Thus, the envelope of the combiner output is $r = \Sigma^{M}_{i=1} a_i r_i$.

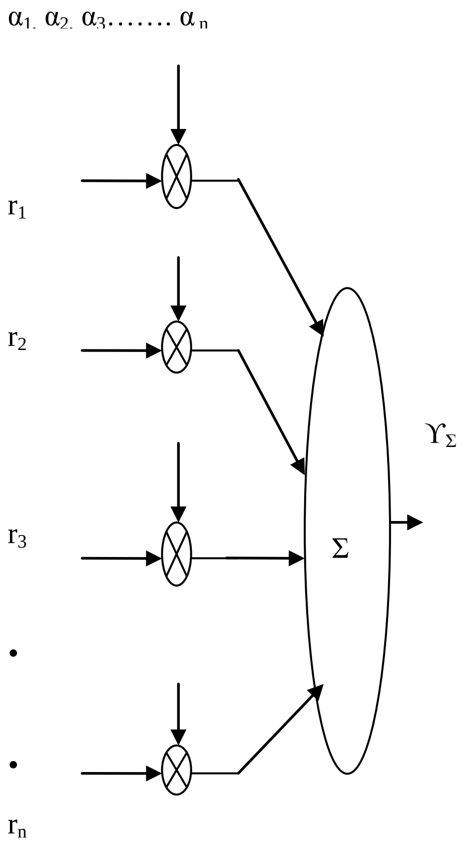

Fig 2. MRC Diversity

Thus, the output SNR of the combiner is

$$\gamma_{\Sigma} = \frac{Es}{No}\sum_{i=1}^{M} r_i^2 = \sum_{i=1}^{M}\gamma_i \qquad (4)$$

where E_s is the energy per symbol of the transmitted signal and an identical noise PSD N_0 on each branch and pulse shaping such that $BT_s = 1$.

The power spectral density (PSD) associated with multipath components as a function of their Doppler frequency; it can be viewed as the distribution of the random frequency due to Doppler associated with multipath. The PSD is useful in constructing simulations for the fading process. A general method for simulating the envelope of a narrowband fading process is to pass two independent white Gaussian noise sources with PSD $N_0/2$ through low pass filters with frequency response. Then each branch has the same SNR $\gamma_i = E_s/N_0$.

An outage event is specified by a specific number of bit errors occurring in a known transmission. The probability of outage is means to judge the efficiency of the signalling scheme in a fading channel [12]. The BER and probability of outage various modulation schemes under various types of fading channel impairments can be evaluated either through analytical technique or through simulations. The outage probability, P_{out}, defined as the probability that γ_s falls below a given value corresponding to the maximum allowable P_s. The corresponding outage probability for a given threshold γ_0 is given by

$$P_{out=}\ p(\gamma_{\Sigma} < \gamma_0) = \int_0^{\gamma_0} p_{\gamma\Sigma}(\gamma)d\gamma = 1 - e^{-\gamma 0/\gamma}\sum_{k=1}^{M}\frac{(\gamma 0/\gamma)^{k-1}}{(k-1)!} \quad (5)$$

where γ_0 typically specifies the minimum SNR required for acceptable performance. An equation (5) is used to find out the outage probability with respect to average diversity gain with receiver diversity. There are two types of performance gain coupled with receiver diversity; those are array gain and diversity gain. The array gain results from coherent combining of multiple receive signals. The MRC antenna diversity gain $\mathbf{A_g}$ is defined as the maximum value of SNR $\boldsymbol{\gamma}$ compared to all branches over the threshold SNR $\boldsymbol{\gamma}$:

$$A_g = \frac{\gamma}{\gamma_0} \quad (6)$$

The array gain allows a system with many transmit or receive antennas in a fading channel to attain better performance than a system without diversity in an AWGN channel with the same average SNR. The more favourable distribution for γ_{Σ} leads to a decrease in P_s and P_{out} due to diversity combining, and the resulting performance advantage is called the diversity gain. However, this diversity technique requires either a sufficient number of directional antennas to span all possible directions of arrival or a single antenna whose directivity can be steered to the angle of arrival of one of the multipath components. Due to the performance analysis found this diversity gain (Ag) dB is

$10\log_{10}^{Ag} = 10\log_{10}^{(\gamma/\gamma_0)}$. The received maximum γ and threshold γ_0 is constant designed value of 2dB are considered to find out the diversity gain. According this calculation, the MRC diversity gain is very minimum compared with other diversity techniques. Thus, at better SNR, the diversity order of MRC is M, the number of antennas and so MRC achieves full diversity order. In this work, the MRC diversity of received signals is investigated and utilized to improve signal detection performance in wireless environments and simulation results shown in Section IV.

3. SIMULATION RESULTS

The proposed system following multiuser diversity reception Nakagami fading channel is analyzed.

3.1. NFC PDF Simulated Result

In Fig.3 Nakagami PDF is illustrated graphically as a function of *R* for various values of *m* with Ω =1. For values of m in the range $0.5 \leq m \leq 1$, we obtain PDFs that have larger tails than a Rayleigh distributed random variables. For values of m>1, the tail of the PDF in Nakagami distribution decompose faster than that of the Rayleigh and Rician distribution.

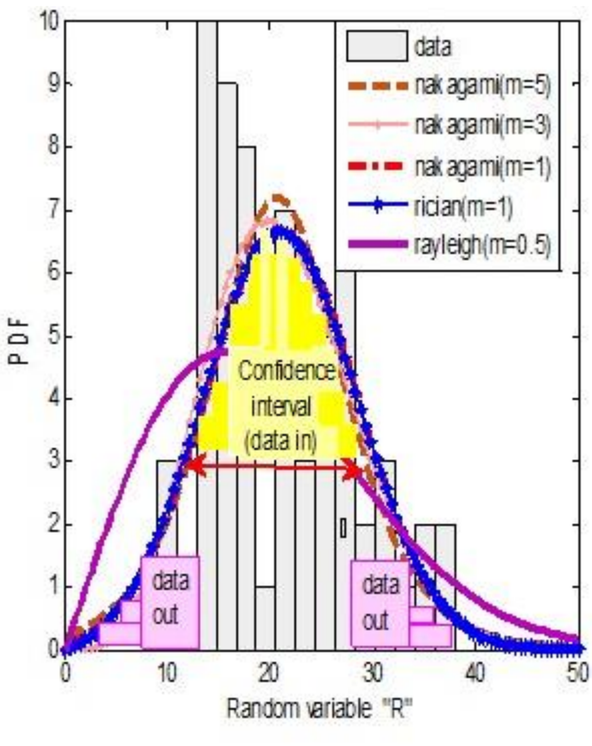

Fig.3. Comparision for PDF of Nakagami Fading Channel over Flat Fading Channel

3.2. Computing NFC PDF

The above simulated Probability Density Function is the vertically normalized PDF that is produced from a signal or measurement that has purely random errors [16]. The mean and median are both equal to the expected value at the peak of the distribution. In the proposed system given random variable is R with mean μ and variance σ^2. The standardized random variable Z has zero mean and unity variance, i.e.

$$Z=(R - \mu)/ \sigma.$$

Its plot is commonly called a "bell curve" because of its shape. Confidence level is defined as the probability that a random variable lies within a specified range of values. The yellow areas in the above plot are called the data inside of the confidence interval. The pink areas in the above plot are called the tails.

i. Interval probabilities:

$$P(R1 < R \leq R2) = F(R2) - F(R1)$$
$$= \Phi\left(\frac{R2-\mu}{\sigma}\right) - \Phi\left(\frac{R1-\mu}{\sigma}\right)$$

ii. σ limits:

$$Rayleigh : P(\mu - \sigma < R \leq \mu + \sigma) \approx 68\%$$
$$Rician : P(\mu - 2\sigma < R \leq \mu + 2\sigma) \approx 85.5\%$$
$$Nakagami : P(\mu - 3\sigma < R \leq \mu + 3\sigma) \approx 93.25\%$$

For this observation a confidence level is 93.25%. Level of significance is defined as the probability that a random variable lies outside of a specified range of values. In the proposed system, the value is 100 – 93.25 = 6.75% confident that a purely random variable lies either below or above two standard deviations from the mean. There are two tails, one on the far left and one on the far right. The two tails together represent all the data outside of the confidence interval, as sketched.

3.3. Estimated NFC PDF

Consider the estimated PDF data set shown in Table1. In the table are arranged in order of survival times due to multipath wave propagation. Extreme value distributions are often used to model the smallest or largest value among a large set of independent, identically distributed random values representing measurements or observations. The extreme value distribution is appropriate for modelling the smallest value from a distribution whose ails decay exponentially fast.

Table.1. Observed PDF for Nakagami Fading Channel, Rayleigh Fading Channel and Rician Fading Channel

Random Variable R	**Probability Density Function $P_R(r)$**		
	Nakagami Fading Channel	**Rician Fading Channel**	**Rayleigh Fading Channel**
9	0.14602	0.15482	0.29127
12.6	0.30821	0.27845	0.35218
16.2	0.45115	0.40589	0.37242
19.8	**0.46625**	0.45427	0.35651
23.4	0.46046	0.44567	0.31427
27	0.36268	0.38607	0.25757
30.6	0.23961	0.25957	0.19747
34.2	0.13706	0.14482	0.14217
37.8	0.06848	0.06713	0.0964
41.4	0.03007	0.02588	0.06168
45	0.01166	0.0083	0.0373

Evaluated the above value of PDF at a particular value of R, go down to the row representing the first two digits of R, go across to the column representing the third digit of R and examine the value of PDF from the table. At R=19.8, PDF of Nakagami Fading Channel = 0.46625. The value is highlighted in the above table. The proposed system is symmetry, multiplication by two yields the probability that R lies within two standard deviations from the mean value, either to the right or to the left. Since 2(0.46625) = 0.9325. According this table is used to calculate the confidence level is 93.25% confident that R lies within ± two standard deviations of the mean.

Finally, Compare the three fading channel along with distribution analysis and PDF estimated value, NFC confidence level is better than others. Therefore Nakagami Fading Channel is used to focus all data toward the receiver side.

3.4. Performance of NFC – MRC Diversity

In this proposed work, we have used antenna systems at each of M=10 receiver terminals without any combining scheme, so the performance of our model will be better than SC and EGC. Most of the previous works do the similar job using combination of selection combiner and MRC using multiple antenna system [17] at one or two terminals without Nakagami fading channel. Simulation analysis is shown in Fig.4 using MRC diversity using Nakagami Fading Channel.

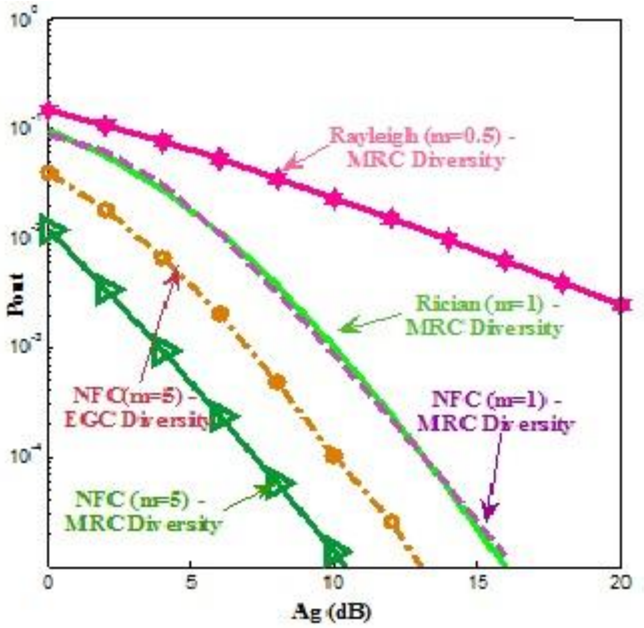

Fig.4. Performance analysis of outage probability on MRC diversity through Nakagami fading channel

For this simulation results, to achieve a probability of bit error on the order of 10^{-2}, that is, one error out of every 1,000 bits transmitted, the system requires over 40 dB of received average SNR (per bit). Visibly, this is not optimal. Once again considering to Fig.4, to attempt to achieve a BER of $<10^{-4}$ for NFC-MRC diversity, the obtained SNR would be enormous power saving in the maximum order of 10 - 20 dB out of 40 dB. With this technique the SNR may decrease due to the loss of multipath components that fall outside the receive antenna beamwidth, unless the directional gain of the antenna is sufficiently large to compensate for this absent power.

The power with outage of a MRC multiuser diversity system with complex Gaussian channel gains is shown in Figure.4 for outage of 1% and 10%. We observed that the difference in outage power for these two outage probabilities increases with SNR. These curves show that at low average SNRs, the distribution is very steep, so that the power with outage at 1% is very close to that at 10% outage. At higher average SNRs the curves become less steep, leading to more of a power difference at different outage probabilities.

In fact the power savings is most substantial going from no diversity to M-branch diversity, with diminishing returns as the number of branches is increased. Thus, the proposed system of SNR indicates that, the system requires less transmit power to achieve the good reception in reliable wireless medium.

4 Conclusion

In this proposed system, we evaluated and compared the performance of wireless communication systems employing antenna arrays utilizing various forms of combining the outputs for without diversity and with multiuser diversity through Nakagami fading channel. According to the simulation results, we show that receiving SNR was increased proportional to decreasing the BER in support of broadcast users and long distance transceivers. This transceiver was used to reduce the amplitude instabilities at symbol transitions, which make the signal more robust against noise and fading. The target of this proposed system is based on the plan that in multiuser channels, the channel quality varies across users, so performance can be improved by allocating system resources at any given time to the users with the best channels. The multiuser diversity provides improved channel quality since only users with the best channels are allocated system resources. Therefore, this proposed system was used to enhance in the direction of raise the reliability and capacity of future satellite broadcasting more than the mobile communication.

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