

Vol. 7, No. 2, 2012.

ISSN 1840-1503

TECHNICS TECHNOLOGIES EDUCATION MANAGEMENT

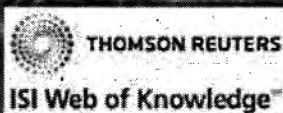
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JOURNAL OF SOCIETY FOR DEVELOPMENT OF TEACHING AND BUSINESS PROCESSES IN NEW NET ENVIRONMENT IN B&H

Indexing on:

SCI Science Citation Index Expanded
<http://www.isiwebofknowledge.com>

EBSCO Publishing (EP) USA
<http://www.epnet.com>



Impact Factor 0.351 (ISI Journal Citation Reports 2011)

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http://www.ttem.ba

Published by *DRUNPP, Sarajevo*
 Volume 7 *Number 2, 2012*
 ISSN *1840-1503*
 Impact Factor *0.351 (ISI Journal Citation Reports 2011)*

Indexing on:

Science Citation Index Expanded
<http://www.isiwebofknowledge.com>

EBSCO Publishing (EP) USA
<http://www.epnet.com>



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Eta-Mu modeled multipath propagation of electromagnetic waves

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Abstract

In this paper multipath propagation of electromagnetic (EM) waves will be analyzed through the η - μ multipath fading propagation model. Constructive and destructive effects of co-channel interference (CCI) occurrence will be considered. Standard performance measures regarding the wireless EM receptions will be obtained. Infinite series expressions are obtained for outage probability (OP) and average bit error probability (ABER). Multiple antenna reception of EM waves with space diversity will be observed, for the purpose of performance improvement.

Key words: EM wave propagation, η - μ multipath fading model, CCI, multiple antenna reception, OP, ABER.

1. Introduction

Wireless multipath propagation of electromagnetic (EM) waves is the phenomenon, that occurs due to various atmospheric and terrestrial objects reflections and refractions of transmitted signal.

Quality of services (QoS) at the receiver are heavily affected by this phenomena, and it is considered as a major source of performance drawback [1-3].

The η - μ fading distribution has been proposed, as a general fading distribution, for representing small scale signal variation in general non-line-of-sight condition [4-5]. The in-phase and quadrature components of the fading signal within each cluster are assumed to be independent from each other and to have different powers. The distribution is written in terms of two physical parameters, namely η and μ and it may appear in two different formats. Roughly speaking, the parameter μ is related to the number of multipath clusters in the environment, whereas the parameter η is related

to the scattered wave power ratio between the in-phase and quadrature components of each cluster of multipath [4]. As a general distribution, this model includes some classical fading distributions as particular cases, e.g. Nakagami- q (Hoyt), one-sided Gaussian, Rayleigh and Nakagami- m [5].

Co-channel interference (CCI) is defined as the interfering signal that has the same carrier frequency as the useful information signal in EM wireless transmission. It appears when, due to frequency reuse, signals from two or more channels operating at the same frequency, but from different locations, interfere [6-7]. Usually is more significant drawback than the front-end Gaussian noise. CCI is also affected by multipath fading and is necessary to incorporate this effect in performance analysis.

Various techniques for reducing multipath fading effect and influence of the CCI are used in wireless communication systems. Upgrading transmission reliability without increasing transmission power and bandwidth, and increasing channel capacity, could be obtained by the principle of providing the receiver with multiple faded replicas of the same information-bearing signal [8-9]. This reception technique is known as space diversity.

In order to study the effectiveness of any modulation scheme and the type of diversity used, there is a need to evaluate the system's performance over the channel conditions. First, infinite series expressions for cumulative distribution function (CDF) and probability distribution function (PDF) of the received SIR (signal-to-interference ratio) are obtained. Capitalizing on them, rapidly converging infinite series expressions for important performance measures, such as the outage probability (OP), is obtained and shown graphically for different system parameters. Using this infinite series formulae, an average error probability (ABER) is efficiently evaluated for several coherent and non-coherent modulation schemes.

