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Performance Enhancement for m-QAM technique using Hybrid Wavelet in OFDM Mobile Handover Technique

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Abstract: ***An Orthogonal frequency-division multiplexing (OFDM) communication classifications, the occurrence offsets in mobile radio channels change the orthogonally between subcarriers and wavelet. In this Research paper, First OFDM method is modeled and simulated under diverse channel circumstances such as AWGN Subsequently pulse shaping procedure for ICI power reduction in OFDM systems is inspected. A number of pulse shaping functions such as Rectangular pulse shape, Till then the power pulse (SP) and Enhanced power pulse (ISP) have been unrushed for ICI power reduction. The act of each pulse shaping purposes such as Rectangular pulse shape, Sinc power pulse (SP) and Improved sinc power pulse (ISP) must been slow for ICI power reduction. The presentation of each pulse shaping function is considered and related with each MQAM technique for 16 and 64 modulation using the parameters such as hybrid discrete wavelet transform, SIR (Signal to Interference Ratio) and BER (Bit Error Rate). HDWT compress the signal with low band in m-QAM technique and simulation in MATLAB.***

Keywords: OFDM, Wi-max, BER, ICI Reduction, AWGN, m-QAM, Hybrid-DWT

1. Introduction

OFDM [5] is a similar broadcast system, where a high-rate serial data stream is splitting up into a set of low rate sub-streams, each of which is moderated on a distinct sub-carrier. The bandwidth of the sub carrier's converts small paralleled with the coherence bandwidth of the channel. The representation period of the sub-streams is made long associated to the delay spread of the time-dispersive radio channel. The stable global successful in the number of users of the global Internet has managed to the improvement of altered fixed and mobile broadband technologies providing provision for high speed streaming multimedia, modified adapted services, ubiquitous analysis and unrestricted QoS. Though the current Wireless Local Area Network (WLAN) and third generation (3G) skills have been effectively providing broadband access for the last numerous years, they have their precise drawbacks, prohibiting their full-fledged growth. WLANs undergo from little variety and constrained scalability.

On the other hand, the 3G systems have such controls as low bandwidth and high infrastructural expenses. The conclusion of the current IEEE 802.16-based Wi-max family of standards (IEEE 802.16a, 16d and 16e and also 64) for Wireless Metropolitan Area Networks has full this opening between the LAN and WAN technologies. Developed as a correctly broadband access solution, the Wi-max expertise deals promising features in terms of high bandwidth, long coverage area and low cost.

This Research focuses on the signal processing methods to overcome the effect of ICI due to phase noise from the headset oscillator of the OFDM system. In data change scheme, the same info symbol is retained on nearby subcarriers to reduce the ICI effect. Even though this system provides better carrier-to-interference ratio (CIR) performance in AWGN channel

2. System Model

Let $\{Sk;\ k = 0, . . .,N - 1\}$ signify the information bearing symbols of the DFT block and N signify the total number of subcarriers. For a block of data, the complex base-band OFDM signal after taking IDFT is written as:

$$S_n = \frac{1}{\sqrt{N \sum_{k=0}^{N-1} Sk e^{\frac{j2\pi nk}{N}}}} \quad \ldots\ldots\ldots\ldots\ldots\ldots..(1)$$

Where n=0,1,2……………N-1

The signal at the receiver, after passing over anoccurrence selective AWGN channel, is written as:

$$y_n = (S_{n \otimes h_n}) e^{j\theta n} + |\omega_n \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where n=0, 1, 2………………..N-1

Where $\otimes$ denotes circular convolution, where $h_0, h_1 . \ . \ . \ h_{L-1}$ are the coefficients of a frequency-selective channel with L taps, ω_n is AWGN at the receiver and θ_n is the discrete Gaussian phase noise generated at the receiver oscillator. This segment noise can be displayed as a zero-mean first order autoregressive (AR) Gaussian process as follows:

$$\theta_n = \alpha\theta_{n-1} + \emptyset_n \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots.. (3)$$

Where α is the first order AR method coefficient and $\varphi n \sim$i. i. d $N0,\ \sigma 2\varphi$.This phase noise classical has been adopted in IEEE 802.11g standard. The signal Yk conventional at the k-th subcarrier after performance the DFT is given by-

$$Y_k = S_k H_K Q_0 + \sum_{\substack{m=0 \\ m\neq k}}^{N-1} S_m H_m Q_{m-k} + W_k \ldots\ldots\ldots\ldots\ldots (4)$$

Where k=0, 1, 2……………….N-1
Where H_K is the channel frequency response (CFR) at the k-thsubcarrier and Wkis the DFT of noise sample at the k-th subcarrier. The term Q_r is the ICI component due to phasenoise and can be conveyed as-

$$Q_r = \frac{1}{N}\sum_{n=0}^{N-1} e^{\frac{j2\pi kn}{N}} e^{j\theta_n} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where, -(N-1) ≤ r ≤ (N-1)
In Eqn. (4), the term *Q*0, called as common phase error (CPE), reduces and rotates the desired symbol *Sk*. The ICI terms due to Q_k in Eqn. (4) interfere with the desired signal and hence limit the detection of *Sk*. This leads to an error floor in BER performance. The effect of phase noise is typicallyreduced by using interference cancellation coding (ICC) at the transmitter and employing interference cancellation decoding (ICD) at the receiver as shown in Fig. 1. The basic idea behind ICC is to position the same data symbol at two dissimilar subcarriers within an OFDM block. At the receiver, ICD services maximal ratio combining (MRC) to detect the data symbols and thereby exploits the occurrence variety.

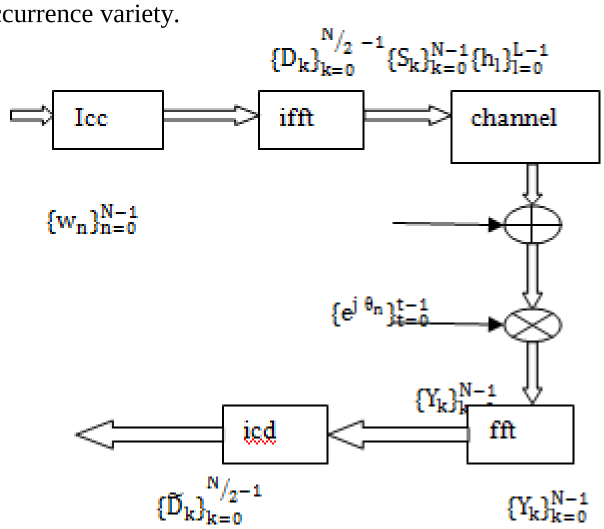

Figure 1: Block diagram of OFDM system with ICI reduction scheme.

3. ICI Reduction Schemes

We now discuss the diversity performance of ICI reduction scheme in OFDM systems in the presence of phase noise over AWGN channels.

3.1 Existing ICI reduction schemes

We denote the input symbols to the ICC block by $\{D_k;\ k = 0. . . ....N/2 - 1\}$ and the output by $\{S_k;\ k = 0, . . .,N - 1\}$. In the adjacent data conjugate (ADC) technique [6], the symbols are mapped in the ICC block as follows: $S_{2k} = D_k$, $S_{2k+1} = -D*k$, for $k = 0. . . N/2 - 1$. The received signal Y_k at the k-th subcarrier after performance the DFT of the signal Y_n is given by

$$Y_{2K} = \sum_{m=0}^{\frac{N}{2}-1} (S_{2m} H_{2m} Q_{2m-2k}) + (S_{2m+1} H_{2m+1} Q_{2m+1-2k}) + W_{2k} \ldots\ldots\ldots\ldots (6)$$

The decision variable $\tilde{D_k}$ after MRC combining the established signals Y_{2k} and Y_{2k+1} is distinct as

$$\tilde{D_k} = \frac{1}{2}(H^*_{2k} Y_{2k} - H_{2k+1} Y^*_{2k+1}),\ k = 0 \ldots\ldots \frac{N}{2} - 1 \ldots\ldots\ldots (7)$$

In Eqn. (7), the CFR *H*2*k* and *H*2*k*+1 are closely the same for all values of *k*; this indication to reduction in the diversity performance of the OFDM system over a multipath AWGN channel. The symmetric data conjugate (SDC) technique has also been proposed in [7] to increase the CIR of an OFDM classification precious by phase noise. The mapping of the communicated symbols in the SDC scheme is done as follows:
$S_k = D_k$
$S_{N-1-k} = -D*$, for $k = 0, . . .,N/2-1$. The received signal Y_k at the *k*-th subcarrier is given by

$$Y_{2K} = \sum_{m=0}^{\frac{N}{2}-1} (S_m H_m Q_{m-k}) + (S_{N-1-m} H_{N-m-1} Q_{N-1-m-k}) + W_k \ldots\ldots\ldots\ldots\ldots\ldots (8)$$

The decision variable $\tilde{D_k}$ at the *k*-th subcarrier is defined as

$$\tilde{D_k} = \frac{1}{2}(H^*_k Y_k - H_{N-1-k} Y^*_{N-1-k})$$
$$,k = 0 \ldots\ldots \frac{N}{2} - 1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

The CFR for H_k, *k* near 0 and *N* −1 have dissimilar standards as given in Eqn. (9). Therefore, the frequency diversity can be attained by SDC only about the carrier situations 0 and *N*−1. The CFR have virtually the same response for standards of *k* near *N*/2. Hence the multiplicity performance of the SDC technique is not improved for values of *k* around *N*/2; this decreases the OFDM method performance over a multipath AWGN channel.

3.2 Literature Survey

There are two main complementary areas of research, that of efficiently scheduling the scanning operation and that of improving handover schemes. Neither attempt to reduce the number of frequencies checked during the scanning operation. Rouil and Golmie [9] recently introduced their Adaptive Channel Scanning (ACS) algorithm. ACS is primarily focused on when to perform scanning by estimating the time required for a MS to scan a list of neighboring BSs and then interleaving the scanning and data transmission intervals. Other work has been focused more specifically on improving handover performance.

Choi et al. [5] have introduced a new management message to receive downlink data during the handover process and thus reduces the downlink packet delay.

Kim et al. [8]proposed Last Packet Marking (LPM) that requires integrating the MAC layer (L2) handover and the network layer (L3) handover. LPM allows a MS to pre-notify a target BS for handover which the target BS can accept or reject. An early work by Van de Berg [10] describes the storing information on the most probable used carrier frequencies in 2 cellular networks on the MS. However, the term most probable is not defined and no mechanism is provided for determining the most probable frequencies. The remainder of the paper is organized as follows. In Section II, we describe the IEEE 802.16 network entry procedure and handovers. We focus in particular on the scanning process. In Section III, we present the current IEEE 802.16e and 64 QAM scanning operation and propose two new strategies. We provide a description of our simulation environment along with our simulation results in Section IV. Finally, we discuss ongoing work and conclude in Section V.

3.3 Proposed Method

The projected impression is to first splitting the conservative signal that is going for FFT, into two fragments. Once this each part is Fourier changed and then the outputs are collective together. Consider a system with 'n' number of signals waiting for Fourier change at the receiver. These 'n' signals are split into two equal parts of length 'n/2'. Each signal is passed complete Fourier alter. It will result in two orders each of length 'n'. These signs will be then added to create the final distorted signal.
After the demodulation of the more signal the predictable bits are compared with the conveyed bits.Let us assume that the frequency offset f_δ is a fraction of subcarrier design $^1/_T$ i.e.$f_\delta = {}^\delta/_T$
Also, for simplifying the equations, lets us assume that the transmitted symbols on all subcarriers, α_k =1
The received signal is,

$$y(t) = s(t)e^{\frac{j2\pi\delta}{T}t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

The output of the correlation for sub-carrier 'm' is, for $\delta = 0$, the integral reduces to the OFDM receiver with no impairments case. Though for non-zero values of δ, we can see that the amplitude of the correlation with subcarrier 'm' includes Distortion due to frequency offset between actual frequency $\frac{m+\delta}{T}$ and the preferred frequency $\frac{m}{T}$. Distortion due to interference with other subcarriers with preferred frequency is $\frac{m}{T}$. This term is also known as Inter Carrier Interference (ICI)

4. Simulation Model

1. Creates an OFDM symbol with all subcarriers moderated with$\alpha_k = 1$.

2. Introduce consistency offset and add noise to result in $\frac{E_b}{N_0}$=30dB.

3. Perform demodulation at the receiver.
4. Find the difference between the desired and actual constellation.
5. Compute the rms value of error across all subcarriers.
6. Repeat this for different values of frequency offset

Table 4.1: Input Parameter for Status value in Proposed simulation model.

Parameter	*Extended Values*
FFT size. N-FFT	32
Number of used subcarriers. N-DSC	64
FFT Sampling frequency	40MHz
Subcarrier spacing	312.5kHz
Used subcarrier index	{-26 to -1, +1 to +26}
Cyclic prefix duration, T_{cp}	0.6us
Data symbol duration, T_d	2.2us
Total Symbol duration, T_s	4us
Number of used subcarriers. N-DSC	52
FFT Sampling frequency	30MHz
Modulation Schemes	Modulation Schemes BPSK, QPSK, 16-QAM, 64-QAM

5. Result and Conclusion

1) Simulation in which all the modulations are used (BPSK, QPSK, 16QAM and 64QAM).

2) When we change the size of the "cyclic prefix" (1/4 1/8 1/16 1/32).
3) We realize the simulation WITH and WITHOUT encoding of the bits and study the difference.
4) We carry out the simulation through different SUI channels (1 al 6).
5) We do a simulation with different values of the nominal BW of the system.
6) To exit the program.

•Please ENTER YOUR OPTION: 1
- Please enter the value of G (Cyclic Prefix) [1/4 1/8 1/16 1/32]: 1/4
- Please enter which channel you wish to simulate (1 al 6) [AWGN = 0]: 1
- Please enter the nominal Bandwidth of the system (BW)
- PossibleValues:28,24,20,15,14,12,11,10,7,6,5.50,5,3.50,3, 2.50,1.75,1.5,1.25 [MHz]:28
- From which number you wish to start calling the resultant figures:2
- Finally enter the number of OFDM symbols to simulate (total bits = 20*symbols):2

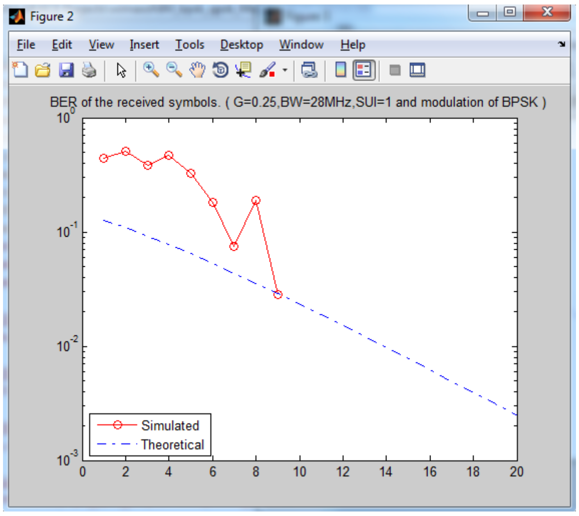

Figure 1: BER Recived Symbol for G=0.25 for BPSK

1. nFFT = 32; % fft size
2. nDSC = 52; % number of data subcarriers
3. nBitPerSym = 52; % number of bits per OFDM symbol (same as the number of subcarriers for BPSK)
4. nSym = 1; % number of symbols frequency Offset(kHz)v = [-200:10:200];
5. EbN0dB = 40; % bit to noise ratio
6. Es/N0dB = Eb/N0dB + 10*log10(nDSC/nFFT) + 10*log10(64/80);

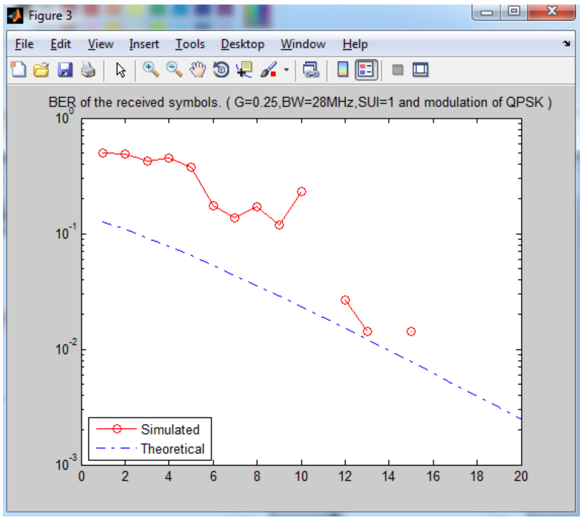

Figure 2: BER Recived Symbol for G=0.25 for QPSK

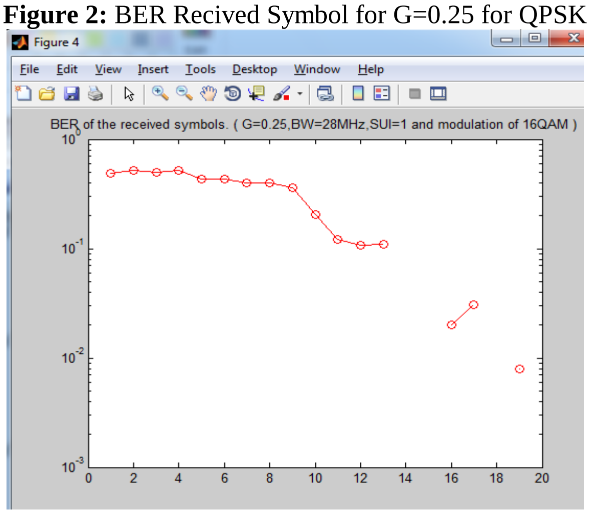

Figure 3: BER Received Symbol for G=0.25 for 16QAM

6. Conclusion

This Research paper evaluates the present transfer situation in Wi-max networks. In the first version of Wi-max standards, the mobility was not maintained at all. By the time became a need of user mobility. Because of this motive numerous types of assignment in Wi-max tools wore presented. In this Research we have inspected the scanning technique for an IEEE 802.16e MS. We have announced two new approaches to aid in decreasing the number of frequencies to check while scanning to find a downlink from a BS and providing some untried results of a simulation based on real-world mobility traces. A number of pulse shaping functions are deliberated for ICI power reduction. The presentation of each pulse shaping function is assessed and associated with each other using the limitation such as ICI power, SIR (Signal to Interference Ratio) and BER (Bit Error Rate). And also AWGN communication channel provides better BER performances over Rayleigh AWGN channel. This work is complementary to the other research mentioned such as that done by Rouil and Gomlie [9]. Future work includes extended the model for ICI reduction technique in AWGN channel with 64-QAM would be reduced for BER and SNR and additional refinement to the model to investigate how different loads on the WiMAX BSs may affect the scanning times and noise.

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