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Image Transmission over OFDM System with Minimum Peak to Average Power Ratio (PAPR)

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ABSTRACT: The aim of this project is reduce the PAPR of transmitted OFDM signals, improve the transmitted image quality & The SPIHT coder is chosen as the source coding technique due to its flexibility of code rate and simplicity of designing optimal system. Trigonometric transforms are used in this scheme for improving the performance of the OFDM system and reducing the Peak-to-Average Power Ratio (PAPR) of OFDM signal. OFDM is an efficient method of data transmission for high speed communication systems. The PAPR is a major drawback of multicarrier transmission system such as OFDM. The Set Partitioning In Hierarchical Tress (SPIHT) algorithm is used for source coding of the images to be transmitted.

KEYWORDS: OFDM, PAPR, SPIHT, LDPC, Trigonometric transforms

I. Introduction

OFDM modulation has been adopted by several wireless multimedia transmission standards, such as Digital Audio Broadcasting (DAB) and Digital Video Broadcasting (DVB-T), because it provides a high degree of immunity to multipath fading and impulsive noise. High spectral efficiency and efficient modulation and demodulation by IFFT/FFT are also advantages of OFDM. In the frequency-selective radio transmission channel, all fading and Inter-Symbol Interference (ISI) result in severe losses of transmitted image quality. OFDM divides frequency-selective channel into several parallel non frequency selective narrow-band channels, and modulates signal into different frequencies. It can significantly improve the channel transmission Performance without employing complex equalization schemes It also has broad application prospect in wireless image and video communications. There are still some challenging issues, which remain unresolved in the design of OFDM systems. One of the major problems is high PAPR of transmitted OFDM signals. Therefore, the OFDM receiver detection efficiency is very sensitive to the nonlinear devices used in its signal processing loop, such as Digital-to-Analog Converter (DAC) and High Power Amplifier (HPA), which may severely impair system performance due to induced spectral re growth and detection efficiency degradation.

II. MOTIVATION

There are still some challenging issues, which remain unresolved in the design of OFDM systems. One of the major problems is high PAPR of transmitted OFDM signals. Therefore, the OFDM receiver detection efficiency is very sensitive to the nonlinear devices used in its signal processing loop, such as Digital to Analog Converter (DAC) and High Power Amplifier (HPA), which may severely impair system performance due to induced spectral regrowth and detection efficiency degradation. All fading and Inter-Symbol Interference (ISI) result in severe losses of transmitted image quality The aim of this project is reduce the PAPR of transmitted OFDM signals, improve the transmitted image quality & The SPIHT coder is chosen as the source coding technique due to its flexibility of code rate and simplicity of designing optimal system.

III. OBJECTIVES

The project concentrates on two targets reducing the PAPR of the OFDM signal and improving the quality of

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the reconstructed images. It considers the trigonometric transforms as a way for reducing the PAPR by using the character of the DCT/DST energy focused in the low component. The data of OFDM signal is modulated by IFFT then using DCTIDST, which can reduce the PAPR. Compared with the means of SLM-OFDM and PTS-OFDM, OFDM system modified by DCT/DST maintain the system orthogonal properties, which will not result in additional noise and need not transmit side information. At the same time, the proposed method reduces the PAPR greatly and the system has character of low complexity hardware.

IV.PROBLEM OF PEAK-TO-AVERAGE POWER RATIO IN OFDM SYSTEMS

High Peak-to-Average Power Ratio has been recognized as one of the major practical problem involving OFDM modulation, High PAPR results from the nature of the modulation itself where multiple subcarriers / sinusoids are added together to form the signal to be transmitted. When N sinusoids add, the peak magnitude would have a value of N, where the average might be quite low due to the destructive interference between the sinusoids. High PAPR signals are usually undesirable for it usually strains the analog circuitry. High PAPR signals would require a large range of dynamic linearity from the analog circuits which usually results in expensive devices and high power consumption with lower efficiency (for e.g. power amplifier has to operate with larger back-off to maintain linearity). In OFDM system, some input sequences would result in higher PAPR than others. For example, an input sequence that requires all such carriers to transmit their maximum amplitudes would certainly result in a high output PAPR. Thus by limiting the possible input sequences to a smallest sub set, it should be possible to obtain output signals with a guaranteed low output PAPR. The PAPR of the transmit signal x(t) is the ratio of the maximum instantaneous power and the average power. The non-linear effects on the transmitted OFDM symbols are spectral spreading, inter-modulation and changing the signal constellation. In other words, the nonlinear distortion causes both in-band and out-of-band interference to signals. The in band interference increases the Bit Error Rate (BER) of the received signal.

No. of sub-carriers	2	4	8	16	32	64	128	256
$PAPR_{WC}$ (db)	3.01	6.02	9.03	12.04	15.05	18.06	21.07	24.01

Table 1: PAPRWC Vs No. of Subcarriers

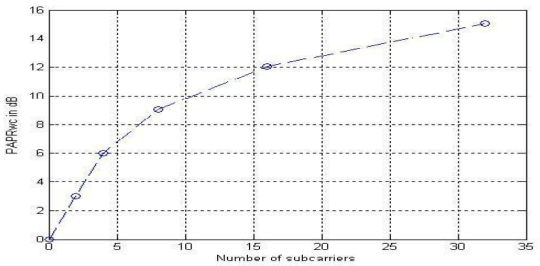

Fig 1: PAPRWC Vs No. of Subcarrier

V. SIMULATION RESULTS AND ANALYSIS

The wavelet decomposition depth is an important criterion that really matters. This simulation revealed a fact that SPIHT is most efficient

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Fig 2: Original Image For Wavelet Transform.

The input image is 8 bits per pixel, gray scale test image, 'Cameraman' from MATLAB toolbox is utilized in the simulation has a resolution 256x256 pixels.

Fig 3: Partition Image Up to 8 Levels

The parameters used in the simulation are the number of subcarriers of a LDPC coded OFDM system (N) is considered to be 256, Cyclic Prefix is 64, Rate of the SPIHT (r) = 0 to l. LDPC code of R = 1;2 is employed with sum-product decoding, where R denotes the code rate and a (512, 1024) parity check matrix is used. The maximum number of iterations in sum-product decoding is set to 10.Finally, the impact of the subcarriers on the performance of the three schemes using the SPIHT rate 0.5 & 1.0 at different PAPR value.

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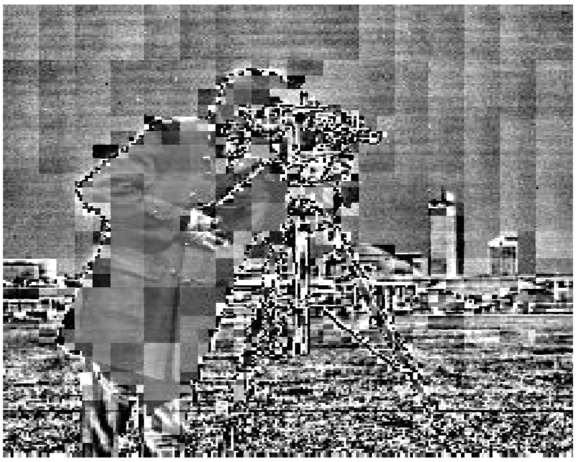

Fig4:256*256 gray scale image

Fig 5: Received image after encoding and decoding

V.CONCLUSIONS

The combination of the high spectral efficiency OFDM modulation technique and LDPC coding will be a good candidate for high speed broadband wireless applications. The BER performance of the Low Density Parity Check Coding- Coded Orthogonal Frequency Division Multiplexing system (LDPC-COFDM) is influenced by the sub channels which have deep fad due to frequency selective fading. According to this combination, several algorithms were introduced into LDPC-COFDM system to improve the BER by adaptive bit loading and power allocation of each subcarrier

VI APPLICATIONS

- Wireless image and video communication
- Handling the increased spatial resolution of today's imaging sensors and evolving Broadcast television for better quality of image i.e. for communication purpose.
- SPIHT exploits properties that are present in a wide variety of images. It had been successfully tested in

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natural (portraits, landscape, weddings, etc.) and medical (X-ray, CT, etc.) images.

- In multimedia image compression and communication.

Video transmission over unreliable network such as Internet or Wireless network suffers from various kinds of adverse condition such as bandwidth fluctuation, burst-error contamination, packet loss, and excessive packet delay due to network congestion.

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