Minimize Bit Error Rate of Massive MIMO System using MMSE Equalization Technique

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Abstract- The MMSE equalization alone is not an efficient way of reduction of ISI, as the equalization is not carried out with the knowledge of channel impairments. To strengthen the effect of equalization for reducing ISI, channel estimation is used to estimate the amplitude/phase shift caused by the wireless channel impairments. A modified pilot channel estimation (MPCE) is proposed for MIMO MC CDMA system in which the number and position of pilots are varied dynamically based on the channel condition. Apart from MPCE based MMSE equalization in the receiver, improved transmit BF (ITBF) is incorporated as a preventive measure where array of antennas are "directed" at a desired target or source by adjusting the relative gain and phase of the array elements. To further improve the system performance, novel relays (NR) are utilized for contiguous coverage of areas with high traffic density. Therefore, cost efficient alternative deployment concepts are needed. One promising alternative deployment is a novel relay with MPCE based equalization and ITBF to extend the high throughput coverage of next generation mobile networks.

Keywords— MC CDMA, OFDM, MMSE, MPCE

I. INTRODUCTION

For voice transmission, the original (1G) was a straightforward FDMA (frequency division multiple access) framework. In order to enhance client limit, voice quality, and range proficiency, the 2G cell frameworks employ advanced adjustment plans based on time division different access (TDMA) with source and error amendment coding procedures. These frameworks had the option to impeccably offer essential types of assistance data transfer capacity administrations like communication, Web access and mixed media whenever and from anyplace through a solitary gadget. Wideband services like remote Internet access (with a maximum speed of 384 Kbps) and video transmissions (with a maximum information rate of 2 Mbps) are available.

The media transmission inquire about network started working for the fourth generation (4G) of remote correspondence as the 3G innovation and its predecessor, 3.5G, clogged in a few years. The goal is to have information rates between 100 and 500 Mbps with high quality and security. Co-channel interference occurs when users of different cells use the same resource, while adjacent cell interference occurs when users of the same cell create interference. Spreading, frequency diversity, and space diversity were used as countermeasures to combat these impairments. As a result, the international telecommunications union (ITU) has standardized the MIMO MC CDMA system for 4G and beyond.

Doppler spread and excessive multi-path propagation degrade the current wireless communication system's performance. The proportion of time dispersion caused by multipath delay spread decreases as the symbol duration increases in lower rate parallel SCs. Despite OFDM's resistance. In contrast to conventional schemes like TDMA/FDMA, this can also handle the asynchronous nature of multimedia traffic in order to cater to a larger number of users with enhanced services. Due to the hostile frequency selective channel and the spreading processing gain, CDMA systems can coherently combine the components of multiple paths by employing Rake receivers. This makes them resistant to interference from multiple users conventional CDMA does not appear to be an option when data rates reach 100 megabits per second.

Further to upgrade the exhibition, the MIMO gathering mechanical assemblies at the two pieces of the deals association recognizes of the transmitter and relay in the network to reduce ISI, accommodate a larger number of users, and enhance performance in order to resolve.

II. METHODOLOGY

Exploration of untapped frequency spectrum, such as mmWave, has begun as a result of the massive rise in popularity of smartphones and mobile data applications that require bandwidth and data rates of the order of Gb/s. In addition to catering to achieving high QoS and QoE and providing seamless connectivity, ongoing research is advancing our understanding of biological safety at high frequencies. It is necessary to update government policies regarding safety standards and regulations and to guarantee the exposed public's safety and dependability. This article is blessed to give a knowledge into wellbeing impacts relating to mmWave frequencies, tending to viewpoints like warm warming in the body tissues with temperature increase, explicit ingestion rate (SAR), power thickness. EM (Electromagnetic) radiation reduction for the mobile communication system has been proposed as a solution in the form of a proposed mode known as "Thermal Radiation" (TR), which endorses its safe use, promotes Green WCN, increases energy efficiency, and reduces complexity for upcoming generations. Based on simulation results, the proposal also confirms that human tissue produces lower power density, SAR, and temperature elevations when compared to other models. It has the potential to improve the security and dependability of future 6G networks and beyond. Since

their inception in the 1970s, the wireless and mobile communication systems have experienced remarkable growth over the past ten years [6].

Due to the effects of electromagnetic radiation on humans, plants, animals, and the ecosystem as a whole, the number of base stations that are being built is increasing rapidly [3]. There have been developing worries and examinations with respect to the unfriendly effect that the radiation openness has caused on the organic wellbeing of the creatures. In addition to increasing the location of base stations, research is underway to explore the mmWave frequency band and other unused spectrum bands.

In, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) outlined the permissible exposure limits and safety standards for EM radiation up to 300 GHz. In, the National Radiological Protection Board (NRPB) of the United Kingdom has also provided guidelines for the same in a number of reports, citing effects like injury, illness, and thermal heating of human tissues.

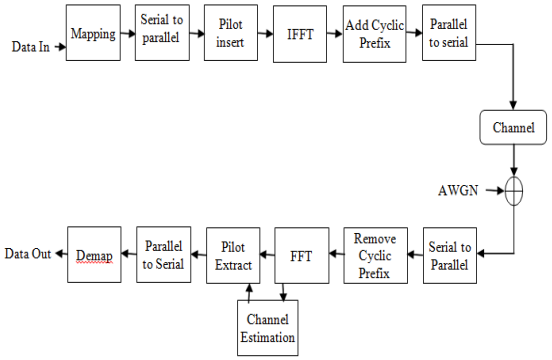


Fig. 1: Block Diagram of OFDM with Channel Estimation

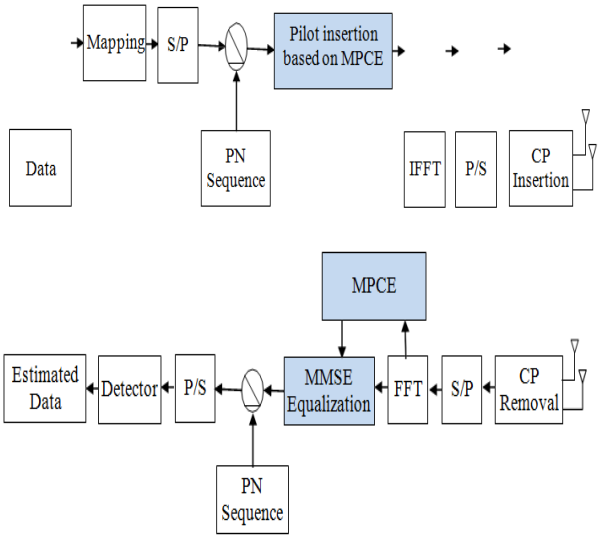


Fig. 2: Block Diagram of MIMO System with PN Sequence

These worries have additionally been featured in the new occasions during ITU. More than half of the emissions are caused by mobile networks alone, followed by telecom devices. This figure is supposed to rise considerably more soon. The frequency of operation and transmission power of the EM radiation emission sources ae present. There are numerous negative effects from this. Because they receive the most exposure, the brain, skin, and eyes are the most affected areas in humans . Damage to the cornea results from radiation absorption by the eyes. Radiation absorption by the epidermis, the skin's surface layer, and the dermis, the skin's deeper layer, also has an impact on the skin. Tissues become heated as a result of the rising temperature, and it has also been confirmed that the power density exposure to the human body is also high at high frequencies like mmWave. After the mode has been identified, the UE, gNB, and AMF do not receive any UL or DL NAS messages or information when they encounter the flight mode. Figure 2 provides a description of the proposed state transition for the user equipment from the Idle state to the Connected state.

III. SIMULATION RESULT

Practically ICE is not possible therefore the proposed system is tested with the actual channel estimation using pilot signal. Hence the MPCE based MMSE increases the E_b/N_o requirement from 9.8 dB to 10 dB. Equalization and channel estimations are carried out in the receiver when the channel is affected by multipath fading effect. To improve the channel quality ITBF is incorporated in the transmitter side that allows the transmitter to concentrate the transmitted power onto a desired spatial direction; thus augmenting the received SNR at the intended receiver and drastically reducing the interference of non desired ones.

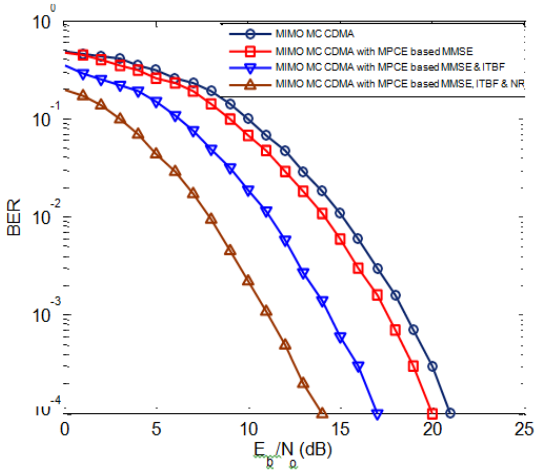


Fig. 3: Execution of 2 x 2 x 2 receiving wire setup for 16 QAM

Thus the ITBF technique reduces the E_b/N_o requirement from 10 dB to 7.2 dB. The channel quality between the transmitter and receiver is improved by NR which in turn reduces the E_b/N_o to 4.2 dB for NR with single antenna and 2.8 dB for NR with two antennas. After incorporating all the techniques the overall performance due to the reduction of ISI, increase in SNR and improvement in link reliability.

The simulation results are depicted in Figures 4 and 5, and the system's performance is also evaluated using 16 QAM modulation, which show the BER performance of MIMO MC CDMA for 64 SCs using 2 x 2 x 2 antennas and 2 x 1 x 2 antennas, respectively. As ITBF improves gain in the desired direction, rejects interference, and relay increases link reliability, the BER of ITBF with NR decreases.

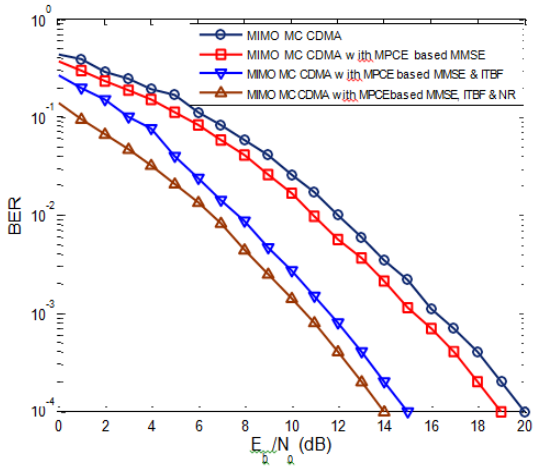


Fig. 4: Execution of 2 x 1 x 2 receiving wire setup for 16 QAM

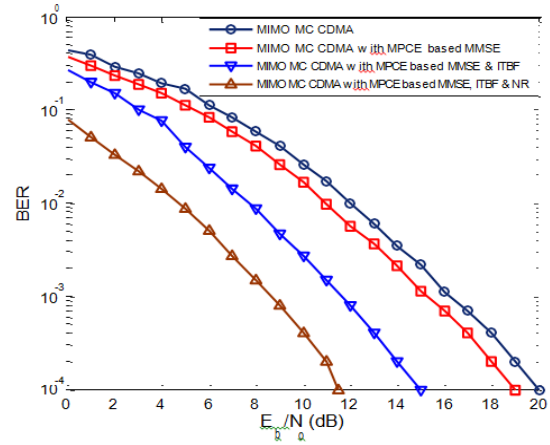


Fig. 5: Execution of 2 x 2 x 2 receiving wire setup for 16 QAM

This zone will be working in low recurrence and not extremely high frequencies so that the destructive influence is restricted as likewise keeping in view the necessity of information pace of such kind of group. Materials with a high penetration loss or material loss will be used in any construction in this area. This is being done to make the zone much safer to use. Concrete wall, concrete slab, and dry wall can be used as building materials in these areas due to their high path loss. It is possible to construct recreational parks, schools for children under the age of 10, and other activities that do not require the labor associated with high data demand in this area. The most vulnerable members of society can be made to operate in much safer and greener areas in this manner.

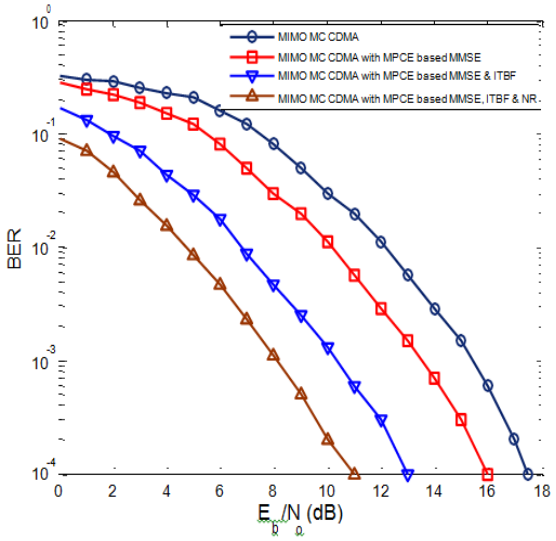


Fig. 6: Execution of 4 x 1 x 4 receiving wire setup for 16 QAM

IV. CONCLUSION

MIMO MC CDMA with Equalization under ICE is practically impossible, so MIMO MC CDMA with MPCE can still be used to optimize the proposed system's performance. To make the framework more practical, MPCE is integrated and the framework execution is tried for various recieving wire design, various SCs and adjustment. MIMO MC CDMA with equalization by MPCE has a performance of 16.66 percent, which is 1.67 percent lower than the system with equalization under ICE for QPSK (128/4 x 4), which is in line with the estimation here. However, for various modulations, the performance is enhanced by increasing antenna diversity and frequency diversity.

When the channel is impacted by multipath fading, the receiver incorporates MPCE-based MMSE equalization to boost system performance. To decrease the impact of multipath blurring in the channel and to further develop the connection execution, the transmitter is outfitted with ITBF in which a variety of recieving wires is coordinated to the ideal client, to further develop the gathering quality. The BER performance improves when an ITBF-based MPCE-based MMSE equalization is used in a MIMO MC CDMA system. The results of a second simulation with different antenna configurations and SCs indicate that the proposed system performs 28% better than MIMO MC CDMA with equalization.

The proposed system also includes cooperative communication through an AF relay node to boost system performance. NR with one antenna (2x1x2,4x1x4) and NR with two antennas (2x2x2,4x2x4) are used in the simulation for MIMO MC CDMA with ITBF and MPCE-based MMSE equalization. Based on the findings, it can be deduced that the proposed NR with a single antenna performs better than MIMO MC CDMA with MPCE-based MMSE equalization and ITBF by 41.66%. Therefore, the loss and noise are the result of NR's reliable link and spatial diversity.

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