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MIMO-OFDM System based on Spectrum Sensing Cognitive Radio Networks for 5G System

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ABSTRACT: Error free transmission and increase in multimedia applications is one of the main aims of wireless communication. MIMO-OFDM is the system to improve the reliability of the WiMAX system. The fundamental tasks that are used in the cognitive radio (CR) networks are spectrum shaping capability and multi carrier systems. In these structures activation of fundamental (primary) users will generate a defined number of sub carriers in the secondary users.

In this paper, the design of MIMO-OFDM system using Matched Filter Detection Spectrum Sensing Cognitive Radio Network is presented. A matched filter is a spectrum-sensing method that detects the free portions of the primary user's spectrum and allocates it to secondary users. It derives from cross-correlating an unknown signal with known ones to detect the unknown signal's presence based on the basis of its SNR. Accordingly, an efficient scheme is developed here that is having better SNR vs BER against a different MIMO-OFDM system.

KEYWORDS: WiMAX, MIMO-OFDM, Cognitive Radio, Matched Filter

I. INTRODUCTION

The constrained accessible range i.e., the range under-use issue have persuaded various activities in the administrative just as research networks to build up another correspondence worldview, which can misuse the range groups sharply. In tending to the range under-use issue, the FCC has as of late endorsed the unlicensed access of the authorized groups [1]. In this unique situation, the term Dynamic Spectrum Access (DSA) has been utilized to allude to the methods that actualize better range the executive's approaches. The key empowering innovation that develops for DSA systems is the intellectual radio (CR), which is upheld by the Software Defined Radio (SDR) innovation. CR is generally based upon a SDR stage and is a setting mindful keen radio, which is equipped for self-ruling reconfiguration by gaining from and adjusting to the encompassing correspondence condition [2]. Officially, the term subjective radio (CR) can be characterized as pursues agreeing to FCC [3]: "A psychological radio is a radio that can change its transmission parameters dependent on connection with the earth in which it works". From the abovementioned definition, the two noteworthy attributes of CR can be characterized as the psychological ability and configurability. The subjective capacity alludes to the capacity of the radio segment to catch (utilizing strategies, for example, self-governing learning and activity choice) or sense data (the fleeting and spatial varieties in the radio condition and the impedance level created to different clients) from its encompassing radio condition. Then again, the configurability alludes to the capacity to empower the transmitter parameters to be progressively customized and altered by the elements of radio condition.

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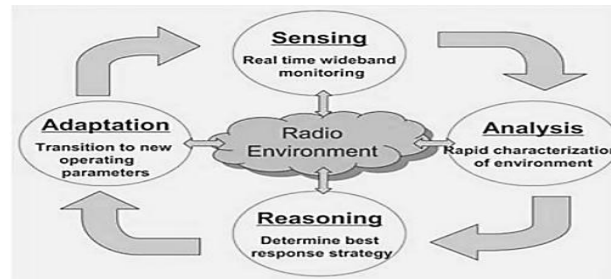


Fig. 1: Cognitive Cycle

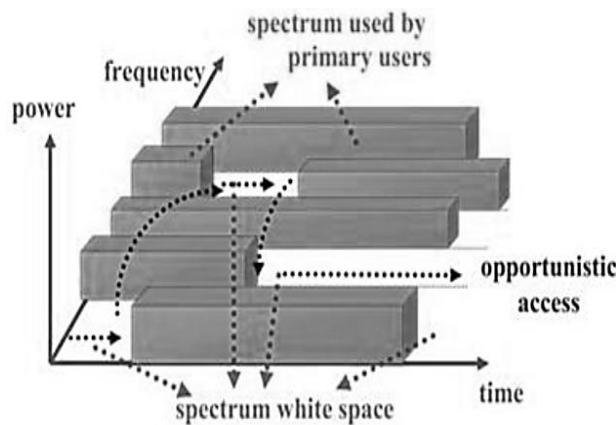


Fig. 2: Opportunistic Usage of Spectrum Holes

Therefore, a CR enabled node in the network adapts dynamically to re configure several parameters such as the operating frequency (to take advantage of detected spectrum holes on different frequency bands), modulation and channel coding (to adapt to the requirements of application and the instantaneous conditions of channel quality), transmission power (to control the possible generated interference), and communication technology (to adapt to specific communication needs). Depending on the characteristics of the detected spectrum holes, as shown in Figure 1 and Figure 2, the CR enables to switch to different spectrum bands opportunistically [4], while the transmitter and receiver parameters are reconfigured accordingly.

II. CR NETWORK ARCHITECTURE

The possible architecture of a CR network as defined is shown in Figure 3. The components of such CR network architecture can be classified into two groups as primary network and secondary network (i.e. cognitive radio network). Primary network: A primary network is referred to an existing network infrastructure, where the nodes called primary users (PUs) have authorized license for exclusively accessing a certain frequency band. Examples of such networks include the cellular and the TV broadcast networks. Primary user (PU) activities are controlled through the primary base-stations in infrastructure based the primary network. Since the PUs have their priority in spectrum access, the operations of PUs should not be affected by any other unlicensed or secondary users.

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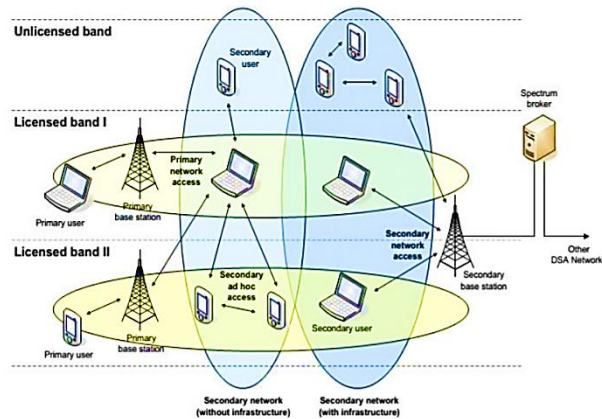


Fig. 3: Cognitive Radio Network Architecture

Optional system: An auxiliary or unlicensed system is eluded to a system, with fixed foundation or dependent on specially appointed correspondence guideline, without permit to work in an ideal authorized band. Subsequently, to share the authorized range band with essential systems, the extra functionalities are utilized by the hubs called CR clients/auxiliary clients (SUs). The foundation based optional systems are outfitted with a focal element called CR base station, which executes a solitary bounce association with SUs. Then again, the optional specially appointed systems have no framework spine and a SU can speak with different SUs through the impromptu association on both authorized and unlicensed range groups. Besides, optional systems may incorporate range dealers, which can assume a job in sharing range assets among various auxiliary systems [5, 6].

With regards to organize design, the range the executives functionalities are actualized by various elements. For example, in foundation based engineering, the range merchant is in charge of organizing the undertakings of range detecting, choice and the executives (sharing and versatility), while in specially appointed design; CR hubs themselves are in charge of range detecting, choice and the executives. The previous requires a committed control direct though in framework less designs utilization of devoted control channel is discretionary [7, 8].

III. PROPOSED METHODOLOGY

Based on the spectrum sensing schemes, the cognitive radio is proposed to reduce the computational complexity in MIMO-OFDM system. On the one hand, apply thematching filter algorithm in a different antenna, and employ the linear property of Inverse Fast Fourier transform (IFFT) to increase the number of candidate sequences so as to achieve better SNRand lower MSE performance.

To analyze a signal in the time domain, IFFT (Inverse Fast Fourier Transform) is applied and converted it from parallel to serial. OFDM signal to add a Cyclic Prefix (CP), which helps avoiding interference between OFDM symbols.

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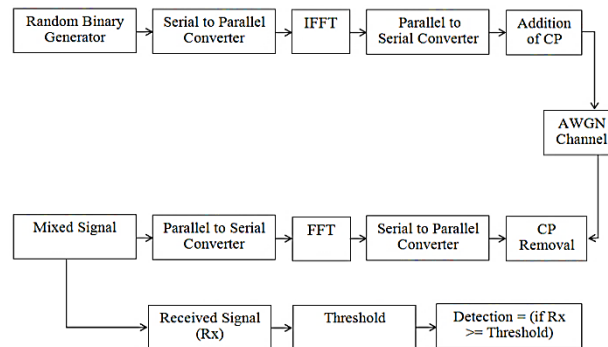


Fig. 4: Design of MIMO-OFDM System using Matched Filter Spectrum Sensing Cognitive Radio Network

This sign is then gone through an Additive White Gaussian Noise (AWGN) channel. At the collector end, the CP is expelled and the sign is changed over from sequential to parallel to get the first, with FFT connected to every image for investigation in the recurrence area. After demodulation, the sign is cross corresponded with that of a period moved neighborhood oscillator.

We executed our circuit (Figure 4) in MATLAB programming, with the primary parameters depicted underneath. We produced an irregular double signal in a sequential way. To examinations a sign in the time space, we apply IFFT (Inverse Fast Fourier Transform) and convert it from parallel to sequential OFDM sign to

Include a cyclic prefix (CP), which maintains a strategic distance from obstruction between OFDM images. We at that point feed this sign through an Additive White Gaussian Noise (AWGN) channel. At the collector end, the CP is expelled and the sign changed over from sequential to parallel to get the first, with FFT connected to every image for examination in the recurrence space. After demodulation, the sign is cross corresponded with that of a period moved nearby oscillator.

SNR to decide if the sign is missing or present; if they got sign is more prominent than the limit esteem, there will be a discovery, generally not:

$$H_0: y(t) = n(t) \quad \text{PU is absent}$$

$$H_1: y(t) = h*s(t) + n(t) \quad \text{PU is present}$$

IV. SIMULATION RESULT

Simulation experiments are conducted to evaluate the SNR VSBit Error Rate (BER) performance of the proposed matched filter detection spectrum sensing 1×1 system is shown in figure 5. To analysis random binary generator signal, a signal in the frequency domain, an IFFT is applied to the signal and converted from parallel to serial for the addition of the CP, one transmitter antenna and one receiver antenna through an AdditiveWhite Gaussian Noise (AWGN) channel.

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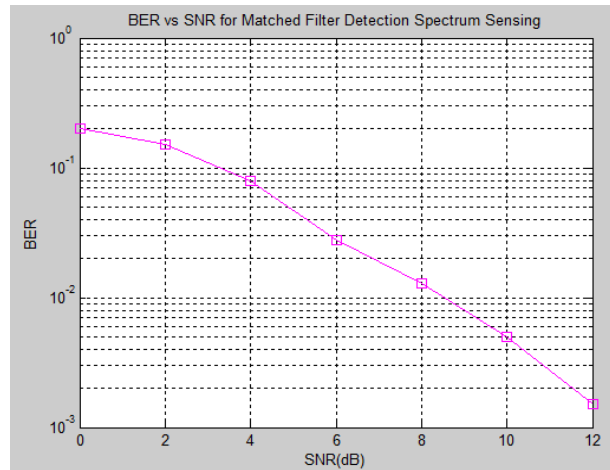


Fig. 5: BER vs SNR for Matched Filter Detection Spectrum Sensing 1×1 System

Simulation experiments are conducted to evaluate the SNR VS BER performance of the proposed matched filter detection spectrum sensing 2×2 system is shown in figure 6. To analysis random binary generator signal, the signal in the frequency domain, an IFFT is applied to the signal and converted from parallel to serial for the addition of the CP, two transmitter antenna and two receiver antenna through an AdditiveWhite Gaussian Noise (AWGN) Channel.

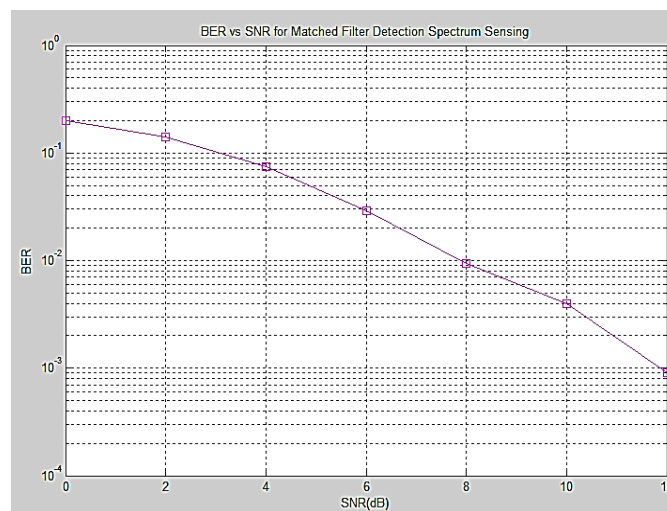


Fig. 6: BER vs SNR for Matched Filter Detection Spectrum Sensing 2×2 System

Simulation experiments are conducted to evaluate the SNR VS BER performance of the proposed matched filter detection spectrum sensing 4×4 system is shown in figure 7.

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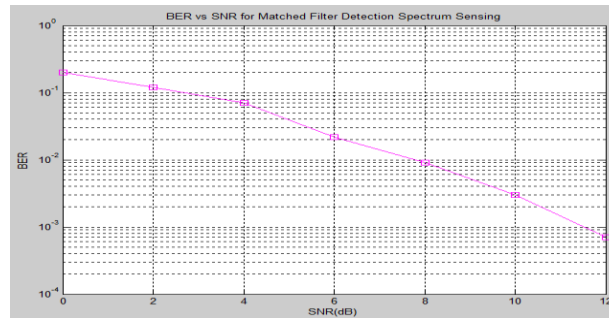


Fig. 7: BER vs SNR for Matched Filter Detection Spectrum Sensing 4x4 System

Simulation experiments are conducted to evaluate the SNR VS BER performance of the proposed matched filter detection spectrum sensing different system is shown in figure 8.

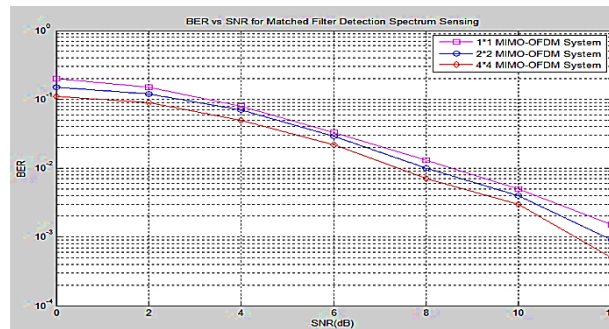


Fig. 8: BER vs SNR for Matched Filter Detection Spectrum Sensing Different System

Simulation experiments are conducted to evaluate the SNR VS BER performance of the proposed matched filter detection spectrum sensing and cyclo-stationary detection spectrum sensing is shown in figure 9.

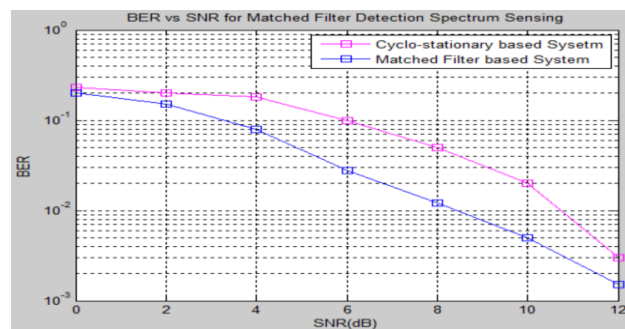


Fig. 9: Comparative Result

Table 1 the tabular illustration of the performance of different SNR discussed in this research work in term of Bit Error Rate (BER). From the analysis of the results, it is found that the proposed matched filter detection spectrum sensing Cognitive Radio Network gives a superior performance as compared with the previous method.

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BER	SNR (dB)						
	0	2	4	6	8	10	12
Previous System	2.3×10^{-1}	2×10^{-1}	1.8×10^{-1}	10^{-1}	5×10^{-2}	2×10^{-2}	3×10^{-3}
Proposed System	2×10^{-1}	1.5×10^{-1}	8×10^{-2}	2.8×10^{-2}	1.2×10^{-2}	5×10^{-3}	1.5×10^{-3}

Table 1: Comparative Result of BER

V. CONCLUSION

Coordinated sifting is known as an ideal strategy for discovery of essential clients when the transmitted sign is known. It is a direct channel intended to amplify the yield sign to commotion proportion for given info signal. It is gotten by corresponding a known sign, with an obscure sign to distinguish the nearness of the known sign in the obscure sign. This is proportionate to convolving the obscure sign with a period switched form of the sign. Convolution is at the core of coordinated channels.

Convolution does basically with two capacities that it places one capacity over another capacity and yields a solitary worth proposing a degree of closeness, and after that it moves the primary capacity an imperceptibly little separation and finds another worth. The final product comes as a chart which tops at the point where the two pictures are generally comparative. The coordinated channel is the ideal straight channel for boosting the Signal to Noise Ratio (SNR) within the sight of added substance White Gaussian Noise. The presentation of executed strategy including remote correspondence is better when contrasted with the past system calculation.

The proposed MIMO-OFDM framework utilizing Matched Filter Spectrum Sensing Cognitive Radio Network give a lower BER 0.0015 dB as contrasted and 0.0030 dB for SNR = 12 dB, past MIMO-OFDM framework utilizing Cyclo-stationary Spectrum Sensing Cognitive Radio Network. The proposed technique is half BER improvement for past strategy.

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