LOW COMPLEXITY REDUCTION OF BE-RATE AND M-SQUARE ERROR USING SU-PROTOCOL AND ET-URBAN METHOD FOR MIMO-OFDM SYSTEM

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Abstract- Orthogonal-FDM is a multicarrier modulation technique in which a single data stream is divided into subcarriers. Just because of highly efficient utilisation of radio spectrum, it is widely used in telecommunication industry. Further it even involves simple equalisation of channels as a single channel is divided into various sub-channels and is even resistive to selective fading. Orthogonal-FDM is used in order to achieve less BE-rate and M-square error. But issues arise due to complexity in design. When we talk about Multi i/p Multi o/p systems we find more complexity. This paper usually works on low complexity reduction of BE-rate and M-square error using SU-protocol and ET-Urban Method. By using the modulation technique like Quadrature-PSK and 16 Quadrature-AM, further evaluation using intended methodology has been done. ET-Urban method and SU-Protocol were able to perform well and in comparison to previous method i.e TD-synchronous Orthogonal-FDM it helped in much more reduction of BE-Rate and M-square error.

Keywords- ET-Urban Method, SU-Protocol, multicarrier modulation, Orthogonal-FDM, BE-rate, M-square error.

Abbreviation: nrx, no. of receiver; ntx, no. of transmitter; fd, Doppler frequency; mt, modulation technique; ET-Urban Method, Extended Typical-Urban Method; SU-Protocol, Stanford University-Protocol; BE-Rate, Bit Error Rate; M-square error, minimum square error; TD-Sync Orthogonal-FDM, time domain synchronous Orthogonal-FDM;

I. INTRODUCTION

The wireless communication has witnessed massive growth since mid-1990. The upcoming wireless technology demands for higher data transmission rates and have become more pervasive and ubiquitous then any one could imagine. The worldwide growth of cellular telephone subscribers has concluded that wireless communication devices are robust and voice viable.

Because of pervasive nature and reliability of these mobile devices, the growth of mobile phone subscribers has increased all over world. [6]. In the field of broadband communication, Orthogonal-FDM has turned out to be successful [1].Orthogonal-FDM is a type of Multi carrier modulation [18] where all subcarriers are orthogonal to each other. It guarantees high data rate transmission with less complexity.

It utilises available spectrum very efficiently and is considered to be useful for multimedia communication. It even overcomes multipath fading and helps in improving bandwidth [32]. The future application of Orthogonal-FDM includes WIMAX and other 4G applications. Orthogonal-FDM is almost similar to fdma as in this spectrum is divided into various channels & provided to user but the difference is that orthogonal-FDM utilises spectrum more efficiently. Traditionally OFDM system assumes that in one symbol duration channel remains static [1].

But when we talk about high speed environment like railways and speedy cars the orthogonality of subcarriers gets destroyed due to which interferences are caused and degrades overall system performance. Further BE-rate and Minimum square error also increases that affects overall performance. Some methods have been used to reduce BE-Rate and M-Square error. [2] used new method for estimating channel for multiple antenna system that can work well in high speed condition like fast moving trains. We can say pn random sequence is used to get partial common support whereas channel recovery is done using pilots that are based on the structured compressive sensing. It had better performance as compared to traditional ones with less complexity. Paper [8] discusses about recovery of data for TD sync- Orthogonal-FDM over DS sparse channels. Here Data Processing and CS approach were described for channel estimation. Here max delay spread of CIR was comparable with guard time duration of Orthogonal-FDM symbols. So in this case proper channel estimation requires improved version of measurement to avoid limitation of small size of IB-Interference free region. The paper [10] has investigated a TF signal structure and related joint T-F channel estimation method in order to enhance the operation of TD- Sync Orthogonal-FDM system over fast fading channels. In order to estimate path delays the proposed method makes use of the One-Sample Shifted TS. While using FD-pilots path gains are estimated. It is found that method could easily track channel estimation. In case of spectral efficiency and synchronization TD-sync Orthogonal-FDM has some advantages but also have some disadvantages like it may suffer from very long delays and can face problems in supporting high order modulation techniques like 256-Quadrature AM [13]. In this paper, a low complexity BE-Rate and M-square error reduction method is proposed. Simulations show that after using proposed method better results were obtained as compared to previous method which is TD-synchronous Orthogonal-FDM in case of linear time invariant system. The method is more efficient when no. of receivers is increased. The remaining paper is organized such that in IInd part the SU-Protocol and ET-Urban method algo is described. Its implementation is described in IIIrd part. Further part IVth and Vth represents simulation result and conclusion table.

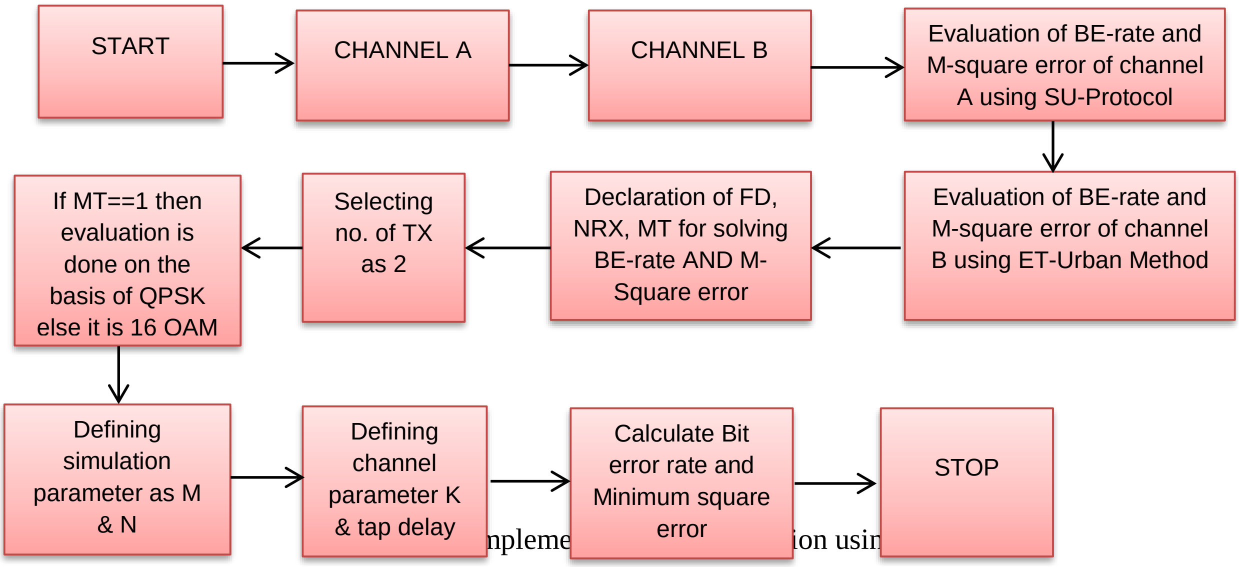
Notation: nrx stands for no. of receiver, ntx stands for no. of transmitter, fd is Doppler frequency and mt is modulation technique

II. SYSTEM MODEL

The section discusses about proposed models which are SU-Protocol also known as Stanford University-protocol and ET-Urban method also known as Extended Typical - Urban method. Stanford University along with 802.16 IEEE did extensive work to develop channel model for 4th generation application in urban environment known as SU-Interim model. It can be used in 3 categories of environment which are hilly terrain that has medium to high tree density, hilly areas with least vegetation and last flat terrain which has minimum path loss condition. ET-Urban method can be used to reduce M-square error and BE-rate. ET-urban method is a type of E-UMTS Terrestrial radio access model that includes certain parameters for example delay profile that is characterised by Doppler frequency and shape of spectrum. The algorithm followed is

a. Consider a channel A and declare functions like Doppler frequency (fd), modulation technique (mt) and no. of Rx order to evaluate BE-rate and M-square error using SU-Interim method. Similarly take channel B and evaluate BE-Rate and M-square error using ET-Urban method
b. Select number of Tx as 2
c. If mt==1, Be-Rate and M-square error will be evaluated for quadrature-psk and if mt==2, BE-Rate and M-square error will be evaluated for quadrature-AM 16
d. Defining simulation parameters which are no. of independent random realisations and no. of taps of Doppler filter.
e. Defining and solving for channel parameters like K parameter and tap delay
f. Calculate BE-Rate and M-square error.

III. IMPLEMENTATION



The above figure 1 represents the implementation of the proposed work. The two channels are taken in which for channel A evaluation of M-square error and BE-rate is done using SU-protocol and for channel B evaluation is done using ET-urban method. While solving for BE-rate and M-square error some parameters are defined which are modulation techniques, no.of Rx and Doppler frequency.

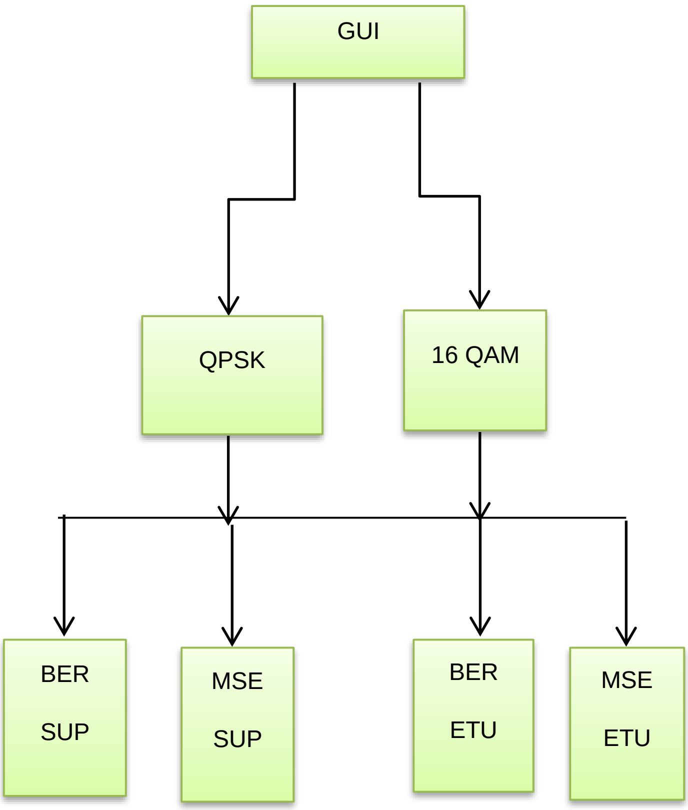


FIGURE 2: GUI REPRESENTATION OF QPSK AND 16QAM

In figure 1(b), for better presentation, further GUI is used that shows graphical representation of BE-rate and M-square error using SU-protocol and ET-urban method under QPSK and 16 QAM. The proposed method results are compared with TD-Synchronous OFDM.

IV. IMPLEMENTATION RESULTS

a. When no. of Rx is 1

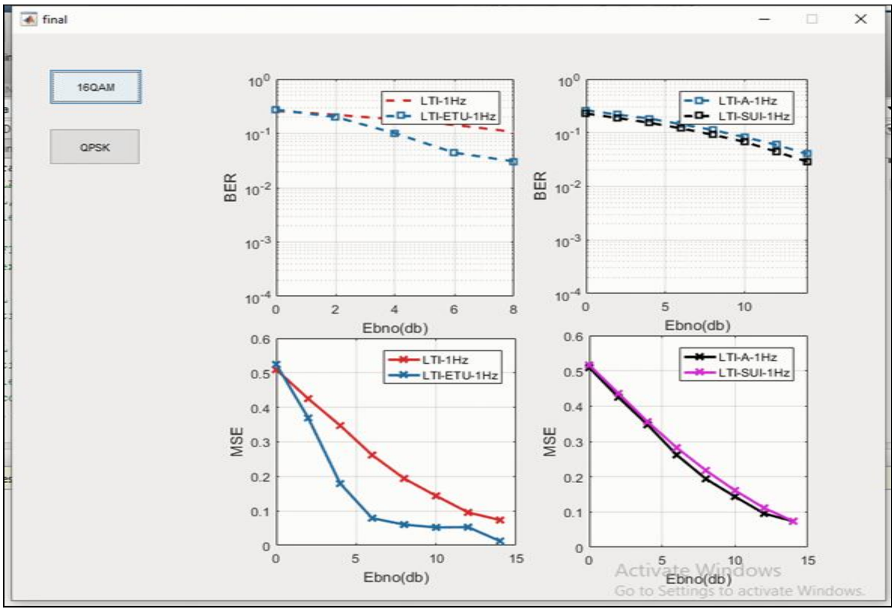


Figure 3: Graphical representation of BE-Rate and M-Square error for 16 QAM at 1 Hz when no. of Rx is 1

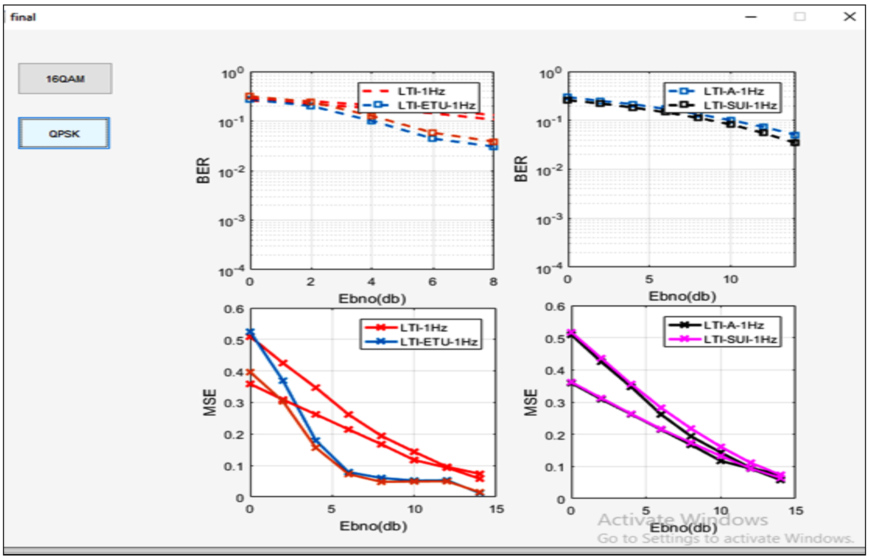


Figure 4: Graphical representation of BE-Rate and M-square error for QPSK when no. of Rx is 1 at 1 Hz

The figure 3 and 4 shows graphical representation of BE-Rate and M-Square error at I Hz frequency using SU-protocol and ET-urban method for 16 QAM and QPSK for no. of Rx as 1 in which a comparison with previous method is obtained in which it is found that by using SU-protocol, BE-rate is further reduced.

b. When no. of Rx are 4

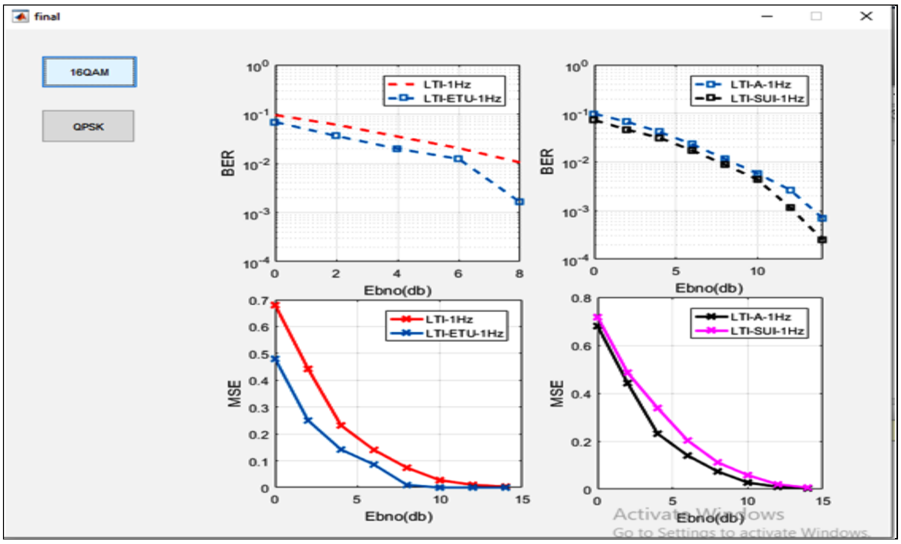


Figure 5: Graphical representation of BE-Rate and M-square error for 16 QAM at 1 Hz when no. of Rx are 4

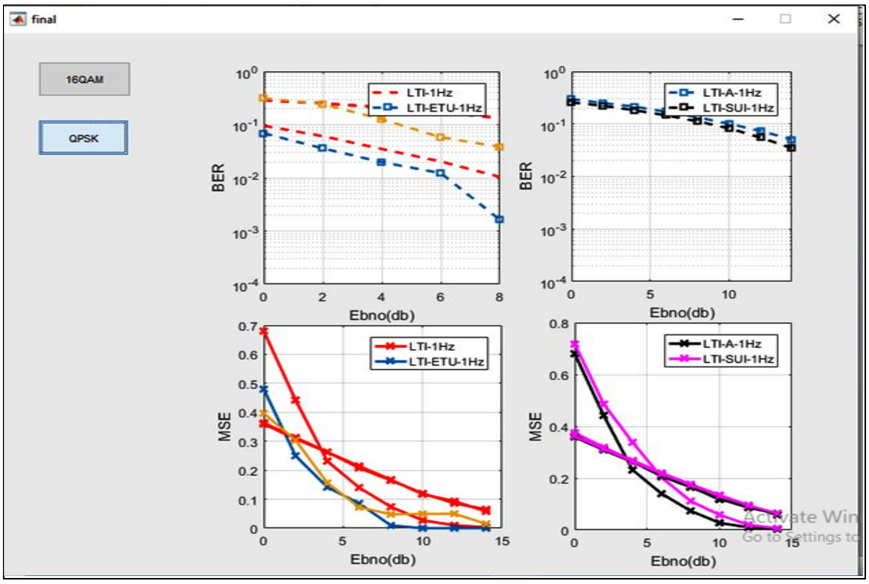


Figure 6: Graphical representation of BE-Rate and M-square error for QPSK at 1 Hz when no. of Rx are 4

The figure 5 and 6 shows graphical representation of BE-Rate and M-Square error at I Hz frequency using SU-protocol and ET-urban method for 16 QAM and QPSK for no. of Rx as 4 in which a comparison with previous method (TD-Synchronous OFDM) is obtained in which it is found that by using SU-protocol, BE-rate is further reduced and by using ET-Urban method BE-Rate and M-square error is reduced.

c. When no. of Rx are 8

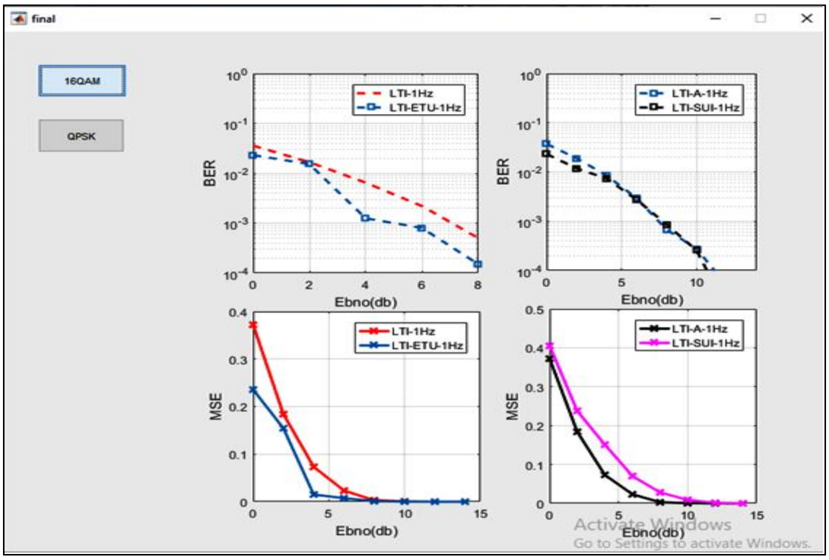


Figure 7: Graphical representation of BE-Rate and M-square error for 16 QAM at 1 Hz when no. of Rx are 8

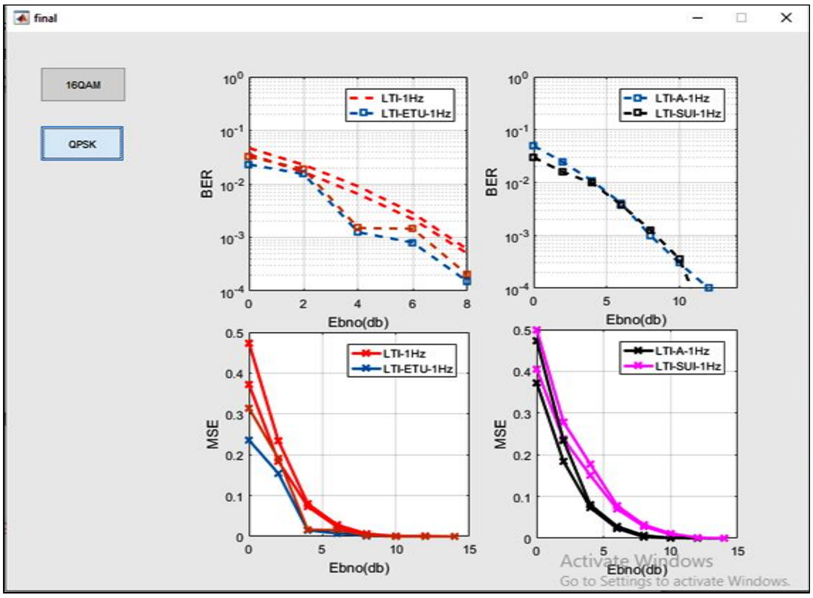


Figure 8: Graphical representation of BE-Rate and M-square error for QPSK at 1 Hz when no. of Rx are 8

The figure 7 and 8 shows graphical representation of BE-Rate and M-Square error at I Hz frequency using SU-protocol and ET-urban method for 16 QAM and QPSK for no. of Rx as 8 in which a comparison with previous method is obtained in which it is found that by using SU-protocol, BE-rate is further reduced and by using ET-Urban method BE-Rate and M-square error is reduced.

V. CONCLUSION

Hence we can conclude that as compared to previous method TD-sync OrthogonalFDM, SU-Interim has led to reduction in BE-Rate whereas through ET-Urban method both M-square error and BE-Rate has reduced. Further we found best results in case of QPSK when no. of rx were 8 and Doppler frequency was 1 Hz. Further we can also work on improvement in Papr (peak to avg power ratio) using SU-Interim and ET-Urban method. We can also work on improvement of frequency domain complexities and noise cancellation and can test using more no.of tx and rx.

CONCLUSION TABLE

			SU-INTERIM		ET-URBAN METHOD	
NO. OF RX	MODULATION TECHNIQUE	FD(IN HZ)	BE-RATE REDUCTION (%)	M-SQUARE ERROR REDUCTION (%)	BE-RATE REDUCTION (%)	M-SQUARE ERROR (%)
		1	20.5	NA	NA	NA
		50	10.8	NA	NA	NA
	QAM	100	NA	NA	NA	NA
		1	20.5	NA	20.5	NA
		50	10.8	NA	10.8	NA
1	QPSK	100	10	NA	10	28.9
		1	36.9	NA	36.9	12
		50	20.5	NA	20.5	NA
	QAM	100	NA	NA	NA	28.9
		1	20.5	NA	36.9	NA
		50	10.8	NA	10.8	NA
4	QPSK	100	20.5	NA	NA	36.8
		1	36.9	NA	36.9	25
		50	20.5	NA	20.5	NA
	QAM	100	NA	NA	NA	NA
		1	36.9	NA	36.9	25.8
		50	39.7	NA	20.5	25
8	QPSK	100	36	NA	25	25

Figure 9: The figure represents percentage reduction of BE-Rate and M-square error as compared to TD-Synchronous method at different frequencies like 1Hz,50 Hz,100Hz and best results were obtained when no. of Rx were 8 having Doppler frequency 1 Hz by using modulation technique as QPSK

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