IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-7, Special Issue-18, May 2019 E-ISSN: 2347-2693

An Approach To Mitigate The Narrowband Jamming in DSSS-CDMA System

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Available online at: www.ijcseonline.org

Abstract: A cost effective approach for better communication to mitigate the narrow band jamming in Code Division Multiple Access (CDMA) system in case of Direct Sequence Spread Spectrum (DSSS) single user system is depicted in the paper. The need for improvement of the jamming problem in modern telecommunication system has huge applications in security sector. A comparative analysis of Power Spectral Density (PSD) of CDMA with and without narrowband jamming condition is proposed in this paper. By variation of signal power and Barker code, an optimised system is illustrated supported by Bit Error Rate (BER) and Signal to Noise Ratio (E_b/N) curve. Increment of signal power provides us low narrowband jamming as well as jamming free PSD. Spreading factor variations supported by Barker Code illustrates the results in favour of optimization of the system under narrow band jamming condition. The entire above spoken CDMA-DSSS system modelling and performance analysis are implemented using MATLAB®.

Keywords: CDMA, DSSS, PSD, BER, MATLAB®

I. INTRODUCTION

The need for improved performance in DSSS-CDMA communication system transmitter and receiver are of real active interest now-a-days as the application areas for the DSSS communication system are increasing day by day because of the w ell-known practical level advantages of such system. This paper is an approach toward the goal of improving the performance of a DSSS-CDMA communication system in the presence of narrowband jamming environment. Here, it has clearly shown that the performance of a DSSS-CDMA receiver system in the presence of narrowband jamming can be significantly improved by modifying the signal power [1-4]. And spreading factor variation with specific barker code illustrated the optimization method.

II. RELATED WORK

Jamming reduction technique in communication system is very tedious job. Anti-jamming solution in CDMA [1] was first proposal in related field since the year 2000.The work was advanced in the specific domain by adding special subspace projection model [2]. By the help of independent component analysis [4] this research work was paws in CDMA domain strongly. In the meantime this jamming concept was introduced in FM technology for reject of particular band [5]. Most significant work done in CDMA detection technique at near -far environment [13].

III. SYSTEM DESIGN AND MODELLING

In this paper we proposed a software base modelling and jamming reduction technique. To implement the problem we consider a spreading factor with specific value. Depends upon the spreading factor generate a barker code. For generate the barker code we depends on following:

$$c_v = \sum_{j=1}^{N-v} a_j a_{j+v} \quad (1)$$

Where, $C_v \leq 1$ for all $1 \leq v \leq N$. Basically the above equation depends on autocorrelation function.

For Barker code modulation following model was considered:

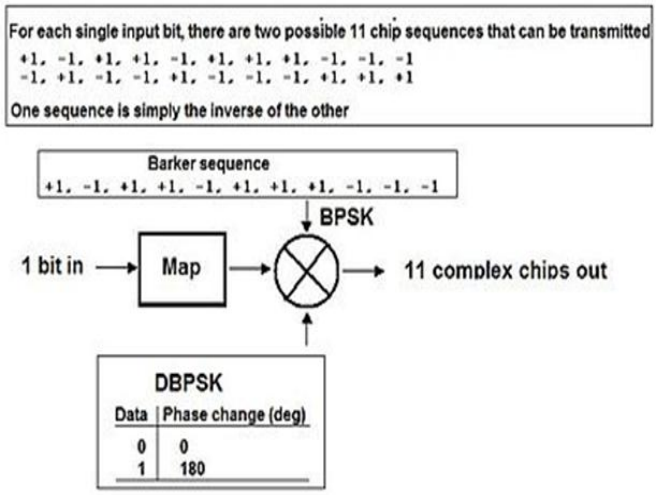

Fig. 1: Barker Code Generation

After generation of barker code we select the modulation technique like QPSK. After modulation we introduced a jamming channel. Now we spread the data as per barker code. Generation of AWGN channel grade up the system noise significantly, as well as the proposed system removed the noise very clearly. In the detecting part the signal de spread first with same barker code. In the detecting edge we capture the PSD for measure the jamming amount.

Depending on the above flowchart we create the model. For removing the jamming we vary the spreading factor as well as Signal to Interference Ratio.

FLOW CHART:

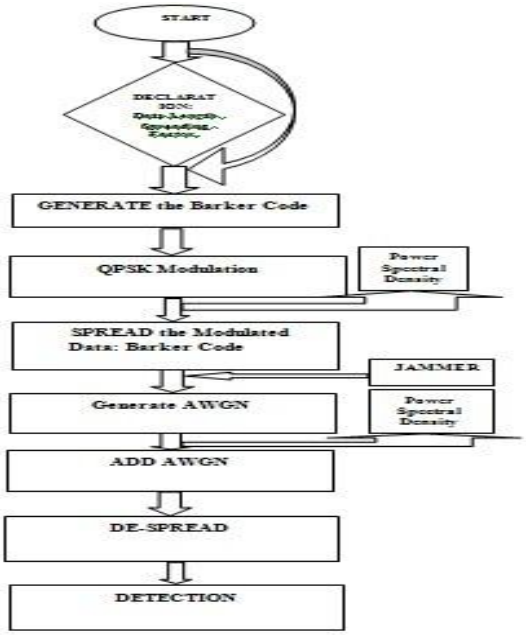

Fig. 2: Proposed Model for DSSS-CDMA System

IV. RESULTS AND DISCUSSION

For minimising the jamming we consider 3 variation of data. In first stage we consider spreading factor value as 11 and Signal to Interference Ratio as 10 in dB. Consideration with three data set the outputs are reflected in Fig. 3, Fig. 4 and Fig. 5. Fig. 3 depicts no jamming result, whereas Fig. 4 describes the jamming concept. In Fig. 4 the jamming portion speeded in positive half of time scale and amplitude swing in between positive and negative half.

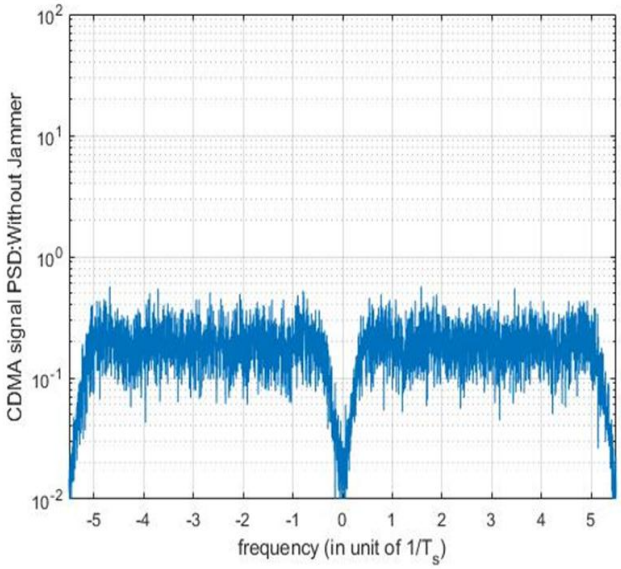

Fig. 3: PSD without Jamming

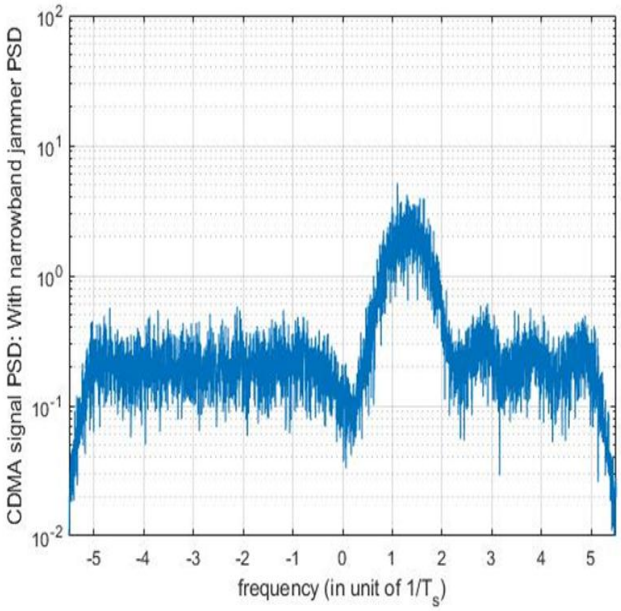

Fig. 4: PSD with Jamming.

As per Fig. 5 no jamming data is reflected on the smooth line, whereas jamming data reflected on dotted line. Here the gape in between two line explain the jamming or error concept. First set of are data not suitable for removing the jamming.

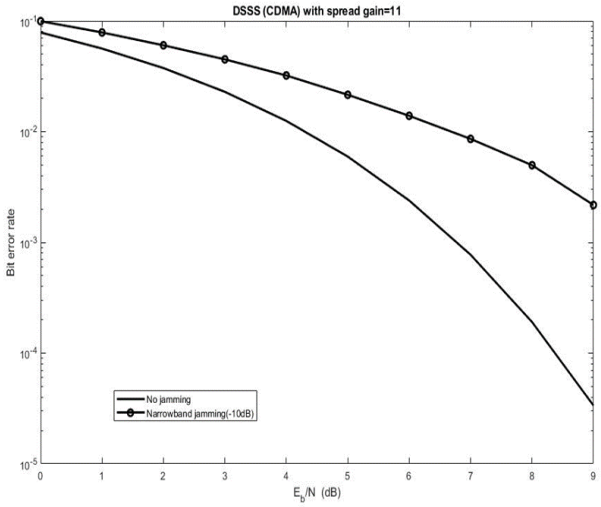

Fig. 5: Bit Error Rate with and without Jamming.

In second stage we consider spreading factor value as 11and signal to interference ratio 20 dB. In this condition results reflected in Fig. 6, Fig. 7 and Fig. 8. Fig. 6 depicts no jamming result, whereas Fig. 7 describes the jamming concept. In Fig. 8 the jamming portion almost vanished with high SIR.

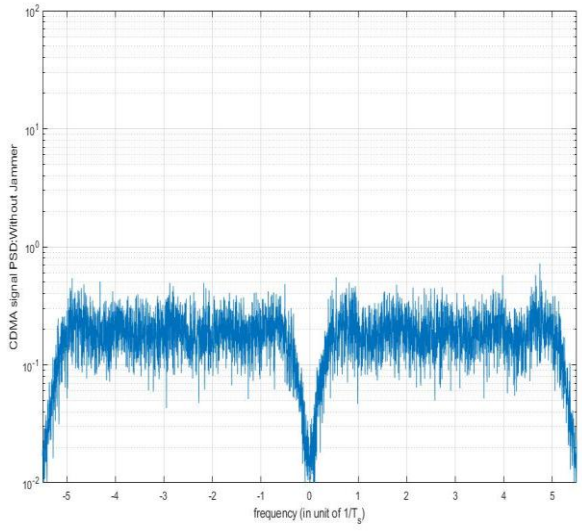

Fig. 6: PSD without Jamming

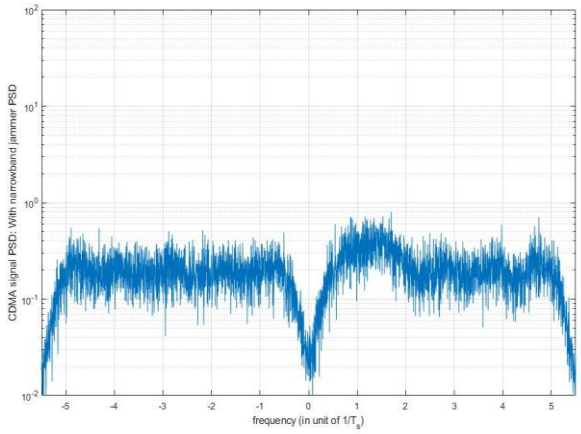

Fig. 7: PSD with Jamming

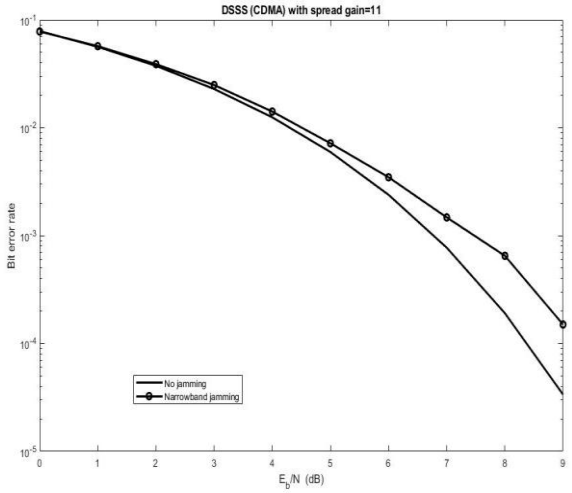

Fig. 8: Error Rate with and without Jamming

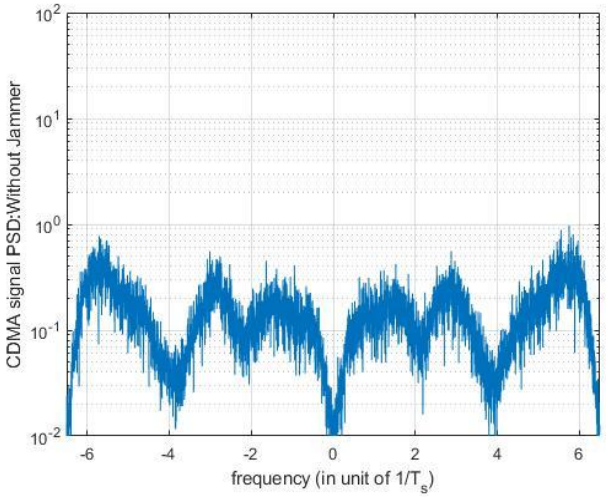

Fig. 9: PSD without Jamming

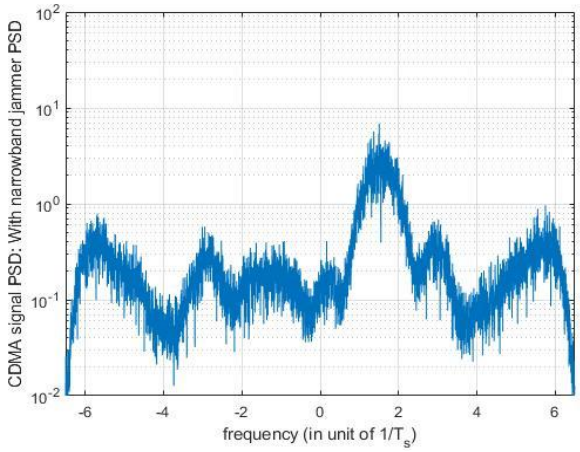

Fig. 10: PSD with Jamming

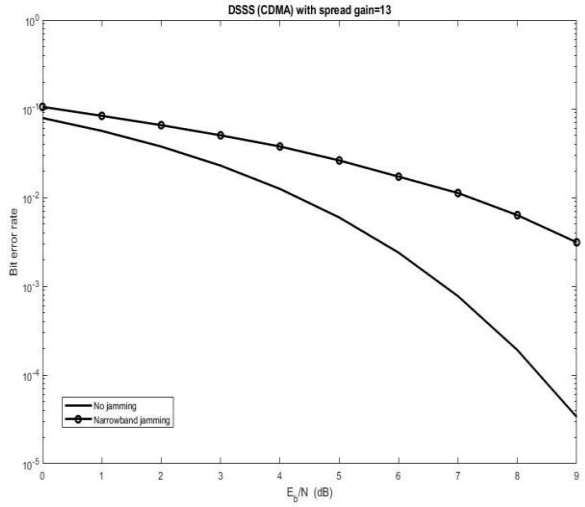

Fig. 11: Error Rate with and without Jamming

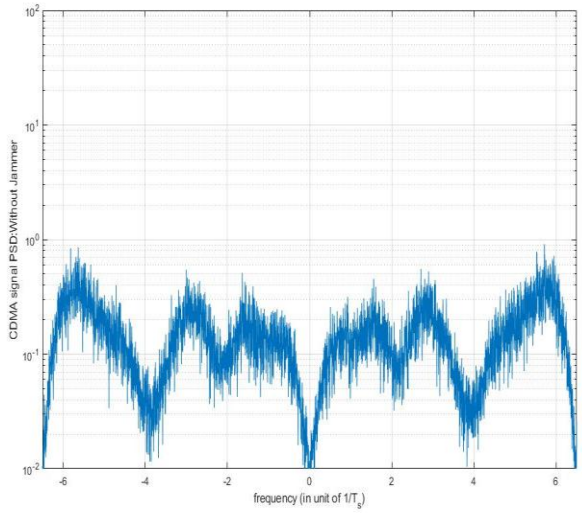

Fig. 12: PSD without Jamming

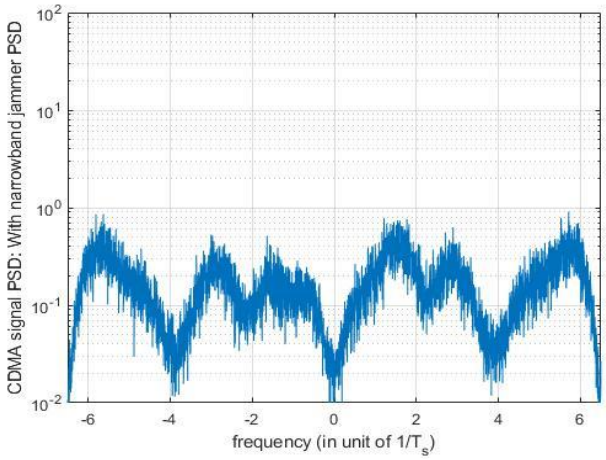

Fig. 13: PSD with Jamming

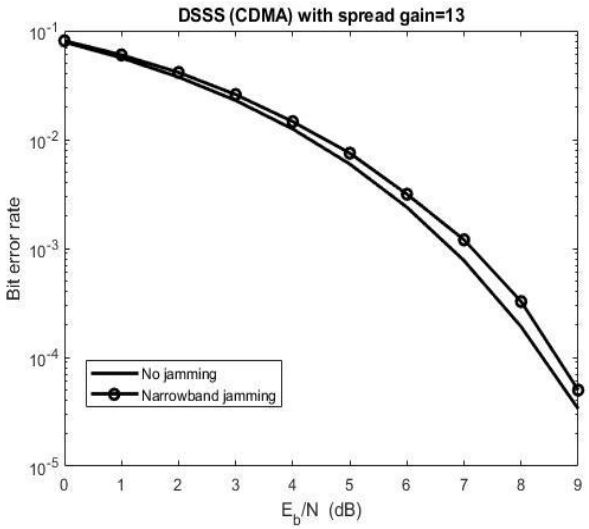

Fig. *14: Error Rate with and without Jamming*

As per Fig. 8 no jamming data reflected in smooth line, where as jamming data reflected in dotted line. Here the gapes in between two lines are minimised, that means BER almost mitigate with high SIR.

Now, we consider spreading factor as 13 and SIR as 10dB. In this condition results reflected in Fig. 9, Fig. 10 and Fig. 11. Fig.9 depicts no jamming result, whereas Fig.10 describes the jamming concept. In Fig. 10 the jamming portion spread in positive half of time scale and amplitude swing in between positive and negative half. But overall performance is not smooth, likely distorted.

As per Fig. 11 no jamming data reflected in smooth line, where as jamming data reflected in dotted line. Here the gapes in between two lines explain the jamming or error concept. This set of are data not suitable for removing the jamming. As well as PSD clarity is not too good.

Now, in same spreading factor if we increase the SIR then jamming also minimised but PSD clarity are not improved, which is depicts in Fig. 12, Fig. 13 and Fig. 14.

V. CONCLISION AND FUTURE SCOPE

As per Table. 1, if we consider the spreading factor value 11 then PSD clarity is good, now depends on SIR jamming and BER minimised. But if we consider spreading factor value 13 then depending on SIR value BER very attractive, in same condition PSD clarity poor. That means spreading factor take a crucial role in system design. And SIR is the leading parameter for removing jamming

Table. 1: Parameter performance of the system

Serial No.	Performance analysis data				
	Spreading Factor(L)	*SIR(dB)*	*PSD without jamming*	*PSD with jamming*	*BER*
1	11	10	good	good	Error present
2	11	20	good	good	Partially present
3	13	10	distorted	distorted	Partially present
4	13	20	distorted	distorted	Almost removed

The system with in specific band structure may propose the model as optimum jamming free system.

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Mr. Tanajit Manna completed the B. Tech degree in 2011,favour of Electronics and Communication Engineering.Completed M. Tech in 2014 with Electronics and Communication Engineering.Presently Mr. Manna working as Assistant Professor in ECE Department at Pailan College of Management & Technology.Insteade of that he worked at Aliah University and RCC Institute of Information Technology as visiting faculty.Mr.Manna has many publication in IEEE Xplore and other reputed joutnal.

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Dr. Alok Kole completed B.E from BESU in 1990 and then M.E in EE and Ph.D in Control system and Artificial Intelligence from Jadavpur University. He has started his career in Tata Steel division as a Sr. Officer From 1991.Then after 6 years of service in Tisco ,he has joined in Bechtel, a world reputed engineering consultancy firm for the prestigious Enron Power Project..Then after that he has served in another reputed MNC organization, GeneralElectric (GE)NuovoPignone as the In-charge of power plant instrumentation and control in HPL Cogeneration Limited. Then after serving ten and half years of service in industry he has switch-overed in academics and research. He has served many engineering colleges including HIT, St.Thomas College of Engineering and Technology and Mody University of Technology and Science. He also acted as Principal in Pailan College of Management and Technology. Presently he is working in RCC Institute of Information and Technology as a Professor and HoD in EE departmentform March, 2014. His special research interest is in Machine learning, AI, Soft computing, Image Processing, Intelligent Control and Smart Grid. He is a Fellow of Institute of Engineers, Member of IEEE and Branch counselor of IEEE Student Branch.He has published more than fifty referred international journals& national journals papers and also International conference papers. Presently he is guiding twoPh.Dscholars. He is the editorial board members of International Journal of Business Intelligence and Data Mining, Inderscience, International Journal of Electronics Science, Technology and applications and Associate editor of International Journal of Intelligent Autonomous System. He is also the regular technical reviewer of differentSCIjournals like International Journal of Machine Learning and Cybernetics,Springer, International Journal of Soft Computing, Springer,Internationals journal of Applied Soft Computing,Elsevier and International Journal of Business Intelligence and Data Mining, Inderscience. He is also acted as the International Advisory board members of different International Conference and also served as conference chair in the International Conference on Intelligent Control Power and Instrumentation (ICICPI-2016) .

