

Realization of CDMA system

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Abstract: Code Division Multiple Access (CDMA) is the technique used widely in today's communication like 3G. The advantage of this system is that it is resilient towards noise and interference. In this paper the authors have developed CDMA system using LabVIEW software. This paper also compares its performance under noisy condition.

Index Terms :Spreading, LabView, CDMA, SNR, BER, communication.

I. INTRODUCTION

CDMA (Code division multiple access):

Code division multiple access is a spread-spectrum multiple-access technique. A spread-spectrum technique spreads the bandwidth of the data uniformly for the same transmitted power.

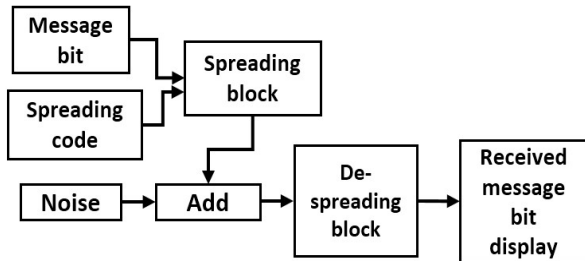


Fig. 1. Basic CDMA system

In CDMA, for secure communication spread spectrum techniques are used which is the method by which a particular bandwidth is spread in the frequency domain resulting in a signal with a wider bandwidth. So, spreading codes are combined in such a way that the bandwidth required is increased so that its gain can be reduced and the signal behaves like noise so that no other receives the signal. At the receiver side, same spreading codes are used to get back the message bits. These codes are specific to each channel/user so that different users can gain access to the system and communicate as required [1]-[3].

For increasing the bandwidth of the signal, the signal is multiplied with the spreading code/PN sequence code which is generated by LFSR (Linear Feedback Shift Register). So in CDMA, we multiply the message signal with the code and transmit it, thus multiplying the code with message increases signal bandwidth and reducing the gain [4].

At the receiver side when the signal is received noise is

also accumulated. The receiver has the same code as that in the transmitter, as the code is multiplied the message signal part is multiplied with the code twice one at the transmitter and the other at the receiver, thus only the message is left and the bandwidth is reduced, then the noise has higher bandwidth and a low pass filter is placed. The low pass filter only allows to pass low frequency signals and rejecting other signals. Thus, message signal is passed and noise is rejected.

The input bit stream and the chip stream is taken as inputs for the spreading block. The spreaded signal is then added along with white Gaussian noise, the output of which is applied as the input chip stream of the de-spreading block and the other input applied is the spreading code. The output bit stream of the de-spreading block is applied at one of the inputs of a sub-tractor and the other input is used as the input message bit stream, after which the absolute values are taken and then a comparator is used to count the number of ones. The total number of one's is divided with the size of the input message bit taken to calculate the BER [5], [6].

II. IMPLEMENTATION OF CDMA

A. CDMA encoder and CDMA decoder

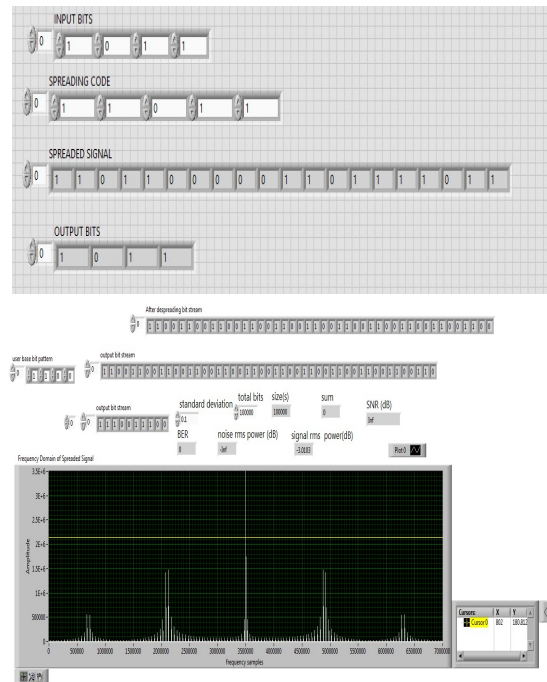


Fig.2. Input and output of CDMA encoder and CDMA decoder

In CDMA encoder spreading codes are multiplied with message bits to form spreaded signal. At CDMA decoder same spreading codes are multiplied with the spreaded signal to get back the message bits. Here the input is taken in the form of digital bits.

In the graph below SNR vs. BER is plotted, and the BER performance is checked for a fixed value of SNR and variable chip lengths.

III. RESULTS

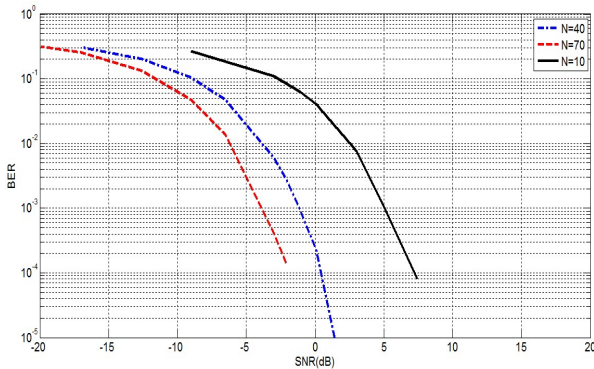


Fig.3. SNR vs. BER plot

From the above graph, it can be concluded that for SNR=-3dB, the BER values of variable chip lengths are-

N=10, BER=0.1094

N=40, BER=0.00614

N=70; BER=0.00041

IV. CONCLUSION

In this paper CDMA system is developed and as can be seen BER of $1E-5$ is being achieved. Also with variation of the length of code, the BER performance increases as the processing gain increases and so is the jamming margin.

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