CHAPTER 5

CONCLUSION

A new type of random multiple access (RMA) technique has been presented. Since the basic transmission scheme of the RMA system is the transformation of each binary bit into multiple-level time-frequency (TF) sequence of symbols, systematic procedures for constructing code sequences by utilizing combinatorial difference sets has been investigated. The properties of the difference sets and the code sequences have been discussed.

A RMA system model and the analysis to determine the signal-to-noise ratio (SNR) at the output of the correlation receiver are presented. An exact expression has been derived for the SNR. There are three parameters that effect the SNR, namely, number of simultaneous user and their associate cochannel symbols with the desired user, sequence length, and energy per data bit.

The approximation of the probability of error of the RMA system has been obtained, based on the Gaussian assumption. It is assumed that the system consists of a large number of users, thus, long sequences are required.

The evaluation of the probability of error and the numerical results are presented. The results show that the sequence length, the number of cochannel symbols in the TF matrix and the number of simultaneous users, which all contribute to the multiple access interference (MAI) parameters, as well as greatly affect the bit error rate. On the contrary, the system performance is not sensitive to the change in the energy-per-bit/channel thermal noise density ratio $(E_b/N_o)_{th.}$. Thus, the system can perform well even when the $(E_b/N_o)_{th.}$ is at some minimum level, provided that the MAI level is low. As a consequence, allowing the use of very small aperture antennas for both transmission and reception. The examples of link budget for very small aperture antennas are given for illustration.

However, the system performance will degrade rapidly as the number of simultaneous users is increasing. Therefore, this access technique is suitable for the system which consists of large number of users with very light traffic. This technique can be applied to emergency network, military network, mobile satellite communication for aeronautical, land or maritime, etc.

For a better practical application, there is a demand for some further study. For instance, in order to guarantee that a particular error rate specification is or is not attainable for a given set of system parameters, bounds on the probability of error are required. The different approach which will improve the accuracy of the approximation of the probability of error without using Gaussian assumption is suggested for future research.