SUMMARY OF Ph.D. DISSERTATION

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Title

A study on the Interference Reduction Schemes for UHF-band Passive RFID Systems

Abstract

This dissertation is concerned with the study on the interference reduction schemes for UHF-band passive RFID systems. Passive RFID systems using UHF-band enable identification from distances up to several meters and are expected to be used for various applications such as logistics management and manufacturing management. Interferences from other readers degrade the communication performance especially in dense reader environments and this issue should be resolved for coming RFID systems into wide use. In this dissertation, efficient solutions for reader-to-tag interference, for which effective solutions have not been studied so far, are proposed.

Chapter 1 shows the background, objectives, and position of this study.

Chapter 2 describes basic communication schemes used in current passive RFID systems. Then, conventional solutions for the interference problems and the issues to be resolved are presented.

In Chapter 3, a novel channel allocation scheme for systems using subcarrier backscattering is proposed. This scheme allows coexistence of transmissions with different bandwidths in overlapped fashion. Evaluated communication probabilities as a function of transmission power leaked to the backscattering channel and problems of the subcarrier backscattering are shown.

Chapter 4 describes proposed distributed interference avoidance algorithms based on the detect-and-abort principle for multi-channel readers which can effectively mitigate the reader-to-tag interference. Computer simulations show that the proposed algorithms can improve the successful communication probability and fairness among readers in dense reader environments.

Chapter 5 describes a proposed distributed modulation index control scheme using a tag's SINR estimation at readers in order to reduce the reader-to-tag interference. This scheme allows a continuous interrogation to tags and it is a very beneficial feature for actual RFID applications. Computer simulations show that the proposed scheme can reduce the minimum required inter-reader distance or increase the number of concurrently operable readers in dense multi-reader environments, especially when there is large unbalance among the reader-to-tag interferences on tags.

Finally, Chapter 6 concludes this dissertation.