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10th IEEE EAST-WEST DESIGN & TEST SYMPOSIUM (EWDTS 2012)

Kharkov, Ukraine, September 14-17, 2012

The main target of the **IEEE East-West Design & Test Symposium** (EWDTS) is to exchange experiences between scientists and technologies of Eastern and Western Europe, as well as North America and other parts of the world, in the field of design, design automation and test of electronic circuits and systems. The symposium is typically held in countries around the Black Sea, the Baltic Sea and Central Asia region. We cordially invite you to participate and submit your contributions to EWDTS'12 which covers (but is not limited to) the following topics:

- Analog, Mixed-Signal and RF Test
- Analysis and Optimization
- ATPG and High-Level Test
- Built-In Self Test
- Debug and Diagnosis
- Defect/Fault Tolerance and Reliability
- Design for Testability
- Design Verification and Validation
- EDA Tools for Design and Test
- Embedded Software Performance
- Failure Analysis, Defect and Fault
- FPGA Test
- HDL in test and test languages
- High-level Synthesis
- High-Performance Networks and Systems on a Chip
- Low-power Design
- Memory and Processor Test
- Modeling & Fault Simulation
- Network-on-Chip Design & Test
- Modeling and Synthesis of Embedded Systems
- Object-Oriented System Specification and Design
- On-Line Testing
- Power Issues in Design & Test
- Real Time Embedded Systems
- Reliability of Digital Systems
- Scan-Based Techniques
- Self-Repair and Reconfigurable Architectures
- Signal and Information Processing in Radio and Communication Engineering
- System Level Modeling, Simulation & Test Generation
- System-in-Package and 3D Design & Test
- Using UML for Embedded System Specification
- CAD and EDA Tools, Methods and Algorithms
- Design and Process Engineering
- Logic, Schematic and System Synthesis
- Place and Route
- Thermal, Timing and Electrostatic Analysis of SoCs and Systems on Board
- Wireless and RFID Systems Synthesis
- Digital Satellite Television

The Symposium will take place in Kharkov, Ukraine, one of the biggest scientific and industrial center. Venue of EWDTS 2012 is Kharkov National University of Radioelectronics was founded 81 years ago. It was one of the best University of Soviet Union during 60th - 90th in the field of Radioelectronics. Today University is the leader among technical universities in Ukraine.

The symposium is organized by Kharkov National University of Radio Electronics and Science Academy of Applied Radio Electronics http://anpre.org.ua/ in cooperation with Tallinn University of Technology. It is technically co-sponsored by the IEEE Computer Society Test Technology Technical Council (TTTC) and financially supported by Trades Committee of Kharkov National University of Radioelectronics and Trades Committee of Students, Aldec, Synopsys, Kaspersky Lab, DataArt Lab, Tallinn Technical University.

CONTENTS

Models for SoC Infrastructure of Radio Frequency Identification with Code-Division Multiple

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Abstract

Application of the direct spread spectrum technology to radio frequency identification system for solving problems of speed, reliability and electromagnetic compatibility is considered. The models of systems-on-chips for tag and reader of RFID systems with code-division multiple, based on technology of direct spread spectrum, are proposed.

1. Introduction

Nowadays, the most promising technology for automatic identification is radio frequency identification (RFID), when data is transferred without any mechanical contact between the devices. Contactless identification technologies correspond to all the requirements of computer control systems, where recognition and registration of objects are realized in real time.

Modern infrastructure of RFID systems (Fig. 1) involves readers, tags and various protocols, which allow integrating the system in global information networks and variety of applications of enterprise levels. In addition, the infrastructure can also include other devices, such as bar code readers, input/output devices, for instance label printers, motion detectors, photo sensors.

Transponder and reader communicate with each other by using radio frequency channel. Wireless data channel is the most vulnerable link in the system, because the data transmitted by radio channel, may be intercepted. Also the problem of electromagnetic compatibility of various wireless devices is important. This paper is devoted to solving this problem through the creation of models of systems-on-chips for tag and reader by using the direct spread spectrum technology (CDMA).

2. SoC models for tag and reader

To implement this system the communication protocol for reader and tag, structural SoC models of tag and reader are developed.

Functional circuit of the tag model involves the following blocks (Fig. 2):

– RF module for transmitting and receiving information from the reader;
– memory ROM (storage of control software and volatile data, such as serial number);
– memory block EEPROM or FRAM (application data);
– control unit, implemented on a microcontroller;
– block for generating pseudorandom sequence (PRS), encoding and decoding useful information, and generator of response time delay;
– sensors (for instance, temperature, humidity);
– I-IP module, focused to solving the design quality problem and increasing yield.

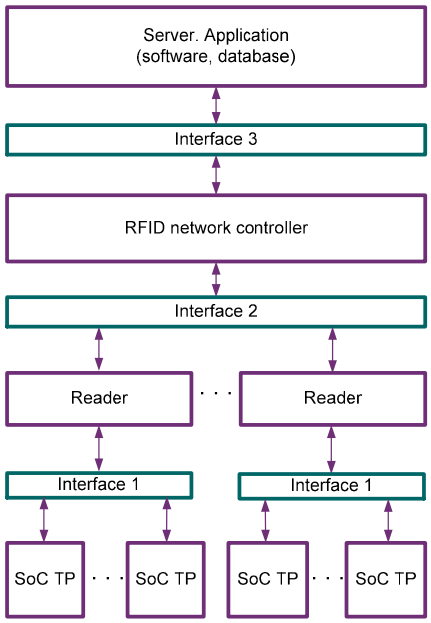

Fig.1. Infrastructure of RFID system

Functional circuit of the reader involves the following blocks (Fig. 3):

– RF module for transmitting and receiving information from the tag;
– memory ROM for storing control software;

– memory block EEPROM or FRAM (application data);
– control unit, implemented on a microcontroller;
– interface block (communication with external devices and applications);
– channel for synchronizing and processing short PRS, designed for synchronization of reader correlator and a tag, and identification of tag number;
– synchronization unit, designed for synchronization of the channels for processing information data from reader;
– processing unit of the received data, including a set of processing channels;
– channel for generating control signal of tag;
– I-IP module.

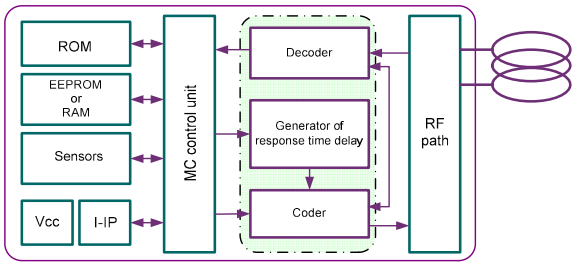

Fig. 2. Tag functional circuit

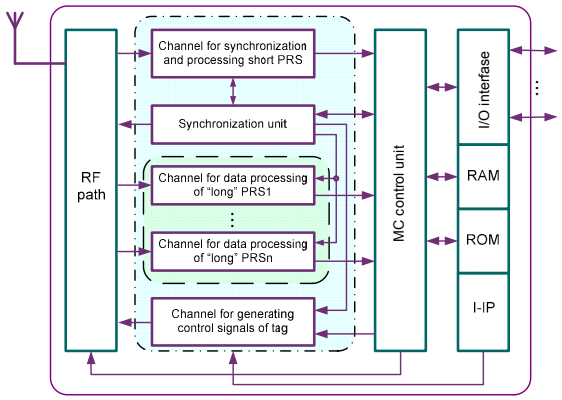

Fig. 3. Reader functional circuit

The protocol for communicating reader and tag, which allows minimizing the time of tag identification, and provide concurrent reading information from a set of tags, is shown in Fig. 4.

To test the project simulation of block for PRS encoding (PRS generation block and unit of modulo 2 sum for the information signal and PRS), and block for decoding (correlator and PRS generator) by using hardware description language VHDL and Quartus II Altera is realized. Functional simulation and verification enable to check the description and logical functioning of blocks. The simulation results are shown in Fig. 5.

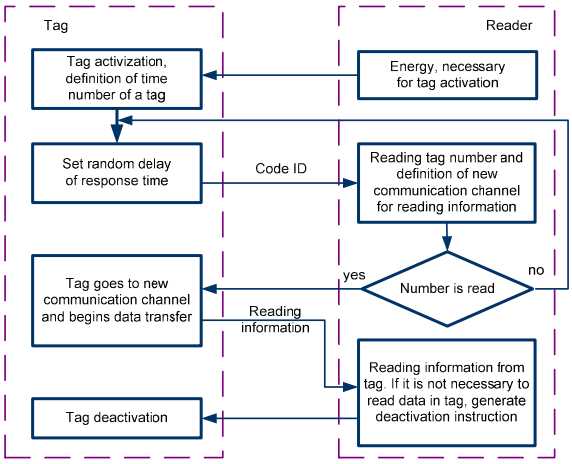

Fig. 4. Flowchart of the protocol for data communication tag-reader

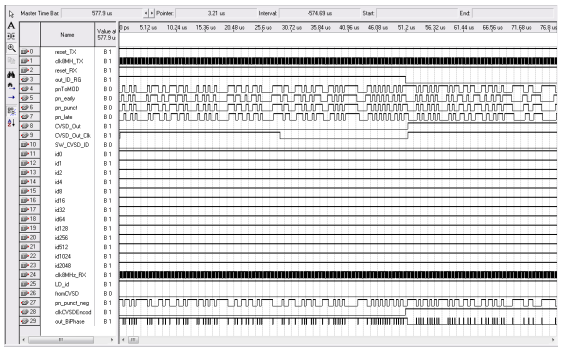

Fig. 5. Timing of the project

4. Conclusion

A model of RFID infrastructure with code division multiple is first proposed. It is based on the technology of direct spread spectrum, which gives the ability to reuse the spectrum with high structural and informational secrecy, increased noise immunity and reliability of information transfer. An infrastructure model allows solving the problem of electromagnetic compatibility of the system with radio devices for different purposes.

SoC models of tag and reader, as well as the protocol of their interaction in RFID infrastructure with code division multiple through direct extension of the spectrum are developed.

Functional simulation and verification of proposed models of tag and reader have confirmed the correctness of the logical operation of the developed system.

10. References

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