

Chapter 10

The Multitag Microwave RFID System with Extended Operation Range

Igor B. Shirokov

Sevastopol National Technical University, Ukraine

ABSTRACT

The problems of radio frequency identification are discussed. It was shown that the use of passive transponders is preferable, but weak energy of system in this case reduces the operation distance and decreases the noise-immunity of the system. The problems of traditional radio-frequency identification systems are discussed. In this chapter the use of homodyne method of useful signal selecting was proposed. The augmentation signal of transponder was obtained by means of frequency shift with the help of controlled phase shifter. This solution allows to increase the energy and the noise-immunity of the system (the operation distance is increased). Furthermore, the interrogator can treat several transponders simultaneously in this case. Additionally the use of one-port transistor amplifier for increasing of operation range was proposed. The energy consumption of such amplifier and its cost are very low, but the gain of amplifier can reach 20 dB and more.

INTRODUCTION

Radio-Frequency Identification (RFID) is of interest for specialists in transport, logistics and other related areas where the identification of object is very important and must be carried out as soon as possible.

The significant advantage of all types of RFID systems is the noncontact matter of their operation and non-line-of-sight nature of the technology.

Tags can be read through a variety of substances, where barcodes or other technologies of optical reading would be useless. Though it is a cheaper technology, RFID has become indispensable for a wide range of automated data collection and identification applications that would not be possible otherwise.

Any RFID system consists of basic unit and mobile unit (tag or transponder), which position and unique code must be identified (Sharpe,

1995). The terms “basic” and “mobile” were assumed conditionally (the tag may be immobile but the seeking device (basic unit) mobile). The basic unit, in turn, consists of transceiver with the decoder and antenna.

The antenna emits signals to activate the tag and read and write the data to it. Antennas are available in a variety of shapes and sizes; they can be placed in a door frame to receive the tag data from people or things passing through the door or it can be mounted on an interstate toll plaza to monitor the traffic on the highway. The electromagnetic field produced by the antenna must constantly take place while multiple tags are expected continuously. If constant interrogation is not required, the field can be activated by a sensor device. The antenna is packaged often with the transceiver and decoder to become a reader (so-called interrogator).

RFID tags are categorized as either active or passive. Active RFID tags are powered by an internal battery and are typically read/written, i.e., tag data can be rewritten and/or modified. The battery-supplied power of an active tag generally gives it a longer reading range. The shortcomings of such solution are greater size, greater cost and the limited operational life.

Passive RFID tags operate without a separate external power source and obtain operating power, generated from the reader. Passive tags are consequently much lighter than active tags, less expensive, and offer a virtually unlimited operational lifetime. The shortcoming is that they have shorter reading ranges than active tags and require a higher output power of reader.

In the chapter we will discuss active tags only, as the operation range of RFID system is of main interest. Furthermore, several transponders can be located within the system service area and the interrogator must recognize each.

UNDERSTANDING OF PROBLEMS OF CONVENTIONAL RFID SYSTEMS

Harmonic RFID System

Functioning of the RFID system assumes a sending of a probing pulse with the help of transceiver of basic unit which activates a transponder, established on the object. Transponder replies by the reciprocal radio-frequency pulse modulated by a unique identification code. The use of passive transponder represents the greater interest for consumers, as its power supplying is carried out due to the energy of a signal of basic unit within the communication time. Under clear reasons the link of such system should be duplex. Due to the increased power of such communication link, there is an opportunity in this case to send several commands to transponder and to organize, thus, any necessary exchange protocol.

The organization of duplex channel involves the engineers in complicated design of transponder and increases its cost. In practice there are widely used so-called harmonic RFID systems (Colpitts et al, 2004) and (Vanjari et al, 2007) in which the transceiver of the interrogator sends initial signal on one radio frequency, and transponder responds on frequency, which is multiple to the initial one. As a rule, frequency rate is equal to two. Such approach satisfies the main principle of duplex communication. On the other hand the doubling of frequency allows us to use the same known antenna for reception and radiation. Multiplication of frequency of the transceiver can be achieved by the elementary technical solution, for example by connection to the terminal of the transponder's antenna of Shottki diodes, as it is shown on Figure 1 a.

Besides the multiplication of interrogator signal frequency, they make its rectifying for transponder modulator feeding. Obviously, the energy of signal, which is received from interrogator and rectified, is weak, and this signal must be presented during entire communication session.

19 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:
www.igi-global.com/chapter/multitag-microwave-rfid-system-extended/65982

Related Content

A Novel Approach in the Detection of Chipless RFID

Prasanna Kalansuriya, Nemaï Chandra Karmakarand Emanuele Viterbo (2012). *Chipless and Conventional Radio Frequency Identification: Systems for Ubiquitous Tagging* (pp. 218-233).

www.irma-international.org/chapter/novel-approach-detection-chipless-rfid/65983

Cultural Adaption of Hypermedia: A Contemporary State of the Art of Industrial Practice and Improvements by Multi-Trees

Judith Dödtmannand Ralf Wagner (2012). *International Journal of Wireless Networks and Broadband Technologies* (pp. 41-50).

www.irma-international.org/article/cultural-adaption-of-hypermedia/94553

Selecting Location for Agro-Based Industry Using ELECTRE III Method

Seema Gupta Bhol, Jnyana Ranjan Mohanty, Proshikshya Mukherjeeand Prasant Kumar Pattnaik (2020). *IoT and WSN Applications for Modern Agricultural Advancements: Emerging Research and Opportunities* (pp. 99-121).

www.irma-international.org/chapter/selecting-location-for-agro-based-industry-using-electre-iii-method/231107

Application of Blockchain Technology in an IoT-Integrated Framework

Lipsa Das, Smita Sharma, Suman Avdhesh Yadavand Khushi Dadhich (2022). *Information Security Practices for the Internet of Things, 5G, and Next-Generation Wireless Networks* (pp. 131-151).

www.irma-international.org/chapter/application-of-blockchain-technology-in-an-iot-integrated-framework/306840

A Dynamic Model for Quality of Service Evaluation of Heterogeneous Networks

Farnaz Farid, Seyed Shahrestaniand Chun Ruan (2020). *International Journal of Wireless Networks and Broadband Technologies* (pp. 17-42).

www.irma-international.org/article/a-dynamic-model-for-quality-of-service-evaluation-of-heterogeneous-networks/257777