Enhancement of ITS application of RFID technology by means of radar techniques.

C. Alcaraz*[(1)], J. Balbastre[(2)], J. F. Vega[(1)]
(1) Universidad Nacional de Colombia, Bogotá, Colombia
(2) Universitat Politècnica de València, Valencia, Spain

This work is focused on the adaptation of well-established radar techniques to enhance the use of RFID (Radio Frequency Identification) technology in IST (Intelligent Transportation Systems) applications. Specifically, the application of monopulse techniques used in SSR (Secondary Surveillance Radar) and Doppler processing is considered herein.

A monopulse system will be integrated into passive RFID readers operating in the 915 MHz ISM (Industrial, Scientific and Medical) band, which is the band reserved by Colombian authorities for ITS applications. There are readily available RFID-based ITS systems (E. D. E. Transporte, E. L. Presidente, D. E. L. A. Rep, S. Inteligentes, G. Nacional, and R. Electr, "Num 2846," 2013) which are able to detect and to register the pass of a vehicle by a control point. With the addition of a monopulse processor, the system will also provide the sense of the vehicle motion, thus allowing to check whether it goes against the permitted one. Furthermore, the use of band-pass Doppler filters centered at different frequencies will provide the velocity of the vehicles detected by the system for statistical purposes (high resolution Doppler processing for law enforcement applications will not be considered due to their high cost).

Vehicles circulating by a single lane road or street can be detected by a conventional RFID system with a single antenna (assuming that an RFID tag has been attached somewhere on the vehicle), but their sense of movement cannot be easily determined. The monopulse processor can detect the presence of the vehicle through the sum channel, as in conventional systems, whereas the polarity of the signal received through the difference channel can be used to determine the sense of the vehicle motion with respect to the antenna location (for instance, the change of positive to negative polarity could mean that the vehicle is circulating from left to right). The information provided for such a system can be used for law enforcement in one sense ways.

The use of very simple and cheap base-band Doppler processing (with homodyne implementation) will provide rough information of vehicle speed. This information can be used to detect significant variations in the average speed of the vehicles circulating in a given area, which can be representative of a traffic incident. Moreover, the average speed information can be used by the traffic authorities to update the traffic policies in a given area.