
Backscatter RF/ID Systems

Automatic vehicle identification (AVI) is one aspect of intelligent vehicle-highway systems (IVHS). It is a good example of the use of RF/ID technology in a practical application. For example, RFID systems are being integrated into electronic toll collection at bridges so that tolls can be deducted from an account by using information stored in a tag mounted in the vehicle's windshield.

One of the key requirements of these systems is that the stationary reader (interrogator) be able to discriminate between individual tags passing the toll booth without interference from other tags or other transmitters that may be operating at the same frequency. Backscatter modulation technology is one method that can be used for such an application.

A block diagram of a typical transponder (tag) for backscatter technology is shown in Fig. 1. The interrogator (reader) sends a modulated RF signal that is received by the tag. The Schottky diode detector demodulates the signal and transfers the data to the digital circuits of the tag. The radar cross section of the tag is changed by a frequency shift keying encoder and switch driver so that the reflected (back-scattered) signal from the tag is modulated and ultimately detected by the reader's receiver antenna. Thus, communication between the tag and reader is established.

By using backscatter technology, interference from nearby transmitters can be avoided, since the reader controls the frequency of operation and can shift it if nearby transmitters are operating at the same frequency. Also, the reflected signal strength from the tag is proportional to the incident interrogator signal, so tags outside the incident beam focus area will reflect a weaker signal that the reader antenna can reject.

Such a backscatter tag can have read/write capabilities that allow flexible digital formats. It can also contain various tag information that can be used in other IVHS applications. A specific minimum field strength is required to put the Schottky detector diode into forward bias so that the tag does not backscatter until the interrogator signal and message data are received, thus minimizing the power requirements of the tag.

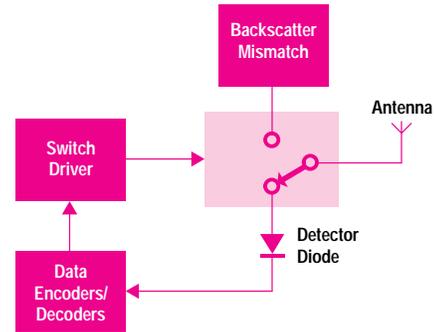


Fig. 1. Typical transponder block diagram for backscatter RF/ID technology.