

## **Semi-Passive RF Tags Intellectual Property**

### **Application Specific Intelligent Microsensor**

**12329-B**

**Patent No: US 6,889,165 & NZ 530434**

An intelligent microsensor module is described that provides a unique sensing technique. The modular sensor unit includes a sensor array layer, a processor and control layer, and a power layer. A communication layer can be added to receive new software to reprogram the smart sensor module for a different application. A network of smart sensor modules can be created.

The intelligent microsensor module can combine the data from different types of sensors and locally determine the current state of the environment in which the unit is placed. The intelligent microsensor module can locally determine and execute an action to be taken based on the determined state of the environment. The resultant state rather than raw data is then communicated to the outside world when the microsensor is queried. The module can be readily reconfigured for multiple applications.

### **A Novel Method of Simultaneously Reading Multiple Radio Frequency Tags**

**12961-B**

**Patent No: 6,995,655**

A method of identifying a plurality of RF tags is described. The RF reader issues an interrogation signal to the RF tags in the area. The reader then blankets the area with a continuous RF illumination field during which time the RF tags respond with their unique identification codes in different randomly selected time slots and on different IF frequencies. The reader monitors these frequencies during the specified time frame and sends an acknowledgement signal to those that are successful in sending their identification code. There may be instances of 'collisions' between tags that have randomly selected the same IF frequency and time slot. These collision events prevent the identification codes from being received by the reader. When collisions are noted, an additional re-randomize command is sent out to those tags that have not yet received an acknowledgement from the reader. This cycle is continued until all RF tags within the area have been acknowledged and identified. Based on the number of collisions detected, the reader can adjust the length of future timeframes to optimized the identification process.

### **Semi-Passive Tag Asynchronous Service Request**

**13094-B**

**Patent Pending, Application no. 10/263,826**

A radio frequency identification device communications system includes a reader and multiple RFID tags. The RF tags can be implemented in active, semi-passive or passive modes. The RF devices can be connected to a stimulus device that senses or monitors the environmental conditions in which it has been placed. In addition to responding to wireless communications sent by the reader, the RF tag can initiate communications with an asynchronous signal based on information received by the attached stimulus device or a timer. This process can save battery life by avoiding the need to respond to regular polling by powering up and communicating only when conditions warrant it.

## **Using ID Compression to Identify RF Tags in the Reader's Field of View**

**13095-B**

**Patent No: 7,009,526**

A method for rapidly identifying RFID tags in an RFID system that includes a reader and a multiplicity of RFID tags, the tags having both permanent and nickname IDs. The nickname IDs can be modified based on bit locations that can be queried for uniqueness and compressed to minimize data transmission time and length. The method of assigning and modifying nicknames minimizes the time necessary to identify a multiplicity of tags.

## **A Method of Minimizing Communications Required to Identify Multiple Radio Frequency Tags in the Field of View**

**13096-B**

**Patent No: 7,009,495**

An RFID system is described that comprises an RFID reader configured to issue a command requesting that RF tags identify themselves. The request includes timing information defining a range of timeslots in which to respond. The RF tags, each with a unique identifier, are configured to randomly select a timeslot in which to reply to the RF command, and to issue a reply. The RF reply includes a frequency pattern to assist in identifying the tag but does not include the tag's entire ID. The reader can be configured to monitor a range of intermediate frequencies as well as timeslots looking for responses. The RF tags can then randomly select from a range of intermediate frequencies and time slots to respond.

## **RF Tag Low Power Wake-up Circuit**

**IR 13154-B**

**Patent No: 7,019,617**

Radio frequency identification devices, backscatter communication device wake-up methods, communication device wake-up methods and a radio frequency identification device wake-up method are described.

A processor capable of processing and controlling a plurality of received and outputted wireless signals is included in all listed embodiments of the invention. The circuitry is configured to respond to the detection of radio frequency energy by outputting a reference signal, which is analyzed and compared to the radio frequency energy. Based on the analysis of the reference signal and the detected radio frequency energy the rest of the circuitry is "woken-up" to process the detected signals. This method conserves electrical energy used by the processor and maximizes battery life for the device.

## **RF Tag Sensitivity Enhancement**

**13218-B**

**Patent No: 6,914,528**

A wireless communication system is described that includes a reader configured to output a wireless communication signal to a second remote communication device such as a radio frequency identification (RFID) device and to receive a wireless communication signal from said device. The remote device can be implemented as a passive or semi-passive RFID tag with power conditioning circuitry included to transform the electromagnetic energy received by the antenna into operational power and/or signal transmission power. The semi-passive device would include an additional energy source, commonly a battery. By increasing the sensitivity of the remote device, the device requires less power to detect the input signal. This can allow the range at which the remote device can receive and transmit to increase.

## **RF Tag Sensitivity Enhancement**

**13219-B**

**Patent Pending, Application no. 10/263,670**

A wireless communication system is described that includes a reader/interrogator and multiple remote communication devices which contain antennas configured to receive electromagnetic energy for processing. Synchronization circuitry is coupled with the antenna and communication circuitry and is configured to generate a clock signal that controls sampling of the electrical energy received by the antennas. This synchronization process contains an edge detector and an oscillator and provides an advantage over other methods by conserving the power used to sample incoming data signals.

## **Hardware Method of Addressing RF Tags**

**13252-B**

**Patent No: 7,019,618**

A wireless communication system that includes radio frequency identification devices (RFID) is described. The reader can be configured to output a multitude of signals that can include different modulation frequencies capable of addressing individual RFID devices or groups of RFID devices. The reader can receive a multitude of wireless signals from the addressed RFID devices. One frequency modulation can be used to wake-up the selected RFID devices, and a second frequency modulation can be used to request a response. Different implementations can use a stimulus device, a watchdog timer, or a clock signal to generate the required frequencies. The RFID devices can also be configured to respond to different frequencies at different times.

**Grounded Co-Planar Wave-Guide (GCPWG) Printed Circuit Board Techniques for Radio Frequency Identification (RFID) Reader PCBs**  
**13592-B**  
**Patent Pending, Application no. 10/269,756**

The invention describes a physically small, inexpensive-to-manufacture, RFID reader/interrogator with excellent performance and sensitivity in dual bands. The interrogator includes at least one surface mount integrated circuit supported on a grounded-coplanar wave-guide circuit board. This RFID reader is small enough that it can be portable as well as stationary. The reader/interrogator transmits data to an RFID tag, generating a carrier for the tag, and receives data back from the tag modulated onto the carrier.

The grounded-coplanar wave-guide circuit board provides an improved technology over those usually used for RF printed circuit boards, including micro-strips. In addition to better performance and lower cost, it offers the following benefits:

- Physically smaller in size for a given frequency
- Greater noise immunity from on-board & off-board sources
- Easier transitions from surface mount devices to transmission lines on the printed circuit board while maintaining proper circuit impedance.
- Enables the manufacture of smaller high performance stationary readers & high performance hand held readers

**Dual Frequency Dual Detection RFID Tag Antenna Dual Compressed Dipole (DCD) Antenna Structure**  
**13593-B**  
**Patent Pending, Application no. 10/336,086**

A wireless communication system is described using at least one reader and one or more radio frequency identification (RFID) tags. Each RFID tag has at least two antennas preferably arranged in a compressed dipole configuration. The antennas can be tuned to the same frequency to provide a fail safe mode to protect against electrostatic discharge events. The device could continue to operate though the communication range would be reduced by half. The antennas can also be tuned to different frequencies permitting operation on a plurality of frequency bands. The sensitivity of this configuration is reduced by half as compared to those configurations where the antennas are tuned to the same frequency.

Implementation of this system may be made with active, semi-passive or passive RFID tags with processing and wake-up circuitry included in all implementations. A battery is included in the active and semi-passive configurations. A case with reflector permits the coupling of the communication device with another object. This configuration allows the mounting of a device upon an object surface with minimal effects of the surface material on the radio frequency communications of the device, e.g. metal, water filled containers, or other materials which are overly reflective or absorptive of RF energy. This implementation provides a 180 degree directional reading capability. By omitting the reflector, the device may be used on the human body or in free space providing a 360 degree reading capability.

**A Challenged Base Tag Authentication Model**  
**13097-B**  
**Patent No: 6,842,106**

A method of providing secured communications over an open, public channel for an RFID system including a reader and multiple RF tags is described. The described system incorporates RF tags with memory capable of storing key pieces of information. Upon receiving a request for information, a method of random number generation is used by the authenticating device to generate an access challenge number. Depending on the configuration, the authenticating device can be either the reader or the tag. The access challenge number is combined with a stored key to authenticate requests for access from the requesting device. Both the requestor and the authenticator perform the same mathematical operation on the access challenge number using the stored key. If the results match, access is granted allowing normal communications between the devices. Otherwise access is denied, maintaining the security of system communications.