

AN IMPROVED HIGH FREQUENCY ANTENNA

The present invention relates to radio frequencies. More particularly, the present invention relates to an improved antenna having an extended read range for radio
5 frequency identification implementations (RFID).

BACKGROUND TO THE INVENTION

Radio frequency identification RFID is a technology similar in theory to bar code
10 identification. With RFID, the electromagnetic coupling in the radio frequency portion of electromagnetic spectrum is used to transmit signals. Typically, an RFID system consists of an antenna or coil, a transceiver with a decoder and a transponder or RF tag electronically programmed with unique information in it. The antenna emits radio signals to activate the tag and to read and write data to it. Antennas are the conduits
15 between the tag and the transceiver, which controls the system's data acquisition and communication. Antennas are available in a variety of shapes and sizes; they can be built into a door frame to receive tag data from persons or mounted on specially designed walkways in shopping malls. The electromagnetic field produced by an antenna can be constantly present when multiple tags are expected continually. RFID
20 tags come in a wide variety of shapes and sizes. Animal tracking tags, inserted beneath the skin, can be as small as a pencil lead in diameter and one-half inch in length.

The significant advantage of all types of RFID systems is the non-contact, non-line-of-sight nature of the technology. Tags can be read through a variety of substances such
25 as snow, fog, ice, paint, and other visually and environmentally challenging conditions, where barcodes or other optically read technologies would be useless. The read/write capability of an active RFID system is also a significant advantage in interactive applications such as inventory or maintenance tracking. Though it is a costlier technology (compared with barcode), RFID has become indispensable for a wide
30 range of automated data collection and identification applications that would not be possible otherwise.

However, commercially available RFID systems come with a limited read range characteristics and fixed antenna size. This type of implementation limits the usage of the RFID and therefore does not maximize the potential of the technology. It is highly desirable to provide an RFID implementation having an improved read range characteristics and a customizable antenna size structure to address these shortcomings.

SUMMARY OF THE INVENTION

It is a first object of the present invention to provide a high frequency antenna with extended read range capability.

It is a second object of the present invention to provide an antenna which can be customised in size and shape.

According to the first aspect of the present invention, there is provided a high frequency antenna with an extended read range capability by using a tuning circuit capable of setting the operating frequency according to the desired implementation.

In yet another aspect of the present invention, an antenna with customizable size and shape is achieved by aligning the antenna circuitry to follow the desired read range capability.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will now be described in greater detail, with reference to the accompanying drawing, in which:

Figure 1 is a schematic diagram showing implementation of a high frequency antenna according to an embodiment of the invention; and

Figure 2 is a perspective view of a high frequency antenna according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring to Figure 1, a high frequency antenna of the present invention consists mainly of a tuning circuit **101**, an antenna **102**, a coaxial cable **103** with variable length, a plastic casing **104**, a male BNC connector **105** that is connected to a high frequency reader **106** that acts as an intermediate device to obtain information from the antenna **102** and transmit the information to an application software installed in a computer **107**. The connection between the computer and the HF Reader is through RS232.

The tuning circuit **101** is used to set the desired frequency for the operations of the RFID. The operating frequency is pivotal to the successful implementation of the present invention as the RF tag will also operate at the same frequency enabling the circuit board or antenna **102** to read information from the RF tag. The present invention operates at a frequency of 13.56 MHz at 50 ohms impedance but is not limited to this frequency. The frequency may be tuned for different implementations.

Still referring to Figure 1, the tuning circuit **101** is connected by circuitry to the loop of the antenna **102** that is made with a copper tape. The antenna **102** is used to activate the RFID tags to read information from RF tags and relay that information using a coaxial cable **103** to an application software via the high frequency reader **106**. The application software is able to display information from the RF tag, write information to the RF tag and enable / disable security measures. The antenna **102** used in the present invention comprise of an antenna loop made of copper and other fixed elements such as variable capacitors, resistors and high speed switching diodes.

The resonance tuning of the circuit board or antenna **102** of 13.56 MHz is achieved by using mica capacitors approximating to 100pF. The fixed elements include variable capacitors of which the value ranges from 10nF to 60nF; all connected in parallel to allow tuning of the antenna **102**. The capacitor legs are modified to allow them to be soldered. A 40K Ω , 2 Watt thick film resistor, adjusts the Q factor of the antenna **102**.

The Q factor in general is used to measure the output of an antenna **102**. The switching diode is used for switching the frequency bands.

5 The antenna **102** is uniquely shaped to follow the plastic casing **104** thus allowing a larger read radius of up to 30cm from the base. The antenna **102** can be customised to different size and different read radius which is among the novel features of the present invention.

10 Information relay from the antenna **102** to the application software is performed using a coaxial cable **103** that is connected to the tuning circuit **101** and the information will then be passed to the computer **107** through the high frequency reader **106** with the coaxial cable ending with BNC connector **105**. Most commercially available computers comes with a female BNC receiver built in the circuit board therefore not requiring any additional hardware cost for the implementation of the present invention.

15 In addition, the plastic casing **104** used in the present invention offers the advantage of weight and mobility while still maintaining overall durability and also protects the antenna and tuning circuit

20 Referring to Figure 2, a high frequency antenna **201** in a preferred embodiment of the invention is a cubical shape enclosed by a housing **202**. A coaxial cable **203** extends out of the housing **202** and connects to the computer (not shown) via the high frequency reader **106**. Preferably, the housing **202** is having, but not limited to, a dimension of 32 cm x 39.5 cm x 3.1 cm.

25 The present invention will now be described by way of an example

EXAMPLE

30 In a preferred embodiment, the present invention can be used in a library for tracking of tagged books. The books can be checked out for borrowing and checked in upon return of the books. The antenna will be able to read approximately 30 cm from the base enabling more books to be read at a time. This will depend on the thickness of

each book. All scanned books from the antenna will display information of the book and details of the borrower in the application software running on a standard computer.

- 5 The antenna can also be used to activate or deactivate a surveillance system or Electronic Article Surveillance (EAS) which is an anti-theft feature that is available within the RFID tag. Typically, EAS systems are used to electronically detect goods with tag that have not been authorised when they are removed from a retailer. For this application, this system will be able to detect if a book is leaving the library premises
- 10 without being checked out first (or the EAS being disabled upon borrowing the book). In an event if the book with enabled EAS is taken out from the library that passes through a gate antenna, an alarm will go off alerting the library personnel that the book is taken out from the library by an unauthorised person or it's taken without being borrowed with authorisation.

WHAT IS CLAIMED IS:

1. An antenna assembly having an extended read range for radio frequency identification implementations comprising:
 - a housing;
 - an antenna provided in the housing and shaped to substantially follow the interior of the housing;
 - a tuning circuit comprising two or more variable capacitors connected in parallel and arranged to adjust the operating frequency of the antenna, the tuning circuit comprising a resistor arranged to adjust the Q factor of the antenna;
 - a coaxial cable comprising a first end connected to the tuning circuit and a second end arranged to be connected to computer via a high frequency reader.
2. An antenna assembly as claimed in claim 1 where the housing dimensions are approximately 32cm x 39.5cm x 3.1cm.
3. An antenna assembly as claimed in claim 1 or claim 2 where the read range is approximately 30cm from the base of the housing.
4. An antenna assembly as claimed in any one of claims 1 to 3 where the capacitors are mica capacitors.
5. An antenna assembly as claimed in any one of claims 1 to 4 where the capacitors have a capacitance of between 10nF and 60nF.
6. An antenna assembly as claimed in any one of claims 1 to 5 where the resistor is a thick film resistor.
7. An antenna assembly as claimed in any one of claims 1 to 6 where the resistor is a 40K Ω , 2W resistor.
8. An antenna assembly as claimed in any one of claims 1 to 7 comprising a BNC connector connected to the second end of the coaxial cable.