PLATFORM TECHNOLOLGY CAPABILITIES

Ensuring a safer food supply – SOMARK's initial focus and an integral element to the greater purpose. The aim is to help curb export trade loss from animal disease scares like BSE (Mad Cow Disease), E. coli and Salmonella while increasing animal productivity and therefore agriculture yields. The vehicle for accomplishment is a patented ID system based on an ink tattoo with chipless RFID functionality. This innovative technology allows SOMARK to address food-export trade bans, issues in identification, traceability, food supply transparency, animal productivity, bioterrorism and credence attributes (assessing quality of product's genetics, health and overall management). And while the technology will be primarily applied to the livestock industry, many secondary applications are emerging. From metal part identification to lab animals, the technology has a profound place in many different markets.

TECHNOLOGY OVERVIEW

The SOMARK identification system is a chipless radio frequency identification (RFID) platform. Typical RFID systems use a microchip and an antenna embedded in a tag affixed to an object. The SOMARK chipless system eliminates the high-cost microchip and antenna, instead using simply an electronic ink to create the identification 'tag'. This ink is deposited directly onto or within the object which creates seamless integration of the object and the identification of that object.

SYSTEM COMPONENTS

TATTOO

The ID 'tag' or tattoo in the SOMARK system is special ink deposited in a unique barcode pattern. The ink is the same for every tattoo, however the pattern in which the ink is injected under the surface of the skin or on the surface of an object is different for each item to be identified. This unique pattern is what gives each item a different and unique number, just like a fingerprint. In the case of animal ID, this pattern is determined at the factory when ink is placed inside a one-time-use disposable cartridge. In non-animal applications the unique pattern could be made through the use of software combined with a printer filled with SOMARK ink or a print cartridge filled with SOMARK ink. Once the ink is deposited in or on the substrate it will be as permanent as any other ink. In non-tissue applications, such as paper or plastic, the ink can be deposited on or within the material. If the ink is printed onto the surface, the ink will wear just like any other ink that would be used, however in high-wear environments a more permanent mark can be created using SOMARK ink because it can be placed under the surface or on the surface with a protective layer covering and protecting it. This can be done because the ink doesn't have to be visible to be read. In living tissue the ink is deposited in the dermal layer, which is the same as traditional tattoos. Ink in this layer of skin will remain permanent for the life of the animal, just like any other tattoo. See *ID & Data* for information on the data storage capabilities.

APPLICATOR

The reusable mechanical date stamp-like applicator is used with the ID ink cartridge to inject the tattoo in animal applications. The user takes a tattoo cartridge and places it into the applicator. By simply pulling a trigger, the pneumatically operated applicator then injects the tattoo while destroying the tattoo cartridge at the same time to prevent reuse. The spent cartridge is ejected from the applicator and discarded. In non-animal applications the applicator could be any number of devices normally used to deposit ink onto or within a surface such as an inkjet printer, sprayer, or offset printing device.

READERS

The SOMARK system has two different types of readers: handheld and panel. The handheld is small and works when the surface of the reader brushes against the 'tattoo.' The panel reader is ideal for high volume reading environments and is permanently affixed into position. The panel reader can read at distance up to 5' and uses very high frequency (>10GHz) microwaves to interrogate the tattoo. SOMARK will develop a commercial handheld system before a panel reader system.

MIDDLEWARE

A piece of middleware will push the ID from the readers to any third party management software or database. The output format of the numbers coming from the reader can easily be configured for any application. Common output formats include XML, ASCII text, etc.

INNER-WORKINGS

In the case of animal ID, a user inserts a one-time use, disposable tattoo cartridge that has been encoded with a unique tattoo pattern at the factory into the SOMARK applicator gun. The cartridge and the applicator are like a bullet and a gun. The user then presses the tip of the applicator gun against the animal that requires identification and pulls a trigger. The applicator injects the ink contained within the tattoo cartridge into the dermal layer of the target animal's skin, while at the same time destroying the cartridge itself, making it impossible to reuse. The user then removes the spent cartridge from the applicator gun and either throws it away or sends it back to SOMARK for cataloguing. From this moment on, the animal is permanently and uniquely identified in a tamper-proof way that is readable through the use of a SOMARK reader. A SOMARK reader sends out a high frequency microwave signal. This signal travels through the air as well as any material (barring metal, thick glass or thick layers of water) between the reader and the tattoo being read. When the signal reaches the tattoo, the signal is instantly reflected from the areas of the tattoo where ink is present and is not reflected where ink is not present. The resulting reflection pattern, which is a function of the unique ink tattoo pattern, then travels back to the reader and is interpreted as a number through the use of digital signal processing, which represents that tattoo's ID number. This ID is displayed to the user and can be stored or transmitted to an external database.

SUBSTRATES

Since the SOMARK ID tattoo is simply an ink and not a complicated assembly consisting of a microchip and an antenna, the SOMARK ID tattoo can be placed on or within virtually any material. Anywhere standard ink could be placed is a possible ID location such as:

- Living tissue
- On the surface or below the surface
- Flexible or rigid
- Bumpy or smooth

Possible substrates include:

- Living tissue
- Metal
- Glass
- Plastic
- Paper
- Wood
- Cardboard
- Liquid containers (full or empty)

ID & DATA

The tattoo encoding format is based on the Datamatrix ECC200 ISO (16022:2006) format. The difference is that while the ECC200 relies upon black and white elements making up the barcode, the SOMARK tattoo relies upon areas where high dielectric ink is present (black) and dielectric ink is not present (white). Using the Datamatrix encoding scheme is beneficial because it is robust, standardized and proven. Because of the way the information is encoded, the tattoo can remain readable even when it is stretched and distorted if it's on a flexible substrate like skin. As the skin grows and stretches, the tattoo remains readable. There is redundancy built into the tattoo, which allows large portions of the tattoo to become unreadable or destroyed without compromising the overall readability of the tattoo. The amount of data that can be stored inside a SOMARK tattoo is completely dependent upon the surface area of the tattoo. Each 'bit' or dot in the tattoo must be the same size and this size is determined on an application-by-application basis. Determining factors include: required reading distance, required reading speed, substrate, and amount of data required. For example, if it is determined that each tattoo bit can be 3mm square and the application requires 16 numbers to be represented on the tattoo, a 12x12 matrix can be used, giving a 36mmx36mm tattoo size. The table below shows the tattoo size vs. data capacity of a SOMARK tattoo.

SOMARK Tattoo Sizes and Data Capacities									
Data Size (digits)	6	10	16	24	36	44	228	912	2100
Matrix Size	10x10	12x12	14x14	16x16	18x18	20x20	40x40	80x80	120x120

APPLICATION

Since the SOMARK ID tattoo is composed only of ink, the possible methods for applying a SOMARK ID tattoo are the same methods used to deposit ink in various situations. The application of SOMARK ink would be the same as any other ink, therefore the same automation capabilities, speed, and methods apply. Application methods can include:

- Injection
- Injection molding
- Printing
- Inkjet printing
- Offset printing
- Gravure printing
- Stamping
- Spraying
- Screen printing
- Pad printing
- Painting
- Laminating
- Application as a sticker or label

DETECTION

There are two ways SOMARK ink can be read. The first involves a handheld reader that only works when the surface of the reader is in direct contact with the tattoo. This method of reading is quick, easy and inexpensive. The second method of reading is more involved and expensive, but allows for remote reading of the tattoo similar to the way RFID tattoos are read through the use of a panel reader. This remote detection method is ideal for fixed-position automated reading of SOMARK tattoos and is more compatible with metal-laden environments than traditional RFID readers because of the fundamental differences in the way the readers work. Distances of up to 5' have been demonstrated in the lab for this type of reading using frequencies of 10GHz and above using a prototype panel reader. SOMARK ink is responsive to all frequencies and is not tuned to a specific frequency; however the frequency chosen does affect how much data can be stored in a tattoo. Both reading methods require some level of tattoo-to-reader orientation. Just like standard barcodes, the tattoo and reader are not required to be perfectly aligned, but the reader cannot decode the tattoo if it is looking at the edge of the tattoo; just like you can't read writing on a piece of paper if you can only see the edge of the paper and not the surface.

ENVIRONMENTAL

With one exception, SOMARK's proprietary RFID ink is composed entirely of GRAS (Generally Recognized as Safe) materials. The one non-GRAS material is a particulate that creates the ink's unique electronic properties. This material is a ceramic currently used in implantable human medical devices and therefore non-toxic. The ink is 100% lead-free, thus lending itself useful for RoHS-compliant electronics.

INTELLECTUAL PROPERTY ESTATE

ISSUED PATENTS

US 7,180,304 – "Method of Interrogating a Barcode"

- Protects the method of communication between the reader and the ID

US 7,221,168 – "Bar code Interrogation System"

- Protects the signal generation, decoding and remote reception of the reader

US 7,205,774 – "Microwave Readable Dielectric Barcode"

- Protects the encoding scheme of the ID

US 78/924960 Trademark and design

- Encoded micro particulates, tattoos and taggants of plastic, metal or silicate for use in the field of passive labeling, tracing or tracking of persons, animals, vehicles or goods.

PENDING PATENT APPLICATIONS

SOMARK has 14 additional applications that are pending.