Future Opportunities and Challenges for RFID

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RFID Systems
RFID: A Solution Waiting for a Problem

Livestock
– The problem: Track and trace
– The solution: Durable RFID tag

Automotive
– The problem: Auto theft
– The solution: The key becomes a security device

Security
– The problem: More secure access control
– The solution: RFID card, fob

Asset tracking
– The problem: Identifying assets
– The solution: Embedded RFID tag
RFID Is / Is Not

- RFID is a powerful tool
- RFID is not a plug and play technology
- RFID is constrained by physics
- RFID is not workable in all instances
- RFID is a safe and secure technology
- RFID is not the problem, criminals are
- RFID is still evolving
- RFID is not going away
## Frequency and Performance

<table>
<thead>
<tr>
<th>Frequency</th>
<th>LF 125 ~ 135 kHz</th>
<th>HF 13.56 MHz</th>
<th>UHF 850 ~ 960 MHz</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read Range</td>
<td>0.5 ~ 1 m</td>
<td>&lt; 1m</td>
<td>&gt; 3m</td>
</tr>
<tr>
<td>Cost</td>
<td>Relatively expensive</td>
<td>Less expensive</td>
<td>Least expensive</td>
</tr>
<tr>
<td>Penetration of materials</td>
<td>Excellent</td>
<td>Poor</td>
<td></td>
</tr>
<tr>
<td>Affected by water?</td>
<td>No</td>
<td>To some extent</td>
<td>Yes</td>
</tr>
<tr>
<td>Power source</td>
<td>Passive (Inductive)</td>
<td>Passive (Inductive)</td>
<td>Passive (Capacitive)</td>
</tr>
<tr>
<td>Data Rate</td>
<td>Slower</td>
<td>Faster</td>
<td>Faster</td>
</tr>
<tr>
<td>Reading Multiple tags</td>
<td>Poor</td>
<td>Good</td>
<td>Very Good</td>
</tr>
<tr>
<td>Applications</td>
<td>Car immobilisers, Animal identification, POS</td>
<td>“Pharma”, Libraries Baggage tracking, Tickets Payments, Passports</td>
<td>Pallet/ Case tracking, Tolls Baggage tracking</td>
</tr>
</tbody>
</table>
RFID Technology Evolution

Key Features: LF
- Penetrates Mat'ls
- Robust Tags
- Operates Globally
- Unique ID’s

Key Features: HF
- Anti-Collision
- Security
- High Baud Rates
- Label Production

Key Features: UHF
- Read range
- Faster data rates
- Better anti-collision
- Use of H-field (for item) and E-field (for range)

Sources: TI estimates, ABI Research 2005/2006

Technology for Innovators™
Low Frequency Tags

- LF frequencies allow adequate power levels to be used worldwide and without special licensing
- Form factors are 3 dimensional
- More complex to build than HF and UHF
- The magnetic field although falling off quickly, creates a reliably defined homogeneous read zone
- Tags are more expensive than those at higher frequencies
LF Transponders

Tiny circuit board, discreet components
Copper, wound antenna
Ferrite rod
Glass encapsulation
HF / UHF Inlay Form Factor

- **Best Current Form Factor**
  - High-speed manufacturing
  - Delivered on Reels (10k per reel)
  - Design Requirements:
    - Pitch, Layout, material thickness
    - Testing, quality, yields
  - Been working since 1997

- **Best Fit to Current Smart Label Conversion Process**
  - Maximizing press speeds to 100% Utilization
  - High incoming yields: 99.4% Tag-it (Historical)
  - Low fall-out in post conversion process
  - Conversion processes stable, reliable

EPC Gen 2 Inlays
The Inlay Up Close

The Gen 2 chip

Performance Enhancing logo

Printed antenna

PET Thin Substrate

95 x 38 mm

Technology for Innovators
Next Generation - The Strap

• The Concept:
  – Chip with 2 connection tabs delivered in a manageable form factor
  – Enables high-speed assembly on printed ink antennas
  – Eliminates need for inlays
  – Reduces cost
  – Allows for direct attach on boxes, packaging
  – Delivered on reels (40k per reel)

EPC Gen 2 Straps

Shipping Now!
The Strap Up Close

- PET Substrate
- The Chip
- Alignment Marker
- Attachment Pads, etched or printed

Technology for Innovators™
Conductive Inks

- Making low-cost high-speed antenna production viable
- Highly Conductive Silver or copper Inks are polymers, highly filled with silver and additives to enhance conductivity of the system, curing
- The cured inks exhibit high flexibility, combined with their excellent conductivity for RFID tags
- Suppliers include: Dow, Parelec, Prescia, Flint

Printable substrate
Metalic particles
In-Line Conversion with Strap

Raw Label Stock → 4-color Towers → Antenna Printing → Converted smart label

Strap Attached
Tag read and verified
Packaging Integration

• Smurfit-Stone – introduced first strap-on-box at RFID World
  – Printed antenna using silver ink
  – Strap-attach at end of corrugation manufacturing
  – Embedded inside the corrugated box

• Item-level next step for embedded RFID tag
  – Permanent part of product packaging
  – Integrated in packaging production
  – programmed at end of final assembly
Emerging Integrated Solutions

Identification:
- EPC number
- Born-on date
- Sell-by date

Sensors:
- Temperature
- Humidity
- Drop, impact
- Food freshness
RFID-enabled Payments
Unlimited Form Factors
Emerging Applications

- Near Field Communications (NFC)
- Like other wireless communication technologies but read range is restricted
Emerging Applications

Remote keyless entry

Tire Identification

Tire Pressure Sensing
Consumer Privacy

• **Biggest concerns for consumers:**
  – Data being shared with third parties
  – Tracking of consumers via their product purchases
  – Potential for increased targeted marketing or government surveillance
  – Small tags can be hidden from consumers
  – Covert reading of tags
  – Tags “broadcasting” my data
Tracking People

• RFID is not a good tracking device
  – Short read range, not much important data
• A cell phone makes a much better tracking device than RFID
  – Yet consumers aren’t afraid of cell phone tracking
• We as consumers fear what we don’t understand
  – And most people don’t understand RFID
Consumer Rights and RFID

• **Consumer Notice**
  – Consumers will be clearly notified of the presence of EPC tags

• **Consumer Choice**
  – Consumers will be informed of their options to discard, disable or remove EPC tags from the products they acquire

• **Consumer Education**
  – Consumers can easily obtain accurate information about EPC and its applications

• **Record Use, Retention and Security**
  – Protect records generated through EPC’s in compliance with all applicable laws
  – Companies will publish information on their policies regarding the retention, use and protection of any consumer-specific data
Adding Security to RFID

- Addressing the **System** security and data privacy needs is essential
- Each application has an “appropriate” level of **system** security
  - Cost, complexity and interoperability have an impact
  - Data sensitivity - Cost to protect vs. Value of data being secured
  - Cost and complexity of breaking the security
  - A chain is only as strong as the weakest link

The RFID link can be (and is) secured by existing technologies so it’s not the weakest link in the system!
A Look at the Threats

- **Eavesdropping:**
  - Intercepting an RFID transaction
  - Addressed by sending encrypted information over the air interface, 128-bit, 3DES, highest allowable encryption

- **Replay attacks:**
  - Capturing and then replaying the transaction
  - Have dynamic, non-predictable data that changes with every transaction and checked at the reader/host

- **Snooping / Sniffing / Unauthorized access:**
  - Reading a concealed tag to capture the data
  - Have access control checks on the tag, require authentication between tag and reader before data transfer
Technology is NOT the Culprit

• Can’t ban the internet because someone sent an illegal e-mail
• Can’t ban the post office because someone sent an illegal letter
• Can’t ban the telephone because someone used it to commit a crime
• Can’t ban cars because someone used it to commit crime
Consensus Building is Key

- Manufacturers can build in the features
- Data CAN be protected where appropriate
- Dialogue and collaboration between all the parties:
  - The legislative community
  - Privacy groups
  - Retailers, credit card issuers
  - RFID manufacturers
- Businesses will not use technologies that their customers find offensive or invasive
What’s Needed?

• **Back-end data is more precious than RFID transactions**
  – A lot to go through for one piece of what could be meaningless data
  – Databases need high security

• **Consumer education on the myths**
  – Truth is, RFID can be very secure

• **Put system checks in place to protect privacy**
  – Governmental policies, legislation, user’s best practices

• **Security evolves over time – what’s good in 2006 may not be sufficient in 2010**
  – Comprehend this in the application and planning
  – Think of the internet and the credit card market evolutions!
Thank You

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www.ti-rfid.com