

2nd Canadian RFID Conference

SHARING THE FACTS; DISPELLING THE MYTHS.



"Tracking the Evolution of RFID Technology and its Applications"
Two Day Conference ♦ April 19-20, 2005
♦ Le Parc, Markham Ontario

Workshop: Understanding RFID (RFID 101)



Moderator:

Keith H. Bray, President & CEO, Markham
Board of Trade

Speakers:

William Allen, Director of Strategic Alliances and
Programs, Texas Instrument





William Allen

Director of Strategic Alliances
and Programs
Texas Instrument



State of the Market



- RFID is arguably on the threshold of pervasive adoption
- RFID Is Not “Emerging” Anymore
 - More than a billion transponders deployed world-wide
 - RFID has been delivering ROI
 - RFID has created new markets



TI-RFID: 15 Years of Innovation

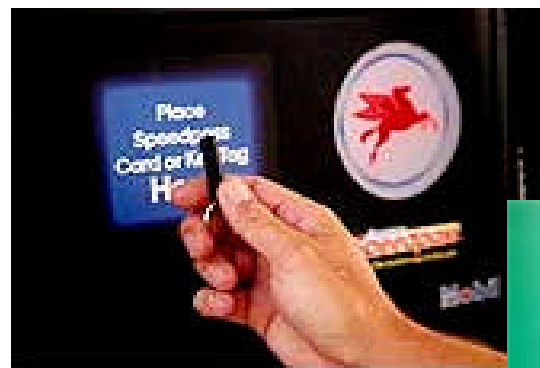


- TI-RFid established as a business unit 15 years ago
 - #1 global supplier of RFID transponders
 - Surpassed 400 million tag milestone
 - Technology behind Tag-itTM smart labels
 - Active participant in standards bodies, ISO/IEC, ANSI, now EPCglobal
 - Awards for engineering, marketing and innovation



RFID Application Milestones

- 100 million keys for anti-theft
- 30 million in livestock tracking
- 20 million library books
- 7 million using Exxon/Mobil Speedpass
- 4 million trays tracked by Marks and Spencer



But Remember...



- RFID is NOT the solution for every business problem
- RFID is NOT a cure for bad business practices
- RFID is NOT a “white knight” technology



RFID Is...



- ...a proven process improvement enabler
- ...a highly capable technology when intelligently implemented
- ...a technology that will evolve and continue to improve



RFID Defined

- **Radio Frequency Identification (RFID) uses a semiconductor (microchip) in a tag or label to store data**
- **Data is transmitted from, or written to the tag or label when it is exposed to radio waves of the correct frequency and with the correct communications protocols**

Some Vital Vocabulary

- **Antenna** - The antenna is the part of the system that radiates the RF energy to, and receives energy from the transponder.
- **Anti-collision** - A reading system that allows more than one transponder in the reader field simultaneously without producing an error report or blocking transaction.
- **Encryption of Data** - A system that scrambles its data to prevent unauthorized duplication.
- **Frequency** - The number of times a signal executes a complete excursion through its maximum and minimum values and returns to the same value (cycles).

More Vital Vocabulary



- **Read range** - The maximum distance between the antenna and a transponder in a radio frequency system at which the signals can be properly received, either for reading the data encoded in the transponder or for re-programming.
- **Reader (Interrogator)** - In an RF system, the device containing the digital electronics which triggers the transponder to respond, and extracts and validates the information from the transponder's modulated RF response.
- **Transponder** - An electronic TRANSMitter/resPONDER which is attached to the object to be identified and, when appropriate signals are received, transmits information as radio signals to a reader.
- **UID Unique Identifier** - A number that uniquely identifies the transponder. This is used for addressing each transponder individually.



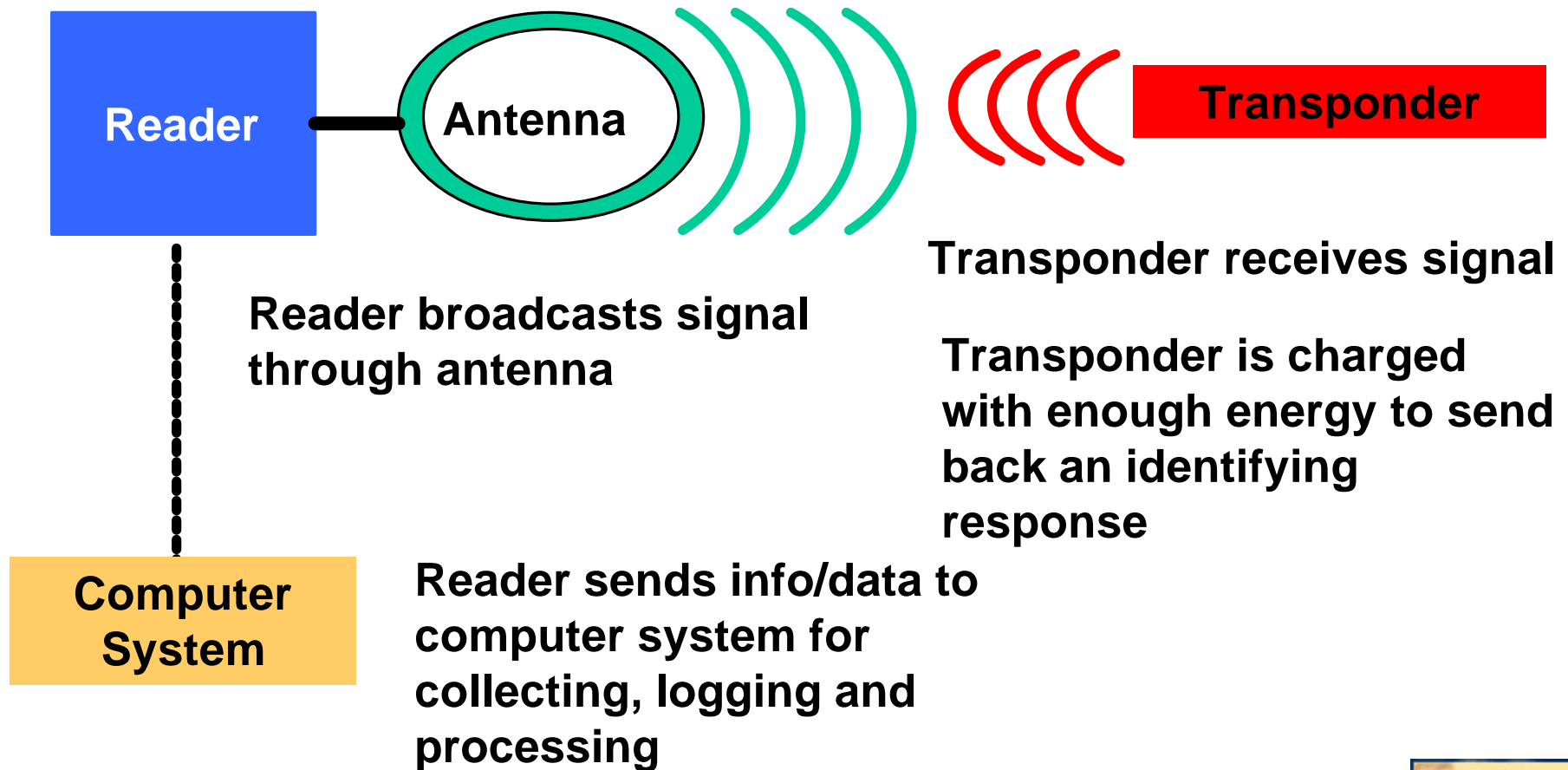
The Original RFID Application ???

Friend or Foe in WW2

RFID Is Maturing

- **Technology has improved**
 - From read-only to read-write
 - From no memory to 2k, 8k, even 16k bits
 - Anti-collision for multiple tags read in the field
 - Better authentication between tag and reader
 - More sophisticated security algorithms
- **Standards are being adopted and agreed upon**
 - ISO 15693 – Smart Labels
 - ISO 14443 – Contactless payments
 - ISO 11784 – Livestock
 - EPC – Retail
 - ISO 18000 – Various frequencies, various applications
- **Markets are maturing**
 - Livestock now 15 years old
 - Automotive immobilizer now 10 years old
 - Contactless payments now 7 years old

How Does RFID Work?



RFID Operating Frequencies

Low Frequency (125 – 134 kHz)

Used in Access control, livestock, race timing, pallet tracking, automotive immobilizers

- Inductively coupled devices, electro-mechanical field
- Antenna coil has many turns
- Read range (near contact to 1 meter)
- Memory usually a UID
- Limited data rate due to a lower bandwidth

RFID Operating Frequencies

High Frequency (13.56 MHz) – Smart Labels

**Used in supply chain, wireless commerce,
ticketing, product authentication**

- Inductively coupled devices
- Fewer antenna turns than LF device
- Read range from proximity to ± 1.5 meters
- Higher data transfer rate than LF

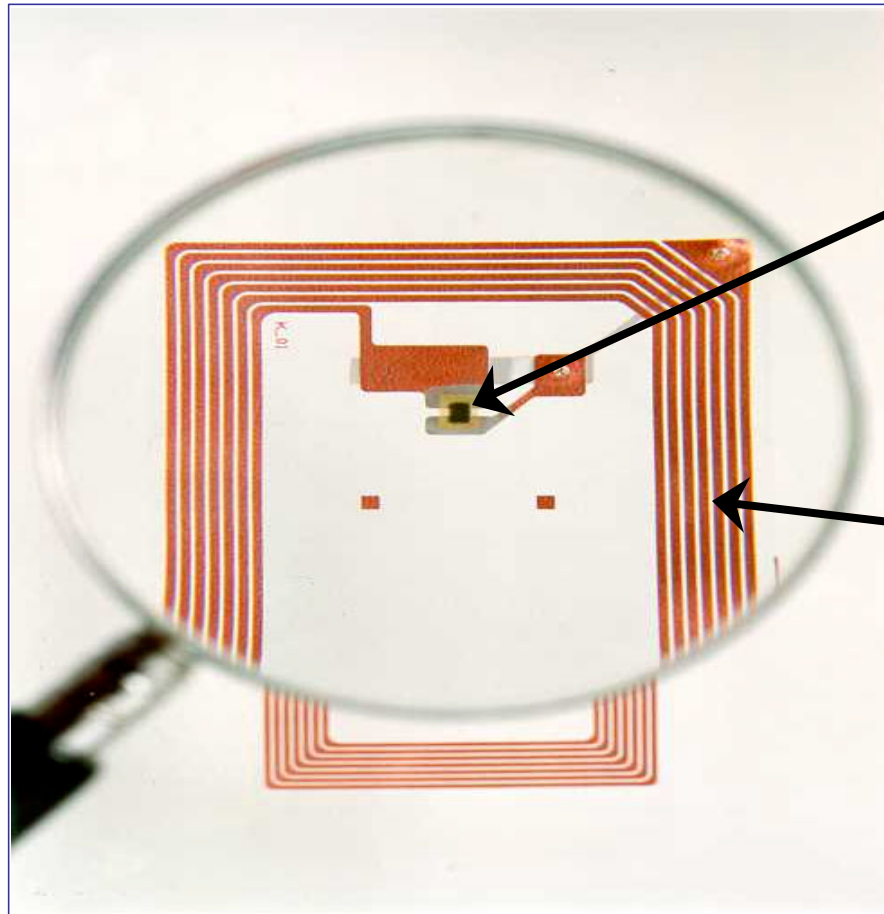
RFID Operating Frequencies

Ultra-High Frequency – UHF (860- 960 MHz)

Supply chain, toll tags, RTLS, EPC case and pallet

- RF communication uses propagation coupling
- Smaller reader antenna design than LF or HF
- Read distance (1m - 10m)
- High data transfer rate
- More complex reader electronic components

RFID Transponder



**Micro-chip,
contains
Unique ID Code
(UID), memory**

**Antenna,
copper or
aluminum,
wound or
etched**

Transponder Characteristics



Tag Types:

- Active tags – battery powered, long read range
- Semi-active – battery power to preserve memory
- Passive tags – low-cost, no battery required, medium read range

Tag Packaging Formats:

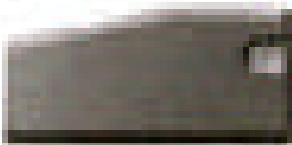
- Weather-proof or environment-proof enclosure
- Pressure Sensitive Label
- Laminated card
- Embedded in packaging or product



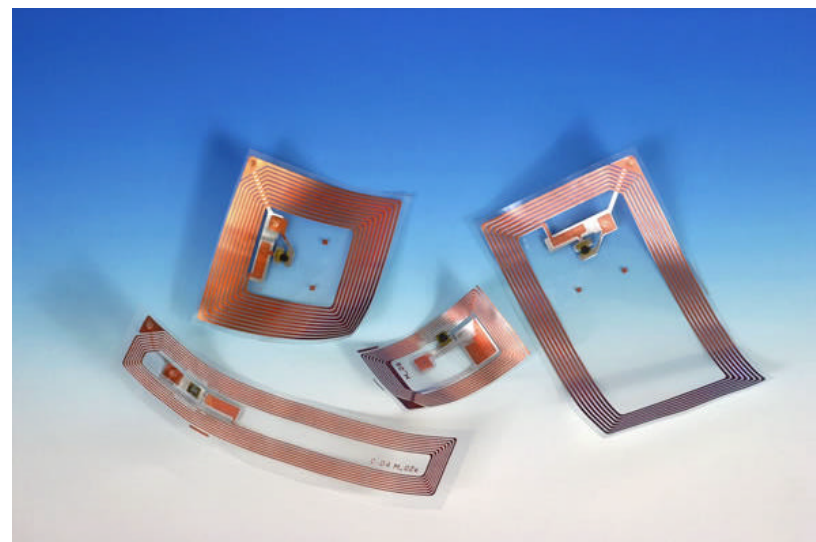
Transponder Examples



**32mm and 23mm
capsule
transponder**



**1/2 inch key head
transponder**



Tag-it Smart Labels



**Circular
transponders**

RFID Readers

Readers are radio frequency devices that:

- Transmit and Receive RF signals
- Contain a control unit to execute commands
- Incorporate an interface to transfer data
- Receives commands from a Host computer
- Passes data back to the Host

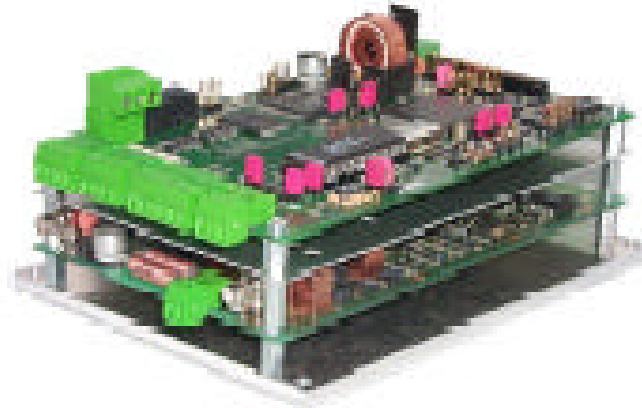
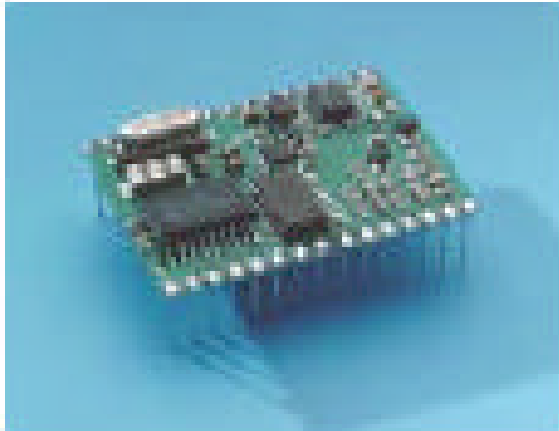
Reader Characteristics



- **Stationary or handheld**
- **Weather-proof or industrialized**
- **Typical read ranges vary from a few centimeters to a few meters**
- **Read Range is dependent upon:**
 - Broadcast signal strength
 - Size of broadcast antenna
 - Size of transponder antenna
 - The environment – Metallic, Liquid
- **Multi-frequency readers**



RFID Reader Modules



Antenna Characteristics



- **Transmits and receives RF signals**
- **Typically made of copper or aluminum, new technologies for printed antennas**
- **Stationary or handheld**
- **Weather-proof / industrialized**
- **Fixed or tunable**

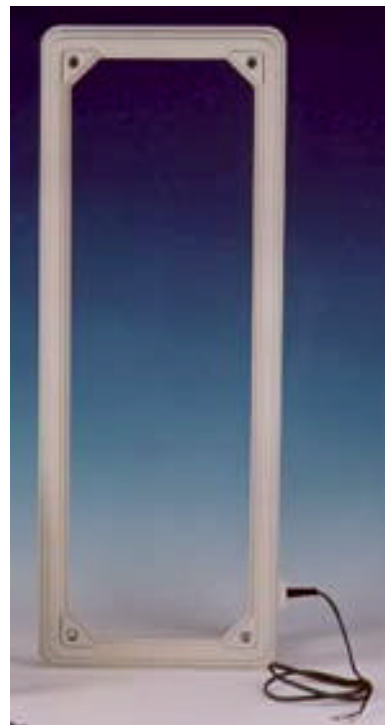


Antenna and Configurations

- **Antenna material typically is copper due to its conducive properties**
 - Wire is used to create a winding to make an antenna round or rectangular.
 - Copper tape can be utilized is used to make a low profile antenna
 - Tubing or pipe also used

- **Using complimentary antenna ports, power splitters, or antenna multiplexers, arrays can be constructed.**
 - Single Plane Antennas are sufficient with optimum tag orientation.
 - Dual plane can improve read rate in portal applications.
 - Rotating field arrays are used to read randomly oriented tags.

RFID Antenna Systems



RFID System Considerations



- **Read distance requirements**
 - Long read range
 - Short read range
- **Frequency**
 - All frequencies have their pros and cons
- **ISO standards**
 - Proprietary or standards-based
- **Government regulations**
 - Varies from country to country



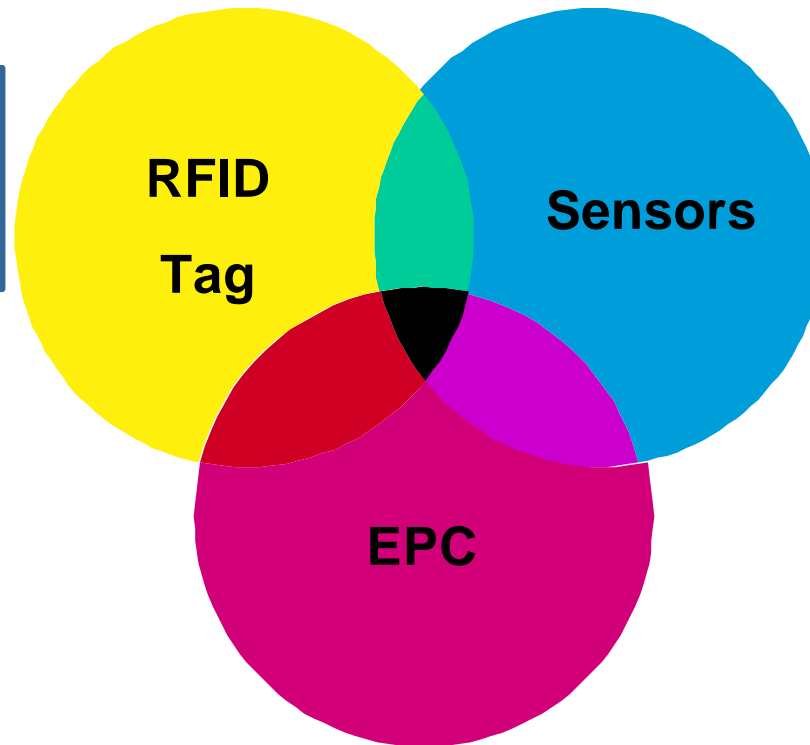
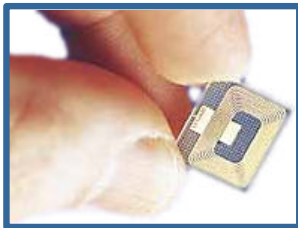
RFID System Considerations



- **Multiple Tag Reading in Same Field**
 - Anti-collision
- **Sensitivity to Orientation**
 - A single orientation or omni-directional
- **Hardware Set-up**
 - Environment can affect performance



Emerging Integrated Solutions



Thank You

Bill Allen

www.ti-rfid.com

Texas Instruments, Inc.
TI-RFid Systems

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RADIO FREQUENCY IDENTIFICATION

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Questions?