

THE FUNDAMENTALS OF RFID: BASICS AND MORE 2023

Edited and Presented by

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Agenda: The Fundamentals of RFID: Basics and More

Time	Topic
09.45 – 10.30 AM	RFID Basics
10.40 – 11.20 AM	The Physics Behind RFID
11.30 – 12.15 PM	Legislation and Standardization
1.00 – 1.40 PM	Live Demo: RFID in the Real World
1.50 – 2.30 PM	Real-World Considerations
2.50 – 3.30 PM	Building an RFID Business Case

RFID Basics – Understanding fundamental RFID concepts and terms

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Presentation overview

- What is RFID?
- Components of an RFID system
- Main categories of RFID systems
- Subcategories of RFID
- Types of RFID systems
- Getting Started

What is radio frequency identification?

RFID is a generic term denoting:

- The ability to identify an object remotely / wirelessly
- Information carried via radio waves
- Data usually stored on microchips
- Tags can be active or passive or a combo of both
- Systems use a variety of frequencies/protocols to transmit data via radio waves

RFID system components

Hardware

- RFID transponders (tags, smart labels)
 - Made up of chip, antenna, substrate, perhaps battery
- RFID reader (also called transceiver / interrogator)
 - Antennas (1, 2, 4 or 8), digital signal processor, network port, input/output ports, and power source
- Edge server (runs filtering middleware)
- Network appliances (manages reader/data flow)

RFID system components

Software

- Firmware (runs the reader)
- Reader software (applications that run on the reader)
- Middleware
- Enterprise applications

RFID system components

Network

- Most readers now run on a LAN or WAN / IP Based / Wireless
- Might need separate network infrastructure
- Wireless LAN in a warehouse
- There are a variety of options here – talk to vendor



RFID system components

How the system works (generically)

- Reader emits energy (via Antenna)
- Tag responds when it receives energy (via Antenna)
- Reader converts radio waves into (binary) ones and zeros
- Network carries binary data to middleware for filtering
- Middleware passes data to enterprise applications

Types of RFID Systems

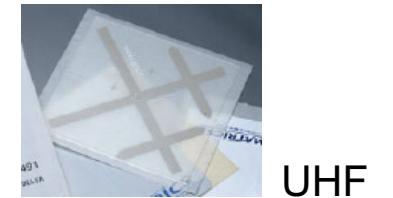
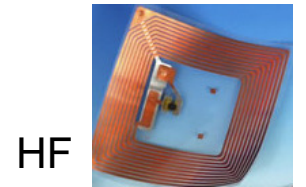
RFID Systems can be broken down into three broad categories:

- Active RFID systems (tags broadcast signal)
- Passive RFID systems (tags have no power source and only reflect energy from the reader)
- Battery-assisted tags (tags have a power source but communicate like passive tags)

Subcategories of RFID

Passive RFID systems include:

- Low frequency (LF) (125 kHz or 134 kHz)
- High frequency (HF) (13.56 MHz)
- Ultra high frequency (UHF) (860 to 960 MHz)
- Microwave (MW) (2.45 Ghz)



Subcategories of RFID

Active RFID systems can be broken down into two major types

- Conventional active RFID
 - Tags are woken when they come within range of a reader
 - Start broadcasting their unique ID and other data
- Real-time location systems
 - Tags beacon at set intervals (user defined)
 - Readers around the perimeter pick up the signal
 - Software determines the location of the item

Types of Conventional Active RFID

There are a variety of conventional RFID systems on the market

- Dash 7
- Active 433 MHz (proprietary air interface)
- Active 900 MHz (proprietary air interface)
- Active 2.45 GHz (IEEE 802.15.4)
- BLE beacons (2.4 GHz)



Types of RFID-based RTLs

There are a variety of real-time location systems that use active RFID transponders

- ZigBee (2.45 GHz, IEEE 802.15.4 air interface protocol)
- Active (433MHz, proprietary air interface protocol)
- Active (900MHz, proprietary air interface protocol)
- Wi-Fi (2.45 GHz, IEEE 802.11 air interface protocol)
- Ultra-wideband (3 to 10 GHz, proprietary air interface protocol)

Types of battery-assisted tags

There are a variety of battery-assisted RFID transponders

- High-frequency (13.56MHz)
 - Usually used for recording temperature
- Ultrahigh-frequency (856 to 960MHz, ISO 18000-6C air interface protocol)
 - Used for recording temperature

Types of hybrid RFID tags

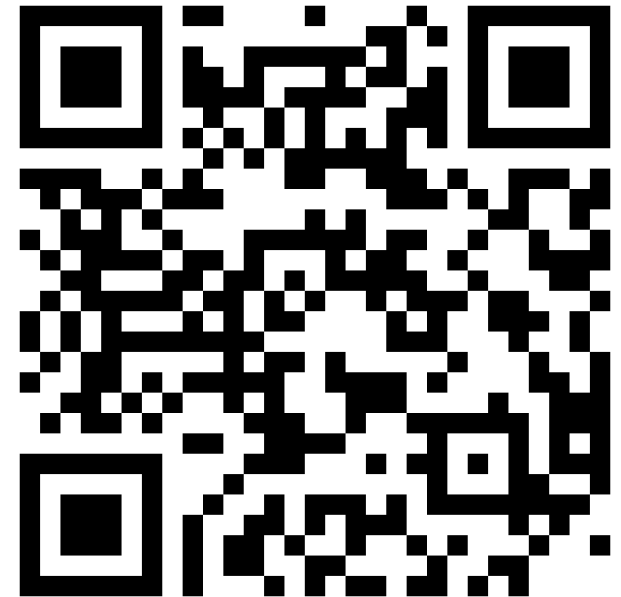
There are a variety of tags that combine active RFID with other technologies

- 433MHz active tags combined with infrared
- 900MHz active tags combined with infrared
- 2.45 GHz Wi-Fi tags combined with infrared
- 433MHz active tags combined with GPS
- 433MHz active tags combined with GPS and GPRS

Alternatives to RFID

There are several non-RFID systems that can be used for identification or real-time locating:

- Infrared
- 2D barcodes + others



How do you choose the right system?

- Each system has different characteristics
- Each has different strengths and weaknesses (**consider system & environment**)
- No one system is likely to meet all your needs
 - Active systems are used to track larger objects over long distances
 - Active tags are affixed to assets and batteries must be replaced
 - Passive tags are used to track smaller objects over shorter distance
 - Tags are usually disposable

Getting Started

- Determine whether you want to deploy RFID as a point solution or as infrastructure
 - Point solution solves one problem
 - Infrastructure can be used to support multiple applications
- Develop a business case to determine a possible ROI for your application (or first application if using an infrastructure approach)
- Run a pilot to test the business case

Questions ?

Thank You

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