

RFID Essentials Complete Syllabus

Overview of *RFID Essentials* Course 1, by Host Dr. Dan Dobkin

- a. Objectives
- b. Features

1. Introduction to Radio Frequency Identification (RFID)

- a. **Background and definitions**
 - 1) Automatic identification technology (Auto-ID)
 - 2) Radio frequency identification (RFID)
 - 3) Serialization
- c. **Application examples**
 - 1) Automobile toll collection
 - 2) Hospital asset tracking using real-time location systems (RTLS)
 - 3) Supply chain tracking
- d. **RFID – bar code comparison**

2. History of RFID

- a. Identification friend or foe technology in World War II
- b. Anti-theft
- c. Contactless keys, traffic control
- d. Railcar identification
- e. Automobile tolling
- f. **Growth of standards supporting supply chain applications**
 - 1) EPCglobal and ISO
 - 2) Implementation by major retailers and their suppliers

3. Technology Basics, Part 1: Physical Components of RFID System

- a. Elements of an RFID system
- b. Radio frequencies: LF, HF, UHF, and SHF Systems
- c. Tag-reader communication: inductive versus radiative coupling
- d. **Powering tags: Passive, semi-passive, and active**
 - 1) Power sources of passive, semi-passive, and active tags
 - 2) Relationships between frequencies (LF, HF, UHF, and SHF), tag-reader communication (inductive and radiative coupling), and how tags are powered (passive, semi-passive, and active)
 - 3) Real-time location systems (RTLS)
- e. **Readers**
 - 1) Reader forms: fixed, modules, printers, and portables
 - 2) Reader components
 - 3) Reader configurations (monostatic versus bistatic) and frequency ranges

4. Technology Basics, Part 2: Reader-Tag Communication

- a. **YouTag Interactive Workshop No. 1: RFID system assembly, tag orientation, and antenna polarization**
- b. **RFID communication: “Air interface” protocol**
 - 1) Elements of communication systems (elements of speech, language and grammar, allocating the right to speak, and interpretation)
 - 2) RFID communication system
 - a) Elements of speech: Medium and modulation
 - b) Language: Packet structure and commands
 - c) Access: Medium access control (MAC)
 - i. Binary Tree Navigation
 - ii. Slotted Aloha
 - d) Interpretation: Object I.D., context, sensor information, and business rules
- c. **Survey of RFID protocols and compatibility**
 - 1) Common protocols by frequency and power
 - 2) Selecting the right protocol

5. Technology Basics, Part 3: Sharing Data Inside and Outside the Enterprise

- a. **The role of RFID middleware**
- b. **EPCglobal Data Architecture**
 - 1) Electronic product code (EPC)
 - 2) Reader protocol
 - 3) Application Level Events (ALE)
 - 4) EPC Information Services (EPCIS)
 - 5) Object Naming Service (ONS)
 - 6) EPC Trust Services
 - 7) EPC Discovery Services
- c. **Vendors of RFID Products and Services**
 - 1) Hardware (tags and readers), middleware, and services
 - 2) Enterprise management tools

6. Materials and RF

- a. **Materials: RF lucent and RF opaque**
- b. **Effects of frequency on readability of tags**

7. Application Examples

- a. **Hospital asset tracking**
 - 1) Technology selection: UHF active
- b. **Supply chain tracking**
 - 1) Technology selection: UHF passive
 - 2) Hot spot testing
- c. ***YouTag Interactive Workshop No. 2: Tag placement***
- d. ***Interactive exercise: aircraft parts tracking***

8. Security and Privacy Issues

a. Introduction to security and privacy issue

b. Tag data security

- 1) Potential attacks: skimming and eavesdropping
- 2) Measures to protect RFID data
 - a) Physical security
 - b) Protocol-based security
 - i. Encryption and mutual authentication
 - ii. Effect of security protocols on performance
 - iii. Gen 2 standard: security measures
 - iv. Frequencies and security
 - v. ePassports: standardized security protocols

c. Safeguarding personal privacy

- 1) Potential threats to personal privacy
- 2) EPCglobal: recommended industry practices for safeguarding consumer privacy
- 3) Regulatory measures: U.S., Europe, and Japan
- 4) Privacy advocates

9. Implementing RFID for Positive ROI

a. Evaluating RFID opportunities

- 1) Operational efficiencies versus new products
- 2) Calculating costs and net benefits - Example: Semper Firmus medical products company
 - a) Project 1: Supply chain tracking from manufacture to retailer
 - b) Project 2: New clinical care product: Semper Attentus
 - c) Comparing the value of the two projects

b. Calculating a project's return on investment (ROI)

- 1) Methods: ROI ratio, Net Present Value (NPV), Internal Rate of Return (IRR), and Payback
- 2) Using NPV, IRR, and Payback to compare Semper Firmus' two projects

c. Implementing RFID in your organization: process and personnel

- 1) Analysis phase
 - a) Survey
 - b) Scorecard
- 2) Implementation
 - a) Team
 - b) Pilot project
 - i. Road map
 - ii. Key performance indicators (KPI's)
- 3) Questions and practice

d. Evolution of RFID market and its effect on business

- 1) Size and projected growth of global market
- 2) Relationship between market size and ROI

e. Real examples of RFID applications delivering ROI

- 1) Applications delivering operational efficiencies
- 2) New products

10. Final exam (optional)

a. May be taken *up to three times*, with each version varying slightly.

b. Exam takes about one hour

c. Comprised of simulations and questions

d. Each question or exercise categorized as “Basic” and “Advanced.”

- 1) Basic questions constitute the majority of points.
- 2) Advanced questions optional; drawn from “In-depth” sections. Certificates
- 3) Score of at least 80 percent of the “Basic” points earns **Certificate of Completion of *RFID Essentials***.
- 4) Score of at least 80 percent of both “Basic” and “Advanced” points earns **Certificate of Mastery of *RFID Essentials***.