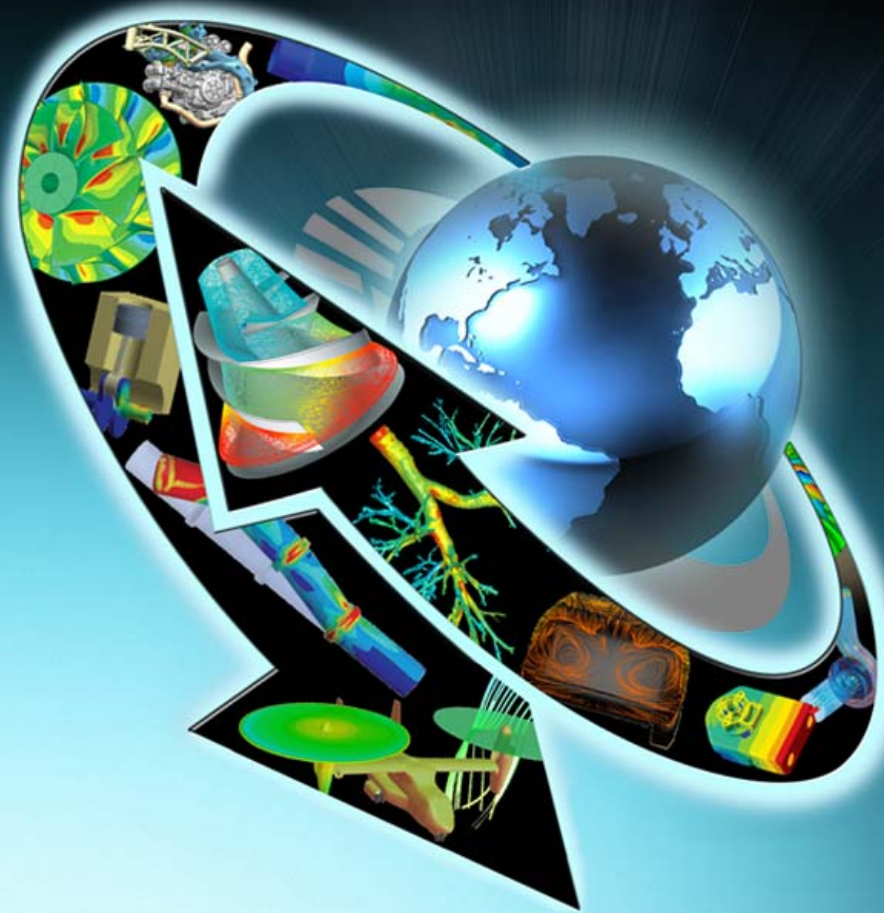




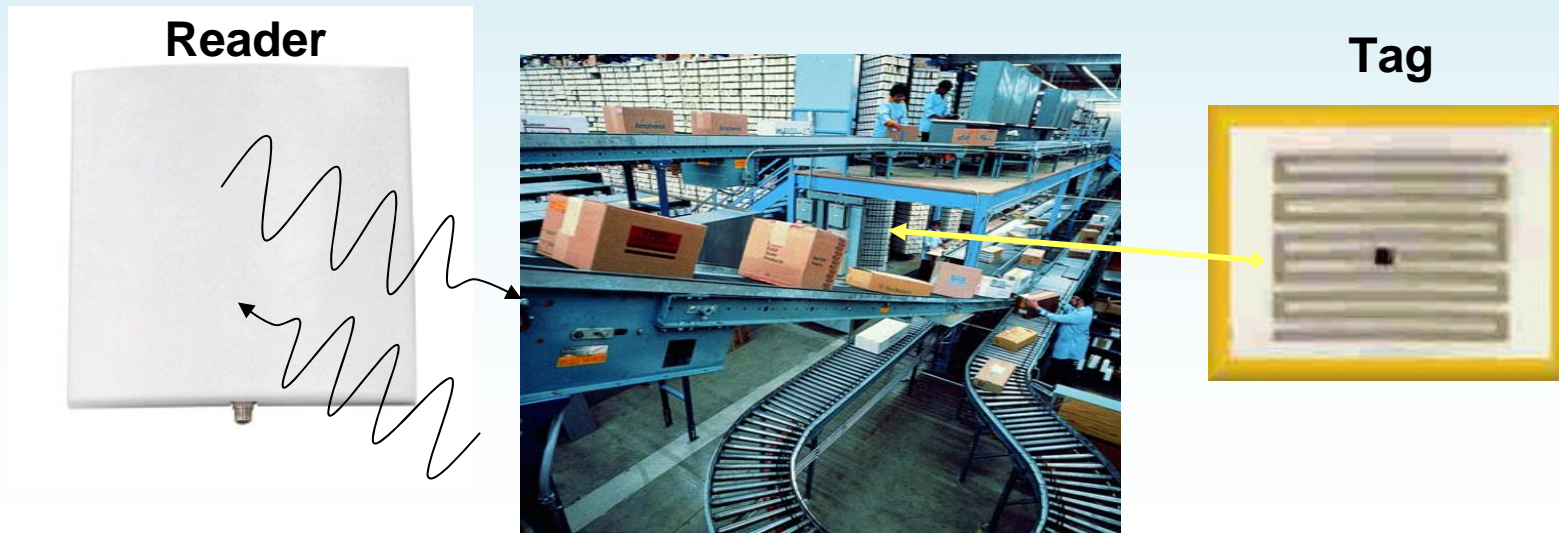
HFSS Application RFID (Radio Frequency Identification)



What is RFID?



- **Wireless identification**
 - Reader Antenna communicates with Tags
 - Applications
 - Inventory
 - Vehicle Tracking
 - Pets
 - Tolls



What is RFID?



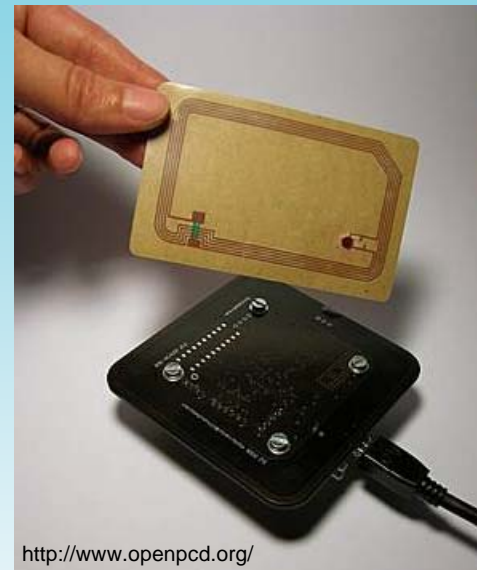
- **Frequencies of operation**
 - Low Frequency
 - 125 kHz
 - 13.56 MHz (near field coupling)
 - Mass production
 - Low Cost
 - Short range usually less than 1 meter
 - UHF
 - 433 MHz
 - 868 MHz
 - 915 MHz
 - 2.45 GHz (far field operation)
 - Larger range usually only used on high cost items

- **HFSS Application**

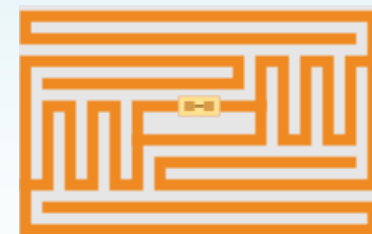
- Reader antenna
- Tag
- Whole transmission setup

- **Types of RFID Tags**

- Active
 - Internal power source
- Passive
 - No internal power source



<http://www.openpcd.org/>



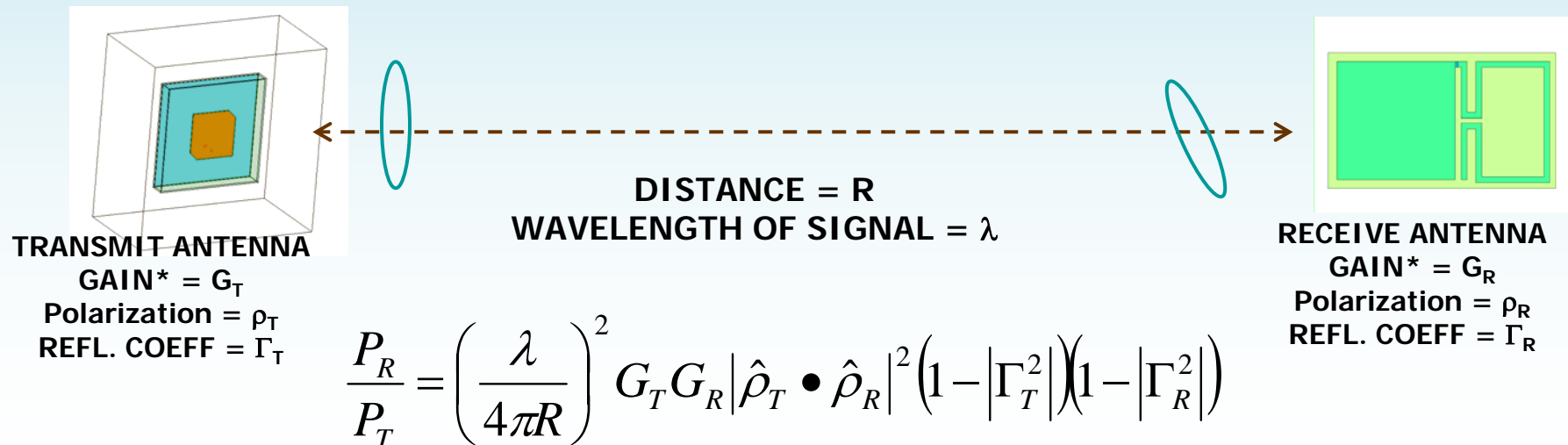
Typical Tag Antenna
used by the world's
largest retailer

Estimation of Transmission Distance Friis Equation



- **Analytical approaches assume**

- Non-disturbed near field conditions
 - No proximity of dielectric and metal objects
- Known antenna characteristics
- No diffraction and reflection effects
- This is not the case in most real RFID situations
 - Full system simulation including reader, tags and environment is necessary

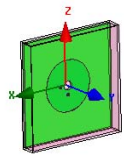


UHF RFID Transmission System

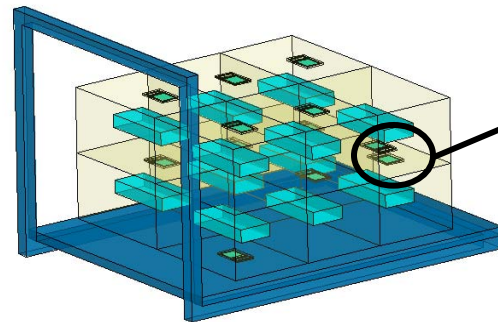


- **RFID System**

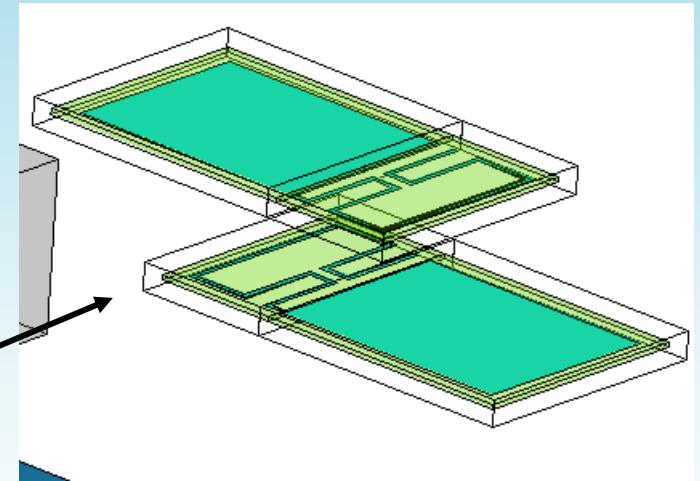
- Wall-mounted 915 MHz reader antenna and pallet with 12 transponder antennas at approximately 2.20 meters away simulated in HFSS v12
- 14 Ports
- Frequency range from 800 MHz to 1GHz



Reader Antenna (with two polarization setups)



Pallet with 12 PS-foam boxes and 12 RFID tags



Two Tags

UHF RFID Transmission System

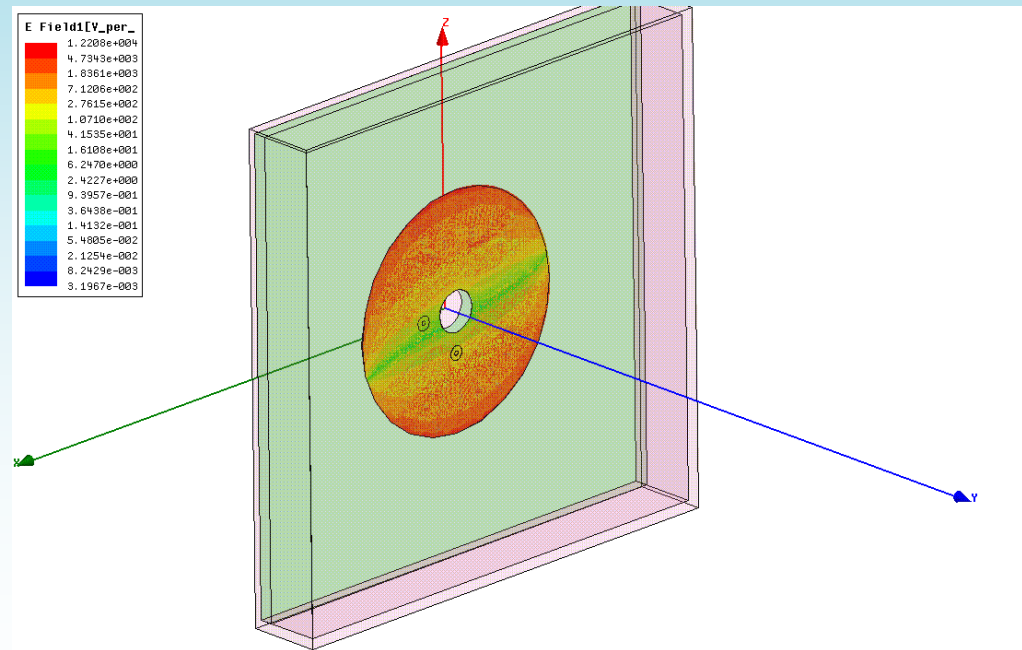
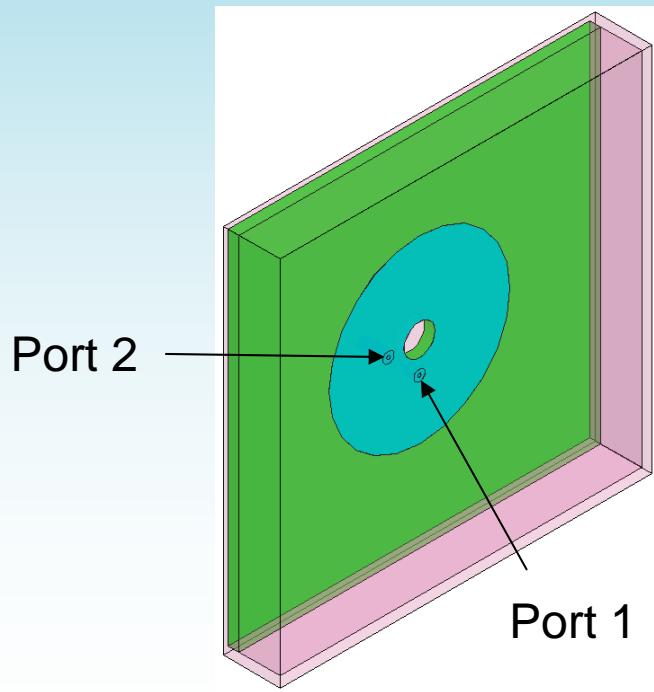


- **Reader Excitations**

- Two Wave Ports

- Circular Polarization

- Allows stable delivery of energy in a radial symmetrical pattern so RFID tags can be read regardless of orientation

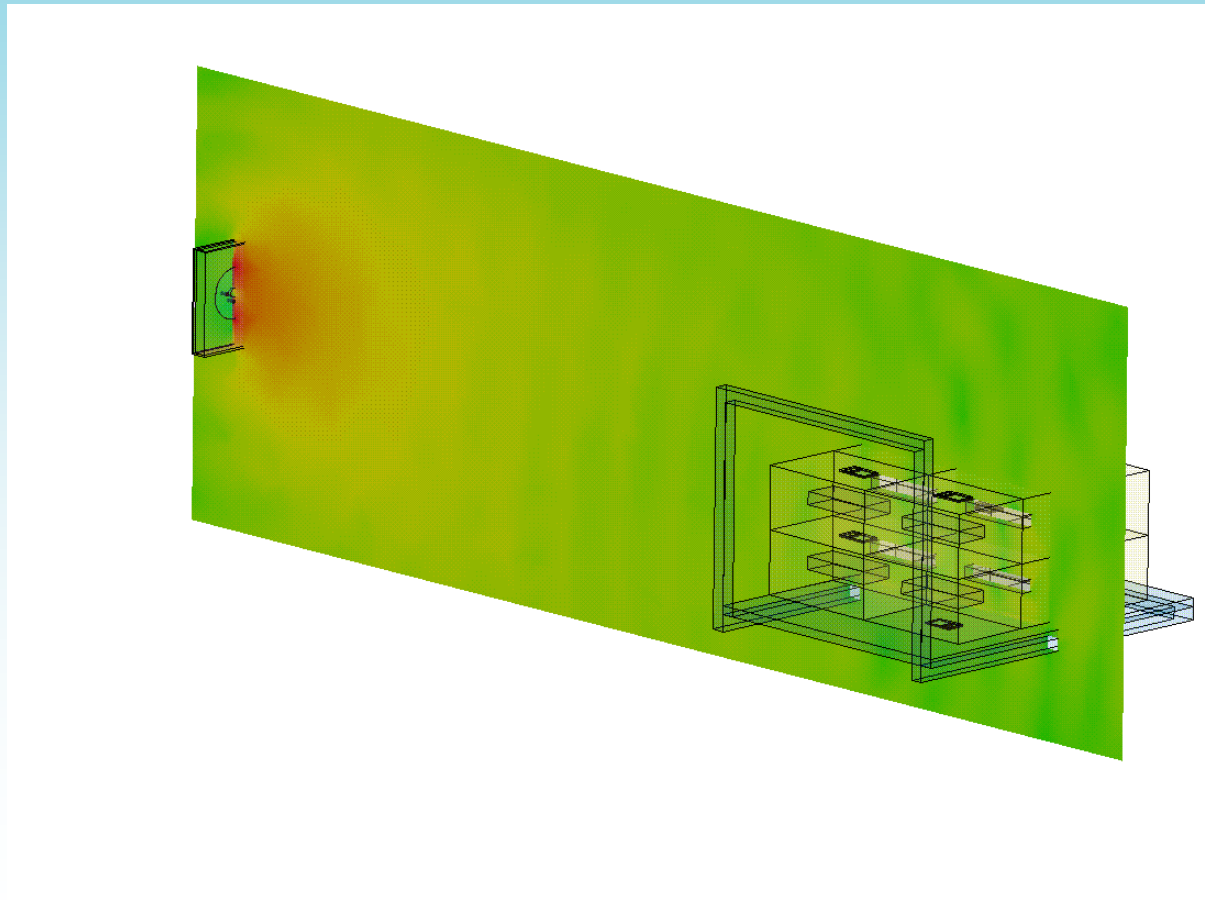


UHF RFID Transmission System



- **Results**

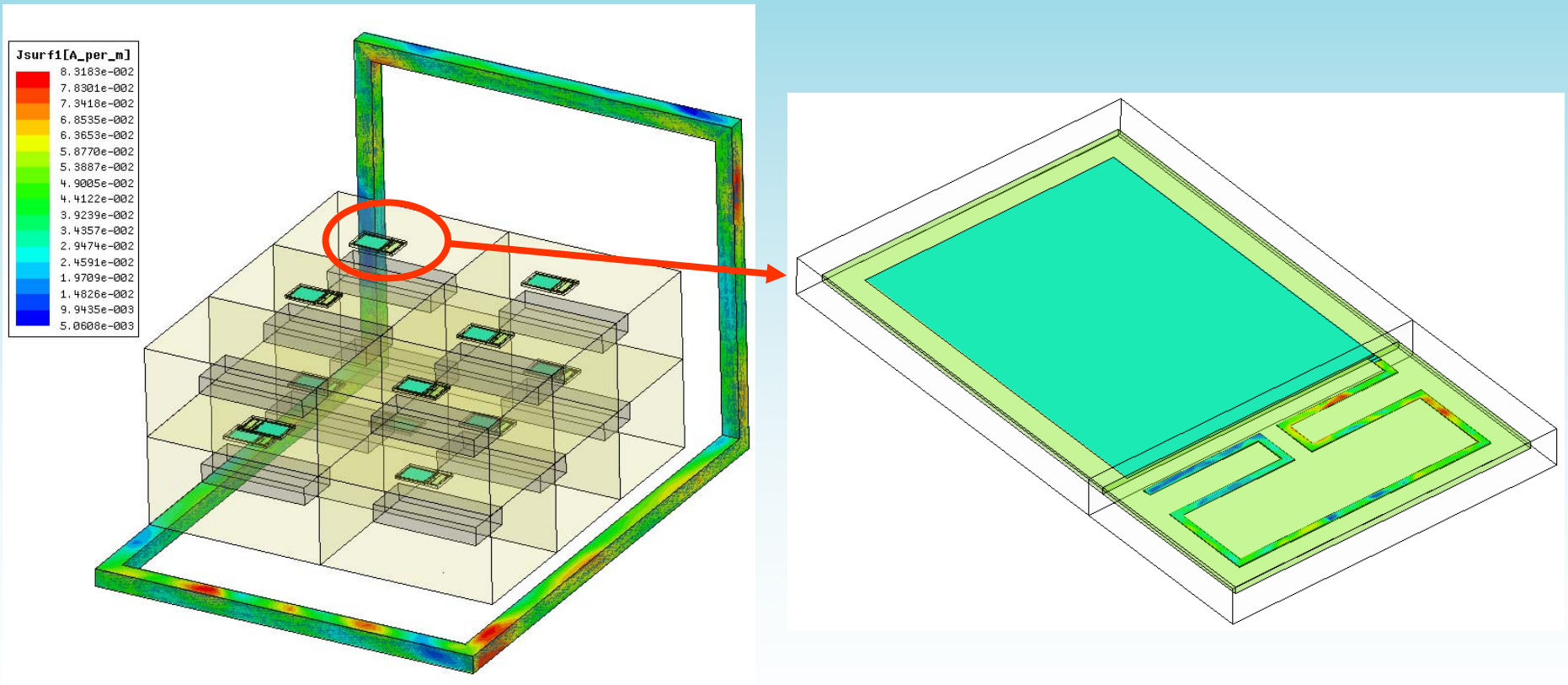
- Mag E



UHF RFID Transmission System



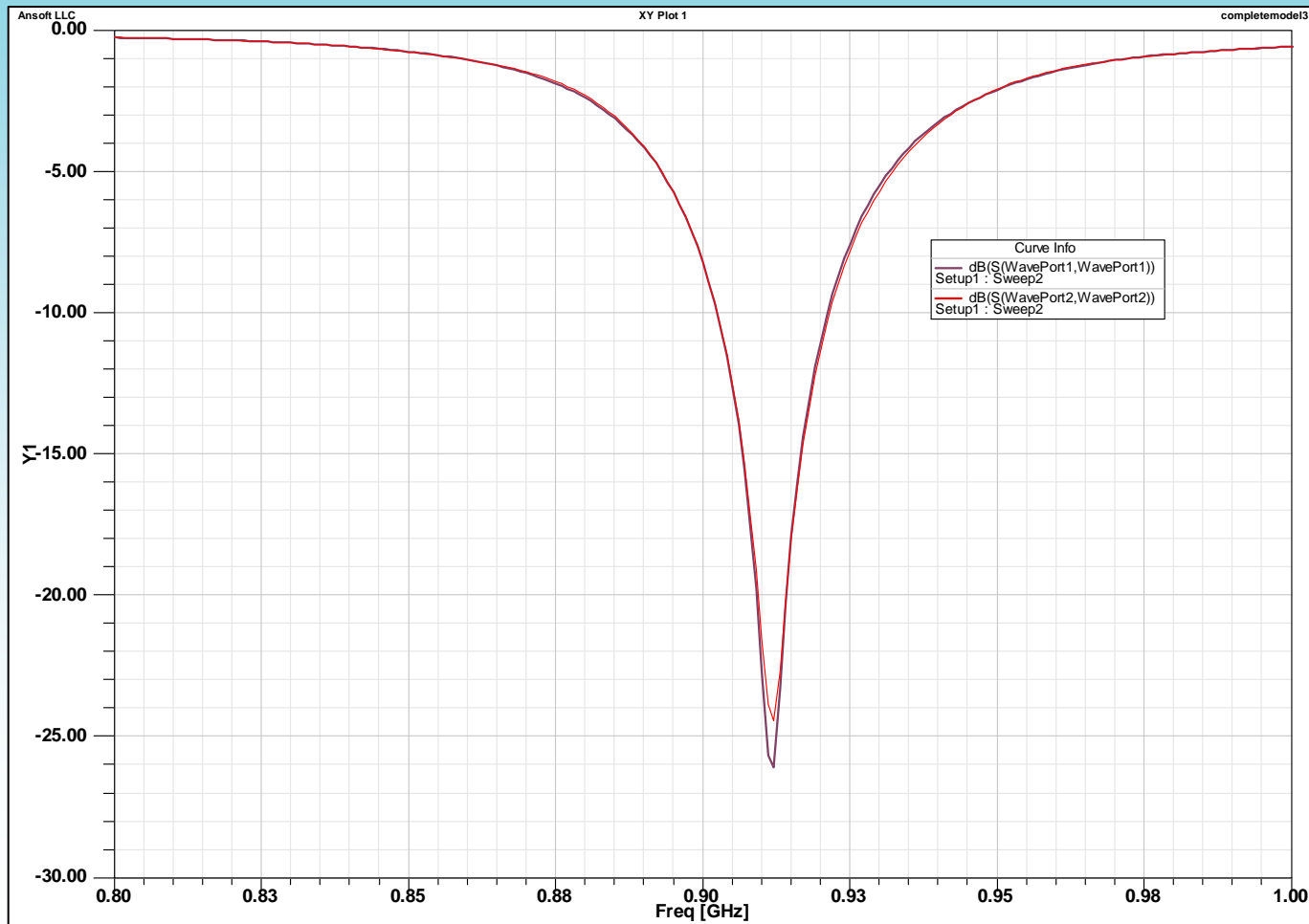
- **Results**
 - Cmplx Mag JSurf



UHF RFID Transmission System



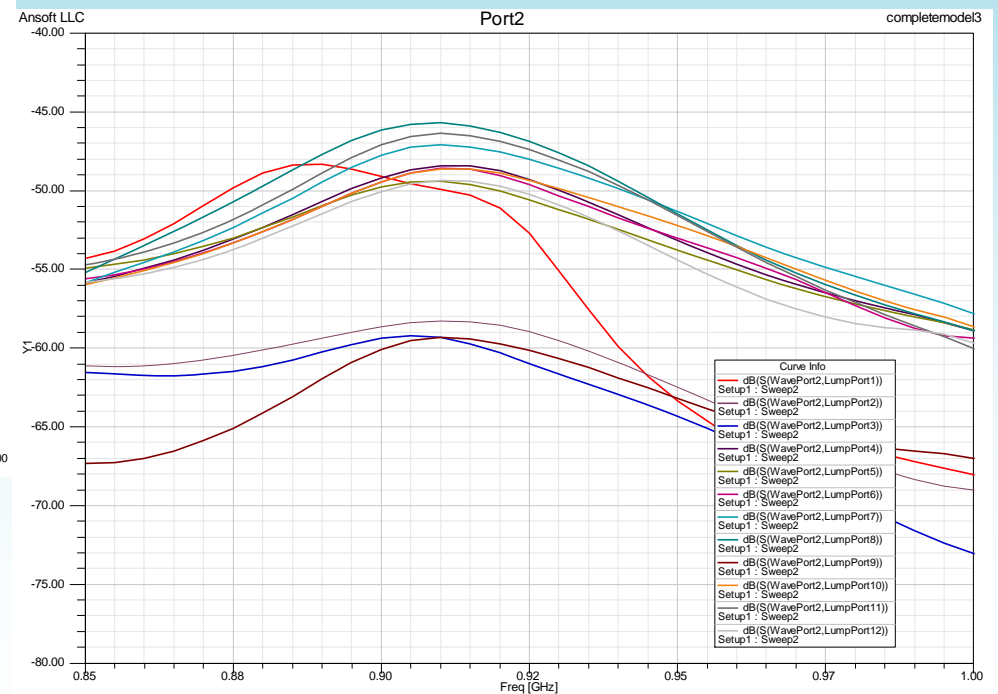
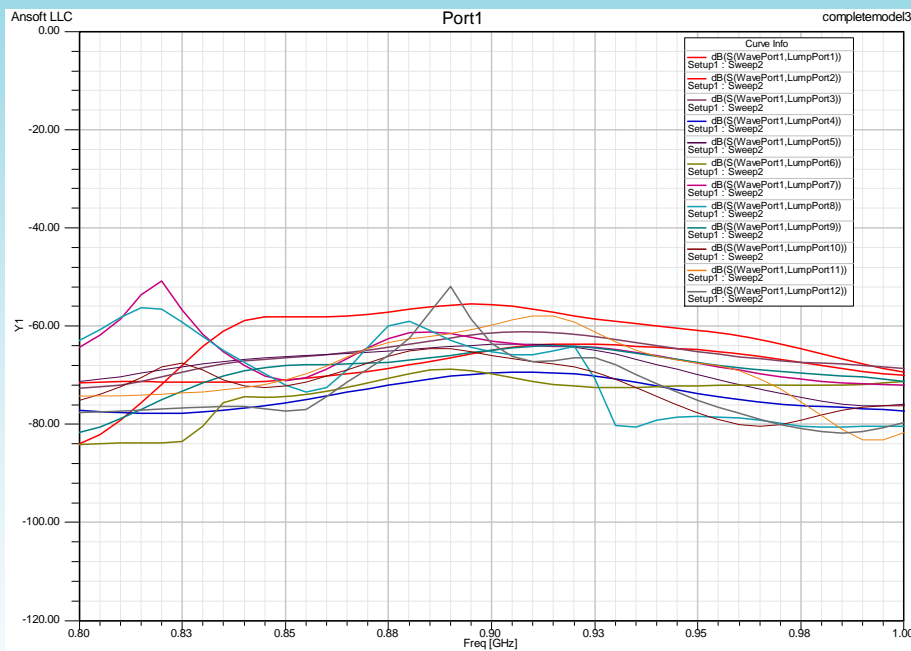
- Results



UHF RFID Results



- Transmission losses between reader antenna and transponders tags (S-parameters)



UHF RFID System



- Parametric change of geometry in the vicinity of the tag-antennas

