

Antennas

Antennas – Part A

Antennas

- Overview
- Performance Parameters
- Design and Technology Issues
- Types
 - Wire Antennas
 - Planar Antennas
 - Some High-Gain Antennas / Arrays
- Impact on Sensor Network Design

Overview

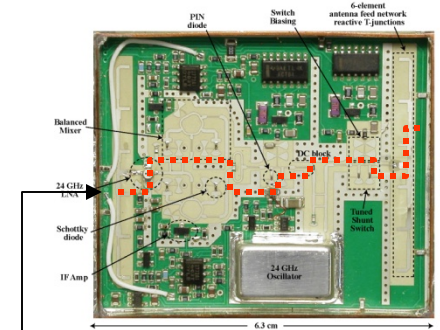
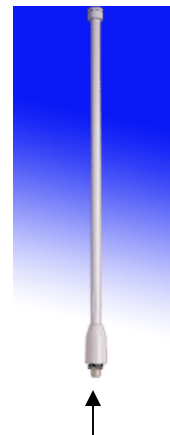
- For wireless devices, antennas are the interface between the ‘wired’ and the ‘wireless’ domains
 - In the ‘wired’ domain energy is guided by transmission line routing
 - In the ‘wireless’ domain energy can be directed by the antenna but is subject to multiple possible forms of interference (people, buildings, trees, cars, etc.)
- Antennas are often described as “transformers” between free-space transverse electromagnetic (TEM) plane waves and the guided waves inside a wireless device



WIRELESS



WIRED



Overview

- Transformer Concept
 - From a circuit standpoint, the antenna is a transformer between the free-space impedance ($E/H = 377 \Omega$) and the circuit impedance (V/I , typically 50Ω). Without this impedance transformation energy is not efficiently transferred across the wired/wireless boundary
 - From a field standpoint, the antenna is a transformer between TEM free-space waves and the EM field configuration that exists on a transmission line
 - Both standpoints illustrate how antennas straddle the “circuit” and “electromagnetic” worlds

Overview

- Reciprocity
 - Antennas receive and transmit energy identically
 - This concept is very useful in describing the behavior of antennas – sometimes it is easier to consider transmission, and other times it is easier to consider reception...we'll see specific examples in the coming slides

Overview

- How to think about antennas:
 - Reception: the antenna collects energy and appears as a source that energizes the receiver
 - Transmission: the antenna radiates energy and appears as a termination (load) to the transmitter

Performance Parameters

Efficiency

Input
Impedance



Common
Dipole
Antenna

Polarization

Radiation
Pattern

Directivity

Gain

Radiation Pattern

“Collection of Little Radiators”



Near-field: Complex E & H Fields

Far-field: Plane Waves