802.11 and Bluetooth Operations and Circuit Implementations

Registration Deadline: January 6, 2003

Fee: $1,400
2.8 CEU

Who should attend
Professionals who are developing or deploying 802.11 a/b/g or Bluetooth systems will benefit from the emphasis on propagation and methods for determining maximum useful range. Each system's method of modulating data and real-world throughput figures will provide insight into its respective capabilities. Security and coexistence issues will be of great interest to designers, deployment engineers and users alike.

Required background
Attendees should have a basic understanding of digital communication methods. No prior familiarity with 802.11 or Bluetooth operations is necessary.

Course description
This four-day course covers the fundamentals of 802.11 and Bluetooth short-range wireless communications. Participants will study indoor propagation characteristics and will be able to estimate range limits easily. The methods used by 802.11 and Bluetooth to modulate information are examined and compared. Next, the operation of 802.11b, 801.11a, 802.11g and Bluetooth networks is presented, followed by a detailed analysis of how security is implanted in each protocol. Countermeasures to various attack strategies are discussed. Coexistence between 802.11 and Bluetooth is analyzed and interference solutions are presented. Finally, circuit architecture and implementation are discussed, followed by a Bluetooth receiver case study.

Instructors
Bob Morrow is president of Morrow Technical Services. Before becoming a wireless communications consultant, he was director of research at the U.S. Air Force Academy and deputy head of the Department of Electrical and Computer Engineering at the Air Force Institute of Technology. Noted for his ability to put theory into practice, he has designed several wireless networks and telemetry systems. He has more than two dozen publications in theoretical and applied research journals, holds a U.S. patent and is a licensed radio amateur. His book Bluetooth Operation and Use recently was published by McGraw-Hill.

See course 1 for E. Sánchez-Sinencio's background.

Monday, February 3

Introduction
Wired vs. wireless communications
Centralized network evaluation
Peer-to-peer network evaluation
History of 802.11 and Bluetooth
Usage models
802.11 and Bluetooth market comparison

Propagation and Range Limit
Review of decibels
Large-scale path loss
802.11 and Bluetooth maximum range
Multipath
Diversity combining
Comparison of RF and infrared propagation

Data Communications
OOK vs. FSK vs. PSK
Increasing data transmission speed
Spread spectrum techniques
Orthogonal frequency division multiplexing
Error control coding
Frequency regulation and administration
802.11 and Bluetooth modulation methods

Tuesday, February 4

802.11 Operations
Wireless Ethernet architecture
The 802.11 radio
Physical layer packet structure
802.11b (Wi-Fi) for increased data rates
802.11a and HIPERLAN comparisons
802.11g draft standard
Medium access control
Hardware examples

Wednesday, February 5

Security
Types of security threats
Operation of 802.11 Wired Equivalent Privacy (WEP)
802.11 WEP weaknesses
Attack countermeasures
Alternatives to WEP
Bluetooth security entities
Link keys and their function
Authentication and encryption
Bluetooth security weaknesses and countermeasures

Coexistence
Consequences of interference
Wi-Fi on Bluetooth
Bluetooth on Bluetooth
Coexistence solutions
Collocated Wi-Fi and Bluetooth nodes

Thursday, February 6

Architecture Implementation Considerations
Bluetooth and Wi-Fi radio Specifications
Radio architectures
Super heterodyne
Low IF architecture
Direct conversion architecture
Transmit architecture selection
Bluetooth transceiver in the literature

Building Block Implementations
LNA and Mixer
Channel select filtering
Band-pass filtering
Poly-phase filtering
Frequency synthesizer and VCOs
Modulators and demodulators
ADCs and AGCs
Receiver 0.35µm CMOS Bluetooth Receiver
Measurement setup
Experimental results

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