Course ID
WIRELESS-TL
Course Duration
3 days

Course Title
Broadband Wireless: Evolution, Technology, Infrastructure, and Regulation

Related Courses

- State-of-the-art of Wireless Communications for Non-engineering Professionals, Managers, and Executives (2-4 days, WIRELESS-EXEC)
- History, State-of-the-art, and Future of Wireless: Wireless Technology and Applications for Businessmen (3-5 days, WIRELESS-BIZ)
- 3G LTE/4G: The Next Generation Mobile Networks (2 days, 3GLTE-4G)
- WiMAX: Technology, Business, and Competitive Landscape (2 days, WIMAX-BIZ)
- State-of-the-art of WiFi for Non-engineering Professionals, Managers, and Executives (1 day, WIFI)
- State-of-the-art of Satellite Communications for Non-engineering Professionals, Managers, and Executives (1 day, SATCOM- EXEC)
- State-of-the-art of VoIP Technology for Professionals, Managers, and Executives (1 day, VOIP-EXEC)
- GSM: A Technology Overview (1 day, GSM-B)
- iDEN™: A Technology Overview (1 day, IDEN-O)
- Wireless Network Structure, Operation, and Technologies (3 days, WIRELESSNET)
- Wireless Technologies: A Comparative Study (2-4 days, COMPARISON)

Aimed At

Those with some non-wireless technical background (such as in Math, Physics, or a branch of Engineering) and some prior exposure to telecommunications, e.g., technical managers, software and hardware engineers, marketing and sales professionals, OSS/BSS personnel and others who wish to learn more about wireless, with emphasis on the latest broadband wireless technologies.

Group Size

5-25

Prerequisites

While there are no formal prerequisites for this course, technical background and some prior exposure to telecommunications will be helpful.

Course in a Nutshell

This three day course provides an intensive "technical light" overview of the evolution, market drivers, capabilities, and technologies of broadband wireless.

The course begins with a discussion of the principles that underlie cellular telecommunications, cellular system components (including base stations and towers), and network design issues. Discussed next is the evolution of cellular from GSM and CDMA to WCDMA/UMTS and CDMA2000. This is followed by a discussion of WiMAX and LTE, the current broadband wireless technologies. The course concludes with a look at spectrum regulation. Upon course completion, you will have acquired an understanding of how broadband wireless networks work and the forces that shaped their evolution.

Customize It!

We can customize this course to include or exclude certain topics and to raise or lower the technical level at which the course is taught. Let us know how we can adjust this course to serve your team's agenda.

Learn How To

- Describe how the radio spectrum is regulated
- Explain the principles that underlie cellular communications
- Describe the structure and components of a cellular network including base station antennas and towers
- Describe GSM and CDMA, technologies key to the evolution of today's broadband wireless
- Describe the evolution of WCDMA/UMTS and CDMA2000
- List the factors that are driving the emergence of WiMAX and LTE
- Explain the principles that underlie WiMAX and LTE

Course Outline

Part 1: Cellular Systems Design and Components

- Introduction
  - The cellular concept and objectives
  - 1G, 2G, 2.5G, 3G and 4G overview
- Performance criteria
  - Voice quality
  - Data quality
  - Service quality and call load
- Radio signal propagation
  - Basic channel modeling
  - Signal strength vs distance
  - Impediments to propagation
- Interference
  - Co-channel interference

  - Carrier-to-interference ratio
  - Adjacent channel interference
- Frequency reuse and planning
  - Cellular hexagonal grid concept
  - Distance to reuse
  - Handoff
- System components
  - Mobile telephone
  - Base station
  - Interconnection to the public switched telephone network (PSTN)

Part 2: Foundations of cellular telephony (GSM, IS-95)

- Pre-2G cellular: AMPS
  - Modulation and channel use
  - In-band control signals
- Digital modulation characteristics
  - Bandwidth efficiency
  - Clarity
  - Effect of bit error rate on speech quality
- Speech coding
  - Tradeoff in rate vs quality
- GSM
  - Time division multiple access (TDMA)
  - Architecture
  - Channels and channel modes
  - Call processing and management
- IS-95 CDMA
  - Code division multiple access (CDMA)
  - Call processing and management
- 2G data systems
  - SMS, HSCSD, GPRS, EDGE, iDEN

Part 3: 3G Cellular (WCDMA/UMTS, cdma2000)

- Operation and comparison of 3G systems
  - Architecture
  - Channels and multiple access
  - Speech coding
  - Call processing and management

Part 4: 4G Broadband Wireless Access (WiMAX and LTE)

- Concept of orthogonal frequency division multiplexing (OFDM)
    - Extension to orthogonal frequency division multiple access (OFDMA)
- BWA basics
    - Requirements and user expectations
- WiMAX and LTE
    - Features and standards summary
    - Mobile operation
    - OFDMA uplink and downlink
- Wi-Fi: The first BWA
    - o Range and data rates
    - o Comparison to WiMAX and LTE

Part 5: Base Station Antennas

- Basic antenna characteristics
    - Effective isotropic radiated power
    - Polarization
    - Directivity and gain
- Antenna types and selection
    - Transmit and receive antennas
    - Downtilt
    - Sectoring antennas
- Advanced antennas for base stations
    - Receive diversity
    - Transmit diversity
    - Beamtilt
    - Modular high-gain antennas
    - Higher order sectorization
    - Fixed and steerable array antennas
    - Antenna technologies for enhancing system capacity

Part 6: Base Station Towers

- Tower types
    - Monopole
    - Free standing
    - Guyed
- Methods of disguising towers

- Tower lighting and marking
- Tower co-siting and collocation
- Maintenance

Part 7: Cellular System Regulation

- Market regulatory structure in the US
    - MSA and RSA
    - Tier A and Tier B carriers
    - Role of the FCC
- Overview of regulation in other markets
    - Europe (ETSI)
    - o Overview of other regulatory agencies
- Discussion and Course Wrap-up
    - Discussion: Issues of interest to the participants
    - Course recap
    - Questions/Answers
    - Course evaluation

How You Will Learn

- You will learn in interactive lecture format from an instructor who's an expert on a range of wireless technologies as well as an excellent teacher.
- If you already know something about wireless, we will build on that knowledge. We will use interesting examples and analogies to simplify the complex subject matter and relate it to your team's agenda.
- The Participant Handbook will provide you with a structure to which you can add the information and insight gained in real-time, turning it into a valuable reference aid that you can take back to your job.

Revised *March 19, 2010f*