Course ID
3G3D
Course Duration
3 days

Course Title
3G Systems: WCDMA/UMTS and CDMA2000 Overview

Related Courses

- 3G Systems: WCDMA/UMTS and CDMA2000 (3G5D, 5 days)
- CDMA Technology and Its Evolution to cdma2000 (CDMA, 3 days)
- UMTS-FDD: Network Architecture, Operation, and Design (UMTS-FDD, 3 days)
- UMTS-TDD: Network Architecture, Operation, and Design (UMTS-TDD, 3 days)
- HSDPA: Network Architecture, Operation, and Design (HSDPA, 2 days)
- HSUPA: Network Architecture, Operation, and Design (HSUPA, 2 days)
- Wireless All-in-One: RF Propagation, Cellular Principles, Personal Radio Services, WiFi, WiMAX, CDMA, and GSM (ALL-IN-ONE, 5 days)
- Principles of OFDM and MIMO (OM, 3 days)
- LTE: A Comprehensive Three Day Course (LTE-C3DC, 3 days)
- LTE: A Comprehensive Tutorial (LTE-CT, 3 days)
- WIMAX: A Comprehensive Three Day Course (WIMAX-C3DC, 3 days)

Aimed At

This course is aimed at technical professionals who are familiar with 2G wireless technologies such as GSM or CDMA and wish to study the 3G technologies, WCDMA and CDMA2000.

Group Size

5-25

Prerequisites

Familiarity with 2G technologies such as GSM and/or CDMA.

Course in a Nutshell

This intensive three-day tutorial will help those familiar with 2G wireless technologies migrate to 3G systems. The course begins with a review of the digital modulation techniques, radio propagation characteristics, and performance improvement techniques. This is followed by a comprehensive discussion of the system building blocks and various system operating scenarios for both the CDMA2000 and WCDMA systems. The course concludes with a study of link budget and system capacity examples.

Customize It!

We can tailor this course to suit the needs of audiences such as hardware designers, application developers, service designers, sales engineers, marketing/sales personnel, radio planners, and persons involved in defense and homeland security endeavors. Those looking for a more in-depth treatment of 3G technologies should consider the 5-day version of this course listed under Related Courses above.

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Course Outline

Digital Modulation Overview

- Introduction to key wireless standards
  - IS-95, GSM
- Multiple access principles (TDMA, CDMA, FDMA, SDMA)
- Complex envelope representation of signals and systems
- Stochastic theory review
- Digital modulation theory
  - BPSK, QPSK, OQPSK, MSK, GMSK, 16QAM, 64QAM, etc.,
  - Pulse shaping filter selection
  - Nonlinear amplification (spectral regrowth)
- Spread spectrum : Frequency Hopping, Direct Sequence CDMA, RAKE Receiver, IS-95 CDMA uplink and downlink example, receiver block diagram

Radio Propagation Characterization

- AWGN channel
- Rayleigh/Rician multipath fading
- Delay spread concept (flat vs. frequency selective fading)
  - Indoor and outdoor propagation measurements
- Delay spread and coherence bandwidth (outdoor and indoor)
- Log normal shadowing
- Path loss models (Free Space, Hata, Walfish-Bertoni, etc.)
  - Micro/macro cell measurements
  - Comparison of worldwide measurements.
- Man-made interference
- Simulating multipath fading channels : Jakes, LPF-ing, etc.

Performance Improvement Techniques

- Forward Error Correction (FEC): Block, Convolutional, Turbo
- Interleaver/de-interleaver - advantages and disadvantages
- Antenna receiver diversity techniques : Switching, Equal Gain, Maximal Ratio, Optimal Combining

CDMA2000 System Components (Building Blocks)

- System goals (latency, throughput, etc.)
- CDMA200 Release A, B and C overview
- CDMA 1xRTT physical channels (UL and DL)
- Logical channels (UL and DL)
- Protocol overview (Layer 1 - PHY, Layer 2- MAC, Layer 3- RLC functions)
- 1xEV-DO Release A, B and C overview
- 1xEV-DO physical channels
- 1xEV-DO Logical Channels
- PN sequences discussion: m sequences, gold codes, Walsh
- Spreader and despreader (Complex and Quadrature)
- RAKE receiver

CDMA2000 System Scenarios

- Echo profile manager (searcher)
- PN time tracking and acquisition
- Paging discussion
- Power control
- Pilot symbol aided coherent detection
- Channel estimation
- QPSK vs. BPSK pilot symbols
- Variable processing gain
- Cell search and handoffs
- Channel assignment
- Traffic channel and radio configurations
- UL/DL performance
- Available data rates
- Multicode transmission
- Receiver implications
- Network architecture (BTS, BSC, CN)
- Migration to packet based systems

3GPP WCDMA System Components (Building Blocks)

- System goals (latency, throughput, etc.)
- 3GPP Release Overview (Release 99 to Release 8 features)
- WCDMA physical channels
- WCDMA logical channels
- WCDMA protocol overview (Layer1-PHY, Layer2-MAC, Layer3-RLC functions)
- HSDPA overview
- HSDPA physical channels
- HSUPA overview
- HSUPA physical channels
- PN sequences discussion: m sequences, gold codes, OVSF
- Spreader and despreader
- RAKE receiver

3GPP WCDMA System Scenarios

- Echo profile manager (searcher)
- PN time tracking and acquisition
- SIR power control
- Pilot symbol aided coherent detection
- Channel estimation
- QPSK vs. BPSK pilot symbols
- Rate matching
- Variable processing gain
- Modulation (HPSK) and filtering
- Cell search and handoffs

- Paging discussion
- Channel assignment
- HSDPA performance results
- Available data rates
- Multicode transmission
- Receiver implications
- Performance
- Network architecture (NodeB, RNC, CN)
- Access Stratum (AS) & Non-Access Stratum (NAS)
- Migration to packet based systems

Link Budget and System Capacity Examples

- Link budget equations
- Example for indoors and outdoors (Excel spreadsheet)
- Cell capacity example
- Frequency bands

Course Wrap-up: Recap and Discussion

How You Will Learn

- A highly qualified engineer/instructor, well-versed in a number of technologies, including 2G, 3G, and 4G+, will present this course in an interactive lecture format.
- Along with the lecture, we employ discussion, group activities, and case studies to help you understand the key points.
- If you already know something about 3G technologies, we will build on that foundation. We'll compare and contrast what's already known to you with what's new, making the new material easier to learn.
- If your background is less technical, we will use appropriate examples and analogies to convey the complex subject matter in terms that make sense.
- You will receive a printed Participant Handbook which will help you remember and retain what you learned in class and use it on the job.

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