will have a clear understanding of the key concepts of HSDPA and will be able to employ this knowledge to effectively plan, implement and deploy HSDPA.
Pre-requiste: Technical background in wireless telecommunications.
Length: 2 days

WCDMA (UMTS) DEPLOYMENT

WCDMA (UMTS) Network Planning
This two day course takes a look at the network deployment process and the network planning principles as applied to UMTS networks. The course will provide the required knowledge and background to perform RF network planning activities for a WCDMA network and is intended to provide the basic concepts behind planning a UMTS network. Topics covered include link budgets, traffic modeling, estimation of coverage, and practical consideration required to successfully plan a WCDMA network.
Pre-requisite: WCDMA (UMTS) technology or similar experience with WCDMA (UMTS), and network planning experience in any 2G technology. Length: 2 days

WCDMA (UMTS) Network Optimization
This two day course provides a review of network planning and an overview of the network optimization process. The course covers common cell configurations such as co-location and overlays of established GSM networks with UMTS. Step-by-step exercises address how to optimize networks for specific customer applications (voice, high data rate, circuit-switched video conferencing, and other new technologies). Topics include the tasks and tools associated with network optimization, key performance indicators (KPI), parameters used for cell reselection, power control, handover and hard handover, pilot survey for RF optimization, and idle and connected mode measurements used to improve speech and data KPI.
Pre-requisite: WCDMA (UMTS) technology or similar experience with WCDMA (UMTS), and network planning experience in any 2G technology. Length: 2 days

WCDMA (UMTS) Handset Test Process
This two day course is intended for test engineers and technicians who will develop and implement the development, production and certification minimum performance testing of UMTS handsets. It will provide an overview of the industry standard test process that UMTS wireless handsets typically must pass before their introduction into the market place. It will walk the student through the test specifications providing insight into how to properly set up and execute tests to the intent of the specification. The value of conducting these tests and the impact to access terminal quality and network performance will be explained. Test equipment and engineering expertise required to conduct the testing will be outlined.
Pre-requisite: Working knowledge of WCDMA (UMTS) standards. Length: 2 days

In-Building Network Planning
This course is for the experienced telecommunications professional including Carrier Engineers, Carrier Network Planners and Carrier Field Technicians that are involved with network design and equipment deployment and/or operation. The motive of this course is to teach the student how to successfully perform an indoor CDMA, UMTS, or 1xEV-DO design as well as harmonize the Indoor and Outdoor networks.
Pre-requisite: WCDMA (UMTS) technology or similar experience with WCDMA (UMTS), and network planning experience in any 2G technology. Length: 2 days

Distributed Antenna Systems
This course covers the practical aspects of deploying an antenna system for indoor coverage. Passive and Active systems will be discussed, along with noise, inter-modulation and sensitivity requirements. The practical aspects of antennas, coax, fiber, and amplification will be discussed. Basic systems engineering relating to proper performance for 3G systems will be given. A practical design example will be shown.
Pre-requisite: None. Length: 2 days

WCDMA (UMTS) Network Optimization Workshop
Network deployment workshops are intended for RF engineers to help bridge the gap between theoretical course and real life experience. The Network Planning and Optimization Workshop provides the student with the knowledge to efficiently use network deployment tools (network planning and network optimization) to successfully deploy a WCDMA network.
Pre-requisite: WCDMA (UMTS) Network Planning and Network Optimization courses. Length: 3-5 Days (4th day with a special focus on the actual customer's network)

Multi-Media available on DVD-ROM (interactive course content)

Current Courses
CDMA2000 1X RC1 and RC2
CDMA2000 1X Release 0 and Release A
CDMA2000 Network Planning
CDMA2000 Voice Network Planning
CDMA2000 Wireless Internet Optimization
CDMA2000 Short Course - Mandarin Version
Repeater Design and Deployment
3G Standards: UMTS/WCDMA and CDMA2000

QUALCOMM can provide courses via Web-based training.

Developer Training
This course is designed specifically for developers building applications to be downloaded from carrier networks onto BREW-enabled devices. For the detailed course description, please go to:
www.qualcomm.com/brew/developer/training/devtraining.html
Pre-requisite: Experience building applications in object-oriented languages (such as C++) is preferred, as well as familiarity with the use of software development tools, compilers, and resource editors. Length: 3 days

If you have questions or want further information, please contact:

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OVERVIEW / Course Descriptions

Code Division Multiple Access (CDMA) is the world's fastest-growing digital wireless technology. 3G technology offers great rewards for carriers, manufacturers and operators through features such as voice, data, integrated messaging services, Internet access, multimedia and much more. To help you reap those rewards, QUALCOMM® introduces CDMA University, a full curriculum of CDMA courses with an emphasis on 3G technology. Our instructors include some of the world's foremost subject matter experts, including the engineers who helped develop the technology. We teach from experience! Our instructors are working in the field (in their area of expertise) when not facilitating classes.

CDMA University classes are available nearly anywhere in the world. Our staff of teaching professionals will travel to most major domestic and international cities. Students are also welcome to enroll in CDMA University courses at QUALCOMM's training facilities in Boulder, Colorado or in San Diego, California.

Whether you are a business professional, a telecommunications expert, or a novice to the wireless industry, QUALCOMM has the right CDMA class for you.

CDMA2000 FOUNDATION

CDMA: The Competitive Advantage
CDMA 90 provides students with answers to questions such as what technology should a telecommunication system carrier adopt or migrate to in order to protect, preserve and advance his investment in his wireless telecommunications business. Topics include an introduction to the basic architecture, infrastructure and history of wireless technologies; advantages of CDMA; global roaming issues; wireless technology status; 3G wireless technology migration issues; and reasons why a carrier should invest in 3G technologies.
Pre-requisite: None. Length: 1 day

CDMA for the Enterprise
This one day course is designed for the Carrier Sales Organization, enterprise CIO, or any telecommunications professional that requires an understanding of wireless technologies and how they can be used to enhance productivity in the enterprise. CDMA for the Enterprise defines the enterprise and identifies the IT decision makers. It then helps build a business case for the wireless solution. The CDMA advantage in providing this solution is described from both a business and a technical perspective.
Pre-requisite: None. Length: 1 day

cdmaOne and CDMA2000 for Business Professionals
CDMA 80 is for individuals who interface with customers and require an understanding of wireless networks and technologies, in particular CDMA. Topics include analog and digital communication, U.S. and international spectrum allocations, cellular systems, standards organizations and governing bodies, and an overview of second-and third-generation wireless technologies.
Pre-requisite: None. Length: 2 days

cdmaOne and CDMA2000 Concepts and Terminology
CDMA 120 is the recommended introductory CDMA course for non-engineers with a technical background. This course provides students with an overview of the concepts and terminology related to cdmaOne technology as well as an introduction to CDMA2000. cdmaOne topics include CDMA standards, power control, Walsh and PN codes, call processing, registration, and the TIA/EIA-95 physical layer. An overview of CDMA2000 and 1xEV-DO high-speed wireless data technology is also provided.
Pre-requisite: Technical background in wireless telecommunications. Length: 2 days

CDMA2000 1x Protocols and Signaling
This two day course takes an in-depth look at the protocols and signaling defined for CDMA2000 Release A systems. The course begins with an overview of CDMA2000 network architecture and air interface concepts. The layer 2 protocols are covered in detail, including Link Access Control, Medium Access Control, and Radio Link Protocol. Layer 3 signaling is covered, including overhead, call control, registration, authentication, encryption, handoff, and power control signaling. Topics pertaining to packet data services include dormancy, mobility management, resource allocation, and performance considerations.
Pre-requisite: Technical background in wireless telecommunications. Length 2 days

CDMA2000 1xEV-DO Release O
This two day course is for the experienced telecommunications professional with a need to learn the in-depth functioning of CDMA2000 1X Evolution Data-Optimized (1xEV-DO) Release O Systems. The course begins with a brief history of the development of 1xEV-DO technology. An overview of 1xEV-DO is then given to provide the student with a "big picture" view of the technology. The course then examines each layer of the 1xEV-DO protocol stack from Physical Layer through Application Layer. Simple IP and Mobile IP operations are compared and contrasted. Terminal operation on 1X and 1xEVDO, known as hybrid operation, is also examined.
Pre-requisite: Familiarity with cdmaOne. Length: 2 days

Repeater Design and Deployment
This course is for repeater designers and carriers who need to learn about repeaters in CDMA networks. Basic repeater elements, requirements, and regulatory requirements are reviewed. The reverse link, the reverse link operating point, impact to the donor base station and repeater effect on the open loop power control estimate are examined in great detail. The deployment of repeaters including set up, stability, antennas, position

location issues and neighbor list planning are discussed. Issues with fiber fed repeaters, PN space and search window planning are examined. Capacity, link budgets, indoor and outdoor issues are briefly discussed.
Pre-requisite: None. Length: 1 day

CDMA2000 Series

CDMA2000 1X RC1 and RC2
This two day course provides the student with an in-depth description of the functioning of a CDMA2000 system according to the key CDMA standards (TIA/EIA-95B and CDMA2000) and the rationale behind the specifications. Course discussions provide a point-by-point description of key processes including power control, physical channel generation, hand-off techniques, and call processing. This course concentrates on Radio Configurations 1 and 2 (RC1 and RC2), which are the backwards-compatible modes to TIA/EIA-95. In addition to the discussion of Radio Configurations 1 and 2, new concepts for CDMA2000 are introduced and briefly discussed.
Pre-requisite: Technical background in wireless telecommunications.
Length: 16-hours (2 days)

CDMA2000 1X Release 0
This one day course provides the student with an in-depth description of the functioning of a CDMA2000 system according to the key CDMA standards (TIA/EIA/IS2000-0). Course discussions provide a point-by-point description of key processes including variable rate Walsh spreading, new traffic channels, new power control modes, spread spectrum signal generation, MAC/LAC processing, hand-off techniques, call processing, registration, authentication, and encryption. Emphasis is placed on new features and capabilities introduced in CDMA2000 Release 0.
Pre-requisite: Working knowledge of TIA/EIA-95. Length: 1 day

CDMA2000 1X Release A
This one day course provides the student with an in-depth description of the functioning of a CDMA2000 system according to the key CDMA standards (TIA/EIA/IS2000-A). Course discussions provide a point-by-point description of key processes including variable rate Walsh spreading, new Walsh code assignments for the new physical channels, Turbo codes, generation of the new overhead physical channels, new power control modes, spread spectrum signal generation, MAC/LAC processing, and call processing for the new overhead channels. Emphasis is placed on new features and capabilities introduced in CDMA2000 Release A.
Pre-requisite: Working knowledge of CDMA2000. Length: 1 day

CDMA2000 DEPLOYMENT

CDMA2000 Network Planning
This two day network planning course will provide the technical professional with the knowledge required to perform RF network planning activities for a CDMA2000 network. Students are expected to be familiar with the CDMA air interface standard, either IS-95 or CDMA2000, as the intent is to review the concepts behind planning a CDMA network. Topics covered include link budgets, propagation models and CDMA traffic modeling. The specifics of CDMA network design are introduced, including PN planning, soft hand-off control, hard hand-off planning, spectrum planning and site selection criteria. The course includes a network planning case study example and an overview of the available network planning tools required to successfully plan a CDMA network.
Pre-requisite: Technical background in wireless communication systems, and a working knowledge of cdmaOne and/or CDMA2000 air interface standards. Length: 2 days

CDMA Network Optimization: Optimization of CDMA2000 Voice Networks
Optimizing for voice is the first step in optimizing most CDMA2000 networks. This two day course is intended for network planners, field engineers, and telecommunications professionals involved with optimizing CDMA2000 voice networks. Topics covered include performance metrics, analysis and troubleshooting of common network problems, and techniques for testing and tuning a CDMA2000 Network.
Pre-requisite: Technical background in wireless communications systems, and a working knowledge of cdmaOne and/or CDMA2000 air interface standards. Length: 2 days

CDMA2000 Wireless Internet Optimization
This two day course is for the experienced telecommunications professional with a working knowledge of CDMA that is responsible for deploying, optimizing, and operating CDMA2000 1X networks. This course begins with an overview of CDMA2000 with an emphasis on Internet access. It provides a solid background in the network fundamentals necessary to offer data services. Packet Data services are a major focus of this course, including IS-707A Packet Data Services, Protocol stacks, RLP, Simple and Mobile IP, QoS, Mobility Management, Dormancy, and Accounting. Building upon this foundation of knowledge, the course then describes and characterizes the parameters to best optimize packet data performance over CDMA2000 to maximize system throughput and minimize user latency. In addition, guidelines and specific tests for troubleshooting a CDMA2000 wireless network are provided to enable the system operator to verify optimal network CDMA handset performance. Finally, the course concludes with a hands-on workshop in which the instructor uses a data-enabled phone and a laptop (equipped with a data logging tool) to establish a Packet Data call. Diagnostic logging of real-time performance statistics is then initiated. Students are then able to explore log files, post-processing and data analysis through a variety of troubleshooting examples.
Pre-requisite: Familiarity with CDMA2000. Length: 2 days

CDMA2000 Network Optimization Workshop
Network deployment workshops are intended for RF and Network engineers to help bridge the gap between theoretical course and real life experience. The CDMA2000 Network Planning Optimization Workshop provides the student with the knowledge to efficiently use network deployment tools to successfully deploy a CDMA2000 network. The course will provide an overview of logging and data analysis tools, as well as provide a review of OTA parameters. The course will conclude with a review of analyses of several real-world scenarios including trouble-shooting and fault-isolation techniques and suggestions.
Pre-requisite: CDMA2000 Wireless Internet Optimization Course
Length: 3/4 Days (4th day with a special focus on the actual customer's network)

CDMA2000 HANDSET TESTING

Laboratory Testing
This two day course is designed for the system test engineer responsible for validation testing of CDMA handsets. The first day begins with an overview of the CDMA2000 industry standard test processes followed by an in-depth practical discussion of how to conduct recommended minimum performance and optional system performance testing of handsets on commercial test equipment in a laboratory environment. The second day focuses on handset signaling conformance testing within an RF cabled environment. The value of conducting these tests and the impact to handset quality and network performance is explained.
Pre-requisite: Familiarity with CDMA2000. Length: 2 days

Field Testing
This one day course (designed as a follow-up to the CDMA Handset Laboratory Testing) will cover over-the-air (OTA) handset field-testing within a commercial network as managed by a CDMA operator. The course will define OTA test methods for validating handset performance within a dynamic network environment per industry standard test specifications. Various interoperability test scenarios will be described as a means for evaluating handset call performance in addition to verifying handset features and service options that have been deployed on host CDMA systems. Finally, this course will review how field test data can be collected for post-processing analysis via the use of handset diagnostic test tools.
Pre-requisite: Familiarity with CDMA2000. Length: 1 day

WCDMA (UMTS) FOUNDATION

WCDMA (UMTS) Overview
This one day course provides an overview of the WCDMA system as defined in the 3GPP Release 99 specifications for UMTS. The course begins with an overview of UMTS and WCDMA concepts, including spectrum allocation, network topology, protocol stack, and channel mapping. In addition, the course covers physical layer transmit procedures, as well as procedures for acquisition, random access, paging, measurements, power control, and transmit diversity. The course

concludes with a discussion of handover and cell reselection procedures, security features, and call setup procedures for packet-switched and circuit-switched calls.
Pre-requisite: Technical background in wireless telecommunications. Length: 1 day

3G Standards: WCDMA (UMTS) and CDMA2000
This two day course provides the student with an overview of two systems, WCDMA (UMTS) and CDMA2000, according to their respective standards. The overview is then followed by a comparison of the two systems, which provides a point-by-point comparison, including network architecture and evolution, signaling layers, physical layer, and services.
Pre-requisite: Technical background in wireless telecommunications. Length: 2 days

WCDMA (UMTS) Physical Layer
This two day course takes an in-depth look at the WCDMA physical layer defined in the 3GPP Release 99 specifications for the UMTS. The course begins with an overview of UMTS and WCDMA concepts and then focuses on the WCDMA physical layer. Next, we describe each block of the transmit chain for downlink and uplink channels, including coding, interleaving, spreading, scrambling, and modulation. The course also covers physical layer procedures for acquisition, random access, paging, measurements, compressed mode, and transmit diversity. The important concepts of handover and power control are discussed in detail. Field logs from real world scenarios are reviewed to illustrate these concepts.
Pre-requisite: Technical background in wireless telecommunications. Length: 2 days

WCDMA (UMTS) Radio Interface Protocols
This two day course takes an in-depth look at the signaling layers and services defined in the 3GPP Release 99 specifications for UMTS. The course begins with an overview of a UMTS network and then focuses on the WCDMA Access Stratum. The procedures of the Radio Resource Control layer are covered in detail, including system information processing, connection management, radio bearer control, handover and cell reselection, paging, and measurement control. Next, Layer 2 procedures are covered, including Radio Link Control, Medium Access Control, Broadcast/Multicast Control and Packet Data Convergence Protocol. Procedures for authentication, ciphering, and integrity protection are also described. Call flows for circuit-switched and packet-switched services are illustrated using field logs. An overview of 3G services is presented, including Multimedia Messaging Services, video teleconferencing, and location services.
Pre-requisite: Technical background in wireless telecommunications. Length: 2 days

WCDMA (UMTS) HSDPA: A Standards and Performance Overview
Target Audience: WCDMA RF Engineers and Managers who will be responsible for, or involved in the deployment of HSDPA. Design Engineers responsible for the development of HSDPA devices or equipment.

Module 1: WCMDA (UMTS) HSDPA Protocols and Physical Layer

This module examines the key features of High Speed Downlink Packet Access (HSDPA) defined in UMTS Release 5. Beginning with a review of the currently implemented Release 99 WCDMA network architecture, the course highlights current limitations and how these are overcome by the enhanced features offered by HSDPA. Particular emphasis is placed on the new Release 5 channels and how fast scheduling and incremental redundancy with Hybrid Automatic Repeat Request (HARQ) are employed, along with UE Channel Quality Indicator (CQI) reporting, to provide high speed downlink data services. Enhancements to Layer 3, Layer 2, and the Physical layer are examined in detail.

Module 2: WCDMA (UMTS) HSDPA Performance and Deployment

This module examines from a performance and deployment perspective. To this end, the maximum theoretical throughput of a single HSDPA user is derived. This is then followed by a detailed discussion on performance issues, with an illustration of the numerous factors that will reduce this maximum throughput in a real deployment scenario. Other deployment matters are also addressed in detail with an illustration of the issues associated with implementing HSDPA as an overlay to a Release 99 network. Further, network planning and dimensioning are discussed using simulations and propagation tool modeling.

The learning objective of this course is that the student, upon completion,