APS Consulting

Another innovation, ultimate success

ADVANCED TECHNOLOGY KNOWLEDGE

LTE NETWORK PLANNING

This course is focused on the important task of network planning. In this course, we will undertake an in-depth study of the considerations related to the planning of Wireless networks (4G) networks including idle mode behavior, channel conditions, and frequency planning models. The course includes case studies to help you thoroughly understand the capacity planning process.

Audience:

This course is aimed at wireless network designers who have a good understanding of LTE and wish to learn how to plan 3G LTE networks.

Prerequisites:

The course assumes an understanding of LTE technical concepts and architecture.

Customize it:

This 2-3 day LTE RF Planning course will be customized to your needs and specifications. We will assist you in identifying those needs and specifications. A word to the wise, there are many vendors of Wireless training. They will typically have a broad and general course, one size fits all, already developed and just put your organizations name on the title slide. This minimizes their effort and time investment.

At TNCS Inc, every course is made to your exact and exacting specifications. We help you ensure what you are getting is what you really need even if at the beginning you weren't too sure of what that was. We fit the class to your needs. We never fit you into our standard, one size fits all, class. Please call or e-mail to schedule a no-obligation conference call to help us understand your audience background and training objectives.

Objectives:

On completing this course, you will be able to:

- Understand the LTE air interface aspects that impact RF planning
- Receive a refresher on RF terms
- Be aware of Frequency Reuse for LTE
- Appreciate the impact of MIMO on LTE and its planning
- Be able to create Link Budgets for LTE
- Understand Timing and Synchronization for LTE
- Understand the use of RF tools for LTE
- Be aware of backhaul considerations

NETWORK PLANNING

Course Outline:

LTE/SAE Introduction

- Evolution of cellular networks
- EPS (E-UTRAN and EPC) logical architecture
- EPS interfaces
- EPC (Evolved Packet Core) architecture
- SAE/LTE interfaces

Radio Interface Principles

- Channel models
- BPSK, QPSK, 16QAM, 64QAM
- OFDM: Principles of operation
- MIMO system
- Radio interface techniques: Uplink/downlink
- Channel structure

LTE Functionality

- Idle mode functionality
- PLMN selection
- Cell selection process: Criteria, normal camping
- Cell reselection evaluation process
- System information
- Paging: DRX for paging

Physical Layer Procedures

- Radio link monitoring
- Downlink transmission
- Power control: Timing adjustments
- Link adaptation
- Uplink transmission
- Random access
- Preample selection
- Channel Quality Indication (CQI)
- Precoding Matrix Indicator (PMI)
- Rank Indicator (RI)\

NETWORK PLANNING

Course Outline:

LTE Cell Planning Principles

- **Frequency Planning**
- --Channel Allocation
- --Basic schemes
- --Factional loading
- --Multiple reuse patterns
- --Reuse partitioning
- **Capacity considerations**
- --Capacity loss from interference
- --Resource allocation principles
- --Frequency-planned systems
- --Reuse-1 with prioritization
- --Soft frequency reuse
- --Reuse partitioning
- --Frequency planning and capacity parameters
- --Spectrum utilization factor
- --Discussion

ADVANCED TECHNOLOGY KNOWLEDGE

UMTS NETWORK PLANNING

Who Should Attend:

Ideal Delegates who would benefit from this course would be technical and engineering professionals, specifying, planning and implementing future 3G networks and services:

- Development Engineers and Technical Managers responsible for 3G systems and products
- Network Planning Managers, Radio Planners, and System Developers
- Technical Sales & Marketing personnel

Prerequisites:

Good knowledge of GSM/GPRS, ideally previous 2G RF/Transmission Planning, some previous background knowledge of UMTS. Any previous radio air-interface/BSS knowledge would also be advantageous.

Course Description:

UMTS, also referred to as wideband code division multiple access (W–CDMA), is one of the most significant advances in the evolution of telecommunications into 3G networks. UMTS allows many more applications to be introduced to a worldwide base of users and provides a vital link between today's multiple GSM systems and the ultimate single worldwide standard for all mobile telecommunications, International Mobile Telecommunications–2000 (IMT–2000).

This course covers the network planning of UMTS network covering the CS, PS domains. This course is vendor-neutral, thus maximizing the true value of this telecom educational experience for its attendees.

Course Objectives:

This course provides you with a comprehensive business and technical foundation in EDGE, UMTS network, migration paths, services and applications development.

UMTS NETWORK PLANNING

Course Outline:

Network Planning

- Overview of 3G Planning
- GOS / Area coverage
- RNP planning procedure
- Preparation -coverage & capacity
- Offered traffic - cell capacity and coverage estimation
- Cell capacity estimation - simulations
- Estimated max cell coverage
- UMTS Network planning process
- Blocking / Trunking efficiency
- Cell count
- Cell count model
- Offered traffic environments
- Load factors
- Estimated cell count

Detailed Network Planning

- Radio environment characterization
- Pilot pollution & power
- Inter-frequency handover
- Non-uniform traffic
- Code requirements
- Control channel planning
- Soft Handover parameter planning
- Hierarchical Cell Structures
- Radio network testing
- Code Planning

Radio Environment & Microcell Planning

- Microcell Network Planning
- SHO design
- Outdoor / Pedestrian / Vehicular
- Microcell - Corner effect
- Indoor / Office planning

UMTS NETWORK PLANNING

Course Outline:

Network Dimensioning

- Channel element planning
- Coexisting with 2G
- Adjacent channel interference
- UMTS radio carriers
- Frequency sharing
- Transmission capacity
- 2G co-planning
- External operator interference
- Uplink Calculations
- Planning with adjacent channel interference
- Actual spectrum allocation
- Guard bands & zones

Link budgets & range calculations

- Spectrum efficiency - Uplink & Downlink
- Eb/No
- Range calculations
- Range in unloaded & loaded networks
- Effect of bit rates on range
- Uplink/Downlink budgets
- Typical UMTS ranges
- Uplink load factor
- Uplink capacity Overheads
- Capacity and coverage gains - transmit diversity
- Coverage improvements
- C/I Ratio
- QOS
- Spectrum efficiency comparisons
- Link budgets and loads
- Processing gain
- Downlink load factor
- Coverage versus capacity
- Capacity improvements

UMTS NETWORK PLANNING

Course Outline:

Radio Resource Management

- RRM algorithms
- Admission control strategy
- Packet scheduler
- Micro diversity
- Power control
- Fast power control
- Uplink fast power control
- Soft handover algorithm
- Handover decision
- Admission control
- Load control (congestion control)
- Interference margin
- Macro diversity
- Open/Closed/Outer and inner loop
- Improved power control signaling
- Handover mechanism
- Handover measurements
- Handover parameters

Traffic Analysis

- Traffic analysis process
- Target coverage
- Sample usage and service offerings

ADVANCED TECHNOLOGY KNOWLEDGE

UMTS/WCDMA RF Planning and Network Optimization

Duration:
4 Days-instructor led training

Overview:
In this course, the candidate will understand UMTS network, architecture and its capabilities.
Candidate will be able to optimize RF, 3G services and quality parameters using. At the end of workshop, counters will be used to study and optimize the network.

Pre-requisites:
Degree in Engineering with sound knowledge on GSM network and basics in knowledge in UMTS/WCDMA is needed.

Who should attend?
Telecom Professionals who are responsible for RF & Design and deployment of UMTS network. This course is also intended for managers and Engineers who are responsible for network optimization.

Course Outline:

Introduction to 3G

- Evolution to 3G
- Requirements of 3G
- 3G key characteristics
- Genesis of UMTS
- Histories of UMTS
- UMTS requirements on 3G
- UMTS versus GSM/GPRS

UMTS Key features

- UMTS Qos classes
- UMTS requirements,
- Background compatibility with GSM/GPRS
- UMTS QoS classes

UMTS/WCDMA RF PLANNING AND NETWORK OPTIMIZATION

Course Outline:

UMTS System Architecture

- UTRAN Architecture
- Network Elements-Node B, RNC, MGW
- Interfaces –Uu, Lu, lub, lur
- Multiple Access Technologies-FDMA, TDMA, CDMA
- Bearer-RAB-Radio Access Bearer Types

Core Network-Circuit switched Domain and packet switched Domain

- Function of 3G MSC and GMSC
- Functions of SGSN and GGSN
- Mobility management Signaling processes
- Concept of PDP context and session management

Spreading and Channelization Codes and Spreading process

- Spreading principle
- Channelization codes
- Scrambling codes
- Spread spectrum Gain
- Scrambling Code planning

Power control, Link Adaptation and Codes and spreading process

- Fast Link Adaptation
- Power and capacity calculations
- Power control
- Open loop
- Outer Loop-RNC
- Inner loop-RBS
- Control Channels and their Power settings
- Power Ramping on RACH
- Softer,Soft,hard hardovers

UMTS/WCDMA RF PLANNING AND NETWORK OPTIMIZATION

Course Outline:

Air Interface and Channels, Signaling and Antenna Systems

- Downlink and Uplink logical channels
- Downlink and Uplink transport Channels
- Downlink and Uplink physical Channels
- Common Pilot Channels and Sync Channels
- Dedicated Control and Sync Channels
- Common Pilot Channel and Sync Channel
- Dedicated Control and Data Channel

Power and Link Budgets

- Link Budgets
- Uplink Link Budgets
- Downlink Link Budgets for CPICH
- Downlink Link Budget for various Services (Connected Mode)
- Uplink and Downlink and Services Comparison

Capacity planning and Optimization

- Basic UMTS Traffic Engineering
- Capacity Requirements
- Uplink Capacity Estimation
- Estimation Downlink Capacity
- WCDMA Traffic Engineering and PS Data
- WCDMA Traffic Engineering and PS Data
- Multi-Service Traffic Engineering
- Uplink and Downlink Capacity Comparison

Optimizing for Capacity

- Coverage and Capacity Tradeoffs
- Capacity Estimation in the Deployed Network
- Capacity Monitoring for a Deployed Network

UMTS/WCDMA RF PLANNING AND NETWORK OPTIMIZATION

Course Outline:

Service Optimization

- KPI and Layered Optimization Approach
- Principal KPI Definitions
- Voice Service Optimization
- Adaptive Multi-Rate(AMR)
- AMR Service
- Call Setup
- Call Retention
- Connection Supervision and Link Quality Indicators
- Troubleshooting AMR Failures
- Parameter Optimization
- Call Quality Metrics

PS Data Services Optimization

- PS Data versus AMR Optimization
- Typical PS Data Application and QoS
- Channel Reconfiguration and QoS Profiles
- Quality Metrics
- Throughput efficiency

Inter-Systems Planning and Optimization

- Inter-System Boundary Planning
- Typical Inter-System Scenarios(2G & 3G)
- Inter-System Transition in Connected Mode
- Inter-System Change Procedure
- Message Flows and Delays
- Compressed Mode Issue and events
- Inter-System Transition in idle Mode
- Inter-System Cell Reselection Parameters

ADVANCED TECHNOLOGY KNOWLEDGE

LTE (4G) OVERVIEW

Long Term Evolution (LTE) is one of the choices for next generation broadband wireless networks and is defined by the 3GPP standards as an evolution to a variety of 3G wireless networks such as UMTS and 1xEV-DO. Its high data rates enable advanced multimedia applications. This course offers a quick and concise overview of LTE networks and the OFDM-based air interface. The LTE network architecture, network interfaces and protocols, air interface and mobility aspects are covered to provide an end-to-end view of the network. A high-level glimpse into the life of an LTE User Equipment (UE) is provided by walking through various stages from power-up all the way to setting up an IP address and exchanging traffic. By the conclusion of this

Learning Objectives:

After completing this course, the student will be able to:

- Describe the state of wireless networks and trends for next generation wireless networks
- Sketch the System Architecture Evolution (SAE) for LTE and its interfaces
- Describe OFDM concepts and how it is used in LTE
- Define the key features of the LTE air interface
- Walk through the mobile device operations from power-up to service setup
- Explain how uplink and downlink traffic are handled in LTE networks
- Walk through a high level service flow setup on an end-to-end basis
- Explain deployment scenarios of LTE networks

Intended Audience:

This course is an end-to-end overview of LTE networks, and is targeted for a broad audience. This includes those sales, marketing, system engineering and deployment groups and management.

Course Length:

2 Days Instructor Led.

LTE (4G) OVERVIEW

Course outline:

Setting the stage

- Transition options to LTE
- Trends for next generation wireless networks
- LTE network changes
- LTE Air interface changes

LTE Network Architecture

- System Architecture Evolution (SAE)
- Network architecture and interfaces
- SAE nodes and functions
- E-UTRAN - eNodeB
- Protocol stacks for network interfaces

LTE air interface

- Shared radio channel concepts
- OFDM/OFDMA, SOFDMA SC-FDMA concepts
- Protocol stack
- Air interface channel structure
- Channel characteristics

LTE UE operations

- System acquisition
- Synchronization
- Initial access procedures
- Data service setup

LTE Traffic handling

- Downlink traffic handling
- Uplink traffic handling

LTE Mobility

- Cell selection/reselection
- Handover

Deployment

- Typical LTE deployment scenarios

ADVANCED TECHNOLOGY KNOWLEDGE

WCDMA/UMTS (3G) OVERVIEW

Introduction:

WCDMA (Wideband Code Division Multiple Access) is the radio access scheme used for third generation cellular Systems that are being rolled out in various parts of the globe. The 3G systems to support wideband services like high-speed Internet access, video and high quality image transmission with the same quality as the fixed networks. In WCDMA systems the CDMA air interface is combined with GSM based networks. The WCDMA standard was evolved through the Third Generation Partnership Project (3GPP) which aims to ensure interoperability between different 3G networks.

This course provides an overview of the WCDMA system, as defined in the 3GPP Release 99 specifications for the Universal Mobile Telecommunications System (UMTS). The course begins with an overview of WCDMA and UMTS concepts, including spectrum allocations, network topology, protocol stack, and channel mappings. It then describes the procedures of the Access Stratum protocol layers, covering the Radio Resource Control, Radio Link Control, and Medium Access Control layers. Next, physical layer transmit procedures are covered, as well as procedures for acquisition, random access, paging, measurements, power control, and transmit diversity. The course concludes with discussion of handover and cell reselection procedures, security features, and call setup procedures for packet-switched and circuit-switched calls.

Audience:

This course is for the experienced telecommunications professional with a need to learn the principals of WCDMA.

Prerequisites:

Technical background in wireless telecommunications

Customize it:

This 2-3-day WCDMA course will be customized to your needs and specifications.

WCDMA/UMTS (3G) OVERVIEW

Course Outline:

The following topics are covered:

- Network architecture
- Protocol layers
- Channels
- Call processing states
- Layer 3 signaling
- Layer 2 (link layer and medium access control)
- Orthogonal spreading
- Generic physical layer procedures (coding, interleaving, spreading, scrambling)
- Physical channel characteristics
- Acquisition
- Random access channel procedure
- Paging
- Measurements
- Power control
- Transmit diversity
- Idle and traffic handoff
- Security
- Call flows

ADVANCED TECHNOLOGY KNOWLEDGE

LEADERSHIP DEVELOPMENT

Introduction:

Creative Leadership Training is proven to help organizations:

- Grow employees into credible, influential and creative leaders
- Lead, motivate and inspire teams to reach new heights and improve performance
- Implement reward programs that keep employees motivated and inspired to reach their goals
- Coach employees regularly and one-on-one to accelerate performance
- Ignite passion in every employee by resolving issues related to poor morale
- Address burnout, apathy and negativity with a new and productive attitude
- Build strong, cohesive teams and empower them to innovate

To be a successful leader in today's organizations, you have to do more than just "lead." Leaders have to be creative, innovative and passionate in order to inspire teams to pull together, solve problems creatively and achieve amazing increases in productivity. We've assembled the training and techniques to inspire, challenge, reward, coach and ignite your employees to consistently outperform themselves, contribute in new and profitable ways and improve your company's bottom line.

Duration:

This 3 days leadership training experience will give employees the skills necessary to establish work environments where inspiration, creativity and people flourish.

Audience:

Directors, Supervisors, Managers Team leaders, Anyone aspiring to fill important leadership roles

Course Outline:

- Identify personal leadership styles in order to better lead others
- Build strong, cohesive teams and empower them to innovate
- Fundamentals of leadership communication
- Coaching tools to accelerate individual performance
- Solve problems creatively and motivate employees to perform at their best
- Create a work environment of creativity and exploration

ADVANCED TECHNOLOGY KNOWLEDGE

STRATEGIC PLANNING

Introduction:

This course is designed to combine proven-by-practice methods with new insights and ideas from a wide range of current strategic thinking. Gain a wider perspective of management practice through breakout sessions, exercises, and case applications. Bring your strategic dilemmas to this program and get direction on analytical and organizational approaches.

Duration:

This 3 days Strategic Planning experience will give management the skills necessary to plan, create, implement best strategies to achieve the goals and drive the organizations towards a clear defined vision

Audience:

Directors, Supervisors, Managers Team leaders, Anyone in important leadership roles

Course Outline:

Strategic Planning Principle

- Determining a frame of reference for strategic planning concepts
- Schools of thought in strategic planning
- The evolution of strategy

An Overview of the Strategic Planning Process

- Basic elements of strategic planning
- Developing and managing the strategy formation process

Understanding Your Organization's Mission

- Your organization's core values
- Creating an inspiring mission statement for your own organization

STRATEGIC PLANNING

Course Outline:

Assessing the External Environment

- Identifying macro and micro factors
- Responding to changes in the environment

Understanding Your Internal Environment

- How to become a high-performing organization
- Financial elements of developing strategy

Formulating Your Strategic Planning

- Data synthesis
- SWOT analysis

Competitive Strategic Planning

- Defining your competitive advantage
- The product/industry/life-cycle curve

Ensuring Strategic Alignment

- Creating organizational accountability
- How to translate the grand design into well-executed strategic planning

Strategic Planning Execution

- Key building blocks
- Learning the three core processes
- Understanding resource allocation and strategy formation

A Strategic Planning Process

- Determining the best processes for your business

ADVANCED TECHNOLOGY KNOWLEDGE

BUSINESS PROCESS REENGINEERING

Course Description:

Business process Reengineering course walks you through the stages of a reengineering project - from initial design and development to implementation. It will help you and your organization determine cost, quality, and time issues that are currently plaguing and restraining your business growth.

Audience:

Project Managers, BPR Team Members, Presidents, Vice Presidents, General Managers, Human Resource Teams, CEOs, CFOs and CIOs, MIS Managers, Government Executives, Management Executives, Consultants, Accountants, and Quality Assurance Teams

Course Outline:

- Introduction to Business Process Reengineering
- BPR, The Quick Test: What it is and What it isn't
- BPR Methods
- Corporate Culture & Change Management
- Benchmarking, Discovering the State of the Art
- Total Quality Management vs. Business Process Reengineering
- Time, Cost, Quality, and Flow Analysis
- Activity Based Costing
- BPR Case Study
- The Human Factor in BPR
- Success with Cross-functional BPR Teams
- How to "Scope" a BPR Project
- Creating your Project Timeline to Assure Success
- What to Take On, What to Leave Alone
- How to Assure Implementation

ADVANCED TECHNOLOGY KNOWLEDGE

PLANNING, MEASURING, AND CONTROLLING O&M PROCESS

Introduction:

This course provides engineers, planners, managers and executives of operations and maintenance departments a way to analyze the current state of their O&M strategy, planning O&M, analyzing processes involved in O&M, Improving Processes and Continuously improving processes by closely monitoring and controlling performance.

Duration:

4 day course

Audience:

Engineers, management teams, O&M personnel

Course Outline:

Strategic Planning for Operations & Maintenance

- Strategic Planning for Operations & Maintenance
- Analyzing current situation
- Defining O&M Strategic Goals
- Developing Objectives
- Identify strategic initiatives
- Performing Gap Analysis
- Develop performance and evaluation process

O&M Management

- O&M Potential Savings and Beyond.
- Developing the Structure.
- Obtaining Management Support.
- Measuring Quality of O&M Programs.
- O&M Contracting.
- Computerized O&M Systems.

PLANNING, MEASURING, AND CONTROLLING O&M PROCESS

Course Outline:

Maintenance Programs

- Reactive Maintenance.
- Preventive Maintenance.
- Predictive Maintenance.
- Reliability Cantered Maintenance.

Metering for O&M

- Metering and the business case behind it.
- Metering and O&M Efficiency.
- Metering for Control.

O&M Operational Planning & Control

- O&M action plan.
- Information and context of the O&M Plan.
- Operating Parameters Vs Maintenance Procedures.
- Controlling Parameters and Procedures.
- Setting Operating Limits and Evaluating Performance.
- Identification of problems.
- Workarounds and backup plans.

O&M Sustainability Planning

- O&M Sustainability Procedures.
- Evaluating O&M Sustainability Criteria.
- Planning Sustainable Maintenance.
- Continuous Monitoring and Performance Control.