Understanding

Carrier Wireless Systems

Course Description

This course provides a detailed scope of modern mobile and cellular network technologies used for second generation, 2G+, 3G and 4G networks. It provides an understanding of the structure and implementation of network technologies and how networks are sized, planned and built.

Students Will Learn

- **Describe in detail the structure and function of modern GSM, 2G+ 3G and 4G networks. mobile networks**
- **Appreciate the design of antenna and air interface subsystems for interfacing with mobile handsets**
- **Identify signaling, circuit and packet network requirements for core networks**
- **Size and Plan a mobile network service**
- **Migrate existing infrastructures using GSM to 2G+ 3G and 4G services**
- **Implement Mobile services for IP and Internet applications**

Target Audience

Mobile Network Planners, Base Station and mobile infrastructure designers, developers for mobile service solutions, Engineers and troubleshooters for mobile carriers.

Course Outline

Module I: The generations of mobile networks

First Generation Analog systems

- Second Generation Digital systems
  - General System Mobile
  - DECT
  - TETRA
- Enhanced Second Generation (2G+)
  - Short Message Service
  - General Packet Radio Service (GPRS)
  - Wireless Application protocols (WAP)

Lab of WAP showing a Learning Tree Advertisement

Module II: Components of a Modern Service for Cellular Wireless System

- Mobile Terminals
  - Subscriber Identification Modules (SIM)
  - International Equipment Identification
  - International Operator Identification
- Service Components
  - BSS, MSC, HLR, VLR, AuC, EIR
- Radio Subsystems and the air interface
  - Physical and logical channels
  - RF Power Control
  - Layer 2 Structure and Operation
  - BCCH Broadcast
  - Handover
  - Layer 3 signaling

- Base Stations and Cells
- Mobile System Controllers
- Core Networks
  - Mobile Intelligent Networks: CAMEL
    - Value Added Services
    - Intelligent Network Concepts
    - Intelligent Network Service Creation
  - Signaling
  - Roaming and Billing
  - User Services
    - HSCSD

Module III: Universal Mobile Telecommunications Services (UMTS) Architecture

- Role of UMTS in 3G
- UMTS Services
- Core network Interfaces
- UMTS Terrestrial Radio Access Network (UTRAN)
- User Equipment

Module IV: Air Interface

Principles of Radio

Link Budgets

Physical Propagation Effects

Scattering, Reflection, Defraction

Channel Modes and Channel Loss

Shadowing

Impacts of Multipath Transmission

Predicting Coverage at VHF, UHF and SHF

Identifying the Characteristics of Antennas

Antenna Structures

Beamforming Antennas

Impacts of Multipath Transmission

Selecting Modulation Techniques

Comparing TDMA and CDMA Performance

Module V: Cell Planning

Using Erlangs and Capacity Measures

Lab of Capacity Calculation on Spreadsheet

Identifying key Radio Transmission and Reception Parameters

Link Budgets and Coverage

Breathing Effects

Hard and Soft Handover

Operating Power Control

Mixing Modes of Traffic

Base Station Subsystems

Module VI: Circuit and Packet Core Network Infrastructures

GSM Core Networks

Defining GPRS Core Network Requirements

Using IP Within the Infrastructure

Evolving UMTS Core Network Interfaces

Addressing elements within the Core

Signaling Interfaces for the Core

Using SDH and ATM for UMTS Core Networks

Module VII: Wireless Microwave for Backhaul

Microwave Link Systems

Dish Antenna Systems

Microwave Link Engineering

Link Design

Capacity and reliability calculation

Module VIII: Sizing Packet Network Services

Calculating Capacity Needs

Circuit Switched Capacity

Packet Switched Capacity

Delay and Queuing

Lab **of Sizing a Core Network Service**

Module IX: Mobile Terminals and Applications

Functions of a mobile Handset

Evolution of handsets

Beyond Voice

Display and Power limitations

Personal Communications Assistants

Functions of a PCA

Potential Configurations

Example PCA Products

Employing Codecs For Voice

G.711 vs GSM 6.1 Codecs

BlueTooth

Overview of Wireless Service

BlueTooth Classes

Nets and Piconets

Master Slave Operation

Performance

Data Interfaces

- Mobile Broadband Internet Access
- Locator Services
  - Where Am I
  - Find Me my Nearest
  - Mobile Advertising

Module X: Future Wireless Mobile Applications

- Near Term
  - 4G and LTE
- Mobile Telemetry
- Mobile Security Systems
- Wireless Trading

Delivery Method

Instructor-Led with numerous Hands-On labs and exercises.

Equipment Requirements

(This apply's to our hands-on courses only)

BTS always provides equipment to have a very successful Hands-On course. BTS also encourages all attendees to bring their own equipment to the course. This will provide attendees the opportunity to incorporate their own gear into the labs and gain valuable training using their specific equipment.

Course Length

3 Days