

# 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, Diffraction

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