



## **WCA Announces Major Training & Certification Program Launch At WCA 2008**

WCA announces next week a major training and certification program to be launched in conjunction with **WCA 2008**, with follow-ups going forward. The program has three components to start: First is a general session open to all convention registrants at 8:45 a.m. on Monday April 21 led by WCA Board member TESSCO Technologies, which chairs WCA's new Training and Certification Committee. Introducing that session is Scott McClure, TESSCO's Product Business Unit Manager for Wireless Broadband & Networking. Beginning immediately afterward is an intensive three-day course entitled "WiMAX Technology & Network Design" that WCA will offer in cooperation with instructors from member company CelPlan Technologies, Inc. This course addresses the needs of engineers and managers who need to understand in-depth WiMAX technology and its network design. The focus is on the latest revision of the standard, which is IEEE 802.16e-2005, corrigendum 2 and task group 802.16m. The course starts with an overview of WiMAX and the IEEE 802.16 family of standards. Then follows a detailed description of the technology techniques, including e2e architecture, permutations (PUSC, FUSC), and MIMO techniques. Next, a WiMAX Network design will be covered, starting from service and traffic definition and then moving to the calculation of network Key Performance Indicators (KPI).

The price is \$2,910 per student before April 4, and \$3,500 after that deadline.

---

On Tuesday morning, WCA and CelPlan will offer a similar course for two days on Long-Term Evolution (LTE), which is described as the future 4G standard of 3GPP. After an overview of 4G standards the course introduces the requirements of LTE, provides insight to the most relevant changes to L1/L2/L3 and the network architecture of E-UTRAN to UMTS, HSDPA, and HSUPA. It is followed by a detailed description of the e2e architecture and MIMO techniques. Next, an LTE Network design will be covered, starting from service and traffic definition and moving to the calculation of network (KPI).

The price is \$1,940 per student before April 4, and \$2,300 after the deadline.

---

Registration for either tutorial is via email: [training@celplan.com](mailto:training@celplan.com).  
Details are available by calling 703-259-4036 or visiting:  
[Tutorial White Paper: www.celplan.com](http://www.celplan.com)



# **LTE Technology and Network Design Tutorial**

## **Table of Contents**

- 1- Principles and Motivation of LTE
  - 1.0- 1.1- Mobile Radio: Comparison between 3G and 4G
  - 2.0- 1.2- Requirements on LTE
  - 3.0- 1.3- LTE and System Architecture Evolution
  - 4.0- 1.4- The E-UTRAN Protocol Stack
  - 5.0- 1.5- Overview of Channels of E-UTRAN
  - 6.0- 1.6- Key Development Trends manifested in LTE
  - 7.0- 1.7- Key Feature Summary
  
- 2- Key Technologies of the LTE Physical Layer
  - 2.1- Introduction to OFDM Technology
  - 2.2- Introduction to MIMO Technology
  
- 3- The Physical Layer of E-UTRAN
  - 3.1- The use of OFDM/OFDMA in LTE
  - 3.2- The DL Physical Channels and Their Frame Structures
  - 3.3- The UL Physical Channels and their Frame Structure
  - 3.4- Overview of Physical Channels
  - 3.5- Physical Layers Procedures
  - 3.6- UE Classes
  
- 4- The Higher Layers of E-UTRAN
  - 4.1- Overview
  - 4.2- Features of MAC
  - 4.3- Features of RLC
  - 4.4- Features of PDCP
  - 4.5- Features of RRC
  - 4.6- NAS Protocol States and Transitions
  - 4.7- Mobility
  - 4.8- QoS in LTE
  - 4.9- Security in LTE
  
- 5- Selected E-UTRAN Scenarios
  - 5.1- Initial Context Setup Procedure
  - 5.2- Tracking Area Update
  - 5.3- PDP Context Establishment
  - 5.4- Intra MME Handover
  - 5.5- Inter MME Handover
  - 5.6- How a TCP MTU is reaching the UE/Internet

## 6- The LTE Business Plan

### 7- Modeling Network Customers

- 7.1- Customer Offered Traffic (COT)
- 7.2- Operator Offered Services (OOS)
- 7.3- Customer Distribution Characterization
- 7.4- RF Environment Characterization
- 7.5- Customer Terminal Models
  - Radio Models
  - Antenna Systems
  - Radio Performance
- 7.6- Design Service Classes

### 8- The RF Channel

- 8.1- RF Channel Characteristics
- 8.2- Channel Models
- 8.2- Propagation Models
- 8.3- RF Interference Modeling

### 9- The 50 steps in designing an LTE Network

- 9.1- GIS
- 9.2- Project Configuration
- 9.3- Site Location
- 9.4- Network Optimization
  - Network Footprint Enhancement
  - Network Resource Optimization
  - Network traffic Simulation
  - Network Statistics
- 9.5- Network Performance
  - Network Predictions
  - Key Parameter Indicators
- 9.6- Network Backhaul Design
- 9.7- Network Report

# WiMAX Technology and Network Design Tutorial

## Table of Contents

- 1- Overview and Essentials
  - 1.1- What is WiMAX?
  - 1.2- Involved Standard Organizations
  - 1.3- Frequency Ranges for WiMAX
  - 1.4- Important Assets and Features of the Physical layer
  - 1.5- Important Assets and Features of the Upper Layers
  
- 2- Architecture Details
  - 2.1- E2E Architecture Overview
  - 2.2- Functionalities within the ASN
  - 2.3- Functionalities within the CSN
  - 2.4- Subscriber Station/Mobile Station
  - 2.5- Definition of Interfaces
  - 2.6- ASN Implementation options
  - 2.7- 3GPP Internetworking Architecture
  - 2.8- Overview of the Initial Entry procedure
  
- 3- OFMD and OFDMA in WiMAX
  - 3.1- Introduction
  - 3.2- Advanced Issues of OFDM and OFDMA
  - 3.3- Multiplexing Several Users on OFDMA Physical Resource
    - Introduction to subchannelization
    - Permutation rules
    - Distributed vs. Adjacent Subcarrier allocation
    - Details and Operation of DL-PUSC
    - Details and Operation of UL-PUSC
    - Details and Operation of FUSC
    - PUSC, FUSC and Frequency Reuse Issues
    - Details and operation of AMC NxM Permutation
    - Number of Subchannels per FFT and Permutation Scheme
  - 3.4- OFDM Frame Structure (TDD)
  - 3.5- Throughput Rates and Performance Variables
  
- 4- Other Aspects of the .16e Physical Layer
  - 4.1- DL-Subframe
  - 4.2- Resource allocation in the DL-Direction
  - 4.3- Resource allocation in the UL-Direction
  - 4.4- Ranging
  - 4.5- AAS-Beamforming
  - 4.6- Space Time Coding (STC)
  - 4.7- MIMO

## 5- Protocol Suite

### 5.1- Protocol Stacks

### 5.2- The MAC layer of IEEE 802.16e

- Task and Functions
- Connection Identifiers (CID)
- Selected MAC PDU types
- Bandwidth Request MAC PDU
- Quality of Service in WiMAX
- MAC Related Network Entry
- Key Generation through PKMv2 and EAP
- Operation modes

## 6- Important Scenarios

### 6.1- Initial Network Entry

### 6.2- EAP-SIM procedure

### 6.3- Handover procedures

## 7- The WiMAX Business Plan

## 8- Modeling Network Customers

### 8.1- Customer Offered Traffic (COT)

### 8.2- Operator Offered Services (OOS)

### 8.3- Customer Distribution Characterization

### 8.4- RF Environment Characterization

### 8.5- Customer Terminal Models

- Radio Models
- Antenna Systems
- Radio Performance

### 8.6- Design Service Classes

## 9- The RF Channel

### 9.1- RF Channel Characteristics

### 9.2- Channel Models

### 9.2- Propagation Models

### 9.3- RF Interference Modeling

## 10- The 50 steps in designing an LTE Network

### 10.1- GIS

### 10.2- Project Configuration

### 10.3- Site Location

### 10.4- Network Optimization

- Network Footprint Enhancement
- Network Resource Optimization
- Network traffic Simulation
- Network Statistics

- 10.5- Network Performance
  - Network Predictions
  - Key Parameter Indicators
- 10.6- Network Backhaul Design
- 10.7- Network Report