# LTE Advanced (LTE-A) - Explained

## Course Outline

**NanoCell Networks Pvt Ltd**
"SRI SAI", # 352, 8th Main, 4th Block
Basaveshwaranagar, Bangalore
INDIA – 560079
Phone: +91 80 41712424

## Course Description:

It is an overview course on 4G LTE advanced. The key concepts behind LTE-advanced (LTE R10 and future releases) will be covered as part of this course. The participants will be able to understand the key ideas being pursued by 3GPP as a part of LTE evolution. The benefits due to the new technologies and the impacts on the various elements of the network will be highlighted.

## Target Audience:

The target audience for this course includes:

- Mobile Device Engineers
- Field Engineers, BSS Engineers
- Network Engineers and Design Engineers, O&M Engineers
- Software Developers and Testers

## Delivery Method:

The delivery will be instructor-led classroom training with extensive practical case studies, interactive discussions and Q&A / quiz sessions

## Course Material:

The course material will be in the form of Presentation Slides (Hardcopy OR Protected Softcopy)

## Pre-requisites:

The participants are expected to have prior knowledge of:

- Basic Mobile Network Architecture
- Knowledge on 2G/3G/LTE Basic Technologies

## Duration:

2 days

## Revision:

1.0

# Course Outline

## Overview of LTE-Advanced

- Expectations of 4G wireless technology
- IMT-Advanced specifications
- 3GPP Evolution
- Key components of LTE advanced (R10 and future)
- UE categories
- Deployment Aspects

## Air-interface enhancements

- Carrier Aggregation
  - Intra-band and inter-band aggregation
- Control plane protocols
- Cross carrier scheduling
- User plane protocols
- Acquisition and connection establishment
- Component carrier management
- UL MAC enhancements
- UL transmitter and receiver enhancements

## MIMO advances and their impact

- DL MIMO schemes; 8-antenna MIMO and enhanced MU-MIMO
- Enhanced reference signals
- CoMP – principle , challenges, and scenarios

## HetNets

- Types of HetNets in LTE-Advanced
- Relay operation with self backhaul
  - Relay protocol architecture
  - Backhaul physical channels and scheduling

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- o Backhaul HARQ
- Pico eNB / small cells support
  - o Enhanced Inter-cell interference coordination (EICIC)
  - o Almost blank sub frames (ABS) and their usage
  - o X2 interface enhancements for EICIC
  - o Interference cancellation methods
- Home eNB
  - o Managing interference in Home eNB deployments
  - o CSG issues and their management
- Remote radio heads

## Data Transmission Aspects

- System acquisition and synchronization signals
- PDCCH changes from LTE to LTE-A
- DL data transmission; reference signals, MIMO modes
- UL data transmission; MIMO modes
- Data rate calculations in DL and UL

## Other topics

- Self organizing networks (SONs) and their role
  - o Automatic neighbour discovery
  - o Physical cell ID management
  - o RACH optimization
  - o Minimization of drive testing
  - o Energy savings
- Location services in LTE networks
  - o ECID,OTDOA, A-GNSS, and other methods
  - o LPP and SUPL protocol
  - o New elements in EPC
- Release update summary
- Migration from LTE to LTE-Advanced