

## MBG: LTE mobile systems

### Online course specification

**Target audience:**

This online course is designed for those who are, or intend to be, involved in planning or commissioning LTE mobile systems.

**Course aim:**

This course describes mobility in, and the provision of services over, LTE (4G) mobile systems. This course also discusses how the enhanced performance provided by an LTE Advanced system is achieved.

**Course level:** Advanced

*An explanation of PTT course levels is given at the end of this document*

**Pre-requisites:**

You will get the most out of this course if you already have an understanding of the role and operation of the functional components of a UMTS (3G) system, and the principles of operation of the LTE radio access network and Evolved Packet Core. It is recommended that the PTT e-learning course "LTE (4G) mobile radio networks" is studied before attempting this course.

**Course structure:**

The course consists of the following 6 modules:

1. Course introduction
2. Quality of service
3. LTE mobility
4. LTE voice and SMS services
5. LTE Advanced
6. Release 11 and beyond

**Module 1:** Course introduction

Module aim: To summarise the aims of each module and introduce the navigation and learning facilities provided by the course.

**Module 2:** Quality of service

Module aim: To describe the factors that determine the Quality of Service (QoS) requirements for a particular service and explain how a LTE Evolved Packet System delivers the required QoS.

After completing this module, a trainee will be able to:

- describe the purpose of a Service Level Agreement (SLA) and the topics typically specified in such a document.
- describe the determination of QoS (Quality of Service) requirements for diverse types of traffic.
- explain the purpose of an Evolved Packet System (EPS) bearer with reference to the provision of data services with a defined QoS.
- explain and compare the purpose and benefits of default and dedicated bearers.

- explain the functions of the Policy and Charging Rules Function.
- describe the UE registration procedure with reference to the provision of a default bearer.
- describe how dedicated bearers are established with reference to the interaction of the EPC with an IP Multimedia System (IMS).

### **Module 3: LTE mobility**

Module aim: To discuss the Evolved Packet Core (EPC) interfaces, protocols and procedures involved with mobility management and interworking with other mobile systems.

After completing this module, a trainee will be able to:

- list the various interfaces between EPC entities, their functions during typical LTE interactions and the protocols used for data transfer and signalling over the interfaces.
- describe the role and significance of tracking areas.
- explain mobility management with reference to the various mobility states.
- describe arrangements for interworking with Release 7 and earlier 3GPP systems and with non-3GPP access systems like WiFi and CDMA2000®.

### **Module 4: LTE voice and SMS services**

Module aim: To describe and compare the various ways of providing a telephony and short message service over an LTE mobile system.

After completing this module, a trainee will be able to:

- explain that an LTE network does not provide circuit switching for voice calls and describe the barriers to offering packet switched telephony.
- explain how a voice service can be provided by requiring a mobile device to handover from the LTE system to a 2G or 3G radio access network ("CS fallback") for voice calls.
- explain how a voice call can be controlled by the CS domain of a 2G/3G network without requiring handover from the LTE RAN to 2G/3G by the use of a VoLGA Access Network Controller (VANC).
- describe the basic functions of the key components of a IP Multimedia Sub-system (IMS).
- explain the role of EPS bearers in establishing a Voice over IP (VoIP) call in a Voice over LTE (VoLTE) system.
- describe the interaction between a UE and an IMS in setting up a VoIP call in a VoLTE system.
- explain how a VoIP call can be maintained while handing over between an LTE radio access network (RAN) and a UMTS RAN.
- describe three ways of providing an Short Message Service to a mobile device attached to an LTE radio access network.

### **Module 5: LTE Advanced**

Module aim: To describe the benefits of LTE Advanced mobile systems and the techniques employed to provide their enhanced performance.

After completing this module, a trainee will be able to:

- list the performance gains offered by LTE Advanced in terms of data transfer capabilities and latency.
- describe the use of spectrum aggregation to increase data transfer speeds.
- describe the enhanced MIMO techniques employed by LTE Advanced systems to increase data transfer speeds and/or reduce interference.

- describe the concept and benefits of a heterogeneous radio access network.
- describe methods of minimising interference between cells in a heterogeneous RAN including ICIC and Enhanced ICIC.
- describe the role and benefits of relay nodes in a radio access network.

#### **Module 6: Release 11 and beyond**

Module aim: To describe the enhancements and new facilities provided for LTE Advanced by the 3GPP releases after Release 10.

After completing this module, a trainee will be able to:

- explain that the development of LTE Advanced has continued beyond Release 10 to enhance its performance and add new facilities.
- describe the concept, role, and applications of Massive MIMO aerial arrays with reference to the constraints on its use.
- describe the role and principles of Coordinated Multipoint transmission and reception.
- explain that the practicality of employing CoMP depends on the architecture of the existing radio access network.
- describe and compare the characteristics of HD Voice and Evolved HD Voice with reference to the interworking between these voice services.
- describe the facilities required by a critical communications (public safety) systems.
- explain that 3GPP is working on adding the facilities required by emergency services to the standards for LTE.
- describe the concept and possible applications of LTE-based machine type communications and describe the special characteristics required by these machines.

**Course access requirements:**

To access the course, a computer running a browser such as Google Chrome, Safari etc is required. The computer should have Internet access. A screen resolution of at least 1024x768 is necessary.

**Learning facilities:**

This online course employs interactive simulations, hypertext links to an online glossary and multiple-choice question sessions to fully involve the trainee in the learning experience. Each module provides revision links to previously studied, relevant topics. A record of progress and level of achievement is recorded for each trainee. Once studied as a structured, assessed course, the content can be browsed for revision or reference.

**PTT course levels:**

PTT online courses are categorised by one of three levels according to the depth of treatment they provide:

**1. Introductory:**

PTT Introductory courses are designed for those with no previous experience or knowledge of telecommunications. These courses provide an overview of telecommunications or discuss the fundamentals of electronic communications. The study of general science at secondary (high) school is a typical pre-requisite for PTT Introductory courses.

PTT Introductory courses are suitable for those joining the telecommunications sector particularly those in an apprenticeship programme.

**2. Intermediate:**

PTT Intermediate courses are designed for technicians and engineers requiring an understanding of a certain aspect of telecommunications. Those planning to study an Intermediate course should have an understanding of the basic principles of electronic communications.

The depth of treatment provided by Intermediate courses is typically equivalent to level 3 of a UK national vocational qualification (NVQ). PTT Intermediate courses can be used to support the attainment of a Communications Technology NVQ at level 3.

**3. Advanced:**

PTT Advanced courses are designed for those who require an in-depth treatment of a certain aspect of telecommunications. Such courses are suitable for system designers as well as those who will be responsible for the maintenance of the system described in the course.

Those planning to study a PTT Advanced course should have a background in telecommunications, and an understanding of telecommunications fundamentals and the principles of the type of telecommunications system described in the course.

PTT  
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