

DVB-H from A - Z

Digital Video Broadcasting to the Handheld

Course Duration:

- ▶ 2 days.

Course Description:

- ▶ This course addresses the needs of engineers and technicians, who need to get familiar with Multimedia Broadcast technologies in general and the Digital Video Broadcast to the handheld in particular.
- ▶ The course starts with an overview of the important video broadcasting technologies, such as Digital Video Broadcasting (DVB), Digital Multimedia Broadcast (DMB), Multimedia Broadcast / Multicast Service (MBMS), Advanced Television Systems Committee (ATSC) and their area of application (stationary desktop, in-car usage, handheld devices).
- ▶ With the general broadcasting overview and competing technologies in mind, we will then focus on the specific architecture of DVB-T and DVB-H. We will explain the logical functions, network entities, operation modes and present some important scenarios.
- ▶ Typical operations from the UE point of view will be explained using FLASH animations.
- ▶ The course continues with the elaboration of important key technologies for DVB-T / H like OFDM, COFDM and the modulation schemes used for the subcarriers (16-QAM, and 64-QAM), comparison to other DVB transmissions (DVB-S, DVB-C) with QPSK and 32-QAM.
- ▶ An important focus is on DVB transport, the frame structure of streams such as Elementary Stream (ES), Packetized Elementary Stream (PES), MPEG2 transport stream (MPEG2-TS) and the control of media packets in such streams.
- ▶ The physical layer section will be completed with a detailed review of the DVB-H specific enhancements as compared to DVB-T, such as IP based MPE over DVB-T and the DVB-H specific TPS signaling.
- ▶ The DVB-H link layer functions, such as Multi-Protocol Encapsulation (MPE) with FEC, Time-Slicing, Handover / Cell Reselection will be presented as the key features of DVB-H.
- ▶ We will then review the higher layer protocol architecture and service delivery from applications. This includes detailed considerations of RTP / RTCP and FLUTE as bearer independent service delivery protocols.
- ▶ The final chapter is dedicated to selected important scenarios of DVB-H operation such as setup and operation of a streaming session, a file download session and delivery of Web pages (webcasting).

Pre-Requisites:

- ▶ It is useful, if the student already has some basic technical understanding of mobile technologies, such as GSM and / or UMTS as well as a general knowledge about the TCP/IP protocol architecture.

Course Target:

After the course, the student will be able to ...

- ▶ describe all technical aspects of the new broadcast technology development and how it compares to other broadcast technologies such as MBMS and DMB.
- ▶ Fully understand the architecture, technology background and implementation impact for the DVB-H service, rollout and operation of both terminal and network related components.

Some of your questions that will be answered:

- ▶ What is Broadcast and Multicast, what are the most popular technologies behind and what are the fields of operation?
- ▶ What does the DVB architecture and look like, where is it based upon and what is DVB-H in particular?
- ▶ What are MPEG streams and how are they applied in DVB-H?
- ▶ How does time-slicing work and does it contribute to power saving in UE's?
- ▶ What is OFDM and COFDM and which modulation schemes are applicable to DVB-T and DVB-H?
- ▶ How do DVB-T and DVB-H relate to each other, what are the differences and why?
- ▶ What is IP Datacast and why is it only applicable to DVB-H?
- ▶ What is FLUTE and how does it work?
- ▶ What are PSI tables and how are they used for service discovery?
- ▶ How does the exchange of security keys and content protection work in DVB?

Who should attend this class?

- ▶ The course is mainly targeted at students who need an introduction to all aspects of Mobile TV technology, equipment and required network architecture, such as UE vendors, infrastructure vendors, network operators and development/testing/operating staff who need to understand, operate and maintain broadcast / multicast services.

Table of Contents:

Overview of Broadcast / Multicast Technologies

- **Important Digital Video and Audio Broadcasting Technologies**
 - ⇒ Broadcast vs Multicast
Content and Service Provision:, Distribution:, Broadcast mode:, Multicast mode:
 - ⇒ Some Important Broadcast Technologies
DVB, DAB, , DMB, ISDB, MBMS, BCMCS, ATSC, MBSAT, FLO
 - ⇒ Broadcast Distribution Types
Satellite Distribution, , Terrestrial Distribution, , Cable Distribution, Cellular Distribution, Hybrid Satellite / Terrestrial Distribution, IPTV
 - ⇒ Broadcast / Multicast in 3G and 4G Networks - MBMS
MBMS Overview, The Broadcast-Multicast Service Center (BM-SC) (Membership function, Proxy and Transport, Session and Transmission, Service Announcement , Key Management, File Repair, Time Synchronisation)
 - ⇒ Protocols at the Gmb Interface
 - ⇒ Overview of MBMS Service Phases
 - ⇒ MBMS Service Areas
 - ⇒ Overview of Multicast Mode Service Phases
Multicast Service Timeline Example Exercise
 - ⇒ IPDC over MBMS
 - ⇒ Overview of a DVB System
DVB Architecture
 - ⇒ DVB Standards and System Overview
 - ⇒ Key Characteristics of Important DVB Distribution Systems
 - ⇒ DVB-S / S2 Parameters
 - ⇒ DVB-C / C2 Parameters
 - ⇒ DVB-T / T2 Parameters
- **DVB-H as mobility enhancement to DVB-T**
 - ⇒ Important DVB-H Features of the Physical Layer
 - ⇒ Important DVB-H Features of the Link Layer
 - ⇒ Comparison of MBMS and DVB-H Protocol Structures
 - ⇒ Frequency Bands Overview – Example: European Situation

- **Comparison between DVB-H and some other broadcast technologies**

Terrestrial DVB transmission with DVB-T

- **DVB-T/H Architecture Overview and Operation**
 - ⇒ Video Encoding
Image Description
 - ⇒ Audio Encoding
Image Description
 - ⇒ Elementary Stream Example
 - ⇒ Packetized Elementary Streams
PES Header Details (PES Indicators, Option Fields indexed by PES Flags)
 - ⇒ MPEG2 Transport Stream Generation
Where does the MPEG2-TS Packet size come from?
 - ⇒ The DVB-T Modulator / Transmitter Overview
Remultiplexing and Randomization, Outer FEC, Interleaver, Inner Coder and Inner Interleaver, Modulation, MPEG-2 TS Frame Coding at DVB-T Transmitter (MPEG-2 Transport Frame, Reed Solomon FEC, Interleaving), Convolutional Coder Principle (The Rate of a Convolutional Coder, The Constraints Length, The Number of Combinations), Puncturing Principle – Different Code Rates (The Principle of Puncturing)

Fundamental Technologies

- **More MPEG Details for DVB Transmission**
 - ⇒ MPEG Standards Overview
 - ⇒ What is a MPEG2 Transport Stream?
 - ⇒ Transport Stream Packet Header Details
Sync Byte, Transport Error Indicator, PID, Continuity Counter, Header extension, Discontinuity indicator, Time stamps
 - ⇒ Optional Adaptation Field Details
Program Clock Reference (PCR), Splice countdown, Transport private flag
 - ⇒ Program Synchronisation with PCR, DTS, PTS
 - ⇒ Program Specific Information
 - ⇒ Details of MPEG-2 Sections
 - ⇒ PSI / SI Table Organisation Example
 - ⇒ MPEG-2 Multi Program Transport Streams
, Practical Exercise:
 - ⇒ MPEG / DVB Information for the Receiver
- **What is OFDM?**

- **... And what is COFDM?**
- **COFDM in DVB-T/H**
 - ⇒ Impact of Orthogonality in the Frequency Domain – 3 Steps
 - ⇒ Practical Exercise: Physical Basics of OFDM / OFDMA
 - ⇒ Practical Exercise: Scaling of OFDM / OFDMA-Systems
 - ⇒ The In-Phase – Quadrature (I/Q) Presentation
- **OFDM / OFDMA and IFFT**
 - Considering the Discrete Oscillator Array Option, Details of the IFFT Option (Why is it called F a s t Fourier Transformation?)
 - ⇒ Modulation Scheme Overview
 - ⇒ Using different Modulation Schemes on Different Subcarriers
 - ⇒ Tackling Inter-Symbol Interference (ISI)
 - Introduction, Delay Spread, Cyclic Prefix – Guard Interval (Variable Duration and other Assets of the Cyclic Prefix, Guard Interval in DVB-T OFDM)
 - ⇒ OFDM in DVB-T
 - ⇒ Layout Principle of a DVB-T OFDM System
 - Remarks on the Brick Wall Image, Subchannelization , Pilot Subcarriers, Continual Pilot Subcarriers, Data Subcarriers, Null Subcarriers, Scattered Pilot Subcarriers, TPS Subcarriers
 - ⇒ Distribution of Scattered Pilots over a DVB-T OFDM Frame
 - ⇒ TPS – The Signaling Channel in DVB-T
 - Init Bit – Bit 0, Synchronization – Bit 1 – Bit 16, Information – Bit 17 – Bit 39, Reserved - Bit 40 – Bit 53, Error Protection - Bit 54 – Bit 67, Details of the TPS Parameters (Length indicator – Bit 17 – Bit 22, Frame number – Bit 23 – Bit 24, Constellation – Bit 25 – Bit 26, Hierarchy information – Bit 27 – Bit 29, Code rates – Bit 30 – Bit 35, Guard Interval – Bit 36 – Bit 37, Transmission Mode – Bit 38 – Bit 39, Cell Identifier – Bit 40 – Bit 47, DVB-H Signaling – Bit 48 – Bit 49, Non-Hierarchical DVB-T Constellations, Hierarchical DVB-T Constellation Example QPSK in 64-QAM, The Effect of Factor Alpha in Hierarchical Constellations, Hierarchical Modulation Principle)

DVB-H – Mobile TV to the Handheld Terminal

- **DVB-H Enhancements Overview**
 - ⇒ The DVB-H Encoder
 - Multi Protocol Encapsulation (MPE), MPE Example, DSM-CC Sections – MPE Sections, DVB-H MPE Section Details , DVB-H Payload in MPE and MPE-FEC Sections, DVB-H Time Slicing, DVB-H Handover (What is a SFN, DVB-H operation with a SFN)
 - ⇒ DVB-H Transmitter Enhancements
 - OFDM Modes and Inner Interleaver, TPS Signals

IP Datacast over DVB-H

⇒ IPDC over DVB-H

- **Operation of RTP and RTCP**

⇒ SSRC (Synchronization Source / 32 bit)

⇒ Payload Type / Media Type

⇒ CSRC (Contributing Source / 32 bit)

⇒ Timestamp Information

⇒ Format of the RTP-Header

Version, P-Bit (Padding), Ext-Bit (Header Extension), CSRC-Count, M-Bit (Marker), Payload Type, Sequence Number, Timestamp, Synchronization Source (SSRC), Contributing Source (CSRC), Extension Header

⇒ Tasks and Functions of RTCP

Quality Report Transfer, Session Control, CNAME (SSRC Binding)

-

- **Details of the FLUTE protocol and usage in MBMS**

⇒ Operational Overview of FLUTE

⇒ Service Distribution with FLUTE

⇒ Segmentation of Data with FLUTE

DVB-H Outlook and Enhancements

⇒ Hybrid Satellite / Terrestrial Network

- **Outlook, Ongoing Activities**

⇒ Studies on handover extensions

⇒ Studies on common signalling management for DVB, MBMS and WiMAX

⇒ Studies on interactive return channels over various technologies

- **Solutions for the Exercises**