

## Course Description

This Hands-On course provides a technical engineering study of television broadcast systems and infrastructures by examining the delivery of TV images for SDTV broadcast quality where MPEG-2 has been used for many years. It will also examine what is required for HDTV using MPEG-4 or H.264 and for delivering compressed television to handheld devices.

Broadcasting systems depend upon delivery over MPEG transport streams so the course will examine how MPEG-2 transport streams can be used to carry services encoded in MPEG-2, MPEG-4 and H.264. Hands-on demonstrations and analysis of services will be used to explore the actual operation of real services. This will provide an understanding of how service information is delivered and how conditional access is encoded. The course will also examine the architecture of set top boxes for DVB-T and address the issues of middleware and chip-sets.

DVB-H can be used to deploy services for either broadcast/multicast or video on demand. These services run over IP and deploy IPTV techniques. Demonstrations of how video can be delivered over IP will be run in the classroom and protocol analysers used to explore the technical mechanisms and protocols used.

## Students Will Learn

- Describe In Detail DVB-T And DVB-H Digital TV Services
- Identify How TV Can Be Encoded Using MPEG-2, MPEG-4 And H.264
- Analyze And MPEG-2 Transport Stream To Identify Video, Audio, Program Service Information And Other Service Information
- Describe How To Multiplex Channels Are Carried
- Analyze IPTV Streams To Understand How RTP/UDP/IP Are Used

- Deploy The Scrambling Used For Conditional Access Systems
- Describe The Architecture And Design Of Set-Top Boxes
- Appreciate The Key Elements Needed In Mobile Terminals To Render DVB-H
- Design And Size Networks To Carry DVB-H Services
- Appreciate The Trend In The Technologies
- And Much More

## Target Audience

This course is intended for developers, technically qualified users, system integrators, application builders and those who need a technical overview who are new to Digital TV systems used in the TV industry.

## Prerequisites

No prior background in electronics, transmission or programming will be assumed and the course will concentrate upon functional aspects and technology comparisons rather than in the construction of the electronics themselves. A background such as that obtained from the one day DVB-T and DVB-H overview will be assumed.

## Course Outline

Module I: MPEG Encoding in DVB Services

Encoding in MPEG-2

Source Encoding

MPEG Compression Concepts

Discrete Cosine Transforms

Prediction and Interpolation

Reordering

Motion: Prediction, estimation and compensation

I, P and B Pictures

MPEG Levels and Profiles

Framing Formats

Multiplexing of Signals

Packetized Element Stream(PES)

Decode Time Stamp (DTS)

Presentation Time Stamp (PTS)

System Clock Reference (SCR)

Quantization of Program and Transport Streams

Hands-on Exercise encoding Video in MPEG-2 using different rates

Module II: MPEG-4 and H.264 Standards

Video Objects (VO)

Video Object Plane (VOP)

I-VOP, P-VOP, B-VOP

Short Header Mode

Motion Vectors

Video Packet Structure

MPEG4 Part 10 and H.264

Syntax of Encoding

H.264 Modes: I, P, B, SP and SI

Slices and Macro Blocks

Macro Prediction

Intra Prediction

Luma, Chroma and Signalling prediction

Deblocking Filter

Transform Quantization

Reordering

B Slices and Reference Pictures

Weighted Prediction

Context-based Adaptive Binary Arithmetic Coding (CABAC)

Extended Profiles

SP and SI Slices

Stream Switching

MPEG-2/MPEG-4/H.264 Comparisons

Hands-on Comparison between MPEG-2, MPEG-4 and H.264 encoding

Module III: MPEG Transport Streams and Packets

Transport stream format

MPEG Packets and headers

Service Information (SI), Program Specific Information (PSI)

Data Broadcasting DSM-CC

MHP Signalling

Program Allocation Table (PAT)

Program Map Table (PMT)

Conditional Access Table (CAT)

Network Information Table (NIT)

Service Description Table (SDT)

Event Information Table (EIT)

Effect on STB Behaviour

Channel Coding and Forward Error Recovery

Energy Dispersal

Reed-Solomon Coding

Convolutional Coding

Interleaving

Trellis Decoding

Temporal Spreading

Hands-on Exercise Analysing MPEG-2 Transport stream from DVB-T

## Module IV: IPTV Delivery

Next Generation Network Technology

Internet Protocol (IP) Delivery

Internet delivery options

TCP and UDP

RTP and RTCP

Studio to distributor delivery

IP Delivery mechanisms

Unicast vs Multicast

Multicasting Addressing and Protocol Issues

PIM and IGMP

Quality of Service Issues

MPLS

21st Century Network Implications

Triple Play and Quad Play Networks

Internet TV Portals

Hands-on Demonstration of Multicast IPTV delivery

Hands-on Analysis of IPTV Protocol Stack and MPEG-2 transport stream using a Protocol Analyser

Hands-on Analysis of VoD service MPEG transport

## Module V: Conditional Access

Conditional Access Mechanisms

CA Standards

DVB-CSA

Simulcrypt & Interoperability

Common Interface

Encryption

Entitlement Management Messages (EMM)

Entitlement Control Messages (ECM)

Encoding ECM and EMM into the transport stream

Subscriber Management Systems (SMS)

Smartcards and how do they work

Pay-Per-View (PPV) & Impulse-Pay-Par-View (IPPV)

Protected and Conditional Access Key interfaces

Encryption Mechanisms

Symmetric and Asymmetric Key Systems

Public Key Infrastructures

RSA Encryption

Key Distribution

Security Issues

Authentication

Protected Broadcast Driver Architecture

Digital Rights Management

Watermarking

Module VI: Set-Top Boxes

STB architecture

Main chipset vendors

Inside a digital STB

STB middleware

Functions of middleware

Middlewares:

MHEG5, goals, features, certification and limitations

MHP, goals, features, certification and limitations

OpenTV, goals, features, certification and limitations

MediaHighway, goals, features, certification and limitations

NDS Core , goals, features, certification and limitations

STB software stack

Customer Interface Issues:

Analog Video Reception

Digital Video Reception

Migration issues from Analogue to Digital

Consumer Electronics Interface

Equipment Compatibility

Networking Interfaces

Decoding Mechanisms

Personal Video Recording Interfaces

In-Home Networking

Hands-on Demonstration of Video On Demand Control Protocols

Module VII: Digital Video Broadcasting for Hand-held

Conceptual structure of DVB-H receiver

Using a DVB-H system (sharing a MUX with MPEG services)

Time-slicing

MPE-FEC

4K mode and in-depth inter-leavers

Data-casting

An overview of the architecture

Nodes and traffic cases

CBMS Reference Points

DVB-H signalling

DVB-H and 3G

DVB-H Physical Layer

Digital Video Broadcasting (DVB)

T-DMB DVB-H Comparison

Framing Structure

Channel Coding

TPS-bit signalling

Modulation for digital terrestrial television (DVB-T)

DVB-H Link Layer

Link Layer Issues

Multi-Protocol Encapsulation (MPE)

Time-slicing

MPE-FEC

Memory Issues

Hands-on Demonstration: Problems multicasting over Wireless

Module VIII: MPEG Service Information

Types of Service: Broadcast, Video Streaming, VoD

Specification for Service Information (SI) in DVB Systems

Content delivery protocols

DVB-H Service Access

Delivery system descriptor

Cell list descriptor

Use of time-slicing and optional MPE-FEC

Support of detection of DVB-H system services on a transport stream

Support of hand-over between transport streams

Network Issues

DVB-H Networks

## System Information and Use

General principles for using DVB-H system

Reference receivers

Coverage Issues

Hands-on Analysis of MPRG Service Information

## Module IX: Industry Trends

Transmission innovations

HDTV and Improved Quality

Connected Home

Convergence Protocols

Evaluation and Review

## 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

4 Days