Hands-On

Modern TV Broadcasting

and HDTV Systems

Course Description

This Hands-On course examines the delivery of TV images for SDTV and HDTV to broadcast quality where MPEG-2 has been used for many years. However to deliver higher resolutions without more bandwidth greater compression is needed so the course will examine advanced Video encoding, MPEG-4 and H.264.

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. It 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 and address the issues of middleware and interfaces for digital display technology and audio output for modern home theater interfaces.

The course will examine and focus on NTSC/ATSC North American standards video and TV but will compare these with European PAL/DVB and BTSC standards.

Students Will Learn

- Describe The Evolution And Architecture Of Modern Digital TV Services
- Consider The Architecture Of Over-Air Terrestrial Digital TV Delivery Systems
- Compare The Impact Of Quality Of Experience And Image Profiles Used
- Size Video Delivery Options
- Identify How To Multiplex Channels, Video Pictures And Sound Within An MPEG-2 Transport Stream
- Deploy The Scrambling Used For Conditional Access Systems
- Enhance Compression With MPEG-4 And H.264 Carried Over MPEG-2 Transports
- Compare The Effectiveness Of The Different Compression Approaches

- Identify The Key Interface Standards For DVI/HDMI And
- Appreciate The Trend In The Technologies
- And Much More

Target Audience

This course is intended for Telecommunications professionals, developers, chip designers, application builders and those who need a solid technical overview of the latest techniques in digital TV broadcasting and HDTV 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.

Course Outline

Module I: Television Architecture and Evolution

Colour Television

NTSC, PAL, SECAM

Digital Video Broadcasting

Formats:

4:2:2, 4:2:0, CIF, QSIF

The Signals

Analog Television

- Teletext, captions and sub-titles

Digitally-Compressed Television

Digital Modulation :MPEG Hierarchy, MPEG1, MPEG2

Digital Video Broadcasting

Over-the-air broadcasting

Module II: Television Head-End Technology for Terrestrial Broadcast

Digital vs Analogue

Head-ends

Signal Reception

Head-end Signal Processing

Head-end Operation

Encoders and Multiplexers

Delivery Mechanisms

- DVB-T2
- DVB-S2
- DVB-C
- Docsys 3.0
- DVB-IPI

Broadband Distribution Systems

Module III: TV Distribution Systems

Terrestrial UHF/VHF Broadcast Delivery

Alternatives

- Satellite Television Delivery
- Cable Television Delivery
- IPTV Deliver

From head-end to viewer

Back-Channel

Set-top Box Issues

Next Generation Media Players

Integration of DVB-T and IPTV Service Features

Encoder Classification: MPEG-2, MPEG-4, H.264

ATSC Digital Video Broadcast Standards

ATSC Standards Structure

Comparison of ATSC Standards with ETSI DVB standards

ATSC and DVB-T frequencies and modulation compared

Module IV: MPEG Encoding

Source Encoding

MPEG Compression Concepts

Prediction and Interpolation

Reordering

Motion: Prediction, estimation and compensation

I, P and B Pictures

MPEG Levels and Profiles

Audio Compression

Framing Formats

Multiplexing of Signals

Hands-on Encoding MPEG-2

Module V: MPEG-2 Transport Streams and Packets

Transport stream format

MPEG Packets and headers

Service Information (SI), Program Specific Information (PSI)
Data Broadcasting DSM-CC

MHP Signalling

Packetised Element Stream(PES)

Decode Time Stamp (DTS)

Presentation Time Stamp (PTS)

System Clock Reference (SCR)

Quantization of Program and Transport Streams

Program Allocation Table (PAT)

Program Map Table (PMT)

NIT, SDT & EITs

Effect on STB Behaviour

Channel Coding and Forward Error Recovery

Energy Dispersal

Reed-Solomon Coding

Convolutional Coding

Interleaving

Trellis Decoding
Temporal Spreading

Hands-on Analyzing a transport stream to extract video and sound

Hands-on Analyzing an HDTV Transport Multiplex

Module VI:Conditional Access

Conditional Access Table (CAT)

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)

Module VII: MPEG-4 and H.264 Standards

Evolution of MPEG4 and H.264

MPEG-4 Parts

MPEG-4 Part 10

Related standards: JPEG and JPEG2000

Video Objects (VO)

Video Object Plane (VOP)

I-VOP, P-VOP, B-VOP

Short Header Mode

Motion Vectors

Video Packet Structure

Interlacing

Motion Compensation of VOP

Static Sprite Coding

Advanced Coding Efficiency (ACE)

Advanced Audio Coding (AAC)

Dolby Digital (AC3)

- Audio Codec 3, Advanced Codec 3, Acoustic Coder 3
- ATSC A/52

Texture Coding

Studio Quality Encoding

Reordering

Entropy Coding

Main Profile

B Slices and Reference Pictures

Weighted Prediction

Context-based Adaptive Binary Arithmetic Coding (CABAC)

Profiles and Extended Profiles

Hands-on MPEG-2/MPEG-4/H.264 Video Comparisons

Module VIII: High Definition Display Interfaces

Display formats: VGA SVGA XGA XGA+ SXGA SXGA+ UXGA QXGA QSXGA QUXGA HXGA HSXGA HUXGA

Widescreen variants: WQVGA WVGA WXGA WSXGA/WXGA+ WSXGA+ WUXGA WQXGA WQSXGA WQUXGA WHXGA WHSXGA WHUXGA

VESA DisplayPort Standard

Silicon Image TMDS

TMDS Overview

HDMI Source TMDS Characteristics

HDMI Sink TMDS Characteristics

Cable Assembly TMDS Characteristics

Hot Plug Detect Signal (HPD)

Link Architecture

Operating Modes Overview

Control Period

Video Data Period

Data Island Period

Packet Definitions

Encoding

Video Format Support

Video Timing Specifications

Pixel Encodings and Colour Depth

Video Quantization Ranges

Colorimetry

Compatibility with DVI

Digital Display Working Group (DDWG)

LVDS Interfaces

EIA-644 and 899

Module IX: Sound and Modern Home Theater Audio Interfaces

NICAM 728 Digital Sound

HDMI Audio

Relationship with IEC 60958 and 61937

BTSC Audio Standards

Audio Sample Clock Capture and Regeneration

Audio Sample Rates

Channel/Speaker Assignment

Audio/Video Synchronization

Audio Data Packetization

Control Configuration

InfoFrames

E-EDID Data Structure

HDMI Vendor-Specific Data Block

Enhanced DDC

Physical Address Discovery

Auto Lipsync Correction Feature

Connectors

Module X: Futures

Super HDTV

Cinema Quality Display

Module XI: 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

Module XII: Customer Interface Issues: Set-top Boxes

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

Protected and Conditional Access Key interfaces

Protected Broadcast Driver Architecture

Digital Rights Management

Watermarking

Review and Evaluation

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