



## IM2 - Display Port 1.1a

*This course covers the Display Port multimedia interface*

### Objectives

- The course describes the architecture of a DisplayPort source-cable-sink system.
- An introduction to Video and Audio standards is done prior to clarifying how this standards are transported through DisplayPort.
- The analog interface is studied in detail.
- The course clarifies information 8b10b coding / decoding schemes.
- Content protection mechanisms are also studied.

A more detailed course description is available on request at [training@ac6-training.com](mailto:training@ac6-training.com)

### Prerequisites

- A basic knowledge of multimedia standards (audio & video).

### Course Environment

- Theoretical course
  - PDF course material (in English) supplemented by a printed version for face-to-face courses.
  - Online courses are dispensed using the Teams video-conferencing system.
  - The trainer answers trainees' questions during the training and provide technical and pedagogical assistance.
- At the start of each session the trainer will interact with the trainees to ensure the course fits their expectations and correct if needed

### Target Audience

- Any embedded systems engineer or technician with the above prerequisites.

## Course Outline

### First day

#### INTRODUCTION TO DISPLAYPORT

- Chip-to-Chip or box-to-box utilization
- Layered architecture
- Pinout
- Forward drive channel and bi-directional auxiliary channel
- Mechanical specification
- Dual mode devices

#### PHYSICAL LAYER

- Hot plug / Unplug detect circuitry
- Main channel
  - 8b10b coding scheme, running disparity
  - Clock recovery logic
  - Channel equalization sequence

- Scrambling, whitening the spectrum, Scrambler reset
- Link quality measurement
- Transmitter and receiver electrical specifications
- Drive current and pre-emphasis level control
- Jitter requirements
- Auxiliary channel
  - Manchester II coding, self-clocking
  - Sync pattern, Stop condition
  - AC coupling
- Compliance test specification

## LINK LAYER

- Isochronous transport services over the main link
  - Enhanced framing mode
  - Link symbols over the main Link without video stream
  - Adapting the stream rate to the link rate
  - Stream reconstruction in the Sink
  - Extracting the secondary data packet
  - Stream clock recovery, synchronous vs asynchronous clock modes
  - Secondary data packet types, purpose of InfoFrames packets
- Auxiliary channel
  - Link and device management over the auxiliary channel
  - Source state machine
  - Arbitration control
  - Policy maker
  - Mapping of I2C onto AUX CH syntax
  - Address mapping for DPCD
- Compliance test specification
  - Device services test procedures
  - Device Link services test procedures

## Second day

### VIDEO STREAMS

- Video standard basics, SDTV, EDTV, HDTV
- Pixel mapping onto link lanes according to pixel coding
- Video timing format
- Direct drive display specification
- Embedded Display Port

### AUDIO STREAMS

- Audio basics, L-PCM coding, IEC standards
- Speakers mapping
- Scheduling of audio stream packet transmission
- Source / Sink device interoperability, audio format
- Structure of audio stream packets

### CONTROL AND CONFIGURATION

- The Display Data Channel [DDC] usage during configuration
- AVI info frame
- Audio info frame
- E-EDID data structure
- Source device behavior upon HPD pulse detection

## CONTENT PROTECTION

- HDCP specification (DRM)
  - Authentication of devices allowed to play HD content
  - Computation of shared key
  - HDCP over Display Port
  - Application to DVD-audio and super-audio CD
- DPCP specification
  - DPCP bulk encryption / decryption blocks
  - AUX CH transactions for DPCP