

## 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.

### Evaluation modalities

- The prerequisites indicated above are assessed before the training by the technical supervision of the trainee in his company, or by the trainee himself in the exceptional case of an individual trainee.
- Trainee progress is assessed by quizzes offered at the end of various sections to verify that the trainees have assimilated the points presented
- At the end of the training, each trainee receives a certificate attesting that they have successfully completed the course.
  - In the event of a problem, discovered during the course, due to a lack of prerequisites by the trainee a different or additional training is offered to them, generally to reinforce their prerequisites, in agreement with their company manager if applicable.

### Plan

#### 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

## Renseignements pratiques

**Inquiry : 2 days**