



## IM1 - HDMI 1.4a

### This course covers the HDMI multimedia interface

#### Objectives

- The course describes the architecture of a HDMI source-cable-sink system.
- An introduction to Video and Audio standards is done prior to clarifying how this standards are transported through HDMI.
- The analog interface is studied in detail, particularly the TMDS specification.
- The course clarifies information coding / decoding schemes.
- Content protection mechanisms are explained.
- Ethernet connectivity and audio return channel are also covered.
- This course has been delivered to several companies developing mobile phone chipsets.

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

#### Prerequisites

- Experience of a digital bus is recommended.

#### Plan

##### First day

#### INTRODUCTION TO HDMI

- Digital link between audio / video source and display or video-projector
- Pinout, source and sink requirements
- Status exchange through VESA DDC channel
- Optional HDMI Ethernet and Audio Return Channel (HEAC)
- Content protection technology
- Compatibility with Digital Visual Interface [DVI], adapter
- Mechanical specification, connectors Type A, B, C, D and E
- Dual link capability
- Maximum possible bit rates

#### PHYSICAL LAYER

- TMDS character time definition
- Single-ended differential signal, definition of the swing
- Sink clock recovery

- Line termination and equalization
- Source pre-emphasis
- Source and sink TMDS characteristics, eye diagrams
- I2C and CEC signal requirements
- Interface testing (compliance checklist)
- Lecroy QualiPHY HDMI test solution
- HEAC physical layer, MLT-3 signaling
- Simultaneous transmitting ARC and MLT-3 100BASE-TX signals
- Differential mode and common mode transmission characteristics

## **SIGNALING AND ENCODING**

- Clock channel, pixel rate
- Encoder mux
- Leading and trailing guard bands and preamble
- TERC4 data coding scheme
- Video data coding
- Purpose of auxiliary data
- Error correction
- Packet formats

## **VIDEO STREAMS**

- Video standard basics, SDTV, EDTV, HDTV
- 3D video format structure
- 3D transmission video formats
- Video data coding 24, 30, 36 or 48 bits
- Video control signals HSYNC, VSYNC
- Video data decoding
- Video format timing specification
- Color depth requirements
- Gamut-related metadata

## **Second day**

## **AUDIO STREAMS**

- Audio basics, L-PCM coding, IEC standards
- Audio sample clock capture and regeneration, N and CTS parameters
- Using a CEC feedback channel to adjust the clock in the Source device
- Audio, video synchronization
- Audio data packetization
- DST usage
- HEAC audio return channel

## **CONTROL AND CONFIGURATION**

- I2C basics
- The Display Data Channel [DDC] usage during configuration
- VESA enhanced display data channel standard
- Physical address discovery algorithm
- AVI info frame
- Audio info frame
- E-EDID data structure
- CEA extension
- HDMI vendor-specific data block

- DVI / HDMI device discrimination
- Consumer Electronic Control
- CEC command description, remote control, AV-link protocol
- HEAC capability discovery and control
- CDC arbitration
- Channel states and transitions
- Activation of an HDMI channel
- HEC control for adjacent devices
- Message description
- Networking using 100BASE-TX
- Connection to internet via home network
- Switching, loop detection and removal

## CONTENT PROTECTION

- HDCP specification (DRM)
- Authentication of devices
- Computation of shared key
- Multimedia contents encryption
- HDCP over HDMI
- ACP packets

## Renseignements pratiques

**Duration : 2 days**  
**Cost : 1250 € HT**



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