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 training@ac6-training.com

Prerequisites

- Experience of a digital bus is recommended.

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 traineein 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 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 : 2070 € HT