MHL (Mobile high-definition link)

Technical overview

Key features of MHL:
- Plug-and-play HD media: 1080p/60 video and up to 108 MHz/7.1 surround sound audio
- Low pin count interface: HD video and digital audio over a 5-pin interface which includes control and power
- Power of the mobile device will supply power to the MHL device
- Content protection: full support of high-bandwidth digital content protection (HDCP)

Interface and pin assignment:

MHL link control bus (CBUS)

The pinout of the connector for the CBUS provides for the following functionality:
- A mechanism for channel management, to prevent the use of an MHL-compliant sink and source device, respectively
- A DDC interface for device control and compliance
- An MHL sideband channel (MSC) is provided for higher-level user functions such as automatic setup tasks or tasks typically associated with infrared remote control usage: remote control protocol (RCP), UTS-8 character protocol (UCP), request action protocol (RAP)

MHL voltage bus (VBUS)

The VBUS provides a minimum of 5 V VBUS (0) power between sink (e.g., TV) and source (e.g., mobile phone). The voltage is required for content protection:
- An MHL-compatible sink (CBUS) is provided for higher-level user functions such as automatic setup tasks or tasks typically associated with infrared remote control usage: remote control protocol (RCP), UTS-8 character protocol (UCP), request action protocol (RAP)

TMDS channel

TMDS protocol video and audio formats

Audio/video

Supported video formats

<table>
<thead>
<tr>
<th>Pixel format</th>
<th>Pixel clock</th>
<th>Frame rate</th>
<th>Bit depth</th>
</tr>
</thead>
<tbody>
<tr>
<td>YCbCr 4:2:2</td>
<td>1920 × 1080</td>
<td>50 Hz</td>
<td>24 bits</td>
</tr>
<tr>
<td>YCbCr 4:4:4</td>
<td>1920 × 1080</td>
<td>50 Hz</td>
<td>30 bits</td>
</tr>
<tr>
<td>YCbCr 4:4:4</td>
<td>1920 × 1080</td>
<td>60 Hz</td>
<td>30 bits</td>
</tr>
</tbody>
</table>

Audio sample rates

<table>
<thead>
<tr>
<th>Sample rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>44.1 kHz</td>
</tr>
<tr>
<td>48 kHz</td>
</tr>
<tr>
<td>96 kHz</td>
</tr>
<tr>
<td>192 kHz</td>
</tr>
</tbody>
</table>

Audio encoding

<table>
<thead>
<tr>
<th>Encoding</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-channel</td>
</tr>
<tr>
<td>6-channel</td>
</tr>
<tr>
<td>10-channel</td>
</tr>
<tr>
<td>20-channel</td>
</tr>
<tr>
<td>40-channel</td>
</tr>
</tbody>
</table>

Control period

<table>
<thead>
<tr>
<th>Control period</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 MHz</td>
</tr>
<tr>
<td>2 MHz</td>
</tr>
<tr>
<td>4 MHz</td>
</tr>
<tr>
<td>8 MHz</td>
</tr>
</tbody>
</table>

Data island

<table>
<thead>
<tr>
<th>Data island</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 MHz</td>
</tr>
<tr>
<td>2 MHz</td>
</tr>
<tr>
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</tr>
<tr>
<td>8 MHz</td>
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</tbody>
</table>

Supported color spaces

<table>
<thead>
<tr>
<th>Color space</th>
</tr>
</thead>
<tbody>
<tr>
<td>AdobeYCC601</td>
</tr>
<tr>
<td>AdobeRGB</td>
</tr>
<tr>
<td>sRGB</td>
</tr>
<tr>
<td>AdobeYCC709</td>
</tr>
</tbody>
</table>

Rohde & Schwarz solutions for MHL

www.the-av-experts.com
MHL (Mobile high-definition link) Technical overview

MHL is the new leading mobile device interface for transmitting video and audio. This interface can connect smartphones, tablet PCs and video cameras with display equipment such as TV sets, projectors and monitors. MHL uses the micro USB port which is already available on many mobile devices. The USB interface can be used for data connections to a PC as usual. When the built-in MHL transmitter chip recognizes an MHL sink, a control channel is established. MHL uses a single-wire data link which connects the source (TX) and sink (RX) devices.

Interfaces and pin assignment

- **Transmitter end (TX end) = source**
- **Receiver end (RX end) = sink**

**CBUS (MHL link control bus)**
- The CBUS provides a communications channel for DDC commands that is used by an MHL source device to determine the capabilities and characteristics (能力和特性) of a MHL sink device.

**VBUS (MHL voltage bus)**
- VBUS supplies +5V DC to the MHL sink. It is used for driving the MHL receiver and for power management.

**Interfaces**

- **Logical channels**
  - Control period
    - 0x00
  - Data island
    - t0
    - t1
    - t2

**Common symbols**

- **MHL+/MHL–**
- **CH1**
- **CH2**
- **CH0**

**Content**

- **Encryption**
- **Demodulation**
- **Modulation**
- **Logic**
- **Demodulation**
- **Modulation**
- **Logic**

**Audio/Video and Control**

- **MHL stream**
- **TMDS protocol**

**TMDS**

- TMDS is used to carry all audio and video data as well as auxiliary data (such as InfoFrame packets) that describes the active audio and video streams. The bit stream is modulated by a clock signal. In 24-bit mode, MHL uses a 24-bit mode to provide 16 bit per pixel.

**Supported color spaces**

- SD: ITU-R Rec. BT.601
- HD: ITU-R BT.709-5
- Additional: xvYCC, sYCC601

**Supported resolutions and frame rates**

- 1 640×480 (VGA) 59.94/60
- 2 1280×720p 50
- 19 1280×720p 59.94/60
- 19 1920×1080i 50
- 19 1920×1080p 59.94/60
- 20 1920×1080i 50
- 88.2 kHz 192 kHz 176.4 kHz
- 5QWTEGU/*.5RGEKƛECVKQP
- 5 & B
- 6 & 5
- 4 % 2
- 32 kHz 48 kHz
- 8 $ 75
- 75 $ 8 $ 75

**Modulation**

- 1x buffering
- ½x multiplier
- 4x clock multiplier

**Glossary**

- MHL link control bus,
- MHL voltage bus,
- TMDS protocol,
- MHL sideband channel,
- MHL stream,
- TMDS protocol video and audio formats,
- Video encoding,
- Audio formats

**Audio formats**

- L-PCM 8 channel audio
- 32 kHz 48 kHz
- 176.4 kHz

**Video formats**

- VGA 640×480
- XGA 1280×720
- Full HD 1920×1080
- 480p 59.94/60
- 1080p 59.94/60
- 1080i 60
- 1200×800 60
- 1680×1050 60
- 1920×1200 60

Rohde & Schwarz as a valued partner of consumer electronics manufacturers offers test and measurement solutions for MHL.