

# MHL (Mobile high-definition link)

## Technical overview

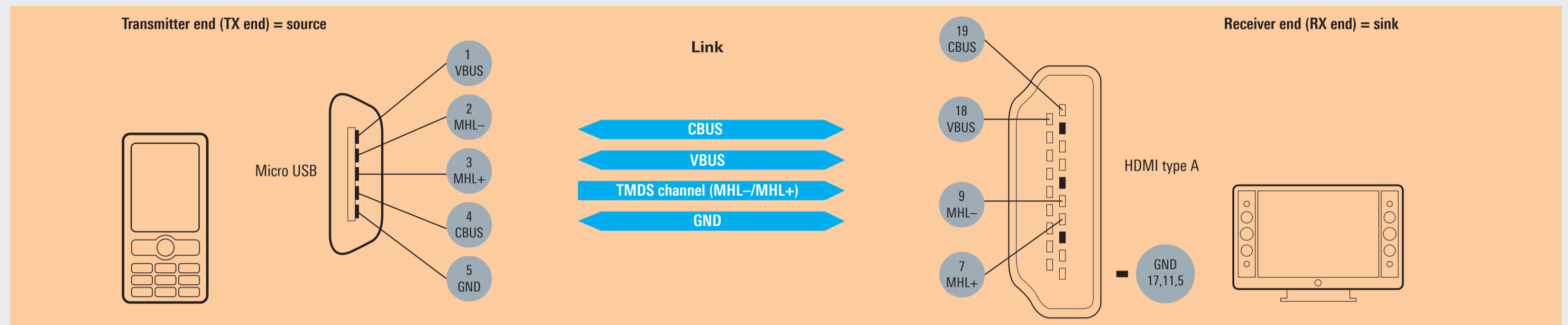
### Mobile high-definition link

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-capable receiver at the other end, it switches into the MHL transmit mode. The MHL transmitter then sends the AV data over two of the five pins on the micro USB port. The control signals are transmitted via one of the other pins. The 5 V line is used to charge the mobile device while transmitting.

### Key features of MHL:

- HD video and digital audio: 1080p/60 video and up to 192 kHz 7.1 surround audio
- Utilization of existing connectors
- Low pin-count interface: HD video and digital audio over a 5-pin interface which includes control and power
- Provision of power to the mobile device: 5 V and 900 mA
- Content protection: full support of high-bandwidth digital content protection (HDCP)

### Interfaces and pin assignment



### MHL link control bus (CBUS)

The point-to-point single-wire CBUS provides the following functionality:

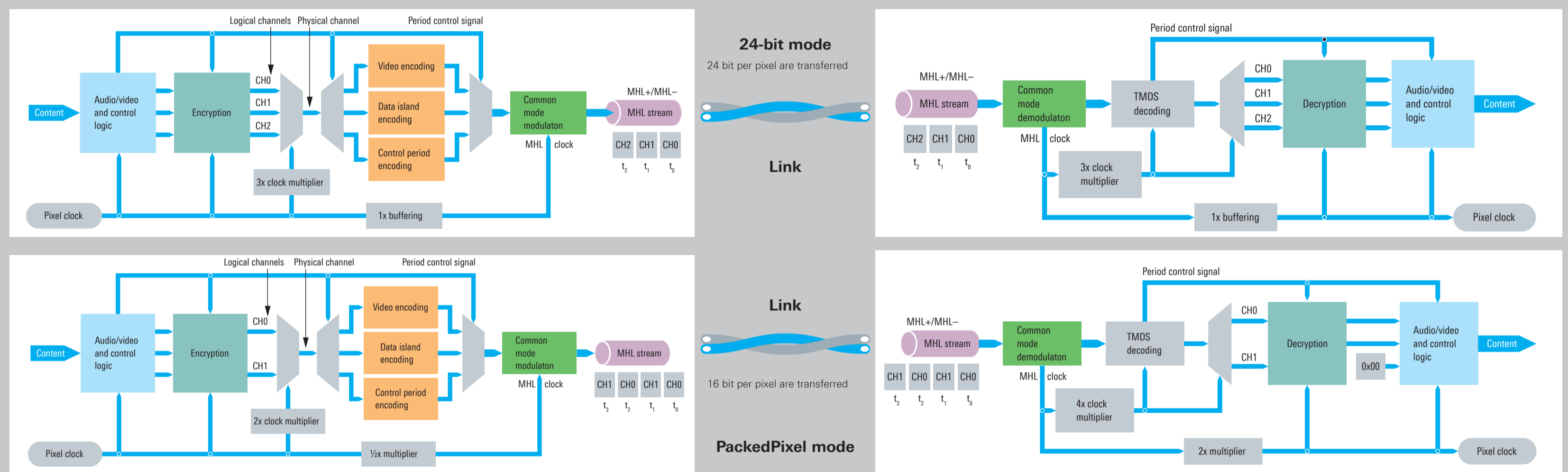
- A mechanism allowing source and sink devices to detect connectivity to an MHL-compliant sink and source device, respectively
- A communications channel for DDC commands that is used by an MHL source device to determine the capabilities and characteristics of the sink device by reading the EDID data structure
- A communications channel for DDC commands that is used by an MHL source device to initiate all register reads and writes required for content protection
- 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)

The CBUS has sufficient headroom to be used for other protocols in the future.

### MHL voltage bus (VBUS)

The VBUS provides a minimum of 5 V/900 mA power between sink (e.g. TV) and source (e.g. mobile phone).

### TMDS channel



### TMDS protocol video and audio formats

Supported video formats			3D video modes			Pixel encoding		Supported color spaces	
Index	Mode	Refresh	Index	Mode	Refresh	3D mode	YCbCr 4:2:2	SD: ITU-R Rec. BT.601	HD: ITU-R BT.709-5
1	640x480 (VGA)	59.94/60	4	1280x720p	59.94/60	top-bottom frame sequential	YCbCr 4:4:4	Additional: xvYCC, sYCC601, AdobeYCC601, AdobeRGB	
2,3	720x480p	59.94/60	19	1280x720p	50	frame sequential left-right	RGB 4:4:4		
17,18	720x576p	50	5	1920x1080i	59.94/60	frame sequential left-right			
4	1280x720p	59.94/60	20	1920x1080i	50	left-right			
19	1280x720p	50	32	1920x1080p	24	top-bottom frame sequential			
5	1920x1080i	59.94/60							
20	1920x1080i	50							
16	1920x1080p	59.94/60							
31	1920x1080p	50							
34	1920x1080p	30							
6,7	720 (1440)x480i	59.94/60							
21,22	720 (1440)x576i	50							

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 single differential channel to transmit TMDS data that, for example, is carried over three different channels in DVI. The incoming three-channel data needs to be packed into one TMDS channel at the TX end and unpacked into three channels at the RX end. There is one TMDS encoder at the TX end and one TMDS decoder at the RX end. TX data is multiplexed into a single lane prior to being encoded. RX data is decoded prior to being demultiplexed into three lanes. In PackedPixel mode, only two channels are multiplexed: channel 0 and channel 1. One clock period of the MHL clock equals two periods of the pixel clock. Each period of the MHL clock transmits four TMDS characters.

**Glossary:**  
**CBUS** = MHL link control bus, **DVI** = digital visual interface, **E-EDID** = enhanced extended display identification data, **GND** = ground, **HD** = high definition, **HDCP** = high-bandwidth digital content protection, **HDMI** = high definition multimedia interface, **MHL** = mobile high-definition link, **MSC** = MHL sideband channel, **RAP** = request action protocol, **RCP** = remote control protocol, **SD** = standard definition, **TMDS** = transition-minimized differential signaling, **UCP** = UTS-8 character protocol, **USB** = universal serial bus, **VBUS** = MHL voltage bus  
 Sources: MHL Specification

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

### Rohde & Schwarz solutions for MHL



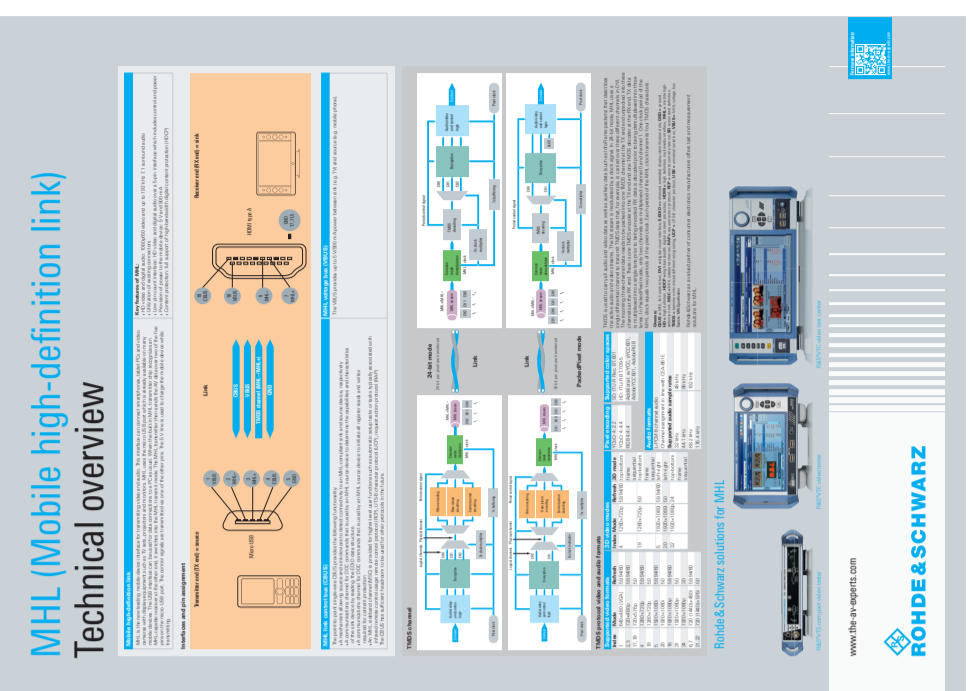
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**Service you can rely on**

- Local and personalized
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