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October 5, 2006

HDMI 1.3 Demystified

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The release of the new HDMI 1.3 specification on 6/22/2006 created both excitement and confusion in the consumer electronics industry. The discussion below is provided to help clarify this new technology and provide you with a better understanding of what you need to know when buying or selling HDMI products.

What is HDMI?

High-Definition Multimedia Interface, or HDMI, is a digital audio, video and control signal format defined by 7 of the largest consumer electronics manufacturers. Released on 12/9/2002, it is supported by more than 300 companies. The advantages HDMI has over other signal formats are:

- Uncompressed digital video and audio signal for the best picture & sound quality
- One cable for video, audio and control signals
- Two-way communication for easy system control
- Automatic display and source matching for resolution, format and aspect ratio
- PC compatibility

What's new in HDMI 1.3?

- Higher speed: max data rate doubled from 5 to 10 Gbps
- Deeper color: color depth increased from 24 bit to 30, 36 or 48 bit, for smoother pictures
- Wider color space: the range of colors is widened to all colors the human eye can typically see
- Supports lossless audio formats: Dolby TrueHD, DTS-HD Master and more
- Lip sync: sync audio and video, compensates for signal processing delays
- New mini plug: Type C for portable devices like camcorders, in addition to the current Type A and B

Want to know more?

Read on. You don't have to understand all the technical terms here in order to grasp the overall concepts.

All the signals travel inside one HDMI cable:

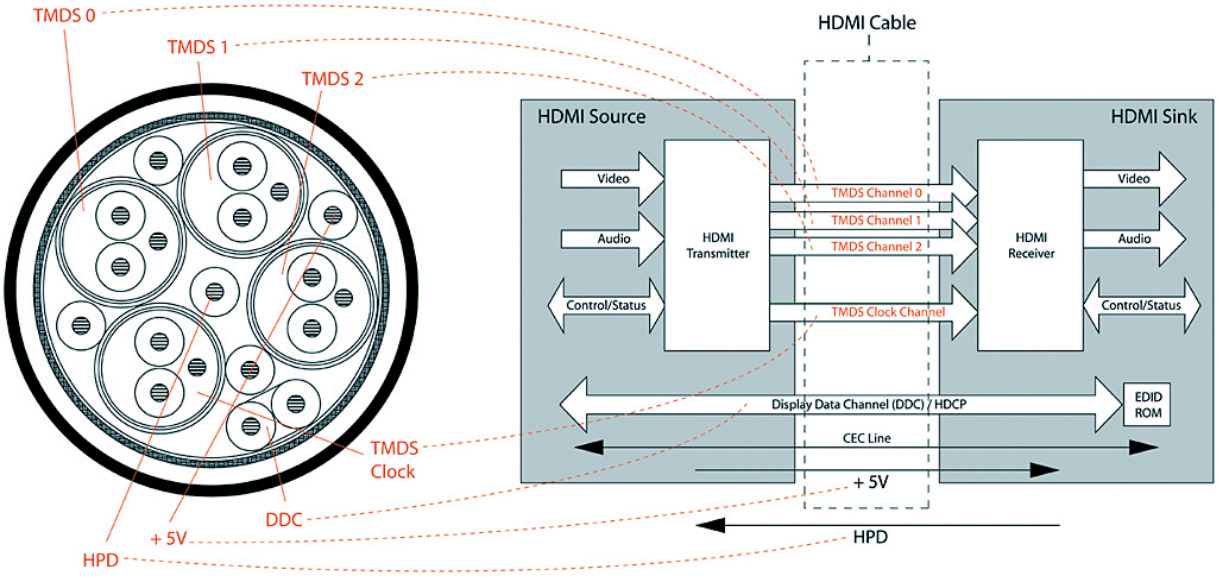

Fig. 1 HDMI Cable: The Components Inside

- **4 TMDS** (Transition Minimized Differential Signaling) signals over 4 twisted pair wires, including 3 digital video signals (RGB or YCrCb) and 1 clock signal; the digital audio signals are also multiplexed into the digital video signals. The Dual-Link HDMI has 3 more twisted pair wires for digital video signals to achieve a higher data rate.
- **DDC** (Display Data Channel) data and clock lines carry the two-way communication signals; the HDCP (High-bandwidth Digital Content Protection) signal also floats here.
- **CEC** (Consumer Electronics Control) data line distributes remote control signals for one-touch system controls.
- **HPD** (Hot Plug Detection) allows the source to detect a display plugged in real time.
- **+5 V** power line supports remote circuits for communication even when the power is not turned on.

Video signal resolution and data rate:

- **Resolution**: refers to how many pixels in a horizontal and vertical direction per frame. 720p has a resolution of 1280x720, while both the 1080i and 1080p are 1920x1080.
- **Refresh rate**: refers to how many frames or fields of pictures per second. The common rates are 30 and 60 Hz in the US, or 25 and 50 Hz in Europe.
- **Color depth**: refers to how many bits of data needed to encode each pixel. Common ones are 24, 30, 36 and 48 bits.

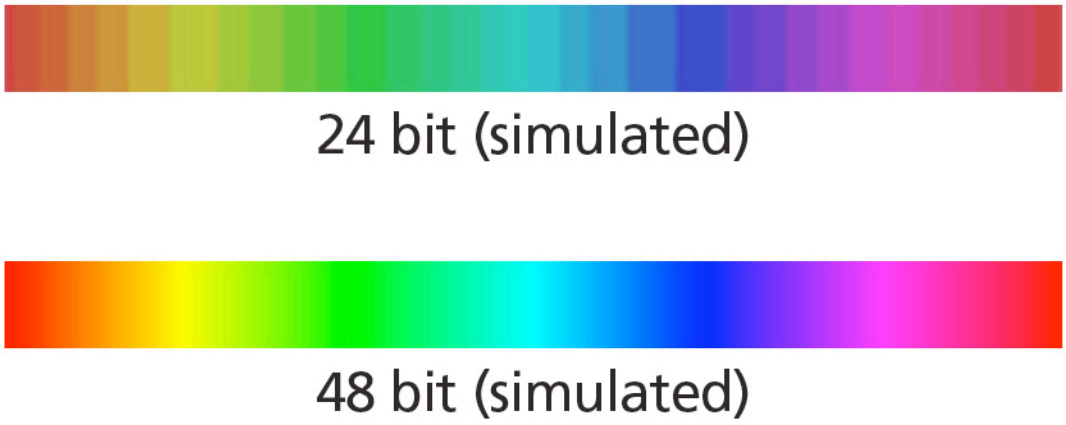

Fig. 2 Deep Color

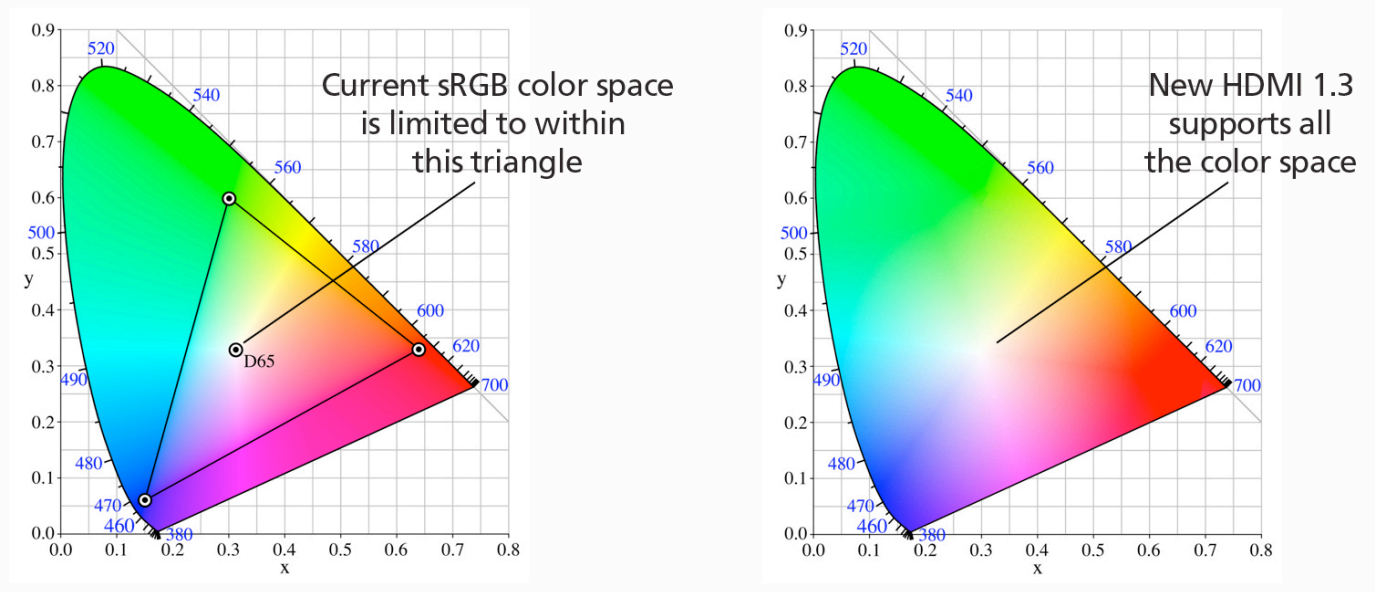

Fig. 3 Wider Color Space

- **Data rate**: refers to the total number of digital bits in a second for a given signal. It's roughly the multiple of all 3 numbers above together. So, the higher the resolution, refresh rate and color depth, the higher the data rate. The max data rate for HDMI 1.0 thru 1.2 is 5 Gbps, while the new HDMI 1.3 max is 10 Gbps.

Type of plugs and Single-Link / Dual-Link:

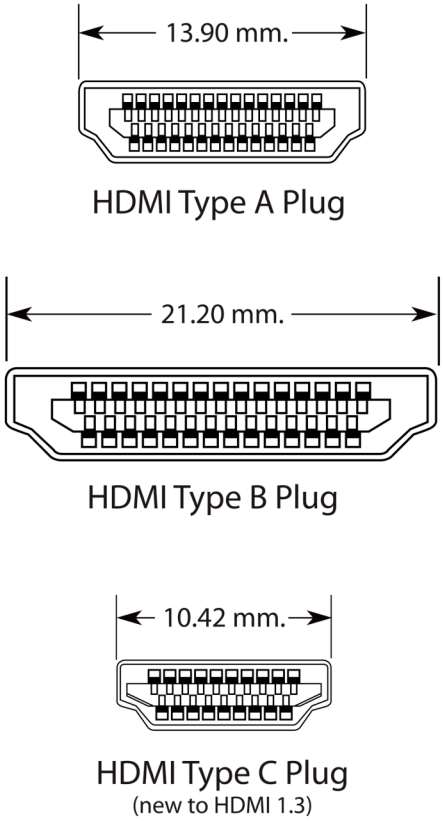

Fig. 4 HDMI Plug Types

- **Type A plug**: the most common HDMI plug, 13.9 mm wide, 19 pins, designed with one set of digital video TMDS lines (Single-Link)
- **Type B plug**: the seldom used HDMI plug, 21.2 mm wide, 29 pins, designed with two sets of digital video TMDS lines (Dual-Link) for higher data rates
- **Type C plug**: the new mini HDMI plug, 10.4 mm wide, 19 pins, designed with one set of digital video TMDS lines (Single-Link) for small portable devices
- **Single-Link** HDMI uses one set of digital video TMDS lines to carry lower data rate signals using a cable with at least 15 conductors
- **Dual-Link** HDMI uses two sets of digital video TMDS lines to carry higher data rate signals using a cable with at least 22 conductors

Before HDMI 1.3, the Single-Link supported up to 5 Gbps; the Dual-Link could handle 10 Gbps. HDMI 1.3 changed that, now the Single-Link can carry 10 Gbps and the Dual-Link even more.

This change raised a majority of the questions and confusion.

Type of HDMI cables:

For the first time, the HDMI 1.3 specification divided the HDMI cables into two categories:

- Category 1 or Cat 1 cable: can carry a signal with a maximum pixel clock of 74.25 MHz (roughly equivalent to data rate of 2.2 Gbps)
- Category 2 or Cat 2 cable: can carry a signal with a pixel clock greater than 74.25 MHz (roughly equivalent to a data rate of 2.2 Gbps)

All HDMI cables made before the publishing of HDMI 1.3 are at least HDMI Cat 1 compliant.

How far can an HDMI signal be transmitted over a cable?

This is a complex question. The maximum length for an HDMI cable to transmit a usable HDMI signal depends on the entire system: the source device performance, the display performance, the signal data rate, and the cable performance and length. The higher the signal data rate, the shorter the maximum usable cable length. If a 5 Gbps HDMI signal can go as far as 10 m (33 ft) on a given cable, a 10 Gbps HDMI signal can only travel 5 m (16.5 ft) on the same type of cable.

All HDMI cables made prior to the enactment of HDMI 1.3 will pass HDMI 1.3 signals, but only half as far for data, which is sent at the MAX rate. Keep in mind that HDMI 1.3 only EXTENDS the max allowable signal data rate; it does not INCREASE the data rate of a given signal. Your cable will still run the same distance on the same 1080p signal regardless of whether the devices are HDMI 1.2 or 1.3.

The maximum distance will be reduced when you run the higher data rate signals now made possible by HDMI 1.3.

Eye pattern:

When the signal arrives at the display, it is degraded more or less. The degradations can be divided into two categories: amplitude loss and time jitters. Both can be visually shown in the “eye” pattern, which is how the digital signal looks on an oscilloscope. When the “eye” is clear and open, the signal is good; when the

eye is fuzzy and closed, it's poor. Most HDMI extenders can boost the amplitude, but only the digital device with signal decoding and recoding can fix the time jitters.

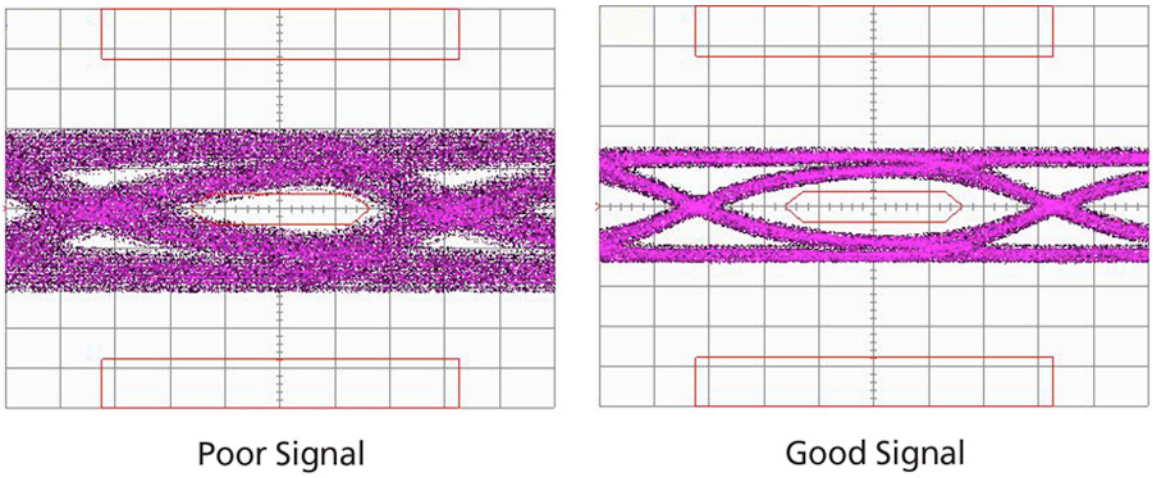

Fig. 5 HDMI "Eye" Patterns

HDMI extender (repeater, amplifier) compatibility with HDMI 1.3

Unlike cables, most of the IC chips used in electronic HDMI extenders have a hard cut max data rate. Therefore, the extenders made before the HDMI 1.3 standard was published most likely won't work with HDMI 1.3 signals and data rates higher than 5 Gbps.

Lip Sync

Modern AV devices have many signal processing features. Most processing causes signal delays. Usually the video processing has a longer delay than the audio processing, causing the picture and sound to be out of synch. HDMI 1.3 added communications via the DDC line to allow the source to adjust the audio delay based on the video-audio mismatches reported by the down stream devices. This solved the lip sync problem. **All HDMI cables made before the HDMI 1.3 specification was published can support Lip Sync features because the inserted data is part of the DDC line.**

1080p

Since the TV manufacturers started promoting 1080p at about the same time the HDMI 1.3 standard released, some people mixed them up. In fact, the two are not the same. 1080p has been part of the HDMI standard since the very first revision 1.0; HDMI 1.3 added signal rates higher than 1080p. You don't need HDMI 1.3 compliant products to enjoy 1080p; but you do need an HDMI connection, because most devices will not output 1080p through the component video because of copyright concerns.

Summary

In most cases, you don't need to worry about the evolution from HDMI 1.2 to HDMI 1.3. Like most new technologies, HDMI 1.3 is backwards compatible. Also, most of the HDMI devices have DDC communication capability. If any device is not HDMI 1.3 compliant, the whole system will fall back to HDMI 1.2 or lower to ensure compatibility through the DDC communication. The only time you may have compatibility issues with HDMI 1.3 is when one of the devices is not HDMI 1.3 compliant, and it does not "speak up" (no DDC communication capability, like many extenders and distribution amplifiers), or if the cable length is too long, AND you are running a signal higher than 1080p 30 Hz.

Hopefully, this has served to clarify your understanding of the many facets of HDMI.

Should you have any questions or concerns, please do not hesitate to contact your local AudioQuest RSM or call our technical support team here in Irvine: 800-747-2770.

Thank you for your interest!

Please visit www.audioquest.com for more information.