3D Features of the HDMI 1.4 Format

By Mike Tsinberg - November 2014

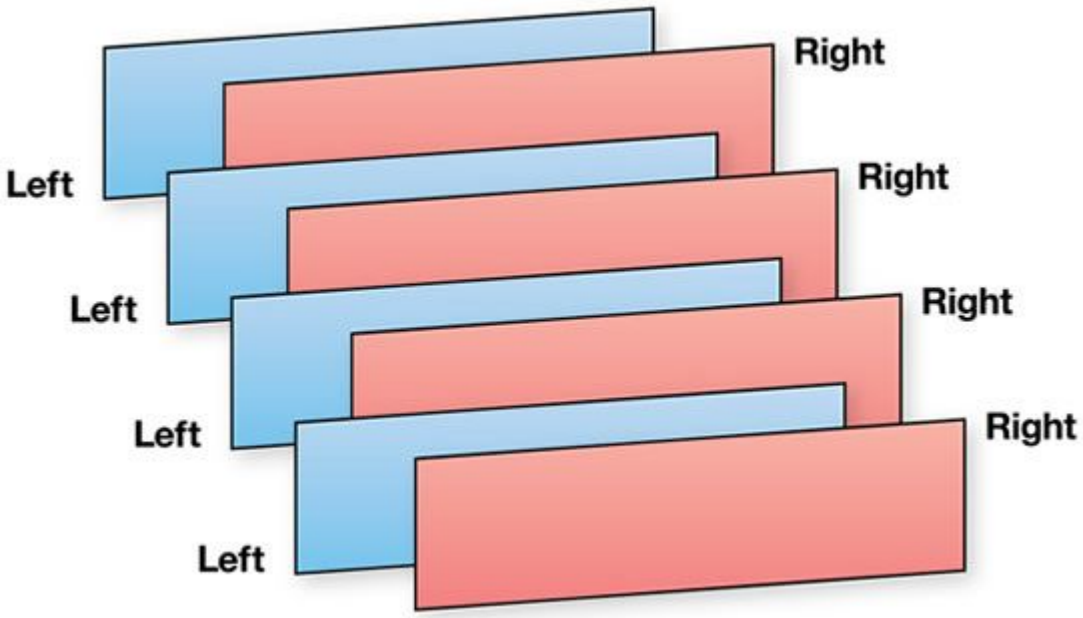
The world of 3D Digital technology is upon us and we have to understand and implement new changes in order to go forward with 3D. However, it is very important to understand the nature of the "beast" for the implementation of these changes.

HDMI 1.4a requires that 3D displays support the following MANDATORY formats: the Frame Packing 3D format at either 720p60/50 or 1080p24/25, Side-by-Side Horizontal at 1080i60/50, and Top-and-Bottom Vertical at 720p60/50 or 1080p24/25.

3D information is conveyed through several methods by transmitting left and right picture information simultaneously. The visual effect and method of 3D television to the viewer is identical to the movie theater 3D technique where visual information for the Left and Right eye are delivered precisely to the Left and Right eye of the viewer. This is achieved by exposing Left and Right frames onto the TV screen, and synchronously opening a light path on left and right glasses to coincide with the frames on the TV screen. In order to display 60 frames per second Left and 60 frames per second Right the 3D TV should have a minimum of 120 Hz refresh rate.

Transmitting the 3D signal to the TV:

1. **Frame Packing Method**

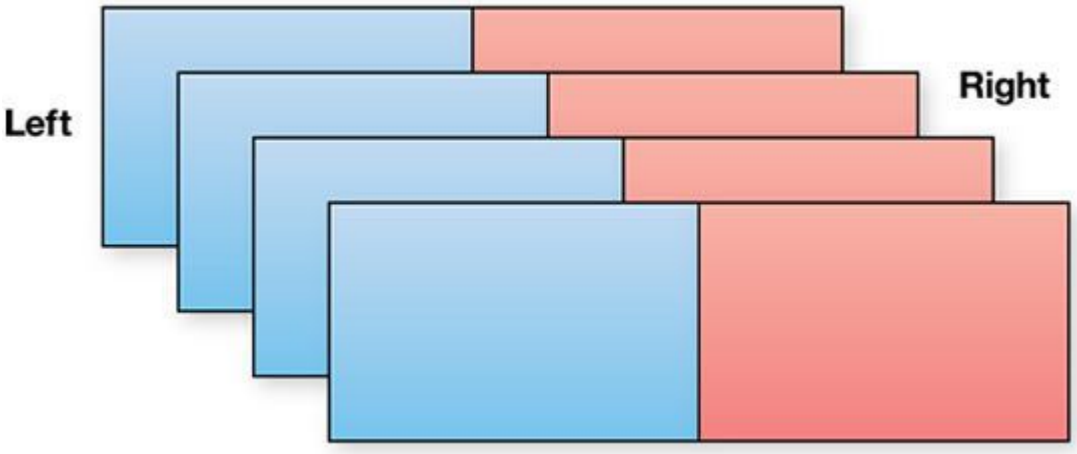


This method describes the left and right image packed into alternating progressive video frames doubling the transmission frame rate for twice the normal bandwidth.

For Movie content originally shot at 1080p/24-25Hz, left and right progressive fields are alternately transmitted each at 24/25 Hz for a complete 3D frame and a total data rate of 1080p/48-50 Hz. This means that the 24/25 Hz information is doubled and alternated for each left and right image.

For Game content originally created at 720p/50-60Hz left and right progressive fields are alternately transmitted each at 50-60Hz for a complete 3D frame and a total data rate of 720p/100-120Hz Hz for left and right information again doubling the 50-60Hz frame rate for alternating left and right material.

2. Side by Side Horizontal

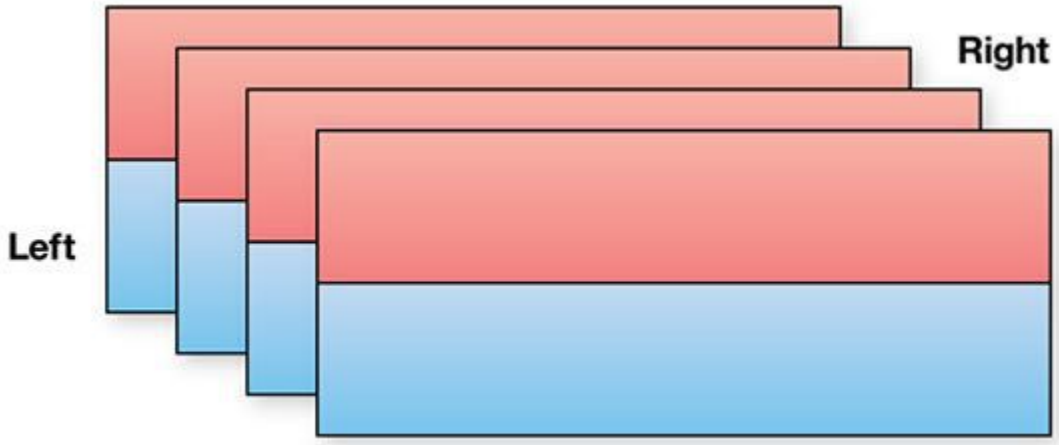


There are 2 different versions of this method, Full or ½. The Side by Side method makes sure that the transmission frame rate remains the same as the original frame rate at 60 Hz or 50 Hz. which is a more compatible scheme for TV broadcasters.

½ Method: For Broadcast content at 1080i/50-60Hz, horizontal left and right material is sub-sampled to half horizontal resolution (960) and stored side by side with each odd and even field shown once. The Display will stretch each side to full width and display them sequentially.

Full Method: For Broadcast content at 1080i/50-60Hz, horizontal left and right material is shown at full resolution (1920) and stored side by side with doubled frame rates. The Display will stretch each side to full width and display them sequentially

3. Top and Bottom Vertical



There are 2 different versions of this method, Full or ½. The Top and Bottom method also makes sure that the transmission frame rate remains the same as the original frame rate of 60 Hz or 50 Hz. which is a more compatible scheme for TV broadcasters.

½ Method – For Broadcast content at 1080p/24-25Hz: left and right material is sub-sampled to half resolution in the vertical axis and stored top and bottom. The Display will stretch each frame to full height and display them sequentially

½ Method – For Broadcast content at 720p/50-60Hz: left and right material is sub-sampled to half resolution in the vertical axis and stored top and bottom. The Display will stretch each frame to full height and display them sequentially.

Full Method – For Broadcast content at 1080p/24-25Hz: left and right material is sampled at full resolution in the vertical axis and stored top and bottom. The Display will stretch each frame to full height and display them sequentially with doubled frame rates.

Full Method – For Broadcast content at 720p/50-60Hz: left and right material is sampled at full resolution in the vertical axis and stored top and bottom. The Display will stretch each frame to full height and display them sequentially with doubled frame rates

The following chart calculates the total data rate in Gbps required for mandatory 3D formats as it relates to Deep Color bit depth accuracy.

Compatibility to existing infrastructure

The 3D format represents a change in both the TMDS and EDID part of the signal. Careful testing and consideration should be done before any HDMI cables, adapters, switchers or processing equipment are used for 3D signals. Current ATSC (terrestrial broadcast format) standards are rigidly established for existing 2D formats up to 1920x1080i/60. Any of the previously listed 3D packing formats such as Frame Packing, Side by Side or Top to Bottom are not supported by ATSC or other digital broadcasting standards throughout the world. The only way to display 3D on a 3D ready TV is through an HDMI connector and the HDMI infrastructure inside the TV that supports 3D.

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