Troubleshooting HDMI 3D Video

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I'm sure you've noticed that video system troubleshooting has become much more challenging with feature-laden HDMI systems than it ever was with analog video systems, like good ole' trusty component video. When an HDMI source device doesn't produce the desired output on an HDMI display device, you most likely struggle to sort through all the possibilites for failure. One reason is that the HDMI cable payload is much more complex, as it is probably carrying video signals and multichannel audio signals, as well as auxilliary channel EDID data, HDCP content protection handshaking, audio and video infoframe data, CEC data, and hot plug signalling data. It may be routed through cable extenders, splitters, AV receiver, and a video processor. This can certainly add up to a challenging signal transmission system to maintain and troubleshoot.

3D HDMI Content

To make HDMI video system installation and maintenance even more challenging for you, the HDMI cable may now also be carrying 3D video images and 3D EDID Vendor Specific Infoframe data. The 3D Infoframe data in the source signal informs the display device that the video signal is 3D and the type of 3D delivery format. The chosen 3D delivery format will vary, depending on the signal source.

- Cable and satellite providers will likely send squeezed side-by-side left eye and right eye images at 1080i30, with each image containing half normal horizontal resolution. This 3D format is known as Side-by-Side (Half).
- Local broadcast stations will likely transmit squeezed top and bottom left eye and right eye images at 720p60 or 1080p24, with each image containing half normal vertical resolution. This 3D format is known as Top & Bottom.
- Blu-ray disks will contain full resolution top and bottom 1920x1080 left eye and right eye images, both packed into a single expanded 1920x2205 frame at a 24 Hz (23.98) frame rate, with a horizontal 45 pixel center blanking bar. This HDMI 1.4a 3D format is known as Frame Packing.

3D compatible source devices are required to provide at least one of these "mandatory" HDMI 1.4a 3D delivery formats, while 3D compatible display devices are required to support all of them, and may optionally support a number of other 3D formats. HDMI repeaters, between the source and display device(s), need to be capable of passing the 3D video images and the 3D Infoframe data. No matter what delivery format is used, 3D consumer TVs convert the signal into sequential left eye/right eye images, for viewing with active shutter glasses. Only the physical resolution and frame rate of the displayed images will vary.

When 3D images aren't properly displayed from a 3D source signal, how do you troubleshoot the complex HDMI system to quickly resolve the problem? You can start substituting cables and

components, or you can try loading new firmware in all the components (which you might want to do anyway), but neither of these are efficient troubleshooting methods, and may just add to your confusion.

Effective 3D Troubleshooting

The Quantum Data 780 Handheld Test Instrument now provides an effective set of 3D troubleshooting tools, along with its existing set of general purpose HDMI troubleshooting tools. I'll cover the general purpose HDMI tools in later articles, but first let me tell you about the new 780 3D troubleshooting tools that are now available as standard equipment on every Quantum Data 780, with the latest firmware (current 780 owners can download this latest firmware at http://www.quantumdata.com/support/downloads/780/780_10063049.zip).
(MP500 owners - give us a call at 877-886-5112 to get an instrument update with these same capabilities.)

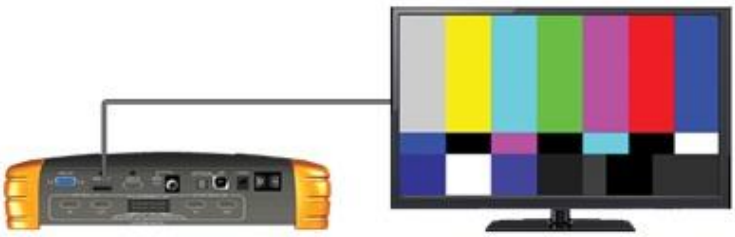
Four Easy 3D Troubleshooting Steps

Here are four easy troubleshooting steps you can perform with the Quantum Data 780 to quickly isolate HDMI 3D problems and identify the reason that 3D images aren't being displayed properly.

1. Emulate a 3D source device with the 780 to test the video display (sink device).

First you want to use the 780 to verify whether the display itself properly renders 3D source material. You just connect the 780 HDMI Out port directly into the video display, select a 3D bitmap at 720p60 format and check for a 3D image on the video display with each of the mandatory 3D formats selected on the 780. Repeat at 1080p24.

HDMI 3D Video, Figure 1



HDMI 3D Video, Figure 2

- If 3D images aren't rendered properly for each of the mandatory formats, you know there is a problem with the video display. You'll want to check whether the display firmware can be updated to fix the problem.
  You can also use the optional 780 ACA source emulation monitor to capture DDC handshaking and hot plug event data. Connect the video display to the 780 ACA Downstream Link Out port. You can view the captured data on the Auxiliary Channel Analyzer (ACA) software, downloadable at http://www.quantumdata.com/support/downloads/882/ACA/ACA_161.zip.

HDMI 3D Video, Figure 3

- If 3D images are rendered properly, proceed to troubleshooting step #2 to test the rest of the components in the signal delivery path.

2. Emulate a 3D source device with the 780 to test the signal delivery path.

Next, you can use the 780 to verify that the entire HDMI signal path from the output of the normal source device to the video display properly passes the 3D signal. Unplug the HDMI cable from the output of the normal HDMI source device (Blu-ray, cable box, etc.) and connect it to the the 780 HDMI Out port. Repeat the tests at 720p60 and 1080p24 that you did in step #1.

HDMI 3D Video, Figure 4

- If 3D images aren't rendered properly, you know there is a problem with one of the repeater devices in the HDMI path between the source device and the display device. Proceed to troubleshooting step #3 to test each of the components in the signal delivery path.

- If 3D images are rendered properly, you know that all of the components in the signal delivery path, plus the display device, are working properly. Proceed to troubleshooting step #4 to test the 3D source device.

3. Emulate both 3D source and sink devices with the 780 to test each of the components in the signal delivery path.

You can use the 780 to verify that each of the repeater devices in the signal delivery path properly passes the 3D signal. The 780 will function both as a known-good source and as a known-good sink device. One by one, connect each of the signal path components (AV receiver, splitter, cable extender, etc.) between the 780 HDMI In and the 780 HDMI Out. Repeat the tests at 720p60 and 1080p24 that you did in step #1 for each of the components.

HDMI 3D Video, Figure 5

- If 3D images aren't rendered properly through one of the signal path components, you know there is a problem with that particular component. You'll want to check whether the component firmware can be updated to fix the problem.
  You can use the 780 Format Analyzer to verify that the 3D metadata is being passed through each of the signal path components. The 3D metadata is displayed on the last couple of lines on the 780 Format Analyzer screen.

HDMI 3D Video, Figure 6

You can also use the optional 780 ACA source emulation monitor to capture DDC handshaking and hot plug event data. Connect the component to be tested between the 780 ACA Downstream Link Out port and the HDMI In port. You can view the captured data on the Auxiliary Channel Analyzer (ACA) software.

HDMI 3D Video, Figure 7

- If 3D images are rendered properly through each of the signal path components, you have now verified proper operation of everything but the 3D source device. Proceed to troubleshooting step #4 to test the 3D source device.

4. Emulate a 3D sink device with the 780 to test the 3D source device.

Use the 780 to view the 3D source video, verify signal timing, and verify the proper 3D metadata. Simply connect the source device HDMI output to the 780 HDMI In port. On the Source Tests page, select the Video Display test and view the 3D image on the 780 LCD. The left eye and right eye images will be displayed side-by-side or top & bottom (with a black center blanking bar for Frame Packing format).

HDMI 3D Video, Figure 8

HDMI 3D Video, Figure 9

HDMI 3D Video, Figure 10

You can use the 780 Format Analyzer to verify that the source device is producing 3D metadata at its HDMI output. The 3D metadata is displayed on the last couple of lines on the 780 Format Analyzer screen.

HDMI 3D Video, Figure 11

- If 3D images aren't rendered properly, you know there's a problem with the 3D source device. You'll want to check whether the source device firmware can be updated to fix the problem.
- If 3D images are rendered properly (not likely at this point in the troubleshooting process), and the proper 3D metadata is present, you know that the source device is working properly.

Simplified HDMI & 3D Troubleshooting

Now, with the Quantum Data 780, you can simplify your HDMI troubleshooting, including 3D problems, and not have to dread HDMI problems anymore. In future articles, we'll talk more about general HDMI troubleshooting procedures available to you with the 780, including detailed analysis of DDC and Hot Plug transaction data at multiple points in an HDMI link.