APPLICATION NOTE

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APPLICATION NOTE
Video Cable Assemblies - Function vs. Compliance

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REVISION HISTORY

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1.0 Abstract

High Definition Multimedia Interface (HDMI) has become a de facto standard for digital audio/video transmission from device sources to monitors, televisions, projectors, etc... DispalyPort is a ubiquitous digital display standard for connecting video sources to display devices. The cables used for the transmission of these protocols must be capable of very high data rates. Length plays an important part in the bandwidth of a cable and questions arise regarding the maximum length attainable for a cable assembly. This document describes Glenair's philosophy to ensure functional cable assemblies, irrespective of length.

2.0 Responsibility

This document is the responsibility of the Engineering team.

3.0 Video Cable Assemblies – Function vs. Compliance

3.1 Background

HDMI and DisplayPort are proprietary interfaces for audio/video data transmission. HDMI technology is managed by the HDMI Forum, a consortium of several companies, while HDMI Licensing, LLC is the agency appointed by the HDMI Forum to oversee licensing. The HDMI Forum develops the HDMI Specification as well as the Compliance Test Specification. DisplayPort technology is managed by VESA (Video Electronics Standards Association), an association of over 300 companies. VESA maintains the DisplayPort Standard which specifies cable parameters.

A basic system incorporating these two protocols consists of a source, a sink, and a cable to connect the two. Neither the HDMI Specification nor the DisplayPort Standard explicitly define cable length limits. Length is not considered for compliance and a cable is considered compliant if it meets interoperability and/or parametric tests which measures physical aspects of the cable.

To sell products that state compliance with the HDMI specification, the HDMI Forum requires that a representative cable be tested. The manufacturer must self-test and then submit the representative sample to an Authorized Testing Center (ACT). However, compliance does not assure proper functionality:
"Successful completion of the Compliance Test Specification or ATC Testing does not guarantee that any product will conform to the High-Definition Multimedia Interfaces, function correctly or interoperate with any other product." (https://www.hdmi.org/resource/testing)

HDMI utilizes a digital data transfer protocol, so signal degradation due to cable length is not easily detected by visual observation. There is not much of an intermediate space between crystal clear and no picture, but there are a couple of visual artifacts that can be observed in this in-between space such as the frames "freezing" and "sparkles". Sparkles are white pixels caused by HDMI error correction being unable to resolve the data for those particular pixels. Compliance testing does not explicitly measure for this lost data.

DisplayPort also utilizes a digital data transfer protocol, so cable induced signal degradations can cause image transfer errors between the two DisplayPort endpoints. These transfer errors likewise result in distorted images.

3.2 Solution

Since a compliant cable assembly doesn't necessarily mean that it will be operable, functional testing can be used to determine cable operability for a specific (or range of) video resolution(s). This functional test consists of an output video data stream being compared to an input video data stream using a HDMI/DisplayPort video signal generator/analyzer. This bit-to-bit, pixel-to-pixel, comparison can detect transmission errors to the lowest level.

Glenair uses the Teledyne LeCroy 780E Video Generator/Analyzer to perform this high degree of functional testing. For HDMI, the 780E is capable of testing pixel rates up to 600MHz. This equates to 6 Gbps/channel or an 18 Gbps aggregate data rate (HDMI 2.0). The 780E can report single bit errors in video data streams ranging from standard definition (480p @60Hz) to ultra-high definition (2160p @60Hz). For DisplayPort, link rates up to 5.4 Gbps with color depths of up to 48 bits can be bit error tested.