P-HFR -- Prototype DCP for High Frame Rate Projection

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Introduction

The motion picture industry is beginning to produce material at frame rates greater than those supported by current standards for d-cinema packages (DCP). While standardization of these new rates is underway, good standards take time and there is an immediate need to prepare and exhibit at least one feature at high frame rate in 2012. This document proposes DCP formulations to be used on an experimental basis to both support immediate exhibition requirements and also to provide input to the standards development process in the form of documentation of an ad-hoc industry practice.

Scope

This proposal is limited to defining the contents of the P-HFR DCP for use in 2k stereoscopic applications. It does not address playback system issues, e.g., projection setup.

1. Background

The current SMPTE standards for digital cinema packaging (SMPTE ST 429-2:2011 and ST 429-13:2009) allow for frame rates and edit rates up to 60/1. While interest in High Frame Rate (HFR) display includes 2D edit rates of 96/1, 100/1 and 120/1, those rates do not need to be supported in the near term. Excluding the higher edit rates allows P-HFR DCPs to be created using existing standards for Composition Playlist, Sound Track Files and Timed Text Track Files. Modification is only required for Picture Track Files.

In addition to higher frame rates, higher image bit rates are also required to maintain relative quality. At this time there is little agreement on appropriate standards for image bit rate, but there is some consensus based on current equipment capabilities that will allow immediate interoperable use within the defined scope.

2. P-HFR Specification

The following sections provide a specification for P-HFR files.

2.1 JPEG 2000 Codestream Formulation

JPEG 2000 Codestreams used in P-HFR files shall conform to ISO/IEC 15444-1:2004, “JPEG 2000 Image Coding System: Core Coding System” and ISO/IEC 15444-1:2004/Amd 1:2006, “Profiles for Digital Cinema Applications” except that the constraints

on bit rate shall be expanded as follows:

a. The data rate of the total codestream shall not exceed 500Mb/s
b. The combined data rates of the Cx and Cz channels shall not exceed 180Mb/s
c. The data rate of the Y channel alone shall not exceed 400Mb/s

2.2 UL Definition

The following UL values are class 14 registered UL values[1]. They have been donated and assigned by the registering organization for the purpose of signaling P-HFR. The ULs designate JPEG 2000 codestreams that conform to the provisions of this document. Note that while the registrar has provided a complete set of UL values, only the 2k value is proposed for use at this time.

P-HFR JP2K @ 2k: 06.0E.2B.34.04.01.01.0D.0E.16.02.02.03.01.01.03
P-HFR JP2K @ 4k: 06.0E.2B.34.04.01.01.0D.0E.16.02.02.03.01.01.04[2]

2.3 Picture Track File Formulation

A stereoscopic Picture Track File in a P-HFR composition shall conform to SMPTE ST 429-13:2009 with the following exceptions:

a. The file shall contain only 2k images.
b. In the MXF FileDescriptor class, the SampleRate property shall be set to indicate the total frame rate of the file. For stereoscopic content this value shall be twice the EditRate (i.e., one of 96/1, 100/1 or 120/1).
c. In the MXF GenericPictureEssenceDescriptor class, the PictureEssenceCoding property shall contain a UL value that indicates the enclosed codestream format (see UL Definition for 2k images above.) See also SMPTE ST 429-4:2006.

2.4 Composition Formulation

Composition Playlist, Sound and Subtitle Track Files comprising a P-HFR composition shall conform to SMPTE ST 429-13:2009. All files in a P-HFR composition shall have equal edit rate, one of 48/1, 50/1 or 60/1.

[1] http://smpte-ra.org/mdd/Class13_14_registrations.html
[2] Defined but not used in this document.