Digital Cinema Initiatives, LLC

High Frame Rates Digital Cinema Recommended Practice

September 28, 2012
Revised September 27, 2013
Revised July 16, 2015

Approved for Distribution September 28, 2012;
September 27, 2013; and July 16, 2015
Digital Cinema Initiatives, LLC, Member Representatives Committee

Copyright © 2012, 2013 & 2015
Digital Cinema Initiatives, LLC (DCI)

High Frame Rates Digital Cinema Recommended Practice

Table of Contents

1. ***Introduction*** 2
2. ***DCDM - Frame Rates*** 2
3. ***Compression - Bit Rate*** 3
4. ***Projection - 3D Peak White Luminance*** 3
5. ***Projection - Forensic Marking*** 3
6. ***Theater Systems - Show Playlists*** 3

1. *Introduction*

This document is a recommended practice for the near-term mastering, distribution and theatrical playback of motion picture D-Cinema content that exceeds the frame rates defined in the DCI Digital Cinema System Specification (DCSS). This recommended practice, which is not a specification, attempts to aid in the interoperability of this nascent High Frame Rate (HFR) content and address insufficient stereoscopic (3D) specifications, while recognizing that the D-Cinema industry is necessarily constrained by an existing installed base of equipment.

DCI continues to study the long-term needs of HFR content and may expand upon the parameters contained herein.

2. *DCDM - Frame Rates*

Proposed frame rates for the Digital Cinema Distribution Master (DCDM) are identified by the letter P in the table below.

Frame Rates (DCSS 1.2 [X], Proposed [P])			
EU/sec	**2K2D**	**2K3D**	**4K2D**
24	**X**	**X**	**X**
48	**X**	P	P
60	P	P	P
96	P		
120	P		

Table 1

DCI has limited frame rates in the above table for efficiency in terms of single inventory, interoperability, and supply chain. DCI believes that, as was the case with the initial digital cinema specifications, alternate frame rates to those indicated above will be identified by the relevant proponents and standardized by SMPTE.

 ©2012, 2013 & 2015 DCI

3. ***Compression - Bit Rate***

The maximum compressed bit rate for support of all proposed frame rates should be 500 Mb/sec.

NOTE: The frame rates and bit rate proposed above are provided to indicate the initial focus and work of DCI and do not insure that all combinations will provide acceptable results with all types of HFR content. For example, certain HFR scenes and content elements may not acceptably compress within the 500 Mb/sec limitation. DCI recommends that content creators should test and validate the entire content creation and delivery pipeline prior to committing to a resolution/frame rate combination.

4. ***Projection - 3D Peak White Luminance***

For 3D presentations utilizing legacy lamp technology, the peak white luminance should be 24 cd/m^2 ± 6.9 cd/m^2 (7 fL ± 2 fL) measured at the center of the screen through all filters and lenses, *i.e.*, light level to the eye. Relative luminance uniformity should be consistent with current SMPTE specifications.

Given the increased light level capabilities of 3D RGB laser illuminated projectors and multi-projector installations, peak white luminance for such projection systems should be 48 cd/m^2 ± 6.9 cd/m^2 (14 fL ± 2 fL) measured at the center of the screen through all filters and lenses, *i.e.*, light level to the eye. Relative luminance uniformity should be consistent with current SMPTE specifications.

5. ***Projection - Forensic Marking***

Forensic marking must be applied to all frames and in the case of any 3D presentations be recoverable from the recording of both eyes or a single eye. All image and audio security forensic requirements must be consistent with the current DCSS.

6. ***Theater Systems - Show Playlists***

The projection system should allow show playlists to be created mixing any formats in Table 1 in any order. Each composition in the show playlist should be presented in its native frame rate. It is expected that playback of such show playlists would provide smooth, minimal transitions.

 ©2012, 2013 & 2015 DCI

NOTICE

Digital Cinema Initiatives, LLC (DCI) is the author and creator of this recommended practice for the purpose of copyright and other laws in all countries throughout the world. The DCI copyright notice must be included in all reproductions, whether in whole or in part, and may not be deleted or attributed to others. DCI hereby grants to its members and their suppliers a limited license to reproduce this recommended practice for their own use, provided it is not sold. Others should obtain permission to reproduce this recommended practice from Digital Cinema Initiatives, LLC.

This document is a recommended practice developed and adopted by Digital Cinema Initiatives, LLC. This document may be revised by DCI. It is intended solely as a guide for companies interested in developing products, which can be compatible with other products, developed using this document. Each DCI member company shall decide independently the extent to which it will utilize, or require adherence to, these recommended practices. DCI shall not be liable for any exemplary, incidental, proximate or consequential damages or expenses arising from the use of this document. This document defines only one approach to compatibility, and other approaches may be available to the industry.

This document is an authorized and approved publication of DCI. Only DCI has the right and authority to revise or change the material contained in this document, and any revisions by any party other than DCI are unauthorized and prohibited.

Conforming to this document may require use of one or more features covered by proprietary rights (such as features which are the subject of a patent, patent application, copyright, mask work right or trade secret right). By publication of this document, no position is taken by DCI with respect to the validity or infringement of any patent or other proprietary right. DCI hereby expressly disclaims any liability for infringement of intellectual property rights of others by virtue of the use of this document. DCI has not and does not investigate any notices or allegations of infringement prompted by publication of any DCI document, nor does DCI undertake a duty to advise users or potential users of DCI documents of such notices or allegations. DCI hereby expressly advises all users or potential users of this document to investigate and analyze any potential infringement situation, seek the advice of intellectual property counsel, and, if indicated, obtain a license under any applicable intellectual property right or take the necessary steps to avoid infringement of any intellectual property right. DCI expressly disclaims any intent to promote infringement of any intellectual property right by virtue of the evolution, adoption, or publication of this document.