

SMPTE TECHNICAL SPECIFICATION

Interoperable Master Format — Application DPP (ProRes)



Page 1 of 19

Every attempt has been made to ensure that the information contained in this document is accurate. Errors in this document should be reported to the SMPTE Technical Specifications proponent(s) identified below with a copy to eng@smpte.org.

This specification normatively references SMPTE RDD 45. Implementers should consult that document for IPR licensing details

All other inquiries in respect of this document, including inquiries as to intellectual property requirements, should be addressed to the SMPTE Technical Specification proponents identified below.

SMPTE Technical Specification Proponent(s) Contact Information:

Digital Production Partnership

4th Floor, Fat Side, ITV, 200 Gray's Inn Road, London, WC1X 8HF, UK.

Email: imf@digitalproductionpartnership.co.uk

Digital Production Partnership is a UK Registered Company. Company Registration Number: 09478697

North American Broadcasters Association

205 Wellington St. W., Suite 9C200, Toronto ON M5V 3G7, Canada

Email: contact@nabanet.com or simplify@nabanet.com

Telephone: +1 416-205-3363

Table of Contents	Page
1 Scope	4
2 Conformance Notation	4
3 Normative References	4
4 Overall	5
5 Image Essence	5
5.1 Constraints	5
5.2 Coding	6
5.2.1 COLOR.8DPP color_primaries, transfer_characteristic and matrix_coefficients	6
5.2.2 Quantization	6
6 Image Track Files	7
6.1 Shim Parameters	7
6.2 Essence	7
6.3 Wrapping	7
6.4 Profiles	7
6.5 Generic Picture Essence Descriptor	7
7 Composition	7
7.1 Application Identification	7
8 Audio	8
9 Metadata	8
10 Access Services	8
10.1 Closed Captions / Subtitles	8
10.2 Audio Description (AD) / Described Video Service (DVS)	8
10.2.1 AD/DVS with Control Signal	8
11 Output Profile List (OPL) (Informative)	9
ANNEX A BIBLIOGRAPHY	10
ANNEX B EXAMPLES OF OUTPUT SPECIFIC METADATA ASSETS (INFORMATIVE)	11
B.1 AMWA AS-11 UK DPP HD V1.1 Specific Metadata	11
B.2 EBU QC Metadata	12
B.3 Dolby SMPTE RDD 6 Audio Metadata	13
B.4 AMWA AS-11 DPP X1 Air Master OPL Overview	15
ANNEX C Color.8dpp Common Image Pixel Color Schemes (Normative)	16
C.1 Integer4096TripletType	16
C.2 COLOR.8DPP-ycbcr-10	16
C.3 COLOR.8DPP-ycbcr-12	17
C.4 COLOR.8DPP-RGB-10	17
C.5 COLOR.8DPP-RGB-12	18
Annex D DPP Metadata Schemas (Informative)	19
D.1 AMWA AS-11 XML Schema	19
D.2 SMPTE RDD 6 DPP XML Schema	19

Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices, Engineering Guidelines and Technical Specifications, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in its Standards Operations Manual.

Intellectual Property

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. SMPTE shall not be held responsible for identifying any or all such patent rights. Any issues relating to patent rights should be referred to the SMPTE Technical Specification proponents with a copy to eng@smpte.org.

Introduction

Building on the pioneering work of SMPTE who created a Mastering Format (IMF) for Feature Films, the Digital Production Partnership (DPP) and the North American Broadcasters Association (NABA) have collaborated to develop a SMPTE Technical Specification for an IMF Application based on the requirements common to many in the broadcast and online sector. This SMPTE Technical Specification is based on the image formats referred to in ITU-R BT.2100 and references SMPTE ST 2067 Interoperable Master Format suite of standards and SMPTE RDD 45:2017 Interoperable Master Format – Application ProRes.

Advice to Readers

Implementers

Implementers are advised to refer to Requirements document SMPTE ER 2121-2:2018.

Users (Including Production and Post Production)

Users are advised to refer to any contractual or delivery documentation supplied by the commissioners or distributors or co-producers, before selecting options such as frame rate, image size, colorimetry etc.

1 Scope

This SMPTE Technical Specification specifies an Application of SMPTE ST 2067 - the Interoperable Master Format. The SMPTE Technical Specification follows the Image Characteristics, Track File and Composition constraints specified in SMPTE RDD 45, Interoperable Master Format – Application ProRes and SMPTE ST 2067-21 Interoperable Master Format – Application #2E, whenever possible. Annexes describe details and worked examples of how broadcaster specific metadata can be referenced using SMPTE ST 2067-9 Interoperable Master Format – Sidecar Composition Map and additional parameters that could be helpful when processing Hybrid Log-Gamma system images.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:".

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword "reserved" indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword "forbidden" indicates "reserved" and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified, the order of precedence of the types of normative information in this document shall be as follows: Normative prose shall be the authoritative definition; Tables shall be next; followed by formal languages; then figures; and then any other language forms.

3 Normative References

The following documents contain provisions, which, through reference in this text, constitute provisions of this SMPTE Technical Specification. At the time of publication, the editions indicated were valid. This SMPTE Technical

Specification is subject to revision and parties to agreements based on this SMPTE Technical Specification are encouraged to investigate the possibility of applying the most recent edition of the documents indicated below.

SMPTE RDD 44:2017, Material Exchange Format — Mapping and Application of Apple ProRes

SMPTE RDD 45:2017, Interoperable Master Format – Application ProRes

SMPTE ST 2067-2:2016, Interoperable Master Format – Core Constraints

SMPTE ST 2067-8:2013, Interoperable Master Format – Common Audio Labels

SMPTE ST 2067-9:2018, Interoperable Master Format – Sidecar Composition Map

SMPTE ST 2067-21:2016, Interoperable Master Format – Application #2E

SMPTE ST 2067-101:2014, Interoperable Master Format – Output Profile List – Common Image Definitions and Macros

SMPTE ST 2067-102:2017, Interoperable Master Format - Common Image Pixel Color Schemes

ITU-R BT.2100, Image parameter values for high dynamic range television for use in production and international programme exchange

WHP 198 BBC R&D White Paper, Audio Description Studio Signal

4 Overall

The normative provisions of SMPTE RDD 45:2017 shall apply in addition to those specified herein unless specified otherwise.

5 Image Essence

5.1 Constraints

Implementations shall support the combinations of image characteristics listed in Table 1 and shall support the mappings of signals for COLOR.8DPP listed in Table 2.

Table 1. Image Parameters

Image Frame Width	1920	3840
Image Frame Height	1080	2160
Frame Structure	Progressive	
Stereoscopy	Monoscopic	
	Stereoscopic	
Frame Rate	24	
	24000/1001	
	25	
	30	
	30000/1001	
	60	

Table 1. Image Parameters

	60000/1001			
Sampling	4:2:2	4:4:4	4:2:2	4:4:4
Quantisation	QE.1	QE.1 QE.2	QE.1	QE.1 QE.2
Color Components	Y'C _B 'C _R '	R'G'B'	Y'C _B 'C _R '	R'G'B'
Colorimetry	COLOR.3 COLOR.5 COLOR.7 COLOR.8DPP	COLOR.5 COLOR.7 COLOR.8DPP	COLOR.3 COLOR.5 COLOR.7 COLOR.8DPP	COLOR.5 COLOR.7 COLOR.8DPP
Pixel Bit Depth	10	12	10	12

COLOR.8DPP corresponds to the Hybrid Log-Gamma (HLG) system specified in Recommendation ITU-R BT.2100

Signal mappings for COLOR.8DPP are listed in Table 2.

Table 2. Colorimetry COLOR.8DPP

System	Description
COLOR.8DPP	R'G'B' components are mapped using the color primaries and white point specified in Recommendation ITU-R BT.2020 and the Hybrid Log-Gamma (HLG) reference non-linear transfer function specified in ITU-R BT.2100. R'G'B' components are mapped to Y'C _B 'C _R ' components using the (non-constant luminance) derivation of Y' and color difference signals specified in Table 4 of Recommendation ITU-R BT.2020.

Note.1: The signal used in the COLOR.7 system (with a transfer function specified in SMPTE ST 2084) is an example of a "display-referred" signal. The COLOR.8DPP system signal (with the Hybrid Log-Gamma (HLG) transfer function specified in ITU-R BT.2100) is an example of a "scene-referred" signal.

5.2 Coding

5.2.1 COLOR.8DPP color_primaries, transfer_characteristic and matrix_coefficients

The color_primaries, transfer_characteristic and matrix_coefficients parameter shall be set according to Table 3, when colorimetry is COLOR.8DPP.

Table 3. Color Primaries, transfer characteristics and matrix coefficients

Colorimetry	color_primaries	transfer_characteristic	matrix_coefficients
COLOR.8DPP	9	18	9

5.2.2 Quantization

COLOR.8DPP shall be constrained to QE1 quantization only (10 bit 64-940 / 12 bit 256 – 3760).

6 Image Track Files

6.1 Shim Parameters

The shim_id parameters shall be equal to the value specified in Table 5.

Other shim parameters shall be equal to those specified in SMPTE RDD 45 Section 6.1.

6.2 Essence

Essence shall conform to section 5.

6.3 Wrapping

Image track parameters shall conform to SMPTE RDD 45 section 6.3.

6.4 Profiles

SMPTE RDD 45 Table 5 Encoding profiles shall be constrained to only those listed in Table 4 below.

Table 4. Coding Profiles

Sampling	ProRes Profile
4:2:2	422 HQ
4:4:4	4444
	4444 XQ

6.5 Generic Picture Essence Descriptor

The value of the COLOR.8DPP Transfer Characteristic item shall be equal to:

060E2B34.0401010D.04010101.010B0000 “Hybrid Log-Gamma OETF Transfer Characteristic” –
registry.smpte-ra.org Labels Register.

7 Composition

Composition parameters shall conform to section 7 of SMPTE RDD 45 (excluding section 7.3 where COLOR.8DPP is used).

7.1 Application Identification

The ApplicationIdentification element, as specified in SMPTE ST 2067-2, shall include exactly one instance of the value listed in Table 5.

Table 5. Application Identification

http://www.digitalproductionpartnership.co.uk/schema/imf/TSP2121-1/2018

8 Audio

The provisions of SMPTE ST 2067-2:2016 shall apply.

9 Metadata

Additional static metadata should be included as assets in a Sidecar Composition Map as defined in SMPTE ST 2067-9:2018. Examples are given in Annex B.

10 Access Services

10.1 Closed Captions / Subtitles

The provisions of SMPTE ST 2067-2:2016 shall apply.

10.2 Audio Description (AD) / Described Video Service (DVS)

If present an audio described/described video service shall be supplied as one or more of the following,

- one or more fully rendered audio soundfield(s) as described in SMPTE ST 2067-8:2013,
- one or more single monaural channel(s) containing Visually Impaired Narrative (VIN) as described in SMPTE ST 428-12:2013. Each Soundfield Group defined in SMPTE ST 2067-8:2013, shall contain 0 or 1 VIN channels,
- one or more soundfield(s) each containing audio channels as described in section 10.2.1.

10.2.1 AD/DVS with Control Signal

In addition to the audio channels defined in SMPTE ST 2067-8 and SMPTE ST 428-12, when required AD/DVS shall be supplied as one or more soundfield(s) each containing exactly one of each audio channels defined in Table 6.

Table 6. Audio Channels for AD/DVS Audio with Control

UL	Symbol	MCA Tag	Description
060e2b34.0401010d. 0302010f.00000000	VisuallyImpairedNarrativeAudioChannel	chVIN	A dedicated narration channel describing the main picture events for the visually impaired.
060e2b34.04010101. 0d010801.01010100	AudioDescriptionStudioSignalDataChannel	chADSSdc	Identifies an Audio Channel carrying a data signal in the format defined by BBC R&D White Paper WHP 198, intended to be used to control the fade and pan of the Main Program audio when it is being mixed with a Visually Impaired Narrative Audio Channel

Also, in addition to the SoundFieldGroups defined in SMPTE ST 2067-8 and SMPTE ST 428-12, Table 7 defines the SoundFieldGroups that shall be used for the AD/DVS as defined in Table 6.

Table 7. Soundfield Groups for AD/DVS Audio with Control

UL	Symbol	MCA Tag	Description
060e2b34.04010101. 0d010801.01020100	AudioDescriptionStudioSignal	sgADSS	Identifies a Soundfield Group carrying a visually impaired narrative audio channel and an audio description studio signal. This is a two channel audio description studio signal defined in BBC R&D White Paper WHP 198.

11 Output Profile List (OPL) (Informative)

The processing or transformation of compliant packages can be specified by OPLs. Within a given IMP each CPL that conforms to this specification could be referenced by at least one OPL in the same IMP.

Note: An overview of an AMWA AS-11 X1 OPL is given in Annex B. Additionally the Common Image Pixel Color Schemes required for HLG processing are defined in Annex C.

Annex A Bibliography

Additional Informative References

AMWA AS-11 series: <https://www.amwa.tv/projects/AS-11.shtml>

Report ITU-R BT.2390, High Dynamic Range for production and international programme exchange

SMPTE ST 2067-200:20XX Dynamic Metadata for Color Volume Transform (DMCVT) Plug-in

SMPTE ST 2094 Dynamic Metadata for Color Volume Transform – Application Suite

SMPTE RDD 6:2008 - Description and Guide to the Use of the Dolby E Audio Metadata Serial Bitstream

Annex B Examples of Output Specific Metadata Assets (Informative)

SMPTE ST 2067-9:2018 describes how assets can be associated with a CPL. An IMP can contain any number of Sidecar Mapping Asset Documents. This Annex gives examples and references for metadata assets that might be required by users of this application when output-specific metadata is included as assets in an SMPTE ST 2067-9 Sidecar Composition Map.

B.1 AMWA AS-11 UK DPP HD V1.1 Specific Metadata

The following is an example of the metadata which would be required in order to produce an AMWA AS-11 UK DPP HD V1.1 Air Master.

AS-11 UK DPP HD V1.1 Example

```
<?xml version = "1.0" encoding = "UTF-8" standalone = "yes"?>
<Programme xmlns = "http://www.digitalproductionpartnership.co.uk/ns/as11/2015">
<Editorial>
<SeriesTitle>Planet Earth II</SeriesTitle>
<ProgrammeTitle>IMF Test Promo</ProgrammeTitle>
<EpisodeTitleNumber>Graphics Version</EpisodeTitleNumber>
<ProductionNumber>TEST123H_01</ProductionNumber>
<Synopsis>Explanatory graphic version of iPlayer test file</Synopsis>
<Originator>BBC</Originator>
<CopyrightYear>2017</CopyrightYear>
<Genre>Tests</Genre>
<Distributor>BBC</Distributor>
</Editorial>
<Technical>
<ShimName>UK DPP HD</ShimName>
<ShimVersion>1.1</ShimVersion>
<Video>
<VideoBitRate unit = "Mbps">100</VideoBitRate>
<VideoCodec>AVC - Intra 100</VideoCodec>
<VideoCodecParameters>High 4:2 : 2 Intra@L4.1</VideoCodecParameters>
<PictureFormat>1080i50 16:9</PictureFormat>
<AFD>10</AFD>
<PictureRatio>16 : 9 (1.78:1)</PictureRatio>
<ThreeD>>false</ThreeD>
<PSEPass>Yes</PSEPass>
<PSEManufacturer>Vidchecker</PSEManufacturer>
<PSEVersion>6.4.1</PSEVersion>
</Video>
<Audio>
<AudioSamplingFrequency unit = "kHz">48</AudioSamplingFrequency>
<AudioBitDepth>24</AudioBitDepth>
<AudioCodecParameters>PCM</AudioCodecParameters>
<AudioTrackLayout>EBU R 123 : 4b</AudioTrackLayout>
<PrimaryAudioLanguage>eng</PrimaryAudioLanguage>
<SecondaryAudioLanguage>zxx</SecondaryAudioLanguage>
<TertiaryAudioLanguage>zxx</TertiaryAudioLanguage>
<AudioLoudnessStandard>EBU R 128</AudioLoudnessStandard>
</Audio>
<Timecodes>
<LineUpStart>09:59:30:00</LineUpStart>
<IdentClockStart>09:59:50:00</IdentClockStart>
<Parts>
<Part>
<PartNumber>1</PartNumber>
<PartTotal>1</PartTotal>
<PartSOM>10:00:00:00</PartSOM>
<PartDuration>00:04:48:00</PartDuration>
</Part>
</Parts>
```

```

<TotalNumberOfParts>1</TotalNumberOfParts>
<TotalProgrammeDuration>00:04:48:00</TotalProgrammeDuration>
</Timecodes>
<AccessServices>
<AudioDescriptionPresent>>false</AudioDescriptionPresent>
<ClosedCaptionsPresent>>false</ClosedCaptionsPresent>
<OpenCaptionsPresent>>false</OpenCaptionsPresent>
<SigningPresent>No</SigningPresent>
</AccessServices>
<Additional>
<CompletionDate>2016-11-03</CompletionDate>
<TextlessElementsExist>>true</TextlessElementsExist>
<ProgrammeHasText>>true</ProgrammeHasText>
<ProgrammeTextLanguage>eng</ProgrammeTextLanguage>
<AssociatedMediaFilename>#work_file#FKAC343E_02.mxf</AssociatedMediaFilename>
<MediaChecksumType>MD5</MediaChecksumType>
<MediaChecksumValue>6c5fda4452edaec5bc12b97675f446f6</MediaChecksumValue>
</Additional>
<ContactInformation>
<ContactEmail>delivery@filmsat59.com</ContactEmail>
<ContactTelephoneNumber>0117 906 4300</ContactTelephoneNumber>
</ContactInformation>
</Technical>
</Programme>

```

Normally an implementation will simply include AMWA AS-11 metadata as supplied by the programme maker, in an SMPTE ST 2067-9:2018 Sidecar. As a guide to implementers wishing to offer additional user input options in order to create the metadata (as detailed at <https://www.amwa.tv/projects/AS-11-UK-DPP-HD.shtml>), an XML Schema element described in Annex D, is included with this SMPTE Technical Specification.

B.2 EBU QC Metadata

When present, EBU QC Template(s) can be included as assets in an SMPTE ST 2067-9 Sidecar Composition Map. EBU QC Templates are XML files that references the EBU QC Items required to test an output file such as an AMWA AS-11 UK DPP HD V1.1 Air Master. EBU QC Templates can be in either EBU or FIMS format. EBU QC XML Reports can also be included as assets in an SMPTE ST 2067-9 Sidecar Composition Map. Details and tools (including and API) can be found at <https://ebu.io/help/qc/>

Below is an example of a QC Template for an AMWA AS-11 UK DPP HD V1.1 Air Master in FIMS format. An implementation only needs to accept EBU QC XML file(s) as supplied by the programme maker.

Part UK DPP Automated QC Template Example (produced by EBU.IO/QC FIMS Template builder)

```

<?xml version="1.0" encoding="utf-8"?>
<qat:qaTemplate qaTemplateID="7f78c10a-fd2d-11e7-b971-0242ac120003"
  qaTemplateName="AQ-DPP" xmlns:bms="http://base.fims.tv"
  xmlns:desc="http://description.fims.tv"
  xmlns:qat="http://mediaqat.fims.tv"
  xmlns:tim="http://baseTime.fims.tv"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<bms:resourceID>7f78c10a-fd2d-11e7-b971-0242ac120003</bms:resourceID>
<qat:qaAtom qaItemID="0001F" qaItemName="Active Format Description">
<qat:qaItemType>check</qat:qaItemType>
<qat:layer>bitstream</qat:layer>
<qat:category>absolute</qat:category>
<qat:qaItemInput>
<qat:parameterName>ActiveFormatDescriptionBitstreamExpected</qat:parameterName>
<qat:value/>
<qat:type>integer</qat:type>

```

```

<qat:unit/>
<qat:representation>decimal or binary left padded with zeros to 5
    digits</qat:representation>
<qat:valueRange>(0,16)</qat:valueRange>
</qat:qaItemInput>
</qat:qaAtom>
<qat:qaAtom qaItemID="0001W" qaItemName="Active Format Description">
<qat:qaItemType>check</qat:qaItemType>
<qat:layer>wrapper</qat:layer>
<qat:category>absolute</qat:category>
<qat:qaItemInput>
<qat:parameterName>ActiveFormatDescriptionExpected</qat:parameterName>
<qat:value/>
<qat:type>integer</qat:type>
<qat:unit>N/A</qat:unit>
<qat:representation>binary left padded with zeros to length 4</qat:representation>
<qat:valueRange>[0,15]</qat:valueRange>
</qat:qaItemInput>
</qat:qaAtom>
<qat:qaAtom qaItemID="0001X" qaItemName="Active Format Description">
<qat:qaItemType>check</qat:qaItemType>
<qat:layer>crosscheck</qat:layer>
<qat:category>absolute</qat:category>
<qat:qaItemInput>
<qat:parameterName>ActiveFormatDescriptionWrapperValue</qat:parameterName>
<qat:value/>
<qat:type>integer</qat:type>
<qat:unit/>
<qat:representation/>
<qat:valueRange>[0,16]</qat:valueRange>
</qat:qaItemInput>
<qat:qaItemInput>
<qat:parameterName>ActiveFormatDescriptionBitstreamValue</qat:parameterName>
<qat:value/>
<qat:type>integer</qat:type>
<qat:unit/>
<qat:representation/>
<qat:valueRange>[0,16]</qat:valueRange>
</qat:qaItemInput>
</qat:qaAtom>
</qat:qaTemplate>

```

B.3 Dolby SMPTE RDD 6 Audio Metadata

When present SMPTE RDD 6 audio metadata can be included as assets in an SMPTE ST 2067-9 Sidecar Composition Map.

SMPTE RDD 6 Metadata Example

```

<?xml version="1.0" encoding="utf-8"?>
<rd6 xmlns = "http://bbc.co.uk/rd/rdd6/201502">
<first_subframe>
<sync>
<rev_id>0x00</rev_id>
<orig_id>0x01</orig_id>
<orig_addr>0x0000</orig_addr>
<frame_count>201</frame_count>
</sync>
<dolby_e_complete>
<program_config>5.1</program_config>
<frame_rate>25</frame_rate>
<descr_text>
<program>DPP_TEST</program>
</descr_text>
</dolby_e_complete>

```

```

<dolby_digital_complete_ext_bsi>
<program_id>0</program_id>
<ac_mode>3/2</ac_mode>
<bs_mode>main_complete</bs_mode>
<center_mix_level>-3.0</center_mix_level>
<sur_mix_level>-6.0</sur_mix_level>
<sur_encoded>>false</sur_encoded>
<lfe_on>>true</lfe_on>
<dialnorm>-23</dialnorm>
<copyright>>true</copyright>
<orig_bs>>true</orig_bs>
<downmix_mode>lo_ro</downmix_mode>
<lt_rt_center_mix>-3.0</lt_rt_center_mix>
<lt_rt_sur_mix>-6.0</lt_rt_sur_mix>
<lo_ro_center_mix>-3.0</lo_ro_center_mix>
<lo_ro_sur_mix>-6.0</lo_ro_sur_mix>
<ad_conv_type>standard</ad_conv_type>
<hp_filter>>true</hp_filter>
<bw_lp_filter>>true</bw_lp_filter>
<lfe_lp_filter>>true</lfe_lp_filter>
<sur_90_filter>>false</sur_90_filter>
<sur_att_filter>>false</sur_att_filter>
<rf_preemph_filter>>false</rf_preemph_filter>
<compr_pf_1>film_light</compr_pf_1>
<dyn_range_pf_1>none</dyn_range_pf_1>
<dyn_range_pf_2>none</dyn_range_pf_2>
<dyn_range_pf_3>none</dyn_range_pf_3>
<dyn_range_pf_4>none</dyn_range_pf_4>
</dolby_digital_complete_ext_bsi>
</first_subframe>
<second_subframe>
<sync>
<rev_id>0x00</rev_id>
<orig_id>0x01</orig_id>
<orig_addr>0x0000</orig_addr>
<frame_count>201</frame_count>
</sync>
<dolby_e_essential>
<program_config>5.1</program_config>
<frame_rate>25</frame_rate>
</dolby_e_essential>
<dolby_digital_essential_ext_bsi>
<program_id>0</program_id>
<ac_mode>3/2</ac_mode>
<bs_mode>main_complete</bs_mode>
<lfe_on>>true</lfe_on>
<dialnorm>-23</dialnorm>
<compr_pf_2>film_light</compr_pf_2>
<dyn_range_pf_5>none</dyn_range_pf_5>
<dyn_range_pf_6>none</dyn_range_pf_6>
<dyn_range_pf_7>none</dyn_range_pf_7>
<dyn_range_pf_8>none</dyn_range_pf_8>
</dolby_digital_essential_ext_bsi>
</second_subframe>
</rdd6>

```

Normally an implementation will simply include SMPTE RDD 6 metadata as supplied by the programme maker, in an SMPTE ST 2067-9:2018 Sidecar. As a guide to implementers wishing to offer additional user input options to create the SMPTE RDD 6, an XML Schema element described in Annex D, is included with this SMPTE Technical Specification.

The DPP supplies a web based application that can be used to generate an SMPTE RDD6 XML file (as shown in the example below), which can be downloaded from <http://dpp-assets.s3.amazonaws.com/wp-content/uploads/specs/bbc/DPPDolbyMetadata.zip>.

B.4 AMWA AS-11 DPP X1 Air Master OPL Overview

As a guide, an AMWA AS-11 X1 OPL overview is given below

Example: AMWA AS-11 X1 25fps HLG OPL Overview

```
<?xml version="1.0" encoding="UTF-8" ?>
<OutputProfileList xmlns="http://www.smpte-ra.org/schemas/2067-100/2014"
  xmlns:lanc="http://www.smpte-ra.org/schemas/2067-101/2014/lanczos"
  xmlns:cipcs="
    http://www.digitalproductionpartnership.co.uk/schema/imf/OPL/X1/2018
  " xmlns:penc="http://www.smpte-ra.org/schemas/2067-101/2014/pixel-
    encoder" xmlns:crop="http://www.smpte-ra.org/schemas/2067-
    101/2014/crop-macro" xmlns:pdec="http://www.smpte-
    ra.org/schemas/2067-101/2014/pixel-decoder"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:ism="http://www.smpte-ra.org/schemas/2067-101/2014/scale-
    macro" xmlns:dcml="http://www.smpte-
    ra.org/schemas/433/2008/dcmlTypes/"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:ds="http://www.w3.org/2000/09/xmldsig#"
  xmlns:oplc="http://www.smpte-ra.org/schemas/2067-101/2014/color-
    schemes" xmlns:arm="http://www.smpte-ra.org/schemas/2067-103/2014">
  <Id>urn:uuid:7c248b50-95fb-4716-8386-c42c1def41a2</Id>
  <Annotation>Simple DPP AS11 OPL</Annotation>
  <IssueDate>2017-10-16T13:42:36+00:00</IssueDate>
  <Issuer>Marquise Technologies</Issuer>
  <Creator>M I S T i/o v4.7.1.0</Creator>
  <CompositionPlaylistId>urn:uuid:13267b46-66ff-488a-9b7f-
    a4cf3a82cc67</CompositionPlaylistId>
  <ExtensionProperties>
  </ExtensionProperties>
  <AliasList></AliasList>
  <MacroList>
    <Macro type="PresetMacroType">
      <Name>DPP_AS11_Macro</Name>
      <Annotation>Simple DPP AS11 Output Macro</Annotation>
      <Preset>https://www.digitalproductionpartnership.co.uk/imf/opl/as11/X1-25-
        HLG</Preset>
    </Macro>
  </MacroList>
</OutputProfileList>
```

Annex C COLOR.8DPP Common Image Pixel Color Schemes (Normative)

This annex defines the additional Common Image Pixel Color Schemes (as defined in SMPTE ST 2067-102:2017) required for COLOR.8DPP.

C.1 Integer4096TripletType

Integer4096TripletType represents a triplet of integers between 0 and 4095, inclusively. It shall be as specified in Table D1

Table D1 – Integer4096TripletType definition

```
<xs:simpleType name="Integer4096TripletType">
  <xs:restriction>
    <xs:simpleType>
      <xs:list>
        <xs:simpleType>
          <xs:restriction base="xs:integer">
            <xs:minInclusive value="0"/>
            <xs:maxInclusive value="4095"/>
          </xs:restriction>
        </xs:simpleType>
      </xs:list>
    </xs:simpleType>
    <xs:length value="3"/>
  </xs:restriction>
</xs:simpleType>
```

C.2 COLOR.8DPP-YCbCr-10

The COLOR.8DPP-YCbCr-10 color scheme shall be as specified in Table D2.

Table D2 – COLOR.8DPP-YCbCr-10 Color Scheme

Name	COLOR.8DPP-YCbCr-10
URI	http://www.digitalproductionpartnership.co.uk/schema/imf/TSP2121-1/2018#COLOR8DPP-YCbCr-10
Description	Y', C' _B , and C' _R components as specified in Table 2, using 10-bit bit depth, COLOR.8DPP colorimetry and QE.1 quantization system.
Mapping from Reference Image Pixel	$Y' = \text{floor}(876 \cdot \text{clamp}(0, 1, P_1) + 0.5) + 64$ $C'_B = \text{floor}(896 \cdot \text{clamp}(-0.5, 0.5, P_2) + 0.5) + 512$ $C'_R = \text{floor}(896 \cdot \text{clamp}(-0.5, 0.5, P_3) + 0.5) + 512$
Mapping to Reference Image Pixel	$P_1 = (Y' - 64) / 876$ $P_2 = (C'_B - 512) / 896$ $P_3 = (C'_R - 512) / 896$ $P_4 = 1.0$
Pixel Encoding Type	<pre><xs:complexType name="COLOR8DPP-YCbCr-10-ColorEncodingType"> <xs:simpleContent> <xs:restriction base="oplcs:ColorEncodingType"></pre>


```
<xs:simpleType>
  <xs:restriction base="oplc:Integer1024TripletType"/>
</xs:simpleType>
</xs:restriction>
</xs:simpleContent>
</xs:complexType>
```

The three elements of the triplet shall correspond to the Y' , C'_B , and C'_R components.

C.3 COLOR.8DPP-YCbCr-12

The COLOR.8DPP-YCbCr-12 color scheme shall be as specified in Table D3

Table D3 – COLOR.8DPP-YCbCr-12 Color Scheme

Name	COLOR.8DPP-YCbCr-12
URI	http://www.digitalproductionpartnership.co.uk/schema/imf/TSP2121-1/2018#COLOR8DPP-YCbCr-12
Description	Y' , C'_B , and C'_R components as specified in Table 2 using 12-bit bit depth, COLOR.8DPP colorimetry and QE.1 quantization system.
Mapping from Reference Image Pixel	$Y' = \text{floor}(3504 \cdot \text{clamp}(0, 1, P_1) + 0.5) + 256$ $C'_B = \text{floor}(3584 \cdot \text{clamp}(-0.5, 0.5, P_2) + 0.5) + 2048$ $C'_R = \text{floor}(3584 \cdot \text{clamp}(-0.5, 0.5, P_3) + 0.5) + 2048$
Mapping to Reference Image Pixel	$P_1 = (Y' - 256) / 3504$ $P_2 = (C'_B - 2048) / 3584$ $P_3 = (C'_R - 2048) / 3584$ $P_4 = 1.0$
Pixel Encoding Type	<pre><xs:complexType name="COLOR8DPP-YCbCr-12-ColorEncodingType"> <xs:simpleContent> <xs:restriction base="oplcs:ColorEncodingType"> <xs:simpleType> <xs:restriction base="oplc:Integer4096TripletType"/> </xs:simpleType> </xs:restriction> </xs:simpleContent> </xs:complexType></pre>

The three elements of the triplet shall correspond to the Y' , C'_B , and C'_R components.

C.4 COLOR.8DPP-RGB-10

The COLOR.8DPP-RGB-10 color scheme shall be as specified in Table D4

Table D4 COLOR.8DPP-RGB-10 Color Scheme

Name	COLOR.8DPP-RGB-10
URI	http://www.digitalproductionpartnership.co.uk/schema/imf/TSP2121-1/2018#COLOR8DPP-RGB-10
Description	R' , G' and B' components as specified in Table 2, using 10-bit bit depth, COLOR.8DPP colorimetry and QE.1 quantization system.
Mapping from Reference Image Pixel	$R' = \text{floor}(876 \cdot \text{clamp}(0, 1, P_1) + 0.5) + 64$ $G' = \text{floor}(876 \cdot \text{clamp}(0, 1, P_2) + 0.5) + 64$ $B' = \text{floor}(876 \cdot \text{clamp}(0, 1, P_3) + 0.5) + 64$
Mapping to Reference Image Pixel	$P_1 = (R' - 64) / 876$ $P_2 = (G' - 64) / 876$

$$P_3 = (B' - 64) / 876$$

$$P_4 = 1.0$$

Pixel Encoding Type	<pre><xs:complexType name="COLOR8DPP-RGB-10-ColorEncodingType"> <xs:simpleContent> <xs:restriction base="oplcs:ColorEncodingType"> <xs:simpleType> <xs:restriction base="oplc:Integer1024TripletType"/> </xs:simpleType> </xs:restriction> </xs:simpleContent> </xs:complexType></pre>
---------------------	--

The three elements of the triplet shall correspond to the R', G' and B' components.

C.5 COLOR.8DPP-RGB-12

The COLOR.8DPP-RGB-12 color scheme shall be as specified in Table D5

Table D5 COLOR.8DPP-RGB-12 Color Scheme

Name	COLOR.8DPP-RGB-12
URI	http://www.digitalproductionpartnership.co.uk/schema/imf/TSP2121-1/2018#COLOR8DPP-RGB-12
Description	R', G' and B' components as specified in Table 2, using 12-bit bit depth, COLOR.8DPP colorimetry and QE.1 quantization system.
Mapping from Reference Image Pixel	$R' = \text{floor}(3504 \cdot \text{clamp}(0, 1, P_1) + 0.5) + 256$ $G' = \text{floor}(3504 \cdot \text{clamp}(0, 1, P_2) + 0.5) + 256$ $B' = \text{floor}(3504 \cdot \text{clamp}(0, 1, P_3) + 0.5) + 256$
Mapping to Reference Image Pixel	$P_1 = (R' - 256) / 3504$ $P_2 = (G' - 256) / 3504$ $P_3 = (B' - 256) / 3504$ $P_4 = 1.0$
Pixel Encoding Type	<pre><xs:complexType name="COLOR8DPP-RGB-12-ColorEncodingType"> <xs:simpleContent> <xs:restriction base="oplcs:ColorEncodingType"> <xs:simpleType> <xs:restriction base="oplc:Integer4096TripletType"/> </xs:simpleType> </xs:restriction> </xs:simpleContent> </xs:complexType></pre>

The three elements of the triplet shall correspond to the R', G' and B' components.

Annex D DPP Metadata Schemas (Informative)

This SMPTE Technical Specification is accompanied by the following elements, which are XML schema documents as specified in XML Schema Part 1: Structures

TSP-2121-1-2018-AMWA-AS-11-DPP-V1.1.xsd

TSP-2121-1-2018-SMPTE-RDD6-DPP.xsd

These elements define the format of XML metadata files described below and are included for the guidance of implementers wishing to offer additional functionality for the examples described in Annex B Section B1 and B3

D.1 AMWA AS-11 XML Schema

The AMWA AS-11 UK DPP HD V1.1 XML schema root element is defined in Table E1.

Table E1 AMWA AS-11 UK DPP HD V.1. XML Schema root element definition

```
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
           targetNamespace="http://www.digitalproductionpartnership.co.uk/ns/as11/2013"
           xmlns:dpp="http://www.digitalproductionpartnership.co.uk/ns/as11/2013">

  <!-- schema definitions found in this document -->

</xs:schema>
```

D.2 SMPTE RDD 6 DPP XML Schema

The SMPTE RDD 6 DPP XML schema root element is defined in Table E2.

Table E2 SMPTE RDD 6 DPP XML Schema root element definition

```
xs:schema targetNamespace="http://bbc.co.uk/rd/rdd6/201502"
          xmlns="http://bbc.co.uk/rd/rdd6/201502"
          xmlns:xs="http://www.w3.org/2001/XMLSchema"
          elementFormDefault="qualified" attributeFormDefault="unqualified">

  <!-- schema definitions found in this document -->

</xs:schema>
```