MASTERING FORMAT
BUSINESS REQUIREMENTS

v1.0

The DPP has pioneered delivery specifications for programme playout but with the increase in versioning for global content, there is now a need for the creation of a programme mastering format. Building on the pioneering work of SMPTE, who created a Mastering Format for Feature Films, the DPP and partners NABA and EBU QC group have collaborated to develop a new variant based on the requirements of the broadcast sector. The Mastering Format Business Requirements v1.0 document is the result of over twelve months of collaboration and is based on applications 2 and 2e of the SMPTE ST 2067-2 IMF standard.

NOTES:

Throughout the following table, the working group agreed two applications are required:

- DPP Option 1 BT. 2100 (progressive only)

- DPP Option 2 BT. 601 & 709 (to include interlace)

- All entries are Agreed in Principle

IMPORTANCE RANKINGS:

Numeric importance rankings are to be interpreted as:

1 Must have   **2** Should have   **3** Could have

DPP BUSINESS REQUIREMENTS	DPP OPTION 1 BT.2100	DPP OPTION 2 BT.601 & 709	IMPORTANCE 1/2/3	CURRENTLY IN IMF? Y/N (AND APP)

VIDEO

Progressive	●	●	**1**	**Y** (App 2)
Interlace	–	●	**1**	**Y** (App 2e)
I-frame codec – Intra only. Defined as a mastering format	●	●	**1**	**Y** (App 2 and 2e)
J2K | H.264 | ProRes are proposed codecs for mastering.	●	–	**1**	

The bitrates detailed are the recommended minimum based on the table at right.

Where further production requirements are necessary or the broadcaster defines higher specific mastering needs , higher bitrates may be requested.

Lower bitrates may constrain the downstream copying of the material due to generation loss or concatenation. Future use should be considered in the definition of codec and bitrate.

The bitrates detailed are the recommended minimum bitrates for the Master Media Files. Where further production requirements are necessary or the broadcaster defines specific mastering needs, higher bitrates may be requested.

For Acquisition and Production requirements, reference should be made to the DPP Technical Specification documentation.

https://www.digitalproductionpartnership.co.uk/what-wedo/technical-specifications/uhd-hd-sd-programmes/

The use of lower bitrates may constrain the downstream copying of the material due to generation loss or concatenation. Future use should be a consideration in the definition of codec and bitrate.

MASTER DELIVERY MINIMUM BITRATES FOR LIBRARY MASTERING Where International Distribution as either Library, Air Master or additional processing is required					
	J2K (Level 5 or higher)	H.264 (RDD32 – RDD39)	ITU-T H.264 High 10 (Level 5 or higher)		ProRes 422HQ (RDD44)
			Library	Air Master	
1080P/25	180 Mb/s	220 Mb/s – 220 Mb/s	200 Mb/s	200 Mb/s	190 Mb/s
1080P/50	350 Mb/s	450 Mb/s – 450 Mb/s	400 Mb/s	400 Mb/s	370 Mb/s
2160P/25	650 Mb/s	400 Mb/s – 800 Mb/s	720 Mb/s	400 Mb/s	740 Mb/s
2160P/50	1200 Mb/s	800 Mb/s – 800 Mb/s	1400 Mb/s	800 Mb/s	1400 Mb/s
Assumes 10-bit processing 4:2:2 Progressive Scan Where 4:4:4, 12-bit, HDR image processing is required, respective minimum data rates may need to increase.					

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For Interlaced content including "psf" **ITU-R BT.601 and ITU-R BT.709 Colour** 8 and 10 bit Colour sub-sampling (e.g. 4:2:2, 4:2:0 etc) as per original. I-frame and Long GoP, as per original. 1 All AS-11 BT.601 and BT.709 codecs as native (AVC & D10N) 2 Uncompressed option (use-case dependent)* 3 Higher-quality (than current AS-11) codec (use-case dependent)* * Must have mxf wrapping option	–	●	1	
HDR Support ITU-R BT.2100 ‖ HLG/PQ	●	–	1	**Not currently**
ITU-R BT.2100 (UHD)	●	–	1	
ITU-R BT.709 colour (HD)	–	●	1	
ITU-R BT.601 colour levels (if we support SD)	–	●	1	

AUDIO

Sound fields per track – 1 sound field per track (UHD, HD & SD)	●	●	1	**Y** (IMF)
Audio tracks – minimum 1 track (1 sound filed) ‖ maximum 128 tracks	●	●	1	**Y** (IMF)
24 bits/48 kHz Minimum	●	●	1	**Y** (IMF)

DPP BUSINESS REQUIREMENTS	DPP OPTION 1 BT.2100	DPP OPTION 2 BT.601 & 709	IMPORTANCE 1/2/3	CURRENTLY IN IMF? Y/N (AND APP)
RDD6 Audio metadata track per multi-channel sound field (optional)	●	●	**1**	**Not directly**
SMPTE Channel Labelling Assumption: all audio configurations (stereo, 5.1 now, and object based audio for the future)	●	●	**1**	**Y** (IMF)

ACCESS SERVICES

Closed captioning formatting to enable storage and subsequent recreation of EBU-TT and STL	●	●	**1**	N
AD Service type definition AD (Audio Description == Video Description across the Atlantic) audio and control • Audio options within stereo, multitrack and object • Control info (Pan and Fade information)	●	●	**2**	N
Signing element as second video track	●	●	**2**	N

METADATA

Carry FIMS/EBU QC XML template data	●	●	**3**	N

DPP BUSINESS REQUIREMENTS	DPP OPTION 1 BT.2100	DPP OPTION 2 BT.601 & 709	IMPORTANCE 1/2/3	CURRENTLY IN IMF? Y/N (AND APP)
XML metadata embedded in IMF package • AS-11 metadata base • Metadata sets to comply or translate from/to FIMS/EBU Core • Mapping to Air Ready files as above	●	●	2	N
CPLs control the timeline and OPLs control the rendering of the asset cut defined by the CPL. • E.g. One CPL might define the timeline for a prewatershed version and a different CPL defines the postwatershed version. For each of those CPLs there might be one OPL for the 2.35:1 letterbox 5.1 rendering and another for the 16:9 stereo rendering. Each OPL is associated with exactly one CPL. • **CPL (A) = Main Copy** CPL (A) + OPL (A) = Main 2.35 + 5.1 CPL (A) + OPL (B) = Main 16:9 + 2.0 • **CPL (B) = Pre Watershed** CPL (B) + OPL (A) = Pre Watershed 2.35 + 5.1 CPL (B) + OPL (B) = Pre Watershed 16:9 + 2.0	●	●	1	N

FILE WORKFLOW REQUIREMENTS

Graphics and overlays (e.g. name, super)	●	●	3	N

DPP BUSINESS REQUIREMENTS	DPP OPTION 1 BT.2100	DPP OPTION 2 BT.601 & 709	IMPORTANCE 1/2/3	CURRENTLY IN IMF? Y/N (AND APP)
Currently there is no definition for frame rate adjustment. We recommend that this should be an OPL macro definition. The link to the audio is also missing, but should also be a macro either in the same (new) document or as an amendment to the existing audio mix macro (SMPTE ST 2067-103:2016) Currently the end user can determine a frame playback rate on transcode of the delivered asset E.g. the CPL will state the master is 24 / 1.001 but the destination transcoder can manage the frames to play back at 25fps on output. The IMF File is decoded at the master frame rate and transcoded to the new playback timeline.	●	●	1	Y (IMF)

APPENDIX

Air Master (Transmission Master)	Master asset for playout to destination (e.g AS-11) – may be traditional linear playout or VOD encode.	**EBU**	*European Broadcasting Union* – an alliance of public service media organisations.
AS-11	Defines the constrained media files used for the delivery of finished media assets (Air Master). DPP has an AS-11 specification for HD and UHD file delivery.	**EBU QC**	A team within the EBU working on guidelines for automated Quality Control – with a sub-group studying the application of IMF for broadcasters.
Audio Channel	A single stream of recorded sound with a location in a sound field (e.g. channel 1 = stereo left).	**Essence**	The pictures and sound that make up a programme.
Audio Track	A single stream of recorded sound with no location in a sound field (e.g. track 1 = programme stereo).	**H.264**	Video codec based on the MPEG-4 (Part 10) Advanced Video Coding (AVC) profile.
BT.2100 (ITU-R BT.2100)	BT.2100 defines the HDR and colourspace formats used within the HD and UHD standards. (see **https://www.itu.int/rec/R-REC-BT.2100**).	**HDR**	*High Dynamic Range* (see BT.2100).
BT.601 (ITU-R BT.601)	Defines the format of SD programmes (see **https://www.itu.int/rec/R-REC-BT.601**).	**IMF**	*Interoperable Master Format* – a package containing video, audio, additional data essences (subtitles) and appropriate metadata to enable the respective playback of the files within (as defined in SMPTE ST-2067-2).
BT.709 (ITU-R BT.709)	Defines the format of SDR HD programmes (see **https://www.itu.int/rec/R-REC-BT.709**).	**InterFrame**	A type of codec that looks across time (temporal) and encodes the difference between frames.
CPL	*Composition Play List* – enables the playback of the correct timeline of the respective video and audio files within the IMF package.	**IntraFrame**	A type of codec that encodes each frame, one at a time.

APPENDIX

J2K	*JPEG 2000* codec. Used by the movie studios as a high quality mezzanine format for distribution.	**RDD32**	RDD that describes technical aspects of the XAVC video codec created by Sony.
Library Master	Highest quality Master from which copies can be made with no loss of image and audio quality. Allows for editing and further rendering without any generation loss.	**RDD39**	RDD that describes technical aspects of the AVC-ULTRA video codec created by Panasonic.
MXF	*Material eXchange Format* (MXF) is a container for video and audio essences.	**RDD44**	RDD that describes technical aspects of the ProRes video codec created by Apple.
NABA	*North American Broadcasters Association* – with members from the USA, Canada and Mexico.	**RDD6**	RDD that describes technical aspects of multichannel audio metadata created by Dolby.
OPL	*Output Profile List* – delivery playback format instructions.	**SMPTE**	*Society of Motion Picture and Television Engineers* – defines standards, recommended practices and engineering guidelines.
ProRes	Video codec created by Apple and used in post production as a file format. ProRes 422HQ is noted as a master format.	**Sound Field**	Describes whether the sound mix is mono, stereo, or multichannel.
RDD	*Registered Disclosure Document* – a document submitted by an entity to make a disclosure of technical information to the public via SMPTE's publication channels.	**XML**	*eXtensible Markup Language* (XML) is a flexible way to electronically share structured data.