TV 2 DANMARK A/S

TECHNICAL SPECIFICATIONS

FOR DELIVERY OF TELEVISION PROGRAMMES

February 2021

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1. PICTURE AND SOUND QUALITY REQUIREMENTS

Video and audio must be of highest possible quality, for programs to be broadcasted on the TV 2 Channels. Each stage in the production chain – including acquisition, production and contribution – needs to meet the quality target set for the program.

All video and audio levels must be in accordance with TV 2 requirements upon delivery, as no further adjustments are done before transmission.

TV 2 may reject programs that do not meet the technical requirements* or recommendations. As a general rule a program must also comply with all relevant EBU, ITU and SMPTE standards** Any deviations from this document must be clearly stated in the contract.

2. SYSTEM FORMATS

High Definition – 1080i/25

Programs in HD must be delivered in either 1080i/25 or 1080PsF/25 system formats.

Programs originated in other TV system formats (720p or better) may be converted to 1080i/25 by a very high quality standards converter before delivery.

Programs originated on Film must be scanned directly onto 1080i/25 (1080PsF/25). Wide format films must be scanned in 16:9 letterbox (Pan Scan or Full Screen are not accepted). Films in 4:3 aspect ratios must be scanned in pillar box format.

3. AUDIO

All programs must contain audio in stereo or mono compatible Surround Pro Logic.

The relative timing of sound to vision should not exhibit any perceptible timing errors. Sound must not lead or lag the vision by more than 5ms.

Loudness

TV 2 wants the sound level throughout the program schedule to be perceived as uniform and consistent and hence follows EBU Recommendation R128 (Loudness normalization and permitted maximum level of audio signals) and R128 S1 (Loudness parameter for short-form content).

The following sound levels are acceptable:

Program

Program Loudness (IL)	0 LU (-23 LUFS)	*measured over the entire program*
	± 1 LU	*accepted tolerance for Live programs*
Maximum True Peak (Max TP)	-3 dBTP	*measured at 4x oversampling*
Program Start (IL)	± 2 LU (-23 LUFS)	*measured over the first minute*
Program End (IL)	± 2 LU (-23 LUFS)	*measured over the last minute*

Short-Form Content

(Adverts, promos, etc.)		
Program Loudness (IL)	0 LU (-23 LUFS) ± 0.5 LU	*measured over the entire program* *accepted tolerance*
Maximum True Peak (Max TP)	-3 dBTP	*measured at 4x oversampling*
Maximum Short-term Loudness	+5 LU (-18 LUFS)	

4. DELIVERY FORMATS

Programs can be delivered using one of the following delivery methods.

- File
- Live transmission
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Specifications for each delivery method are listed on the following pages.

5. DELIVERY OF FILE

5.1 HD

Name: XDCAM HD 422 MXF
Wrapper: MXF OP-1a (SMPTE 378M)

Video (Single stream)
Codec: MPEG-2 422P@HL Long GOP "XDCAM HD 422 1080i/25 (1080i50)" (SMPTE RDD 9-2009)
Bit rate: 50 Mb/s (CBR)

Resolution:	1920 x 1080	1080i/25
Interlacing:	Upper Field First	
Frame rate:	25 fps (50 fields per second interlaced)	

Audio

Track 1 (AES1):	Stereo Left / Lt - Surround Pro Logic
Track 2 (AES1):	Stereo Right / Rt - Surround Pro Logic
Track 3 (AES2):	Stereo IT Left
Track 4 (AES2):	Stereo IT Right
Track 5 (AES3):	Multichannel 5.1 Left
Track 6 (AES3):	Multichannel 5.1 Right
Track 7 (AES4):	Multichannel 5.1 Center
Track 8 (AES4):	Multichannel 5.1 LFE
Track 9 (AES5):	Multichannel 5.1 Left Surround
Track 10 (AES5):	Multichannel 5.1 Right Surround

Codec:	Uncompressed (PCM)
Sample Rate:	48 kHz,
Sampling Size:	16 or 24 bit

6. DELIVERY OF LIVE TRANSMISSION

6.1 GENERAL VIDEO AND AUDIO REQUIREMENTS

The below specifications for video and audio apply to all delivery options via link, regardless of the technology used.

Video

Resolution:	1920 x 1080	1080i/25
Interlacing:	Upper Field First	
Frame rate:	25 fps (50 fields per second interlaced)	
Color subsampling:	4:2:2	

Audio

Codec:	Uncompressed PCM when possible. If the signal must be carried in a compressed format, Stereo audio should be carried as MPEG1 Layer II (stereo) at 384kbs
Sample Rate:	48 kHz
Sampling Size:	16 or 24 bit

Audio track layout option 1

Track 1 (AES1): Stereo Left / Lt - Surround Pro Logic
Track 2 (AES1): Stereo Right / Rt - Surround Pro Logic
Track 3 (AES2): Stereo IT Left
Track 4 (AES2): Stereo IT Right
Track 5 (AES3): Multichannel 5.1 Left
Track 6 (AES3): Multichannel 5.1 Right
Track 7 (AES4): Multichannel 5.1 Center
Track 8 (AES4): Multichannel 5.1 LFE
Track 9 (AES5): Multichannel 5.1 Left Surround
Track 10 (AES5): Multichannel 5.1 Right Surround

Audio track layout option 2

Track 1 (AES1):	Stereo Left / Lt - Surround Pro Logic
Track 2 (AES1):	Stereo right / Rt - Surround Pro Logic
Track 3 (AES2):	Multi-channel audio (Dolby E)***
Track 4 (AES2):	Multi-channel audio (Dolby E)***

6.2 DELIVERY VIA COMPRESSED SATELLITE LINK

Where fiber is not available, single-hop satellite links may be used. The following are permissible and achievable largely by using DVB-S2 modulation schemes.

Modulation schemes should be carefully chosen so that the increase in transponder capacity (in MHz) required to deliver the optimal video bitrate (in Mbps) does not come at the cost of a decreased robustness of signal.

Two options are available:

Option #1

Nominal bitrate:	45Mbps
Codec:	MPEG4 H.264 Long GOP 4:2:2****

Option #2

Nominal bitrate:	60Mbps
Codec:	MPEG2 Long GOP 4:2:2****

6.3 DELIVERY VIA UNCOMPRESSED OPTICAL FIBRE

Content remains uncompressed along its route to the point of delivery.

One option is available:

Nominal bitrate:	1.485 Gb/s
Codec:	HD-SDI uncompressed, SMPTE 292M

6.4 DELIVERY VIA COMPRESSED OPTICAL FIBRE

Links that provide a 1.5Gbs HD-SDI connection at the point of delivery, but which use compression/decompression along their route.

Three options are available:

Option #1

Nominal bitrate:	140 Mbps
Codec:	JPEG 2000

Option #2

Nominal bitrate:	45 Mbps
Codec:	MPEG 4, H.264, Long GOP, 4:2:2****

Option #3

Nominal bitrate:	60 Mbps
Codec:	MPEG 2 Long GOP, 4:2:2****

APPENDIX

* Compared to reference levels the max deviation accepted is:
Video Luminance ± 2%
Video Color difference: ± 5%
Video Black level: ±1%
Audio levels: ± 1 dB

Other Reason for rejection could be: Poor audio or picture quality; Poor synchronization between audio and picture; Abrupt ending of audio and/or picture; Unintelligible speech/text

** *EBU standards on www.ebu.ch - SMPTE standards on* http://standards.smpte.org/

- SMPTE 377M-2010: “Material Exchange Format (MXF) – File Format Specification”
- SMPTE 378M-2004: “Material Exchange Format (MXF) – Operational pattern 1A (Single Item, Single Package)”
- SMPTE 379M-2010: “Material Exchange Format (MXF) – MXF Generic Container”
- SMPTE 381M-2005: “Material Exchange Format (MXF) - Mapping MPEG Streams into the MXF Generic Container”
- SMPTE 386M-2004: “Material Exchange Format (MXF) – Mapping Type D-10 Essence Data to the MXF Generic Container”
- SMPTE 382M-2007: “Material Exchange Format – Mapping AES3 and Broadcast Wave Audio into the MXF Generic Container”
- ITU-R BT.709-5: “Parameter values for the HDTV standards for production and international programme exchange”

- EBU R128-2010: “Loudness normalisation and permitted maximum level of audio signals”
- EBU Tech 3341-2010: “Loudness Metering: “EBU Mode’ metering to supplement loudness normalisation in accordance with EBU R 128”
- EBU Tech 3342-2010: “Loudness Range: A descriptor to supplement loudness normalisation in accordance with EBU R 128”
- EBU Tech 3343-2011: “Practical guidelines for Production and Implementation in accordance with EBU R 128”
- EBU R122-2007: “Material Exchange Format Timecode Implementation”
- EBU R 128 s1-2014: “Loudness Parameters for Short-Form Content”

*** The Dolby E encoded signal must be in sync with the stereo signal.

Dolby E encoding should be performed according to the below specifications:

Sample Rate:	48 kHz
Sampling Size:	16 or 20 bit
Dolby E track layout	Front Left, Front Right, Centre, LFE, Surround Left, Surround Right, Not Used, Not Used

**** Additional requirements for encoders used for Live Transmission

MPEG 2 Encoders

- GOP (Group of Pictures) should be 15 frames. This represents a good balance between coding efficiency (requiring long GOPs) and error resilience (requiring short GOPs).
- B-frames should not be used as these are typically coded at a lower quality than I and P frames and will lead to poor picture quality in the home. Note: not all encoders on the market allow B-Frames to be disabled, so please check before accepting the unit.
- GOP structure should be /IPPPPPPPPPPPPP/
- 4:2:2 color subsampling should be used to avoid color smearing when concatenated with the 4:2:0 emission coders used for broadcast transmission.
- “Intra-DC precision “should be set to 11 bits. 11 bits are required in the DCT (discrete cosine transform) domain in order to accurately convey an 8 bit video signal. This is not normally a user setting but should be checked with an analyzer before accepting the encoder.

MPEG 4 Encoders

- 10-bit video is preferred. There is no bitrate penalty.
- GOP length should be a minimum of 15, in line with MPEG2
- Tests suggest MPEG4 encoders do not suffer from the poor quality B-frames. Currently Band hierarchical B-frames are permitted.
- 4:2:2 color subsampling is preferred but 4:2:0 may be acceptable whilst encoder technology is developing.