

## ***TECHNICAL SPECIFICATIONS***

### ***FOR DELIVERY OF TELEVISION PROGRAMMES***

**Valid from April 2<sup>nd</sup> 2024**

**Version 1.1**

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## 1. PICTURE AND SOUND QUALITY REQUIREMENTS

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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 made before transmission.

TV 2 may reject programs that do not meet the technical requirements\* or recommendations.

As a rule a program must also comply with all relevant EBU, ITU and SMPTE standards\*\*

Handheld recordings, i.e. mobile phones, drones action cameras etc., **must** comply with supported frame rates (25/50).

**Any** deviations from this document must be clearly stated in the contract.

## 2. SYSTEM FORMATS

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### 2.1 *High Definition – 1080p50*

Programs in HD must be delivered in 1080p50 system format.

Programs originated on film may be scanned directly onto 1080p/25. Wide format films should be delivered with a horizontal resolution of 1920 and a height that matches the aspect ratio using square pixels.

### 2.2 *Ultra High Definition – 2160p50*

Programs in UHD must be delivered in 2160p50 system formats.

Programs originated on film must be scanned directly onto 2160p25. Wide format films should be delivered with a horizontal resolution of 3840 and a height that matches the aspect ratio using square pixels.

Media files in the 4096x2160 resolution is **not** accepted.

### 2.3 *Licensed / original content*

Must comply with 25 or 50 fps and resolutions above

### 2.4 *4:3 content*

Specific for content originating in 4:3 aspect ratio. Content in 4:3 format should be delivered with a vertical resolution of 1920 or 2160 pixels. Letterboxing is not allowed.



### 3. AUDIO

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

Failing to deliver with either 2 or 10 tracks as defined in formats, will result in a rejection.

MOS is accepted.

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 5 ms.

#### ***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:

#### *Programs*

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

#### *Short-Form Content (ads, promos, etc.)*

Program Loudness (IL)	0 LU (-23 LUFS)	<i>measured over the entire program</i>
	± 0.5 LU	<i>accepted tolerance</i>
Maximum True Peak (Max TP)	-3 dBTP	<i>measured at 4x oversampling</i>
Maximum Short-term Loudness	+5 LU (-18 LUFS)	

## 4. DELIVERY FORMATS

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

- File
- Live transmission

Specifications for each delivery method are listed on the following pages.

## 5. DELIVERY OF FILE

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### 5.1 *General file requirements*

Programs that are delivered as 1080p50 SDR or 2160p50 HDR will at TV 2s discretion be down converted to 1080i25 SDR, to support playout on outputs available as HD only.

Timecode must always be zero-based (starting at 00:00:00:00) for all episodes.

File naming must be: [productcode]-[version].mxf (ie. 12345678-v4.mxf).

Delivery in 2160p50 HDR requires that capture and post processing is done in an appropriate high bitrate video codec with the minimum requirements;

- Bit depth: Minimum 10-bit
- Resolution: Minimum 3840x2160
- Color space: BT rec. 2020
- Dynamic range: HDR HLG rec. 2100
- Grading: Done in the same HDR format as the delivery

## 5.2 Full HD Delivery – 1080p50

Standard file format: XAVC HD Intra MXF

Wrapper: MXF OP1a

### Video

Codec: XAVC HD Intra class 100 CBG  
Resolution: 1920x1080  
FPS: 50 preferred, 25 possible  
Aspect ratio: 16:9  
Color space: BT.709

### Audio

Tracks: 5.1 Multichannel  
Stereo Lt,Rt (Pro Logic compatible downmix of 5.1 multi channel audio)  
Stereo M&E

Track layout:

Track 1 (AES1):	Stereo Left
Track 2 (AES1):	Stereo Right
Track 3 (AES2):	Multichannel 5.1 Left
Track 4 (AES2):	Multichannel 5.1 Right
Track 5 (AES3):	Multichannel 5.1 Center
Track 6 (AES3):	Multichannel 5.1 LFE
Track 7 (AES4):	Multichannel 5.1 Left Surround
Track 8 (AES4):	Multichannel 5.1 Right Surround
Track 9 (AES5):	M&E Left
Track 10 (AES5):	M&E Right

Codec: PCM  
Bit depth: 24-bit  
Sample Rate: 48Khz

Stereo composed of two discrete mono-channel audio tracks (1+2) MUST be included. If 5.1 sound is included, six discrete mono-channel audio tracks (3-8) is expected.

If 5.1 sound is not included, six discrete mono-channel of silence (MOS) MUST be used.

The delivery may include M&E sound composed of two discrete mono-channel audio tracks (9-10). If a M&E sound is not available, two discrete mono-channels of silence (MOS) MUST be used. M&E is defined as Music & Effects, with NO speech, for use with trailer production and was formerly referred to as IT-tracks.

The container metadata shall include a Material Package Timecode Track and a Source Package Timecode Track synchronous to the video essence of the program content.

### 5.3 HD Delivery – 1080i50

**Notice: Interlaced format is phased out, if used by exception observe different audio track layout!**

Standard file format: XAVC HD Intra MXF

Wrapper: MXF OP1a

#### Video

Codec: HD MPEG HD422 (XDCAM HD422), long GOP  
Resolution: 1920x1080  
FPS: 50 preferred  
Aspect ratio: 16:9  
Color space: BT.709

#### Audio

Tracks: 5.1 Multichannel  
Stereo Lt,Rt (Pro Logic compatible downmix of 5.1 multi channel audio)  
Stereo M&E

Track layout: Track 1 (AES1): Stereo Left  
Track 2 (AES1): Stereo Right  
**Track 3 (AES2): M&E Left**  
**Track 4 (AES2): M&E 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: PCM  
Bit depth: 24-bit  
Sample Rate: 48Khz

**Notice: FOR INTERLACED CONTENT – M&E IS RETAINED ON TRACK 3+4**

Stereo composed of two discrete mono-channel audio tracks (1+2) MUST be included. If 5.1 sound is included, six discrete mono-channel audio tracks (5-10) is expected.

If 5.1 sound is not included, six discrete mono-channel of silence (MOS) MUST be used.

The delivery may include M&E sound composed of two discrete mono-channel audio tracks (3-4). If a M&E sound is not available, two discrete mono-channels of silence (MOS) MUST be used. M&E is defined as Music & Effects, with NO speech, for use with trailer production and was formerly referred to as IT-tracks.

The container metadata shall include a Material Package Timecode Track and a Source Package Timecode Track synchronous to the video essence of the program content.

## 5.4 UHD Delivery – 2160p50

Standard file format: XAVC QFHD Intra MXF

Wrapper: MXF OP1a

### Video

Codec: XAVC QFHD Intra class 300 CBG

Resolution: 3840x2160

FPS: 50 preferred, 25 possible

Aspect ratio: 16:9

Color space: BT.2020 if delivering HDR, otherwise BT.709

Dynamic Range: HDR HLG\* Rec. BT 2100

*\*(SDR, HDR10, HDR10+ and Dolby Vision possible after agreement with TV2)*

### Audio

Tracks: 5.1 Multichannel

Stereo Lt,Rt (Pro Logic compatible downmix of 5.1 multi channel audio)

Stereo M&E

Track layout:	Track 1 (AES1):	Stereo Left
	Track 2 (AES1):	Stereo Right
	Track 3 (AES2):	Multichannel 5.1 Left
	Track 4 (AES2):	Multichannel 5.1 Right
	Track 5 (AES3):	Multichannel 5.1 Center
	Track 6 (AES3):	Multichannel 5.1 LFE
	Track 7 (AES4):	Multichannel 5.1 Left Surround
	Track 8 (AES4):	Multichannel 5.1 Right Surround
	Track 9 (AES5):	M&E Left
	Track 10 (AES5):	M&E Right

Codec: PCM

Bit depth: 24-bit

Sample Rate: 48Khz

Stereo composed of two discrete mono-channel audio tracks (1+2) MUST be included. If 5.1 sound is included, six discrete mono-channel audio tracks (3-8) is expected.

If 5.1 sound is not included, six discrete mono-channel of silence (MOS) MUST be used.

The delivery may include M&E sound composed of two discrete mono-channel audio tracks (9-10). If a M&E sound is not available, two discrete mono-channels of silence (MOS) MUST be used. M&E is defined as Music & Effects, with NO speech, for use with trailer production and was formerly referred to as IT-tracks.

The container metadata shall include a Material Package Timecode Track and a Source Package Timecode Track synchronous to the video essence of the program content.



## 5.5 *Guidelines regarding production in interlaced or mixed framerates*

TV 2 wants, to the extent technically possible, content to be produced in progressive format. We understand that there is currently a significant amount of equipment that can only work with 1080i50, but we expect that this will be upgraded over time to handle 1080p50.

TV 2 requires, at a minimum, productions to be in the resolutions provided (1920x1080/3840x2160) (delivery at least in the same resolution or higher).

TV 2 prefers that production occurs at the same framerate as the delivery, with 50 FPS as the standard, unless otherwise specified in the contract.

For content delivery where the majority is produced and recorded in 1080i50 due to specific technical reasons related to studios and OB vans, we request the content to be delivered as 1080p50. When de-interlacing, it is the producer's responsibility to ensure that there are no visible artifacts or stuttering in clips and graphics.

For content recorded in 1080p25 but with graphics or other elements produced in 1080p50, the delivery should be in 1080p50. It is the producer's responsibility to ensure that this does not pose challenges related to motion smoothing or similar issues on TV. The producer is responsible for ensuring that 25 FPS still provides a good user experience and that there are no graphics, pans, or similar elements that appear "stuttering" to TV 2's customers. TV 2 encourages testing the content on consumer devices and reserves the right to reject it if perceived as a technical error.

For content produced in 1080p25, where everything, including graphics, is in 1080p25, the delivery should be in 1080p25. This should only happen in exceptional cases, as TV 2 believes that graphics, etc., are typically experienced as "stuttering" in 25 FPS, creating a poor user experience. It is the producer's responsibility to ensure that 25 FPS still provides a good user experience and that there are no graphics, pans, or similar elements that appear "stuttering" to TV 2's customers. TV 2 encourages testing the content on consumer devices and reserves the right to reject it if perceived as a technical error.

## 6. DELIVERY OF LIVE TRANSMISSION

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### 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 can be delivered in one out of 3 accepted formats.**

<b>Format 1:</b>	<b>1080i25</b>
Resolution:	1920 x 1080
Aspect ratio:	16:9
Interlacing:	Upper Field First
Frame rate:	1080i/25
Color subsampling:	25 fps (50 fields per second interlaced)
Color space:	4:2:2
Dynamic range:	BT 709
	SDR
<b>Format 2:</b>	<b>1080p50</b>
Resolution:	1920 x 1080
Aspect ratio:	16:9
Frame rate:	50 fps (50 frames per second progressive)
Color subsampling:	4:2:2
Color space:	BT 709
Dynamic range:	SDR
<b>Format 3:</b>	<b>3840 x 2160p50</b>
Resolution:	3840 x 2160
Aspect ratio:	16:9
Frame rate:	50 fps (50 frames per second progressive)
Color subsampling:	4:2:2
Color space:	BT 2020
Dynamic range:	HDR HLG, BT 2100

**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 384 kbps

Sample Rate: 48 kHz

Sampling Size: 16 or 24 bits

**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): Multichannel 5.1 Left

Track 4 (AES2): Multichannel 5.1 Right

Track 5 (AES3): Multichannel 5.1 Center

Track 6 (AES3): Multichannel 5.1 LFE

Track 7 (AES4): Multichannel 5.1 Left Surround

Track 8 (AES4): Multichannel 5.1 Right Surround

Track 9 (AES5): M&E Left

Track 10 (AES5): M&E Right

**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)\*\*\*

For Live transmissions, TV 2 requires both a high quality primary transmission link and a back-up link that may be in a lower quality than the primary link.

Transmission links, (fiber, satellite, internet and cloud) will normally be arranged by TV 2, and must in all cases be arranged together with TV 2 MCR.

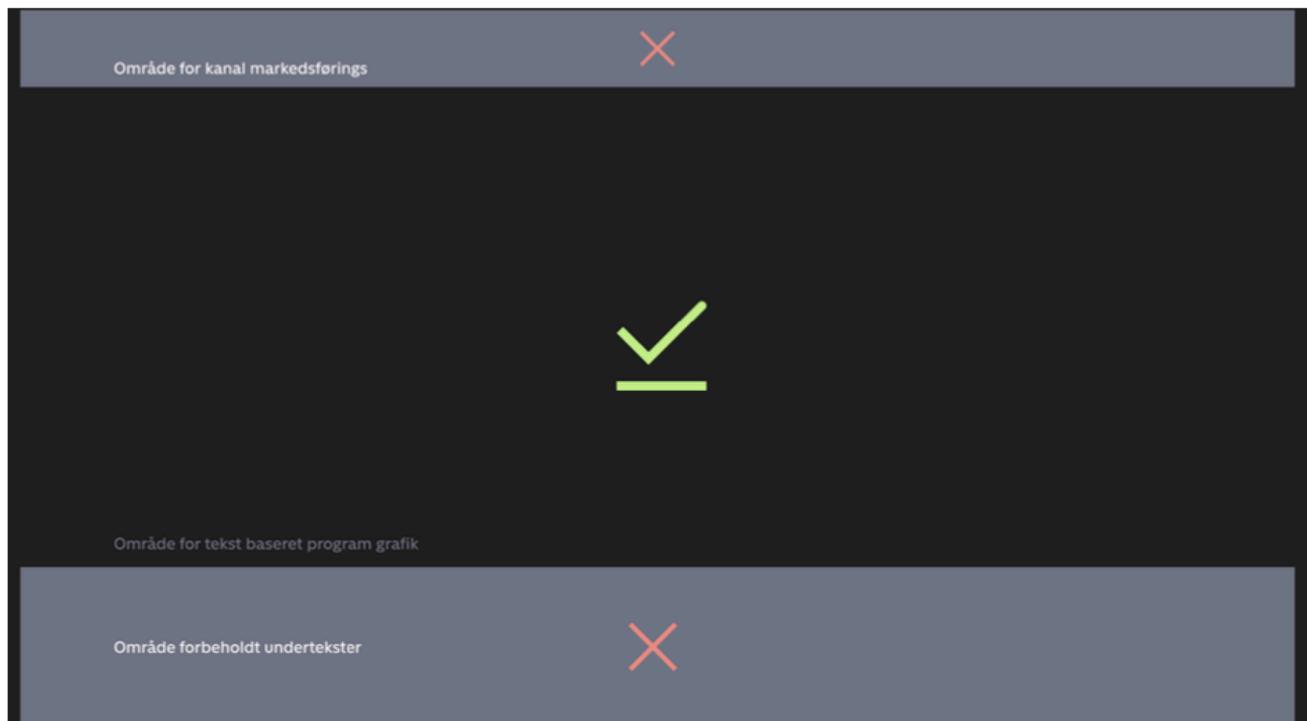
## 7. GRAPHIC SAFE AREA

All graphics and credits is clearly visible and within the safe area. Deliveries with graphics overlapping areas with TV 2 graphics will be rejected.

For 1080 deliveries the:

- top 220 px should be left without graphics, reserved for logos and TV 2 branding
- bottom 240 px should be left without graphics, reserved for subtitles

For more information contact Media Management – [mediaman@tv2.dk](mailto:mediaman@tv2.dk)



## 8. SPECIFICATIONS FOR ACQUISITION PROGRAMMES

### APPENDIX A

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- \* Compared to reference levels the max deviation accepted is:  
Video Luminance  $\pm$  2%  
Video Color difference:  $\pm$  5%  
Video Black level:  $\pm$ 1%  
Audio levels:  $\pm$  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](http://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 /IPPPPPPPPPPPPPP/
- 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.